Byford Structure Plan Amendment

Lot 2 (640) South Western Highway
Byford, Western Australia

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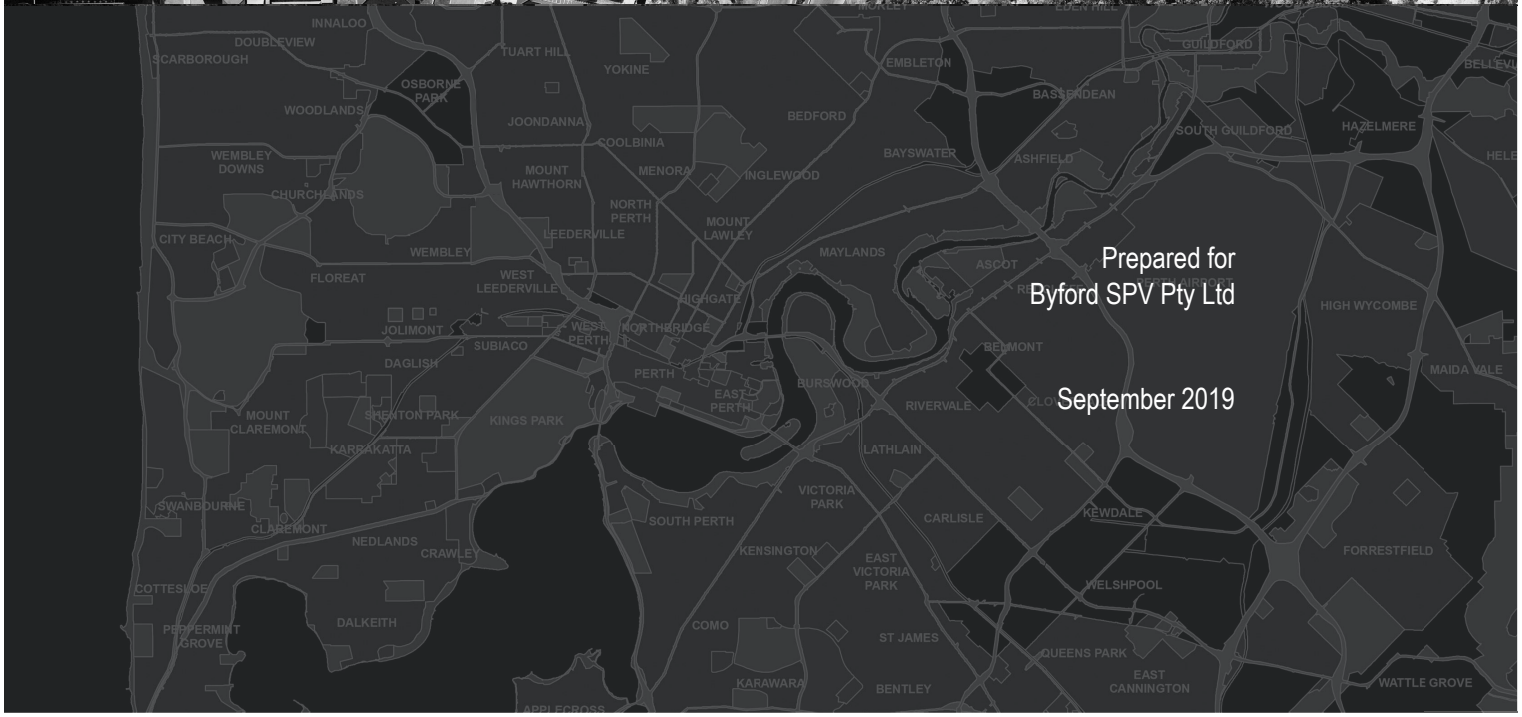

Prepared for
Byford SPV Pty Ltd

September 2019

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Project Details

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Rev 0	190913 6172 Structure Plan Amendment Request	13 September 2019
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Contents

Figures

Appendices

1 Introduction

Planning Solutions acts on behalf of Byford SPV Pty Ltd T/A Stavretis Property Trust, the landowner of Lot 2 (640) South Western Highway, Byford (**subject site**).

Planning Solutions has prepared the following report in support of an application to amend the Byford Structure Plan (**structure plan**) currently applicable to the subject site, pursuant to clause 29(1) of Schedule 2 (**Deemed Provisions**) of the *Planning and Development (Local Planning Schemes) Regulations 2015* **(LPS Regulations).**

This report will discuss various issues pertinent to the proposal, including:

- Site details.
- Background.
- Development Constraints.
- Proposal.
- Justification.

The land surrounding the subject site within the structure plan area has been progressively developed, with the subject site being the last remaining vacant undeveloped parcel of land within the precinct. The structure plan map currently identifies the subject site for 'Residential (R20)', however, this nominated zoning does not appropriately respond to the unique site context, opportunities and constraints, and is effectively preventing any viable development from occurring on the land.

Accordingly, this application seeks to amend the structure plan to identify the subject site as 'Commercial'. Such a preferred zoning classification will facilitate the orderly and proper development of the land, and provide the local population catchment with convenient local services / retail offerings that are currently unavailable.

As stated in clause 17.5 of the Western Australian Planning Commission's (**WAPC**) *Structure Plan Framework*:

> *When an application to amend such a structure plan is received, the structure plan will generally not be required to be updated to the manner and form contained in this framework. The structure plan will be required to be updated to the extent needed to undertake the amendment proposed.*

For this reason, the scope of proposed structure plan amendments is limited to the classification of the subject site and associated provisions.

Planning Solutions respectfully requests the WAPC grant approval to amend the structure plan at the earliest opportunity.

2 Site Details

2.1 Land Description

The Byford Structure Plan comprises of area generally bound by Thomas Road to the north, Hopkinson Road and Tonkin Highway to the west, Cardup Siding Road to the south and the Byford townsite and Darling Range foothills to the east. The structure plan excludes the Byford Trotting Centre within the central portion of the structure plan area.

The subject site is situated in the north eastern portion of the structure plan area and is legally described as "*Lot 2 on Diagram 35013*", being the whole of the land contained within Certificate of Title Volume 1667 and Folio 185. The subject site has a total area of 4,052m^2, and is held under ownership of Byford SPV Pty Ltd.

A Memorial (Document No. N792571) pertaining to site contamination is listed on the Certificate of Title. Such contamination matters are further discussed in Section 4.2.2 of this report.

Refer to **Appendix 1** for copy of the Certificate of Title, Plan and Memorial documents.

2.2 Location

2.2.1 Regional Context

The structure plan area is situated within the Shire of Serpentine-Jarrahdale (**Shire**) and comprises the emerging Byford locality. Being situated approximately 5.8 kilometres south of the Armadale city centre and approximately 31 kilometres south east of the Perth city centre, the structure plan area is on the southern peri-urban fringe of the Perth metropolitan area.

More specifically, the subject site is situated in the north eastern portion of the structure plan area, on the south western corner of the Thomas Road and South Western Highway intersection. These regional roads provide links to the wider Perth metropolitan area and regions beyond. The subject site's strategic location at the north eastern periphery of the Byford Structure Plan area gives it prominence at a key entry point to the Byford urban area

2.2.2 Local Context, Land Use and Topography

The broader structure plan area is being progressively developed for urban purposes, and comprises a variety of residential, commercial and civic land uses and reserves. The Byford town centre is situated approximately 1.5 – 1.8 kilometres south of the subject site and contains the Byford Shopping Centre as well as a variety of other commercial uses and activities along South Western Highway.

The centre of the structure plan area comprises the Byford Trotting Grounds and associated rural-residential development. Several parcels of remnant bushland and vacant land are also contained within the structure plan area and will be progressively developed in accordance with the structure plan.

The subject site is currently vacant and contains small portions of vegetation, partially screening the subject site and adjacent properties. The subject site has direct road frontage to Hay Road, Thomas Road and South Western Highway, and shares its southern boundary with a residential property containing a single dwelling.

Refer **Figure 1,** aerial location plan.

The wider urban precinct located generally south and west of the Thomas Road / South East Highway intersection has been subdivided and developed for low density residential land uses, drainage corridors and areas of public open space. Sunrays Park is situated approximately 120 metres south of the subject site.

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SCALE	1: 2,000 @ A4
DATE	12 September 2019
FILE	01 190912 6172 Aerial Photograph.dwg
REVISION	1/DR/First Draft/12.09.2019

Scale Bar (m) 0 50

AERIAL PHOTOGRAPH

LOT 2 (640) SOUTH WESTERN HIGHWAY
BYFORD, WA

FIGURE 01

3 Planning background

3.1 Historic use of subject site

For a period of approximately 45 years, the 'Oakland Service Station' operated on the subject site, closing circa 2000. The service station buildings and features have been subsequently removed from the land, which now remains vacant and unused. The historic use of the subject site for fuel retailing is consistent with it's strategic location at the corner of Thomas Road and South Western Highway, and high degree of exposure to passing trade.

Historic fuel tank leaks on the subject site prior to the service station's closure have led to the site's classification as a contaminated site under the *Contaminated Sites Act 2003.* Notwithstanding remediation efforts and investigations over the last 20 years, the site's classification effectively restricts the use of the subject site to "*commercia l/ industrial uses, which excludes sensitive uses with accessible soils such as childcare centres, kindergartens, pre-schools and primary schools. The site should not be developed for a more sensitive use such as recreational open space, residential use or childcare centres without further contamination assessment and/or remediation*."

Refer **Figure 2** below for a historic aerial photograph from 1994, showing the Oakland Service Station during its period of operation, and prior to its closure in circa 2000.

Figure 2: 1994 aerial photograph of subject site and operational Oakford Service Station (Source: Landgate)

Also refer **Figure 3** below for a historic aerial photograph from 2004, showing the subject site following closure and removal of the Oakland Service Station.

Figure 3: 2004 aerial photograph of subject site, with Oakford Service Station removed (Source: Landgate)

3.2 Shire of Serpentine Jarrahdale Town Planning Scheme No.2

The subject site and majority of the surrounding Byford Structure Plan area is zoned Urban Development pursuant to the Shire's Town Planning Scheme No.2 (**TPS2**), gazetted in 1989 and since amended. The Urban Development zone is consistent with the land's Urban zoning under the Metropolitan Region Scheme (**MRS**) and provides for the orderly planning of large areas of land, facilitated by the establishment of Structure Plans to coordinate development.

The subject site also falls within Development Area No.3: Byford Urban Development Zone (**DA3**) as identified in Appendix 9 of TPS2, which is subject to the provisions of the Byford Structure Plan. Plan No.9A (formerly 15A) of TPS2 identifies the subject site within Precinct 9 of DA3.

Table 1: Zoning Table of TPS2 does not assign a land use permissibility classification (P, AA, SA or IP) to the majority of listed land uses, and instead, provides a '#' symbol indicating that land use permissibility is to be informed by an approved structure plan (in this case, the Byford Structure Plan).

3.3 Byford Structure Plan

The Byford Structure Plan (**structure plan**) was originally adopted by the Shire of Serpentine Jarrahdale in 2005, and has since been amended with the approval of the Western Australian Planning Commission (**WAPC**) in 2009. The structure plan, as amended, remains in effect and provides a district level planning framework for the development of the locality, including the subject site.

The structure plan identifies the subject site and surrounding precinct as having an indicative zoning of 'Residential (R20)'. Permissible land uses in the TPS2 Residential zone predominantly comprise residential and community uses, while most commercial/retail land uses are prohibited (e.g. Convenience Store, Fast Food/Takeaway, Office, Restaurant, Service Station, Shop and Showroom).

Refer to **Appendix 2** for copy of the current operational Byford Structure Plan.

Part 3 of the structure plan provisions states that development or subdivision should not occur until a local structure plan has been prepared (with local structure plans not to be prepared for an area smaller than a precinct as depicted in TPS2). Notwithstanding this, the remainder of Precinct 9 surrounding the subject site has been progressively subdivided and developed for residential purposes in the absence of an approved local structure plan. This has left the subject site as an isolated vacant parcel of land. Furthermore, no local/neighbourhood scale retail offering has been delivered in any of the 'neighbourhood node' locations planned to service the surrounding population catchments to the west and south of the subject site, including the Marri Park Estate and Byford Central local structure plan areas. This is further discussed in section 3.4 below and identified in **Figure 4** over the page.

3.4 Amendment No.178 to Town Planning Scheme No.2

In 2012, the Council resolved to support Amendment No.178 to the Shire's Town Planning Scheme No. 2 (**TPS2**) to rezone the subject site from 'Urban Development' to 'Commercial', on the basis of the sites contaminated status and suitability for a variety of non-residential land uses.

In April 2013, the (then) Minister for Planning refused to grant final approval to proposed Amendment No.178 for the following reasons:

1. *The proposed amendment is inconsistent with State Planning policy No.42 'Activity Centres for Perth and Peel' which encourages commercial developments such as that proposed to be located in District Centres and Neighbourhood/Local Centres. The subject site is not considered to be located in the Byford Activity Centre and constitutes an out of centre development.*

2. *The amendment is not supported by the planning framework could undermine efforts to develop the Byford Town Centre and secondary Neighbourhood Centres identified in the Byford (District) Structure Plan and Byford Town Centre Local Structure Plan.*

Refer **Appendix 3** for a copy of the determination notice concerning Amendment No.178.

Since Amendment No.178 was refused in 2013, development has continued throughout the structure plan area, with the precinct(s) surrounding the subject site fully developed for urban purposes. Of particular note, none of the three identified neighbourhood nodes within a 1km radius of the subject site have been developed for retail land uses as contemplated by the structure plan. This has created a large residential catchment measuring at over 100 hectares in the north east portion of the structure plan area, with no access to local or neighbourhood scale retail activities. The closest existing centres to the subject site are the Byford Town Centre, approximately 1.5km – 1.8km to the south, and a retail centre (comprising fast food and fuel retail activities) located approximately 3km to the west. Actual walking and driving distances for residents living in this area to access commercial/retail services can be significantly greater than the distances quoted above, due to the lack of convenient and direct transport routes.

Figure 4 below identifies the area of the structure plan that has been subdivided and developed for urban residential purposes, with no local retail provision within any of the planned 'neighbourhood nodes' or their associated 400m radius catchment areas.

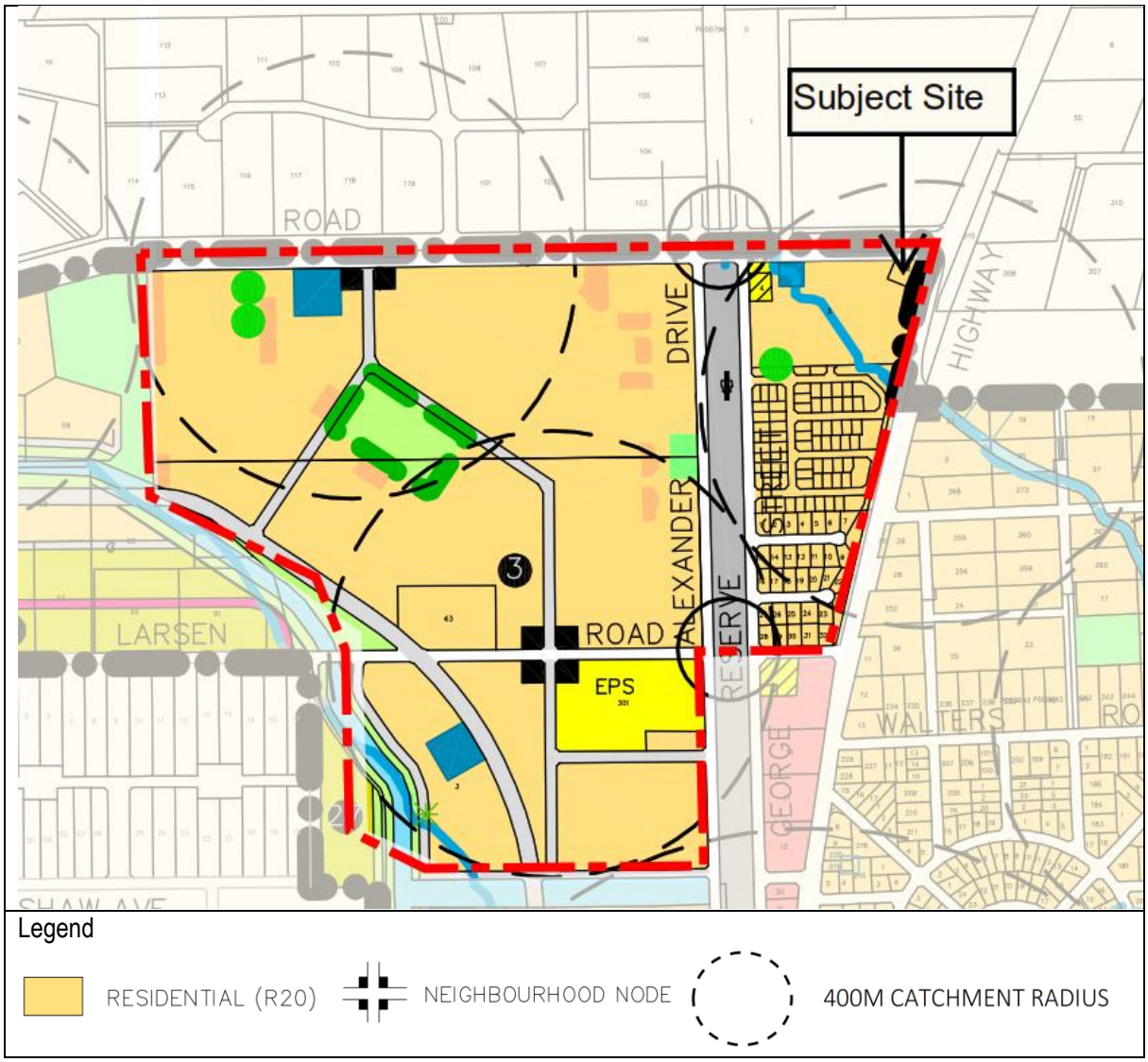


Figure 4: Developed portion of structure plan area with no retail activities within planned neighbourhood nodes

3.5 Service station development application

In 2017, the landowner's representatives undertook preliminary engagement with the DPLH and Shire in respect to a proposal to develop the subject site for a service station, consistent with the historic use of the land. With the Shire and DPLH offering no in-principle objection to a service station development, a development application for a Service Station was lodged in December 2017.

The development application was ultimately considered and refused at the Metro East Joint Development Panel (**JDAP**) meeting held 8 June 2018. One of the refusal reasons was the land's indicative designation for 'Residential' under the structure plan, and is quoted as follows:

> *Approval of a 'Service Station' land use would be contrary to the principles of orderly and proper planning for the locality. Such an approval would prejudice the preparation of a Local Structure Plan as required by the Byford Structure Plan, which designates the land indicatively as a Residential zoning. A 'Service Station' use would be prohibited within the Residential zone.*

This application seeks to amend the structure plan and apply an alternate indicative zoning to the subject site, thereby facilitating the orderly and proper development of activities deemed more suitable for establishment on the subject site.

3.6 Draft Byford District Structure Plan

In December 2018, the Shire Council considered the draft Byford District Structure Plan (**draft DSP**) for the purpose of public advertising, alongside associated amendments to the Shire's TPS2 and draft development contribution arrangements. The draft DSP was intended to replace the structure plan but has not yet been advertised due to ongoing negotiations and liaison between the Shire and Department of Planning, Lands and Heritage (**DPLH**).

The draft DSP map identifies the subject site and surrounding precinct as 'Low (Suburban): R20-35)', while clause 1.7.2 of the draft DSP (Part 1) acknowledges that the "*strategic location of this site at the intersection of South Western Highway and Thomas Road and the potential of this site to provide an entry statement to Byford requires other provisions to be included within the Byford District Structure Plan*". Such draft provisions include the nomination of additional discretionary land uses for the subject site, comprising a range of residential, community and commercial/retail land uses.

Refer to **Appendix 4** for copy of the draft DSP map.

It is also noted that the draft DSP map removes all references to 'neighbourhood nodes' (as contained on the current structure plan) and does not identify the location of any local centres/nodes (even though it assumes approximately 3,200m^2 of retail floor space being provided across various nodes). Only the Town (District) centre and three Neighbourhood centres area identified on the map, with the residential catchment to the west and south of the subject site having no identified centres/nodes within a walkable catchment area.

While the draft DSP acknowledges the subject site has a unique strategic location potentially suitable for a range of non-residential land uses, its current status and timeframes are uncertain, due to broader considerations and issues to be resolved between the Shire and DPLH/WAPC. Given this uncertainty, a separate amendment to the existing structure plan is required to facilitate viable development outcomes in a timely manner.

4 Future land use considerations

Having regard for the planning history of the subject site, it is clear that the current planning framework and structure plan classification of the subject site as 'Residential R20' is not appropriate. Having regard for its contaminated site restrictions, strategic location fronting two regional roads, and the lack of any local/convenience retail offerings in the surrounding residential catchment, an alternate indicative zoning should be applied to the site in order to facilitate a broader range of potential uses.

In considering the range of other land uses potentially suitable for consideration on the subject site, the following matters must also be taken into account.

4.1 Environmental Noise

As the subject site fronts South Western Highway and Thomas Road, any development would be subject to the provisions of State Planning Policy 5.4 – Road and Transport Noise and Freight Considerations in Land Use Planning (**SPP5.4**). SPP5.4 aims to protect sensitive land uses from road and rail noise as well as to protect major freight corridors from encouraging sensitive land uses.

To establish the suitability of various land uses on the subject site, an acoustic review has been undertaken by a qualified acoustic consultant. Refer **Appendix 5** for a copy of the acoustic review.

The acoustic review analysed the potential development of sensitive residential land uses against the provisions of SPP5.4. The review concluded that to comply with the provisions of SPP5.4, any residential development on the subject site would require three metre high boundary fences to South Western Highway and Thomas Road as well as quiet house design standards to the buildings. Additionally, it was noted that it would be difficult to achieve compliance with the outdoor requirements of SPP5.4 due to the volume of traffic on the surrounding roads.

The requirement for 3m high acoustic fencing has the potential to impact the amenity of the locality, and views of the prominent corner site at the northern entry to the Byford locality. The requirement for quiet house designs also increases development costs, further reducing the viability of developing the land for residential purposes.

Conversely, the review concluded that noise emission from any commercial development would most likely be masked by road traffic noise, ensuring that commercial development on the subject site would have a negligible effect on the acoustical environment of the area. Furthermore, acoustic reporting undertaken in support of the previously refused service station development confirmed that the "*noise received at the neighbouring (*residential*) premises from the development would be deemed to comply with the regulatory requirements at all times and no noise mitigation is required*".

In summary, the development of sensitive premises on the subject site would require significant noise mitigation measures that detract from the amenity of the locality and attract increased development costs, reducing viability. Conversely, non-sensitive (commercial/retail) land uses are not constrained by traffic noise, and are unlikely to generate noise impacting on neighbouring residential premises.

4.2 Site contamination

According to a Department of Water and Environmental Regulation (**DWER**) Basic Summary of Records Search Response (ID No.6218), the subject site classified as "remediated for restricted use". Refer **Appendix 6** for a copy of the Basic Summary of Records Response.

The summary identifies that hydrocarbons are present in the soils and groundwater beneath the subject site, due to the sites historic use. As such, the land use of the site is "*restricted to commercial/ industrial uses, which excludes sensitive uses with accessible soils such as childcare centres, kindergartens, pre-schools and primary schools. The site should not be developed for a more sensitive use such as recreational open space, residential use or childcare centres without further contamination assessment and/or remediation*."

Soil remedial work and soil investigations have been undertaken on the subject site, and a detailed risk assessment completed in 2010 concluded that restrictions on use of the site were necessary to manage risks. Further independent review in 2017 concluded that the site is suitable for restricted commercial/industrial land use, with these findings accepted by DWER.

While remediation work and extensive investigations have been undertaken over the last 20 years, the subject site remains unsuitable for residential or other sensitive uses. The development of residential uses as required by the structure plan is in direct conflict with the site's status and classification under the *Contaminated Sites Act 2003,* while other commercial uses suitable for development on a contaminated site are not supported by the structure plan. This misalignment of land use restrictions is effectively sterilising the land from any development, necessitating a structure plan amendment to facilitate the development of more suitable commercial/retail land uses on the subject site.

4.3 Vehicular access

The subject site fronts South Western Highway to the east, Thomas Road to the north, and Hay Road to the west. South Western Highway is reserved as a Primary Regional Road (**PRR**) under the MRS and classified as a Primary Distributor under the Main Roads WA (MRWA) Functional Road Hierarchy. Thomas Road is reserved as an Other regional Road (**ORR**) under the MRS, and classified as a Distributor A road under the MRWA Functional Road Hierarchy. Hay Road falls within the MRS Urban zoned area (zoned Urban Development under TPS2) and is classified as an Access Road under the MRWA Functional Road Hierarchy.

The subject site's exposure to three roads, including the intersection of two regional roads, gives it prominence as a key entry point to the Byford locality, and well suited to commercial/retail activities reliant on passing trade exposure. However, as with any development adjacent regional roads and their intersections, careful consideration of vehicle access arrangements is necessary to ensure the safe and efficient operation of the road network. While detailed analysis of site-specific vehicle access arrangements is typically required at development application stage, a Transport Impact Assessment has been undertaken in support of this proposed structure plan amendment and is enclosed at **Appendix 7**.

SIDRA analysis of the subject site, assuming a commercial form of development reasonably capable of development on a site of this size, indicate that the key regional road intersections (South Western Highway / Thomas Road, and Hay Road / Thomas Road) will continue to operate at acceptable levels of service during the weekday peak period, and the impact on intersection operations comfortably accommodated within the existing practical road capacity under 2031 road traffic conditions. The construction of additional right and left turn pockets at the Thomas/Hay Road intersection may ultimately be necessary to accommodate development on the subject site, depending on the final land use and design configuration.

Furthermore, the level of traffic generated from potential commercial/retail development of the subject site is considered to have a negligible impact on the existing road safety risk profile.

Importantly, should any future development application for the subject site seek direct access to regional roads, this will require further detailed traffic assessment and demonstrated compliance with the provisions of WAPC *Development Control Policy 5.1 – Regional Roads (Vehicular Access)* (**DC5.1**).

In summary, the Transport Impact Assessment provided at **Appendix 7** demonstrates that the traffic levels potentially generated by a commercial/retail development on the subject site are capable of being accommodated safely and efficiently within the surrounding road network.

4.4 Bushfire risk

The subject site is located in an area designated as 'Bushfire Prone' by the Fire and Emergency Services (**FES**) Commissioner. *State Planning Policy 3.7: Planning in Bushfire Areas* (**SPP 3.7**) requires strategic planning proposals (including structure plan amendments) to be supported by a bushfire hazard level assessment / bushfire

attack level (**BAL**) contour plan, and the assessment of any identified bushfire hazard issues demonstrating compliance with bushfire protection criteria.

A BAL assessment report has been undertaken for the subject site by a Level 2 bushfire planning and assessment (BPAD) practitioner from Natural Area Consulting Management Services, and is enclosed at **Appendix 8** of this report. The assessment confirms a maximum BAL rating of BAL-12.5 applicable to the south eastern corner of the subject site, while the remainder of the site has no BAL rating. It also confirms that a commercial development on the subject site is compliant with relevant SPP3.7 objectives and associated bushfire protection criteria.

4.5 Activity centres hierarchy

The current approved structure plan provided for a hierarchy of activity centres to be provided across the Byford locality. The Byford Town Centre is planned to function as the principal centre of retail activity across the district, while a network of neighbourhood centres and smaller scale neighbourhood nodes are to be distributed across the remainder of the locality, serving 400m radius catchments.

As previously noted, however, subdivision and development of the area to date seen no local/neighbourhood scale retail offering delivered in any of the 'neighbourhood node' locations planned to service the population catchments south and west of the subject site. None of the three identified neighbourhood nodes within a 1km radius of the subject site have been developed for retail land uses as contemplated by the structure plan.

Pracsys have undertaken retail needs analysis (**RNA**) in support of the proposed structure plan amendment, in order to quantify levels of demand for convenience retail in the Byford area, and the potential impact of delivering such land uses on the subject site. Refer **Appendix 9** for a copy of the RNA report.

Having regard for both existing and planned activity centres in the Byford locality, the RNA identified a sizable undersupply of 10,300m^2 - 11,000m^2 of convenience retail floorspace as compared with Greater Perth and National supply rates. Gap analysis for other commercial uses also identified an undersupply of 6,000m^2 of commercial floorspace in the locality. Given the size of the site, and an assumed potential floorspace of some 1,000m^2, the site's potential development for commercial/retail uses is not expected to negatively impact on the Byford Town Centre, nor any other nearby neighbourhood / local centres.

In summary, there is an identified shortfall in the existing/planned supply of retail and commercial floorspace in the Byford locality, particularly the north eastern portion surrounding the subject site. While a commercial rezoning of the site was refused in 2013 on the grounds that it could undermine efforts to deliver the Byford Town Centre, significant new retail developments have now been delivered in the Byford Town Centre, providing an important anchor supporting the establishment of other surrounding activities. Nonetheless, the complete lack of any local convenience retail in the walkable catchments surrounding the subject site presents an issue that can't be addressed simply through the development of a Town Centre some 1.5 – 1.7km away.

The provision of retail/commercial land uses on the subject site is well within the existing and planned floorspace capacity of the area, would provide a level of service currently not available to a large existing community, and would not undermine the function/development of other planned centres in the area. For these reasons, the development of commercial/retail land uses on the subject site is considered to be consistent with the local activity centres hierarchy and the objectives of State Planning Policy 4.2 – Activity Centres for Perth and Peel (**SPP4.2**).

4.6 Liveable Neighbourhoods

Liveable Neighbourhoods is an operational policy of the WAPC used to guide structure planning and subdivision of greenfield and large brownfield (urban infill) sites across Western Australia. Element 1 of Liveable Neighbourhoods addresses the key principles of community design and structure, while Element 2 provides further detailed guidance with respect to activity centres and employment. At present, the existing structure plan and lack of any neighbourhood/local centres in the locality surrounding the subject site is contrary to Liveable Neighbourhoods objectives and requirements, including:

Element 1, O2 *– To provide safe, convenient and attractive neighbourhoods and towns that meet the diverse and changing needs of the community and offer a wide choice of housing, leisure, local employment opportunity and associated community and commercial facilities.*

Element 7, O1 *– That new residential areas are provided with sufficient and appropriately located land for activity centres and other employment and business needs.*

Element 7, O4 *– To facilitate well-distributed town (district) and neighbourhood centres throughout the urban area, such that a substantial majority of dwellings are in a 400 to 500 metre radius of a centre, such centres can support, at a minimum, daily local retail, a post box and a public transport stop.*

Element 7, O9 *– To promote the restructuring of existing urban areas to improve the distribution of centres in walking distance of residences, and to upgrade the quality and function of existing centres to support mixed uses, public transport, walkability, intensification, sense of community, amenity, and reduced car travel.*

Element 7, R14 *– Neighbourhood centres should be located and distributed to provide a centre for most residents in a 400-500 m walk. Centres should be on sites that have adequate surrounding custom, sufficient traffic, and appropriate exposure and amenity to provide for the successful operation of the centre.*

Element 7, R28 *– Potential strategic business sites should be excluded from residential use. These sites may include freeway interchanges, frontages to freeways, many arterial road intersections, or sites with strategic suitability related to local resources.*

In discussing the function, location and design parameters for neighbourhood and smaller local scale centres, Liveable Neighbourhoods notes that:

- The majority will be quite small, with many local centres only comprising a corner store of 100-250 m^2 as the only shop and/or retail component.
- Small neighbourhood and local centres located to provide local retail, and possibly other services, in walking distance of most dwellings is a key element of Liveable Neighbourhoods.
- Neighbourhood and local centres cannot comprise just schools or parks, as these do not provide a sufficiently useful walkable node or regular destination for the majority of the population.
- It is better to have fewer centres with better viability. Too few will result in many residents not being in walking distance of any centre. The design and spacing of the arterial and neighbourhood connector street network will influence the location and frequency of successful neighbourhood centres.
- Successful centres generally require a minimum local residential population of approximately 2,000 people in a 400-450 m radius, locatied at an intersection of relatively busy streets with good through traffic levels.
- In limited circumstances, centres on busy arterials "*may include a service station with convenience store. To provide some local walking and urban amenity, these complexes can be designed to locate the convenience store as a corner building, with the petrol pumps tucked in behind*".

Figure 5 below illustrates the broad structure and distribution of town and neighbourhood level centres as advocated by Liveable Neighbourhoods.

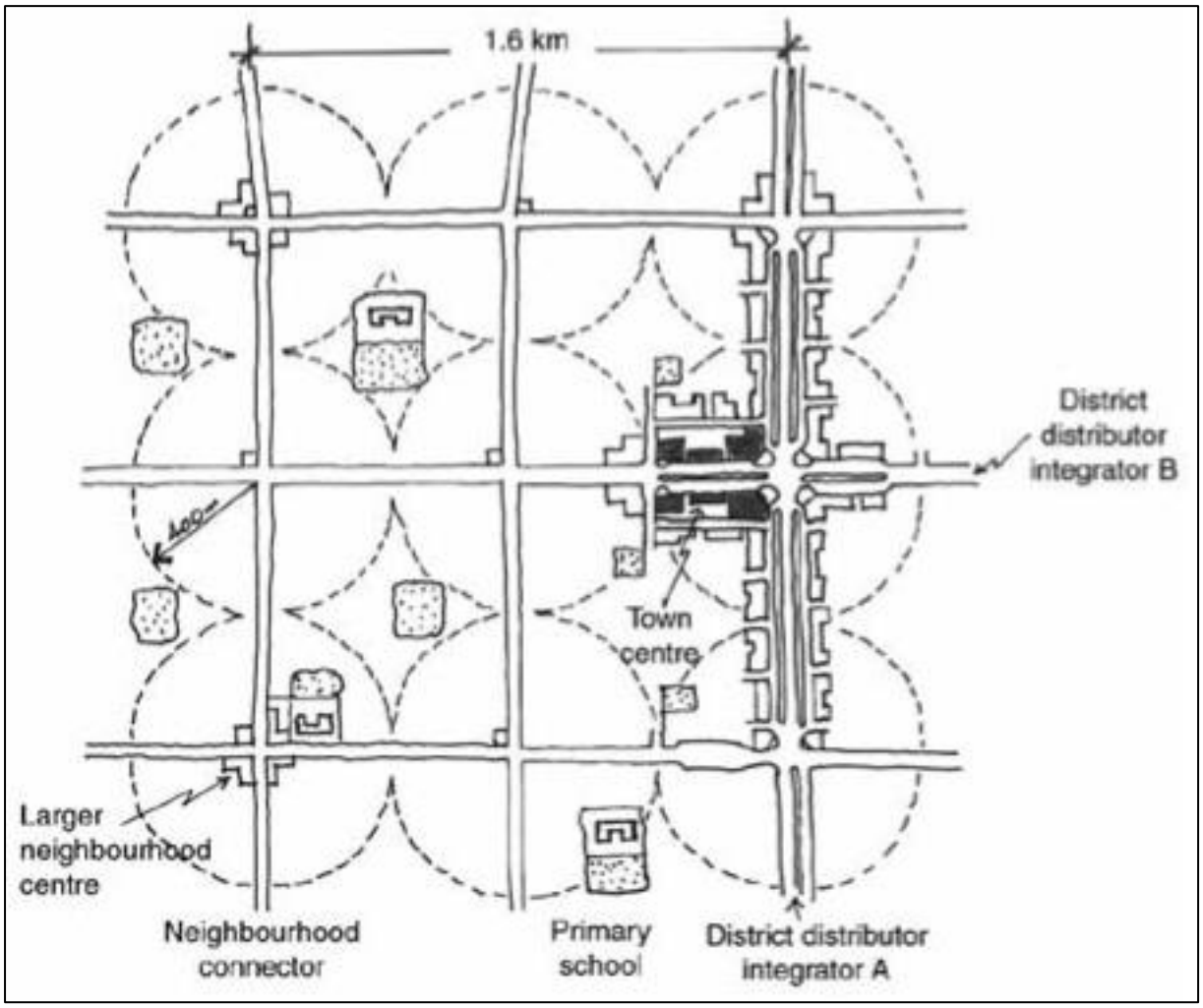


Figure 5: Liveable Neighbourhoods community design / neighbourhood structure (*Liveable Neighbourhoods, 2009*)

The subject site is well located and configured to accommodate land uses akin to a local centre, being conveniently located to serve an existing underserviced walkable residential catchment and at the corner of a key intersection. This would help to improve Structure Plan alignment with Liveable Neighbourhoods objectives/requirements and deliver better planning outcomes at the local/neighbourhood level.

4.7 Sub-regional planning framework

The South Metropolitan Peel Sub-regional Planning Framework (**framework**) provides the long-term integrated planning framework for land use and infrastructure to guide future growth across the sub-region. The framework has been developed to inform future rezoning proposals, strategies, schemes and structure plans.

Plan 1 of the framework identifies the Byford locality and subject site as 'Urban', Thomas Road / South Western Highway as 'Regional Roads (Existing)', and the Byford Town Centre as a 'District Centre'. Notably, the plan also identifies land on the northern side of Thomas Road and west of South Western Highway as a combination of 'Urban' and 'Urban Investigation', effectively envisaging a continuous corridor of urban land between Byford and Darling Downs, extending north from the Byford Structure Plan area.

The framework calls for a more consolidated urban form, with growth to be focused on underutilised land ensuring a cost-effective urban structure. Consolidation of urban areas also require improved access to commercial facilities, leading to an increase in employment self-sufficiency, reducing car dependency and integrating nodes with existing infrastructure. By addressing the relationship between where people live and work, the framework seeks to create a more sustainable and resilient sub-region. As stated on page 19 of the framework:

> *The framework seeks to optimise the use of land close to existing transport infrastructure and key centres of activity and community amenity. To achieve this, a focus for both infill and new urban areas will be the development and evolution of new and existing activity centres into vibrant, mixed-use community hubs that are integrated with high-quality public transport connections.*

The subject site is located on the corner of two regional road corridors serviced by frequent high-quality bus routes, with bus stops located on both Thomas Road and South Western Highway in immediate proximity of the subject site. Furthermore, the subject site is located approximately 250m east of the rail corridor being upgraded to accommodate an extension of passenger rail services to Byford as part of the METRONET project. This is shown as 'Passenger rail – proposed (Stage 1 METRONET)' on Plan 1 of the framework. It is understood that the METRONET team is currently working with the Shire to explore potential station locations within Byford, within the area identified in **Figure 6** below, extending along the rail corridor in close proximity to the subject site.

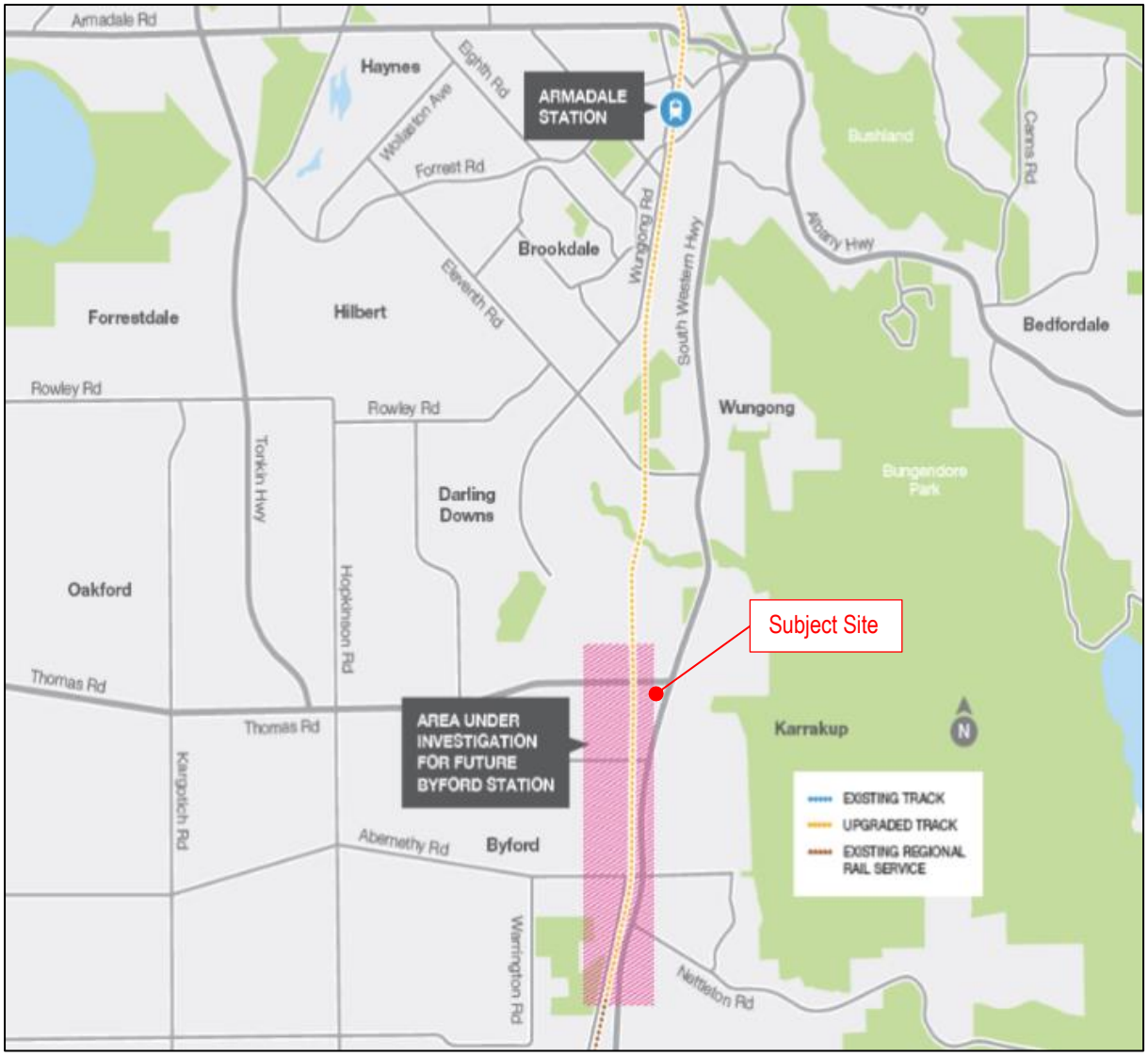


Figure 6: Investigation area for future Byford station (Source: METRONET)

A structure plan amendment to expand the land use permissibility for commercial/retail land uses on the subject site will help to create a more walkable and self-sufficient residential cell. In addition, the provision of commercial uses and activities at the intersection of key roads and public transport (bus) routes, and in close proximity to future urban development north of Thomas Road (along with a potential rail station in close proximity) is considered to be consistent with the objectives and vision established in the framework.

4.8 Summary and analysis of appropriate land uses

The subject site's identification as 'Residential R20' under the structure plan has effectively sterilised the land from any viable development outcome, given the contaminated site land use restrictions and range of other considerations outlined above. An amendment to the structure plan is warranted to reclassify the site, such that a wider range of appropriate commercial/retail land uses are capable of being approved (without requiring a further structure plan to be prepared over the final remaining undeveloped property within the precinct).

In order to determine the suitability of future land uses on the subject site, a selection of land uses listed in TPS2 have been assessed against the key site constraints and opportunities, with a summary of this assessment provided in **Table 1** below.

The list of land uses is not exhaustive, but generally reflects the range of land uses typically considered for development on a site of this (relatively modest) size, configuration and location. For example, while 'Shopping Centre' is a listed land use within the TPS2 zoning table, but it has not been considered for this site as the land use definition limits it to an integrated group of activities being in excess of 5,000 square metres of gross leasable area. This would significantly exceed the extent of floorspace reasonably capable of delivery on the subject site, accounting for other typical access, parking and landscaping requirements).

Table 1: Assessment of various potential land uses against key site constraints/opportunities

TPS2 Land Use	**Contaminated site** (no sensitive uses permitted)	**Traffic noise** (additional development requirements for sensitive uses)	**Traffic generation** (sufficient capacity in surrounding road network)	**Local services** (meets unmet demand for commercial / retail floorspace in a walkable catchment)	**Supported by planning framework** (optimise land uses close to transport infrastructure)
Aged and Dependent Persons' Dwelling					
Child Minding Centre					
Consulting Rooms					
Convenience Store					
Fast Food/ Takeaway					
Market					
Medical Centre					
Office					
Private Recreation					
Residential (including home businesses / occupation)					
Restaurant					
Service Station					
Shop					
Showroom					

Legend

Land use is well suited to address identified constraint/opportunity	Land use is capable of addressing identified constraint/opportunity	Land use is not well suited to address identified constraint/opportunity

Based on the above matrix, the following uses are assessed as being most suitable for establishment on the subject site, having regard for key site constraints/opportunities.

- Convenience Store
- Fast Food/ Takeaway
- Market
- Office
- Restaurant
- Service Station
- Shop
- Showroom

By comparison, the following uses are assessed as being least suitable for establishment on the subject site, having regard for key site constraints/opportunities.

- Aged and Dependent Persons Dwelling;
- Child Minding Centre;
- Residential (all forms).

As per the WAPC's *Structure Plan Framework* (August 2015), a structure plan "*is to align with the local planning scheme*", and the structure plan map is to show "*proposed zones and reservations, based on the zones and reservations listed in the local planning scheme*". While the structure plan refers to 'neighbourhood nodes', this does not align with any zone in TPS2, and could be a contributing factor to why none of the surrounding planned neighbourhood nodes have been delivered with any convenience retail land uses. For this reason, it is considered necessary to apply an alternate TPS2 zoning classification to the subject site.

Having regard for the land use permissibility arrangements presented in the zoning table of TPS2, it is considered that the 'Commercial' zone is most closely aligned with the suitability of land uses as described above. This comparative assessment is summarised below:

Table 2: Permissibility of various land uses in the TPS2 Commercial zone

TPS2 Land Use	Suitability given site constraints/opportunities	Permissibility within 'Commercial' zone of TPS2
Aged and Dependent Persons' Dwelling	Low	Not permitted
Child Minding Centre	Low	Discretionary
Consulting Rooms	Medium	Permitted
Convenience Store	High	Discretionary (following advertising)
Fast Food/ Takeaway	High	Permitted
Market	High	Discretionary
Medical Centre	Medium	Permitted
Office	High	Permitted
Private Recreation	Medium	Discretionary
Residential (including home businesses / occupation)	Low	Not permitted
Restaurant	High	Permitted
Service Station	High	Discretionary (following advertising)
Shop	High	Permitted
Showroom	High	Discretionary

5 Proposed Amendment

Based on the analysis provided in the preceding sections of this report, this application seeks to amend the Byford Structure Plan to reclassify the subject site from an indicative 'Residential (R20)' zoning to a 'Commercial' zoning.

More specifically, it is proposed to:

- Amend the structure plan map by adding a new 'Commercial' classification to the Legend, and applying the associated 'Commercial' colour coding to the subject site (thereby replacing the existing 'Residential (R20') classification).
- Insert the following provision within Part 1 of the structure plan text:

  6.8 Precinct 9
  Land use permissibility for the Commercial site at the corner of Thomas Road and South Western Highway is to be in accordance with the Commercial Zone requirements of the Scheme. Notwithstanding any other requirement of this structure plan, no further precinct level structure planning is required prior to development of the Commercial site.

- Renumber the following provisions accordingly.

Refer to **Appendix 10** for copy of the proposed (amended) Byford Structure Plan map.

Although substantially addressed in the preceding sections of this report, the proposed structure plan amendment is justified and warranted on the following grounds.

1. The existing 'Residential (R20)' zoning classification of the subject site is effectively sterilising it from supporting a viable development outcome, as residential and other sensitive land uses are prohibited from being developed on the land due to its classification under the *Contaminated Sites Act 2003*.

2. Even if the site was free of any site contamination constraints, the development of residential or other noise sensitive land uses would require built form treatments and a design configuration inappropriate on a prominent corner site at the entry to the Byford locality. Even with such treatments, it will be difficult to comply with State Planning Policy noise targets for outdoor areas. A 3m high noise wall along the Thomas Road and South Western Highway frontages, combined with increased building standards to mitigate traffic noise, would present a poor outcome in terms of streetscape amenity, and impact viability due to increased development costs.

3. The subject site has direct exposure and frontage to the intersection of two regional roads (Thomas Road and South Western Highway), along with direct frontage to a third local road (Hay Road). This level of exposure to passing trade, at a prominent entry point to the Byford locality, warrants the consideration of commercial/retail uses on the subject site, acknowledging its historic use as a service station site. The opportunities to incorporate public art are also significantly greater for a commercial/retail development site, and would be well suited to such a prominent corner location.

4. Traffic reporting undertaken in support of this structure plan amendment demonstrates that traffic levels potentially generated by a commercial/retail development on the subject site are capable of being accommodated safely and efficiently within the surrounding road network.

5. The surrounding locality, including existing residential properties to the south and west of the subject site, is not provided with any convenience retail or other commercial floorspace serving the day to day needs of residents, contrary to contemporary principles of neighbourhood design as detailed in the state planning framework and Liveable Neighbourhoods. The residential catchment around the subject site would benefit from the provision of a limited amount of retail/commercial floorspace on the subject site, to potentially serve day to day needs and reduce unnecessary travel.

6. The Retail Needs Assessment undertaken in support of this structure plan amendment demonstrates that there is a sizable undersupply of existing/planned retail floorspace in the Byford locality, in the order of 10,300m^2 - 11,000m^2. There is also an identified commercial floorspace undersupply of approximately 6,000m^2 in the locality. Given the size of the subject site and the scale of floorspace potentially achieved, its potential development for commercial/retail uses is not expected to negatively impact on the Byford Town Centre, nor any other nearby neighbourhood / local centres.

7. The South Metropolitan Peel Sub-regional Planning Framework promotes a more consolidated urban form, with growth to be focused on underutilised land ensuring a cost-effective urban structure. It seeks to optimise the use of land close to existing transport infrastructure, and the development of new and existing activity centres integrated with high-quality public transport connections. The subject site warrants optimisation for commercial/retail activities given it is significantly underutilised, located at the intersection of important regional roads and bus routes, and is in close proximity to the future passenger rail line and potential Byford railway station location.

8. An assessment of various potential land uses as defined by TPS2 has found that the site is particularly well suited to the establishment of commercial/retail land uses such as Convenience Store, Fast Food / Takeaway, Market, Office, Restaurant, Service Station, Shop and Showroom. By comparison, sensitive land uses such as Aged and Dependent Persons Dwelling, Child Minding Centre and all forms of Residential were found to be poorly suited to the subject site, given its unique opportunities and constraints. Based on this, and having regard for TPS2 land use permissibility arrangements, it is considered that a 'Commercial' zoning is most appropriate for the subject site.

6 Conclusion

On behalf of the landowner of Lot 2 (640) South Western Highway, Byford, Planning Solutions seeks to amend the Byford Structure Plan pursuant to clause 29(1) of the Deemed Provisions of the *Planning and Development (Local Planning Schemes) Regulations 2015.* More specifically, we seek the approval of the WAPC to modify the subject site's classification on the structure plan map, from 'Residential (R20)' (existing) to 'Commercial' (proposed).

The proposed structure plan amendment is consistent with the principles of orderly and proper planning, and warrants the support of the Shire and approval of the WAPC for the following reasons:

- The existing 'Residential (R20)' classification of the subject site is effectively sterilising it from development due to the land's contaminated status and restrictions under the *Contaminated Sites Act 2003*.

- The development of residential or other noise sensitive land uses would require built form treatments (including a 3m high noise wall along the Thomas Road and South Western Highway frontages) resulting in a poor design outcome in terms of streetscape amenity at a prominent corner location.

- The subject site has direct exposure to passing trade at a prominent entry point to the Byford locality, warranting the consideration of commercial/retail uses.

- Traffic levels potentially generated by a commercial/retail development on the subject site are capable of being accommodated safely and efficiently within the surrounding road network.

- The surrounding residential locality has no convenience retail or other commercial offering serving the day to day needs of residents and would benefit from the provision of a limited amount of retail/commercial floorspace on the subject site.

- There is a sizable undersupply of existing / planned retail and commercial floorspace in the Byford locality. Given the size of the subject site and the scale of floorspace potentially achieved, its potential development for commercial/retail uses is not expected to negatively impact on the Byford Town Centre, nor any other nearby centres.

- Optimisation of commercial / retail activities on the subject site is consistent with sub-regional planning framework objectives, given its location at the intersection of important regional roads and bus routes, and is proximity to the future passenger rail line and potential Byford railway station location.

- An assessment of various potential land uses as defined by TPS2 has found that the site is particularly well suited to the establishment of commercial/retail land uses, but is poorly suited to accommodate sensitive land uses such as Aged and Dependent Persons Dwelling, Child Minding Centre and all forms of Residential.

We respectfully seek WAPC approval of the proposed structure plan amendment at the earliest opportunity, and would be pleased to engage further with the Shire and/or WAPC in order to resolve the existing land use planning issues currently preventing the site's development.

Appendix 1
Certificate of Title, Deposited Plan and Memorial Documents

Appendix 2
Current Byford Structure Plan

Appendix 3
Scheme Amendment No.178 Determination Notice

Appendix 4
Draft Byford District Structure Plan Map

Appendix 5
Acoustic Review

Appendix 6
Basic Summary of Records Search

Appendix 7
Transport Impact Statement

Appendix 8
Transport Impact Statement

Appendix 9
Bushfire Attack Level (BAL) Assessment

Appendix 10
Proposed (amended) Structure Plan Map

WESTERN AUSTRALIA

REGISTER NUMBER	
2/D35013	
DUPLICATE EDITION	DATE DUPLICATE ISSUED
2	21/5/2018

VOLUME 1667 FOLIO 185

RECORD OF CERTIFICATE OF TITLE

UNDER THE TRANSFER OF LAND ACT 1893

The person described in the first schedule is the registered proprietor of an estate in fee simple in the land described below subject to the reservations, conditions and depth limit contained in the original grant (if a grant issued) and to the limitations, interests, encumbrances and notifications shown in the second schedule.

REGISTRAR OF TITLES

REGISTRAR OF TITLES WESTERN AUSTRALIA

LAND DESCRIPTION:

LOT 2 ON DIAGRAM 35013

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

BYFORD SPV PTY LTD OF 18 GREBE STREET STIRLING WA 6021

(T N900144) REGISTERED 18/5/2018

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)

1. *N792571 MEMORIAL. CONTAMINATED SITES ACT 2003 REGISTERED 20/12/2017.

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.
* Any entries preceded by an asterisk may not appear on the current edition of the duplicate certificate of title.
Lot as described in the land description may be a lot or location.

----------END OF CERTIFICATE OF TITLE----------

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND:	1667-185 (2/D35013)
PREVIOUS TITLE:	106-109A
PROPERTY STREET ADDRESS:	640 SOUTH WESTERN HWY, BYFORD.
LOCAL GOVERNMENT AUTHORITY:	SHIRE OF SERPENTINE-JARRAHDALE

CT 1667 0185 F

1667 185

Transfer C773965

Volume 106 Folio 109A

WESTERN AUSTRALIA

CERTIFICATE OF TITLE

UNDER THE "TRANSFER OF LAND ACT, 1893" AS AMENDED

1667 VOL. 185 FOL.

Page 1 (of 2 pages)

I certify that the person described in the First Schedule hereto is the registered proprietor of the undermentioned estate in the undermentioned land subject to the easements and encumbrances shown in the Second Schedule hereto.

N. J. Smyth

REGISTRAR OF TITLES

OFFICE OF TITLES WESTERN AUSTRALIA

Dated 18th May, 1984

ESTATE AND LAND REFERRED TO

Estate in fee simple in portion of Wungong Lot 67 and being Lot 2 on Diagram 35013, delineated and coloured green on the map in the Third Schedule hereto, limited however to the natural surface and therefrom to a depth of 60.96 metres.

FIRST SCHEDULE (continued overleaf)

Tan Thong Kie of 51B Langham Street, Nedlands, Retired Solicitor.

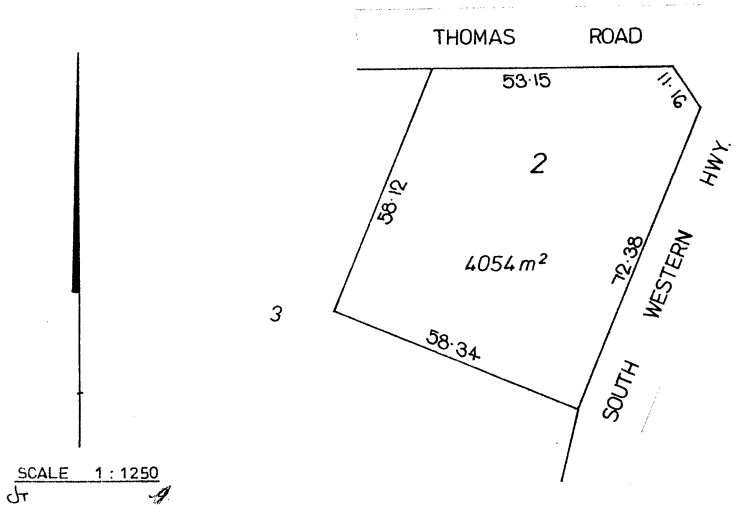
SECOND SCHEDULE (continued overleaf)

1. LEASE C360299 to The Shell Company of Australia Ltd., of 200 St. George's Terrace, Perth, for five years from 1.11.79. Registered 20.5.82 at 9.05 o'c.

N. J. Smyth

REGISTRAR OF TITLES

THIRD SCHEDULE



PERSONS ARE CAUTIONED AGAINST ALTERING OR ADDING TO THIS CERTIFICATE OR ANY NOTIFICATION HEREON

NOTE: RULING THROUGH AND SEALING WITH THE OFFICE SEAL INDICATES THAT AN ENTRY NO LONGER HAS EFFECT. ENTRIES NOT RULED THROUGH MAY BE AFFECTED BY SUBSEQUENT ENDORSEMENTS.

72009/12/77–45M–S/2860

LT. 37

FIRST SCHEDULE (continued)

NOTE: RULING THROUGH AND SEALING WITH THE OFFICE SEAL INDICATES THAT AN ENTRY NO LONGER HAS EFFECT. ENTRIES NOT RULED THROUGH MAY BE AFFECTED BY SUBSEQUENT ENDORSEMENTS.

REGISTERED PROPRIETOR	INSTRUMENT NATURE	INSTRUMENT NUMBER	REGISTERED	TIME	SEAL	INITIALS

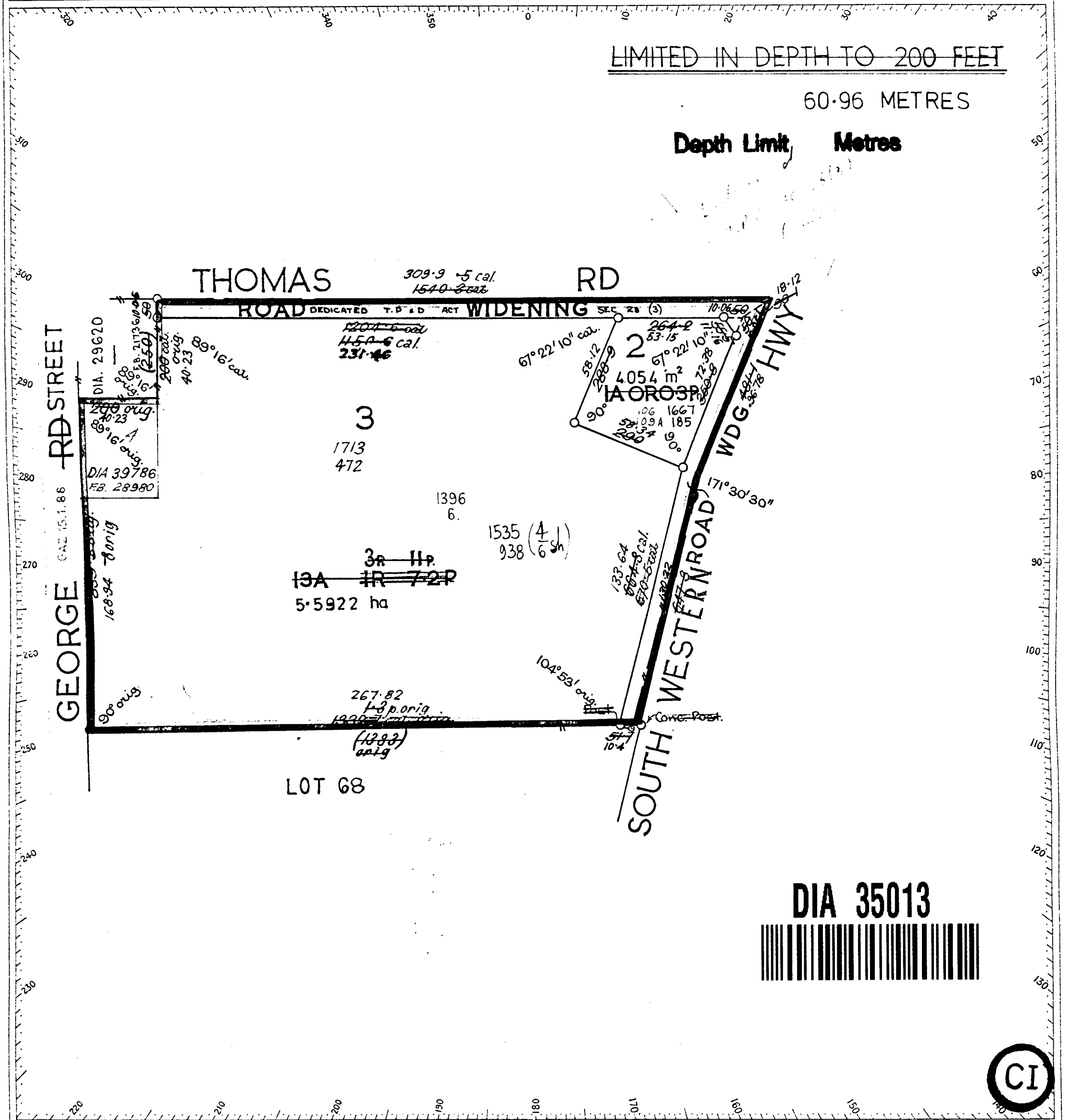
SECOND SCHEDULE (continued)

NOTE: RULING THROUGH AND SEALING WITH THE OFFICE SEAL INDICATES THAT AN ENTRY NO LONGER HAS EFFECT. ENTRIES NOT RULED THROUGH MAY BE AFFECTED BY SUBSEQUENT ENDORSEMENTS.

