

The background of the entire page is a photograph of a coastal landscape. In the foreground, there is a hillside covered in dry, yellowish-brown grass and small shrubs. In the middle ground, a large, cylindrical, grey water storage tank sits on a slight rise. To the left of the tank, a small cluster of houses with light-colored roofs is visible. In the background, the land meets the sea under a clear, pale blue sky. The horizon is marked by distant, low-lying hills.

Shire of Roebourne
Roebourne Water and Wastewater Services Capacity
Assessment
Future Services Capacity Report

February 2013

Executive summary

Water and wastewater services in Roebourne are supplied by the Water Corporation. Through discussions with the Water Corporation, GHD has discovered that the water and wastewater systems will generally be at capacity once the NASH development is established.

Integrated water management strategies were also investigated in an effort to delay significant upgrades to the water and wastewater infrastructure in Roebourne. Reducing scheme water demand, increasing the efficiency of irrigation of public open space and using recycled water for non-potable water uses all present opportunities for consideration by the Shire. If development in Roebourne progresses in a water sensitive manner, significant delays to infrastructure upgrades are possible.

The integration of land and water planning is required by the Western Australian government. It is recommended that the SoR investigate the need for a local water management strategy to support the Roebourne Structure Plan approvals process.

This report is intended to inform the SoR strategic planning for development in Roebourne. Planning of water and wastewater services is the domain of the Water Corporation. Early discussions and negotiations between the Water Corporation and SoR will assist both parties with planning for the future in Roebourne. SoR should share the draft Structure Plan with the Water Corporation once available, as Water Corporation may set conditions for land development that will need to be incorporated into the Structure Plan.

Existing water consumption data, population projections and a plan of the potential developable land in Roebourne were used to assess the water and wastewater servicing constraints. The key findings in relation to the proposed Structure Plan are as follows:

- Water and wastewater servicing of all areas of the proposed Structure Plan is feasible, subject to the water supply capacity of Mt Welcome tank, the capacity of the wastewater treatment plant as well as the constraints summarised in Table 1, with reference to potential development areas identified by the SoR and shown in Figure 1.
- Water conservation and recycling could be adopted to defer water and wastewater infrastructure upgrade requirements:
 - Reduce scheme water demand
 - Install water recycling scheme

This report is subject to, and must be read in conjunction with, the limitations set out in Section 1.2 and the assumptions and qualifications contained throughout the Report.

Table 1 Feasibility of servicing potential development areas

Area	Feasibility of water supply	Feasibility of wastewater collection
1 – 3	<ul style="list-style-type: none"> Feasible but upgrades to the upstream reticulation/distribution pipes would be required 	<ul style="list-style-type: none"> Feasible to service (using pump stations and pressure mains) if WWTP capacity was increased to handle additional flow/load
4	<ul style="list-style-type: none"> Feasible to supply but the supply capacity in the upstream network would need to be assessed 	<ul style="list-style-type: none"> Partly sewerer, remainder within proposed NASH sewer system
4a	<ul style="list-style-type: none"> Serviced as part of NASH development 	<ul style="list-style-type: none"> Serviced as part of NASH development
5	<ul style="list-style-type: none"> Feasible by extending the existing reticulation network, subject to supply capacity in the upstream network 	<ul style="list-style-type: none"> Partly sewerer, remainder is feasible to service via connection to existing sewerage network subject to WWTP capacity
6	<ul style="list-style-type: none"> Feasible by extending the existing reticulation network, subject to supply capacity in the upstream network 	<ul style="list-style-type: none"> Partly sewerer, remainder is feasible to service via connection to existing sewerage network subject to WWTP capacity
7	<ul style="list-style-type: none"> Feasible by extending the existing reticulation network, subject to supply capacity in the upstream network 	<ul style="list-style-type: none"> Outside the current wastewater operating area, but feasible to service via connection to existing sewerage network subject to WWTP capacity
7a (infill)	<ul style="list-style-type: none"> This area is very close to the Mt Welcome tank, and could be serviced by extending the existing reticulation network 	<ul style="list-style-type: none"> These undeveloped lots are all within existing infill sewer areas and could be connected to the existing sewer system
8	<ul style="list-style-type: none"> Partly serviced, the remainder could be serviced by extending the existing network, subject to supply capacity in the upstream network 	<ul style="list-style-type: none"> Partly serviced by pressure mains and private pump stations, the remainder could feasibly be serviced (using pump stations and pressure mains) subject to WWTP capacity
9	<ul style="list-style-type: none"> This area could be serviced by extending the reticulation network subject to sufficient supply capacity in the upstream network 	<ul style="list-style-type: none"> The north-west portion of this area is outside of the proposed pump station catchment but it is feasible to extend the catchment to service the area subject to WWTP capacity
10	<ul style="list-style-type: none"> No existing reticulation: could be serviced by extending the network from the north or east 	<ul style="list-style-type: none"> Parts of this area are outside the current wastewater operating area, but feasible to service (using pump stations and pressure mains) subject to WWTP capacity

Figure 1 Potential areas for staged development (SoR draft, November 2012)

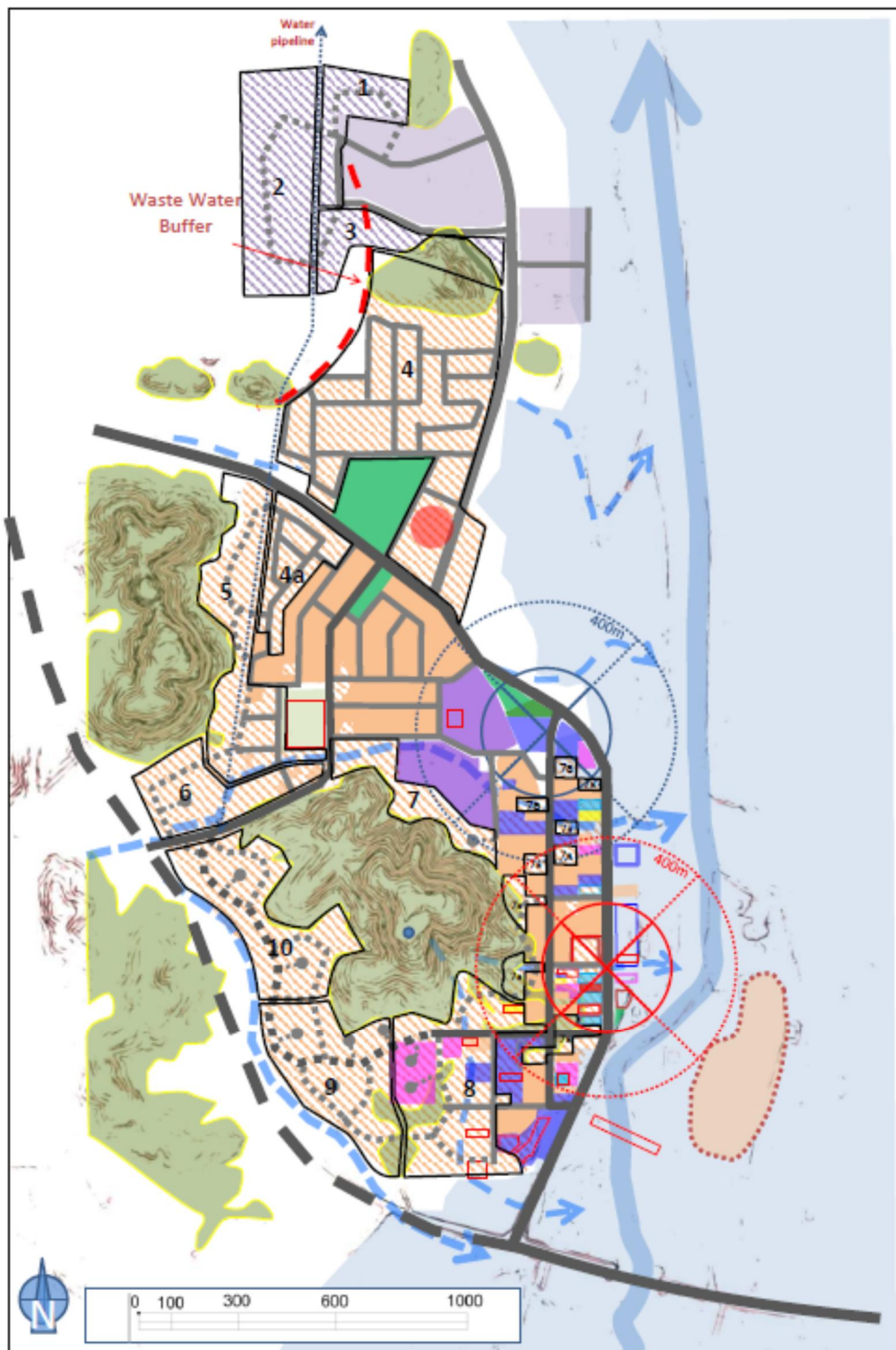


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Appendices

- Appendix A – Structure Plan information (Shire of Roebourne)
- Appendix B – Services map (Economic Regulatory Authority)
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1. Introduction

1.1 Purpose of this report

This report summarises work undertaken by GHD to support the Shire of Roebourne in strategic planning for the township of Roebourne. This report highlights water and wastewater development constraints in meeting demands and identifies “triggers” for water and wastewater (potential) operational and infrastructure changes. The Shire of Roebourne will use the findings and recommendations of this report to define areas for potential future development under the Roebourne Structure Plan.

1.2 Scope and limitations

The Shire will use this report together with the constraints maps in the development of the Roebourne Structure Plan. The Structure Plan will have to incorporate key elements of a local water management strategy as required by Better Urban Water Management (WAPC, 2008). This report will address the need for water use efficiency and opportunities for improved performance and utilisation of existing water and wastewater infrastructure. It will provide the basis for discussion with the Water Corporation of when and how to develop their water and wastewater infrastructure to meet development and growth in the township of Roebourne.

This report: has been prepared by GHD for Shire of Roebourne and may only be used and relied on by Shire of Roebourne for the purpose agreed between GHD and the Shire of Roebourne as set out in section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than Shire of Roebourne arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section 1.3 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Shire of Roebourne, the Water Corporation and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

GHD has not been involved in the preparation of the Roebourne Structure Plan and has had no contribution to, or review of the Roebourne Structure Plan other than in the Roebourne Water and Wastewater Services Capacity Assessment. GHD shall not be liable to any person for any error in, omission from, or false or misleading statement in, any other part of the Roebourne Structure Plan.

1.3 Assumptions

In preparing this document, GHD has made assumptions as follows:

- The information provided in this report will be used for strategic and Structure Planning only – and not for design of infrastructure (which would require more detailed modelling)
- Data received from the Shire and the Water Corporation is complete and up to date and suitable for use for the purpose of this report.

2. Data collection

Information was collected from the Shire of Roebourne (SoR) and from meetings with the Shire and the Water Corporation as summarised below.

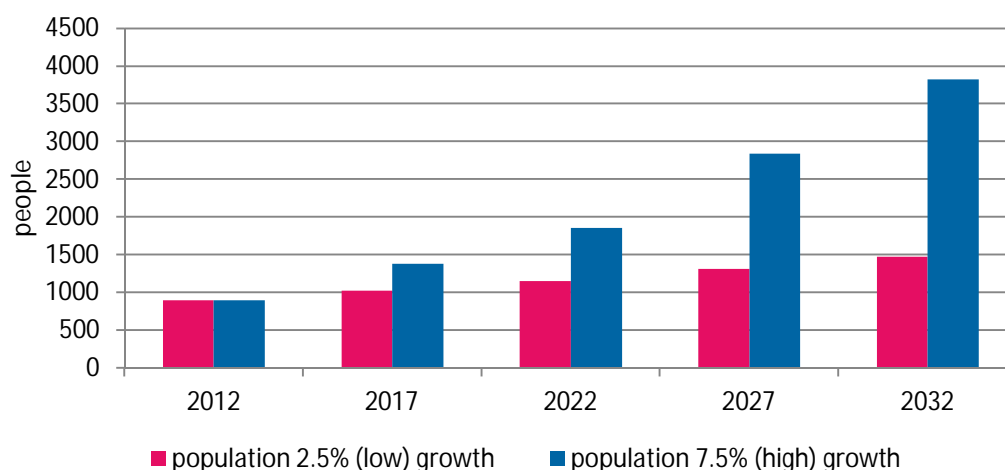
- Letter from Water Corporation to Shire of Roebourne (dated 3 May 2012) regarding the Shire of Roebourne local planning strategy, and associated attachments (water and wastewater plans).
- Email from Frank Kroll (Water Corporation) to Fiona Kenyon (GHD) dated 18 May 2012 containing information and wastewater scheme planning map for Roebourne
- Town Planning Scheme 8 (Department of Planning website).
- Meeting between GHD and Water Corporation 10 October 2012 (minutes GHD document number 126634)
- Meeting between GHD and Shire of Roebourne 22 October 2012 (minutes GHD document number 127055)
- Map of water services controlled and operating areas in Western Australia (Economic Regulatory Authority, 2011)
- Licence for Roebourne Waste Water Treatment Plant issued by Department of Environment and Conservation (6247/1991/7)
- Government Sewerage Policy – Consultation Draft (Department of Health WA, 2011)
- Draft Structure Plan presentation provided by Chris van Tonder of SoR on 8 November 2012
- Latest water consumption data for Roebourne (approved for use by the Water Corporation, Frank Kroll 30 November 2012)

3. Capacity assessment

3.1 Demand projection

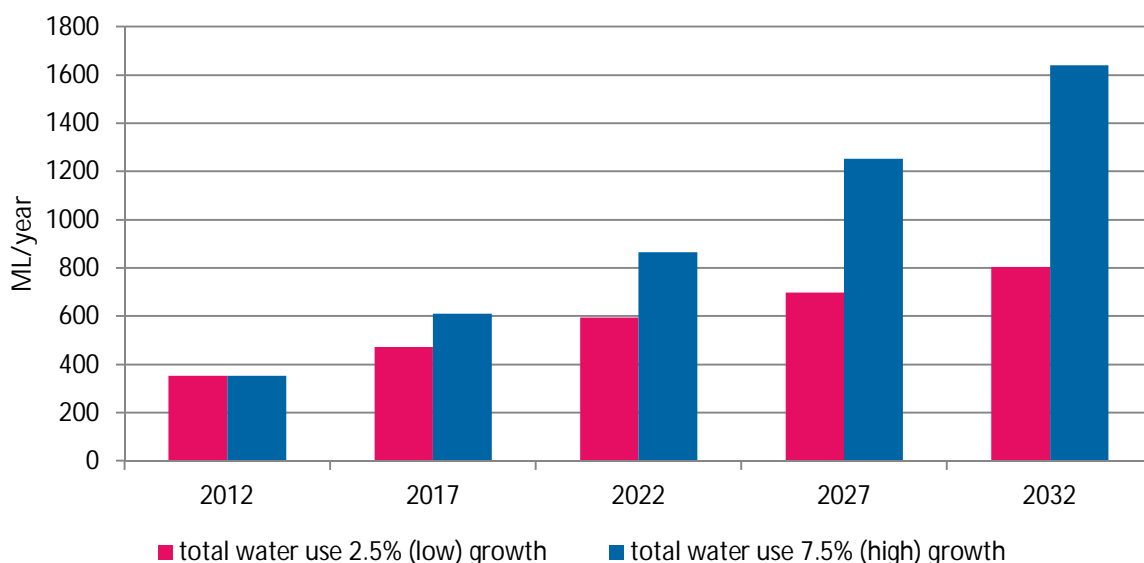
Population projections from Shire of Roebourne were adopted for this study based on information provided by SoR (growth demands, see Appendix A). The expected population of Roebourne over time under low (2.5% p.a.) and high (7.5% p.a.) growth scenarios is shown in Figure 2. The current population of Roebourne is 900 and it is expected to increase to between 2.5 and 7.5% per annum. By 2032, this growth will have resulted in a town population of 1475 to 3823.

Figure 2 Population projection



Scheme water use projections were calculated from population estimates as discussed above and from Water Corporation data for existing water use in Roebourne. Scheme water was assumed to be for residential and commercial uses and irrigation of public open space (POS), including recreational areas. With reference to Figure 3, the current demand (2012) is 350 ML per year (where 1ML = 1 million litres). Under the low and high growth scenarios, by 2032, annual scheme water demand would increase to approximately 800 ML and 1600 ML respectively.

Figure 3 Scheme water use projection



3.2 Water supply system

Services mapping published by the Economic Regulatory Authority and attached in Appendix B shows that the entire West Pilbara Controlled Area (water) is controlled by the Water Corporation. The ERA issues operating licences to service providers which include obligations to customers. As the service provider for water in this area, and subject to conditions for connection, the Water Corporation provides this service within the Operating Area.

The Roebourne town water supply network (see Figure 4) is serviced by a storage tank situated on Mt Welcome in the centre of the townsite. One main pipe (running north along the western edge of the town) feeds this tank, with water supplied as part of the West Pilbara Water Supply

Scheme operated by the Water Corporation. Water for the scheme comes from various groundwater and surface water sources including the Millstream Borefield and Harding Dam.

The Water Corporation provided basic information on the existing water supply infrastructure in Roebourne which is summarised in Table 2. A plan, supplied by the Water Corporation, depicting the water service networks in Roebourne is provided in Figure 4. The outlet pipe with a diameter of 250 mm connects the tank with the reticulation network of the Roebourne townsite. Water reticulation pipes have nominal diameters of 100-200 mm, supplying water to individual customers.

Table 2 Existing water supply infrastructure information

Water infrastructure item	Details
Roebourne water storage tank	Top water level 64.6 m AHD Capacity 2,250 m ³
Water supply pipe to tank (inlet)	Diameter 250 mm
Water supply main pipe from tank (outlet)	Diameter 250 mm

In discussions with Water Corporation and through the review of available information, the following general comments can be made with regard to the water supply system. Section 3.4 analyses specific constraints to the water supply system in reference to potential development areas in Roebourne (see Figure 5). Planning for connecting future development areas to the existing water supply system will be negotiated and agreed on between SoR and the Water Corporation, following the completion of a draft Structure Plan by the SoR.

Water storage tank

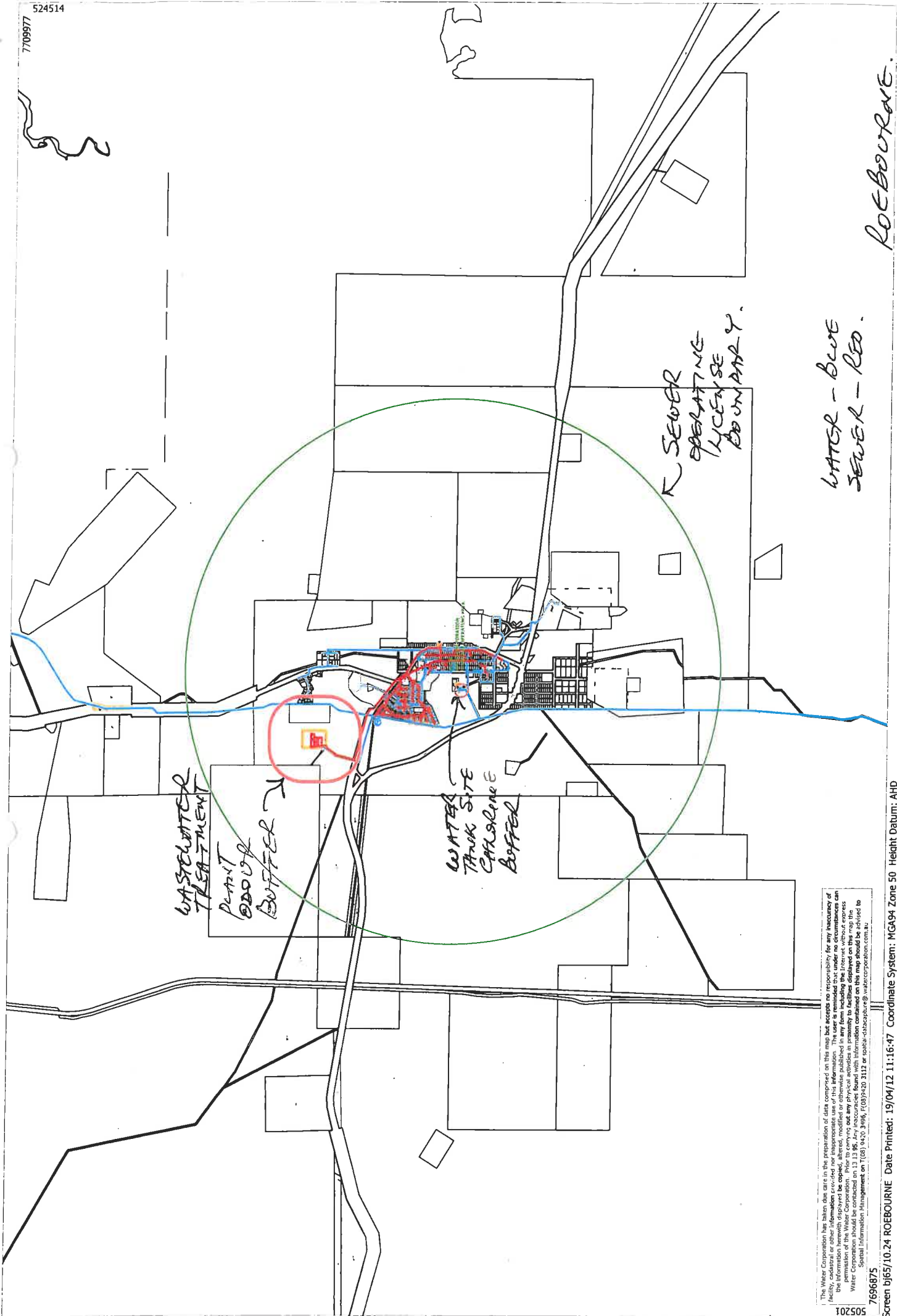
Water Corporation advised GHD that the current water storage is at capacity, and any additional water demand would require upgrades to the water system including the storage.

Water distribution – tank outlet pipe

A high level hydraulic assessment of the tank outlet pipe showed that the current configuration has some spare capacity that would enable supply for an additional 1500 people.

Water reticulation network

As shown in Figure 4, no reticulation exists in the areas west and south of Mt Welcome. Any development in these areas would require the expansion of the reticulation network. Connection to the network in some areas may necessitate the upgrade of upstream pipework, and hydraulic modelling would be carried out by the Water Corporation to determine infrastructure requirements for new developments.



The Water Corporation has taken due care in the preparation of data comprised on this map but accepts no responsibility for any inaccuracy of the data. The user is advised that the data is provided for informational purposes only and should not be used for any other purpose. The user is reminded that under no circumstances can the Water Corporation be held liable for any loss or damage arising from the use of the data. The user is advised that the data is provided for informational purposes only and should not be used for any other purpose. The user is reminded that under no circumstances can the Water Corporation be held liable for any loss or damage arising from the use of the data. The user is advised that the data is provided for informational purposes only and should not be used for any other purpose. The user is reminded that under no circumstances can the Water Corporation be held liable for any loss or damage arising from the use of the data.

7696875

ROEBORNE

WATER - Bore
SEWER - Red.

3.3 Wastewater collection and treatment system

Services mapping published by the Economic Regulatory Authority (Appendix B) shows that a controlled area exists for the Roebourne townsite, and that sewerage services are supplied by one service provider. The Water Corporation is the service provider for wastewater in this area, and subject to conditions for connection, provides sewer connections within the Operating Area.

Wastewater services in the town of Roebourne consist of a sewerage network including gravity and pressure pipework, pumping stations and a pond-type wastewater treatment plant (WWTP) that treats wastewater to a secondary standard and disposes of treated wastewater in evaporation/infiltration ponds. Basic information on the existing wastewater system infrastructure in Roebourne is summarised in Table 3.

A wastewater scheme planning map was produced by Water Corporation and provided for information purposes to GHD. The plan is out of date and subject to change and should not be relied upon, however it is useful for understanding the Roebourne sewerage system. It is included in Appendix C of this report and was used to gather the following information:

- The sewerage network consists of gravity sewers in the town to the north and east of Mt Welcome. Sewage flows via gravity to a pumping station on the eastern edge of the town and is pumped to the WWTP located north-west of Roebourne.
- An area (sewage catchment) south of Mt Welcome is serviced by pressure main sewers and there are 4 additional pumping stations in this area that pump sewage to the southern end of the gravity sewer system (beginning on North West Coastal Highway north of Withnell Street).
- An odour buffer of 500 m around the WWTP restricts development within this area. This area should be noted in the Roebourne Structure Plan.
- Future gravity and pressure sewers and two new pump stations are planned for the development north of North West Coastal Highway, known to be the site for the Ngarluma Aboriginal Sustainable Housing (NASH) project.

Table 3 Existing wastewater supply infrastructure

Wastewater infrastructure item	Details
WWTP odour buffer	500 m
WWTP process type	Pond (secondary) treatment

The following general comments can be made on aspects of the wastewater collection and treatment. In section 3.4, specific constraints to wastewater servicing are discussed in reference to potential development areas in Roebourne. Planning for connection of future development areas to the existing sewer network is to be negotiated between SoR and Water Corporation following the completion of a draft Structure Plan by the SoR.

Gravity sewer network

For development in areas adjacent to and at a higher land level than existing gravity sewered lots, extension of existing wastewater catchments may be possible, depending on the capacity of the existing sewers. The gravity sewer network would need to be extended and downstream pump stations may need to be upgraded.

Pressure conveyance network

Increased wastewater flows would necessitate increased pump station capacity and changes may be required. Potential development areas that are not adjacent to and higher (land level) than existing sewers will necessitate the construction of new pump stations and pressure mains.

WWTP

Discussions with Water Corporation confirmed that although the WWTP was recently upgraded, the increase in flows as a result of new connections associated with NASH will bring the WWTP to capacity. Information on the capacity of the WWTP was not made available to GHD and represents a gap in the background information review. Planning for any additional development in Roebourne will require negotiation and agreement with Water Corporation on upgrading the WWTP.

3.4 Development areas

Areas identified for potential development or for inclusion in the Roebourne Structure Plan are shown in draft information provided by the Shire of Roebourne (Figure 5). Each area has been assessed for constraints to provide water and wastewater services, with comments shown in Table 4. The caravan park area, highlighted in orange on the opposite side of Harding River from the town in Figure 5, has also been assessed for water and wastewater servicing.

Maps depicting the existing and feasible extensions to the water and wastewater serviced areas of Roebourne are provided in Figure 6 and Figure 7 and provide a visual aid to interpreting the information in Table 4.

Figure 5 Potential areas for staged development (SoR draft, November 2012)

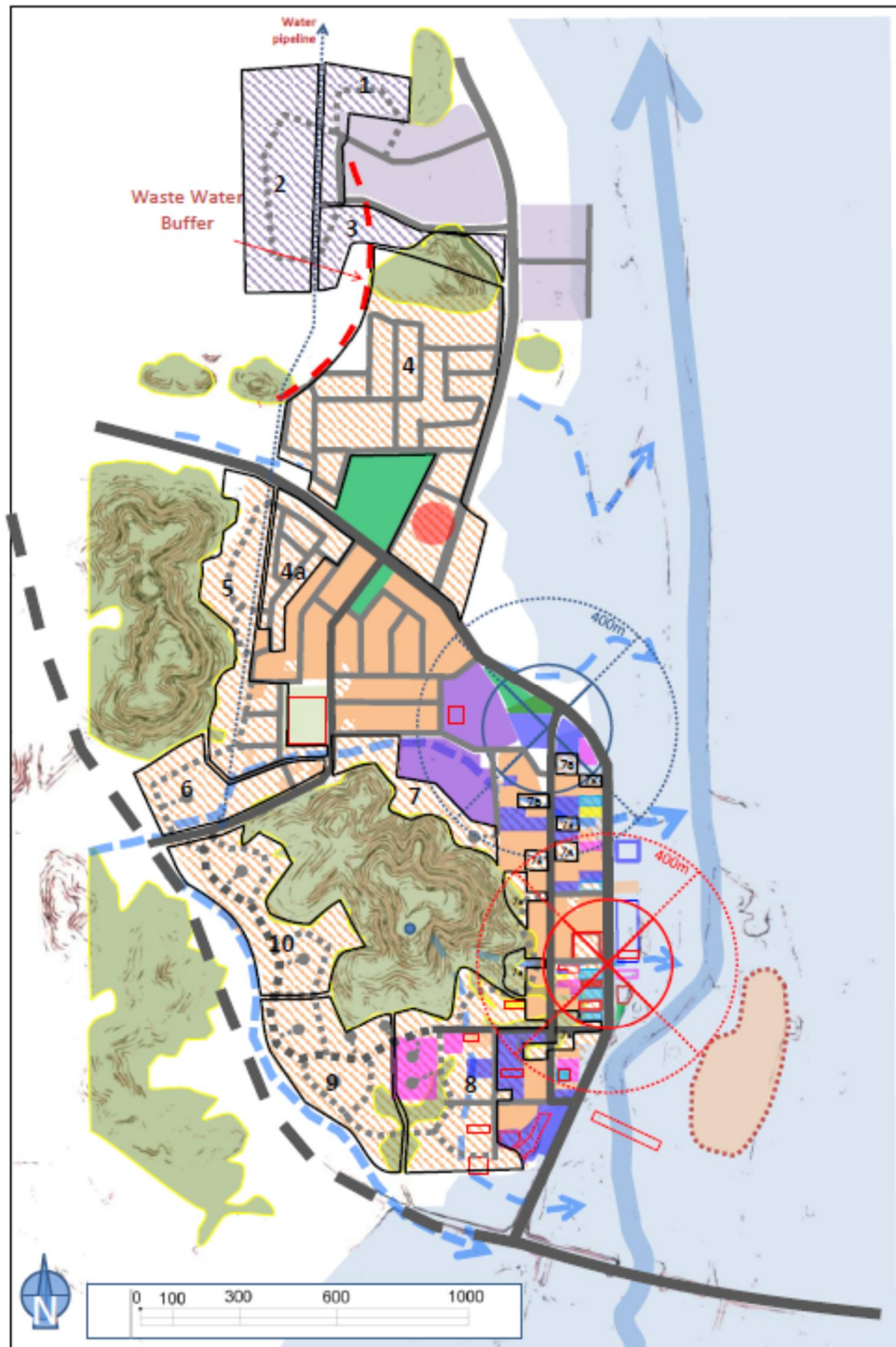


Table 4 Potential development areas and water and wastewater servicing constraints

Area ID (as per Figure 5)	Description	Water reticulation	Wastewater (sewer system)
1 – 3	Extension of Jager Street Industrial Estate 25 ha Industrial area	<ul style="list-style-type: none"> Development is restricted by the WWTP buffer zone. Basic hydraulic assessment shows that land lower than 30 m elevation could feasibly be supplied by the Mt Welcome tank (i.e. source for Roebourne's reticulation network). Pipeline capacity to this area is limited: basic hydraulic assessment indicates that changes to the upstream reticulation/distribution pipes would be required to achieve adequate water supply in this area. 	<ul style="list-style-type: none"> Areas 1 and 2 are outside the proposed potential wastewater catchment areas (as marked on the plan provided by the Water Corporation, see Appendix C). Area 1 could be serviced by an extension of the planned wastewater catchment and sewerage system north (and uphill) into this area. Given its proximity to the WWTP, a small sewer pump station could be used to pump wastewater collected in Area 2 directly to the WWTP. Area 3 is within the wastewater catchment plan. It will also receive sewage flow from the new NASH development.
4	NASH development north of Cleaverville Road 36.5 ha 293 lots 1024 people	<ul style="list-style-type: none"> Development in this area will be supplied via an extension to the reticulation network serviced by a DN200 pipeline that crosses Cleaverville Road at Andover Way. Water supply in this area is dependent on sufficient supply capacity in the upstream network (between the Mt Welcome tank and this water reticulation area). Development in the western part of this area is limited by the WWTP buffer zone. Basic hydraulic assessment shows that all land lower than 30 m elevation could feasibly be supplied by the 	<ul style="list-style-type: none"> Part of this area is already sewerred, and the remainder is within the proposed wastewater catchment area which is planned to service the NASH development.

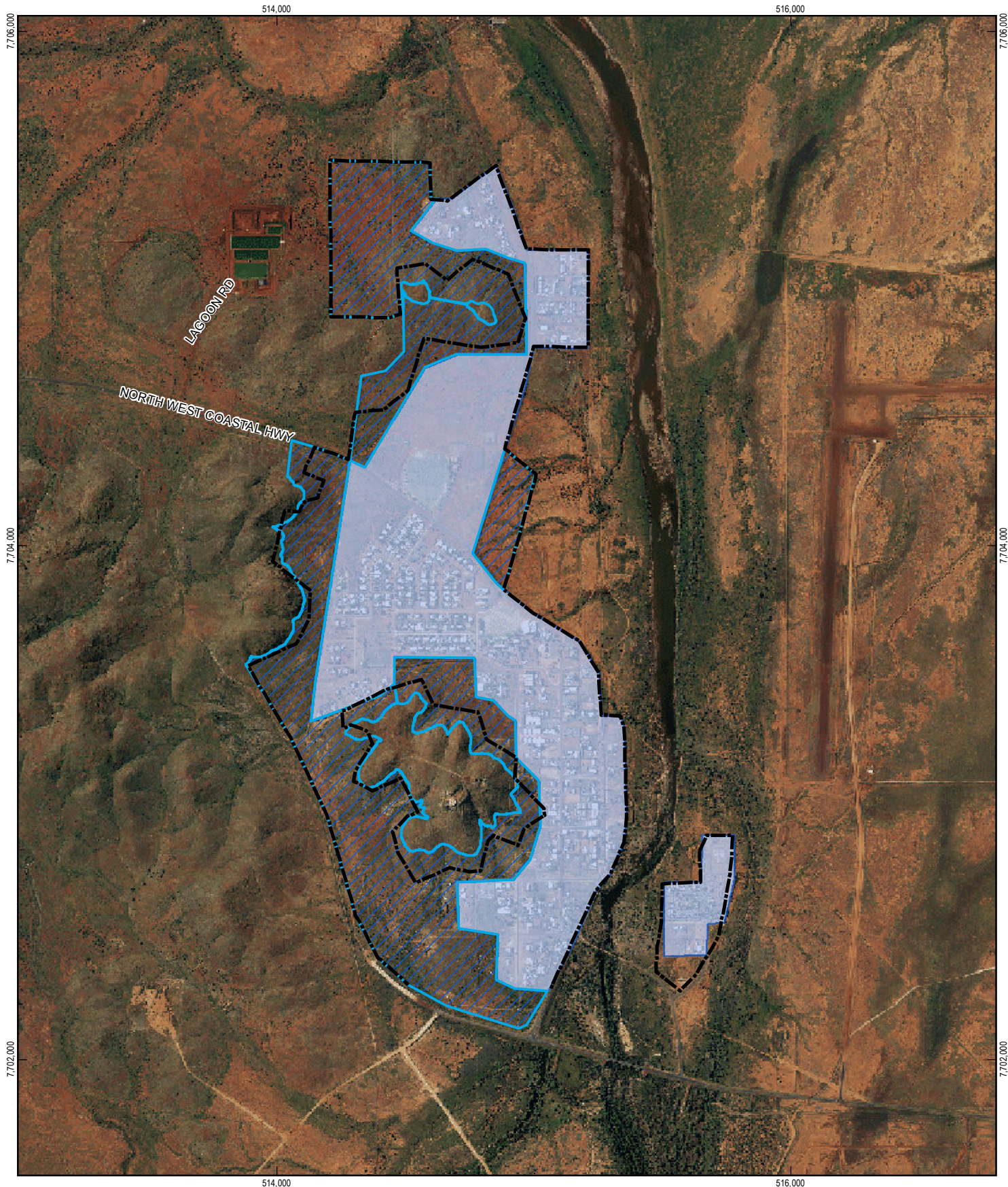
Area ID (as per Figure 5)	Description	Water reticulation	Wastewater (sewer system)
		<p>Mt Welcome tank.</p> <ul style="list-style-type: none"> The current exclusion zones around the hills north and west of NASH are appropriate with land levels at or greater than 30 m. The small area marked for development east of the oval and on either side of Point Sampson-Roebourne Road (retail and housing area) can be serviced from either the NASH pipeline or from the pipeline east of the town that services the Jager Street Industrial Area. 	
4a	<p>NASH development south of Cleaverville Road</p> <p>5.4 ha</p> <p>82 lots</p> <p>286 people</p>	<ul style="list-style-type: none"> This area is supplied through an extension of the reticulation network. 	<ul style="list-style-type: none"> This area is serviced by the Water Corporation through an extension of the existing sewerage network.
5	<p>West of area 4a and infill west and south of Roebourne Cemetery</p> <p>13.5 ha</p> <p>203 lots</p> <p>711 people</p>	<ul style="list-style-type: none"> The existing main water supply pipeline to the Mt Welcome tank runs along the edge of town in this area (see Figure 4) and separates Area 5 from the existing developed land. If development in Area 5 was to be progressed, this pipeline may need to be relocated (below ground). An easement would also need to be left to enable Water Corporation access to the pipeline. This area may be able to be serviced by extending the existing reticulation network, however this is subject to sufficient supply capacity in the upstream network (of 	<ul style="list-style-type: none"> This area is mainly outside the current wastewater operating area. The area is within the declared sewerage area which extends radially 4 km from the centre of Roebourne, and covers all existing and proposed development. However, frontal and non-frontal lot developments are subject to Water Corporation approval and conditions. Parts of this area are already serviced (west of the cemetery). The undeveloped area west of the current town

Area ID (as per Figure 5)	Description	Water reticulation	Wastewater (sewer system)
		<p>distribution pipes between the Mt Welcome tank and this area).</p> <ul style="list-style-type: none"> Development up the hill to the west of area 5 is limited by the Mt Welcome tank and outlet/distribution system hydraulically by the level of water in the supply from the Mt Welcome tank. Land levels of up to ~30 m AHD can feasibly be serviced. 	<p>boundary is higher (uphill from) adjacent areas of land parcel 4a and the existing lots in the Cleaver Ct area, and as such could be connected to the sewerage network here.</p>
6	<p>West of water pipe and current town boundary and infill in area south of area 5 and north of Andover Way</p> <p>8.4 ha 126 lots 441 people</p>	<ul style="list-style-type: none"> This area may be able to be serviced by extending the existing reticulation network to the remainder of the area A, however this is subject to sufficient supply capacity in the upstream network (e.g. between the Mt Welcome tank and this area). The existing main water supply pipeline to the Mt Welcome tank runs along the edge of the town in this area and separates the undeveloped area of parcel 6 from the existing developed land. To develop this area, this pipeline may need to be relocated (below ground), and an easement would also need to be left to enable Water Corporation access to the pipeline. 	<ul style="list-style-type: none"> Parts of this area are outside the current wastewater operating area, which appears to follow the water supply pipeline. Parts of this area are already serviced (south of the cemetery). The undeveloped area west of the current town boundary is higher (uphill from) adjacent areas of land of parcel 4a and the existing lots in the Cleaver Ct area, and as such could be connected to the sewerage network here (via gravity sewers).
7	<p>Area between Hampton/Fraser Streets and base of Mt Welcome</p> <p>5.2 ha 78 lots</p>	<ul style="list-style-type: none"> This area could be serviced by extending the existing reticulation network (Fraser Street or Hampton Street) to the area. The feasibility of providing water to lots in this area is subject to sufficient supply capacity in the upstream network (between the Mt Welcome tank and this area). 	<ul style="list-style-type: none"> This area lies outside the current wastewater operating area. This land lies higher than adjacent developed land to the north and east. It could be connected via gravity sewers to existing sewerage catchments.

