Attachment 1

Submission

Perth and Peel@3.5million






shire of kalamunda

Contents

1.0 Draft Perth and Peel@3.5million

The *Draft Perth and Peel@3.5 million* document is the long awaited strategic vision document for Perth and Peel. It acknowledges the reality of the historic and future population expansion in the region and positions itself as a strategic suite of documents that will provide a large level of certainty on our ability to provide the land, the infrastructure and the services for the predicted population of 3.5 million in the next 40 years.

The draft document concerned itself with the sustainable future of growing the Perth and Peel regions. It identifies a connected city as the blueprint for such growth and builds a framework that will provide State Government bodies, individual local governments, developers and other stakeholders with the knowledge of the future potential of the land.

The Shire of Kalamunda has worked closely with the Department of Planning (DoP) on three of its past strategic projects: the Shire's Local Planning Strategy, endorsed by the WAPC in 2013, the Bushfire Prone Mapping, currently with the WAPC for their endorsement and the Forrestfield North District Structure Plan. Those projects were fed into the compilation of the data by the DoP in order to inform the *Draft Perth and Peel@3.5million*, as it relates to our area, however are not necessarily evident in the resulting frameworks.

The Shire of Kalamunda appreciates the opportunity to comment on the draft document and hopes that further discussion relating to a number of issues pertinent to its area will be initiated through this submission.

In response to the *Draft Perth and Peel@3.5million,* the Shire has identified the following pertinent issues:

1.1 Methodology

The Shire of Kalamunda is extremely disappointed by the lack of engagement and consultation that the State Government undertook in creating this document. Contemporary planning practice has encouraged the Urban Planning profession to move to more inclusive and collaborative approaches to development of strategic planning documents such as this. The *design and defend* approach taken in this circumstance, not only has created and disappointing outcome for local government, but has resulted in an incredibly flawed development of the sub regional frameworks.

With the input of local governments to help develop and review the draft plan, mistakes, such as the deletion of areas already identified for future development in WAPC endorsed documents, could have been avoided. This is despite repeated requests for information and offers of assistance by local governments to ensure that the document was accurate and robust.

The Shire of Kalamunda has been unable to ascertain exactly how the conclusions drawn in the draft Plan and Framework were formulated, despite repeated requests for further information. It is concerning that there is no commentary on the methodology employed by the report's authors or why the Shire's Local Planning Strategy, which was only adopted in 2013, appears to be simply ignored.

Recommendation

1. That the Commission publish a detailed methodology of how the conclusions of the Sub-Regional Frameworks were developed, including all supporting documentation.

2. That the Department consult and engage in meaningful dialogue with Local Government prior to the finalisation of the Sub Regional Frameworks.

1.2 Urban Versus Suburban

The document makes the assumption that, given the opportunity, the majority of people would prefer to live in the Central sub-region, and the document proposes to facilitate this by placing more than 55% of the urban infill in that region. All the outer regions combined will provide less infill opportunities than the Central sub-region. While that is in line with the key principle of this strategy, to house people close to the work opportunities, from the Shire of Kalamunda's perspective, there seems to be some opportunities lost.

The construction of the Forrestfield Airport Rail Link, the future land use planning around the station including a district level centre and associated Transit Oriented Development, and the existing and proposed industrial area to the east of the Perth airport, with supporting employment options, have not been sufficiently represented as opportunities to develop a wider urban catchment in the Foothills in the future. This argument will be further addressed in relation to the specific Draft North-East Sub-Regional Planning Framework.

The Shire engaged AECgroup to produce and economic analysis of the proposed TOD development, which concluded that the Shire should plan for a District Centre in the study area. This development will in the longer term increase the self-sufficiency from the existing 61.6% currently present in the region.

Recommendation

3. Recognise the development of the Forrestfield Train Station Site as a new activity centre.

1.3 Developer Contributions

Most local governments, including the Shire of Kalamunda, are supportive of achieving higher density development in appropriate areas. However, the delivery and upgrading of infrastructure has been, and will likely be, the most restrictive factor in achieving infill residential development. The costs of upgrading required infrastructure (roads, sewer, water, power) of these infill developments can be in the millions of dollars. The solution for this is for developers to fund the required upgrades. As the Department is aware, fragmented land ownership and differing timeframes and agendas of landowners can pose a significant obstacle for a coordinated approach to upgrading infrastructure.

While developer contributions arrangements are a good tool for managing infrastructure upgrades, there have been some issues that stop them being used. The first issue is that, over large areas, the 'need and nexus' as dictated by the State Planning Policy 3.6 cannot be satisfactorily demonstrated. This leaves landowners to pay the costs individually, as and when required, which can dramatically slow or stall development.

The second issue is that there is currently no requirement for any area to have a development contribution arrangement in place prior to development or subdivision. Current provisions under State Planning Policy 3.6 give guidance on how and when to implement DCPs, but the local planning scheme does not require it prior to development. The policy states that a local government may require a DCP but a local government may not withhold its support for development if there is no DCP in place. This causes incongruent and inefficient development taking place without direction or expectations.

The third issue is that upgrades can only take place, when money has been collected by the fund. Because of the way developer contributions work, landowners only pay their contribution once they have subdivided. Many landowners cannot subdivide, however, without certain infrastructure in place. And if they cannot subdivide, then they cannot be asked to pay their contribution. For this cycle to break, a party needs to front the costs and be reimbursed at a later date. Unfortunately, not many landowners are willing to pay over a million dollars for certain infrastructure upgrades, even if they will be reimbursed later.

Consideration should be given to the time at which developer contributions fall due. Traditionally this is at development clearance or approval, which impacts the timeliness of the payments. If developer contributions were payable at point of sale of any land that was subject to a developer contribution, this would have a two-fold benefit in ensuring that land price was not artificially inflated by rezoning as well as ensuring timely payment of contributions. This in turn may benefit housing affordability.

Lastly, local governments who administer developer contribution arrangements are unfairly compromised through the reporting of local government ratios. Whilst the local governments are undertaking work that would ordinarily be the responsibility of the developer, the cost of the works are taken into account in the local government's reportable renewal ratio.

Given that the future delivery of a significant portion of the city's future growth is dependent on fragmented land being developed, it is integral that the Department ensure that there are

development models that will support infrastructure development. Without considerable examination of the functionality of SPP 3.6, there is likely to be a reluctance by local governments to recode areas to allow for infill.

Recommendation

4. Consideration regarding developer contributions and the responsible parties for initially funding infrastructure upgrades. The main document should outline where the developer contributions should be used.

5. The review of State Planning Policy 3.6 as a priority, to ensure that it adequately addresses greenfield and brownfield development.

6. Service agencies be required to provide seed funding for infrastructure upgrades and recuperate their costs either through a developer contributions scheme that they themselves manage, or through a special area rate that applies to all new dwellings.

7. Investigation into the impact of making developer contributions payable when land is sold.

8. Review the way developer contributions are considered and reported in local government budgeting and reporting.

1.4 Aged Care

The ageing of the population is believed to be one of the most significant challenges facing the nation in the future and will have a major impact on the delivery and built form of a city of 3.5 million people. It was estimated through the Shire's Local Planning Strategy that, by 2031, 1 in 3 people will be over 55 and half of that group will be over 70 years of age. Neither of the draft documents provides guidance or information on a number of issues surrounding aged care.

Regional aged care facilities will be required as the number of frail and elderly people rises. High care facilities benefit from economies of scale and need appropriate high level planning in order to attract the developers capable of providing such facilities in appropriate locations.

On the local scale, aged and dependent persons' dwellings can be used to cater for self-sufficient residents. There are incentives in place to encourage these sorts of developments but there are no monitoring instruments in place to track their development.

In the Shire's opinion, the Draft Perth and Peel@3.5million as well as the Sub-Regional Planning Frameworks should address the issue in specific detail, given its planning implications for all levels of government. The predicted figures and the discussion on the region's needs and ability to provide for ageing population would have been a helpful guidance for local governments when working to provide the aged housing and high care facilities.

Due to low housing affordability in Perth, ageing in place has been gaining in popularity. The State government encourages high density living, but provides little guidance on design elements that can help provide development options for helping people age in place.

Consideration of sites that allow for transition from independent living through to assisted and

eventually residential care within the same facility should be investigated. It is recognised that such Integrated Aged Care sites require larger land areas than conventional nursing home type developments. Land of an appropriate size (6+ hectares) is generally only available on the fringe in rural areas. Consideration should be given to the highest and best use of these sites in the context of the delivery of aged care.

The Shire has been working with a number of stakeholders on a steering group, chaired by Ken Wyatt (Federal Member for Hasluck) investigating the potential sites for aged care. The preliminary findings are that the land is in short supply. The Shire is also aware of alternative models of delivery, such as hub and spoke, however suitable analysis is required to determine what development typologies will assist in the effective delivery of care which addresses the needs of the growing population.

Complementary services such as health care and recreation should be identified wherever strategic aged care facilities are provided; whether that be through the sub-regional framework or another mechanism.

Recommendation

9. Additional information and analysis of the planning for an ageing population should be incorporated in the final documents.

10. Land for high care aged facilities should be identified on the sub-regional plans. To circumvent constraining a certain landowner, the plans could show a number of potential locations or an area where a facility could be located.

11. Specific targets should be set for local aged care dwellings in each local government authority, based on local demographics and locational suitability. Guidance should also be provided to inform local governments on how to encourage more aged care dwellings to be developed.

12. Investigate the suitability of land on the fringe of the metropolitan area to be used for aged care, given the opportunities to acquire larger sites.

13. The State Government should develop additional information for developers and prospective purchasers on housing options suitable for ageing in place.

1.5 Implementation

Much of the detail of how the plan will be implemented is unclear at this time. Of the 50 suggested actions in the plan, 45 list Local Government as being a responsible agency for implementation. However it remains quite unclear about who is the lead agency ultimately responsible.

It is noted through other proposed changes, such as the Planning and Development (Local Planning Schemes) Regulations 2015, the WAPC will be responsible for the determination of a wider range of matters, such as Local Structure Plans. It is of concern to the Shire, that the implementation of the Perth and Peel strategy and framework will be compromised, unless the

Department grows in size to accommodate the amount of work required to implement this scheme, as well as provide for the determination of a range of new application types.

Clearly there is substantial additional work to be done in this area and it will be important that there is clear two-way dialogue with local government about the expectations of the Commission to ensure that there is capacity within the industry to deliver the final plan.

Recommendation

14. Establish a lead agency for each of the implementation actions.

15. Ensure that the Department of Planning is suitably resourced to undertake the development work ahead.

16. Ensure appropriate local government representation during planning for the implementation of the frameworks.

2.0 North East Sub-Regional Planning Framework

Consolidated Urban Form

The Shire of Kalamunda's Local Planning Strategy, approved by the WAPC in 2013 was based on the urban targets set out by Directions 2031. The Key Planning Elements Plan (Attachment 1) presented the scenario for the population increase of 30,000 by the year 2031. This plan, which was adopted by the Shire of Kalamunda's Council and the WA Planning Commission identified a number of areas for future Urban Investigation, based on those figures.

The North East Sub-Regional Planning Framework predicts that the population of the Shire will almost double in the next 40 years and yet, the Framework Plan excluded all of the land identified as Foothills Investigation Area from the land with future urban potential. This discrepancy between forecast population and provision of developable land, particularly considering that the draft Planning Framework looks 20 years further than Directions 2031, would appear to be a major oversight.

The Shire's Local Planning Strategy acknowledged that the majority of areas identifies as Investigation Areas will have to be subject to comprehensive planning and analysis of, amongst others, bushfire, servicing and biodiversity protection issues, prior to any future rezoning. The Shire believes that all the areas shown as Foothills Investigation Areas in the Shire's Local Planning Strategy should be identified as Urban Expansion in the framework.

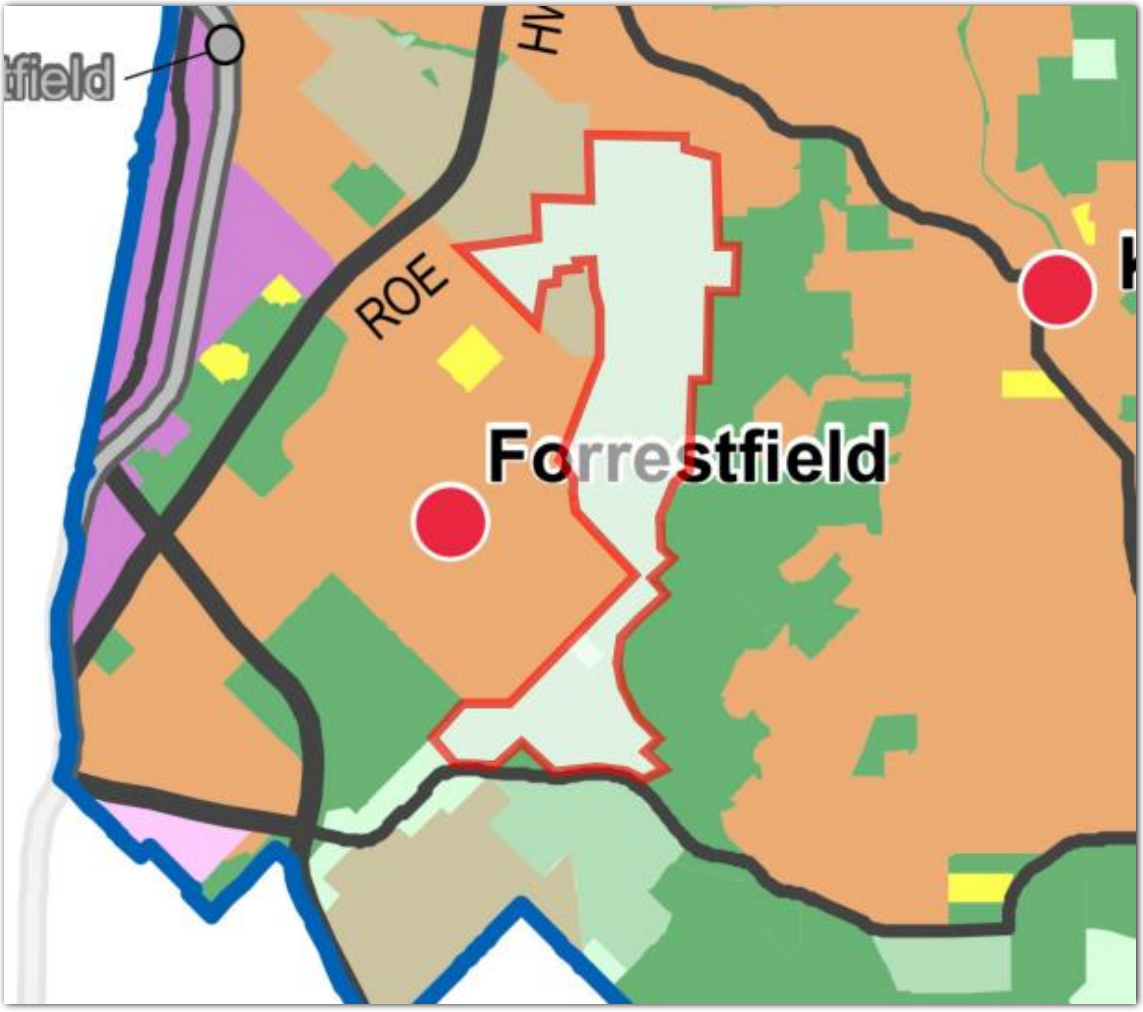
In order to support the Shire's submission to the Draft North East Sub-Regional Planning Framework, the Shire compiled broad level bushfire risk, servicing and environmental studies for the areas discussed below. The findings of these studies will be presented in the submission and are attached to this report, for your information.

2.1 Area 1: Foothills Investigation Area

2.1.1 Local Planning Strategy

The Shire's Local Planning Strategy (LPS) was endorsed by the WAPC in 2013. Included in the LPS is the 'Foothills Investigation Area', which identifies large areas of Wattle Grove, Forrestfield, and High Wycombe as an area with future subdivision potential. The Strategy outlines the intention to increase density in this area following detailed investigations including servicing, bushfire risk, biodiversity protection and structure planning. The North East Sub-Regional Framework, however, has excluded this area from any urban expansion potential.

The Shire's target for infill by 2050 is 11,000 new dwellings. Initial calculations estimate that the Foothills Investigation Area alone could support over 7,000 new dwellings.



As stated in the main document and the North East Framework, the Department of Planning has chosen areas of Urban Expansion by their strategic need, bushfire risk, environmental significance and infrastructure servicing. Apart from being necessary in meeting the Shire's infill targets, this area has been identified in the Local Planning Strategy as having a close proximity and necessary connections to the Perth CBD and other employment centres. This advantage is now substantially increased by the 2020 construction of the Forrestfield Airport Rail Link that will bring a convenient public transport connection within the 3 km of this area.

The exclusion of the area from a future Urban Expansion area ignores the strategic decision made by the Shire and the WA Planning Commission at the time. The decision also does not take into account the substantial change in the area's ability to be connected with the major employment centres of Perth Airport, the existing and planned industrial areas of Forrestfield and Kewdale and Perth CBD in the medium to long term.

Building on the Local Planning Strategy recommendation of Residential Bushland R2.5-R5 zoning potential for this area, in the light of the Forrestfield Rail Link Train Station and the new level of public transport connectivity, and the supporting employment opportunities, we believe that this area should now be considered for urban densities of up to R40.

It is noted that the then Department of Planning and Urban Development conducted studies into the development of the region in the 1990s, at which time there was resistance to development. Through the Shire's consultation on the Local Planning Strategy and additional direct contact by land owners, the Shire is aware of growing pressure to re-examine these conclusions. When considered in the context of the Perth region as well as future investment in the area, there are compelling grounds to reconsider the conclusions of the 1992 Foothills Structure Plan.

In order to demonstrate the relevance and the importance of the inclusion of this area in the Urban Expansion zone in the North East Sub Regional Planning Framework, the Shire has engaged a number of consultants in order to address the concerns that the Department of Planning may have had while assessing the area's suitability for future urban expansion.

2.1.2 Bushfire Risk Analysis

As detailed in the attached bushfire report (Attachment 2), bushfire risk can be managed in the Foothills area as long as appropriate mitigation measures are put in place. The bushfire risk was assessed assuming a development of the area at up to Residential R40.

The majority of bushfire threat within the area would be removed through the clearing of land as part of redevelopment. However, for areas adjacent to the subdivision (escarpment), the bushfire risk remains. The report identifies an extreme bushfire risk along the entire eastern edge of the Foothills Investigation Area. As a result, the report states that subdivisions and properties within 100m of bushland will need to comply with improved construction standards or other mitigation measures.

The measures applicable may include:

- Hazard separation zones of up to 100m between new properties and bushland of moderate or extreme bushfire risk. This zone can include roads, open grassed areas or other low fuel zones. This zone can only be achieved through the removal of bushland, not through the reduction of fuel loads.
- If the 100m buffer zone cannot be met, construction standards would be necessary to achieve a minimum of BAL 29.
- Vegetation separation distances reduced in accordance with performance based outcomes such as in AS3959-2009.
- A minimum of 20m building protection zone.

The proposed measures are not overly onerous, and can reasonably be accomplished through the planning and development process.

The rezoning of the area of this size would allow for some broad bushfire mitigating measures to be implemented, which would ultimately result in the better planning outcome.

2.1.3 Environmental Study

The Shire engaged a consultant to determine environmental impacts of the proposed development in this area (Attachment 3). The consultant identified the following characteristics of the area:

- The majority of the area has low to moderate risk of acid sulfate soils;
- The area contains small pockets of native remnant vegetation mostly as an ecological corridor from the more urbanized area of Forrestfield to the eastern boundary along the Scarp;
- One bush forever site exists adjacent to Welshpool Road East;
- Nine environmentally sensitive areas exist, typically within the southern portion; and
- There are no significant wetlands in the study area.

Key environmental values are associated with the bush forever site on Welshpool Road and the identified Environmentally Sensitive Areas. The study suggests that adequate protection can be provided for these areas in order to enable future residential development. Typically this would be through the structure planning process where sensitive areas could be protected.

2.1.4 Servicing Study

The Shire engaged a consultant to determine the current and projected level of servicing required for sewer, water, power, telecommunications and gas supply (Attachment 4).

Sewer

The Water Corporation has provided long term planning for wastewater reticulation in this area, however they have not completed detailed planning for provision of wastewater assets over the Investigation Area based on the proposed Residential zoning as at the time of this report.

Due to strong topographical changes, a gravity sewer system can be design in this area.

The Foothills Investigation Area falls into three different Water Corporation catchments, Gooseberry Hill to the north, Forrestfield in the central catchment and Wattle Grove to the south.

To the north, Water Corporation planning shows a series of proposed services that should be robust enough for a dwelling yield of R30. This includes the extension of assets through the Forrestfield North DSP area along Berkshire Road (375mm) and Sultana Road West (300mm).

The central catchment between Berkshire Road and Welshpool Road does not appear to currently

be in Water Corporation Planning and will need to be planned. The infrastructure extensions required for this catchment will be more complex in the short to medium term and should be discussed with the Water Corporation. The forecast requirements, as part of this preliminary study, indicate the need for a 450mm primary distribution main which drains generally to the south and particularly toward infrastructure in Brentwood Road.

In the south, the Water Corporation has planned extensions to the area directly south-west of the Foothills Investigation Area. These extensions could be brought further into the Foothills Investigation Area to enable residential development. It would likely require a 375mm primary distribution main in the catchment, leading to the 600mm main in Bickley Road.

In summary, the distribution of wastewater services in the Investigation Area is predicated on the construction of services to the west in Forrestfield North DSP area and in Wattle Grove/Kenwick North. The timing for the extension of these services can be confirmed through the planning phases.

Water

In the northern and central catchment, major infrastructure traverses the catchment from north to south. The Canning Foothills Trunk main provides sufficient infrastructure for future residential servicing in this location. Existing water mains are available in most existing road reservations in the catchment.

The southern catchment includes the Canning Trunk Main, with the Canning Foothills Trunk Main branching off at Hale Road. In discussions with the Water Corporation, the consultants identified that a network of local infrastructure can be planned pending confirmation of road layouts. Existing water mains are available in most existing road reservations in the catchment.

Each of the southern, central and northern catchments can be serviced with a suitable network of potable water infrastructure with the Canning Foothills Trunk Main providing an effective spine throughout each of the catchment areas. The information provided in the servicing study represents the first step in a detailed planning process.

Further to this, the Shire's innovative approach to stormwater harvesting is working to increase water availability in the region. Managed aquifer recharge will increase the availability of sustainable water supplies for open space, meaning that this region will be able to manage more intensive use of playing fields and parklands which a higher population will bring.

Power

Requirements for power will be met and managed by Western Power. Western Power will review planning information through the District Structure Plan and Local Structure Plan phases of this project.

Telecommunications

Telstra/NBN Co. will meet requirements for telecommunications at the time of subdivision application and submission of detailed design plans for coordination. The NBN Co. is likely to be

a potential supplier if larger developers take significant expanses of land and submit development layouts with greater than 100 lots (or equivalent thereof).

Gas

The road network is generally serviced by ATCO Gas in the northern catchment as shown in the Perth North infrastructure map below, however minimal existing infrastructure is available in the central and southern catchments.

Conclusion

The contradiction between the sub-regional framework and the Local Planning Strategy should be rectified to ensure a consistent approach to infill development. Services are planned for the area and can be further developed through an appropriate staging process, even up to medium density development. The Shire respectfully requests that the entire Foothills Investigation Area be shown on the draft framework as Urban Expansion. This area is identified as potential urban development in preceding planning studies and the Shire has a full understanding of the issues that need to be addressed in order to progress further planning stages.

Due to the new train station positioned within 3 km, and the existing and future employment opportunities, this area should be prioritised for medium to long-term urban potential. By including this area in the land identified for future urban, the Shire of Kalamunda could readily meet and exceed its target for infill development, reducing the pressure for land development in areas more removed from the urban front.

Recommendation

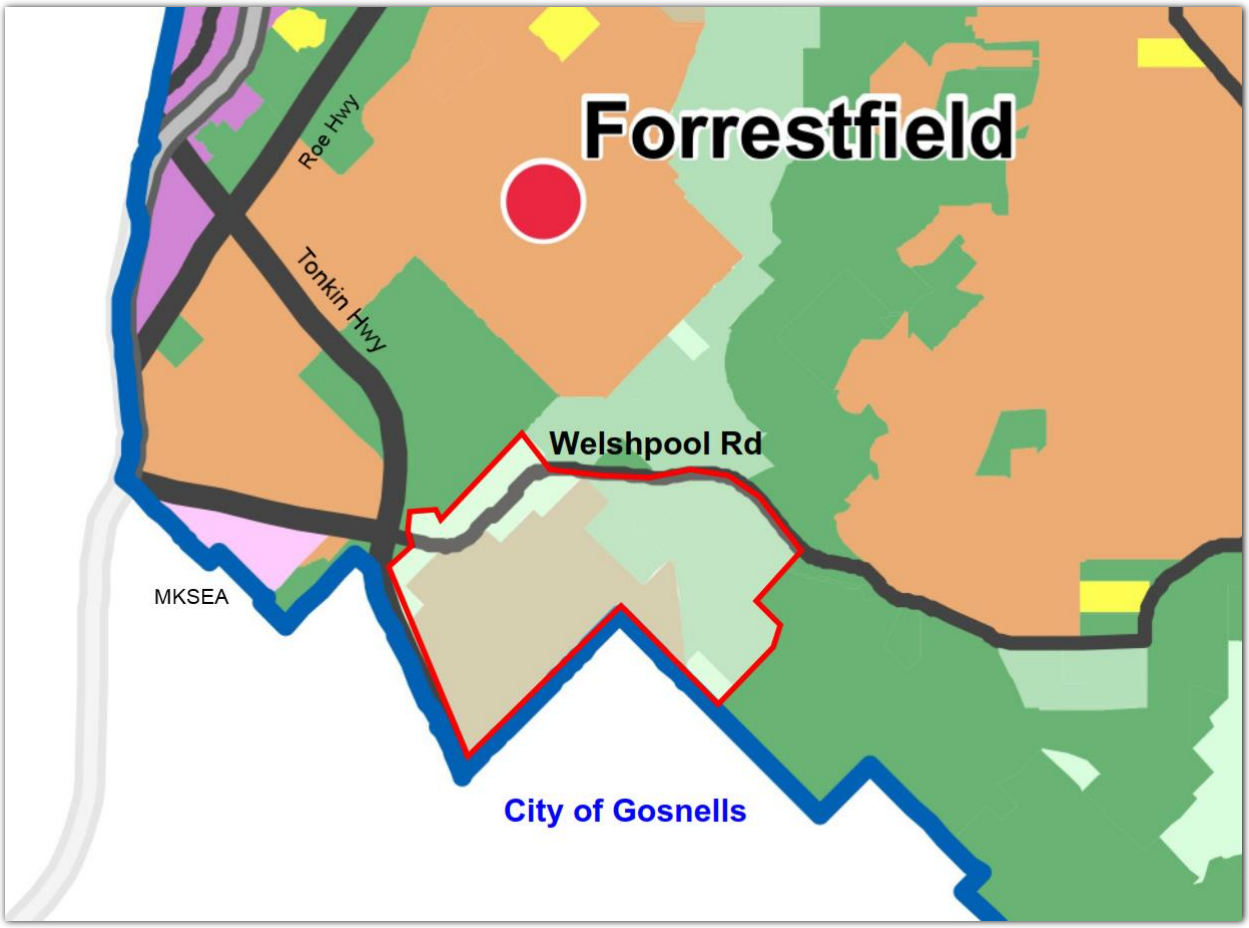
17. That Area 1 - Foothills Investigation Area be identified in the Sub Regional Framework as Urban Expansion

2.2 Area 2: Wattle Grove South

2.2.1 Local Planning Strategy

Under the Shire's Local Planning Strategy, a portion of this area was identified as Urban Investigation Area and an area to the East and North identified as part of the Foothills Investigation Area (Attachment 1).

