Flinders Shire Council

15 Mile Irrigation Project
Impact Assessment Report

July 2019

Executive summary

In line with their Guiding Principles, Flinders Shire Council (Council) is committed to taking actions that promote sustainable growth in the Shire and has identified that future development will be in establishing the Shire as an emerging centre for irrigated agriculture. Council consider the 15 Mile Irrigation Project (the project) a key development that aligns with this principle.

The project arises from the CSIRO report, Agricultural resource assessment for the Flinders catchment (CSIRO, 2013) as part of the North Queensland Irrigated Agriculture Strategy (NQIAS). The report identified that the Flinders Catchment has potential to support significant areas of irrigated agricultural development however, there is more soil suited to irrigation than there is water to irrigate it (CSIRO, 2013). Further, it determined that the high capital costs of water infrastructure might preclude reliable economic returns on irrigated farming however, with the introduction of third party investment in water infrastructure commercial returns on irrigated agriculture are possible (CSIRO, 2013).

In order to address these barriers to entry for new irrigated agriculture investment, Council has resolved to undertake significant steps to facilitate the project. Council has purchased Lot 168 on SP262319, a property that previously formed part of the Reserve known as "15 Mile" and has undertaken a substantial technical investigation across the site. Council is in the process of obtaining major development approvals [i.e. purpose of this Impact Assessment Report (IAR)] and associated water licences for the project will reconfigure the allotment into viable agricultural development blocks for private investment. Council will promote intensively grown, efficiently irrigated, low volume, high value agricultural crops which will result in better returns and outcomes for the Shire when compared to broad acre, low-return, high volume crops. These types of enterprises meet Council's goals of providing employment prospects for residents as well as encouraging migration of skilled workers to the Shire where these positions cannot be filled locally.

The project is well defined and entails approximately 305 ha of developable land for high value agricultural crops and 157 ha of developable land for farming infrastructure and water storages. The balance of the site (approximately 450 ha) will consist of environmental buffers to watercourses, wetlands and regulated vegetation. As outlined within the IAS, there is limited potential for negative impacts of any magnitude or scale to amenity (noise, air quality, vibration, lightning, urban design and visual aesthetics) and the social, economic and built environment of the Shire as a result of the Project. Council consider that the project will deliver positive outcomes with respect to these settings.

Following a desktop review of site environmental values and relevant literature with respect to irrigated agricultural development, the IAS identified key environmental risks relevant to the project as follows:

- *Salt accumulation and in soil root zone (salinity and sodicity) from trickle irrigation and / or poor quality irrigation water.*
- *Soil loss and degradation.*
- *Increased sediment, nutrients and pesticides loads from irrigation to the Flinders River.*
- *Ecological implications of altered groundwater and surface water flow regimes on riparian ecology.*
- *Over abstraction of the groundwater aquifer and associated flow on ecological and social impacts.*

- *Loss of biodiversity as a result of vegetation clearing, habitat destruction and loss of connectivity.*
- *Introduction of invasive species and diseases.*

Subsequent to the IAS, Council has commissioned further technical investigations that have been considered within this IAR. The findings of these investigation have been incorporated into this IAR informing:

- *The suitability of the site for irrigated agriculture*
- *The precinct master plan and project description*
- *The existing site environmental values*
- *The potential environmental impacts and associated mitigation requirements*
- *The local and state approvals framework and associated Planning Scheme and State interest compliance assessments applicable to the project.*

As outlined within the IAS and this IAR, no Mattes of National Environmental Significance (MNES) and/or Matters of State Environmental Significance (MSES) are expected to be significantly impacted by the project. The project has been designed to accommodate key natural features in the master plan and will be constructed and operated in accordance with best practice environmental controls and farming techniques. Council has committed to developing a suite of impact mitigations plans (i.e. salinity, soil conservation and general environmental management) and propose the Coordinator General include the requirement for these plans to be developed by a suitably qualified and experienced person and submitted to the State for review prior to the commencement of clearing.

The State Planning Policy 2017 (SPP) and State Development Assessment Provisions (SDAPs) define the State's interest in land use planning and development assessment, and includes the assessment benchmarks or matters that an application is assessed against. The SPP has been integrated into the Flinders Shire Planning Scheme and an evaluation against the relevant SDAP State Codes has been completed herein. The project is considered to comply with the performance outcomes (and associated acceptable outcomes).

Similarly, the project promotes the advancement of economic development in the Shire through development of irrigation based intensive agriculture in the line with the objectives of the Flinders Shire Planning Scheme and North West Regional Plan. The project is code assessable under the Planning Scheme for development involving a material change of use, reconfiguration of a lot and operational works. For the purpose of this IAR, the project has been evaluated against the relevant provisions of the Planning Scheme including the Rural zone code, relevant overlay codes, use codes and other development codes and is considered to comply.

Based on the information outlined herein, it is requested that the Coordinator-General and Sate advisory agencies support the activity, subject to reasonable and relevant conditions and Council provision of further information as required.

This report is subject to, and must be read in conjunction with, the limitations set out in section 1.5 and the assumptions and qualifications contained throughout the Report.

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1. Introduction

1.1 Background information

1.1.1 Flinders shire overview

The Flinders Shire is located in the heart of North West Queensland covering an area of 41,632 square kilometres (MITEZ, 2018). Hughenden is the main business centre for the shire, which also encompasses the smaller communities of Prairie, Torrens Creek and Stamford (FSC, 2018a).

Hughenden is situated on the banks of the Flinders River at the crossroads of the Flinders Highway and the inland Hann Highway (refer Figure 1-1). The Flinders Highway connects Hughenden to Townsville (380 km) in the east and Mount Isa (520 km) in the west. The inland Hann Highway and Kennedy Development Road further links Hughenden to Cairns (730 km) in the north and Melbourne (2,300 km) in the south. These along with direct access to the Mt Isa rail line and the Hughenden airport makes Hughenden a major transport hub in the region.

1.1.2 Need for the 15 Mile Irrigation Project

The Flinders Shire is predominantly a grazing area with the major industry being beef cattle production (FSC, 2018a and MITEZ, 2018). There are approximately 230 rural grazing properties, with a gross agricultural production value of $73.5 M, within the Shire (MITEZ, 2018). Despite this, Flinders Shire has experienced negative average annual growth rates over the past decade (-1.9%) with an increasing negative trend in the last 5 years (-3.2%) (QGSO, 2018). As detailed in the Initial Advice Statement (IAS) and supporting documentation, the Shire is experiencing above State average economic disadvantage, with most major demographic indicators trending below the average for the whole of Queensland. In line with their Guiding Principles, Flinders Shire Council (Council) is committed to taking actions that promote sustainable growth in the Shire and has identified that future development will be in establishing the Shire as an emerging centre for irrigated agriculture. Council consider the 15 Mile Irrigation Project (the project) a key development that aligns with this principle.

The project arises from the CSIRO report, *Agricultural resource assessment for the Flinders catchment* (CSIRO, 2013)[1] as part of the North Queensland Irrigated Agriculture Strategy (NQIAS). The report identified that the Flinders Catchment has potential to support significant areas of irrigated agricultural development however, there is more soil suited to irrigation than there is water to irrigate it (CSIRO, 2013). Further, it determined that the high capital costs of water infrastructure might preclude reliable economic returns on irrigated farming however, with the introduction of third party investment in water infrastructure commercial returns on irrigated agriculture are possible (CSIRO, 2013).

In order to address these barriers to entry for new irrigated agriculture investment, Council has resolved to undertake significant steps to facilitate the project. Council has purchased Lot 168 on SP262319, a property that previously formed part of the Reserve known as “15 Mile” and has undertaken a substantial technical investigation across the site (refer Figure 1-1). Council is in the process of obtaining major development approvals [i.e. purpose of this Impact Assessment Report (IAR)] and associated water licences for the project will reconfigure the allotment into viable agricultural development blocks for private investment. Council will promote intensively grown, efficiently irrigated, low volume, high value agricultural crops which will result in better

[1] https://www.csiro.au/en/Research/LWF/Areas/Water-resources/Assessing-water-resources/Flinders-Gilbert

returns and outcomes for the Shire when compared to broad acre, low-return, high volume crops. These types of enterprises meet Council's goals of providing employment prospects for residents as well as encouraging migration of skilled workers to the Shire where these positions cannot be filled locally.

1.1.3 Coordinated project declaration and scope of work for the IAR

The project was declared a 'coordinated project requiring an impact assessment report' by the Coordinator-General under Part 4, section 26(1)(b) of the *State Development and Public Works Organisation Act 1971* (SDPWO Act) on 24 August 2018. The requirements for an IAR are set out in section 34G(2) of the SDPWO Act and this document has been drafted to address these requirements.

1.2 Purpose of this IAR

The purpose of this IAR is to:

- To assist the Coordinator-General in assessing the project's environmental impacts and propose mitigation measures in the form of an evaluation report.
- Provide the information necessary to assist the Coordinator-General making a recommendation to progress with the project subject to conditions and recommendations designed to ensure the project's environmental impacts are properly managed.

1.3 Scope of IAR

The scope of this IAR is for all aspects of the proposed 15 Mile Irrigation Project on Lot 168 Plan SP262319.

1.4 Assumptions

The following assumptions were made in the development of this report:

- Environmental values established through Queensland Government supplied mapping and data reviewed in desktop assessments reflect actual site conditions.
- Annual water requirements for the precinct are based on estimates for initial development crops as provided by third party investors.
- Workforce demands for full development of the precinct are based on numbers for initial development crops provided by third party investors.
- Gross production value for full development of the precinct are based on numbers for initial development crops provided by third party investors at the time of drafting the IAS dated August 2018.

1.5 Statement of limitations

This report: has been prepared by GHD for Flinders Shire Council and may only be used and relied on by Flinders Shire Council for the purpose agreed between GHD and the Flinders Shire Council as set out in section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than Flinders Shire Council 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 1.4 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 Flinders Shire Council 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.

2. Project site

2.1 Location

The project consists of a master planned irrigated agricultural precinct on Lot 168 on Plan SP262319 (the site). The site is situated on the banks of the Flinders River, approximately 12 km north, north-west of Hughenden (refer Figure 1-1).

2.2 Existing land use, structures, frontage and access

The site was previously part of the 15 Mile Reserve which also included parts of the adjacent Lot 167 on Plan SP262319 (refer Figure 2-1). The 15 Mile Reserve formed part of the Queensland Stock Route Network prescribed under *Stock Route Management Act 2002* and was administered by Council and the Department of Natural Resources Mines and Energy (DNRME).

The 15 Mile Reserve provides watering facilities including the Stock Route Watering Facility consisting of a Solar Pump which fills two 10,000 gallon tanks and a trough as well as a dam at the southern end of the Reserve. The Reserve is agisted on a 1 month agistment permit basis.

Council purchased the site from the Queensland Government in 2016 and it has subsequently been removed from the Stock Route Network. Council hold the site as estate in fee simple (i.e. freehold) however, it is still currently in use for cattle grazing. Queensland Government (Queensland Globe, 2018a) Stock Route Network mapping (refer Figure 2-2) shows the remaining areas of the Stock Route Network adjacent to the site (i.e. Lot 167 on SP262319 and Old Richmond Road Reserve).

Queensland Globe (2018a) land use mapping identifies the site and wider area as predominantly ‘grazing native vegetation’ being production from relatively natural environments aligning with the major industry (i.e. beef cattle production) in the Shire and ‘marsh/wetland’ generally aligning with site environmental characteristics as described within section 4 of this IAR.

Access to the site is via Old Richmond Road (managed by Council) which is sealed and dual lane and links directly to the Flinders Highway. An unsealed local road off Old Richmond Road passes through the site providing access to properties and a residence/farming building and infrastructure approximately 350 m north of the Flinders River.

2.3 Surrounding land uses and strata titles

The site is bounded to the north by the Flinders River and to the east by private leasehold land. The site is bounded to the west and south by a Council held Reserve (Lot 167 on SP262319) and Old Richmond Road respectively which both form part of the remaining Queensland Stock Route Network. The site and all adjacent properties are zoned ‘Rural’ under the Shire of Flinders Planning Scheme (the Planning Scheme).

Queensland Globe (2018a) land use mapping identifies the nearest residential land use (i.e. farm buildings/infrastructure) as being approximately 4 km to the south of the site. However, aerial photography shows an unsealed local road off Old Richmond Road passing through the site providing access to properties and a residence/farming building and infrastructure approximately 350 m north of the Flinders River.

Land tenures and strata rights and interests of adjacent properties shown on Figure 2-2 and are reflective of the primary land use for the Shire being beef cattle production and the adjacent Queensland Stock Route Network.