Area ID (as per Figure 5)	Description	Water reticulation	Wastewater (sewer system)
	274 people	<ul style="list-style-type: none"> The land elevation appears to be sufficiently low for the tank commanding this system. Development should be feasible below elevations of 32 m AHD. 	
7a (infill)	Vacant lots within eastern part of current town total 5.2 ha total 104 lots 365 people	<ul style="list-style-type: none"> This area is close to the supply tank at Mt Welcome and could be serviced by extending the existing reticulation network. It is feasible to develop land below the 32 m AHD contour line. 	<ul style="list-style-type: none"> These undeveloped lots are all within existing infill sewer areas and could be connected to the existing sewer system.
8	South of Mt Welcome, vacant lots around south-western border of current town development 17.2 ha 258 lots 904 people	<ul style="list-style-type: none"> This area is partially serviced already – further development in this area could be serviced by extending the existing network, subject to sufficient supply capacity in the upstream network (between the Mt Welcome tank and this area). The land elevation appears to be sufficiently lower than the tank commanding this system and development should be feasible below elevations of 32 m AHD – this requirement allows for some land to be developed north of Withnell Street (see Figure 6). Extension of Area 8 south of Cherratta Road would also be feasible from a water supply perspective subject to sufficient upstream capacity as discussed above. 	<ul style="list-style-type: none"> Parts of this area are already serviced by pressure mains and private pump stations that connect to the existing gravity sewer system north of Withnell Street. Further development in this area is feasible from a wastewater servicing point of view, but subject to negotiations with the Water Corporation to install new sewer infrastructure. Extension of area 8 south of Cherratta Road would require the establishment of an additional sewer pump station.
9	Southwest of Mt Welcome	<ul style="list-style-type: none"> This area could be serviced by extending the reticulation network from the north or east, depending 	<ul style="list-style-type: none"> The north-west portion of this land is outside of the proposed pump station catchment delineated on the

Area ID (as per Figure 5)	Description	Water reticulation	Wastewater (sewer system)
	(extension to current town development) 12.9 ha 193 lots 677 people	<p>on the order of development in Roebourne. This is subject to sufficient supply capacity in the upstream network (between the Mt Welcome tank and this area).</p> <ul style="list-style-type: none"> It would potentially be more economical to develop areas closest to existing reticulated lots first and extending development into greenfield areas in subsequent development stages. The land elevation appears to be sufficiently lower than the tank commanding this system and development should be feasible below elevations of 32 m AHD. This allows also for some land to be developed north of Withnell Street (see Figure 6). The existing main water supply pipeline to the Mt Welcome tank runs along the edge of town in this area and then climbs the hill (to connect to the tank) in the vicinity of the boundary between land parcels 9 and 10. To develop this area, this pipeline may need to be relocated (below ground) in some sections, and an easement would also needed to enable Water Corporation access to the pipeline. 	<p>plan provided by the Water Corporation (see Appendix C). This area is at a higher elevation than the pump station catchment so the catchment could be extended to service the full land area of parcel 9.</p>
10	West of Mt Welcome between areas 6 and 9, only on Roebourne side of potential town bypass road	<ul style="list-style-type: none"> There is no existing reticulation in this greenfield area. This area could be serviced by extending the reticulation network from the north or east, depending on the order of development in Roebourne. Ultimately, if areas 6, 9 and 10 were all to be developed, then a ring main pipeline around the base of Mt Welcome 	<ul style="list-style-type: none"> Parts of this area (especially the northwest) are outside the current wastewater operating area, which appears to follow the water supply pipeline. This area would become a new wastewater pump station catchment and could be pumped north to Area 6 to connect to the existing sewers, subject to detailed

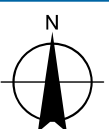
Area ID (as per Figure 5)	Description	Water reticulation	Wastewater (sewer system)
	12.6 ha 189 lots 663 people	<p>could be installed to service these areas or to connect the reticulation networks that will extend from the north and south into this area.</p> <ul style="list-style-type: none"> The land elevation appears to be sufficiently lower than the tank commanding this system and development should be feasible below elevations of 32 m AHD The existing main water supply pipeline to the Mt Welcome tank runs close to the bypass road easement and then climbs the hill (to connect to the tank) in the vicinity of the boundary between land parcels 9 and 10. To develop this area, this pipeline may need to be relocated (below ground) in some sections, and an easement would also need to be left to enable Water Corporation access to the pipeline. 	sewer collection system modelling and agreement by the Water Corporation.
Caravan park area		<ul style="list-style-type: none"> Water supply is connected to this area. 	<ul style="list-style-type: none"> This area lies within the existing wastewater operating area. There are no existing sewers in this area – a pump station would be required to bring flows across the Harding River and connect to the existing sewer system.



LEGEND

- Proposed Structure Plan Boundary
- ▨ Feasible Extension to Water Supply
- Existing Water Supply Area

1: 20,000 (at A4)
0 100 200 400 600 800
Metres
Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

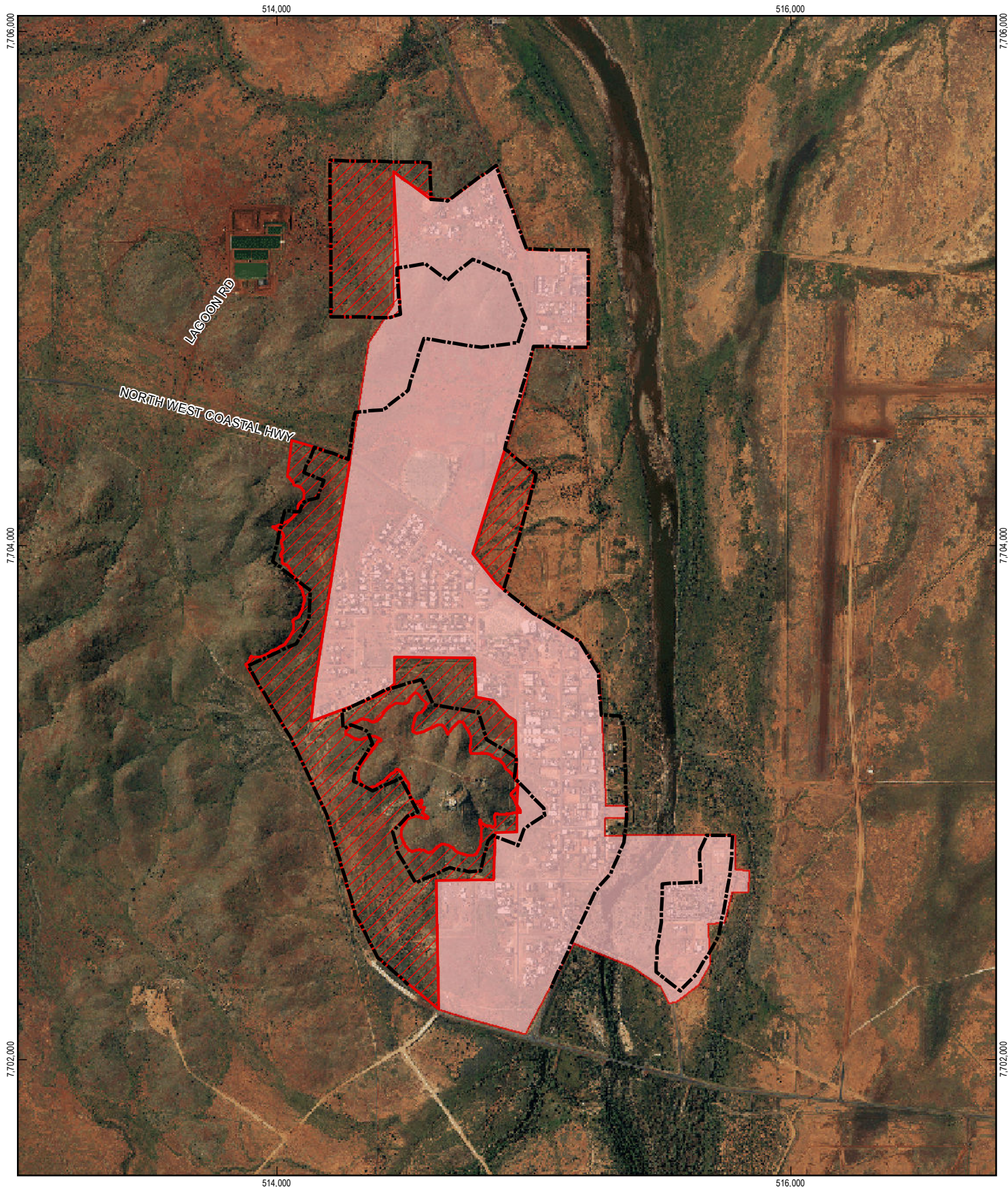


Shire of Roebourne
Roebourne Water and Waste Water
Services Capacity Assessment

Job Number 61-28764
Revision 0
Date 06 Feb 2013

Water Services

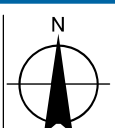
Figure 6



LEGEND

- Proposed Structure Plan Boundary
- ▨ Feasible Extension to WWTP Area
- ▨ Existing WWTP Catchment Area

1: 20,000 (at A4)
0 100 200 400 600 800
Metres
Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50



Shire of Roebourne
Roebourne Water and Waste Water
Services Capacity Assessment

Job Number	61-28764
Revision	0
Date	06 Feb 2013

Wastewater Services

Figure 7

4. Integrated water management

4.1 Integrating land and water planning

Better Urban Water Management (WAPC, 2008) provides guidance on the integration of water planning with the land planning process. At each stage of the land planning process, consideration of water management issues relevant to the scale of the plan should be made and recorded in strategies or plans. The scope of Better Urban Water Management includes total water cycle management: surface water, groundwater, water supply infrastructure, wastewater infrastructure and stormwater management.

To accompany a local Structure Plan or local planning scheme amendment, Better Urban Water Management (WAPC, 2008) and the State Planning Policy 2.9 Water Resources (State Government Western Australia, 2006) require the preparation of a local water management strategy, to guide future detailed planning. In particular, the local water management strategy should set requirements for monitoring (e.g. of surface and groundwater quality) and for urban water management plans (to be prepared by development proponents in future planning stages). Water management issues should be discussed in a chapter of the Structure Plan and a complete local water management strategy document included as an appendix. Much of the desktop assessment work required to complete a local water management strategy will have been completed as part of the consultants' research phase of the SoR Structure Plan preparation. The information contained in this report could be used to inform the sections of the local water management strategy about water and wastewater infrastructure.

4.2 Integrated water management strategies for Roebourne

Integrated water management (IWM) is a way of managing all aspects of the water cycle in a holistic manner to achieve triple bottom line benefits. IWM strategies investigated for Roebourne and presented here aimed to delay water and wastewater (potential) operational and infrastructure changes. If water demand or sewage flows could be reduced, additional population could be serviced with existing infrastructure. The following items were assessed:

1. reduced scheme water demand for residential and commercial users
2. water efficient irrigation for POS and recreational areas currently on water supply (i.e. to reduce demand)
3. using recycled water (treated wastewater from the WWTP) for irrigation rather than the potable water supply.

The results of these assessments are provided below and are divided into scheme water demand reduction, scheme water savings for irrigation of public open space, and a combination (IWM) scenario where water use is reduced, water recycling and water efficient irrigation occurs.

4.3 Reducing scheme water demand (residential and commercial)

Water use in the Pilbara is very high, indeed the region has the highest per capita volume of water supplied anywhere in Western Australia (Water Corporation, 2012).

The town of Roebourne currently uses water at a rate of nearly 400 kL/person/year (this includes commercial, residential and irrigation usage – based on Water Corporation data as discussed in Section 3.2). Considering only commercial and residential uses, per capita water use is currently ~280 ML/y. This is still higher than the State Water Plan (Department of Premier

and Cabinet, 2007) target of 100 kL/person/year total water use, of which the aim is for only 40-60% to come from scheme water.

The very high water use in Roebourne suggests that there are significant opportunities for water savings. Water conservation can be achieved through various measures, including the following outlined by Water Corporation in their 10-year plan for Western Australia (Water Corporation, 2012):

- Encourage water efficient behaviour in the community (through education and support of Water Corporation initiatives)
- Replace old fittings with new, water efficient ones in homes and small businesses
- Request installation of smart meters that allow residents and small businesses to track water use
- For new housing and commercial developments, waterwise features (such as subsoil irrigation or planting drought tolerant species) can become conditions for development and be defined in the Structure Plan to minimise water use and retain amenity.

It was assumed that water savings from residential and commercial water users were possible (~10%), which would result in an annual scheme water saving of 28 ML/y (at 2012 rates). Under a high growth scenario, by 2032 the savings would equate to 118 ML/y (or water for more than 400 additional people or approximately 160 dwellings in Roebourne).

4.4 Irrigation of public open space

Irrigation demand

It is understood that POS and recreational areas in Roebourne are currently irrigated with potable water from the town water supply. Existing POS identified in the proposed Structure Plan and using aerial photography consists of:

- Gus Jager Oval on Cleaverville Road in the town's north (~5 ha)
- Park on corner of Cleaverville Road and Harding Street associated with recreation centre (~2 ha)
- Neighbourhood Park on Andover Way (~1 ha)

Basic irrigation demand calculations were undertaken for turf using average climate data from nearby weather stations (Bureau of Meteorology: rainfall from Roebourne weather station #4035, evaporation from Dampier Salt weather station #5061). Irrigation Calculator is a simple crop irrigation requirement program released by the WA Department of Agriculture and was used to assess the watering demand of Roebourne POS. The input files were adjusted for Roebourne climate data, and it was assumed that the soil was sandy, and sprinklers were used to irrigate POS in Roebourne. The output of the model is monthly irrigation water requirements: per hectare of turf; the program predicted an irrigation demand of over 16 ML annually, which was used to predict future irrigation water demand.

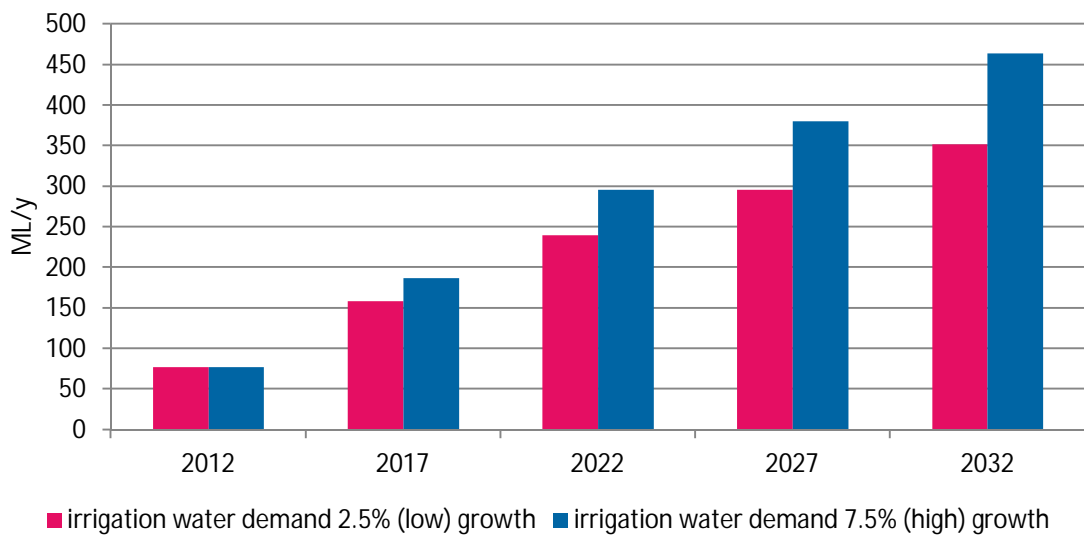
To determine the total irrigation demand (volume) in the future, it was assumed that a certain proportion of future development area would be used for POS. Of the 142 ha of vacant land potentially available for development in the proposed Structure Plan (as per Section 3.4) it was assumed that the POS would be developed as per Table 5.

Table 5 POS assumptions for future development (to 2032)

Growth scenario	POS accounts for % of future developed area	POS area (ha) in future developed area – in addition to existing ~8 ha	2032 ultimate development – total POS area (ha)
High growth	15%	21	29
Low growth	10%	14	22

The water demand for irrigating these POS areas is significant, with up to 464 ML/y required for the high growth scenario and 350 ML/y for the low growth scenario in 2032 (Figure 8).

Figure 8 Irrigation water demand projection for POS



Water efficient irrigation

Water savings can be made with irrigation systems by minimising evaporation losses. This can be achieved with subsoil drip irrigation systems. Subsoil irrigation is also favoured where recycled water is used (which is discussed in Section 4.5). The Irrigation Calculator applies a loss factor of 20% for spray irrigation systems. The irrigation demand calculations described above were repeated for the water efficient subsoil irrigation scenario, and the 2032 high growth POS irrigation water demand was 387 ML/y (compared to 464 ML/y).

Irrigation demand could be lowered by planting drought tolerant or native species adapted to the local environment. Such species often require irrigation only during their establishment and then survive on seasonal rain alone.

Potential to use recycled water for irrigation

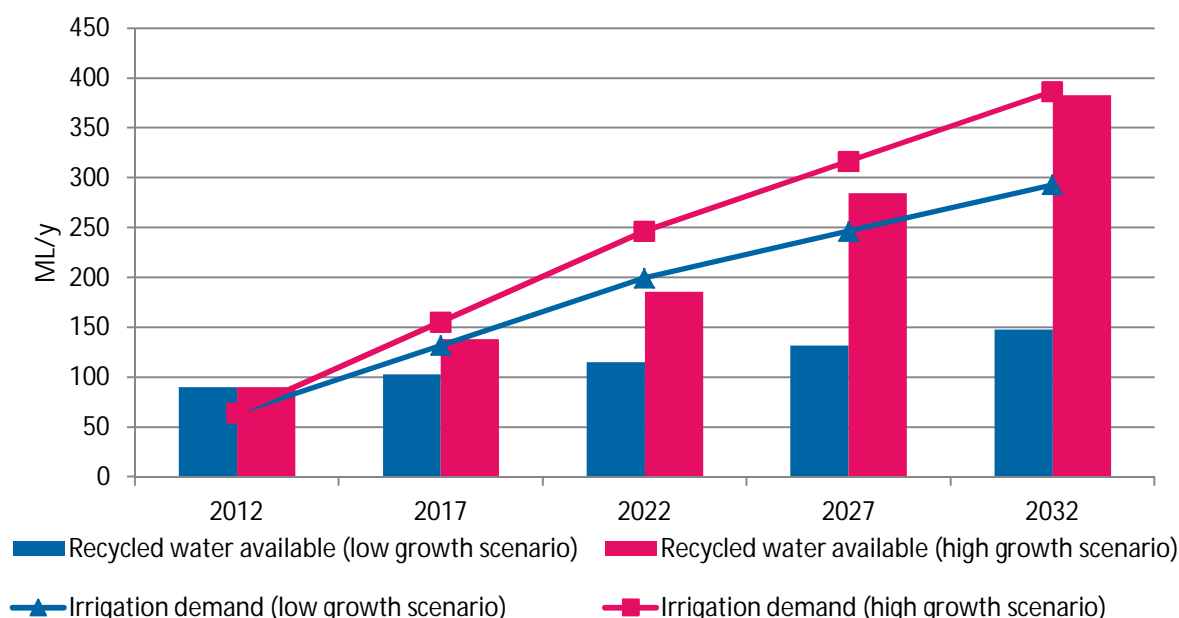
Recycled water is used in many regional towns for irrigation of parks and ovals. An opportunity may exist in Roebourne to use recycled water in the form of treated wastewater from the WWTP for irrigation of town POS. No water quality data was available for treated effluent from the WWTP and this is a knowledge gap for this assessment. Health and environmental risks apply to the use of recycled water for irrigation, and future assessment of the potential for a recycled water scheme would be required before any such scheme could be considered feasible. The Water Corporation should be consulted on the treated effluent quality if a recycled water scheme in Roebourne warrants further assessment.

The assessment conducted and described here focuses on the potential of a recycled water scheme from a volumetric perspective only: that is, how much of the irrigation demand can be met with treated wastewater from the WWTP.

It was assumed that 48% of water used in residential and commercial lots in Roebourne flowed to the WWTP (i.e. contributed to sewage, based on Water Corporation online published data on water use in the home). Water use efficiencies were assumed (10% reduction) as discussed in Section 4.3. Water lost (via evaporation) from the WWTP ponds was calculated using average annual evaporation (as discussed above for irrigation demand) and an assumed pond surface area (assuming existing pond configuration, ~10,800 m²) and equated to 33 ML/y. Total available recycled water was projected into the future, refer Figure 9.

Currently, recycled water has the potential to fully service the irrigation demand for existing Roebourne POS. By 2032, the irrigation demand would outstrip the recycled water volume and additional (potentially scheme) water sources would be required to subsidise the recycled water, which would meet ~50% of demand in the low growth scenario, and almost 100% in the high growth scenario. These estimates are order of magnitude accuracy only and are designed to provide information that could be used by the SoR to prioritise future investigations.

Figure 9 Irrigation demand and recycled water use opportunities



An order of magnitude cost estimate for wastewater recycling scheme infrastructure to service the existing POS in Roebourne was prepared and included: a disinfection plant, recycled water storage tank, pump station and pipelines to supply existing POS and continuing down Roe Street to Withnell Street to enable connection of future POS/street trees. The general layout of the potential scheme as costed is shown in Figure 10.

It was assumed that water efficient irrigation would be used, and irrigation would occur daily in summer. If irrigation was scheduled to occur over an 8 hour period (running different stations over this period) the hourly flowrate was estimated to be ~30 m³/h. Pipe diameters and pump capacity was estimated based on this flowrate, and the cost estimate prepared accordingly. Allowing for construction in Roebourne and a 50% contingency, the capital expenditure of the recycled water scheme infrastructure could be of the order of \$2.1 million. A breakdown of order of magnitude costs is shown in Table 6.

Table 6 Cost estimate of water recycling scheme infrastructure






Symbol	Description	Cost (AUD)
	Chlorine gas plant	\$460k
	100 kL steel tank	\$440k
	Pump station	\$260k
	1.6 km of 125 mm PE pipe	\$610k
	1.7 km of 90 mm PE pipe	\$520k
	TOTAL	\$2.1 million

Figure 10 Schematic of water recycling scheme infrastructure (potential irrigation areas shown in blue)



4.5 Water sensitive scenario (demand reduction plus water recycling)

By reducing residential and commercial water use and using recycled water for irrigation, scheme water can be saved for residential and commercial use. Water savings on 2012 rates were projected to calculate the additional population that could be serviced if water efficiency and water recycling measures as discussed above were adopted in Roebourne. It was estimated that an additional 378 people (or 108 lots) could be supplied with scheme water. This saving can also be described in terms of the potential to defer upgrading the main water supply infrastructure (for example, the main storage tank on Mt Welcome and the main water pipe from this tank) in Roebourne:

- For the low growth scenario, the current infrastructure could potentially support the town until 2026 by adopting water sensitive urban design
- For the high growth scenario, the current infrastructure could potentially support the town until 2016 by adopting water sensitive urban design.

Water reticulation to individual lots is not included in this assessment and would obviously need to be extended for additional population to be serviced.

Ultimately, as the population of Roebourne grows, the water savings with water efficiency and water recycling can become significant. In 2032, if water infrastructure had been installed to service the projected population at current demands, the use of water efficiency and water recycling would equate to:

- ~250 ML/y water saving (or water for approximately 800 additional people) under the low population growth scenario
- ~580 ML/y water saving (or water for approximately 1800 additional people) under the high population growth scenario.

5. Conclusion

5.1 Summary of findings

Water supply system

- The hydraulics of water supply in Roebourne are constrained by gravity supply from the Mt Welcome tank, which has a top water level of ~64 m AHD.
- The Mt Welcome tank is assumed to be at capacity, and increases in town water demand will necessitate additional storage.
- In the north of town, it appears hydraulically feasible to supply water to land with elevations of up to ~30 m AHD, subject to sufficient upstream pipe capacity
- In the town (around Mt Welcome), it appears feasible to supply water to land with elevations of up to ~32 m AHD, subject to sufficient upstream pipe capacity.
- Most areas in the proposed Structure Plan can be supplied from the existing tank, although more volume will be required to supply more people.
- Areas 1, 2, 3 and 8 can be extended beyond their current defined boundaries, subject to sufficient upstream pipe capacity and storage volume.
- The existing tank outlet (main water pipe from tank) will not be able to meet the ultimate flow requirements (demand) of the projected population growth in Roebourne. The Water

Corporation will determine the requirements for upgrading this to provide an adequate level of service based on development/population projections provided by SoR in the Roebourne Structure Plan.

- There is the potential to save water with water conservation measures (e.g. water efficiency, wastewater recycling for irrigation) to defer the (potential) operational and infrastructure changes to the tank, outlet and distribution network. In particular, the opportunity to meet the town's POS and recreational areas irrigation water demands with recycled water in the form of treated wastewater from Roebourne WWTP may warrant further investigation.

Wastewater collection and treatment system

- The existing WWTP is at capacity (it includes the NASH development) and extra treatment/volume capacity is needed via upgrades to support additional connections
- Much of the proposed development areas lie within the existing Water Corporation wastewater operating area, with the exception of areas 1, 2 and 10 and some areas of 5, 6, and 9.
- It is feasible to connect most of the undeveloped land adjacent and uphill of existing developed and sewered areas without major infrastructure upgrades. However, potential development areas 2 and 10 would probably require new pump stations.
- The existing wastewater catchments are serviced by sewers and pump stations designed for sewage flows within the operating area. All additional development outside of this area would necessitate a review of the capacity of the existing sewer conveyance infrastructure to enable connection.
- The caravan park is currently not sewered and could be connected in the future by pumping to an adjacent wastewater catchment.
- Treated wastewater is currently disposed of by evaporation and infiltration. The potential for treated wastewater to be used for non-potable uses, such as POS and recreational area irrigation, may warrant further investigation.

5.2 Recommendations

Integration of water planning with land planning

The Structure Plan Guidelines (WAPC, Structure Plan Preparation Guidelines, 2012) require pre-lodgement consultation with numerous stakeholders, including the Water Corporation. Development in Roebourne that is proposed within the Water Corporation operating area may trigger Water Corporation to set conditions for land development that will need to be incorporated into the Structure Plan. Early discussions and negotiations between the Water Corporation and SoR will assist both parties with planning for the future in Roebourne. SoR should gain approval of the draft Structure Plan with the Water Corporation once available.

The planning scheme which will be prepared for Roebourne following the implementation of the Structure Plan provides an opportunity to set requirements for development. As part of the development requirements, water and wastewater requirements could be included, referencing a local water management strategy, and outline the need for developers to investigate alternative water sources, stipulate water efficiency fixtures and appliances, and waterwise landscaping, for example.

To accompany a local Structure Plan or local planning scheme amendment, Better Urban Water Management (WAPC, 2008) and the State Planning Policy 2.9 Water Resources (State Government Western Australia, 2006) require the preparation of a local water management

strategy, to guide future detailed planning. It is recommended that the SoR consult the Department of Planning on the water planning requirements for the Roebourne Structure Plan.

Reducing water demand

The work presented here highlights the potential for reducing scheme water demand. The SoR can use the Structure Plan to outline the water conservation and efficiency measures that must be undertaken for future development to be approved. This is likely to be an important issue for the Water Corporation and one of their conditions for planning to increase water supply to the town.

Water recycling

The use of recycled water for irrigation is an opportunity that should be explored further. Water recycling has the potential to reduce scheme water demand improve the amenity of the town by providing irrigation water to public open space. The Water Corporation should be consulted on the water quality of treated effluent from the Roebourne WWTP and the feasibility of implementing a recycled water scheme.

Appendices

Appendix A – Structure Plan information (Shire of Roebourne)

PART 1: Roebourne Structure Plan – sub-regional context

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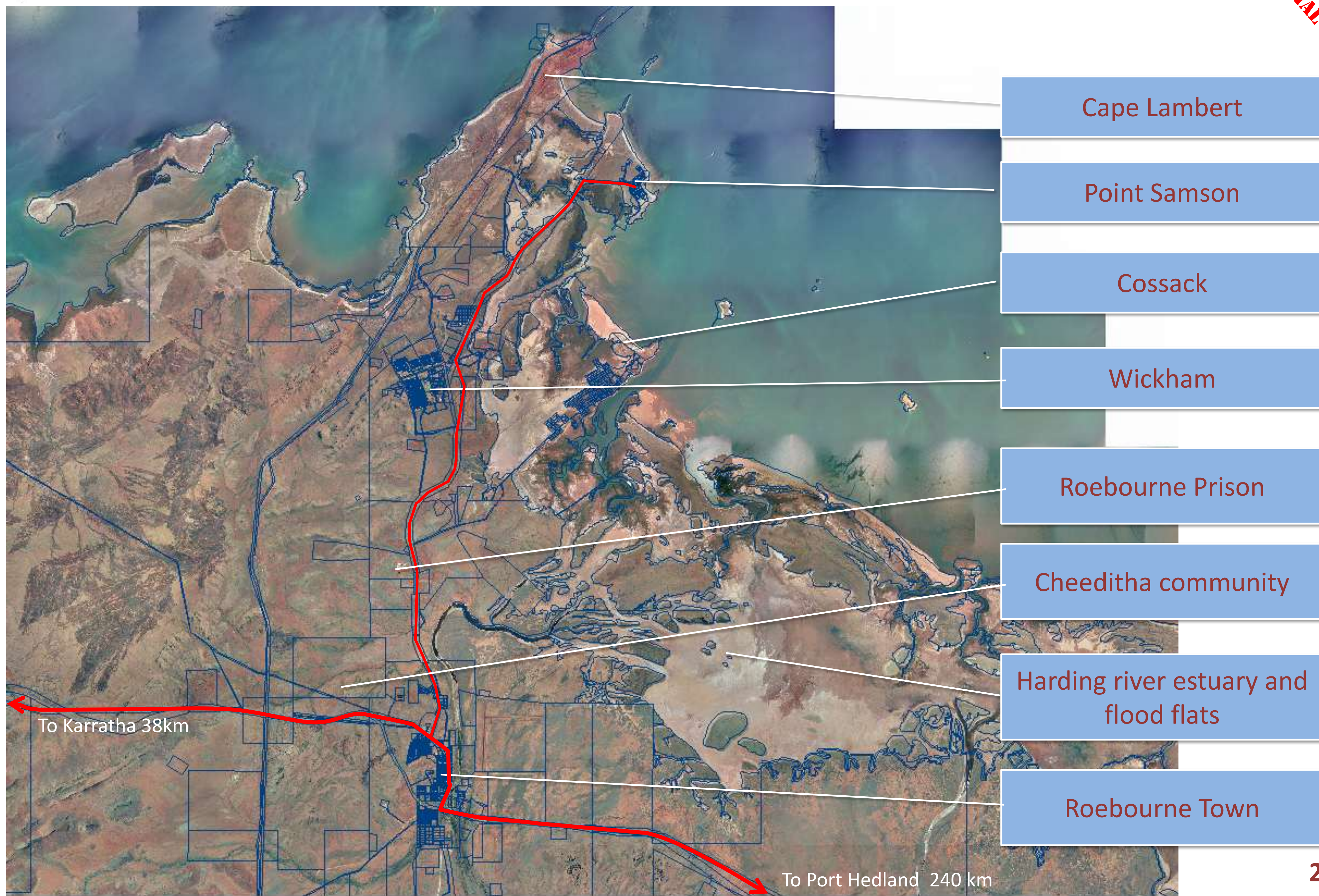
The approach

- Geographical Context
- An insight of the people, the spatial issues and the area
- Graphic outline of the current and future situation
- Utilise an iterative process which will challenge and refine our insights and intuition
- Distil into an effective, workable structure plan which will solicit general support



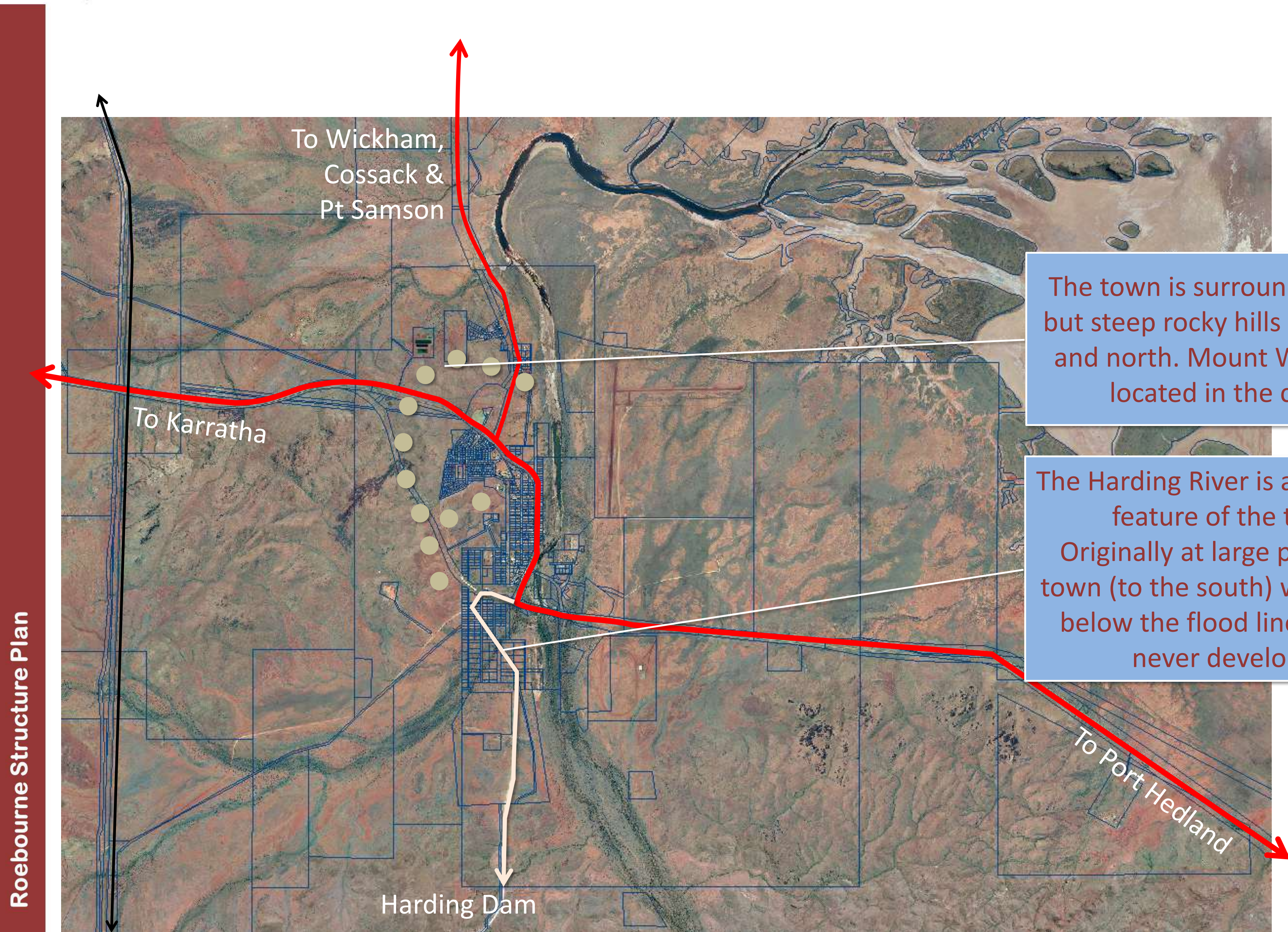
Sub-regional context

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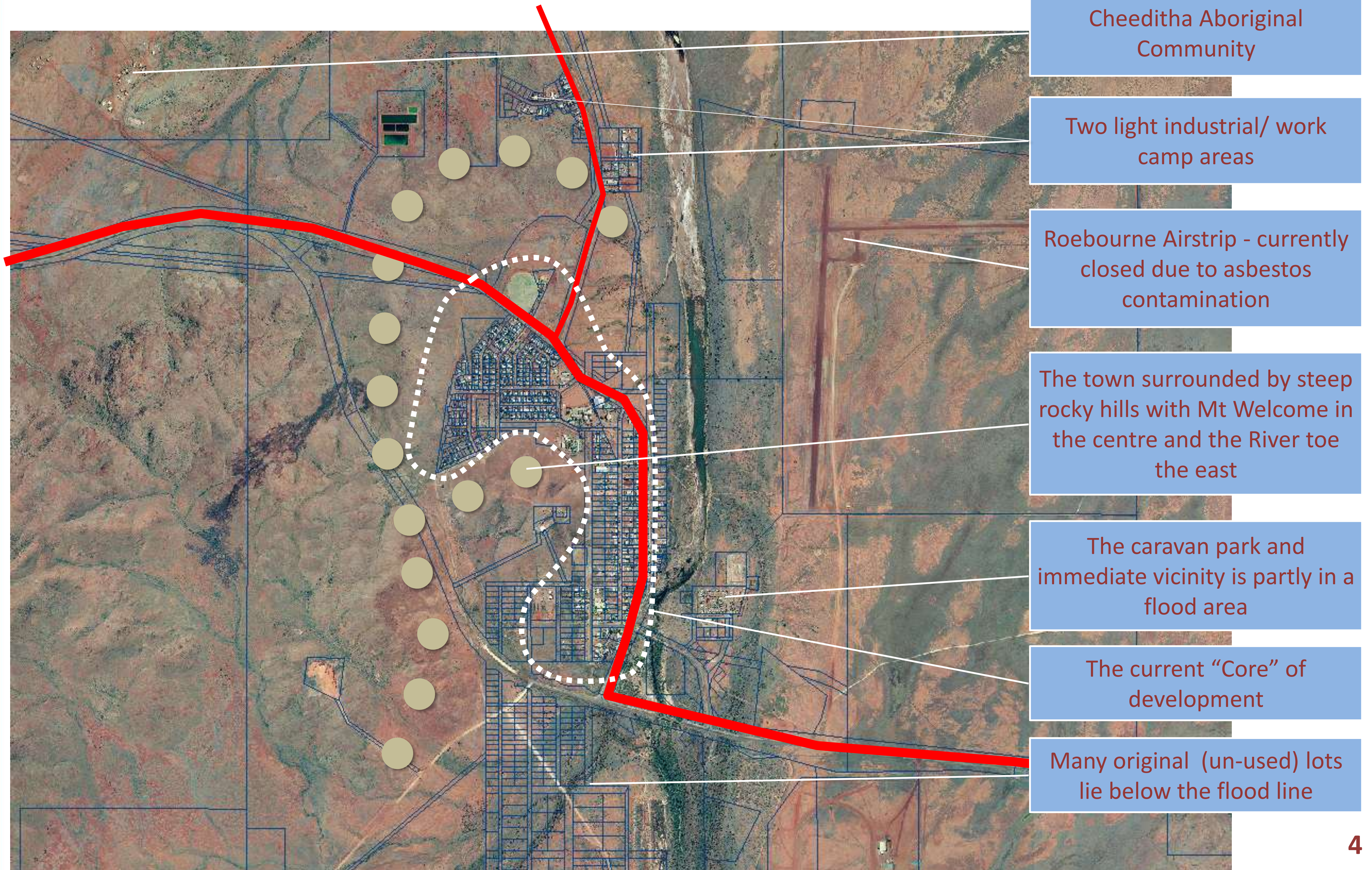
Sub-regional context: Surrounding environment

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Sub-regional context: Local

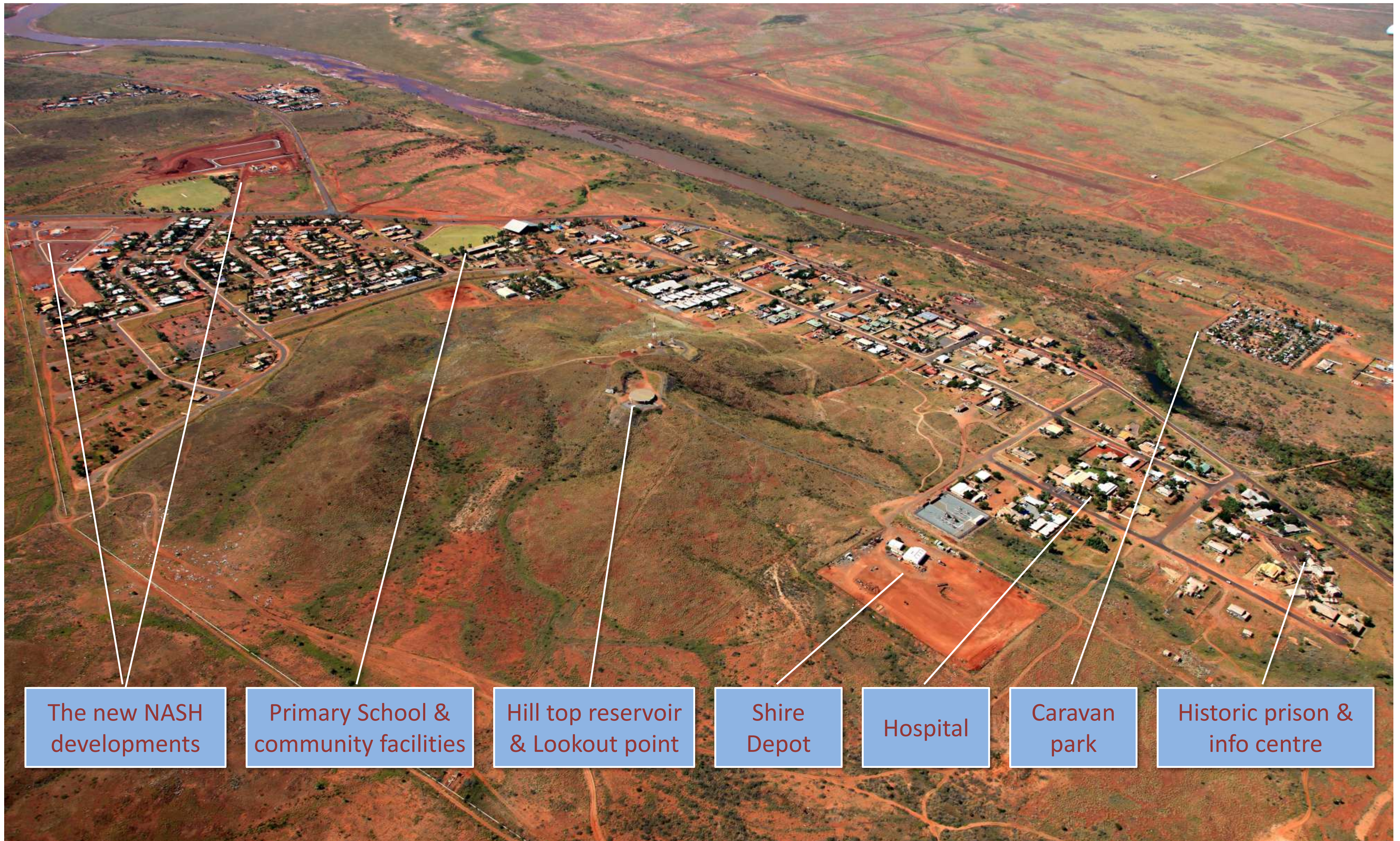
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Sub-regional context: aerial views

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Roebourne viewed from the air highlighting the gently sloping hills (below), the river and airfield (top) and caravan park (right)