The Sub-Regional Framework identifies an area, loosely based on the Shire's identified Urban Investigation Area as Urban Expansion, however, the plan leaves a significant portion of Wattle Grove as Rural Residential. Continuing on our argument to include the Foothills Investigation Area in Urban Expansion, the Shire considers that the identified Urban Expansion area, in its current form, does not represent the most logical expansion of the urban area and excludes a large amount of land with a good potential for future urban. The Wattle Grove area is possibly the best connected area in Kalamunda foothills. It is placed conveniently close to Tonkin and Roe Highways and is less than 25 minutes away from the Perth CBD. This positioning was recognised through the Local Planning Strategy and we believe it should also be acknowledged through the North East Sub-Regional Planning Framework.



Again, it is noted that the 1992 Foothills Structure Plan conclusions are in need of reconsideration, given the changing attitudes to development of some land owners and the future investment in the region.

2.2.2 Bushfire Risk Analysis

As detailed in the attached bushfire report (Attachment 2), bushfire risk can be managed in the Wattle Grove South area as long as appropriate mitigation measures are put in place. The bushfire risk was assessed assuming a development of the area at up to Residential R40.

The majority of bushfire threat within the area would be removed through the clearing of land as part of redevelopment. However, for areas adjacent to the subdivision (escarpment), the bushfire risk remains. The report identifies an extreme bushfire risk along the entire eastern edge of the Wattle Grove South area. As a result, the report states that subdivisions and properties within 100m of bushland will need to comply with improved construction standards or other mitigation measures.

The measures applicable may include:

- Hazard separation zones of up to 100m between new properties and bushland of moderate or extreme bushfire risk. This zone can include roads, open grassed areas or other low fuel zones. This zone can only be achieved through the removal of bushland, not through the reduction of fuel loads.
- If the 100m buffer zone cannot be met, construction standards would be necessary to achieve a minimum of BAL 29.
- Vegetation separation distances reduced in accordance with performance based outcomes such as in AS3959-2009.
- A minimum of 20m building protection zone.

The proposed measures are not overly onerous, and can reasonably be accomplished through the planning and development process.

The rezoning of the area of this size would allow for some broad bushfire mitigating measures to be implemented, which would ultimately result in the better planning outcome.

2.2.3 Environmental Study

The Shire engaged a consultant to determine environmental impacts of the proposed development in this area (Attachment 3). The consultant identified the following characteristics of the area:

- The majority of the area has low to moderate risk of acid sulfate soils;
- The area contains small pockets of native remnant vegetation mostly as an ecological corridor from the more urbanized area of Forrestfield to the eastern boundary along the Scarp;
- One bush forever site exists adjacent to Welshpool Road East;
- Nine environmentally sensitive areas exist, typically within the southern portion; and
- There are no significant wetlands in the study area.

Key environmental values are associated with the bush forever site on Welshpool Road and the identified Environmentally Sensitive Areas. The study suggests that adequate protection can be

provided for these areas in order to enable future residential development. Typically this would be through the structure planning process where sensitive areas could be protected.

2.2.4 Servicing Study

The Shire engaged a consultant to determine the current and projected level of servicing required for sewer, water, power, telecommunications and gas supply (Attachment 4).

Sewer

The Water Corporation has provided long term planning for wastewater reticulation in this area, however they have not completed detailed planning for provision of wastewater assets over the Investigation Area based on the proposed Residential zoning as at the time of this report.

Due to strong topographical changes, a gravity sewer system can be design in this area.

In the Wattle Grove South area, the Water Corporation has planned extensions to the area directly south-west of the area. These extensions could be brought further into the Wattle Grove South area to enable residential development. It would likely require a 375mm primary distribution main in the catchment, leading to the 600mm main in Bickley Road.

The timing for the extension of these services can be confirmed through the planning phases.

Water

The southern catchment includes the Canning Trunk Main, with the Canning Foothills Trunk Main branching off at Hale Road. In discussions with the Water Corporation, the consultants identified that a network of local infrastructure can be planned pending confirmation of road layouts. Existing water mains are available in most existing road reservations in the catchment.

Wattle Grove South can be serviced with a suitable network of potable water infrastructure with the Canning Foothills Trunk Main providing an effective spine throughout each of the catchment areas. The information provided in the servicing study represents the first step in a detailed planning process.

Power

Requirements for power will be met and managed by Western Power. Western Power will review planning information through the District Structure Plan and Local Structure Plan phases of this project.

Telecommunications

Telstra/NBN Co. will meet requirements for telecommunications at the time of subdivision application and submission of detailed design plans for coordination. The NBN Co. is likely to be a potential supplier if larger developers take significant expanses of land and submit development layouts with greater than 100 lots (or equivalent thereof).

Gas

The road network is generally serviced by ATCO Gas in the northern catchment, however minimal existing infrastructure is available in the central and southern catchments.

Conclusion

The contradiction between the sub-regional framework and the Local Planning Strategy should be rectified to ensure a consistent approach to infill development. Services are planned for the area and can be further developed through an appropriate staging process, even up to medium density development. The Shire respectfully requests that the entire Foothills Investigation Area be shown on the draft framework as Urban Expansion. This area is identified as potential urban development in preceding planning studies and the Shire has a full understanding of the issues that need to be addressed in order to progress further planning stages.

The area's close proximity to major arterial connections, such as Roe and Tonkin Highways, means existing employment opportunities extend as far as Midland, Welshpool and Canning Vale. Future employment precincts include the new Maddington Kenwick Strategic Employment Area immediately to the west, the new Forrestfield Industrial Area and the Hazelmere Enterprise Area.

The Department's focus for employment self-sufficiency justifies why this area should be prioritised for medium to long-term urban potential. By including this area in the land identified for future urban, the Shire of Kalamunda could readily meet and exceed its target for infill development, reducing the pressure for land development in areas more removed from the urban front.

Recommendation

18. The Shire recommends that the Urban Expansion area be extended to the east, all the way to the Regional Open Space, and to the north, covering all proposed rural and rural residential land in Wattle Grove on both sides of Welshpool Rd.

2.3 Area 3: Pickering Brook Townsite Expansion Area

2.3.1 Local Planning Strategy

The Shire's Local Planning Strategy identifies the Pickering Brook Townsite as an investigation area (Attachment 1). The proposed outcome will be low density residential properties approximately 2000sqm surrounding an improved and expanded commercial town centre. Through increasing population and flexibility of land uses, the Shire is also aiming to improve tourism and small business activity in the area.

Planning is already underway for this project, including preliminary involvement from Department of Planning, Department of Water and the Water Corporation. The Shire has contracted and completed studies to address bushfire risk, environmental constraints, traffic impact and issues and servicing requirements in the proposed area. These studies have been used to inform an MRS amendment request to rezone the land from Rural to Urban, which is currently being prepared by the Shire.

2.3.2 Bushfire Risk Analysis

The proposed Pickering Brook townsite expansion area is surrounded by dense vegetated areas including Korung National Park, a popular location for bushwalking and mountain biking. Given the level of vegetation within close proximity to the site, it is crucial that fire risks are accounted for during design of the proposed expansion.

A preliminary bushfire risk assessment has been undertaken that shows the proposed urban area as being surrounded by medium and high fire risk areas. The assessment suggests:

- Locating development away from high risk areas;

- Connecting roads for evacuation purposes; and
- Preparing a fire management plan at the local structure planning stage.

The Shire considers that, for the purposes of an MRS amendment, the investigation into the bushfire issues and possible mitigation has demonstrated that the bushfire risk can be addressed in order to facilitate a low key commercial and low density residential development in this area.

2.3.3 Environmental Study

The area in question is characterised by a number of properties engaged in agricultural activities and predominantly cleared, some intermittent vegetated areas and quite a dense bush outside the boundaries of the proposed town centre. Shire engaged a consultant to determine environmental impacts of the proposed development in this area as part of an MRS amendment application. The consultant identified the following characteristics of the area:

- Low to nil risk of aced sulfate soils;
- Existing agriculture may cause issues with proposed residential;
- Site is currently a Priority 2 PDWSA;
- Not located within a groundwater area;
- The majority of the vegetation is rated as 'Completely Degraded' due to historical clearing for agricultural activity;
- Unlikely to be a significant site for protected species; and
- No registered contaminated sites.

To enable future residential development, the environmental study suggests the following investigations/management measures are undertaken:

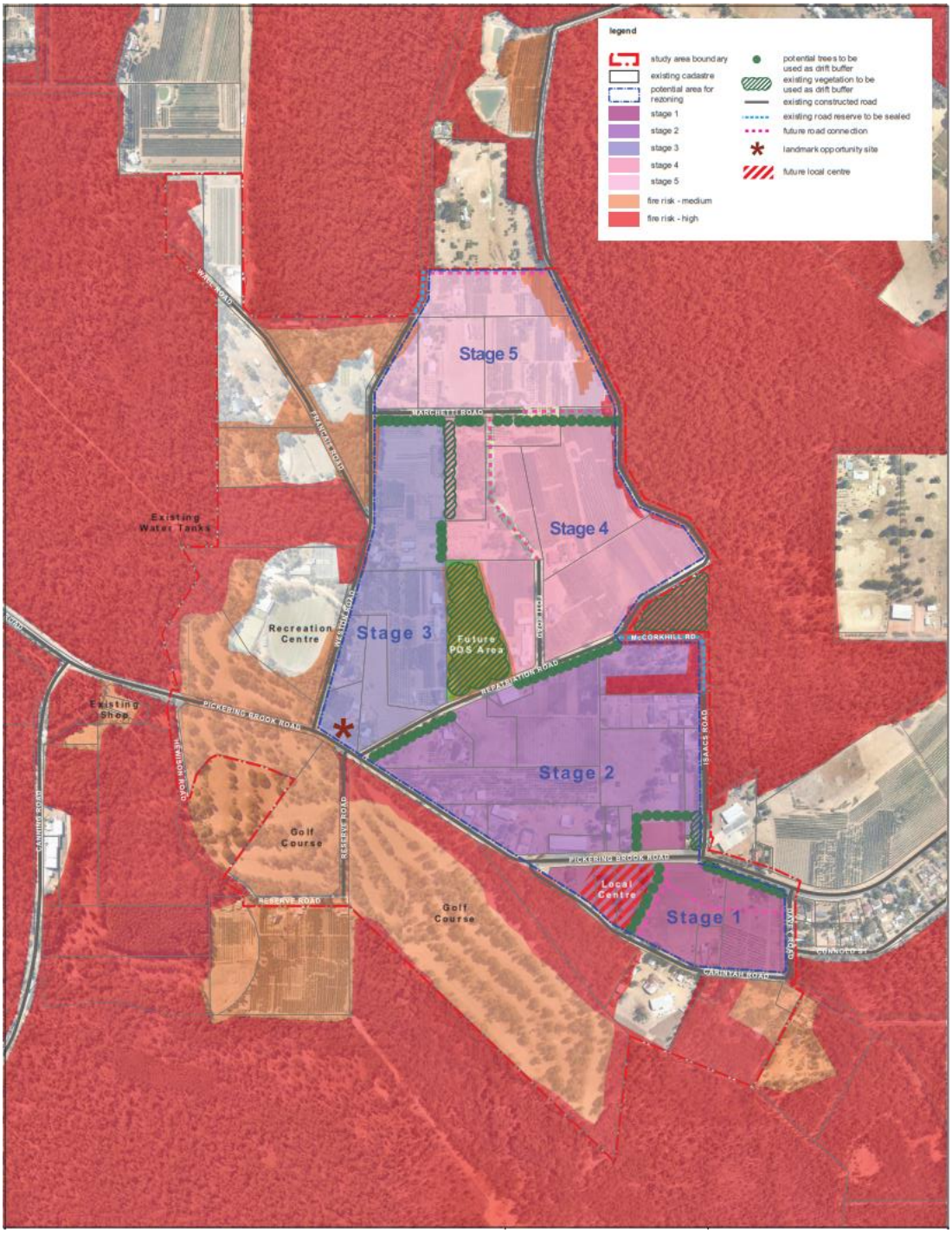
- Level 2 flora and vegetation assessment of two specific lots;
- Significant tree assessment focused on 4 specific lots;
- Creation of vegetated buffer areas to protect from spray drift;
- A preliminary site investigation for each subdivision to ensure there is no contamination of soils; and
- Reclassifying the Priority 2 PDWSA to a Priority 3 area, which the Shire has progressed through discussions with Department of Water and engaging a consultant to create a District Water Management Strategy.

The environmental study concludes that development of the site for residential purposes is likely to have minimal potential environmental impacts provided the above issues are addressed prior to development. Final design for the development will incorporate additional environmental management actions to assist in the retention of environmental values at the site.

2.3.4 Servicing and Traffic Study

These studies identified the potential challenges of servicing the future residential/commercial development in the future.

Based on the opportunities and constraints inherent to the site, the progress of planning work is proposed to be done in five stages. First three stages will be able to be progressed without too many issues, whereas the stages 4 and 5 might need to address a number of potential constraints further before being able to be developed.



Conclusion

The Shire is of the opinion that the area as shown on the attached map, should be included as Urban Expansion in the North East Sub-Regional Framework. The investigations conducted thus far, and the discussions/meetings held with government agencies including the Department of Planning, indicate there are no inherent constraints that would prevent the area from being identified Urban Expansion.

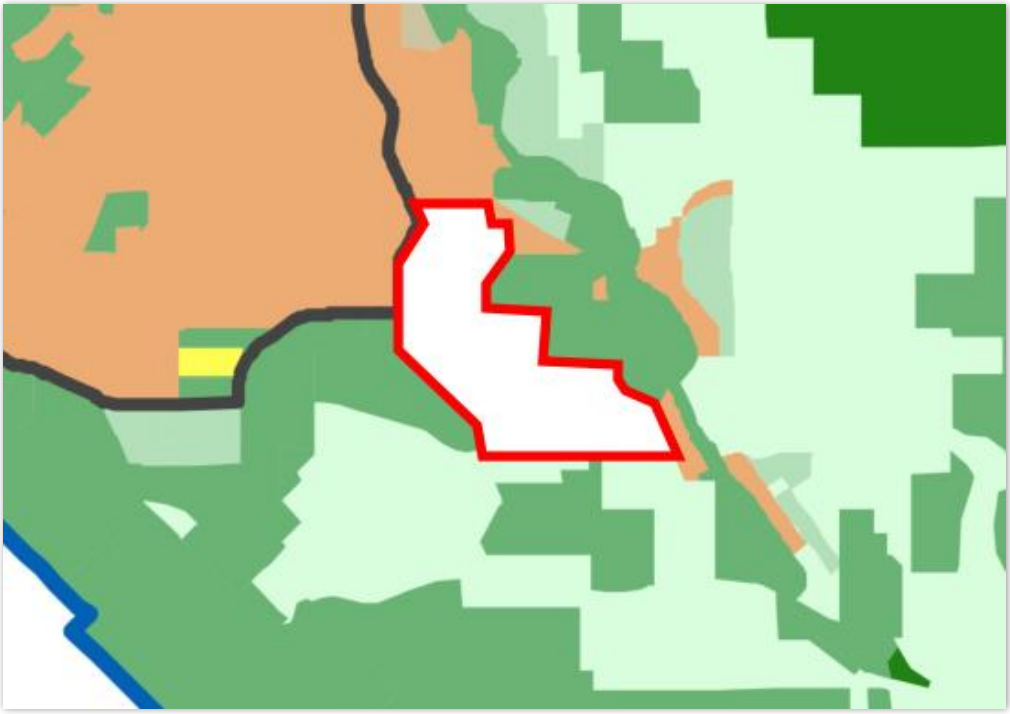
Recommendation

19. That Area 3 – Pickering Brook Townsite be identified as Urban Expansion in the Sub-regional Framework.

2.4 Area 4: Carmel Investigation Area

2.4.1 Local Planning Strategy

The Shire's Local Planning Strategy identifies the Carmel Investigation Area for potential subdivision into residential lifestyle blocks. However, the Sub-Regional Framework identifies this area as Rural-Residential, contrary to the endorsed Local Planning Strategy. The area identified below incorporates the current investigation area as well as a logical expansion north to represent a continuation of the Urban zone adjacent to existing residential development.



Currently, the properties in this area are zoned Rural Landscape Interest, Rural Agriculture and Special Rural in Local Planning Scheme No. 3. The Shire's intent is to investigate opportunity for large residential lots (1-2000sqm) and potentially improve flexibility of land uses. This development would likely be actioned through a rezoning to Residential, which requires an Urban zone under the MRS.

2.4.2 Bushfire Risk Analysis

The majority of land within this zone comprises mixed jarrah/marri woodland. The mitigation of bushfire risk in this type of vegetation requires hazard reduction programs every five to seven years at a minimum to maintain fuel loads at acceptable levels. Despite existing mitigation works, there are still large pockets of heavy fuels zones on private and public property. The area is also adjacent to large areas of state forest and National Park, where DPaW carries out mitigation work.

Road access in this area is variable, with a number of dead-end streets and cul-de-sacs limiting the movement of vehicles. There is a reticulated water supply throughout the area, although it is to rural standards and hydrants may be up to 500m away from existing properties.

Given the nature of the proposed development in this area, it is impractical to consider implementing a 100m hazard separation zone. Instead, each subdivision would need to comply

with Planning for Bushfire Protection Guidelines, with each individual property being constructed in accordance with AS3959. The planning process would also include provision for reticulated water supplies and appropriate emergency access/egress.

2.4.3 Environmental Study

The Shire engaged a consultant to determine environmental impacts of the proposed development in this area. The consultant identified the following characteristics of the area:

- Unknown acid sulfate soils risk, areas most at risk are those which remain wet throughout the year and are dried at some point;
- No contaminated sites are registered;
- Approximately 70% of the area is native remnant vegetation;
- No bush forever areas or environmentally sensitive areas;
- Adjacent to Priority 1 and 2 Public Drinking Water Source areas; and
- No waterways or wetlands within the area.

As the Carmel investigation area is not located within the Middle Helena Catchment, any water discharging from the site will not flow into the Middle Helena Catchment Area Public Drinking Water Source Area so risks to the water quality of the drinking water resource are minimal. It is considered that the incorporation of water sensitive urban design principles into the design, construction and maintenance of the future development will be adequate to manage water quality risks.

There are also significant amounts of potentially good quality native vegetation remaining in the investigation area and the Draft North-East Sub-Regional Planning Framework indicates an ecological linkage running through the site which is likely to need to be retained. The Carmel investigation area may contain protected species.

2.4.4 Servicing Study

Due to a lack of proximity to sewer, it is likely that development of the investigation areas will require on-site wastewater disposal. Consideration will need to be given to the infiltrative capacity of the soils to ensure that lots are of sufficient size to provide for an adequate land application area for disposal of the wastewater. Setbacks from waterways and appropriate responses to slope will be required.

Conclusion

The Shire requests that the Carmel Investigation Area be identified as Urban Investigation under the Sub-Regional Framework. The Shire recognises that this area requires additional study before development can take place. Urban Investigation will allow the Shire to progress feasibility studies in the area in order to ascertain the extent of the potential of this area for future urban.

Recommendation:

20. That Area 4 – Carmel Investigation Area be identified as Urban Investigation in the North-East Sub-regional Framework.

2.5 Area 5: Croxton Road Investigation Area

2.5.1 Local Planning Strategy

The Croxton Road area in Piesse Brook is currently zoned Rural in the MRS and Rural Landscape Interest in Local Planning Scheme No. 3; it is also identified as an investigation area in the Local Planning Strategy. Similar to the Carmel Investigation Area, the North East Sub-Regional Framework shows the Croxton Road area as Rural, contrary to the endorsed Local Planning Strategy. While there are currently no plans by Water Corporation to extend sewer to this investigation area, the Shire's position is that this area should be investigated for potential low density Urban development. While remaining on septic systems, State policy allows properties to subdivide to ~2000m^2. Once the sewer is extended, this area will permit higher density development. As such, the Sub-Regional Framework should show Urban Investigation in order to be consistent with the Shire's intentions and the WAPC-endorsed Local Planning Strategy.

2.5.2 Bushfire Risk Analysis

The majority of this land is situated on sloping land with a predominantly easterly and northerly aspect. There are large areas of bushland within this study area. Virtually none of the buildings within the area currently comply with construction standards of AS3959 as the area is not designated Bushfire Prone.

Despite existing mitigation works, there are still large pockets of heavy fuels zones on private and public property. The area is also adjacent to large areas of state forest and National Park, where DPaW carries out mitigation work.

Road access in this area is variable, with heavily overgrown and steep streets limiting the movement of vehicles. There is a reticulated water supply throughout the area, although it is to

rural standards and hydrants may be up to 500m away from existing properties.

Properties in this area are at risk of fire during the summer months predominantly under the influence of an easterly or northerly wind which would push any bushfire up the hill towards existing properties. Winds are exacerbated along Hummerston Road due to gully conditions which funnel and increase wind speed. The land slopes to the east and north between 10º and 30º.

Given the nature of the proposed development in this area, it is impractical to consider implementing a 100m hazard separation zone. Instead, each subdivision would need to comply with Planning for Bushfire Protection Guidelines, with each individual property being constructed in accordance with AS3959. The planning process would also include provision for reticulated water supplies and appropriate emergency access/egress.

2.5.3 Environmental Study

The Shire engaged a consultant to determine environmental impacts of the proposed development in this area. The consultant identified the following characteristics of the area:

- Unknown risk of acid sulfate soils;
- No registered contaminated sites;
- One environmentally sensitive area, which is part of the Kalamunda National Park;
- The entire area is within a Priority 2 area of the Middle Helena Catchment Area Public Drinking Water Source Area (PDWSA); and
- No waterways or wetlands of significance are known to occur in the area.

The most significant constraint to development is the location of the Croxton Road investigation area within a Priority 2 area of the PDWSA. This places significant restrictions on development in order to protect the quality of the drinking water resource. For the Croxton Road investigation area to be developed for residential purposes, it would need the approval of the Department of Water to change the classification from Priority 2 to Priority 3. This requires detailed technical investigations and a potentially lengthy assessment process. Native vegetation is also a significant issue that would need to be addressed at later planning stages. This would likely require more detailed surveys and possible retention of bushland.

2.5.4 Servicing Study

Due to a lack of proximity to sewer, it is likely that development of the investigation areas will require on-site wastewater disposal. Consideration will need to be given to the infiltrative capacity of the soils to ensure that lots are of sufficient size to provide for an adequate land application area for disposal of the wastewater. Setbacks from waterways and appropriate responses to slope will be required.

Recommendation

21. The evidence presented above indicates that the Croxton Road Investigation Area is a feasible location to conduct preliminary planning. The Shire requests that the Croxton Road Investigation Area be identified as Urban Investigation on the Sub-Regional Framework.

2.6 Area 6: Hillview Golf Course Site

2.6.1 Justification for Urban Development

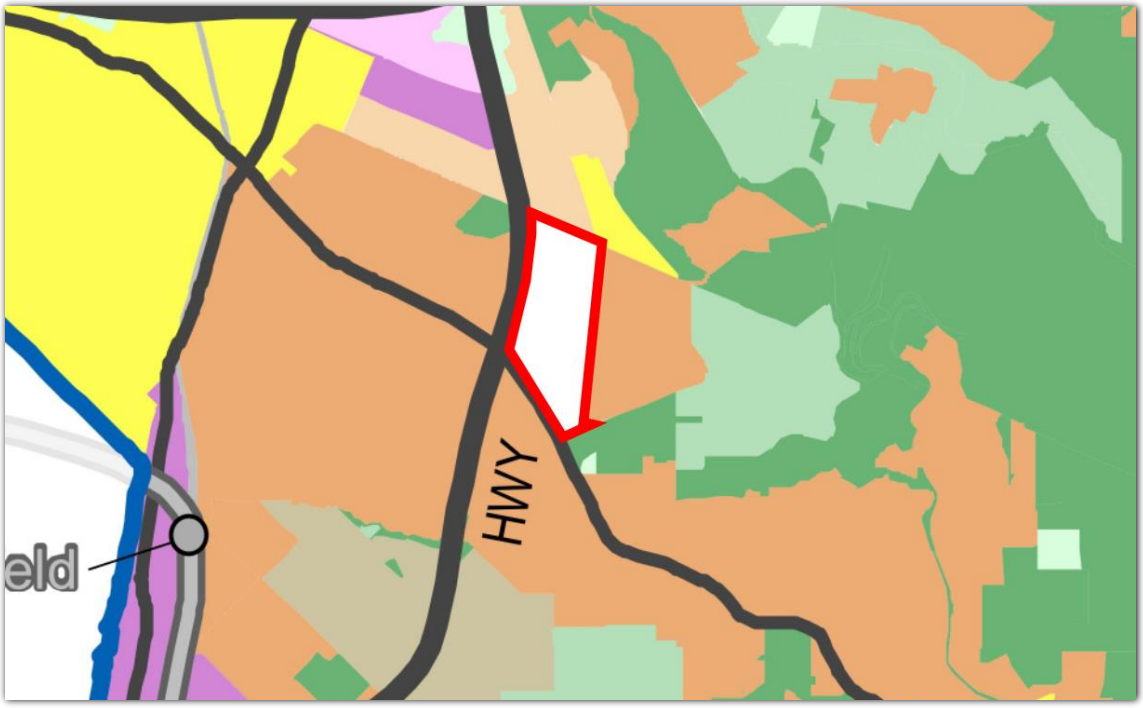
The Hillview Golf Course and old garden centre (Lot 800 and 801 DP63033) is currently zoned Rural under the MRS, and 'Private Clubs and Institutions' and 'Special Use' under Local Planning Scheme No. 3. Currently, Medium and low density residential development surrounds the properties to the east, west and south.