INSTRUMENT NATURE	INSTRUMENT NUMBER	PARTICULARS	REGISTERED	TIME	SEAL	INITIALS	CANCELLATION	NUMBER	REGISTERED OR LODGED	SEAL	INITIALS
Caveat	F776419	Lodged 9.1.1995 at 15.14 hrs.			OFFICE OF TITLES WESTERN AUSTRALIA	JP					

CERTIFICATE OF TITLE VOL. 1667 185

Town or District.	Number of Lot or Location.	Field Book.	Scale	Certificate in which Land is Vested.	Area
WUNGONG	Part Lot 67	26103	1: 2376 ~~3 Chains to one inch.~~	Vol. 1288 Fol. 662	~~A. R. P. 14. 3. 11·3 Green. 1 1 10·1 Brown. 16. 0. 21·4 Total.~~



CERTIFICATE	Approved by Town Planning Board
I hereby certify that this survey was performed by me personally (or under my own personal supervision, inspection and field check) in strict accordance with the Licensed Surveyors (Guidance of Surveyors) Regulations, 1961.	acting Chairman
Licensed Surveyor. Date	Date 20/9/67

Approved	On	Registered	Diagram No.
Inspector of Plans and Surveys. Examined Date 12 · 3 · 68	Plan Diagram Index Plan ~~8927~~ PEEL 5000 09.15	$2.00 1/85632 2/9/67	35013

J. Kelly Cal Bk 21 p 35.

Docket Dia 22801.

INSTRUCTIONS

1. If insufficient space in any section, Additional Sheet Form B1, should be used with appropriate headings. The boxed sections should only contain the words "see page....."

2. Additional Sheets shall be numbered consecutively and bound to this document by staples along the left margin prior to execution by the parties.

3. No alteration should be made by erasure. The words rejected should be scored through and those substituted typed or written above them, the alteration being initialled by the persons signing this document and their witnesses.

NOTES

1. **DESCRIPTION OF LAND**
   Lot and Diagram/Plan/Strata/Survey-Strata Plan number or Location name and number to be stated.
   Extent - Whole, part or balance of the land comprised in the Certificate of Title to be stated. If this document relates to only part of the land comprised in the Certificate of Title further narrative or graphic description may be necessary. The volume and folio number to be stated.

2. **REGISTERED PROPRIETOR**
   State full name and address of the Registered Proprietors as shown on the Certificate of Title and the address / addresses to which future notices can be sent.

3. **INFORMATION CONCERNING SITE CLASSIFICATION**
   Include information concerning site classification as either: contaminated – restricted use, contamination – remediation required, remediated for restricted use or possibly contaminated – investigation required.

4. **CHIEF EXECUTIVE OFFICER'S ATTESTATION**
   This document must be signed by or on behalf of the Chief Executive Officer, Department of Water and Environmental Regulation under Section 91 of Contaminated Sites Act 2003. An Adult Person should witness this signature. The address and occupation of the witness must be stated.

EXAMINED

N792571 ML
20 Dec 2017 08:47:04 Perth

MEMORIAL
CONTAMINATED SITES ACT 2003

LODGED BY
Department of Water and Environmental Regulation

ADDRESS
Level 4, 168 St Georges Terrace
Perth, WA 6000

PHONE No. 1300 762 982

FAX No. (08) 9333 7575

REFERENCE No. 6218

ISSUING BOX No. 888V

PREPARED BY
Contaminated Sites
Department of Water and Environmental Regulation

ADDRESS
Level 4, 168 St Georges Terrace
Perth, WA 6000

PHONE No. 1300 762 982 FAX No. (08) 9333 7575

INSTRUCT IF ANY DOCUMENTS ARE TO ISSUE TO OTHER THAN LODGING PARTY

TITLES, LEASES, DECLARATIONS ETC LODGED HEREWITH

1.
2.
3.
4.
5.
6.

Received Items

Nos. 0.

Receiving Clerk

Lodged pursuant to the provisions of the TRANSFER OF LAND ACT 1893 as amended on the day and time shown above and particulars entered in the Register.

APPROVAL NUMBER

DEPARTMENT OF WATER AND ENVIRONMENTAL REGULATION
Client ID 557

WESTERN AUSTRALIA
TRANSFER OF LAND ACT 1893 AS AMENDED

MEMORIAL

CONTAMINATED SITES ACT 2003

SECTION 58(1) (a) (i) (I) (II) (III) (IV)

DESCRIPTION OF LAND (Note 1)	EXTENT	VOLUME	FOLIO
LOT 2 ON DIAGRAM 35013	Whole	1667	185

REGISTERED PROPRIETOR (Note 2)

MICHAEL ROBERT ELPHICK OF 23 BROWN STREET, CLAREMONT
LAN ANWAR OF 17 CARNHILL CIRCLE, HELIOS RESIDENCES, 11-08, SINGAPORE 229816

AS EXECUTORS OF THE WILL OF THONG-KIE TAN WHO DIED ON 29.07.2012

INFORMATION CONCERNING SITE CLASSIFICATION (Note 3)

Under the Contaminated Sites Act 2003, this site has been classified as "remediated for restricted use". For further information on the contamination status of this site, please contact Contaminated Sites at the Department of Water and Environmental Regulation.

Dated this Eighteenth day of December Year 2017

CHIEF EXECUTIVE OFFICER'S ATTESTATION (Note 4)

Lomas Capelli
A/MANAGER
DELEGATE OF THE CHIEF EXECUTIVE OFFICER
DEPARTMENT OF WATER AND ENVIRONMENTAL REGULATION
UNDER SECTION 91 OF THE
CONTAMINATED SITES ACT 2003

SIGNATURE OF WITNESS
FULL NAME: Christopher Chau
ADDRESS: 168 St Georges Tce,PERTH WA 6000
OCCUPATION: Senior Business Systems Officer

BYFORD STRUCTURE PLAN

Operative Part

DISCLAIMER

This is a copy of the Operative Part to the Byford Structure Plan. Whilst all care has been taken to accurately portray the current Structure Plan provisions, no responsibility shall be taken for any omissions or errors in this documentation.

Updated 10 September 2009

Prepared by the Shire of Serpentine-Jarrahdale

Trim Document Number: E09/5682

SCHEDULE OF MODIFICATIONS TO OPERATIVE PART

Modification No.	General Description	Council decision	WAPC decision
1	Creation of Operative Part	22 June 2009	14 August 2009
2	Reduction in Abernethy Road width from 40 metres to 30 metres (Clause 4.2.1)	27 July 2009	1 September 2009

Byford Structure Plan
Schedule 1 - Operative Part

As provided for under the provisions of the Shire of Serpentine-Jarrahdale Town Planning Scheme No. 2 ('the Scheme'), this part of the Byford Structure Plan has the same force and effect as a provision, standard or requirement of the Scheme. In the instance that there is an inconsistency between the Structure Plan and the Scheme, the Scheme shall prevail.

This part shall form part of the provisions of the Byford Structure Plan, pursuant to clause 5.18.2.1 and Appendix 15, section DA 3, clause (1) of the Scheme.

1.0 STRUCTURE PLAN AREA

The land subject of the Structure Plan is depicted on Figure 1 as 'The Structure Plan Area' and is bounded by Thomas Road to the north, Hopkinson Road and the future Tonkin Highway to the west, Cardup Siding Road to the south and the Byford townsite and Darling Range foothills to the east. The Structure Plan Area excludes the Byford Trotting Centre and surrounding rural residential area.

2.0 STRUCTURE PLAN

2.1 Figure No.1 - Byford Structure Plan

2.2 The Byford Structure Plan is a District Structure Plan. The Structure Plan provides the broad-district level planning framework for development of the Structure Plan area. It provides the broad disposition of land use, major roads, rail and other community infrastructure. It is intended that the Structure Plan will form the general basis for subsequent preparation of Local Structure Plans on a precinct-basis.

3.0 REQUIREMENT FOR THE PREPARATION OF LOCAL STRUCTURE PLANS

3.1 This Structure Plan provides indicatives zonings, residential density codings and detailed development standards and requirements. Consequently, no subdivision or development should be commenced or carried out until such time as a Local Structure Plan has been prepared, adopted by Council and approved by the Western Australian Planning Commission for the relevant precinct within the Structure Plan area.

3.2 In accordance with Appendix 15, Section DA 3, Clause 2 (a) of the Scheme, Local Structure Plans shall be prepared for a geographical area not smaller than those precincts depicted in Plan 15A of the Scheme, unless otherwise resolved by Council.

3.3 Local Structure Plans for the district (as applicable to the respective precinct) shall address the requirements set out in Clause 5.18.2.4 of the Scheme.

3.4 Notwithstanding Clause 3.1 above, any application for development submitted before a Structure Plan has been adopted by Council and approved by the Western Australian Planning Commission shall be considered in accordance with clause 5.18.7 of the Scheme.

4.0 RELEVANT PLANNING CONSIDERATIONS – DISTRICT STRUCTURE PLAN AREA

The planning considerations outlined in this section shall apply to the entire District Structure Plan Area. The provisions in this section shall be read in conjunction with the Zone-specific provisions outlined in Section 5, the Precinct- specific provisions outlined in Section 6 and the General notations outlined in Section 7.

4.1 *Public Open Space*

4.1.1 The Structure Plan provides 8.6% public open space. The balance 1.4% public open space will be required to be identified in Local Structure Plans and to be given up at the time of subdivision.

4.2 Road Network

4.2.1 Thomas Road, Abernethy Road and Orton Road are to be widening to accommodate stormwater in accordance with the Byford Urban Stormwater Management Strategy. The Structure Plan requires the final width of Abernethy Road to be 30 metres unless otherwise determined at the local structure plan stage. The general locations of Thomas Road, Abernethy Road and Orton Road is shown as number 6 on the Structure Plan.

4.2.2 The future construction of Abernethy Road should include measures to provide an amenity buffer to the residential land uses on the south side of Abernethy Road. Such measures could include dense landscaping, appropriate fencing or bunding. Abernethy Road/Tonkin Highway may interact by means of a grade separation. The general location of Abernethy Road is shown as number 12 on the Structure Plan.

4.3 Pedestrian and Cycle Network

4.3.1 A pedestrian and bicycle plan shall be provided as part of each Local Structure Plan, in accordance with the Shire's Bicycle and Pedestrian Master Plan.

4.4 Land within 200 metres of the Byford Trotting Complex

4.4.1 Prospective purchasers of all new residential lots created within 200 metres of any lot contained within the Byford Trotting Complex will be required to be notified that they are within proximity of the Trotting Complex and associated land uses. The 200 metres shall be measured from the dashed-line around the Trotting Complex, depicting the boundary of the Structure Plan Area.

4.5 *Equestrian Use and Bridle Trails*

4.5.1 Equestrian use within the rural residential buffer is limited to one horse per lot stabled at the rear of the lot adjacent to the bridle path. No connection between the bridle path and public road is to be made. This provision shall apply to those locations marked with a number 2 on the Structure Plan.

4.6 ***Land Abutting Rural Residential Areas***

4.6.1 Notwithstanding land having a classification of Residential (R20) where such land abuts land classified Rural Residential an appropriate (lower) interface density of development may be required to be implemented.

4.6 Noise Attenuation to Tonkin Highway

4.6.1 A further review of noise attention requirements and options for land adjacent to Tonkin Highway is required in Local Structure Plans. The general locations for these requirements is shown as number 25 on the Structure Plan.

5.0 RELEVANT PLANNING CONSIDERATIONS – SPECIFIC ZONES

The planning considerations outlined in this section shall only apply to those zones depicted on the Structure Plan. The provisions in this section be read in conjunction with the Structure Plan-wide provisions outlined in Section 4, the precinct-specific provisions in Section 6 and the General notations outlined in Section 7.

5.1 Town Centre

5.1.1 Town Centre requires the preparation and completion of a Local Structure Plan, complete with detailed area plans and design guidelines. The Local Structure Plan is to include an investigation into increased residential densities within the 800 metre walkable catchment and its relationship with transit oriented urban design; the location, nature, role, relationship and distribution of different activities within the town centre. Any change to residential densities or uses within the 800 metre walkable catchment of the town centre will be subject to a separate modification to the District Structure Plan and associated community consultation. The general location of the Town Centre zone is shown as number 17 on the Structure Plan.

6.0 RELEVANT PLANNING CONSIDERATIONS – SPECIFIC PRECINCTS

Plan 15A of the Scheme defines precincts for the preparation of Local Structure Plans. The following provisions are intended to be apply to the specific precinct. These provisions shall be read in conjunction with the Structure Plan-wide provisions outlined in Section 4, the Zone-specific provisions outlined in Section 5 and the General notations outlined in Section 7.

6.1 Precinct 1

6.1.1 The final location of the intersection with Thomas Road will be determined through further detailed planning. The indicative location is shown as number 24 on the Structure Plan map.

6.2 Precinct 2

6.2.1 Further consideration for the retention of the homestead building within Lot 7 Briggs Road will be required during Local Structure Planning including consultation with DET (if required) and further detail as to the proposed function and suitability of the building for community purposes. The general location of the homestead building is shown as number 15 on the Structure Plan.

6.2.2 The exact location of the primary school within Lot 7 Briggs Road is to be determined at the Local Structure Plan Stage. The indicative location for the primary school is shown as number 16 on the Structure Plan.

6.3 Precinct 4

6.3 Intersection treatment of new Town Centre District Distributor Integrator 'B' Road and Larsen Road is to be reviewed as part of the Local Structure Plan. The indicative location of the District Distributor Road is shown as number 3 on the Structure Plan.

6.4 Precinct 5

6.4.1 The final location of the primary school and the corresponding location of the Rural Residential Zone shall be determined through the Local Structure Plan, in consultation with the Department of Education and Training. The indicative location of the primary school is shown as number 23 on the Structure Plan.

6.5 Precinct 6

6.5.1 The existing waterway in the Town Centre will be subject to water sensitive urban design principles at the detailed engineering design stage. The specific width of the water way will be determined through the Local Structure Plan. The general location of the existing waterway is shown as number 18 on the Structure Plan.

6.5.2 Additional area may be required for drainage purposes and shall be determined through detailed structure planning, including the preparation and finalisation of a drainage and nutrient management plan.

6.5.3 In the Rural Residential zone, in close proximity to waterway, no horses are permitted. The indicative location of this zone is illustrated as number 27 on the Structure Plan.

6.5.4 The final alignment of the Town Centre Distributor Road through Lot 1 will be determined through detailed structure planning. The indicative location of the road is illustrated as number 28 on the Structure Plan.

6.6 Precinct 7

6.6.1 Any Local Structure Plans for the land abutting the south side of Abernethy Road should include measures to provide for an additional buffer between Abernethy Road and the Rural land on the north side of Abernethy Road. Such measures could include, but are not limited to, the orientation of lots, location of local public open space and attention to the local road system. The general location of Abernethy Road is shown as number 11 on the Structure Plan.

6.6.2 The High School site will be a prominent landmark. Further investigations are required at the Local Structure Plan stage to determine the possibility of co-locating the school site with other community facilities. The facilities should be located in the north east corner of the school site along Abernethy Road. Design guidelines are to be prepared for the Community Purposes site as part of the Local Structure Plan for the Town Centre. The general location of the prominent landmark site is shown as number 19 on the Structure Plan.

6.6.3 Local structure plans for portions of the Doley Road/Warrington Road precinct, are to be prepared as determined by the Shire. The Local Structure Plan submitted for the area adjacent to the western edge of the Brickwood Reserve is to show a road reserve adjacent to Brickwood Reserve separating it from the residential area. The Local Structure Plan shall also include a public open space link between Brickwood Reserve and the multiple use corridor on turner road. The location of drainage within Doley Road/Warrington Road precinct is indicative only and will be refined at the Local Structure Plan stage. The general location of the Doley Road/Warrington Road precinct is shown as number 20 on the Structure Plan.

6.6.4 The final location of the primary school north of Orton Road and West of Doley Road is to be determined through the preparation and finalisation of the Local Structure Plan. The indicative location of the primary school is shown as number 29 on the Structure Plan.

6.7 Precinct 8

6.7 Cardup Brook foreshore reserve has a nominal width of 30 metres. Final width will be subject to review as part of the Local Structure Plan. Land is to be ceded free of cost upon subdivision, in accordance with Western Australian Planning Commission subdivision policy. The indicative location of the Cardup Brook foreshore is shown as number 4 on the Structure Plan.

6.8 Precinct 11

6.8.1 Residential density shall be limited to R30 in accordance with the Byford Townsite Detailed Area Plan. The general location of the area to be limited to the R30 design coding is shown as number 21 on the Structure Plan.

7.0 GENERAL NOTATIONS

7.1 At such time as any land currently designated for non-residential uses (including rural residential or rural-living purposes) is subdivided for residential purposes, there will be an expectation of a standard contribution towards public open space and other infrastructure.

7.2 A possible alternate location for a future railway station has been identified on the Structure Plan as number, based on the recommendations of the Townscape Study. The possible alternate location is shown as number 7 on the Structure Plan.

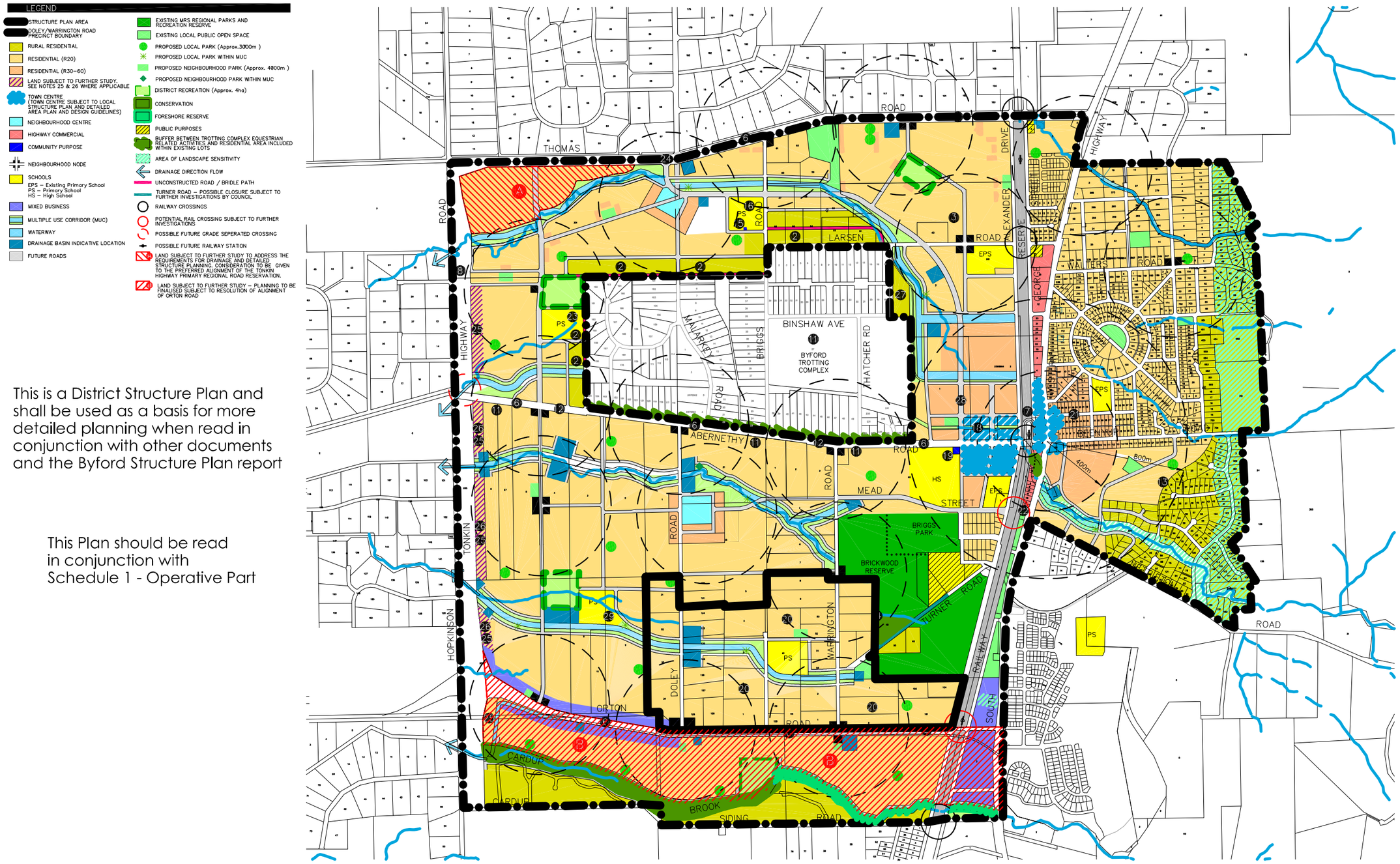
7.3 The Byford District Structure Plan is not responsible for the acquisition of Lot 48 Turner Road (Bush Forever site) and that this matter is to be addressed separately by the Western Australian Planning Commission. The general location of Lot 48 is shown as number 14 on the Structure Plan.

7.4 The provision of land for the community purposes will need to be in accordance with Council's Community Services and Facilities Plan.

7.5 An approximate location for a sewer pump station and 150 metre buffer has been identified, depicted by the number 8 on the Structure Plan.

7.7 There is a potential for a rail crossing linking Mead Street and South Western Highway. However, this is a long term option and subject to consultation with the public transport authority. The identified location is depicted by the number 22 on the Structure Plan.

7.8 Land adjacent to Tonkin Highway, south of Abernethy Road to Orton Road, may be required for a possible future Water Corporation Service Corridor. The general location for the possible corridor is shown as number 26 on the Structure Plan.



This is a District Structure Plan and shall be used as a basis for more detailed planning when read in conjunction with other documents and the Byford Structure Plan report

This Plan should be read in conjunction with Schedule 1 - Operative Part

Figure 1

Byford Structure Plan

Adopted by Council (Original) - 22nd AUG 2005
Adopted by Council (Review No.1) - 13th FEB 2007
Updated 23 June, 2009

Western Australian Planning Commission

Our Ref: TPS/0917
Your Ref: SJ1404-02:HM:ks
Enquiries: Alexander Watson (655 19611)

Chief Executive Officer
Shire of Serpentine-Jarrahdale
6 Paterson Street
MUNDIJONG WA 6123

Dear Sir

TOWN PLANNING SCHEME No 2
AMENDMENT No 178

In response to your letter of 18 December 2012 it is advised that the Minister for Planning determined the submissions, and has refused to grant final approval to the above amendment for the following reasons:

1. The proposed amendment is inconsistent with State Planning Policy No. 4.2 'Activity Centres for Perth and Peel' which encourages commercial developments such as that proposed to be located in District Centres and Neighbourhood/Local Centres. The subject site is not considered to be located in the Byford Activity Centre and constitutes an out of centre development.

2. The amendment is not supported by the planning framework could undermine efforts to develop the Byford Town Centre and secondary Neighbourhood Centres identified in the Byford (District) Structure Plan and Byford Town Centre Local Structure Plan.

Attached are two sets of the amending documents and it is advised that this office has retained one set for record purposes.

Yours faithfully

Neil Thomson
Secretary
Western Australian Planning Commission

SHIRE OF
12 APR 2013
SERPENTINE JARRAHDALE

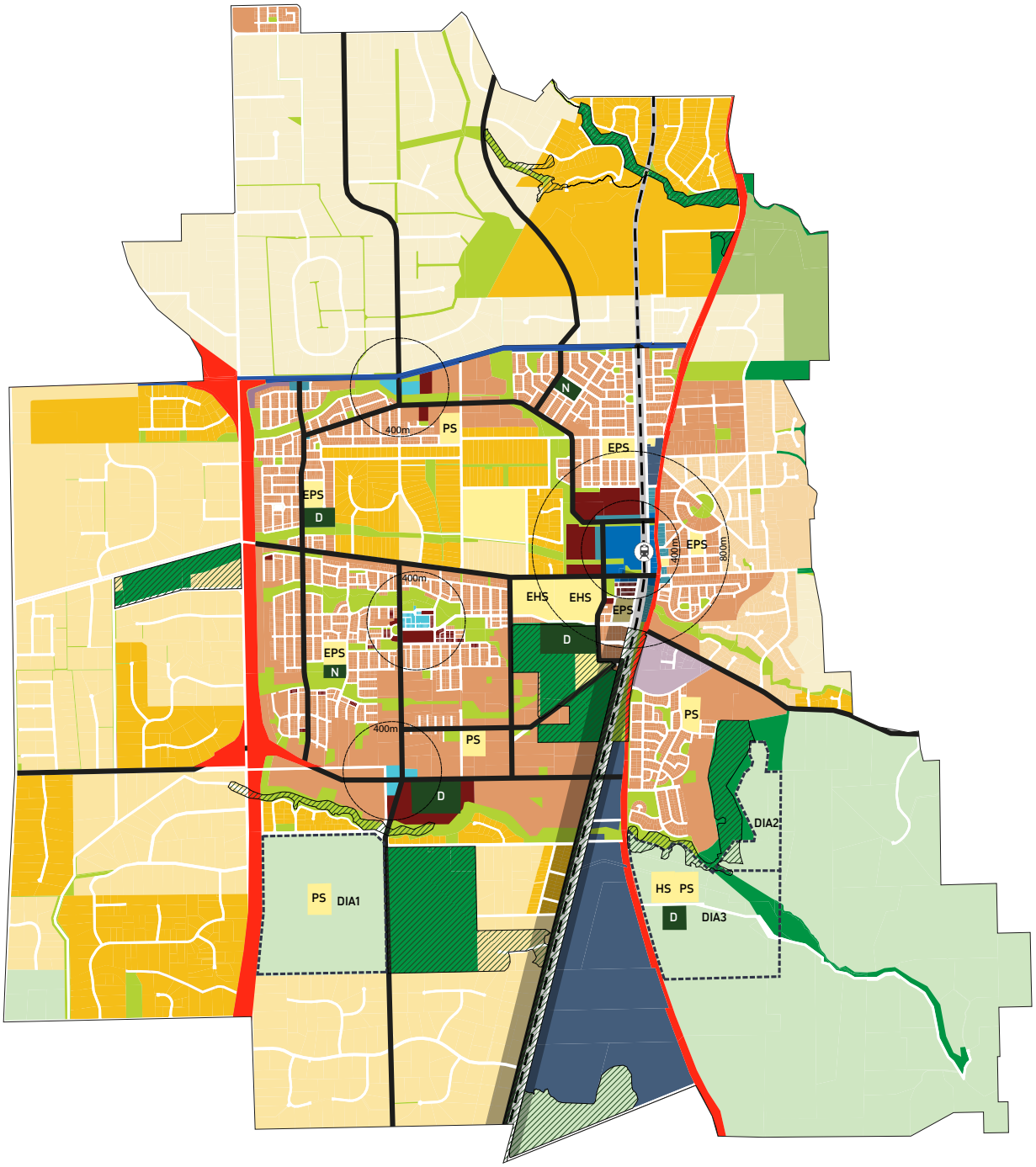
Attach

Copy to: Downings Legal

10 April 2013

Postal address: Locked Bag 2506 Perth WA Street address: 140 William Street Perth WA 6000
Tel: (08) 655 19000 Fax: (08) 655 19001 TTY: 655 19007 Infoline: 1800 626 477
corporate@planning.wa.gov.au www.planning.wa.gov.au
ABN 35 482 341 493

Figure 1: Byford District Structure Plan



Byford District Structure Plan

Status : Preliminary (not to be used for feasibility purposes)
Path : P:\43874 Development Strategies for Serpentine-Jarrahdale

Scale: 1:15,000 @ A1
0 100 200 300 400
© Hames Sharley

North:

Project Number: 43874
Drawing Number: A101
Revision: A
Date: 29/11/18

Hames Sharley

LEGEND

- BYFORD DSP BOUNDARY
- DISTRICT CENTRE
- NEIGHBOURHOOD CENTRE
- MIXED USE
- COMMUNITY AND PUBLIC PURPOSE
- LIGHT INDUSTRIAL
- SERVICE COMMERCIAL
- BUSH FOREVER
- DISTRICT/ NEIGHBOURHOOD OPEN SPACE
- RESERVE
- MULTIPLE USE CORRIDOR/LOCAL OPEN SPACE
- MEDIUM - HIGH: R40-100
- LOW (SUBURBAN): R20-35
- LOW (TRANSITIONAL): R2-10
- SPECIAL RESIDENTIAL
- RR-1
- RR-2
- RURAL SMALL HOLDINGS
- RURAL
- PRIMARY DISTRIBUTOR
- SECONDARY DISTRIBUTOR
- DISTRICT DISTRIBUTOR
- RAILWAY RESERVE
- HIGH FREQUENCY TRANSIT CORRIDOR
- PASSENGER RAIL LINE
- RAIL STATION
- DIA BOUNDARY
- DIA DEVELOPMENT INVESTIGATION AREA
- EHS EXISTING HIGH SCHOOL
- EPS EXISTING PRIMARY SCHOOL
- HS HIGH SCHOOL
- PS PRIMARY SCHOOL
- D DISTRICT OPEN SPACE
- N NEIGHBOURHOOD OPEN SPACE

HERRING STORER ACOUSTICS

Our ref: 24753-1-17286-02

30 August 2019

Megara
Level 1
662 Newcastle Street
LEEDERVILLE WA 6007

Attention: Trent Durward
Email: Trent.Durward@megara.net.au

Dear Trent,

640 SOUTH WESTERN HIGHWAY
ACOUSTIC REVIEW OF SITE

As requested, we have undertaken an acoustic review of the possible development of 640 South Western Highway as residential, compared to a commercial site.

SUMMARY

To be developed as a residential development, noise received at the residences would need to achieve compliance with the requirements of State Planning Policy 5.4.

From the Main Road Traffic Digest, in 2017, the South Western Highway carried 16,270 vpd and of those vehicles approximately 15% are heavy vehicles, with the traffic flow of Thomas Road being approximately 7,900vpd and approximately 15% heavy vehicles. Under the Policy, the assessment needs to be undertaken for 15 – 20 years from now. It is noted that with 15% of the vehicles being heavy vehicles, from previous studies, the night time period would be the critical period for compliance.

From an preliminary analysis undertaken, to comply with the requirements of State Planning Policy 5.4, the following would be required :

- 3 metre high boundary fence to both the South Western Highway and Thomas Road;
- Package B “Quiet House” design to ground floors; and
- Package C “Quiet House” design to any upper floors.

It is also noted that apart from the above requirements for this lot, with 2 roads carrying reasonable volumes of traffic, this is a difficult location to achieve compliance with the outdoor requirements of the policy.

We also note that with the current ambient noise level in the area, noise emission from a commercial development would most likely be masked by the road traffic noise. Although, this is not taken into account when undertaking an assessment of any development, as the assigned noise levels are fixed (ie : determined

by the addition of an Influencing Factor to base noise levels), acoustically, a commercial development on this site would have a negligible effect on the acoustical environment of the area.

STATE PLANNING POLICY 5.4 CRITERIA

Under the Western Australian Planning Commission (WAPC) Planning Policy 5.4 *"Road and Rail Transport Noise and Freight Considerations in Land Use Planning"* the following external criteria are listed:

> **"Noise Limits"**
> $L_{Aeq(Day)}$ of 60 dB(A); and
> $L_{Aeq(Night)}$ of 55 dB(A).

As external noise levels exceed the "Noise Target" noise levels, then the residential premises should be designed to comply with the following internal noise levels:

> **"Internal Criteria"**
> $L_{Aeq(Day)}$ of 40 dB(A) in living and work areas; and
> $L_{Aeq(Night)}$ of 35 dB(A) in bedrooms.

We also note that under the SPP5.4, noise mitigation measures should be implemented with a view to achieve, in at least one outdoor area, the L_{Aeq} of 50 dB(A) noise level for the night period.

MODELLING

To determine the noise received within the site from vehicles travelling along both the South Western Highway and Thomas Road, acoustic modelling was carried out using SoundPlan, using the Calculation of Road Traffic Noise (CoRTN) algorithms. Noise modelling was undertaken in accordance with the "Implementation Guidelines" for the State Planning Policy 5.4.

The input data for the model included:

- Ground contours as obtained from Google Maps;
- Other Traffic data as listed in Table 1.

TABLE 1 - NOISE MODELLING INPUT DATA

Parameter	Value	
	South Western Hwy	Thomas Road
Current Traffic Flow (vpd)	16,270	7900
Future Traffic Flow (spd)	23,560	11,440
Speed (km/hr)	60	70
Heavy Vehicles (%)	15	15
Other		
Receiver Level (m)	+1.5 above ground	+1.5 above ground
Façade Correction	+ 2.5 dB(A)	+ 2.5 dB(A)
Road Surface (Current and Future)	Existing	Existing

Given the percentage of heavy vehicles and monitoring undertaken for these type of roads (ie with high percentages of heavy vehicles), the difference between the $L_{Aeq,8hr}$ and the $L_{Aeq,16hr}$ would be around 3dB(A), thus the night period becomes the critical period for compliance. Therefore, noise modelling was only undertaken for the night period.

Noise modelling was undertaken for the following scenarios :

1. Future traffic, without any no mitigation.

2. Future traffic flows, with a 2.4 metre barrier located at the boundary to the road reserve to both the South Western Highway and Thomas Road, with a 3 metre high section near the intersection.

Contour plots for the above scenarios are attached for information.

DISCUSSION

Based on the analysis undertaken noise received at any residences would, even with the boundary walls to the South Western Highway and Thomas Road, be 57 dB(A) at ground floors and 65 dB(A) at upper floors. Thus, to comply with the internal acoustic criteria, the following would be required :

- 3 metre high boundary fence to both the South Western Highway and Thomas Road;
- Package B “Quiet House” design to ground floors; and
- Package C “Quiet House” design to any upper floors.

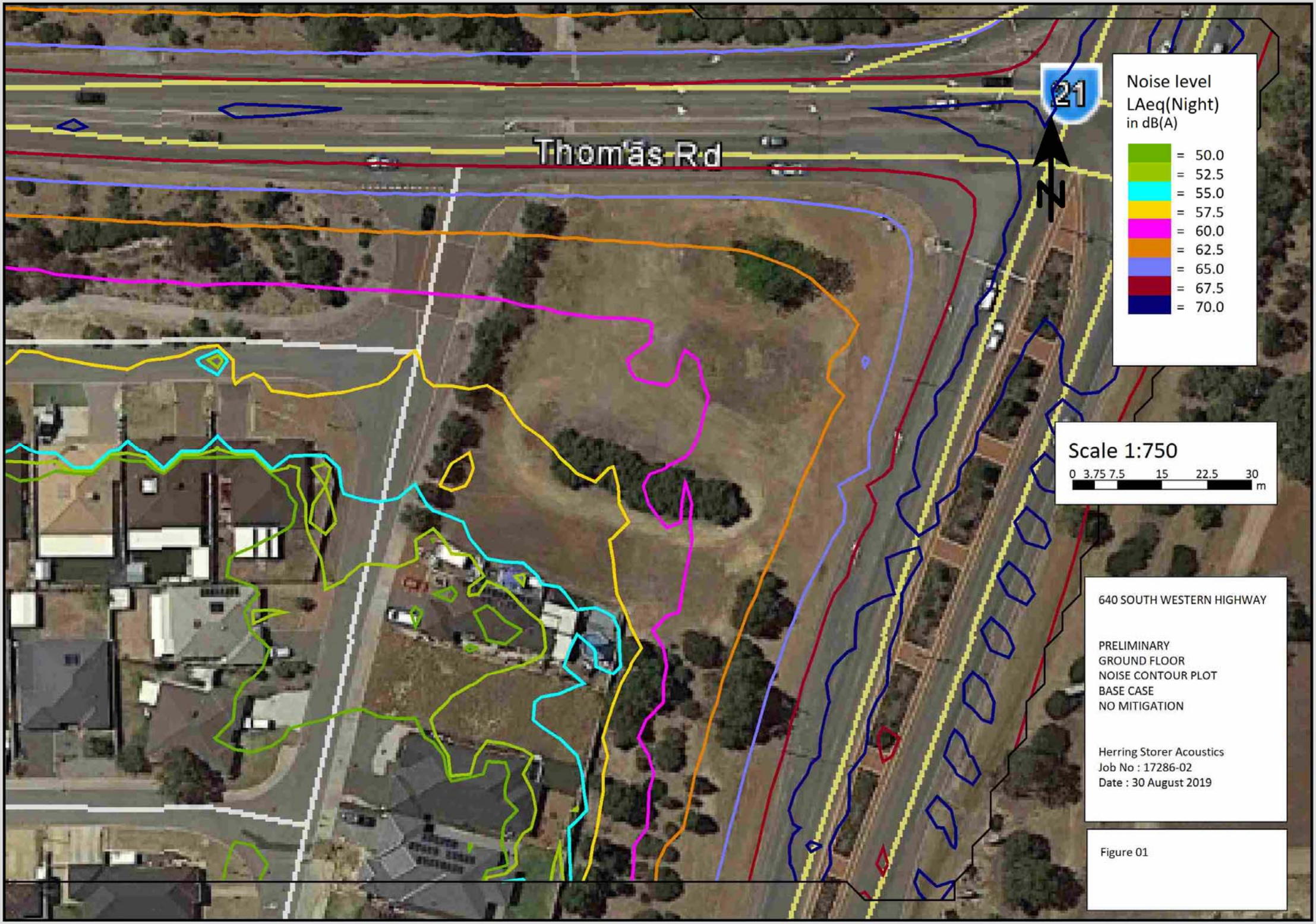
It is also noted that apart from the above requirements for this lot, with 2 roads carrying reasonable volumes of traffic, this is a difficult location to achieve compliance with the outdoor requirements of the policy.

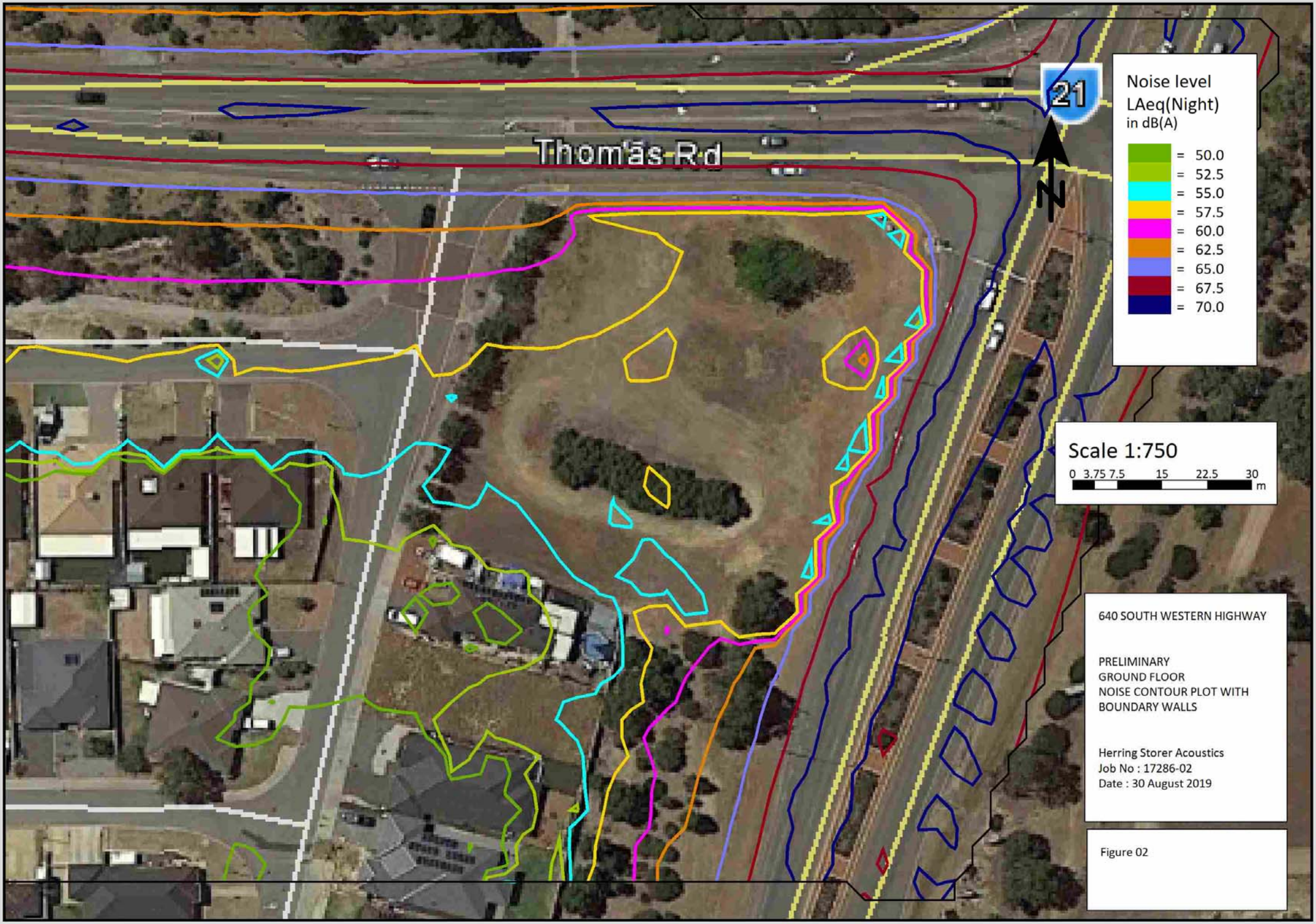
We also note that with the current ambient noise level in the area, noise emission from a commercial development would most likely be masked by the road traffic noise. Although, this is not taken into account when undertaking an assessment of any development, as the assigned noise levels are fixed (ie : determined by the addition of an Influencing Factor to base noise levels), acoustically, a commercial development on this site would have a negligible affect on the acoustical environment of the area.

Yours faithfully,
for **HERRING STORER ACOUSTICS**

Tim Reynolds

Att.


Thomas Rd
21
N
Noise level
LAeq(Night)
in dB(A)
= 50.0
= 52.5
= 55.0
= 57.5
= 60.0
= 62.5
= 65.0
= 67.5
= 70.0
Scale 1:750
0 3.75 7.5 15 22.5 30
m
640 SOUTH WESTERN HIGHWAY
PRELIMINARY
GROUND FLOOR
NOISE CONTOUR PLOT
BASE CASE
NO MITIGATION
Herring Storer Acoustics
Job No : 17286-02
Date : 30 August 2019
Figure 01


Thomas Rd
21
N
Noise level
LAeq(Night)
in dB(A)
= 50.0
= 52.5
= 55.0
= 57.5
= 60.0
= 62.5
= 65.0
= 67.5
= 70.0
Scale 1:750
0 3.75 7.5 15 22.5 30
m
640 SOUTH WESTERN HIGHWAY
PRELIMINARY
GROUND FLOOR
NOISE CONTOUR PLOT WITH
BOUNDARY WALLS
Herring Storer Acoustics
Job No : 17286-02
Date : 30 August 2019
Figure 02

Contaminated Sites Act 2003
Basic Summary of Records Search Response

Report generated at 04:01:19PM, 08/05/2019

Receipt No:	
ID No:	*6218*

Search Results

This response relates to a search request received for:

640 South Western Hwy
Byford, WA, 6122

This parcel belongs to a site that contains 1 parcel(s).

According to Department of Water and Environmental Regulation records, this land has been reported as a known or suspected contaminated site.

Address	640 South Western Hwy Byford, WA, 6122
Lot on Plan Address	Lot 2 On Diagram 35013
Parcel Status	**Classification:** 23/08/2017 - *Remediated for restricted use* **Nature and Extent of Contamination:** Hydrocarbons (such as from petrol) are present in soils at depth (greater than 4 metres below ground level) beneath the north-east corner of the site. Hydrocarbons (such as from petrol) are present in groundwater beneath the north-east corner of the site as a plume which extends off-site in a north westerly direction. **Restrictions on Use:** The land use of the site is restricted to commercial/industrial use, which excludes sensitive uses with accessible soil such as childcare centres, kindergartens, pre-schools and primary schools. The site should not be developed for a more sensitive use such as recreational open space, residential use or childcare centres without further contamination assessment and/or remediation. The installation of permanent below ground voids such as basements and utility pits to depths greater than two metres below ground level is restricted without further assessment, and if necessary, management. A site-specific health and safety plan is required to address the risks to the health of workers undertaking intrusive works to depths greater than two metres below ground level. Other than for analytical testing or remediation, disturbance of hydrocarbon-impacted soils present at depths greater than four metres below ground level is restricted. Other than for analytical testing or remediation, groundwater abstraction is not permitted at this site due to the nature and extent of groundwater contamination. **Reason for Classification:** This site was reported to the Department of Water and Environmental Regulation (DWER) prior to the

Contaminated Sites Act 2003
Basic Summary of Records Search Response

Report generated at 04:01:19PM, 08/05/2019

commencement of the 'Contaminated Sites Act 2003' (the Act). The site was first classified under section 13 of the Act based on information submitted to DWER by November 2007, with the reasons for classification updated in February 2012. The site has been classified again under section 13 of the Act to reflect additional technical information submitted to DWER by August 2017.

This site was historically used as a service station for approximately 45 years, from 1955 to 2000. This is a land use that has the potential to cause contamination, as specified in Appendix B of 'Assessment and management of contaminated sites' (Department of Environment Regulation 2014).

The site was reported because a contamination assessment undertaken in 1999 found that former underground fuel infrastructure had leaked, and that hydrocarbons (such as from petrol or diesel) were present in soil and groundwater beneath the site.

Soil remedial work was carried out in 2000 and 2003 comprising the excavation of hydrocarbon-impacted soil for off-site disposal or on-site bioremediation and re-use.

Soil investigations carried out at the site between 2003 and 2010 found that soils had been successfully remediated to a depth of 4 metres below ground surface. Hydrocarbons (such as from petrol or diesel) remained in soils more than 4 metres below the ground surface near the former underground storage tanks (USTs).

Groundwater investigations carried out at the site between 1999 and 2010 found hydrocarbons (such as from petrol) were present in groundwater beneath the site as a plume which extended off-site from the north east corner of the site in a north westerly direction.

The substances in soil and groundwater beneath the site were deemed to pose a potentially unacceptable human health risk via vapour inhalation. Soil vapour investigations carried out in 2008 and 2010 found hydrocarbon vapours were present in soils beneath the site.

A detailed risk assessment completed in 2010 concluded that restrictions on use of the site were necessary to manage potential vapour intrusion risks and prevent exposure to contaminated groundwater.

Soil and groundwater investigations, soil remedial work and risk assessment carried out at the site up until October 2010 were the subject of an independent review by an accredited contaminated sites auditor. The auditor's assessment was documented in a mandatory auditor's report dated 28 October 2011. The auditor concluded that this site was suitable for its current use as residential land and road reserves provided restrictions on groundwater abstraction and intrusive works were in place.

Further groundwater investigations and risk assessment carried out between 2013 and 2016 have demonstrated that the plume is decreasing in size and concentrations through natural attenuation. Concentrations of hydrocarbons (such as from petrol) in groundwater beneath the north eastern corner of the site appear to have reduced to below health-based guidelines set for non-potable uses of groundwater such as groundwater irrigation but continue to pose a potential vapour intrusion risk for subsurface voids such as basements or utility pits that are greater than 2 metres deep. A site management plan (SMP) has been developed which sets out the ongoing monitoring that is required to address groundwater contamination at related affected sites.

The further investigations, risk assessment and site management plan completed between 2013 and 2016 were the subject of an independent review by an accredited contaminated sites auditor. The auditor's review is documented in a mandatory auditor's report (MAR) dated 2 August 2017. The

Contaminated Sites Act 2003
Basic Summary of Records Search Response

Report generated at 04:01:19PM, 08/05/2019

	auditor recommended that the site is suitable for restricted commercial/industrial land use and can be classified as 'remediated for restricted use' provided the auditor endorsed site management plan dated July 2017 is implemented. DWER accepts the findings of the auditor. The site is contaminated and has been remediated such that it is suitable for restricted commercial/industrial land use, but may not be suitable for more sensitive land uses. Therefore, the site is classified as 'remediated for restricted use'. DWER, in consultation with the Department of Health, has classified this site based on the information available to DWER at the time of classification. It is acknowledged that the contamination status of the site may have changed since the information was collated and/or submitted to DWER, and as such, the usefulness of this information may be limited. **Other Relevant Information:** Additional information included herein is relevant to the contamination status of the site and includes DWER's expectations for action that should be taken to address potential or actual contamination described in the Reasons for Classification. Based on the available information, contamination present beneath this site has also been identified beyond the site boundary beneath the adjacent land, consistent with the definition of a "source site" specified in Part 1, Section 3 of the Act. In accordance with Regulation 31(1)(b) of the 'Contaminated Sites Regulations 2006', reports or information submitted to DWER that are relevant to the investigation, assessment, monitoring or remediation of a source site are required to be accompanied by a mandatory auditor's report (MAR) prepared by an accredited contaminated sites auditor. Where the land is part of a transaction - sale, mortgagee or lease agreement, the land owners MUST PROVIDE WRITTEN DISCLOSURE (on the prescribed Form 6) of the site's status to any potential owner, mortgagee (e.g. financial institutions) or lessee at least 14 days before the completion of the transaction. A copy of the disclosure must also be forwarded to DWER. **Action Required:** The auditor endorsed site management plan dated July 2017 'Former Oakland service station (Q036), 640 South Western Highway, Byford, Western Australia - site management plan' is to be implemented and will apply to the site until further notice.
Certificate of Title Memorial	Under the Contaminated Sites Act 2003, this site has been classified as "remediated for restricted use". For further information on the contamination status of this site, please contact Contaminated Sites at the Department of Water and Environmental Regulation.
Current Regulatory Notice Issued	**Type of Regulatory Notice:** *Nil* **Date Issued:** *Nil*
General	No other information relating to this parcel.

Project:	**Transport Impact Assessment – V2** Proposed Structure Plan Amendment – Lot 2 (640), South Western Highway, Byford Byford Structure Plan
Owners:	**Byford SPV Pty. Ltd.**
Author:	Heidi Herget
Signature:	
Date:	16th September 2019

P.O. Box 525 Applecross WA 6953.
PHONE +61 0434 189 788
EMAIL info@moveconsultants.com.au

Document Status.

Ver. No.	Author	Reviewed by	Date	Issued for	Signature	Date
1	HH	HH	10/09/19	FINAL		10/09/19
2	HH	HH	16/09/19	REV		16/09/19

CONTENTS

1. INTRODUCTION

1.1 Overview

This Transport Impact Assessment has been prepared for a proposed Scheme Amendment to the Byford Structure Plan in relation to Lot 2 (640), South-Western Highway, Byford in the Shire of Serpentine-Jarrahdale.

This assessment has been prepared by Move Consultants to support the amendment Local Structure Plan and outlines the likely impacts associated with the proposed Structure Plan on the boundary movement network – namely network traffic flows, safe and efficient access to and from the lands, pedestrian and cycling facilities and public transport.

1.2 Lands Location

The lands are located within the south-western corner of the signalised intersection of South-Western Highway/Thomas Road in the Shire of Serpentine-Jarrahdale. Existing urban residential uses are in place to the south and west of the lands and existing rural residential uses to the north and east of the lands. The Byford Town Centre is located approximately 1.8km to the south of the lands. The lands are currently vacant and has frontage to South-Western Highway to the east, Thomas Road to the north and Hay Road to the west, respectively. The subject lands are shown in Figure 1.

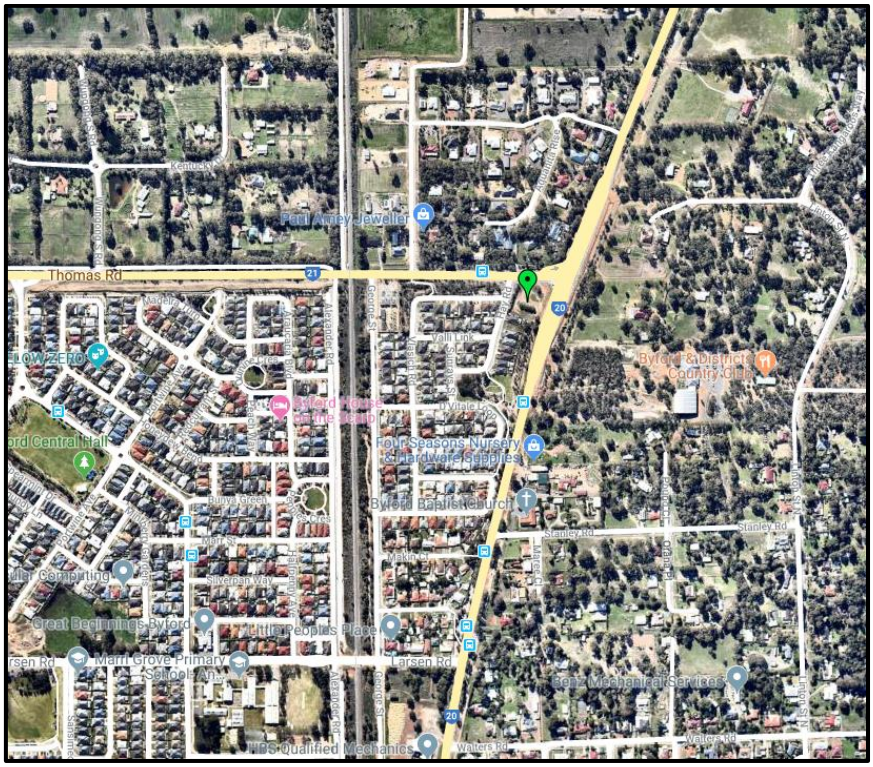


Figure 1: Lands Location

The locational context is shown in Figure 2.

Figure 2: Metropolitan Context

1.3 Transport Assessment Objective

This Transport Assessment outlines the expected impacts to the movement network within and external to the proposed structure plan on road network flows, safe and efficient access to and from the subject lands, pedestrian and cycling facilities and local amenity and safety. As part of the assessment, Move Consultants has considered the likely vehicular change in traffic demands associated with future urban development within the LSP area as well as potential impacts to the rest of the existing and planned movement network.

The assessment considers aspects associated with:

- Traffic generation and impacts to the existing and future base traffic volumes;
- Integration with the surrounding land uses;
- Use of public and other transport modes such as walking, cycling and public transport; and
- Safety and access issues.

1.4 Scope of Assessment

This updated assessment has been prepared in accordance with the Western Australian Planning Commission's *Transport Assessment Guidelines for Developments: Volume 2 – Structure Plans* (2016).

Specifically, this report aims to assess the impacts of the proposed structure plan amendment on the boundary road network and specifically in the context of the proposed changes associated with the amended LSP to allow for commercial development in the place of residential development on connections to the road network and anticipated changes order to identify any modifications, to lands or road layout, which may be required to serve the proposed lands. In addition, the assessment considers the proposed access, circulation, and egress arrangements to and from the lands. The proposed modified structure plan is attached in **Appendix A.**

For this purpose, the traffic operations on the boundary road network during the peak periods and on a daily basis have been assessed inclusive of the existing and future development traffic associated with the amended structure plan.

2. EXISTING SITUATION

2.1 Road Infrastructure

The proposed uses are to be constructed on lands which is currently vacant. Existing rural residential and bushland uses are in place to the north and east with recently established urban residential uses in place to the west and south of the lands. The Byford town Centre is located approximately 3km to the south of the lands.

South-Western Highway is a primary north-south road providing direct access between the Bunbury Regional Centre to the south through to the Armadale City Centre to the north It is a primary link in the State Highway system and serves a broad catchment of users between the south-eastern suburbs of the Perth Metropolitan Area with major road corridors and activity centres such as Armadale, Bunbury, Mundijong and Pinjarra as well as to urban development within the broader Byford Structure Plan cell flanking Thomas Road to the west and South-Western Highway to the south. It has been classified as a *Primary Distributor* road under the Main Roads *Functional Road Hierarchy* and has been defined as a road which *"…provide for major regional and inter-regional traffic movement and carry large volumes of generally fast-moving traffic. Some are strategic freight routes, and all are National or State roads and are managed by Main Roads Western Australia."* It operates under a speed limit of 70kph in the vicinity of the intersection with Thomas Road to 90kph further to the south and north. It has been constructed as a dual divided carriageway with a fixed raised central median near the lands.

Thomas Road is a primary east-west road providing direct access between Byford and South-Western Highway through to the Tonkin Highway, Kwinana Freeway and Kwinana Industrial Area to the west. It is a primary link and connects users between major north-south higher order roads as well as major employment and activity nodes. It also functions as promising direct access to the Byford Structure Plan residential cells to the west of the lands. It has been classified as a *District Distributor A* road under the Main Roads *Functional Road Hierarchy* and is defined as a road which *"…carry traffic between industrial, commercial and residential areas and generally connect to Primary Distributors. These are likely to be truck routes and provide only limited access to adjoining property and are managed by Local Government."* Thomas Road operates under a speed limit of 60kph in the vicinity of the lands transitioning to 80kph further west beyond the intersection with Hay Road. It has been constructed as a dual divided carriageway in the vicinity of the lands. It is owned, operated and maintained by the Shire of Serpentine-Jarrahdale. Thomas Road has also been designated as an *Other Regional Road* or *Blue Road* under the *Metropolitan Region Scheme.*

Hay Road, along the western boundary of the lands, has been classified as an *Access Road* under the Main Roads *Functional Road Hierarchy* and is defined as a road which *"…provides access to abutting properties with amenity, safety and aesthetic aspects having priority over the vehicle movement function. These roads are bicycle and pedestrian friendly and are managed by Local Government."* It has been constructed as a wide single carriageway to the south of Thomas Road adjacent to the lands. It operates under a speed limit of 50kph and is owned, operated and maintained by the Shire of Serpentine-Jarrahdale.

Both Thomas Road and South-Western Highway are on the RAV network.

Figure 3 shows the functional road hierarchy in the vicinity of the lands.

Figure 3: MRWA Functional Road Hierarchy Excerpt

A detailed lands visit was conducted on Thursday 30th November 2017 to collect information relating to existing road geometry, speed limits, and sightlines and to observe existing traffic operations on the adjacent boundary road network. Detailed traffic surveys were undertaken on Wednesday 6th, Thursday 8th December 2017 during the roadway a.m. (7:00 to 9:00 a.m.) and p.m. (4:00 to 6:00 p.m.) peak periods to measure traffic entering and existing the Hay Road approach to Thomas Road as well as to measure outbound right-turning gaps from Hay Road northbound to Thomas Road eastbound and the downstream queuing patterns within the northbound approach lanes on South-Western Highway to Thomas Road along the eastern frontage of the lands. Additional traffic data for the signalised intersection of South-Western Highway/Thomas Road was sourced from SCATS data (MRWA, 2018).