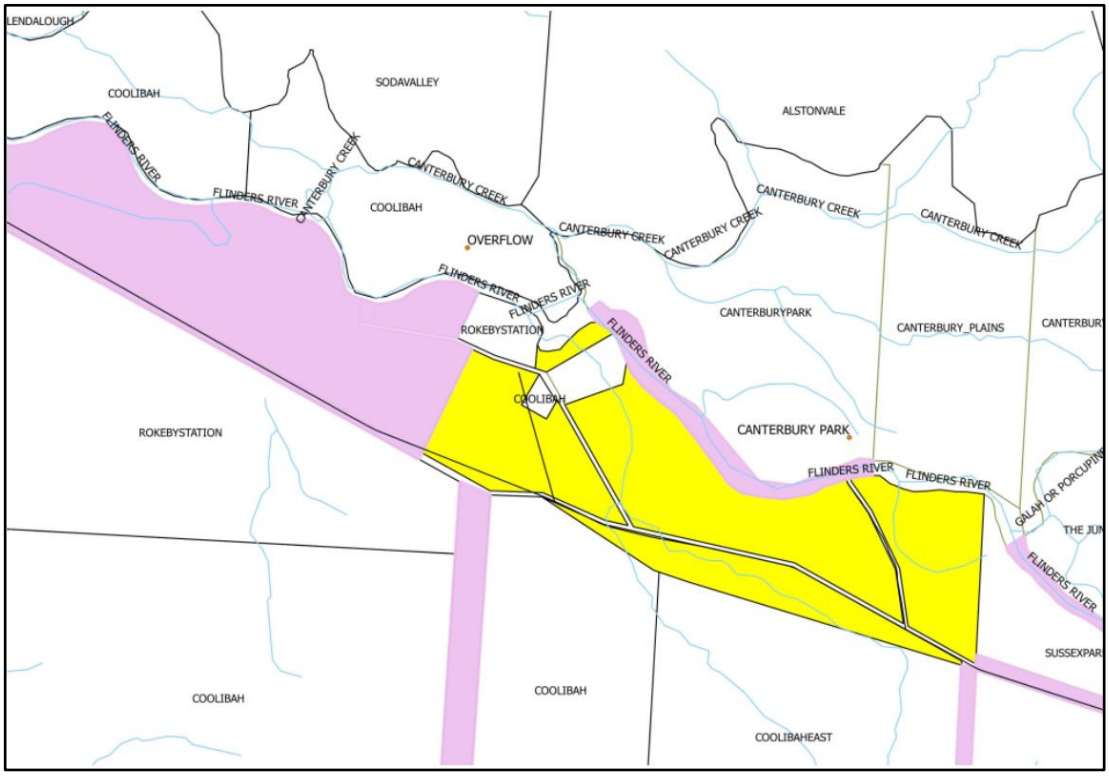
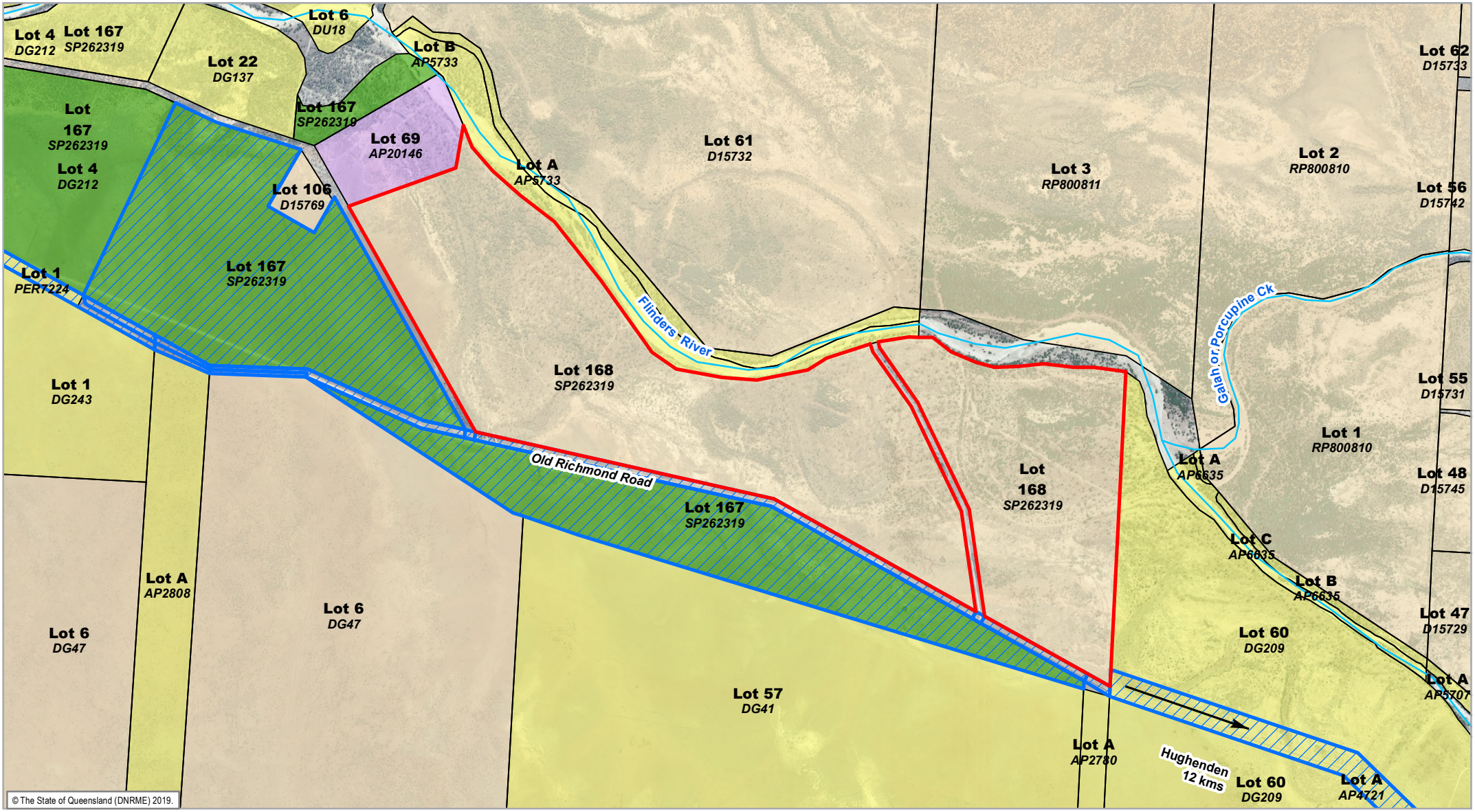


Figure 2-1 FSC (2018c) Previous 15 Mile Reserve prior to Council purchase of the site



Legend

- Major Rivers
- Property Boundary
- Stock Routes
- Lot Type Parcel

Tenure

- Easement
- Freehold
- Lands Lease
- Reserve
- State Land

1:40,000

0 500 1,000 1,500 2,000 Metres

N

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

GHD

Flinders Shire Council
15 Mile Project

Adjacent properties and land tenures

Project No. **42-20851**
Revision No. **A**
Date **03 Jul 2019**

FIGURE 2-2

N:\AU\Toowoomba\Service\Geospatial\42\20851\Maps\MXD\42-20851-07_AdjProperties_revA.mxd
Print date: 03 Jul 2019

Data source: DNRME - Roads, Towns, Rivers, Cadastre, Stockroutes (2019). Google Earth Pro - Imagery (Date extracted: 01/05/2017). GHD - Project Boundary (2019). Created by: tngavranic

2.4 Topography, geology and soils

2.4.1 Topography

The site generally slopes from approximately 300 m Australian Height datum (AHD) in the south-east to approximately 290 m AHD in the north-west. The site is relatively flat with some steeper banks to site drainage features and the Flinders River.

NRA (2019) states that the variation in topography reflects underlying geology and patterns of deposition and erosion within the Flinders River alluvial plain. Following a review of 1 m elevation contour mapping (refer Figure 2-3), NRA (2019) further described the topography of the site as transitioning between slightly higher elevations associated with land on the Cretaceous sediments of the Rolling Downs (Mitchell grass plains) and the Quaternary alluvial deposits that comprise the bulk of the site.

2.4.2 Geology

Queensland Government (Queensland Globe, 2018a) 1:100K geological mapping for the site is summarised in Table 2-1. NRA (2019) mapping of these geological units is provided as Figure 2-4. CSIRO (2013) provides simplified surface geology for the Flinders catchment with the site located within the Alluvium associated with the Flinders River with the GAB (Rolling Downs) unit present in the broader Hughenden Area.

Table 2-1 Queensland Globe (2018a) site geology

Rock unit name	Lithology summary
Qa-QLD	Clay, silt, sand and gravel; flood plain alluvium
Ranmoor Member (Ku/r)	Mudstone, commonly carbonaceous, minor siltstone

2.4.3 Soils

2.4.3.1 Desktop soil assessment

Queensland Globe (2018a) Atlas of Australia soil mapping identifies the site as alluvial plains with slightly elevated old levees and shallow prior stream channels (Si9). Si9 soil properties are described in Table 2-2. CSIRO (2013) provides soil generic group (SGG) classes for the Flinders Catchment with the site falling within the cracking clay soils SGG, being dominated by moderately deep to very deep (0.5 m to greater than 1.5 m) black and brown cracking clay Vertosols derived from the sedimentary rocks of the Rolling Downs Group and Alluvium (refer Table 2-3).

Table 2-2 Queensland Globe (2018a) Si9 soil properties

Property	Description
General soil type	Hard pedal yellow duplex soils
Dominant principal profile form meaning	Duplex yellow-grey, hard setting A horizon, A2 horizon sporad bleached, alk pedal whole col B horizon

Table 2-3 CSIRO (2013) Cracking clay soils description

General description	Landform	Management considerations
Clay soils with shrink–swell properties that cause cracking when dry. Usually alkaline and deep to very deep.	Floodplains and other alluvial plains. Undulating to rolling Mitchell Grass Downs country (formed on Mesozoic fine grained sedimentary rock). Minor occurrences in basalt landscapes.	Generally moderate to high agricultural potential. The flooding limitation will need to be assessed locally. Most soils are high in salt (particularly those associated with the Rolling Downs), which limits crop rooting depth (<1 m) and moderate to moderately high water holding capacity (75 to 120 mm). Gilgai and coarse structured surfaces may occur. Surface stone common near plateaus. Scalded clays common on alluvial plains have bare hard setting surface, prone to wind erosion and high in salts close to the surface.

2.4.3.2 Preliminary site assessment (NAWS, 2017)

NAWS (2017) conducted preliminary assessments of the potential for irrigated agricultural development on the site with consideration to irrigation water sources including the Flinders Alluvial Aquifer. NAWS (2017) assessment comprised a site visit to inspect topography and potential irrigation water storage sites and an initial assessment of the landscape and soil resources of the site. NAWS (2017) inspection confirmed that the cracking clay soils in the south western part of the property have limited suitability for irrigated agriculture; however the alluvial soil of the north-east sector are suited to irrigated agriculture, having excellent drainage, good root depth and texture. The soils were expected to have few chemical limitations and therefore be suited to a broad range of irrigated agricultural enterprises.

2.4.3.3 Land suitability study (NRA, 2019)

To facilitate the IAR and address specific requirements of the State Development Assessment Provisions (SDAP), Council commissioned a land suitability study (NRA, 2019) for the site. The land suitability study included a review of readily available desktop information supplemented by soil sampling and laboratory analysis to identify soil units and assess these against established decision rules. NRA (2019) soil units are shown on Figure 2-5. A copy of the land suitability study is provided at Appendix A.

