Feasible Alternatives Assessment Report – Flood Hazard

Barcaldine Region Planning Scheme

Prepared for

Barcaldine Regional Council

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BARCALDINE REGIONAL COUNCIL

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1 Purpose of Report

The purpose of this report is to outline Barcaldine Regional Council's proposed planning scheme approach to reducing risks to persons or property resulting from flooding hazards at Alpha.

The proposed Barcaldine Region Planning Scheme ('the proposed planning scheme') includes provisions to effectively relocate the town of Alpha to ensure that future development occurs on land that is not affected by the High and Extreme Hazard Area. The proposed planning change seeks to reduce the flood risk to persons and property within Alpha.

This report considers alternative approaches to those planning changes contained in the proposed planning scheme to determine their feasibility, as required by Section 30(4)(e) of the *Planning Act 2016* ('the Planning Act').

2 Description of Sites Affected by the Proposed Planning Change

The proposed planning change seeks to introduce the Alpha High and Extreme Hazard Area to the Flood Hazard Overlay Map which encompasses a majority of the township of Alpha. The real property description and site address of all land affected by the proposed planning change is listed in **Appendix B**. This land is hereafter referred to as 'the affected land'. The affected land is also shown on Map 1 in **Appendix A**.

The townships of Barcaldine, Aramac, Jericho and Muttaburra are also subject to risk associated with flooding however the risk is not considered to be of the same significance as Alpha. These townships are not considered to have experienced the same level of planning change as Alpha on the basis that current planning intent for this land has not substantially changed between the current planning schemes (Aramac Shire Planning Scheme 2006, Barcaldine Shire Planning Scheme 2006 and Jericho Shire Planning Scheme 2006) and the proposed planning scheme.

It is specifically noted that the provisions of the Natural Hazards Overlay of the proposed planning scheme are drafted in such a manner that will allow for the ongoing and future use of land in these townships (subject to design requirements), despite the natural hazard risk. Further discussion of the townships of Barcaldine, Aramac, Jericho and Muttaburra is therefore not provided in this report.

3 Anticipated Risks to Affected Properties due to the Flood Hazard

The best available flood hazard information for the Alpha township is a report prepared by Connell Wagner for Barcaldine Regional Council titled “Alpha Town Flood Mitigation Study” and dated 2 July 2008.

The scope of the study included the development of a two-dimensional hydraulic model of Alpha Creek and its floodplain to the confluence with Native Companion Creek. The model was calibrated against the following flood events:

- April 1990 flood event (10.26 metres [351.86 metres AHD] at BoM Gauge 35229)
- February 1997 flood event (7.45 metres [349.05 metres AHD] at BoM Gauge 35229)
- February 2003 flood event (7.5 metres [349.10 metres AHD] at BoM Gauge 35229)

It is acknowledged in the supporting flood study that both the 1997 and 2003 Flood Events did not indicate flood waters entering the township of Alpha. In the 1990 Flood Event, an existing levee built in 1983 was breached and the maximum depth of flood waters recorded in the township of Alpha was approximately 2.5 metres.

Limited available data (i.e. rainfall and stream gauge records) provided a challenge in modelling the design flood events. The flood study determined that the historical 1990 Flood Event was equivalent to a 100 year ARI design event and that the 1997 and 2003 Flood Events were equivalent to smaller than a 50 year ARI design event.

A hazard review of the 1990 Flood Event is represented in a preliminary flood hazard map for the town area of Alpha, which shows the majority of the town centre within the extreme flood hazard area (refer to Map 2, **Appendix A**). The velocities were in the order of 0.4 – 0.8 m/s (medium to high hazard) however the flood depths at approximately 2.5 metres represent a high to extreme flood hazard.

4 Existing Uses

Map 2 of **Appendix A** comprises a recent aerial photograph of the land affected by the proposed changes. As indicated on this map the predominant use of the land is for the township, being residential, commercial and industrial land uses. Alpha State School is situated towards the eastern extent of the township.

5 Existing Planning Scheme Arrangements

5.1 Overview

This section of the report describes the current intended planning outcomes for the town of Alpha.

The town of Alpha is currently under the jurisdiction of the Jericho Shire Council Planning Scheme 2006 ('the existing planning scheme'). The majority of the affected land is included in one of the following zones, as shown in Map 5 of **Appendix A**:

- Commercial Zone
- Industrial Zone
- Open Space and Recreation Zone
- Urban Zone
- Rural Zone

The balance of the town comprises land within the Community Facilities, Industrial Investigation, Rural, Emerging Communities and Recreational and Open Space Zones.

The current intended outcomes for the aforementioned zones are expressed in the zone intent and purpose of the relevant zone code. These elements of the existing planning scheme are reproduced below (direct extract in italics). Where flood hazard is addressed in the codes, bold emphasis is added.

5.2 Commercial Zone

The Commercial Zone is intended primarily for commercial activities. "Commercial activities" is defined by the existing planning scheme as activities which involve the provision of goods, food, services or entertainment. Such uses may include a catering business, shop, tourist facility, office and hotel.

The purpose of the zone, as articulated in the zone code, is replicated below.

(1) The Shire has an appropriate land use structure that is in accordance with the environmental characteristics of the locality and that avoids conflict between incompatible "uses".

(2) A range of "commercial activities" are allowed for, to ensure the Commercial "Zone" continues as the main commercial focus for the Shire.

(3) The existing Commercial area is consolidated.

(4) Within the Commercial "Zone", "development":

(a) contributes to an identifiable, vibrant, compact business core servicing the Shire;

(b) is located, designed and operated in a manner that protects and enhances commercial scale, intensity, form and character;

(c) maintains the environment, including soil, air and water compatible with healthy natural systems and public health and safety;

(d) does not prejudice or impact adversely on other "uses" including those within other "Zones";

(e) has an appropriately designed access to the road network and traffic generated by the development does not impact adversely on the local road network;

(f) protects areas and sites of conservation importance, including cultural and high landscape values;

(g) protects and maintains the integrity of the Lake Eyre Basin;

(h) is undertaken in an orderly and logical sequence to achieve an efficient provision of infrastructure, including social infrastructure;

(i) is located and designed in ways that minimise the need for flood and landslide mitigation, and to protect people and premises from such natural events;

(j) has water supply, stormwater disposal, sustainable effluent and waste disposal and power, to appropriate standards, adequate for the "use"; and

(k) does not impact adversely on infrastructure.

(5) *Within the Commercial "Zone", the Commercial "Zone" Code allows for:*

(a) "community oriented activities", necessary to service the town and its surrounding rural area; and

(b) *"tourist facilities" and "visitor accommodation".*

5.3 Industrial Zone

The Industrial Zone is intended primarily for industrial activities. "Industrial activities" is defined by the existing planning scheme as activities which involve manufacturing, production, servicing, storage and distribution of goods, articles, equipment or vehicles. The types of activities may include extractive and noxious industries, service station, storage facility and transport terminal.

The purpose of the zone, as articulated in the zone code, is replicated below.

(1) The Shire has an appropriate land use structure that is in accordance with the environmental characteristics of the locality and that avoids conflict between incompatible "uses".

(2) The Industrial "Zone" continues to accommodate a wide range of "industrial activities".

(3) Within the Industrial "Zone" "industrial activities":

(a) are consolidated, within an identifiable area, so as to ensure other "uses" in the locality are protected from any adverse impacts associated with "industrial activities"; and

(b) are not prejudiced by the intrusion of incompatible "uses".

(4) Within the Industrial "Zone", "development":

(a) is located, designed and operated in a manner that maintains the industrial scale, intensity, form and character;

(b) maintains the environment, including soil, air and water compatible with healthy natural systems and public health and safety;

(c) does not prejudice or impact adversely on other "uses" including those within other "Zones";

(d) has an appropriately designed access to the road network and traffic generated by the development does not impact adversely on the local road network;

(e) protects areas and sites of conservation importance, including cultural and high landscape values;

(f) protects and maintains the integrity of the Lake Eyre Basin;

(g) is undertaken in an orderly and logical sequence to achieve an efficient provision of infrastructure;

*(h) **is located and designed in ways that minimise the need for flood and landslide mitigation, and to protect people and premises from such natural events**;*

(i) has water supply, stormwater disposal, sustainable effluent and waste disposal and power, to appropriate standards, adequate for the "use"; and

(j) does not impact adversely on infrastructure.