The existing geometry of the signalised intersection is shown in Figure 4. Dual right-turn pockets and a channelised left-turn pocket are currently in place on the eastbound approach to the intersection on Thomas Road. A dedicated northbound left-turn pocket is in place on the northbound approach and a dedicated right-turn pocket is in place on the southbound approach on South-Western Highway.

The Thomas Road/Hay Road intersection consists of a break in the existing 4m median on Thomas Road to allow for full movements into and out of Hay Road. No dedicated turn pockets are in place on Thomas Road. The Hay Road approach consists of a wide road seal on approach to Thomas Road to allow for simultaneous outbound left- and right-turns into Thomas Road.

Figure 4: Existing Geometric Layout – South-Western Highway/Thomas Road and Thomas Road/Hay Road

Existing traffic volumes were obtained from Main Roads WA for both South-Western Highway and Thomas Road from SCATS data dated November 2017. Traffic data for Hay Road was sourced via on-lands traffic surveys undertaken on Wednesday 6th December 2017 during the weekday a.m. (7:00 to 9 a.m.) and p.m. (4:00 to 6:00 p.m.) peak periods at the intersection of Thomas Road/Hay Road for the boundary road network to the north-west of the lands.

Table 1 details the updated existing daily traffic volumes in the vicinity of the lands and the practical capacities of these roads in the context of their respective road classification, adjacent land uses and geometric road cross-sections.

Table 1: Existing Traffic Volumes

Road Link	Daily (vpd)	Practical Capacity (vpd)
South-Western Highway (North)	16,900 vpd	20,000 to 25,000 vpd
South-Western Highway (South)	16,800 vpd	20,000 to 25,000 vpd
Thomas Road (West)	8,000 vpd	20,000 vpd
Hay Road (South)	1,200 vpd (approx..)	3,000 vpd

Figure 5 illustrates the updated existing roadway peak hour volumes at the South-Western Highway/Thomas Road intersection.

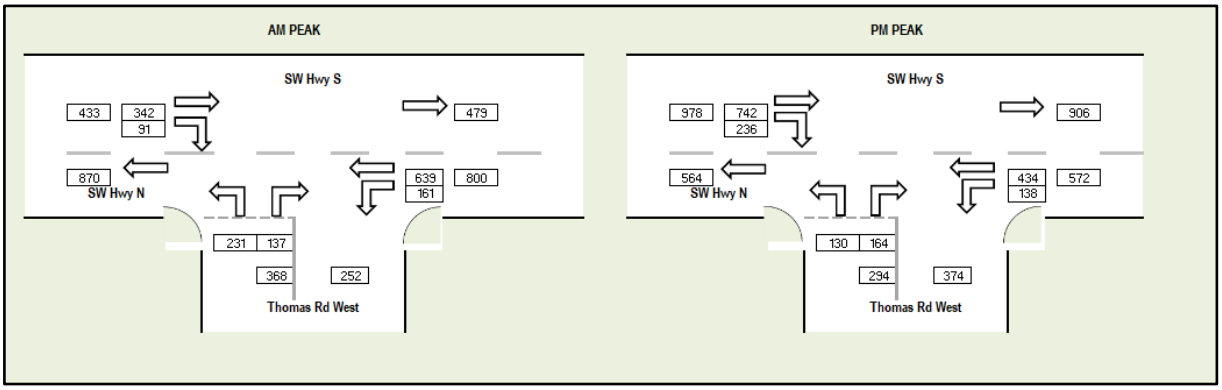


Figure 5: Existing Traffic Volumes – South-Western Highway/Thomas Road

Figure 6 shows the existing traffic at Thomas Road/Hay Road.

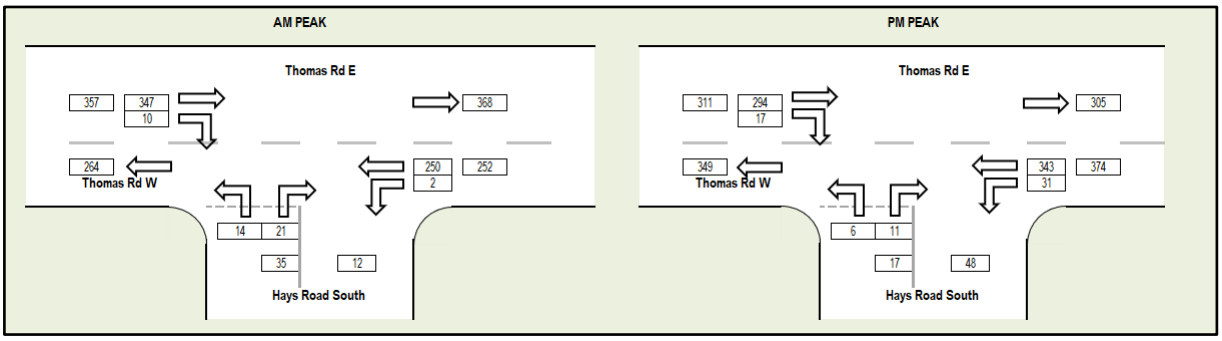


Figure 6: Existing Traffic Volumes – Thomas Road/Hay Road

These volumes were then used as input into the intersection modelling program SIDRA to assess the existing traffic operations at this location. The results of this traffic assessment are detailed in Section 4 with detailed SIDRA outputs provided under separate cover.

The critical outbound left- and right-turning opportunities from Hay Road into and out of Thomas Road and the signalised intersection of South-Western Highway/Hay Road were assessed to ascertain any queuing and/or vehicular delays along the western frontage of the lands. This assessment has been based upon both observed gap and queuing data collected during the surveys and has allowed for an interpretive review of the theoretical SIDRA intersection analysis results. The results of these surveys and associated analysis are also outlined in Section 4.

2.2 Public Transport, Pedestrian, and Cyclist Facilities

Transperth offers line haul services via Bus Routes 252 and 254 serving South-Western Highway and Thomas Road via the Byford Town Centre with bus stops in place on both sides of South-Western Highway to the south of the lands and along Thomas Road in the vicinity of the lands with a 5-minute walking distance. Figure 7 shows the public transport services in the vicinity of the lands.

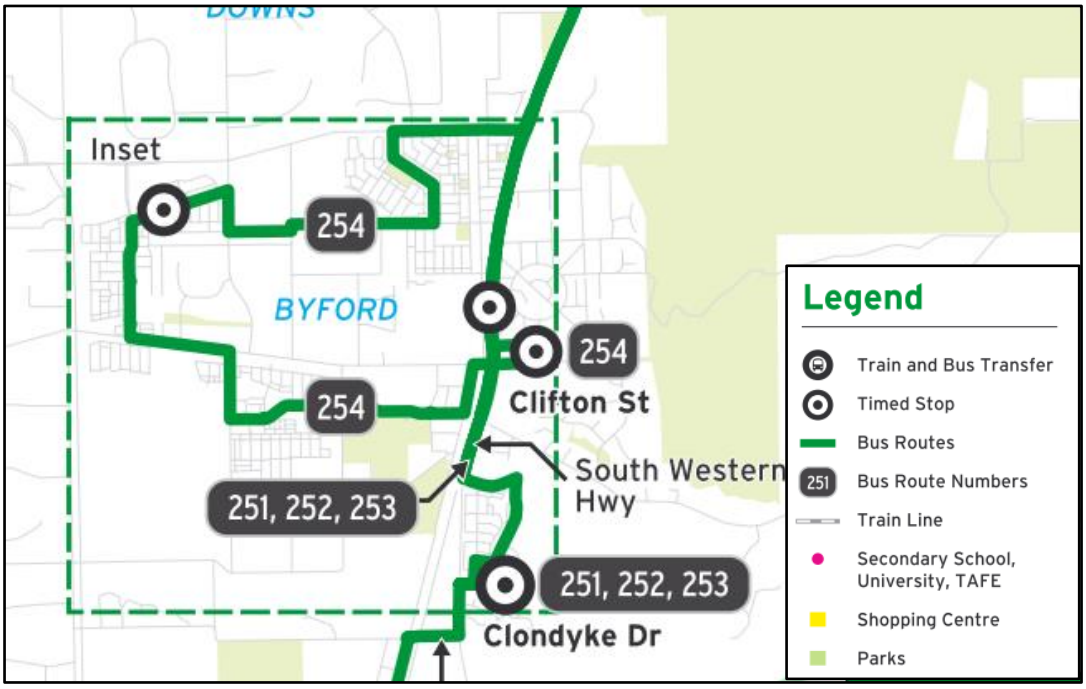


Figure 7: Existing Public Transport Services

There are high quality shared paths on the north side of Thomas Road and east side of South-Western Highway, respectively in the vicinity of the lands. Figure 8 shows the pedestrian/cycling network in the vicinity of the lands.

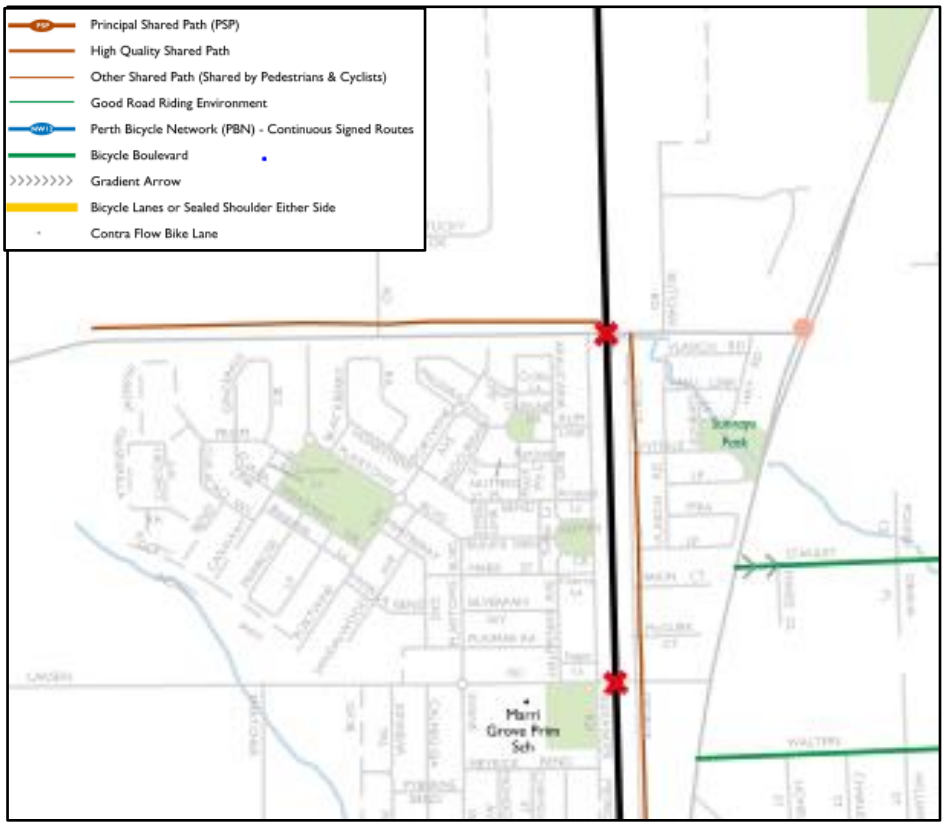


Figure 8: Existing Pedestrian/Cycling Infrastructure

3. PROPOSED AMENDED STRUCTURE PLAN

The proposed amended LSP is attached in **Appendix A**. Indicative access arrangements to the boundary road network occur primarily through the Thomas Road/Hay Road intersection. Any additional private crossover from the public road network to the proposed development on the lands will be addressed as part of a future Development Application.

3.1 Revised Proposed Land Uses

The proposal seeks approval of an amendment to the Byford Structure Plan to redesignate uses on the lands from *Residential* to *Commercial* which is inclusive of *Other Commercial-Showroom* uses.

3.2 Proposed Access and Parking Arrangements

For the purposes of this assessment, traffic generation has been assumed for the proposal on the lands with an estimate of overall maximum traffic generation for adjacent lands to be developed in the future under a separate application in order to address the ultimate build-out scenario of the entire lot to assess the cumulative traffic impacts of full development on the boundary road network under future operating conditions. This traffic generation is inclusive of urban development already delivered in the area.

No direct access is proposed via Thomas Road along the northern frontage of the lands. Proposed access points to the public road network and proposed car parking will be assessed as part of future Development Applications and as part of the development of site plans for these developments.

This assessment has been prepared in a format suitable for submission to the Shire of Serpentine-Jarrahdale as well as the Department of Transport, Main Roads Western Australia, the Public Transport Authority and the Western Australian Planning Commission. This assessment has been prepared in accordance with the WAPC Guidelines for *Transport Assessment – Volume 2: Structure Plans* and the Shire of Serpentine-Jarrahdale's *Town Planning Scheme No. 2* as well as the *Byford Structure Plan* and other relevant district planning policies.

4. CHANGES TO EXTERNAL TRANSPORT NETWORKS

Proposed changes to the Thomas Road/Hay Road intersection will be addressed during the detailed design stages of the project. No other changes will be required.

5. TRANSPORT ANALYSIS

In order to assess the potential traffic impacts associated with the proposed structure plan uses detailed on the amended plan on the boundary road network, a traffic generation and distribution exercise was undertaken. The aim of this exercise was to establish the anticipated traffic volumes which would be generated from the overall development of the amended structure plan area in order to quantify the effect that the additional traffic has on the boundary road network, specifically on the operations of the nearby intersections with traffic associated with existing activities within the area.

5.1 Assessment Period

The time periods chosen for assessment have been based upon full development of the lands under a 2031 traffic demand scenario.

5.2 Trip Generation

The traffic generated by the amended structure plan has been predicted by applying trip generation rates sourced from both the Institute of Transportation Engineers' (ITE) *Trip Generation Manual, 10th Edition* and the RTA *Guide to Traffic Generating Developments* for commercial *type* uses. The total anticipated maximum traffic generated by the proposed development is estimated to be in the order of 1,302 vehicular trips (50% inbound/50% outbound) on a daily basis; 81 vehicular trips (41 inbound/40 outbound) during the a.m. peak hour; and 107 vehicular trips (56 inbound/51 outbound) during the p.m. peak hour. The trip generation estimate has been based upon a maximum or 'worst case' scenario for potential commercial development on the lands.

It has been assumed be noted that the passing trade component for the type of uses proposed would be in the order of 50% to 80% during a typical weekday; however, a conservative 'worst case' scenario of 50% passing trade has been assumed in this assessment. This would therefore result in a net maximum increase in traffic of +650 vpd and +41 and +54 vph during the weekday a.m. and p.m. peak hours.

5.3 Trip Distribution

The following results illustrate the total anticipated daily and a.m./p.m. peak hour traffic volumes associated with the amended LSP on the boundary road network after the full build-out of the lands. The additional site-generated traffic associated with the amendment can be comfortably accommodated within the practical road capacities of the public road network with a minimal impact to the boundary road network with the majority of traffic destined to and originating from the higher order roads and connecting via Thomas Road and South-Western Highway at the relevant established nodes.

Based upon the existing traffic patterns in the area and the spatial distribution of adjacent land uses, the following distribution for the proposed 'new' development generated traffic has been broadly assumed:

- A.M. Peak Hour:
    - 40% from South-Western Highway (north)
    - 35% to South-Western Highway (north)
    - 60% from South-Western Highway (south)
    - 25% to South-Western Highway (south)
    - 40% to Thomas Road (West)

- P.M. Peak Hour:
    - 60% from South-Western Highway (north)
    - 35% to South-Western Highway (north)
    - 40% from South-Western Highway (south)
    - 25% to South-Western Highway (south)
    - 40% to Thomas Road (West)

Single purpose traffic generated from south of Thomas Road via Hay Road is expected to be negligible.

The number of trips entering / exiting the lands via Hay Road has been assigned based upon the most logical route for vehicles to take given their origin / destination.

The anticipated increases in site-generated traffic was then assigned to the boundary road network based upon the existing proportions for both the weekday a.m. and p.m. peak hours. The resultant increases in weekday daily and a.m. and p.m. peak hour-generated traffic under the 'worst case' scenario for the boundary road network would be as follows:

- South-Western Highway (North)
    - Daily: +325 vpd
    - A.M. Peak Hour: +20 vph
    - P.M. Peak Hour: +7 vph
- South-Western Highway (South)
    - Daily: +325 vpd
    - A.M. Peak Hour: +14 vph
    - P.M. Peak Hour: +6 vph
- Thomas Road (West)
    - Daily: +260 vpd
    - A.M. Peak Hour: +22 vph
    - P.M. Peak Hour: +48 vph
- Hay Road (South)
    - Daily: +910 vpd
    - A.M. Peak Hour: +44 vph
    - P.M. Peak Hour: +96 vph

These increases in daily and a.m./p.m. peak hour volumes will have a minimal impact on existing traffic operations in the area and can be comfortably accommodated within the practical capacities of the respective links in the boundary road network. It should be noted that the majority increase in traffic on Hay Road along the western frontage of the lands is along a short section of road between Thomas Road and a potential access into the lands and therefore the site-generated traffic will have a negligible impact further to the south within the residential areas and in particular on local road operations. The effective and efficient distribution of traffic via the boundary road network with orientation of the future development of the lands under the amended LSP to the north and east will allow for the maximisation of safe and effective vehicle operations into and out of the lands while still maintaining amenity for the local community who access the primary road network via Thomas Road/Hay Road. Figure 9 and Figure 10 **s**how the future traffic volumes at the South-Western Highway/Thomas Road and Thomas Road/Hay Road intersections during the a.m. and p.m. roadway peak hours.

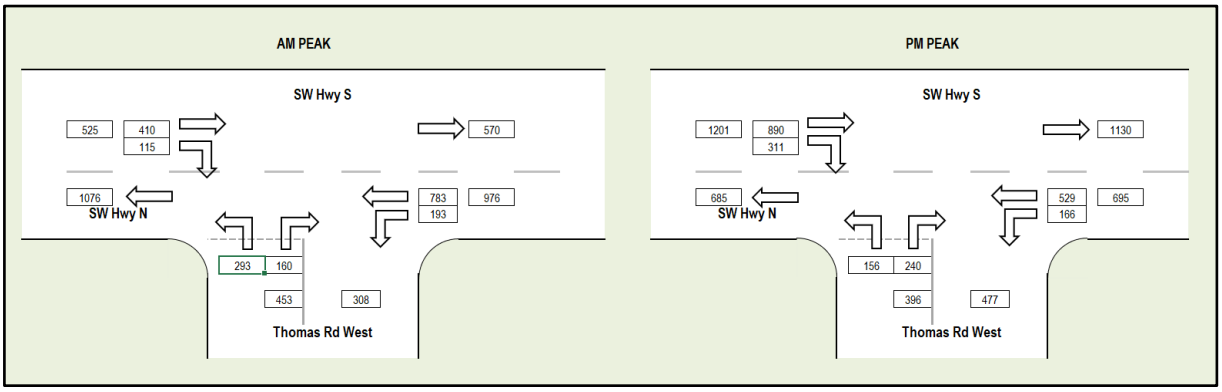


Figure 9: Future Total Traffic at South-Western Highway/Thomas Road Intersection (2031)

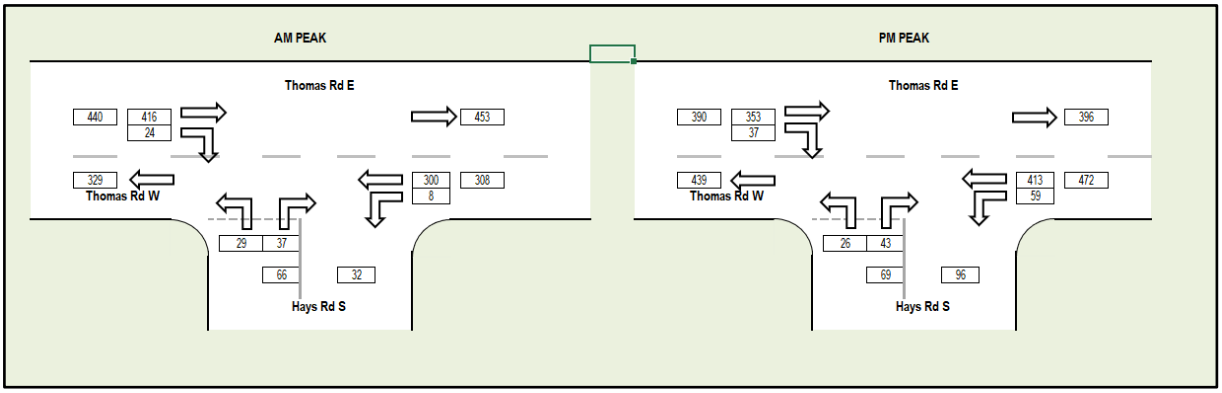


Figure 10: Future Total Traffic at Thomas Road/Hay Road Intersection (2031)

5.4 Intersection Assessment

5.4.1 SIDRA Intersection Analysis

The operational performance of the signalised intersection of South-Western Highway/Thomas Road and the unsignalised intersection of Thomas Road/Hay Road have been assessed using the software program *SIDRA Intersection 8.0* for existing and future road conditions. This was undertaken for existing conditions and also with the addition of the future development generated traffic associated with the amendments to the LSP under the future scenario. It has been assumed that under future road conditions that ambient background traffic for South-Western Highway and Thomas Road would be based upon 2031 traffic demand projections which are reflective of the extension of Tonkin Highway further to the west further south of Thomas Road with future traffic stabilising along these links. However, for the purposes of this assessment of the 'worst case' scenario, a 5% growth rate per annum has been assumed for through traffic in order to be consistent with MRWA ROMS modelling for 2031 traffic volumes. The heavy vehicle percentages have been derived from current MRWA data available through the IRIS system with an assumed heavy vehicle percentage of 12% on South-Western Highway and 14% on Thomas Road – of which less than 3% represents heavy vehicles greater in length than 19m. For Hay Road, it was assumed that heavy vehicle traffic would be less than 5%. It should be noted that the existing and future signal analysis was conducted with regard to the existing phasing options provided through the MRWA SCATS data; however, as the signal controllers typically operate under 'demand responsive' or 'dynamic' control, any one or all of the four (4) phases triggered by this intersection could be 'called' during a given cycle. The assessment has therefore been undertaken using optimum timing and signal phasing with modified phasing assigned to future 2031 road conditions, which may vary from the existing operation.

Based upon extensive on-site traffic data collection, gap acceptance and queuing surveys, heavy vehicle percentage during the respective a.m. and p.m. peak periods was in fact observed to be less than 5%.

SIDRA is a commonly used intersection modelling tool used by traffic engineers for all types of intersections. Outputs for four standard measures of operation performance can be obtained, being Degree of Saturation (DoS), Average Delay, Queue Length, and Level of Service (LoS).

- **Degree of Saturation** is a measure of how much physical capacity is being used with reference to the full capability of the particular movement, approach, or overall intersection. A DoS of 1.0 equates to full theoretical capacity although in some instances this level is exceeded in practice. SIDRA uses maximum acceptable DoS of 0.90 for signalised intersections for its Design Life analysis. Design engineers typically set a maximum DoS threshold of 0.95 for new intersection layouts or modifications.
- **Average Delay** reports the average delay per vehicle in seconds experienced by all vehicles in a particular lane, approach, or for the intersection as a whole. For severely congested intersections the average delay begins to climb exponentially.
- **Queue Length** measures the length of approach queues. In this document we have reported queue length in terms of the length of queue at the 95th percentile (the maximum queue length that will not be exceeded

for 95 percent of the time). Queue lengths provide a useful indication of the impact of signals on network performance. It also enables the traffic engineer to consider the likely impact of queues blocking back and impacting on upstream intersections and accesses.

- **Level of Service** is a combined appreciation of queuing incidence and delay time incurred, producing an alphanumeric ranking of A through F. A LoS of A indicates an excellent level of service whereby drivers delay is at a minimum and they clear the intersection at each change of signals or soon after arrival with little if any queuing. Values of B through D are acceptable in normal traffic conditions. Whilst values of E and F are typically considered undesirable, within central business district areas with significant vehicular and pedestrian numbers, corresponding delays/queues are unavoidable and hence, are generally accepted by road users.

5.4.2 Results of SIDRA Analysis

The results of the revised SIDRA analysis under existing and proposed peak hour conditions are detailed in results submitted under separate cover in PDF format**.** The results indicate that the intersections of South-Western Highway/Thomas Road and Thomas Road/Hay Road will continue to operate at acceptable urban Levels of Service during the weekday roadway peak periods with the impact of site-generated traffic on intersection operations comfortably accommodated within the existing practical road capacity under future 2031 road traffic conditions.

A review of the impacts of site-generated traffic coupled with growth in ambient background traffic to a 2031 horizon year scenario indicates that under the ultimate build-out of the lands plus a minor growth in general background traffic on Hay Road would still allow for ample practical capacity at the Thomas Road/Hay Road intersection for outbound left- and right-turns and that it is not expected that downstream queuing westbound in the eastbound lanes of Thomas Road on approach to South-Western Highway would extend beyond the Hay Road and impact outbound turning traffic from Hay Road. Similarly, no queuing on Thomas Road eastbound to turn southbound into Hay Road is expected and as part of the development of the lands, a dedicated eastbound right-turn pocket with a minimum length of 40m will be constructed within the existing central median. A dedicated westbound left-turn pocket at the Thomas Road/Hay Road intersection would also be warranted as part of the build-out on the lands in accordance with the amended LSP.

The Thomas Road/Hay Road intersection has been modelled utilising the assumption that a dedicated eastbound right-turn pocket would be constructed within the existing fixed central median on the eastbound approach to the intersection. Discussions with MRWA indicate that there are long term plans to grade separate the existing railway level crossing further to the west on Thomas Road; however, these works are not currently planned, programmed or funded within the 5-year Capital Works Program. A review of the Carriageway Pattern Plans (CPPs) and Land Protection Plans (LPPs) provided by Main Roads WA indicates that the proposal and its associated proposed access arrangements are consistent with future planning by both MRWA and the Department of Planning.

The results of the SIDRA analysis are documented in **Appendix B.**

The results of the revised assessment have been confirmed through the collection of gap acceptance data on-site at the Thomas Road/Hay Road intersection with expected minimum outbound right-turning capacity from the Hay Road approach measured at 76 and 96 vehicles per hour during the respective weekday a.m. and p.m. peak hours. No downstream queuing on Hay Road was observed which would significantly impact on northbound lands-generated traffic or on inbound southbound traffic turning right into the lands. These gap surveys were undertaken in early December 2017 during the same week as the traffic data collection and queuing surveys on South-Western Highway. A staged crossing of the intersection of Thomas Road/Hay Road is not required to accommodate future total traffic, inclusive of site-generated traffic.

In conclusion, it should be noted that based both on a review of the modelled total traffic assessment and observed traffic operations of the boundary road system, the anticipated site-generated traffic associated with the amended LSP is minimal. The only changes required to the boundary road network are the construction of a dedicated eastbound right-turn pocket on Thomas Road at Hay Road and potentially a dedicated westbound left-turn pocket on Thomas Road on approach to Hay Road. These road improvements will be negotiated with the Shire and Main Rods WA. There is currently no justification for the modification of the existing median arrangements within Thomas Road to restrict right-turning movements into and out of Hay Road to accommodate site-generated traffic inclusive of as-of-right 19m vehicles into and out of Hay Road which currently use this intersection effectively and efficiently with no impacts to existing traffic operations.

Discussions with the Shire of Serpentine-Jarrahdale in 2017 regarding the proximity of the Hay Road access to the intersection with Vlasich Road have resulted in the potential to close off the eastern terminus of Vlasich Road at Hay Road in order to eliminate potential conflict between entering/exiting vehicles to and from Vlasich Road and the proposal's site-generated traffic.

The lands will not cater to or accommodate vehicles larger than 'as of right' 19m vehicles with only fuel tankers entering and exiting the lands and hence no changes to the existing RAV network are required.

Details associated with the design of any required intersection treatments at the primary road network will be identified and concept designs will be prepared during the detailed subdivision stages of the development, in consultation with the Shire of Serpentine-Jarrahdale and Main Roads WA.

6. CYCLING AND PEDESTRIAN FACILITIES

A review of the need for additional cycling and pedestrian infrastructure has been undertaken in the context of the proposal. The existing pedestrian and cycling crossings at the South-Western Highway/Thomas Road and Thomas Road/Hay Road intersection are sufficient to accommodate the limited expected demand associated with the development. If additional pedestrian and cycling infrastructure is required along Hay Road, this will be negotiated directly with the Shire during any future Development Application stage of the project.

7. PUBLIC TRANSPORT FACILITIES

As part of the build-out of the LSP area and as noted within the *Greater Bunbury Strategy*, local bus service will be enhanced and expanded as part of continued urban development to the east and north.

8. SAFETY ISSUES

A review of the crash history on the adjacent established road network for the 5-year reporting period 2014-18 a low rate of crashes on the boundary road network and this is likely due to the recent delivery and/or upgrade of existing roads. The high quality of the boundary road network and the effective and efficient distribution of traffic through the area indicates that the risk profile will not be impacted by the traffic generated by the amended Structure Plan.

9. NOISE

The proposed development is not likely to generate any unacceptable traffic noise or vibration.

10. CONCLUSIONS

This Transport Impact Assessment has been prepared for a proposed Scheme Amendment to the Byford Structure Plan in relation to Lot 2 (640), South-Western Highway, Byford in the Shire of Serpentine-Jarrahdale.

This assessment has been prepared by Move Consultants to support the amendment Local Structure Plan and outlines the likely impacts associated with the proposed Structure Plan on the boundary movement network – namely network traffic flows, safe and efficient access to and from the lands, pedestrian and cycling facilities and public transport.

A traffic generation and distribution exercise has been undertaken to assess the potential traffic impacts associated with the proposed amendment to the LSP. The aim of this exercise was to establish the maximum traffic volumes which would be generated from the proposed development and to quantify the effect that the additional traffic has on the surrounding road network, specifically on the signalised intersection of South-Western Highway/Thomas Road and the unsignalised intersection of Thomas Road/Hay Road.

The results of the SIDRA analysis under existing and proposed peak hour conditions are detailed in **Appendix B.** The results indicate that the intersections of South-Western Highway/Thomas Road and Thomas Road/Hay Road will continue to operate at acceptable Levels of Service during the weekday roadway peak periods with the impact of lands-generated traffic on intersection operations comfortably accommodated within the existing practical road capacity under future 2031 road traffic conditions. Detailed traffic operational analysis at future connections to the public road network will be undertaken as part of a Development Application for the lands.

A review of the crash history associated with the key node(s) and links on the boundary road network indicates that the anticipated lands-generated traffic will have a negligible impact the existing risk profile.

Upgrades to the boundary road network will consist of the construction of an eastbound dedicated right-turn pocket within the fixed central median on the eastbound approach along Thomas Road to Hay Road and a dedicated westbound left-turn pocket on Thomas Road at Hay Road.

Details associated with the design of any required intersection treatments at the primary road network will be identified and concept designs will be prepared during the detailed subdivision stages of the development, in consultation with the Shire of Serpentine-Jarrahdale.

In conclusion, it should be noted that based both on a review of the modelled total traffic assessment and observed traffic operations of the boundary road system, the anticipated site-generated traffic associated with the amendment to the LSP can be accommodated within the future practical capacities and functional road classifications of the boundary road network and that the design of the internal road network is safe, efficient and effective.

11. APPENDIX A – PROPOSED MODIFIED STRUCTURE PLAN

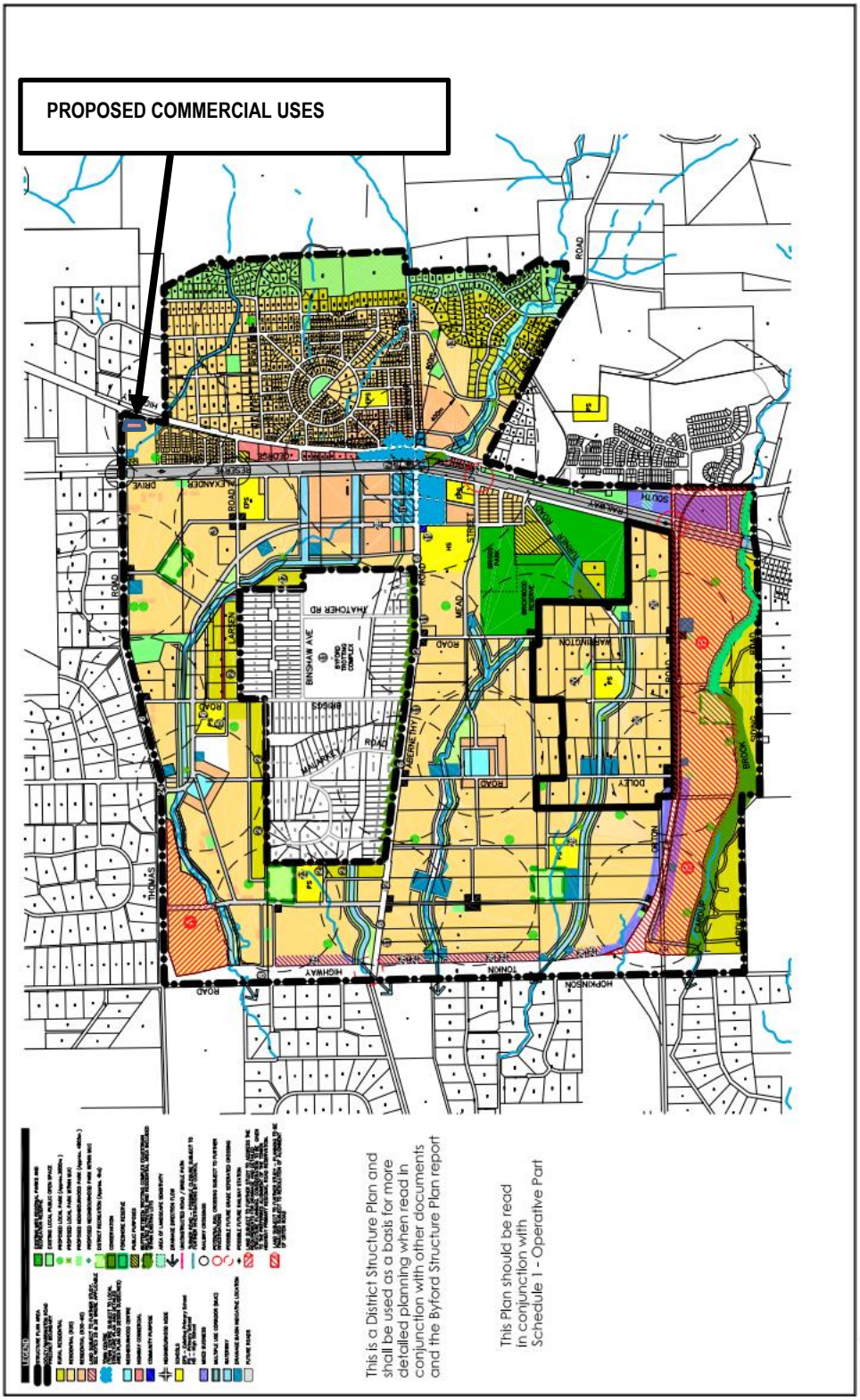


Figure 1

Byford Structure Plan

Adopted by Council (Original) - 22nd AUG 2005
Adopted by Council (Review No.1) - 13th FEB 2007
Updated 23 June, 2009

12. APPENDIX B – SIDRA RESULTS

SOUTH-WESTERN HIGHWAY/THOMAS ROAD:

EXISTING A.M. PEAK HOUR -

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: SW Hwy South											
1	L	136	18.0	0.160	13.1	LOS B	3.2	25.8	0.96	0.80	31.2
2	T	538	18.0	0.568	35.8	LOS D	9.9	79.7	0.91	0.83	30.3
Approach		674	18.0	0.568	31.2	LOS C	9.9	79.7	0.92	0.82	30.5
North: SW Hwy North											
8	T	360	18.0	0.168	10.5	LOS B	3.8	30.4	0.46	0.65	32.8
9	R	96	18.0	0.339	19.4	LOS B	2.5	20.3	0.92	0.75	28.3
Approach		456	18.0	0.340	12.3	LOS B	3.8	30.4	0.55	0.67	31.8
West: Thomas Road West											
10	L	243	20.0	0.199	2.4	LOS A	1.3	11.1	0.21	0.40	28.3
12	R	144	20.0	0.225	25.2	LOS C	3.3	27.1	0.86	0.67	15.8
Approach		387	20.0	0.225	10.9	LOS B	3.3	27.1	0.45	0.50	21.9
All Vehicles		1517	18.5	0.568	20.3	LOS C	9.9	79.7	0.69	0.69	28.0

EXISTING P.M. PEAK HOUR

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: SW Hwy South											
1	L	116	18.0	0.163	13.2	LOS B	2.4	19.8	0.96	0.78	31.2
2	T	365	18.0	0.449	33.5	LOS C	6.3	51.1	0.90	0.81	31.4
Approach		482	18.0	0.449	28.6	LOS C	6.3	51.1	0.92	0.80	31.4
North: SW Hwy North											
8	T	781	18.0	0.353	9.9	LOS A	7.0	56.9	0.51	0.69	33.2
9	R	149	18.0	0.453	16.9	LOS B	3.3	26.9	0.92	0.77	29.4
Approach		930	18.0	0.453	11.0	LOS B	7.0	56.9	0.57	0.70	32.5
West: Thomas Road West											
10	L	137	20.0	0.116	2.4	LOS A	0.7	6.0	0.23	0.40	28.3
12	R	173	20.0	0.319	25.1	LOS C	3.4	27.9	0.92	0.72	15.8
Approach		309	20.0	0.319	15.1	LOS B	3.4	27.9	0.61	0.58	19.7
All Vehicles		1721	18.4	0.453	16.7	LOS B	7.0	56.9	0.68	0.71	28.8

FUTURE 2031 A.M. PEAK HOUR

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: SW Hwy South											
1	L	122	18.0	0.317	29.0	LOS C	4.8	38.7	0.98	0.79	24.8
2	T	664	18.0	0.878	46.2	LOS D	13.4	108.6	1.00	1.04	25.9
Approach		786	18.0	0.878	43.6	LOS D	13.4	108.6	1.00	1.00	25.7
North: SW Hwy North											
8	T	432	18.0	0.195	9.2	LOS A	3.8	30.5	0.44	0.65	33.6
9	R	73	18.0	0.204	15.6	LOS B	1.5	12.4	0.85	0.72	30.1
Approach		504	18.0	0.204	10.1	LOS B	3.8	30.5	0.50	0.66	33.0
West: Thomas Road West											
10	L	308	20.0	0.350	5.3	LOS A	4.7	38.2	0.40	0.51	27.2
12	R	168	20.0	0.311	25.0	LOS C	3.3	27.3	0.92	0.71	15.8
Approach		477	20.0	0.350	12.3	LOS B	4.7	38.2	0.58	0.58	21.7
All Vehicles		1767	18.5	0.878	25.6	LOS C	13.4	108.6	0.74	0.79	26.1

FUTURE P.M. PEAK HOUR

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: SW Hwy South											
1	L	140	18.0	0.270	17.3	LOS B	3.4	27.3	0.97	0.79	29.2
2	T	445	18.0	0.893	54.9	LOS D	11.0	88.9	1.00	1.05	23.1
Approach		585	18.0	0.893	45.9	LOS D	11.0	88.9	0.99	0.99	24.4
North: SW Hwy North											
8	T	937	18.0	0.391	9.3	LOS A	8.5	69.1	0.46	0.67	33.5
9	R	535	18.0	0.875	26.4	LOS C	14.1	114.1	1.00	1.00	25.7
Approach		1472	18.0	0.875	15.5	LOS B	14.1	114.1	0.66	0.79	30.1
West: Thomas Road West											
10	L	164	20.0	0.140	2.3	LOS A	0.9	7.3	0.20	0.39	28.3
12	R	253	20.0	0.544	32.0	LOS C	5.8	47.2	0.97	0.78	15.0
Approach		417	20.0	0.544	20.3	LOS C	5.8	47.2	0.67	0.62	18.4
All Vehicles		2474	18.3	0.893	23.5	LOS C	14.1	114.1	0.74	0.81	25.9

THOMAS ROAD/HAY ROAD:

EXISTING A.M. PEAK HOUR:

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Hays Road South											
1	L	15	5.0	0.013	9.3	LOS A	0.1	0.5	0.32	0.60	47.5
3	R	13	5.0	0.015	9.6	LOS A	0.1	0.6	0.38	0.59	47.4
Approach		28	5.0	0.015	9.4	LOS A	0.1	0.6	0.35	0.60	47.5
East: Thomas Road East											
4	L	2	5.0	0.078	8.4	LOS A	0.0	0.0	0.00	1.09	49.0
5	T	263	20.0	0.077	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		265	19.9	0.077	0.1	LOS A	0.0	0.0	0.00	0.01	59.9
West: Thomas Road West											
11	T	1	20.0	0.000	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
12	R	11	14.0	0.012	9.6	LOS A	0.1	0.5	0.32	0.60	47.7
Approach		12	14.5	0.012	8.7	LOS A	0.1	0.5	0.29	0.54	48.6
All Vehicles		305	18.3	0.077	1.3	NA	0.1	0.6	0.04	0.08	58.0

EXISTING P.M. PEAK HOUR:

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Hays Road South											
1	L	6	5.0	0.006	9.6	LOS A	0.0	0.2	0.38	0.60	47.3
3	R	7	5.0	0.013	13.6	LOS B	0.1	0.5	0.61	0.71	43.8
Approach		13	5.0	0.013	11.7	LOS B	0.1	0.5	0.50	0.66	45.4
East: Thomas Road East											
4	L	33	5.0	0.114	8.4	LOS A	0.0	0.0	0.00	0.99	49.0
5	T	361	20.0	0.114	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		394	18.8	0.114	0.7	LOS A	0.0	0.0	0.00	0.08	58.9
West: Thomas Road West											
11	T	267	20.0	0.077	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
12	R	18	5.0	0.020	9.6	LOS A	0.1	0.7	0.38	0.62	47.5
Approach		285	19.1	0.077	0.6	LOS A	0.1	0.7	0.02	0.04	59.0
All Vehicles		692	18.6	0.114	0.9	NA	0.1	0.7	0.02	0.08	58.6

FUTURE A.M. PEAK HOUR:

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Hays Road South											
1	L	31	5.0	0.027	9.5	LOS A	0.2	1.1	0.36	0.62	47.4
3	R	23	5.0	0.033	11.3	LOS B	0.1	1.0	0.52	0.75	45.9
Approach		54	5.0	0.033	10.3	LOS B	0.2	1.1	0.43	0.68	46.7
East: Thomas Road East											
4	L	8	5.0	0.094	8.4	LOS A	0.0	0.0	0.00	1.07	49.0
5	T	316	20.0	0.094	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		324	19.6	0.094	0.2	LOS A	0.0	0.0	0.00	0.03	59.7
West: Thomas Road West											
11	T	438	20.0	0.127	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
12	R	25	5.0	0.041	10.7	LOS B	0.2	1.5	0.43	0.66	46.5
Approach		463	19.2	0.127	0.6	LOS B	0.2	1.5	0.02	0.04	59.1
All Vehicles		841	18.4	0.127	1.1	NA	0.2	1.5	0.04	0.07	58.3

FUTURE P.M. PEAK HOUR:

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Hays Road South											
1	L	27	5.0	0.027	10.0	LOS B	0.2	1.1	0.43	0.64	47.1
3	R	27	5.0	0.072	17.3	LOS C	0.4	2.6	0.70	0.88	40.8
Approach		55	5.0	0.072	13.6	LOS C	0.4	2.6	0.56	0.76	43.7
East: Thomas Road East											
4	L	62	5.0	0.143	8.4	LOS A	0.0	0.0	0.00	0.94	49.0
5	T	435	20.0	0.143	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		497	18.1	0.143	1.0	LOS A	0.0	0.0	0.00	0.12	58.4
West: Thomas Road West											
11	T	372	20.0	0.108	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
12	R	39	5.0	0.049	10.3	LOS B	0.2	1.7	0.44	0.67	47.0
Approach		411	18.6	0.108	1.0	LOS B	0.2	1.7	0.04	0.06	58.5
All Vehicles		962	17.6	0.143	1.7	NA	0.4	2.6	0.05	0.13	57.3

Megara Pty Ltd

BAL-Assessment
– 640 South Western Hwy Byford

V1.1 – 18 September 2019

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Disclaimer

Natural Area Holdings Pty Ltd, trading as Natural Area Consulting Management Services (Natural Area), has prepared this BAL-assessment for use by:

- Owner/occupiers of 640 South Western Hwy Byford
- Megara Pty Ltd
- Shire of Serpentine-Jarrahdale.

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Document Title	MEG R BAL 640 SW Hwy Byford Aug 2019.docx
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Version No.	Date	Changes	Prepared by	Approved by	Status
V1	05 September 2019	New document	SB	LS	Final
V1.1	18 September 2019	Minor Adjustments	SB	SH	Final

Contents

1.0 Introduction

Natural Area Holdings Pty Ltd T/A Natural Area Consulting Management Services has prepared this bushfire attack level (BAL) assessment report to support the preparation of a structure plan for commercial development at 640 (Lot 2) South Western Highway Byford (Figure 1) within the Shire of Serpentine-Jarrahdale at the request of Megara Pty Ltd. The Lot is located at the corner of Hay Road, Thomas Road and South Western Hwy, and adjacent to residential housing to the west, north and south, and rural property to the east.

This report details the following:

- site details and location
- vegetation classification
- site slope
- fire danger index
- potential bushfire impacts
- indicative Bushfire Attack Level (BAL) zones for the Lot.

The site assessment was undertaken on 21 August 2019 and the report has been prepared by Sue Brand, a Level 2 bushfire planning and assessment (BPAD) practitioner accredited with the Fire Protection Association of Australia.

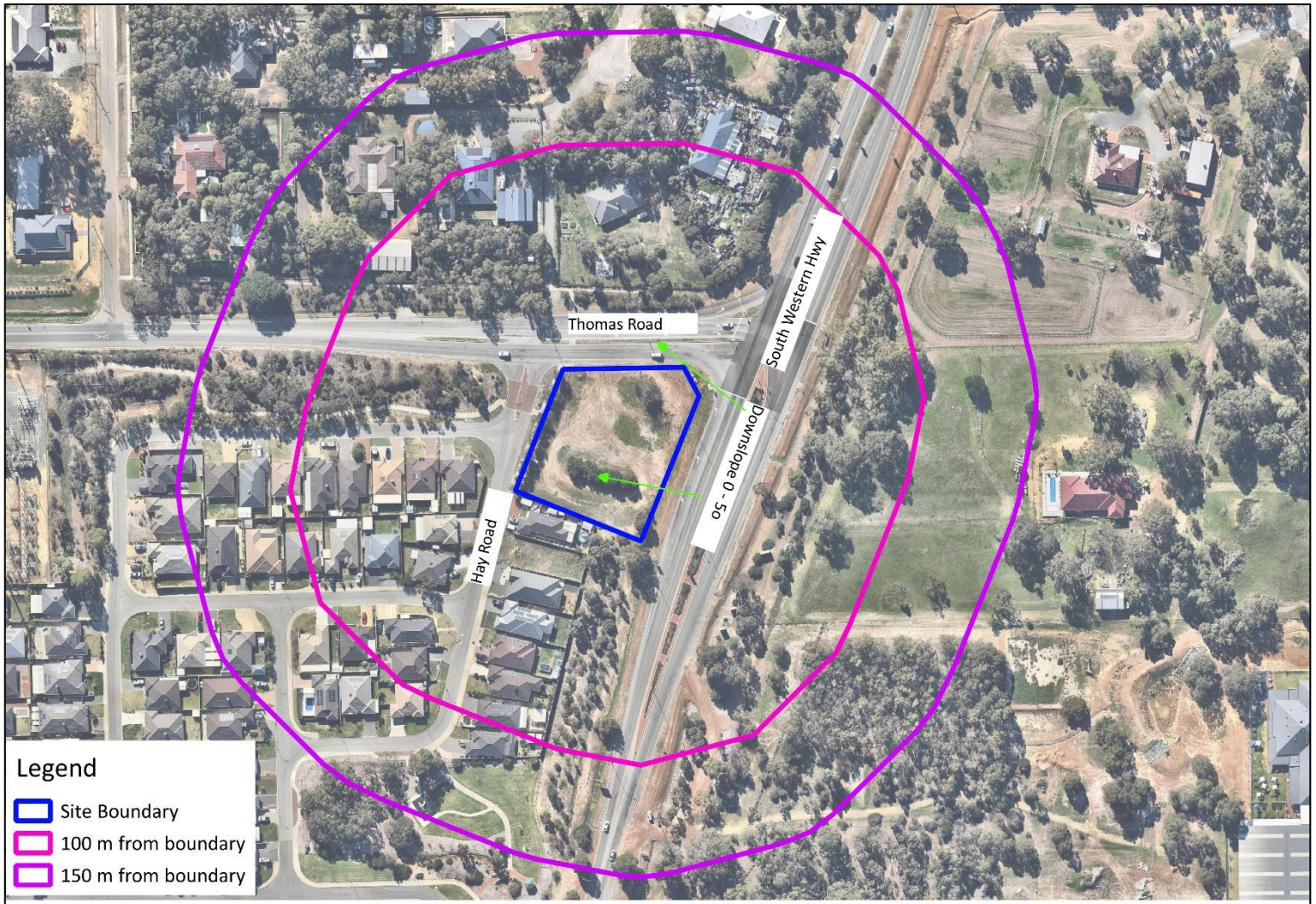


Figure 1:
Location and Slope,
640 South Western Hwy Byford

2.0 Bushfire Threat

2.1 Site Characteristics

2.1.1 Location

No. 640 South Western Hwy is located at the intersection of Hay Road, Thomas Road and South Western Hwy on the northern boundary of the town of Byford (Figure 1). The site is approximately 4.053 ha, and zoned urban development on the Byford Structure Plan (Shire of Serpentine-Jarrahdale, 2019).

2.1.2 Slope

The site has a gentle rise towards the east; meaning that to the west it is downslope 0 – 5^{o} (Figure 1)

2.1.3 Land use

The site is vacant land with some shrubs and grassy weeds present (Figure 2).

Figure 2: Land use, 640 South Western Hwy, Byford

2.2 Vegetation Classification

All vegetation within 100 m of the proposed Lots was classified in accordance with Clause 2.2.3 of *AS 3959 – 2018 Construction of Buildings in Bushfire-prone Areas* (Figure 9). The site is largely cleared with some remnant trees that will be cleared to accommodate the proposed development (Figures 1, 2). The predominant vegetation that will influence the BAL-ratings within the Lot is the Class B Woodland across South Western Hwy to the east.

2.2.1 Area 1: Class D Scrub – Exclusion Clause 2.2.3.2 (b)

Class D Scrub is present in the drainage reserve to the west of the site and is characterised by shrubs 2 – 4 m with a continuous canopy with occasional trees (Figure 3). This area of vegetation is downslope 0 – 5° and is associated with a creek line/drainage area. As this area is < 1 ha and is more than 40 m from low-threat vegetated areas in Aquanita Rise to the north and more than 100 m to the Class B Woodland located across South Western Hwy to the east, it is subject to exclusion clause 2.2.3.2 (b) of AS 3959 -2018.

Area 1 **Classification or Exclusion Clause** Class D Scrub – Exclusion Clause 2.2.3.2 (b)

Photo ID: 1

Photo ID: 2

Figure 3: Class D Scrub to the west and downslope of the site

2.2.2 Area 2: Class B Woodland – Exclusion Clause 2.2.3.2 (b)

Area 2 is Class B Woodland is present in a 0.1 ha stand in the rear of Lot 216 Aquanita Rise, across Thomas Road to the north (Figure 4). It is characterised by trees to 10 m with a canopy cover of around 30% over a grassy understorey. As this vegetation is < 1 ha (0.1 ha) and more than 100 m from the Class B Woodland located across South Western Hwy to the east, it is subject to Exclusion Clause 2.2.3.2 (b) of AS 3959 – 2018.

Area 2 **Classification or Exclusion Clause** Class B Woodland – Exclusion Clause 2.2.3.2 (b)

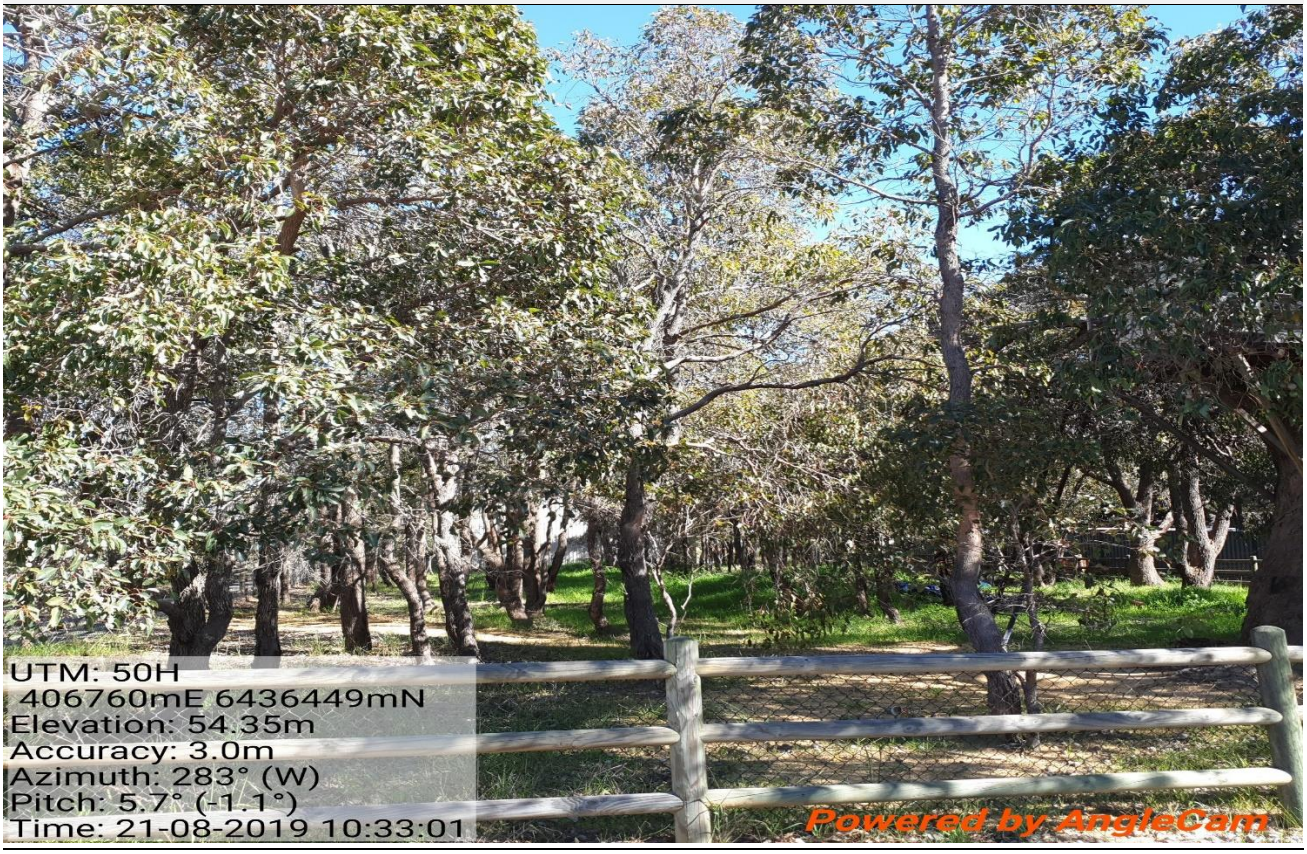


Photo ID: 3 - Lot 216 Aquanita Rise to the north

Figure 4: Class B Woodland < 1 ha across Thomas Road

2.2.3 Area 3: Class B Woodland

Area 3 is Class B Woodland present in a local reserve at Lot 2857 Linton St that backs onto South Western Hwy to the east (Figure 5). This vegetation is characterised by trees to 10 m with a canopy cover of around 30% over a grassy understorey, is upslope, and approximately 90 m from the site, thus is classified vegetation as per AS 3959 -2018. This vegetation will be retained in the longer term as it is associated with the Bowra and O'Dea Memorial Tree Park.

Area 3	**Classification or Exclusion Clause**	Class B Woodland

Photo ID: 4 – Lot 2857 Linton St to the east

Figure 5: Class B Woodland

2.2.4 Area 4: Class G Grassland

Class G grassland in the form of sown pasture is present in rural land across South Western Hwy to the east (Figure 6) and appears to be cultivated on a cyclic basis; a review of aerial imagery indicates the land has been cultivated since November 1953, the date of the first aerial image available for the site. This vegetation class is more than 60 m from the site and will have no influence on the BAL-rating.

Area 4	**Classification or Exclusion Clause**	Class G Grassland

Photo ID: 5

Figure 6: Class G Grassland in rural land across South Western Hwy

2.2.5 Area 5: Low-threat Vegetation

Low-threat vegetation is present in a nature strip along the perimeter of South Western Hwy to the east and Thomas Road to the north of the site (Figure 7). These are strips of vegetation less than 20 m wide or single rows of shrubs that act as a noise and visual buffer between houses with a frontage to South Western Hwy and/or Thomas Road, and are more than 20 m from classified vegetation. Similar vegetated buffers are present along the boundaries of several Lots in Aquanita Drive to the north where there is also evidence of management present in the form of irrigation pipes and sprinklers.

Area 5 **Classification or Exclusion Clause** Low-threat vegetation – exclusion clause 2.2.3.2 (f)

Photo ID: 6

Photo ID: 7

Figure 7: Low-threat vegetation – nature strip along South Western Hwy to the south

2.2.6 Area 6: Non-vegetated Areas

Non-vegetated areas are present in and around the site, and includes roads, residential areas, footpaths and road verges (Figure 8); these areas are subject to exclusion clause 2.2.3.2 (e) of AS 3959 – 2018.

Area 5	**Classification or Exclusion Clause**	Non-vegetated areas – exclusion clause 2.2.3.2 (e)

Photo ID: 8

Figure 8: Non-vegetated areas, Hay Road, Byford

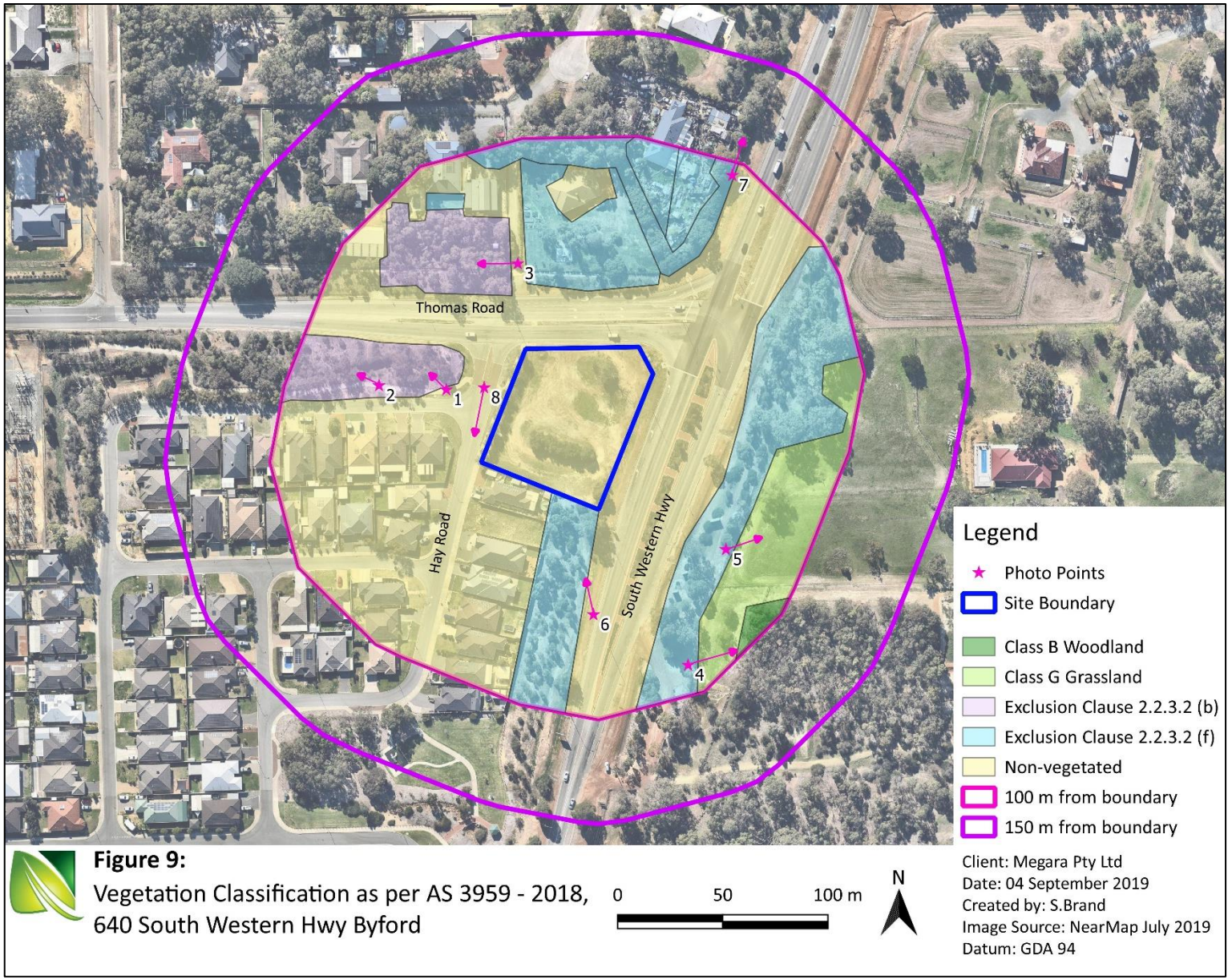


Figure 9:
Vegetation Classification as per AS 3959 - 2018, 640 South Western Hwy Byford

2.3 Bushfire Hazard Level

2.3.1 Relevant Fire Danger Index

The fire danger index for this site is FDI 80, as documented in Table 2.4.3 of AS 3959 and which is the nominated FDI for Western Australia.