The new NASH
developments

Primary School &
community facilities

Hill top reservoir
& Lookout point

Shire
Depot

Hospital

Caravan
park

Historic prison &
info centre

Sub-regional context: geography

The influence on future development

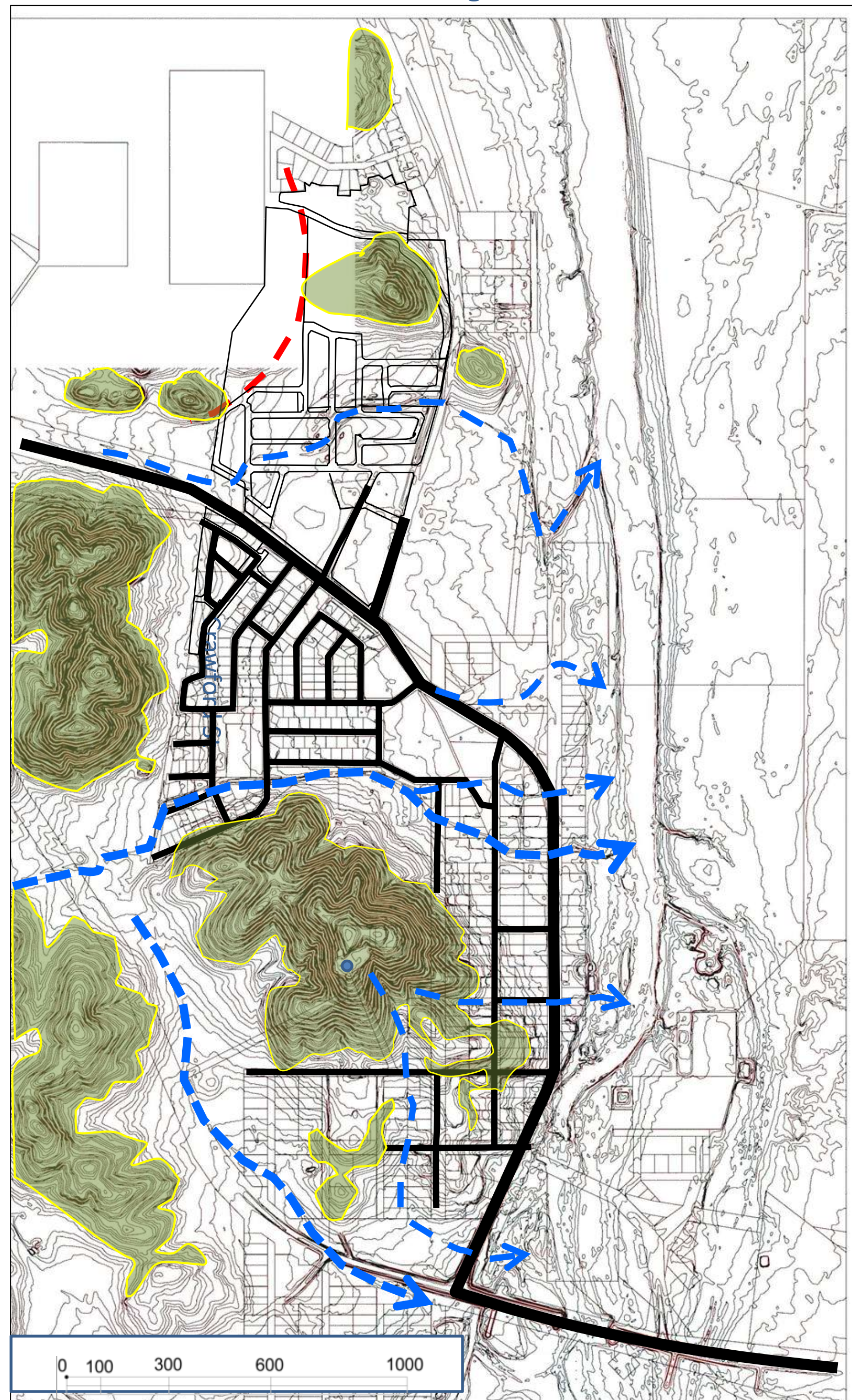
- Ecology – flora and fauna
- Geotechnical conditions
- Flooding
- climate



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Geographic Conditions: Areas too steep for development

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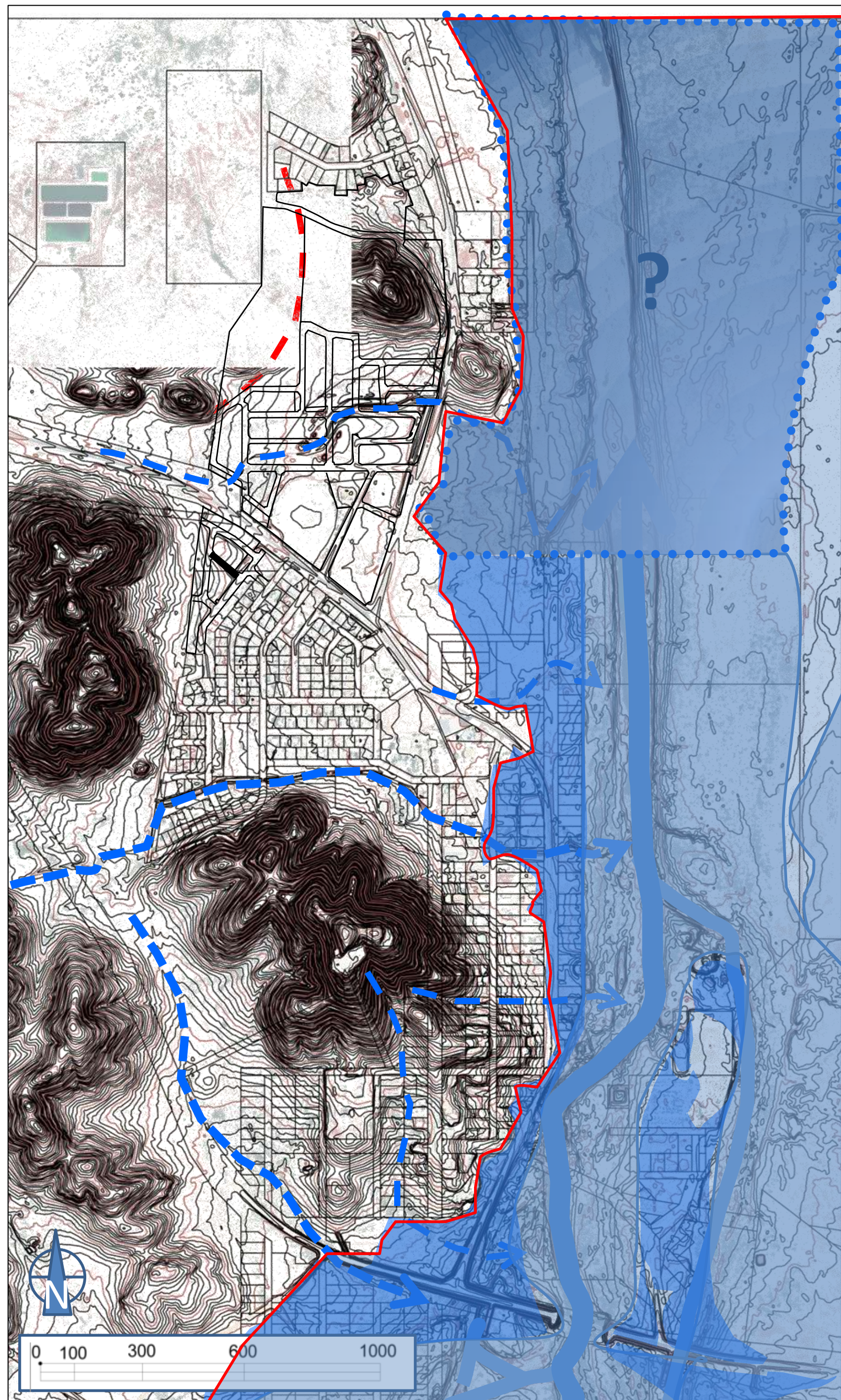
Slopes approximate 1: 5 and steeper

Over land flow path

Waste Water Treatment plant buffer

- The analysis shows that the larger areas of steep slopes are all confined to Welcome hill and the hills to the west of it.
- However some smaller areas of steep slopes extend into the town in the south west, but do not preclude development around them.
- Care should be taken to make sure overland storm water flow paths are taken into account as these can be a real hazard to development

Geographic Conditions: Areas impacted by flooding

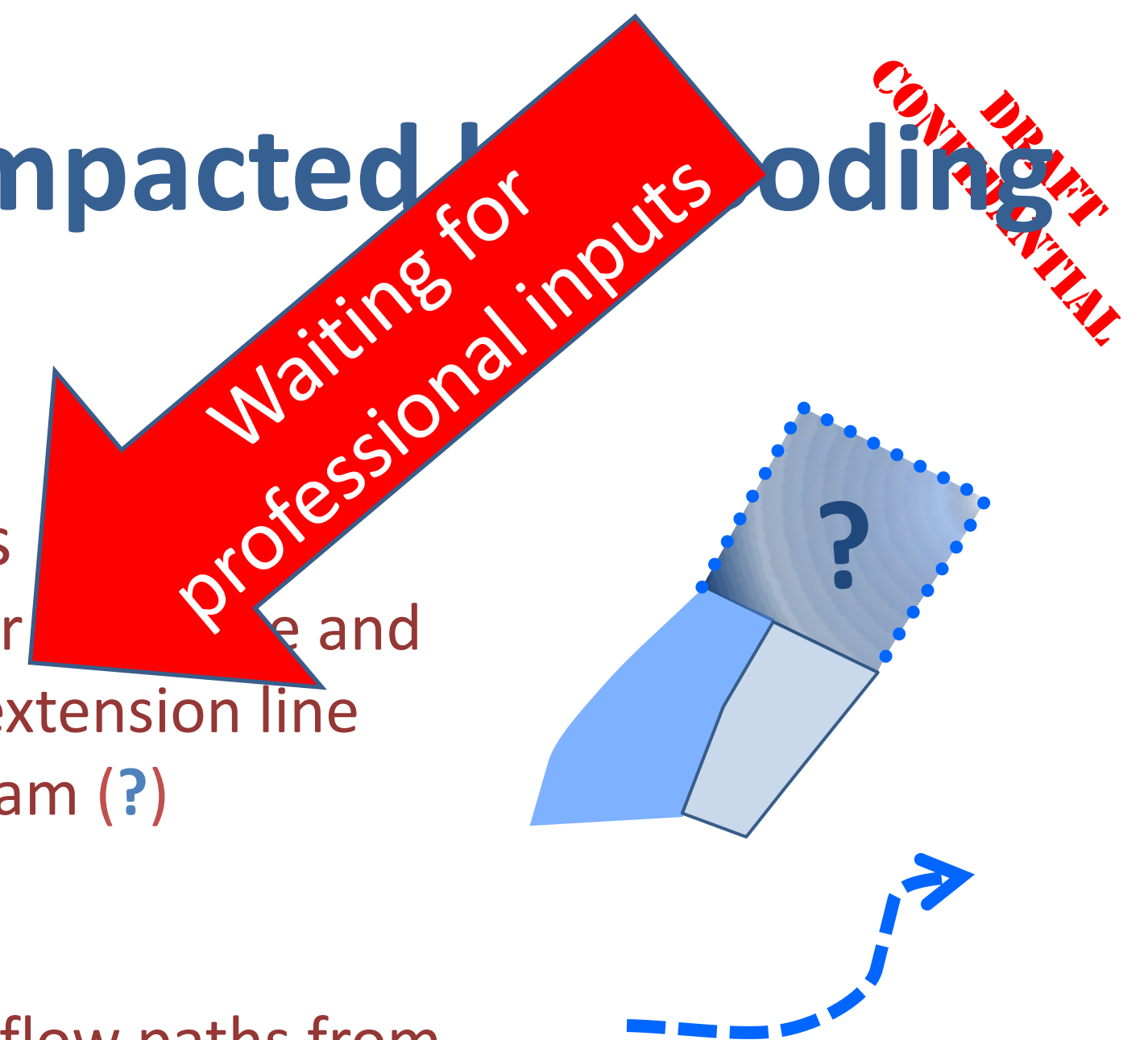


Flood areas

- 1:100 year flood area and possible extension line downstream (?)

- Overland flow paths from the hills

- Apart from the flood area arising from the Harding River, care should be taken to make sure overland storm water flow paths are taken into account as these can be a real hazard to development.
- A new study is commissioned to determine the flood area relative to current requirements of climate change interpretations

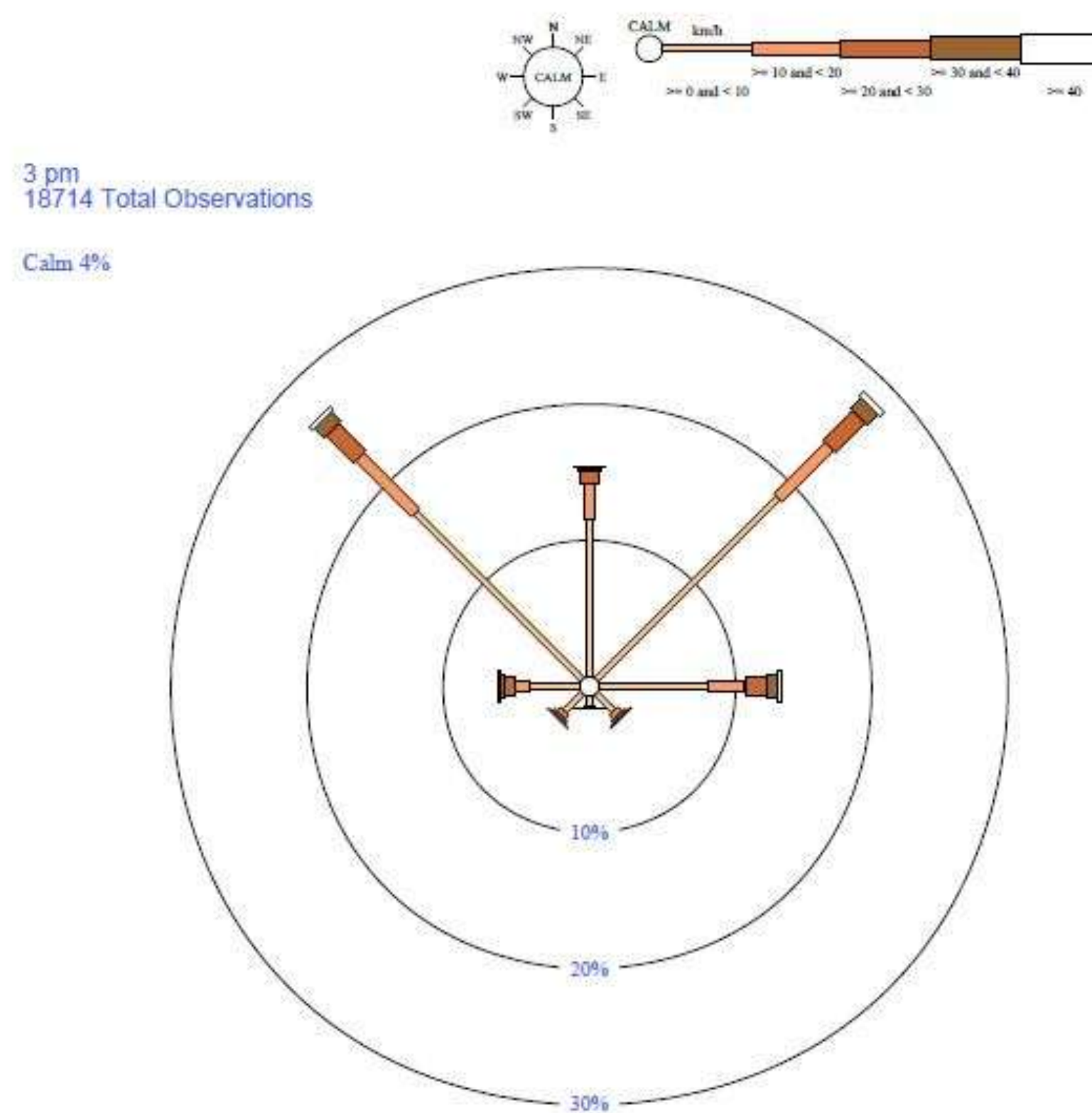
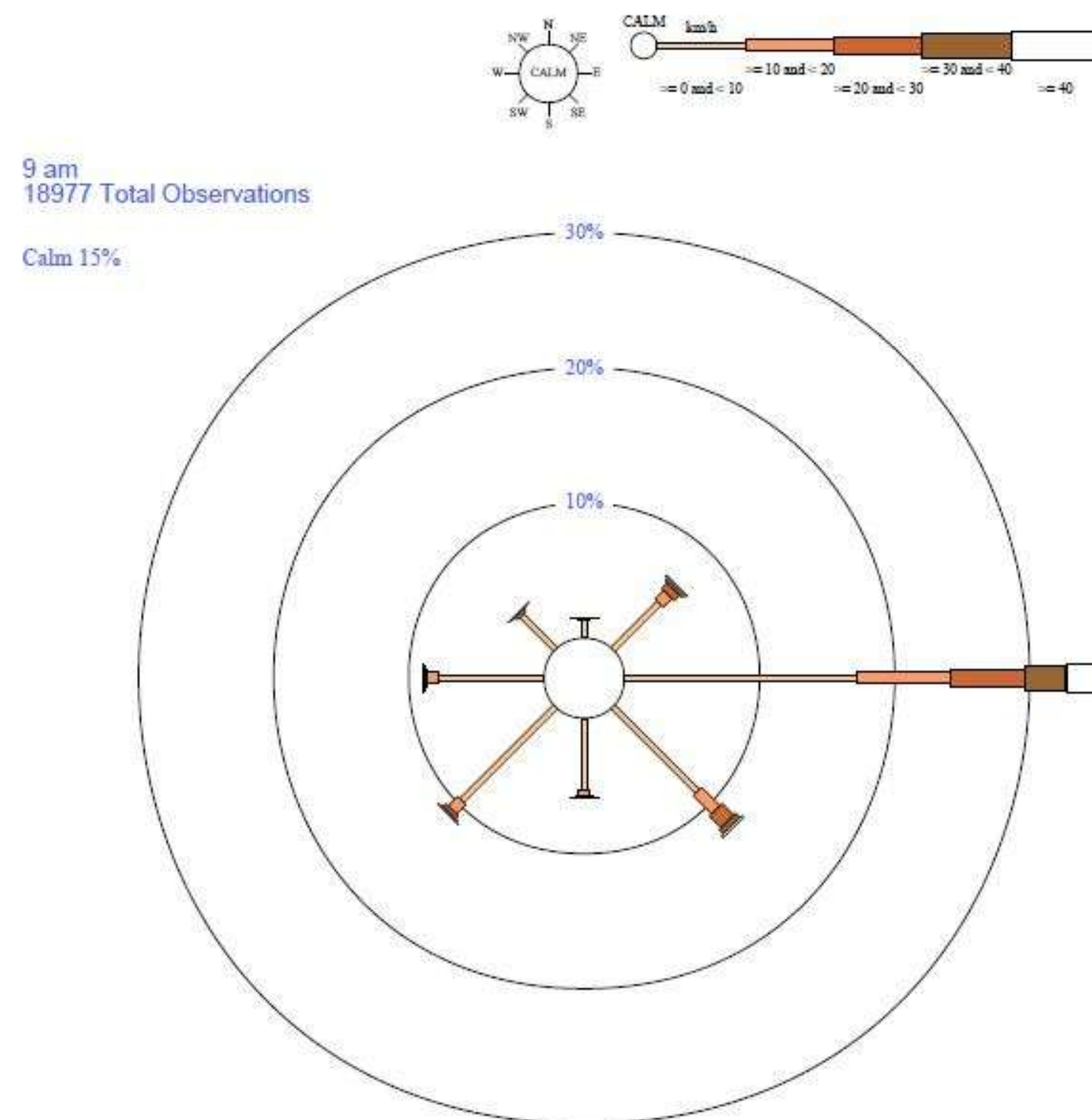


Sub-regional context: Climate

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The influence on future development

- Wind rose information



- Form the above it is clear that over the long term the wind in the morning is predominantly from the East
- In the afternoon it tends to come from the northern sector varying from north west to north east

Rose of Wind direction versus Wind speed in km/h (01 Jan 1957 to 30 Sep 2010)

Custom times selected, refer to attached note for details

ROEBOURNE

Site No: 004035 • Opened Jan 1887 • Still Open • Latitude: -20.7767° • Longitude: 117.1456° • Elevation 12m

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

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

Sub-regional context: Climate

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Need professional
inputs

The influence on future development

- Rainfall
 - Cyclones and structures
- Temperatures
 - Effect on planting and lifestyle
- Adapting built environment to climate
 - Paving colours and texture
 - Housing orientation and exposure
 - shade
- Walkability issues
 - providing shelter resistant to winds and drought



Children playing at the old bridge - December 2008

PART 2: Development overview - Roebourne in context

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The old
and
the new
(1985)



Hopefully the old bridge (left) is not completely abandoned – it has much to contribute yet!



An array of good, bad and indifferent structures - yet most with potential to be iconic and of value to the future character and identity of Roebourne

Historic context

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Roebourne, established by pastoralists, pearlers, gold miners and traders in the 1860s, was gazetted as a town in 1866.

The town served as the primary service centre of for the Shire of Roebourne until 1975 (109 years), when government offices moved to the newly established town of Karratha. Subsequently, Roebourne has experienced a steady decline in the provision of local services and economic growth. The Town has largely remained isolated from the benefits of the mineral rich region notwithstanding its relative close proximity to other centres of activity.

Roebourne has a rich history as one of the earliest settlements on the West Coast of Australia. However, a range of diverse events have led to the deterioration of the town over many years. This Structure Planning has as one of its prime objectives is to bring the town to life again and foster an appreciation of its illustrious past.

A number of the buildings in town have the potential to support a significant heritage precinct. These include a number of significant architectural treasures, some of which have been restored, others in various stages of neglect and disrepair (e.g. the Victoria Hotel). The focus is to determine how these treasures can, jointly, together with new developments bring this part of the town to life again.

It is essential that the planning process will illustrate and describe how the changes in the public realm can be brought about, absorbing cultural and lifestyle elements which are of significance to the current population and what will also be of significant to newcomers and tourists as the town grow anew. The most recent extensions of the town lack the character needed to achieve that. Restoring the liveability of the town is a key objective.

The following analysis will amongst other things show that the whole of the current main street is in a state of flux and under severe pressure. Through the proximity of other close by developments (Wickham) its retail has diminished to the extent that only a general dealer (proxy for a supermarket), an indigenous art gallery and a petrol station are left. All the remaining main street uses are related to community support services. The new NASH development at the north end of town also has a 2.5ha commercial site which is well located to attract retail business and put further pressure on current business in town.

The 2011 Census indicates that there were 1410 people in Roebourne on census night.



Evolving development– new housing & amenities

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Some of the latest housing developments leave much to be desired as far as aesthetics is concerned (left above), but hopefully designs will adjust to climatic demands whilst contributing to the street scape. There is an urgent need to develop a generic design vernacular for Roebourne that would assist to enhance both the appreciation of the existing historic component of the town as well as guide new development to ultimately build a strong local design character, contributing to liveability



The primary school with the old school house, the children's play park and new youth centre are positive elements in an otherwise lacklustre neighbourhood. However, the critical lack of natural surveillance and poor lighting leads to the limited use of these facilities by the community

Hall Street Industrial

Work camps are not an ideal solution. In addition housing being part of an industrial area is not normally conducive to good community integration and outcomes.

This development is totally bereft of any community support services or liveable design suited for the climate.



The pictures above shows the new work camp extension which is the left hand part on the aerial image. The image below are the edge of the development close to the River. Despite some treed sites, the quality of both the site developments and the street amenity are lacking. It is likely that the area is susceptible to flooding by the Harding River.

PART 3: Analysis

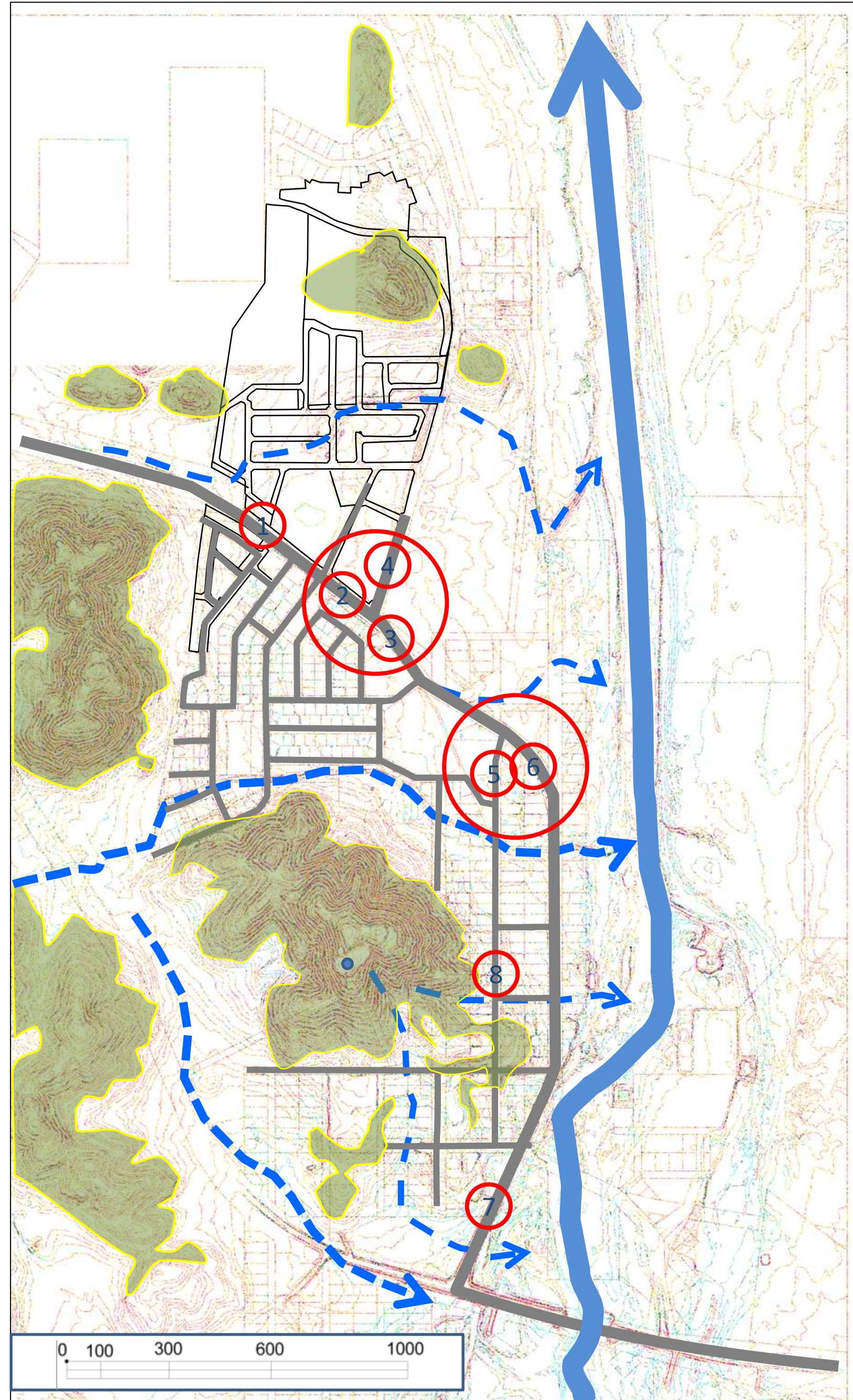
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Including:

- Core Development Characteristics
 - Ownership
 - Land use
- Walkability & Connectivity
 - Transport, Traffic & Safety
 - Including:
 - ✓ Footpaths
 - ✓ Parking
 - ✓ shade
- Infrastructure services
 - Water
 - Wastewater
 - Electricity

Analysis – Traffic counts

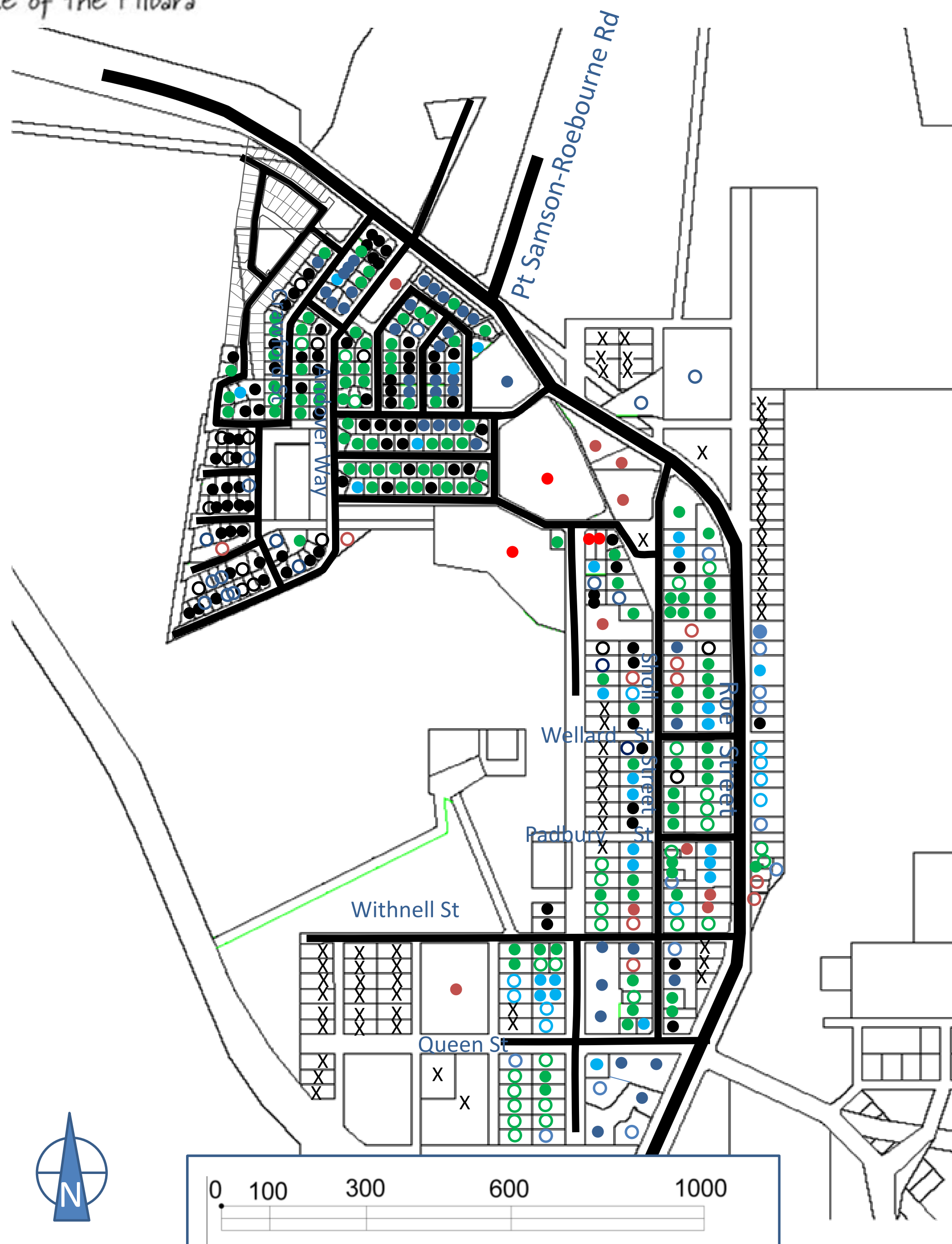
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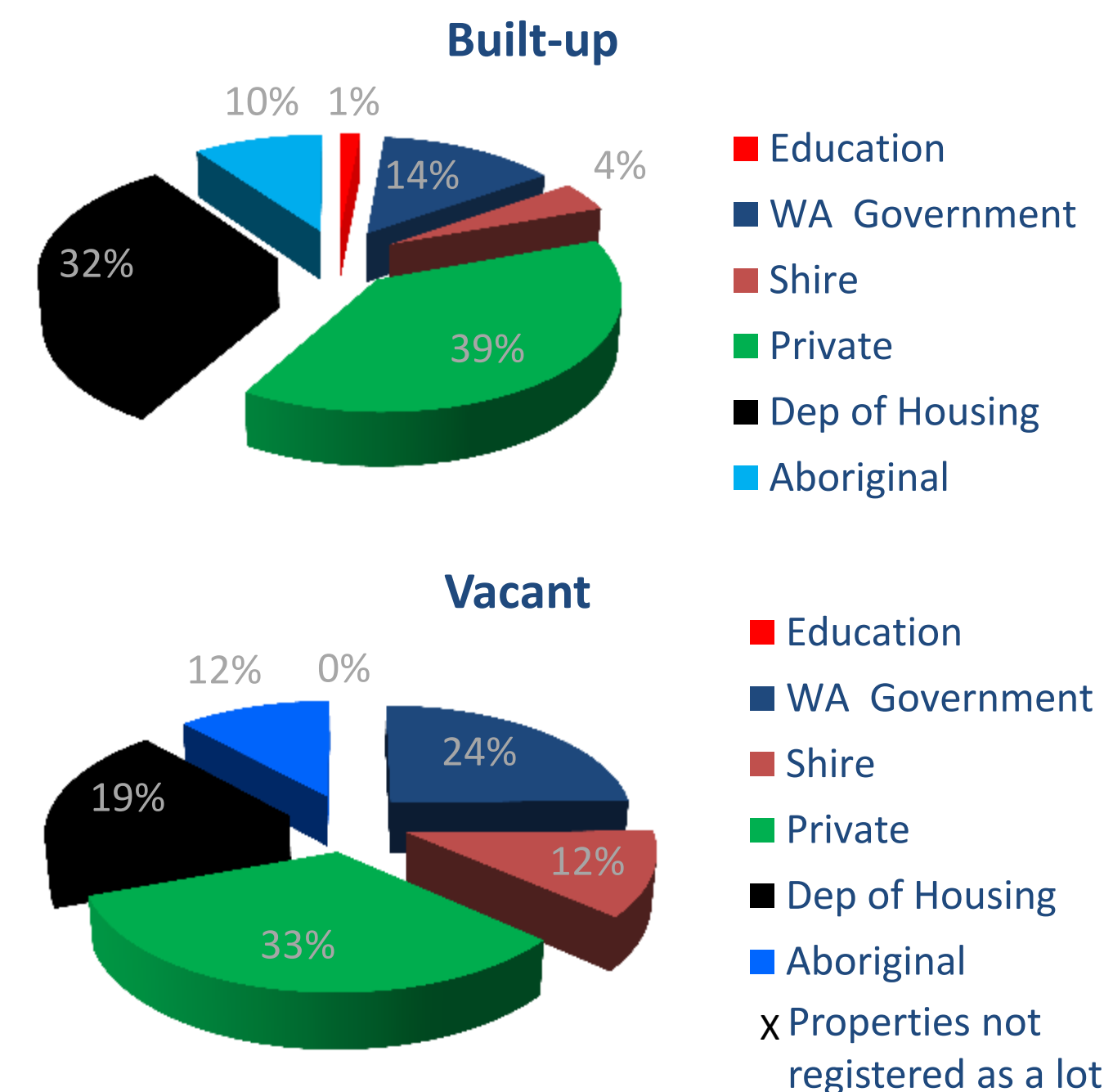
- Count points

Core development – Land ownership

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Ownership	Built-up		Vacant	
Education	4	1.5	0	0.0
WA government	36	13.7	21	24.7
Shire	11	4.2	10	11.8
Private	102	38.9	28	32.9
Department of Housing	83	31.7	16	18.8
Aboriginal	26	9.9	10	11.8
TOTAL	262	100	85	100



Property ownership is quite diverse with the private sector having the largest share (39%)
 Approximately 25% of all lots are vacant and of those the largest proportion (33%) are privately owned

Core development – Land use

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• Current land use map

Uses

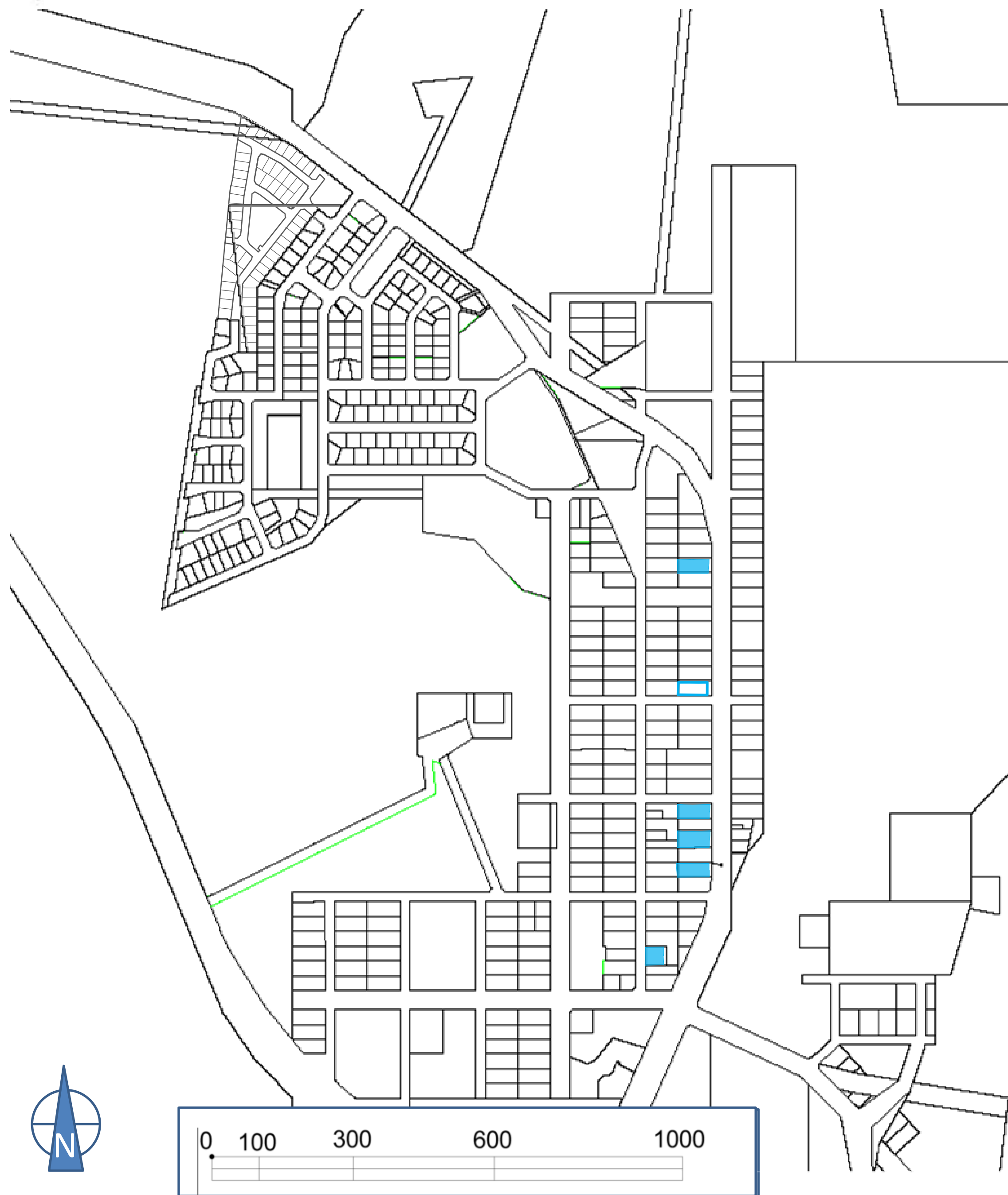
● Residential

- In a field survey 205 housing lots were counted with a few having multiple houses on them and a number under construction. (this is likely to be the difference between this number and the Census figures below)
- There are also 3 houses across the river by the caravan park, as well as accommodation in the caravan park.
- According to the 2011 Census there were to following numbers of housing according to type:

Dwelling structure						
	Separate house	house etc. terrace house, town or Semi-detached, row or apartment	Flat, unit or apartment	Other dwelling	Not stated	Total
Owned outright	20	0	0	22	0	42
Owned with a mortgage(b)	30	0	0	3	0	33
Rented	103	11	0	5	3	122
Other tenure type(e)	0	0	0	0	0	0
Tenure type not stated	10	0	0	3	0	13
Total	163	11	0	33	3	210

Core development – Land use

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• Current land use map

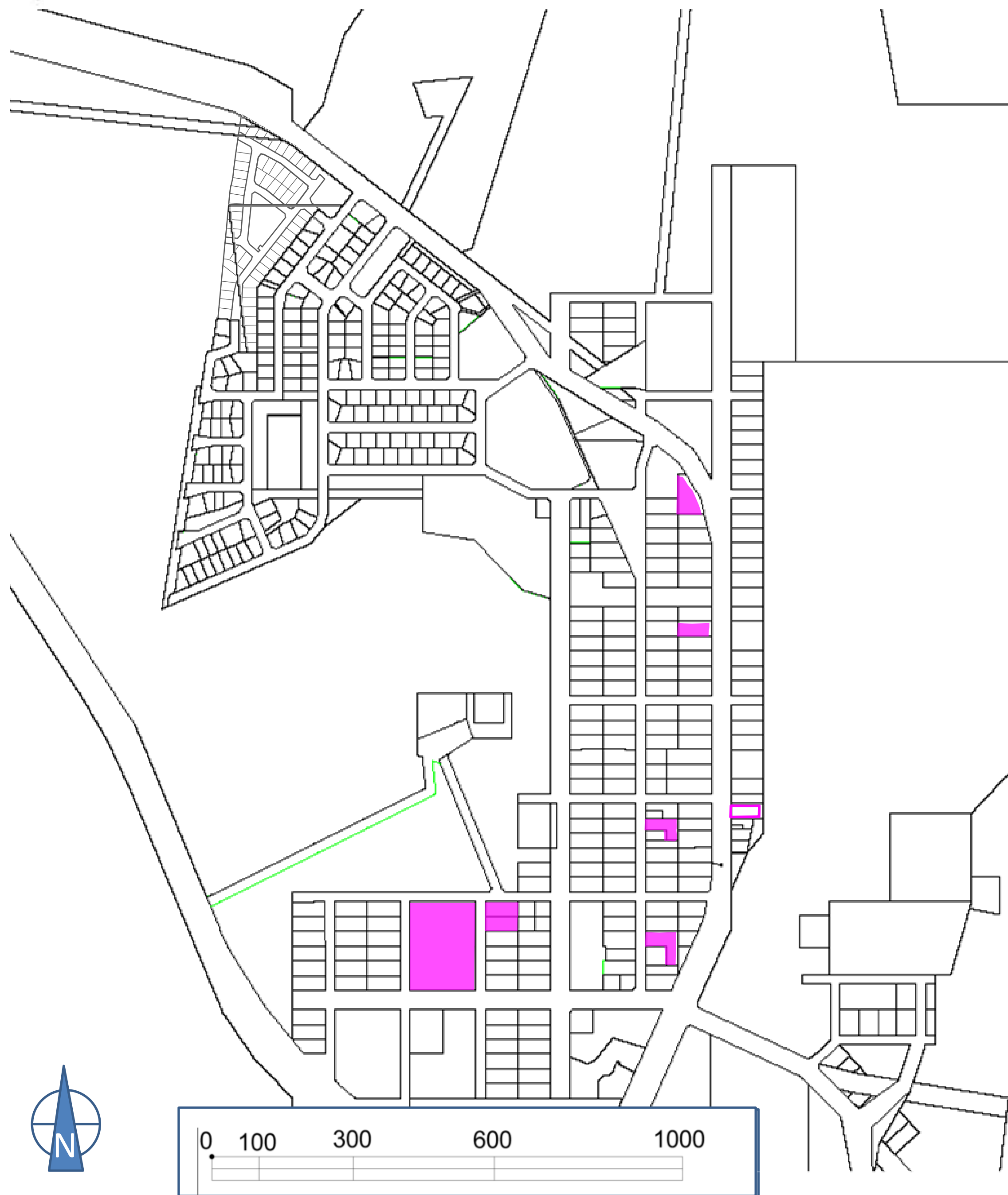
Uses

● Retail

- The survey also identified 5 sites with retail component.
- The retail component is poorly represented with essentially only the General Dealer store on Roe Street of any significance and the Post Office shop on Sholl Street.
- There are some specialist stores including the art gallery and an Opshop by the Aboriginal Church on Roe Street and a Resource Centre on Padbury Street.
- All the shops have poor uninviting facades which does not contribute to the street scene and lacks in attractiveness.