5.4 Open Space and Recreation Zone

The Open Space and Recreation Zone is intended for open space and recreation activities, parks and areas of conservation value. "Open space and recreation activities" is defined by the existing planning scheme as activities involving sport or active or passive recreation carried out either indoors or outdoors.

The purpose of the zone, as articulated in the zone code, is replicated below.

(1) The Shire has an appropriate land use structure that is in accordance with the environmental characteristics of the locality and that avoids conflict between incompatible "uses".

(2) The Open Space and Recreation "Zone" ensures:

(a) the continued conservation of protected areas; and

(b) areas remain for the provision of recreational facilities.

(3) "Development" in protected areas:

(a) results in minimal impacts on the natural environment; and

(b) maintains conservation, biodiversity and habitat values.

(4) *"Development" in areas other than protected areas:*
- (a) *is located, designed and operated in a manner that protects the local amenity;*
- (b) *does not prejudice or impact adversely on other "uses" including those within other "Zones";*
- (c) *has an appropriately designed access to the road network and traffic generated by the development does not impact adversely on the local road network and local amenity;*
- (d) *has water supply, stormwater disposal, sustainable effluent and waste disposal and power, to appropriate standards, adequate for the "use";*
- (e) *maintains the environment, including soil, air and water, compatible with healthy natural systems and public health and safety;*
- (f) *is undertaken in an orderly and logical sequence to achieve an efficient provision of infrastructure;*
- (g) *protects areas and sites of conservation importance, including cultural and high landscape values;*
- (h) *protect and maintain the integrity of the Lake Eyre Basin;*
- (i) ***is located and designed in ways that minimise the need for flood, bushfire and landslide mitigation, and to protect people and premises from such natural events**; and*
- (j) *does not impact adversely on infrastructure.*

5.5 Rural Zone

The Rural Zone is intended primarily for rural uses and associated activities.

The purpose of the zone, as articulated in the zone code, is replicated below.

(1) *The Shire has an appropriate land use structure that is in accordance with the environmental characteristics of the locality and that avoids conflict between incompatible "uses".*
(2) *The Rural "Zone" retains its viability as an area of primary production.*
(3) *Future "Rural activities" are appropriately located within the Rural "Zone" and existing and future "Rural activities" are not prejudiced by inappropriate development.*
(4) *Within the Rural "Zone", "development":*
- (a) *maintains the environment, including soil, air and water, compatible with healthy natural systems and ensures public health and safety;*
- (b) *protects Good Quality Agricultural Land (GQAL) from fragmentation, alienation or encroachment of incompatible land "uses" in accordance with State Planning Policy 1/92 – Development and Conservation of Agricultural Land;*
- (c) *is located, designed and operated in a manner that protects and enhances the predominant rural scale, intensity, form and character;*
- (d) *maintains the rural amenity;*
- (e) *does not prejudice or impact adversely on other "uses" including those within other "Zones";*
- (f) *does not prejudice extractive or mining resources;*
- (g) *has an appropriately designed access to the road network, and traffic generated by the development does not impact adversely on the local road network;*
- (h) *protects areas and sites of conservation importance, including cultural and high landscape values;*
- (i) *protects and maintains the integrity of the Lake Eyre Basin;*
- (j) *is undertaken in an orderly and logical sequence to achieve an efficient provision of infrastructure;*
- (k) ***is located and designed in ways that minimise the need for flood, bushfire and landslide mitigation, and to protect people and premises from such natural events**;*
- (l) *has water supply, stormwater disposal, sustainable effluent and waste disposal and power, to appropriate standards, adequate for the "use"; and*
- (m) *does not impact adversely on infrastructure.*

(5) *Within the Rural "Zone", the Rural "Zone" Code allows for:*
- (a) *tourist related uses ("bed and breakfast premises" and "visitor accommodation") and "home businesses" where they are of a small scale and are compatible with surrounding "uses"; and*

(b) *limited industrial "uses", where it can be demonstrated those "uses" are associated with rural production and cannot reasonably be established in the Industrial "Zone".*

5.6 Urban Zone

The Urban Zone is intended primarily for residential uses.

The purpose of the zone, as articulated in the zone code, is replicated below.

1. *The Shire has an appropriate land use structure that is in accordance with the environmental characteristics of the locality and that avoids conflict between incompatible "uses".*
2. *The Urban "Zone" remains for a range of "residential activities" and housing types.*
3. *Existing urban areas are consolidated and "residential activities" are not prejudiced by inappropriate development.*
4. *Within the Urban "Zone", "development":*
   (a) *enhances the residential amenity;*
   (b) *maintains the environment, including soil, air and water compatible with healthy natural systems and public health and safety;*
   (c) *is located, designed and operated in a manner that protects and enhances residential scale, intensity, form and character;*
   (d) *does not prejudice or impact adversely on other "uses" including those within other "Zones";*
   (e) *has an appropriately designed access to the road network and traffic generated by the development does not impact adversely on the local road network;*
   (f) *protects areas and sites of conservation importance, including cultural and high landscape values;*
   (g) *protects and maintains the integrity of the Lake Eyre Basin;*
   (h) *is undertaken in an orderly and logical sequence to achieve an efficient provision of infrastructure, including social infrastructure;*
   (i) ***is located and designed in ways that minimise the need for flood and landslide mitigation, and to protect people and premises from such natural events**;*
   (j) *has water supply, stormwater disposal, sustainable effluent and waste disposal and power, to appropriate standards, adequate for the "use"; and*
   (k) *does not impact adversely on infrastructure.*
5. *Within the Urban "Zone", the Urban "Zone" Code allows for:*
   (a) *tourist related "uses" ("bed and breakfast premises", "visitor accommodation") where they are of a small scale and are compatible with surrounding "uses"; and*
   (b) *"community oriented activities", necessary to service the town and its surrounding rural area, where they are of a small scale and are compatible with surrounding "uses".*

5.6 Summary

A common outcome for each of the relevant zones, as emphasised above, is that development is located and designed in ways that minimise the need for flood, bushfire and landslide mitigation, and to protect people and premises from such natural events.

Similarly, each zone code has a Performance Criterion which requires that:

"Premises are designed and located so as:

(a) not to be adversely impacted upon by flooding;
(b) to protect life and property; and
(c) not to have an undesirable impact on the extent or magnitude of flooding."

While the outcomes of the relevant zone codes regulate the way in which development must respond to the flood hazard, the current planning scheme contemplates that urban uses consistent with the zones would occur within the affected land.

6 Proposed Planning Change

6.1 Overview

This section of the report identifies and describes the trigger for the proposed planning change and the effects of the change on the existing situation.

6.2 Description of the Proposed Change

The proposed planning change seeks to reduce, as far as practicable, the risk of flood hazard and its impact on persons and property within the town of Alpha. The policy direction responds to the effects of major flood events in the region as discussed in Section 6.3 below, and can assist the town to remain resilient through demonstrating a feasible response to the hazard.

The proposed change seeks to limit development within the existing township and provide overarching policy support to a progressive relocation of the township, the intention of which is to significantly reduce the risk of flood hazard to persons and property through avoidance of the hazard.

6.3 Reason for the Proposed Change

The township of Alpha is located along the western bank of Alpha Creek, which flows north from its confluence with Native Companion Creek (approximately 15 kilometres to the south).

A number of major flood events have affected the township over the past 70 years (see section 3 of this report for further discussion), including a major event in 1990 which had an estimated maximum flood height of 10.26 metres. This estimated flood height equated to a peak depth of flood waters of 2.5 metres within the town.

In drafting the proposed planning scheme, Council is required to assess the risk to persons and property, and reduce that risk to a level that is manageable and tolerable in accordance with the State Planning Policy 2017 ('the SPP').