2.3.2 Potential Fire Impacts

The potential fire impacts to the building could include smoke from fires beyond the immediate vicinity of the site. Table 1 summarises the separation distance and slope as it relates to the site.

Table 1: Separation distances from classified vegetation

Vegetation Class	Slope	Separation Distance (m)	BAL-rating
Class B Woodland	Upslope	89	BAL-12.5
Class B Woodland < 1 ha	Downslope 0 – 5°	33	Low – Exclusion Clause 2.2.3.2 (b)
Class D Scrub < 1 ha	Downslope 0 – 5°	25	Low – Exclusion Clause 2.2.3.2 (b)
Class G grassland	Upslope	> 60	Low
Other low-threat vegetation	Downslope 0 – 5° and Upslope	> 25	Low – Exclusion Clause 2.2.3.2 (f)
		Overall BAL-rating	**BAL-12.5**

2.4 Bushfire Attack Level

As the only classified vegetation is the Class B Woodland located in Lot 2857 Linton Ave across South Western Highway to the east, it will determine the bushfire attack level (BAL) at 640 South Western Hwy. A BAL-contour diagram has been prepared showing the extent of each BAL-zone within the site (Figure 10). Depending on the proposed building layout when development occurs, a maximum rating of BAL-12.5 may apply, with the actual being confirmed when the building configuration is known.

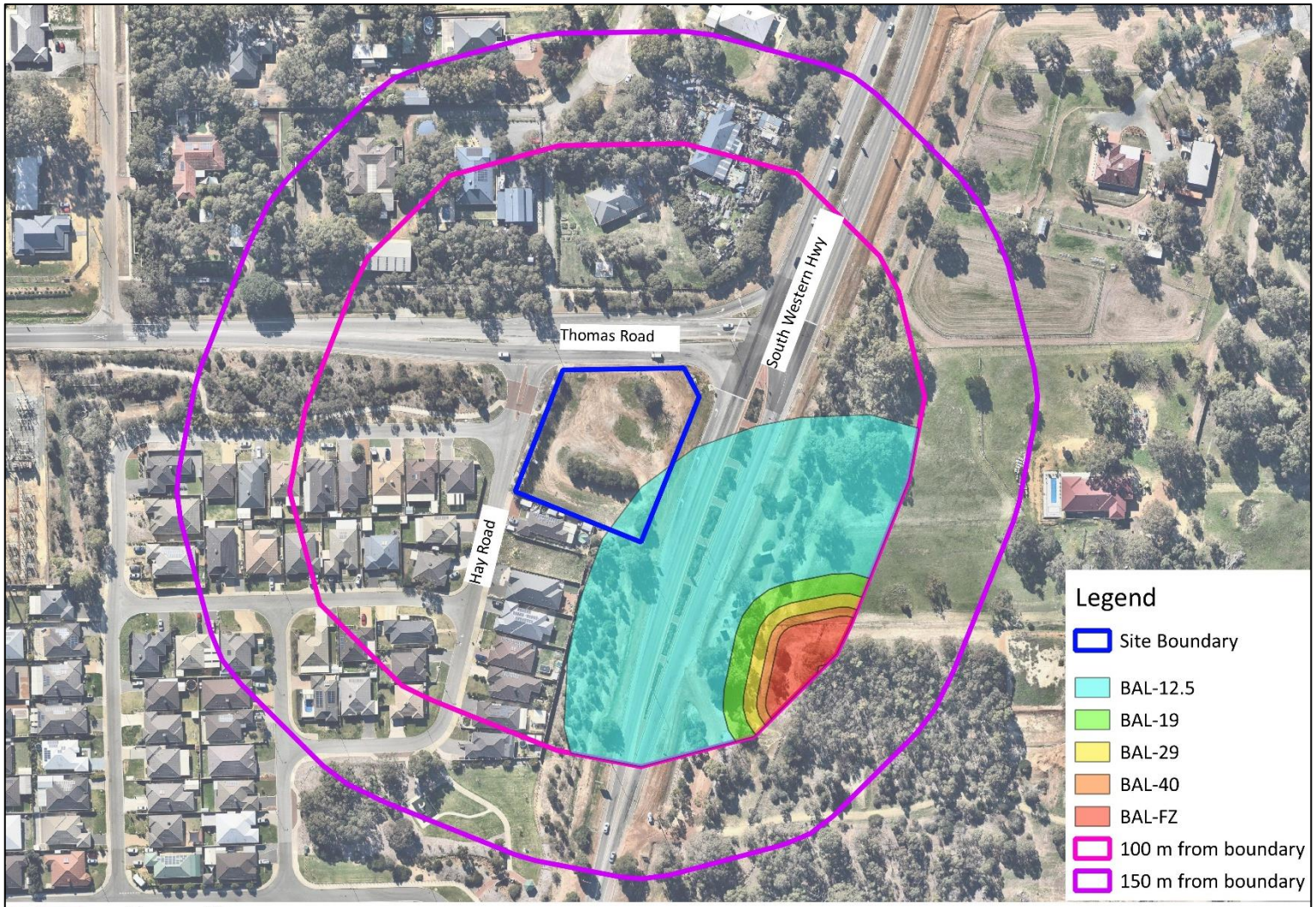


Figure 10:
BAL-contours,
640 South Western Hwy Byford

3.0 Compliance and Justifications

3.1 SPP 3.7 Objectives and Application of Policy Measures

The intent of *State Planning Policy (SPP) 3.7 Planning in Bushfire Prone Areas* (Department of Planning and Western Australian Planning Commission, 2015) is to ensure that bushfire risks are considered in a timely manner and that planning documents demonstrate the appropriate application of the various policy measures. Table 2 summarises the intent and objectives of SPP 3.7 and provides evidence of how 640 South Western Hwy Byford complies.

Table 2: Evidence of compliance with SPP 3.7 intent and objectives

SPP Reference	Description	Evidence of Compliance
Intent	▪ Ensure that risks associated with bushfires are planned using a risk-based approach	▪ Undertaking a BAL-assessment and documenting in report that complies with SPP 3.7 ▪ Hazard assessment indicates risks associated with bushland are manageable
Objective 1	▪ Avoid any increase in the threat of bushfire to people, property and infrastructure	▪ Hazard assessment indicates risks associated with bushland are manageable ▪ A maximum BAL-12.5 rating applies to the south-eastern portion of the Lot
Objective 2	▪ Reduce vulnerability to bushfire	▪ Hazard assessment indicates risks associated with bushland are manageable ▪ A maximum BAL-12.5 rating applies to the south-eastern portion of the Lot
Objective 3	▪ Ensure that higher order strategic planning documents and proposals consider bushfire protection requirements at an early stage	▪ The BAL-assessment applies to the proposed commercial use of the site based on current information levels
Objective 4	▪ Achieve an appropriate balance between bushfire risk management and biodiversity conservation	▪ Conservation of biodiversity has been considered during earlier planning stages

3.2 Bushfire Protection Criteria

Table 3 demonstrates how development of 640 South Western Hwy complies with Bushfire Protection Criteria. No other bushfire protection mechanisms are required.

Table 3: Compliance with bushfire protection criteria

Intent	Performance Principle	Solution
Element 1: Location		
Ensure subdivision and development applications are located in areas with the least possible risk of bushfire	▪ Bushfire hazard assessment is or will on completion be moderate or low ▪ BAL-rating is BAL-29 or lower	▪ The commercial land use will occur in and existing lot ▪ Bushfire hazard assessment indicates the risk is manageable ▪ A maximum BAL-12.5 rating applies to the south-eastern portion of the Lot
Element 2: Siting and Design of Development		
Siting and design of development minimises the level of bushfire impact	▪ Siting and design of development is appropriate to the level of bushfire threat and minimises risk to people, property and infrastructure	▪ Bushfire hazard assessment indicates that the bushfire risk is manageable ▪ A maximum BAL-12.5 rating applies to the south-eastern portion of the Lot
Element 3: Vehicular Access		
Vehicular access servicing a subdivision is available and safe during a bushfire event	▪ Internal layout, design and construction of public and private vehicular access and egress in the subdivision allow emergency and other vehicles to move easily and safely at all times	▪ Access will be via the existing road network, with no additional road construction within or in the immediate vicinity of the site ▪ Site fronts three roads, namely Hay Rd, Thomas Rd and South Western Hwy
Element 4: Water		
Water is available to the subdivision, development or land use to enable people, property and infrastructure to be defended from bushfire	▪ Subdivision is provided with a permanent and secure water supply that is sufficient for firefighting purposes	▪ Site is located in a reticulated water supply area

3.3 Compliance with Relevant Documents

Sections 3.1 and 3.2 demonstrate how the proposed commercial use of 640 South Western Hwy Byford complies with *State Planning Policy 3.7* (Department of Planning and WA Planning Commission, 2015) and *Guidelines for Planning in Bushfire Prone Areas* (Department of Planning, Department of Fire and Emergency Services and WA Planning Commission, V1.2, 2017).

The owners must comply with relevant sections of the annual firebreak notice and bushfire information prepared by the Shire of Serpentine Jarrahdale, such as total fire ban and hazard reduction programs.

3.4 Compliance Statement

This BAL-assessment report has been prepared in accordance with the requirements of *State Planning Policy 3.7 Planning in Bushfire Prone Areas* (Department of Planning and Western Australian Planning Commission, 2015) and *Guidelines for Planning in Bushfire Prone Areas* (Department of Planning, Lands and Heritage, the Western Australian Planning Commission, and the Department of Fire and Emergency Services, V1.2, 2017). The BAL-contour map was prepared in accordance with the simple procedure (Method 1) of AS 3959 - 2018. The BAL-rating contours are accurate as at 05 September 2019.

Signed:
Dated: 18 September 2019
Accreditation Number: 36638
Accreditation Expiry Date: 30 April 2020

BPAD
Bushfire
Planning & Design
Accredited Practitioner
Level 2

4.0 References

AS 3959 – 2018 Construction of Buildings in Bushfire Prone Areas

Department of Planning, Lands and Heritage, the Western Australian Planning Commission, and the Department of Fire and Emergency Services, (2017), *Guidelines for Planning in Bushfire Prone Areas* (V1.2), Western Australian Planning Commission, Perth, Western Australia.

Department of Planning and the Western Australian Planning Commission, (2015), *State Planning Policy (SPP) 3.7 Planning in Bushfire Prone Areas*, Western Australian Planning Commission, Perth, Western Australia.

Shire of Serpentine Jarrahdale, (2017), *Online Mapping*, accessed September 2019 via http://sjsmunadmz2.sjshire.wa.gov.au/intramaps80/.

pracsys.

Megara

Retail Need Analysis 640 South West Highway

September 2019

Document Control				
Document Version	**Description**	**Prepared By**	**Approved By**	**Date Approved**
v 1.0	Briefing Note	Brayden Keizer	Dawson Demassiet-Huning	03 September 2019
v 2.0	Briefing Note	Brayden Keizer	Dawson Demassiet-Huning	06 September 2019

CONTENTS

1 INTRODUCTION

This report investigates the need for retail land uses at Lot 640 of South West Highway, having regard for local demand and the level of supply currently offered by existing and planned activity centres. Various site constraints limit the viability of developing it for residential purposes, and the property's exposure to passing trade on a prominent corner of two regional roads warrants further consideration of commercial/retail activities. A previous request to amend the planning framework and rezone the subject site was not supported by the WA Planning Commission on the grounds that it was 'Out of Centre' development and could impact the Town Centre. However, since this decision in 2013, there has been retail development both inside and outside of the Town Centre, catering to the rapid growth in Byford.

The Shire of Serpentine-Jarrahdale's existing Byford Structure Plan focuses on District and neighbourhood level floorspace provision in the Town Centre. The proposed 2018 District Structure Plan indicates that in addition to the District Centre and three Neighbourhood centres, the growing population of Byford would support 3,200m^2 of additional local centres[1]. The population surrounding the proposed development site is underserviced with no provision of convenience within a walkable catchment.

This report uses a gap analysis to estimate the need for convenience retail in the Byford area and assess the potential impact that 1,000m^2 of convenience retail floorspace at the proposed site could have on the Byford Town Centre.

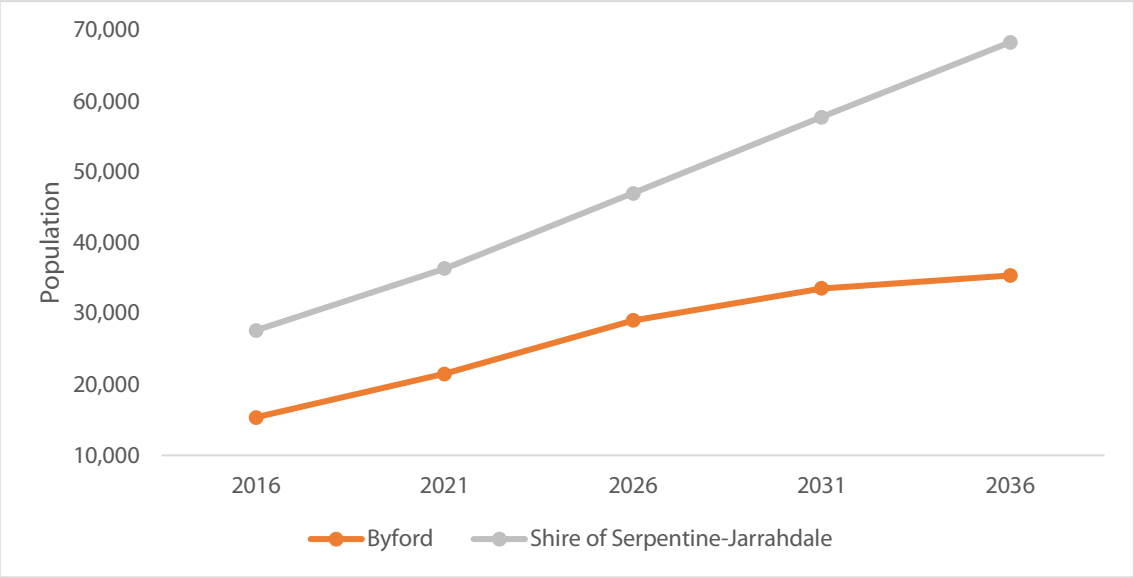
1.1 Context

As retail is a population driven use, a look at the current population and future trajectory is critical when determining need. At the time of the last census (2016), the population of the Byford area was 15,375.[2] The population is set to grow to 21,519 by 2021, reflecting a 40% increase over just 5 years. This rapid rate of growth is mirrored within Serpentine-Jarrahdale as a whole, with the Shire forecast to grow by 32% to 36,403 residents by 2021. When looking beyond 2021, the Shire is forecast to continue growing by a rapid 4.3% per year, and Byford continues to expand quickly at 3.4% (Figure 1).

[1] The Shire's draft District Structure Plan is yet to be advertised or formally assessed by the WAPC. A copy of the Structure Plan is appended.

[2] ABS 2016, *Census of Population and Housing*.

Figure 1. Actual and Forecast Population Growth Estimates



Source: Forecast .id 2019

The majority of the commercial development in the Byford Town Centre was completed between 2013 and 2018. Whilst this recent in-centre development provided a vital 15,156m2 of Shop/Retail commercial floorspace, Byford's rapidly growing residential population continues to face a shortage of convenience retail. This shortage will only be exacerbated as Byford's population continues to grow. The proposed development at 640 South West Highway can play an important role in filling some of this gap between the supply of and demand for convenience retail as Byford expands.

1.2 Subject Site

The subject site is located at 640 South West Highway. This location is a corner block bordered by South West Hwy to the East, Thomas road to the North, Hay Rd to the West and residential properties to the South (Figure 2).

Figure 2. Subject Site

Source: Megara 2019

The subject site has been deemed as unsuitable for residential development by the Environmental Protection Agency and the Shire of Serpentine-Jarrahdale due to previous land uses and its location on the intersection of a primary and secondary distributor road. A commercial offering at this site represents an opportunity to achieve the best use of the land.

The proposed development will only be able to take up a certain amount of the total site due to the need for appropriate set-backs, landscaping, vehicle access and parking arrangements. The total possible retail floorspace provision is thus relatively minor. It is estimated that a floorspace area in the order of 1,000m^2 could potentially be developed on the site; this upper limit has been used to inform assessment of the site and potential impacts on the activity centre hierarchy.

2 STRATEGIC ALIGNMENT

This section demonstrates how the proposed development site is suitably located to meet the need of the local community based on state policy for activity centres and liveable neighourhoods.

2.1 State Planning Policy 4.2 Activity Centres for Perth and Peel

The State Planning Policy 4.2 Activity Centres for Perth and Peel (SPP 4.2) outlines the need to distribute activity centres to meet different levels of community need. It also proposes that these activity centres enable employment, goods and services to be accessed efficiently and equitably by the community. The current distribution of activity centres in Byford is extremely focused on density around the Town Centre. While this is a generally advisable strategy of retail planning, there is a need to consider the requirements of Byford's residents that are not within the walkable catchment of existing developments. Of particular concern is the failure to implement local activity centre nodes within the pedestrian catchment areas of Byford's northern residential areas. In fact, none of the planned nodes near the subject site at 640 South West Highway north of the Town Centre have included a retail offering, leaving a wide catchment of residential dwellings without a commercial/convenience retail centre within their walkable catchment. Considering this demonstrated community need, the subject site represents an ideal opportunity to service a shortage in retail floorspace supply and already has a willing investor who is progressing the necessary planning requirements to do so. Development of the subject site will fulfil a vital local-level activity centre function, enabling efficient and equitable access for residents of the surrounding residential zones.

SPP 4.2 further states that activity centres should be planned to support a wide range of commercial premises. The provision of a limited amount of convenience retail in this location will not compete directly with the in-centre grocery chains such as Coles, Woolworths and Aldi and as such do not represent a threat to the viability of the Town Centre. Similarly, given the space constraints of the site, there is limited opportunity for it to expand and create the agglomeration of activity needed to threaten the Town Centre. These characteristics of the development reflects the Policy's objective to promote a competitive retail and commercial market and service community needs.

2.2 Liveable Neighbourhoods Policy

The WAPC's Liveable Neighbourhoods policy stipulates, in objective O1, that new residential areas must be provided with sufficient and appropriately located land for activity centres and other employment and business needs. Currently, residents of dwellings between Thomas, Alexander and Larsen roads to the north of the Byford town centre are without any such centre. The subject site is located in the pedestrian catchment of households currently without walking access to an activity centre. This aligns with objective O4 of the Policy, which identifies the need for a substantial majority of residences to have access to a centre within a 500m radius. Additionally, the Policy states in objective R14 that neighbourhood centres should be located on sites with sufficient traffic and appropriate exposure to facilitate the successful operation of the centre.

Similarly, R28 of the Policy identifies that strategic business sites such as freeway frontages and arterial road intersections should be excluded from residential use. The proposed site at the corner of South West Highway and Thomas Road demonstrably satisfies these requirements. Its development for commercial purposes is indeed ideal for the site, with ease of access for vehicles from arterial roads which takes advantage of strategic commercial location.

2.3 Perth and Peel @3.5million

A key objective of the Perth and Peel @3.5miilion framework is the consolidation of urban areas to provide more efficient use of urban land and improved access to commercial facilities. This objective is embodied by the proposed provision of commercial floorspace at the subject site, which will consolidate and densify Byford's urban profile. Additionally, use of vacant land that has been historically contaminated (and is thus unfit for residential use) aligns directly with the aim of using urban land efficiently and sustainably. By delivering a convenience retail offering at the corner of two main arterial road networks, access to commercial facilities for residents of the northern Byford area will be significantly enhanced.

Another objective of the Framework is to promote employment opportunities and increase the number of people who live and work within sub-regions, while maximising use of existing infrastructure. Development of the subject site as convenience retail floorspace will provide numerous employment opportunities for residents of the Byford area. Additionally, the site maximises the advantage of the existing arterial road infrastructure.

South Metropolitan Peel Sub-regional Planning Framework

The South Metropolitan Peel Sub-regional Planning Framework establishes the planning framework specific to Perth's southern metropolitan areas, which includes Byford. The Framework identifies that the south-eastern sector, in which Byford is located, currently exhibits an employment self-sufficiency of just 45 per cent[3]. The proposed commercial floorspace offering at the subject site will provide employment opportunities for Byford's labour force and contribute to improving the subregion's employment self-sufficiency.

The Framework identifies that the subregion's future economic structure is projected to focus on manufacturing, construction, retail, healthcare and social assistance industries. The subject site's likely provision of convenience retail, bulky goods retail, medical and/or service industry floorspace is thus well aligned with the subregion's economic specialisation strategy.

[3] Department of Planning, Lands and Heritage, *South Metropolitan Peel Sub-regional Planning Framework*, p. 28.

3 RETAIL ANALYSIS

This section assesses the current supply of retail in the Byford area and uses benchmark analysis to identify any potential gaps in the provision of convenience floorspace. The analysis compares any identified gaps with the estimated upper limit of the proposed development, which is approximately 1,000m^2.

3.1 Retail Supply

Current

A study area (the Study Area) of 5km was used to estimate the total floorspace that would provide convenience retail goods and services for the Byford population. The total provision of Shop/retail floorspace in the Study Area was estimated through:

- Department of Planning, Lands and Heritage: Land-use and Employment Survey (LUES)
- Manual estimation of new centres (gross area was measured, it was assumed that Net Lettable Area (NLA) is approximately 90% of gross area)

The estimated NLA within the Byford Town Centre is currently 15,156m^2 and includes recent convenience retail floorspace development in the area. The Study Area's total provision of Shop/Retail floorspace is currently 20,888m^2.

Future

The existing approved Byford Structure Plan establishes a broad framework for the establishment of retail centres throughout the Structure Plan area, including a town centre, two neighbourhood centres and a series of fourteen 'neighbourhood nodes' (distributed on the basis of 400m radius pedestrian catchment areas). This planned hierarchy of activity centres and neighbourhood nodes has not, however, been implemented in the manner shown on the Structure Plan, with many of the neighbourhood nodes not delivered or supplying any convenience retail function.

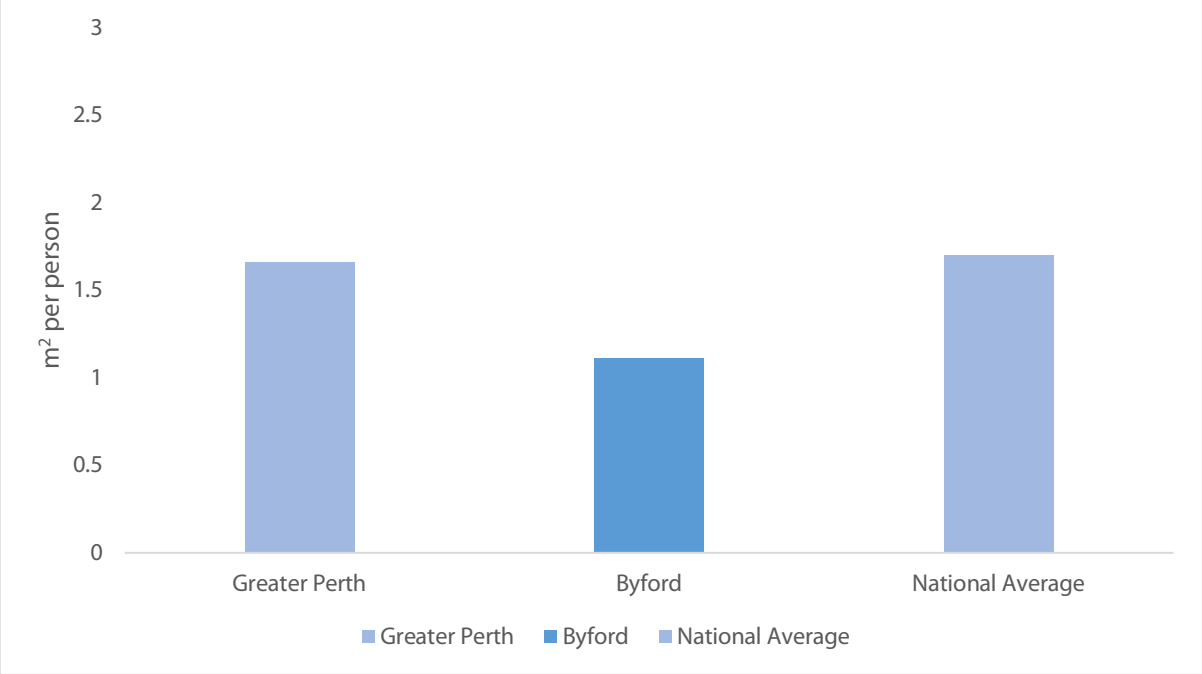
The Shire's more recently prepared Draft Structure Plan (unadvertised) estimates that the projected population of the Structure Plan Area will generate the need for approximately 32,900m^2 net lettable area (NLA) of retail floorspace. The Byford Town Centre is allocated 14,700m^2 of retail floorspace, Neighbourhood centres are to accommodate 5,000m^2 each and local nodes are to collectively provide 3,200m^2 of Shop/retail floorspace. While the Town Centre and proposed neighbourhood centres are spatially identified on the draft (unadvertised) Structure Plan map, no local nodes are identified.

3.2 Retail Gap Analysis

Benchmark Comparison

The 2019 population of Byford is approximately 18,814,[4] equating to a provision ratio of 1.11m^2 of Shop/Retail floorspace per resident.[5] This is considerably lower than the Greater Perth average, which supplies approximately 50% more floorspace at 1.66m^2 per resident. The provision of retail floorspace in the Greater Perth area has been restrained until recently due to floorspace caps. A common retail to population provision ratio in Australia is 2.2m^2 per person for all retail categories and an estimated 1.70m^2 per person for Shop/retail, based on national averages.[6]

Figure 3. Retail Provision Rate Comparison

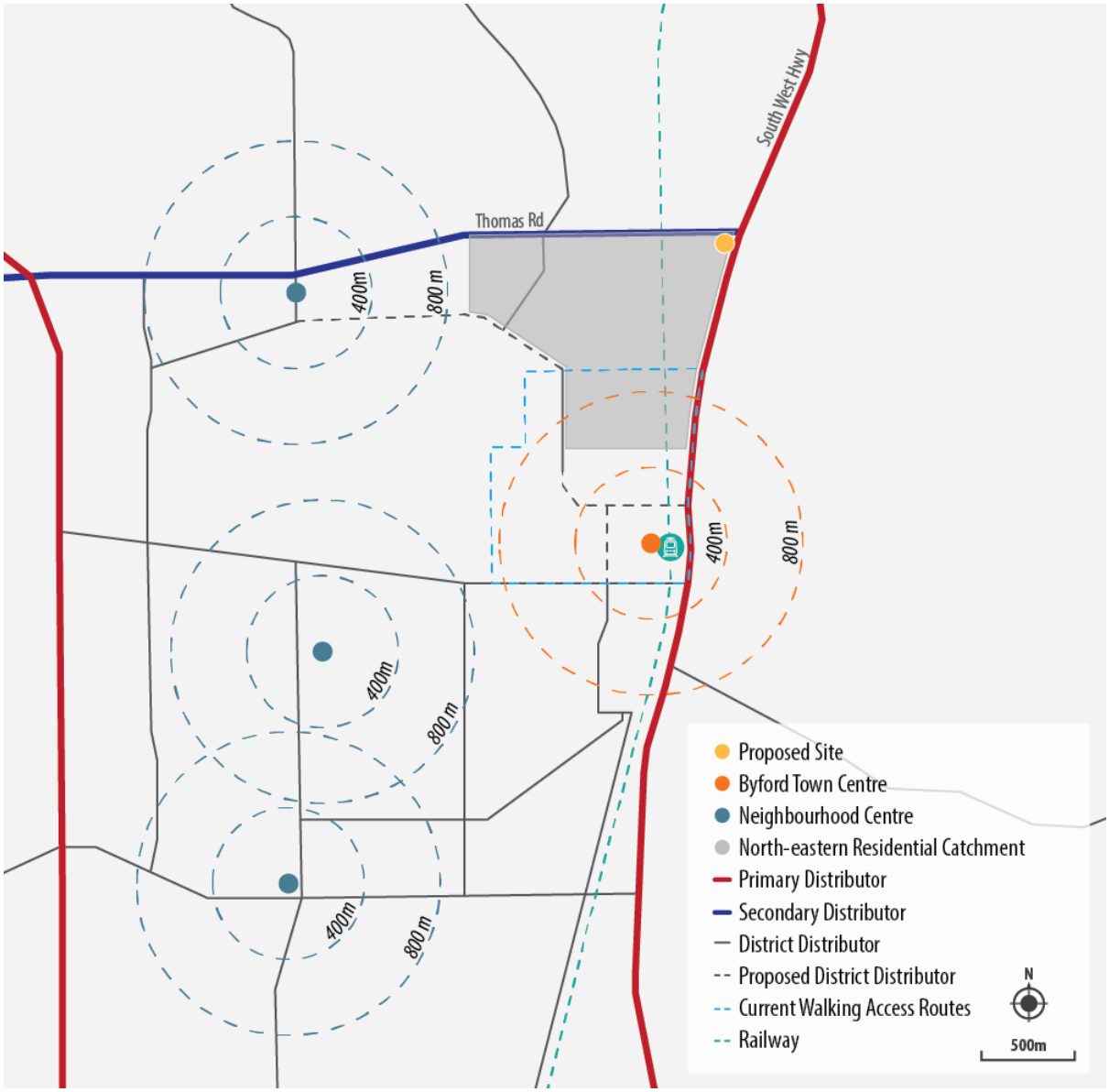


Source: Department of Planning, Lands and Heritage 2015/16, Pracsys 2019

The shortage of Shop/Retail supply is most noticeable for residents of Byford's north-east residential catchment, amongst which the proposed development at 640 South West Highway is situated. This catchment is between 1.5km and 1.8km from the Byford Town Centre and not within its pedestrian shed zone (Figure 4).

[4] Forecast.id 2019, *Byford Area – About the forecast areas*
[5] This estimate is conservatively high as the population estimate covers and area equivalent to the Byford Disctrict Structure Plan area and the floorspace is based on the 5km Study Area
[6] Macroplan Demasi 2014, *More Retail Floorspace or Less?*

Figure 4. Byford Centre Distribution



Sources: Byford District Plan 2018, Pracsys 2019

Access is further limited by a lack of pedestrian links through to the Byford town centre with developments in the central and southern areas needing to travel away from the Town Centre to find walking routes. This is partly due to a number of proposed distributor roads that have not yet been built. The proposed development will reduce the walking time for convenience items by between 5 to 15 minutes depending on where a person is located in the North-eastern Residential catchment.[7] This increases the reliance on vehicle usage even for small grocery trips. The north-east residential catchment faces an even larger under-supply of convenience retail considering their relative lack of access to the majority of convenience retail offerings in Byford.

[7] Google maps directions 2019

Estimated Gap

Using the benchmarked Shop/retail provision ratios it is possible to identify the gap in retail provision for the Byford area. Raising the provision of Shop/retail floorspace in the centre to the Greater Perth or national average would equate to an additional 10,300m^2 to 11,000m^2 of floorspace in the Byford DSP area (Figure 5).

Figure 5. Benchmark Provision Ratios Applied to Byford Population

Location	Provision Ratio (m^2) per person	Shop/retail Floorspace (m^2) – Benchmarked Level	Gap (m^2)
Byford	1.11	20,888	
Greater Perth	1.66	31,184	10,300
National Average	1.70	31,930	11,000

Source: Pracsys 2019

The estimated upper limit of 1,000m^2 in Shop/retail at the proposed site is well within the identified gap in the provision of Shop/Retail floorspace. The proposed centre will make up less than 10% of the potential gap in Shop/retail floorspace; there will be no negative impact on the Town Centre. Furthermore, there is an allowance in the Byford DSP for 3,200m^2 of Shop/retail floorspace in other local nodes; the proposed centre fits well within this limit with sufficient leftover floorspace for other local nodes to provide the necessary amenity within the area.

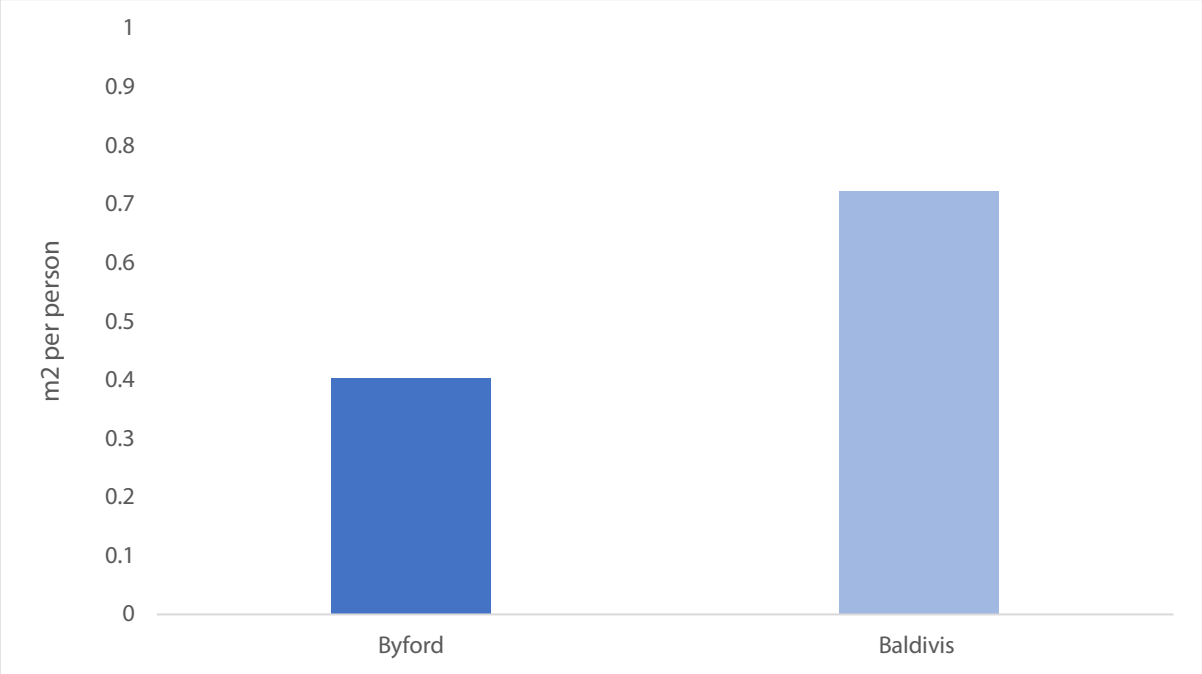
3.3 Other Commercial Uses

The 1,000m^2 of floorspace capacity on the subject site is likely to include a component of commercial floorspace other than Shop/retail. The type of uses that could potentially be included at the site include bulky goods retail, medical and service industry uses such as those that are currently located along South West Highway.

A high-level assessment was undertaken to assess the provision of other commercial uses (excluding Shop/retail) in the Byford DSP area. The potential under supply of this type of zoning has been undertaken using the Baldivis area as a benchmark.[8] Byford currently has an estimated provision ratio of 0.45 m^2 per person for highway commercial uses, approximately 44% less than the Baldivis area.

[8] Baldivis is a district centre and has been used for the purposes of assessing highway commercial floorspace due to the drivers of floorspace uses such as office space which are more business orientated than population driven

Figure 6. Benchmark Other Commercial Provision Ratio



Source: Department of Planning, Lands and Heritage 2015/16, Pracsys 2019

There is a clear gap in the provision of other commercial uses. Applying the provision ratio of Baldivis indicates the Byford population could support an additional 6,000m^2 of other commercial uses. The proposed centre will therefore be addressing a small component of the potential gap in these commercial uses. In addition, the proposed site is ideally located for commercial uses being on the intersection of a primary and a secondary distributor road.

Household Expenditure on Transport and Vehicle Maintenance

Expenditure by Serpentine-Jarrahdale households on transport made up 13% of total expenditure. This is 40% higher than the Greater Perth average. Similarly, analysis of car ownership indicates 75% of households in the Shire of Serpentine-Jarrahdale had access to two or more motor vehicles, compared to just over half of Greater Perth households. These comparisons indicate that Serpentine-Jarrahdale residents spend a higher proportion of household income on motor vehicle use and maintenance than the Greater Perth average. This is necessitated by the semi-rural nature of the Shire. Due to these characteristics, access to a commercial offering caters specifically to the need of residents in the area and is representative of the market requirements. The proposed development site is suitably located on the corner of a primary and a secondary distributor road that will provide convenient access to residents of the northeastern residential zone (Figure 4).

Additionally, the comparatively high expenditure on motor vehicles in the Shire represents greater potential for cost saving. As a high proportion of Shire residents are currently required to travel further (e.g. to the Town Centre) and/or more frequently to source commercial goods such as those which may be provided by the

proposed development, commercial development at 640 South West Highway would reduce vehicle operating costs and travel time costs. The monetisation of these potential cost savings is beyond the scope of this submission, but they remain an important consideration.

4 CONCLUSION

The subject site at 640 South West Highway has the potential to support a mix of convenience commercial/other commercial land uses to meet the need of the local community. The Byford population is rapidly growing, creating an ongoing demand for additional retail floorspace. The proposed development site's location is in keeping with state policy regarding the development of activity centres and liveable neighbourhoods. In addition, the Shire's draft (unadvertised) Structure Plan for Byford includes the provision of 3,200m^2 of retail floorspace in local activity nodes to meet the needs of local residential communities in the Byford area; the proposed development is well within this allocated floorspace provision.

The current provision of retail floorspace was assessed and a gap analysis identified a potential under provision of 10,300m^2 to 11,000m^2 of convenience retail floorspace based on Greater Perth and National averages. The proposed development has an estimated upper floorspace potential of 1,000m^2; even if this was all convenience floorspace, the proposed development would not negatively impact the Byford Town Centre given the identified gap in provision. Additionally, the proposed centre's location will provide improved access for residents in the surrounding area who currently have no convenience offering within a walkable catchment.

The gap analysis was repeated for other commercial uses and identified a potential gap of 6,000m^2. The proposed development will likely include a mix of floorspace uses in addition to its convenience element that will help address this gap. Its location on the corner of two important distributor roads means it will reduce the cost of living for local residents.

This analysis finds that the proposed development site is suitable for convenience retail and other commercial land uses. Given the modest scale of the subject site and the amount of floorspace reasonably achievable on the land, such land uses are not considered to negatively impact the Byford Town Centre as there is an identified gap in the provision of both convenience retail and other commercial floorspace that is significantly larger than the proposed development.

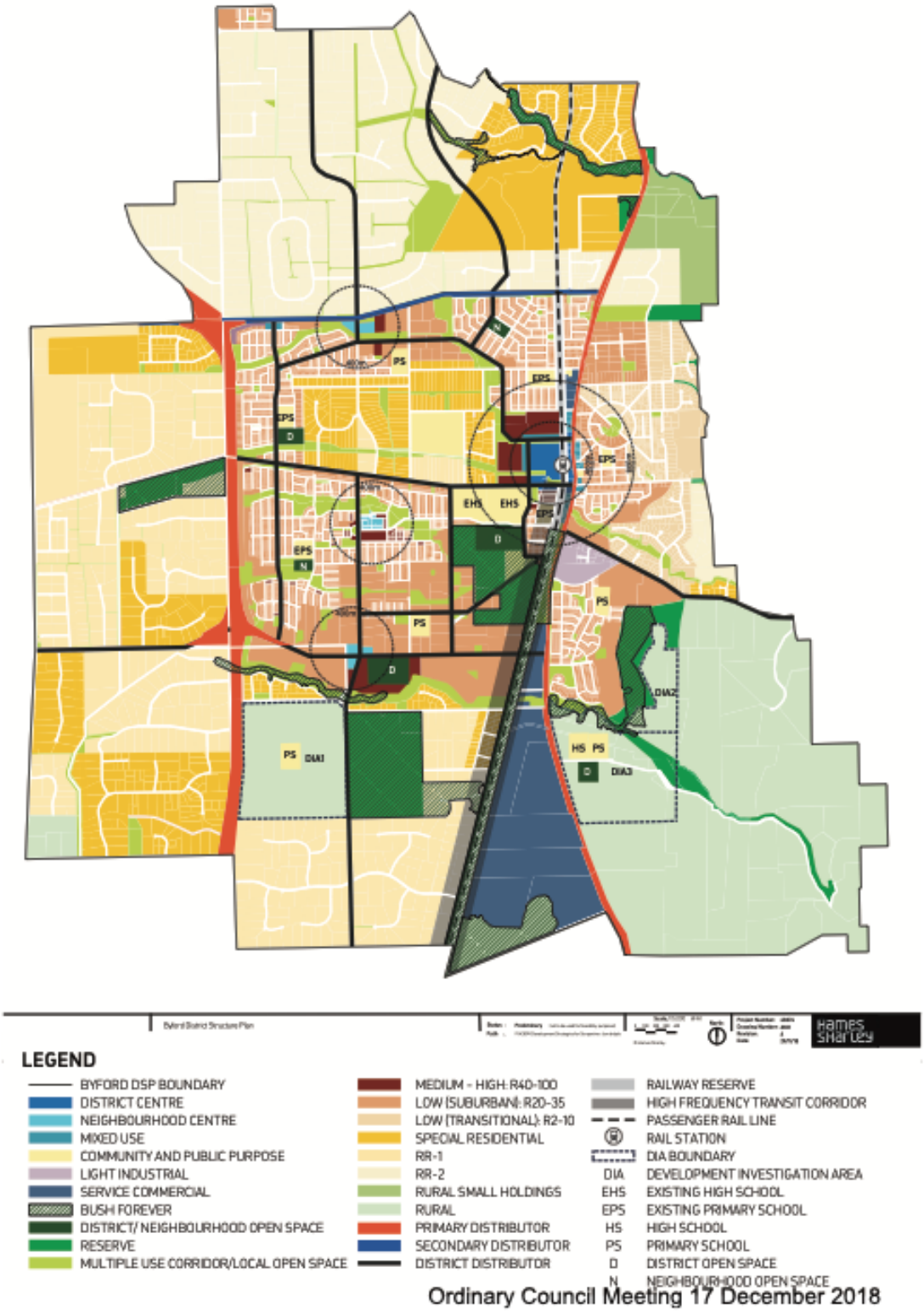
5 APPENDIX 1: DISTRICT STRUCTURE PLANS

Please find the full Draft District Structure Plan (Unadvertised) at the following web address:

http://www.sjshire.wa.gov.au/assets/Uploads/OCM/OCM-2018/OCM-17-DECEMBER/OCM147.2.12.18.pdf

Draft Structure Plan Map:

Figure 1: Byford District Structure Plan



Current District Structure Plan:

BYFORD STRUCTURE PLAN

Operative Part

DISCLAIMER

This is a copy of the Operative Part to the Byford Structure Plan. Whilst all care has been taken to accurately portray the current Structure Plan provisions, no responsibility shall be taken for any omissions or errors in this documentation.

Updated 10 September 2009

Prepared by the Shire of Serpentine-Jarrahdale

Trim Document Number: E09/5682

SCHEDULE OF MODIFICATIONS TO OPERATIVE PART

Modification No.	General Description	Council decision	WAPC decision
1	Creation of Operative Part	22 June 2009	14 August 2009
2	Reduction in Abernethy Road width from 40 metres to 30 metres (Clause 4.2.1)	27 July 2009	1 September 2009

Byford Structure Plan
Schedule 1 - Operative Part

As provided for under the provisions of the Shire of Serpentine-Jarrahdale Town Planning Scheme No. 2 ('the Scheme'), this part of the Byford Structure Plan has the same force and effect as a provision, standard or requirement of the Scheme. In the instance that there is an inconsistency between the Structure Plan and the Scheme, the Scheme shall prevail.

This part shall form part of the provisions of the Byford Structure Plan, pursuant to clause 5.18.2.1 and Appendix 15, section DA 3, clause (1) of the Scheme.

1.0 STRUCTURE PLAN AREA

The land subject of the Structure Plan is depicted on Figure 1 as 'The Structure Plan Area' and is bounded by Thomas Road to the north, Hopkinson Road and the future Tonkin Highway to the west, Cardup Siding Road to the south and the Byford townsite and Darling Range foothills to the east. The Structure Plan Area excludes the Byford Trotting Centre and surrounding rural residential area.

2.0 STRUCTURE PLAN

2.1 Figure No.1 - Byford Structure Plan

2.2 The Byford Structure Plan is a District Structure Plan. The Structure Plan provides the broad-district level planning framework for development of the Structure Plan area. It provides the broad disposition of land use, major roads, rail and other community infrastructure. It is intended that the Structure Plan will form the general basis for subsequent preparation of Local Structure Plans on a precinct-basis.

3.0 REQUIREMENT FOR THE PREPARATION OF LOCAL STRUCTURE PLANS

3.1 This Structure Plan provides indicatives zonings, residential density codings and detailed development standards and requirements. Consequently, no subdivision or development should be commenced or carried out until such time as a Local Structure Plan has been prepared, adopted by Council and approved by the Western Australian Planning Commission for the relevant precinct within the Structure Plan area.

3.2 In accordance with Appendix 15, Section DA 3, Clause 2 (a) of the Scheme, Local Structure Plans shall be prepared for a geographical area not smaller than those precincts depicted in Plan 15A of the Scheme, unless otherwise resolved by Council.

3.3 Local Structure Plans for the district (as applicable to the respective precinct) shall address the requirements set out in Clause 5.18.2.4 of the Scheme.

3.4 Notwithstanding Clause 3.1 above, any application for development submitted before a Structure Plan has been adopted by Council and approved by the Western Australian Planning Commission shall be considered in accordance with clause 5.18.7 of the Scheme.

4.0 RELEVANT PLANNING CONSIDERATIONS – DISTRICT STRUCTURE PLAN AREA

The planning considerations outlined in this section shall apply to the entire District Structure Plan Area. The provisions in this section shall be read in conjunction with the Zone-specific provisions outlined in Section 5, the Precinct- specific provisions outlined in Section 6 and the General notations outlined in Section 7.

4.1 *Public Open Space*

4.1.1 The Structure Plan provides 8.6% public open space. The balance 1.4% public open space will be required to be identified in Local Structure Plans and to be given up at the time of subdivision.

4.2 Road Network

4.2.1 Thomas Road, Abernethy Road and Orton Road are to be widening to accommodate stormwater in accordance with the Byford Urban Stormwater Management Strategy. The Structure Plan requires the final width of Abernethy Road to be 30 metres unless otherwise determined at the local structure plan stage. The general locations of Thomas Road, Abernethy Road and Orton Road is shown as number 6 on the Structure Plan.

4.2.2 The future construction of Abernethy Road should include measures to provide an amenity buffer to the residential land uses on the south side of Abernethy Road. Such measures could include dense landscaping, appropriate fencing or bunding. Abernethy Road/Tonkin Highway may interact by means of a grade separation. The general location of Abernethy Road is shown as number 12 on the Structure Plan.

4.3 Pedestrian and Cycle Network

4.3.1 A pedestrian and bicycle plan shall be provided as part of each Local Structure Plan, in accordance with the Shire's Bicycle and Pedestrian Master Plan.

4.4 Land within 200 metres of the Byford Trotting Complex

4.4.1 Prospective purchasers of all new residential lots created within 200 metres of any lot contained within the Byford Trotting Complex will be required to be notified that they are within proximity of the Trotting Complex and associated land uses. The 200 metres shall be measured from the dashed-line around the Trotting Complex, depicting the boundary of the Structure Plan Area.

4.5 *Equestrian Use and Bridle Trails*

4.5.1 Equestrian use within the rural residential buffer is limited to one horse per lot stabled at the rear of the lot adjacent to the bridle path. No connection between the bridle path and public road is to be made. This provision shall apply to those locations marked with a number 2 on the Structure Plan.

4.6 ***Land Abutting Rural Residential Areas***

4.6.1 Notwithstanding land having a classification of Residential (R20) where such land abuts land classified Rural Residential an appropriate (lower) interface density of development may be required to be implemented.

4.6 Noise Attenuation to Tonkin Highway

4.6.1 A further review of noise attention requirements and options for land adjacent to Tonkin Highway is required in Local Structure Plans. The general locations for these requirements is shown as number 25 on the Structure Plan.

5.0 RELEVANT PLANNING CONSIDERATIONS – SPECIFIC ZONES

The planning considerations outlined in this section shall only apply to those zones depicted on the Structure Plan. The provisions in this section be read in conjunction with the Structure Plan-wide provisions outlined in Section 4, the precinct-specific provisions in Section 6 and the General notations outlined in Section 7.

5.1 Town Centre

5.1.1 Town Centre requires the preparation and completion of a Local Structure Plan, complete with detailed area plans and design guidelines. The Local Structure Plan is to include an investigation into increased residential densities within the 800 metre walkable catchment and its relationship with transit oriented urban design; the location, nature, role, relationship and distribution of different activities within the town centre. Any change to residential densities or uses within the 800 metre walkable catchment of the town centre will be subject to a separate modification to the District Structure Plan and associated community consultation. The general location of the Town Centre zone is shown as number 17 on the Structure Plan.

6.0 RELEVANT PLANNING CONSIDERATIONS – SPECIFIC PRECINCTS

Plan 15A of the Scheme defines precincts for the preparation of Local Structure Plans. The following provisions are intended to be apply to the specific precinct. These provisions shall be read in conjunction with the Structure Plan-wide provisions outlined in Section 4, the Zone-specific provisions outlined in Section 5 and the General notations outlined in Section 7.

6.1 Precinct 1

6.1.1 The final location of the intersection with Thomas Road will be determined through further detailed planning. The indicative location is shown as number 24 on the Structure Plan map.

6.2 Precinct 2

6.2.1 Further consideration for the retention of the homestead building within Lot 7 Briggs Road will be required during Local Structure Planning including consultation with DET (if required) and further detail as to the proposed function and suitability of the building for community purposes. The general location of the homestead building is shown as number 15 on the Structure Plan.

6.2.2 The exact location of the primary school within Lot 7 Briggs Road is to be determined at the Local Structure Plan Stage. The indicative location for the primary school is shown as number 16 on the Structure Plan.

6.3 Precinct 4

6.3 Intersection treatment of new Town Centre District Distributor Integrator 'B' Road and Larsen Road is to be reviewed as part of the Local Structure Plan. The indicative location of the District Distributor Road is shown as number 3 on the Structure Plan.

6.4 Precinct 5

6.4.1 The final location of the primary school and the corresponding location of the Rural Residential Zone shall be determined through the Local Structure Plan, in consultation with the Department of Education and Training. The indicative location of the primary school is shown as number 23 on the Structure Plan.

6.5 Precinct 6

6.5.1 The existing waterway in the Town Centre will be subject to water sensitive urban design principles at the detailed engineering design stage. The specific width of the water way will be determined through the Local Structure Plan. The general location of the existing waterway is shown as number 18 on the Structure Plan.

6.5.2 Additional area may be required for drainage purposes and shall be determined through detailed structure planning, including the preparation and finalisation of a drainage and nutrient management plan.

6.5.3 In the Rural Residential zone, in close proximity to waterway, no horses are permitted. The indicative location of this zone is illustrated as number 27 on the Structure Plan.

6.5.4 The final alignment of the Town Centre Distributor Road through Lot 1 will be determined through detailed structure planning. The indicative location of the road is illustrated as number 28 on the Structure Plan.

6.6 Precinct 7

6.6.1 Any Local Structure Plans for the land abutting the south side of Abernethy Road should include measures to provide for an additional buffer between Abernethy Road and the Rural land on the north side of Abernethy Road. Such measures could include, but are not limited to, the orientation of lots, location of local public open space and attention to the local road system. The general location of Abernethy Road is shown as number 11 on the Structure Plan.

6.6.2 The High School site will be a prominent landmark. Further investigations are required at the Local Structure Plan stage to determine the possibility of co-locating the school site with other community facilities. The facilities should be located in the north east corner of the school site along Abernethy Road. Design guidelines are to be prepared for the Community Purposes site as part of the Local Structure Plan for the Town Centre. The general location of the prominent landmark site is shown as number 19 on the Structure Plan.

6.6.3 Local structure plans for portions of the Doley Road/Warrington Road precinct, are to be prepared as determined by the Shire. The Local Structure Plan submitted for the area adjacent to the western edge of the Brickwood Reserve is to show a road reserve adjacent to Brickwood Reserve separating it from the residential area. The Local Structure Plan shall also include a public open space link between Brickwood Reserve and the multiple use corridor on turner road. The location of drainage within Doley Road/Warrington Road precinct is indicative only and will be refined at the Local Structure Plan stage. The general location of the Doley Road/Warrington Road precinct is shown as number 20 on the Structure Plan.

6.6.4 The final location of the primary school north of Orton Road and West of Doley Road is to be determined through the preparation and finalisation of the Local Structure Plan. The indicative location of the primary school is shown as number 29 on the Structure Plan.

6.7 Precinct 8

6.7 Cardup Brook foreshore reserve has a nominal width of 30 metres. Final width will be subject to review as part of the Local Structure Plan. Land is to be ceded free of cost upon subdivision, in accordance with Western Australian Planning Commission subdivision policy. The indicative location of the Cardup Brook foreshore is shown as number 4 on the Structure Plan.

6.8 Precinct 11

6.8.1 Residential density shall be limited to R30 in accordance with the Byford Townsite Detailed Area Plan. The general location of the area to be limited to the R30 design coding is shown as number 21 on the Structure Plan.

7.0 GENERAL NOTATIONS

7.1 At such time as any land currently designated for non-residential uses (including rural residential or rural-living purposes) is subdivided for residential purposes, there will be an expectation of a standard contribution towards public open space and other infrastructure.

7.2 A possible alternate location for a future railway station has been identified on the Structure Plan as number, based on the recommendations of the Townscape Study. The possible alternate location is shown as number 7 on the Structure Plan.

7.3 The Byford District Structure Plan is not responsible for the acquisition of Lot 48 Turner Road (Bush Forever site) and that this matter is to be addressed separately by the Western Australian Planning Commission. The general location of Lot 48 is shown as number 14 on the Structure Plan.

7.4 The provision of land for the community purposes will need to be in accordance with Council's Community Services and Facilities Plan.

7.5 An approximate location for a sewer pump station and 150 metre buffer has been identified, depicted by the number 8 on the Structure Plan.

7.7 There is a potential for a rail crossing linking Mead Street and South Western Highway. However, this is a long term option and subject to consultation with the public transport authority. The identified location is depicted by the number 22 on the Structure Plan.

7.8 Land adjacent to Tonkin Highway, south of Abernethy Road to Orton Road, may be required for a possible future Water Corporation Service Corridor. The general location for the possible corridor is shown as number 26 on the Structure Plan.