The properties are not included as an investigation area in the Shire's Local Planning Strategy; however, its potential for future urban development should be noted and recognised, formally. The subject site is in prime location for future development due to a number of factors.

The properties have indirect access to Roe Highway via Kalamunda Rd; this provides the site with a convenient network of employment centres and public transport. The Forrestfield Airport Link will also service the site, with Forrestfield Station only 3km away, giving future residents even more employment opportunities. The site also has an existing connection to reticulated water that should have capacity to expand in future depending on proposed density. There is nearby sewer, which would require extension and possible upgrade.

There is some remnant bushland on the site, although the large majority has been cleared previously for the golf course and garden centre. Any environmentally sensitive areas or protected wildlife species would need to be addressed through a structure planning process.

Additionally, the land is surrounded by Urban zoning, as can be seen below. It is only logical to include this area as Urban Expansion as pressure from surrounding developments increase. Examples from Guildford, Midland and Wanneroo show a similar scenario; however, the sites in those cases were identified as Urban Expansion in the Frameworks.



Conclusion

As discussed above, the Shire has determined that the Hillview Golf Course area may be suitable for urban development. The Urban Investigation definition is "land that may be suitable for urban development, but has not been identified for that purpose in preceding planning studies, or requires further investigation to determine its suitability." As such, the Shire requests that this land be included in the North East Sub-Regional Framework as Urban Expansion.

Recommendation

22. Include Area 6 – Hillview Golf Course Site as Urban Expansion in the North-East Sub-regional Framework.

2.7 Area 7: Maddington Kenwick Strategic Employment Area

2.7.1 Correction to Mapping

The Maddington Kenwick Strategic Employment Area (MKSEA) is proposed over the triangular portion of Wattle Grove, south of Welshpool Rd, as shown on the below plan. The MKSEA structure plan shows the entire precinct as Industrial but the Sub-Regional Framework shows a small portion of that as Urban.

While light industrial uses may be permitted under the Urban MRS zone, the intention of the MKSEA structure plan and its associated MRS amendment application is to rezone the entire area south of Welshpool Road East to Industrial (excluding the Reserve).

This was most likely included as the land is already zoned Urban in the MRS but, nonetheless, should be updated to show the proposed classification of the entire precinct as Industrial Development.

Recommendation

23. Include the Urban zoned land (south of Welshpool Road East and west of Tokin Highway) as Industrial Expansion in the North-East Sub-regional Framework.

3.0 Summary and Conclusion

The Shire of Kalamunda supports the concept of a high level strategic document to guide the next 40 years of land development in Perth and Peel. The core principles underlining the Sub-Regional Planning Frameworks, namely the protection of significant environmental values, water source protection, productive rural land preservation and the management of the bushfire threat in order to achieve sustainable growth outcomes are fully supported.

However, the Shire is concerned that these principles are not fully reflected in the conclusions drawn by the Sub Regional Framework. The Shire is fully aware of the relevance the North East Sub-Regional Planning Framework will have on the Shire's ability to plan for urban growth in the short, medium and long term. Therefore, it is vital that the Western Australian Planning Commission understands that the Shire considers the document flawed and requiring further amendments prior to being considered as a planning framework for the future development of the region. A number of areas currently excluded from the Framework can provide sustainable growth opportunities in the medium to long term. The Shire's preparation of a bushfire risk assessment, servicing study and environmental study demonstrate sufficient planning justification for the proposals.

In reference to the 'connected city' scenario, emphasised by the provision of housing opportunities close to the employment opportunities, that seems to form the basic premise of *Perth and Peel @3.5million*, we believe we raised a valid argument in favour of inclusion of following areas as future Urban Expansion areas:

1. Area 1: Foothills Investigation Area
2. Area 2: Wattle Grove South
3. Area 3: Pickering Brook Townsite Investigation Area
4. Area 6: Hillview Golf Course Site

Additionally, acknowledging that further detailed investigation is necessary to determine whether the areas have a full development potential, the following areas to be included as Urban Investigation Areas:

1. Area 4: Carmel Investigation Area
2. Area 5: Croxton Road Investigation Area.

We welcome any further discussion with the Department of Planning on any of the issues raised in our submission report and are happy to provide supporting or any further information needed in order to substantiate our argument.

Summary of Recommendations

Topic	Recommendations
Draft Perth and Peel@3.5million	1. That the Commission publish a detailed methodology of how the conclusions of the Sub-Regional Frameworks were developed, including all supporting documentation. 2. That the Department consult and engage in meaningful dialogue with Local Government prior to the finalisation of the Sub Regional Frameworks.
Urban Versus Suburban	3. Recognise the development of the Forrestfield Train Station Site as a new activity centre.
Developer Contributions	4. Consideration regarding developer contributions and the responsible parties for initially funding infrastructure upgrades. The main document should outline where the developer contributions should be used. 5. The review of State Planning Policy 3.6 as a priority, to ensure that it adequately addresses greenfield and brownfield development. 6. Service agencies be required to provide seed funding for infrastructure upgrades and recuperate their costs either through a developer contributions scheme that they themselves manage, or through a special area rate that applies to all new dwellings. 7. Investigation into the impact of making developer contributions payable when land is sold. 8. Review the way developer contributions are considered and reported in local government budgeting and reporting.

Topic	Recommendations
Aged Care	9. Additional information and analysis of the planning for an ageing population should be incorporated in the final documents. 10. Land for high care aged facilities should be identified on the sub-regional plans. To circumvent constraining a certain landowner, the plans could show a number of potential locations or an area where a facility could be located. 11. Specific targets should be set for local aged care dwellings in each local government authority, based on local demographics and locational suitability. Guidance should also be provided to inform local governments on how to encourage more aged care dwellings to be developed. 12. Investigate the suitability of land on the fringe of the metropolitan area to be used for aged care, given the opportunities to acquire larger sites. 13. The State Government should develop additional information for developers and prospective purchasers on housing options suitable for ageing in place.
Implementation	14. Establish a lead agency for each of the implementation actions. 15. Ensure that the Department of Planning is suitably resourced to undertake the development work ahead. 16. Ensure appropriate local government representation during planning for the implementation of the frameworks.
Area 1: Foothills Investigation Area	17. That Area 1 - Foothills Investigation Area be identified in the Sub Regional Framework as Urban Expansion

Topic	Recommendations
Area 2: Wattle Grove South	18. The Shire recommends that the Urban Expansion area be extended to the east, all the way to the Regional Open Space, and to the north, covering all proposed rural and rural residential land in Wattle Grove on both sides of Welshpool Rd.
Area 3: Pickering Brook Townsite Expansion Area	19. That Area 3 – Pickering Brook Townsite be identified as Urban Expansion in the Sub-regional Framework.
Area 4: Carmel Investigation Area	20. That Area 4 – Carmel Investigation Area be identified as Urban Investigation in the North-East Sub-regional Framework.
Area 5: Croxton Road Investigation Area	21. The evidence presented above indicates that the Croxton Road Investigation Area is a feasible location to conduct preliminary planning. The Shire requests that the Croxton Road Investigation Area be identified as Urban Investigation on the Sub-Regional Framework.
Area 6: Hillview Golf Course Site	22. Include Area 6 – Hillview Golf Course Site as Urban Expansion in the North-East Sub-regional Framework.
Area 7: Maddington Kenwick Strategic Employment Area	23. Include the Urban zoned land (south of Welshpool Road East and west of Tokin Highway) as Industrial Expansion in the North-East Sub-regional Framework.

Local Planning Strategy - Key Planning Elements

KENNETH ROAD AND BERLE WAY SHOPPING CENTRES

•Improved urban design outcomes through the preparation of townscape Improvement Plans.

TRANSPORT INITIATIVE

Investigation of potential rail line option linking Perth Airport to eastern suburbs.

URBAN GROWTH

•Residential infill in existing older urban area of High Wycombe/Maida Vale through increased residential densities in selected areas.

KALAMUNDA DISTRICT CENTRE

•Encourage economic development of the town centre by encouraging a range of commercial uses and the introduction of residential land uses into the centre.
•Improved urban design outcomes through the preparation of Townscape Improvement Plans.
•Promotion of the town centre and surrounds as a tourist centre.
•Maintain 'Village' character in the town centre.

EMPLOYMENT/ECONOMIC OPPORTUNITIES

•Development of Forrestfield/High Wycombe as a key strategic industrial area.
•Access Park Industrial Area, Forrestfield Industrial Area, Forrestfield Intermodal Container Facility.

URBAN INVESTIGATION AREA *

FOOTHILLS INVESTIGATION AREA *

TOURIST ATTRACTIONS

•Commencement of Bibbulmun Walking Track.

INVESTIGATION AREA *

URBAN GROWTH

•Residential infill in existing older urban area of Forrestfield through increased residential densities in selected areas.

KALAMUNDA DURE SCHEME AREA

•Residential infill in Kalamunda where connection to sewer is available.

ENVIRONMENT

•Protection of Middle Helena Water Catchment Area.

URBAN GROWTH

•Residential infill in existing older urban area of High Wycombe/Maida Vale through increased residential densities in selected areas.

FORRESTFIELD DISTRICT CENTRE

•Improved urban design outcomes through the preparation of Townscape Improvement Plans for the District Centre.
•Develop concept of Forrestfield as a designated Activity Centre through the preparation of a Structure Plan.

TOURIST ATTRACTIONS

•Perth Hills Wine Region.
•National Parks and Reserves.

INDUSTRIAL DEVELOPMENT INVESTIGATION AREA *

EDINBURGH ROAD SHOPPING CENTRE

•Improved urban design outcomes through the preparation of Townscape Improvement Plans for the Shopping Centre.

URBAN INVESTIGATION AREA *

INVESTIGATION AREA *

That in investigating the future potential of this area, high regard will be given to the issue of bush fire risk and management.

PICKERING BROOK TOWNSITE INVESTIGATION AREA *

SUSTAINABLE PLANNING APPROACH

SOCIAL	ECONOMIC	ENVIRONMENT
• Increased housing opportunities for aged accommodation. • Increased local employment opportunities through planned industrial areas. • Development of bush fire hazard assessment. • Provide well located quality community facilities. • Provide for a range of passive and active recreation facilities.	• Increase local employment opportunities. • Take advantage of growing employment base at Perth airport. • Promotion of tourist based activities. • Support ongoing horticultural activities in hills orchard areas.	• Protection of biodiversity and natural environment. • Protection of water catchment areas.

Legend

- POTENTIAL FUTURE SEWERAGE
- INVESTIGATION AREAS
- PROPOSED INDUSTRIAL DEVELOPMENT AREAS
- PROPOSED RESIDENTIAL INFILL AREAS
- URBAN DEVELOPMENT AREAS

*** An exact boundary for the investigation has not yet been determined.**

Shire of Kalamunda: Local Planning Strategy - Key Planning Elements

The Shire of Kalamunda accepts no responsibility for the accuracy of this image or the results of any actions taken when using this image. Based on information provided by and with the permission of the Western Australian Land Information Authority (2012).

Author: K. Ito

Map Produced: 2/01/2013

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Review of Issues Related to Bushfire Risk for Three Proposed Development Areas within the Shire of Kalamunda

By

Bushfire Prone Planning

Final

June 2015

Contents

1. Introduction

This report assesses current and potential bushfire risk for three zones within the Shire of Kalamunda targeted for zoning change and development under the WA Planning Commission's *Draft North-East Sub-regional Planning Framework* and the Shire of Kalamunda's *Local Planning Strategy 2013*. Under these documents the Shire proposes to change the zoning in three specific study areas:

(i) the Foothills Study Area, comprising areas of Forrestfield and Wattle Grove;
(ii) The Carmel Study Area comprising an area between Pomeroy and Carmel Roads; and
(iii) The Croxton Road study area, to the east of the Kalamunda townsite.

Proposed zoning changes to "Residential Bushland" would allow development within the Carmel and Croxton Road areas under new zonings from R2.5 or R5, and within the Foothills area to "Residential" up to R40.

Based on an assessment of bushfire risk within the three study areas, this report provides the following:

(i) A broad overview of the current bushfire issues and risk in the subject area and the impact of that risk onto the adjacent Kalamunda Scarp;
(ii) A broad overview of the potential bushfire issues and risk in the subject area, assuming the area is developed under the Residential zone, and the potential impact of that risk onto the adjacent Kalamunda Scarp;
(iii) A broad comparison of the two scenarios; and
(iv) Recommendations based on the above.

While this report is written based on current statutory requirements, it should be noted that the WAPC's *Draft North-East Sub-regional Planning Framework* states that "Any proposal for urban development will need to consider, and where applicable, apply draft *State Planning Policy 3.7 Planning for Bushfire Risk Management*" (pg. 22) and as such it is likely that all new development adjacent to bushland will need to comply with both the *Planning for Bushfire Protection Guidelines, Edition 2* (2010) and *AS 3959-2009 Construction of buildings in bushfire prone areas (hereafter referred to as "Planning for Bushfire Protection Guidelines" and "AS 3959-2009").*

2. Methodology

Three factors were considered in developing the findings of this report. These were;

(i) A historical overview of major fire events and hazard reduction practices;
(ii) A consideration of factors affecting wildfire behaviour; and
(iii) The guidelines and standards for new development in bushfire prone areas.

These were combined to provide an overview of potential bushfire risk, and strategies required to mitigate that risk, for each of the three proposed development areas. Specifics for each method are as follows.

2.1 Historical Overview

A brief historical overview of fire incidents and mitigation strategies in the proposed development areas since 1995 was conducted using known fire histories. While these areas have been impacted by bushfire since European development of the area in the 19th century, the past 20 years provide a suitable analogue, as all areas have been similarly developed during that time, and hazard management strategies have been similar throughout. Additionally, fire records for the period before 1990 are generally more limited than those for the past 20 years. While hundreds of wildfire incidents have occurred in the three development areas over the past 20 years, only major incidents (those that would be considered level 2 or above under the DFES classification scale) that occurred within a 1km radius of the three development areas are considered.

In particular, one historical fire event that occurred outside the study areas, the 2010 Roleystone Fire, which destroyed 69 houses in a single afternoon, should be considered to affect this analysis. An inquiry held in the aftermath of this fire, resulted in the Keelty Report (2011), which made a number of recommendations that have since been implemented. These include increased hazard reduction work, changes to fire response strategies, and changes to land development and building design standards for "bushfire prone areas" (see below). Some of these changes have impacted the study areas, in particular in terms of hazard mitigation and fire response strategies.

The historical overview is used to develop an understanding of the frequency and severity of fire events and the frequency and effectiveness of mitigation strategies for each of the three proposed development areas.

2.2 Factors that Affect Wildfire Behaviour

A number of known factors combine to influence the Rate of Spread (ROS – or speed a fire moves) and intensity of bushfires. These are weather conditions, topography and fuel loads.

Fire weather is expressed as a rating under the Fire Danger Index (FDI) system. Fire weather fluctuates during the year with worse fires expected during the summer months. Generally, fire behaviour will be worse at times of high temperature, low humidity and high winds, with other factors such as Soil Dryness (SDI), the Keech-Byram drought index, and high/low atmospheric pressure also playing a part. The FDI is provided daily as a score out of 100, with any score over 32 considered to be fire weather in which bush fires will be difficult to bring under control. These are categorised as a Fire Danger Rating (FDR) of *Very High* or above (including *Severe*, *Extreme*, and *Catastrophic* FDI ratings). The number of days recorded each year with an FDR of *Very High* or above are increasing under the influence of climate change. For

reference, recent major fires at Roleystone, Toodyay, Prevelly and Parkerville, in which hundreds of houses have been destroyed, have all occurred on days with an FDR of *Very High* or above.

Topography affects the ROS of a fire in a number of ways. Slope has a significant impact on the speed a fire burns, with each 10^{o} of slope doubling the ROS of a fire burning uphill and halving the ROS of a fire burning downhill. Topographic features such as aspect can impact on the speed of vegetation drying and curing, while features such as gullies can increase fire intensity through the potential to funnel and increase wind speeds.

Fuel loads are dependent upon vegetation and require regular mitigation methods (usually through hazard reduction burning) to be kept at manageable levels. While fuel loads build up at different speeds in different vegetation regimes, in general, fuel loads over 7 tonnes per hectare are considered to be unmanageable in the event of a fire occurring under an FDI of *Very High* or above. In jarrah/marri forest, fuel builds up on average at a rate of 1 tonne per hectare per year, requiring mitigation efforts at least every seven years (or potentially more frequently).

These factors affecting bushfires are considered for each proposed development area.

2.3 Guidelines and Standards

Currently, development standards for new sub-divisions and the construction of new buildings are only applied in areas declared as "bushfire prone", or places where there is a high risk of destructive bushfires occurring. Currently none of the three proposed areas are declared as bushfire prone. However, the WAPC's *Draft North-East Sub-regional Planning Framework* states that "Any proposal for urban development will need to consider, and where applicable, apply the draft *State Planning Policy 3.7 Planning for Bushfire Risk Management*" (pg. 22) and as such it is likely that all new development adjacent to bushland will need to comply with both the *Planning for Bushfire Protection Guidelines* and *AS 3959-2009.* Additionally, the *Planning for Bushfire Protection Guidelines* states that:

> "…the exercise of statutory planning discretions, such as planning approval and subdivision approval involving land that has a moderate or extreme bush fire hazard level or a building attack level (BAL) between BAL-12.5 and BAL-FZ is likely to impose a duty of care on decision-making authorities. In these circumstances the information contained in the guidelines should be applied wherever practicable by both applicants and government decision-makers to achieve acceptable fire protection outcomes, so that life and property are adequately protected from the risk of bush fires." (*Planning for Bushfire Protection Guidelines* 2010, pp. 2-3).

As such it is highly likely that the two following documents will be applied for all future development within and adjacent to bushland and it is in the best interest of statutory authorities to comply with the guidelines when considering new development.

2.3.1 Planning for Bushfire Protection Guidelines, Edition 2 (2010)

This document is published by the WA Planning Commission in accordance with *State Planning Policy 3.4: Natural Hazards and Disasters*. It provides guidelines for the development of new sub-divisions and buildings in bushfire prone areas. It requires a range of processes to be applied including the development of *Bushfire Management Plans*, the provision for vehicular access, the provision of water supplies, and the implementation of *Building Separation Zones* and *Hazard Separation Zones*.

Appendix One of the *Planning for Bushfire Protection Guidelines* provides a methodology for determining bushfire hazard in a particular area based on vegetation and topography. Hazard assessments are

provided as *low*, *moderate*, or *extreme*. This report provides a preliminary strategic assessment of bushfire hazard in the three study areas using local knowledge of the area and steps 1 & 2 of the assessment process as outlined on page 18 of Appendix One of *Planning for Bushfire Protection Guidelines*.

The Guidelines also reference the following Australian standard.

2.3.2 AS 3959-2009 Construction of Buildings in Bushfire Prone Areas

This Australian Standard provides guidelines for the construction of buildings in bushfire prone areas. The Standard requires specific building codes to be applied for all new developments, including the determination of a *Bushfire Attack Level* (BAL) for each new building and subsequent mitigation measures dependent upon the BAL.

This report considers both *Planning for Bushfire Protection Guidelines* and the *AS 3959-2009*, in its discussion of bushfire risk in the proposed development areas.

3. Current Bushfire Issues

There are a range of current bushfire issues for the three study areas. At present the three areas predominantly comprise bushland located adjacent to large areas of natural bush, either State Forest or National Park. These comprise a high bushfire risk to any adjacent development, as they are unlikely to be developed themselves and require regular bushfire hazard mitigation activities to reduce that risk. In almost all scenarios these areas of State Forest and National Park will provide a residual and ongoing bushfire risk to any adjacent development.

3.1 Foothills Study Area

This proposed development area to the east of Lewis and Hawtin Road, and south of Welshpool Road, in Forrestfield and Wattle Grove, has a number of existing bushfire issues. The majority of this land is situated on the foothills of the Darling Scarp, on sloping land with a predominantly westerly aspect. The area is currently zoned “special rural” and while there are a range of land uses, there are large areas of bushland within these zones, and other bushfire risk zones such as open grass paddocks. Many properties adjoin the Darling Range Regional Park to the east.

As this area is not a designated “Bushfire Prone” area, virtually none of the buildings currently existing within the proposed zone, or at the top of the scarp, comply with construction standards outlined within *AS 3959-2009*, or with the *Planning for Bushfire Protection Guidelines*. As such buildings in these areas should be considered to be at higher risk of damage during a serious bushfire than if these standards and guidelines were applied.

Vegetation regimes on nominated land comprise predominantly wandoo and banksia woodlands, with some areas of heavier jarrah/marri forest and woodland. The mitigation of bushfire risk in this type of vegetation requires hazard reduction programs every five to seven years at a minimum to maintain fuel loads at acceptable levels. Some areas within the proposed area, particularly south of Welshpool Road, comprise rural farmland, requiring yearly mitigation strategies to control the growth of grass.

Hazard mitigation in the past 20 years has been piecemeal. On Shire land the Shire of Kalamunda has applied various fire mitigation strategies, but in many cases heavy fuel loads have been allowed to build up in large areas of bush on private property. In the Regional Park mitigation is managed by the Department of Parks and Wildlife (DPaW) who attempt to conduct regular hazard reduction. However, they are constrained by political and environmental factors, and regular wildfires which burn out parts of the Regional Park and leave others untouched. As such some areas of the Regional Park have excessive fuel loads on them adjacent to existing property.

Road access in this area is variable, with a number of dead-end streets and cul-de-sacs limiting the movement of vehicles. There is a reticulated water supply throughout the area, although it is to rural standards and hydrants may be up to 500m away from existing properties.

Bushfires in these areas provide high risk when under the influence of two specific weather conditions during the summer months:

(i) South-westerly or westerly winds, usually in the afternoons, which provide a bushfire threat for properties positioned to the east of bushland; and

(ii) Easterly katabatic winds, usually after midnight through to midday, which provide a bushfire threat for properties positioned to the west of bushland.

Winds are exacerbated in certain areas due to gully conditions which funnel and increase wind speed, in particular in gullies associated with creek systems. These include Lesmurdie Falls, Whistlepipe Gully and Kalamunda Road. The slope ranges from approximately 5^{o} at the base of the scarp to close to 45^{o} in certain areas such as Lesmurdie Falls. Property along the immediate top of the scarp on roads such as Melaeleuca Drive, Nelson Crescent, Ashurst Drive, Conner Road, Ozone Terrace, Prospect Crescent, Harbour Road, Brine Road and Snowball Road have an elevated bushfire risk in the event of a fire burning up the scarp from the west. However, the nature of katabatic winds, which suck easterly winds down slope, mean that easterly wind gusts in excess of 75km/hr are not uncommon occurrences at the immediate base of the scarp. In these conditions wind speeds counteract the effect of downslope slowing of fire ROS and properties located downslope from a wildfire can also be severely threatened.

When the FDR is *Very High* or above it should be considered that extinguishing any bushfire within the proposed area will be generally impossible until weather conditions change, and there is a likelihood of property losses at both the top and bottom of the scarp. For example, during the 2011 Roleystone Fire which occurred during S*evere* fire weather conditions, under the influence of a strong easterly wind, many of the property losses were in residential zoned areas at the bottom of the scarp adjacent to bushland.

A number of roads at the bottom of the scarp have property situated on sloping land, with bush above and below them, with some situated on dead-end roads limiting firefighting access. These include Crystal Brook Road, Honey Road, Waterfall Road, Palm Terrace, Whistlepipe Court, parts of Holmes Road, parts of Lewis Road, and West Terrace.

These combined conditions provide high bushfire risk during the summer months, as evidenced by the regular occurrence of major fires in the area. Table 1 provides a list of major bushfires in the area in the past 20 years.

Table 1: Major fire events in the Foothills study area between 1995 and 2015.

Year	Location	Impacts
1996	Welshpool Road to Lesmurdie Falls	300 hectares burnt, 1 fire appliance damaged, numerous power-poles destroyed, a number of houses damaged
1997	Wattle Grove / Paxwold	600 hectares burnt
1997	Whistlepipe Gully / Ozone Terrace	250 hectares
1999	Lesmurdie Falls / Palm Terrace / Lewis Road	53 hectares burnt
2000	Holmes Road	25 hectares burnt
2002	Crystal Brook Road	50 hectares burnt, two fire appliances damaged
2003	Kalamunda Road	10 hectares
2003	Lesmurdie Falls / Conner Road	65 hectares burnt
2006	South of Kalamunda Road	Two houses lost, 30 hectares burnt
2008	Palm Terrace / Honey Road	20 hectares burnt
2010	Honey Road	25 hectares burnt

On average a major fire occurred somewhere in the study area every 2-3 years between 1995 and 2010. While no major fires have occurred in the area during the past five years there have been numerous smaller fires which have burnt up to 5 hectares of bush and threatened property, including two such fires over the 2014/15 fire season. The lack of large fires in the past 5 years is partly attributable to (i) no fire occurrences on days when the FDR exceeds a *High* rating; (ii) lower fuel loads as the result of increased hazard reduction on the part of DPaW; and (iii) rapid firefighting response (including helicopter waterbombing) for all fire events. These processes were adopted in part as a response to the Keelty Report (2011) in the aftermath of the major Roleystone fire. However, despite these processes being adopted, any occurrence of fire in this area when the FDI exceeds *Very High* still has the potential to cause a major wildfire event.