Core development – Land use

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• Current land use map

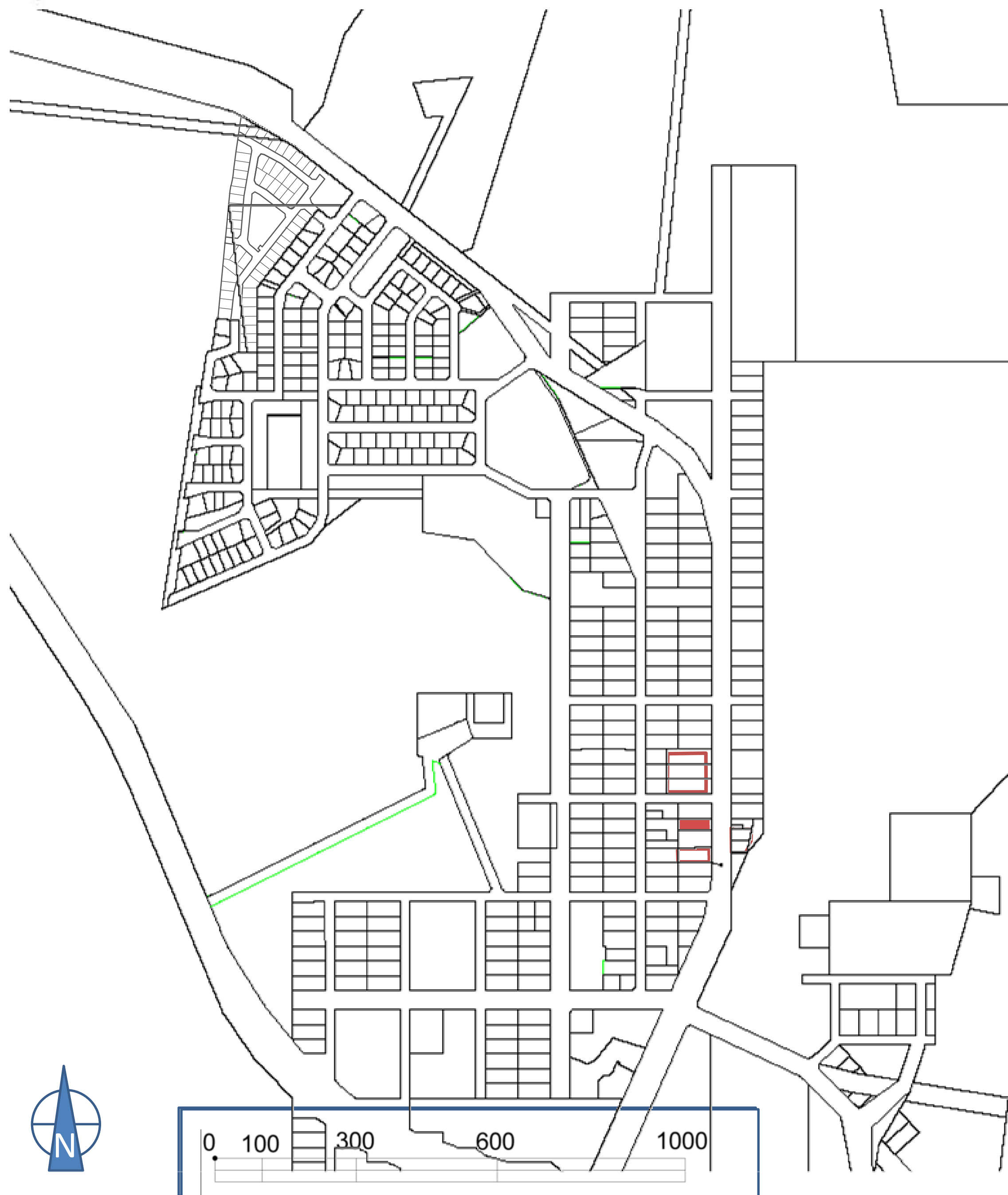
Uses

● Services Business

- 6 sites with service business are spread through the town.
- A key business is the BP Service station
- The largest site is the Shire Depot which is currently being closed down
- There is also an electricity transformer site of the Regional Power Corporation and a telecommunication site of the Australian Telecommunication Commission.
- The remainder of the sites seem to be transport related businesses - some run from home.

Core development – Land use

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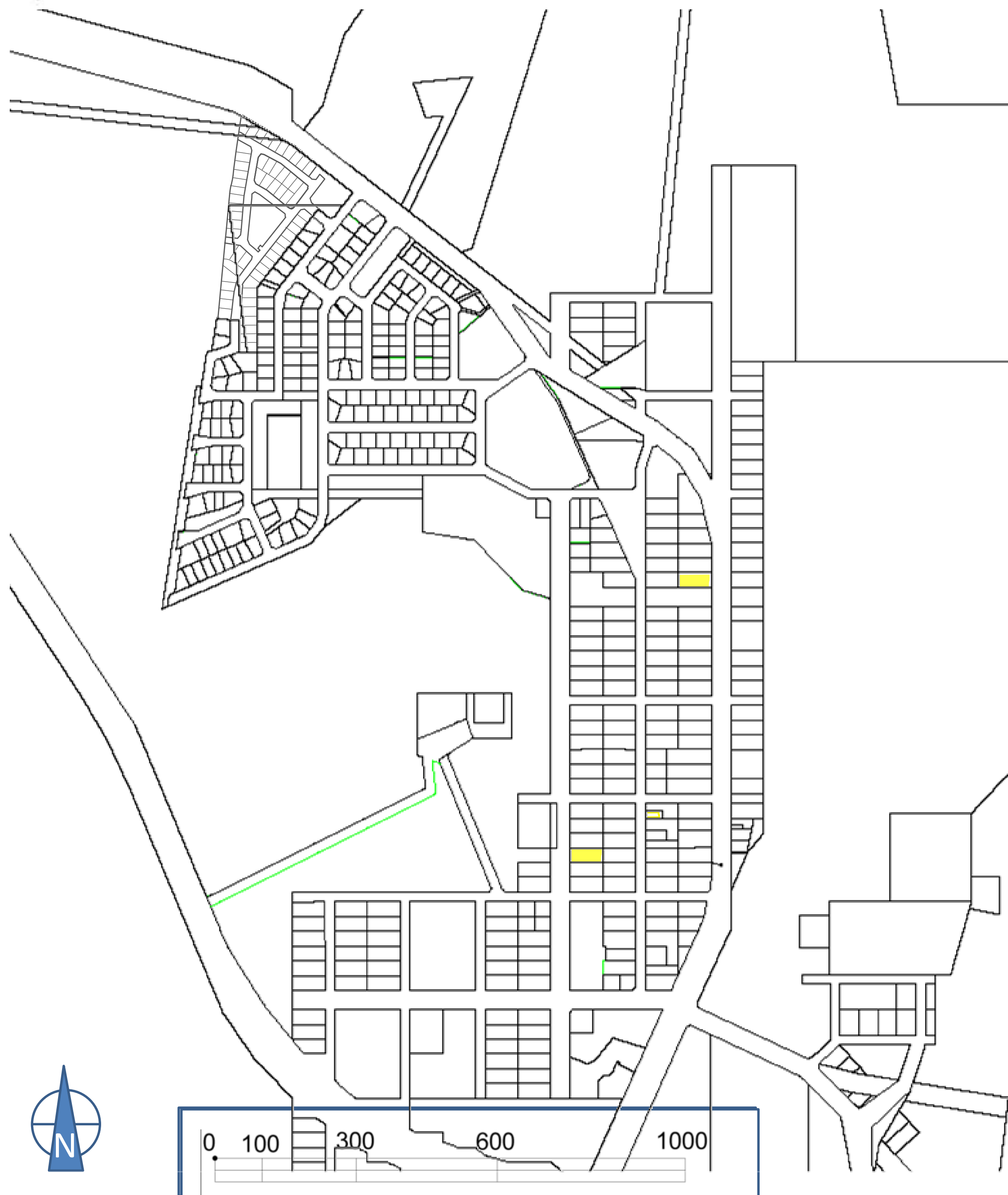
- Current land use map

Uses

- Other business/accommodation
- There were only two sites with active office type activities and 4 vacant sites, including the larger Victoria Hotels site which was put up for sale on a liquidation action, but was not sold at the time

Core development – Land use

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- Current land use map

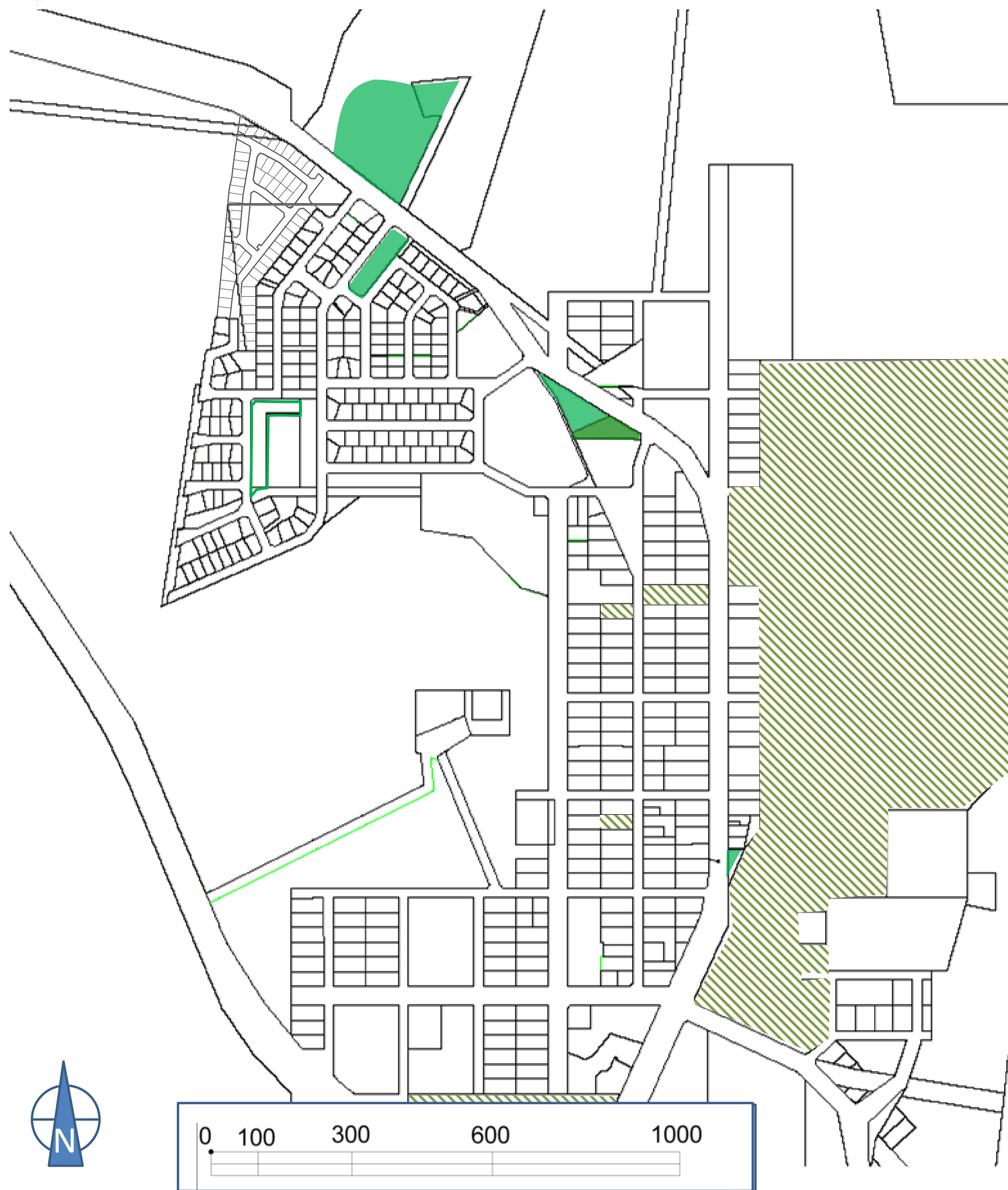
Uses

● Church

- The most prominent of the old buildings is the Holy Trinity Church up above Whitnell and Sholl Streets. The building is in disrepair and not safe to use.
- The other church building is the Aboriginal Church on Roe Street

Core development – Land use

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• Current land use map

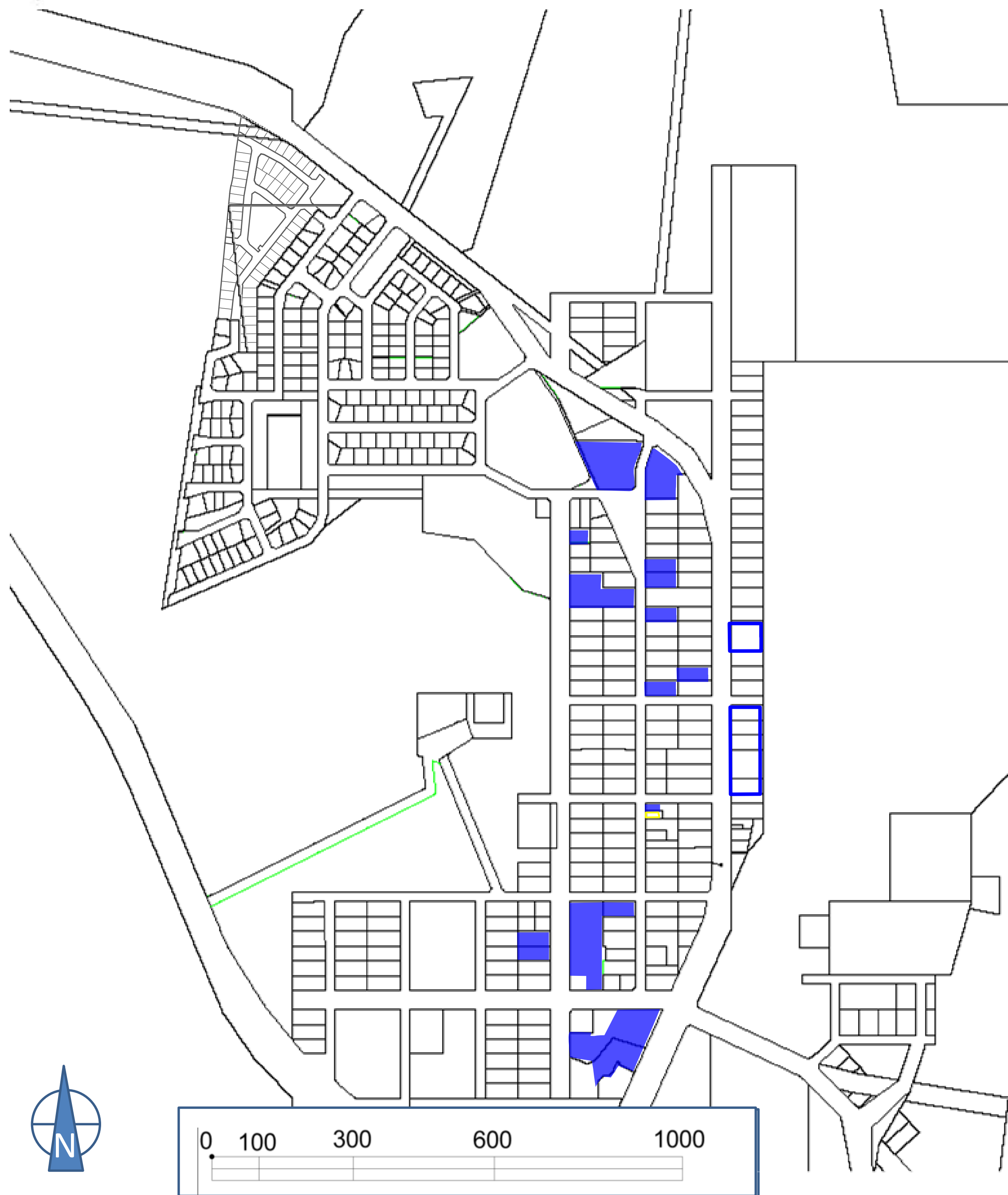
Uses

- Parks/sports
- Recreation

- The parks consist of two ovals one to the north of the highway, now surrounded by the new NASH development and the other next to the Primary School on the same site.
- There is also a kids play park on Andover Street in the northern part of town.
- In addition there is a small park across the street from the old Shire Offices on Roe Street.
- These are all the developed parks in the town.
- However, the lined area down to and across the river is also zoned as park but has not been developed as such

Core development – Land use

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- Current land use map

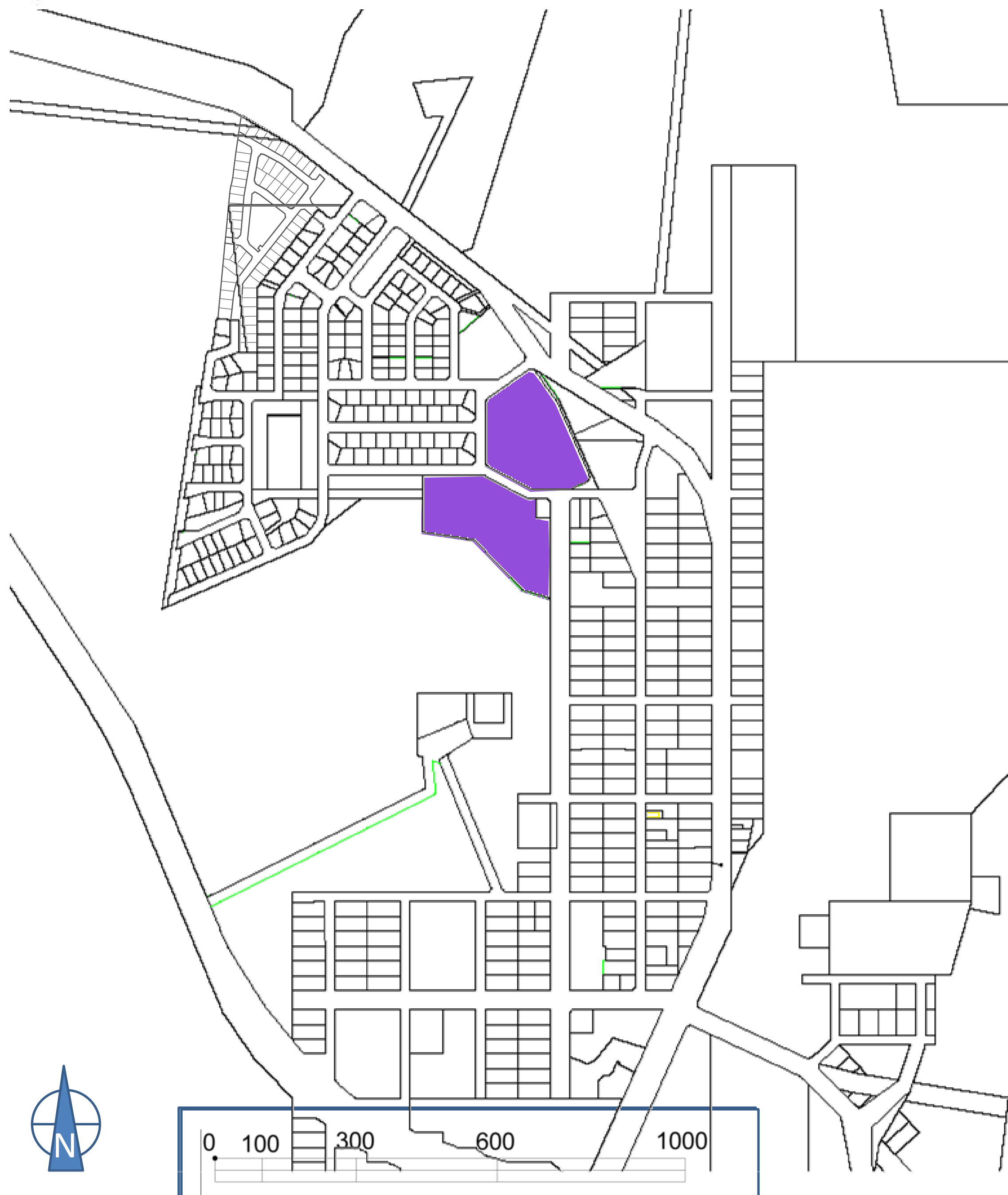
Uses

- Community services

- Apart from houses this is the highest single land use type and covers mostly office-type accommodation for community services agencies covering a wide variety. This includes the local hospital with associated activities around it.
- The Info Centre, located in the old Goal next to the law courts forms an important heritage hub.
- There are also the old Youth Centre on Roe Street recently replace by a new centre next to the “Fifty Cents building”.

Core development – Land use

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- Current land use map

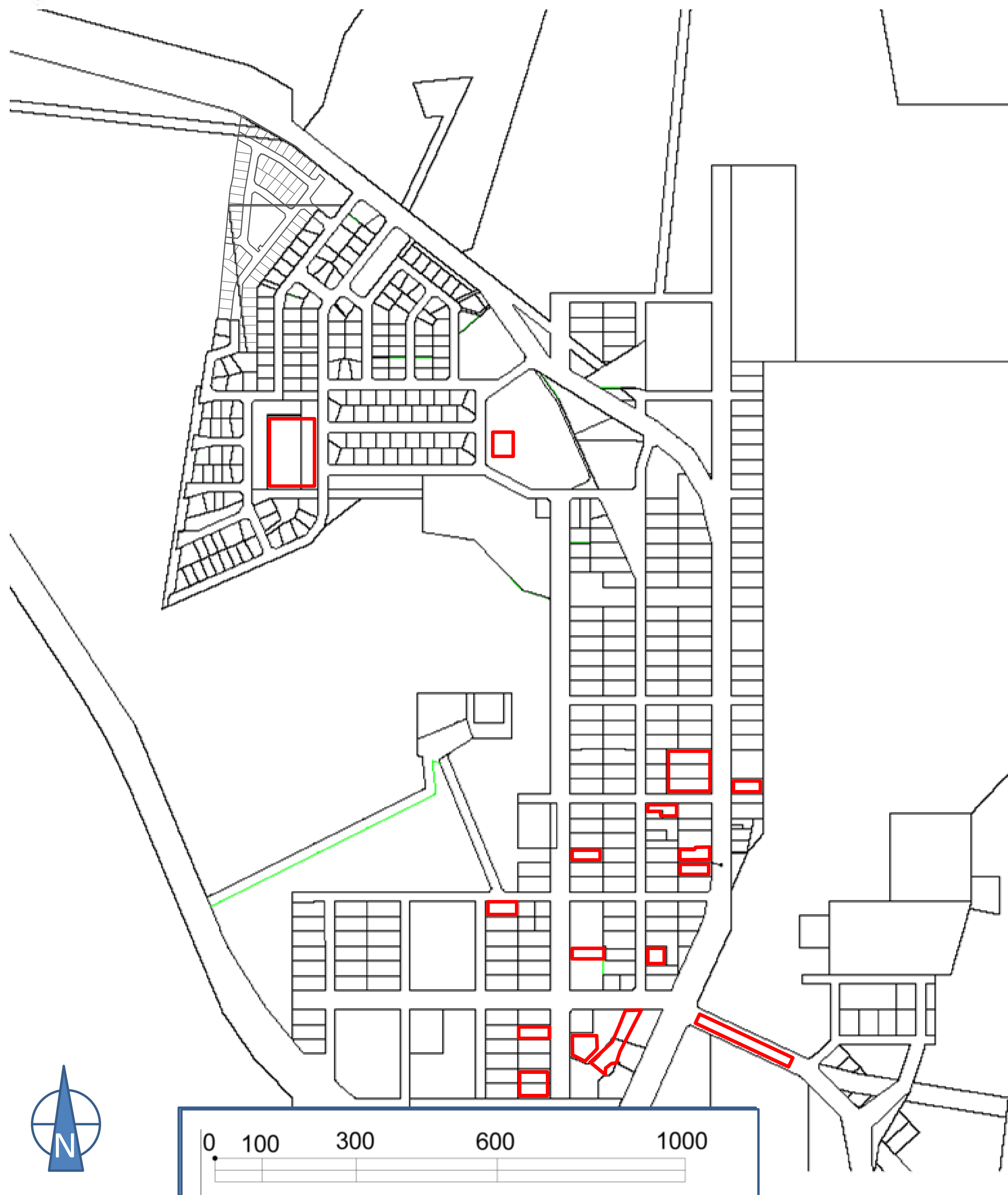
Uses

● Education

- There are two key education sites, both on Fraser Street next to the community centre and other recreational facilities

Core development – Land use

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- Current land use map

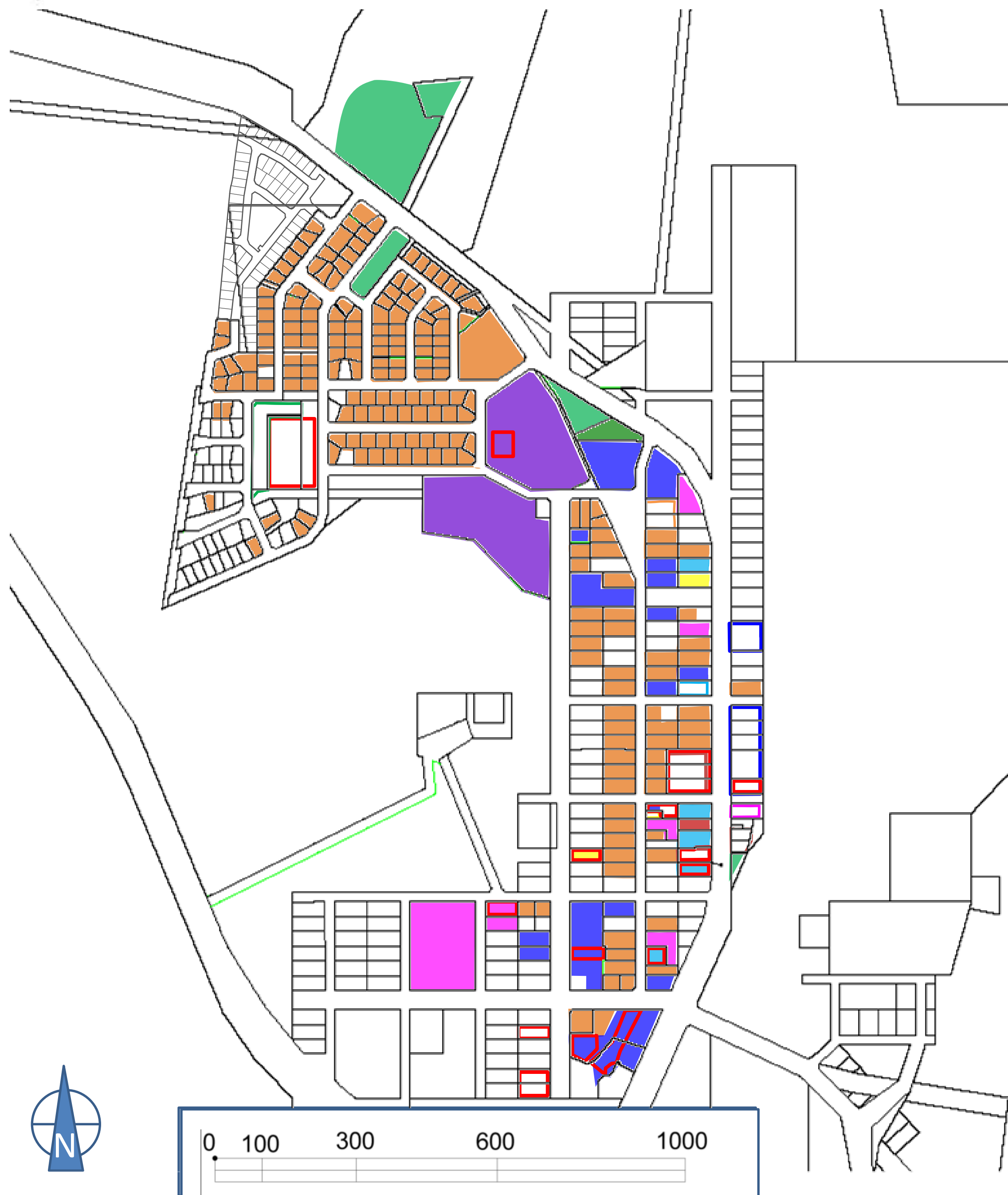
Uses

 Heritage buildings

- As indicated, there is a significant heritage precinct, mostly focussed around the southern end of town. (This element is covered in more detail in a previous section)

Core development – Land use

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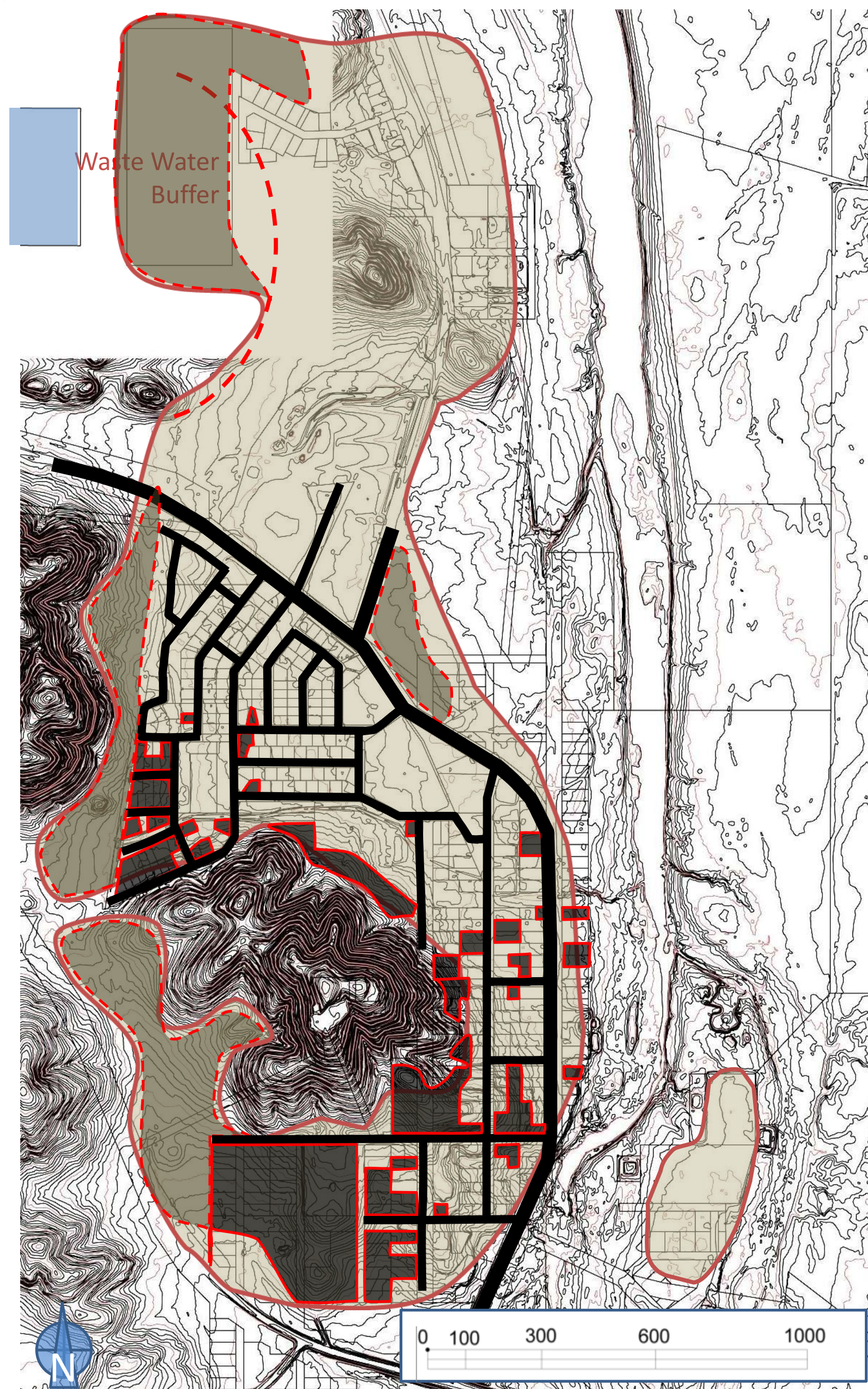
• Current land use map Uses

- Residential
- Retail
- Services Business
- Other business/accommodation
- Church
- Parks/sports
- Recreation
- Community services
- Education
- Heritage buildings




The figure of the combined uses show that there are some scattered and some focused land uses. The residential component was traditionally concentrated along Sholl and Roe Streets in the older part of town, however, a range of other uses infiltrated this area. It consist mainly of community services-type uses, with clusters in the north and south. The northern cluster accommodates the education facilities, whilst the southern area has a health-focus as well as tourism and limited retail.

Core Analysis – Potential Development Framework

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Estimate of vacant land potentially useable for development

-  Indicative development boundary
-  Vacant land in the original town layout, some serviced and some not serviced
-  Vacant land outside of the original town layout

Capacity for Growth preliminary conservative estimate

Location	Ha	Housing units	People @ 3.5/unit
Vacant sites in town	22.5	362	1270
Vacant development land adjoining the town	±47ha	710	2500
Total		1082	3770

As shown above the preliminary estimate (contingent on many factors) shows that

- the potential increase in population by utilising all current vacant land in the town could be some 1270 people in 362 homes.
- In addition, an estimated 2500 people (at 3.5 persons per housing unit and 15-20 units /ha), can be accommodated on some 47ha of land around town. The bulk of it is to the south and west (including the Depot site)

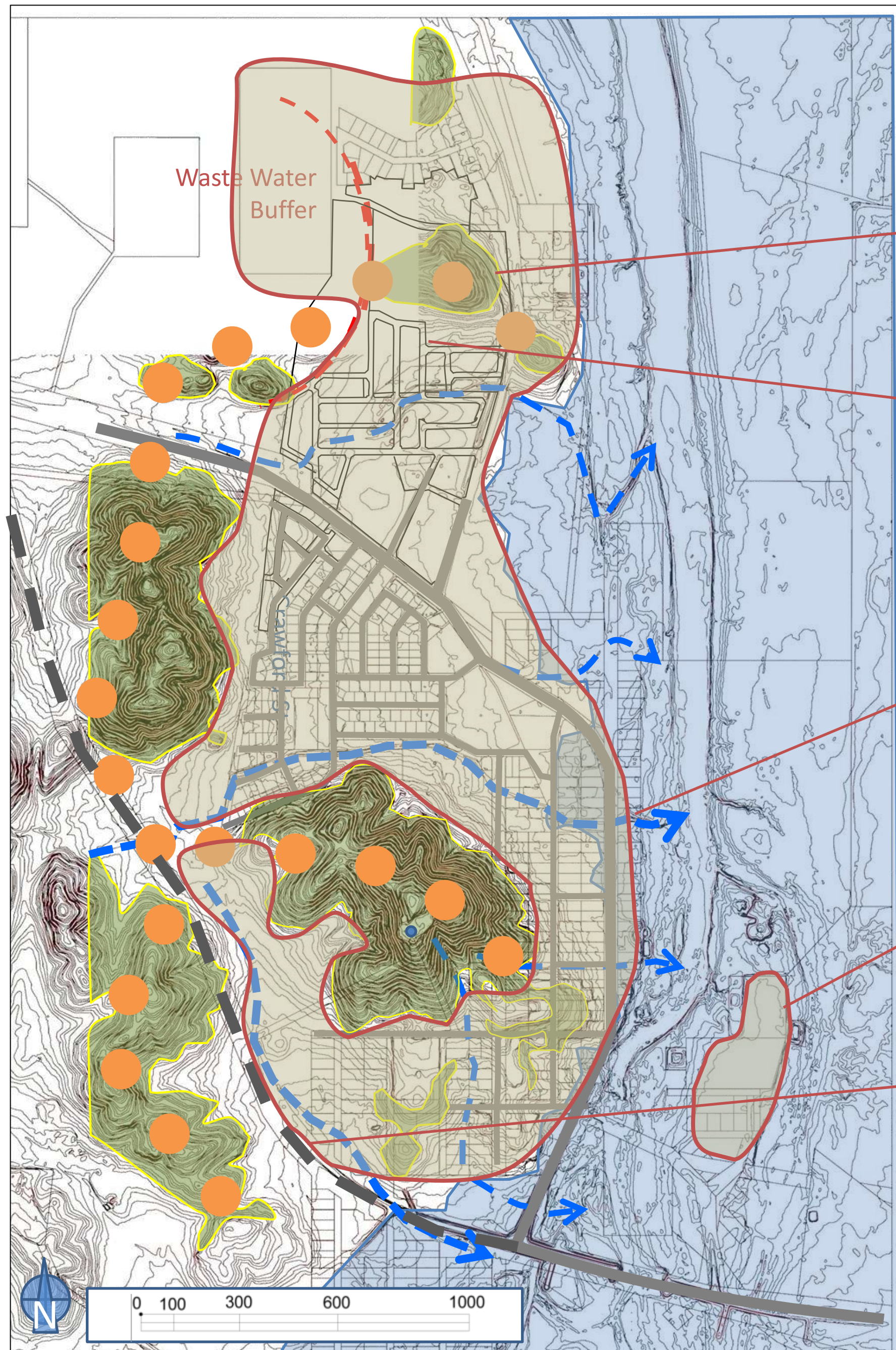
This excludes:

- the NASH project, which could accommodate up to 1350 people
- development of the workers camp in the caravan park
- the workers camps in the industrial area of Hall Street
- redevelopment of current houses on large sites in the old town

Basically there is room to accommodated a total of at least double the current population with a total population capacity of around 2500 - 3000.

Potential development framework

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Indicative development boundary broadly described by surrounding hills.