LEGEND

- STRUCTURE PLAN AREA
- DOLEY/WARRINGTON ROAD PRECINCT BOUNDARY
- RURAL RESIDENTIAL
- RESIDENTIAL (R20)
- RESIDENTIAL (R30-60)
- LAND SUBJECT TO FURTHER STUDY, SEE NOTES 25 & 26 WHERE APPLICABLE
- TOWN CENTRE (TOWN CENTRE SUBJECT TO LOCAL STRUCTURE PLAN AND DETAILED AREA PLAN AND DESIGN GUIDELINES)
- NEIGHBOURHOOD CENTRE
- HIGHWAY COMMERCIAL
- COMMUNITY PURPOSE
- NEIGHBOURHOOD NODE
- SCHOOLS
  EPS – Existing Primary School
  PS – Primary School
  HS – High School
- MIXED BUSINESS
- MULTIPLE USE CORRIDOR (MUC)
- WATERWAY
- DRAINAGE BASIN INDICATIVE LOCATION
- FUTURE ROADS
- EXISTING MRS REGIONAL PARKS AND RECREATION RESERVE
- EXISTING LOCAL PUBLIC OPEN SPACE
- PROPOSED LOCAL PARK (Approx.3000m)
- PROPOSED LOCAL PARK WITHIN MUC
- PROPOSED NEIGHBOURHOOD PARK (Approx. 4800m)
- PROPOSED NEIGHBOURHOOD PARK WITHIN MUC
- DISTRICT RECREATION (Approx. 4ha)
- CONSERVATION
- FORESHORE RESERVE
- PUBLIC PURPOSES
- BUFFER BETWEEN TROTTING COMPLEX EQUESTRIAN RELATED ACTIVITIES AND RESIDENTIAL AREA INCLUDED WITHIN EXISTING LOTS
- AREA OF LANDSCAPE SENSITIVITY
- DRAINAGE DIRECTION FLOW
- UNCONSTRUCTED ROAD / BRIDLE PATH
- TURNER ROAD – POSSIBLE CLOSURE SUBJECT TO FURTHER INVESTIGATIONS BY COUNCIL
- RAILWAY CROSSINGS
- POTENTIAL RAIL CROSSING SUBJECT TO FURTHER INVESTIGATIONS
- POSSIBLE FUTURE GRADE SEPERATED CROSSING
- POSSIBLE FUTURE RAILWAY STATION
- LAND SUBJECT TO FURTHER STUDY TO ADDRESS THE REQUIREMENTS FOR DRAINAGE AND DETAILED STRUCTURE PLANNING. CONSIDERATION TO BE GIVEN TO THE PREFERRED ALIGNMENT OF THE TONKIN HIGHWAY PRIMARY REGIONAL ROAD RESERVATION.
- LAND SUBJECT TO FURTHER STUDY – PLANNING TO BE FINALISED SUBJECT TO RESOLUTION OF ALIGNMENT OF ORTON ROAD

This is a District Structure Plan and shall be used as a basis for more detailed planning when read in conjunction with other documents and the Byford Structure Plan report

This Plan should be read in conjunction with Schedule 1 - Operative Part

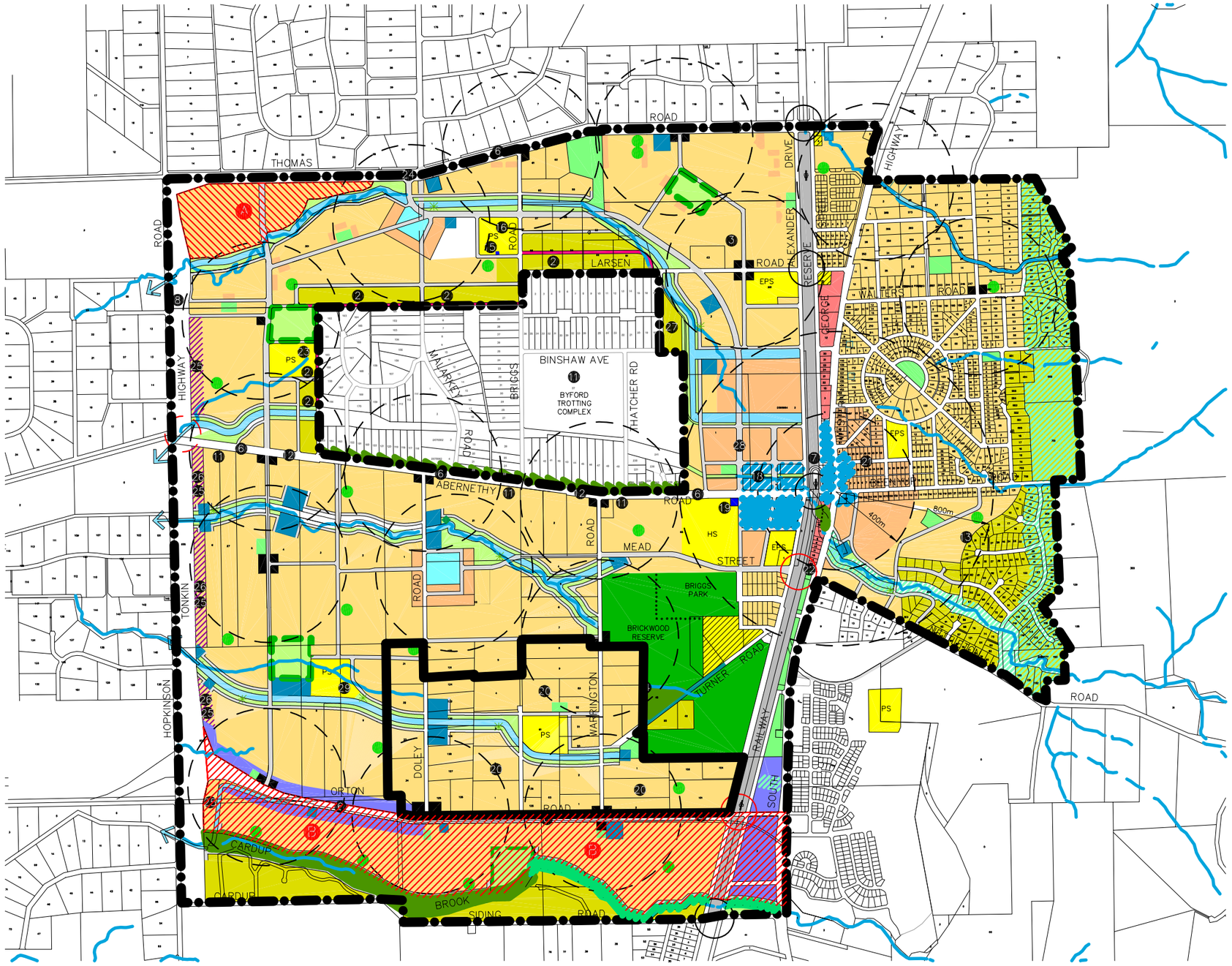


Figure 1

Byford Structure Plan

Adopted by Council (Original) - 22nd AUG 2005
Adopted by Council (Review No.1) - 13th FEB 2007
Updated 23 June, 2009

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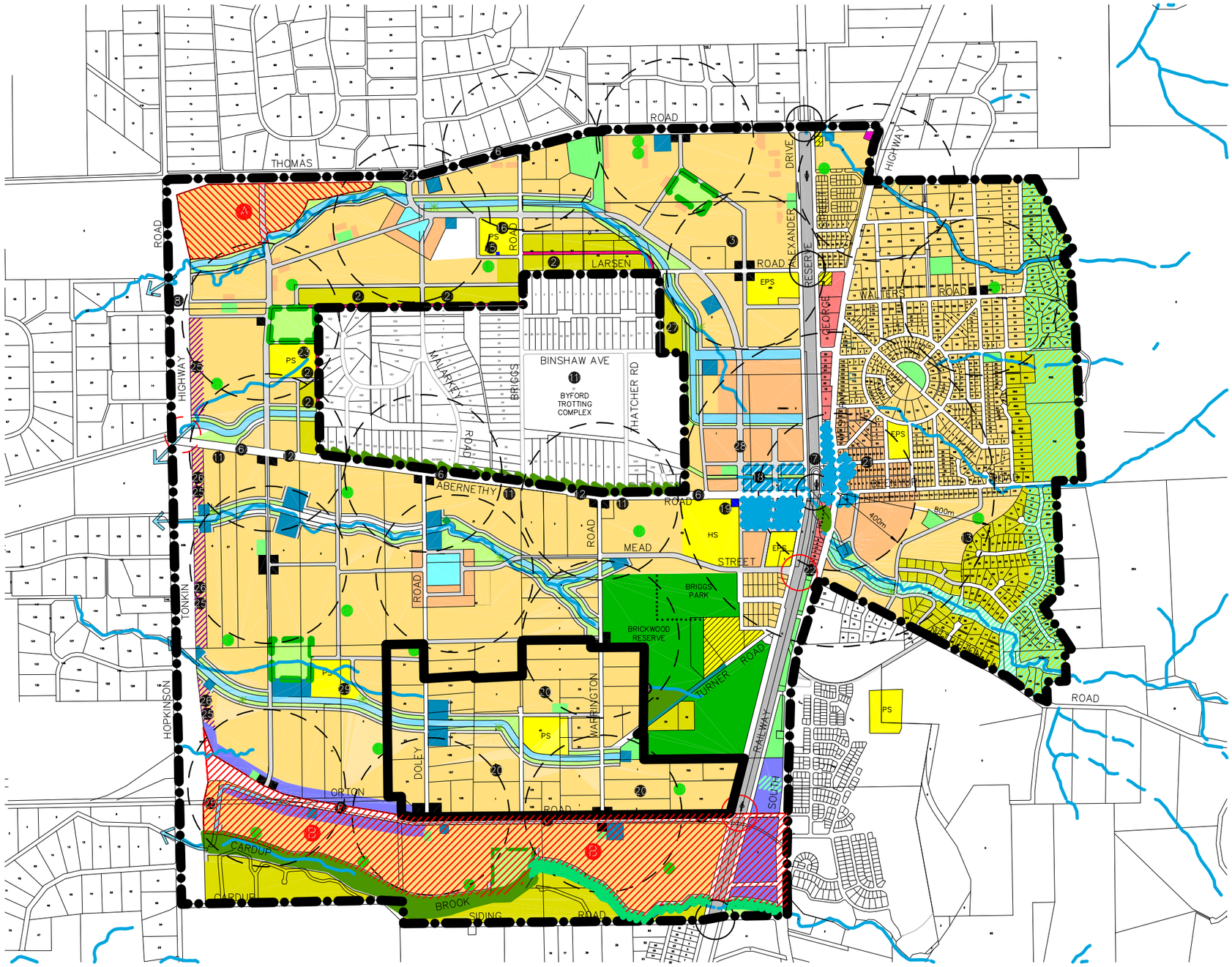
Legend

- STRUCTURE PLAN AREA
- DOLEY/WARRINGTON ROAD PRECINCT BOUNDARY
- RURAL RESIDENTIAL
- RESIDENTIAL (R20)
- RESIDENTIAL (R30–60)
- LAND SUBJECT TO FURTHER STUDY. SEE NOTES 25 & 26 WHERE APPLICABLE
- TOWN CENTRE (TOWN CENTRE SUBJECT TO LOCAL STRUCTURE PLAN AND DETAILED AREA PLAN AND DESIGN GUIDELINES)
- NEIGHBOURHOOD CENTRE
- HIGHWAY COMMERCIAL
- COMMERCIAL
- COMMUNITY PURPOSE
- NEIGHBOURHOOD NODE
- SCHOOLS
  EPS – Existing Primary School
  PS – Primary School
  HS – High School
- MIXED BUSINESS
- MULTIPLE USE CORRIDOR (MUC)
- WATERWAY
- DRAINAGE BASIN INDICATIVE LOCATION
- FUTURE ROADS
- EXISTING MRS REGIONAL PARKS AND RECREATION RESERVE
- EXISTING LOCAL PUBLIC OPEN SPACE
- PROPOSED LOCAL PARK (Approx.3000m²)
- PROPOSED LOCAL PARK WITHIN MUC
- PROPOSED NEIGHBOURHOOD PARK (Approx. 4000m²)
- PROPOSED NEIGHBOURHOOD PARK WITHIN MUC
- DISTRICT RECREATION (Approx. 4ha)
- CONSERVATION
- FORESHORE RESERVE
- PUBLIC PURPOSES
- BUFFER BETWEEN TROTTING COMPLEX EQUESTRIAN RELATED ACTIVITIES AND RESIDENTIAL AREA INCLUDED WITHIN EXISTING LOTS
- AREA OF LANDSCAPE SENSITIVITY
- DRAINAGE DIRECTION FLOW
- UNCONSTRUCTED ROAD / BRIDLE PATH
- TURNER ROAD – POSSIBLE CLOSURE SUBJECT TO FURTHER INVESTIGATIONS BY COUNCIL
- RAILWAY CROSSINGS
- POTENTIAL RAIL CROSSING SUBJECT TO FURTHER INVESTIGATIONS
- POSSIBLE FUTURE GRADE SEPERATED CROSSING
- POSSIBLE FUTURE RAILWAY STATION
- A LAND SUBJECT TO FURTHER STUDY TO ADDRESS THE REQUIREMENTS FOR DRAINAGE AND DETAILED STRUCTURE PLANNING. CONSIDERATION TO BE GIVEN TO THE PREFERRED ALIGNMENT OF THE TONKIN HIGHWAY PRIMARY REGIONAL ROAD RESERVATION.
- B LAND SUBJECT TO FURTHER STUDY – PLANNING TO BE FINALISED SUBJECT TO RESOLUTION OF ALIGNMENT OF ORTON ROAD



Amended Byford Structure Plan

This is a District Structure Plan and shall be used as a basis for more detailed planning when read in conjunction with other documents and the Byford Structure Plan report

This Plan should be read in conjunction with Schedule 1 - Operative Part

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Attachment 1

Our ref: 25020-3-17286-02

19 November 2019

Megara
Level 1
662 Newcastle Street
LEEDERVILLE WA 6007

Attention: Trent Durward
Email: Trent.Durward@megara.net.au

Dear Trent,

640 SOUTH WESTERN HIGHWAY
ACOUSTIC REVIEW OF SITE FOR COMMERCIAL USES

As requested, we have undertaken an acoustic review of the possible development of 640 South Western Highway for commercial land uses with regards to the requirements of the *Environmental Protection (Noise) Regulations 1997*.

It is noted that Herring Storer Acoustics have previously undertaken an environmental acoustic assessment in support of a proposed service station development, in December 2017 and this assessment showed that compliance with the Environmental Protection (Noise) Regulations 1997 would be achieved. Additionally, we have undertaken an acoustic review of the subject site and its suitability for residential land uses, in August 2019.

From information provided, we understand that the possible commercial uses for the site could include the following, subject to an amended structure plan zoning classification :

- Consulting rooms
- Convenience store
- Fast food / takeaway
- Market
- Medical centre
- Office
- Private recreation (e.g. gym)
- Restaurant
- Service station
- Shop
- Showroom.

The following provides a review of possible noise emissions from additional noise sources that where not assessed under the previous acoustical assessment for compliance with the Environmental Protection (Noise) Regulations 1997. From the above, we believe that the additional sources that would need to be considered are :

- Mechanical services; and / or
- Alfresco dining areas.

SUMMARY

To be developed for commercial purposes, noise emissions from the site would need to comply with the requirements of the *Environmental Protection (Noise) Regulations 1997*. Under the Regulations, the Influencing Factor at the neighbouring residences would be at least 6 dB. Additionally, if the development operated during the night period, noise received at the neighbouring premises would need to comply with the appropriate assigned night period noise level.

Based on the preliminary review and considering the previous assessment undertaken for the site, noise received at the neighbouring premises from the development would be capable of complying with the Regulatory requirements at all times. However, some care and possibly some noise mitigation of exhaust systems (ie for kitchen exhausts) and / or alfresco areas may be required. Even so, the mitigation, if required depending on the development, would not be onerous and compliance could be easily achieved.

Note : With regards to gyms, we note that even though most gyms operate 24 hour, the internal noise levels are low and the building structure would be capable of containing any noise produced, hence compliance with the Regulations would not be an issue.

ENVIRONMENTAL PROTECTION (NOISE) REGULATIONS 1997

The allowable noise level for noise sensitive premises in the vicinity of the proposed Facility site is prescribed by the *Environmental Protection (Noise) Regulations 1997*. Regulations 7 and 8 stipulate maximum allowable external noise levels or assigned noise levels that can be received at a premise from another premises. For residential premises, this noise level is determined by the calculation of an influencing factor, which is then added to the base levels shown below. The influencing factor is calculated for the usage of land within two circles, having radii of 100m and 450m from the premises of concern. The base noise levels for residential premises and the assigned noise levels for industrial premises are listed in Table 1.

TABLE 1 - BASELINE ASSIGNED OUTDOOR NOISE LEVEL

Premises Receiving Noise	Time of Day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
Noise sensitive premises: highly sensitive area	0700 - 1900 hours Monday to Saturday (Day)	45 + IF	55 + IF	65 + IF
	0900 - 1900 hours Sunday and Public Holidays (Sunday / Public Holiday Day)	40 + IF	50 + IF	65 + IF
	1900 - 2200 hours all days (Evening)	40 + IF	50 + IF	55 + IF
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and Public Holidays (Night)	35 + IF	45 + IF	55 + IF
Noise sensitive premises: any area other than highly sensitive area	All hours	60	75	80

Note: L_{A10} is the noise level exceeded for 10% of the time.
L_{A1} is the noise level exceeded for 1% of the time.
L_{Amax} is the maximum noise level.
IF is the influencing factor.

It is a requirement that received noise be free of annoying characteristics (tonality, modulation and impulsiveness), defined below as per Regulation 9.

"impulsiveness" means a variation in the emission of a noise where the difference between L_{Apeak} and $L_{Amax(Slow)}$ is more than 15 dB when determined for a single representative event;

"modulation" means a variation in the emission of noise that –

(a) is more than 3 dB L_{AFast} or is more than 3 dB L_{AFast} in any one-third octave band;

(b) is present for more at least 10% of the representative assessment period; and

(c) is regular, cyclic and audible;

"tonality" means the presence in the noise emission of tonal characteristics where the difference between –

(a) the A-weighted sound pressure level in any one-third octave band; and

(b) the arithmetic average of the A-weighted sound pressure levels in the 2 adjacent one-third octave bands,

is greater than 3 dB when the sound pressure levels are determined as $L_{Aeq,T}$ levels where the time period T is greater than 10% of the representative assessment period, or greater than 8 dB at any time when the sound pressure levels are determined as L_{ASlow} levels.

Where the noise emission is not music, if the above characteristics exist and cannot be practicably removed, then any measured level is adjusted according to Table 2 below.

TABLE 2 - ADJUSTMENTS TO MEASURED LEVELS

Where **tonality** is present	Where **modulation** is present	Where **impulsiveness** is present
+5 dB(A)	+5 dB(A)	+10 dB(A)

Note: These adjustments are cumulative to a maximum of 15 dB.

For this development, the closest residential premises of concern are located, as shown on Figure 1 below.

FIGURE 1 – AREA AROUND PROPOSED FACILITY

The influencing factor (IF) at the above neighbouring residential premises has been determined to be +7 dB for the residences to the west and south; and +6 dB for the residence to the north. Hence, the assigned outdoor noise levels for the neighbouring residential locations are as listed in Tables 3 and 4.

TABLE 3 - ASSIGNED OUTDOOR NOISE LEVEL – RESIDENCES TO WEST AND SOUTH

Premises Receiving Noise	Time of Day	Assigned Level (dB)		
		$L_{A\ 10}$	$L_{A\ 1}$	$L_{A\ max}$
Noise sensitive premises : Highly sensitive area	0700 - 1900 hours Monday to Saturday	52	62	72
	0900 - 1900 hours Sunday and Public Holidays	47	57	72
	1900 - 2200 hours all days	47	57	62
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and Public Holidays	42	52	62

Note: L_{A10} is the noise level exceeded for 10% of the time.
L_{A1} is the noise level exceeded for 1% of the time.
L_{Amax} is the maximum noise level.

TABLE 4 - ASSIGNED OUTDOOR NOISE LEVEL - RESIDENCE TO NORTH

Premises Receiving Noise	Time of Day	Assigned Level (dB)		
		$L_{A\ 10}$	$L_{A\ 1}$	$L_{A\ max}$
Noise sensitive premises : Highly sensitive area	0700 - 1900 hours Monday to Saturday	51	61	71
	0900 - 1900 hours Sunday and Public Holidays	46	56	71
	1900 - 2200 hours all days	46	56	61
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and Public Holidays	41	51	61

Note: L_{A10} is the noise level exceeded for 10% of the time.
L_{A1} is the noise level exceeded for 1% of the time.
L_{Amax} is the maximum noise level.

We note that from information received from DWER, the bitumised area would be considered as a road, thus noise relating to the "propulsion and braking of motor vehicles is exempt from the *Environmental Protection (Noise) Regulations 1997*. We note that these noise sources are rarely critical in the determination of compliance.

However, if noise emissions from vehicles was to be considered, it is noted that any vehicle circulation and / or drive through areas would be designated as public places. Regulation 6 of the *Environmental Protection (Noise) Regulations 1997* relates to noise emissions from public places and under this Regulation, "*the person who is causing or permitting that noise to be emitted is to be treated as the occupier...*". Therefore, noise emissions from each individual vehicle using the drive-thru or using the car park, if applicable, would be assessed.

Finally, with regards to vehicles, which considered cars, trucks (including refuelling trucks), it is noted that the noise associated with vehicles as shown by the previous assessment for the site, would comply with the regulatory requirements.

MODELLING

To determine the noise received at the neighbouring residences from the site, noise modelling was undertaken of noise emission associated with :

- Plant by way of the air conditioning, exhaust systems and refrigeration plant; and
- Alfresco area.

The calculations for the mechanical services were based on the noise levels listed in Table 5.

TABLE 5 – MECHANICAL SERVICES NOISE LEVELS

Plant Item	Noise Level dB(A)
Air Conditioning Condensing Units	2 at 52 dB(A) @ 1m
Exhaust Fans	2 at 38 dB(A) @ 3m 2 at 50 dB(A) @ 3m

To be conservative, the noise associated with the alfresco area was based on a sound power level of 66 dB(A)/m2 for an area of 200m^2.

Notes :

1. A noise level of 66 dB(A)/m^2 equates to a person talking with a loud voice every square meter, which for a restaurant alfresco area, would be quite conservative.
2. Noise modelling was undertaken without any mitigation.

RESULTS

Calculations were undertaken to the 3 neighbouring premises of concern (ie worst case locations) located around the development and the resultant noise levels listed in Table 6.

TABLE 6 – WORST CASE CALCULATED NOISE LEVELS

Item	Calculated Noise Levels (dB(A))		
	West	North	South
Mechanical services	31	27	36
Alfresco	39	37	30

Noise emissions from the mechanical services would be steady state and would operate for the majority of time. Hence noise received from the mechanical services and the alfresco area need to comply with the assigned L_{A10} noise level.

Noise emissions from speech are broad band and do not contain any annoying characteristics. However, noise emissions from the mechanical services could be considered tonal. Thus, a +5 dB(A) penalty has been applied to the calculated noise level associated with the mechanical services. Table 7 lists the characteristics that should be included in the assessable noise level.

TABLE 7 – APPLICABLE ADJUSTMENTS AND ASSESSABLE L_{A10} NOISE LEVELS, dB(A)
MECHANICAL SERVICES

Locations	Calculated Noise Level, dB(A)	Applicable Adjustments to Measured Noise Levels, dB(A)			Assessable Noise Level, dB(A)
		Where Noise Emission is NOT music			
		Tonality	Modulation	Impulsiveness	
West	31	+5	-	-	36
North	27	+5	-	-	32
South	36	+5	-	-	41

Tables 8 and 9 summarise the applicable Assigned Noise Levels, and assessable noise level emissions for each identified case that needed to be considered.

TABLE 8 – ASSESSMENT OF L_{A10} NOISE LEVEL EMISSIONS
MECHANICAL SERVICES

Location	Assessable Noise Level, dB(A)	Applicable Times of Day	Applicable Assigned L_{A10} Noise Level (dB)	Exceedance to Assigned Noise Level (dB)
West	36	Night Period	42	Complies
North	32	Night Period	41	Complies
South	41	Night Period	42	Complies

* Although unlikely to be tonal, to be conservative, a +5 dB(A) penalty for a tonal component has been included in the assessment.

TABLE 9 – ASSESSMENT OF L_{A10} NOISE LEVEL EMISSIONS
ALFRESCO

Location	Assessable Noise Level, dB(A)	Applicable Times of Day	Applicable Assigned L_{A10} Noise Level (dB)	Exceedance to Assigned Noise Level (dB)
West	39	Night Period	42	Complies
North	37	Night Period	41	Complies
South	30	Night Period	42	Complies

DISCUSSION

To be developed for commercial land uses, noise emissions from the site would need to comply with the requirements of the *Environmental Protection (Noise) Regulations 1997*. Under the Regulations, the Influencing Factor at the neighbouring residences would be +6 or +7 dB. Additionally, any activity operating during the night period, would need to comply with the appropriate assigned night period noise level.

We have reviewed possible noise emissions from the site for compliance with the Environmental Protection (Noise) Regulations 1997. Based on the preliminary review and considering the previous assessment undertaken for a proposed service station on the site (in 2017) noise received at the neighbouring premises from the development would be capable of complying with the Regulatory requirements at all times. However, some care and possibly some noise mitigation of exhaust systems (ie for kitchen exhausts) and alfresco areas would be required. Even so, the mitigation measures would not be onerous and compliance could be easily achieved.

Note : With regards to gyms, we note that even though most gyms operate 24 hour, the internal noise levels are low and the building structure would be capable of containing any noise produced, hence compliance with the Regulations would not be an issue.

Noise emissions from the site, if developed for commercial land uses, would easily be able to achieve compliance with the requirements of the *Environmental Protections (Noise) Regulations 1997.* This is also demonstrated by the environmental acoustic assessment undertaken for a previously proposed service station development on the subject site, which found that “noise received at the neighbouring premises from the development would be deemed to comply with the Regulatory requirements at all times”.

Yours faithfully,
for **HERRING STORER ACOUSTICS**

Tim Reynolds

Attachment 2

IMPORTANT NOTICE

Former Oakland Service Station (Q036), 640 South Western Highway, Byford, Western Australia ("Site")

The attached Site Management Plan, July 2017 in relation to the Site was prepared by Environmental Resource Management Australia Pty Ltd in respect of the Site ("**Report**"). The Report was commissioned by Viva Energy Australia Ltd ABN 46 004 610 459 ("**Viva Energy**") for its own internal purposes, and the findings and conclusions contained in the Report should therefore not be relied upon by any other person or entity.

Viva Energy makes no representations or warranties as to, and accepts no liability for, the accuracy of any information contained in, or any interpretation of the Report. To the maximum extent permitted by law, Viva Energy accepts no liability whatsoever in relation to the information contained in the Report or any use of or reliance on such information by any third person or entity.

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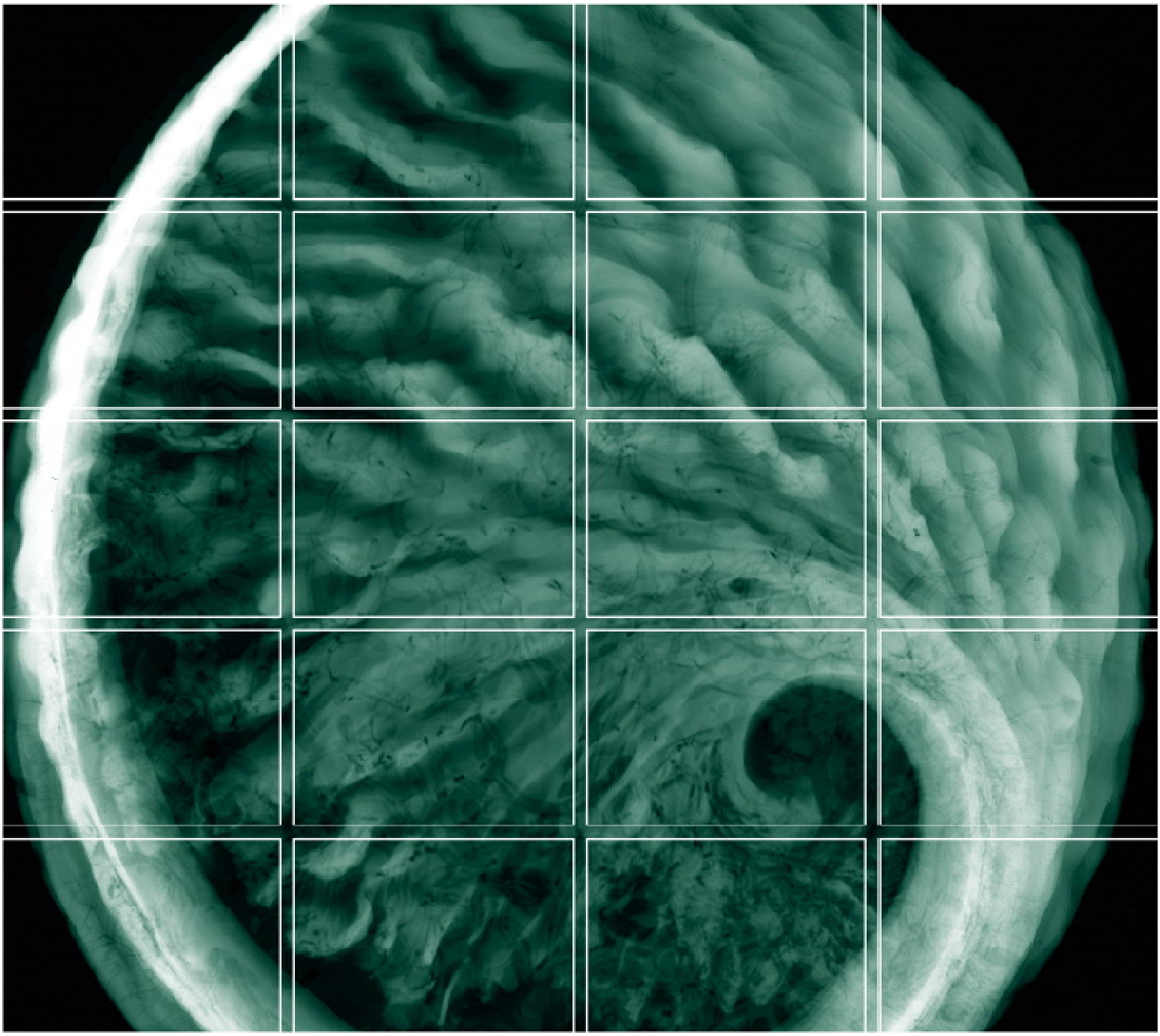

Former Oakland Service Station (Q036), 640 South Western Highway, Byford, Western Australia

Site Management Plan

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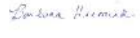
The business of sustainability

ERM

Approved by:	Barbara Heemink
Position:	*Project Manager*
Signed:	
Date:	July 2017
Approved by:	Ed Dennis *Partner in Charge*
Position:	*Principal*
Signed:	
Date:	July 2017

Environmental Resources Management Australia Pty Ltd Quality System

Former Oakland Service Station (Q036), 640 South Western Highway, Byford, Western Australia

Site Management Plan

uly 201

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CONTENTS

LIST OF TABLES (IN TEXT)

CONTENTS

LIST OF TABLES (ATTACHED)

FIGURES

ANNEXES

ABBREVIATIONS

Abbreviation	Definition
AMCS	Assessment and Management of Contaminated Sites
BTEX	Benzene, toluene, ethylbenzene, toluene
COPCs	Concentrations of the Chemicals of Potential Concern
CRR	Contaminated Remediation Required
CRU	Contaminated Restricted Use
CSM	Conceptual Site Model
DER	Department of Environment Regulation
DPH	Dissolved Phase Hydrocarbon
DSI	Detailed Site Investigation
DWER	Department of Water and Environmental Regulation
GIL	Groundwater Investigation Level
HHRA	Human Health Risk Assessment
MNA	Monitored Natural Attenuation
NA	Natural Attenuation
NAPL	Non-aqueous Phase Liquid
NPUG	Non-potable groundwater
ROA	Remedial Options Analysis
RRU	Remediated for Restricted Use
SAQP	Sampling Analysis and Quality Plan
SMP	Site Management Plan
TRH	Total Recoverable Hydrocarbons

1 INTRODUCTION

Viva Energy Australia Pty Ltd (Viva Energy) engaged Environmental Resources Management Australia Pty Ltd (ERM) to develop a site management plan (SMP) in relation to groundwater conditions associated with the operation of a former service station located at 640 South Western Highway, Byford, Western Australia (WA) ('the site') (refer to F*igure 1*). The site and *affected* land parcels were classified under the *Contaminated Sites Act 2003* (CS Act), as shown on *Figure 2*. This report must be read in conjunction with the Statement of Limitations presented in *Annex A.*

The site is identified as a *source* site under the CS Act and has been classified by the Department of Environment Regulation[1] (DER) as *Contaminated – remediation required* (CRR). Due to the presence of an offsite dissolved phase hydrocarbon (DPH) plume emanating from the site from the time of operation, four down-gradient residential properties (*Lots 215, 216, 230 and 231 on Plan 51299)*, a small public access way (Aquanita Rise [*Lot 229 on Plan 51299*]), a footpath along the northern side of Thomas Road (*Lot 300 on Plan 51299*) and a portion of the Thomas Road reserve were considered *affected* sites by the DER and also subsequently classified as CRR. The aerial extent of these classifications is shown on *Figure 2.*

A number of site characterisation and remedial works have been completed on- and offsite between 1999 and 2017. Due to the extent of works completed at the site since 1999, a technical studies overview was undertaken as part of the Site Closure Report (ERM, 2017a). All investigation works and findings discussed and evaluated in the Site Closure Report (ERM, 2017a) were sourced directly from assessment of site contamination and remediation documents referenced in *Annex B*. A summary overview is provided in *Table 1,* attached. The key findings are summarised as follows:

- The extent of the DPH plume has been delineated (refer to *Figure 3*);
- The DPH plume extent is reducing in size and concentration of identified chemicals of potential concern (COPCs);
- There is no non-aqueous phase liquid (NAPL) present, moreover NAPL has not been reported at the site since 1999;
- It is demonstrated that the quality of groundwater will not deteriorate in the future;

[1] The Department of Water and Environmental Regulation (DWER) was established by the Government of Western Australia on 1 July 2017. It is a result of the amalgamation of the Department of Environmental Regulation, Department of Water and the Office of the Environmental Protection Authority.

- The site and *affected* sites are suitable for use within the context of their nominated land and groundwater environmental values and land use scenarios;

- There is no unacceptable risk to human health associated with the DPH in groundwater;

- Potential residual human health risks can be managed through the implementation of institutional controls; namely, restrictions on use under reclassification; and

- Natural attenuation is working and is the preferred remedial option.

The findings of ERMs Site Closure Report (2017a) identified the following:

- The site is suitable for reclassification to RRU, with implementation of recommended restrictions (refer to *Table 1-1*) for a commercial land use scenario;

- Lot 230 on Plan 51299 (*32 Aquanita Rise*) and Lot 231 on Plan 51299 (*4 Butcher Road*) are suitable for reclassification to *Decontaminated*;

- Part of the Thomas Road reserve, the footpath along the northern side of Thomas Road [*Lot 300 on Plan 51299*], the Aquanita Rise access lane [*Lot 229 on Plan 51299*] are suitable for reclassification to RRU, with continued implementation of existing restrictions for a commercial land use scenario; and

- Lot 215 on Plan 51299 *(49 Aquanita Rise)* and Lot 216 on Plan 51299 *(34 Aquanita Rise)* are suitable for reclassification to RRU, with implementation of recommended restrictions (refer to *Table 1-1*), for residential land use scenario.

Clarity is provided here that the restrictions currently in place for part of the Thomas Road reserve, the footpath along the northern side of Thomas Road [Lot 300 on Plan 51299], the Aquanita Rise access lane [Lot 229 on Plan 51299] will remain unchanged and reclassification of these sites are not subject to the SMP.

It is noted that whilst RRU is a potentially acceptable end-point classification for Lot 215 on Plan 51299 (*49 Aquanita Rise*) and Lot 216 on Plan 51299 (*34 Aquanita Rise*), the DER has stated that *Decontaminated* is the required target for affected private land in the absence of signed agreement from the landowner for a permanent restriction. As such, this SMP has been drafted for implementation to facilitate future reclassification from RRU to *Decontaminated*. This approach is open to being modified based on consultation with property owners.

This SMP has been developed for the purpose of seeking an end-point of *Decontaminated* for Lot 215 on Plan 51299 and Lot 216 on Plan 51299 following their reclassification to RRU.

At the time of this writing, existing restrictions are in place for the site and Lots 215 and 216, as detailed in *Table 1-1*. These restrictions are reflected on the Memorial on Title for the sites and were aimed at managing potential risks to receptors whilst the plume was being investigated. Recommended restrictions for the site and Lots 215 and 216 are also detailed in *Table 1-1*

Table 1-1 Current Restrictions on Use: Site and Lots 215 and 216

Site Identification	Current Restrictions on Use	Recommended Restrictions on Use
Source Site: Former Oakland Service Station (Q036)	• Land use restricted to commercial/industrial; • The site should not be developed for sensitive use without further contamination assessment and/or remediation; • Basements and permanent utility pits (such as deep sewers or manholes) are not permitted to be constructed below 1.5 m depth due to the presence of hydrocarbons in soil and groundwater and the presence of hydrocarbon vapours in soil; • A site-specific health and safety plan is also required to address the risks to the health of any workers undertaking any other intrusive works below 1.5 m depth; • Access to soils below 4 m depth is restricted, other than for analytical testing or remediation, because of the presence of hydrocarbons in soil that may pose a source of further groundwater contamination if disturbed; and • Groundwater abstraction, other than for analytical testing or remediation, is not permitted at this site due to the nature and extent of groundwater contamination.	• Land use restricted to commercial/industrial; • The site should not be developed for sensitive use without further contamination assessment and/or remediation; • *The excavation of basements and permanent utility pits (such as deep sewers or manholes) below 2m depth should be appropriately assessed and should not create a new ongoing pathway for hydrocarbons to contact receptors;* • A site-specific health and safety plan is also required to address the risks to the health of any workers undertaking any other intrusive works *below 2 m depth;* • Access to soils below 4 m depth is restricted, other than for analytical testing or remediation, because of the presence of hydrocarbons in soil that may pose a source of further groundwater contamination if disturbed; and • Groundwater abstraction, other than for analytical testing or remediation, is not permitted at this site due to the nature and extent of groundwater contamination.
Affected Sites*:* Lots 215 and 216 on Plan 51299	• Groundwater abstraction, other than for analytical testing or remediation, is not permitted at this site due to the nature and extent of groundwater contamination; • Basements and permanent utility pits (such as deep sewers or manholes) are not permitted to be constructed below 1.5 m depth due to the presence of hydrocarbons in soil and groundwater and the presence of hydrocarbon vapours in soil; and • A site-specific health and safety plan is also required to address the risks to the health of any workers undertaking any other intrusive works below 1.5 m depth.	• Groundwater abstraction, other than for analytical testing or remediation, is not permitted at this property due to the nature and extent of groundwater contamination; • *The excavation of basements and permanent utility pits below 1.5 m depth should be appropriately assessed and should not create a new ongoing pathway for hydrocarbons to contact receptors; and* • A site-specific health and safety plan is also required to address the risks to the health of any workers undertaking any other intrusive works below 1.5 m depth.

1.1 OBJECTIVES

The targeted end points for Lots 215 and 216 (*affected* sites) are detailed in *Table 1-2*. The purpose of this SMP is to document a plan that can be implemented to demonstrate how the end points will be met.

Table 1-2 Targeted End-Points

Targeted Sites	Targeted End-Point	Targeted Classification	Resultant Outcome
Lot 215 and Lot 216 on Plan 51299 (*affected* sites)	• Groundwater quality suitable for abstraction for non-potable uses • Soil and soil vapour conditions be lifted in relation to restrictions on basements and permanent utility pits and other subsurface activities	Decontamination	Change to Memorial on Title and removal of all relevant restrictions

The key objectives are to document:

- A groundwater monitoring program, including contingency measures, which will be undertaken until the target end-point is reached for the targeted sites; and
- The method for measuring achievement of the end-points.

Site management procedures, in line with the existing restrictions, have been provided as supplementary information (refer to *Annex C*). These procedures include the management of intrusive works and building restrictions in relation to residual hydrocarbon impacted groundwater for the site owner and properties owners of Lots 215 and 216.

1.2 SCOPE OF WORK

The scope of this SMP was developed to accord with the DER *Assessment and Management of Contaminated Sites,* Contaminated Sites Guidelines (DER, 2014) (AMCS Guideline). Consistent with the AMCS Guideline, the scope of this SMP is to:

- Document:
    - Site activities to be managed, and the groundwater monitoring and maintenance requirements (inclusive of 'end-point' risk management criteria);
    - The time frame for which site management is currently considered necessary;

- Reporting framework;
- Contingency measures;
- Outline of responsibilities for implementing the SMP; and

- Provide a Sampling and Analysis Quality Plan (SAQP).

2 BACKGROUND

2.1 SITE (SOURCE) AND AFFECTED SITES OVERVIEW

The site is located along the south-western corner of Thomas Road and the South Western Highway in Byford, WA. Key details regarding the site are summarised in *Table 2-1*. At the time of this SMP, the site is vacant. The site topography is generally flat. There is limited vegetation with ground cover predominantly being exposed fill material and nominal grass landscape. The current site setting and features are shown on *Figure 2*.

Table 2-1 Site Identification

Attribute	Discussion
Site Name:	Former Oakland Service Station
Current Registered Owner:	Robert Elphick and Lan Anwar (Executor of the estate of Thong-Kie Tan)
Legal Description:	Lot 2 on Diagram 35013, Volume 1667 Folio 185
Local Government Authority (LGA):	Shire of Serpentine Jarrahdale
Zoning:	Urban Development Area (Shire of Serpentine-Jarrahdale Town Planning Scheme No.2, amended 10 June 2016)
Area:	Approximately 4,052 square metres (m^2) (i.e., 0.405 hectares (ha)]
Proposed Land Use:	Retail Petroleum Fuel Station

Details of the *affected* sites are summarised in *Table 2-2*.

Table 2-2 Affected Sites

Affected Site	Legal Description	Land Use
49 Aquanita Rise, Darling Downs 6122	Lot 215 on Plan 51299	Residential
34 Aquanita Rise, Darling Downs 6122	Lot 216 on Plan 51299	Residential

2.2 ENVIRONMENTAL SETTING

There are no surface water bodies onsite or on the *affected* sites. The nearest surface water body is Wungong Brook located approximately 1.15 km north of the site at its closest point. There are no artificial or natural stormwater drainage features either on the site or on or adjacent to the *affected* sites. The DPH plume does not extend past the *affected* sites and is shown to be contracting. As such, the groundwater at the site and *affected* sites does not support aquatic ecosystem protection associated with surface water presence at the Wungong Brook.

Groundwater is present within a semi-confined clay to sandy clay hydrostratigraphic unit. Historical groundwater flow has generally been inferred to occur towards the north-west; however, groundwater has

occasionally been observed to flow to the west. A Department of Water (DOW) groundwater bore search conducted by ERM in 2016 identified two registered groundwater bores within a 500 m radius of the site. These bores are located more than 200 m cross-gradient from the identified groundwater plume. None of these bores are located within the zone of historic or current residual hydrocarbon impacted groundwater.

There are no currently existing viable private domestic bores on the site or *affected* sites. It is noted that the residential properties surrounding the site are supplied by scheme water system. The site will be serviced by scheme water pending development.

Groundwater at the site and *affected* sites are not used for drinking water, stock, irrigation, or non-potable use (i.e., gardening) purposes. Consistent with the information provided in the Byford Townsite Detailed Area Plan, prepared for the Shire of Serpentine-Jarrahdale, dated 8 June 2004 and amended 3 November 2004, there is insufficient yield in interim and localised saturated zones up until approximately 21 metres below ground level (m bgl) to sustain ongoing use for any purpose.

3 TIER 1 RISK ASSESSMENT

A revised Tier 1 human health risk assessment (HHRA) was completed based on the outcomes of the technical findings completed to date and detailed in the Site Closure Report (ERM, 2017a). A summary overview is detailed in this section.

The nominated environmental value for the site and *affected* sites in its current and realistic foreseeable future land use setting is provided in *Table 3-1*. The nominated environmental value for groundwater at the site and surrounding area, including the *affected* sites subject to this SMP, in the current and realistic foreseeable future is non-potable groundwater use.

Table 3-1 Nominated Land Environmental Value

Attribute		Nominated Environmental Value
Site		
Current Primary Activity:	Vacant (however, former primary activity was petroleum service station)	Commercial
Proposed Primary Activity (realistic foreseeable future):	Petroleum service station	
Affected Sites: Thomas Road reserve including footpath, Aquanita Rise public access way		
Current Primary Activity :	Fully paved main streets and access ways subject to use by entities for commercial access purposes	Commercial
Proposed Primary Activity (realistic foreseeable future):		
Affected Sites: 34, 49 Aquanita Rise		
Current Primary Activity:	Residential dwelling	Residential
Proposed Primary Activity (realistic foreseeable future):		

The current COPCs in groundwater are:

- Benzene, toluene, ethylbenzene, and xylene (BTEX); and
- Total recoverable hydrocarbon (TRH) fractions, specifically
  - TRH C_6-C_{10};
  - TRH >C_{10}-C_{16}; and
  - TRH >C_{16}-C_{34}.

As identified, non-potable groundwater use is the only environmental value of concern that applies to the site and *affected* sites; and as such, non-potable groundwater use (NPUG) is the nominated screening level applied for the assessment of groundwater quality.

A comparison of the analytical data collected since 2013 indicate that BTEX (predominantly benzene) concentrations have reduced to below NPUG values at all residential *affected* sites with the exception of one (Lot 215), which is

closest to the site. One or more BTEX compound concentrations exceed NPUG values at the road reserve just north of the site, at the southern portion of the Aquanita Rise access way, and the site between residential sites) and onsite.

A CSM was developed to assess the potential for risk from potentially complete or actually complete exposure pathways to human health and the environment. The revised CSM is provided as *Table 2*, attached. Key outcomes are as follows:

- All primary sources of hydrocarbon have been removed;
- There are no residual vadose zone hydrocarbon impacted soils that could act as secondary sources;
- Under current conditions and extrapolated future conditions, there is a low risk to human health from the DPH plume;
- The NPUG screening levels are exceeded; however, there is an incomplete exposure pathway under the current site setting; and
- There is a potentially complete exposure pathway for access to groundwater through advancement of unregistered bores on residential properties or potential direct contact/ingestion by maintenance workers (unlikely as depth to water is at minimum >4 m bgl). Restrictions on land use would support the mitigation of risk associated with this potentially complete exposure pathway.

A Tier 1 risk assessment was completed based on the information provide through this report and the sections above. The outcomes of the risk assessment are detailed in *Table 3-2.*

Table 3-2 Tier 1 Risk Assessment

Potentially Complete Exposure Pathways	Exceedance to Tier 1 Human Health Risk Assessment Criteria	Risk Assessment	Proposed Risk Management Measures
Incidental ingestion/dermal contact with groundwater private domestic bores that could potentially be installed by residents at 34 and 49 Aquanita Rise in realistic foreseeable future	NPUG values are exceeded for benzene and/or ethylbenzene in groundwater samples collected from MW29, MW38R, and MW34	There is a low likelihood of risk as the potable water is supplied by scheme network and the plume is decreasing in concentrations and geometry, which is expedited by natural attenuation of hydrocarbons *Risk management measures recommended.*	• Groundwater abstraction, other than for analytical testing or remediation, is not permitted at this site due to the nature and extent of groundwater contamination; • Basements and permanent utility pits (such as deep sewers or manholes) are not permitted to be constructed below 1.5 m depth due to the presence of hydrocarbons in soil and groundwater and the presence of hydrocarbon vapours in soil; and • A site-specific occupational health and safety plan is also required to address the risks to the health of any workers undertaking any other intrusive works below 1.5 m depth.
Incidental ingestion/dermal contact with groundwater from excavations or trenches by residents at 34 and 49 Aquanita Rise currently and in the realistic future	NPUG values are exceeded for benzene and/or ethylbenzene in groundwater samples collected from MW29, MW38R, and MW34	There is moderate likelihood of risk will eventually become negligible as plume is decreasing in concentrations and geometry *Risk management measures recommended*	
Incidental ingestion/dermal contact with groundwater from excavations or trenches maintenance work onsite or within the Thomas Road reserve and footpath north of the road reserve, currently in the realistic foreseeable future	NPUG values are exceeded for benzene and/or ethylbenzene in groundwater samples collected from MW29, MW38R, and MW34	There is low likelihood of risk which will eventually become negligible as plume is decreasing in concentrations and geometry *Risk management measures recommended*	• Land use restricted to commercial/industrial; • The site should not be developed for sensitive use without further contamination assessment and/or remediation; • Basements and permanent utility pits (such as d sewers or manholes) are not permitted to be constructed below 1.5 m depth due to the presei of hydrocarbons in soil and groundwater and th presence of hydrocarbon vapours in soil; • A site-specific health and safety plan is also required to address the risks to the health of any workers undertaking any other intrusive works below 1.5 m depth; • Access to soils below 4 m depth is restricted, other than for analytical testing or remediation, because of the presence of hydrocarbons in soil that may pose a source of further groundwater contamination if disturbed; and • Groundwater abstraction, other than for analytical testing or remediation, is not permitted at this site due to the nature and extent of groundwater contamination.
Incidental ingestion/dermal contact with groundwater from excavations or trenches maintenance work at the Aquanita Rise public access way undertaken by intrusive maintenance currently and in the realistic foreseeable future	There are no exceedances of NPUG values	Risk is considered negligible considering plume reduction in size and COPC concentrations.	
Inhalation of petroleum vapours in indoor air by residents at 34 and 49 Aquanita Rise currently and in the realistic foreseeable future.	There are no exceedances of the COPCs to the nominated PVI. This is complimented by the findings of the two PVI HERAs	Risk is considered negligible considering plume reduction in size and COPC concentrations.	
Inhalation of petroleum vapours in indoor air by onsite workers in buildings that could be built onsite in the realistic foreseeable future	TRH C_6-C_9 less BTEX was detected in the June 2015 GME at MW29 (onsite). However, the following GME data did not report TRH C_6-C_9 less BTEX above the laboratory LORs	There is a low likelihood of risk which will eventually become negligible as groundwater quality trends indicate reduction in concentrations, expedited by natural attenuation of hydrocarbons.	
Inhalation of petroleum vapours in ambient air in excavations or trenches by workers undertaking intrusive work onsite and on *affected* sites, including residents at 34 and 49 Aquanita Rise	There are no criteria		

4 COMMUNITY CONSULTATION

4.1 STAKEHOLDERS

The success of the SMP relies on the active participation of all persons who have the potential to be *affected* by residual groundwater contamination. Each of these persons must clearly know their role in this SMP covering restrictions on groundwater abstraction. Stakeholders have been identified in *Table 4-1* based on current Certificate of Titles (refer to *Annex D*).

4.2 ROLES AND RESPONSIBILITIES

The roles and responsibilities of the stakeholders will include the following:

Viva Energy: the nominated entity to have overall responsibility for implementation of this SMP. Viva Energy will be responsible for commissioning the continued environmental works at the site. Provide updates to the identified stakeholders at the agreed frequency.

DWER: Act as government regulator who will ensure that all parties are meeting their obligations under the CS Act;

Land Owners and Managers: Convey information regarding the management strategies set out in this SMP to tenants and/or workers conducting intrusive activities and make these parties aware of the presence and location of monitoring wells at the site(s) and the importance of protecting wells from damage;

Tenants: Report any hydrocarbon odours within the buildings suspected to originate from the sub-slab to the land owner who will inform Viva Energy. Staff will also convey information on restrictions to intrusive maintenance workers; and

Workers Conducting Sub-surface Activities: Consider potential health risks and develop a site-specific health and safety plan prior to any intrusive works.

4.3 STAKEHOLDER ACKNOWLEDGEMENT

All of the stakeholders identified in *Table 4-1* must be aware of the SMP, its requirements and the appropriate means by which these requirements are to be met. Site-specific management plans for the individual *affected* Lots are provided in *Annex C.*

A written statement from the current owners of the '*source*' site and '*affected*' sites, acknowledging agreement of the management strategy will be sought. This statement will detail consent of access to conduct on-going groundwater monitoring (on the site only) and acknowledging that any future owners of the sites will also need to provide a similar commitment. As detailed in *Section 1*, RRU is a potentially acceptable end-point classification for Lot 215 on Plan 51299 and Lot 216 on Plan 51299; however, the DER has stated that *Decontaminated* is the required target for affected private land in the absence of signed agreement from the landowner for a permanent restriction.

Viva Energy intends to consult with the property owners of Lots 215 and 216 regarding this SMP and seek their written agreement. If agreement cannot be confirmed, Viva Energy intends to proceed with implementation of the SMP as rationalised below:

- Relevant restrictions remain largely unchanged;
- There are no relevant access or management commitments for the affected sites (Lots 215 and 216) property owners;
- The RRU classification represents an improvement from CRU; and
- Viva Energy is facilitating reclassification to *Decontamination* of the two *affected* residential properties in the future.

It is highlighted that this approach is open to being modified based on consultation with property owners at any time in the future.

Table 4-1 Identified Stakeholders

Property	Certificate of Title	Property Description	Stakeholder	Stakeholder Contact	Contact Details
640 South Western Hwy, Byford	Lot 2 on Diagram 35013	Vacant commercial	Executor of the will of Thong-Kie Tan	Lan Anwar	17 Carnhill Circle, Helios Residences, 11-8, Singapore 229816
				Michael Robert Elphick	23 Brown Street, Claremont
34 Aquanita Rise, Darling Downs	LOT 216 on Plan 51299	Residential	Land owner	Troy Robert Beet	9 Bray Street, Kelmscott
49 Aquanita Rise, Darling Downs	LOT 215 on Plan 51299	Residential	Land owner	Adam Leigh Broomhall	30 Acton Avenue, Rivervale
General Project Stakeholders	All above	N/A	Viva Energy	Viva Energy Community Relations	+61 3 8823 4677 CommunityRelations@vivaenergy.com.au
			DWER	Rowena Beaton	+61 8 9333 7573 rowena.beaton@dwer.wa.gov.au
			Serpentine Jarrahdale Shire	Tony Turner and Chris Portlock	Serpentine Jarrahdale Shire
			CS Auditor	Jeremy Hogben	+61 8 6324 0200

5 GROUNDWATER MANAGEMENT PLAN

As detailed in *Table 1-1*, restrictions are currently in place to manage potential risks to receptors from the DPH plume. Specific management plans for relevant stakeholders are presented in *Annex C,* which outlines the management procedures required to implement restrictions and mitigate risk exposure.

This section provides discussion on the nominated groundwater remediation strategy with focus placed on monitoring of groundwater quality and method for measuring when the end-point of *Decontaminated* for the two residential sites has been met. This section is accompanied by a SAQP, provided as *Annex E.*

5.1 GROUNDWATER REMEDIATION STRATEGY

Natural attenuation is considered the most suitable option to meet the remedial objectives for the site and represents the adopted remedial strategy. A program of monitored natural attenuation (MNA) and trend analysis of COPCs is proposed to confirm that natural attenuation continues to reduce petroleum hydrocarbon concentrations in groundwater.

5.1.1 Remediation Goal

The remediation goals for the *affected* residential sites (Lots 215 and 216) are as follows:

- Concentrations of petroleum hydrocarbons in groundwater are reduced to a level that would allow abstraction for domestic non-potable purposes; and

- Removal of restrictions on construction of basements/ permanent utility pits in relation to hydrocarbon vapours in groundwater, and on requirement of a site-specific health and safety plan to address risks to health of workers undertaking intrusive works.

Screening level criteria for use of groundwater for non-potable purposes have been nominated as target criteria to demonstrate that the remediation end-point for groundwater at Lots 215 and 216 have been met. These criteria have been adopted from the DoH (2014) *Contaminated Sites Ground and Surface Water Chemical Screening Guidelines* document. The non-potable use screening levels are generally 10 times the health related guideline value or the unadjusted aesthetic guideline value as set out in the Australian Drinking Water Guidelines (ADWG) (NHMRH, NRMMC, 2011). These screening levels are identified as non-potable groundwater use levels, or NPUG.

NPUG values are available for BTEX; however, it is identified in the DOH (2014) document that the ADWG aesthetic guideline value will be directly applied for ethylbenzene, toluene, and xylene. The nominated NPUG values are provided in *Table 5-1. Consideration should be made for the broader intent of the guideline; i.e., as part of the data analysis, if the aesthetic values for ethylbenzene, toluene, and xylene are marginally exceeded, but there is no detectable odour, then allowance is given that the remediation goals may have been met.*

In the absence of DoH (2014) values for the TRH C_6-C_{10}, TRH C_{10}-C_{16}, and TRH C_{16}-C_{34} fraction, a 10-fold factor was applied to the drinking water guidelines provided in WHO (2008). It is identified that the total petroleum criteria (TPH) is presented as Equivalent Carbon (EC) indices and not as TRH. A derivation of the TRH C_6-C_{10}, TRH C_{10}-C_{16}, and TRH C_{16}-C_{34} fractions were made to translate nominated WHO (2008) TPH criteria to associated TRH fractions. These nominated criteria are provided in *Table 5-1*. The following considerations are made with regards to these criteria:

- They are highly conservative in relation to other acknowledged global drinking water criteria (USEPA, 2016; MADEP, 2014); and
- Though acceptable limits for TRH C_6-C_{10} and TRH C_{10}-C_{16} is set at 900 µg/L as estimated via WHO (2008), allowance is made for the use of 1,000µg/L if warranted to determine that the remediation goals have been met.

Table 5-1 Target Criteria – NPUG

Compounds[1]	Accepted Limit (µg/L)
Benzene	10
Toluene	25
Ethylbenzene	3
Xylenes	20
TRH C_6-C_{10} and TRH C_{10}-C_{16}[2]	900
TRH C_{16}-C_{34}[2]	1,000

[1] DoH (2014)
[2] WHO (2008)

5.1.2 *Remediation Timeframe*

A plume duration assessment has been completed for the study area that indicates that the dissolved phase hydrocarbon concentrations are decreasing. Additionally, the assessment provided approximate estimates of likely timeframes for the dissolved phase concentrations to reach acceptable levels (NPUG).

The most current assessment indicates the NPUG concentrations will be achieved by approximately 2030 on the road reserve immediately to the north of the *source* site. The road reserve is located between the site and 34 and 49 Aquanita rise. Monitoring of groundwater quality will be undertaken at monitoring wells located immediately up-gradient of these residential properties within the road reserve. Measurement of groundwater in wells located in the road reserve provides conservative groundwater quality data expected for Lots 215 and 216. These wells also represent sentinel wells in monitoring natural attenuation at the site.

It is noted that this date is an approximation based on a number of variable factors and the potential uncertainties associated with the natural environment. The reduction of concentrations to an acceptable level may require more or less time than calculated. As detailed in the SAQP presented in *Annex E*, the mechanism for monitoring the remediation timeframe will be through an MNA program. The sampling frequency and extent would be expected to decrease subject to the interpretation of the MNA performance.

5.2 *GROUNDWATER SAMPLING*

The plan covers the monitoring requirements required to ensure that natural attenuation is taking place. The following sub-sections outline the strategy to be adopted as part of the groundwater management plan. Additional details pertaining to groundwater sampling has been included in the SAQP provided in *Annex E.*

5.2.1 *Spatial Coverage*

It is noted that no wells located on residential properties have been included in the monitoring program due to the difficulties encountered in the past with negotiating access to these properties. Four strategically located monitoring wells have been nominated for inclusion in the monitoring program to provide spatial coverage to adequately represent groundwater beneath the two residential properties (Lots 215 and 216). The four monitoring wells selected and the rationale is outlined below:

- MW29 – monitor DPH concentrations as a downgradient site boundary well as well as being up gradient of MW38R for plume geometry purposes;

- MW34 and MW38R– monitor DPH concentrations beneath the road reserve and footpath; and

- MW34 and MW46 – monitor DPH concentrations immediately up-gradient of Lots 215 and 216.

5.2.2 Sampling Frequency

Given that the findings of the investigations to date, which demonstrate continued plume reduction and the viability of MNA as the management approach, it is proposed that future GMEs be initially conducted biennially in the month of October. *Further detail is provided in the attached SAQP.* October has been conservatively selected as the most suitable period for future sampling as it typically represents the end of the rainy winter season when groundwater levels are usually at their highest and when historically the mobilisation of capillary fringe and unsaturated zone residual COPCs has been greatest.

5.2.3 Network Maintenance

Groundwater monitoring wells to be sampled should be inspected for serviceability and potential damages during each monitoring event with repairs being made as necessary.

In the event that any of the monitoring wells to be sampled become unserviceable the adequacy of the monitoring well network will need to be reviewed. If the review concludes that the number of sampling points is not sufficient to obtain the required dataset, replacement groundwater wells may be installed.

Consideration is made that monitoring well MW29, located on the site, may be destroyed should the site be developed. Dependent on the groundwater quality data obtained up until that time and the continued presence of monitoring wells MW34, MW38R, and MW46, instalment of a replacement well will be considered but may not be necessary.

5.3 CONTINGENCY MEASURES

A contingency plan is required in the event that NA does not perform to expectations and/or regulatory requirements. It has been noted that the concentrations within the DPH plume are variable based on groundwater depths. Contingency measures have been developed in relation to groundwater quality monitoring and are based on decision rules as detailed in the SAQP, attached.

5.4 *REPORTING REQUIREMENTS*

Once the determination is made that the end-point for the residential properties (Lots 215 and 216) has been met, a report will be developed and submitted to DWER seeking reclassification to *Decontaminated.*

Additionally, Viva Energy will update the owners of the site and Lots 215 and 216 once every two years with the results of the groundwater monitoring program.

5.5 *CESSATION OF MONITORING*

The cessation of monitoring of groundwater contamination can occur when concentrations of petroleum hydrocarbons in groundwater have reduced to a level that would allow abstraction for domestic non-potable purposes on the *affected* residential properties in accordance with the decision – rule identified in the SAQP, attached. Such conditions would also be considered commensurate with lifting of the other restrictions related to subsurface structures and activities.

A defined timeframe for cessation of monitoring cannot be made. The detailed evaluation of the data following the second GME will support a refined understanding and prediction of when the cessation of monitoring is likely to occur.

6 CONCLUSIONS AND RECOMMENDATIONS

The objective of this SMP was to summarise site conditions, identify the potential risk posed by petroleum hydrocarbons beneath the site and detail how they should be managed. This SMP outlines the restricted activities for the on- and offsite properties, how they should be managed and the requirements of the *affected* properties during the duration of the MNA program. The management strategies have been based on the risk assessment for the study area, which indicated that no unacceptable risks are posed to the identified receptors except via groundwater use and during excavation to the level of groundwater. Based on the assessments completed to date, the site and *affected* properties are considered to be suitable for ongoing current use under the classification of RRU, provided that the restrictions outlined in this SMP remain in place.

For the *affected* sites subject to this SMP, the cessation of monitoring of groundwater contamination can occur when the remedial end-point is met in the nominated offsite groundwater monitoring wells. Once the remedial end-point has been met, NA will further reduce contaminant concentrations to background levels, over time.

For the site, the cessation of monitoring will occur simultaneous with the *affected* sites programme.

7 *REFERENCES*

Department of Health (DoH) (2014): Contaminated Sites Ground and Surface Water Chemical Screening Guidelines, 2014.

Department of Environment Regulation (DER) (2014): Assessment and Management of Contaminated Sites, Contaminated Sites Guidelines, 2014.