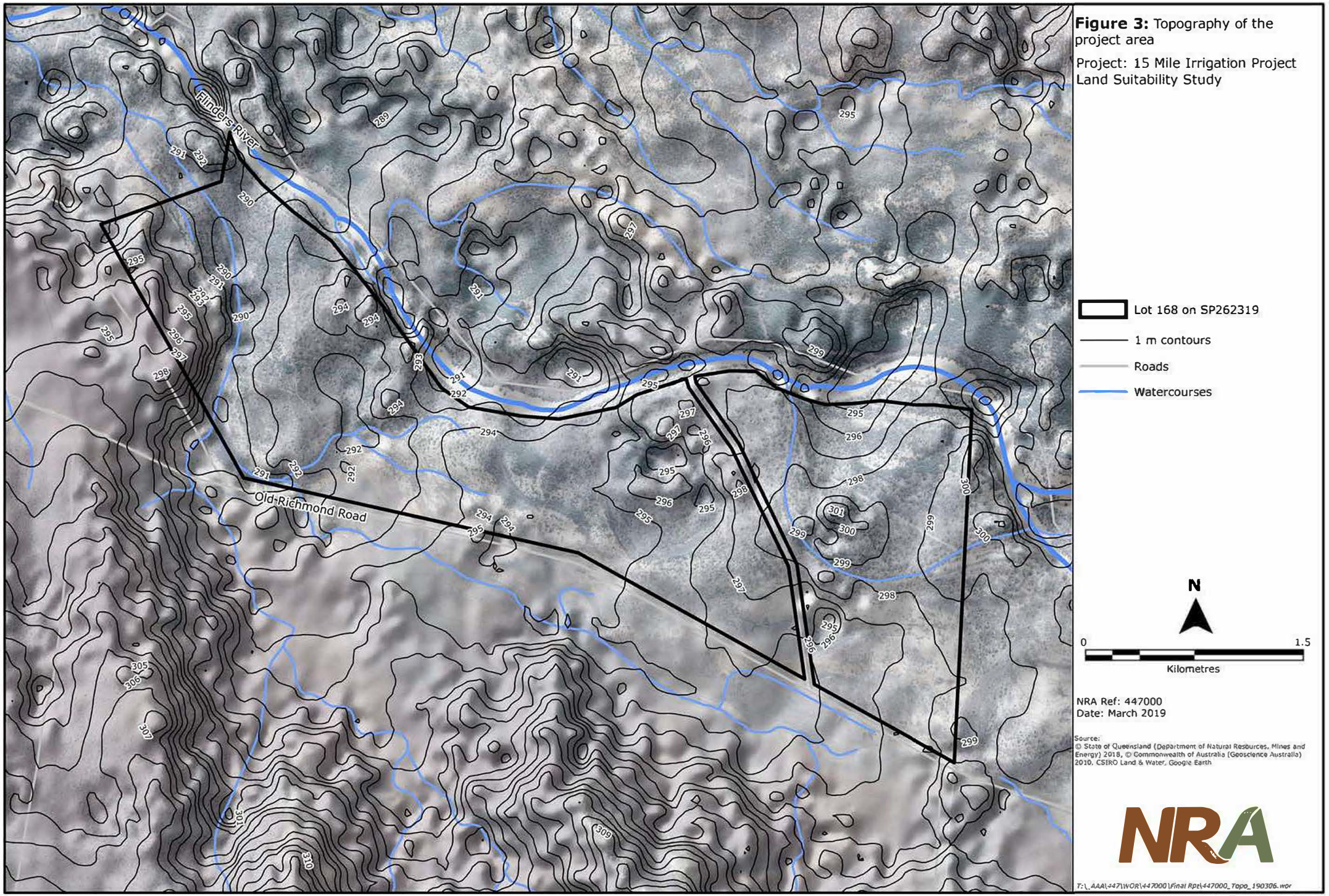


Figure 2-3 NRA (2019) Topography of the project area

Figure 2-4 NRA (2019) Geology mapped in the project area

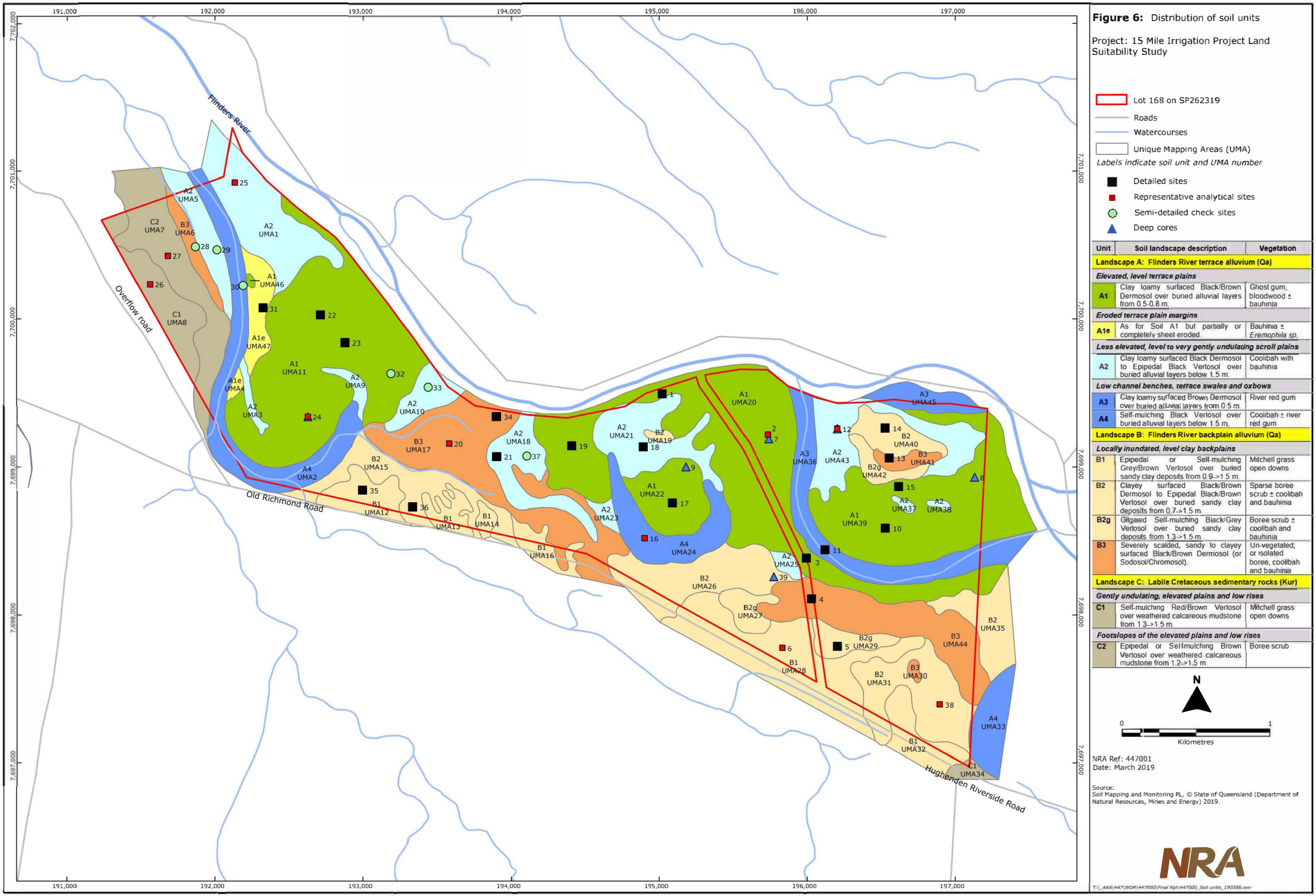


Figure 2-5 NRA (2019) Distribution of soil units

3. Project description

3.1 Project overview

The project consists of a master planned irrigated agricultural precinct on Lot 168 on Plan SP262319. The site is situated on the banks of the Flinders River, approximately 12 km north, north-west of Hughenden (refer Figure 1-1).

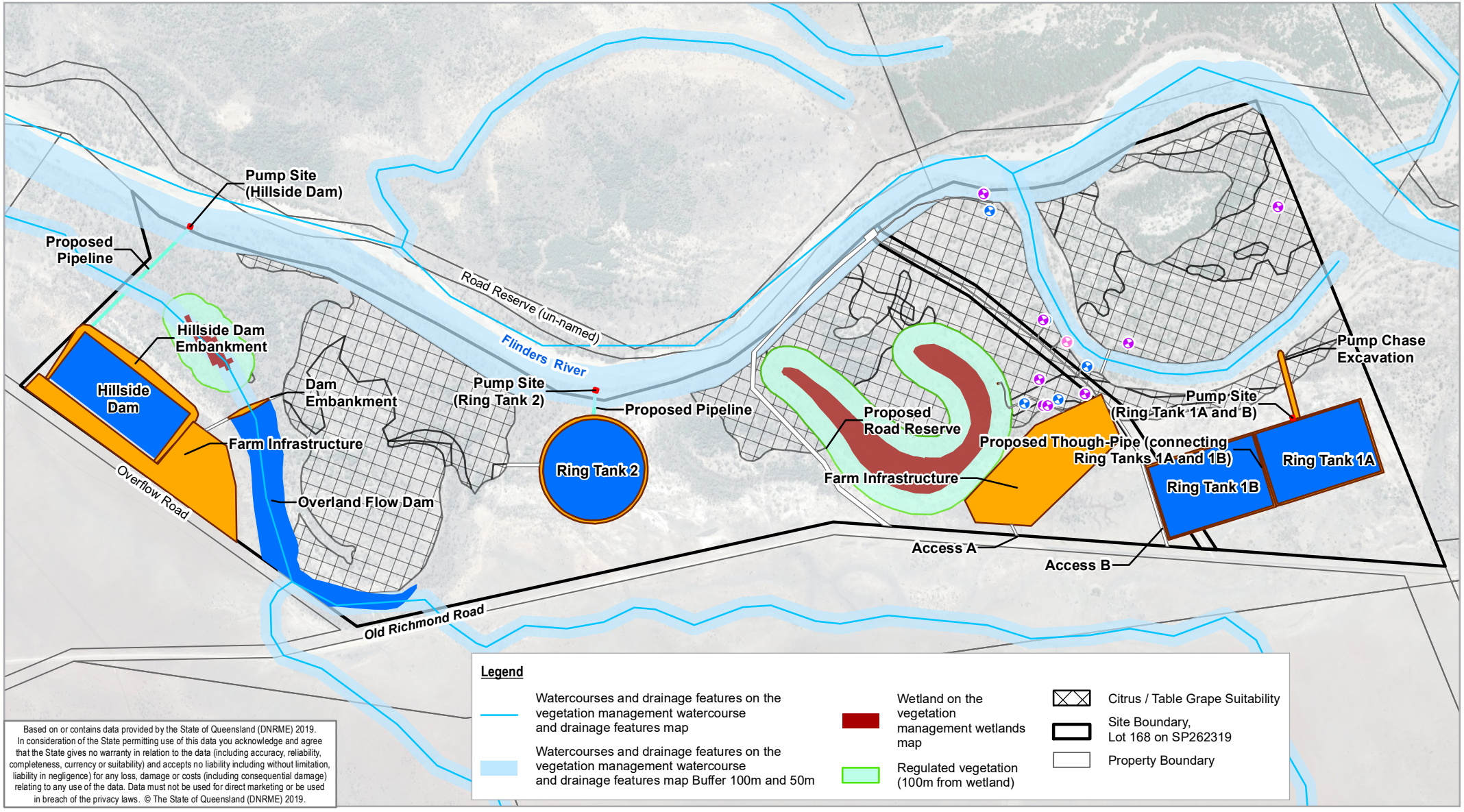
Council purchased the site from the Queensland Government in 2016 and has since been undertaking necessary works to facilitate the project. This has also included consultation with relevant State departments to ensure that appropriate consideration of existing site environmental characteristics in development of the master plan. Primary drivers of the site master plan are soil characteristics and land suitability for intended crops and watercourses, wetlands and regulated vegetation identified as Matters of State Environmental Significance (MSES).

Based on current knowledge of land suitability on the site, the master plan (refer Figure 3-1 and Table 3-1) provides for approximately 305.7 ha of developable land for high value agricultural crops and 156.6 ha of developable land for farming infrastructure and water storages. The balance of the site (450.2 ha) will consist of environmental buffers to watercourses, wetlands and regulated vegetation.

The master plan has been developed with respect to infrastructure requirements (primarily water) and land suitability for proposed cropping as outlined within the following sections as well as environmental values described within section 4 of this report.

Table 3-1 Master plan site area breakdown

Aspect	Area
High value irrigated agriculture	305.7 ha
Farming infrastructure (excluding water storage)	64.7 ha
Water storage	91.9 ha
Environmental buffers to watercourses, wetlands and regulated vegetation	450.2 ha



1:25,000 (Paper Size A4)

0 200 400 600 800 1,000

Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

Flinders Shire Council
15 Mile Project

Precinct Master Plan

Project No. **42-20851**
Revision No. **B**
Date **04 Jul 2019**

FIGURE 3-1

N:\AU\Toowoomba\Service\Geospatial\42\20851\Maps\MXD\42-20851-02_masterplan_revB.mxd
Print date: 04 Jul 2019

Data source: DNRME: Cadastre, Wetland Mapping (2018); Vegetation Management Wetlands, Vegetation Watercourses (2019); GHD: Citrus and Grape Suitability (2019); FSC: Infrastructure (2019); GE: Imagery extracted 7/9/2018. Created by: tngavranic

3.2 Details of proposed crops and suitability

Initial development crops planned for the precinct will comprise 150 ha of primarily citrus (75 ha) and table grapes (50 ha) and potential for avocado (25 ha). These will fulfil current market opportunities within Council's initial third party investor supply chains for major supermarkets within Australia and internationally.

Cropping within the remaining developable area will ultimately be determined by future investors/growers and market demands. Council's requirements for future development will be intensively grown, efficiently irrigated, low volume, high value agricultural crops as these types of enterprises meet Council's goals of providing employment prospects for residents as well as encouraging migration of skilled workers to the Shire where these positions cannot be filled locally.

The land suitability study (refer Appendix A) included an assessment for avocado in addition to table grapes and citrus. Five land suitability classes as described in Table 3-2 were nominated in in the land suitability study in accordance with relevant guidelines. NRA (2019) concluded that land in Classes 1, 2 and 3 for a given use is regarded as 'suitable' for this purpose. Suitable land is defined by NRA (2019) as "*land that can attain optimum, sustainable production with current technology, while minimising degradation to the land resource and environment in the short to medium and long term*".

Table 3-2 NRA (2019) Adopted land suitability classes

Class	Definition	Description
1	Suitable land with negligible limitations	Highly productive land requiring only simple management practices to maintain sustainable production
2	Suitable land with minor limitations	Land with minor limitations that either constrain production or require more than the simple management practices of Class 1 land to maintain sustainable production.
3	Suitable land with moderate limitations	Land with moderate limitations that further constrain production or require more than the management practices of Class 2 land to maintain sustainable production.
4	Unsuitable land with severe limitations	Currently unsuitable land with severe limitation that preclude successful or sustained use under existing condition. Further changes in knowledge, economics or technology may alter this.
5	Unsuitable land with extreme limitations	Land with extreme limitation that preclude any possibility of successful or sustained use, either now or in the future.

NRA (2019) established land use limitations to assess land suitability for the proposed uses (i.e. table grapes, citrus and avocado). The limitations were established with guidance from DNRME representatives and relevant published literature. For each land use (i.e. table grapes, citrus and avocado), NRA (2019) established eighteen (18) limitations as follows:

- **Climatic limitations:** climate stress – heat, frost, temperature (minimum).
- **Landscape limitation:** wind erosion, water erosion, flooding, salinity, discharge potential, microrelief, wetness, soil complexity, topographic complexity.

- **Soil profile limitations:** infiltration – soil profile recharge, soil water availability, soil depth to physical root barrier, rockiness.
- **Soil physical limitations**: surface soil conditions.
- **Soil nutrient limitations:** nutrient balance – pH soil reaction trend.

Decision rules were developed for each land use (i.e. table grapes, citrus and avocado) and each of the above references limitations with the framework used to assess irrigated agriculture suitability for the site (NRA, 2019).

The land suitability assessment (NRA, 2019) found 370.4 ha of the site is suitable for irrigated table grapes and citrus and 311.0 ha is suitable for irrigated avocado production (refer Figure 3-2 through Figure 3-4 and Table 3-3). The following provides a brief summary NRA (2019) with respect to site land suitability for table grapes, citrus and avocadoes:

- Table grapes and citrus:
    - Production is not constrained by unsuitable climatic conditions (severe heat stress, frequent frost or insufficient or excessive chill factor) however, heat stress is a moderate limitation.
    - Soil unit A1 and elevated occurrences of Soil Unit A2 (refer Figure 2-5) have soil and land characteristics suitable for agronomy and production.
    - These soil units are deep, rarely flooded, non-saline, rock free and moderately well drained, with negligible to moderate subsoil constraints. A2 variation relates primarily to differences in location and landscape position whereby lower elevations are subject to flooding, salinity and sodicity constraints.
    - A1 and A2 limitations for production include flooding, water erosion (A2), infiltration, plant available water capacity (PAWC) (A1 only) soil surface condition, discharge potential (A2 only) and wetness (drainage).
- Avocado:
    - Production is not constrained by unsuitable climatic conditions (severe heat stress, frequent frost or insufficient or excessive chill factor) however, heat stress is a moderate limitation and would be expected to affect fruit set and harvest of the crop.
    - Soil unit A1 (refer Figure 2-5) has edaphic characteristics suitable for agronomy and production.
    - These soil units are deep, rarely flooded, non-saline, rock free and moderately well drained, with negligible to moderate subsoil constraints
    - A1 limitations for production include flooding, infiltration, soil surface condition and wetness.