Due to the frequency and intensity of major fires in this area, the proposed development area should be considered to be a Bushfire Prone area. Based on the application of the methodology outlined in Appendix One of *Planning for Bushfire Protection Guidelines,* vegetation and topography within the area would be considered in most cases to comprise an *extreme* bushfire risk, with some areas south of Welshpool Road having a *moderate* bushfire risk. As such measures outlined in the *Planning for Bushfire Protection Guidelines*, and in *AS 3959-2009* are likely to be applied for all future development in this study area. Property within and adjacent to this zone has a high risk from bushfire during the summer months.

3.2 Croxton Road Study Area

This proposed development area is located to the east of the Kalamunda townsite. The majority of this land is situated on sloping land with a predominantly easterly and northerly aspect. The area is currently zoned “rural landscape interest” and while there are a range of land uses, there are large areas of bushland within this zone.

As this area is not a designated “Bushfire Prone” area, virtually none of the buildings currently existing within the proposed zone, comply with construction standards outlined within *AS 3959-2009*, or with

Planning for Bushfire Protection Guidelines. As such buildings in these areas should be considered to be at higher risk of damage during a serious bushfire than if these standards and guidelines were applied.

Vegetation in the area is predominantly previously logged regeneration mixed jarrah/marri forest, with some areas of she-oak and wandoo forest and woodland. The mitigation of bushfire risk in this type of vegetation requires hazard reduction programs every five to seven years at a minimum to maintain fuel loads at acceptable levels.

Hazard mitigation in the area has been carried out by private landowners on private property, the Kalamunda Shire Hazard Reduction Crew on shire land, and by DPaW in the Kalamunda National Park. In general mitigation is carried out fairly regularly, with most landowners carrying out regular hazard reduction programs. Despite this there are still large pockets of heavy fuels zones on private property. Additionally, despite mitigation programs carried out by DPaW within the Kalamunda National Park, there has not been a major fire in the southern part of the park since 1986 and pockets remain where a significant fuel load exists.

Road access in this area is variable, with heavily overgrown and steep streets limiting the movement of vehicles during a bushfire. There is a reticulated water supply throughout the area, although it is to rural standards and hydrants may be up to 500m away from existing properties.

Properties in this area are at risk of fire during the summer months predominantly under the influence of an easterly or northerly wind which would push any bushfire up the hill towards existing properties. Winds are exacerbated along Hummerston Road due to gully conditions which funnel and increase wind speed. The land slopes to the east and north between 10^{o} and 30^{o}.

When the FDR is *Very High* or above it should be considered that extinguishing any bushfire within the proposed area will be generally impossible until weather conditions change, and there is a likelihood of property losses.

These combined conditions provide high bushfire risk during the summer months. Despite this there has been a lower occurrence of major fires in the area over the past 20 years than in the foothills development area. While there have been numerous small fires only one major fire has occurred, shown in Table 2.

Table 2: Major fire events in the Croxton Study Area between 1995 and 2015

Year	Location	Impacts
1995	Jourgensen Park	400 hectares burnt

While the Croxton Road area has had a lesser incidence of major fires over the last two decades, there have been numerous smaller fire incidents occurring regularly within this area over the past two decades. This area should be considered a bushfire prone area. Based on the methodology outlined in Appendix One of *Planning for Bushfire Protection Guidelines, Edition 2* (2010), vegetation and topography within the area would be considered to comprise an *extreme* bushfire risk. As such measures outlined in the *Planning for Bushfire Protection Guidelines*, I and in *AS 3959-2009* are likely to be applied for all future development in this study area. Property within and adjacent to this zone has a high risk from bushfire during the summer months.

3.3 Carmel Study Area

This proposed development zone is located south of Pomeroy Road, east of Canning Road, north of Carmel Road and west of Reeds and Ash roads. The majority of this land is situated on land that slopes to the south with a predominantly southerly aspect. The area is currently zoned "rural" with a range of land uses. The majority of land within this zone comprises mixed jarrah/marri woodland. The mitigation of bushfire risk in this type of vegetation requires hazard reduction programs every five to seven years at a minimum to maintain fuel loads at acceptable levels.

Hazard mitigation in the area has been carried out by private landowners on private property, the Kalamunda Shire Hazard Reduction Crew on Shire land, and by DFES Mitigation Crews on Unallocated Crown Land. Mitigation work has been piecemeal, with some landowners carrying out regular hazard reduction programs. Despite this there are still large pockets of heavy fuels zones on private and public property. The area is also adjacent to large areas of state forest and National Park, where mitigation work is carried out by DPaW.

As this is not a designated "Bushfire Prone" area, virtually none of the buildings currently existing within the proposed zone, comply with construction standards outlined within *AS 3959-2009*, or with *Planning for Bushfire Protection Guidelines*. As such buildings in these areas should be considered to be at higher risk of damage during a serious bushfire than if these standards and guidelines were applied.

Road access in this area is variable, with a number of dead-end streets and cul-de-sacs limiting the movement of vehicles. There is a reticulated water supply throughout the area, although it is to rural standards and hydrants may be up to 500m away from existing properties.

Properties in this area are at risk of fire during the summer months predominantly under the influence of an easterly wind or south-westerly wind. The land slopes to the south to a maximum of 10^{o}.

When the FDR is *Very High* or above it should be considered that extinguishing any bushfire within the proposed area will be generally impossible until weather conditions change, and there is a likelihood of property losses.

These combined conditions provide high bushfire risk during the summer months. While there has been a lower occurrence of major fires in the area over the past 20 years than in the foothills development area there have been a number of major fires, as shown in Table 3.

Table 3: Major fire events in the Carmel study area between 1995 and 2015

Year	Location	Impacts
1996	Pomeroy Road to Canning Road	35 hectares burnt, fences damaged, one fire appliance damaged
2001	Canning Road Australia Day Fire	25 hectares burnt,
2002	Carmel Fireworks Factory Fire	100 hectares burnt, major property damages
2005	Perth Hills Fire	27,000 hectares burnt, major impact to the operation of business throughout the Perth metropolitan area
2010	Pickering Brook Fire, Forrest Road	40 hectares burnt, fences damaged
2011-11	Tanner Road / Welshpool Road series of fires	25 hectares burnt total

On average, for the past two decades, the Carmel Study Area has been impacted by two major fires every five years. Due to the frequency and intensity of major fires in this area, the proposed development area should be considered to be a Bushfire Prone area. Based on the methodology outlined in Appendix One of *Planning for Bushfire Protection Guidelines*, vegetation and topography within the area would be considered to comprise an *extreme* bushfire risk. As such measures outlined in the *Planning for Bushfire Protection Guidelines*, and in *AS 3959-2009* are likely to be applied for all future development in this study area. Property within and adjacent to this zone has a high risk from bushfire during the summer months.

4. Potential Bushfire Risk under the Proposed Changes

Based on the above assessment we would consider the three study areas to have a bushfire risk of *extreme* to *moderate*, requiring mitigation measures and the application of development and building standards outlined in *Planning for Bushfire Protection Guidelines* and *AS 3959-2009*.

In most cases development of land in areas assessed as having *extreme* bushfire risk will not be permitted unless it can be shown that the bushfire risk is manageable. Development must be conducted in such a way as to reduce the risk to *moderate* or *low*, or alternatively, to provide a hazard separation zone of at least 100m between bush assessed as having *extreme* risk and new buildings. Buildings constructed within areas of moderate risk should comply with a minimum of BAL 29 and associated building standards. In addition new developments should meet the five performance criteria outlined in Appendix Two of *Planning for Bushfire Protection Guidelines* , namely applying planning processes that meet minimum standards for location; vehicular access; provision of water; siting of development; and location of development. Under these provisions, planners can mitigate some bushfire issues through the appropriate laying out of new sub-divisions as outlined in Appendix Two. This includes ensuring the provision of two way vehicular access, the siting of civic buildings such as schools well away from areas of bushfire risk, and the positioning of roads, median strips and parks at the edge of developments to improve the *hazard separation zone* between bushland and buildings. In addition, significant population increase may also necessitate the inclusion of new infrastructure (including roads) and the upgrading of existing infrastructure. For example roads such as Holmes and Hawtin Roads may be widened, again potentially increasing the *hazard separation zone* between bush and structures.

4.1 Foothills Study Area

The following presumes the development of the area under a zoning of R40.

On a general scale, the redevelopment of this area with a medium to high density housing strategy would remove any bushfire threat *within* the study area, as this form of development involves the wholesale clearing of land and consequently the removal of any bushfire threat.

However, while land clearing removes bushfire threat within the boundaries of a subdivision, it does not remove the threat from bushland *adjacent* to that subdivision. As this area borders the Darling Range Regional Park, the entire eastern edge of the development area will be sited adjacent to an *extreme* bushfire risk. As a result subdivisions and properties built within 100m of bushland will need to comply with construction standards outlined in *AS 3959-2009*, and *Planning for Bushfire Protection Guidelines*. The determination of individual mitigation requirements is dependent upon an assessment of BAL for each new structure and sub-division, which is beyond the scope of this report. However, in all cases bushfire management strategies are required within 100m of bushland rated as having a *moderate* or *extreme* bushfire risk. In practice this means that all new property constructed within 100m of a *moderate* or *extreme* bushfire risk must have some form of hazard mitigation.

The provisions of *Planning for Bushfire Protection Guidelines* transfers some of the cost of bushfire mitigation to developers, in terms of sub-division planning that ensures access, water supplies and turn around zones. In contrast the application of *AS 3959-2009* construction standards to BAL 29 or below has the effect of increasing construction costs for landowners through the application of specific fire resistant and fire proof construction elements in new buildings. This trade-off should be factored into future development plans. As described above it may be possible for developers to defray costs to landowners by factoring in *hazard separation zones* of a minimum of 100m between bushland and new buildings.

Regardless a range of broad based strategies are available to mitigate risk at a macro level. These include:

(i) The implementation of a *hazard separation zone* of up to 100m between bushland assessed as having a *moderate* or *extreme* bushfire risk and new property to be constructed. This is a zone in which vegetation is reduced so as to bring the bushfire hazard to *Low*. This zone can include roads, open grassed areas or other low fuel zones. This zone can only be achieved through the removal of bushland, not through the reduction of fuel loads via hazard reduction burning;

(ii) Where a 100m buffer zone is not achievable between property and bushland rated as *extreme* or *moderate* then all new properties should be constructed to achieve a minimum of BAL 29; and

(iii) Vegetation separation distances may be reduced by using a Performance based solution such as compliance with *AS3959-2009*; and

(iv) All such properties require a minimum 20m *building protection zone.*

In addition, new developments should comply with the five criteria laid out in *Planning for Bushfire Protection Guidelines,* namely location; vehicular access; water supply; siting of development; and location of development.

In the event that the area was developed to a lower zoning density, the provisions outlined in section 4.2 below would be more applicable.

4.2 Croxton Road Study Area and Carmel Study Area

The following presumes the development of the area under a zoning of R2.5 to R5.

Unlike the foothills study area the development of these areas to this zoning standard will not remove the bushfire hazard. Instead it will distribute properties within a bushfire hazard zone currently rated as either *moderate or extreme*. Given the nature of proposed development in each of these two zones it is impractical to consider implementing a 100m *hazard separation zone* for each property. Instead each sub-division would need to comply with Appendix Two of the *Planning for Bushfire Protection Guidelines,* with each individual property needing to be constructed in accordance with *AS359-2009* unless the bushfire risk is reduced or appropriate *hazard separation is* achieved. Any new subdivision in these zones would need to include provisions for reticulated water supplies, and appropriate access for emergency services vehicles and access/egress for residents during a bushfire emergency

4.3 Population Increase and Bushfire

Research conducted by the Australian Bushfire Cooperative Research Centre on incidences of fire indicated that human agency was responsible for a majority of incidences of bushfire in Australia, with both accidental and deliberate ignition being responsible for starting bushfires. Major recent fires including Roleystone and Parkerville have been the result of accidents, while the Prevelly fire resulted from an escaped hazard reduction burn. Numerous fires are also deliberately lit with up to 50% of fires being the result of arson with incidences generally increasing (Willis 2004: vii). This study also suggests that arsonists target areas with high risk such as those with steep slopes and vegetation close to property, in order to make it harder for firefighting agencies to extinguish those fires (Willis 2004: vii-viii). While it is impossible to speculate how an increase in population in the three study areas would exactly impact on the likelihood of increased fire events, it is probable that an increase in population in a particular area will also likely result in an increase in the incidence of deliberate and accidental fires and that these will occur in areas where their suppression becomes more difficult.

5. Comparison of the Two Scenarios

If the status quo is maintained little will change from the situation outlined in section 3 of this report. Major fires will continue to occur periodically with their severity dependent upon fire weather conditions, and the continued application of mitigation and response strategies. Even if no zoning changes were to occur in the three study areas, all new construction will be required to comply with the provisions laid out in *Planning for Bushfire Protection Guidelines,* and *AS 3959-2009* in order to mitigate this fire risk.

In comparison, under the proposed development strategies a number of changes will occur. The following is based on an assumption that current areas of national and Regional Park will remain as such, and that the proposed development occurs:

(i) A greater population will be exposed to bushfire risk, particularly those located in areas within 100m of bushland assessed as having *extreme* or *moderate* bushfire risk;

(ii) However, where developments and structures are sited and built to comply with the provisions laid out in *Planning for Bushfire Protection Guidelines* and *AS 3959-2009*, people and property will be more likely to survive an incidence of destructive bushfire;

(iii) The development to R40 of the foothills area will decrease the bushfire risk *within* the development zone and decrease the amount of bush available to burn in the event of a major fire occurring.

(iv) Incidences of deliberate and accidental ignition of fires will likely increase with a corresponding increase in population;

(v) This is problematic for the Regional Park at the front of the scarp where weather and topography combine to increase fire risk, particularly for property located at the top of the scarp. An increase in population at the bottom of the scarp consequently also increases the risk for people living at the top.

6. Summary of Findings

The three study areas discussed in this report have been found to comprise areas with predominantly *extreme* bushfire risk, with some areas of *moderate* risk also included. The historical assessment showed that major fires occurred regularly and that mitigation strategies to reduce the risk of such were historically piecemeal and affected by political and other considerations. As such they could be considered unreliable long term mitigation strategies. The assessment of topography and weather conditions showed that they had the potential to exacerbate any fires that did occur, particularly those on the front of the scarp. Under these existing conditions hundreds of properties located in these areas are currently exposed to a high level of bushfire risk. As such these areas should be declared as "bushfire prone".

Any new development that occurs within or adjacent to bushland with *extreme* or *moderate* bushfire risk should comply with guidelines and standards set out in *Planning for Bushfire Protection Guidelines, Edition 2* (2010) and *AS 3959-2009 Construction of Buildings in Bushfire Prone Areas*. Risk can be mitigated in a number of ways including the application of hazard separation zones, layout of new developments and access to resources, and construction standards for new buildings that meet specific BAL ratings.

Development within the study areas will reduce the land available to be burnt within those areas but population increase will also likely increase the frequency of fires in adjacent bushland.

6.1 Recommendations

Based on the findings of this report Bushfire Prone Planning makes the following recommendations:

(i) The three study areas should be declared bushfire prone areas;
(ii) The Shire of Kalamunda should undertake a detailed bushfire risk assessment for the proposed development areas, prior to any development commencing;
(iii) All new development should comply with the *Planning for Bushfire Protection Guidelines, Edition 2* (2010);
(iv) All new buildings within 100m of bushland should be constructed to standards laid out in *AS 3959-2009 Construction of Buildings in Bushfire Prone Areas*; and
(v) The Shire of Kalamunda should consider mitigating risk in the foothills area by implementing a fuel reduced hazard separation zone between bushland and property.

7. Attachments

The following maps accompany this report;

- Foothills (South) Indicative Bushfire Attack Level
- Foothills (North) Indicative Bushfire Attack Level
- Croxton Rd Indicative Bushfire Attack Level
- Carmel Indicative Bushfire Attack Level

These maps detail the potential Bushfire Attack Levels (BAL) for each of the three areas. They are indicative only and based only on the vegetation adjacent to the development areas (National and Regional Parks) and do not take into consideration any vegetation within the three study areas.

8. References

AS 3959-2009 Construction of Buildings in Bushfire Prone Areas 2009. Standards Australia.

Planning for Bushfire Protection Guidelines, Edition, 2 2010. Western Australian Planning Commission and Fire and Emergency Services Authority.

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Shire of Kalamunda. 2010. Local Planning Strategy. Unpublished planning document.

Western Australian Planning Commission. 2015. Draft North-east Sub-regional planning framework: Towards Perth and Peel 3.5 Million. Unpublished planning document.

Willis, Matthew. 2004. *Bushfire Arson: A Review of the Literature*. Australian Institute of Criminology Public Policy Series No. 61: Canberra.

FOOTHILLS (South)

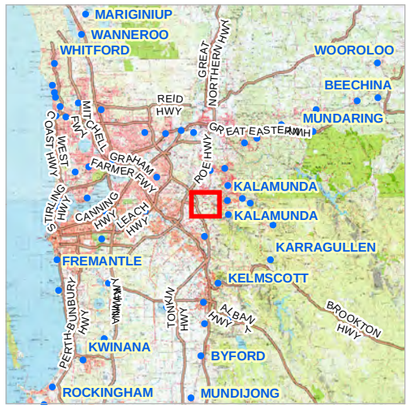
Indicative Bushfire Attack Level

Sub-regional Planning,
Shire of Kalamunda

LEGEND

- Foothills
- Other Lot Cadastre
- Planning Area
- BAL FZ
- BAL 40
- BAL 29
- BAL 19
- BAL 12.5
- BAL LOW

LOCALITY



SCALE BAR

0 250 500 750

Meters

BUSHFIRE PRONE PLANNING

N

DATE CREATED: 12/06/2015

THIS PLAN HAS BEEN PREPARED FOR PLANNING PURPOSES.
ANY AREAS, CONTOURS AND OR DIMENSIONS SHOWN ARE SUBJECT TO SURVEY.

FOOTHILLS (North)

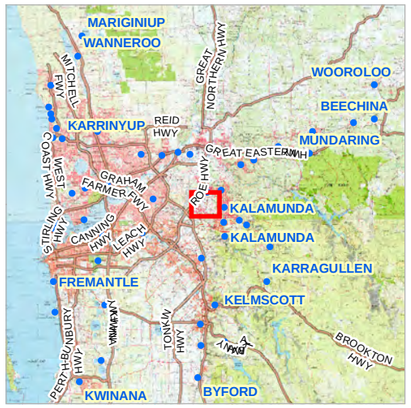
Indicative Bushfire Attack Level

Sub-regional Planning,
Shire of Kalamunda

LEGEND

- Foothills
- Other Lot Cadastre
- Planning Area
- BAL FZ
- BAL 40
- BAL 29
- BAL 19
- BAL 12.5
- BAL LOW

LOCALITY



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BUSHFIRE PRONE PLANNING

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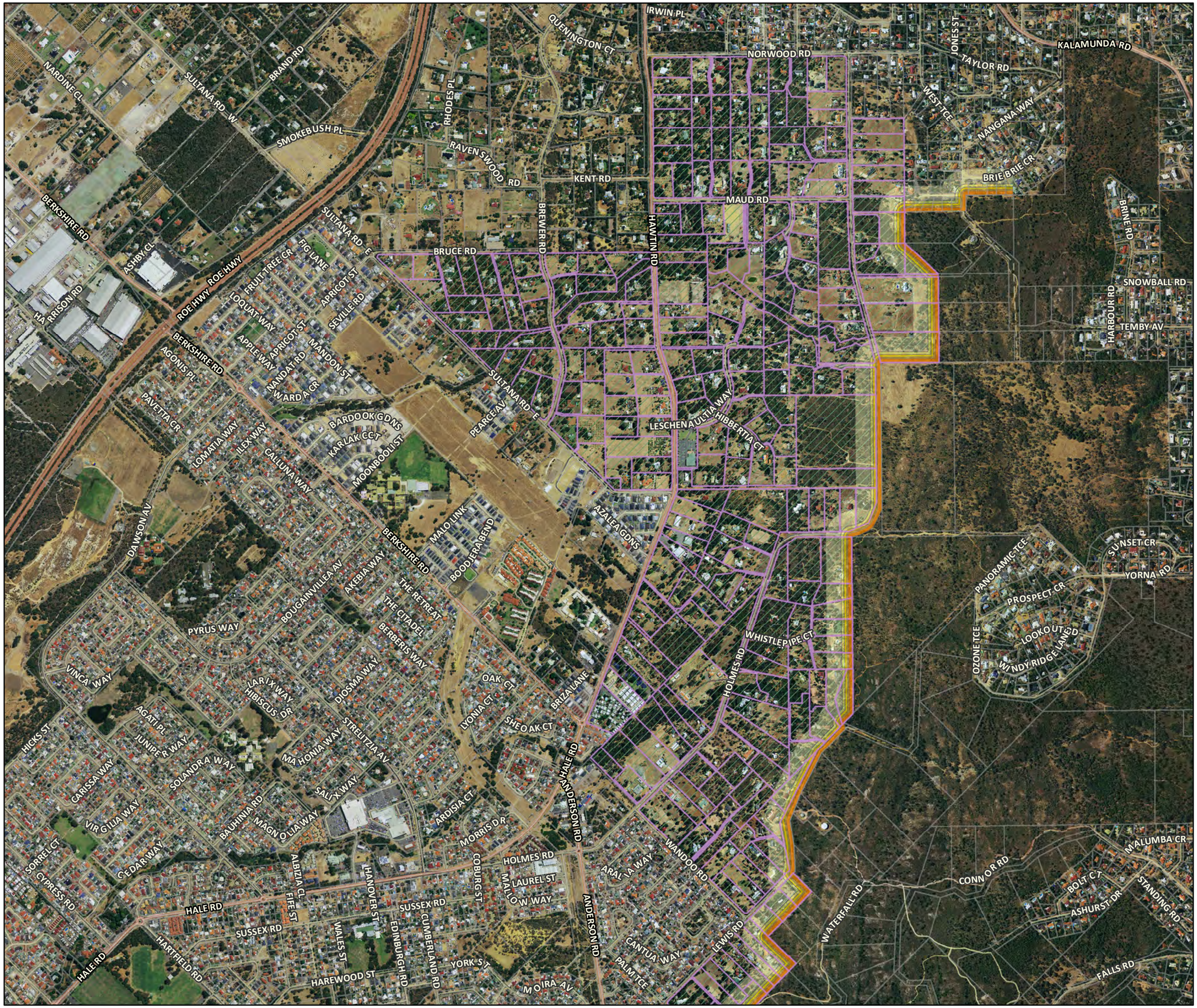

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CROXTON RD

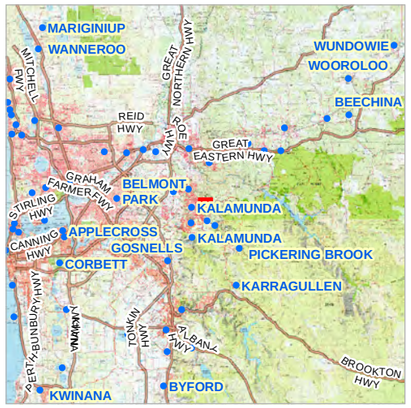
Indicative Bushfire Attack Level

Sub-regional Planning,
Shire of Kalamunda

LEGEND

- Croxton Rd
- Other Lot Cadastre
- Planning Area
- BAL FZ
- BAL 40
- BAL 29
- BAL 19
- BAL 12.5
- BAL LOW

LOCALITY



SCALE BAR

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Meters

BUSHFIRE PRONE PLANNING

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DATE CREATED: 12/06/2015

THIS PLAN HAS BEEN PREPARED FOR PLANNING PURPOSES.
ANY AREAS, CONTOURS AND OR DIMENSIONS SHOWN ARE SUBJECT TO SURVEY.

CARMEL

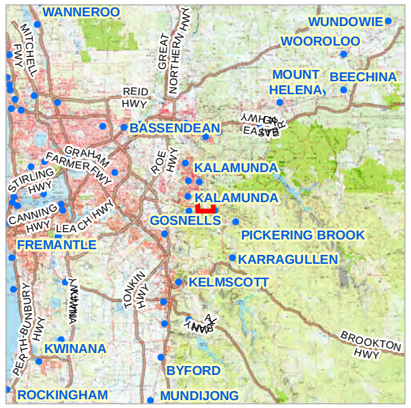
Indicative Bushfire Attack Level

Sub-regional Planning,
Shire of Kalamunda

LEGEND

- Carmel_Planning
- Other Lot Cadastre
- Planning Area
- BAL FZ
- BAL 40
- BAL 29
- BAL 19
- BAL 12.5
- BAL LOW

LOCALITY



SCALE BAR

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Meters

BUSHFIRE PRONE PLANNING

N

DATE CREATED: 11/06/2015

THIS PLAN HAS BEEN PREPARED FOR PLANNING PURPOSES.
ANY AREAS, CONTOURS AND OR DIMENSIONS SHOWN ARE SUBJECT TO SURVEY.

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Report on Environment for Forrestfield/Wattle Grove Foothills Area

Prepared for Shire of Kalamunda

By Essential Environmental

June 2015

essential environmental

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if not now...
land & water solutions
when?

1 BACKGROUND

The Shire of Kalamunda's Local Planning Strategy, endorsed by the WA Planning Commission in 2013, identified the subject area as a Foothills Investigation Area, with the intention of changing the zoning from Special Rural to Residential Bushland with the residential coding of R2.5 or R5.