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Figures

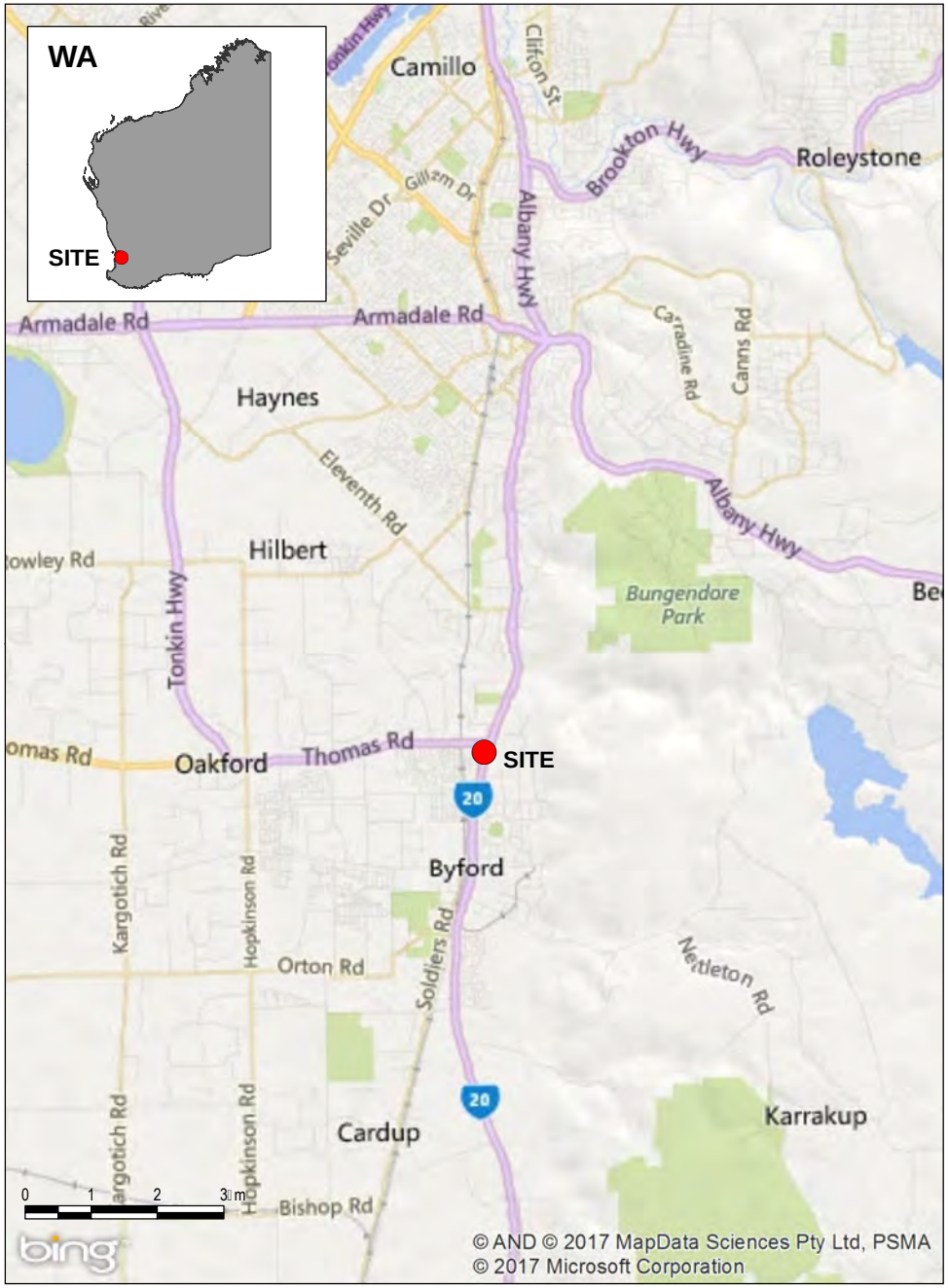

Image Source: © nearmap 17 June 2016

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Figure 1 - Site Location Map

Site Management Plan
ormer Shell a land Ser ice Station (036),
nr homas oad and South Western Highway, Byford

n ironmental esources Management A

Auc land, Brisbane, anberra, hristchurch, Melbourne, ewcastle, Perth, Port Mac uarie, Sydney

ERM

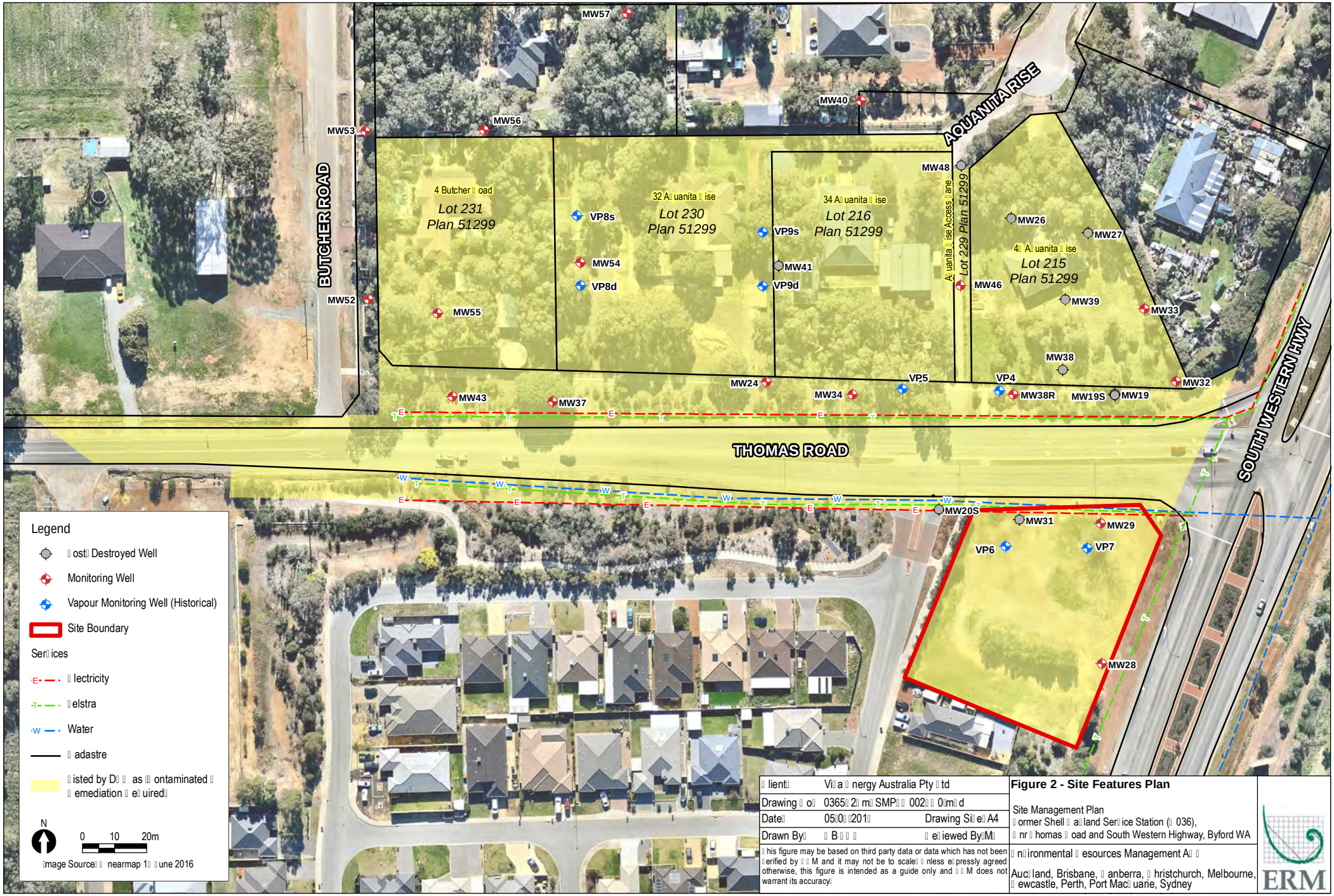

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Figure 2 - Site Features Plan

Site Management Plan
Former Shell Aaland Service Station (036),
nr Thomas Road and South Western Highway, Byford WA

Environmental Resources Management A
Auckland, Brisbane, Canberra, Christchurch, Melbourne, Newcastle, Perth, Port Macquarie, Sydney

ERM

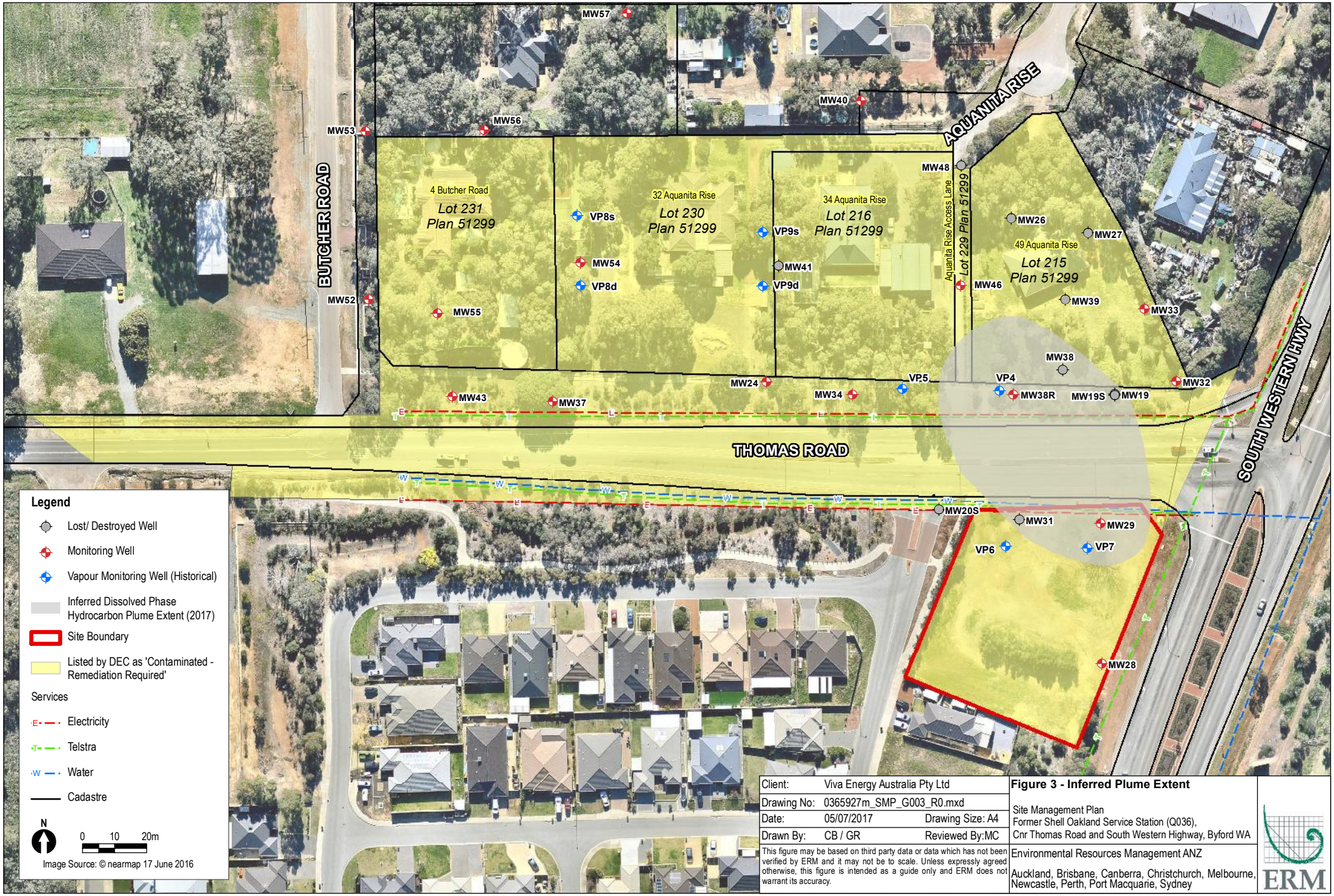

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Figure 3 - Inferred Plume Extent

Site Management Plan
Former Shell Oakland Service Station (Q036),
Cnr Thomas Road and South Western Highway, Byford WA

Environmental Resources Management ANZ

Auckland, Brisbane, Canberra, Christchurch, Melbourne, Newcastle, Perth, Port Macquarie, Sydney

ERM

Tables

Table 1: Previous Investigations and Current Hydrocarbon Impact Overview

Activity	Overview	Key Summary Findings
Soil Remediation and Validation	During operation of the site as a service station, there were seven operational underground storage tank (UST) fuelling systems with associated piping network and bowsers. These USTs were identified as T1 to T7. Two of the USTs (T2 and T3) had been removed in 1995. Between 2000 and 2003, the following remediation and decommissioning activities were completed: • Decommissioned and removal of f buildings; • Removal of four UST systems (T1, T4, T5 and T7), an oil/water interceptor, and drainage network systems, including man holes. The excavations were subsequently backfilled with imported fill material and validated landfarmed excavated soils. Anecdotal evidence indicated that UST T6 may have been located to the immediate west of UST T1. No tank was found during building demolition activities, nor any evidence of a former UST, when that area was excavated A ground-penetrating radar (GPR) survey completed in 2010 confirmed that no underground utilities or tanks were identified indicating the likelihood that UST T6 had previously been removed from site. • All excavated areas were sampled and validated to the adopted guideline values except for several sampling locations at the base of the main excavation pit.	• The likely sources of hydrocarbon impacts are releases from USTs T1 and T7; both unleaded petroleum; • The contaminants of potential concern (COPCs) are benzene, toluene, ethylbenzene, and xylene (BTEX), total petroleum hydrocarbons (TPH) and naphthalene. The lightest TPH fractions detected were the TPH C_6 to C_9 band; • Ecological Investigation Levels (EILs) were the only nominated Tier 1 assessment criteria exceeded. BTEX compounds were the only COPCs that exceeded the EILs; and • Localised residual hydrocarbon impacts were identified in saturated zone soils in the vicinity of USTs T1 and T7, near the north-north-east corner of the site.
Delineation of Hydrocarbon Impacted Soils	Seventeen (17) soil bores were advanced across the site in June 2009 to complete further validation sampling proximal to former onsite USTs and to further delineate known onsite soil impacts. Selected soil samples were submitted for laboratory analysis. With the exception of three samples, all COPC concentrations were below the laboratory LOR. The impacted samples indicate hydrocarbon impacts at the soil/groundwater interface were related to the groundwater impacts beneath the site.	• The lateral and vertical extent of residual hydrocarbon impacted had been delineated to the capillary fringe and smear zone localised to the vicinity of former UST T1; and • Hydrocarbon impacted soils do not extend offsite.
Petroleum Vapour Intrusion (PVI) Human Health and Ecological Risk Assessments (HERA)	Two PVI HERAs from impacted groundwater were completed; one in 2003 and one in 2010. The HHRA model results indicated the following: • The health of adult employees working onsite and largely within a slab-on-grade development is unlikely to be at significant risk from the inhalation of vapours derived from groundwater impacts; • The health of onsite child residents with a slab-on-grade development are unlikely to be at significant risk from the inhalation of vapours based upon soil vapour input data; and • There are not likely to be significant risks to the health of offsite residents as a result of vapour intrusion from impacted groundwater under their properties.	It was concluded that there are no unacceptable health risks for future onsite commercial users or for on and offsite residents (including children) associated with petroleum vapour intrusion from groundwater.

Table 1: Previous Investigations and Current Hydrocarbon Impact Overview

Activity	Overview	Key Summary Findings
Groundwater Quality Trend Analysis - Hydrocarbons	A total of 46 groundwater monitoring wells were installed between 1999 and 2006 with an additional eight groundwater monitoring wells (MW46, MW48, MW52, MW53, MW54 – MW57) installed between January 2008 and April 2010. Groundwater monitoring events have occurred between 1999 and 2016 for analysis of BTEX, TPH, naphthalene and lead. A statistically-backed groundwater quality trend analysis was completed using the Mann-Kendall procedure incorporating the historic data and groundwater sample data. A comparison of analytical data overtime was further undertaken.	• Based on the ERM (2010) initial trend analysis, the 2015 statistical analysis, and comparison of the September 2016 GME data to the 2010 and 2015 trend analysis, the assessment was made that the DPH concentrations and plume is stable or decreasing both on and offsite, with no increasing trends noted across the data set. Moreover, there is no evidence of recent migration; • The decreasing trends indicate that although spikes in reported COPC concentrations may occur seasonally, a significant ongoing secondary source of petroleum hydrocarbons does not exist at the site and that natural attenuation appears to be occurring; • The offsite DPH plume has been delineated and an extensive set of data is available for monitoring wells typifying offsite impact which includes MW19 (with 10 rounds of monitoring data collected over 12 years) and MW34 (with 10 rounds of monitoring data collected over 10 years); • There has been no NAPL detected in groundwater; • Lead, naphthalene, and the TRH C_{34} to C_{40} fractions have not been detected above the laboratory LORs and are therefore no longer considered to constitute COPCs; and • The current COPCs in groundwater are BTEX, and TRH fractions; namely TRH C_6 to C_9, TRH C_{10}-C_{16}, and TRH C_{16}-C_{34}.
Groundwater Quality Trend Analysis – Natural Attenuation	Natural attenuation (NA) parameters have been assessed as part of the GMEs since 2002. A plume duration assessment (PDA) focussing on degradation rates of the COPCs at offsite monitoring locations was completed to provide and estimation on the duration for which a restriction maybe be placed on the extraction and use of groundwater within offsite areas. The works completed included: • Data quality review of groundwater data to ascertain the useability and suitability of data available for this assessment; • Estimation of degradation rates of COPCs within groundwater sampled from all appropriate offsite monitoring wells; • Using the aforementioned degradation rates, estimate the duration required to restore potential beneficial uses through natural attenuation taking into account observed concentrations and groundwater quality goals (i.e. An estimation of the duration for which a restriction may need to be placed on the extraction and use of groundwater within offsite areas); and	In summary, over the monitoring period groundwater sampling results indicate that offsite groundwater impact has contracted over time. The estimated timeframes to reaching groundwater quality goals outlined above fall within a 30-year timeframe, which is considered reasonable for the implementation of MNA as an offsite remediation strategy coupled with a suitable monitoring program.

Table 1: Previous Investigations and Current Hydrocarbon Impact Overview

Activity	Overview	Key Summary Findings
	• Estimated degradation rates for the COPCs were calculated for offsite monitoring locations that have had detections of BTEX and TPH C_6-C_9 above the laboratory limits of reporting during one or more of the last four sampling rounds undertaken in 2013 through to 2016.	
Remedial Alternatives Analysis	A Remedial Alternatives Analysis (RAA) was completed in 2013. The focus of this RAA was the reduction of concentrations of COPCs in groundwater beneath the residential *affected* sites. While a consequence of groundwater quality improvement in these areas may be a reduction in concentrations beneath the road reserve and the site that is not the focus of this RAA. The outcomes of an initial screening process identified two potential remediation options as having the most appropriate (either in part or in full) potential for application at the *affected* sites and should be considered in more detail: • (MNA; and • Aerobic bioremediation (an in situ submerged oxygen curtain). A technology feasibility rating and overall feasibility assessment was undertaken for the above. The findings identified that: • MNA was feasible and practicable; and • Aerobic bioremediation (the in situ submerged oxygen curtain) was feasible with limitations. MNA scored the highest rating overall (46) on the basis of widespread application and its acceptance as an effective method for the clean-up of DPH groundwater plumes. It is regarded as being both feasible and practical based on the site-specific conditions.	Based on the extent of groundwater impact, the hydrogeological setting and evidence of natural anaerobic biodegradation processes, plume duration assessment and feasibility of remediation technologies, MNA is considered to be the most feasible and practicable approach for remediation of the impacted groundwater beneath the residential properties.
Site Closure Report	The intent of this closure report was to condense the chronology site characterisation, site decommissioning and remediation work and subsequent onsite and offsite risk assessment and performance monitoring completed since 1999 into a single standalone document which supported the case for the reclassification of the *source* and *affected* sites going forward.	• Following excavation of hydrocarbon impacted vadose zone soils, the lateral and vertical extent of impacted vadose zone soils is laterally delineated to a localised area onsite. • Hydrocarbon impact to the phreatic zone soils extends to approximately 8.5 m bgl. The extent of the hydrocarbon impacted saturated zone soils is localised at the *source* site (onsite). • There is negligible risk to human health from soil derived PVI onsite under the current commercial/industrial land use. • As above there is no NAPL present, moreover NAPL has not been reported at the site since 1999.

Table 1: Previous Investigations and Current Hydrocarbon Impact Overview

Activity	Overview	Key Summary Findings
		• The longitudinal and lateral extent of the DPH plume has been delineated (refer *to Figure 3*). • GMEs and statistically-backed trend assessments have confirmed a reduction in the DPH plume extent and the concentrations of the COPCs have been shown to be diminishing. This is seasonably demonstrable during fluctuating water levels at the site. • MNA parameters were interpreted as part of the GMEs and an MNA assessment was completed. Interpretation of the primary and secondary lines of evidence indicates that MNA is working. The conclusion is to apply MNA as a preferred remedial option and no other valid remedial options are warranted. • The PDA and associated contaminant fate and transport modelling demonstrated that MNA will work for the site within a 30-year timeline. TPH concentrations at residential *affected* sites have been reported below the adopted NPUG value of 1,000 µg/L over the last several years. • BTEX (predominantly benzene) concentrations have reduced to below NPUG values at all residential *affected* sites with the exception of one which is closest to the *source* site. One or more BTEX compound concentrations exceed NPUG values at the road reserve, pathway (i.e., the alleyway between residential sites) and onsite. • It is demonstrated from the above findings that the quality of groundwater will not deteriorate in the future with the presence of a secondary phreatic zone source on site. • There are no exceedances to nominated assessment criteria for groundwater PVI. • There is no defined petroleum vapour intrusion risk which has been confirmed by sample data. • The nominated environmental value is beneficial use; specifically non-potable groundwater use. Multiple lines of evidence demonstrate that groundwater use does not include drinking water, irrigation (in line with Water Quality Guidelines – staple crop), stock water, nor does it support aquatic ecosystem protection requirements.

Table 1: Previous Investigations and Current Hydrocarbon Impact Overview

Activity	Overview	Key Summary Findings
		• Groundwater at the *source* site, the a*ffected* road reserve site, *affected* alley way site, and *affected* residential sites is not currently used. There are no private or unregistered bores for potable use. • Under current conditions and extrapolated future conditions, there is a low risk to human health from the DPH plume. The extrapolated conditions would need to be validated with groundwater monitoring. This groundwater monitoring and contingency plan would be provided in an SMP. • The NPUG screening groundwater investigation levels (GILs) are exceeded; however there is an incomplete exposure pathway under the current setting. • There is a potentially complete exposure pathways for access to groundwater through advancement of unregistered bores on residential properties or potential direct contact/ingestion by maintenance workers (unlikely as depth to water is at minimum >4 m bgl). Restrictions on land use would support the mitigation of risk associated with this potentially complete exposure pathway.

Secondary Source	COPCs	Migration Pathway	Exposure Route	Receptor	Exposure Point	Current Setting		Realistic Foreseeable Future	
						Exposure Pathway	Rationalisation	Exposure Pathway	Rationalisation
DPH Plume	BTEX, TRH C_6-C_9, TRH C_{10}-C_{16}, and TRH C_{16}-C_{34}.	• Advection, diffusion, dispersion of colloids • Seasonal flux from residual hydrocarbon impacted saturated soils localised at the former UST T1 area of the site	Incidental ingestion/ dermal contact	Residents at 34 and 49 Aquanita Rise	Abstraction bore effluent	Incomplete	There are no existing or viable domestic private abstraction bores at these properties.	Potentially Complete	Domestic bore installation is considered unlikely due to the provision of potable water via scheme network, and poor groundwater yield (a notable deterrent). However, conservative consideration should be made that the installation of a private domestic bore could happen.
					Groundwater expression in excavations or trenches	Potentially complete	---	Potentially complete	---
		Petroleum vapour Intrusion	Inhalation		Indoor air	Potentially complete	There are buildings but no basements	Potentially complete	There are buildings but no basements
		Petroleum vapour emitted to ambient air	Inhalation	Residents at 34 and 49 Aquanita Rise and workers undertaking intrusive maintenance work	Ambient air in open excavations or trenches	Potentially complete	---	Potentially complete	---

Secondary Source	COPCs	Migration Pathway	Exposure Route	Receptor	Exposure Point	Current Setting		Realistic Foreseeable Future	
						Exposure Pathway	Rationalisation	Exposure Pathway	Rationalisation
		• Advection, diffusion, dispersion of colloids • Seasonal flux from residual hydrocarbon impacted saturated soils localised at the former UST T1 area of the site	Incidental ingestion/ dermal contact	Onsite employees or workers undertaking intrusive maintenance work at the onsite or within the Thomas Road reserve, footpath north of the road reserve, or the Aquanita Rise public access way	Abstraction bore effluent	Incomplete	There are no existing domestic private bores	Incomplete	There will be no private domestic bores
					Groundwater expression in excavations or trenches	Potentially complete	---	Potentially complete	---
		Petroleum vapour Intrusion	Inhalation	Onsite employees	Indoor air	Incomplete	There are no buildings	Potentially complete	Buildings likely to be constructed
				Public and workers undertaking intrusive maintenance work at the road reserve, footpath, access way		Incomplete	There are no buildings	Incomplete	There are no buildings
		Petroleum vapour emitted to ambient air	Inhalation	Onsite workers undertaking intrusive maintenance work	Ambient air in open excavations or trenches	Incomplete	Site is vacant	Potentially complete	If the site is developed
				Workers undertaking intrusive maintenance work on the road reserve, footpath, access way or at the site		Potentially complete	---	Potentially complete	---

Annex A

Statement of Limitations

STATEMENT OF LIMITATIONS

This SMP (the 'report') was prepared in accordance with the scope of work outlined within this report and subject to the applicable cost, time and other constraints. ERM performed the services in a manner consistent with the normal level of care and expertise exercised by members of the environmental profession. ERM makes no warranty concerning the suitability of the site for any purpose or the permissibility of any use, development or re-development of the site. Except as otherwise stated, ERM's assessment is limited strictly to identifying specified environmental conditions associated with the subject site and does not evaluate structural conditions of any buildings on the subject site. Lack of identification in the report of any hazardous or toxic materials on the subject site should not be interpreted as a guarantee that such materials do not exist on the site.

This assessment is based on site inspection conducted by ERM personnel, sampling and analyses described in the report, and information provided by Viva Energy Australia Pty Ltd ("Viva Energy" or "the client") or other people with knowledge of the site conditions. All conclusions and recommendations made in the report are the professional opinions of the ERM personnel involved with the project and, while normal checking of the accuracy of data has been conducted, ERM assumes no responsibility or liability for errors in data obtained from such sources, regulatory agencies or any other external sources, nor from occurrences outside the scope of this project.

ERM is not engaged in environmental consulting and reporting for the purpose of advertising, sales promoting, or endorsement of any client interests, including raising investment capital, recommending investment decisions, or other publicity or investment purposes.

Nothing in this section or in this report in any way affects, limits or qualifies ERM's obligations and liabilities, or Viva Energy's rights and benefits under the agreement entitled Global Framework Agreement for the procurement of services (and related goods) (RET/10/0313/GLES) between Viva Energy Australia Pty Ltd and ERM (as amended, varied, supplemented, novated or replaced).

ERM PREPARED THIS REPORT FOR THE SOLE AND EXCLUSIVE BENEFIT AND USE OF VIVA ENERGY. NOTWITHSTANDING DELIVERY OF THIS REPORT BY ERM OR VIVA ENERGY TO ANY THIRD PARTY, UNLESS OTHERWISE EXPRESSLY AGREED, ANY COPY OF THIS REPORT PROVIDED TO A THIRD PARTY IS PROVIDED FOR INFORMATIONAL PURPOSES ONLY, WITHOUT THE RIGHT TO RELY AND ERM DISCLAIMS ALL LIABILITY TO SUCH THIRD PARTY TO THE EXTENT PERMITTED BY LAW. ANY USE OF THIS REPORT BY A THIRD PARTY IS DEEMED TO CONSTITUTE ACCEPTANCE OF THIS LIMITATION.

Annex B

Previous Investigation Reference Documents

REFERENCES

MAR 2008 Assessed Documents:

The following documents were assessed for the 2008 MAR:

Woodward-Clyde (October 1999) Final Report "Shell 'Oakland' Service Station Environmental Site Assessment (ESA)".

IT Environmental (August 2003a) "Soil Validation Report, Former Shell Oakland Service Station (Q036) May 2003, Corner of Thomas Road and South Western Highway, Byford, Western Australia".

IT Environmental (October 2003b) "Health and Environmental Risk Assessment, Former Shell Oakland Service Station (Q036), Corner Thomas Road and South Western Highway, Byford, Western Australia".

IT Environmental (March 2004) "Environmental Site Assessment, Former Shell Oakland Service Station (Q036), Corner of Thomas Road and South Western Highway, Byford, Western Australia".

IT Environmental (January 2004) "Environmental Site Assessment, Former Shell Oakland Service Station (Q036), Corner of Thomas Road and South Western Highway, Byford, Western Australia".

Coffey Environments (January 2007) "Environmental Site Assessment Report, Former Shell Oakland Service Station (Q036) Corner Thomas Road and Southwest Highway, Byford, Western Australia". Field Work 29 June – 2 July, 12-15 July, 13-14 and 20-21 November 2006.

MAR 2011 Assessed Documents:

In addition to the documents assessed as part of the 2008 MAR, the following documents were assessed for the 2011 MAR:

ERM (2009) "Groundwater and Soil Vapour Monitoring Event, former Shell Oakland Service Station, Intersection of Thomas Road and Southwestern Highway, Byford, WA" April 2009. Document 0093843 R01 Draft

ERM (2010a) "Environmental Site Assessment Report, Former Shell Oakland Service Station, Thomas Road and South Western Highway, Byford". February 2010

ERM (2010b) "Environmental Site Assessment Report, Former Shell Oakland Service Station, Thomas Road and South Western Highway, Byford". Fieldwork October 2010.

ERM (2010c) "Health and Environmental Risk Assessment, Former Shell Oakland Service Station, Thomas Road and South Western Highway, Byford". October 2010.

Post 2012 Assessment of Site Contamination Reports:

The assessment of site contamination works completed since 2012 are detailed in the following documents:

Department of Health (3 January 2012) Letter "Request for Technical Advice – Human Health Risk Assessment (HHRA) – Lot 2 on Diagram 35013 (Source Site) and Lots 215, 216, 217, 218 and 229 on Plan 51299 and Road Reserve Thomas Street, Footpath Lot 300 Thomas Street (Affected Sites) Oakland Byford".

Department of Environment and Conservation (12 March 2012) Letter "Mandatory Auditor's Report: Former Shell Oakland Service Station, Corner Thomas Road and South Western Highway, Byford".

Department of Environment and Conservation (28 March 2012) Letter "Further Work Required: Former Shell Service Station, Corner Thomas Rd & South Western Hwy, Byford".

ERM (November 2013a) "Former Oakland Service Station Additional Risk Assessment of Vapour Intrusion Pathway".

ERM (November 2013b) "Former Oakland Shell Service Station Remedial Alternatives Analysis".

ERM (March 2014) "Former Oakland Shell Service Station Groundwater Monitoring Event".

ERM (September 2015) "2014/2015 Groundwater Monitoring Event and Trend Assessment, Former Oakland Service Station (Q036), 640 South Western Highway, BYFORD WA".

ERM (November 2016a) "October 2016 Groundwater Monitoring Event, Former Oakland Service Station (Q036), 640 South Western Highway, Byford Western Australia". Document 0365927

ERM (November 2016b) "Site Management Plan, Former Oakland Service Station (Q036), 640 South Western Highway, Byford, Western Australia". Document 0365927_DraftV2.

ERM (July 2017a): "Site Closure Report, Former Oakland Service Station (Q036), 640 South Western Highway, Byford, Western Australia" July 2017. Document 0412033_Closure Report_FV1

ERM (July 2017b) "Plume Duration Assessment, Final, Former Oakland Service Station (Q036), 640 south Western Highway, Byford, Western Australia". Document 0365927_F

Annex C

Documents to Support Community Consultation

Management Plan for 34 Aquanita Rise, Darling Downs (Lot 216)

Introduction

This document is intended for use by the owner and residents of 34 Aquanita Rise, Darling Downs (Lot 216, in the figure below). The lot has been notified to the Department of Water and Environmental Regulation (DWER) on the basis of the known presence of contamination relating to the operation of the former Service Station to the south east the site and has been regulated as an affected site. A number of temporary restrictions have been put in place as part of the DWER regulation. This document provides information on the restrictions and the proposed management plan for removing them.

Chemicals that may be present in groundwater

Petroleum hydrocarbons have been identified in groundwater beneath 34 Aquanita Rise, Darling Downs. The general human population is exposed to these compounds through the use of motorised transport and breathing urban air. Contact with some compounds may have an undesirable affects and as such should be avoided.

Management Plan for 34 Aquanita Rise, Darling Downs (Lot 216)

How to prevent contact

To prevent contact with chemicals while the concentrations reduce to acceptable levels the DWER has placed temporary restrictions on groundwater abstraction. The excavation of basements and permanent utility pits (such as deep sewers and manholes) below 1.5 metres depth should be appropriately assessed and should not create a new ongoing pathway for hydrocarbons to contact receptors. In the unlikely case that hydrocarbon like odours and or staining be encountered in the subsurface below 1.5m works should stop and Viva Energy advised.

Who to contact

Should any additional information be required please contact Viva Energy Community Relations on (03) 8823 4677 or CommunityRelations@vivaenergy.com.au.

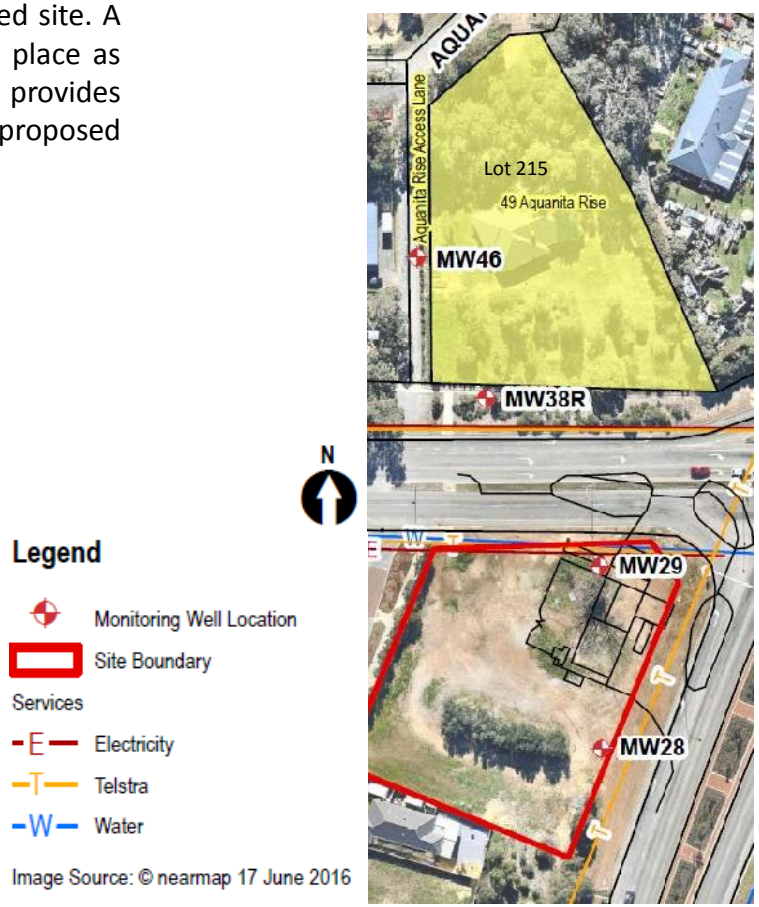
Management Plan for 49 Aquanita Rise, Darling Downs (Lot 215)

Introduction

This document is intended for use by the owner and residents of 49 Aquanita Rise, Darling Downs (Lot 215, highlighted yellow on the figure below). The lot has been notified to the Department of Water and Environmental Regulation (DWER) on the basis of the known presence of contamination relating to the operation of the former Service Station to the south east of the site and has been regulated as an affected site. A number of temporary restrictions have been put in place as part of the DWER regulation. This document provides information on the restrictions and the proposed management plan for removing them.

Chemicals that may be present in groundwater

Petroleum hydrocarbons have been identified in groundwater beneath 49 Aquanita Rise, Darling Downs. The general human population is exposed to these compounds through the use of motorised transport and breathing urban air. Contact with some compounds may have an undesirable affects and as such should be avoided.



Management Plan for 49 Aquanita Rise, Darling Downs (Lot 215)

How to prevent contact

To prevent contact with chemicals while the concentrations reduce to acceptable levels the DWER has placed temporary restrictions on groundwater abstraction. The excavation of basements and permanent utility pits (such as deep sewers and manholes) below 1.5 metres depth should be appropriately assessed and should not create a new ongoing pathway for hydrocarbons to contact receptors. In the unlikely case that hydrocarbon like odours and or staining be encountered in the subsurface below 1.5m works should stop and Viva Energy advised.

Who to contact

Should any additional information be required please contact Viva Energy Community Relations on (03) 8823 4677 or CommunityRelations@vivaenergy.com.au.

Management Plan for 640 South Western Highway (Lot 2)

Introduction

This document is intended for use by owner and users of 640 South Western Highway (Lot 2), highlighted in red on the plan below. The lot has been notified to the Department of Water and Environmental Regulation (DWER) on the basis of the known presence of contamination relating to the operation of the former Service Station at the site and has been regulated as a source site. A number of restrictions have been put in place as part of the DWER regulation. This document provides information on the restrictions..

Chemicals that may be present in groundwater

Petroleum hydrocarbons have been identified in soil and groundwater beneath 640 South Western Highway. The general human population is exposed to these compounds through the use of motorised transport and breathing urban air. Contact with some compounds may have an undesirable affects and as such should be avoided.

Management Plan for 640 South Western Highway (Lot 2)

How to prevent contact

To prevent contact with chemicals while the concentrations reduce to acceptable levels the DWER has placed restrictions on groundwater abstraction. The land use of the site should remain commercial/industrial as per the current zoning, and should not be changed to a more sensitive use without DWER approval. Any commercial development should allow for the requirement of groundwater monitoring as detailed below.

The excavation of basements and permanent utility pits (such as deep sewers and manholes) below 2 metres depth should be appropriately assessed and should not create a new ongoing pathway for hydrocarbons to contact receptors. A site specific health and safety plan is required to assess the risk to the health of any workers undertaking any other intrusive works below 2 metres depth. This might include the type of personal protective equipment that would be needed.

What access will be needed and when

In order for the levels of petroleum hydrocarbons in groundwater to be measured, access to the groundwater monitoring bores located on the site (MW29 and MW28) will be required every two years (generally in October). The commencement date of the monitoring period is October 2018. The requirement for onsite monitoring is expected to cease once groundwater conditions at offsite affected residential lots are restored for domestic non-potable use.

Protection of Monitoring Wells

The monitoring wells listed above are critical tools in the ongoing monitoring at the site. It would be appreciated if effort could be made to protect and preserve these bores. If any damage is noticed, please contact Viva Energy (details below).

Who to contact

Should any additional information be required please contact Viva Energy Community Relations on (03) 8823 4677 or CommunityRelations@vivaenergy.com.au.

Annex D

Certificate of Titles

WESTERN AUSTRALIA

REGISTER NUMBER	
216/DP51299	
DUPLICATE EDITION	DATE DUPLICATE ISSUED
1	27/12/2006

VOLUME 2642 FOLIO 687

RECORD OF CERTIFICATE OF TITLE

UNDER THE TRANSFER OF LAND ACT 1893

The person described in the first schedule is the registered proprietor of an estate in fee simple in the land described below subject to the reservations, conditions and depth limit contained in the original grant (if a grant issued) and to the limitations, interests, encumbrances and notifications shown in the second schedule.

REGISTRAR OF TITLES

REGISTRAR OF TITLES WESTERN AUSTRALIA

LAND DESCRIPTION:

LOT 216 ON DEPOSITED PLAN 51299

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

TROY ROBERT BEET OF 9 BRAY STREET, KELMSCOTT

(T K326615) REGISTERED 31/8/2007

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)

1. *K025474 NOTIFICATION CONTAINS FACTORS AFFECTING THE WITHIN LAND. LODGED 15/12/2006.
2. *K113968 MEMORIAL. CONTAMINATED SITES ACT 2003 REGISTERED 8/3/2007.
3. *K326615 RESTRICTIVE COVENANT BURDEN. REGISTERED 31/8/2007.
4. *K326616 MORTGAGE TO AUSTRALIA & NEW ZEALAND BANKING GROUP LTD REGISTERED 31/8/2007.

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.
* Any entries preceded by an asterisk may not appear on the current edition of the duplicate certificate of title.
Lot as described in the land description may be a lot or location.

----------END OF CERTIFICATE OF TITLE----------

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND:	DP51299
PREVIOUS TITLE:	1277-144
PROPERTY STREET ADDRESS:	34 AQUANITA RISE, DARLING DOWNS.
LOCAL GOVERNMENT AUTHORITY:	SHIRE OF SERPENTINE-JARRAHDALE

NOTE 1: DUPLICATE CERTIFICATE OF TITLE NOT ISSUED AS REQUESTED BY DEALING K326616

WESTERN AUSTRALIA

REGISTER NUMBER	
215/DP51299	
DUPLICATE EDITION	DATE DUPLICATE ISSUED
1	27/12/2006

VOLUME 2642 FOLIO 686

RECORD OF CERTIFICATE OF TITLE

UNDER THE TRANSFER OF LAND ACT 1893

The person described in the first schedule is the registered proprietor of an estate in fee simple in the land described below subject to the reservations, conditions and depth limit contained in the original grant (if a grant issued) and to the limitations, interests, encumbrances and notifications shown in the second schedule.

REGISTRAR OF TITLES

REGISTRAR OF TITLES WESTERN AUSTRALIA

LAND DESCRIPTION:

LOT 215 ON DEPOSITED PLAN 51299

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

ADAM LEIGH BROOMHALL
LEILA MAREE JACKSON
BOTH OF 49 AQUANITA RISE, DARLING DOWNS
AS JOINT TENANTS

(T N002794) REGISTERED 19/5/2015

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)

1. *K025474 NOTIFICATION CONTAINS FACTORS AFFECTING THE WITHIN LAND. LODGED 15/12/2006.
2. *K113090 RESTRICTIVE COVENANT BURDEN. REGISTERED 8/3/2007.
3. *K113968 MEMORIAL. CONTAMINATED SITES ACT 2003 REGISTERED 8/3/2007.
4. *N002795 MORTGAGE TO COMMONWEALTH BANK OF AUSTRALIA REGISTERED 19/5/2015.

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.
* Any entries preceded by an asterisk may not appear on the current edition of the duplicate certificate of title.
Lot as described in the land description may be a lot or location.

----------END OF CERTIFICATE OF TITLE----------

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND: DP51299
PREVIOUS TITLE: 1277-144
PROPERTY STREET ADDRESS: 49 AQUANITA RISE, DARLING DOWNS.
LOCAL GOVERNMENT AUTHORITY: SHIRE OF SERPENTINE-JARRAHDALE

NOTE 1: DUPLICATE CERTIFICATE OF TITLE NOT ISSUED AS REQUESTED BY DEALING K113091

Annex E

Sampling Analysis and Quality Plan

Annex E: SAQP – Groundwater Monitoring

1 DATA QUALITY OBJECTIVES

Data quality objectives (DQOs) have been developed to define the type and quality of data required to achieve the groundwater monitoring objectives for the site and affected sites. The DQOs have been prepared in line with the DQO process outlined in National Environment Protection Council (NEPC) *National Environment Protection (Assessment of Site Contamination) Measure (NEPM) 1999.*

1.1 STEP 1: STATE THE PROBLEM

This SAQP is a program of monitored natural attenuation (MNA) in groundwater to confirm that natural attenuation continues to reduce petroleum hydrocarbon concentrations in groundwater, allowing for the progression of 34 and 49 Aquanita Rise (Lots 215 and 216, respectively) from RRU to *Decontaminated*.

1.2 STEP TWO: IDENTIFY THE DECISION

The decisions are as follows:

- Has the remediation goal been achieved; and
- Does contingency need to be implemented?

1.3 STEP 3: IDENTIFY INPUTS TO DECISION

The inputs required to make the above decisions are as follows:

1. Laboratory measurement of groundwater samples for BTEX, and TRH fractions; namely TRH C_6-C_{10}, TRH >C_{10}-C_{16}, and TRH >C_{16}-C_{34},and NA parameters;
2. Direct measurement of environmental variables including groundwater level and physiochemical parameters;
3. Application of target criteria;
4. Method for measuring achievement of the end points;
5. Contingency measures; and
6. Field and laboratory quality assurance/quality control data.

Items 3, 4, 5 and 6 are discussed in further detail in the subsections below.

1.3.1 Target Criteria - NPUG Screening Levels

Screening level criteria for use of groundwater for non-potable purposes have been nominated as target criteria to demonstrate that the remediation end-point for groundwater at Lots 215 and 216 have been met. These criteria have been adopted from the DoH (2014) *Contaminated Sites Ground and Surface Water Chemical Screening Guidelines* document. The non-potable use screening levels are generally 10 times the health related guideline value or the unadjusted aesthetic guideline value as set out in the Australian Drinking Water Guidelines (ADWG) (NHMRH, NRMMC, 2011). These screening levels are identified as non-potable groundwater use levels, or NPUG.

NPUG values are available for BTEX; however, it is identified in the DOH (2014) document that the ADWG aesthetic guideline value will be directly applied for ethylbenzene, toluene, and xylene. The nominated NPUG values are provided in *Table 1-1*. Consideration should be had for the broader intent of the guideline as being protective of aesthetics to allow for a degree of flexibility in interpreting the data (e.g., as part of the data analysis, if the aesthetic values for ethylbenzene, toluene, and xylene are marginally exceeded, but there is no detectable odour, then allowance is given that the remediation goals may have been met).

In the absence of DoH (2014) values for the TRH C_6-C_{10}, TRH >C_{10}-C_{16}, and TRH >C_{16}-C_{34} fraction, a 10-fold factor was applied to the drinking water guidelines provided in WHO (2008). It is identified that the total petroleum criteria (TPH) is presented as Equivalent Carbon (EC) indices and not as TRH. A derivation of the TRH C_6-C_{10}, TRH >C_{10}-C_{16}, and TRH >C_{16}-C_{34} fractions were made to translate nominated WHO (2008) TPH criteria to associated TRH fractions. These nominated criteria are provided in *Table 1-1*. The following considerations are made with regards to these criteria:

- They are highly conservative in relation to other acknowledged global drinking water criteria (USEPA, 2016; MADEP, 2014); and
- Though acceptable limits for TRH C_6-C_{10} and TRH >C_{10}-C_{16} is set at 900 µg/L as estimated via WHO (2008), allowance is made for the use of 1,000µg/L if warranted to determine that the remediation goals have been met.

Table 1-1 Target Criteria – NPUG

Compounds[1]	Accepted Limit (µg/L)
Benzene	10
Toluene	25
Ethylbenzene	3
Xylenes	20
TRH C_6-C_{10} and TRH >C_{10}-C_{16}[2]	900
TRH >C_{16}-C_{34}[2]	1,000

[1] DoH (2014)
[2] WHO (2008)

1.3.2 Data Usability

The suitability of data will be assessed based on acceptable limits for field and laboratory QA/QC samples outlined in relevant guidelines made or approved under t*he Contaminated Sites Act 2003.* In the event that acceptable limits are not met by laboratory analyses, the field observations of the samples should be reviewed and if no obvious source for the non-conformance is identified, such as an error in sampling, preservation of sample(s) or heterogeneity of sample(s), liaison with the laboratories will be undertaken to identify the non-conformance.

If the data was deemed to be unsuitable, additional analyses will be undertaken on the original sample/s, on duplicate samples or on other samples, if required, to meet the objectives of the assessment. If no explanation for the non-conformance is identified, the concentrations for the affected samples will be considered an estimate. Appropriateness of Limit of Reporting

Comparison of the laboratory limit of reporting (LOR) to the screening criteria will be undertaken to confirm that the laboratory LORs were less than the assessment criteria for groundwater samples.

1.4 STEP 4: DEFINE THE STUDY BOUNDARIES

There are no groundwater monitoring wells located on Lots 215 and 216 due to the difficulties encountered in the past with negotiating access to these properties. Four strategically located monitoring wells have been nominated for inclusion in the monitoring program which provides proper spatial coverage to best represent groundwater beneath the two residential properties (Lots 215 and 216). The four monitoring wells selected (refer to *Figure 3*) and the rationale is outlined below:

- MW29 – monitor DPH concentrations as a downgradient site boundary well as well as being up gradient of MW38R for plume geometry purposes;

- MW34 and MW38R– monitor DPH concentrations beneath the road reserve and footpath; and

- MW34 and MW46 – monitor DPH concentrations immediately up gradient of Lots 215 and 216.

1.5 STEP 5: DEVELOP A DECISION RULE

1.5.1 Method for Measuring Achievement of End Points

Given that the findings of the investigations to date, which demonstrate continued plume reduction and the viability of MNA as the management approach, it is proposed that future GMEs be initially conducted biennially in the month of October. October has been conservatively selected as the most suitable period for future sampling as it typically represents the end of the rainy winter season when groundwater levels are usually at their highest and when historically the mobilisation of capillary fringe and unsaturated zone residual COPCs has been greatest.

A trend assessment on the COPCs is the most suitable method for determining if the end-point of non-potable groundwater use for the residential properties is met and that the classification of RRU for these sites can be changed to *Decontaminated.*

The key measure that the end point has been reached is:

- *A minimum of three consecutive groundwater sampling events from monitoring wells MW34, MW38R and MW46 with consecutive reporting of concentrations for BTEX and TRH C_6-C_{10}, TRH >C_{10}-C_{16}, and TRH >C_{16}-C_{34} at or below NPUG screening levels (as identified in Table 1-1); and*

- *Assuming these measurements are in the context of multiple lines of evidence that otherwise support that natural attenuation has occurred in the manner anticipated and other relevant conditions remain consistent.*

In stating the above, allowance is made for flexibility in assessing the data which are:

- Allowance is made for the use of 1,000µg/L for the TRH C_6-C_{10} and TRH >C_{10}-C_{16} to determine that the remediation goals have been met;

- Consideration should be made for the broader intent of the guideline in relation to marginal exceedances of the aesthetic values for ethylbenzene, toluene, and xylene;

- Alternative criteria may be used if the WHO (2008) criteria are revised or regulatory guidelines are revised to allow for more practicable criteria; and

- Although the sampling frequency is every two years, allowance is made to increase sample frequency to bi-annual (during wet and dry seasons) if there is sufficient evidence indicating the likelihood that the quality of groundwater to non-potable use has been met and determination needs to be empirically made that the end point has been met.

Should two-yearly sampling be implemented, reassessment of sample frequency, and/or continued inclusion of one or more COPCs should be made after each GME. An evaluation will subsequently be made based on the results of the second GME to determine if NA continues to be a viable remediation option. In addition, consideration should be made at that time if alternative criteria can be applied reflective of future regulations or if flexibility can be made in assessing the data as described above.

Of note, consideration is made that monitoring well MW29, located on the site, may be destroyed should the site be developed. Dependent on the groundwater quality data obtained up until that time and the continued presence of monitoring wells MW34, MW38R, and MW46, instalment of a replacement well will be considered may not be necessary.

1.5.2 Contingency Measures

Triggers that incur contingency measures are as follows:

- Presence of product; and

- Exceedances of NPUG screening levels in groundwater samples that follow an increasing trend after two consecutive GMEs from monitoring wells MW34, MW38R and MW46.

Should product be observed at any time, an assessment of the product will be made as it will likely not be from the historic release from the site. The assessment will include analytical analysis; i.e. 'fingerprinting' of the product and identification of the source.

There have been no detections of BTEX and TRH C_6-C_{10}, TRH >C_{10}-C_{16}, and TRH >C_{16}-C_{34} in groundwater samples collected from monitoring wells MW34

and MW46 as part of the September 2016 GME, which is the last GME undertaken as part of site characterisation activities. Should there be detections of these COPCs above NPUG that follow an increasing trend after two consecutive GMEs in monitoring wells MW34, MW38R and MW46, a reassessment of site and surrounding conditions should be undertaken to determine if there is an alternate source of hydrocarbon in the groundwater and if not, re-evaluate if NA continues to be an effective and viable remediation option.

1.6 STEP 6: SPECIFY LIMITS ON DECISION ERRORS

Comparison of the laboratory LOR to the screening criteria will be undertaken to confirm that the laboratory LORs are less than the assessment criteria for groundwater samples.

1.7 STEP 7: DEVELOP (OPTIMISE) THE PLAN FOR COMPLETING THE WORKS

The DQOs have been developed based on a review of existing data, and discussions with relevant stakeholders. If data gathered during the assessment indicated that the objectives of the works are not being met, the sampling design (including sampling pattern, type of samples and analytes) would be adjusted accordingly using feedback (where necessary) from project stakeholders.

The scope of works described herein was assessed as the most efficient from both a technical and cost perspective. The detailed plan for completing the works is described in the following sections of this SAQP.

2 SCOPE OF WORKS

To achieve the stated objectives of the monitoring programme, the following sections present the groundwater monitoring requirements to adhere to during this program.

2.1 FIELD ACTIVITIES

The phases of work will include the following activities:

- Prepare a health, safety and environment plan and job hazard analyses (JHAs) relevant to the works being undertaken;
- Sampling four existing groundwater monitoring wells (MW29, MW34, MW38R and MW46) using low flow techniques (refer to *Figure 3*);

- Dispatch of all primary and secondary groundwater samples to National Association of Testing Authority (NATA) accredited laboratories for analysis; and

- Engaging a suitably qualified waste removal contractor, following classification, for removal and disposal of generated waste at an appropriately licensed facility.

2.2 *SAMPLING FREQUENCY AND ANALYSIS*

Groundwater sampling in the area of investigation will be every two years in October with samples being analysed as per *Table 2-1* below. However, as detailed as part of the decision-rule, a revisitation of the frequency of sampling will be made following the each GME.

Table 2-1 Sample Analysis

MW Well ID	*Analysis*	*Test Method Reference*	*Units*	*Limits of Reporting*
MW29, MW34, MW38R and MW46	TRH C_6-C_{10} and TRH >C_{10}-C_{16}	USEPA8260	µg/L	900
	TRH> C_{16}-C_{34}	USEPA8260	µg/L	1,000
	BTEX	USEPA 8260B	µg/L	BTE: 1 X: 3
MW29, MW38R	Carbon Dioxide (CO_2)	APHA 4500-CO2 C	mg/L	5
	Manganese	USEPA 6020	µg/L	5
	Ferrous Iron (Fe2+)	APHA 3500-Fe BAPHA	µg/L	50
	Sulphate (SO42-	4500-SO4	mg/L	5
	Methane	MGT 136APHA 4500-	µg/L	50
	Nitrate (NO3-)	NO3		20

3 *METHODOLOGY*

3.1 *GROUNDWATER SAMPLING*

Each GME should include gauging and sampling of selected groundwater monitoring wells.

Groundwater monitoring wells should be gauged for static water level (SWL) and total depth to assess depth to groundwater and for the presence of non-aqueous phase liquid (NAPL). Groundwater monitoring wells should then be micro-purged using a low flow pump and dedicated low density polyethylene (LDPE) tubing. Any change to the sampling methodology should be justifiable through a demonstration of the consistency data with the alternate technique.

Annex E: SAQP – Groundwater Monitoring

A water quality meter should be used to record groundwater quality parameters prior to sampling to ensure that the groundwater sampled is representative of the formation.

Continue purging until stabilisation is achieved when three consecutive readings are within the limits shown in *Table 3-1* below:

Table 3-1 Groundwater Stabilisation Parameters and Criteria

Parameter	Stabilization Criteria
EC:	5% µS/cm
pH:	±0.1 pH units
Temp:	3% °C
DO:	10 %
Redox :	±10 mV

Groundwater samples should be collected within laboratory pre-supplied treated containers following the stabilisation of field parameters. Sample containers should be sealed and immediately placed in an insulated cooler, on ice, and stored to minimise potential loss or degradation of COPCs.

3.2 INVESTIGATION DERIVED WASTE

Groundwater investigation derived waste will be disposed of at a licenced waste receiver in accordance with existing waste management regulations and legislation. Disposal documentation will be maintained for record-keeping purposes.

4 *QUALITY ASSURANCE/QUALITY CONTROL*

Quality Assurance/ Quality Control (QA/QC) procedures for this project will be aligned with the requirements of the ASC NEPM and are summarised in the following table.

QA/QC Procedure	Description
Record Keeping	Detailed records of all field activities including sample collection and groundwater description will be maintained on standard field sheets.
Calibration Procedures	All equipment used in the field will be used under the appropriate technical procedures and calibrated prior to use in accordance with the manufacturer's specifications.
Sample Labelling	Unique sample numbers will be used for each sample to clearly specify the sample origin (source, date and sample type code), preservation techniques used and accepting custody [of samples].
Chain of Custody	Chain of custody documentation will be used for all sample transfers. Custody forms include sample numbers, description, sample date, type of analysis required and signatures of the persons transferring and accepting custody of the samples.
Sample Storage	Samples will be transferred in approved sampling containers with appropriate preservation as required and placed in cool storage prior to transfer to the laboratory via road courier.
Decontamination	Sampling equipment used in the sampling process will be decontaminated between investigation locations using a phosphate free detergent followed by rinsing with deionised, or preferably ultra-high purity water.
Field duplicates	In addition to the analysis of primary samples, field duplicate samples will be analysed by the same laboratory at a frequency of at least 1 in 10 samples. In addition trip blanks (1 per esky per day) will be analysed.
Rinsate Blanks	A rinsate blank checks the effectiveness of the process of equipment decontamination. One rinsate blank sample will be obtained each day where sampling equipment that is not 'single use' is employed (i.e., interface probe). The rinsate solution is collected by washing laboratory supplied distilled water over the equipment after decontamination and submitting the sample for laboratory analysis.
Trip Blanks and Trip Spikes	Trip blanks and trip spikes are prepared by the laboratory, and are designed to assess the potential for loss of volatiles and cross contamination resulting from the sampling storage and handling procedures. One of each will be taken to the field to accompany groundwater samples analysed for volatile contaminants to the primary laboratory. One trip blank and trip spike sample will be included with each batch of samples transported to the laboratory.
Laboratory Internal QA/QC	Use NATA accredited laboratories and ensure they use NATA accredited methods. Where appropriate, the laboratory will use internal standards to check the consistency of the analytical processes (eg injection volumes, instrument sensitivity and retention times for chromatographic systems). Sample splits and method validation processes will also be used as part of their internal QA/QC procedures.

Attachment 3

IMPORTANT NOTICE

Former Oakland Service Station, 640 South Western Highway, Byford, Western Australia ("Site")

The attached Mandatory Auditor's Report, 2 August 2017 in relation to the Site was prepared by Senversa Pty Ltd in respect of the Site ("**Report**"). The Report was commissioned by Viva Energy Australia Ltd ABN 46 004 610 459 ("**Viva Energy**") for its own internal purposes, and the findings and conclusions contained in the Report should therefore not be relied upon by any other person or entity.

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Mandatory Auditor's Report

Former Oakland Service Station, 640 South Western Highway, Byford, Western Australia

Prepared for:
Viva Energy Australia Pty Ltd
Level 20 Exchange Tower
2 The Esplanade
Perth WA 6000

2 August 2017

Distribution

Mandatory Auditor's Report

Former Oakland Service Station, 640 South Western Highway, Byford, Western Australia

2 August 2017

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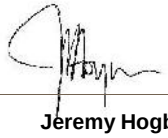
Primary Author		**Project Manager**	
	Jeremy Hogben WA DER Accredited Auditor		**Claire Stewart** Senior Associate

Executive Statement

Mr Jeremy Hogben of Senversa Pty Ltd is pleased to present this Mandatory Auditor's Report (MAR) for the former Oakland Service Station located at 640 South Western Highway, Byford, Western Australia (the Site). The Site location is shown on **Figure 1**.

The Site is currently vacant but operated as a service station from 1956 until it was decommissioned in 2000.

The Site was classified by the Department of Water and Environmental Regulation (DWER)[1] as *Contaminated – Remediation Required* on 29 January 2007 and was designated as a source site. Contamination originating from the Site migrated to affect a portion of Thomas Road reserve and land to the north now described as a footpath along the northern side of Thomas Road (Lot 300 on Plan 51299), four down-gradient residential properties (Lots 215, 216, 230 and 231 on Plan 51299) and a small public access way (Aquanita Rise [Lot 229 on Plan 51299]) and were also classified as *Contaminated – Remediation Required*.

Because groundwater impacts have been identified extending beyond the Site boundary, the audit was commissioned to meet obligations triggered by r.31(1)(b) of the *Contaminated Sites Regulations 2006* as a requirement relevant to, the investigation, assessment, monitoring or remediation of a source site.

An MAR was submitted by the previous auditor for the site in October 2011 to the DWER which encompassed assessment reports from 1999 to the end of 2010 to provide DWER with an update on the status of investigations and to inform decisions in relation to site classification and associated details.