Table 3-3 NRA (2019) Summary of the extent (ha) of suitable (Classes 1, 2 and 3) and unsuitable land (Classes 4 and 5) within the 15 Mile project area

Land suitability class	Table grapes (ha)	Citrus (ha)	Avocado (ha)
Class 1	0	0	0
Class 2	0	0	0
Class 3	370.4	370.4	311.0
Class 4	220.5	220.5	194.7
Class 5	297.3	297.3	382.4

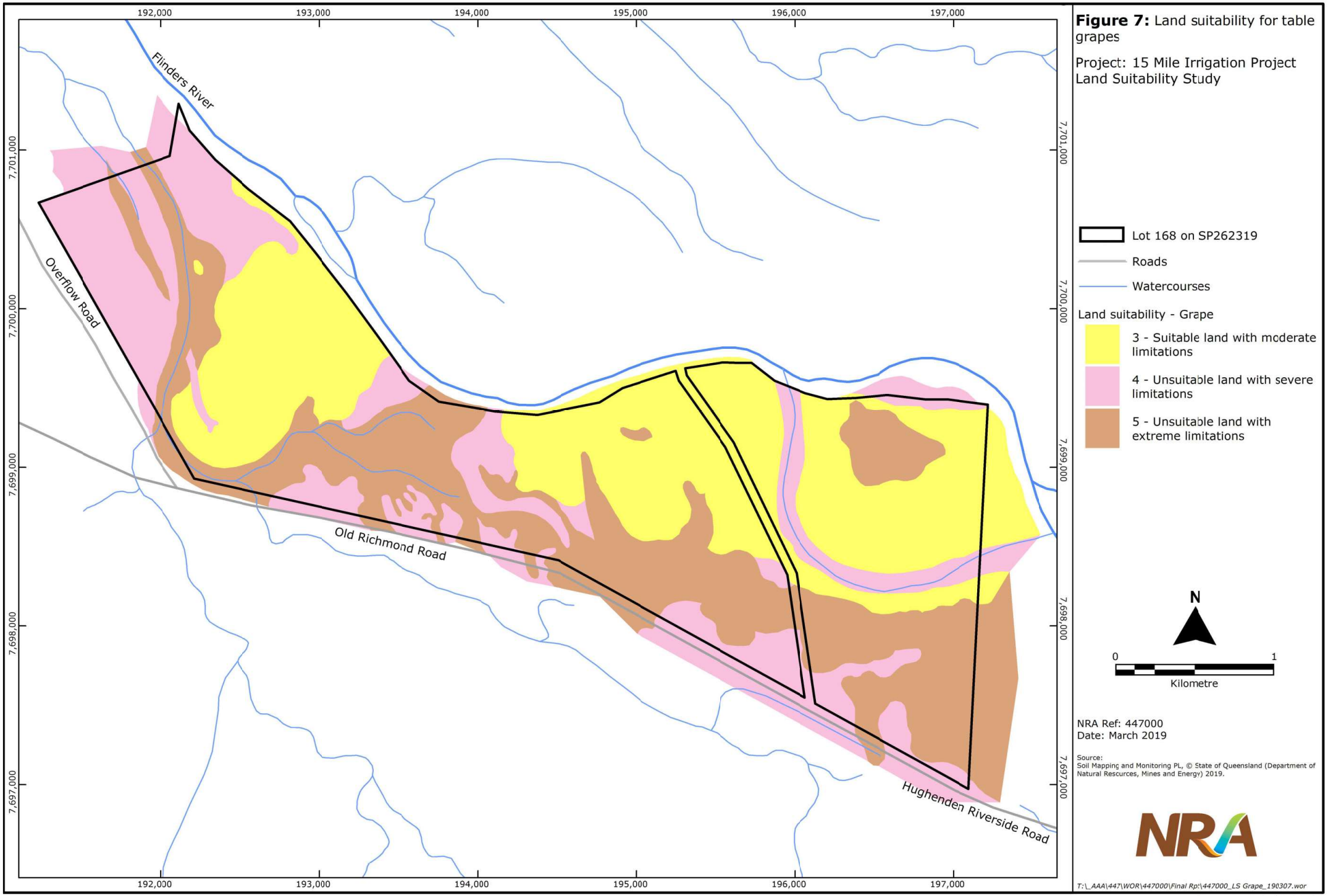


Figure 3-2 NRA (2019) Land suitability for table grapes

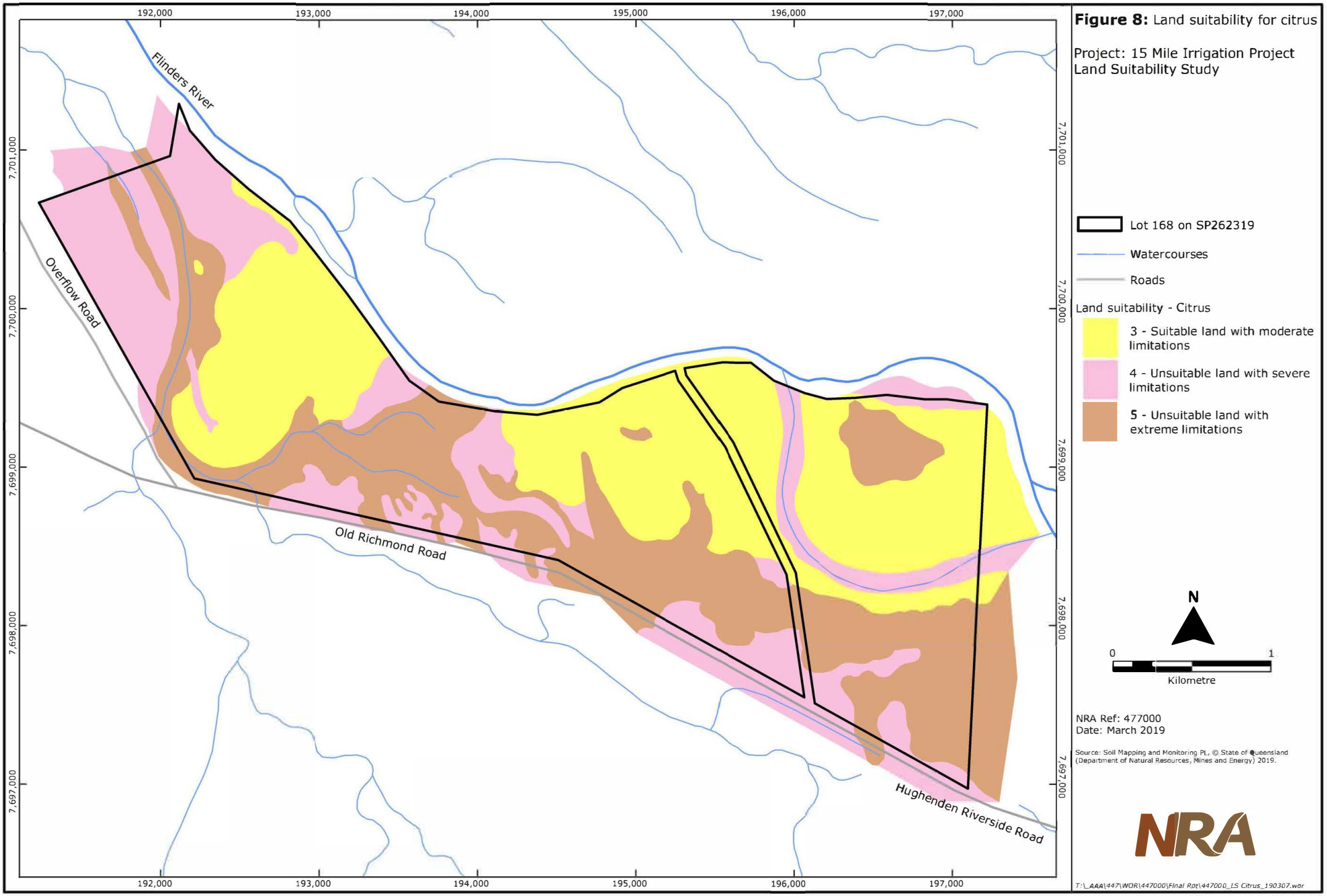


Figure 3-3 NRA (2019) Land suitability for citrus

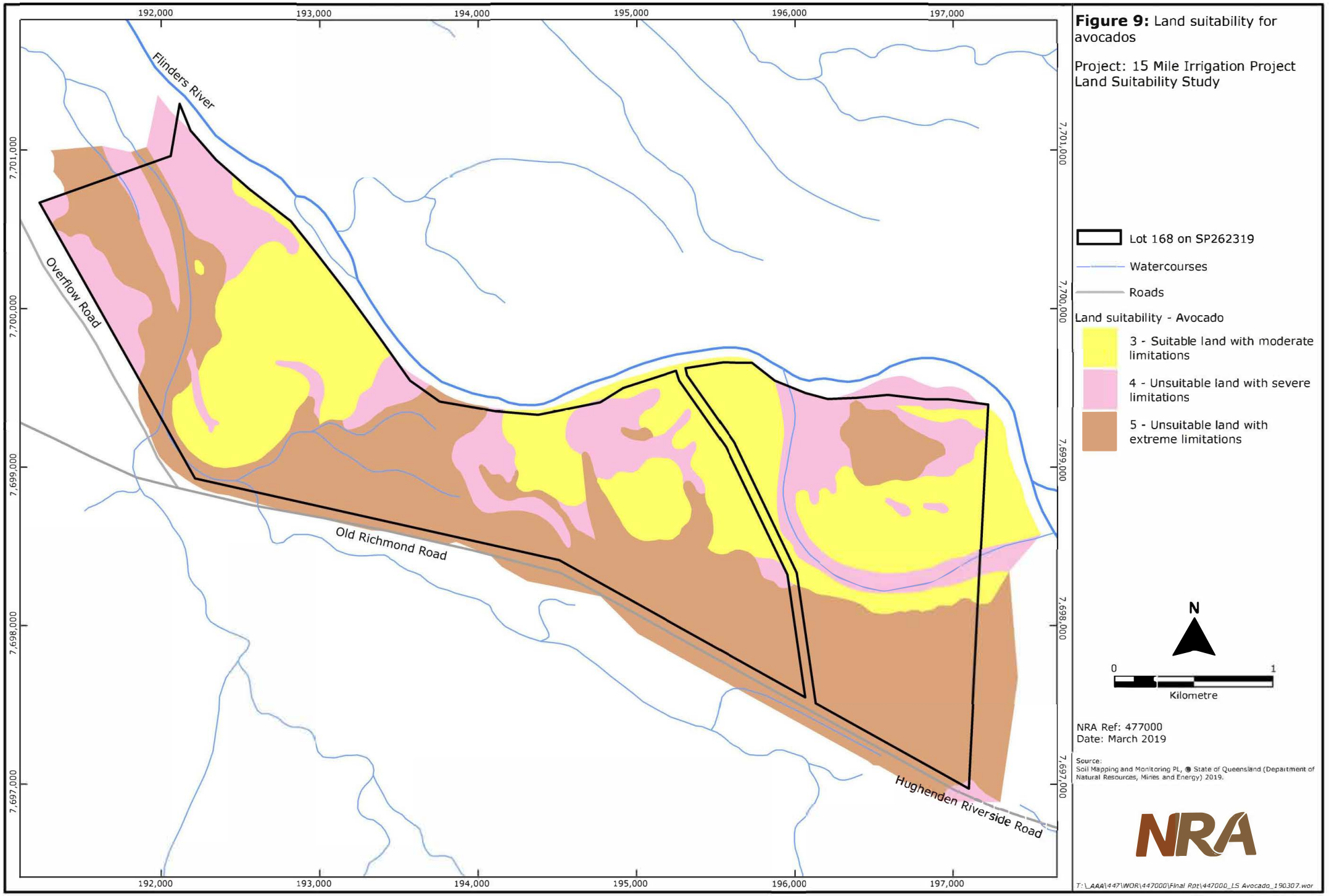


Figure 3-4 NRA (2019) Land suitability for avocado

3.3 Infrastructure requirements

The following outlines farming, road, power, telecommunication and sewerage infrastructure requirements. A detailed description of water infrastructure is provided in section 3.4 of this report.

3.3.1 Farming infrastructure

Farming infrastructure will be located on the site adjacent to developable land as shown on Figure 3-1 and described within Table 3-1). Farming infrastructure on the site will include:

- Production bores, pumps, dams and irrigation networks.
- Co-use cooling, packaging and logistics facility (co-use facility) and associated workforce amenities.
- Machinery and chemical storage sheds.
- Two cabins for caretaker and owner.
- Power supply infrastructure.
- Public and internal access roads.

Subject to Government funding, the co-use facility is planned for initial development of the site and will be made available as additional investors/growers develop the precinct. The purpose of the co-use facility will be to reduce initial set-up costs for new investors/growers and reduce barriers for further development of the site. The co-use facility will also serve to provide a greater number of freight options and markets for all investors/growers.

The infrastructure footprint includes provisions for necessary firebreaks to critical infrastructure (i.e. buildings) in accordance with the Planning Scheme generally being 20 metres or 1.5 times the height of the tallest adjacent tree as calculated in Table 3-4.

Table 3-4 Firebreaks calculated from Queensland Herbarium Corveg data

Regional Ecosystem	Representative maximum height (m)	Multiply by 1.5	Firebreak/Safety Buffer Outcome (minimum 20 m)
4.3.4x2d	12.5	18.75	20
4.3.10c	20	30	30
4.3.20	6	9	20
4.3.23	10.75	16.125	20

3.3.2 Roads

There are no significant road infrastructure requirements for the project. Vehicle movements per day associated with initial development are summarised in Table 3-5. Estimates for full development are also provided based on cropping assumptions for ultimate development of the site.

Table 3-5 Operational vehicle movements

Aspect	Table grapes	Citrus	Avocado
Initial development area (ha)	50	75	25
Light vehicles per day (year round)		3	
Light vehicles per day (harvest)	20	5	5
Heavy vehicles per day (harvest)	1	2	2
Total development area (ha)	110	150	50
Light vehicles per day (year round)		7	
Light vehicles per day (harvest)	45	10	10
Heavy vehicles per day (harvest)	4	4	4

Access to the site is via Old Richmond Road (managed by Council) which is sealed and dual lane and links directly to the Flinders Highway. An unsealed local road off Old Richmond Road passes through the site providing access to properties and a residence/farming building and infrastructure approximately 350 m north of the Flinders River.

Council has drafted a survey plan and is in the process of finalising approval for simultaneous opening and closing of the road traversing the site. The layout for the new road is shown on Council's proposed reconfiguration plan (refer Figure 3-5).

The realignment will have provision for a 12 m wide footprint and unsealed road off which direct access to site facilities will be provided with the alternative being direct access off Old Richmond Road. The width of the proposed road corridor is limited to 20 m. In accordance with the Flinders Shire Planning Scheme, the road will be constructed per Institute of Public Works Engineers of Australia (IPWEA) Standard Drawings generally including 7-8 m formation, 75 mm wearing course and table drains. Access to each property off the realigned road (or Old Richmond Road) (refer Figure 3-5) will be constructed in accordance with IPWEA Standard Drawings for rural driveways.

These will form part of the conditions of approval for the subsequent initial development Reconfiguration of a Lot application (refer section 6 of this IAR) that will be finalised following the Coordinator-Generals assessment of the project.

Internal access and perimeter roads (generally 10-15 m wide corridor) have been provided for in the proposed infrastructure layouts and are also shown on Figure 3-5. These corridors will also service irrigation pipes connecting pumps, bores and water storage facilities.

3.3.3 Power

There are no significant power generation or transmission infrastructure requirements for the site. Initial development of the site will be serviced with 3 phase power via connection to the reticulated electricity infrastructure network. Power supply will be the responsibility of third party investors/growers as required.