The existing potential flood risk to the township of Alpha is significant and the proposed planning change, as described in Section 6.2 of this report, has been undertaken to appropriately respond to the potential flood risk, having regard to the SPP.

These changes are discussed in detailed in section 6.4.

6.4 How the Proposed Change is Reflected in the Proposed Planning Scheme

The proposed planning change, with specific reference to the township of Alpha, are reflected in those elements of the proposed planning scheme listed below.

Planning Scheme Component	Relevant Section / Element
Strategic Outcomes	
Regional Outcomes	Section 3.2.1 (18)
Alpha – Town Outcomes	Section 3.4.1 (5), (6)
Alpha – Land Use Outcomes	Section 3.4.2 (2), (4), (5), (7), (10)
Strategic Outcome Map for Alpha Town to include a Limited Development Area	Strategic Outcome Map SOM-2
Natural Hazard Overlay	
Categorisation of all development in the Natural Hazards Overlay – Alpha High and Extreme Flood Hazard Overlay Area as Assessable Development that is subject to Impact Assessment	Section 5.8
Natural Hazards Overlay Code	Purpose of the Code Performance Outcomes 8, 9, 10 and 11
Mapped Alpha High and Extreme Flood Hazard Area	Overlay Map OM-2.1

Each of these components are discussed in greater detail in the following sub-sections.

6.4.1 Strategic Outcomes

The Strategic Outcomes set the policy direction for the proposed planning scheme. Specific to the town of Alpha, the Strategic Outcomes identify Regional Outcomes, Town Outcomes and Land Use Outcomes which support the ultimate relocation of the township due to the known severe risk of flood hazard. The specific provisions are replicated below:

Section	Extract
Section 3.2 'The Barcaldine Region'	
3.2.1 'Regional Outcomes' The Environment and Natural Hazards	*(18) Development supports the progressive improvement in the community's resilience to flood hazards. Development outcomes on flood-affected land, including development siting, layout, design, access and evacuation options, will be carefully managed so that risk to personal safety, property and the environment during future flood events is minimised. New development is preferred to be located on land that is not flood affected, supporting the gradual and long-term movement of the region's towns away from flood-affected land.*
Section 3.4 'The Town of Alpha'	
3.4.1 'Town Outcomes'	*(5) Future development in Alpha is to respond to the legacy issue of the town's development on the floodplain of Alpha Creek. In response to the flood hazard risk, existing development within the floodplain is to be relocated to flood-free land. The relocation of the town will occur over a long-term planning horizon that will exceed the lifetime of this Planning Scheme.*
	(6) The Local Government Infrastructure Plan will facilitate new development through the relocation of the town in response to flood hazards.
3.4.2 'Land Use Outcomes'	*(2) The Limited Development Area identifies land that is located within the Alpha Creek floodplain and is subject to flood hazards. New development is not located within the Limited Development Area. The continued improvement and adaptive re-use of existing buildings in the Limited Development Area is supported where the development is compatible with the nature and extent of flood hazard risk.* *Note – Examples of instances where development may be considered to be compatible with the nature and extent of the flood hazard risk, include:* • *House renovations;* • *Upgrading rural infrastructure at the Alpha Dip Yards;* • *Changing the use of existing premises from one business to another; and* • *Minor building extensions where engineered to withstand flood impacts.*
	(4) The Town Expansion Area provides flood free land that is intended to accommodate the long-term relocation of the Alpha township. Any interim development of this area should not prejudice this long-term land use intent.
	(5) The Town Expansion Area includes the Existing Golf Course, which will be relocated to the Future Golf Course site to facilitate development of the Town Expansion Area for township purposes.
	(7) The Future Alpha Investigation Area protects land for the future expansion of the Alpha township and is intended to accommodate growth from the resources sector.
	(10) The existing urban form and land use pattern of development in the Town Centre will be maintained until such time that the Alpha township is relocated to the Town Expansion Area.

In summary, the Strategic Outcomes state that:

(a) Future development in Alpha is to respond to the legacy issue of the town's development on the floodplain of Alpha Creek.

(b) In response to the flood hazard risk, existing development within the floodplain is to be relocated to flood-free land.

(c) The relocation of the town will occur over a long-term planning horizon that will exceed the lifetime of the planning scheme.

(d) The Local Government Infrastructure Plan will facilitate new development through the relocation of the town in response to flood hazards.

6.4.2 Natural Hazards Overlay

The proposed planning scheme includes the Natural Hazards Overlay. The overlay comprises:

(a) provisions which categorise development where located within the mapped extent of the overlay, in Part 5 of the proposed planning scheme;

(b) a Natural Hazards Overlay Code in Section 7.2.3 of the proposed planning scheme; and

(c) mapping to support the aforementioned provisions, which is provided as part of Schedule 2 of the proposed planning scheme.

Each of these aspects of the overlay is discussed below.

6.4.2.1 Mapping

The affected land is included within the Alpha High and Extreme Flood Hazard Area by the Flood Hazard mapping for the Natural Hazards Overlay. This mapping is shown in Map 3 of **Appendix A**.

6.4.2.2 Categories of Development and Assessment

Table 5.8.1 of the proposed planning scheme identifies that development within the Alpha High and Extreme Flood Hazard Area is categorised as Assessable Development that is subject to Impact Assessment.

The effect of this change is that any proposed development will be subject to assessment against the entire planning scheme and to the assessment and decision process for Impact Assessment under the Planning Act. Of specific note is the requirement to undertake statutory public notification and the appeal rights of any person who makes a properly made submission. Assessable Development subject to Impact Assessment is the "highest" category of development and assessment that may be used in a planning scheme, noting that under Section 44(5)(a) of the Planning Act there are currently no circumstances under which a planning scheme may categorise development as Prohibited Development.

6.4.2.3 Overlay Code

The purpose of the Natural Hazards Overlay Code is to first avoid, then minimise and mitigate risk to people, property and essential infrastructure systems from flooding and bushfire. The code has been discussed to the extent it relates to flooding and specifically the proposed planning change.

The purpose of the code is to be achieved through the following overall outcomes (emphasis added):

(a) Development in a natural hazard area is avoided or managed to protect people and property and enhance the community's resilience to flooding and bushfire;

(b) Development does not increase the potential for damage on the site or to other properties or infrastructure;

(c) **There is no fragmentation of land or further intensification of residential, commercial, retail and industrial uses within the Alpha High and Extreme flood hazard area as shown on Map OM – 2.1**;

(d) Reconfiguring of lots ensures that subsequent use and development of the created lots can:

1. occur outside of flood hazard areas and bushfire prone areas, or where it is not possible to avoid these areas, development mitigates the risk to people and property to an acceptable or tolerable level; and
2. support, and not hinder, disaster management capacity and capabilities.

(e) Development for essential community services and facilities only occurs within a natural hazard area where it is not practicable to locate the development elsewhere and the development is designed and constructed to maintain operation during a hazard event; and

(f) Natural processes and protective function of landforms and vegetation are maintained. (emphasis added)

The relevant Performance Outcomes and Acceptable Outcomes of the Natural Hazards Overlay Code for development within the Alpha High and Extreme Flood Hazard Area are PO8-PO11 and the related Acceptable Outcomes. These provisions are extracted below.

Performance Outcomes		***Acceptable Outcomes***	
Development within the Alpha High and Extreme Flood Hazard Area			
PO8	*Development does not involve the further intensification of land uses*	***AO8***	*Development does not involve new buildings or structures.*

Performance Outcomes		Acceptable Outcomes	
	and does not increase the risk to people and property. *Editor's note – A flood management plan can be undertaken in accordance with AO1.4 of the Natural Hazard Overlay Code.*		
PO9	*Development avoids the release of hazardous materials into floodwaters.*	***AO9***	*Hazardous chemicals and materials are not manufactured, handled or stored on flood prone land.*
PO10	*Development does not result in the creation of additional lots.*	***AO10***	*Reconfiguring a lot does not result in new lots.*
PO11	*Development does not materially impede the flow of floodwaters through the site or worsen flood flows external to the site.*	***AO11***	*Development does not involve any physical alteration to a watercourse (including vegetation clearing) or net filling exceeding 10m³.*

6.4.3 Summary

The proposed planning scheme provides a clear policy intent, through all levels of the scheme, that the development of the majority of sites in the town of Alpha will be restricted. The overarching purpose of each of the provisions discussed above is to protect people and property from a known severe flood hazard.