The overall purpose of this audit was to:

1) confirm that the investigations conducted to date adequately characterised the contamination status of the Site and surrounds;
2) confirm that, following remediation and based on the proposed land use (and including relevant restrictions), no environmental impacts that pose a potentially unacceptable risk to human health, the environment or environmental values exist; and
3) provide conclusions and recommendations to the Department of Water and Environmental Regulation (DWER) in relation to classification of the Site and affected sites under the *Contaminated Sites Act 2003* and their suitability for the current (or reasonably envisaged) land uses.

The Site has been the subject of a series of investigations, remediation and validation since 1999. Assessment works have included soil and groundwater investigations largely focussed on the former service station and associated groundwater impacts and included the installation and monitoring of numerous on- and offsite groundwater monitoring wells. Recent remedial works have included Monitored Natural Attenuation (MNA).

The findings of the work conducted indicate that following characterisation and remediation the contamination status of the Site and the affected sites is such that:

1) affected sites 4 Butcher Road and 32 Aquanita Rise was considered suitable for unrestricted use (consistent with their current residential land use) and eligible to be reclassified as *Decontaminated*; and

[1] References to the current Department of Water and Environmental Regulation (DWER) also includes previous titles for this department including the Department of Environment Regulation (DER), Department of Environment and Conservation (DEC) and Department of Environment (DoE).

2) other classified sites do not represent an unacceptable risk to human health or the environment based on current and reasonably envisaged land use with appropriate land use restrictions in place and as such are eligible to be reclassified as *Remediated for restricted use*.

The Auditor is satisfied that the information contained in the reviewed reports when considered as a whole, are generally complete, accurate and compliant with the requirements of the Department of Environment Regulation (DER) Contaminated Sites Guidelines, National Environment Protection (Assessment of Site Contamination) Measure and other relevant published technical guidance.

The Auditor concurs with ERM's conclusions in relation to the contamination status of the classified sites and recommended reclassifications and notes that a Site Management Plan (SMP) has been prepared to facilitate progress from *Remediated for Restricted Use* to *Decontaminated* for 34 Aquanita Rise (Lot 216, Plan 51299), 49 Aquanita Rise (Lot 215, Plan 51299).

As such, the Auditor recommends that, pursuant to *Part 2 Division 2* of the *Contaminated Sites Act 2003*, the DER classify the source and affected sites as detailed below:

1) Butcher Road (Lot 231, Plan 51299) and 32 Aquanita Rise (Lot 230, Plan 51299) as ***Decontaminated***.

2) 640 South Western Highway (Lot 2 on Diagram 35013) as ***Remediated for Restricted Use***.

   In addition to the general land use restrictions e.g. commercial/industrial use, the auditor recommends specific restrictions associated with the proposed classification (largely consistent with existing restrictions) include:

   - implementation of the Site Management Plan (ERM, 2017f);
   - the excavation of basements and permanent utility pits (such as deep sewers or manholes) below 2m depth should be appropriately assessed and should not create a new ongoing pathway for hydrocarbons to contact receptors;
   - a site-specific health and safety plan is also required to address the risks to the health of any workers undertaking any other intrusive works below 2 m depth;
   - access to soils below 4 m depth is restricted, other than for analytical testing or remediation, because of the presence of hydrocarbons in soil that may pose a source of further groundwater contamination if disturbed; and
   - groundwater abstraction, other than for analytical testing or remediation, is not permitted at this site due to the nature and extent of groundwater contamination.

3) 34 Aquanita Rise (Lot 216, Plan 51299), 49 Aquanita Rise (Lot 215, Plan 51299) as ***Remediated for Restricted Use****.*

   The Auditor recommends specific restrictions associated with the proposed classification include:

   - implementation of the Site Management Plan (ERM, 2017f);
   - groundwater abstraction, other than for analytical testing or remediation, is not permitted at this property due to the nature and extent of groundwater contamination;
   - the excavation of basements and permanent utility pits below 1.5 m depth should be appropriately assessed and should not create a new ongoing pathway for hydrocarbons to contact receptors; and
   - a site-specific health and safety plan is also required to address the risks to the health of any workers undertaking any other intrusive works below 1.5 m depth.

4) The affected a portion of Thomas Road reserve, the footpath along the northern side of Thomas Road (Lot 300 on Plan 51299) and the public access way (Aquanita Rise [Lot 229 on Plan 51299]) as ***Remediated for Restricted Use***.

In addition to the general land use restrictions eg road reserve and public access way the Auditor recommends the existing restrictions remain associated with the proposed classification and these include:

- restriction on groundwater abstraction (including dewatering) for purposes other than for analytical testing; and
- the need for an appropriate health and safety plan to manage potential exposures associated with intrusive works such and underground service maintenance.

It is noted that the Site Management Plan is only considered appropriate as a formal component of restrictions (as a memorial on title) for the source and two affected residential properties due to the ongoing groundwater assessment component of the plan. That is, since ongoing groundwater monitoring is not directly relevant to the road reserves (including the footpath and access way), the Site Management Plan has no specific bearing on the recommended end point classification for these sites.

With these restrictions in place the source and affected sites are not considered to represent unacceptable risk to human health, the environment or any environmental value.

Contents

List of Acronyms

Acronym	Definition
AHD	Australian Height Datum
ASC NEPM	National Environment Protection (Assessment of Site Contamination) Measure
ASS	Acid Sulphate Soils
bgl	Below Ground Level
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
CBD	Central Business District
COPC	Contaminants of Potential Concern
CSM	Conceptual Site Model
DWER	Department of Water and Environmental Regulation (Western Australia)
NPUG	Non-Potable Use Guidelines
DQI	Data Quality Indicators
DQO	Data Quality Objective
DSI	Detailed Site Investigation
EIL	Ecological Investigation Level
ESA	Environmental Site Assessment
ESL	Ecological Screening Level
HIL	Health Investigation Level
HSL	Health Screening Levels
LOR	Limit of Reporting
MAR	Mandatory Auditor's Report
NEPC	National Environment Protection Council
OCP	Organochlorine Pesticides
OPP	Organophosphorus Pesticides
PAH	Polycyclic Aromatic Hydrocarbons

Acronym	Definition
PSI	Preliminary Site Investigation
RAP	Remediation Action Plan
RVP	Remediation and Validation Plan
SAQP	Sampling and Analysis Quality Plan
SRV	Site Remediation and Validation Report
TPH	Total Petroleum Hydrocarbons
UST	Underground Storage Tank
WHO	World Health Organisation

1.0 Introduction

1.1 Audit Details

Mr Jeremy Hogben of Senversa Pty Ltd is pleased to present this Mandatory Auditor's Report (MAR) for the former service station located at 640 South Western Highway, Byford, Western Australia (the Site). The Site location is shown on **Figure 1**. The Site operated as a service station since 1956 prior to decommissioning in 2000, and has been vacant since 2000. Site infrastructure removal and remedial works were undertaken between 2000 and 2003.

The Site was classified by the Department of Water and Environmental Regulation (DWER) as *Contaminated – Remediation Required* on 29 January 2007 and was designated as a source site. Contamination originating from the Site migrated to affect a portion of Thomas Road reserve and land to the north now described as a footpath along the northern side of Thomas Road (Lot 300 on Plan 51299), four down-gradient residential properties (Lots 215, 216, 230 and 231 on Plan 51299) and a small public access way (Aquanita Rise [Lot 229 on Plan 51299]) and were also classified as *Contaminated – Remediation Required*.

This MAR has been prepared in accordance with the *Contaminated Sites Act 2003* to achieve compliance with the Western Australian Department of Environment Regulation (DER) *Contaminated Sites Guidelines,* including *The Western Australian Contaminated Sites Auditor Scheme* (DER 2016a) and *Requirements for Mandatory Auditors' Reports* (DER 2016b).

A statement of engagement of the Auditor is included as **Appendix A**, and audit details are summarised in **Table 1**.

Table 1: Audit Details

Item	Detail
Auditor	Mr Jeremy Hogben Jeremy.Hogben@senversa.com.au Mobile: 0419 122 534 Senversa Pty Ltd Level 17, 140 St Georges Terrace Perth WA 6000
Date of Accreditation	6 December 2006
Commencement Date of Audit	3 May 2017
Reason for Audit	Mandatory audit to meet obligations triggered by r.31(1)(b) of the *Contaminated Sites Regulations 2006* as a requirement relevant to, the investigation, assessment, monitoring or remediation of a source site.
Site Address	640 South Western Highway, Byford, WA 6104 Lot 2 on Diagram 35013 Volume: 1667, Folio: 185

1.2 Background

The Site is located at 640 South Western Highway (corner of South Western Highway and Thomas Road) Byford. It is currently vacant. The Site was formally occupied by a service station from 1956 until it was decommissioned in 2000.

The Site was classified by the Department of Water and Environmental Regulation (DWER) as *Contaminated – Remediation Required* on 29 January 2007 and was designated as a source site. Contamination originating from the Site migrated to affect a portion of Thomas Road reserve and land to the north now described as a footpath along the northern side of Thomas Road (Lot 300 on Plan 51299), four down-gradient residential properties (Lots 215, 216, 230 and 231 on Plan 51299) and a small public access way (Aquanita Rise [Lot 229 on Plan 51299]) and were also classified as *Contaminated – Remediation Required*.

The Site has been the subject of a series of investigations, remediation and validation by various consultants since 1999 although recent works have all been carried out by ERM. Assessment works have included soil and groundwater investigations largely focussed on the former service station and associated groundwater impacts and included the installation and monitoring of numerous on- and offsite groundwater monitoring wells.

A MAR was submitted by the previous auditor for the site in October 2011 to the DWER which encompassed assessment reports from 1999 to the end of 2010 to provide DWER with an update on the status of investigations and to inform decisions in relation to site classification and associated details.

This MAR details the work undertaken since the submission of the previous MAR. The list of consultant reports provided to the Auditor that are the subject of this MAR is included in **Section 3.1**, with the most recent groundwater investigation undertaken by ERM in September 2016.

1.3 Purpose of the Audit

The overall purpose of the audit was to:

1) confirm that the investigations conducted to date adequately characterised the contamination status of the Site and surrounds;
2) confirm that, based on the proposed residential land use, no environmental impacts exist that pose a potentially unacceptable risk to human health, the environment or environmental values; and
3) provide conclusions and recommendations in relation to classification of the Site under the *Contaminated Sites Act 2003* and the Site's suitability for the current (and proposed) land uses.

1.4 Limitations of the Audit

All of the information and opinions given in this MAR are based on a review of the information provided in the reports listed in **Section 3.1**. Apart from the site inspection, the Auditor has not carried out any independent investigations in relation to the condition of the Site.

The Auditor assumes no responsibility or liability for any errors or omissions in the information provided in the reports reviewed and the analytical data presented to the Auditor.

The overall purpose of this MAR is to assess the suitability of the Site for the specified current and future use. No other warranties expressed or implied are made. Any subsequent changes to the Site following the issue of this MAR are outside the scope of the audit.

This MAR relates only to below ground contamination and off-site impacts from soil, soil vapour and groundwater, and does not include evaluation of geotechnical issues or any other issues associated with the Site

1.5 Guidelines Used

The Auditor acknowledges Appendix A of the DER guidance *Requirements for Mandatory Auditor's Report* (DER, November 2016), which details the guidance that must be considered in undertaking an audit. This MAR has been based the technical review or relevant consultant documents, on professional experience and relevant published guidelines that include but are not limited to:

1) DER *Contaminated Sites Guidelines* (http://www.der.wa.gov.au/your-environment/contaminated-sites/61-contaminated-sites-guidelines).
2) National Environment Protection Council (NEPC) (1999) *National Environmental Protection (Assessment of Site Contamination) Measure* (as amended 15 May 2013) (ASC NEPM).

2.0 Site Identification

Site identification details are summarised in **Table 2**. The site location is shown on **Figure 1**. The certificate of title is presented in **Appendix B**.

Table 2: Site Identification Details

Site Identification Details	
Street Address	640 South Western Highway, Byford, WA 6104
Certificate of Title	Lot 2 on Diagram 35013 Volume: 1667, Folio: 185
Site Owner	Robert Elphick and Lan Anwar (Executor of the estate of Thong-Kie Tan)
Site Occupier	Vacant
Local Government Authority	Shire of Serpentine Jarrahdale
Current Zoning	Urban Development Area (Shire of Serpentine-Jarrahdale Town Planning Scheme No.2, amended 10 June 2016)
Site Area	4,052 m^2

3.0 Audited Documentation

3.1 Documents Reviewed

An MAR dated 28 October 2011 was previously submitted to the DWER and provided an update of the Site's (and surrounds) contamination since status since classification in 2007. Summary information from the MAR in relation to the site contamination status been reproduced in **Section 5.1.**

The documents listed below describe assessment works completed since the issue of the MAR (in October 2011) and are the central subject of this MAR.

1) ERM (November 2013a) *Former Oakland Service Station Additional Risk Assessment of Vapour Intrusion Pathway.*
2) ERM (November 2013b) *Former Oakland Shell Service Station Remedial Alternatives Analysis*.
3) ERM (March 2014) *Former Oakland Shell Service Station Groundwater Monitoring Event*.
4) ERM (May 2017a) *Plume Duration Assessment, Former Oakland Service Station (Q036), 640* South Western Highway, *Byford, Western Australia*
5) ERM (June 2017b) *Groundwater Monitoring Event, Former Oakland Service Station (Q036) 640 South Western Highway, Byford, Western Australia*
6) ERM (June 2017c) *2014/2015 Groundwater Monitoring Event and Trend Assessment, Former Oakland Service Station (Q036), 640 South Western Highway, Byford WA.*
7) ERM (June 2017d) *October 2016 Groundwater Monitoring Event, Former Oakland Service Station (Q036) 640 South Western Highway, Byford, Western Australia*
8) ERM (July 2017e) *Site Closure Report Former Oakland Service Station (Q036), 640 South Western Highway, Byford, Western Australia*.
9) ERM (July 2017f) *Former Oakland Shell Service Station (Q036), 640 South Western Highway, Byford, Western Australia, Site Management Plan*.

The Auditor considers that the data provided in the audited reports allows for a sufficient characterisation of the contamination status of the Site.

Specific comments provided by the Auditor in interim audit advice during the project is presented in **Appendix C**.

3.2 Site Inspections

The Auditor undertook an inspection of the Site on 17 July 2017.

4.0 Environmental Setting and Site History

4.1 Site Description

The Site is located at 640 South Western Highway, Byford, along the south-western corner of Thomas Road, approximately 41 km south-south-east of the Perth central business district (CBD). All site infrastructure has been demolished and removed and the site is currently vacant. There is currently limited vegetation with ground cover predominantly being exposed fill material and nominal grass landscape.

The Auditor is satisfied that the site description is appropriately detailed and accurate.

4.2 Surrounding Environment

The predominant land use in the vicinity of the site is for residential purposes with residential properties to the south and west of the site the South Western Highway followed by residential and rural properties to the east and Thomas Road followed by residential properties (some of which are currently classified by the DWER as 'affected sites') to the north.

The Auditor is satisfied that the description of the surrounding environment is appropriately detailed and accurate.

4.3 Topography

Following decommissioning and site restoration, the topography of the site is relatively flat with an elevation of 55 m Australian Height Datum (AHD). The topography across the wider area slopes gradually to the north-west toward Wungong Brook located approximately 1.15 kilometres (km) north of the site at its closest point.

The Auditor is satisfied that the description of the topography of the Site is acceptable.

4.4 Geology

ERM (2017b) states that the local geological setting consists of Quaternary deposits overlying the Pleistocene-aged Guildford Formation on the Swan Coastal Plain. The Quaternary lithology is characterised by thick colluvium consisting of gravely, sandy and clayey materials associated with the Piedmont Zone of the Darling Escarpment (formed from granite and gneiss), located approximately 700 m to the east of the site.

The underlying Guildford Formation typically consists of interbedded sands, silts, clays and gravels, primarily of fluvial and alluvial origin. The stratigraphic succession of the Guildford Formation (from surface) initiates with the upper sequence, described as gravely sandy clay, variable, with lenses of silt and gravel, and quartz sand. The lower sequence is described as gravely clayey sand, weathered bedrock, gravel rock fragments and angular quartz/feldspar sand. The combined thickness of these soils is estimated to be generally between 20 and 40 m and underlain by shales and sandstone.

There is an imported fill layer that extends over the northern portion of the site. In this area, the fill layer is reported to be between 1.5 and 3.5 m thick. The material is generally described as light brown clay/gravel mixtures. Investigations confirmed this general stratigraphy.

The Auditor is satisfied with the geological summary and considers that the investigations undertaken have encountered soils consistent with those described by published sources.

4.5 Hydrogeology

Groundwater is present within a semi-confined clay to sandy clay hydrostratigraphic unit. Historical groundwater flow has generally been inferred to occur towards the north-west; however, groundwater has occasionally been observed to flow to the west. The hydraulics of the groundwater system are controlled by surface water inflows (recharge) along the Darling Escarpment to the east of the site and the topographic slope of the land to the west.

Groundwater monitoring events determined that the depth to groundwater underlying the area of the site fluctuates between approximately 1 – 7 m bgl with historical gauging indicating significant fluctuation in the piezometric surface influenced by seasonal rainfall. Depth to water fluctuation can range up to 5 m between wet and dry seasons.

A Department of Water (DOW) groundwater bore search conducted by ERM in 2016 identified two registered groundwater bores within a 500 m radius of the site. These bores are located more than 200 m cross-gradient from the identified groundwater plume. The current use of these licensed wells is not known. No information regarding installation depth or the registered usage of each bore was available, however none of these bores are located within the zone of historic or current residual hydrocarbon impacted groundwater.

There are no currently existing viable private domestic bores on the site or affected sites. ERM (2017e) noted that the residential properties surrounding the site are supplied by scheme water and the site will be serviced by scheme water pending development.

Groundwater at the site and affected sites are not used for drinking water, stock, irrigation, or non-potable use (i.e., gardening) purposes. It is further stated in the Byford Townsite Detailed Area Plan, prepared for the Shire of Serpentine-Jarrahdale, dated 8 June 2004 and amended 3 November 2004 that:

"The presence of silt and clay at depth is likely to reduce the potential for groundwater, although the sand intersected in the southern holes at depths of 21 and 22 metres will form an aquifer". As such there is insufficient yield in interim and localised saturated zones up until approximately 21 m bgl to sustain ongoing use for any purpose.

ERM considers that the highest beneficial use for groundwater is for non-potable use.

The Auditor is satisfied that the description of the hydrogeology of the Site (that includes relevant discussion in relation to adopted assessment criteria) is appropriately detailed and accurate.

4.6 Hydrology

There are no surface water bodies onsite or on the affected sites. The nearest surface water body is Wungong Brook located approximately 1.15 km north of the site at its closest point (see **Figure 1**). There are no artificial or natural stormwater drainage features either on the site or on or adjacent to the affected sites.

The Auditor is satisfied that the description of the hydrology of the Site is appropriately detailed and accurate.

4.7 Potential Sensitive Receptors

The following potential receptors (paraphrased) were identified in the Site Closure Report (ERM, 2017b):

4.7.1 Onsite Receptors:

1) Current and future site users in an ongoing commercial/industrial land use
2) Construction/maintenance trench workers at the site
3) Groundwater resources beneath the site

4.7.2 Offsite Receptors

4) Surrounding land users such as residential dwellings including users of registered and unregistered groundwater bores located down-gradient of the site
5) Surrounding land users such as residential dwellings in the event they are exposed to hydrocarbon vapours
6) Workers conducting subsurface excavations, trenching or entering underground manholes at the site in the event they come into dermal contact with impacted soil or inhale contaminated vapour

The Auditor considers that appropriate potential environmental and human receptors of contamination at the Site have been identified and considered.

4.8 Historical Land Use

The site was cleared and utilised for agricultural purposes from 1936 to 1955. The site commenced operation as a service station in 1956 when it was leased to the Neptune Oil Company. In 1967, Neptune Oil Company surrendered its lease to the Shell Company of Australia (Shell) who leased the site from the then owners: Raymond Brady, Victor Padbury Davidson and Elsie Maud Brady until 1984. In 1984, the owners sold the site to Mr Thong-Kie Tan who maintained the lease with Shell until April 2000, when the fuel station was decommissioned.

During operation of the site as a service station, there were seven operational UST fuelling systems with associated piping network and bowsers. These USTs were identified as T1 to T7. Two of the USTs (T2 and T3) had been removed in 1995. In April 2000, IT validated the removal of four UST systems (T1, T4, T5 and T7). In addition, oil/water interceptor and drainage network systems, including man holes, were removed.

ERM (2017e) noted that anecdotal evidence indicated that T6 it may have been located to the immediate west of T1. No tank was found during building demolition activities, nor any evidence of a former UST, when that area was excavated as part of the May 2003 validation works (IT, 2003). A ground-penetrating radar (GPR) survey completed in 2010 confirmed that no underground utilities or tanks were identified indicating the likelihood that UST T6 had previously been removed from site.

Based on available information, all petroleum related infrastructure was removed during decommissioning in 2000 and the site has been vacant since that time.

Shell divested its downstream assets to Viva Energy in 2014. Upon Mr Tan's death, site ownership was transferred to the executor of Mr. Tan's estate, identified as Lan Anwar, and Robert Elphick.

The Auditor is satisfied with the summary of historical land use reported.

4.8.1 Chronology of Events

A chronology of works undertaken at the site is summarised in **Table 3** below. The works undertaken since the time of the October 2011 MAR are the focus of this MAR.

Table 3: Chronology

Date	Activity
1955 to 2000	Site operated as a service station. Storage and distribution of leaded and unleaded petroleum, diesel, kerosene, various petroleum additives, and an assorted range of motor oils and lubricants
1995	USTs T2 and T3 were removed
March, 1999	Woodward-Clyde Pty Ltd conducted an ESA
February, 2000	Woodward-Clyde Pty Ltd conducted an GME
April, 2000	IT Environmental conducted an Environmental Sensitivity Survey
April, 2000	Site was decommissioned, with removal of USTs, interceptors, drainage systems, bowsers, and infrastructure. Majority of secondary sources of hydrocarbon impact were removed. Further excavation was prohibited by the building and fiber optic cable.
August, 2000	Woodward-Clyde Pty Ltd conducted a Phase II
April, 2001	Woodward-Clyde Pty Ltd conducted a GME
October, 2001	URS Australia Pty Ltd (formerly AGC Woodward-Clyde Pty Ltd) conducted a GME
October, 2002	URS Australia Pty Ltd conducted a Phase II ESA
March, 2003	Remaining on-site buildings and associated cement pads were decommissioned
March, 2003	IT Environmental conducted a GME
May, 2003	IT Environmental conducted further soil validation sampling in areas where access was historically restricted.
October, 2003	IT Environmental conducted a Health and Environmental Risk Assessment.
November to December, 2003	IT Environmental conducted a Phase II ESA including private bore survey
October, 2004	IT conducted a Phase II ESA
June to November, 2006	Coffey Environments conducted an ESA
January 2007	Source and affected sites classified as Contaminated – Remediation Required
May, 2008	ERM conducted an ESA at the site
November, 2008	ERM installed Vapour Monitoring Wells VMW4-VMW7
November, 2008	ERM conducted a GME

Date	Activity
March, 2009	ERM conducted a GME
May, 2009	ERM conduct Ground Penetrating Radar Survey
June, 2009	ERM conducted further soil sampling to validate historical tank removals, and conduct GME
September, 2009	ERM conducted a GME
April - May 2010	ERM conducted an ESA at the site
October, 2010	ERM conducted a Human Health and Ecological Risk Assessment (HERA)
October, 2011	MAR for site and affected sites submitted (by Dr Ian Swane, SKM See **Section 5.1**)
February, 2012	Supplementary information provided to DER by Ian Swane, SKM. Letter dated 1 February 2012 titled *Site Auditor Feedback on MAR for the Former Shell Oakland Service Station Site, Corner Thomas Road & South Western Highway, Byford (22 Pages)*.
November, 2013	ERM provided information to supplement the HERA regarding additional risk assessment of the vapour intrusion pathway (ERM, 2013a. See **Section 5.2**)
November, 2013	ERM undertook a remedial alternatives analysis (ERM, November 2013b. See **Section 5.3**)
November, 2013	ERM conducted a GME (ERM, 2014. See **Section 5.4)**
October and November 2014	ERM conducted a GME in October 2014. An additional GME was undertaken in November 2014 to support a re-appraisal of the high benzene concentrations analytical data from an onsite monitoring well (MW29) and to collect samples on the down-gradient property immediately to the north of the site which was inaccessible during the October 2014 GME. (ERM 2017b, See **Section 5.4**)
June 2015	Well installation works (to replace MW19 and MW38 with MW38R) were completed including a survey, subsequently followed by a GME. (ERM 2017c, See **Section 5.4**)
September 2016	ERM conducted a GME (ERM, 2017d. **See Section 5.4**)
May 2017	ERM undertook a Plume Duration Assessment (ERM, 2017a. See **Section 5.5**)
July 2017	ERM produced a Site Closure Report (ERM, 2017e. See **Section 5.6**)
July 2017	ERM developed a Site Management Plan (ERM, 2017f. See **Section 5.7**).

5.0 Investigation and Remediation Review

5.1 Summary from MAR (SKM, 2011) and Associated Correspondence

5.1.1 Contamination Status Summary

The former service station property (CSS_ID 6218) is referred to as Lot 2 on Diagram 35013. Leakage/spillage from USTs caused the land to be contaminated. Remedial work was undertaken at the land between 2000 and 2003, which involved the removal of the USTs and associated equipment and the on-site landfarming of contaminated soils. Further investigations and monitoring of the residual contamination has occurred between 2003 and 2010. Investigations have found there is a low risk of significant soil contamination extending into the Road Reserve and Footpath along Thomas Road in significant quantities at concentrations above the EILs.

The investigations show that the upper 1.0m of soil across the former service station property meets DEC requirements for commercial/industrial land use. Deeper contaminated soils remain at the former UST areas in the north-eastern corner of the former service station property. The contaminant levels were found to be low and less than the EILs to depths down near the water table (4.8-7.8m bgl). Contamination hot-spots in deeper soils (extending to depths of more than 8.4m bgl) remain in the area, with petroleum concentrations exceeding the EILs and benzene concentrations exceeding the HIL F criteria. Sufficient locations were investigated to define the lateral and vertical extent of these hot-spots. The extent of aesthetically impacted soil should be limited to these hot-spots.

Petroleum hydrocarbon contamination (such as from petrol/diesel/oil) continues to remain in groundwater at this land parcel at concentrations exceeding the DOH (2006) Domestic non-potable groundwater criteria. The groundwater also remains odorous. The hydrocarbon plume extends in a north-westerly direction from the property, and continues to remain in groundwater beneath the road reserve and footpath along Thomas Road and Lots 215, 216, 217, 218 and 229 at concentrations that may exceed the DOH (2006) Domestic non-potable groundwater criteria. The plume is considered to be stable and shrinking when the effects produced by seasonal fluctuations in groundwater levels and disturbances to contaminated soils in the source zone are considered.

Soil vapour concentrations onsite, beneath the road reserve and footpath and Lots 215, 216 and 229 at depths of 1.5m and more below the ground surface may exceed residential air screening levels. Soil vapour concentrations may exceed Safe Work Australia Occupational Exposure Standards near the water table.

5.1.2 Data Gaps

Following receipt of the 2011 MAR, consultation was held between the DWER, Department of Health (DOH), the former contaminated sites auditor, ERM and Viva Energy in early 2012.

The DWER and DOH set out the following concerns:

1) *Remediated for restricted use* (RRU) was not considered a suitable classification under the CS Act for residential affected sites when the COPCs present would be amenable to further remediation such that a classification of *Decontaminated* could be achieved;
2) no ongoing monitoring was proposed post-reclassification; and
3) MNA was not considered to be demonstrated as a suitable remediation approach.

It is understood that agreement was made on the following as part of the consultation:

1) the use of Non-Potable Groundwater Use (NPUG) as a remedial target;
2) additional assessment of site contamination and remedial works to include:

- development of a remediation action plan (RAP) that assessed alternative remediation strategies and document preferred approach;
- completion of additional six-monthly groundwater monitoring events (GMEs);
- completion of a natural attenuation (NA) assessment in line with DER guidelines;
- completion of a Human Health and Environment Risk Assessment (HERA);
- the development of an SMP;
- community consultation; and
- further remediation.

5.2 Additional Risk Assessment of Vapour Intrusion Pathway (ERM, November 2013a)

5.2.1 Objectives

ERM prepared this document to supplement the ERM (2010) Human Health and Ecological Risk Assessment (HERA) to negate the need for a restriction on accessing soils below 1.5 m bgl and future construction of residences with basements through the assessment of the potential risks posed to receptors by concentrations of petroleum hydrocarbon that may migrate from impacted groundwater into future off-site trenches or basements.

5.2.2 Scope of Work

Selected soil vapour sample results were used to assess the potential risk posed to the identified receptors via the following exposure scenarios:

1) residents in a one-level basement development;
2) residents conducting intrusive works (e.g. excavation of deep swimming pool); and
3) construction / utility workers conducting intrusive works.

5.2.3 Results

The maximum concentrations of petroleum hydrocarbon within the selected soil vapour wells were compared to appropriate screening criteria. Based on the findings of the assessment ERM considered it unlikely that the identified concentrations of petroleum hydrocarbons present an unacceptable risk to the off-site residents and intrusive maintenance workers, even under the assumptions of future residents and intrusive works below 1.5 m bgl.

5.2.4 Conclusions

ERM concluded that the need for a restriction on accessing soils below 1.5 m bgl was not necessary, however deep excavations beyond 2.5 meters may require management. Utilities workers were considered likely to be the only receptors that might be required to excavate beyond 2.5 metres depth and control measures should be adopted in these circumstances.

The Auditor considers that the assessment was appropriate and agrees with the conclusions presented by ERM.

5.3 Remedial Alternatives Analysis (ERM, November 2013b)

5.3.1 Objectives

The objective of the Remedial Alternatives Analysis (RAA) was to review remedial options and their feasibility to render affected residential properties suitable for unrestricted use.

5.3.2 Scope of Works

The scope of the RAA included the following:

1) a Summary of the geological and hydrogeological characteristics of the affected sites;
2) review of the historical environmental works completed in the study area, particularly groundwater investigation works completed to date; and
3) evaluation of a range of potentially feasible remedial options based on the affected site setting, contaminant nature, extent of impact and considering sustainability.

5.3.3 Results

Several remediation technologies were considered and assessed for suitability for implementation at the affected site for remediation of the hydrocarbon impacted groundwater.

Based on the initial screening process, ERM considered two potential remediation options as having the most appropriate (either in part or in full) potential for application at the affected sites. To assess the feasibility of these in more detail, a number of technical, logistical, financial and policy related factors were considered and ranked.

5.3.4 Conclusions

Based on the extent of groundwater impact, the hydrogeological setting and evidence of natural anaerobic biodegradation processes, plume duration assessment and feasibility of remediation technologies, Monitored Natural Attenuation was considered to be the most feasible and practicable approach for remediation of the impacted groundwater beneath the residential properties.

The Auditor considers that the approach taken in considering the remedial options was reasonable and the selected option was justifiable.

5.4 Groundwater Monitoring Events

Groundwater monitoring events (GMEs) were undertaken in November 2013, October and November 2014, June 2015 and October 2016 as detailed in the reports listed below:

1) ERM (March 2014) Former Oakland Shell Service Station Groundwater Monitoring Event.
2) ERM (June 2017a) Groundwater Monitoring Event, Former Oakland Service Station (Q036) 640 South Western Highway, Byford, Western Australia
3) ERM (June 2017b) 2014/2015 Groundwater Monitoring Event and Trend Assessment, Former Oakland Service Station (Q036), 640 South Western Highway, Byford WA.
4) ERM (June 2017b) October 2016 Groundwater Monitoring Event, Former Oakland Service Station *(Q036) 640 South Western Highway, Byford, Western Australia*

5.4.1 Objectives

The objectives of the GMEs were to:

1) provide an updated assessment of groundwater conditions both on and off-site;
2) update the previously developed conceptual site model (CSM); and
3) assess the potential for the ongoing occurrence of natural attenuation of hydrocarbons beneath the site.

5.4.2 Scope of Works

ERM undertook four GMEs. The first was undertaken in November 2013 on four wells (MW24, MW28, MW29 and MW34). ERM also conducted a GME in October 2014 on four wells (MW24, MW28, MW29 and MW34). An additional GME was undertaken in November 2014 to support a re-appraisal of a high benzene concentration in an onsite monitoring well (MW29) and to collect samples from the down-gradient property immediately to the north of the site (MW32, MW33, MW46) which was inaccessible during the October 2014 GME.

In June 2015, well installation works (to replace MW19 and MW38 with MW38R) were completed including a survey, subsequently followed by a third GME (MW19, MW24, MW28, MW29, MW34 and MW38R).

In September 2016, a final GME was undertaken (MW24, MW28, MW29, MW34, MW37, MW38R, MW43, MW46). It should be noted that although the works were undertaken in September 2016 and reported in June 2017 the subsequent report was titled October 2016 GME.

The primary groundwater samples were analysed for total recoverable hydrocarbons (TRH), benzene, toluene, ethylbenzene and xylene (BTEX), lead. The analysis in 2013, 2015 and 2016 also included monitored natural attenuation (MNA) parameters.

5.4.3 Results

The key findings of the groundwater monitoring events are summarised below.

LNAPL was not detected in any monitoring wells.

The groundwater flow direction was generally inferred to occur toward the north-west. The 2015 data inferred that groundwater flow was toward the west, however ERM noted that the monitoring locations immediately west of the historical on-site source have not previously contained COPCs above the laboratory limit of reporting (LOR).

In 2013 no olfactory or visual indication of hydrocarbon impact was noted during groundwater sampling. However, in 2014 a hydrocarbon odour and sheen was observed from purged groundwater removed at on-site monitoring well MW29. In 2015 and 2016 a hydrocarbon odour was observed from purged groundwater at off-site monitoring well MW38R.

In 2013 ethylbenzene was detected above NPUG in on-site source monitoring well MW29 only.

The analytical results from the October 2014 GME reported a benzene concentration in MW29 of 4,000µg/L which was comparable with the magnitude of results not previously reported since 2006. The reported benzene concentration at MW29 from the October 2014 GME was the driver for the sampling undertaken in November 2014. ERM sampled monitoring well MW29 in November 2014 to corroborate the findings from the October GME. The October sample reported a benzene concentration of 4000µg/L, the initial sample obtained during the November GME (following routine low-flow purging) reported a benzene concentration of 1µg/L. The second sample (collected following vigorous purging) reported a benzene concentration of 834µg/L. The sample collected from MW29 in June 2015 reported a benzene concentration of 30µg/L.

Toluene (October 2014), ethylbenzene (October 2014 and November 2014) and xylenes (October 2014) also exceeded NPUG in MW29.

In June 2015 benzene exceeded NPUG in offsite wells MW34 and MW38R only with ethylbenzene also exceeding NPUG in MW38R.

In 2016 the COPCs were reported at concentrations below the tier 1 screening criteria or below the LOR except for benzene and ethylbenzene at MW38R, which were reported in excess of the NPUG guideline, however was below the Site Specific Screening Level (SSSL) for residential direct contact. This result was within the range of historical results from MW38R and monitoring wells in the vicinity of this location on Thomas Road.

Heavy fraction TRH (C_{15}-C_{36}) was also detected in monitoring well MW43 during this GME at concentrations above the recent historical range. ERM stated that this result appears to be an outlier and may not be associated with the plume originating from the Site. Multiple groundwater wells between the source area and monitoring well MW43 were sampled during the GME and did not indicate the presence of heavy-end TRH. Furthermore, the profile of the concentrations, i.e. high heavy-end concentrations and non-detect lighter-end fractions, are not consistent with the historical observations within the plume which has historically been consistent with a petrol source. Given that field observations suggested that the well has been tampered with, it was considered likely that these concentrations were associated with deliberate interference or a source unrelated to the site.

For all the GMEs where MNA parameters were analysed, the increase in metabolic by-products (ferrous iron) and the decrease in electron acceptors (nitrate) are indicative of increased metabolic function within identified hydrocarbon impacted areas and this suggests that microbial degradation of petroleum hydrocarbons is occurring. Overall the reduction in plume geometry and contaminant concentrations presented indicates that natural hydrocarbon attenuation is occurring.

In 2014 and 2015 RPD exceedances were reported due to inconsistencies in the LOR between the laboratories and the low concentrations detected. Laboratory QA/QC outliers were reported from one work order for the frequency of laboratory duplicate and laboratory matrix spike samples conducted for TRH – semi volatile fractions. This work order was for one inter-laboratory duplicate sample collected during the June 2015 sampling event. ERM stated and the auditor agrees that the outlier results are not considered to impact on the reliability of data presented in this report. In 2013 and 2016 the field QA/QC results were acceptable and the analytical data from this investigation was therefore considered suitable for their intended purposes.

5.4.4 Conclusions

In 2013 ERM concluded that based on the results of that phase of work the potential risk posed via the abstraction of groundwater was likely to be acceptably low for some of the affected lots and a restriction on groundwater use may no longer be necessary. However, the report stated that further monitoring of groundwater wells within residential properties could potentially support these findings.

Since that time ERM has drawn the following conclusions:

1) dissolved phase hydrocarbon impacts have been assessed to be appropriately delineated, and generally exhibiting statistically significant decreasing or stable trends;
2) there is evidence demonstrating that the natural attenuation of hydrocarbon impact beneath the site has and is occurring;
3) all primary hydrocarbon sources have been removed and an ongoing source of free or dissolved phase hydrocarbon to soil and groundwater is not considered present to an extent that is resulting in the continued degradation of groundwater quality;
4) no complete SPR linkages were considered to be present in relation to groundwater impact on the basis that potential risk relating to groundwater abstraction is currently managed by restrictions imposed on the classified land parcels;
5) further down-gradient receptors, where abstraction bores are located, are not considered to be potentially at-risk due to the delineation of impacts at the northern side of Thomas Road;
6) the findings of the 2010 HERA, which determined that no unacceptable risk exists for on or offsite receptors also remains valid, although to provide a mechanism for the protection of off-site intrusive maintenance workers and DBYD notification should be made; and

7) following DBYD notification for the classified land parcels containing the site and Thomas Road, and the continued restriction on groundwater abstraction, it is considered that these land parcels may be appropriately reclassified as of the site to *Remediated for restricted use*.

The Auditor was generally satisfied the GMEs were of an adequate standard and broadly conformed to relevant guidance.

It should be noted that the GMEs referred to a DBYD notification as a proposed administrative control which is a process that is beginning to occur in Western Australia through some local councils but is not well established here. For this reason, the Auditor considers that the potential risk to receptors should also be managed though the placement of memorials on titles including the implementation of a SMP where appropriate.

5.5 Plume Duration Assessment (ERM, May 2017a)

5.5.1 Objectives

The objective was to complete a plume duration assessment focussing on the degradation rates of specific COPCs to provide an estimation of the duration for which a restriction may be placed on the extraction and use of groundwater within the off-site impacted areas.

5.5.2 Scope of Works

ERM undertook the following scope of work:

1) data quality review of groundwater data to ascertain the useability of data available for the assessment;
2) estimation of degradation rates of COPCs within groundwater sampled from all appropriate off-site monitoring wells; and
3) using the aforementioned degradation rates, estimation of the duration required to restore potential beneficial uses through natural attenuation taking into account observed concentrations and groundwater quality goals (i.e. an estimation of the duration for which a restriction may need to be placed on the extraction and use of groundwater within off-site areas).

5.5.3 Results and Conclusions

Groundwater sampling results over the monitoring period demonstrated that off-site groundwater impact has contracted over time. The degradation rate calculations and associated estimation of plume duration indicate that groundwater conditions beneath the nearest residential lots should be acceptably low by 2030 or earlier. The estimated timeframes to reaching groundwater quality goals fall within a 30-year timeframe, which is considered reasonable for the implementation of monitored natural attenuation as an off-site remediation strategy, subject to additional verification monitoring.

The plume duration assessment was reviewed by the appropriate member of the Auditor's expert support team and it was determined that the approach and equations were appropriate and the discussion of uncertainty and conclusions made were reasonable.

5.6 Site Closure Report (ERM, July 2017b)

5.6.1 Objectives

The purpose of the closure report was to demonstrate that there is sufficient data to define suitability of source site and affected sites land use settings for current and realistic foreseeable future uses such that Viva Energy's short-term end-points have been meet.

5.6.2 Scope of Works

The works completed included the following:

1) a consolidated technical overview of the findings of the assessment of site contamination works completed following the 2011 MAR, complemented where warranted by previous investigation outcomes, intended to demonstrate the current and likely realistic foreseeable future hydrocarbon impact conditions in subsurface media at the site and affected sites;
2) an updated 'Tier 1' risk assessment, inclusive of an updated conceptual site model (CSM) and multiple lines of evidence, that expanded on the current and realistic foreseeable future human health and ecological risk status from hydrocarbon impacted media onsite and at affected sites; and
3) risk management measures than can be implemented institutionally (i.e., reclassification with restrictions on use under the CS Act).

5.6.3 Results and Conclusions

ERM drew the following conclusions within the site closure report:

1) the DPH plume has reduced in COPC concentrations, geometry and mass;
2) there has been no NAPL present in groundwater since 1999;
3) MNA has been and will continue to be the most viable remedial option for hydrocarbon impacted media;
4) the site and affected sites are suitable for use within the context of their nominated land and groundwater environmental values and land use scenarios;
5) there is no unacceptable risk to human health associated with the DPH in impacted groundwater; and
6) potential residual human health risks can be managed through the implementation of institutional controls; namely, restrictions on use under reclassification.

Supporting information, derived from the review of background information to support the case for reclassification included those aspects summarised below.

1) Groundwater monitoring events (GMEs) and statistically-backed trend assessments have confirmed a reduction in the DPH plume extent and the concentrations of the contaminants of potential concern (COPCs) have been shown to be diminishing. This is seasonably demonstrable during fluctuating water levels at the site.
2) There is no non-aqueous phase liquid (NAPL) present, moreover NAPL has not been reported at the site since 1999.
3) Monitored natural attenuation (MNA) parameters were interpreted as part of the GMEs and an MNA assessment was completed. Interpretation of the primary and secondary lines of evidence indicates that MNA is working. The conclusion is to apply MNA as a preferred remedial option and no other valid remedial options are warranted.

4) The plume duration assessment (PDA) and associated contaminant fate and transport modelling demonstrated that MNA will work for the site within a 30-year timeline. TPH concentrations at residential affected sites have been reported below the adopted NPUG value of 1,000 over the last several years.
5) It is demonstrated that the quality of groundwater will not deteriorate in the future with the presence of a secondary phreatic zone source on site. The nominated environmental value is beneficial use; specifically, non-potable groundwater use.
6) Multiple lines of evidence demonstrate that groundwater use does not include drinking water, irrigation (in line with Water Quality Guidelines – staple crop), stock water, nor does it support aquatic ecosystem protection requirements.
7) There are no exceedances to nominated assessment criteria for groundwater PVI. There is no defined petroleum vapour intrusion risk which has been confirmed by sample data.
8) Groundwater at the source site, the affected road reserve site, affected alley way site, and affected residential sites is not currently used. There are no private or unregistered bores for potable use.
9) Under current conditions and extrapolated future conditions, there is a low risk to human health from the DPH plume. The extrapolated conditions would need to be validated with groundwater monitoring. This groundwater monitoring and contingency plan would be provided in an SMP.
10) BTEX (predominantly benzene) concentrations have reduced to below NPUG values at all residential affected sites except for one which is closest to the source site. One or more BTEX compound concentrations exceed NPUG values at the road reserve, pathway (i.e., the alleyway between residential sites) and onsite. However, there is an incomplete exposure pathway under the current setting.
11) There is a potentially complete exposure pathway for access to groundwater through advancement of unregistered bores on residential properties or potential direct contact/ingestion by maintenance workers (unlikely as depth to water is at minimum >4 m bgl). Restrictions on land use would support the mitigation of risk associated with this potentially complete exposure pathway.

5.6.4 Recommendations

ERM made the following recommendations:

1) the reclassification of 4 Butcher Road and 32 Aquanita Rise to *Decontaminated*;
2) the reclassification of the remaining properties to RRU; and
3) the implementation of an SMP that allows for groundwater monitoring to facilitate progress from RRU to *Decontaminated* for 34 and 49 Aquanita Rise through demonstration that contamination beneath these properties had reduced to a point where land use restrictions were no longer required.

The closure report noted that GMEs were undertaken on an annual basis which varied from the DER 2012 request to undertake bi-annual groundwater monitoring. The rationale for deviation in frequency was attributed to professional judgement that:

1) there was sufficient historic datasets to allow for reasonable understanding of expected groundwater levels;
2) there wasn't an immediate or unacceptable risk to human health under existing conditions and with consideration given to restrictions identified in the classifications for the site; and

3) there was sufficient historic datasets demonstrating that annual sampling was sufficient for continued assessment of NA.

The Auditor agrees that the rationale was reasonable and justifiable.

5.7 Site Management Plan (ERM, July 2017c)

The Site Management Plan (SMP) was prepared to document the relevant restrictions and associated management measures relevant to residual impacts at the source and relevant affected sites and to detail the ongoing groundwater monitoring program to be undertaken to facilitate reclassification of two affected residential properties (34 and 49 Aquanita Rise).

The SMP highlights that restrictions already in place for those sites that are proposed to remain classified with restricted land uses remain largely valid with some minor amendments for the source and affected residential sites (34 and 49 Aquantita Rise) and provides some additional detail as to how these restrictions might best be managed.

The SMP also details that regular monitoring of selected representative wells will continue until it is demonstrable that groundwater quality has improved to the extent that 34 and 49 Aquanita Rise may be reclassified as *Decontaminated*. The SMP includes a Sampling Analysis and Quality Plan (SAQP) for this monitoring and the DQOs refer to an appropriate set of decision criteria to determine whether contingency measures should be considered and to determine that remedial goals have been achieved.

Importantly, the SMP notes that whilst it has some relevant information associated with the proposed restricted use of the affected road reserves and public access ways it should only be a formally recognised restriction related to the source site and the two affected residential sites (49 and 34 Aquanita Rise) as a function of the ongoing groundwater monitoring component.

The SMP also appropriately recognises that its key functional component is associated with a commitment by Viva Energy to progress the affected residential sites from *RRU* to *Decontaminated* and that this commitment could be altered through private agreement between the relevant parties.

The Auditor reviewed several versions of the SMP and liaised with Viva Energy and ERM to finalise the documents. The Auditor confirms that the finalised SMP represents an appropriately documented mechanism to achieve its stated objectives.

The Auditor notes that aspects of the community consultation associated with the proposed interim reclassifications of 34 and 49 Aquanita Rise and the related SMP have not been finalised but considers the reclassification and SMP implementation should proceed regardless since:

1) relevant restrictions will remain unchanged;
2) there are no relevant access or management commitments required of the two property owners;
3) the *RRU* classification represents an improvement from the current CRR classification; and
4) Viva Energy have committed to facilitating reclassification to *Decontaminated* for these sites in the future.

The plan also recognises that relevant intentions may be modified by private agreement pending future consultation.

It is noted that whilst *Remediated for restricted use* is a potentially acceptable end-point classification for 34 and 49 Aquanita Rise (with owner approval) Viva Energy currently intends seeking a *Decontaminated* end point classification for these properties and this intention is proposed to form part of an agreement with the property owners and hence should currently be recognised as a relevant restriction. Should a different agreement be made or the intended agreement change, it will be possible to modify the property's classification to remove this restriction without otherwise changing the classification. That is, progressing 34 and 49 Aquanita Rise to a *Decontaminated* classification is a private commitment by Viva Energy to be agreed with the property owners and not a requirement under the *Contaminated Sites Act 2003*.

6.0 Final Site Status

The findings of the various phases of work performed indicate that soils and groundwater at the Site are variously impacted by potential contaminants of concern. Groundwater impacts originating from the Site have impacted off site areas to the north and north-west.

Extent of Remaining Soil Impact

Areas within the Site with soil impacts were restricted to the north-east corner of the Site in the vicinity of the former Underground Petroleum Storage Systems (UPSS). Validation samples collected during decommissioning of the Site in April 2000 were below the limit of reporting. It was noted that residual impacted soil was left in-situ on the north-east face of the excavation bounded by fibre optic cable preventing its removal (IT, 2004).

In June 2009, an additional 17 soil bores were advanced to validate the historical soil remediation with the results reported in ERM (February 2010) *Environmental Site Assessment*. One sample from SB08 in the north-east corner of the site at 8.4m depth exceeded HIL-F for Benzene by an order of magnitude with a concentration of 15mg/kg (HIL-F 1.5mg/kg). Addtional samples exceeded the DEC (2003) EILs and had detections of total petroleum hydrocarbon (TPH) fractions. These hydrocarbon impacts were all located in the groundwater smear zone.

Extent of Remaining Soil Vapour Impacts

Two soil vapour monitoring events (SVME) have been undertaken, with vapour samples collected from two on-site and six off-site locations, on and adjacent to the residential properties. The reported COPC concentrations were below the vapour intrusion assessment criteria during the December 2008 and May 2010 SVME therefore the data set does not indicate an unacceptable risk to off-site residents from hydrocarbon vapours. Potential exposure to intrusive maintenance workers may exist when conducting excavations beyond 2.5m bgl along Thomas Road, in the vicinity of the Site.

Extent of Remaining Groundwater Impacts

Thirteen GMEs have been conducted in relation to the site between 2006 and 2016. Dissolved phase hydrocarbon concentrations in groundwater have been reported proximal to the location of the former UPSS, near the north-east corner of the site, extending north-west to the northern side of Thomas Road. Historical detections of hydrocarbons in groundwater have been reported beneath the residential properties north of the site however recent monitoring events reported concentrations below the limit of reporting.

In the most recent GME undertaken in 2016 the COPCs were identified at concentrations below the tier 1 screening criteria or below the LOR except at one monitoring well, namely MW38R (located on the northern portion of the Thomas Road reserve near the southern boundary of 49 Aquanita Rise) which contained benzene at 270 µg/l and ethylbenzene at 19 µg/l. These concentrations were reported in excess of the NPUG guidelines of 10 µg/l and 3 µg/l respectively.

Overall, the Auditor is satisfied with the nature and quality of the works undertaken at the Site and considers this to appropriately characterises the final site status (including the source and affected sites).

7.0 Auditor's Assessment

7.1 Quality and Completeness

The scope of work subject to audit was undertaken in a staged approach, consistent with the approach recommended in the ASC NEPM and *Contaminated Sites Guidelines*.

The Auditor has critically and independently reviewed all of the reports identified as subject of the audit in **Section 3.1** and provided interim audit advice as relevant. The reports were subsequently finalised to incorporate the interim audit advice, or a response was provided by the consultant where areas of the report could not be amended.

The Auditor is satisfied that the overall quality and completeness of the assessment is adequate to form the basis for risk assessment and site characterisation.

7.2 Relevance of Environmental and Human Health Criteria

The Auditor is satisfied that environmental and human health criteria adopted were adequate for the purposes of the assessment.

7.3 Assessment of Risk to Human Health and the Environment

The Auditor is satisfied that the assessment of environmental and human health risk for the Site has been adequate.

The Auditor considers that the findings of the audited reports provide sufficient confidence that the soil and groundwater impacts are unlikely to present risk to human health, the environment or environmental values under a commercial/industrial land use scenario for the Site.

7.4 Potential for Off-Site Migration

Contamination originating from the Site has migrated to affect a portion of Thomas Road reserve, located to the north of the site a footpath along the northern side of Thomas Road (Lot 300 on Plan 51299), four down-gradient residential properties (Lots 215, 216, 230 and 231 on Plan 51299) and a small public access way (Aquanita Rise [Lot 229 on Plan 51299]). They were designated *affected sites* by the DER and have been classified *Contaminated – Remediation Required*.

It is noted that this MAR concludes impact no longer extends off-site to Lots 230 and 231.

7.5 Expert Support

The following members of the Auditor's expert support team were utilised during the audit. A Form J is provided in Appendix A.

Andrei Woinarski – Senior Associate, hydrogeologist

Andrei provided specific advice in relation to ERM's Plume Duration Assessment (ERM, 2017a) as described in **Section 5.5** of this MAR.

7.6 Audit Correspondence

Copies of key correspondence relevant to the MAR is provided is presented in **Appendix C**.

8.0 Auditor's Conclusions and Recommendations

8.1 Consultant's Conclusions

Based on site investigations ERM drew the conclusions paraphrased below within the site closure report.

1) The DPH plume has reduced in COPC concentrations, geometry and mass.
2) There has been no NAPL present in groundwater since 1999.
3) MNA has been and will continue to be the most viable remedial option for hydrocarbon impacted media.
4) The site and affected sites are suitable for use within the context of their nominated land and groundwater environmental values and land use scenarios.
5) There is no unacceptable risk to human health associated with the DPH in impacted groundwater;
6) Potential residual human health risks can be managed through the implementation of institutional controls; namely, restrictions on use under reclassification.

Supporting information, derived from the review of background information to support the case for reclassification included those aspects summarised below.

1) Groundwater monitoring events (GMEs) and statistically-backed trend assessments have confirmed a reduction in the DPH plume extent and the concentrations of the contaminants of potential concern (COPCs) have been shown to be diminishing. This is seasonably demonstrable during fluctuating water levels at the site.
2) There is no non-aqueous phase liquid (NAPL) present, moreover NAPL has not been reported at the site since 1999.
3) Monitored natural attenuation (MNA) parameters were interpreted as part of the GMEs and an MNA assessment was completed. Interpretation of the primary and secondary lines of evidence indicates that MNA is working. The conclusion is to apply MNA as a preferred remedial option and no other valid remedial options are warranted.
4) The plume duration assessment (PDA) and associated contaminant fate and transport modelling demonstrated that MNA will work for the site within a 30-year timeline. TPH concentrations at residential affected sites have been reported below the adopted NPUG value of 1,000 over the last several years.
5) It is demonstrated that the quality of groundwater will not deteriorate in the future with the presence of a secondary phreatic zone source on site. The nominated environmental value is beneficial use; specifically, non-potable groundwater use.
6) Multiple lines of evidence demonstrate that groundwater use does not include drinking water, irrigation (in line with Water Quality Guidelines – staple crop), stock water, nor does it support aquatic ecosystem protection requirements.
7) There are no exceedances to nominated assessment criteria for groundwater PVI. There is no defined petroleum vapour intrusion risk which has been confirmed by sample data.
8) Groundwater at the source site, the affected road reserve site, affected alley way site, and affected residential sites is not currently used. There are no private or unregistered bores for potable use.

9) Under current conditions and extrapolated future conditions, there is a low risk to human health from the DPH plume. The extrapolated conditions would need to be validated with groundwater monitoring. This groundwater monitoring and contingency plan would be provided in an SMP.
10) BTEX (predominantly benzene) concentrations have reduced to below NPUG values at all residential affected sites except for one which is closest to the source site. One or more BTEX compound concentrations exceed NPUG values at the road reserve, pathway (i.e., the alleyway between residential sites) and onsite. However, there is an incomplete exposure pathway under the current setting.
11) There is a potentially complete exposure pathway for access to groundwater through advancement of unregistered bores on residential properties or potential direct contact/ingestion by maintenance workers (unlikely as depth to water is at minimum >4 m bgl). Restrictions on land use would support the mitigation of risk associated with this potentially complete exposure pathway.

The Auditor concurs with the conclusions of the consultant and considers that, based on the information presented, the Source Site is suitable for commercial/industrial use and the affected sites are suitable for their current land uses.

The Auditor considers that potential soil and groundwater impacts beneath the Site have been adequately characterised (and remediated as appropriate) for these current and proposed land uses.

8.2 Consultant's Recommendations

ERM made the following recommendations:

1) the reclassification of 4 Butcher Road and 32 Aquanita Rise to *Decontaminated*;
2) the reclassification of the remaining properties to *RRU*; and
3) the implementation of an SMP that allows for groundwater monitoring to facilitate progress from *RRU* to *Decontaminated* for 34 and 49 Aquanita Rise through demonstration that contamination beneath these properties had reduced to a point where land use restrictions were no longer required.

The Auditor concurs with the recommendations of the consultant that 4 Butcher Road and 32 Aquanita Rise are no longer impacted and are suitable for residential use without restriction.

The Auditor also agrees that the remaining properties are suitable for their current land uses, with restrictions on groundwater abstraction, precautions taken associated with subsurface activities, an SMP (ERM, 2017f) detailing relevant management measures and a program of ongoing groundwater monitoring is applicable to 34 and 49 Aquanita Rise and the Source Site.

Consultation with affected property owners has been initiated by Viva Energy but at the time of preparing this MAR, no response had been received and hence there is no documented agreement regarding Viva Energy's intended approach.

The Auditor considers the reclassification and SMP implementation should proceed regardless since:

1) relevant restrictions will remain unchanged;
2) there are no relevant access or management commitments required of the two property owners;

3) the *RRU* classification represents and improvement from the current CRR classification; and
4) Viva Energy have committed to facilitating reclassification to *Decontaminated* for these site in the future.

8.3 Regulation and Guideline Compliance

The Auditor is satisfied that the information contained in the reports referenced as the subject of the audit in **Section 3.1** is complete, accurate and sufficiently compliant with the requirements of the ASC NEPM, *Contaminated Sites Guidelines*, and other relevant published technical guidance as set out in this MAR.

8.4 Auditor's Conclusions and Recommendations

The Auditor is satisfied that the information contained in the reviewed reports when considered as a whole, are generally complete, accurate and compliant with the requirements of the Department of Environment Regulation (DER) Contaminated Sites Guidelines, National Environment Protection (Assessment of Site Contamination) Measure and other relevant published technical guidance.

The findings of the work conducted by ERM indicate that following characterisation and remediation the contamination status of the Site and the affected sites is such that:

1) affected sites 4 Butcher Road and 32 Aquanita Rise are considered suitable for unrestricted use (consistent with their current residential land use) and eligible to be reclassified as *Decontaminated*; and
2) other classified sites do not represent an unacceptable risk to human health or the environment based on current and reasonably envisaged land use with appropriate land use restrictions in place and as such are eligible to be reclassified as *Remediated for restricted use*.

As such, the Auditor recommends that, pursuant to *Part 2 Division 2* of the *Contaminated Sites Act 2003*, the DER classify the source and affected sites as detailed below:

1) Butcher Road (Lot 231, Plan 51299) and 32 Aquanita Rise (Lot 230, Plan 51299) as ***Decontaminated***.
2) 640 South Western Highway (Lot 2 on Diagram 35013) as ***Remediated for Restricted Use***.

   In addition to the general land use restrictions e.g. commercial/industrial use, the auditor recommends specific restrictions associated with the proposed classification (largely consistent with existing restrictions) include:

   - implementation of the Site Management Plan (ERM, 2017f);
   - the excavation of basements and permanent utility pits (such as deep sewers or manholes) below 2m depth should be appropriately assessed and should not create a new ongoing pathway for hydrocarbons to contact receptors;
   - a site-specific health and safety plan is also required to address the risks to the health of any workers undertaking any other intrusive works below 2 m depth;
   - access to soils below 4 m depth is restricted, other than for analytical testing or remediation, because of the presence of hydrocarbons in soil that may pose a source of further groundwater contamination if disturbed; and

- groundwater abstraction, other than for analytical testing or remediation, is not permitted at this site due to the nature and extent of groundwater contamination.

3) 34 Aquanita Rise (Lot 216, Plan 51299), 49 Aquanita Rise (Lot 215, Plan 51299) as ***Remediated for Restricted Use***.

The Auditor recommends specific restrictions associated with the proposed classification include:

- implementation of the Site Management Plan (ERM, 2017f);
- groundwater abstraction, other than for analytical testing or remediation, is not permitted at this property due to the nature and extent of groundwater contamination;
- the excavation of basements and permanent utility pits below 1.5 m depth should be appropriately assessed and should not create a new ongoing pathway for hydrocarbons to contact receptors; and
- a site-specific health and safety plan is also required to address the risks to the health of any workers undertaking any other intrusive works below 1.5 m depth.

4) The affected a portion of Thomas Road reserve, the footpath along the northern side of Thomas Road (Lot 300 on Plan 51299) and the public access way (Aquanita Rise [Lot 229 on Plan 51299]) as ***Remediated for Restricted Use***.

In addition to the general land use restrictions eg road reserve and public access way the Auditor recommends the existing restrictions remain associated with the proposed classification and these include:

- restriction on groundwater abstraction (including dewatering) for purposes other than for analytical testing; and
- the need for an appropriate health and safety plan to manage potential exposures associated with intrusive works such and underground service maintenance.