This report provides a preliminary analysis of the environmental considerations associated with the Forrestfield/Wattle Grove Foothills Area to support the Shire in preparing its submission on the Draft *North-East Sub-regional Planning Framework,* recently released by the Western Australian Planning Commission (WAPC).

The report reviews the potential environmental constraints to development and proposes broad approaches to mitigate these constraints on the basis of future low density residential use.

1.1 Study area

There are three defined project areas within the Forrestfield/Wattle Grove Foothills Area referred to as, Foothills (Figure 1), Carmel Rd (Figure 2) and Croxton St (Figure 3) investigation areas.

These areas are currently zoned largely for Rural use under the Metropolitan Region Scheme and Shire of Kalamunda Local Planning Scheme No. 3.

The Draft *North-East Sub-regional Planning Framework* (WAPC, 2015) has not recommended the sites for future development. An ecological linkage is identified along Welshpool Rd, passing through the Foothills investigation area and through the Carmel Rd investigation area along the edge of the catchment.

1.2 Methodology

Due to the different characteristics of the three investigation areas, the report discusses (and maps) them individually. The findings are intended to provide a summary which can be readily incorporated into the Shire of Kalamunda's submission on the Draft *North-East Sub-regional Planning Framework.*

The following information has been provided on the basis of a desk top investigation only using data and information that is publically available. No attempt has been made to verify the information on-ground. Further detailed site investigations will be required to address the findings of this report prior to any application for rezoning.

2 EXISTING ENVIRONMENT

A desktop environmental investigation of the study area has been undertaken, the findings of which are presented below.

2.1 Foothills investigation area

The Foothills investigation area is approximately22 km^2 and sits at the foot of the Darling Scarp. The investigation area is characterised by small farms and businesses, orchids, horses and a semi-rural lifestyle.

2.1.1 Topography, soils

The Foothills investigation area sits adjacent to the Darling Scarp where the elevation ranges from 125m AHD to 25m AHD. The steepest incline within the investigation area is along the eastern boundary where the slope is in the range of 1:5. Closer to the western boundary, the investigation area experiences a much lower incline and the slope is in the range of 1:75.

The surface geology of the Foothills investigation area is defined largely by gravelly silt which runs the length of the investigation area. The land along this stretch has a very gradual slope, with the elevation on the eastern border reaching 155m AHD to 25 - 45m AHD to the west. There are some pockets of gravel and sandstone along the elevated eastern border of the area with a large sand deposit along the low laying southern border. The north western border is defined by pebbly silt lowlands.

Five main soil types exist within the investigation area (Figure 1):

- Sand (S12 and S8) – Yellow and fine to medium grained, moderately to well sorted. This is mostly restricted to the southern portion of the site. These soil types are the most prone to erosion;
- Gravelly Silt (Mgs2) – Strong brown, tough with common pebbles of fine to coursed grained granite. This soil type is found between the boundary of the Darling scarp eastern boundary and Gravel, as described below. Gravelly silt is less prone to erosion, however can still be prone when exposed, if not properly compacted and/or stabilised;
- Granite (GR) – fine to course grained, ranges in composition from granodioite to granite, adamellite being the most common. Granite sits exclusively along the eastern boundary of the investigation area;
- Pebbly Silt (Mgs1) – Strong brown silt with common fine to course grained quartz and heavy weathered granite pebble. This soil type is found at the north western boundary of the investigation area. Pebbly silt is less prone to erosion, however can still be prone when exposed, if not properly compacted and/or stabilised;
- Sandstone (SS) – Light grey, hard, compact, and moderately weathered. A small section of sandstone occurs approximately half way along the eastern boundary.

A small section of Sandy Silt (Ms4) occurs in the south western portion of the investigation area. This soil type occurs at the Yule Creek and has a high to moderate acid sulfate soil risk.

A review of Department of Environment Regulation acid sulfate soils risk mapping identifies moderate to low risk of acid sulfate soils occurring within 3m of the natural surface within the southern portion of the Foothills investigation area, south of Hartfield Rd, and high to moderate risk following the Yule Brook at the south western border of the investigation area (Figure 1).

A search of the Department of Environment Regulation contaminated sites database shows no registered contaminated sites within the Foothills investigation area.

2.1.2 Flora, fauna, vegetation

The area contains small pockets of native remnant vegetation, with most being approximately 8ha in size. Much of the remnant vegetation within the site acts as an ecological corridor from the western boundary of the more urbanised area of Forrestfield to the eastern boundary which is dominated by native vegetation along the steep incline of the Darling Scarp.

One Bush Forever Site exists within the Foothills investigation area (BFS site 50 Welshpool Rd Bushland, Wattle Grove), positioned adjacent to Welshpool Road East along the northern verge. The Bush Forever Site has an associated 500m buffer or environmentally sensitive area, shown in Figure 1.

Environmentally sensitive areas are declared to prevent incremental degradation of important environmental values such as declared rare flora, threatened ecological communities or significant wetlands. Nine environmentally sensitive areas exist within the Foothills investigation area, typically within the southern portion, Wattle Grove area. As identified by the Department of Environment Regulation, eight of the nine environmentally sensitive areas are known growth areas of declared rare flora (Figure 2).

A search of the Department of Parks and Wildlife's *NatureMap* identified forty four (44) species protected under the *Wildlife Conservation Act 1950* likely to be found within an approximate 1km radius of the investigation area. This includes twelve species that are Rare or likely to become extinct; two Priority 5 species; nine Priority 4 species; eight Priority 3 species; one Priority 1 species and one species of Other specially protected fauna. The Rare or likely to become extinct species are listed in Table 1.

Table 1: NatureMap database species records for rare or likely to become extinct species within 1 km of the Foothills investigation area

Category	Name ID	Taxa
Rare or likely to become extinct.		*Flora*
	3219	Acacia anomala (Grass Wattle)
	32211	Banksia mimica (Summer Honeypot)
	1213	Calectasia cyanea (Blue Tinsel Lily)
	10862	*Thelymitra stellata (Star Orchid)*
	13999	*Conospermum undulatum*
	5505	*Darwinia apiculata (Scarp Darwinia)*
		Fauna
	24162	Bettongia penicillata subsp. ogilbyi (Woylie, Brush-tailed Bettong)
	24784	Calidris ferruginea (Curlew Sandpiper)
	24790	Calidris tenuirostris (Great Knot)
	24731	Calyptorhynchus banksii subsp. naso (Forest Red-tailed Black-Cockatoo
	24734	Calyptorhynchus latirostris (Carnaby's Cockatoo (short-billed black-cockatoo)
	24092	*Dasyurus geoffroii (Chuditch, Western Quoll)*

An EPBC Act Protected Matters search of the Foothills investigation area noted the likelihood of the presence of 29 listed threatened species and seven (7) listed threatened migratory species protected as Maters of National Environmental Significance under the *Environment Protection Biodiversity Conservation Act 1999* (EPBC Act). This includes the Forest Red-tailed Black-Cockatoo, Baudin's Black-Cockatoo, Carnaby's Black-Cockatoo, Chuditch, and Western Ringtail Possum.

2.1.3 Water resources

There are no Conservation Category Wetlands, resource enhancement wetlands or multiple use wetlands in the Foothills investigation area. There are, however four waterways that cross the area from east to west; Crumpet Creek, Woodlupine Brook, Whistlepipe Gully and Yule Brook (Figure 3).

Just beyond the south-western border of the area, all three wetland types occur.

The Perth Groundwater Atlas does not extend to the hills catchments and as such, there is no available information on depth to groundwater. The groundwater conditions will vary in response to the geology and topography.

The Foothills investigation area is located within the Karri groundwater sub area. This aquifer is not actively managed by the Department of Water as the yield is unpredictable and highly variable.

2.1.4 Considerations for future development

A key environmental consideration in the Foothills investigation area is vegetation. Key values are associated with BFS site 50 Welshpool Rd Bushland, Wattle Grove, and the identified Environmentally Sensitive Areas. It is also noted that the Draft *North-East Sub-regional Planning Framework* (WAPC, 2015) identifies an ecological linkage though the Bush Forever site along Welshpool Rd.

The Foothills investigation area also borders Mundy Regional Park to the east. This has implications for bushfire risk, as well as for the management of potential impacts on the Regional Park from "edge effects" including weeds, rubbish, feral animals, off road vehicles and uncontrolled access.

Any development within this area will need to consider stormwater management and water quality to receiving waterways. It will be important to understand current stormwater discharges from the site and ensure that any changes as a result of development will be able to be accommodated within the system and not increase flood risk downstream.

Due to a lack of sewer availability, any development would need to dispose of its wastewater on site. The infiltrative capacity of the soils (which will dictate the size of the land application area of the wastewater disposal system), slope and the proximity to waterways will be key factors which will need to be considered to facilitate appropriate wastewater disposal.

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Figure 1: Foothills investigation area: Geology and topography

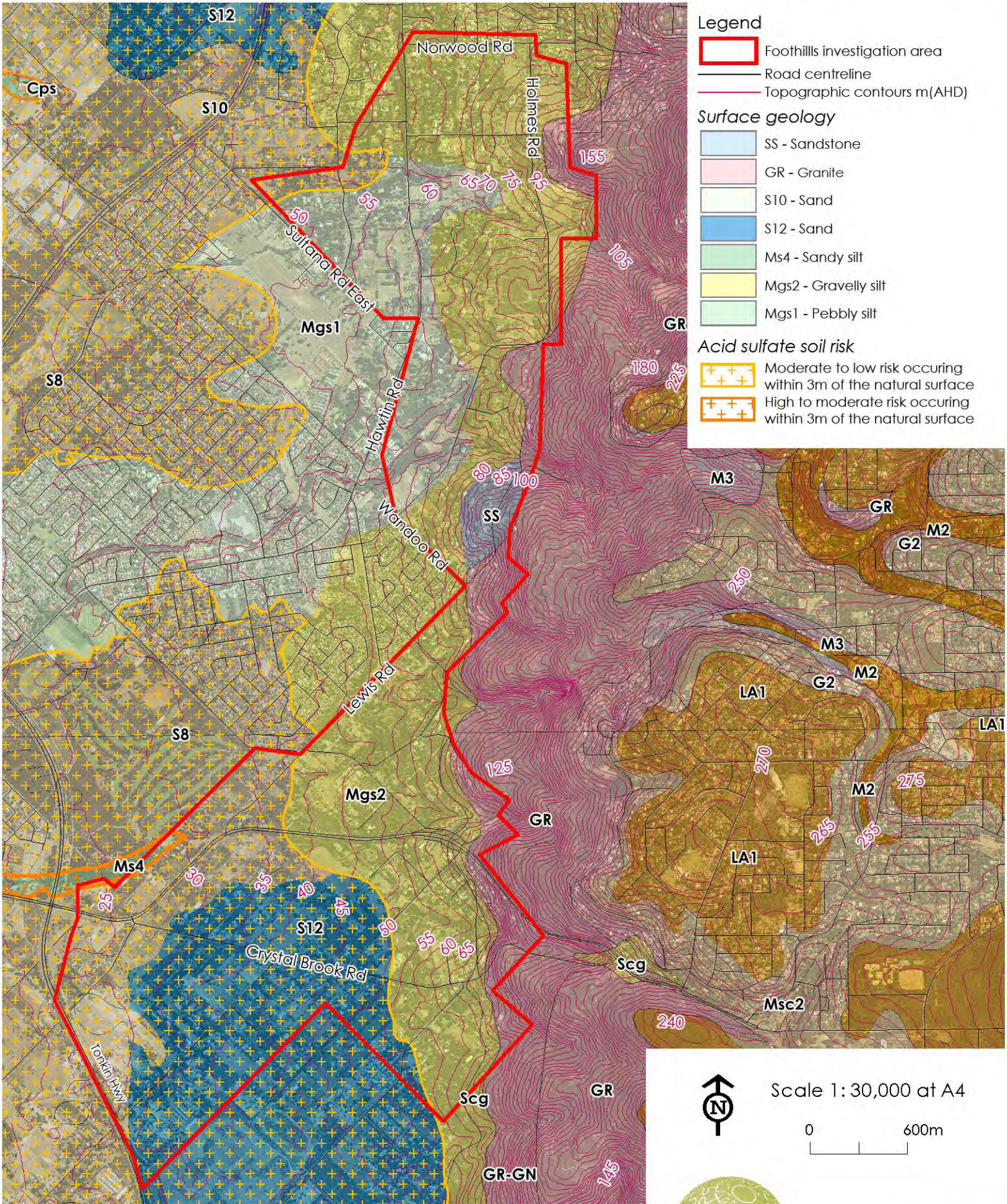

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Figure 2: Foothills investigation area: Vegetation

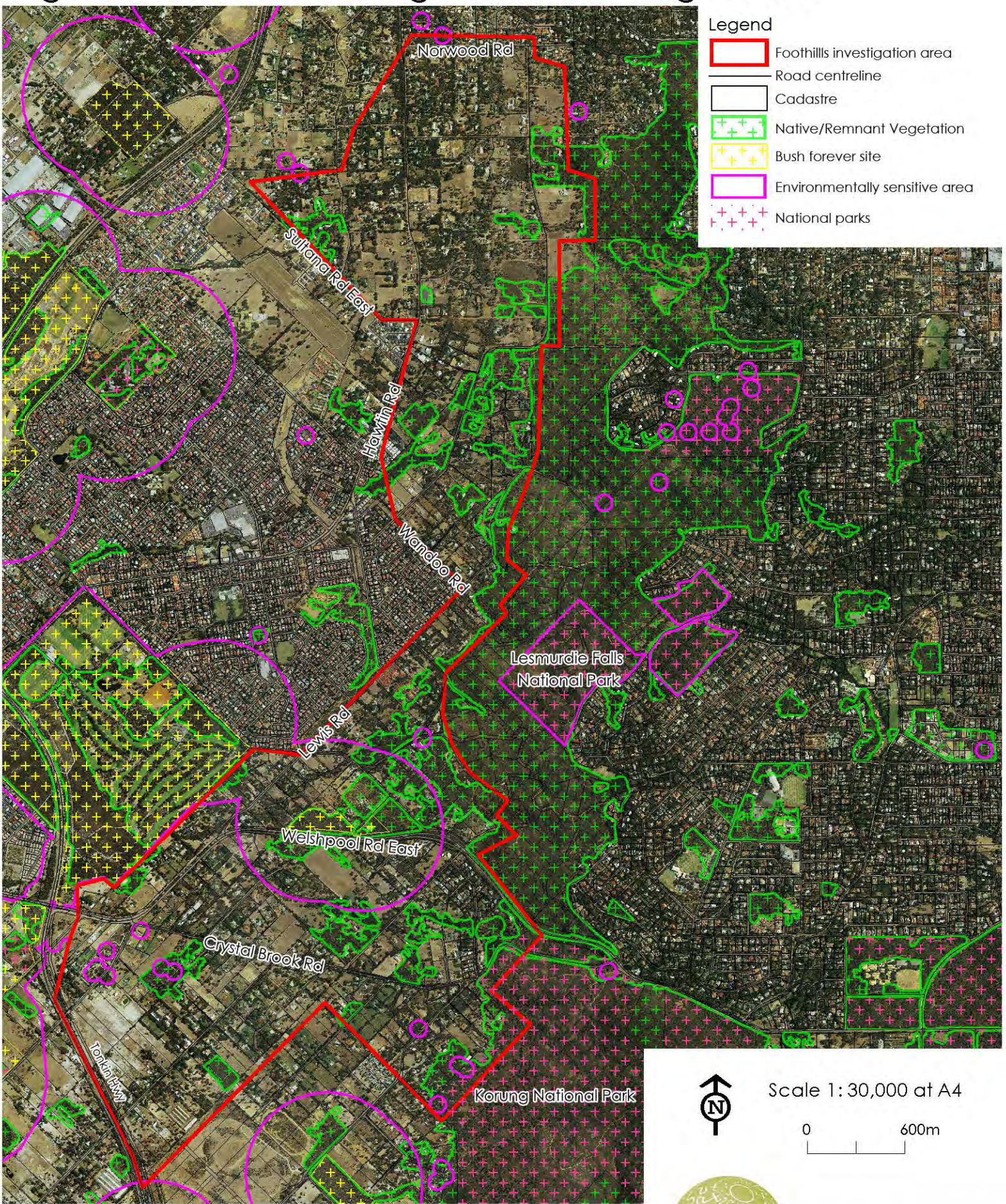

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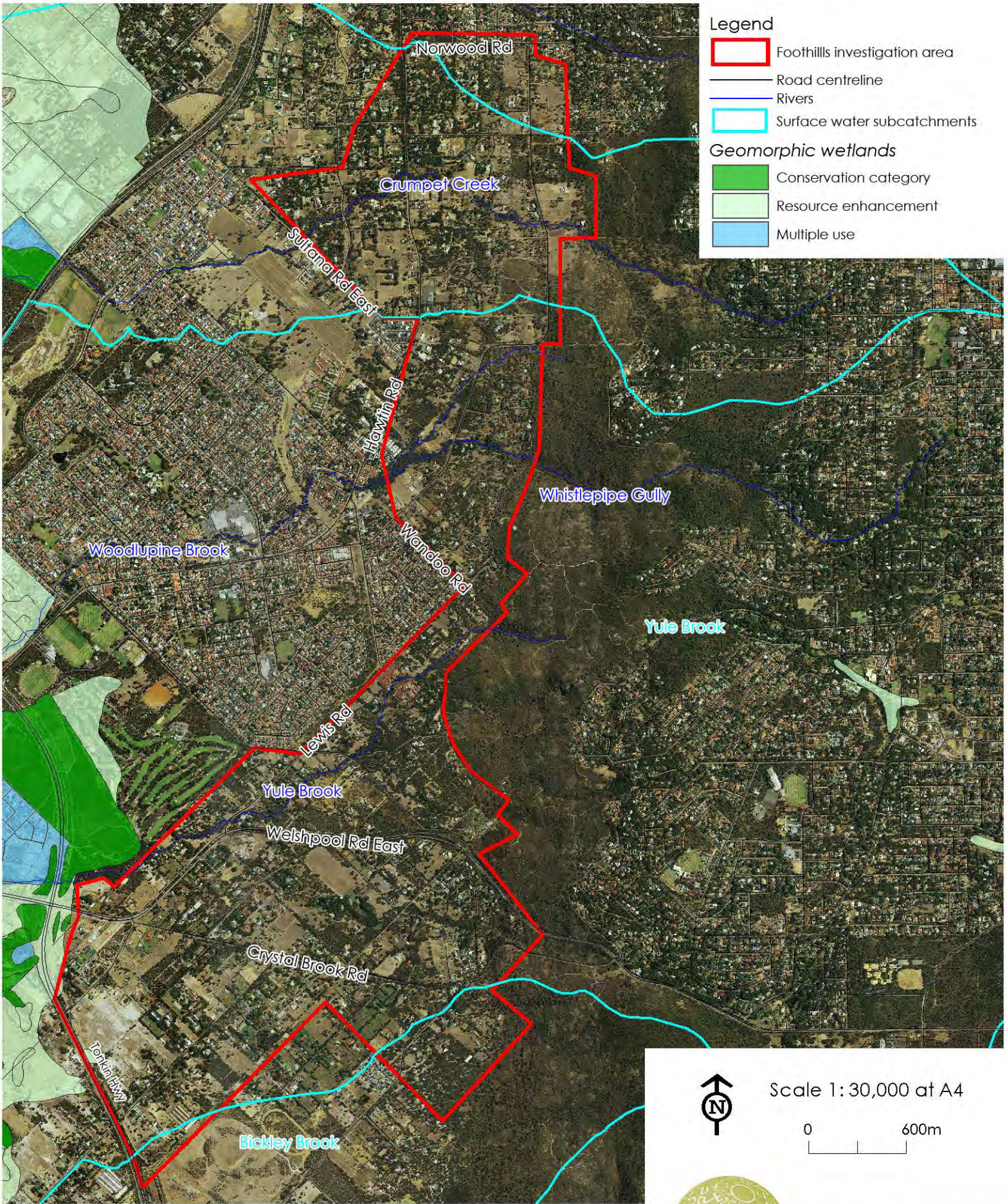
Figure 3: Foothills investigation area: Water resources



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2.2 Carmel Road investigation area

The Carmel Road investigation area is approximately 1.4km^2. The south western portion of the investigation area is positioned at the termination of Welshpool Road East at Canning Rd. Lot sizes are typically around 4 hectares with a few lots being in the range of 7 hectares.

The current land use is predominantly large lot rural residential living with large areas of retained native vegetation. Fairbrossen Winery is located on Carmel Rd and a high voltage transmission line crosses the Carmel Rd investigation area at the south eastern corner.

2.2.1 Topography, soils

The Carmel Road investigation area is typically characterised by the rolling hills of the Walliston/Carmel area with elevations ranging from 314m AHD to 271m AHD with a greater than 8% grade (slope of 1:12.5) in the southern portion of the investigation area.

The surface geology of the Carmel Road investigation area mostly consists of two strata (Figure 4):

- Laterite (LA1) - a cemented and occasionally vesicular, up to 4m in thickness, overlaying a zone of mottled and/or pallid clays and saprolite. Laterite has a moderate to low potential for erosion; and
- Gravel (G2) - moderately sorted rounded pebbles in a clay mixture. Gravel has a high potential for erosion.

As the Department of Environment Regulation's acid sulfate soils mapping does not extend to the Carmel Road investigation area, the risk of acid sulfate soils is not known. Areas most likely at risk of being affected by acid sulfate soils are those which remain wet throughout the year and are dried at some point for some reason.

A search of the Department of Environment Regulation's contaminated sites database revealed no registered contaminated sites within the Carmel Road investigation area.

2.2.2 Flora, fauna, vegetation

Approximately 70% of the Carmel Road investigation area is native/remnant vegetation (Figure 5). Some areas have been cleared for vineyards, horticultural and recreation use. The investigation area has no Bush Forever Sites or environmentally sensitive areas.

A search of the Department of Parks and Wildlife's *NatureMap* identifies 4 significant species (category T to Priority 5) located within the Carmel Road investigation area (Table 2).

A Protected Matters search indicated that fifteen listed threatened species and seven listed migratory species were likely to occur within the study area. These species are identified as Matters of National Environmental species and protected under the EPBC Act.

Table 2: NatureMap database species records within the Carmel Rd investigation area

Category	Name ID	Taxa
Rare or likely to become extinct.		*Fauna*
	24734	Calyptorhynchus latirostris (Carnaby's Cockatoo (short-billed black-cockatoo)
Protected under international agreement	24598	Merops ornatus *(Rainbow Bee-eater)*
Priority 5	25478	Isoodon obesulus *(Southern Brown Bandicoot)*
Priority 4		*Flora*
	5260	Pimelea rara *(Summer Pimelea)*

2.2.3 Water resources

The Carmel Road investigation area is adjacent to Priority 1 and 2 areas of the Middle Helena Catchment Area Public Drinking Water Source Area.

The Carmel Road investigation area straddles the Bickley Brook and Lesmurdie Brook catchment divide which roughly coincides with Annetts Road. The southern half of the investigation area is therefore a part of the Bickley Brook catchment whilst the northern half is in the Lesmurdie Brook catchment.

There are no waterways within the investigation area itself with the Lesmurdie and Bickley Brooks both flowing east-west approximately 1km to the north and south of the respective boundaries.

There are no geomorphic wetlands in the Carmel Road investigation area. A small pocket of multiple use wetland approximately 100m north of the boundary associated with the headwaters of the Lesmurdie Brook leads into the brook itself which is resource enhancement wetland and flows westward (Figure 6) to eventually join the Yule Brook.

Similarly to the Foothills investigation area, there is a lack of available information on the groundwater resources of the Carmel Road investigation area. This is largely due to the hydrogeology which results in highly variable groundwater conditions. Depth to and availability of groundwater will be dependent on the geology and topography of the individual site. However, being located along a catchment divide away from waterways it is likely that groundwater is present only within rock fractures rather than as a consistently yielding aquifer.

2.2.4 Considerations for future development

The location of the site adjacent to the Middle Helena Catchment Area Public Drinking Water Source Area is likely to be of interest to both the Department of Water and Office of the Environmental Protection Authority. It is noted; however, that as the Carmel Road investigation area is not located within the Middle Helena Catchment, any water discharging from the site will not flow into the Middle Helena Catchment Area Public Drinking Water Source Area and so risks to the water quality of the drinking water resource are minimal. It is considered that the incorporation of water sensitive urban design principles into the design, construction and maintenance of the future development will be adequate to manage water quality risks.

The Carmel Road investigation area is likely to be subject to high bush fire risk as land to the west and north east is reserved for Parks and Recreation and likely to be retained as native vegetation. There are also significant amounts of potentially good quality native vegetation remaining in the investigation area and the Draft *North-East Sub-regional Planning Framework* indicates an ecological linkage running through the site which is likely to need to be retained. It is also possible that Carmel Road investigation area may contain protected species.