This will form part of the conditions of approval for the subsequent initial development Reconfiguration of a Lot application (refer section 6 of this IAR) that will be finalised following the Coordinator-Generals assessment of the project.

3.3.4 Telecommunications

There are no significant telecommunication infrastructure requirements for the site. Initial development of the site will likely be serviced by mobile broadband. Telecommunications will be the responsibility of third party investors/growers as required.

3.3.5 Sewerage

There are no significant sewerage infrastructure requirements for the site. For initial development, waste water generated will be from limited staff (1 cabin) and caretaker accommodation (1 cabin) and associated workforce amenities only, with no requirement for process water within the packaging process. This is also expected to be the case of any subsequent development of the site.

The site will not be connected to the reticulated sewerage network. In accordance with the Flinders Shire Planning Scheme, development not having reasonable access to the reticulated sewerage network are serviced by an on-site waste water treatment in accordance with Water Services Association of Australia (WSAA) Sewerage Code of Australia.

This will form part of the conditions of approval for the subsequent initial development Reconfiguration of a Lot application (refer section 6 of this IAR) that will be finalised following the Coordinator-Generals assessment of the project.

3.4 Water impoundment, extraction, discharge, injection use or loss of surface water or groundwater

NAWS (2019) water resource development strategy describes the infrastructure required to harness current and proposed water sources for initial development and investigations required to support additional water sources to increase reliability of water supply for future development.

NAWS (2019) strategy has been developed in the context of the NRA (2019) land suitability study in particular with consideration to climatic limitations including frost and heat stress.

The following sections provide a summary of the NAWS (2019) water resource development strategy which assumed ultimate development of the site consisting of 110 ha of table grapes, 150 ha of citrus and 50 ha of avocado for a total developable area of 310 ha. This was based on the outcomes of the land suitability assessment (NRA, 2019) and environmental buffer requirements to watercourses and wetlands with the precinct. As outlined within section 3.1, further review of the total developable area following subsequent master plan development has resulted in a minor reduction to the total available area of developable land to 305.7 ha. Therefore, annual irrigation requirements outlined within the following sections are to be considered slightly conservative.

3.4.1 Annual irrigation requirements

NAWS (2019) reviewed monthly Class A pan evaporation data to estimate the potential evapotranspiration for the proposed crops and made a range of assumptions to develop annual irrigation requirements for table grapes, citrus and avocado. A copy of the NAWS (2019) water resource development strategy is provided at Appendix A.

Table grapes, citrus and avocado will be irrigated by well managed trickle or under tree, low-pressure micro-irrigation irrigation systems consisting of dual drip lines and mini sprinklers for climate control (NAWS, 2019).

NAWS (2019) calculated annual irrigation and climate control rates for proposed cropping is summarised in Table 3-6. The total development annual water requirement is expected to be in the order of 3,395 ML/yr.

Table 3-6 Cropping irrigation and climate control water requirements

Aspect	Table grapes	Citrus	Avocado
Irrigation (ML/ha/yr)	7.0	9.0	10.2
Climate control (ML/ha/yr)	6.5	0	1.0
Total (ML/ha/yr)	13.5	9.0	11.2
Initial development area (ha)	50	75	25
Initial development annual water requirement (ML/yr)	675	675	280
Total development area (ha)	110	150	50
Total development annual water requirement (ML/yr)	**1,485**	**1,350**	**560**

3.4.2 Current water sources

There are four main water sources currently proposed for the project and to be considered within the scope of this IAR as follows:

- Flinders River Alluvium:
    - Flinders River Alluvium <1 km from Flinders River (450 ML/yr).
    - Flinders River Alluvium >1 km from Flinders River (1,038 ML/yr).
- Great Artesian Basin (720 ML/yr).
- Flinders River Surface Water (5,000 ML/yr).

These are discussed in the following sections in order of development precedence (i.e. order of establishment on the site in line of initial and ultimate development of the site).

3.4.2.1 Flinders River Alluvium

Extensive groundwater investigations in the south-eastern part of the site in 2015-2017 (RLA, 2017) and 2018 (RLA, 2018) have been completed on behalf of Council. This has included installation of a number of exempt groundwater bores for the purposes of testing the water production capacity, water production quality and hydraulic properties of the aquifer. Investigations have shown a relatively confined, shallow sand/gravel aquifer of good quality water that lies beneath the upper left bank of the Flinders River (NAWS, 2019). The aquifer is regulated in two ways generally being, < 1 km from the Flinders River, or > 1 km from the Flinders River.

This delineation relates generally to the requirements of the Gulf Water Plan (refer section 6.3 for regulatory assessment details) which prescribes groundwater in the aquifer under the Flinders River, or under land within 1 km of the Flinders River, is declared to be water in the watercourse requiring a water licence. Council hold an existing water licence 609134 for the take of 450 ML from the aquifer from within < 1 km of the Flinders River.

No water licence is required for bores within the aquifer > 1 km from the Flinders River however, development approval in the form of operational works will be required as the network does not currently comply with the critical distances prescribed for exempt bores. RLA (2018) assessment of pump-test results indicates that the long-term, safe annual yield from the production bores located >1 km from the Flinders River is 1,038 ML per year.

The groundwater bore network within the Flinders River Alluvium is shown on Figure 3-1 and described in Table 3-8. Copies of the RLA (2017 and 2018) reports are provided at Appendix A. NAWS (2019) reported that samples were obtained from the recently constructed production bores and observation bores for water quality determination with results of laboratory analysis demonstrating that water quality (conductivity) varies from 332 - 960 µS/cm-1, (approximately 212 - 614 mg/l for total dissolved salts) and pH is in the neutral range of 6.3 to 7.5.

3.4.2.2 Great Artesian Basin

Under the Water Plan (Great Artesian Basin and Other Regional Aquifers) 2017, unallocated water may be granted from the State reserve for a coordinated project declared under the SDPWO Act.

Following coordinated project determination, council made application for an entitlement of 1,020 ML per year from the Great Artesian Basin (GAB). DNRME have advised that their current groundwater impact assessments required as part of the fixed price sale indicated a sustainable allocation of 720 ML/yr from the Hutton formation. These Terms of Sale have been accepted by Council.

The 720 ML GAB water allocation will be accessed by means of a production bore designed to exploit the Hutton formation. GAB bore 1, will be constructed in close proximity to the initial development. Obtaining a significant entitlement from the GAB was paramount to the success of the project, as all other available sources rely on river flow or run-off and are therefore subject to

seasonal variation and may be negatively affected by prolonged droughts (NAWS, 2019). The groundwater bore network within the GAB is shown on Figure 3-1.

NAWS (2019) included a review of literature with respect to water quality within the GAB Hutton formation and found that they are generally less than 1,000 mg/l total dissolved salts. It is intended the water from the GAB bore will be mixed with the better quality alluvial or river water sources to produce irrigation water supply of acceptable quality for the intended crops (NAWS, 2019).

3.4.2.3 Flinders River surface water and ring tank dams

Council hold a water licence 618019 for extraction of up to 5,000 ML/yr from the Flinders River when flow at the Richmond gauging-station, (DNRME station. 915008A), exceeds 1,500 ML per day. NAWS (2019) undertook a review of long term publically available DNRME data, with the mean and median number of days these conditions are met is 29 days and 24 days respectively.

An extraction rate of about 208 ML per day (or 2407 L/s) would be required in order to access the 5,000 ML annual entitlement. NAWS (2019) considers it unlikely that investment in a pump-station of such capacity could be justified, as the 80% reliable pumping opportunity is only about 8 days per year. The IAS proposed a 450 ML off-stream storage, or ring-tank, in close proximity to the bore-field and the initial development. NAWS (2019) proposes that a 500 ML fully-enclosed ring-tank (1a) dam be constructed in the early years of the project's development, as irrigation water demands ramp-up. This facility would be supplied during Flinders River flow events (that exceeding the water-harvesting trigger level) by a typical water-harvesting installation comprising dual pump-units with a combined capacity of approximately 60 ML per day capable of extracting 500 ML per year with 80 % reliability (NAWS, 2019).

As initial development crops mature and irrigation water demands reach peak levels or with further development of the site, a second similarly-sized storage cell will be added to the ring-tank (1b) dam to provide a combined capacity of approximately 1,000 ML. Water-harvesting capacity will be augmented by duplication of the original pump-station (i.e. 120 ML per day). The location of the proposed ring tank dam (1a and 1b) is shown on Figure 3-1.

Additional provision is provided for future development of the balance of suitable agricultural land on the central and western portions of the block. This would likely include similarly sized 500 ML ring tank (2) and associated pumping infrastructure along with a 500ML Hillside Dam and associated pumping infrastructure.

Indicative dimensions for water storage infrastructure is provided in Table 3-7. Ring-tank embankments will be in the order 3.5 m mean height, with 4 m crest and 3:1 (h:v) batters. The hillside dam embankments will be in the order of 4.5 m maximum and 3.75 m mean height with 4 m crest and 3:1 (h:v) batters.

Preliminary site investigations indicate that on-site materials appear to be suitable for dam construction however, permeable sub-soils at depth will need to be addressed. Requirements for imported material will determined during detailed design and subsequent secondary approval phases (i.e. operational works).

Table 3-7 Indicative dimensions for ring tanks and hillside dam

Structure	Area	Storage volume
Ring tank dam 1a	18.68 ha	500 ML
Ring tank dam 1b	18.76 ha	500 ML

Structure	Area	Storage volume
Ring tank 2	18.74 ha	500 ML
Hillside dam	17.53 ha	500 ML

3.4.2.4 Overland flow dam

NAWS (2019) conducted a preliminary investigation of a potential dam-site on a drainage feature in the north-western part of the site (refer Figure 3-1). NAWS (2019) concluded that the drainage feature appears to have potential for development of a gully-dam to collect overland flow from a 2,200 ha catchment. Based on NAWS (2017a) preliminary site assessment and information contained with the NRA (2019) land suitability assessment, NAWS (2019) concluded that on-site materials appear to be suitable for earth-dam construction.

Development of the site is limited by its proximity to Old Richmond Rd and the presence of permeable, sandy loam in the upper gully banks which may limit the available storage depth however, it is considered that a volume of 220 to 250 ML is achievable (NAWS, 2019). Requirements for imported material will determined during detailed design and subsequent secondary approval phases (i.e. operational works). The indicative area of the overland-flow dam is 18.13 ha.

3.4.2.5 Water infrastructure summary

Table 3-8 provides a summary of the proposed water infrastructure associated with the development.

Table 3-8 Water infrastructure summary

Source of water	Volume	Water licence requirement	Staging	Bore production rate	UTM Grid	Registered number& local name	Drilling program	Purpose
Phase 1 water production and infrastructure summary								
Flinders Alluvium < 1 km from Flinders River	450 ML	609134	Phase 1a	7.38 l/s	195852E, 7698863S	RN183123 / #1179	2018	Production & monitoring
				5.5 l/s	195828E, 7699457S	RN163722 / #4	2016	Production & monitoring
				42 l/s	197097E, 7698885S	RN183245 / 1163-4	2018	Production & monitoring
Flinders Alluvium > 1 km from Flinders River	1,038 ML	No Licence requirement	Phase 1a	12 l/s	195588E, 7698543S	RN163723 / #1	2016	Production & monitoring
				22.5 l/s	195743E, 7698491S	RN175331 / #2	2017	Production & monitoring
				19.0 l/s	1955512E, 7698685S	RN175333 / #3	2017	Production & monitoring
				17.5 l/s	195876E, 7698459S	RN183236 / 1140-6	2018	Production & monitoring
				12.3 l/s	195937E, 7698578S	RN183275 / 1177-5	2018	Production & monitoring
Great Artesian Basin (Hutton Formation)	720 ML	Licence to be granted. Terms of Sale have been accepted by Council.	Phase 1a	TBA	195898E, 7698725N	GAB 1	TBA	Production & monitoring
Ring tank dam 1a	500 ML	618019	Phase 1a	-	-	N/A	N/A	Water storage
Ring tank dam 1b	500 ML	618019	Phase 1b	-	-	N/A	N/A	Water storage
Phase 1 total volume	**3,208 ML**	-	-	-	-	-	-	-
Phase 2 water infrastructure summary								
Ring tank dam 2	500 ML		Phase 2	-	-	N/A	N/A	Water storage
Overland flow dam	250 ML		Phase 2	-	-	N/A	N/A	Water storage
Hillside dam	500 ML		Phase 2	-	-	N/A	N/A	Water storage
Phase 2 total volume	**1,250 ML**		Phase 2	-	-	N/A	N/A	Water storage
Total Phase 1 & 2 water volume	**4,458 ML**							
Phase 1 & 2 groundwater monitoring infrastructure summary								
Flinders River Alluvium	-	-	Existing	-	195667E, 7698497S	RN183052 / OB1	2016	Monitoring
	-	-	Existing	-	195872E, 7698462S	RN175265 / OB2	2016	Monitoring
	-	-	Existing	-	195702E, 7698618S	RN175318 / OB3	2016	Monitoring
	-	-	Existing	-	195686E, 7698488S	RN91500046	1967	Monitoring
	-	-	Existing	-	195836E, 7699544S	RN91500047	1969	Monitoring
	-	-	Existing	-	196165E, 7698596S	RN183111 / 1126-2	2016	Monitoring
			Existing	-	195840E, 7698868S	RN183013 / 1126-4	2018	Monitoring
	-	-	Existing	-	197097E, 7698885S	RN183245 / 1163-4	2018	Monitoring

3.4.3 Reliability assessment for current water sources

NAWS (2019) provided a reliability assessment for currently proposed water sources outlined above. This is summarised in Table 3-9 and demonstrates capacity to meet irrigation and climate control demands for full development of the site (refer Table 3-6).

Table 3-9 NAWS (2019) Reliability assessment for currently proposed water sources

Source	Reliability category	Reliability (%)	Volume (ML/yr)
Flinders River Alluvium < 1 km from Flinders River	High Reliability	100	450
Flinders River Alluvium > 1 km from Flinders River	High Reliability	100	1,038
Great Artesian Basin Hutton formation	High Reliability	100	720
Total (High Reliability)			**2,208**
Flinders River surface water and ring tank dam 1a	Medium-high Reliability	80	500
Flinders River surface water and ring tank dam 1b	Medium-high Reliability	80	500
Flinders River surface water and ring tank dam 2	Medium-high Reliability	80	500
Overland flow dam	Medium-high Reliability	80	250
Hillside dam	Medium-high Reliability	80	500
Total (Medium-high Reliability)			**2,250**
Total			**4,458**

3.5 Description of proposed lot reconfiguration

Council has drafted a survey plan for the proposed Reconfiguration of a Lot application (refer section 6 of this IAR) for initial development that will be finalised following the Coordinator-Generals assessment of the project. The layout for the new lots (eastern part – 474.4 ha and western part 2 – 441.6 ha) and road realignment layout is shown on Council's survey plan (refer Figure 3-5).