With these restrictions in place the source and affected sites are not considered to represent unacceptable risk to human health, the environment or any environmental value.

It is noted that whilst *Remediated for restricted use* is a potentially acceptable end-point classification for 34 and 49 Aquanita Rise (with owner approval) Viva Energy currently intends seeking a *Decontaminated* end point classification for these properties and this intention is proposed to form part of an agreement with the property owners and hence should currently be recognised as a relevant restriction. Should a different agreement be made or the intended agreement change, it will be possible to modify the property's classification to remove this restriction without otherwise changing the classification. That is, progressing 34 and 49 Aquanita Rise to a *Decontaminated* classification is a private commitment by Viva Energy to be agreed with the property owners and not a requirement under the *Contaminated Sites Act 2003*.

8.5 Assumptions and Uncertainties

Conclusions made in this report are subject to the following assumptions:

1) soil, soil vapour and groundwater sample results are representative of actual conditions of the media; and
2) potential sources and receptors of significance have not been excluded from the Conceptual Site Model (CSM).

Whilst it is acknowledged that uncertainties in the data may exist, the Auditor considers that they are not great enough to affect the overall assessment of risk for the Site.

9.0 References

Australian and New Zealand Environment and Conservation Council & Agriculture and Resources Management Council of Australia and New Zealand (2000) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*.

Department of Environment and Conservation (2006) *Site Classification Scheme*.

Department of Environment Regulation (2014) *Contaminated sites guidelines: Assessment and management of contaminated sites*

Department of Environment Regulation (2016a) *Requirements for Mandatory Auditors' Reports Contaminated Sites Guidelines.*

Department of Environment Regulation (2016b) *The Western Australian Contaminated Sites Auditor Scheme Contaminated Sites Guidelines*.

Department of Health (2006) *Contaminated Sites Reporting Guideline for Chemicals in Groundwater*.

ERM (November 2013a) *Former Oakland Service Station Additional Risk Assessment of Vapour Intrusion Pathway.*

ERM (November 2013b) F*ormer Oakland Shell Service Station Remedial Alternatives Analysis.*

ERM (March 2014) *Former Oakland Shell Service Station Groundwater Monitoring Event.*

ERM (May 2017a) *Plume Duration Assessment, Former Oakland Service Station (Q036), 640 South Western Highway, Byford, Western Australia.*

ERM (June 2017b) *Groundwater Monitoring Event, Former Oakland Service Station (Q036) 640 South Western Highway, Byford, Western Australia.*

ERM (June 2017c) *2014/2015 Groundwater Monitoring Event and Trend Assessment, Former Oakland Service Station (Q036), 640 South Western Highway, Byford WA.*

ERM (June 2017d) *October 2016 Groundwater Monitoring Event, Former Oakland Service Station (Q036) 640 South Western Highway, Byford, Western Australia.*

ERM (July 2017e) *Site Closure Report Former Oakland Service Station (Q036), 640 South Western Highway, Byford, Western Australia.*

ERM (July 2017f) *Former Oakland Shell Service Station (Q036), 640 South Western Highway, Byford, Western Australia, Site Management Plan.*

National Environment Protection Council (1999) *National Environmental Protection (Assessment of Site Contamination) Measure (as amended 2013)*.

Figures

Figure 1: Site Location Map (ERM 2017e)

Figure 2: Site Features Plan (ERM 2017d)

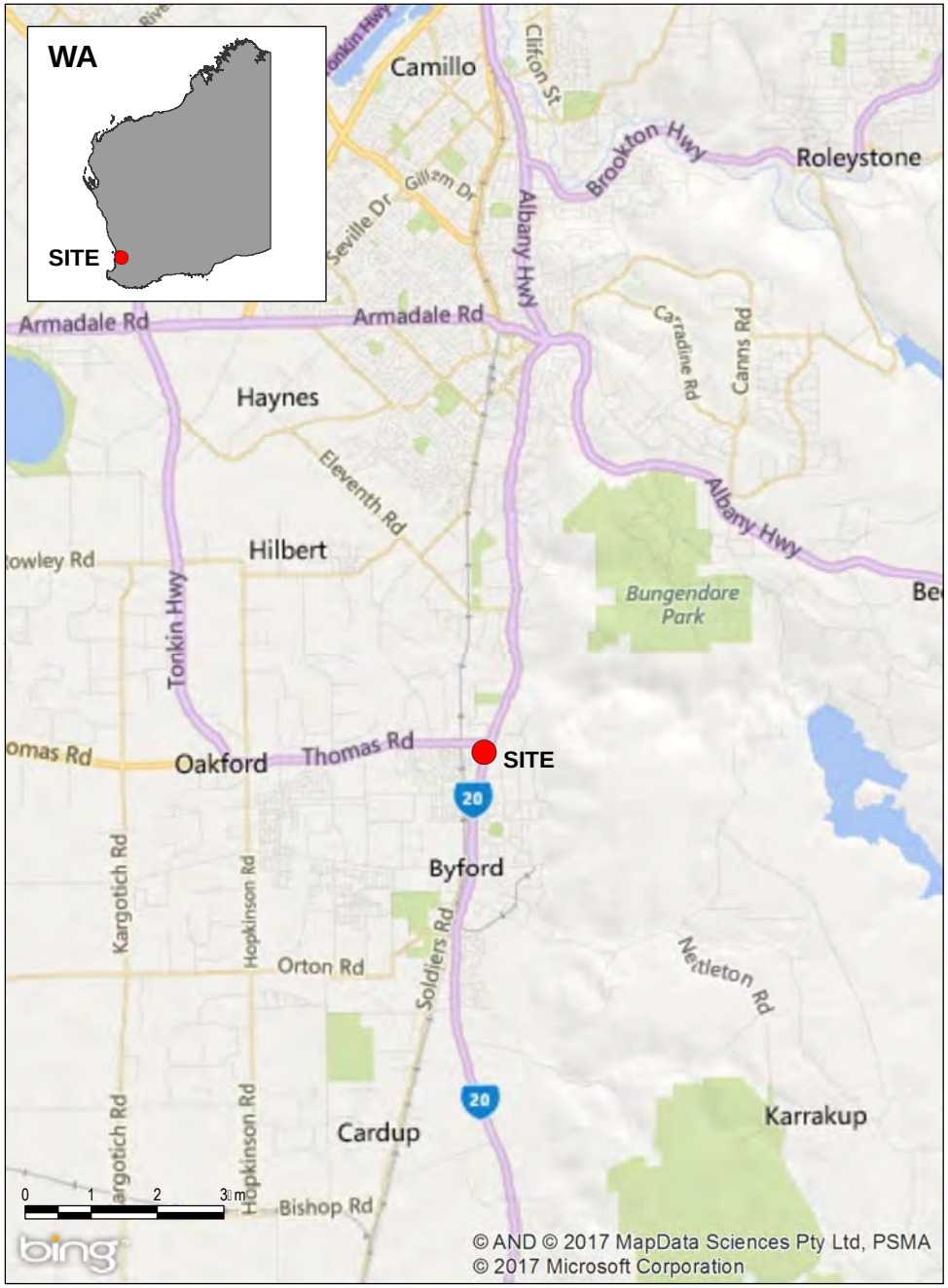


Image Source: © nearmap 17 June 2016

N

Client	Viva Energy Australia Pty Ltd		
Drawing No.	0412033m_S_001_0m_d		
Date	05.0_.201_	Drawing Size	A4
Drawn By	B_ _	Reviewed By	M_

This figure may be based on third party data or data which has not been verified by _ M and it may not be to scale_ nless expressly agreed otherwise, this figure is intended as a guide only and _ M does not warrant its accuracy.

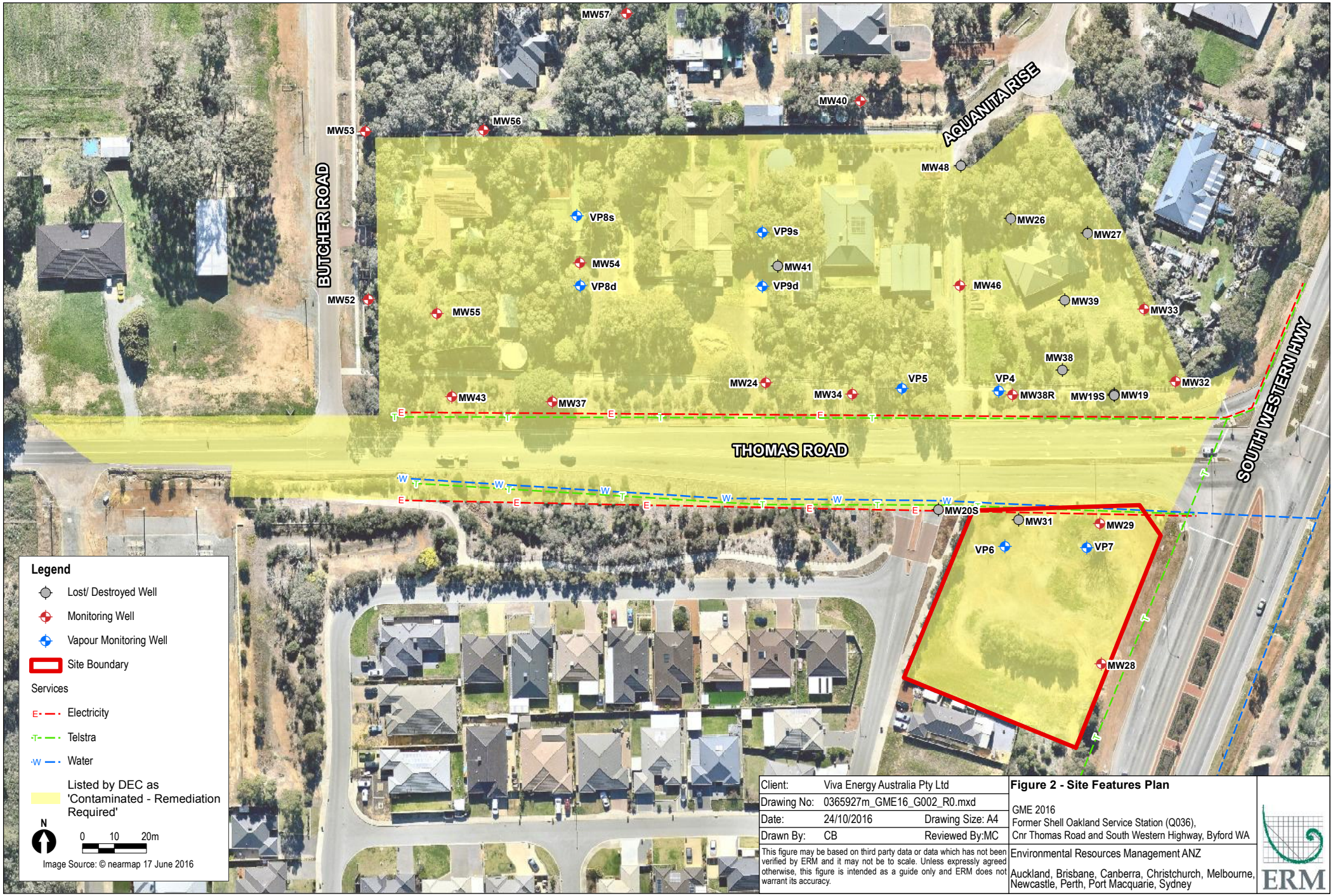
Figure 1 - Site Location Map

Site _losure _eport
_ormer Shell _ a_land Ser_ice Station (_036),
_nr _homas _oad and South Western Highway, Byford

_nvironmental _esources Management A_ _

Auc_land, Brisbane, _anberra, _hristchurch, Melbourne, _ewcastle, Perth, Port Mac_uarie, Sydney

ERM



Client:	Viva Energy Australia Pty Ltd		
Drawing No:	0365927m_GME16_G002_R0.mxd		
Date:	24/10/2016	Drawing Size: A4	
Drawn By:	CB	Reviewed By:MC	

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

Figure 2 - Site Features Plan

GME 2016
Former Shell Oakland Service Station (Q036),
Cnr Thomas Road and South Western Highway, Byford WA

Environmental Resources Management ANZ

Auckland, Brisbane, Canberra, Christchurch, Melbourne, Newcastle, Perth, Port Macquarie, Sydney

ERM

Appendix A: Audit Forms

Government of **Western Australia**
Department of **Water and Environmental Regulation**

[DWER reference no.]

DMO:

Contaminated sites auditor scheme

Contaminated Sites Act 2003 section 73(a)

Form H: Mandatory auditor's report—commissioner's statement

This form is to be prepared by **the person commissioning the mandatory auditor's report**.

Part 1 Details of person commissioning auditor's report	
Full name	Tanya Astbury
Contact address	Level 20 Exchange Tower, 2 The Esplanade, Perth WA 6000
Postal address (if different from above)	As above
Telephone	(08) 6330 7153
Mobile	0404 042 587
Fax	
Email	Tanya.astbury@vivaenergy.com.au
Current employer: (company name)	Viva Energy Australia Pty Ltd
In accordance with s 73(a) of the *Contaminated Sites Act 2003* I formally advise the CEO of the Department of Water and Environmental Regulation that I have engaged an accredited auditor to prepare a mandatory auditor's report in respect of the following site.	
Site address	640 South Western Highway, Byford, WA 6104
Certificate of title details (parcel/lot number)	Lot 2 on Diagram 35013
Site description (attach site plan as appropriate)	Former Oakland Service Station
Name of accredited auditor engaged to provide a mandatory auditor's report	Jeremy Hogben
Date of engagement	03/05/2017

Part 2 Declaration and signature

Under s 73(a) of the *Contaminated Sites Act 2003*, a mandatory auditor's report cannot be accepted unless it is accompanied by a statement identifying and signed by the person who engaged the auditor to prepare the mandatory auditor's report.

I declare that

I Tanya Astbury (the person described in this statement)

am the person who engaged the auditor to prepare this mandatory auditor's report, relating to

certificate of title details (parcel/lot number)	Lot 2 on Diagram 35013
site description	Former Oakland Service Station
site address	640 South Western Highway, Byford, WA 6104

and, that

- I have not provided information to the auditor that I know is false or misleading in a material particular;
- I have not provided information with reckless disregard as to whether or not the information is false or misleading in a material particular; and
- I have disclosed to the auditor all information that I know is materially relevant.

_____ Date 2/8/17

(Signature—person who commissioned the mandatory auditor's report)

_____TANYA ASTBURY_____

(Full name in block capitals)

Government of **Western Australia**
Department of **Water and Environmental Regulation**

[DWER reference no.]
DMO:

Contaminated sites auditor scheme

Contaminated Sites Act 2003 section 73(a)

Form I: Mandatory auditor's report—auditor's statement

This form is to be prepared by **the contaminated sites auditor**.

Part 1 Details of accredited auditor	
Full name	Jeremy Hogben
Contact address	Level 17, 140 St Georges Terrace, Perth WA 6000
Postal address (if different from above)	As above
Telephone	(08) 6324 0200
Mobile	0419 122 534
Fax	
Email	jeremy.hogben@senversa.com.au
Current employer: (company name)	Senversa Pty Ltd
In accordance with s 73(b) of the *Contaminated Sites Act 2003* I formally advise the CEO of the Department of Water and Environmental Regulation that I have prepared the attached mandatory auditor's report in respect of the following site.	
Site address	640 South Western Highway, Byfrod, WA 6104
Certificate of title details (parcel/lot number)	Lot 2 on Diagram 35013
Site description (attach site plan as appropriate)	Former Oakland Service Station
Name of person engaging the auditor to provide a mandatory auditor report	Tanya Astbury
Date of engagement	1/08/2017

Part 2 Declaration and signature

Under s 73(b) of the *Contaminated Sites Act 2003*, a mandatory auditor's report cannot be accepted unless it is accompanied a statement identifying, and signed by the auditor to the effect that the report is accurate.

I declare that

I, Jeremy Hogben (the auditor described in this statement) am the auditor engaged to prepare this mandatory audit report, relating to

certificate of title details (parcel/lot number)	Lot 2 on Diagram 35013
site description	Former Oakland Service Station
site address	640 South Western Highway, Byfrod, WA 6104

and, that

- I have not provided information in the report that I know is false or misleading in a material particular;
- I have not provided information in the report with reckless disregard as to whether or not the information is false or misleading in a material particular; and
- I have disclosed in the report all information that I know is materially relevant.

_____ Date 1/08/2017

(Accredited auditor's signature)

_____JEREMY HOGBEN____

(Full name in block capitals)

Government of **Western Australia**
Department of **Water and Environmental Regulation**

[DER reference no.]
DMO:

Contaminated sites auditor scheme

Contaminated Sites Regulations 2006 regulation 32(2)

Form J: Mandatory auditor's report—expert support team member's statement

This form is to be prepared by **the expert support team member**.

Part 1 Details of expert support team member	
Full name	Andrei Woinarski
Contact address	Level 5, The Grafton Bond Building, 201 Kent Street, Sydney, NSW 2000
Postal address (if different from above)	As above
Telephone	(02) 8252 0000
Mobile	0401 472 687
Fax	
Email	Andrei.Woinarski@senversa.com.au
Current employer: (company name)	Senversa Pty Ltd
In accordance with r 32(2) of the *Contaminated Sites Regulations 2006* I formally advise the CEO of the Department of Water and Environmental Regulation that I have been engaged as part of an expert support team to prepare part of the attached mandatory auditor's report in respect of the following site.	
Site address	640 South Western Highway, Byford, WA 6104
Certificate of title details (parcel/lot number)	Lot 2 on Diagram 35013
Site description (attach site plan as appropriate)	Former Shell Service Station
Name of accredited auditor engaged to provide the mandatory auditor report	Jeremy Hogben
Date of expert support team member engagement	26 June 2017
Nature and extent of work undertaken	Review of ERM (2017) Plume Duration Assessment

Relevant report section reference(s)	Whole report

Part 2 Declaration and signature

Under r 32(2)) of the *Contaminated Sites Regulations 2006*, where part of a mandatory auditor's report has been prepared, and is based on work undertaken by a person other than the auditor, or a person employed by the auditor, the report cannot be accepted unless it is accompanied by a statement identifying, and signed by that person, to the effect that that part of the report is accurate.

I declare that

I, Andrei Woinarski (the expert support team member described in this statement) am the expert engaged to prepare part of this mandatory audit report, relating to

certificate of title details (parcel/lot number)	Lot 2 on Diagram 35013
site description	Former Oakland Service Station
site address	640 South Western Highway, Byford, WA 6104

and, that

- I have not provided information in the part of the report described above that I know is false or misleading in a material particular;
- I have not provided information, in the part of the report described above, with reckless disregard as to whether or not the information is false or misleading in a material particular; and
- I have disclosed, in the part of the report described above, all information that I know is materially relevant.

_____ Date 27/07/2017

(Expert support team member signature)

_____ANDREI WOINARSKI_____

(Full name in block capitals)

Appendix B: Certificate of Title

WESTERN AUSTRALIA

REGISTER NUMBER	
2/D35013	
DUPLICATE EDITION	DATE DUPLICATE ISSUED
1	12/4/2013

VOLUME 1667 FOLIO 185

RECORD OF CERTIFICATE OF TITLE

UNDER THE TRANSFER OF LAND ACT 1893

The person described in the first schedule is the registered proprietor of an estate in fee simple in the land described below subject to the reservations, conditions and depth limit contained in the original grant (if a grant issued) and to the limitations, interests, encumbrances and notifications shown in the second schedule.

REGISTRAR OF TITLES

LAND DESCRIPTION:

LOT 2 ON DIAGRAM 35013

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

MICHAEL ROBERT ELPHICK OF 23 BROWN STREET, CLAREMONT
LAN ANWAR OF 17 CARNHILL CIRCLE, HELIOS RESIDENCES, 11-08, SINGAPORE 229816
AS EXECUTORS OF THE WILL OF THONG-KIE TAN WHO DIED ON 29.07.2012
(TA M183614) REGISTERED 12/2/2013

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)

1. *K113967 MEMORIAL. CONTAMINATED SITES ACT 2003 (CONTAMINATED SITE - REMEDIATION REQUIRED) REGISTERED 8/3/2007.

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.
* Any entries preceded by an asterisk may not appear on the current edition of the duplicate certificate of title.
Lot as described in the land description may be a lot or location.

----------END OF CERTIFICATE OF TITLE----------

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND: 1667-185 (2/D35013)
PREVIOUS TITLE: 106-109A
PROPERTY STREET ADDRESS: 640 SOUTH WESTERN HWY, BYFORD.
LOCAL GOVERNMENT AUTHORITY: SHIRE OF SERPENTINE-JARRAHDALE

NOTE 1: K549393 DUPLICATE C/T NOT PRODUCED FOR DEALING K549393

Appendix C: Audit Correspondence

Senversa Pty Ltd
Level 17, 140 St Georges Terrace, Perth, WA 6000
ABN 89 132 231 380 www.senversa.com.au

30 June 2017

Tanya Astbury
Environment Risk and Assurance Lead
Viva Energy Australia
Level 20 Exchange Tower, 2 The Esplanade
PERTH WA 6000

Dear Tanya,

Re: Provision of Interim Audit Advice
Former Oakland Service Station, 640 South Western Highway, Byford, WA

Senversa Pty Ltd (Senversa) is pleased to provide Viva Energy Australia Pty Ltd (Viva) with this Interim Auditor Advice associated with contamination assessment undertaken for the former Oakland Service Station located at 640 South West Highway, Byford, Western Australia (the Site).

This letter represents Interim Auditor Advice in relation to the scope of work described in **Section 3** only and is not an Audit Report.

1. Project Appreciation

The Site operated as a service station from 1956 until 2000. Potentially contaminating activities generally associated with the normal day-to-day operation of fuel storage and distribution occurred during this period.

Previous environmental investigations at the Site, carried out by ERM have identified a plume of dissolved phase petroleum hydrocarbons in groundwater beneath the south-west portion of the Site, which was migrating down hydraulic gradient to the north and west beneath Thomas Road and the residential properties to the north of Thomas Road.

The former service station property was classified by the DER in January 2007 as *Contaminated – remediation required* and as a source site. Properties (including residential properties and council road reserves) to the north and north-west of the service station were also classified by the DER as *Contaminated – remediation required* and as affected sites.

As a source site, the Site requires mandatory auditing in accordance with *Contaminated Sites Regulations 2006* Section 31 (1) (b). It is understood that Viva's objectives for the Site is to achieve reclassification to *remediated – restricted use* (RRU) (suitable for commercial/industrial use with a restriction on groundwater abstraction) and *decontaminated/not contaminated – unrestricted use* or RRU for the affected sites. It is recognised that RRU for one of more of the affected sites may be considered an interim classification by Viva whilst attenuation is monitored and the contamination status is subsequently confirmed as supporting a *decontaminated* classification.

A range of investigations have been completed by ERM for the Site in relation to contamination assessment and remediation, which appear to have commenced in 1999 shortly prior to decommissioning in 2000. The previous Auditor (Ian Swane) submitted a Mandatory Auditor's Report (MAR) to the DER in October 2011. The MAR recommended reclassification of the source and affected Sites but the recommendations were rejected by the DER at the time who indicated active remedial options should be pursued and that restricted use classifications appeared to not be appropriate for the affected sites at that time.

DER requirements in response to the MAR prompted additional assessment works (as listed below) that have culminated in Viva proposing that all issues have now been resolved and that the Site and affected sites are suitable for reclassification. This position is detailed in the Site Closure Report (ERM, June 2017) that summarises the works completed and the contamination status of the Site and surrounds. It is understood that a Site Management Plan (SMP) is being prepared that will detail management measures relevant to the proposed restricted use classifications and that addresses progress of affected sites towards a *decontaminated* classification should this be desired. This will be subject to separate auditor review.

On this basis, whilst all relevant historical information has been considered, this review (and the subsequent MAR to be prepared) focusses on the additional assessment work undertaken since the 2011 MAR and in particular concerns itself with the issues considered outstanding at this time (ie on the basis that all other issues are resolved).

2. Review Objective

The objective of the review was to provide Auditor advice in relation to the quality and validity of the documents reviewed and in particular in relation to their consistency with relevant guidance and the veracity of conclusions drawn.

As a summary of all works and the key document that draws relevant conclusions and recommendations in relation to the contamination status of the classified sites, the review places an emphasis on the Site Closure Report and makes as assessment of the information summarised as a basis for a final MAR.

3. Scope of Work and Methodology

The scope of work included detailed review of the following documents (in order of works undertaken as opposed to date of release):

- ERM (2013a) *Former Oakland Service Station Additional Risk Assessment of Vapour Intrusion Pathway.* Letter dated 26 November 2013
- ERM (2013b) *Former Oakland Shell Service Station Remedial Alternatives Analysis.* Report dated 26 November 2013
- ERM (2014) *Former Shell Oakland Groundwater Monitoring Event.* Report dated 21 March 2014.
- ERM (2017a) *Groundwater Monitoring Event Former Oakland Service Station (Q036) 640 South Western Highway, Byford, Western Australia.* Report dated 6 June 2017.
- ERM (2017b) *2014/2015 Groundwater Monitoring Event and Trend Assessment Former Oakland Service Station (Q036) 640 South Western Highway, Byford WA.* Report dated 2 June 2017.
- ERM (2017c) *October 2016 Groundwater Monitoring Event. Former Oakland Service Station (Q036) 640 South Western Highway, Byford, Western Australia.* Report dated 2 June 2017.
- ERM (2017d) *Plume Duration Assessment. Former Oakland Service Station (Q036) 640 South Western Highway, Byford, Western Australia.* Final draft report dated 26 May 2017.

- ERM (2017e) *Site Closure Report Former Oakland Service Station (Q036), 640 South Western Highway, Byford, Western Australia.* Report dated 21 June 2017.

These reports, together with a Site Management Plan will form the basis of the MAR.

The review was completed by Jeremy Hogben in his capacity as accredited Contaminated Sites Auditor. Expert support in relation to the plume duration assessment was provided by Andre Woinarski (Senior Associate – Hydrogeologist) of Senversa.

The review was undertaken in a manner consistent with guidance provided by the DER, specifically including: *Contaminated Sites Guidelines: Requirements for Mandatory Auditors' Reports* (2016)

4. Review Findings

The scope of work completed by ERM included annual GMEs in November 2013, October 2014, June 2015 and September 2016. This was supplemented with an additional risk assessment of vapour intrusion, the development of a remedial alternatives assessment, the completion of a plume duration assessment which included plume degradation modelling and the completion of a consolidated closure report.

4.1 General Comments

Works completed at the Site to date have been well synthesised in the Closure Report (supported by the Plume Duration Assessment) and any issues identified relate to these documents (in terms of their relevance to overall site characterisation). in the 2011 MAR

It is noted that potential chlorinated solvents impact was closed out in the 2011 MAR and subsequent correspondence (letter from Ian Swane to DER dated 1 February 2012). In addition, although MTBE has not been tested for (despite numerous requests by the previous auditor), it seems the previous auditor was reluctantly satisfied that this did not pose a risk and reflected such in the 2011 MAR. On the basis that DEC/DoH did not comment on it in the response to the MAR dated 12 March 2012 and that the Auditor broadly concurs with the previous auditor's assessment, it is considered that this issue is satisfactorily resolved.

4.2 Detailed Comments

Additional Risk Assessment of Vapour Intrusion Pathway (ERM, 2013a)

Soil vapour investigations involving 12 soil vapour bores were conducted across the Site over two monitoring rounds in 2008 and 2010, with the results documented by ERM in two ESA reports issued in 2010. These reports were documented in the 2011 MAR. These investigations were undertaken prior to the release of the NEPM (2013) guidelines, which provided Health Screening Levels (HSLs) for vapour intrusion. This additional assessment utilised the current NEPM Tier 1 screening values and was undertaken to provide supporting evidence that a restriction on accessing soils below 1.5m bgl and the future construction of residences with basements was not warranted.

The Auditor considers that the approach undertaken was reasonable and agrees with the conclusions presented.

Remedial Alternatives Analysis (ERM, 2013b)

The objective of the remedial alternatives analysis was to identify and evaluate potentially feasible remedial alternatives to address the dissolved-phase hydrocarbon groundwater impact that has been identified under off-site residential properties. This included the appraisal of the feasibility of active and passive measures to address the subsurface impact based on a combination of technical, logistical and financial considerations, as well as the expected timeframe for restoration of beneficial uses. The Auditor considers that the approach was reasonable, and agrees that the selection of Monitored Natural Attenuation was justifiable.

2013, 2014, 2015 and 2016 GMEs (ERM, 2014, 2017a, 2017b and 2017c)

These reports have been reviewed and it is considered that the recommendations made in the reports are reasonable. The 2013-2015 GME reports contain a few minor errors and inconsistencies noted within the text. However, given these reports have essentially now been superseded by the 2016 GME report and the site close out report and given the length of time that passed since the fieldwork was undertaken the Auditor considers that revising the previous reports will add little value to the audit process.

The plume diagram presented in the 2016 GME does not appear to accurately represent the current plume configuration. Consideration should be given to revising the diagram and presenting it in the final version of the closure report.

Plume Duration Assessment (2017d)

The Auditor considers that the approach ERM have referenced to estimate point decay rates is appropriate. The equations are also considered appropriate and the discussion of uncertainty and conclusions are reasonable. The following comments are provided for consideration in finalising the document.

1) ERM should include degradation plots for wells other than MW29.
2) ERM have used the decay rate with the best fit (highest R2 value) for plume life calculations – rather, it may be more appropriate to look at the range as there may be spatial variability in decay.
3) TRH C_{10-16} has not been addressed, though it's stated as a COPC.

Closure Report (ERM, 2017e)

Points of clarification for your consideration in finalising the report are listed below.

1) The DER advised in their March 2012 letters that bi-annual groundwater monitoring was required if MNA was to be adopted as the proposed remediation strategy for the source site. This monitoring needed to be undertaken in the spring and autumn when groundwater levels were at their highest and lowest, respectively, in order that the influence of changes in climatic conditions on water levels and contaminant concentrations could be assessed. However, it appears as if GMEs were undertaken annually. Although the Auditor agrees that the dataset provided is adequately robust, the report would benefit from the inclusion of some commentary justifying the approach adopted (particularly as a deviation from DER recommendation). It is noted that the scope of work presented in Section 2 of the Closure Report states that ongoing six-monthly GMEs were undertaken and this may have to be revised if appropriate.
2) From Table 5 in the 2016 GME report, it appears as if the groundwater level in some wells may sometimes have been above the top of the well screen during certain GMEs. This is probably worthy of comment and a description of relevant implications.
3) Reference to Figure 2 at the bottom of page 24 is confusing and may require review or explanation.
4) Figure 2 should include the lot boundaries and lot or house numbers.

Summary Comments

On the basis of the contamination status summarised in Section 7.1 of the Site Closure Report, ERM recommend:

1) reclassification of 4 Butcher Road and 32 Aquinita Rise to *Decontaminated*;
2) the reclassification of all other classified sites (both source and affected) as *Remediated for restricted use* (RRU); and
3) the implementation of an SMP.

It is assumed that the SMP will detail relevant restrictions proposed associated with the RRU classifications and will facilitate their implementation (as relevant) and also establishes a mechanism for those affected sites to be reclassified as *decontaminated* in the future should this be the desired endpoint for them.

The Auditor concurs with the conclusions of the Site Closure report and endorses the recommendations made.

It is recognised that a critical aspect associated with reclassification of the source and affected sites to RRU will be community consultation (which in turn will inform relevant aspects of the SMP – eg end point classifications and associated requirements) and the Auditor notes this aspect remains outstanding.

5. Closure

If you have any comments or questions, please do not hesitate to contact the undersigned at Jeremy.hogben@senversa.com.au or via mobile on 0419 122 534.

Yours sincerely,

Jeremy Hogben
Contaminated Sites Auditor (WA)

CS/JH

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Attachment 4

Megara Pty Ltd

BAL-Assessment
– 640 South Western Hwy Byford

V1.2 – 31 October 2019

Natural Area Holdings Pty Ltd
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Disclaimer

Natural Area Holdings Pty Ltd, trading as Natural Area Consulting Management Services (Natural Area), has prepared this BAL-assessment for use by:

- Owner/occupiers of 640 South Western Hwy Byford
- Megara Pty Ltd
- Shire of Serpentine-Jarrahdale.

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Document Title	MEG R BAL 640 SW Hwy Byford Oct 2019.docx
Location	Client Folders NAC/Megara/2019 BAL Assessment - Byford/Report/

Version No.	Date	Changes	Prepared by	Approved by	Status
V1	05 September 2019	New document	SB	LS	Superseded
V1.1	18 September 2019	Minor Adjustments	SB	SH	Superseded
V1.2	31 October 2019	Minor Adjustments	SB	SH	Final

Contents

1.0 Introduction

Natural Area Holdings Pty Ltd T/A Natural Area Consulting Management Services has prepared this bushfire attack level (BAL) assessment report to support the preparation of a structure plan for commercial development at 640 (Lot 2) South Western Highway Byford (Figure 1) within the Shire of Serpentine-Jarrahdale at the request of Megara Pty Ltd. The Lot is located at the corner of Hay Road, Thomas Road and South Western Hwy, and adjacent to residential housing to the west, north and south, and rural property to the east.

This report details the following:

- site details and location
- vegetation classification
- site slope
- fire danger index
- potential bushfire impacts
- indicative Bushfire Attack Level (BAL) zones for the Lot.

The site assessment was undertaken on 21 August 2019 and the report has been prepared by Sue Brand, a Level 2 bushfire planning and assessment (BPAD) practitioner accredited with the Fire Protection Association of Australia.

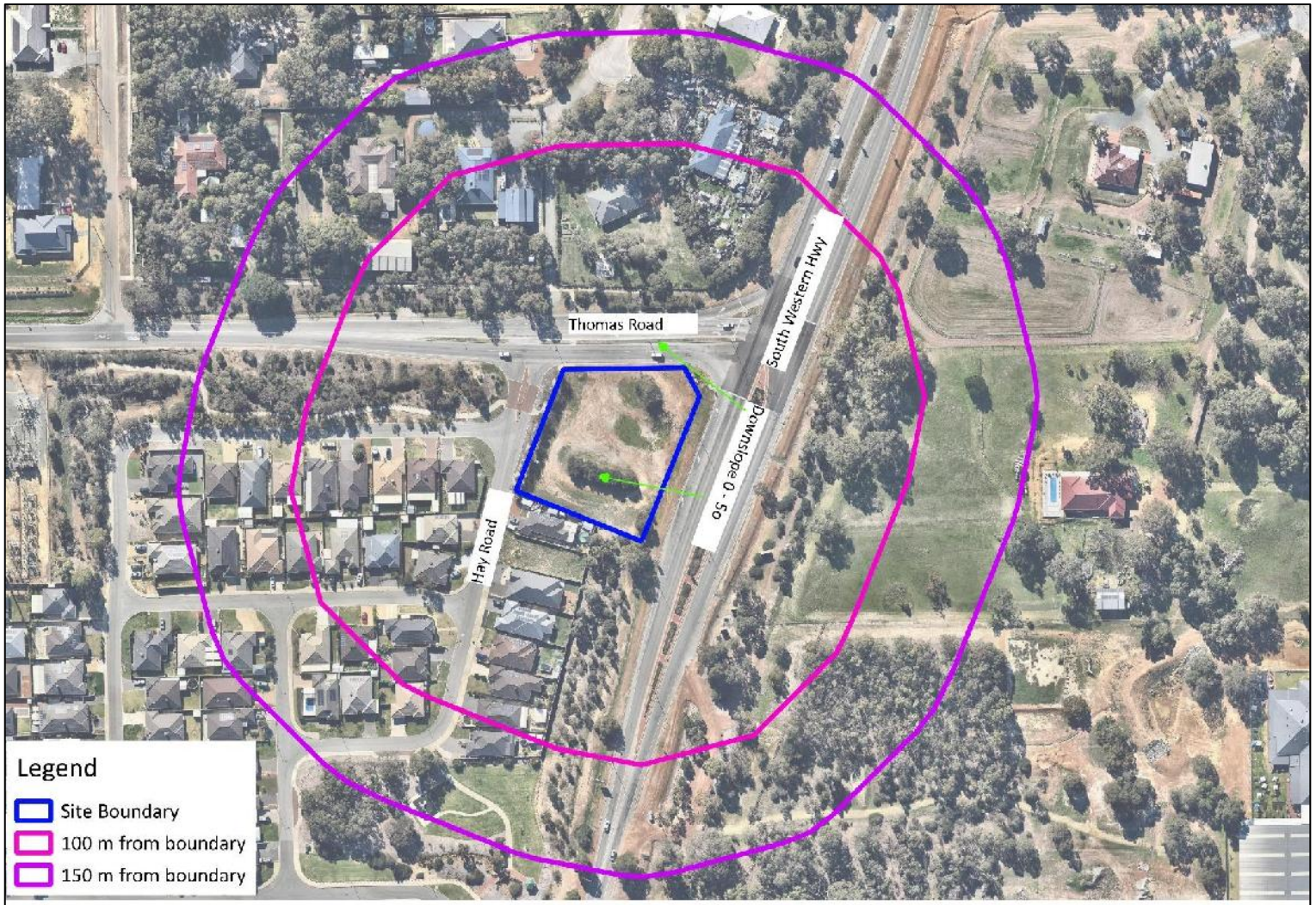


Figure 1:
Location and Slope,
640 South Western Hwy Byford

2.0 Bushfire Threat

2.1 Site Characteristics

2.1.1 Location

No. 640 South Western Hwy is located at the intersection of Hay Road, Thomas Road and South Western Hwy on the northern boundary of the town of Byford (Figure 1). The site is approximately 4.053 ha, and zoned urban development on the Byford Structure Plan (Shire of Serpentine-Jarrahdale, 2019).

2.1.2 Slope

The site has a gentle rise towards the east; meaning that to the west it is downslope 0 – 5^{o} (Figure 1)

2.1.3 Land use

The site is vacant land with some shrubs and grassy weeds present (Figure 2).

Figure 2: Land use, 640 South Western Hwy, Byford

2.2 Vegetation Classification

All vegetation within 100 m of the proposed Lots was classified in accordance with Clause 2.2.3 of *AS 3959 – 2018 Construction of Buildings in Bushfire-prone Areas* (Figure 9). The site is largely cleared with some remnant trees that will be cleared to accommodate the proposed development (Figures 1, 2). The predominant vegetation that will influence the BAL-ratings within the Lot is the Class B Woodland across South Western Hwy to the east.

2.2.1 Area 1: Class D Scrub – Exclusion Clause 2.2.3.2 (b)

Class D Scrub is present in the drainage reserve to the west of the site and is characterised by shrubs 2 – 4 m with a continuous canopy with occasional trees (Figure 3). This area of vegetation is downslope 0 – 5° and is associated with a creek line/drainage area. As this area is < 1 ha and is more than 40 m from low-threat vegetated areas in Aquanita Rise to the north and more than 100 m to the Class B Woodland located across South Western Hwy to the east, it is subject to exclusion clause 2.2.3.2 (b) of AS 3959 -2018.

Area 1 **Classification or Exclusion Clause** Class D Scrub – Exclusion Clause 2.2.3.2 (b)

Photo ID: 1

Photo ID: 2

Figure 3: Class D Scrub to the west and downslope of the site

2.2.2 Area 2: Class B Woodland – Exclusion Clause 2.2.3.2 (b)

Area 2 is Class B Woodland is present in a 0.1 ha stand in the rear of Lot 216 Aquanita Rise, across Thomas Road to the north (Figure 4). It is characterised by trees to 10 m with a canopy cover of around 30% over a grassy understorey. As this vegetation is < 1 ha (0.1 ha), more than 40 m from the Class D Scrub across Thomas Road and more than 100 m from the Class B Woodland located across South Western Hwy to the east, it is subject to Exclusion Clause 2.2.3.2 (b) of AS 3959 – 2018.

Area 2 **Classification or Exclusion Clause** Class B Woodland – Exclusion Clause 2.2.3.2 (b)

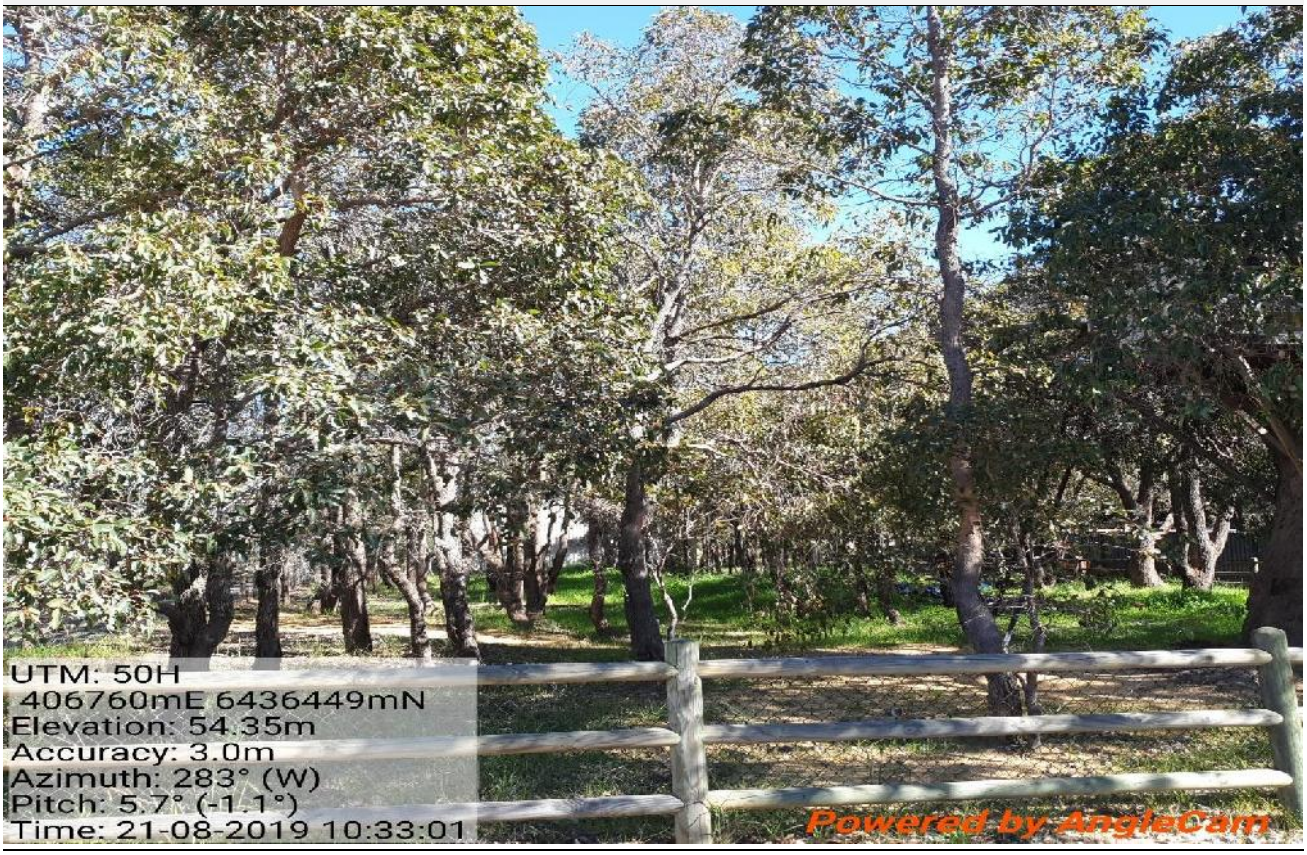


Photo ID: 3 - Lot 216 Aquanita Rise to the north

Figure 4: Class B Woodland < 1 ha across Thomas Road

2.2.3 Area 3: Class B Woodland

Area 3 is Class B Woodland present in a local reserve at Lot 2857 Linton St that backs onto South Western Hwy to the east (Figure 5). This vegetation is characterised by trees to 10 m with a canopy cover of around 30% over a grassy understorey, is upslope, and approximately 90 m from the site, thus is classified vegetation as per AS 3959 -2018. This vegetation will be retained in the longer term as it is associated with the Bowra and O'Dea Memorial Tree Park.

Area 3	**Classification or Exclusion Clause**	Class B Woodland

Photo ID: 4 – Lot 2857 Linton St to the east

Figure 5: Class B Woodland

2.2.4 Area 4: Class G Grassland

Class G grassland in the form of sown pasture is present in rural land across South Western Hwy to the east (Figure 6) and appears to be cultivated on a cyclic basis; a review of aerial imagery indicates the land has been cultivated since November 1953, the date of the first aerial image available for the site. This vegetation class is more than 60 m from the site and will have no influence on the BAL-rating.

Area 4	**Classification or Exclusion Clause**	Class G Grassland

Photo ID: 5

Figure 6: Class G Grassland in rural land across South Western Hwy

2.2.5 Area 5: Low-threat Vegetation

Low-threat vegetation is present in a nature strip along the perimeter of South Western Hwy to the east and Thomas Road to the north of the site (Figure 7). These are strips of vegetation less than 20 m wide or single rows of shrubs that act as a noise and visual buffer between houses with a frontage to South Western Hwy and/or Thomas Road, and are more than 20 m from classified vegetation. Similar vegetated buffers are present along the boundaries of several Lots in Aquanita Drive to the north where there is also evidence of management present in the form of irrigation pipes and sprinklers.

Area 5 **Classification or Exclusion Clause** Low-threat vegetation – exclusion clause 2.2.3.2 (f)

Photo ID: 6

Photo ID: 7

Figure 7: Low-threat vegetation – nature strip along South Western Hwy

2.2.6 Area 6: Non-vegetated Areas

Non-vegetated areas are present in and around the site, and includes roads, residential areas, footpaths and road verges (Figure 8); these areas are subject to exclusion clause 2.2.3.2 (e) of AS 3959 – 2018.

Area 5	**Classification or Exclusion Clause**	Non-vegetated areas – exclusion clause 2.2.3.2 (e)

Photo ID: 8

Figure 8: Non-vegetated areas, Hay Road, Byford

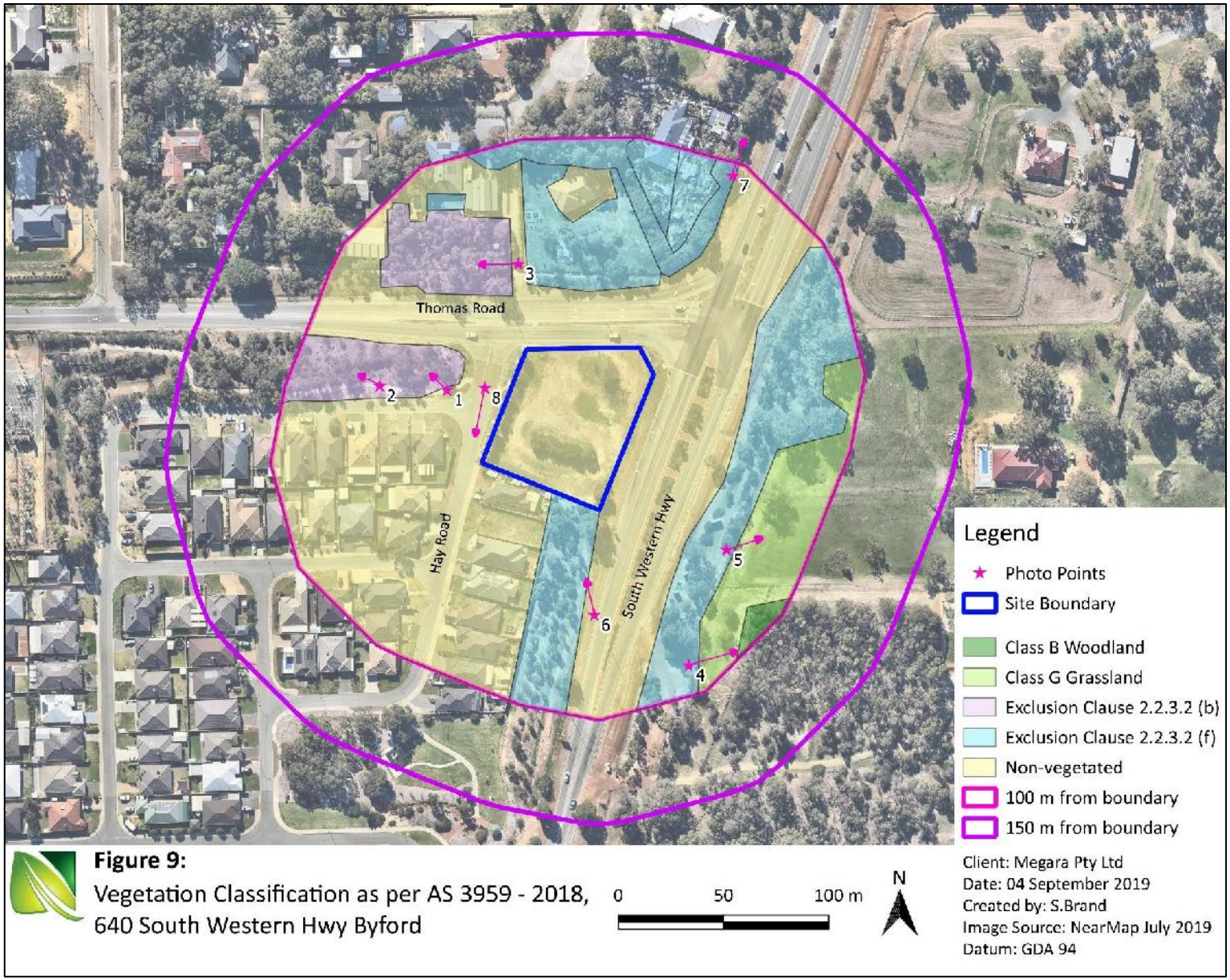


Figure 9:
Vegetation Classification as per AS 3959 - 2018, 640 South Western Hwy Byford

2.3 Bushfire Hazard Level

2.3.1 Relevant Fire Danger Index

The fire danger index for this site is FDI 80, as documented in Table 2.4.3 of AS 3959 and which is the nominated FDI for Western Australia.

2.3.2 Potential Fire Impacts

The potential fire impacts to the building could include smoke from fires beyond the immediate vicinity of the site. Table 1 summarises the separation distance and slope as it relates to the site.

Table 1: Separation distances from classified vegetation

Vegetation Class	Slope	Separation Distance (m)	BAL-rating
Class B Woodland	Upslope	89	BAL-12.5
Class B Woodland < 1 ha	Downslope 0 – 5°	33	Low – Exclusion Clause 2.2.3.2 (b)
Class D Scrub < 1 ha	Downslope 0 – 5°	25	Low – Exclusion Clause 2.2.3.2 (b)
Class G grassland	Upslope	> 60	Low
Other low-threat vegetation	Downslope 0 – 5° and Upslope	> 25	Low – Exclusion Clause 2.2.3.2 (f)
		Overall BAL-rating	**BAL-12.5**

2.4 Bushfire Attack Level

As the only classified vegetation is the Class B Woodland located in Lot 2857 Linton Ave across South Western Highway to the east, it will determine the bushfire attack level (BAL) at 640 South Western Hwy. A BAL-contour diagram has been prepared showing the extent of each BAL-zone within the site (Figure 10). Depending on the proposed building layout when development occurs, a maximum rating of BAL-12.5 may apply, with the actual being confirmed when the building configuration is known.

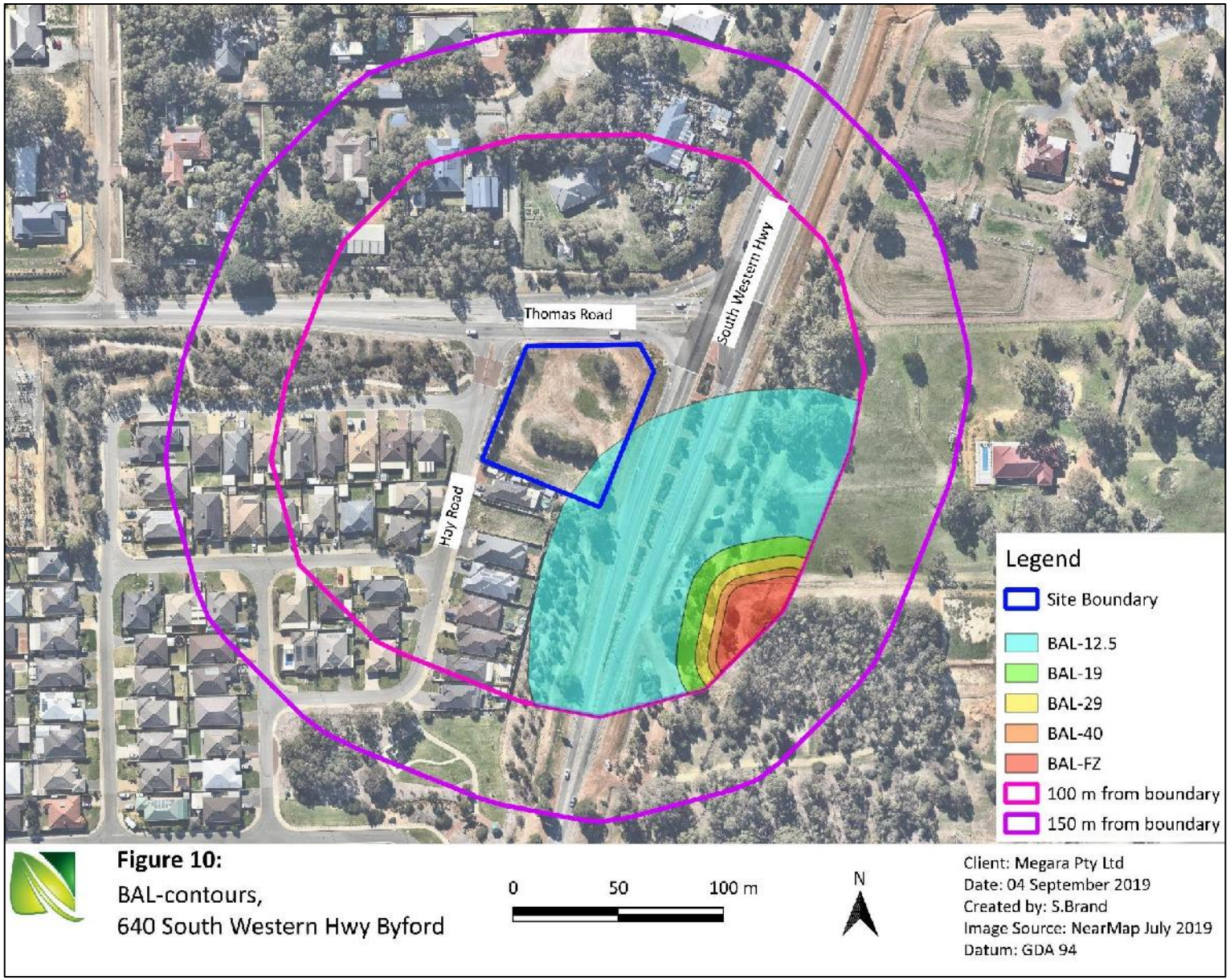


Figure 10:
BAL-contours,
640 South Western Hwy Byford

3.0 Compliance and Justifications

3.1 SPP 3.7 Objectives and Application of Policy Measures

The intent of *State Planning Policy (SPP) 3.7 Planning in Bushfire Prone Areas* (Department of Planning and Western Australian Planning Commission, 2015) is to ensure that bushfire risks are considered in a timely manner and that planning documents demonstrate the appropriate application of the various policy measures. Table 2 summarises the intent and objectives of SPP 3.7 and provides evidence of how 640 South Western Hwy Byford complies.

Table 2: Evidence of compliance with SPP 3.7 intent and objectives

SPP Reference	Description	Evidence of Compliance
Intent	▪ Ensure that risks associated with bushfires are planned using a risk-based approach	▪ Undertaking a BAL-assessment and documenting in report that complies with SPP 3.7 ▪ Hazard assessment indicates risks associated with bushland are manageable
Objective 1	▪ Avoid any increase in the threat of bushfire to people, property and infrastructure	▪ Hazard assessment indicates risks associated with bushland are manageable ▪ A maximum BAL-12.5 rating applies to the south-eastern portion of the Lot
Objective 2	▪ Reduce vulnerability to bushfire	▪ Hazard assessment indicates risks associated with bushland are manageable ▪ A maximum BAL-12.5 rating applies to the south-eastern portion of the Lot
Objective 3	▪ Ensure that higher order strategic planning documents and proposals consider bushfire protection requirements at an early stage	▪ The BAL-assessment applies to the proposed service station at the site, and which has been determined ahead of building
Objective 4	▪ Achieve an appropriate balance between bushfire risk management and biodiversity conservation	▪ Conservation of biodiversity has been considered during earlier planning stages

3.2 Bushfire Protection Criteria

Table 3 demonstrates how development of 640 South Western Hwy complies with Bushfire Protection Criteria. No other bushfire protection mechanisms are required.

Table 3: Compliance with bushfire protection criteria

Intent	Performance Principle	Solution
Element 1: Location		
Ensure subdivision and development applications are located in areas with the least possible risk of bushfire	▪ Bushfire hazard assessment is or will on completion be moderate or low ▪ BAL-rating is BAL-29 or lower	▪ The service station will be constructed in an existing Lot zoned urban development ▪ Bushfire hazard assessment indicates the risk is manageable ▪ A maximum BAL-12.5 rating applies to the south-eastern portion of the Lot
Element 2: Siting and Design of Development		
Siting and design of development minimises the level of bushfire impact	▪ Siting and design of development is appropriate to the level of bushfire threat and minimises risk to people, property and infrastructure	▪ Bushfire hazard assessment indicates that the bushfire risk is manageable ▪ A maximum BAL-12.5 rating applies to the south-eastern portion of the Lot
Element 3: Vehicular Access		
Vehicular access servicing a subdivision is available and safe during a bushfire event	▪ Internal layout, design and construction of public and private vehicular access and egress in the subdivision allow emergency and other vehicles to move easily and safely at all times	▪ Access will be via the existing road network, with no additional road construction within or in the immediate vicinity of the site ▪ Site fronts three roads, namely Hay Rd, Thomas Rd and South Western Hwy
Element 4: Water		
Water is available to the subdivision, development or land use to enable people, property and infrastructure to be defended from bushfire	▪ Subdivision is provided with a permanent and secure water supply that is sufficient for firefighting purposes	▪ Site is located in a reticulated water supply area

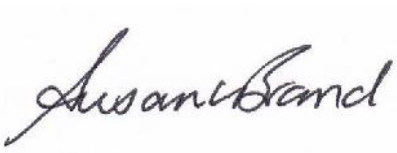
3.3 Compliance with Relevant Documents

Sections 3.1 and 3.2 demonstrate how the construction of the proposed service station at 640 South Western Hwy Byford complies with *State Planning Policy 3.7* (Department of Planning and WA Planning Commission, 2015) and *Guidelines for Planning in Bushfire Prone Areas* (Department of Planning, Department of Fire and Emergency Services and WA Planning Commission, V1.2, 2017).

The owners must comply with relevant sections of the annual firebreak notice and bushfire information prepared by the Shire of Serpentine Jarrahdale, such as total fire ban and hazard reduction programs.

3.4 Compliance Statement

This BAL-assessment report has been prepared in accordance with the requirements of *State Planning Policy 3.7 Planning in Bushfire Prone Areas* (Department of Planning and Western Australian Planning Commission, 2015) and *Guidelines for Planning in Bushfire Prone Areas* (Department of Planning, Lands and Heritage, the Western Australian Planning Commission, and the Department of Fire and Emergency Services, V1.2, 2017). The BAL-contour map was prepared in accordance with the simple procedure (Method 1) of AS 3959 - 2018. The BAL-rating contours are accurate as at 31 October 2019.



Signed:
Dated: 31 October 2019
Accreditation Number: 36638
Accreditation Expiry Date: 30 April 2020

BPAD Bushfire Planning & Design Accredited Practitioner Level 2

4.0 References

AS 3959 – 2018 Construction of Buildings in Bushfire Prone Areas

Department of Planning, Lands and Heritage, the Western Australian Planning Commission, and the Department of Fire and Emergency Services, (2017), *Guidelines for Planning in Bushfire Prone Areas* (V1.2), Western Australian Planning Commission, Perth, Western Australia.

Department of Planning and the Western Australian Planning Commission, (2015), *State Planning Policy (SPP) 3.7 Planning in Bushfire Prone Areas*, Western Australian Planning Commission, Perth, Western Australia.

Shire of Serpentine Jarrahdale, (2017), *Online Mapping*, accessed September 2019 via http://sjsmunadmz2.sjshire.wa.gov.au/intramaps80/.