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Figure 4: Carmel Rd investigation area: Geology and topography

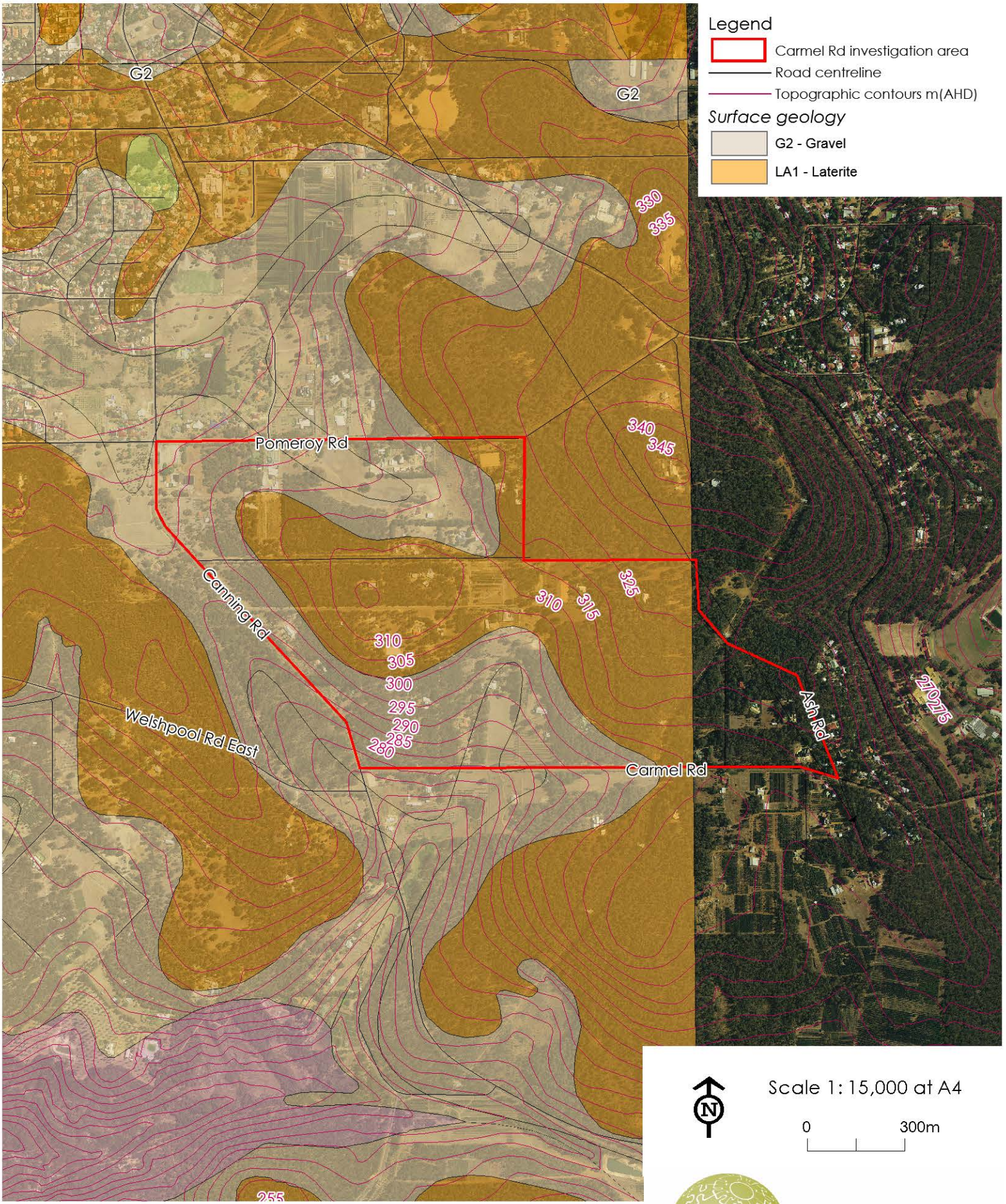

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Figure 5: Carmel Rd investigation area: Vegetation

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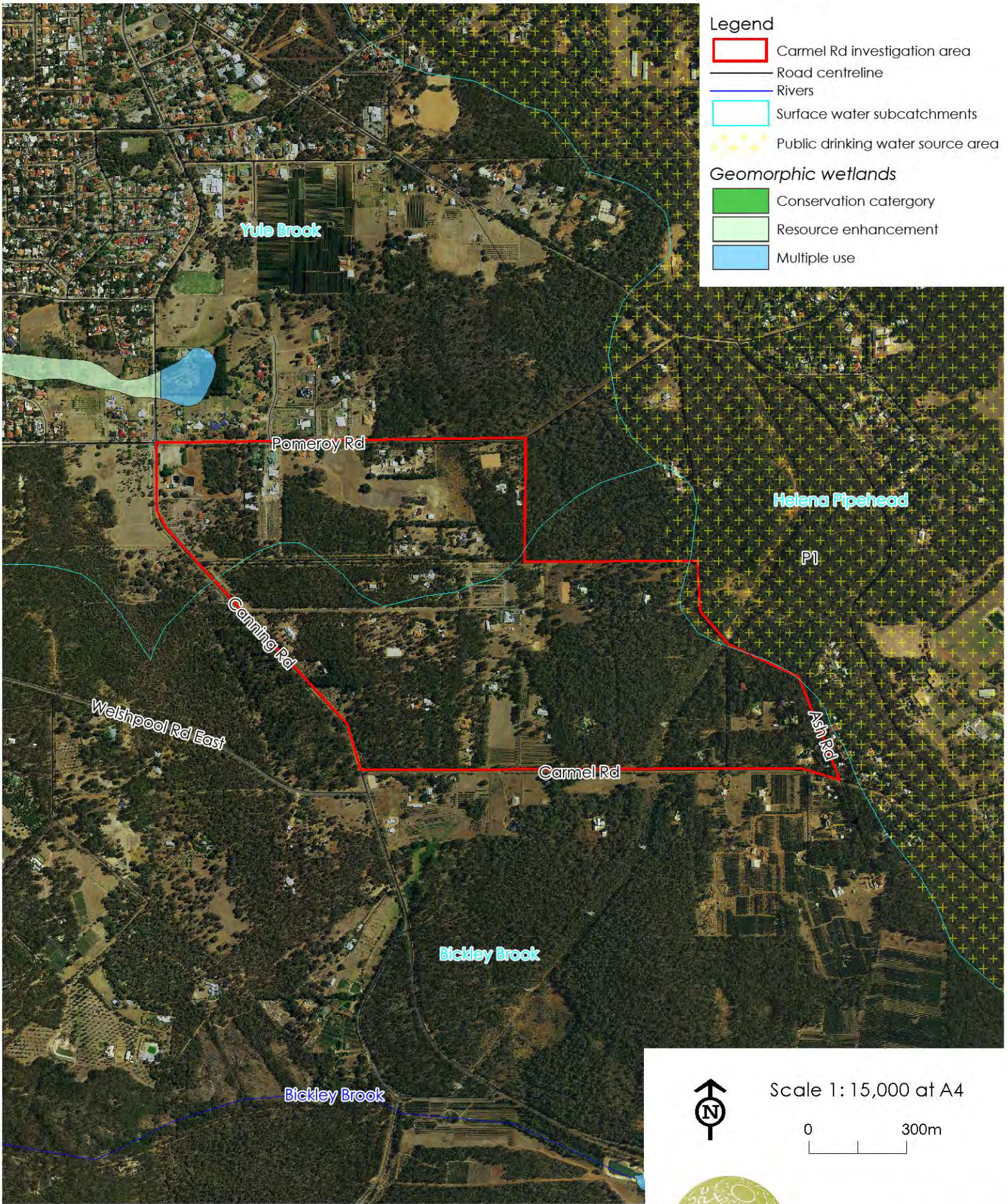
Figure 6: Carmel Rd investigation area: Water resources



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2.3 Croxton Road investigation area

The Croxton Road investigation area is approximately 0.4km^2 and is situated nearly 1km east of the Kalamunda town-centre. Lots are typically 2 hectares in size and provide for rural living uses. The lots in the south of the Croxton Rd investigation area are largely cleared, whilst those in the centre and to the north and east have retained large amounts of native vegetation. The Croxton Road investigation area is situated within the Priority 2 Middle Helena Catchment Area Public Drinking Water Source Area.

2.3.1 Topography, soils

The gradient of the land ranges from 255m AHD in the south western corner of the investigation area to 180m AHD in the north eastern part (Figure 7), showing a gentle rising slope from east to west of around 1:6 to 1:8.

The surface geology of the investigation area mostly consists of three strata (Figure 7):

- Gravel (G2) - moderately sorted rounded pebbles in a clay mixture. Gravel has a high potential for erosion;
- Silt (M3) - , yellowish brown, mottled, firm when dry and soft when wet. Silt is less prone to erosion, however needs to be properly compacted and/or stabilised to prevent erosion; and,
- Granite (GR) - fine to course grained ranging from granodiorite to granite. Granite has a low potential for erosion.

No information is available with regards to acid sulfate soil risks.

A search of the Department of Environment Regulation's contaminated sites database revealed no registered contaminated sites within the Croxton Road investigation area.

2.3.2 Flora, fauna, vegetation

A large portion of the Croxton Road investigation area contains native/remnant vegetation. Although the Department of Parks and Wildlife dataset only recognises some portions of native vegetation on site (Figure 8), lots in the eastern and northern sections of the Croxton Road investigation area have also retained large areas of bushland. Land reserved for Parks and Recreation containing native vegetation also exists to the north, south west and south east.

An environmentally sensitive area, also listed on the Register of the National Estate exists to the north, which is part of the Kalamunda National Park. There are no other environmentally sensitive areas within the study area.

A search of the Department of Parks and Wildlife's *NatureMap* database identifies four species of significance within the Croxton Road investigation area ranging from rare or likely to become extinct to Priority 5 (Table 3). These species are protected under the *Wildlife Conservation Act 1950*.

A Protected Matters search identified eleven listed threatened species and seven listed migratory species protected as Matters of National Environmental Significance under the EPBC Act as having the potential for them or their habitat to occur within the Croxton Road investigation area.

Table 3: NatureMap database species records within 1 km of the Croxton Rd investigation area

Category	Name ID	Taxa
Rare or likely to become extinct.		*Fauna*
	24092	Dasyurus geoffroii (Chuditch, Western Quoll)
Protected under international agreement	24598	Merops ornatus *(Rainbow Bee-eater)*
Priority 5	25478	Isoodon obesulus *(Southern Brown Bandicoot)*
Rare or likely to become extinct.		*Flora*
	3219	Acacia anomala *(Grass Wattle)*

2.3.3 Water resources

The Croxton Road investigation area is located within a Priority 2 area of the Middle Helena Catchment Area Public Drinking Water Source Area. Accordingly, land use and development should be consistent with the *Middle Helena Catchment Area Land Use and Water Management Strategy* (WAPC, 2010).

The *Middle Helena Catchment Area Land Use and Water Management Strategy* recommends that only land uses that conform with the objective for priority 2 source protection areas are permitted and precludes urban and industrial development. It recommends that lots are sized to suit local conditions based on land capability and suitability assessment, with a recommended minimum lot size of two hectares in areas zoned for rural living or equivalent zones or four hectares in areas zoned rural.

No waterways or wetlands of significance are known to occur within the the investigation area which is located close to the head of catchment of a minor tributary of the Piesse Brook with the low-point roughly at the areas centre. A recognisable creekline has formed by the time it crosses Hummerston Road and this creek joins the Piesse Brook approximately 600m north of the site.

No information is available on groundwater resources and the depth and availability will depend on the hydrogeological conditions of the site. The Croxton Road investigation area is located within the Karri groundwater sub-area.

2.3.4 Considerations for future development

The most significant constraint to development is the location of the Croxton Road investigation area within a Priority 2 area of the Middle Helena Catchment Area Public Drinking Water Source Area. This places significant restrictions on development in order to protect the quality of the drinking water resource. For the Croxton Road investigation area to be developed for residential purposes, it would need the approval of the Department of Water to change the classification from Priority 2 to Priority 3. Whilst this has been achieved in a number of locations, it requires detailed technical investigations and a potentially lengthy assessment process.

Similarly to the other two investigation areas, native vegetation is also a significant environmental issue that would need to be addressed in the Carmel Road investigation area.

This includes consideration of the likelihood of occurrence of species or habitat of protected species, as well as implications for development in relation to bushfire risk.

Unlike the other development areas, a Water Corporation sewer line is located within one or two kilometres of the site. This provides an opportunity for connection of this area to sewer (if capacity is available) and allowing for greater density of development should the priority classification be amended, noting the restrictions on sewer infrastructure in the *Middle Helena Catchment Area Land Use and Water Management Strategy* and latest version of the Land Use Compatibility in Public Drinking Water Source Areas water quality protection note (DoW, 2015).

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Figure 7: Croxton Rd investigation area: Geology and topography

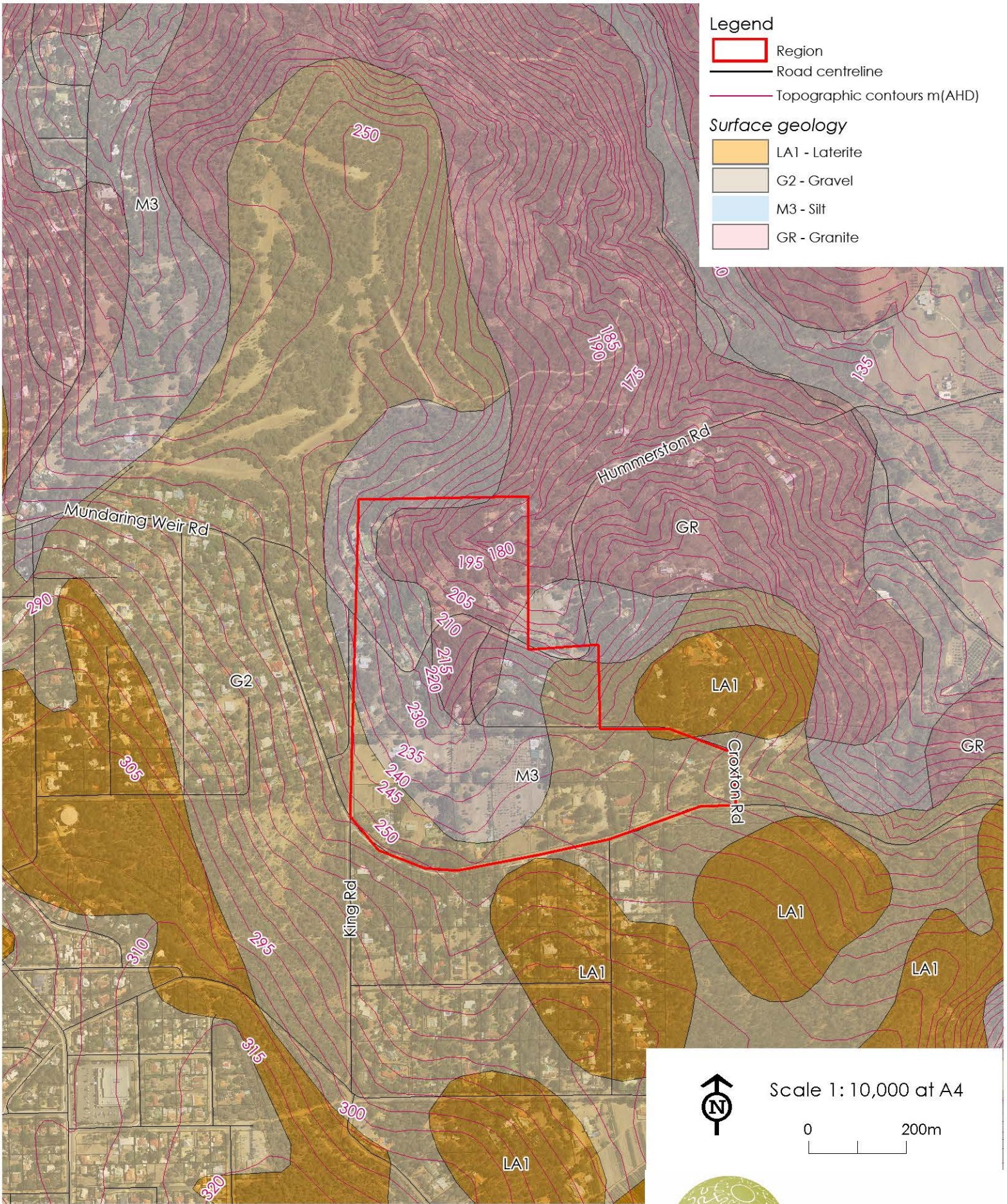

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Figure 8: Croxton Rd investigation area: Vegetation

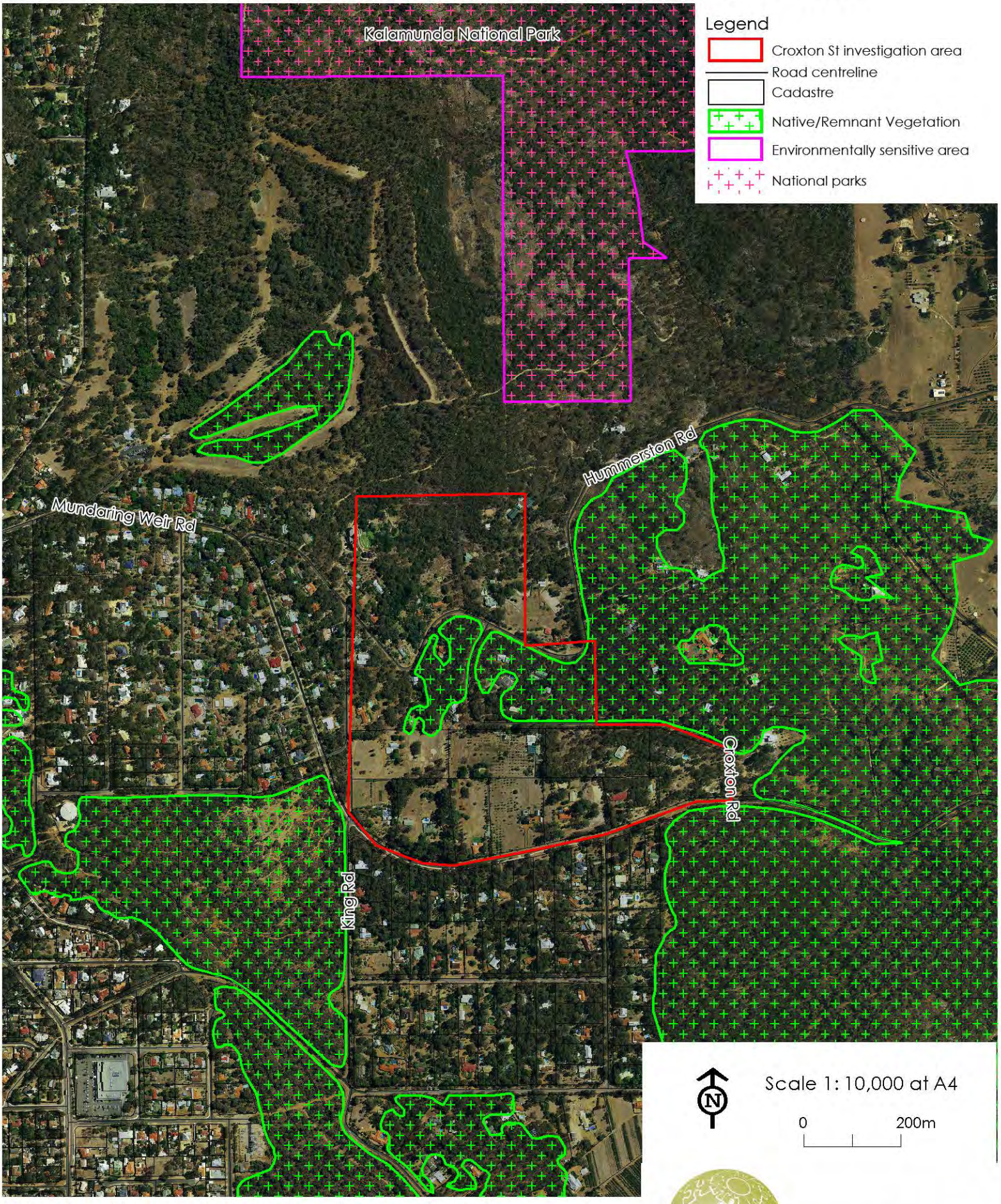

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Figure 9: Croxton Rd investigation area: Water resources

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3 FINDINGS

The Foothills, Carmel Rd and Croxton St investigation areas are currently zoned for Rural use. None of these sites has been recommended for future development in the Draft *North-East Sub-regional Planning Framework* (WAPC, 2015).

3.1 Environmental considerations

This study, based on desk top information, has identified a number of environmental issues which would need to be considered if these sites were to be proposed for low density residential use.

3.1.1 Public drinking water source protection

The Croxton Rd investigation area is located within a Priority 2 area of the Middle Helena Catchment Area Public Drinking Water Source Area. This designation precludes residential development. In order for the Croxton Rd investigation area to be rezoned for residential purposes, the priority classification would need to be changed by the Department of Water from P2 to P3. This would require significant investigations and a potentially lengthy assessment with no guarantee of the desired outcome.

Any development of the Carmel Road investigation area will require implementation of best practice water sensitive urban design in order to appropriately manage water quality risks.

3.1.2 Protected species and threatened ecological communities

Searches of State and Federal databases revealed a number of protected species which are likely to occur within the investigation areas. Any occurrences would need to be confirmed with on-site field surveys; however, it is recognised that the surrounding protected areas of bushland are also likely to provide appropriate habitat and/or conditions for these species.

It is recommended that the identified Environmentally Sensitive Areas in the foothills investigation area are retained and protected through appropriate reservation for conservation.

3.1.3 Vegetation

Each of the investigation areas contains a proportion of remnant vegetation which is likely to be of good quality. The sites are also surrounded by many areas of vegetation already protected in National Parks or through reservation for Parks and Recreation in the Metropolitan Region Scheme. Where these sites abut the proposed investigation areas, the future development of the investigation areas has the potential to impact on the environmental values of the conservation areas.

The Draft *North-East Sub-regional Planning Framework* (WAPC, 2015) identifies an ecological linkage through the Foothills investigation area along Welshpool Rd, and through the Carmel Rd investigation area along the edge of the catchment. The retention of ecological linkages is recommended to enhance the resilience of natural systems and provide increased amenity for the community.

Due to the proximity of vegetated areas and the likely retention of native vegetation as part of any future development, consideration will need to be given to the appropriate management of bushfire risk.

3.1.4 Waterways and surface water

The foothills investigation area contains four waterways. Flows into and through these waterways would need to be understood and managed appropriately. This would include consideration of water quality and any impacts on downstream flood risk.

The significant slopes which characterise each investigation area will require appropriate management of surface water flows to minimise erosion risk. It is considered that erosion risk is lowest in the Carmel Rd investigation area.

3.1.5 Groundwater

Groundwater in the hills is inconsistently found in rock fractures and some small areas of alluvial or colluvial valley floors where they form small dampland or sumpland type wetlands. Seasonal groundwater springs from the fractured rocks are also not uncommon and contribute to streamflows. Depth to groundwater is dependent on geology and topography but is generally least in valley floors.

All investigation areas are contained within the Karri groundwater management subarea. The Department of Water does not actively manage the groundwater resources in this area; however, and proponents should contact the Department of Water for advice regarding availability.

Key threats to groundwater quality, and therefore downstream surface water quality, are nutrients from applied fertilisers and septic tanks.

3.1.6 Wastewater

Due to a lack of proximity to sewer, it is likely that development of the investigation areas will require on-site wastewater disposal. Consideration will need to be given to the infiltrative capacity of the soils to ensure that lots are of sufficient size to provide for an adequate land application area for disposal of the wastewater. Setbacks from waterways and appropriate responses to slope will be required.

3.1.7 Summary of environmental issues

A summary of the environmental issues as they relate to each investigation area is provided in Table 4. It should be noted that although an issue may be indicated, this does not necessarily reflect the magnitude of the issue.

Table 4: Summary of potential environmental issues in each investigation area

Environmental issue	Foothills investigation area	Carmel Rd investigation area	Croxton Rd investigation area
Public drinking water source area			✓
Protected species	✓	✓	✓
Loss of regionally significant values	✓		
Loss of remnant vegetation	✓	✓	✓
Bushfire risk	✓	✓	✓
Loss of ecological linkages	✓	✓	
Impact on existing conservation areas	✓	✓	
Impacts on/from waterways	✓		
Groundwater availability	✓	✓	✓
Wastewater disposal	✓	✓	

3.2 Potential management and mitigation actions

It is considered that the proposed development of the investigation areas for low density residential development has the potential to impact on a number of environmental values. Recommendations for management and mitigation of these impacts are as follows.

- Consult the Department of Water regarding the potential for reclassification of the Croxton Rd investigation area from a Priority 2 to a Priority 3 Public Drinking Water Source Area;
- Provide adequate protection for Bush Forever Site 50 and the identified Environmentally Sensitive Areas including an appropriate buffer and on-going management actions;
- Retain the ecological linkages as indicated in Draft *North-East Sub-regional Planning Framework* (WAPC, 2015);
- Undertake appropriate investigations for protected species and threatened ecological communities;
- Ensure appropriate "edge treatments" around the development to minimise impacts on abutting conservation areas. This should include management of weeds, uncontrolled access, pests and disease, litter and bushfire risk;
- Undertake sufficient modelling of surface water systems within the Foothills investigation area to ensure that the development will not increase downstream flood risk and will address any potential impacts on water quality;
- Development to address stormwater management and erosion risk consistent with *State Planning Policy 2.9: Water Resources* and *Better Urban Water Management* (WAPC, 2008);

- Any development which requires a source of water for irrigation would need to assess the geological conditions to determine an appropriate location for the installation of a bore; and
- On-site disposal of wastewater to consider soil type and slope consistent with AS/NZS 1547: 2012 on-site domestic wastewater management.

3.3 Conclusion

It is considered that there are no significant environmental constraints to the development of the Foothills and Carmel Rd investigation areas for low density residential development, providing bushfire risk can be adequately managed and the actions identified in section 3.2 are undertaken.

Rezoning of the Croxton Rd investigation area for residential development will require reclassification of the site from a Priority 2 to a Priority 3 Public Drinking Water Source Area and any future development to be consistent with the *Middle Helena Catchment Area Land Use and Water Management Strategy* (WAPC, 2010).

4 REFERENCES

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Client: Shire of Kalamunda

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INFRASTRUCTURE SERVICING REPORT

Forrestfield and Wattle Grove Foothills Investigation Area, Western Australia

July 2015

Rev B

kctt

HISTORY AND STATUS OF THE DOCUMENT

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1. Introduction

KCTT have been requested to provide an infrastructure servicing report (ISR) to support the continued planning processes associated with the rezoning of the Forrestfield and Wattle Grove Foothills Investigation area from Special Rural to Urban. This report provides an assessment of the likely servicing requirements within the proposed area. The Foothills Investigation area is within the Shire of Kalamunda, who is the direct client of this report.