As the planning provisions serve to limit development in the township due to the flood risk, it follows that the reasonable outcome is to gradually relocate the town to land that is flood-free.

7 Consistency with State Planning Policy (July 2017)

The SPP includes the State Interest 'Natural Hazards Risk and Resilience'. This State Interest seeks to ensure that 'the risks associated with natural hazards, including the projected impacts of climate change, are avoided or mitigated to protect people and property and enhance the community's resilience to natural hazards.'

The SPP requires that:

(4) Development in bushfire, flood, landslide, storm tide inundation or erosion prone natural hazard areas:

- *(a) avoids the natural hazard area; or*
- *(b) where it is not possible to avoid the natural hazard area, development mitigates the risks to people and property to an acceptable or tolerable level.*

The approach taken by the proposed planning scheme of avoiding the establishment of new uses and lots in these areas aligns with the SPP Part E, State Interest – Natural Hazards, Risk and Resilience Policy, Section 4 (a) of avoiding the natural hazard areas.

The proposed planning change aligns with Policy 4 in that an assessment has been made that the known flood risk cannot be avoided or mitigated to the point where the residual risk is manageable by disaster management or mitigation works. The residual risk remains high and presents an unacceptable or intolerable risk to the community, persons and property.

8 Feasible Alternatives Assessment

8.1 Overview

This section of the report includes a summary and assessment of the alternatives proposed to avoid or mitigate the flood hazard on the township of Alpha. These options are described below.

8.2 Option 1 - Avoid Natural Hazard Area

Option 1 is to avoid the natural hazard area and to do so effectively requires the relocation of the township to flood free land.

Relocation of the township can be achieved through a combination of planning controls over the existing township and the new township area. The following two sub-options have been further examined:

- Gradual relocation of the township, with the existing township to be included in zones that maintain its function in the short-term.
- Gradual relocation of the township, with the existing township to be included in a Limited Development Zone (or similar) to prevent future development and encourage relocation.

These sub-options are discussed in the sub-sections below. The relocation of the town other than gradually is not considered as being feasible at a fundamental level and therefore has not been further considered.

8.2.1 Gradual Relocation and Maintain Zoning

The proposed planning scheme has adopted an approach whereby the Strategic Outcomes and associated mapping have identified an area to the west of the current township which is a Town Expansion Area and another area further west which is a Future Alpha Investigation Area. The zoning of the existing township has been maintained to allow ongoing (and limited future) use of the existing town area to a level that is appropriate in the short to medium term, having regard to flood risks.

This option is considered feasible in the long term for the following reasons:

1. The proposed town relocation is gradual, and the timeframe will extend beyond the life of the proposed planning scheme. In the interim, the town is required to continue operating until a viable relocation option becomes available.
2. The gradual relocation does not prevent the short to medium term continuation of land uses within the township, in accordance with the provisions of the proposed planning scheme.
3. The long term timeframe enables appropriate infrastructure planning and delivery to occur, as well as making appropriate arrangements for residents to acquire flood free lots.
4. The cost of the option can be distributed over a long time, reducing the financial burden on residents and Council.
5. The long term outcome is a fully functioning township that is not exposed to high or extreme flood hazard.

8.2.2 Gradual Relocation and Restrict Zoning

An alternative approach would be to include the land within the township in a Limited Development Zone (or similar) and prevent future development or works on land within the town. This option is not considered to be feasible as:

1. A Limited Development Zone is intended to capture land that is known to be affected by extremely unacceptable risks from a hazard such that it poses severe restrictions on the ability of the land to be developed for urban purposes. The zone would likely prevent the ongoing, short-term use (and reuse) of existing land and buildings in the established township which is considered unfeasible given the need to undertake the relocation of the town gradually. The existing township will need to continue to serve the existing and short term needs of the residents and town.
2. The use of a Limited Development Zone would likely erode the continuity of the existing township and lead to a piecemeal land use outcome, which would be detrimental to the local community, particularly given the intended gradual relocation.

3. Development can be appropriately limited and controlled through the Strategic Outcomes and the provisions of the Natural Hazards Overlay Code.

8.3 Option 2 - Mitigate Risks to People and Property

The previously cited report titled “Alpha Town Flood Mitigation Study”, prepared by Connell Wagner and dated 2 July 2008 (the Flood Study) investigated structural and non-structural flood mitigation works. These methods are discussed below as potential alternative options.

8.3.1 Structural Works

The Flood Study recommended eleven structural mitigation options, including:

- Removal of Central Railway (embankment and structures);
- Removal of Capricorn Highway (embankment and structures);
- Removal of both Central Railway and Capricorn Highway (embankment and structures);
- Replacement of/addition to existing railway culverts to increase waterway area;
- Levee construction along Alpha Creek overbank from the Capricorn Highway to the Central Railway;
- Levee construction along Alpha Creek overbank from the Capricorn Highway to the Central Railway extended parallel and to the north of the Central Railway;
- Excavation of overbank area D of Alpha Creek north of Alpha;
- Dedicated floodway between Swinburne and Moore Streets from Alpha Creek at the Road Bridge extended to the creek – 10 metre base, side slopes of 1 in 4, depth 2-4 metres;
- A combination of the dedicated floodway and levee A to B;
- Introduction of creek channel maintenance from the Capricorn Highway bridge to directly north of Neil Street;
- Introduction of creek channel maintenance from south of Alpha extending past Alpha Town.

In mitigating the risk of flooding in the town of Alpha, the structural solutions (including the construction of a levee or a dedicated floodway) were not considered to be feasible as:

1. There is available flood-free land situated to the west of the existing township which can accommodate a progressive relocation of the town.
2. Most option have limited capacity to effectively reduce the flood impacts or delay inundation. For example, the removal of embankments and additions of culverts assist in only the rising stages of a flood and the water quickly overtops and the flood hazard is only delayed.
3. A levee would assist in achieving flood immunity however a levee would need to be at a height of 2-3 metres. Further, its construction would be costly, divert the floodwaters to properties on the eastern bank of the creek and would remove any views towards the creek.
4. The physical construction of many of the solutions would be at significant financial cost to the ratepayers of the region. These costs would be associated with the required significant technical investigations, land resumption, construction and maintenance. Other factors include impacts on the environment, land stability and cultural heritage, together with costs and timeframes associated with any approvals. Given there are areas available for the future relocation of the township of Alpha, the cost benefit of such a significant investment would be unlikely to be justifiable.
5. A majority of the physical works would not improve the flood extent or flow patterns.

8.3.2 Non-Structural Measures

The non-structural recommendations to mitigate and minimise flood hazard are described below.

Type	Measures

Planning mechanisms	• Raising of flood prone properties; • Proposing a freeboard height above the highest known flood level to facilitate the passage of floodwaters without inundation to habitable floor levels; • Limit the filling of lots as this could have an adverse effect on surrounding properties if flood waters are redirected; • Limiting the intensification of uses on flood-affected lots;
Infrastructure	• Augmenting existing flood warning system; • Community awareness and training; • Implementing a 'Buy-back' or 'Land Swap' scheme of flood prone properties.

This option is considered feasible, to minimise the effects of flood hazard, for the following reasons:

1. Many of the options are able to be implemented immediately (short term) and at low cost.
2. The environmental impacts of the options are minimal and are unlikely to require extensive State or local government approvals, if any.
3. Training and awareness, once established, will be an ongoing activity for residents of the town and elected representatives.
4. House raising and building extensions / new buildings and houses above flood level will be a cost effective response to reducing the flood risk in the short to medium term.
5. Social benefits will be realised in a short timeframe and enable improvements to local development, transport, social and business infrastructure, and improve capacity to increase population.