Initial development of the site is planned to occur in the reconfigured eastern part (474.4 ha). The first phase of the initial development will occur in the areas adjacent to existing water supply infrastructure (i.e. groundwater bores) to offset development and operational costs then subsequently extend towards the eastern property boundary.

Council may consider future reconfiguration of the western part (441.6 ha) into viable agricultural development blocks for private investment ranging from 5 ha to 20 ha in size subject to third party investors/grower interest.

Land Title Act 1994 ; Land Act 1994
Form 21 Version 4

SURVEY PLAN

Sheet 1 of 3

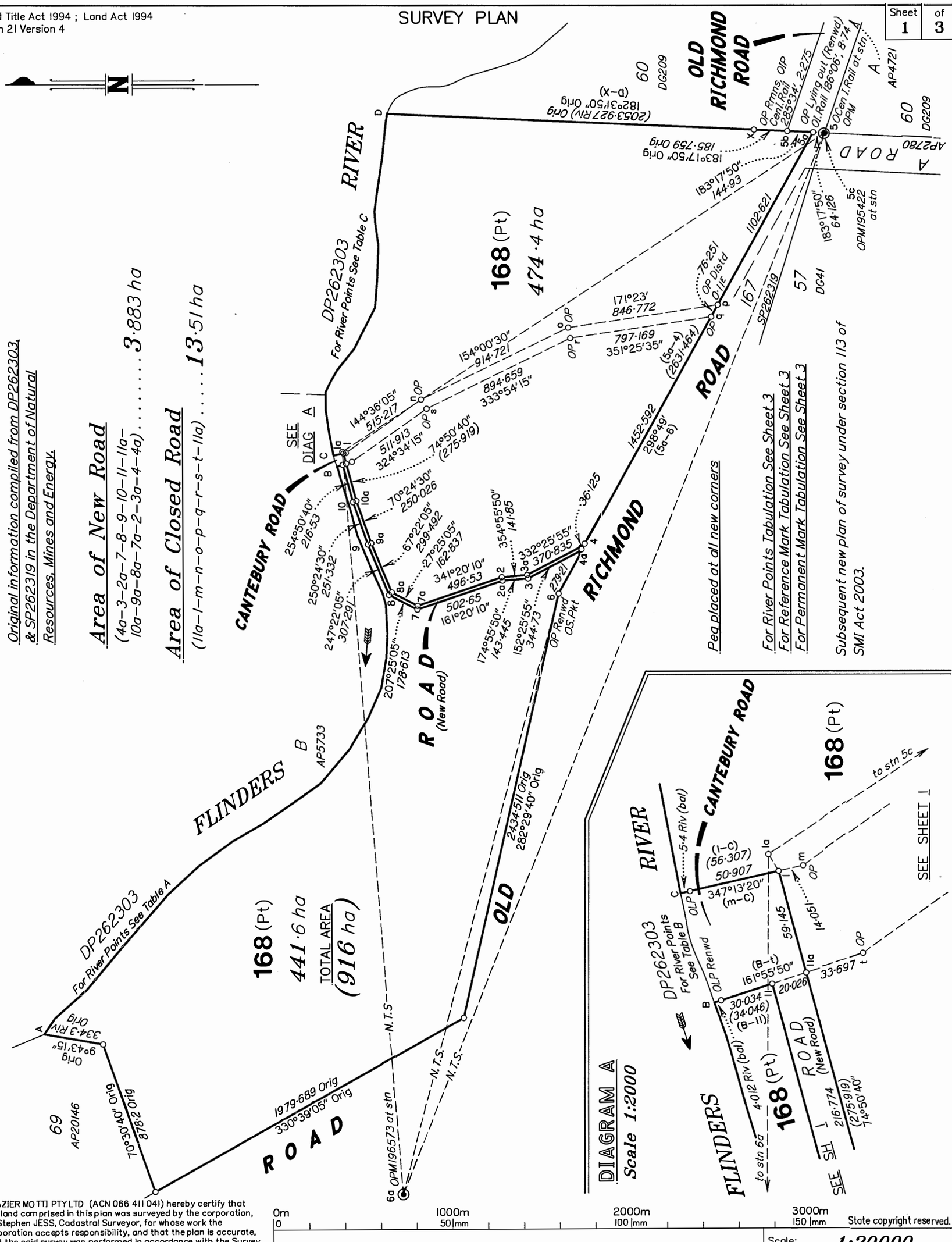
Original information compiled from DP262303 & SP262319 in the Department of Natural Resources, Mines and Energy.

Area of New Road

(4a–3–2a–7–8–9–10–11–11a–10a–9a–8a–7a–2–3a–4–4a) ..... *3·883 ha*

Area of Closed Road

(11a–l–m–n–o–p–q–r–s–t–11a) ..... *13·51 ha*



BRAZIER MOTTI PTY LTD (ACN 066 411 041) hereby certify that the land comprised in this plan was surveyed by the corporation, by Stephen JESS, Cadastral Surveyor, for whose work the corporation accepts responsibility, and that the plan is accurate, that the said survey was performed in accordance with the Survey and Mapping Infrastructure Act 2003 and Surveyors Act 2003 and associated Regulations and Standards and that the said survey was completed on 14th March, 2019.

BRAZIER MOTTI PTY LTD THE COMMON SEAL OF ACN 066 411 041 Director Date 13/06/2019

Scale: 1:20000

Format: STANDARD

Plan of Lot 168

Cancelling Lot 168 on SP262319 and part of USL (being closed road)

LOCAL GOVERNMENT: *FLINDERS SHIRE COUNCIL*

LOCALITY: ***DUTTON RIVER***

Meridian: *MGA (Zone 55) Vide Cors*

Survey Records: *No*

SP307189

41891/001 3CHO

Figure 3-5 Lot 168 Survey plan

3.6 Construction activities

Construction of the project will involve the following works:

- Preparation including clearing, deep ripping with cutterbar, levelling, application of manure and gypsum (or other soil amelioration if required subject to further investigation of land suitability and soil chemistry) and perimeter fence construction.
- Irrigation set-up including bore construction, pump and spin filter installation, irrigation water distribution and field set-up (i.e. submains, sprinklers and drip lines) and irrigation dam construction.
- Field development for grapes including posts, trellis, wires, grafted vines and vine guards and citrus including grafted trees and tree guards.
- Building and infrastructure construction including logistics facility, sheds, cold rooms, packing facilities, machinery sheds pump and filter sheds, chemical storage sheds and amenities.

The existing Council and State-controlled road network will be the main mode of transporting machinery and infrastructure during construction. Best practice environmental controls as outlined within section 5 will be implemented during construction phase activities.

3.7 Estimated workforce requirements during construction and operation

Estimated direct workforce numbers for initial development of the site are described in Table 3-10.[2]

Table 3-10 Initial development estimated workforce requirements

Period	Employment	FTEs (annual basis)
Construction and establishment phase over the first 5 years	Five FTEs to undertake infrastructure development	5 FTEs
Total (development)		**5 FTEs**
Table grapes year 3 production (50 ha)	Two people per hectare for five months of the year (typically between November to May)	41 FTEs
Citrus year 3 production (100 ha)	One person per hectare for four months of the year (typically between May to September)	34 FTEs
Operational staff	Two full time staff in operations	2 FTEs
Total (operations)		**77 FTEs**

[2] Specific calculations for Avocado are not provided. For the purpose of this IAR, 100 ha citrus and 50 ha table grape for initial development has been assumed.

Workforce demands for full development of the remaining area of developable land for high value agricultural crops, assuming similar cropping, is provided in Table 3-11.[3]

Table 3-11 Full development estimated workforce requirements

Period	Employment	FTEs (annual basis)
Construction and establishment phase over the first 5 years	Fifteen FTEs to undertake infrastructure development	15 FTEs
Total (development)		**15 FTEs**
Table grapes year 3 production (110 ha)	Two people per hectare for five months of the year (typically between November to May)	91 FTEs
Citrus year 3 production (200 ha)	One person per hectare for four months of the year (typically between May to September)	68 FTEs
Operational staff	Two full time staff in operations	6 FTEs
Total (operations)		**165 FTEs**

The project has potential to generate in the order of 165 FTEs/annum for the life of the enterprise along with 15 FTEs/annum during the construction and establishment phase. Once full development is realised (likely over 5-10 years), this would make the precinct one of the largest employers in the Shire. The benefit of this staged approach, being a necessary outcome of the development type (i.e. varying timeframes for crops to mature and reach full production) is that employment opportunities will be generated incrementally providing opportunities for local employment initially (which will be encouraged through Council policy and dealings with third party investors) then supplemented by seasonal works as required in the future.

3.8 CAPEX and gross production values

Capital costs for initial development of the site will be in the order of $20 million with full development a further $27 million. Production value of initial development will be market dependent. DAF (2018) and Willet et al (2018) indicates average gross ($/ha) for citrus in the order of $25,000/ha. Annual gross value for citrus would be approximately $1.9 million per year at full production. CSIRO (2013) identified that the Flinders catchment may have advantages in that it could supply southern markets ‘out of season’. SMR (2014) indicates farm gate weighted average ($/ha) for table grapes (1997-2014) as $29,425/ha. Annual farm gate value for table grapes would be approximately $1.5 million per year at full production.

Assuming the remaining developable land for high value agricultural crops have similar value ($/ha), the project may generate in gross value in the order of $8-9 million per year at full production for the life of the enterprise. Council will promote intensively grown, efficiently irrigated, low volume, high value agricultural crops within the precinct which will result in better returns and outcomes for the Shire when compared to broad acre, low-return, high volume crops. These types of enterprises meet Council’s goals of providing employment prospects for residents as well as encouraging migration of seasonal and skilled workers to the Shire where these cannot be filled locally.

[3] Specific calculations for Avocado are not provided. For the purpose of this IAR, 110 ha citrus and 200 ha table grape for full development has been assumed.

Though difficult to predict, flow on employment opportunities will likely be industries associated with agricultural supplies (i.e. pumps, fertilisers and chemical suppliers, machinery supply and service industries) and transport industries.

4. Summary of environmental values

The following provides a summary of environmental values for the site. Information presented within the IAS has been reviewed in the context of the following technical reports that have since been completed on behalf of Council:

- GHD (2019) EPBC significant impact assessment.
- NRA (2019) land suitability study.
- NAWS (2019) water resource development strategy.
- RLA (2018) groundwater investigations.
- Wild (2018) flora and fauna assessment.
- Wild (2018a) property map of assessable vegetation (PMAV).

Copies of each report are provided at Appendix A. Figure 4-1 provides a summary of key environmental features present on the site.

4.1 Natural environment

4.1.1 Groundwater

4.1.1.1 Flinders River Alluvium

Extensive groundwater investigations in the south-eastern part of the site in 2015-2017 and 2018 have been completed on behalf of Council. Technical assessment of the drilling programs (refer RLA, 2017 and RLA 2018 at Appendix A) identified the following key characteristics for the aquifer:

- It is usually encountered at a depth of about 10 m below ground level (bgl) and extends to a depth of between 15-18 m bgl.
- It is unconfined with an average saturated thickness of about 6 m.
- It is underlain by the Ranmoor Member of the Wallumbilla Formation, being the cap rock for the Great Artesian Basin sequence. The Ranmoor member is stiff grey clay or black mudstone with very little porosity and is generally considered the hydrogeological basement of the aquifer.
- It likely experiences episodic recharge during and after high intensity rainfall events which cause the gullies and lagoons on the site to flow or store higher than usual volumes of water.
- It primarily flows to the north and north-east towards the Flinders Rivers (gradient is 0.008 towards the north).
- It is primarily recharged via infiltration of rainfall with river flows having little influence on the aquifer.

Council hold an existing water licence 609134 for the take of 450 ML from the aquifer from within < 1 km of the Flinders River. No water licence is required for bores within the aquifer > 1 km from the Flinders River.

Based on the above referenced aquifer characteristics, the total volume of groundwater in storage > 1 km from the Flinders River is calculated to be 1,297 ML (RLA, 2018). However, not all of that volume will be available for extraction as some groundwater remains attached to the aquifer matrix during pumping (known as ‘dead storage’). Assuming that approximately 20% of

the total storage is ‘dead storage’ with long-term, RLA (2018) calculated the safe annual yield from the production bores located >1 km from the Flinders River at 1,038 ML, assuming that regular annual rainfall recharge occurs.

The groundwater bore network within the Flinders River Alluvium is shown on Figure 3-1 and will provide for the full 450 ML allocation under water licence 609134 (< 1 km of the Flinders River) and 1,038 ML calculated by RLA (2018) (< 1 km from the Flinders River).

NAWS (2019) reviewed water quality samples that were obtained from the recently constructed production bores and observation bores for water quality determination with results of laboratory analysis demonstrating that water quality (electrical conductivity) varies from 332 - 960 µS/cm-1, (approximately 212 - 614 mg/l for total dissolved salts) and pH is in the neutral range of 6.3 to 7.5.

RLA (2017) also included an analysis of water quality data for initial investigation bores and concluded that:

- Groundwater is generally of a higher electrical conductivity than surface water, attributed to being in contact with the Ranmoor Formation. However, all groundwater and surface electrical conductivity water is moderately low.
- Water with an electrical conductivity of less than 1,000 µS/cm-1 and pH of between 6.5 - 8.5 is generally suitable for drinking water, with most water in the vicinity of the site meeting these criteria.

4.1.1.2 Great Artesian Basin

Queensland Government development assessment mapping indicated the site is located within the Great Artesian Basin and Other Regional Aquifer water resource plan area. The Water Plan (Great Artesian Basin and Other Regional Aquifers) 2017 (the Water Plan) regulates the area and defines the availability of water in the plan area. Per schedule 2 of the Water Plan, the site falls within the following groundwater units and groundwater sub-areas:

- Betts Creek beds groundwater unit.
- Clematis groundwater unit.
- Hooray groundwater unit.
- Hutton groundwater unit.
- Rolling Downs groundwater unit.
- Springbok Walloon groundwater unit.
- Winton Mackunda groundwater unit.