The new NASH development goes right up to the development boundary and connect to the Jager Street Industrial Estate

The Harding River flood regime curbs development below Roe Street and below the Wickhan-Point Samsom Road

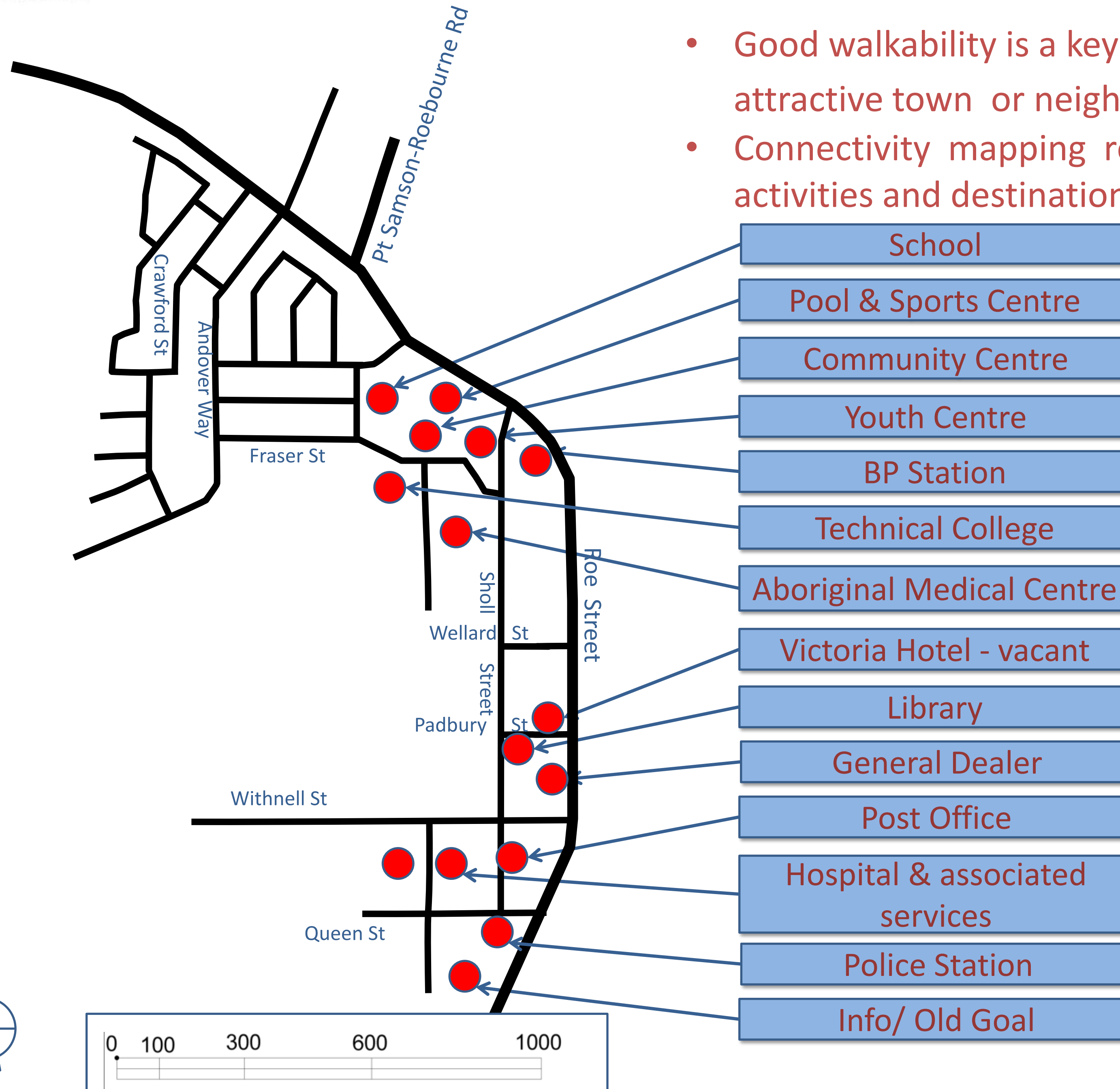
The current caravan park is still an essential part of tourism and will now also extend to provide worker accommodation

Earlier planning made provision for a bypass of the town

PART 4: Liveability Assessment - Connectivity

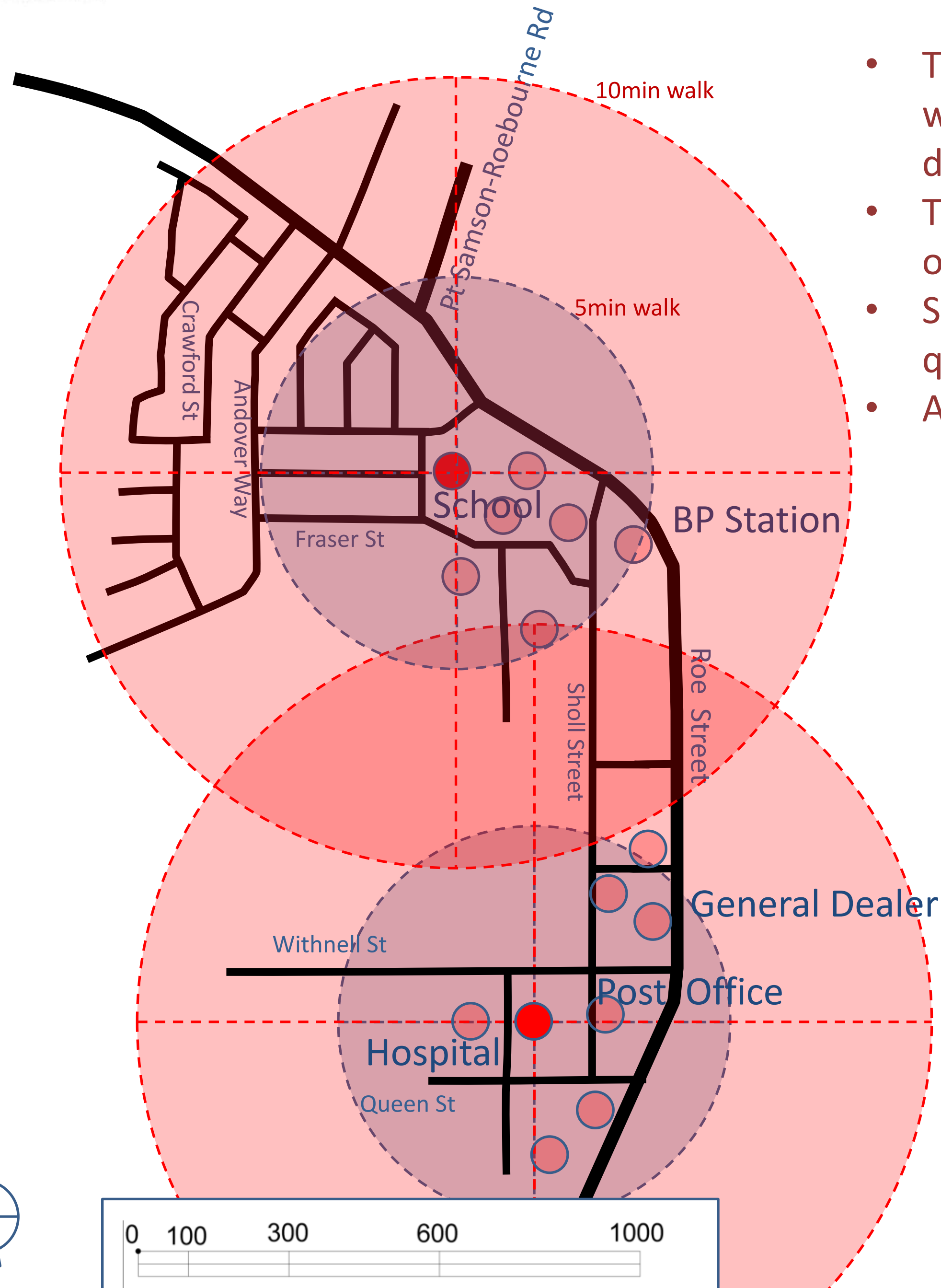
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- Good walkability is a key characteristic of an attractive town or neighbourhood environment.
- Connectivity mapping relative to selected activities and destinations.



Core Walkability

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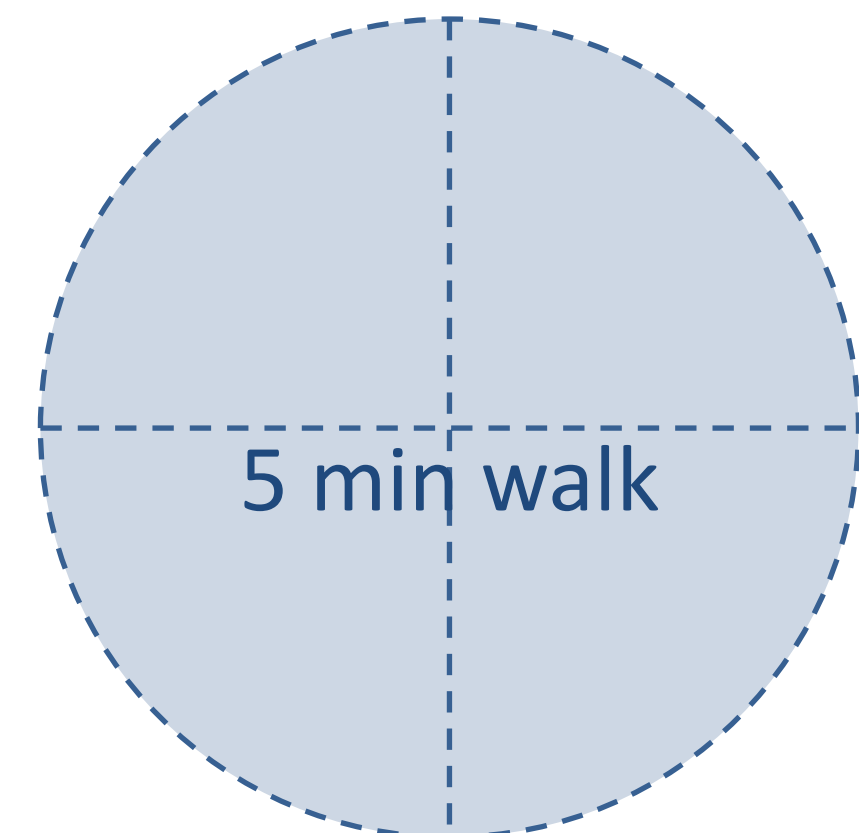
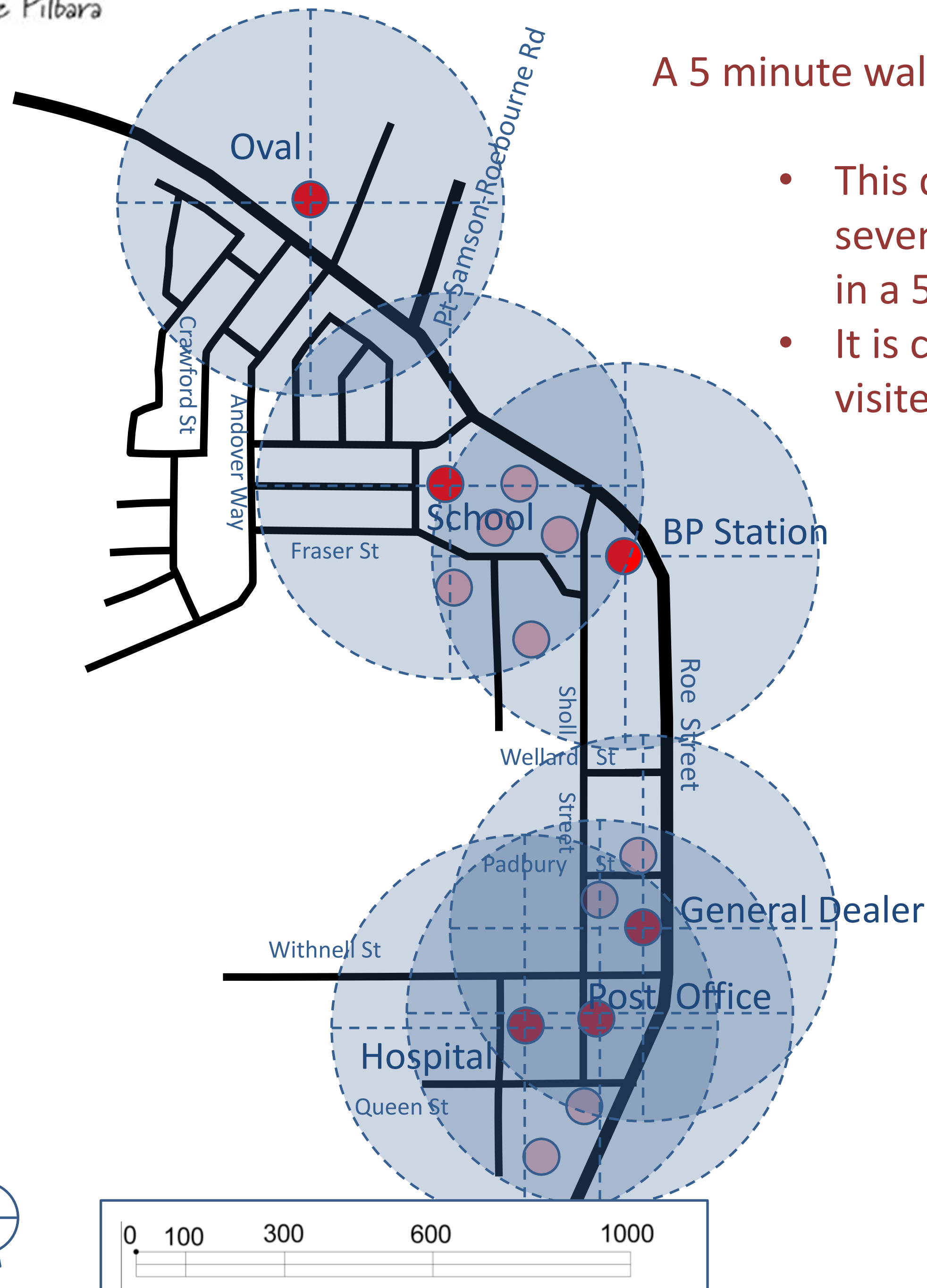
- The circles indicate the overall potential areas within walkable reach to/from selected activities and destinations
- The diagram depicts the possible extent of a 400m or 5min walk and a 800m or 10min walk
- Some key activities which are regularly visited are quite a long walk apart
- Activities appear to be in two clusters

Core Walkability

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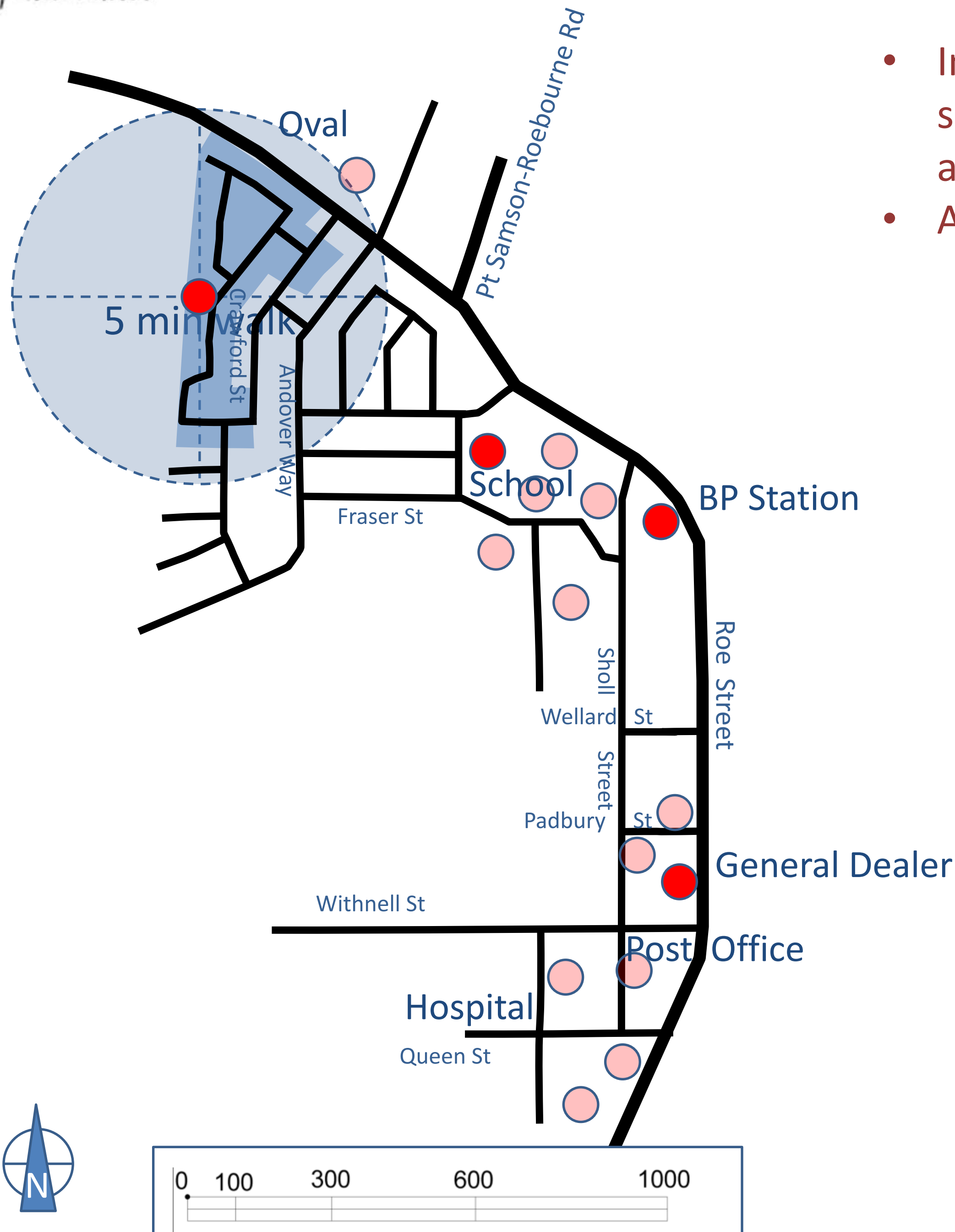
A 5 minute walk should cover most day-to-day destinations.

- This diagram depicts the relative walkability of seven selected activities and destinations covered in a 5 minute walk (400m)
- It is clear that key activities which are regularly visited are quite a long walk apart



Core Walkability

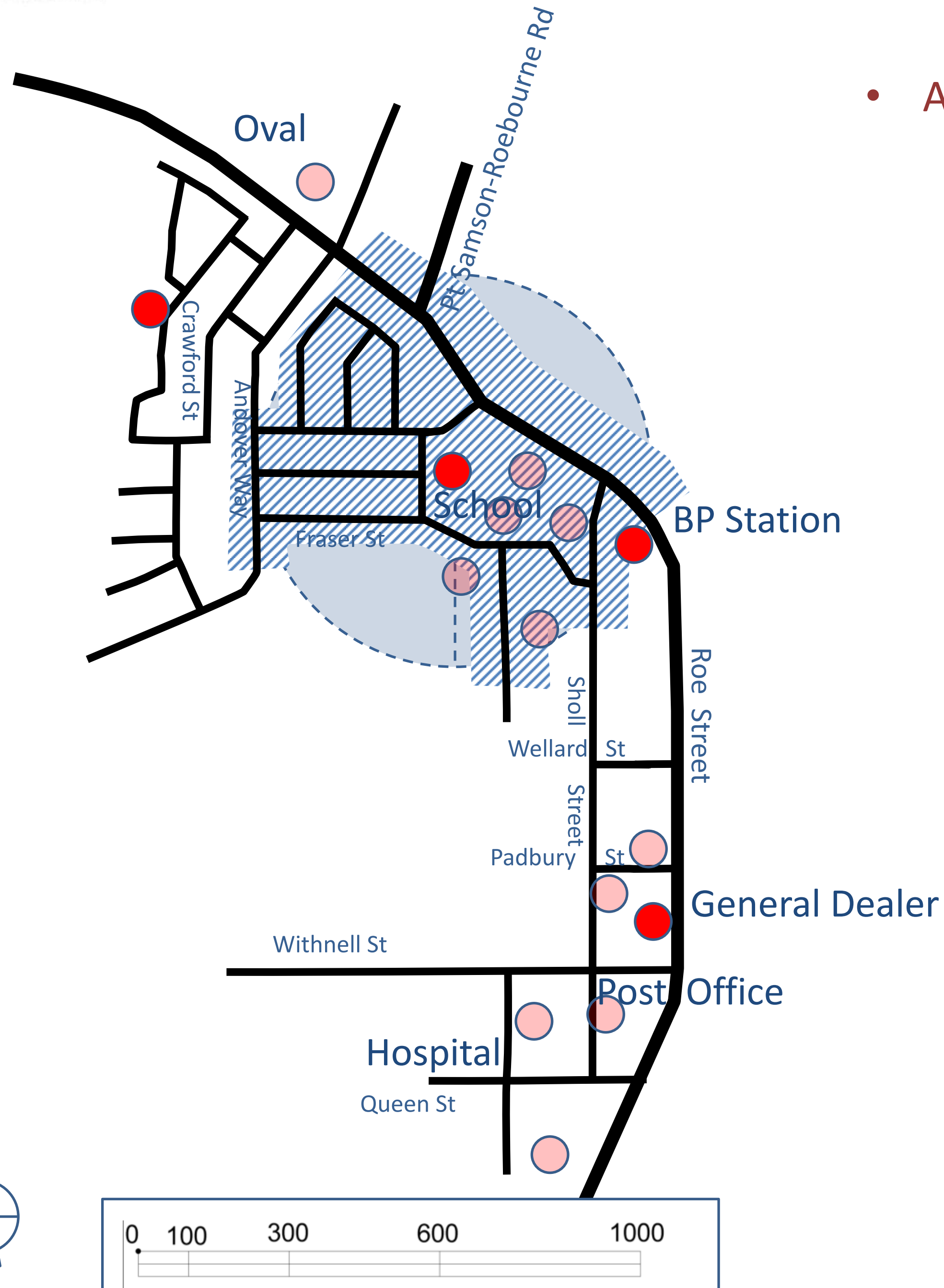
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- In contrast to the foregoing this diagram shows the actual areas reachable from three activity nodes (●) or a residential location
- Access to the school
 - Due to connectivity limitations people living on the northern western fringe of town can't reach the school inside a 5 minute walk (shaded area)
 - A large part of the area inside the expected catchment is also not reachable because of the street layout

Core Walkability

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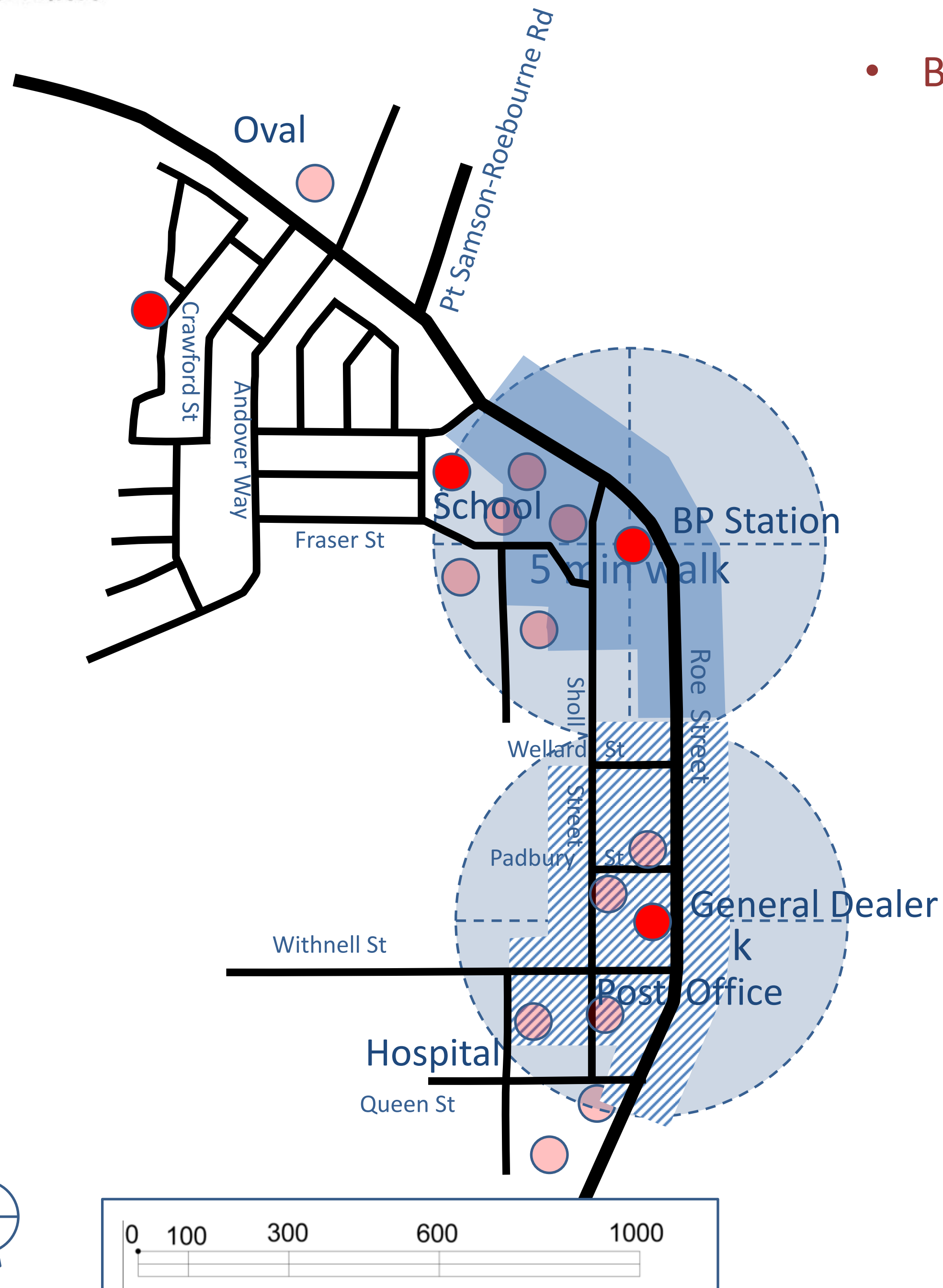


- Access to the school

- The school is located at the heart of the northern residential area and is within walking distance of most students living there (see lined area). However, everybody beyond Wellard and Sholl Street are further than a 5 minute walk and most are more than a 10 minute walk away.
- All students living near Wellard Street down Sholl Street are also further than 5 minutes away from the school

Core Walkability

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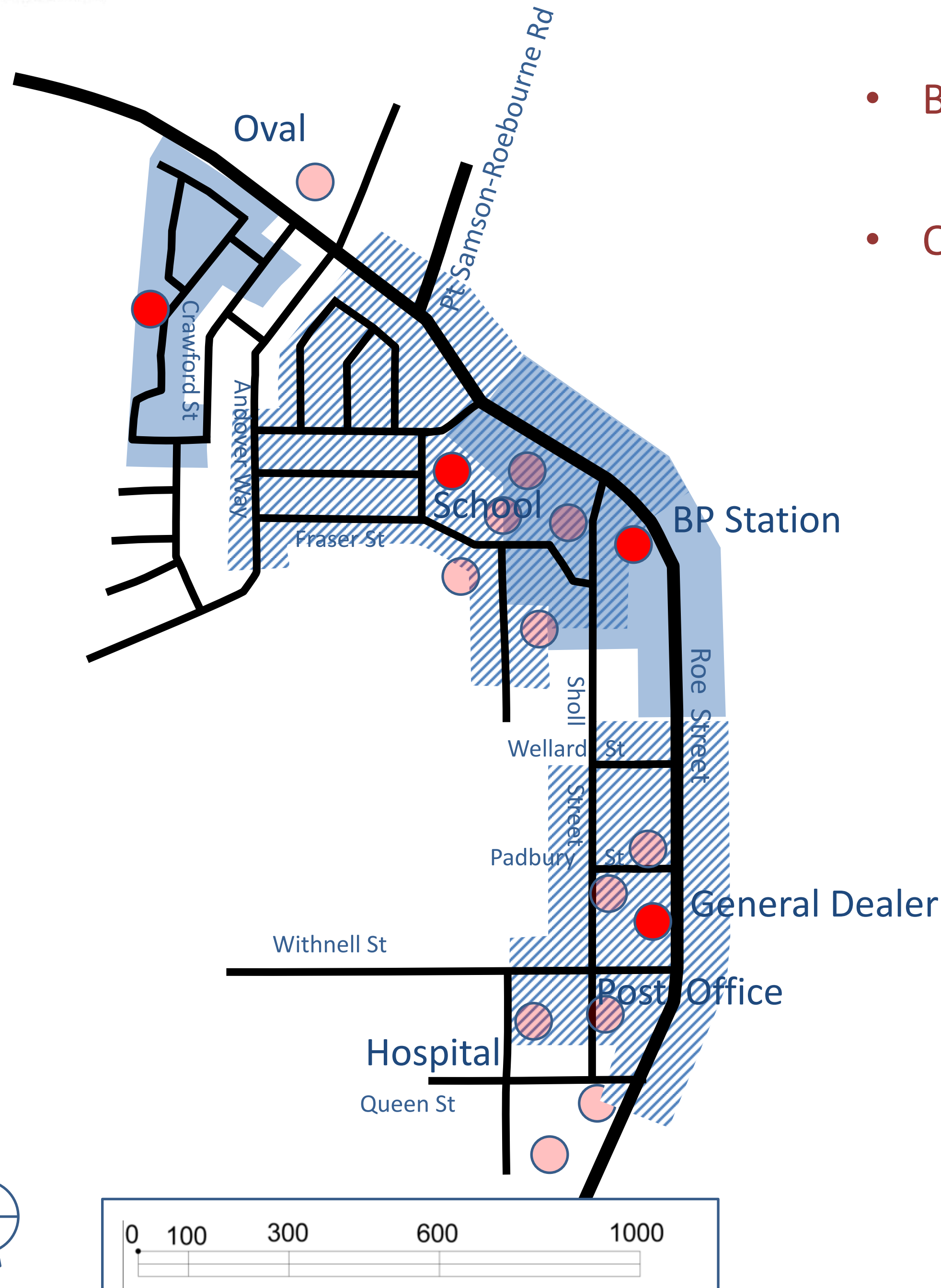


- **Business Access**

- Most of the northern residential areas are more than a 5 minute walk from any business, with some just reaching the BP Station
- The southern activity clustered (lined) is also remote from the majority of the residents but is easily reached by people inside the 5 minute walk circle

Core Walkability

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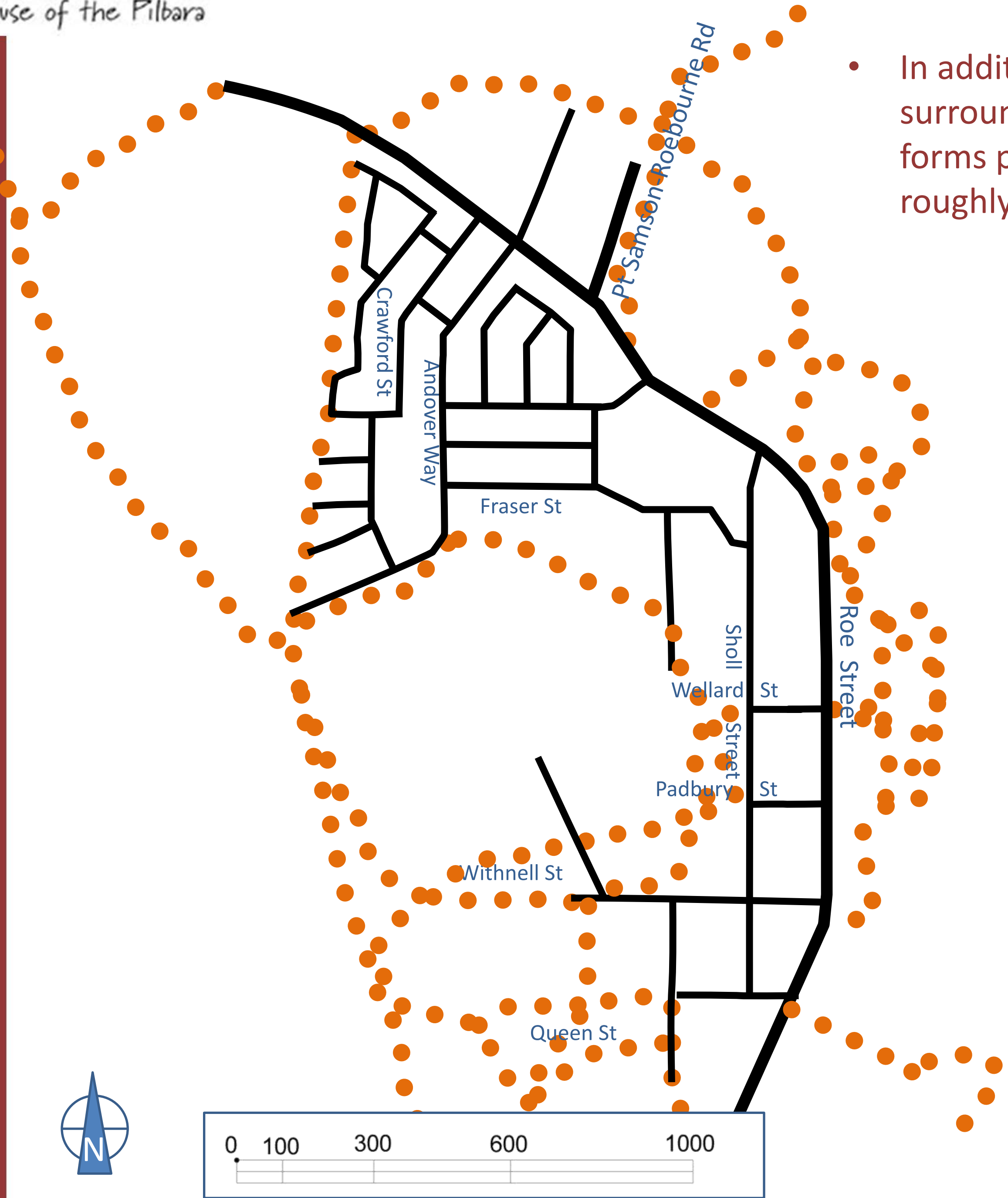


- **Business Access**
 - The southern activity clustered (lined) is also remote from the majority of the residents
- **Overall Accessibility**
 - The town has a near-linear form which reduces pedestrian access, in an environment in which a large proportion of people have no access to transport

Core Informal connectivity

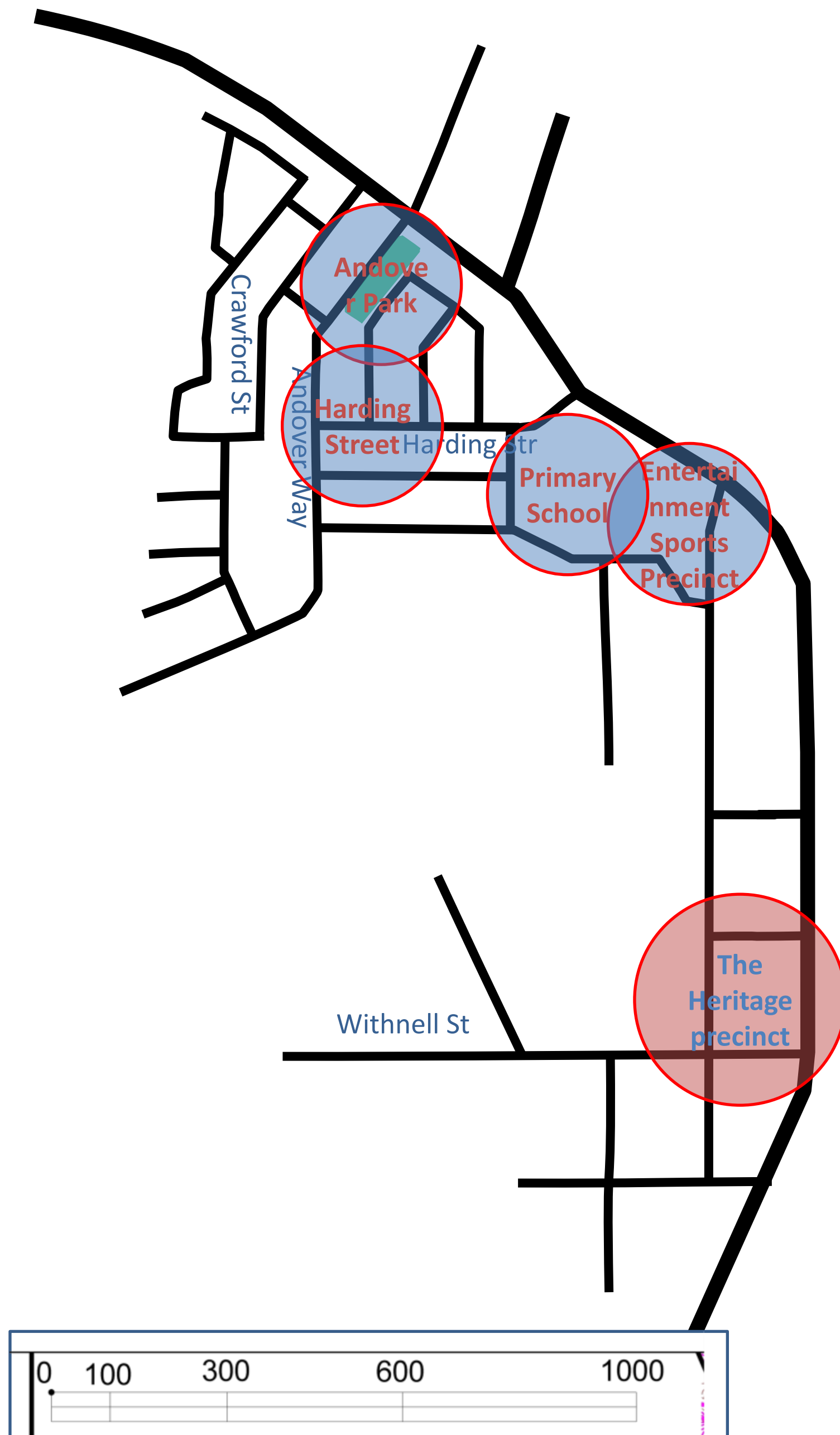
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- In addition to the formal street layout the town is surrounded by a network of informal tracks which forms part of the current circulation system. This is roughly depicted in the picture



Liveability Assessment - Safety & surveillance

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The following is an excerpt from conclusions reported by Amlec House in their investigation for the Shire in 2011. Some comments are included to cover changes that took place since the investigation took place.

The report also does not cover the rest of the town. This was covered by further special observations and is presented below.

- Roebourne accounts for 28 per cent of the Shire of Roebourne's reported crime statistics. Common offences throughout Roebourne include assault and burglary.
- Police's priorities were burglary, domestic violence, assault and hooning.
- The Aquatic Centre is a major issue for police experiencing a range of offences including, disturbances, alarm, burglary, stealing, damage, trespass and graffiti.
- The Basketball Courts are well illuminated, but lacks supporting street lighting to illuminate pathways to residential areas.
- Lighting require significant improvement with the majority of the town insufficiently illuminated.
- Poor maintenance contributes to the tardy appearance of the area and requires significant improvements.
- Overall there are significantly more negative attributes than positive attributes concerning CPTED strategies within Roebourne's public space.

Of the areas assessed the following are highlighted below:

- Andover Park
- Harding Street
- Entertainment Sports Precinct
- The Primary School

Safety & surveillance – issues & recommendations

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View South Lockyer Way - Day



View North Lockyer Way - Night



South Entrance to Park - Day



Andover Park - Night

Andover Park — bordered by Lockyer Way, Hicks Street and Andover Way

The park which have a considerable range of equipment is surrounded by a fence

Positive

- There are trees throughout the park encouraging its use providing shade for the community.
- Shaded seating is available encouraging use of the area. Generating activity can increase community pride and enhance a sense of ownership.
- The play equipment appears to be in a good working condition, encouraging activity in the area.

Negative

- Some trees in the Park limit natural surveillance to connecting areas around the park.
- The fence around the park can create a feeling of being trapped
- Cans and other litter were observed inside the fencing surrounding the play equipment
- Graffiti was observed throughout the park.
- Poor lighting in / around the park and the surrounding area leads to poor perceptions of safety and natural surveillance.
- The areas surrounding the park appear overgrown and unmaintained. Well maintained areas can increase a sense of ownership for the community and encourage use of an area.
- Prohibition signage facing the play equipment do not contribute to a clean entrance statement.

CPTED Recommendations

- Pruning trees in the park will improve both aesthetics and natural surveillance and safety.
- Maintaining benches, play equipment, vegetation and litter is required.
- Prohibition signage should be located at the entrance points to the park, not inside
- Graffiti was observed throughout the park. Ensure policing and quick response maintenance
- Rectify lamps not operating and poor illumination

Safety & surveillance – issues & recommendations

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Harding Street

Negative

- Harding Street was observed to be overgrown and contained litter throughout. This has since been cleaned up
- Graffiti was observed on light poles throughout Harding Street.
- Poor illumination throughout the street during the hours of darkness provides poor perceptions of safety and natural surveillance.
- A rusted shell of a mini bus is located at the front of a residential property.

CPTED Recommendations

- Maintenance of vegetation will improve aesthetics and enhance a sense of ownership for the community.
- Ensure reporting for police attention of graffiti and as well as prompt maintenance, and monitor trends and possible covert/interim surveillance, if required
- Rectify lamps not operating.