1.1 Scope of the ISR

The information provided herein addresses the civil engineering aspects of potential residential and local centre development of the subject landholdings and assesses the availability of existing and proposed infrastructure assets in proximity to the subject sites. Rational engineering judgement will be exercised to provide advice on the potential infrastructure requirements to support the proposed development. The professional advice provided in this report is preliminary and subject to change in the planning, detailed design and implementation phases of the project as the information we are receiving from the agencies is preliminary until a formal planning phase is commenced. In addition to assessing the existing conditions of the study area and describing the general site works required for the nature of works involved, this report discusses the upgrade/connection requirements for the proposed developments in terms of major infrastructure, which includes: -

- **Stormwater –** The Shire of Kalamunda (SoK) will provide the technical requirements for storm water drainage. Conveyance of internal road drainage and treatment of 1, 5 and 100 year storm events are likely to be the key requirements with the stormwater drainage system likely to be a piped network for the 1 in 5 year event with treatment areas for the 1 in 1 year event and drainage detention required for the 1 in 100 year event.
- **Wastewater (Sewer) –** The extension of wastewater (sewer) assets will be a key requirement of this area. KCTT will review the location of existing sewer assets and provide commentary on what we believe will be the likely requirements for upgrade of services both through the Foothills area as well as to the surrounding area to accommodate the future growth requirements. The Water Corporation will need to enter into a formal planning phase with the Shire of Kalamunda, which will include using specific concept plan layouts prior to providing finalised information.
- **Potable Water Supply –** The extension of water assets is also a key requirement of this Area and the future LSP developments. KCTT will hold informal discussions with Water Corporation Officers and document the findings in this report. The Water Corporation will need to enter into a formal planning phase with the Shire of Kalamunda, which will include using specific concept plan layouts for the proposed LSP prior to providing finalised information.

- **Power –** KCTT will assess the closest possible locations for connection of services to support residential land / mixed use and industrial development through the Forrestfield and Maida Vale Foothills area. KCTT will review the Western Power Network Capacity Model and the Dial Before You Dig data and provide general commentary only for extension of Western Power assets.
- **Telecommunications –** KCTT will provide general commentary relating to telecommunications requirements based on the information available as at the date of this reporting. We will discuss potential connection points based on the information identified from Dial Before You Dig data.
- **Gas –** KCTT will discuss potential opportunities for the connection and extension of gas through the area with ATCO Gas.

1.2 Location and Description of the Proposed Local Structure Plan Area

The Forrestfield and Wattle Grove Foothills Investigation area is special rural land within a general location bounded by Mundy Regional Park to the east, Tonkin Highway and Victoria Road to the south, Roe Highway to the west and Norwood Road to the north. The land uses surrounding the Foothills area include residential development with general R20 codings to the west, commercial / industrial uses to the south and a regional park to the east.

A road layout is currently present with the Foothills Area, however with rezoning and further development, the internal road network will need to be upgraded. The Foothills Area nominated the following development yields: -

Table 1 – Foothills Investigation Area (Likely Development Yields)

Development Type	Total Area (hectares)	Equivalent Area (hectares)	No of Dwellings
Urban (Residential Bushland)	867.44	565.0	16,800 (R30)

Note: * the equivalent hectares calculation is based on a reduction in the total area of the Foothills Investigation Area that allows for the provision of public open space, roads, drainage infrastructure and landscaping. This assessment is intended to be conservative for the purpose of determining infrastructure requirements only.

1.3 Available Information

- **Dial Before You Dig** – KCTT have collected data through the Dial Before You Dig (DBYD) service. This was performed in multiple enquiries to cover the area of interest.
- **Aerial Imagery** (Nearmaps) – Nearmaps has been utilised to obtain aerial imagery of the subject site. The imagery obtained will aid in the determination of the vegetation coverage of the area proposed for the development.
- **Landgate SLIP** – The use of the Landgate SLIP program will enable KCTT to locate existing utility services on and around the subject sites. The SLIP enabler can also reveal information about the

topography, soil conditions, surrounding environmentally sensitive areas and planned capital works by the various authorities, (including Water Corporation).

- **ESInet** – The ESINet platform provides information relating to existing sewer and water infrastructure and contour information.
- **Site Visit** – Colin Kleyweg of KCTT has conducted several site inspections as part of this ISR and as part of previous studies.

Note: Some information included in this report has been sought from the relevant regulatory authorities, although it is important to note that the information given is preliminary in nature. If the proposed development is to proceed, the client is advised to note that the information received from these authorities is subject to change in the formal application process. Of further importance, no service authority can guarantee the information provided in this report as each authority will need to proceed with formal planning once more detailed layouts are developed. Each service authority is required to provide their input via a formal process with the WAPC and the Shire of Kalamunda.

Therefore the information in this Servicing Report is preliminary in nature and for general information only to assist the Shire of Kalamunda in its planning for the future development of the region. This report should be viewed as the first step in a series of regulatory requirements for the future development of the Foothills Investigation Area.

2. Infrastructure Servicing

The area of study for this ISR is the Forrestfield and Maida Vale Foothills Investigation area as mentioned in Section 1. The area is currently zoned as Special Rural, with the intention of rezoning the area to urban with an R-coding of R30.

This section on Infrastructure Servicing includes the following discussion points: -

- Section 2.1 – Topography and Environment
- Section 2.2 – Geotechnical Conditions
- Section 2.3 – Building and Earthworks
- Section 2.4 – Roads and Stormwater Drainage
- Section 2.5 – Wastewater (Sewerage)
- Section 2.6 – Water
- Section 2.7 – Power, Telecommunications and Gas Supply

2.1 Topography and Environment

The Foothills Investigation area exhibits a slope generally from the Mundy Regional Park in the east at levels around RL 60.00 toward the west where the natural surface is around RL 28.00m AHD.

The Mundy Regional Park forms a natural vegetative boundary to the east of the Investigation area. This is located immediately south of Maida Vale Road.

Groundwater levels are available for the south western portion of the area, which indicate AAMGL between RL 13.0m and RL17.0m, approximately 15 metres below the natural surface level. We therefore believe that interface to groundwater should not pose excessive risk to the project, however there can be localised issues with perching of groundwater when combined with presence of cemented rock formations such as “coffee rock”.

2.2 Geotechnical Conditions

The Foothills Investigation area is located within the Swan Coastal Plain formation. The area features soils equally split between Bassendean Sands and Guildford clays in pockets around the site. Yoganup formations are present in the southern portion of the Investigation area. Colluvium is also present in the eastern and northern portions of the site, most likely due to being at the base of hills within the Mundy Regional Park. This information is observed from the Perth Groundwater Atlas.

In areas where significant new works are required, (such as new roads, stormwater drainage infrastructure etc.) detailed geotechnical reporting should be undertaken prior to the commencement of the design phase as the

presence of hard rock, soft clays and other deleterious materials will impact the design intent. This information should be available in detail to inform the general design.

Mapping for the area shows that the western portion of the Investigation area has a low to moderate risk of encountering acid sulphate soils within 3 metres of the natural ground level. The remainder of the area has not been determined to pose a risk of encountering acid sulphate soils however where deeper works are required, for instance for sewer and stormwater infrastructure, more in-depth geotechnical reporting should be conducted to manage the risk of any exposure to acid sulphate soils, in accordance with standard industry practices.

2.3 Building and Earthworks

The Foothills area is being investigated for its suitability in rezoning to urban with a Residential coding of R30. All development in the area should be staged where possible to follow the natural surface level of the land. Sewer and stormwater drainage should be designed to follow the natural contours of the land, so as to minimise earthworking required for the provision and installation of services. This is discussed in further detail in Sections 2.5 and 2.6. This should allow for land development in the area to follow the general natural surface levels and therefore limit the amount of import fill required. The use of imported fill in an area such as Forrestfield and Wattle Grove is likely to be expensive and further the use of import fill is a finite resource and should be considered in terms of its sustainability. In the current market we estimate the cost of imported fill to be in the region of $35 to $40 per m^3, (pending the size of each respective project to be developed). Earthworks in the Investigation area should therefore be confined to: -

- Replacement of local materials which are not suitable as sub-grades in the development of residential urban landholdings;
- Removal of material for the construction of stormwater drainage infrastructure including basins and the like;
- Importation of fill for areas of road construction which sit directly above hard rock, bed rock or similar;
- Replacement of existing material in trenches for wastewater, water, power, gas and telco services (import select fill).

2.4 Roads and Stormwater Drainage

The Forrestfield and Wattle Grove Foothills Investigation area is special rural land within a general location bounded by Mundy Regional Park to the east, Tonkin Highway and Victoria Road to the south, Roe Highway to the west and Norwood Road to the north. The internal road layout has not been formalised at this stage, however will be developed in further iterations as part of more detailed investigation in the planning phases.

The Shire of Kalamunda has an important role in developing the design by offering a pragmatic approach to construction of roads on steeper slopes. In some local government authorities there has been a move recently to

limit longitudinal road grades to 6% preferred. We believe this will be an overly conservative measure which will have a major impact on construction costs in the Foothills area.

The proposed road cross sections and intersections are to be designed to meet the change in traffic conditions as a result of the development of the Foothills Investigation area. The design of the rod network in particular should consider the external conditions on roads at the boundary of the Investigation Area. The design of the road network will need to be legible and deter the movement of "through" traffic in residential areas. In particular there will need to be deterrence for industrial vehicles to enter the Investigation Area given the proximity of Tonkin Highway to the south and the Forrestfield North Industrial Area to the west of the Investigation Area.

The Investigation Area has a fairly simple overland flow-path with the overland flow generally directed westerly within the Investigation Area. As part of detailed area designs, specific locations of any detention structures which will be required will need to be determined. This can either be provided within a formalised road reserve, or it can be included in private landholdings with a specific area for easement purposes to the benefit of the Shire of Kalamunda. Given the goal density targets of R30, it is also important to note that connection to the City's main stormwater drainage lines may be required for lots with not enough space for on-site detention. These requirements are likely to play a key role in the stormwater drainage design process in the Investigation Area. As a general rule of thumb for R20 to R30 development (which needs to be confirmed through the DWMS / LWMS and UWMP phases): -

- 2% of the total land area will be needed for the 1 in 1 year event;
- 5% of the total land area will be needed for the 1 in 5 year event;
- 8% of the total land area will be needed for the 1 in 100 year event;

Based on these general principles, KCTT have determined that the following approximate areas will be required for stormwater drainage requirements: -

- Northern Catchment (R30) = 253 hectares
    - 1 in 1 year = 2% or 50,000m^3 at approx. 0.3m depth
    - 1 in 5 year = 5% or 125,000m^3 at approx. 0.5m depth
    - 1 in 100 year = 8% or 200,000m^3 at approx. 0.65m depth
- Central Catchment (R30) = 404 hectares
    - 1 in 1 year = 2% or 80,000m^3 at approx. 0.3m depth
    - 1 in 5 year = 5% or 200,000m^3 at approx. 0.5m depth
    - 1 in 100 year = 8% or 320,000m^3 at approx. 0.65m depth
- Southern Catchment (R30) = 211 hectares
    - 1 in 1 year = 2% or 42,500m^3 at approx. 0.3m depth
    - 1 in 5 year = 5% or 105,000m^3 at approx. 0.5m depth

- 1 in 100 year = 8% or 170,000m^3 at approx. 0.65m depth

Some drainage may be able to be withheld within future proposed lots, however this will be determined by ultimate lot sizing. Generally we recommend that the Shire commences a general strategy of earmarking lower-lying areas for drainage functions to allow for the orderly development of the Investigation Area.

In general, the design for roads and stormwater drainage should be considered in tandem to take into account natural surface levels and directions of flow.

2.5 Wastewater (Sewer)

The Water Corporation has provided long term planning for wastewater reticulation in this area, however they have not completed detailed planning for provision of wastewater assets over the Investigation Area based on the proposed Residential Bushland zonings as at the time of this report. The basis of this report therefore, is not to discuss Water Corporation Planning, but to provide an indication of what we believe are the likely requirements of a wastewater system over the Investigation Area. This report is therefore the commencement of an iterative process in developing a future strategy for the provision of wastewater assets.

The Water Corporation's Design and Construction Requirements for Gravity Sewers DN 150 to DN 600 Manual (Design Standard No DS 50) states: -

" Wastewater schemes shall be designed so that land will be sewered by a gravity scheme in preference to a pumping scheme." Ref: Section 4. Design Criteria, Section 4.1 Introduction paragraph 6, page 26 of 75.

We believe that a gravity system can be designed in this area due to the strong topographical changes from east to west (RL 60.00 to the east down to around RL 20.00 in the west.)

The following points in Section 4.2 Sewer Design are of key importance to this assessment: -

Table 2 – Water Corporation Wastewater Design Parameters

Water Corporation Design Parameter	Investigative Area Requirements
a. The design flow in sewers shall include the wastewater flow from the design population contributing to the sewer and an allowance for stormwater and groundwater infiltration and approved industrial flows or special peak flows where appropriate.	Noted.
b. The Local Authority's current of proposed Residential Planning Code (R Code) which indicates the number of dwellings per net hectare in any area, together with the anticipated number of persons per dwelling shall form	Proposed yields – R30

the basis for the calculation of contributing populations.	
c. A Residential Planning Code of R15 shall be used where the Local Authority Code is less than R15 or where no Code exists	Not applicable
d. *Wastewater design flows shall be calculated from the data shown in Tables 4.1, 4.2 and 4.3. The data shown in these tables represent minimum requirements. Where special factors or local information indicate the possibility of higher flows these shall be individually assessed.*	Demonstrated in table 3 below.
e. The basis for calculating flows from town and city centres other than Perth shall be evaluated in each case.	Not applicable.
f. The Daily Flow from a residential area shall be the product of the population density, the daily flow per person and the net area.	Demonstrated in table 3 below.
g. The Daily Flow from a non-residential area shall be the product of the flow per net hectare and the net area.	Demonstrated in table 3 below.
h. The sewer Design Flow shall be 1.5 times the Daily Flow, unless special factors or local information indicate the possibility of higher flows which shall be individually assessed.	Demonstrated in table 3 below.
i. In areas where there is an existing or proposed subdivision plan the net area shall be the total area of the individual lots that can be connected to the wastewater system.	Not Applicable. Too early in the planning phase to provide a lot layout.
j. When broadacre catchments are being evaluated the net area for the application of zoning densities shall be obtained by deducting the area of large recreation reserves and major roads from the gross area and reducing the remaining area by 25% to allow for public open space and minor roads.	KCTT have utilised an equivalent area for residential development representing approximately 65% of the total area for the purposes of this ISR.
k. Sewers serving a gravity area shall be designed to carry the Sewer Design Flow. When pumped flows are discharged into a gravity sewer, the gravity sewer shall be designed to accept the pumped flow rate plus the Sewer Design Flow from any gravity area contributing to the discharge point of the catchment. At these flows the depth of flow in the sewer shall not be more than: - • *Half full for DN 150 pipes.*	To be confirmed by Water Corporation.

• *Two thirds full for DN225 and larger pipes.*	
l. The minimum size of sewers in residential areas and serving small commercial areas and shopping centres shall be DN 150. Where the Gravity Sewer Design Flow is at least 3 L/second a DN225 sewer at 1:300 grade may be used. Small commercial areas and shopping centres are defined as areas / centres not exceeding 0.5 hectares/	Noted. The Investigation Area is expected to be generally residential ("Urban Area" as noted by the Shire of Kalamunda).
m. The minimum size of sewers serving industrial, light industrial, large commercial areas and large shopping centres shall be DN225 with the following exceptions: - • *Single lots in industrial and commercial subdivisions can be served by a DN150 sewer.* • *A DN150 sewer can serve two industrial or commercial lots or an industrial and a commercial lot provided that the combined area of the two lots does not exceed 0.5 hectares.*	Not applicable for the Foothills Investigation Area
n. Pipe diameters with corresponding minimum and maximum grades, maximum distances between access chambers and the maximum allowable flows within ranges of grades are shown in Table 4.4. *The flow capacity of pipes is based on the Colebrook-White equation using a roughness coefficient (k) of 1.0mm.* *Where the grade is required to be steeper than the minimum because of flow requirements it shall be marked on the drawing as the minimum grade allowable.*	KCTT expect the majority of wastewater pipe infrastructure to be laid at minimum grades, however there may be some sections of steeper infrastructure which are installed to suit the longitudinal grades that naturally occur in the Investigation Area.
o. The minimum grades shown in Table 4.4 may be varied as follows: - *The minimum grade of a DN150 sewer may be reduced to 1:250 provided that one of the following is achieved: -There is a reduction in the number of permanent pumping stations through which the flow discharges.* *The area is drained to a gravity sewer rather than to a pumping station.* *The number of entries to sewers DN300 and larger is reduced.*	Noted. This item is more applicable for detailed design requirements than the planning phases.

p. The minimum grade of a DN225 sewer may be reduced to 1:350 where a pumping station discharges at least 14L/second into the sewer.	Noted. As above.
q. When servicing industrial, light industrial, large commercial areas and large shopping centres the DN225 sewer shall be constructed at a minimum grade of 1:200 if the Sewer Design Flow is less than 3 L/second.	Not Applicable for the Investigation Area.
r. The maximum and minimum grades of sewers are shown in Table 4.4	Noted.
s. The minimum size of a sewer receiving discharge from a pressure main shall be DN225 unless otherwise approved by the Water Corporation.	Noted.
t. Where the discharge rate of a pressure main exceeds two thirds of the capacity of a receiving gravity sewer the system design is to be discussed with the Corporation.	Noted
u. The diameter of a sewer downstream of any point should not be reduced.	Noted.
v. The centre lines of all sewers entering or leaving an Access Chamber should intersect at the centre point of the Access Chamber in plan unless the Access Chamber is a re-entrant Access Chamber.	Noted – detailed design procedure.

The Investigation Area falls into three different Water Corporation catchments, Gooseberry Hill SD234 to the north, Forrestfield SD025 in the central catchment and Wattle Grove SD073 to the south. KCTT have calculated the following design requirements for the proposed land uses in the Foothills Investigation Area (this information is collated from Tables 4.2 and 4.3 of the design standard): -

Table 3 – Foothills Investigation Area Estimated Wastewater (Sewer) Flows

Development Type	Total Area (ha)	Equivalent Area (ha)	Number of Persons Per Dwelling	Population Density Persons / Net Ha	Flow (Wet Ground)	GSDF (Sewer Design Flow in Wet Ground) L/sec/Net ha	Total Design Flow	Primary Distribution Main
Northern Catchment	253 ha	165 ha	3.5	105	205**	0.374	61.71 L/sec	375mm-diameter
Central	404 ha	263 ha	3.5	105	205**	0.374	98.36	450mm-

Catchment							L/sec	diameter
Southern Catchment	211 ha	137 Ha	3.5	105	205**	0.374	51.24 L/sec	375mm-diameter
Total	**867.4 ha**	**565 ha**					**211.31 L/sec**	

Note: ** L/person/day.

2.5.1 Foothills Investigation Area – Southern Catchment

The Water Corporation have provided two planning diagrams for the wastewater, which show the existing planning through the southern section of the Foothills Investigation Area. A general description of these planning diagrams is provided below: -

- Wattle Grove SD 1 shows a planned series of catchments generally south of Welshpool Road toward Bickley Road. These catchments are required for the development of land east of Tonkin Highway in the Foothills Investigation Area and drain via Brentwood Road in a 375mm-diameter and 450mm-diameter main toward 600mm-diameter mains in Bickley Road in the southwest. Wattle Grove SD1 is located to the west of the Investigation Area, however the infrastructure is required for the expansion of lands in the south of the Investigation Area
- Wattle Grove SD 2 shows a planned series of catchments generally northeast of Tonkin Highway, south of Crystal Brook Road and west of Victoria Road. This is the southern section of the Investigation Area. These catchments have a rudimentary network of planned primary distribution mains, comprising of 225mm-diameter and 300mm-diameter mains draining toward Brentwood Road with a northern portion draining toward Boundary Road. There is no planning shown north of Welshpool Road.

2.5.2 Foothills Investigation Area – Central Catchment

The Central Catchment of the Foothills Investigation Area is described for the purposes of this report as being located north of Welshpool Road, west of the Mundy Regional Park, south of Berkshire Road and east of the existing suburb of Forrestfield. Planning for the Forrestfield SD025 area was not available at the time of this report, however it appears the Water Corporation does not have any wastewater planning currently in this area. This was determined by observing that there are no catchments shown on the Gooseberry Hill Sheet 4 of 5 Planning which is to the north of the Central Catchment and no catchments in the Wattle Grove Sheet 2 Planning Sheet in the southern portion of the Central Catchment. KCTT however have assessed that this location is likely to drain generally to the south and could be drained into the southern catchment, particularly toward infrastructure in Brentwood Road if sufficient grades are available. This would need to be confirmed with the Water Corporation.

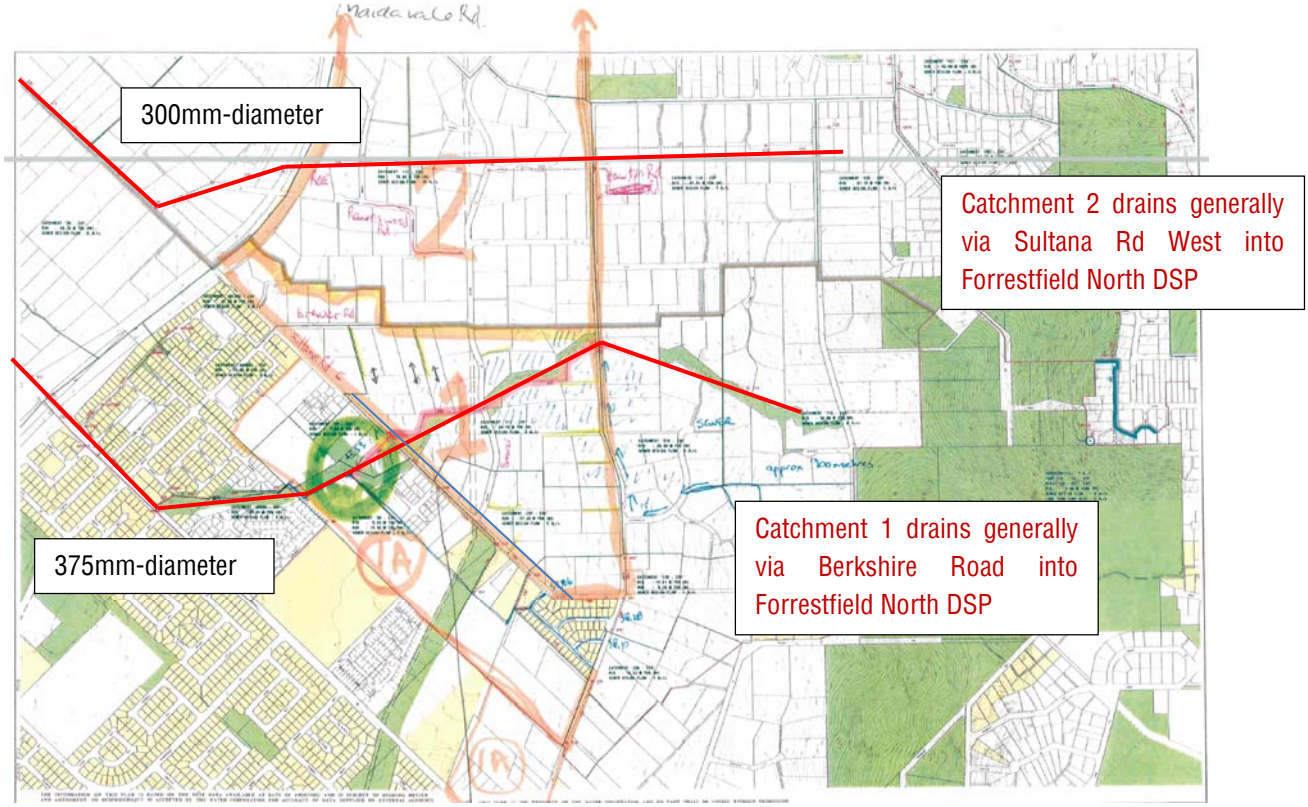
2.5.3 Foothills Investigation Area – Northern Catchment

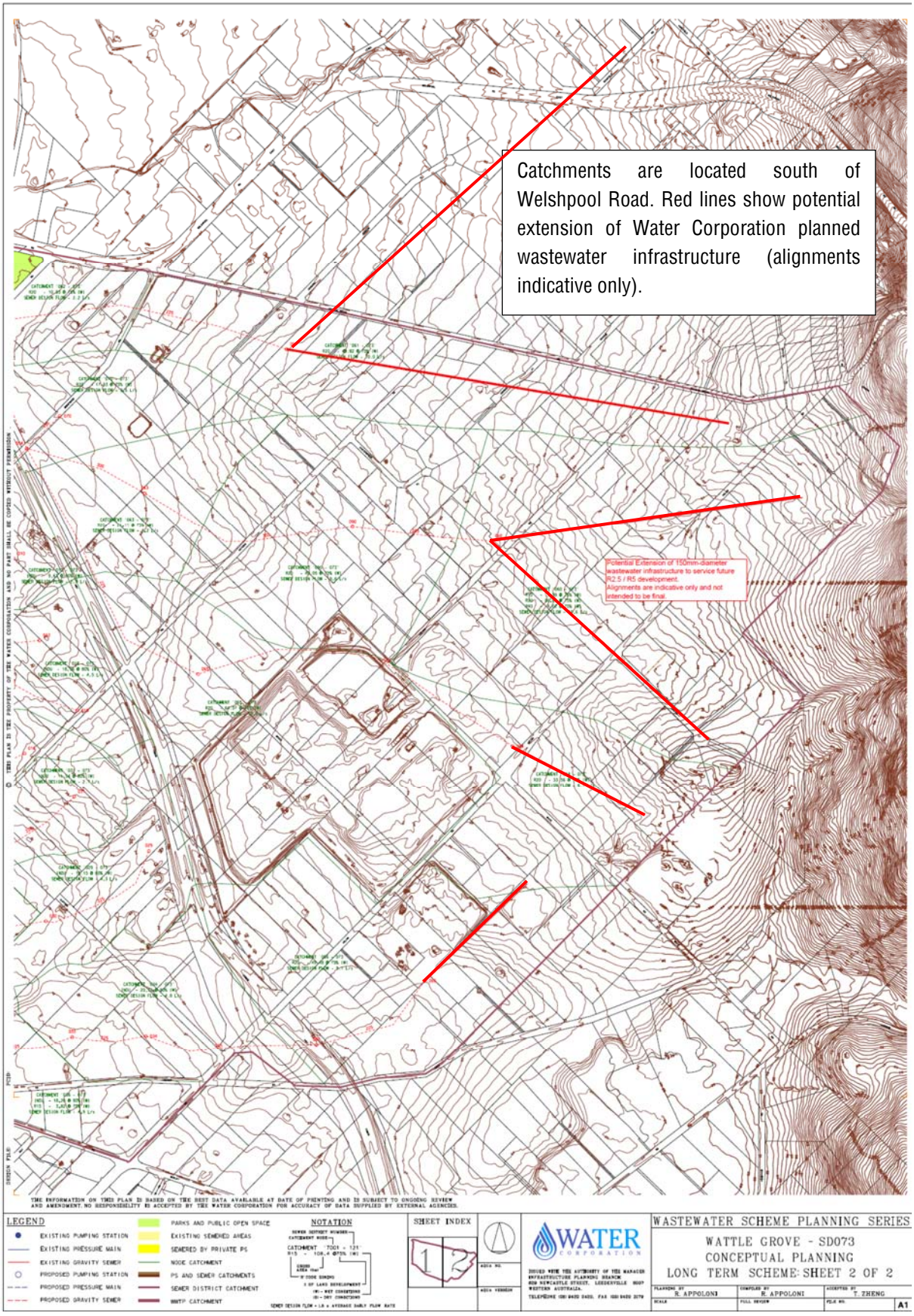
KCTT have previously received planning for the northern catchment of the Foothills Investigation Area, which we have loosely bounded between Norwood Road to the north, the Mundy Regional Park to the east, Sultana Road East to the south and Roe Highway to the west. The Water Corporation Planning Sheet is Gooseberry Hill Sheet 4 of 5: -

- Gooseberry Hill Sheet 4 of 5 shows a planned series of catchments east of Roe Highway in Forrestfield and the southern portion of Maida Vale, north of Berkshire Road and inclusive of Sultana Road East and Hawtin Road.
- The expansion of landholdings in the northern section of the Investigation Area (Sultana Road East / Hawtin Road / Maida Vale Road is generally reliant on future expansion of wastewater services along: -
    - Berkshire Road (west of the Roe Highway) – 300mm-diameter; and
    - Sultana Road West – 300mm-diameter.