Notwithstanding the viability of the non-structural measures, this option provides only a short-term solution and does not solve the long-term situation of flood hazard and ongoing extreme risk to person and property.

8.4 Summary

As outlined in the assessment contained herein, the gradual relocation of the township and the maintenance of a zoning in the existing township, to support short term land uses, is considered the most feasible option. This option has been adopted in the proposed planning scheme, as detailed in Chapter 6 of this report.

9 Conclusion

As demonstrated in this report, a number of options have been presented and assessed to determine what the feasible alternatives are to the proposed planning change.

The feasibility assessment concludes that the most appropriate way to manage and uphold the SPP intent to avoid or mitigate flood hazard, is to gradually relocate the township through strategic and considered planning decisions. Throughout the proposed planning scheme, provisions are included to address the risk of flood hazards for the existing town and to facilitate and provide support for the establishment of the township in an alternative, flood-free location.

The proposed planning scheme contains various provisions which integrate the consideration of the applicable hazards, through the use of an overlay which:

- identifies the extent of hazard areas;
- triggers specific categories of development and assessment; and
- applies relevant assessment benchmarks.

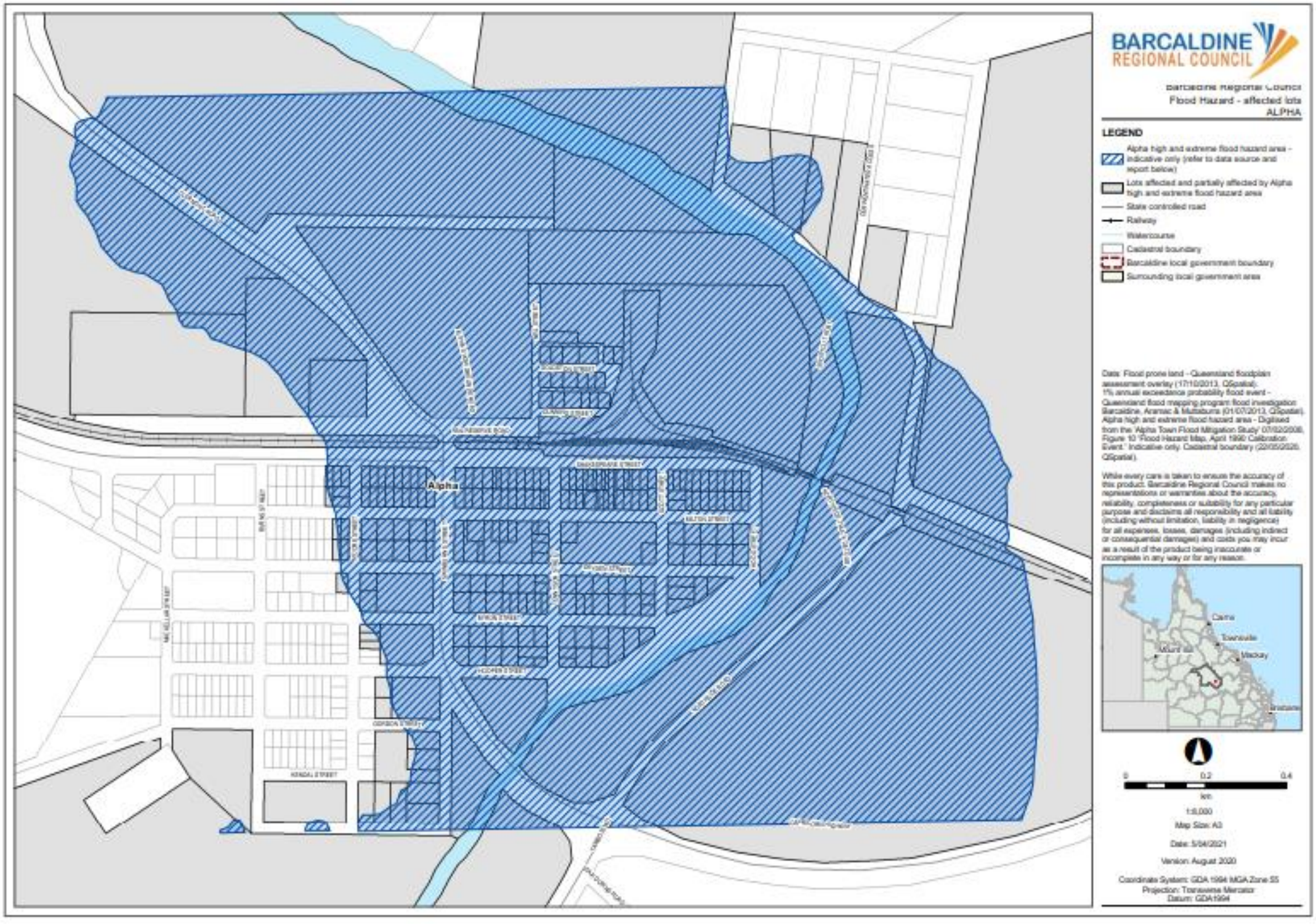
The provisions of the proposed planning scheme are intended to ensure that development is resilient to these natural hazards, and that future development will be required to consider and respond to the relevant natural hazards and the level of risk that they pose, while providing an opportunity for relocation of the town.