Council has made application for an entitlement of 1,020 ML per year from the Great Artesian Basin (GAB). DNRME have advised that their current groundwater impact assessments required as part of the fixed price sale indicate a sustainable allocation of 720 ML/yr from the Hutton formation.

NAWS (2019) included a review of literature with respect to water quality within the GAB Hutton formation and found that they are generally less than 1,000 mg/l total dissolved salts. It is intended the water from the GAB bore will be mixed with the better quality alluvial or river water sources to produce irrigation water supply of acceptable quality for the intended crops.

4.1.2 Surface water features

The site is located on the southern bank of the Flinders River, a necessary requirement for access to water sources (e.g. Flinders River Alluvium groundwater and surface water) and the

most suitable agricultural soil types. A number of ephemeral hydrological features are also located on the site generally draining towards the Flinders River (refer Figure 4-1).

Queensland Government development assessment mapping identified the Flinders River as a Major risk (purple) waterway and the ephemeral hydrological feature in the north east of the site as a Low risk (green) waterway. Physical and hydrological attributes of a waterway (e.g. bed and banks, flow characteristics and habitat) inform colour coding relevant to the level of risk of adverse impact on fish movement resulting from a barrier with green being the lowest risk and purple being major risk.

Queensland Globe watercourse identification mapping identified the Flinders River as "watercourse" (blue) and the ephemeral hydrological feature in the north-west of the site as "unmapped" (light grey). All other site features were identified as "drainage features" (red).

The implication of waterway and watercourse mapping with respect to project approvals are discussed in detail in section 6 of this report.

CSIRO (2013) undertook a comprehensive review of the ecology of the Flinders catchment and associated surface water feature with key findings as follows:

- Streamflow in the Flinders catchment, like many other north Queensland catchments, is extremely seasonal with low water volumes and poor water quality in remnant waterholes and reaches in the dry season acting as dry-season refugia for aquatic biota (CSIRO, 2013).
- During times of high streamflow, connectivity occurs along the entire river length and laterally to off channel water bodies and wetlands, providing important migration opportunities for aquatic animals (CSIRO, 2013).

4.1.3 Wetlands

4.1.3.1 Desktop assessment

MSES Environmental Reporting indicated that the site does not contain High Ecological Significance (HES) or High Ecological Value (HEV) wetlands nor do these occur within the immediate project area. However, referrable wetland mapping indicated the site contains General Environmental Significance (GES) wetlands (refer Figure 4-1). EPBC Act PMST mapping did not identify any Wetlands of International Importance occurring within 3 km of the site.

4.1.3.2 Wild (2018) field survey

The abandoned river channels throughout the site are characteristic of wetland habitats and these channel systems form depressions in an otherwise flat floodplain landscape consisting of sometimes bare ground or a distinct ground layer of native forbs or invasive species (Wild (2018). These areas are subject to seasonal wetting and drying cycles and therefore can be described as palustrine wetlands.

One small wetland holding water was observed and considered unusual by Wild (2018) given the time of year (August 2018 being in the late dry season). It was concluded that this was likely to be artificial as there was evidence of an earthen bund wall constructed on the northern inside edge of the oxbow lake providing a permanent water source for cattle. This is referencing infrastructure used for cattle watering associated with the current use of the site for the Stock Route Network (refer section 2.2 of this report).

4.1.4 Protected areas

Matters of State Environmental Significance (MSES) Environmental Reporting indicated that the site is not located within or adjacent to a protected area.

EPBC Act Protected Matters Search Tool (PMST) mapping did not identify any protected areas of National Environmental Significance (MNES) (i.e. World Heritage Properties, National Heritage Places, Wetlands of International Importance, Marine Parks or Marine Areas) occurring within 3 km of the site.

4.1.5 Ecological communities

4.1.5.1 Desktop assessment

EPBC Act PMST mapping did not identify any Listed Threatened Ecological Communities occurring within 3 km of the site.

4.1.5.2 Wild (2018) field survey

There were no Listed Threatened Ecological Communities identified on site during the Wild (2018) field survey.

4.1.6 Vegetation (regional ecosystems)

Vegetation on the site is predominantly remnant mixed eucalypt open woodlands, with fringing northern Mitchell Grass Downs grassland communities along the south western boundary with smaller areas of *Acacia cambagei* (Gidgee) woodlands on alluvial plains found sporadically throughout.

The sparse open nature of vegetation on the site as indicative of the vegetation's natural low density reflecting seasonally dry and arid conditions as well as the sustained and intensive grazing pressure which has likely suppressed tree recruitment and shrub density. Ground cover is indicative of intensive over- grazing being particularly sparse in some areas with the native grass *Astrebla* species dominating across the majority of the Wild (2018) survey sites.

A PMAV was approved for the site on 31 January 2019. Regional ecosystems present on the site are shown on Figure 4-1 and described in Table 4-1. It should be noted that section 8 of the *Vegetation Management Act 1999* (VMA) and Schedule 5 of the Vegetation Management Regulation 2012 precludes regional ecosystems 4.3.15, 4.3.14 and 4.9.1c being defined as vegetation and as such, development within these regional ecosystems is considered exempt development under Schedule 21 of the *Planning Regulation 2017* (Planning Regulation).

In addition to these regional ecosystems, MSES Environmental Reporting indicates that the site contains the following key vegetation features:

- 4.6 km of Regulated Vegetation – Intersecting a Watercourse (refer Figure 4-1).
- 73.57 ha of Regulated Vegetation – within 100 m of a Vegetation Management Wetland (refer Figure 4-1).

Table 4-1 Regional ecosystems present on the site

Regional ecosystem	VMA status	Category	Description	Structure category
4.3.4x2d	Least concern	B	Eucalyptus coolabah low woodland, commonly with *Lysiphyllum gilvum* and *Acacia cambagei*. The ground layer is tussock grasses. Occurs on alluvial plains of northern flowing rivers, flooded drainage lines and flat plains Floodplain (other than floodplain wetlands).	Very sparse
4.3.10c	Least concern	B	*Corymbia terminalis* and/or *C. dallachiana* woodland to open forest. Lower trees include *Lysiphyllum spp.*, *Grevillea striata*, *Atalaya hemiglauca* and *Vachellia sutherlandii*. A sparse variable shrub layer may occur. The ground layer is tussock grasses. Occurs on levees of major watercourses in the north-east of the bioregion. Sandy and loamy soils.	Very sparse
4.3.20	Least concern	B	Either grasses or forbs dominate the ground layer depending on seasonal conditions and at times extensive areas may be denuded of any species. *Sporobolus mitchellii* and *Astrebla spp.* occurs frequently and may be prominent (5-15% cover), while *Eragrostis setifolia* is locally common. After favourable seasons, herbs form a distinct but discontinuous ground cover. The dominant ephemerals include *Iseilema vaginiflorum*, *Arabidella nasturtium*, *Atriplex velutinella*, *Brachyscome dentata*, *Pycnosorus pleiocephalus*, *Ethuliopsis cunninghamii*, *Euphorbia drummondii*, *Goodenia fascicularis* and *Senecio pinnatifolius var. pinnatifolius.* Scattered low shrubs may occur with emergent trees fringing the association. Scattered low shrubs may occur and major drainage lines are frequently fringed by Eucalyptus coolabah low open woodland, *E. camaldulensis* low open woodland. *Acacia cyperophylla var. cyperophylla* low open woodland or *A. cambagei* tall open shrubland or a combination of these associations. The plant association fringing the drainage line is dependent on the local habitat. After summer local flooding, *Dactyloctenium radulans, Panicum laevinode, Iseilema spp.* and *Chloris pectinata* usually predominate. *Atriplex spp., Sclerolaena spp.,* and *Asteraceae conspicuous* after winter local flooding. *Echinochloa turneriana* usually predominates after early summer (general) flooding with *Pycnosorus pleiocephalus* and *Trigonella suavissima* conspicuous after early winter flooding. Occurs on flat infrequently flooded alluvial plains of major rivers with minor occurrences on interchange alluvia and in well drained clay pans. Soils very deep, grey and brown cracking clays. Flooding frequency variable depending on position in landscape.	Grassland

Regional ecosystem	VMA status	Category	Description	Structure category
4.3.23	Least concern	B	Mixed low open woodland, including combinations of the species *Acacia tephrina*, *Lysiphyllum spp.*, *Acacia cambagei*, *Ventilago viminalis*, *Atalaya hemiglauca* and *Flindersia maculosa*. Occasional canopy species include *Alectryon oleifolius*, *Corymbia terminalis*, *Eucalyptus coolabah* and *Acacia crombiei*. A sparse shrub layer may occur. The ground layer is tussock grasses. Occurs on active, silty alluvial plains, predominantly in the north-east of the bioregion.	Very sparse
4.3.15	Least concern	B	*Astrebla squarrosa* (10-30% cover) predominates and together with *A. elymoides* (1-10%) and *A. lappacea* (1-5%) forms a tussock grassland. *Dichanthium spp.* (1-15%), *Eulalia aurea* (1-5%) and *Iseilema vaginiflorum* (1-5%) are usually conspicuous. A number of ephemeral forbs and grasses may be prominent in good seasons. Sparsely scattered shrubs and trees may occur along the channels. Occurs on alluvia immediately above drainage lines. Soils moderately deep to deep, red and brown clays. The surface is usually crusting. Soils are neutral to alkaline and gypsum occurs at depth.	Grassland
4.3.2c	Least concern	B	*Eucalyptus camaldulensis* and/or *E. coolabah* woodland. Lower trees include *Melaleuca spp.* and *Lysiphyllum spp*. The ground layer is sparse tussock grasses Occurs on fringes of major watercourses in the north-east of the bioregion. Riverine wetland or fringing riverine wetland.	Sparse
4.9.1c	Least concern	B	*Astrebla spp.*, *Iseilema spp.* tussock grassland, commonly with *Panicum decompositum*, *Dichanthium spp.*, *Eulalia aurea*, *Chrysopogon fallax*, *Sarga plumosum*. Emergent *Atalaya hemiglauca* commonly occur. Occurs on level to gently undulating downs derived from Cretaceous mudstones (predominantly Allaru Mudstone) in the north of the bioregion.	Grassland
4.3.14	Least concern	B	*Astrebla lappacea* predominates sometimes in association with/or *A. pectinata* and form a cover of 10-30%. *A. squarrosa* (1-5%) is usually present, and *A. elymoides* and *Aristida latifolia* frequently form part of the tussock grassland. *Iseilema vaginiflorum*, *Panicum spp*. and *Dichanthium sericeum* may also be prominent in the tussock grassland. A number of forbs are present and increase in density after winter rainfall. Sparsely scattered shrubs may occur. Occurs on alluvia and drainage lines in undulating clay plains dominated by *Astrebla spp.* tussock grasslands. Soils are predominately deep, red, brown or grey, cracking clays.	Grassland

4.1.7 Native flora

4.1.7.1 Desktop assessment

Regulated vegetation management reporting identified areas of the site and wider project area as being within a high-risk area where particular provisions of the *Nature Conservation Act 1992* apply to the clearing of protected plants. These areas align with regional ecosystem 4.3.20 and 4.3.14 for Pink Gidgee.

MSES Environmental Reporting and Species list indicated that the site does not contain threatened and/or special least concern species records.

EPBC Act PMST mapping identified the following Listed Threatened Species of plants as relevant within 3 km of the site:

- Pink Gidgee (Vulnerable) – species or species habitat likely to occur within area.
- King Blue-grass (Endangered) – species or species habitat likely to occur within area.

4.1.7.2 Wild (2018) field survey

Pink Gidgee or King Blue grass were not identified as being present on the project site however, Wild (2018) undertook an assessment of the likelihood of their occurrence summarised as follows:

- Pink Gidgee (likely to occur):
    - The species appears to be most abundant within an area 100 km south and 1500 km north-west of Hughenden.
    - Historically, specimens have been recorded in the surrounds of the project area, and the habitat description is suitable for the project site.
    - Vegetation surveys found that regional ecosystems (4.3.20, 4.3.23 and 4.3.14) the species is known to inhabit are present on the site.
    - Although the species was not observed, limitations of the site survey means that it cannot be ruled out that the species does not exist.
- King Blue-grass (unlikely to occur):
    - The species was not observed and is unlikely to occur due to the site not matching the habitat preference for the species.

It is noted that although regional ecosystems the Pink Gidgee is known to inhabit were identified on the site (4.3.20, 4.3.23 and 4.3.14), these are not associated with land determined to be suitable for cropping. Council completed an EPBC significant impact assessment (refer Appendix A) with respect to these conservation significant fauna species. The assessment was completed in accordance with the *Significant Impact Guidelines 1.1 - Matters of National Environmental Significance* and associated Guidelines for EPBC Act listed species as relevant to the site. The outcomes of the assessment are provided in section 5.

4.1.8 Weeds (invasive species)

4.1.8.1 Desktop assessment

EPBC Act PMST mapping identified the following invasive species of flora as relevant within 3 km of the site:

- Prickly acacia – species or species habitat likely to occur within area.
- Rubbervine – species or species habitat likely to occur within area.

- Cotton-leaved Physic-Nut (Bellyache Bush) – species or species habitat likely to occur within area.
- Parkinsonia (Jerusalem Thorn) – species or species habitat likely to occur within area.
- Parthenium weed – species or species habitat likely to occur within area.
- Mesuite and Algaroba – species or species habitat likely to occur within area.
- Blackthorn – species or species habitat likely to occur within area.

4.1.8.2 Wild (2018) field survey

Field surveys confirmed the presence of dense weed infestations throughout and in the majority of sites investigated. Mesquite (*Prosopis pallida*) and Prickly acacia (*Vachellia nilotica*) were widespread throughout the shrub and low tree layer within eucalypt and gidgee communities. Mesquite and Prickly acacia were often observed as the dominant structure and Wild (2018) reported this as a potential cause for the low dominance of native shrubs.

Other invasive species identified in the survey included Rubber Vine (*Cryptostegia grandiflora*), Chinee Apple (*Ziziphus mauritiana*), Parkinsonia (*Parkinsonia aculeata*), Mimosa Bush (*Vachellia farnesiana*), Sida spp. and *Malvastrum americanum*.

4.1.9 Native fauna

4.1.9.1 Desktop assessment

MSES Environmental Reporting and Species list indicated that the site does not contain essential habitat or threatened species and/or iconic species.