Our understanding is there is intent from developers to increase dwelling yields in this northern section of the Foothills Investigation Area with a target yield around R30 in some sections of the Investigative Area. The 300mm-diameter networks discussed above should be robust for this type of expansion. These networks connect into a 600mm-diameter network near the intersection of Berkshire Road and Dundas Road in the Forrestfield North DSP.

Figure 1 - Foothills Investigation Area Northern Catchment




Catchments are located south of Welshpool Road. Red lines show potential extension of Water Corporation planned wastewater infrastructure (alignments indicative only).
Potential Extension of 150mm-diameter wastewater infrastructure to service future R2.5 / R5 development. Alignments are indicative only and not intended to be final.
LEGEND
EXISTING PUMPING STATION
EXISTING PRESSURE MAIN
EXISTING GRAVITY SEWER
PROPOSED PUMPING STATION
PROPOSED PRESSURE MAIN
PROPOSED GRAVITY SEWER
PARKS AND PUBLIC OPEN SPACE
EXISTING SEWERED AREAS
SEWERED BY PRIVATE PS
NODE CATCHMENT
PS AND SEWER CATCHMENTS
SEWER DISTRICT CATCHMENT
WWTP CATCHMENT
NOTATION
SHEET INDEX
WATER CORPORATION
WASTEWATER SCHEME PLANNING SERIES
WATTLE GROVE - SD073
CONCEPTUAL PLANNING
LONG TERM SCHEME: SHEET 2 OF 2
A1

In summary, we believe the distribution of wastewater services in the Investigation Area is predicated on the construction of services to the west in Forrestfield North DSP area and in Wattle Grove / Kenwick North. The timing for the extension of these services can be confirmed through the planning phases.

2.6 Water

KCTT have held preliminary discussions with the Water Corporation relating to water design requirements for the Investigation Area. The Water Corporation have confirmed there are significant water assets which run through the Investigation Area inclusive of the Canning Trunk Main and the Canning Foothills Trunk Main. The Corporation has adopted a long term water planning strategy for the Investigation Area, however will only generally review the existing assets in the area and will not commence a formal detailed planning review until they are in receipt of detailed future development yields and road layouts within the Structure Plan.

The Corporation has stated that the distribution main planning for the Foothill Scheme identifies the need for a 400mm or 500mm diameter distribution main running down Sultana Road in the future.

The following table highlights the Water Corporation's design parameters as noted in the Water reticulation Standard Design Standard DS63: -

Table 4 – Water Corporation Design Parameters and Foothills Investigation Area requirements

Water Corporation Design Parameter	Foothills Investigation Area Requirements
Design Criteria	
Minimum head at the reference ground level of every serviced lot shall be 17m in the Perth Metropolitan Area.	Water head pressure likely to be sufficient. The area is serviced by the Canning Foothills Distribution Main.
Maximum head shall be 100m.	Additional Pressure Reducing Valve's (PRV's) may be required.
Sizing of mains – water reticulation mains shall be sized so that the velocity of flow in pipes is kept below 2m/sec	To be confirmed by Water Corporation in planning.
The largest pipe size for water reticulation shall be DN250.	Noted – all proposed mains for servicing properties in the Foothills Investigation Area shall be between DN100 and DN250. Distribution mains of DN300 and greater will not be used for any direct connection to properties
Minimum size DN150 for industrial development and retail / commercial centres.	Not applicable.
Improvements to Existing Mains	

Improvements to the hydraulic capacity of existing mains may be necessary as a result of a proposed development. The nature and extent of the improvements will be determined by the Corporation.	To be confirmed as structure planning continues.
Sizing of Mains	
The impact of adjoining water supply schemes and high-level supply zone boundaries or operational control zones.	To be considered in planning phase.
The impact of staging the water supply to a development area in the event that all of the distribution mains defined in the Scheme design are not in place at the time of initial supply.	To be considered by the Water Corporation at submission of Subdivision Application
The eventuality of a single distribution main connection being closed.	We believe the network of water mains will be closed.
The eventuality of any one section of the water reticulation being isolated.	Valves to be located in detailed design / construction phases which enable the isolation of sections of line.
All aspects of the overall long-term supply situation.	To be considered by the Water Corporation.
As many services as hydraulically possible be placed on each main to ensure it remains self-cleansing within the limits of minimum supply heads.	The Foothills Investigation Area proposes sufficient numbers of services to ensure self-cleansing of the main and replenishment of water supplies.
Reticulation Layout	
The water reticulation shall as far as practicable, form a series of closed loops to minimise dead end mains. Every group of 50 or more properties shall be supplied by more than one pipe route.	Proposed concept planning should offer opportunities for closed loops with minimal use of cul-de-sacs.
Within a subdivision agreement area, mains shall be provided across the full frontage of all lots created except where the future extension of the main will not be required. Every lot shall be served by a reticulation main along one of the street frontages of the property, i.e. in gazetted road reserves.	Mains are already provided across the frontage of all existing “super lots”.
Mains and Services Location	
Mains shall align within the existing or proposed connection points from the distribution system and be located within road reserves on an alignment of 2.1 metres.	Mains shall be placed on standard 2.1 metre alignments.

The following table shows the yields with commentary relating to the minimum pipe sizing in each zone.

Table 5 – Development Zones and General Minimum Requirements for Water Infrastructure

Development Type	Total Area (m^2)	Equivalent Area	Minimum Pipe Sizing	Notes
Northern Catchment	253	165 ha	100mm-diameter	Primary Distributor Main at 250mm-diameter Secondary Distributor Main 200mm-diameter
Central Catchment	404	263 ha	100mm-diameter	Primary Distributor Main at 250mm-diameter Secondary Distributor Main 200mm-diameter
Southern Catchment	211	137 Ha	100mm-diameter	Primary Distributor Main at 250mm-diameter Secondary Distributor Main 200mm-diameter
Total	**867.44ha**	**565.0ha**		

2.6.1 Foothills Investigation Area – Southern Catchment

The Water Corporation have major water infrastructure throughout the Foothills Investigation Area. The southern catchment includes the Canning Trunk Main, with the Canning Foothills Trunk Main branching off at Hale Road. In discussions with the Water Corporation, we believe a network of local infrastructure can be planned pending confirmation of road layouts.

Existing water mains are available in most existing road reservations in the catchment.

2.6.2 Foothills Investigation Area – Central Catchment

As for the southern catchment, the central catchment is categorised with major infrastructure traversing the catchment from north to south. The Canning Foothills Trunk Main provides sufficient infrastructure for future residential servicing in this location.

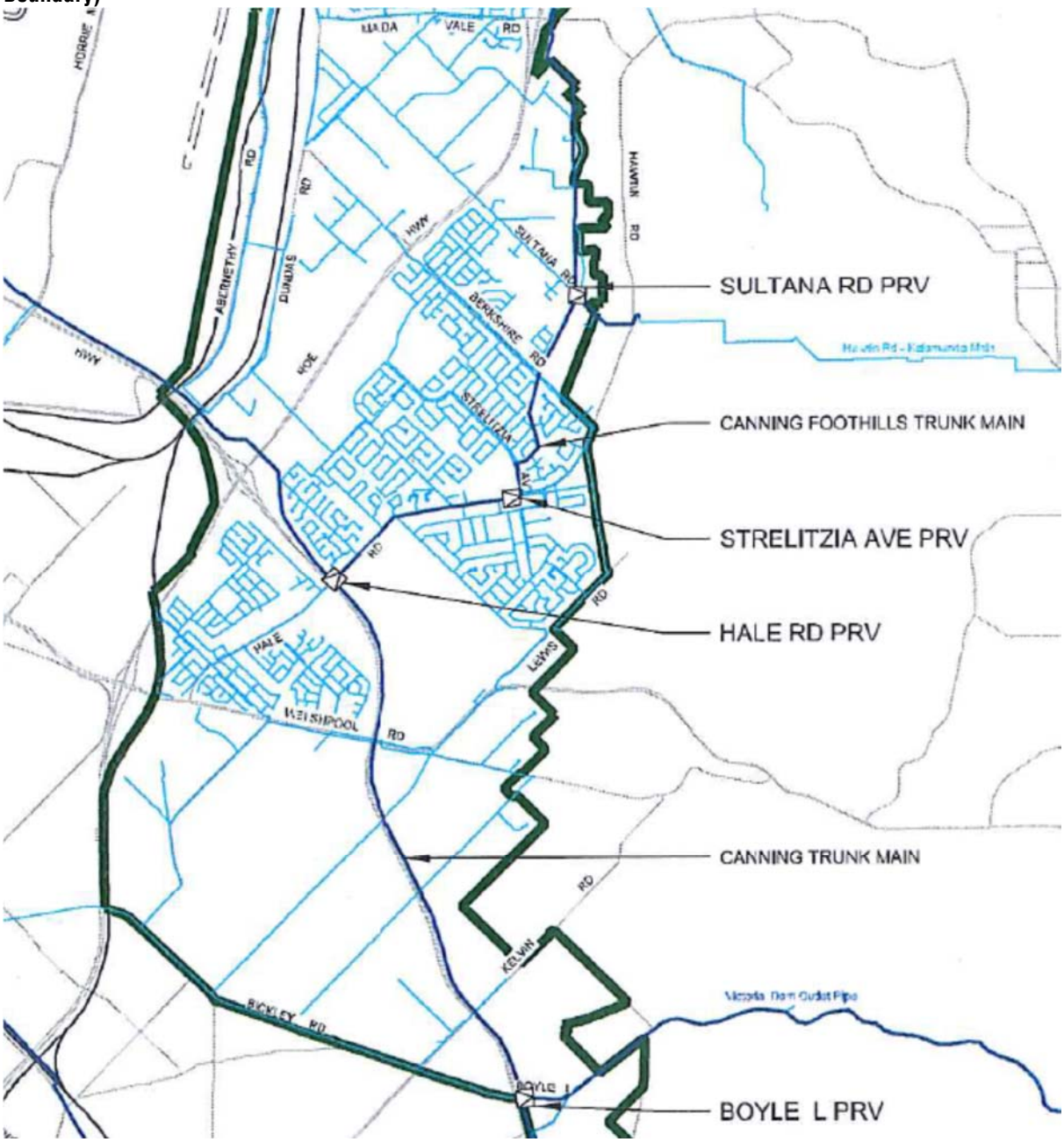
Existing water mains are available in most existing road reservations in the catchment.

2.6.3 Foothills Investigation Area – Northern Catchment

The northern catchment is also categorised with major infrastructure traversing the catchment from north to south. The Canning Foothills Trunk main provides sufficient infrastructure for future residential servicing in this location.

Existing water mains are available in most existing road reservations in the catchment.

Figure 2 - Major Water Assets (source: SKM Investigation – modified to suit Foothills Investigation Area Boundary)



2.7 Power, Telecommunications and Gas Supply

The provision of power, telecommunications and gas supply will be a requirement for all future developers in the Investigative Area.

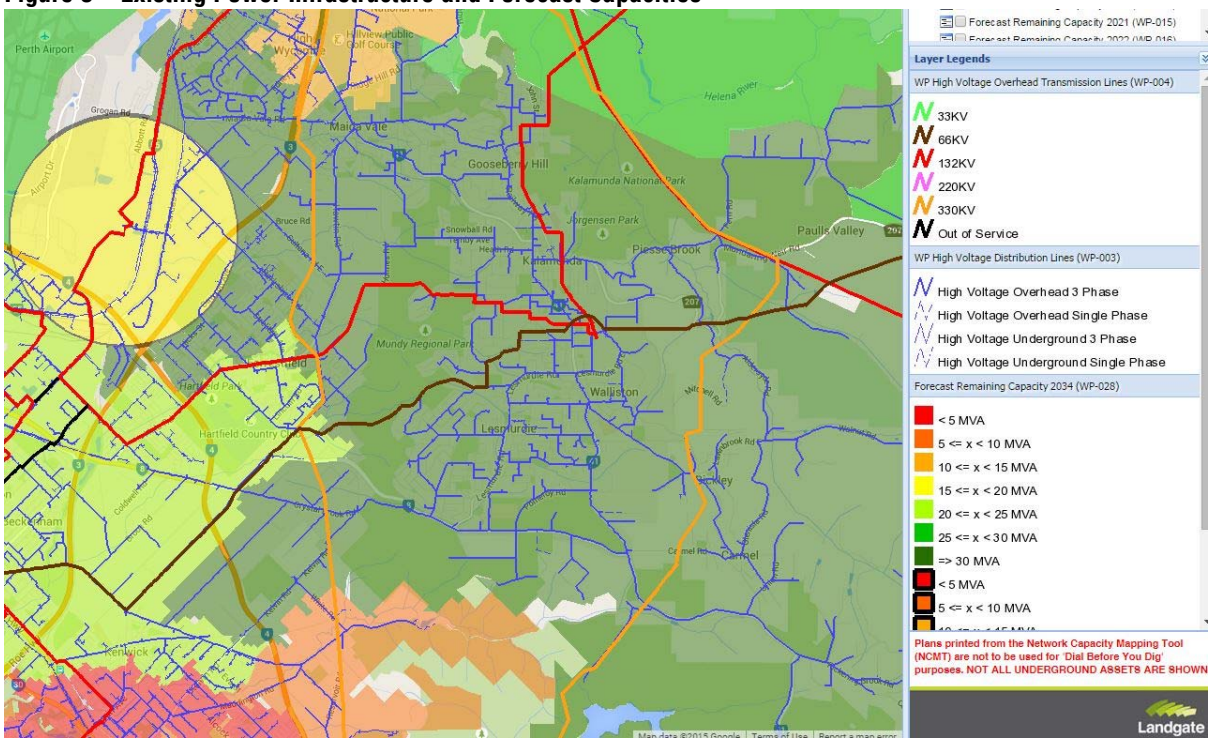
2.7.1 Power

Western Power requires that developers underground all existing overhead power assets which are located on the development side of any road reservation. This cost should be considered in any future development.

Western Power has an online management tool known as the Network Capacity Mapping Tool, or NCMT. Using this tool, we have reviewed the "forecast remaining capacity" and found that: -

- The northern catchment between Berkshire Road and Norwood Road generally has a forecast capacity of 30MVA in the year 2034.
- The central catchment between Berkshire Road and Welshpool Road generally has a forecast capacity of 20 to 25MVA in the year 2034.
- The southern catchment between Welshpool Road and Tonkin Highway generally has a forecast capacity of 20 to 25MVA in the year 2034.

Figure 3 – Existing Power Infrastructure and Forecast Capacities



High Voltage overhead 3 phase power infrastructure is currently available through most of the DSP Area as follows: -

- Hale Road to Mundy Regional Park (132kV)

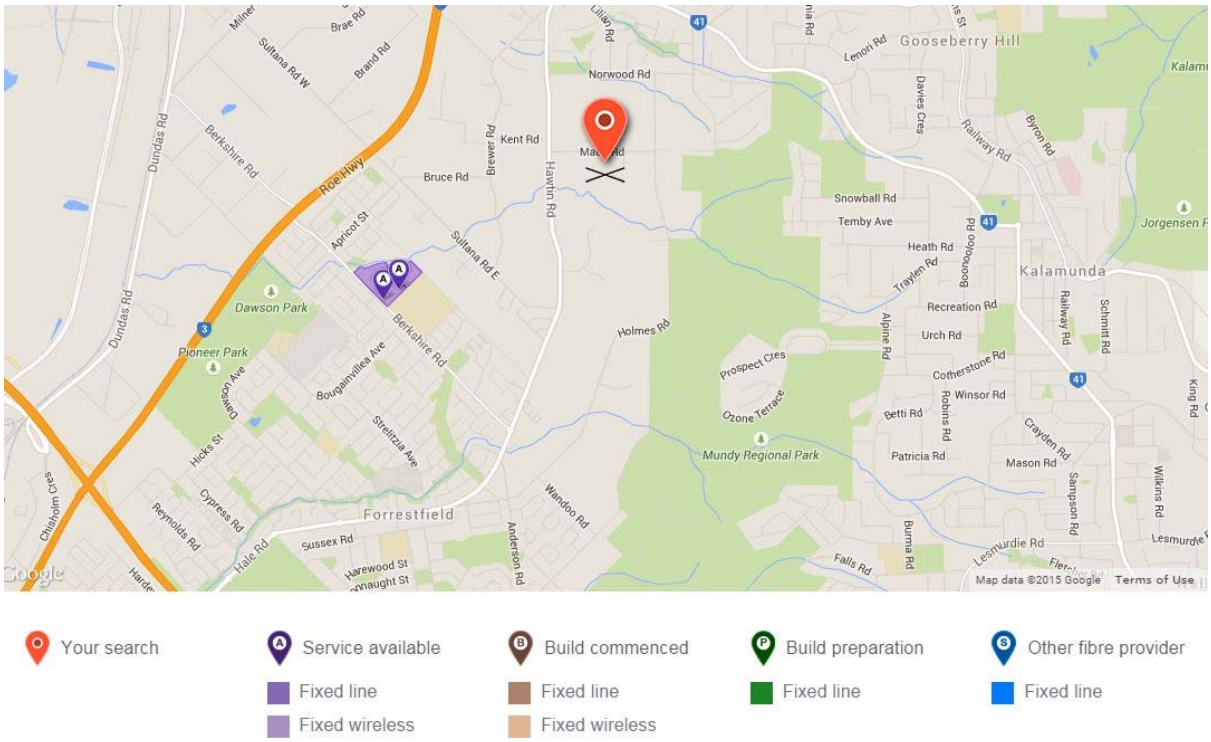
- West of Hawtin Road (330kV) near the Canning Foothills Trunk Main water alignment
- 66kV assets on the south-eastern boundary of the Investigation Area.

2.7.2 Telecommunications

The Foothills Investigation Area has existing telecommunications assets which are suitable for general telephony. There are no NBN rollouts currently planned in this area. NBN Co has a charter to work with local governments and developers, particularly for larger scale developments (+100 lots). The NBN map below shows there are some assets available around Berkshire Road. Provision of telecommunications infrastructure will be negotiated by developers directly with NBN and / or Telstra or other service providers during the subdivision application phases.

For the purposes of this Infrastructure Servicing Report, we believe there will be sufficient telecommunication services for development in the Foothills Investigation Area and the provision of suitable services can be negotiated.

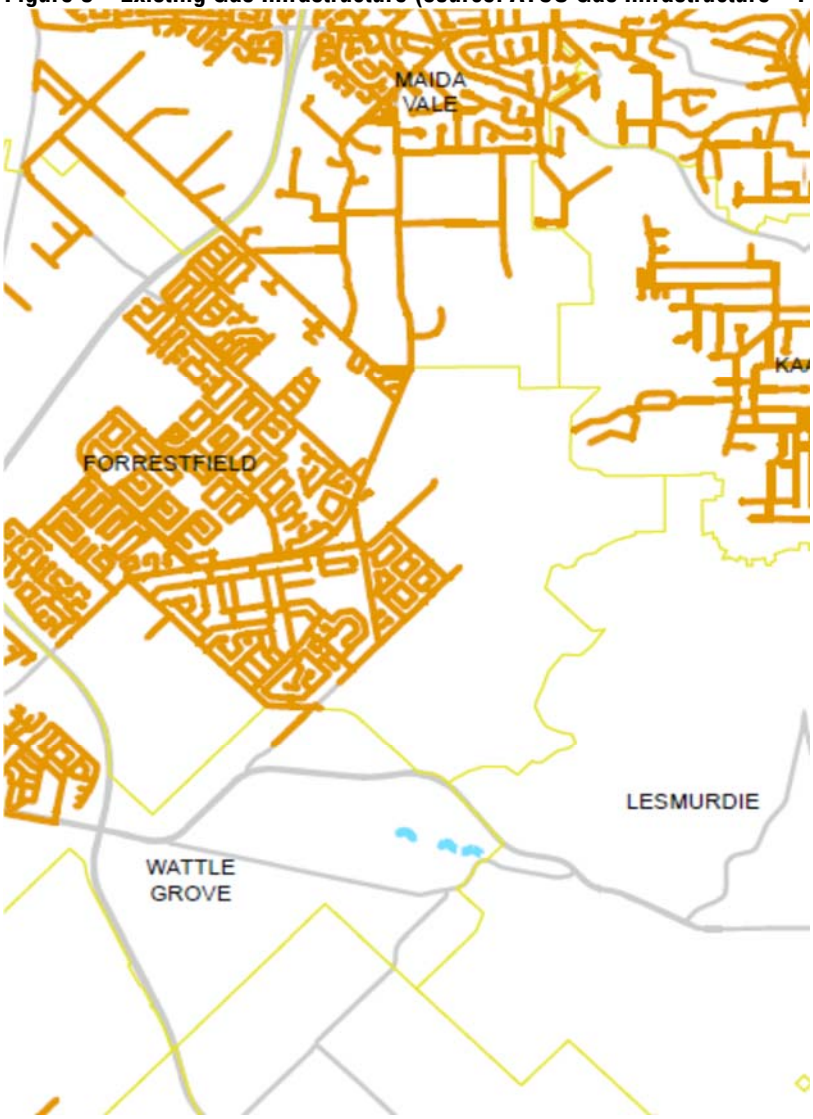
Figure 4 - Location of NBN Assets (Source: NBN Co Mapping)



2.7.3 Gas

The road network is generally serviced by ATCO Gas in the northern catchment as shown in the Perth North infrastructure map below, however minimal existing infrastructure is available in the central and southern catchments.

Figure 5 – Existing Gas Infrastructure (source: ATCO Gas Infrastructure – Perth North Map)



3. Opportunities and Challenges

The Foothills Investigation Area offers a series of opportunities and challenges in terms of infrastructure provision. With existing infrastructure in place, and key infrastructure upgrades planned by the various regulatory authorities there is potential for development across the Investigation Area. Key considerations that should be noted as part of this development include: -

- **Stormwater Drainage**
    - Designing stormwater drainage and wastewater infrastructure to suit the topography and therefore to minimise the volume of imported fill required.
    - Providing sufficient area for stormwater drainage infrastructure. As a general rule of thumb for R20 to R30 development (which needs to be confirmed through the DWMS / LWMS and UWMP phases): -
        - 2% of the total land area will be needed for the 1 in 1 year event;
        - 5% of the total land area will be needed for the 1 in 5 year event;
        - 8% of the total land area will be needed for the 1 in 100 year event;
- **Water**
    - KCTT believe each of the southern, central and northern catchments can be serviced with a suitable network of potable water infrastructure with the Canning Foothills Trunk Main providing an effective spine throughout each of the catchment areas.
    - The information provided in this report represents the first step in a detailed planning process.
- **Wastewater**
    - The northern catchment is reliant on extension of assets through the Forrestfield North DSP area along Berkshire Road in the south (375mm-diameter) and Sultana Road West in the north (300mm-diameter).
    - The central catchment between Berkshire Road and Welshpool Road does not appear to currently be in Water Corporation Planning and will need to be planned. The infrastructure extensions required for this catchment will be more complex in the short to medium term and should be discussed with the Water Corporation.
    - The southern catchment is shown as an extension of the Wattle Grove Sewer Planning area. This area generally drains via Boundary Road and Brentwood Road toward 600mm-diameter infrastructure in Bickley Road.
- **Power, Telecommunications and Gas**
    - Requirements for power will be met and managed by Western Power. Western Power will review planning information through the DSP and LSP phases of this project.

- Requirements for telecommunications will be met by Telstra / NBN at the time of subdivision application and submission of detailed design plans for coordination. The NBN is likely to be a potential supplier if larger developers take significant tranches of land and submit development layouts with greater than 100 lots (or equivalent thereof).