Barcaldine
Region
Planning
Scheme

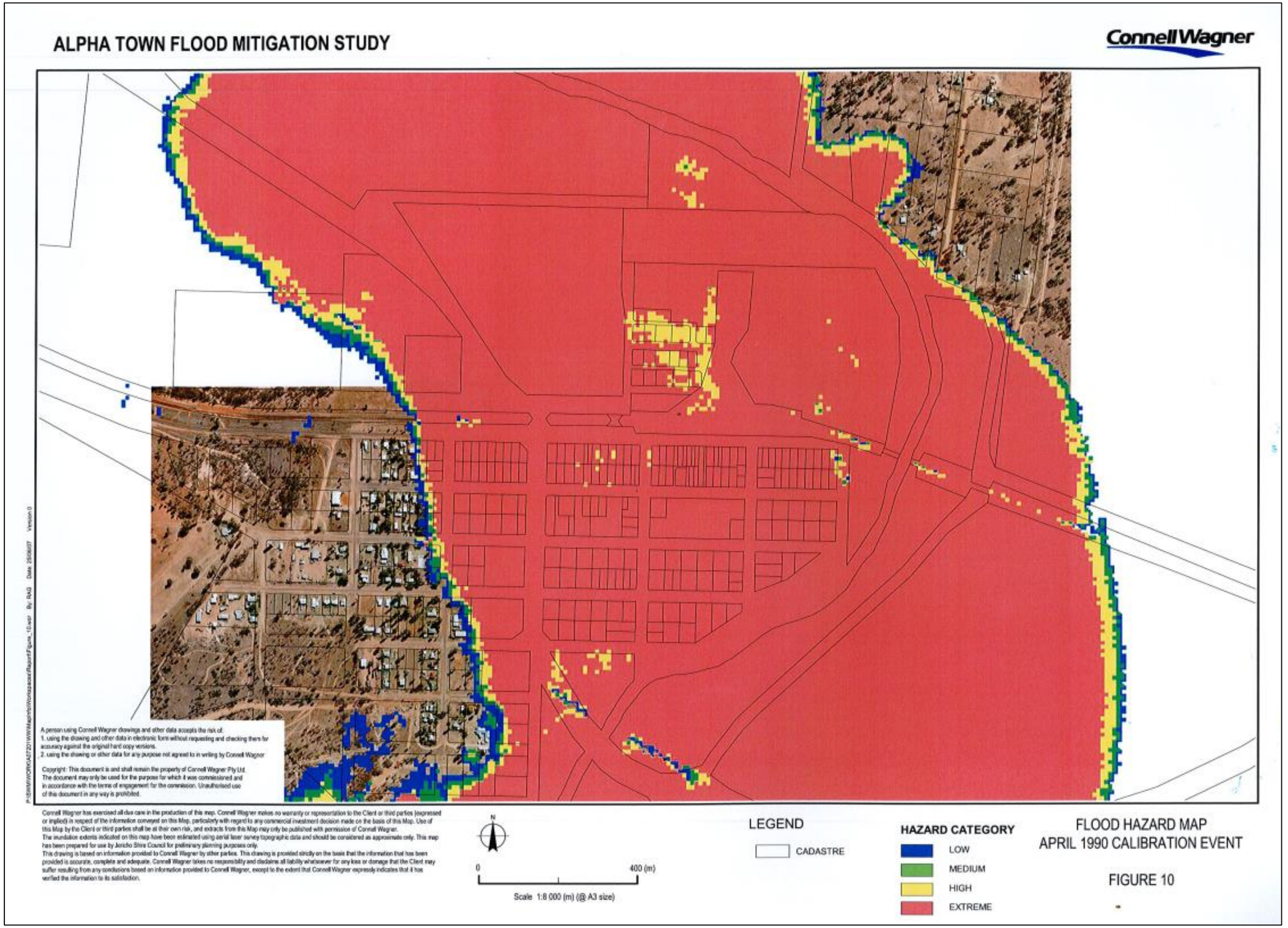
APPENDIX A

MAPS

Map 1: Affected Land



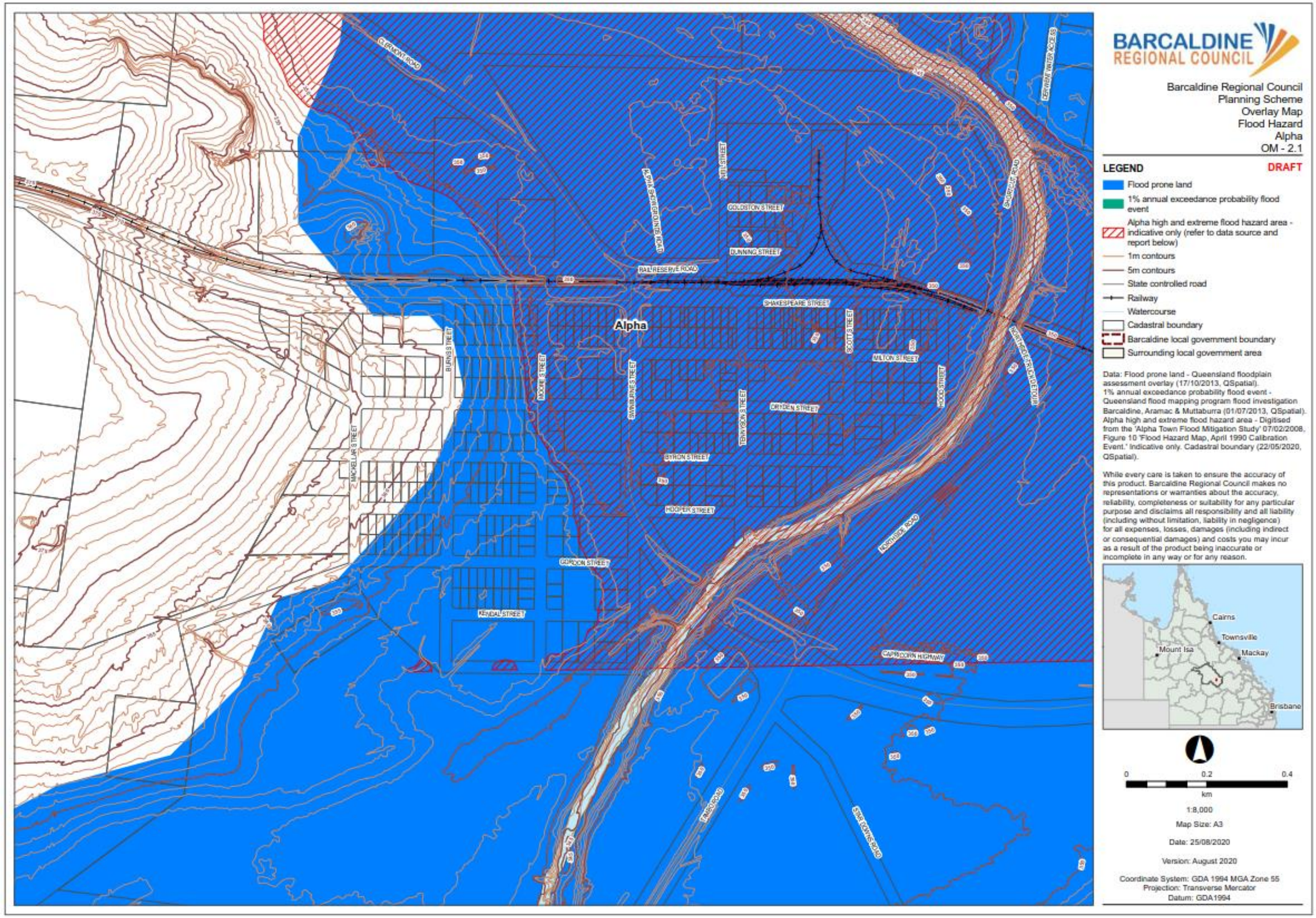
Map 2: Preliminary Flood Hazard Map (Connell Wagner, 2007)



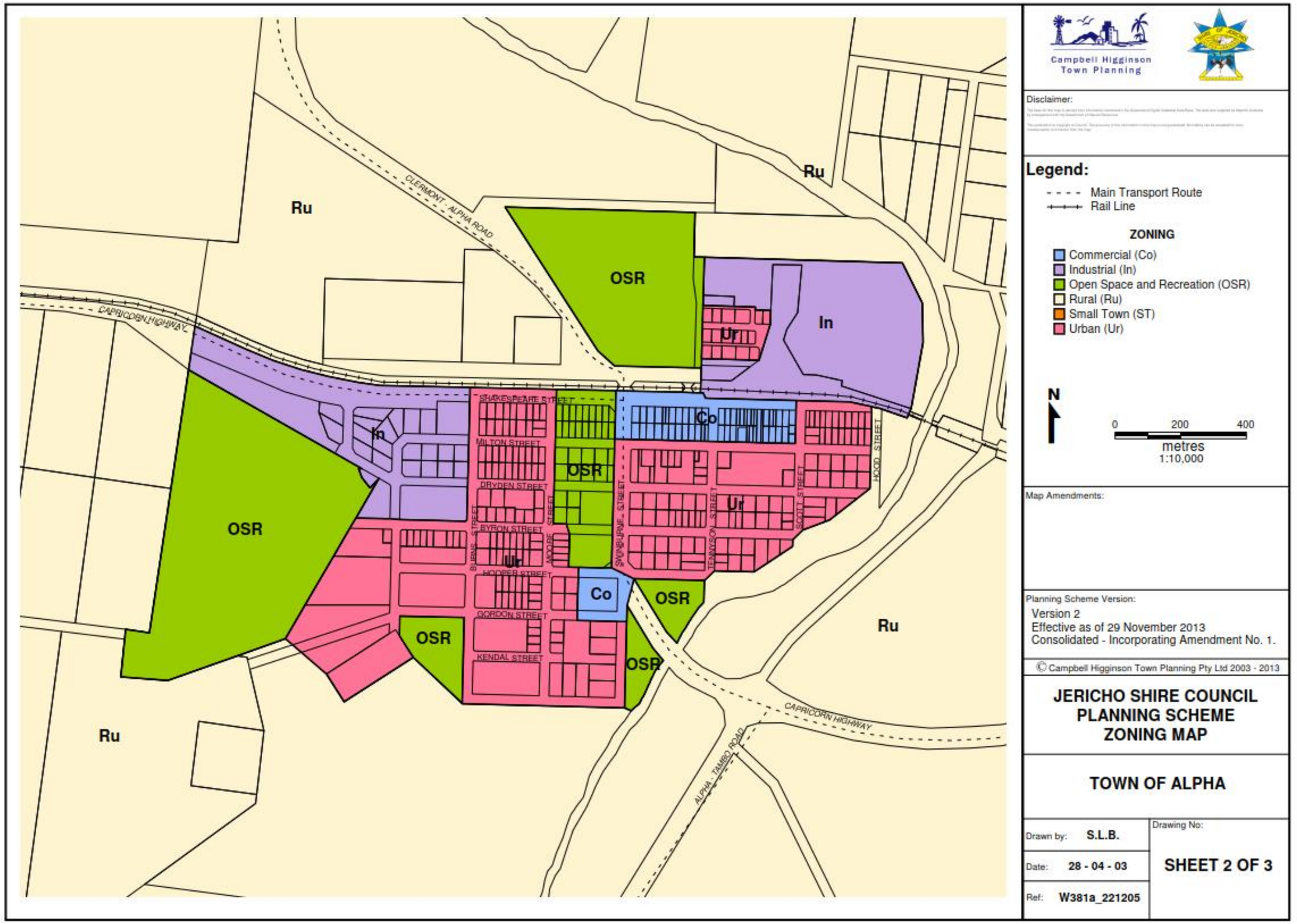
Map 3: Alpha Township (Source: QLD Globe, July 2020)