View East Harding Street - Day



View East Harding Street - Night



Wreck and by unkempt street



View East Sherlock Street - Night



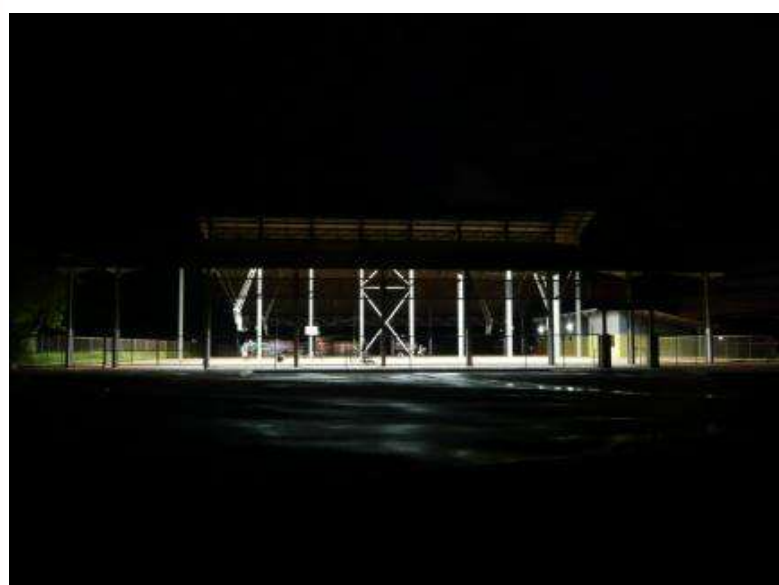
East view of 50 Cent Hall



Same view at night



Basketball courts



Same view at night

Entertainment Sports Precinct

Positive

- The community bus stops at 50 Cent Hall and the Aquatic Centre but it only operates 3 times a week. This generates activity in the area which increases natural surveillance and perceptions of safety.
- The Aquatic Centre contains a well maintained entrance gate, with clear signage and information.
- During the audit the basketball courts were well utilised at night and appeared well lit.
- There is good natural surveillance in selected areas.

Negative

- Graffiti was observed in the Aquatic Centre car park and at the basketball courts.
- A number of youths were roaming the streets after dark. With current poor lighting and numerous dark and hiding spots, this does not contribute to a feeling of safety and security.
- Although the basketball court was well attended in the evening there is no supporting street lighting.

CPTED Recommendations

- The ongoing graffiti and vandalism at 50 Cent Hall, basketball courts, around the aquatic centre and the car park needs attention. Ensure reporting and maintenance, and monitor trends for police attention and covert/interim surveillance.
- Introduce a mural on the exterior wall of the 50 Cent Hall to limit opportunities for graffiti.
- Significantly improve lighting around the basketball courts, youth centre and aquatic centre and the surrounding residential areas to increase perceptions of safety and natural surveillance for youths returning home during the hours of darkness.
- Ensure all car parks are sufficiently and consistently illuminated, in particular to reduce crime displacement and support CCTV image quality during the hours of darkness.



Primary School oval seen from south east



Outdated signage attracting graffiti



Entrance to parking – obstructed views



View south east of school

Primary School

Positive

- The Shire of Roebourne has recently applied a policy to extend the hours the lights are turned on at the primary school oval to 10:00pm. They have organised planned activities on the majority of nights to encourage community participation and natural surveillance.
- The oval appears well maintained and suitable for a variety of sporting activities. Generating activity can increase a sense of ownership and natural surveillance in specified areas.

Negative

- The primary school contains no exterior lighting providing poor perceptions of safety and natural surveillance.
- Signage is located at the oval showing redevelopment plans from 2007. This signage has been subjected to graffiti.
- Excessive foliage limits natural surveillance throughout the car park at the primary school. Limited natural surveillance decreases perceptions of safety.

Primary School CPTED Recommendations

- Improve exterior lighting of the primary school to enhance perceptions of safety and natural surveillance.
- Removal of outdated signage will remove opportunities for vandalism and graffiti and improve aesthetics in the area.
- Consistent pruning of foliage and up-limbing of trees to about 5 metres can increase natural surveillance by removing obstructions and increase perceptions of safety.
- Ensure all car parks are sufficiently and consistently illuminated, in particular to reduce crime displacement and support CCTV image quality during the hours of darkness.



There are good footpaths along the western side of the street but in places shrubs obscure views



The median is being improved and is well maintained. No graffiti on the memorials at the old Shire offices



The heritage buildings are not being presented well and the sites are neglected. Generally the street scene is unkempt and overgrown. It needs tidying up. Lighting is poor

Roe Street

Positive

- The footpath on Roe Street were recently upgraded and although they are simple in design they are pleasant to use. The light colour lessen heat absorption making it good for foot traffic.
- The new arena opposite the old Victoria Hotel could bring more activity into the area. Generating activity can increase a sense of ownership and natural surveillance along the street and the open space areas.
- The small pocket park developed across the street from the old Shire office is well laid out and is well used by passing travellers

Negative

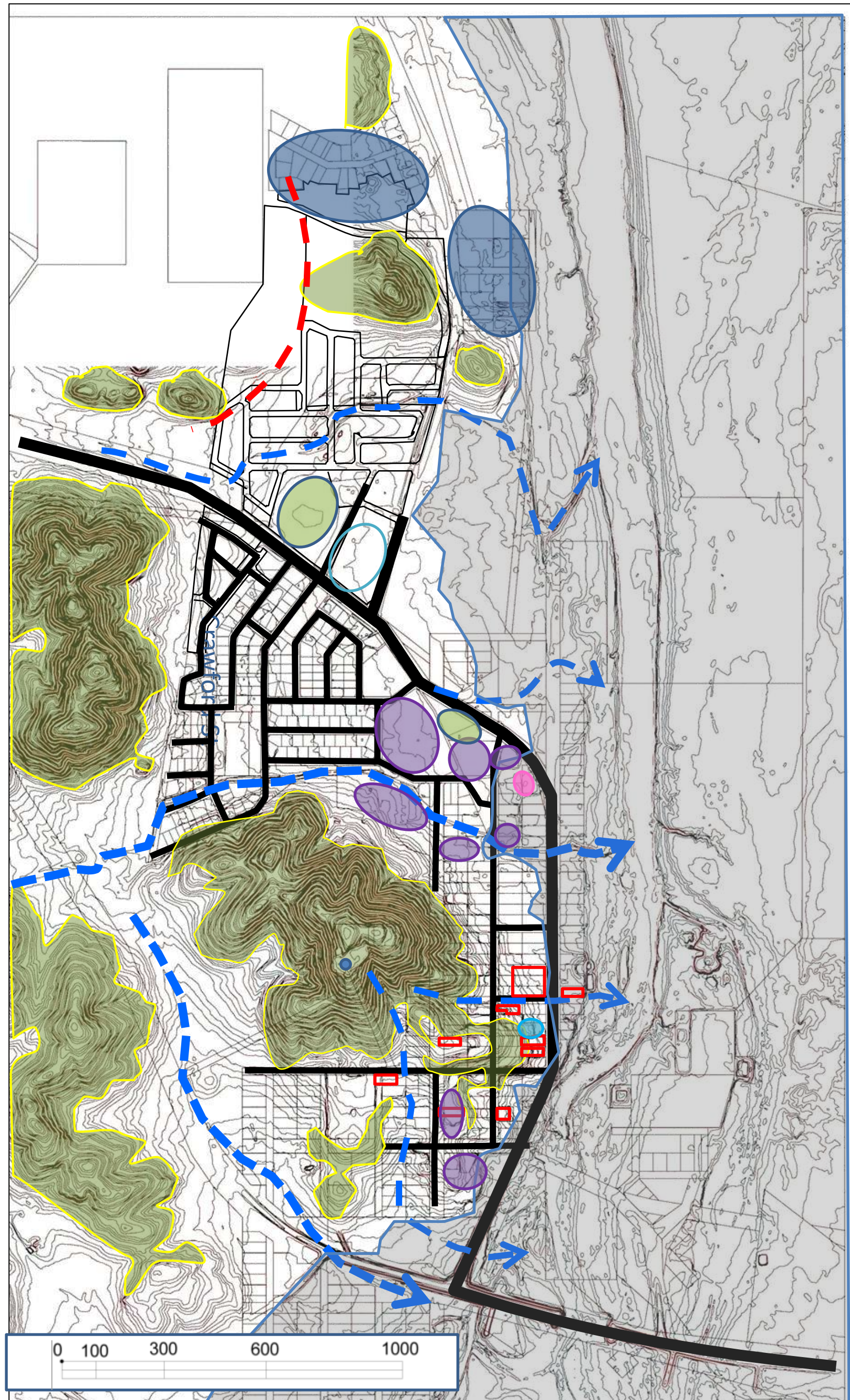
- Very few activities along the street actually face the street or have a view over the street. This results in a poor perceptions of safety and surveillance.
- The good foot paths lacks good shady areas along the way, but shrubs tend to limit surveillance.
- The unkempt, poorly maintained premises and vacant properties leave a negative feel to the visitor.

CPTED Recommendations

- Improve the use of the street by assisting/coordinate tidying up properties.
- Pruning of foliage and up-limbing of trees to about 5 metres can increase natural surveillance.
- Encourage building owners to provide some oversight to the street – creating a presence on the street
- Improve lighting to foot paths to make it safer at night when this area is quite desolate

PART 5: Development Framework Options

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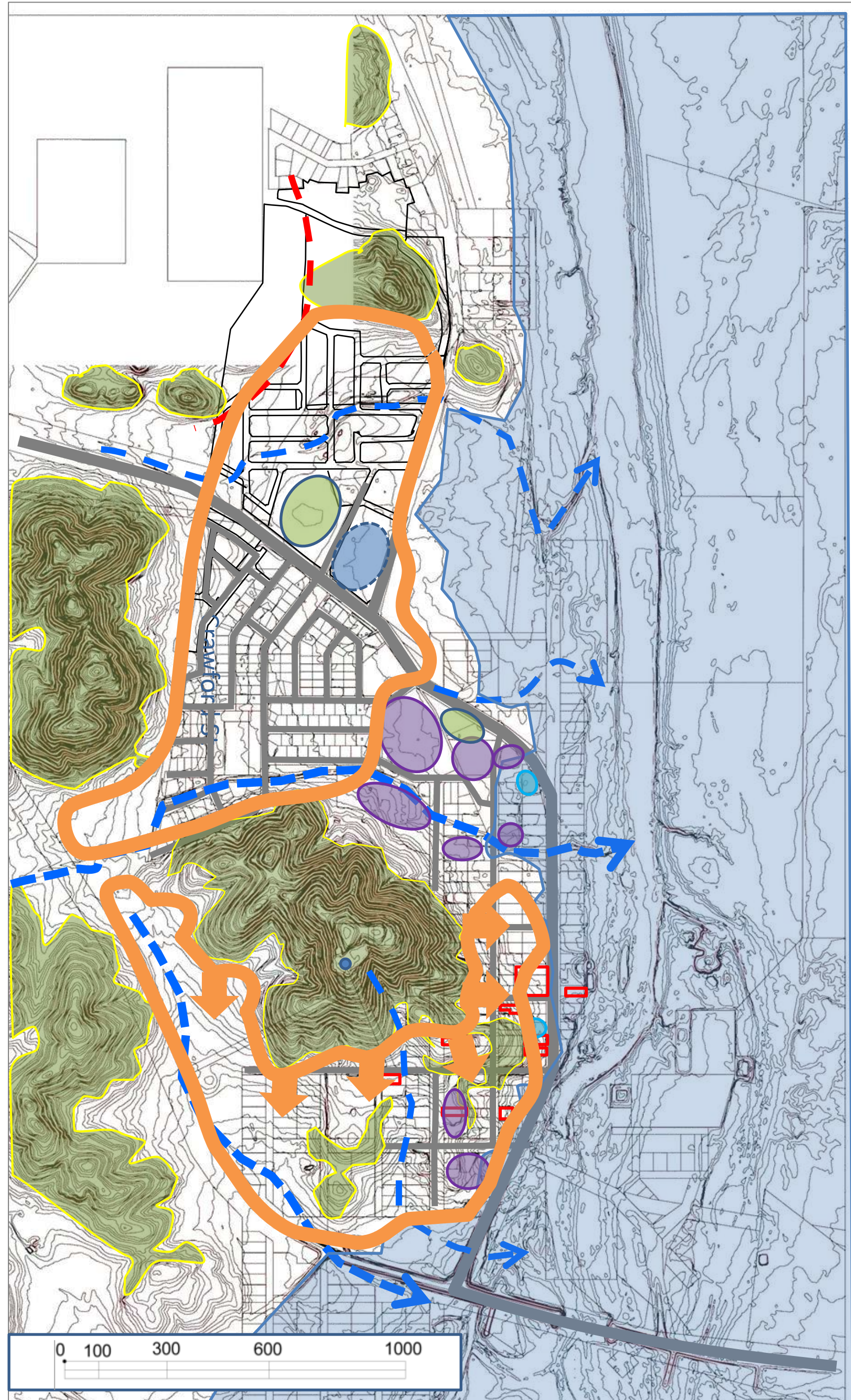


- The current distribution of key activities Activities in town is currently mostly focused into three broad locations
 - A Northern cluster of industrial activity as well as a work camp. These are beyond the set of hills surrounding the town
 - A broadly defined node in the northern part of the core area contain a number of
 - community service organisations
 - recreation including basket ball courts and the aquatic centre
 - an education hub with the primary school and technical institute and
 - the filling station/shop
 - A southern node includes
 - the general dealer
 - a variety of small community service type businesses
 - the library, post office and police station
 - Hospital and associated medical services and
 - the information centre, all set in the midst of a significant heritage cluster

Development Framework Options:

Land use potential

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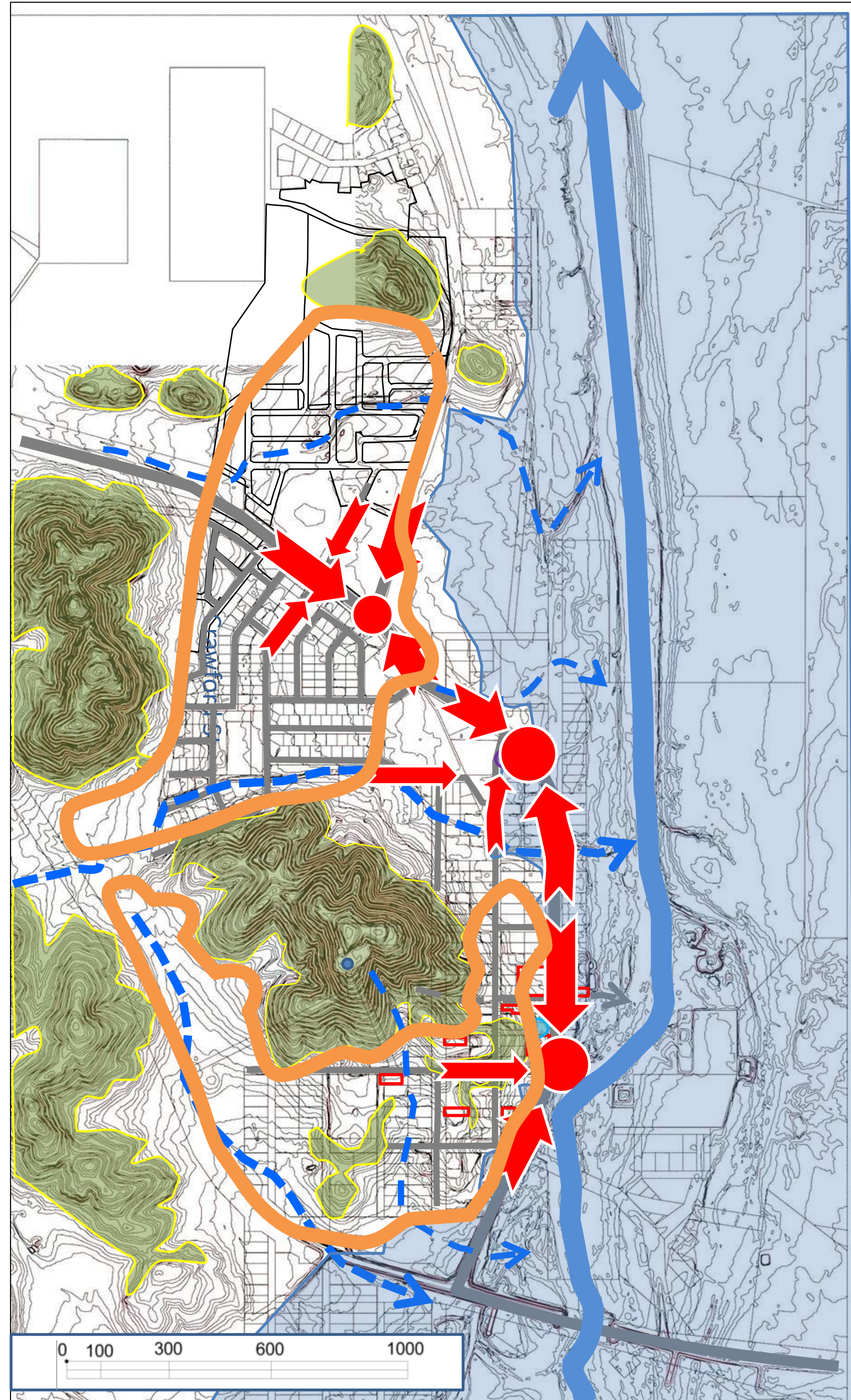


- Potential residential extent
- From the earlier analysis it is clear that there is limited scope for extending the town in any direction. Development opportunities are contained by both the steep hill sides as well as the river and its associated flood regime.
- This leaves essentially two broad residential 'enclaves' one north and one south
- The northern enclave is basically all laid out into lots with the NASH development currently developing. According to its owners this can take more than 10 years
- The southern enclave comprises the old town, in parts developed and in part vacant as well as areas set out but never developed as well as bringing in new areas to the east along the proposed bypass route. This area has magnificent views to the east and south.
- The two areas have very different characters and present different opportunities for housing elements

Development Framework Options:

Traffic, access and visibility

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General Traffic Observations

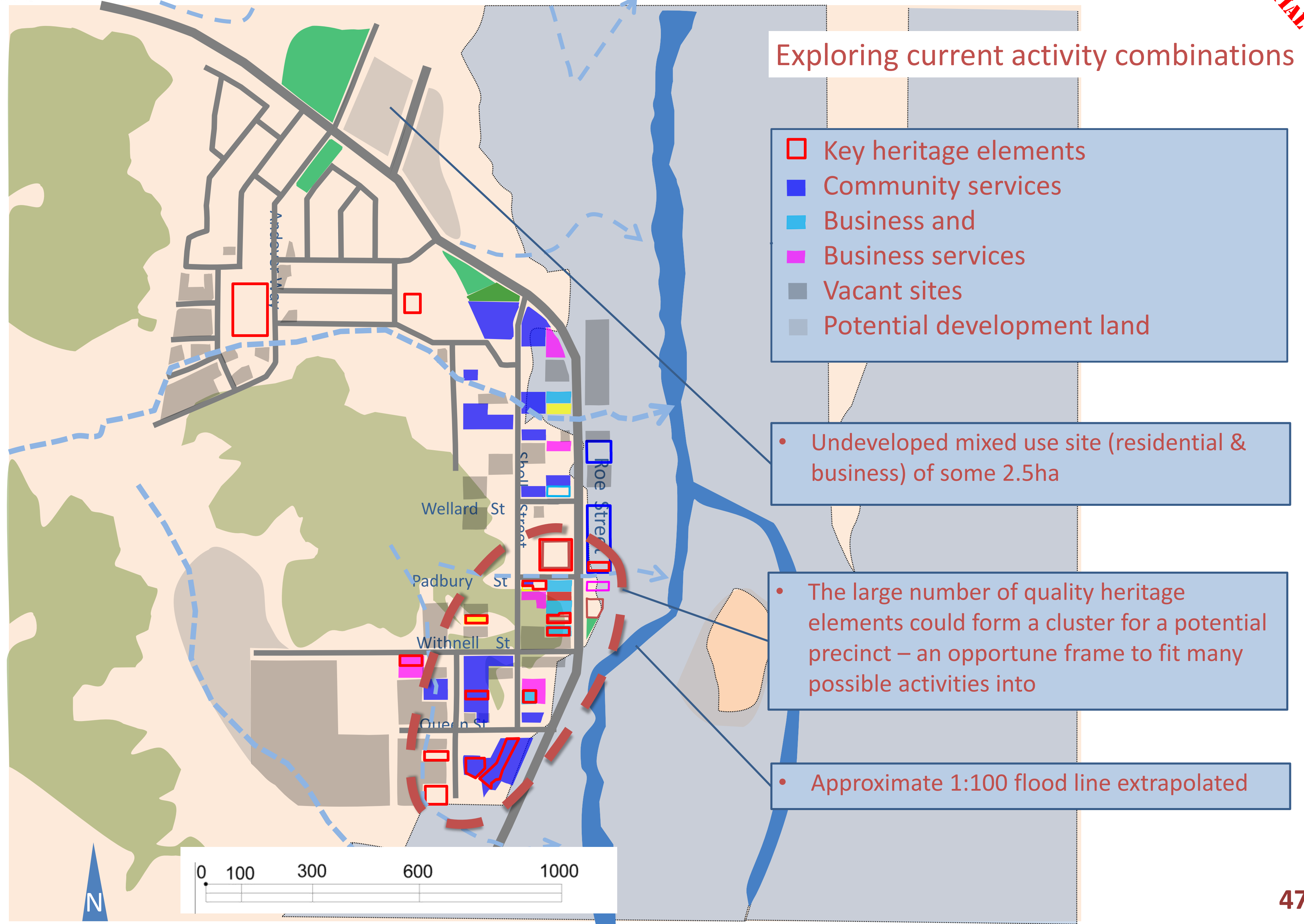
- The West Coast Highway traverses the town with all traffic through to the north and down to the south, passing through the town along Roe Street.
- The road to the Roebourne Prison, Wickham, Cossack, Cape Lambert and Point Samson comes off the Great Coastal Highway in town.
- This main intersection has relatively good lines of sight in all directions. However, there are several minor intersections onto Roe Street close by, all with turning vehicles and pedestrians which already poses a problem
- A large proportion of the traffic, especially from the north, comes a long way since their last stopping opportunity and make stops in town
- Some road trains go off Roe Street across from Sholl Street and leave their trailers/load (or part of it) there to be collected later

Main Focal Points along the Route

- Sightlines at key focal points are reasonable, providing some opportunities for improvement as well as posing some constraints which will require more detailed traffic design
- At some stage in future it will be necessary to implement the bypass which was designed with the new route and bridge over the in the Harding River at which time more traffic constraints could be put in place in town, but the traffic through to Cape Lambert with remain an issue in town

Development Framework Options - Clustering concepts

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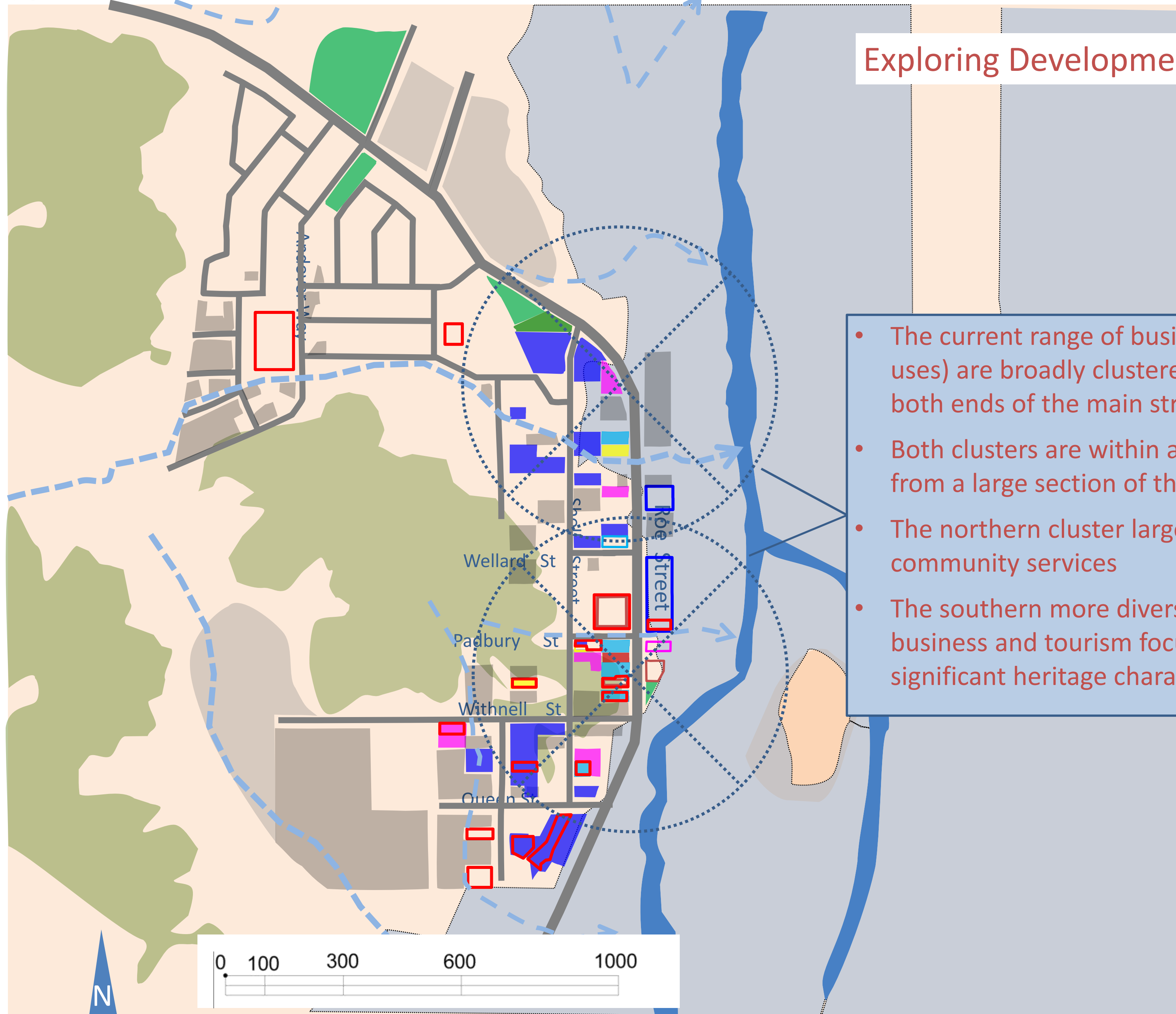


Development Framework Options – Clustering concepts

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Exploring Development Options

- The current range of business services (land uses) are broadly clustered in 2 groups, at both ends of the main street
- Both clusters are within a five minute walk from a large section of the population
- The northern cluster largely focused on community services
- The southern more diverse and with stronger business and tourism focus, backed by a significant heritage character



Development Framework Options – Clustering concepts

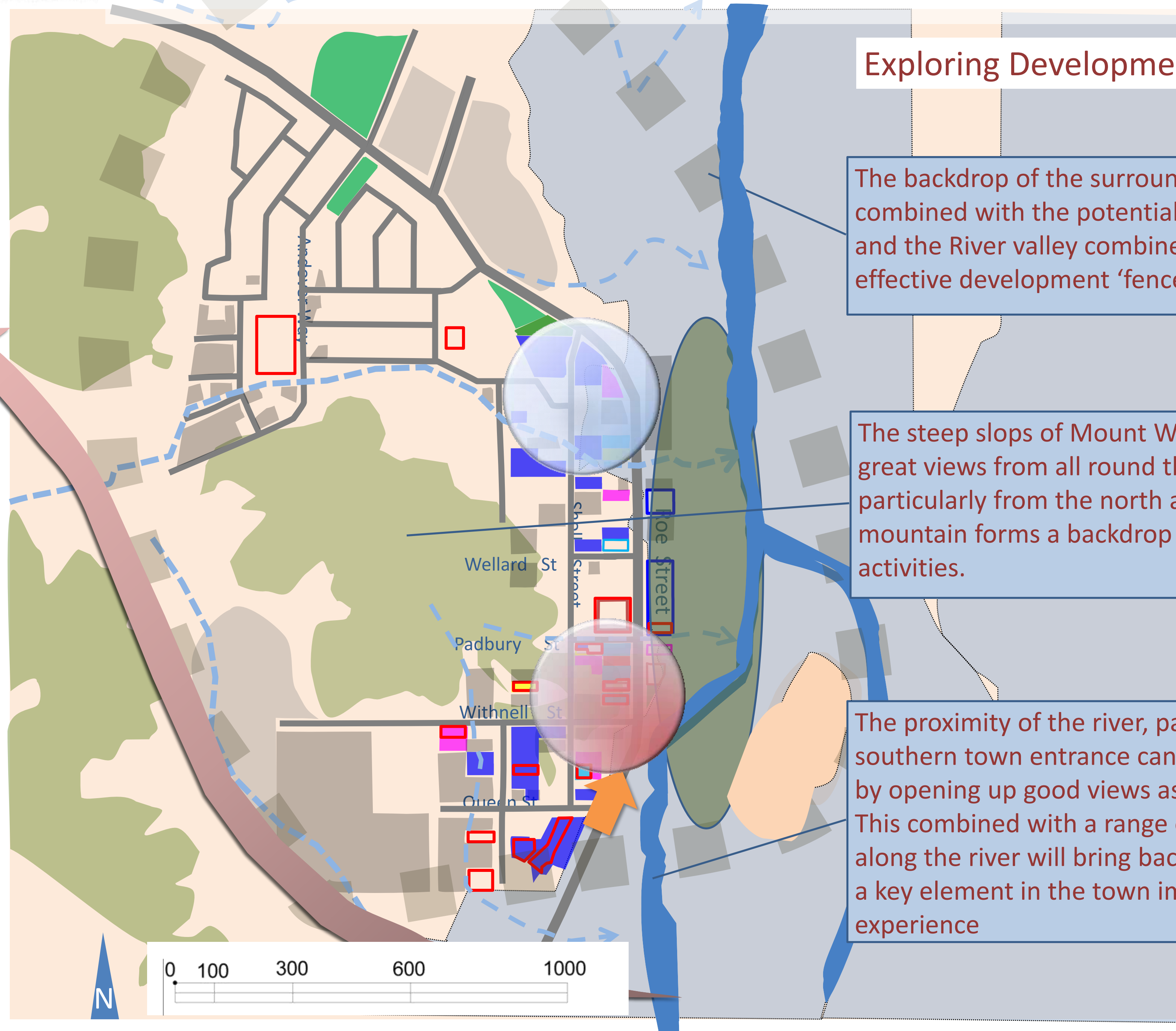
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Exploring Development Options

The backdrop of the surrounding ranges, combined with the potential bypass route and the River valley combine to form an effective development 'fence'

The steep slopes of Mount Welcome offers great views from all round the town and particularly from the north and east. The mountain forms a backdrop to many key activities.

The proximity of the river, particularly at the southern town entrance can be emphasised by opening up good views as well as access. This combined with a range of open space along the river will bring back this feature as a key element in the town image and experience



Development Framework Options – Clustering concepts

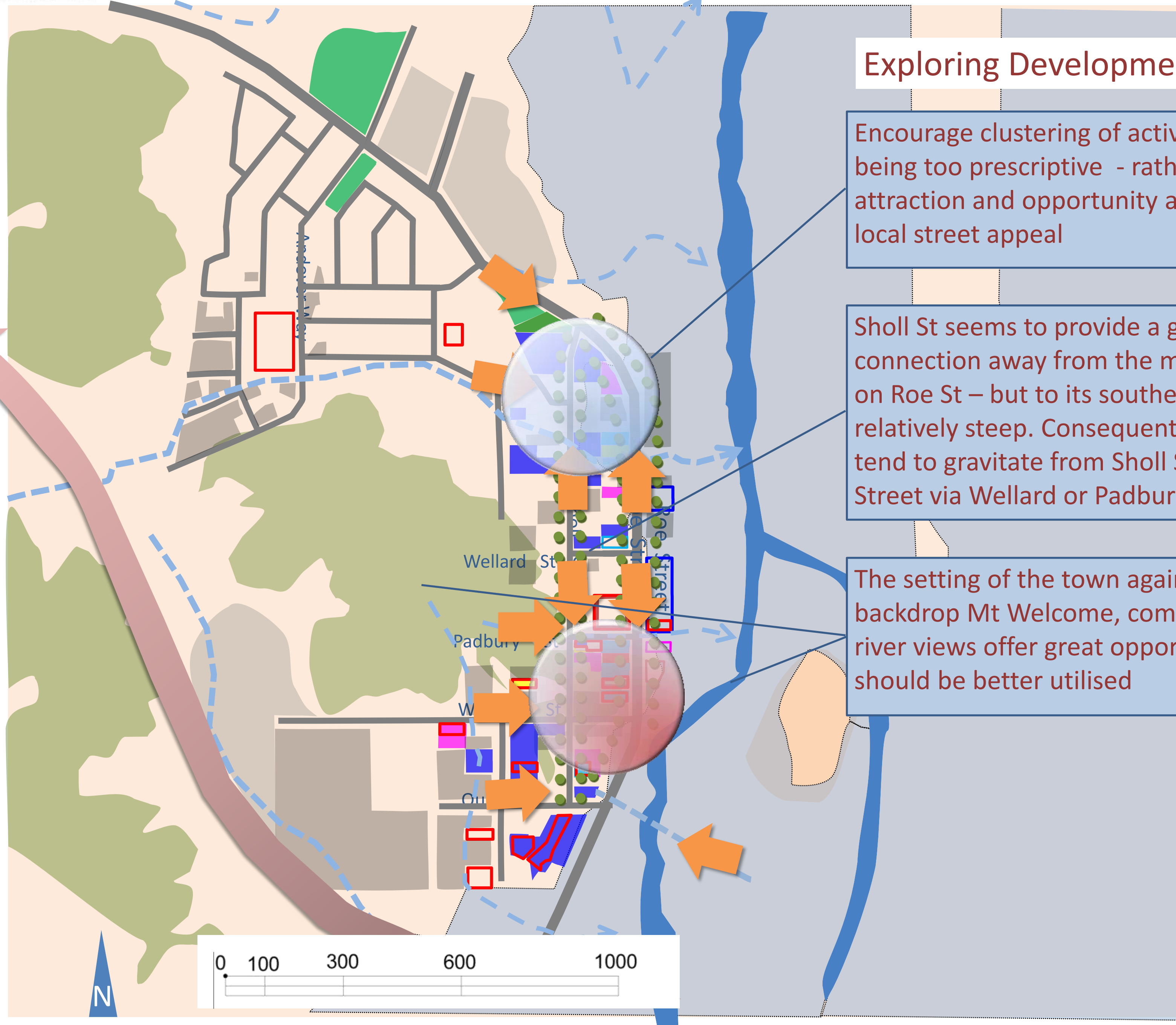
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Exploring Development Options

Encourage clustering of activities without being too prescriptive - rather create attraction and opportunity and develop a local street appeal

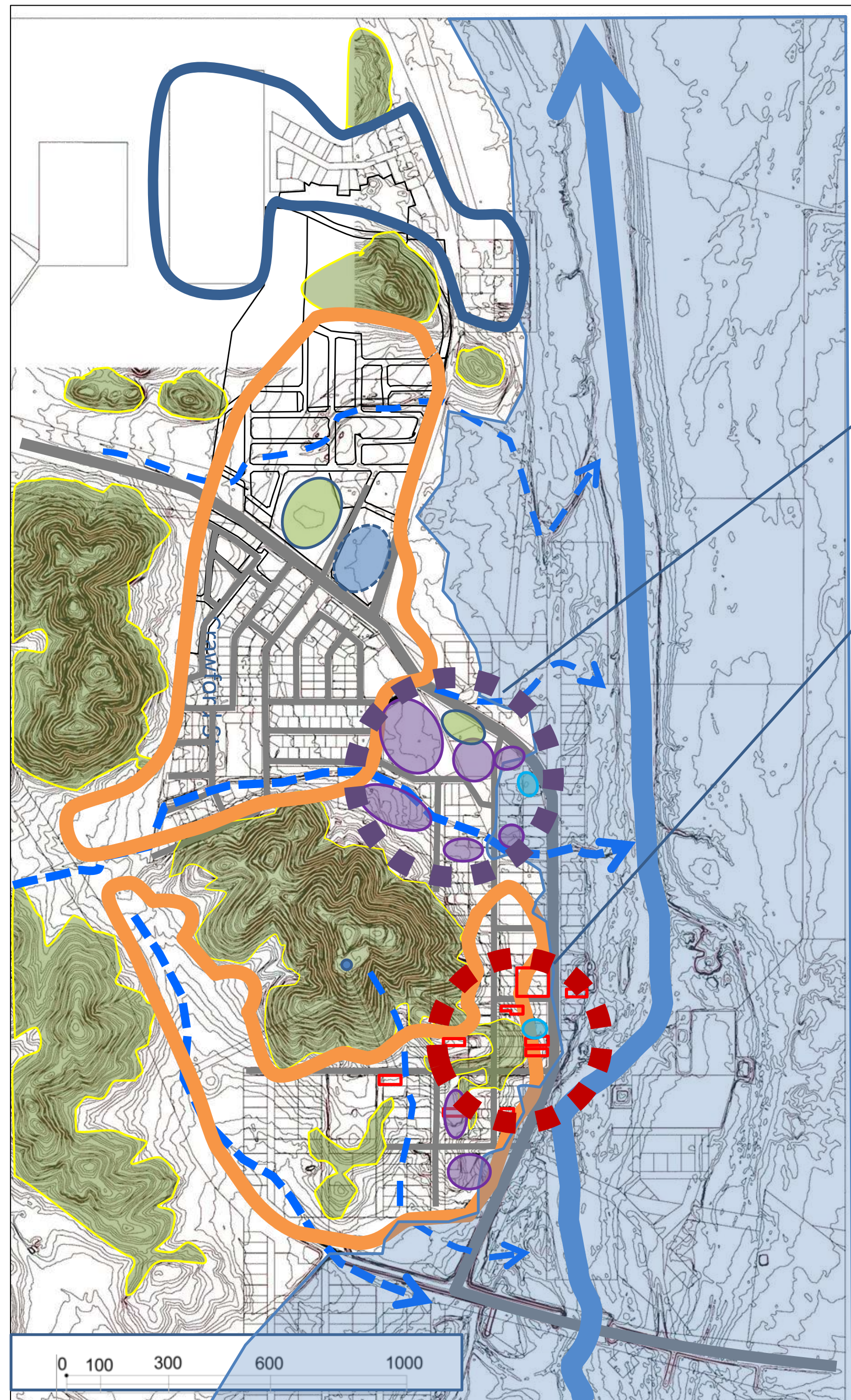
Sholl St seems to provide a good pedestrian connection away from the main traffic flows on Roe St – but to its southern end it is relatively steep. Consequently pedestrians tend to gravitate from Sholl Street to Roe Street via Wellard or Padbury Street

The setting of the town against the backdrop Mt Welcome, complemented by river views offer great opportunities and should be better utilised



Development Framework Options: Key conclusion

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There is a potential opportunity to consolidate key activities, together with future growth into two broad areas. These could in future have a business identity and a services based, education and entertainment character

Cluster of activities with primarily a community focus

A loose cluster consisting of primarily heritage buildings and businesses

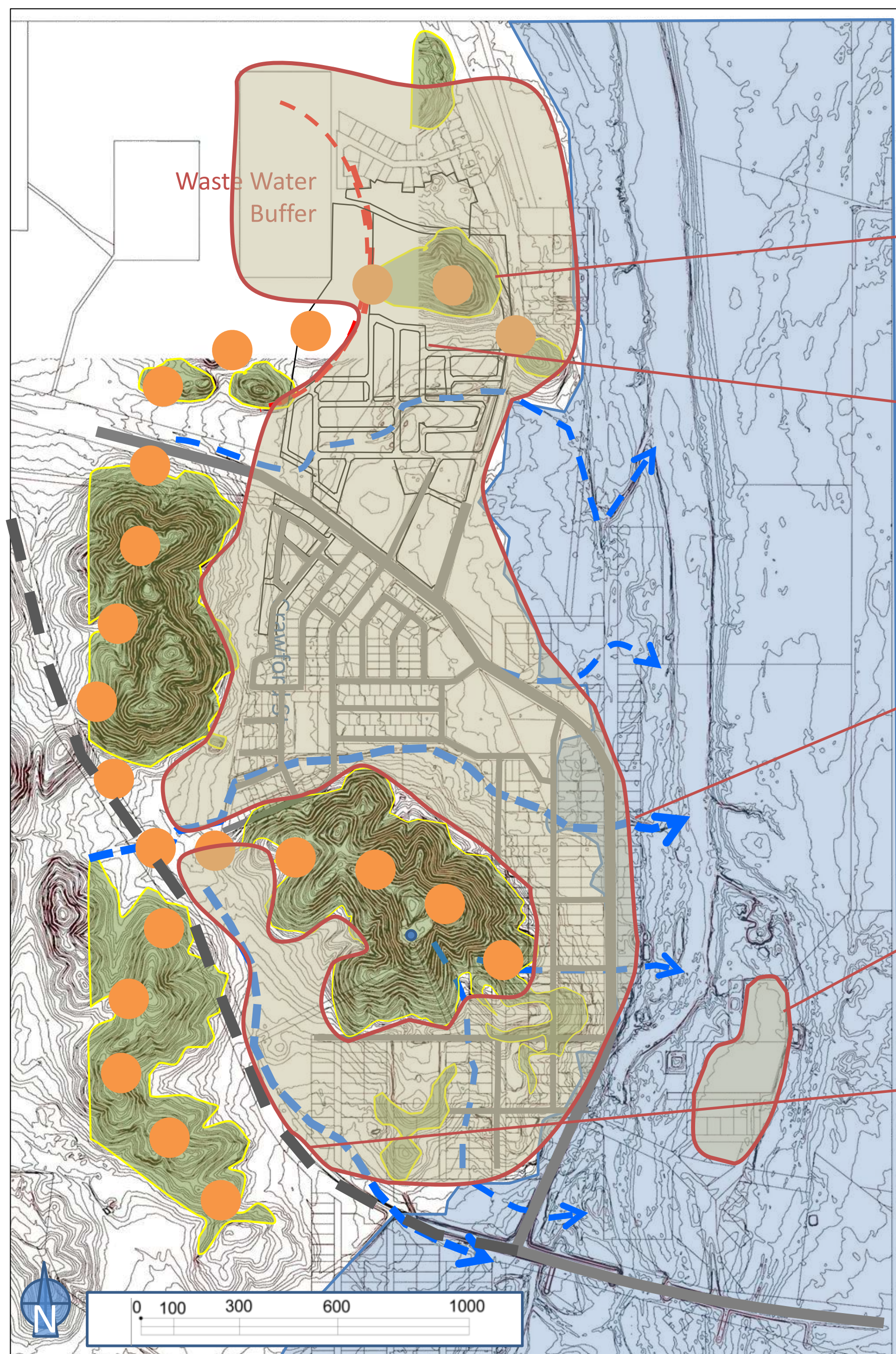
Although they have potential, there are areas with potential traffic/pedestrian safety issues as depicted on the right.