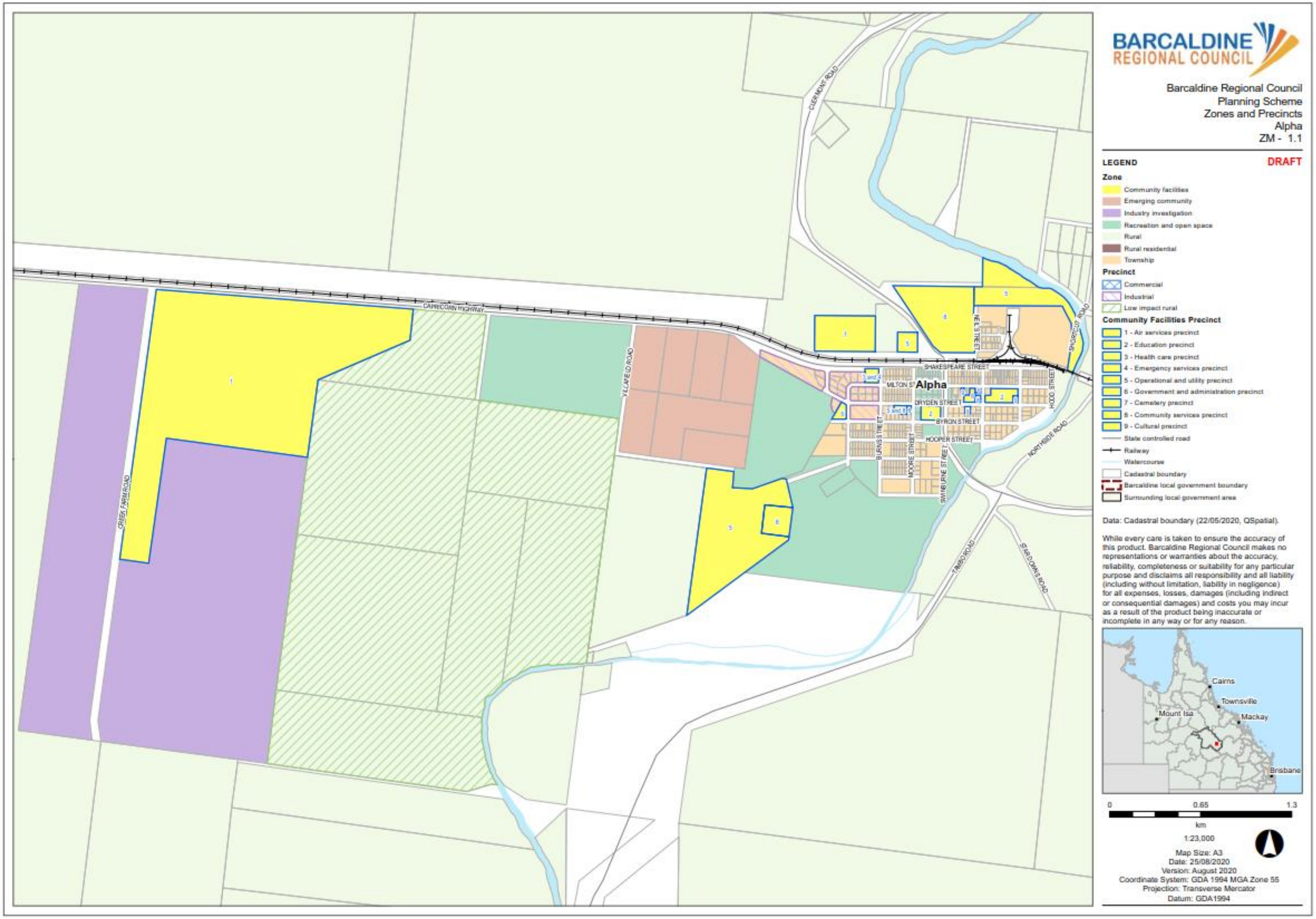
Map 4: Proposed Barcaldine Region Planning Scheme - Overlay Map for Flood Hazard



Map 5: Current Jericho Shire Council Planning Scheme 2006 – Zone Map (Alpha)



Map 6: Proposed Barcaldine Region Planning Scheme - Proposed Zone Map (Alpha)



Barcaldine
Region
Planning
Scheme

APPENDIX B

LIST OF AFFECTED PROPERTIES

LOT	PLAN	TENURE	Zone
315	A3011	Reserve	Recreation and open space
408	A3011	Reserve	Recreation and open space
316	A3011	Reserve	Recreation and open space
303	A3011	Reserve	Recreation and open space
2	A3018	Freehold	Township
14	A3017	Freehold	Township
15	A3017	Freehold	Township
806	A3011	Freehold	Township
809	A3011	Freehold	Township
906	A3011	Reserve	Recreation and open space
9	SP136857	Reserve	Community facilities
126	SP118529	Freehold	Rural
3	SP127184	Freehold	Township
114	A3011	Freehold	Township
1	RP603117	Freehold	Township
612	A3011	Freehold	Community facilities
6	SP136857	Reserve	Recreation and open space
102	SP259522	Freehold	Township
8	A30116	Freehold	Township
116	A3011	Freehold	Township
108	A3011	Freehold	Township
5	RP607621	Freehold	Township
2	SP120226	Freehold	Township
18	SP123579	Freehold	Community facilities
15	SP120226	Freehold	Township
8	SP120226	Freehold	Township
4	SP120226	Freehold	Township
1	AP5422	State Land	Township
105	A3011	Freehold	Township
212	A3011	Freehold	Township
13	A3014	Freehold	Township
2	RP607995	Freehold	Township
4	A3018	Freehold	Township
2	A3014	Freehold	Township
102	A3015	Freehold	Rural
2	SP136857	Reserve	Rural
243	SP108313	Lands Lease	Nil
704	A3011	Freehold	Township
710	A3011	Freehold	Township
405	A3011	Reserve	Recreation and open space
406	A3011	Reserve	Recreation and open space
407	A3011	Reserve	Recreation and open space
317	A3011	Reserve	Recreation and open space
319	A3011	Reserve	Recreation and open space

LOT	PLAN	TENURE	Zone
410	RP617542	Freehold	Recreation and open space
2	SP143232	Reserve	Recreation and open space
6	RP619633	Freehold	Township
244	SP108313	Lands Lease	Rural
209	A3011	Freehold	Township
205	A3011	Freehold	Township
5	SP120226	Freehold	Township
10	SP120226	Freehold	Township
123	A3011	Freehold	Township
124	A3011	Freehold	Township
16	A3017	Freehold	Township
15	A3014	Freehold	Township
2	SP232186	Freehold	Township
11	SP243901	Freehold	Community facilities
502	SP249560	Freehold	Community facilities
11	A3014	Freehold	Township
8	A3017	Freehold	Township
504	A3011	Reserve	Township
4	A3014	Freehold	Township
709	A3011	Freehold	Township
304	A3011	Reserve	Recreation and open space
701	A3011	Freehold	Township
12	A3017	Freehold	Township
20	A3017	Freehold	Township
808	A3011	Freehold	Township
2	RP607378	Freehold	Township
309	A3011	Reserve	Recreation and open space
308	A3011	Reserve	Recreation and open space
113	A3011	Freehold	Township
272	SP108314	Lands Lease	Nil
216	A3011	Freehold	Township
219	A3011	Freehold	Township
705	A3011	Freehold	Township
1	BE159	Freehold	Township
33	A30111	Reserve	Community facilities
101	SP259522	Freehold	Township
3	SP120226	Freehold	Township
52	A3017	State Land	Township
55	A3017	State Land	Township
201	A3011	Freehold	Township
12	SP243901	Freehold	Township
6	A3017	Freehold	Township
1	A3014	Freehold	Township
117	SP148107	Freehold	Township

LOT	PLAN	TENURE	Zone
4	SP136857	Reserve	Rural
3	SP136857	Reserve	Rural
307	A3011	Reserve	Recreation and open space
305	A3011	Reserve	Recreation and open space
22	A3017	Freehold	Township
28	A3017	Freehold	Township
27	A3017	Freehold	Township
803	A3011	Freehold	Community facilities
1	SP104443	Freehold	Community facilities
57	SP175997	Reserve	Community facilities
606	A3011	Freehold	Township
3	RP607621	Freehold	Township
1	RP604397	Freehold	Township
115	A3011	Freehold	Township
9	A30118	Freehold	Community facilities
2	A30119	Freehold	Township
51	A3017	Freehold	Township
13	SP120226	Freehold	Township
14	SP120226	Freehold	Township
122	A3011	Freehold	Township
2	RP607266	Freehold	Township
17	A3014	Freehold	Township
20	A3014	Freehold	Township
102	A3012	Freehold	Township
103	A3012	Freehold	Township
211	A3011	Freehold	Township
1	SP232186	Freehold	Township
10	A3014	Freehold	Township
1	A3017	Freehold	Township
1	RP815709	Freehold	Township
104	A3015	Freehold	Rural
2	SP136857	Reserve	Rural
273	SP108314	Lands Lease	Nil
402	A3011	Freehold	Recreation and open space
23	A3017	Freehold	Township
2	RP604984	Freehold	Township
1	A3013	Freehold	Township
20	A3013	Freehold	Township
1	A30120	Freehold	Township
2	A30120	Freehold	Township
804	A3011	Freehold	Township
1	RP608184	Freehold	Township
312	A3011	Reserve	Recreation and open space
271	SP158090	Lands Lease	Nil

LOT	PLAN	TENURE	Zone
50	SP249557	Freehold	Township
135	BE169	Reserve	Recreation and open space
505	A3011	Reserve	Township
2	RP869087	Freehold	Township
2	RP603117	Freehold	Township
206	A3011	Freehold	Township
214	A3011	Freehold	Township
218	A3011	Freehold	Township
3	A30113	Reserve	Community facilities
6	A30113	Reserve	Community facilities
137	BE169	Reserve	Township
4	RP607621	Freehold	Township
53	A3017	State Land	Township
102	A3011	Freehold	Township
2	RP608184	Freehold	Township
7	A3017	Freehold	Township
4	A3017	Freehold	Township
1	RP836537	Freehold	Township
3	RP836537	Freehold	Township
8	A3014	Freehold	Township
103	A3015	Freehold	Rural
201	A3015	Freehold	Rural
8	SP136857	Reserve	Rural
2	RP604397	Freehold	Township
702	A3011	Freehold	Township
314	A3011	Reserve	Recreation and open space
404	A3011	Reserve	Recreation and open space
409	A3011	Reserve	Recreation and open space
25	A3017	Freehold	Township
1	A3018	Freehold	Township
3	A3018	Freehold	Township
21	A3017	Freehold	Township
7	BE167	Lands Lease	Township
3	A30120	Freehold	Township
807	A3011	Freehold	Township
805	A3011	Freehold	Township
802	A3011	Freehold	Township
311	A3011	Reserve	Recreation and open space
51	SP249557	Freehold	Township
39	A30115	Reserve	Community facilities
19	A3013	Freehold	Township
706	A3011	Freehold	Township
9	SP120226	Freehold	Township
210	A3011	Freehold	Township

LOT	PLAN	TENURE	Zone
204	A3011	Freehold	Township
202	A3011	Freehold	Township
217	A3011	Freehold	Township
1	RP604524	Freehold	Township
1	RP614123	Freehold	Township
56	A3017	State Land	Township
9	RP619633	Freehold	Township
2	SP127184	Freehold	Township
14	A3014	Freehold	Township
16	A3014	Freehold	Township
1	RP616252	Freehold	Township
1	RP607621	Freehold	Township
5	A3017	Freehold	Township
1	RP607995	Freehold	Township
2	RP815709	Freehold	Township
3	A3014	Freehold	Township
6	A3014	Freehold	Township
105	BE97	Freehold	Rural
306	A3011	Reserve	Recreation and open space
1	RP617518	Freehold	Recreation and open space
318	A3011	Reserve	Recreation and open space
2	RP607989	Freehold	Township
29	A3017	Freehold	Township
101	A3012	Freehold	Township
1	RP604984	Freehold	Township
11	A3017	Freehold	Township
73	USL44737	State Land	Recreation and open space
1	RP607378	Freehold	Township
310	A3011	Reserve	Recreation and open space
1	BE165	Freehold	Community facilities
2	A3013	Freehold	Township
208	A3011	Freehold	Township
203	A3011	Freehold	Township
2	RP607621	Freehold	Township
213	A3011	Freehold	Township
215	A3011	Freehold	Township
220	A3011	Freehold	Township
5	SP136857	Reserve	Recreation and open space
112	A3011	Freehold	Township
7	A30118	Reserve	Township
2	RP614123	Freehold	Township
12	SP120226	Freehold	Township
7	SP120226	Freehold	Township
16	SP120226	Freehold	Township

LOT	PLAN	TENURE	Zone
18	SP120226	Freehold	Township
1	SP120226	Freehold	Township
6	SP120226	Freehold	Township
1	RP607266	Freehold	Township
103	A3011	Freehold	Township
2	RP604524	Freehold	Township
18	A3014	Freehold	Township
2	RP616252	Freehold	Township
3	A3017	Freehold	Township
9	A3017	Freehold	Township
2	RP836537	Freehold	Township
5	A3014	Freehold	Township
7	A3014	Freehold	Township
7	SP175997	Reserve	Rural
703	A3011	Freehold	Township
711	A3011	Freehold	Township
125	A3011	Freehold	Township
403	A3011	Reserve	Recreation and open space
24	A3017	Freehold	Township
2	RP607013	Freehold	Township
1	RP607013	Freehold	Township
13	A3017	Freehold	Township
905	A3011	Reserve	Recreation and open space
313	A3011	Reserve	Recreation and open space
707	A3011	Freehold	Township
37	A30112	Reserve	Community facilities
2	RP614925	Freehold	Township
221	A3011	Freehold	Township
136	BE169	Reserve	Recreation and open space
111	A3011	Freehold	Township
1	RP608842	Freehold	Township
11	SP113231	Lands Lease	Nil
19	SP120226	Freehold	Township
2	RP843184	Freehold	Township
1	RP843184	Freehold	Township
47	A3017	Freehold	Township
54	A3017	State Land	Township
12	A3014	Freehold	Township
11	SP120226	Freehold	Township
19	A3014	Freehold	Township
16	A3012	Freehold	Township
2	A3017	Freehold	Township
10	A3017	Freehold	Township
110	SP118530	Reserve	Rural

LOT	PLAN	TENURE	Zone
5	A3018	Freehold	Township
101	A3015	Freehold	Rural
57	K103792	Freehold	Rural
3	SP136857	Reserve	Rural
6	SP136857	Reserve	Recreation and open space
6	SP136857	Reserve	Recreation and open space