- In the north (top right) it overlaps with the population cells
- In the south (bottom right) businesses are on both sides of the street, but the central median strip makes for safer crossing of the traffic lanes



PART 6: Formulating a Development Framework

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Indicative development boundary broadly described by surrounding hills.

The NASH development goes up to the Jager Street Industrial Estate where there is space for industrial development to the west

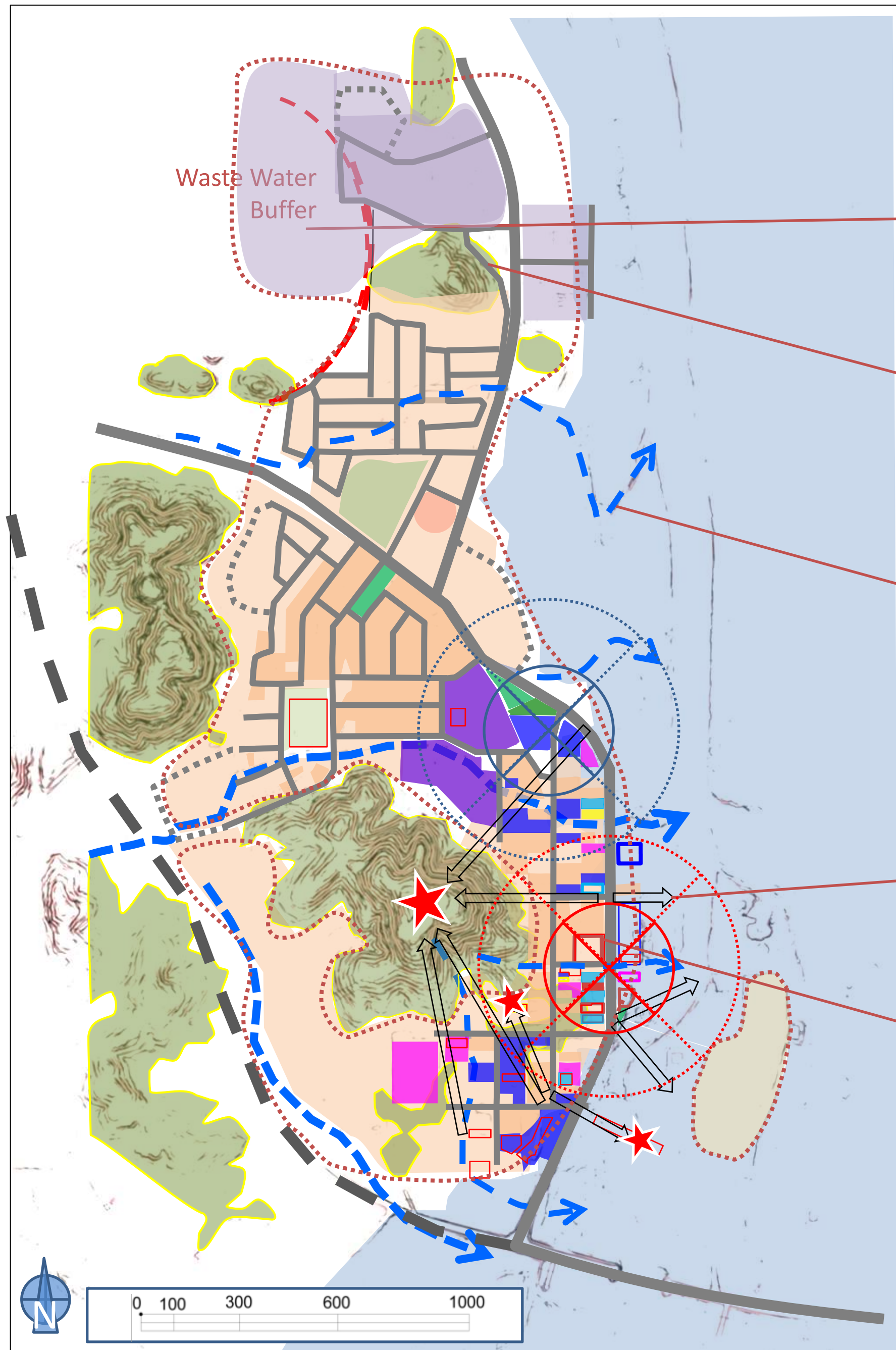
The Harding River flood regime curbs development along and possibly above Roe Street as well as below the Wickham-Point Samsom Road

The current caravan park is still an essential part of tourism and will now also extend to provide worker accommodation

Earlier planning made provision for a bypass of the town

Proposed Structure Plan: key outline

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Indicative development option of the Jager Street Industrial Estate

The new NASH development also provides access to the Jager Street Industrial Estate

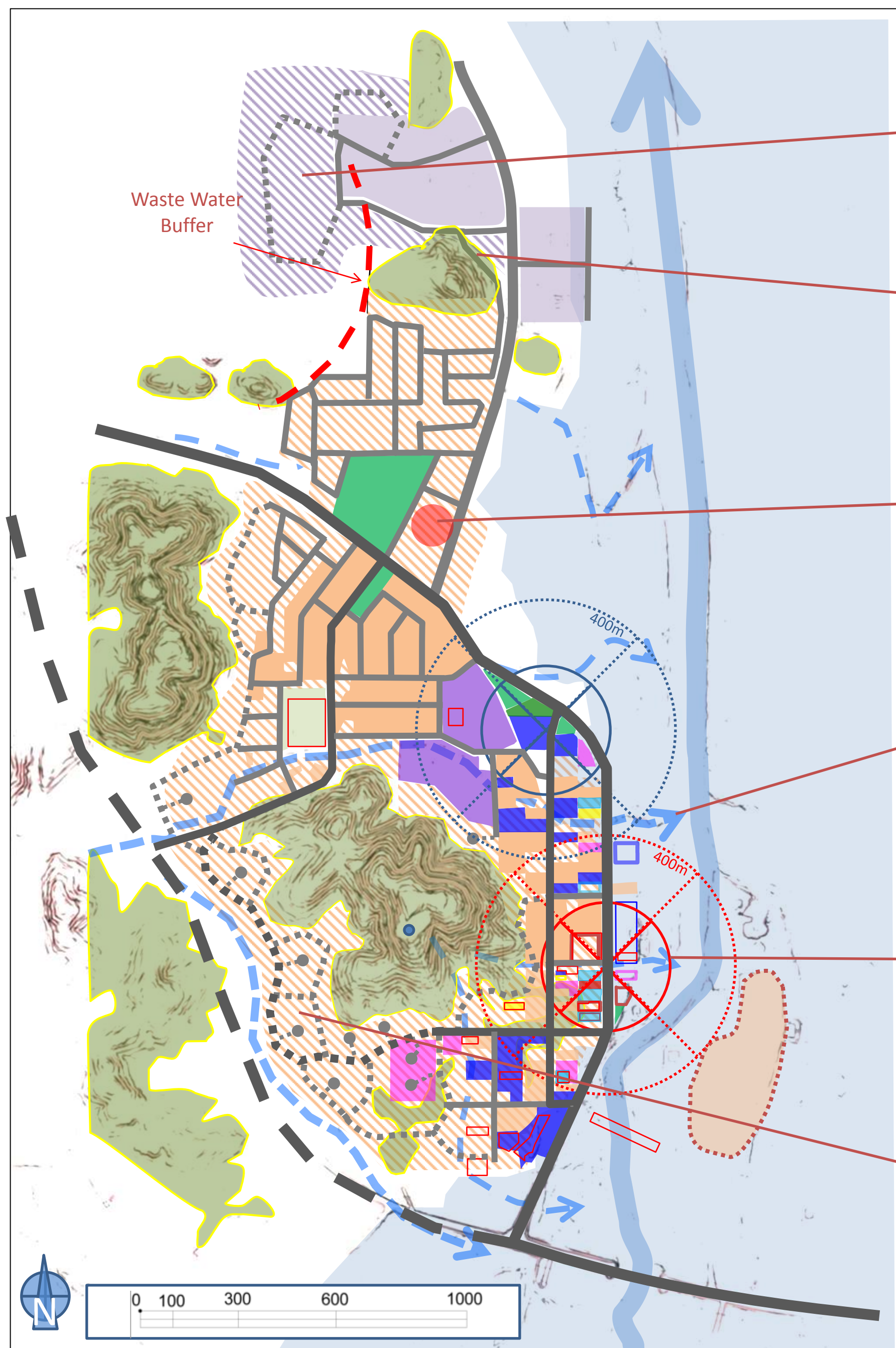
There are multiple streams with their origin on Mount Welcome which could cause localised flash floods during storm events

There are various important sightlines which should be protected in future development. These anchor the town, particularly the two identified nodes, to well-known landmarks and historic events

The heritage elements of the town are highlighted in red and is mainly clustered in the south

Proposed Structure Plan: key outline

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Indicative future development of the Jager Street Industrial Estate. This area lies right next to the current wastewater purification plant

The new NASH development also connects to the Jager Street Industrial Estate

The development also allows for a mixed use site (retail and housing) with limited access off the street network

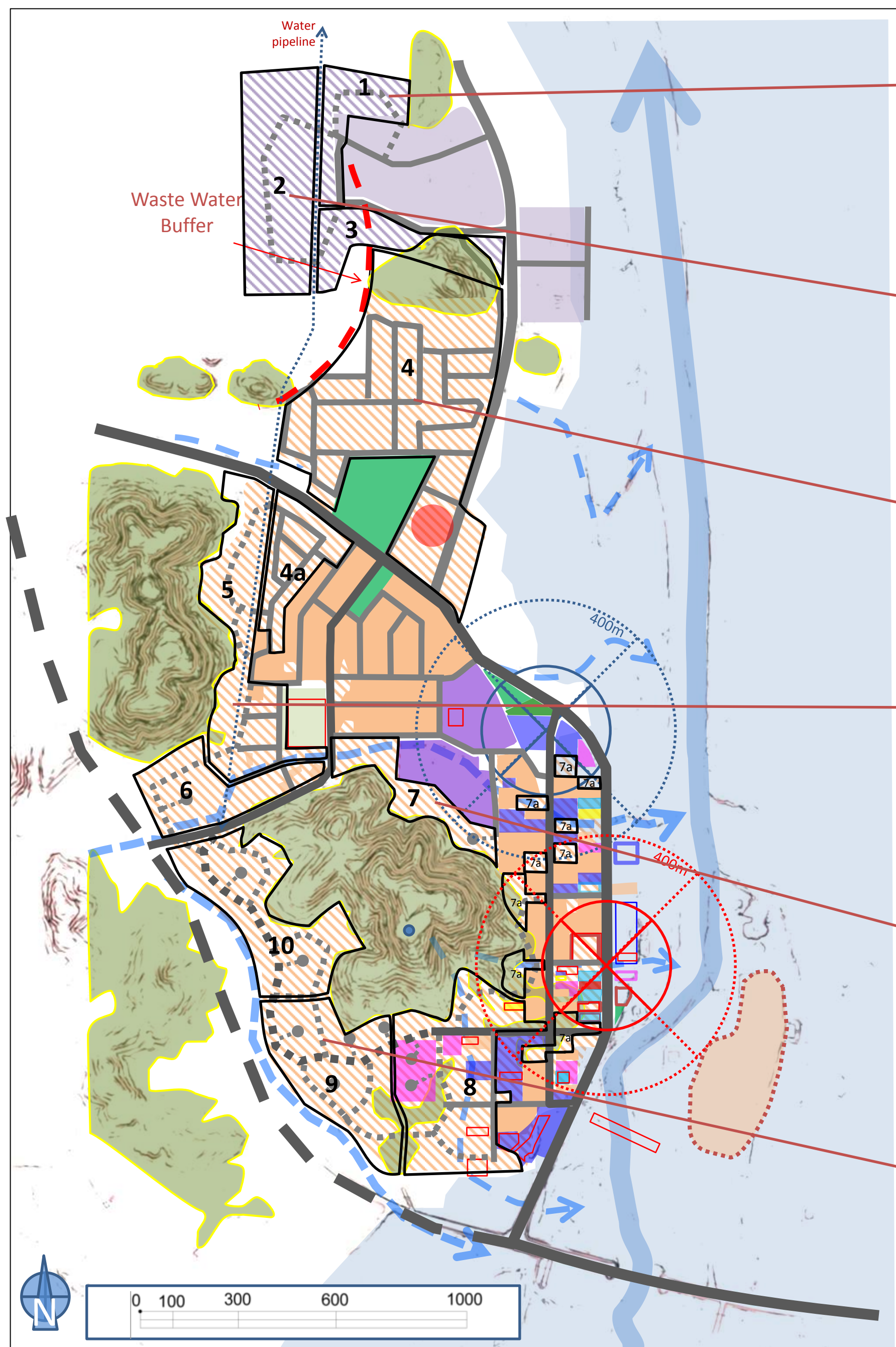
There are multiple streams with their origin on the slopes of Mount Welcome which could cause localised flash floods during storm events

The two identified nodes, north and south, are intended to become the hub and focus of future development, supported by a significant number of walk-up residents providing improved surveillance in and around them

Residential development will eventually reach round the Mountain, providing a large variety of dwellings and lifestyle types

Proposed Structure Plan: potential staged development

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The industrial component is broken up into 3 parts with part 1 & 3 likely to develop at an early stage as it could more readily connect to services.

Part 2 is west over the main water supply line. It could follow after parts 1 & 3. This land is privately owned and the new owner want to develop it for industrial use

The owners of the NASH subdivision aim to develop over a period of some 20 years with the first stage (part 4a) adjacent to the current housing estate

There is some room for further development to the west of the current established housing estate which should be able to connect to current services (part 5 & 6) and establish improved flash flooding protection

Part 7 is adjacent to the old Roebourne Town, with part 7a which consists of a number of sections scattered around town. These opportunities are all within walkable distance from the proposed nodes and could suit higher density development, but mant will need verification of potential flooding

Part 8, 9 & 10 all lie to the south and west of Mt Welcome and could provide very interesting development opportunities with good views and great access to the envisaged southern business node

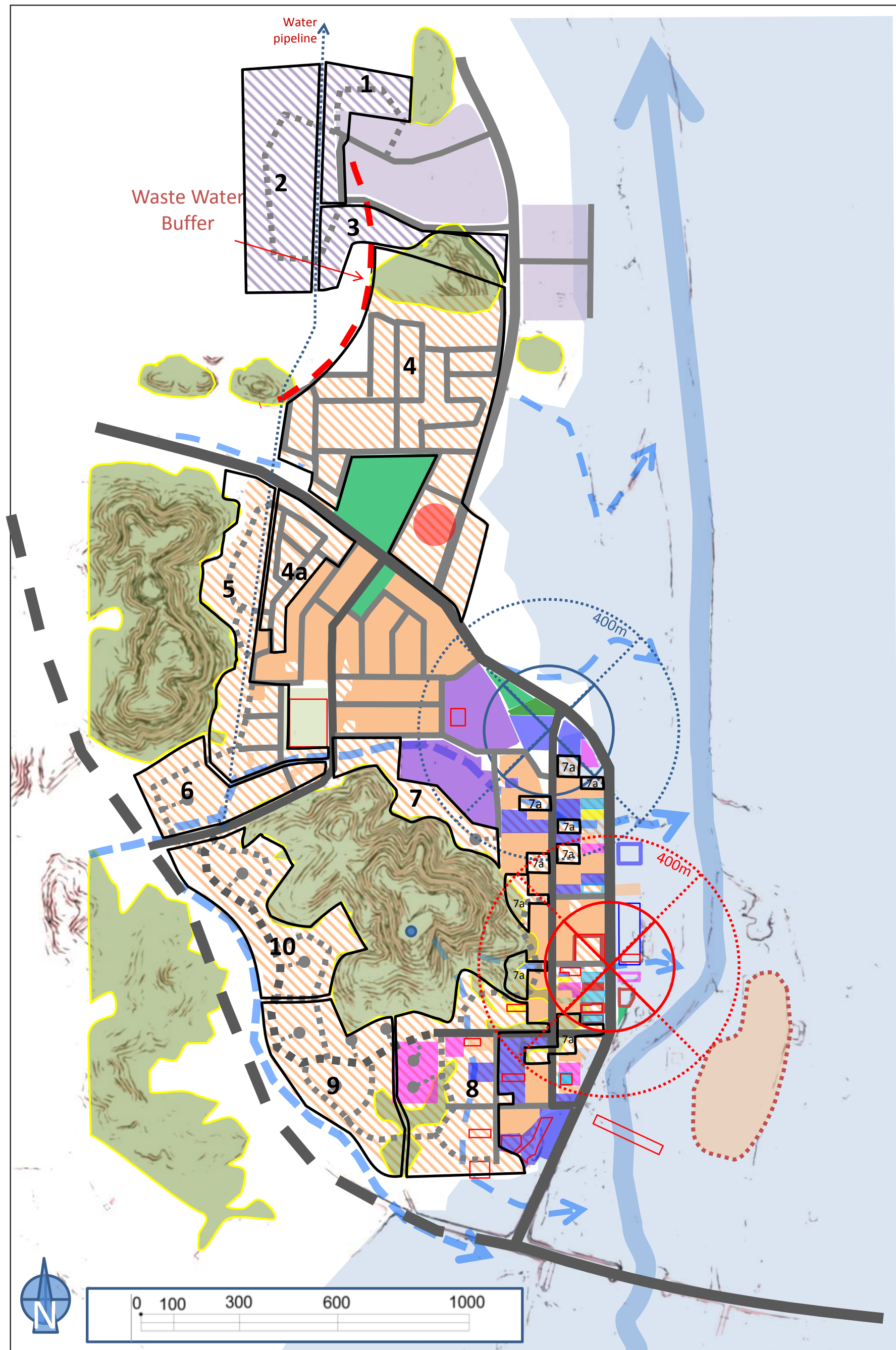
Proposed Structure Plan: potential staged development

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Vacant areas potentially available for development

Densities are gross, including streets and local open space elements

Development Areas					
Area		M ²	Potential		
			Density houses /ha	Houses	Population @ 3.5/house
1		58892	0	0	0
2		149850	0	0	0
3		42254	0	0	0
4		365800	8	292.64	1024.24
4	A	54441	15	81.662	285.815
5		135399	15	203.1	710.845
6		83916	15	125.87	440.559
7		52156	15	78.234	273.819
7	A	4060	20	8.12	28.42
7	B	1917	20	3.834	13.419
7	C	2405	20	4.81	16.835
7	D	2705	20	5.41	18.935
7	E	4076	20	8.152	28.532
7	F	4067	20	8.134	28.469
7	G	9812	20	19.624	68.684
7	H	10071	20	20.142	70.497
7	I	13128	20	26.256	91.896
8		172254	15	258.38	904.334
9		128863	15	193.29	676.531
10		126314	15	189.47	663.149
Total		1422380		1527.1	5344.98



Proposed Structure Plan - Growth Demands

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Population growth

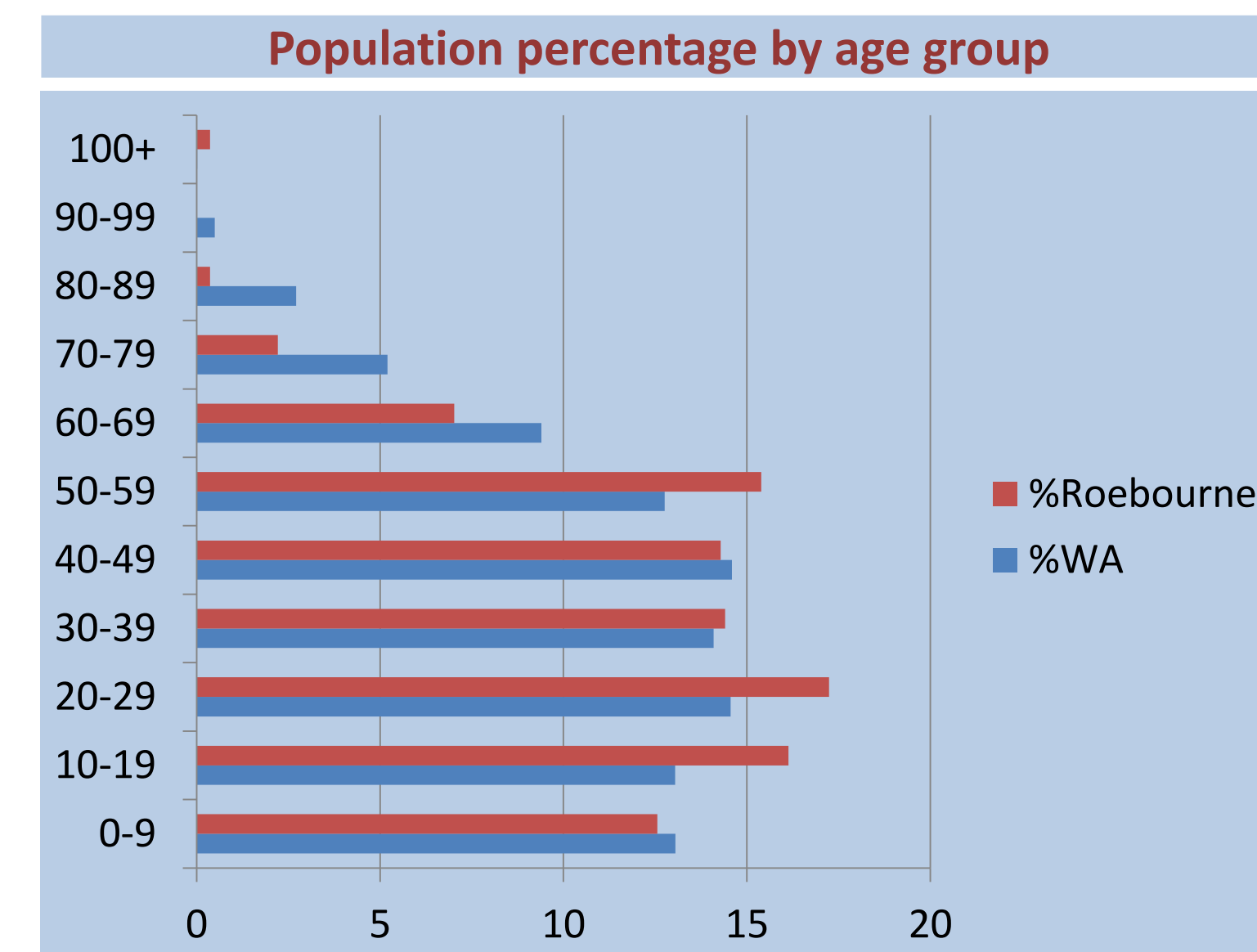
Numbers and Composition

- The population currently (2011 Census) in Roebourne numbers 812 persons
- There is 52 more males than females. This ration is somewhat different to the norm where females would be slightly more than males. However, even Western Australia as a whole also shows some imbalance with a ratio of just 1.012 male for every female.
- The Roebourne imbalance is likely to be due to the single workers and workers staying in work camps like the one on Hall Street which explains the over representation of males in some working age cohorts of the population (see table on the right).

Projections

- The Roebourne population has been very stable for some years with only slight increases during the last 10 years.
- However, both new housing developments in town and the influence of regional development will have an impact on future population growth. The greater Shire region will all be impacted by new mineral extraction developments and a significant element of that growth will be focused around the Cape Lambert facilities as well as potential mining in the sub-region. In addition the greater need for services from the whole Shire area will also make an impact, particularly the developments close to an within the Roebourne – Wickham – Point Samson corridor.
- Growth pressures in the rest of the Shire and the high prices of development land may also play a role in future distribution of activities, which may positively impact on Roebourne.
- All of this could however be held back by a lack of amenity and attractiveness and investment – all of which will need to be addressed by the Structure Plan
- In conclusion it is anticipated that growth will fall between a low of 2.5 and 7.5% per annum
- As indicated in the table (lower right), this would result in a total population of between 1475 and 3823 people in 20 years, or an increase of 575 – 2923 people.

Population percentage by Age				
age group	WA	Roebourne	%WA	%Roebourne
0-9	294012	102	13.05	12.56
10-19	293894	131	13.04	16.13
20-29	327961	140	14.55	17.24
30-39	317511	117	14.09	14.41
40-49	328786	116	14.59	14.29
50-59	287554	125	12.76	15.39
60-69	211691	57	9.39	7.02
70-79	117259	18	5.20	2.22
80-89	61136	3	2.71	0.37
90-99	11145	0	0.49	0.00
100+	306	3	0.01	0.37
Total	2253255	812	100.00	100.00



Population Projection		
Year	Growth Rate	
	2.5%	7.5%
2012	900	900
2022	1152	1855
2032	1475	3823

Proposed Structure Plan - Growth Demands

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Growth Demands

ROEBOURNE TOWN							
Population		Low Projection (growth @ 2.5%pa)			High Projection (growth @ 7.5%pa)		
		2022	2032	20 year average increase p.a.	2022	2032	20 year average increase p. a.
Population totals	2012 900	1152	1475		1855	3823	
Increment	-	+252	+323	+29	+955	+1968	150
Total Residences	254	326	418	+8.2	527	1089	+54
Increase in households @ ±3.5 persons/household	-	+72	+92		+273	+562	
Estimated residential land demands	Units per ha	Increase split evenly between density bands of 15, 20 & 25/ha					
Low density	15	+1.6ha	+2.1ha	+0.19ha	+6.0ha	+12.5ha	+0.90ha
Medium density	25	+1.0ha	+1.2ha	+0.11ha	+3.6ha	+7.5ha	+0.56ha
High density	35	+0.7ha	+0.9ha	+0.08ha	+2.6ha	+5.3ha	+0.40ha
Total additional land for residential use		+3.3ha	+4.2ha	+0.38ha	+12.2ha	+25.3ha	+1.88ha

Proposed Structure Plan: outlining key elements

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Roebourne viewed from the air highlighting the key concepts and components of the structure plan proposals

Roebourne Structure Plan



Sites for industry & commercial/residential

Key community services node

Curtail spread of community services groups, co-locate with retail

Business zone with residential on Sholl St

Consolidate caravan park/twc

Promote Primary Character Business Node

Create park along the Harding River as well as 3 feature focal points

Key significant heritage focus points

Linking main access routes

Potential new residential development areas

Key ring route connecting all parts of town

PART 7: Infrastructure – Issues & Options

- Water
- Wastewater
- Electricity
- Streets and footpaths
- Parks



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PART 8: Formulating a Vernacular: Analysis & Design

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Jager's house on Withnell Street which is still in use



Ruins of Freddie Ye Palk's Store (circa 1880's) on Roe Street



Roe Street with Dalgety House (1880) Union Bank (1888) and the war memorial

1. Environmental conditions and development – to follow
 - Climate in general and cyclones
 - Fauna and flora
2. The Public Realm – Accommodating key activities
 - A. Heritage
 - taking it into the future
 - design vernacular
 - B. Business Environment
 - C. Community Node including parks and recreation
 - D. Living – culture, lifestyle and housing

2. Public Realm: Accommodating Essential Activities

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A Range of Essential Activities

To be successful as a town there is a need for a wide range of interrelated activities. Normally these form a cluster or clusters where you can obtain your daily needs in terms of retail, services and socialising. It also provides local employment opportunities. However, it is normal for small towns to lose a large component of their market to larger towns nearby, but as the town grows it should not only retain services, but also attract more.

In Roebourne that has typically been the case. On the one hand larger towns (Wickham and Karratha) undermined them for retail services whereas on the other hand local community services (and therefore local employment) have been proliferating in most recent times.

However, the impact of the above trend, seen from an urban design and liveability perspective, was mostly negative. This is so mainly because the businesses/services had a scattergun approach – settling all over town with no identifiable cluster other than the focal point around the community centre/ youth centre. In short the overall increase in activity has not created a *'place'*. Neither has it provided a convenient central location for their customers to come to, rather clients have to cover all of the town to access individual services where they are scattered.

This state of affairs is actually responsible for the lack of any substantial retail outlet in town apart from the General Dealer on Roe Street. As a consequence Roebourne lacks a town centre.

As a consequence there is also not a particular place in town where retail or other supporting services would prefer to settle (and invest and provide jobs) and singularly and in isolation it is difficult for any one business to survive.

Even to the remaining activities Tis now under threat by a mixed use development site of some 2.5ha in the NASH development

Community Support Services

If the present trend continues, these services will continue to spread throughout the town with no particular pattern and apart from not supporting a focal point they negatively impact on the residential component of the town. The integrity of residential neighbourhoods is interrupted by offices and clients coming and going throughout the day, whilst after hours and over weekends these premises stand unused and could become a security risk.

Town Centre choices

The logical conclusion is to advocate a town centre or at least a couple of nodal locations where activities can congregate deriving some synergies. This will not be an immediate panacea, but over time as businesses grow, upgrade premises and change, a nodal concept can take hold providing benefits to all – the businesses as well as the community. The current investments in office space is insecure. A nodal location will bring about security. The current wide spread of activities do not allow for efficiencies of conglomeration or good access to supporting services.

From all the analysis there would seem to be a possible enduring solution by providing for two nodes.

- One, a business and retail cluster coinciding with the southern heritage precinct and
- Two, a community facilities and services node focused in the vicinity of the current community centre and the BP station

A choice for a better future needs to be taken now.

Residential areas

It is important to develop a simple, easy to maintain streetscape vernacular here which clearly identifies the living neighbourhood, slowing traffic, making it pleasant to walk and visit on the street. A relatively calm environment with good surveillance, especially round the education hub.

Framing a workable Vernacular

Because of the above somewhat confused scenario, where a broad mix of uses are spread throughout the town with little rhyme or reason, and where the current situation will be difficult to unravel, it will be necessary to demonstrate through a very strong and somewhat simple vernacular design where the focal points in the town will be supported in future. In terms of the streetscape the following elements are suggested:

- Heritage – taking it into the future**
- Business centre node with strong heritage elements**
- Community focus node with parks, recreation and some retail business**
- Residential Communities, culture lifestyle and the public realm**



The last retail outlet standing! Standing separated from its support base



Various small community service agencies scattered throughout the town (above and below) – breaking up the potentially quiet, peaceful neighbourhood environments. They are not ideal neighbours!



The Victoria Hotel – a fallen victim to a changed environment.

Public Realm: A. Heritage – taking it into the future

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Hidden Gem behind kicked-in palisade fence (above and below)



Hidden Gem behind painted masonry cottage (below)



Historic plaque in honour of woman



- Character, attractiveness, liveability and sustainability of a town are not easily defined elements – an intricate mosaic of culture, heritage, lifestyles and many other aspects thrown together over life times all contribute to the town scape. With age it reflects a rich patina which you cannot easily replicate
- Roebourne has many of the above characteristics with historic relics operating as living structures from their founding day, as well as a large number of tired structures in various states of disrepair. Contrasting these there are numerous relatively new buildings, including housing, sports facilities and community support structures functioning well
- However, the built environment is also part of the rather inferior living environment which comes across as unkempt and in a state of neglect. Even the more recent buildings are not immune to this condition and they do not reflect their qualities because of the environment they are operating under.
- This poor state of affairs is impacting on everything around it. Even during meeting representatives on local heritage in broad daylight the roof of the “50 Cents Building” was continuously pelted with rocks
- Fortunately this negative image is offset by great examples of care, tidiness and good design and maintenance of selected current facilities
- Going forward, building up the town without celebrating the past and the current, will not deliver the positive results we would like to envisaged. This will only happen if it is brought about by the local community with support of the Shire. Short term positive outcomes which can bolster participation, stuartship and pride is key to success



Watson's Tee Store, the current library building (above and below)



Dalgety House 1880's (below)



Public Realm: A. Heritage – design vernacular approach

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Richard

The Public Realm

- Active environments
 - Ensure overlooking windows of living rooms/kitchens on street
 - Ensure active street fronts in activity areas
 - Ensure good lighting – providing true colour, not too harsh for ambience, brilliant enough for person recognition and limiting light spill
- Walkability in the local climate
 - Connectivity - provide clear route options with good sightlines without hidden areas
 - Footpath design – width, colours/heat absorption/- radiation
 - Safety CPTED – surveillance – day/night
- Streetscape
 - Ensure buildings offer a diverse but coherent façade to the street
 - In business activity areas allow no setbacks unless to accommodate outdoor activities integrated with the street environment
 - Allow footpath seating for restaurants/cafes only if it does not pose an obstacle to good pedestrian movement – e.g. at least 2.4m footpath width in activity nodes
 - Shaded nodes enroute – sails or trees – minor stops and major congregating point. Street trees to be up-limbed to at least 5m. Ensure young growing trees are well-protected against vandalism – have community planting days and after that community care days to ensure their success
- Public spaces
 - Ensure these special places have good natural surveillance.
 - Keep open vistas with shrubs trimmed down to less than 1m height and trees up-limbed to at least 3m height
 - Integrate the river with the Roe Street experience – emphasise views, create informal footpaths where there are current traditional footpaths wherever possible



Jager's house (left) overlooking Withnell Street – no footpath. The Library (Watson's Tee Store) overlooks Padbury Street but not Sholl Street where oversight is needed.



The Roe Street footpath at Padbury Street looking south. This part of the town centre has full paving to the property line although not all buildings are built to line.



The trees above are few and far between with a cluster at the old Shire Office. These have low branches and need up-limbing to about 5m allowing street light to penetrate under them.



Large part of Roe Street has no trees for amenity or shade. It fails to serve tourists wanting to explore the heritage sites on foot or assist locals to walk in comfort.



Public Spaces are very limited in Roebourne. Left is a public space stretching over Roe Street with great ambience despite its location. Right is the space in front of the community facilities which comes across as harsh and uninviting with no natural surveillance, no shade and no amenity. Not a place to be. Other than this there is no significant public space.

Public Realm: B. Business Environment – Roe Street

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The Main Street - gateways

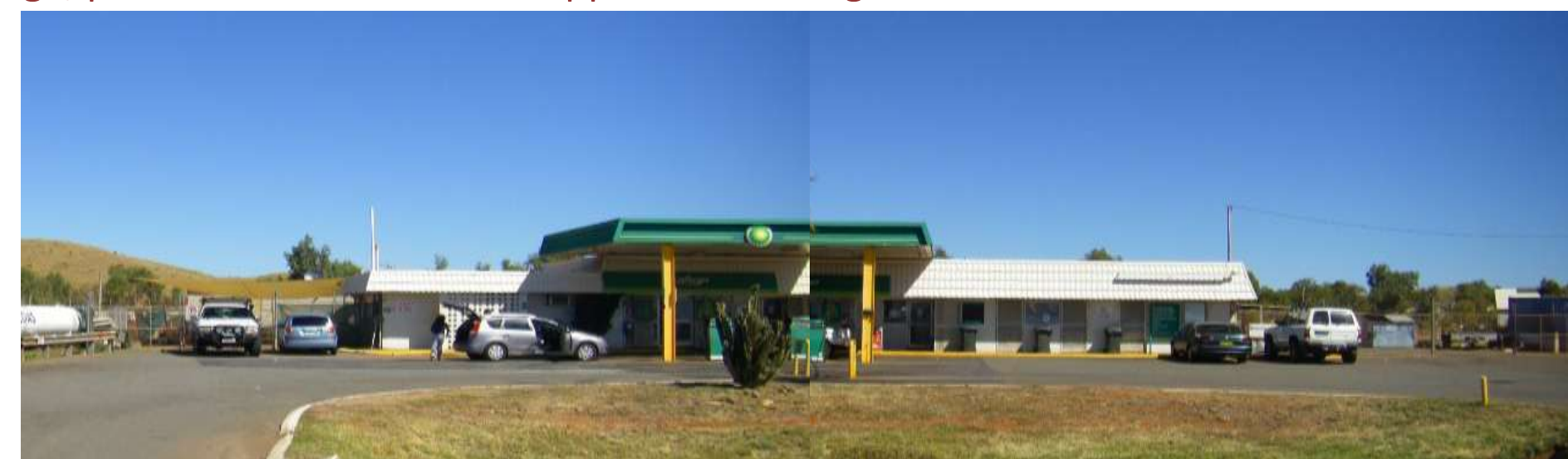
The town's visual attractiveness is essentially limited to a few outstanding heritage items. However there are many opportunities to remedy this apparent lack of identity through systematic improvements in the streetscape. Roe Street (south) already has the basic combination of elements making it interesting and attractive. This is a good skeleton to flesh out into a unique landmark.

This is a mosaic of significant heritage architecture, a convenient and attractive small park, memorials and backed by potentially excellent river views. However, this gateway is marred by broken balustrades and fences as well as neglected gardens of the heritage buildings.

The entrance from the north is different – lacking in amenity and attraction, but offers some opportunities.

- It is dominated by the BP filling station and shop with vacant land in the flood plain of the Harding River opposite.
- It would seem the filling station has limited support for its retail. This end of town mainly accommodates a range of community-type services.
- Approaching from both the north and the south there is limited visibility for turning vehicles and it presents a pedestrian safety hazard.
- The NASH mixed use lot on the corner of the Wickham – Pt Samson Road could in future generate competition but it also has a major pedestrian safety problems and vehicle access will not be from the main roads close to the intersection.

The images below is Roe Street North with few positive elements. The images to the right depicts some of the better elements of Roe Street South – a combination of heritage, park and business – with opportunities to grow



Public Realm: B. Business Environment – Roe Street

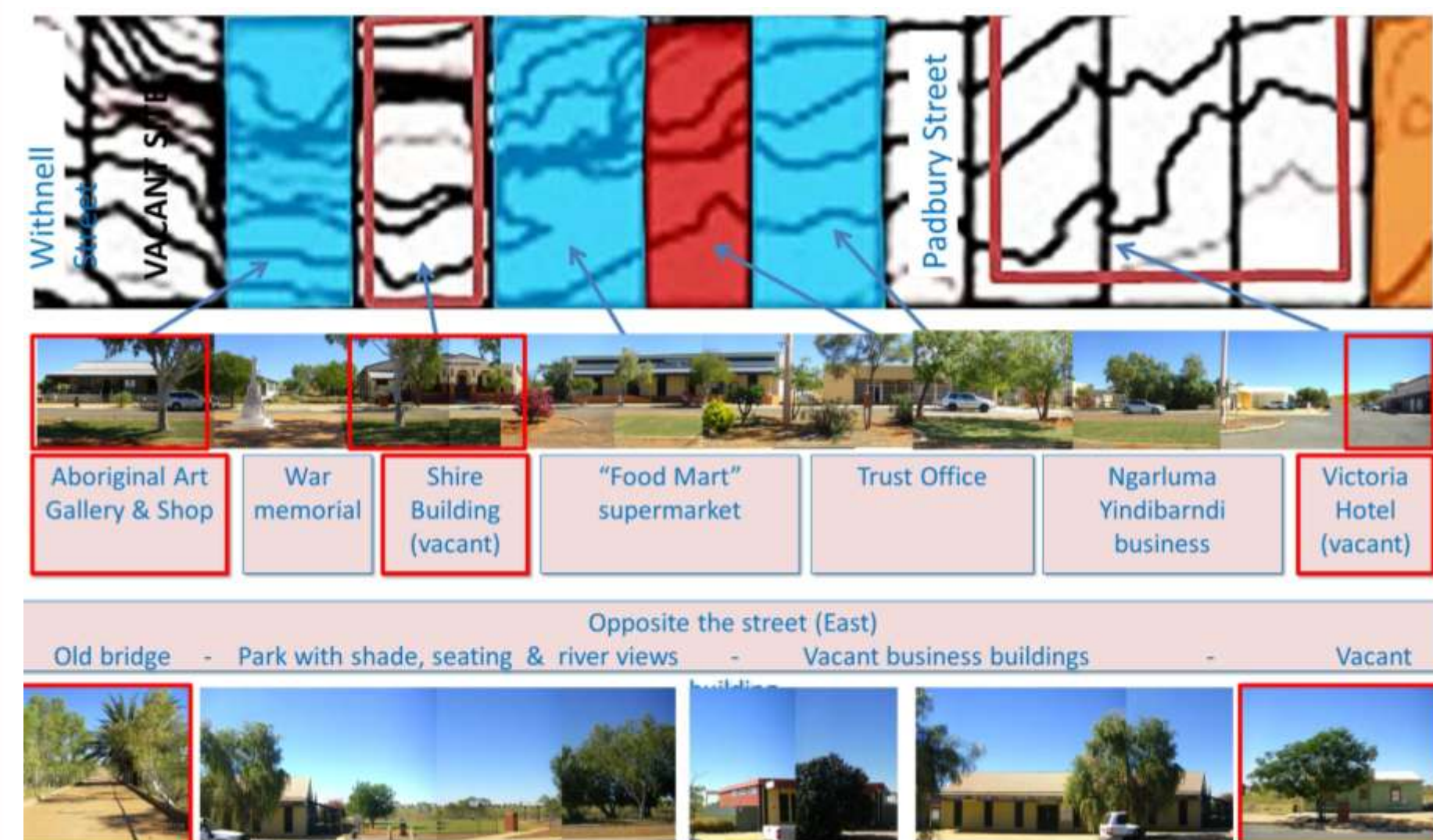
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General conditions

The town's streets are quite bleak with few viable attractors which could serve as anchors or focal points for new development.

Roe Street South

Items of interest are scattered through the southern part of the town, but with a recognisable heritage precinct at the southern point of Roe Street.



The illustration above highlights the current land use (the heritage items outlined in red) with the buildings both sides of the street. As pointed out earlier, Roe Street (south) already has the basic combination of a few historic treasures making it quite interesting and pleasant. It has the makings of a special precinct and could provide an anchor or "bookend" for the southern part of the "Mainstreet" environment.

However, it is quite vulnerable and needs supporting activities as soon as possible to stop further deterioration of the remaining mainstreet activities.

Roe Street North

The northern part of town is of more recent vintage with a single heritage building (the Old School House) on the current primary school premises. The BP station in the north is the only filling station in town serving an extensive area. As the diagram shows it is quite isolated with no neighbours either side or across the road.



Right: Banners welcoming visitors to town – entering from the north end of Roe Street it is basically the only sign of life!



Public Realm: B. Business Environment – Roe Street

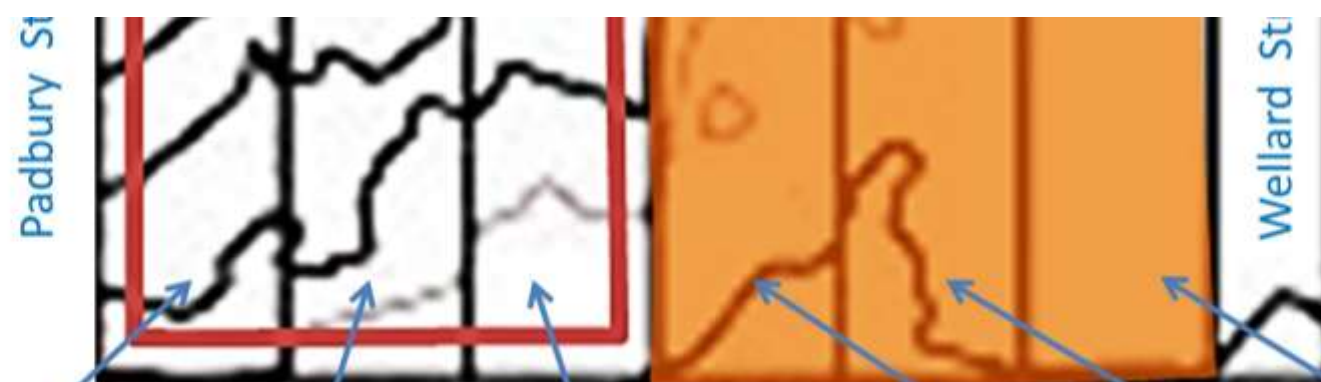
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Central Roe Street

- The central part of the street boasts the new outdoor amphitheatre facility which can bring some identity to the otherwise bleak environment. It also combines well with the River backdrop.
- The Victoria Hotel is an important landmark overlooking this new development, but at this stage seems to have a limited chance of remaining unscathed. It has been in the market for some time with no takers. With few prospective users wanting to establish in town, it would seem that the cost of restoration outstrips potential income. However it is of such significance that it is suggested that its restoration is key to the success of the revival of the “Mainstreet”.
- With its large number of outbuildings (including ensuite rooms) , a vacant restaurant and a retail store, it offers space for numerous potential uses – a real mixed-use opportunity.
- However, it has asbestos in its structure which will need to be removed to render it suitable before use – adding to the cost of renewal.

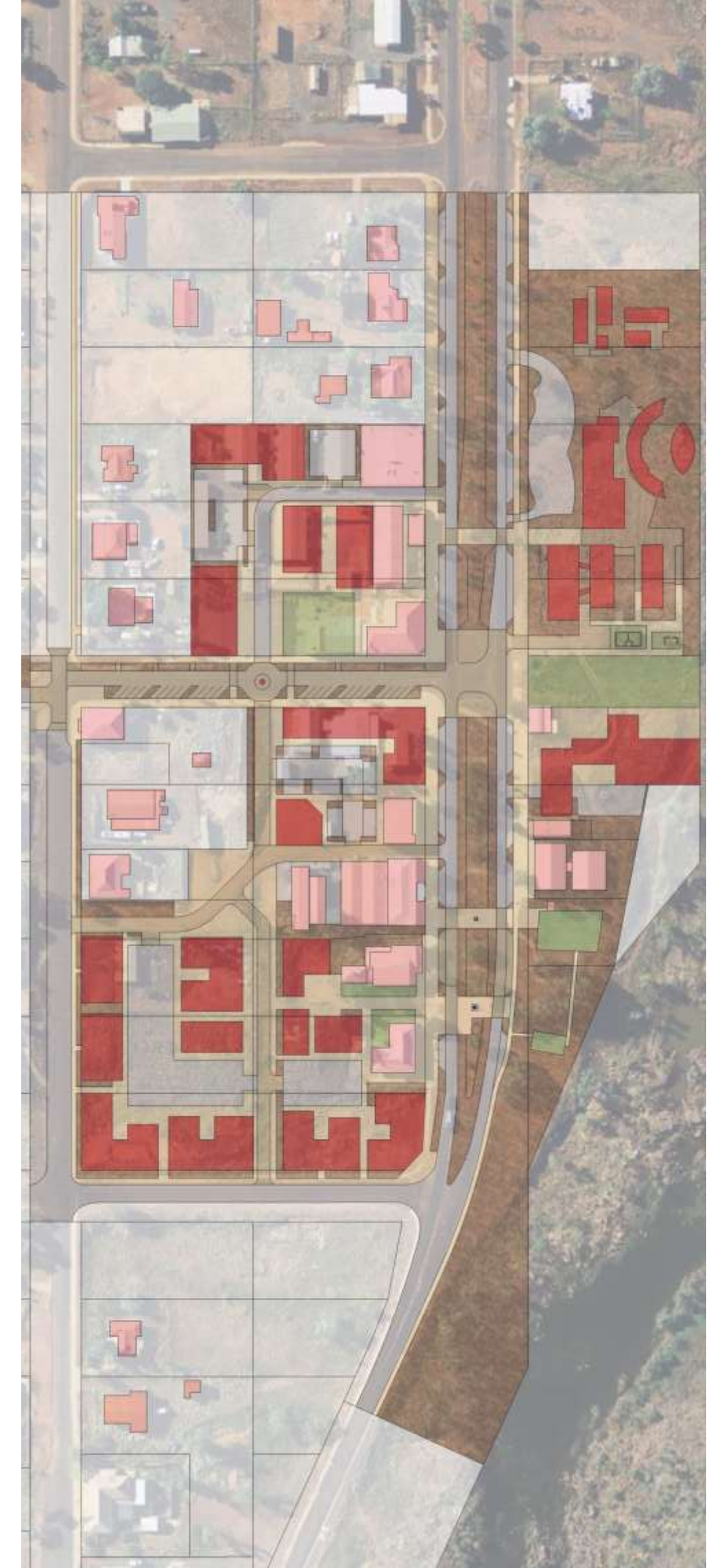


- Not all of the structures on the Hotel site are of historic significance. It is mainly part of the two storey building on the corner of Padbury and Roe Street that requires salvage – the balance could, if needed be demolished potentially providing an excellent development site centrally located and highly accessible



Public Realm: B. Business environment – Roe Street

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8.2. Public Realm: C. Community Node + parks & recreation

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Sholl Street – general observations

- Apart from Roe Street this is the only other street of the old town that runs the full length of town.
- Sholl Street has many activities located along its length, particularly close to its northern and the southern ends.
- Most of the other activities in town, like the school, the technical institute and community support services ultimately is reached via Sholl Street. This make it the busiest street with mostly local traffic, compared to through traffic on Roe Street. Having a wide road reserve with wide verges, it is operating more like a rural highway than a local suburban street with high speeds putting pedestrians at risk.
- From an urban design perspective the street lacks character and identity with many buildings tucked away behind fences, overgrown by shrubs. There is a footpath on the eastern side but the verges are totally bereft of trees and shade, making it unpleasant to walk along in the summer heat. With very few walking in town, there is a feeling of isolation which turns to concerns for safety at night. (see lighting and safety). The wide expanse is conducive to vehicles speeding.

The Community Centre Design Issues

- Vandalism here is an issue. In the main the problem stems from the fact that this set of buildings do not have good natural surveillance.



A range of views on Sholl St

- Although there are activities throughout most of the day and the evening, they are hidden from view behind walls and screens. Ideally the Aquatic Centre, the 50 Cents Hall and the new Youth Centre should provide the necessary surveillance over the area with activities spilling over to the outside of the premises. The trees and shrubs along the street side is not helpful either.



- As indicated above the *blue* arrow points to fairly neutral surveillance. The *red* over the 50 Cents Building and the Aquatic Centre indicates poor surveillance and the light *green* sign that there is some surveillance from the street and from the St Johns Ambulance across the way. This set of conditions are poor – installing CCTV cameras alone won't rectify it.
- Behind the Youth Centre (south) on Weerianna Street the surveillance is equally poor. However this area actually lends itself to become a small local park and would provide in a definite need as there is a dearth of parks in the town. It will also serve to redefine this end of Sholl and Fraser Streets by emphasising a change of environment, progressing from a predominantly community focus to a residential neighbourhood.

The back of the new Youth Centre - no active elements overlooking Weerianna Street



Public Realm: C. Community Node

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2.1 Parks – current qualities

There are some undeveloped park sites. Firstly, the whole area in town along the River is zoned as a park, but it is currently undeveloped. This is a magnificent asset and could become a real treasure with some coordinated community effort to make it useable (see image right). There are two other park sites, : one at 39 Sholl Street, depicted below which is totally undeveloped, and one which serves as a drainage reserve at 722 Roe Street.

The image below is of a site which is part of Weerianna Street intersection with Sholl Street. It forms a strategic link between the different land use components on all sides and can form a excellent focal point as a park with good footpath traversing it to all directions



The magnificent river views from a range of angles are all but forgotten (above). With careful design it can become once again become the backdrop to a vibrant town centre and living environment. Part of this park is the old bridge across the River (below) which is still used as a footpath to the caravan park.



The site (above) seems to serve as an additional access to the private site to the left and is located next to an office development to the right.

2.2 Vernacular

Current space – Design elements:

- In keeping with the current nature of the Roebourne environment, which, on one way conveys an informal countryside feel whilst also needs to support and “frame” the heritage elements of the town, it would be good to keep the design as simple as possible placing the focus on key feature like the River and the heritage elements and key focal points. This should combine with treatment of the streetscape.



Public Realm: C. Community Node

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2. Public Realm: D. Living – culture, lifestyle and housing

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Special Community & Cultural Needs

It is important to make sure that the future of the town takes care of its residents – both socially, culturally as well as in terms of their accommodation, education, their employment and their recreation.

Our analysis shows that the current planning provisions lack in certain areas and that future needs and requirements are generally not fully taken into account.

Lifestyles and Associated Requirements

Lifestyle depends amongst many elements on the amenity of your living space – both the town and neighbourhood and the accommodation you can find to fit your lifestyle.

The proposals formulated here will need to be tempered by way of participation in community discussions and comments so that changes can be affected to bring proposals in line with community needs.

Roebourne have a extended array of specialist community focused services including:

- Primary School
- Technical institute
- Community centre and youth centre
- Hospital and St John's Ambulance
- Sports and recreation, including basket ball courts, aquatics centre, ovals, children's play park
- Services of a wide range of community support agencies, inter alia justice services, vocational training, childcare and protection services
- Police
- Courts
- Tourist information centre

Living Environment and Housing Aims

Living Environment

Housing is generally a very personal thing – it is not a “one size fits all” item. It involves family size and income, extended family living, family groups cohabiting, young independent persons' accommodation and cultural preferences. In addition in this region there are work camps and “fly in fly out” or FIFO accommodation. The latter is only now rearing it head in the Roebourne area, whilst all the other is present to greater or lesser extent. To address the needs of local indigenous people a community workshop on “Healthy Homes” were held in Roebourne in June 2010. This led to a large set of information regarding their views on housing and associated planning and design issues. These inputs are invaluable to this process and will assist to define housing requirements and the impact on the urban design outcomes. A recent example following the workshop is the NASH (*Ngarluma Aboriginal Sustainable Housing*) project with specialised housing designs worked up with the local community.

What will the future hold? The following emanated from the 2010 workshop:

Facilities needed:

- Local play equipment like basket ball hoops for boys and girls
- Skatepark
- Motorbike track
- Kiddies play equipment
- Street/park BBQ places
- Street clean-up bins
- Urban design minimising crime
- Native landscapes
- Shade and fruit trees at houses and in streets
- Waterpark
- Safe pathways

Business & Safety:

- Indigenous small business training centre
- Laundromat
- Shopping – clothes, food
- Tourism caravan park
- Attract new business to town
- Art gallery
- Local gyms with air conditioning separately for men and women
- Train and use local indigenous building skills
- Good street lighting

Public Realm: D. Living – culture, lifestyle and housing

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Housing Aims

Different housing types, typologies and sizes should be allowed for in the urban design to serve different occupants’ requirements.

Previously large lot developments could accommodate a wide range of housing typologies and ancillary uses, as was the case in the original town layout. However, this do not necessarily reflect today’s specific needs for more compact arrangements on one hand, or the expectations of extended family living arrangements on the other. The more recent developments (like that found to the west of the Primary School) caters for a range of housing typologies on site ranging from around 800 - 1000m². These include a number of semi-detached houses. But without any special provision for family groups or for pensioner housing.

To accommodate the outcomes generated by the 2010 Community Workshop will require a high level of coordination between the provider groups and those seeking accommodation, which will require good design.

The new NASH development is said to specifically providing for the diversity of the demand recorded in the 2010 Community Workshop.

Apart from their development, the opportunities for similar new subdivisions is severely limited by the opportunities left. It would therefore be important to best utilise the vacant and under-utilised potential of the town. The most recent developments here is ongoing do not necessarily achieve the outcomes sought by the 2010 Community Workshop.

Overall residential property ownership shows that 46% of all occupied land parcels in Roebourne belongs to the Department of Housing and the WA Government. With some 49% in private or aboriginal ownership.

	Residential Lots			
	Occupied (ha)	Number	Vacant (ha)	Number
Old Town	38.5	90	5.5	28
North-west	14.1	178	3.7	38
TOTAL	52.6	268	9.2	66

The table (above) indicates that 268 residences are spread over 52.6ha and a further 66 vacant residential stands over 9.2ha.

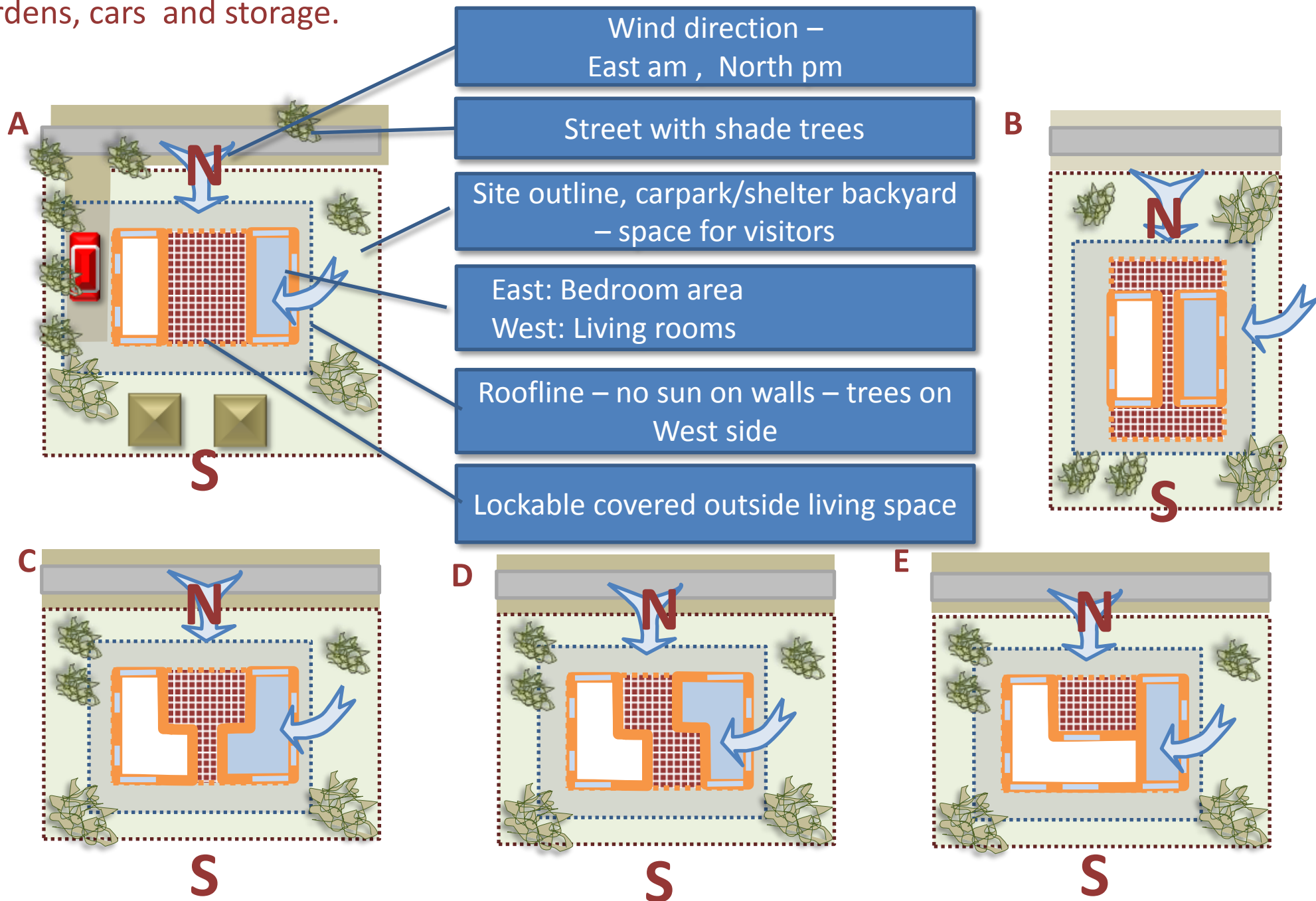
This points to an overall net density of 1 household per 1940m² which is very low for an urban area but fits with semi-rural town which is what Roebourne was over many years.

Catering for Housing Needs: Key Typologies

The main aim with outlining a number of potential housing typologies is to arrive at the influence on the liveability, the streetscape, walkability and safety of the urban environment, whilst allowing for climate and lifestyle. Taking the outcomes of the 2010 Community Workshop, the demands of the weather conditions (heat, sun and cyclonic aspects), the street environment and the family structures / culture, can assist in defining the future townscape.

Typologies

The following five diagrams depict houses facing north to the street (or south with similar outcomes) allowing for afternoon breezes and flexibility for visitors’ tents/swags, pets, gardens, cars and storage.



- Wind**

The Windrose information (courtesy of BoM) shows that the morning the breeze is normally from the east and in the afternoon it is more variable coming mainly from the north west to the north east.
- Sun**

The sun at this tropical latitude is mostly high with limited penetration north or south, but could be quite severe particularly in the late afternoon from the west. This side would be the appropriate location for a car shelter.

Residential environments

• Typical Clusters and Street Layouts

– Low Density Residential 15 – 20 units per ha

As indicated below, housing lots varying between some 500m² and 750m² can produce intimate living environments around local places geared to extended family living or just to provide quiet locations away from through traffic.

This option delivers lots for large houses on a single level with multiple car parking and large backyards. It therefore caters for the extended families rather than small unitary families.

This delivers outcomes with quiet shared street environment which offer much more than infill housing hidden away behind other houses.

The street environment can be softened with local secluded places where paving changes to create a 'place' and trees/planting to create a separate identity

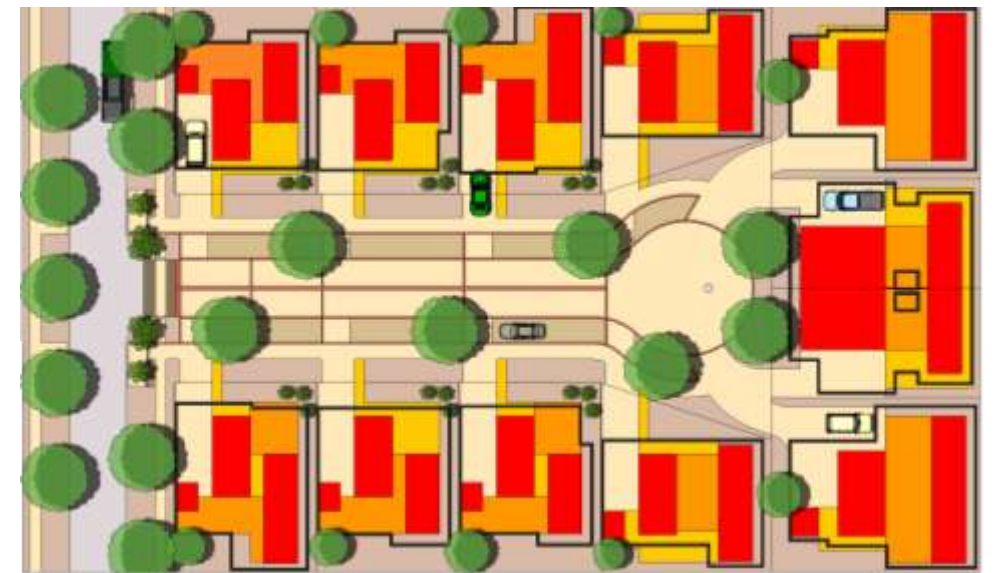
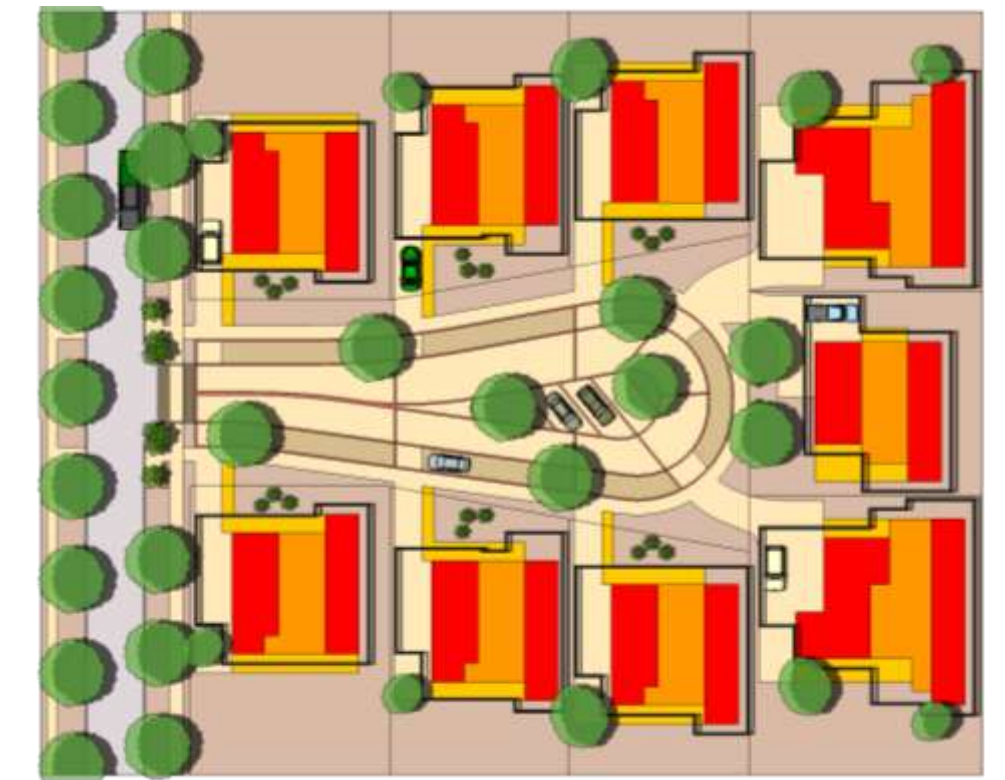
– Medium Density Residential 20-30 units per ha

This selection will still deliver potentially medium to large single storey houses on smaller sections, with the potential to have two units on the outside corners if needed

– High Density Residential 30+ units per ha

This category of housing development should be limited to selected core areas in and around nodes. This density mostly provides for semi detached units and apartments which could be located on larger sites with internal circulation of vehicles and pedestrians. The accommodation can come with or without shared facilities like pools and open space elements

Low density example. Image on right show a diagram of the houses with breezeways (orange) between living areas and bedroom areas (red) with no sun on walls & informal street layout in concrete with brick liners.

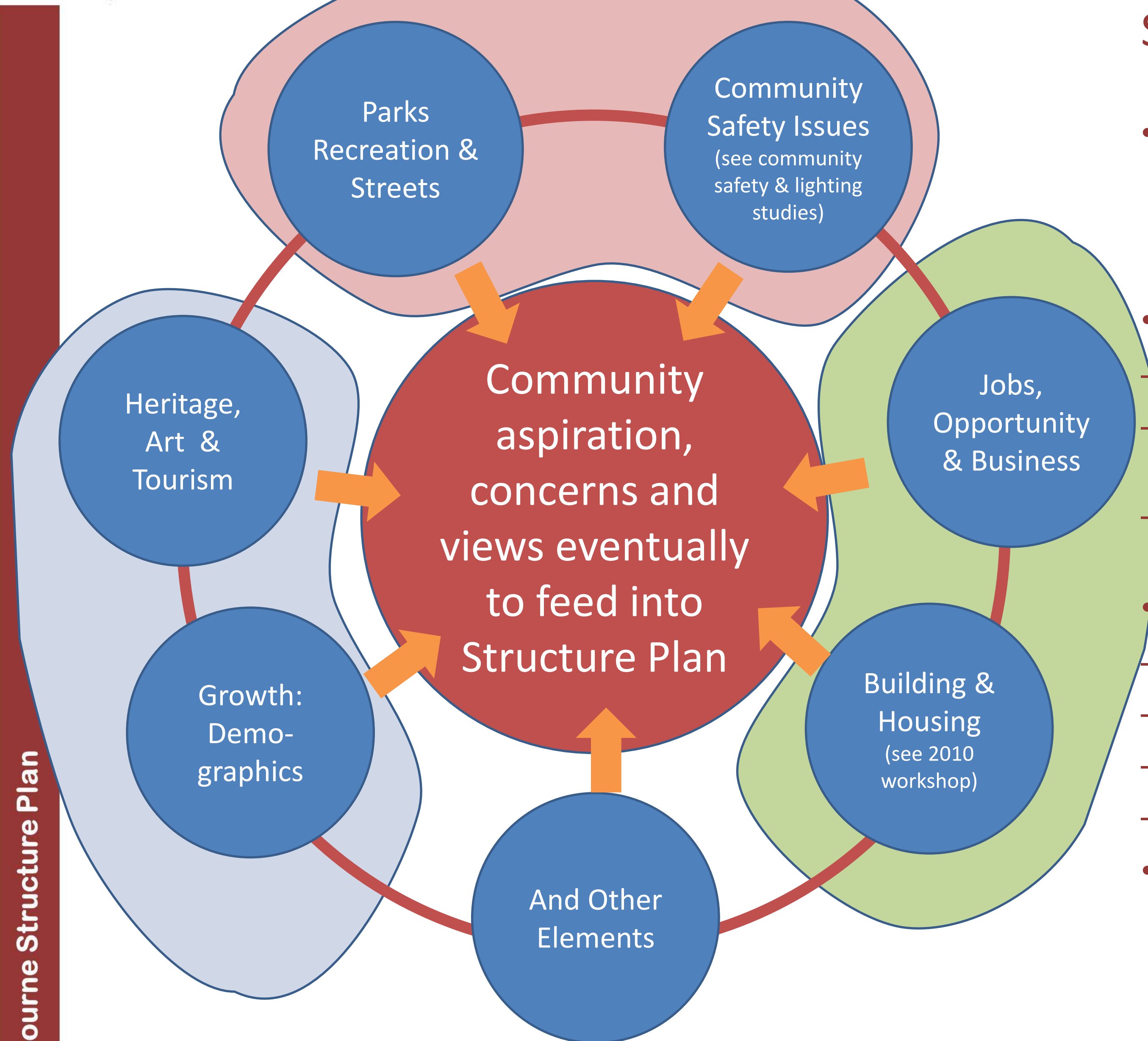


Medium density example. Houses also with lockable breezeways with no sun on walls & informal street layout where families can meet and children play



PART 9: Consultation approach

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Structure Plan** Consultation

- Approach : solicit views separately on 3 key component sets relevant to community, testing and “building” a comprehensive plan with it
- Use independent facilitator to:
 - tease out issues
 - talk one on one with key stakeholders – respect business confidence
 - ensure to meet with affected parties well in advance to secure key sites/concepts
- Elements of consultation
 - Use focus groups where appropriate
 - Consult key stakeholders
 - Provide feedback
 - Be available to talk to
- Use feedback to adapt/build the structure plan in light of foregoing analysis, aspirations, concerns and views

* Consultation should focus on key elements as exposed by the analysis, or other issues that come to light in the consultation conversations with a direct bearing on planning

**Consultation will solicit a wide range of issues. It is important to take note of overlapping elements and other concerns . Consultation can deal with 3 key clusters of issues as indicated.

Consultation approach: Community input

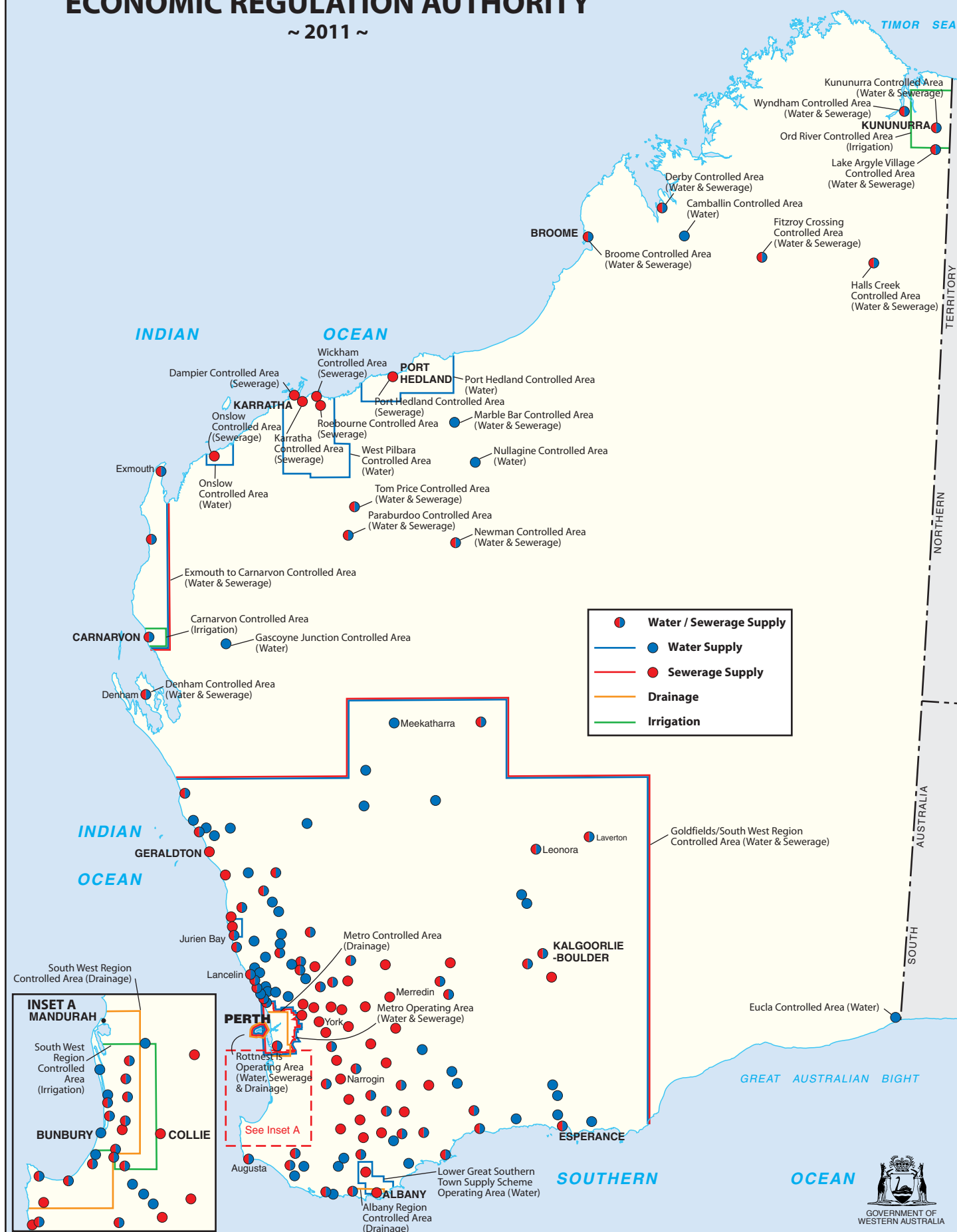
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- Outcomes are only valued if the community(-ies) take ownership
- It is essential to facilitate understanding of various ‘competing’ activities and pressures in the development process – the ‘*big picture*’
- The question is: what are the local issues and potential challenges in the context of the evolving sub-region?
 - Community stewardship – obtain community input - identify issues and formulate solutions from community’s perspective (e.g. on liveability, housing quality, site maintenance, providing supporting activities, etc
 - Cheeditha community – can/will they be absorbed into Roebourne. If so would they want a special location. Knowing it at an early stage will help facilitate appropriate accommodation and supporting services
 - Work camps– how do these impact on the local community - any special provisions to be catered for?
 - Key critical activity/services availability which may impact/improve local liveability
 - Potential future street network/walkability qualities – redefining neighbourhoods and focal points and identify qualities needed to support walkability in this harsh climate
- With these and other inputs, generate design options and examples of where and how development elements can fit and how the present structure will need to evolve
- Demonstrate how all the ‘building blocks’ would eventually fit together using a placemaking approach combined with a community sensitive design vernacular

Appendix B – Services map (Economic Regulatory Authority)

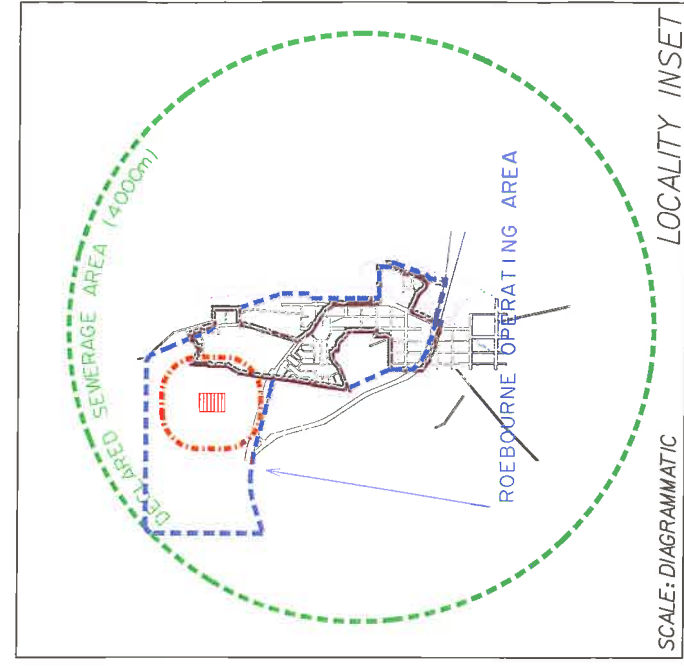
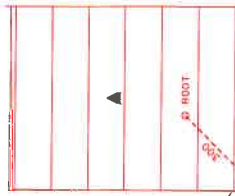
Western Australia

~ 2011 ~



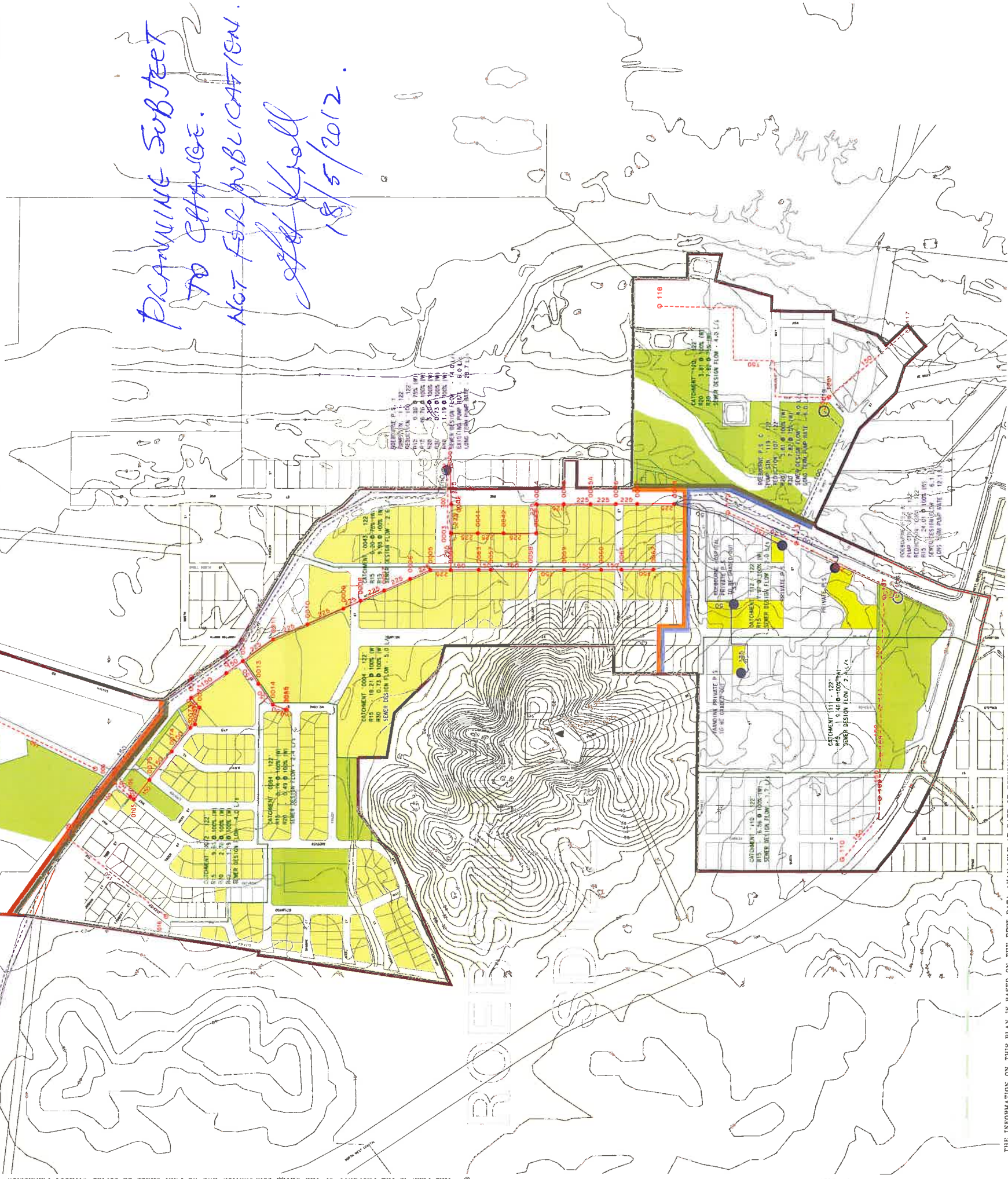
Appendix C – Wastewater planning map (Water Corporation)

ROEBOURNE
WASTEWATER
TREATMENT
PLANT



The scheme planning shows normal sewer design flows as set out in the Sewerage Manual. These are based on full development of the specified land zoning, but make no allowance for additional inflow/infiltration.

In this documentation project, no attempt has been made to review the impact of ultimate flows on the existing scheme.



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LEGEND	NOTATION	SHEET INDEX
EXISTING PUMPING STATION	PARKS AND PUBLIC OPEN SPACE	100 4 075% (W)
EXISTING PRESSURE MAIN	EXISTING SEWERED AREAS	100 4 075% (W)
EXISTING GRAVITY SEWER	SEWERED BY PRIVATE PS	100 4 075% (W)
PROPOSED PUMPING STATION	NODE CATCHMENT	100 4 075% (W)
PROPOSED PRESSURE MAIN	PS AND SEWER CATCHMENTS	100 4 075% (W)
PROPOSED GRAVITY SLUR	SEWER DISTRICT CATCHMENT	100 4 075% (W)
	WWTP CATCHMENT	100 4 075% (W)



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WASTEWATER SCHEME PLANNING SERIES			
ROEBOURNE - SD122			
CONCEPTUAL PLANNING			
LONG TERM SCHEME			
PLANNING BY	DESIGNED BY	ACCEPTED BY	DATE
G. PEDERSEN	G. PEDERSEN	T. ZHENG	27 MAY 2010
SCALE	1:5000	VERSION	1.000

GHD


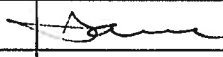
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