EPBC Act PMST mapping identified the following Listed Threatened Species, Listed Migratory Species and Lister Marine Species as relevant within 3 km of the site:

- Listed Threatened Birds:
    - Critically Endangered: Curlew Sandpiper - Species or species habitat may occur within area.
    - Endangered: Star Finch - Species or species habitat likely to occur within area and Southern Black-throated Finch and Australian Painted Snipe - Species or species habitat may occur within area.
    - Vulnerable: Red Goshawk, Painted Honeyeater, Masked Owl - Species or species habitat may occur within area.
- Listed Migratory Birds:
    - Terrestrial birds: Oriental Cuckoo, Grey Wagtail, Yellow Wagtail.
    - Marine birds: Fork-tailed Swift.
    - Wetland birds: Common Sandpiper, Curlew Sandpiper, Sharp-tailed Sandpiper, Pectoral Sandpiper, Latham's Snipe.
- Listed Marine Birds:
    - Common Sandpiper, Fork-tailed swift, Great Egret, Cattle Egret, Sharp-tailed Sandpiper, Pectoral Sandpiper, Black-eared Cuckoo, Oriental cuckoo, Lantham's Snipe, White-bellied Sea-Eagle, Rainbow Bee-eater, Grey Wagtail, Yellow Wagtail, Painted Snipe.
- Listed Threatened Mammals:

- Vulnerable: Ghost Bat and Koala - Species or species habitat likely to occur within area and Greater Bilby and Julia Creek Dunnart - Species or species habitat may occur within area.

- Listed Threatened Reptiles:
  - Vulnerable: Plains Death Adder, Yakka Skink - Species or species habitat may occur within area.
- Listed Marine Reptiles:
  - Reptiles: Freshwater Crocodile.

Conservation significant terrestrial fauna species identified by Wild (2018) via database searches for the site are described in Table 4-2.

Table 4-2 Wild (2018) terrestrial fauna species identified via database searches for the area

Scientific name	Common name	NC Act status	EPBC Act status
Petauroides volans minor	Northern greater glider	V	V
Phascolarctos cinereus	Koala	V	V
Tachyglossus aculeatus	Short-beaked echidna	SL	
Grantiella picta	Painted honeyeater	V	V
Glareola maldivarum	Oriental pratincole	SL	
Actitis hypoleucos	Common sandpiper	SL	
Charadrius veredus	Oriental plover	SL	
Falco hypoleucos	Grey falcon	V	
Apus pacificus	Fork-tailed swift	SL	
Geophaps scripta	Squatter pigeon (southern subspecies)	V	V

V – Vulnerable

SL – Special least concern

4.1.9.2 Wild (2018) field survey

Surveys recorded 80 fauna species including 51 birds, 21 mammals and eight reptiles. Surveys were completed between 27 August 2018 and 1 September 2018 using a mix of survey techniques including:

- Remote motion sensor baited camera traps.
- Spotlighting.
- Scat, track, and sign search.
- Diurnal active searches for reptiles.
- Diurnal bird surveys using active search techniques.
- Microbat echolocation call detection.
- Opportunistic observations during other survey works.

The following sections provide a summary of survey results.

Habitat value, connectivity, condition and integrity

The following four broad habitat types were present at the site:

- Eucalypt woodland with grassy understory.
- Paleo channels with fringing woodlands and levees.
- Riparian areas along the Flinders River.
- Palustrine wetlands with intermittently ephemeral wetting cycles.

Most of the habitat was identified as woodland with a grassy understory and sparse and occasional shrub layer showing evidence of historical clearing and heavy weed infestation. As described in section 4.1.8.2, weed species were often the dominant structure. Piles of woody weeds and woody debris from clearing were found to provide refuge to some species, such as button quails.

Key fauna habitat features identified were the paleo channels. These included large cracks in the clay containing coarse wooden debris where the majority of reptiles were identified, taking shelter in the cracks of the clay once disturbed.

Overall the position of the site in the landscape was observed as one of a connected landscape forming a general wildlife corridor along the riparian and floodplain zone of the Flinders River.

Birds

Fifty-one bird species were recorded during field surveys with one listed as a vulnerable species under the EPBC Act and NC Act (Squatter Pigeon) and one a listed marine species (Rainbow bee-eater). No listed migratory species were reported as being observed in the field.

The majority of bird species were identified as woodland and grassland birds, with some waterbirds associated with the water storage within the central oxbow lake. Although there was low groundcover observed at the oxbow lake, considered likely by Wild (2018) due to overgrazing, it provided habitat for waterbirds including, pink-eared ducks, pacific black ducks, and dotterels.

Areas nearby to water were dominated by large flocks of budgerigars, galahs, cockatiels, masked wood swallows, and white-browed wood swallows. Wood swallow flocks were observed feeding on flowering *Lysiphyllum gilvum* and *L. carronii* trees. The open woodland and grasslands also supported suitable habitat for generalist woodland and grassland species such as emu, galahs, and quails.

For nocturnal bird species, only the barn owl was identified. Wild (2018) considered this a lower than expected outcome and possibly not representative of the sites full nocturnal bird assemblage.

Mammals

Twenty-one mammal species were identified across the site with 17 being species of microbats. Bat call analysis did not identify any species of conservation significance. Red Kangaroos (*Macropus rufus*), Eastern Grey Kangaroos (*Macropus giganteus*) and feral pigs (*Sus scrofa*) were most frequently observed.

A distinct lack of arboreal mammals was observed, which Wild (2018) attributed to a combination of distribution and dominance of arboreal nesting birds such as galahs which were present throughout the site. The Short-beaked Echidna (*Tachyglossus aculeatus*) was identified during surveys and is listed as a special least concern mammal under the NC Act.

Reptiles

Eight species of least concern reptile were recorded including three different species of snake (*Boiga irregularis, Pseudonaja textilis* and *Suta suta*), two species of skink (*Carlia munda* and *Carlia rubigo*) and three species of gecko (*Heteronotia binoei*, *Gehyra versicolor*, and *Diplodactylus tessellatus*). Dragon species (*Pogona barbatal*) was observed in the broader site area.

Wild (2018) considered it is likely that the Project site supports more reptile species and that numbers recorded may reflect the cryptic nature of many reptiles and seasonality.

Conservation significant fauna species

Wild (2018) identified one conservation significant species during the field survey, Southern Squatter Pigeon (*Geophaps scripta scripta*), a listed vulnerable species under the EPBC Act and NC Act.

Wild (2018) identified one migratory and marine species during the field survey, the Rainbow Bee-eater (*Merops ornatus*). Wild (2018) assessed the following migratory and marine species as likely to occur within the site based on previous records:

- Cattle Egret (*Ardea ibis*)
- Fork Tailed Swift (*Apus pacificus*).

Wild (2018) also considered it is possible that the following migratory and marine species may occur on the site:

- Great Egret (*Areda alba*).

Wild (2018) did not observe any other conservation significant fauna species on the project site and undertook an assessment of the likelihood of occurrence for key species summarised as follows:

- Julia Creek Dunnart (*Sminthopsis douglasi*) (possible to occur):
    - Distribution is poorly known due to population fragmentation and sporadic records. Records suggest that the population is found between Julia creek and Richmond with patchy populations east of Cloncurry extending south-east to Barcaldine.
    - The site is located outside of the species ‘confirmed distribution’ however, the site is potentially suitable for the Julia Creek Dunnart being that it is dominated by tussock grasses and cracking clay soils.
    - Other fauna species were observed sheltering in the cracks of the clay (Curl snake and Tessellated Gecko), indicative of the suitability of the clay habitat.
    - Historical records have been reported in the wider area, with the site being located in the possible distribution range of the species.
    - Sightings of feral cats may impact on the possibility of the species being present in the area as they are known to prey heavily on this species.
    - The degraded nature of the habitat by heavy grazing, is a reasonable risk to the presence of the species.
- Southern Squatter Pigeon (*Geophaps scripta scripta*) (known to occur):
    - Squatter Pigeons (flocks of 5) were recorded on site during field surveys always sighted in close proximity (< 600 m) to standing water.
- Black-throated Finch (southern subspecies) (*Poephila cincta cincta*) (unlikely to occur):

- The site is located within the 'possible' distribution for the species however, it is unlikely to occur on the site with the National Recovery Plan not listing any of the identified regional ecosystems being associated with Black-throated Finch.
- The long-term viability of the species is limited by: quality of habitat and availability of food; availability of permanent water sources which persist throughout the dry season; and suitability of trees for nesting. Although the site is currently heavily grazed, this is not necessarily an inhibiting factor on its own.
- Connectivity to existing populations may be an issue for this site and previous surveys in other areas near Hughenden have not identified the species.

- Red Goshawk (*Erythrotriorchis radiatus*) (possible to occur):
  - It is possible that this species inhabits the Project site. The site is located within the possible distribution of the Red Goshawk, however no specimens were recorded during field surveys.
- Short-beaked *echidna* (*Tachyglossus aculeatus*) (known to occur).

Council engaged GHD (2019) to undertake an EPBC significant impact assessment with respect to conservation significant fauna species identified by Wild (2018) (refer Appendix A). The assessment was completed in accordance with the *Significant Impact Guidelines 1.1 - Matters of National Environmental Significance* and associated Guidelines for EPBC Act listed species as relevant to the site. The outcomes of the assessment are provided in 5.

4.1.10 Pests

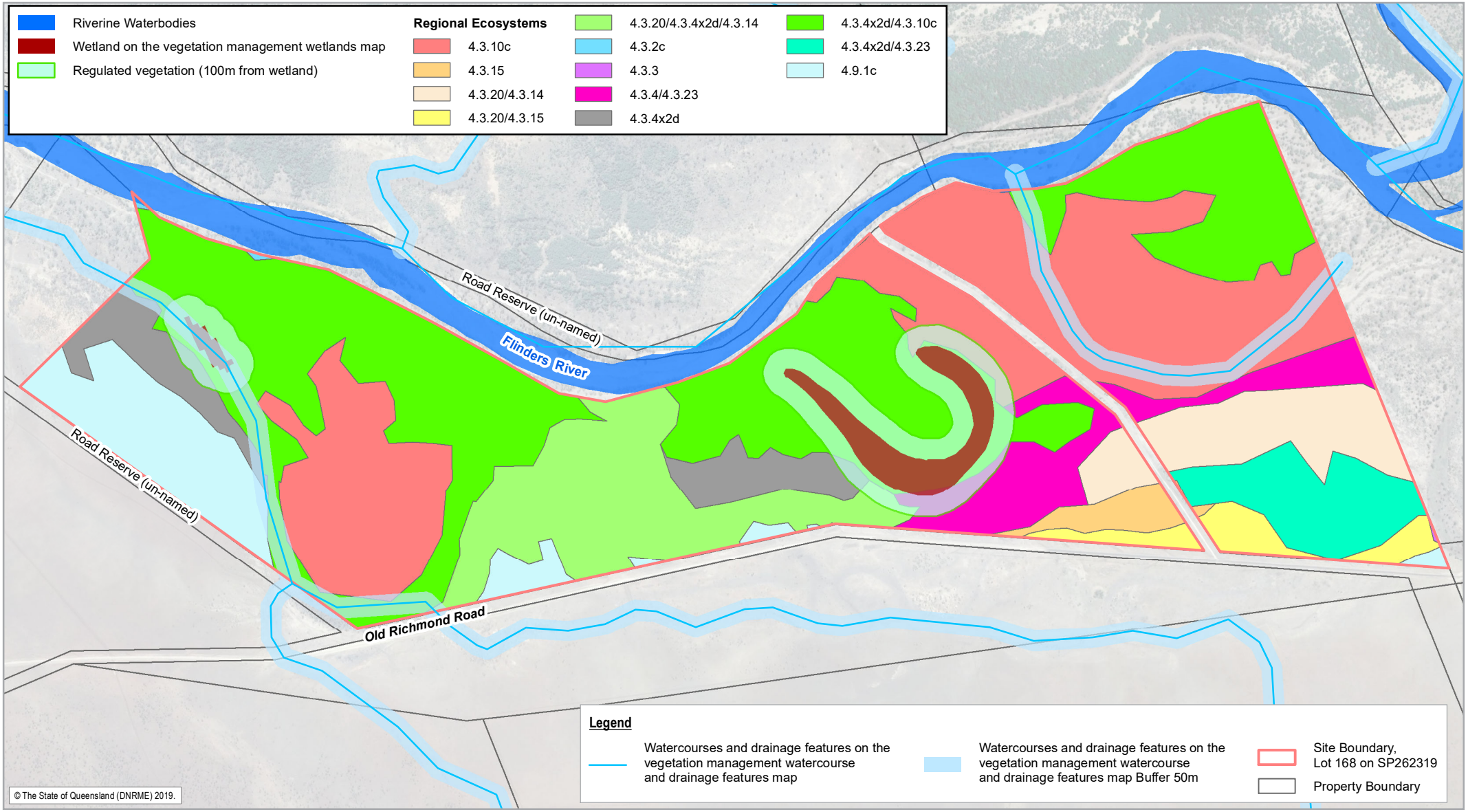
4.1.10.1 Desktop assessment

DoE (2019) EPBC Act PMST mapping identified the following invasive species of animals as relevant within 3 km of the site.

- Birds: Rock Pidgeon, Rock Dove, Domestic Pidgeon, House Sparrow.
- Frogs: Cane Toad.
- Mammals: Domestic Dog, Domestic Cat, Rabbit, Pig, Red Fox.
- Reptiles: Asian House Gecko.

4.1.10.2 Wild (2018) field survey

Wild (2018) confirmed the presence of Dingo/Wild Dog (*Canis lupus dingo/familiaris*), Rabbit (*Oryctolagus cuniculus*), Cat (*Felis catus*) and Pig (*Sus scrofa*), as well as livestock (i.e. cattle and horses). Dingo's are considered native wildlife under the NC Act and are protected in national parks however, elsewhere throughout Queensland are considered a pest (Wild, 2018). The Dingo/Feral dog was identified through tracks and evidence of an active den however, no visual observations were made by Wild (2018) to confirm species.



1:25,000 @ A4

0 250 500 750 1,000

Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

Flinders Shire Council
15 Mile Project

Environmental values

Project No. **42-20851**
Revision No. **A**
Date **03 Jul 2019**

FIGURE 4-1

N:\AU\Toowoomba\Service\Geospatial\42\20851\Maps\MXD\42-20851-05_watercourse_revA.mxd
Print date: 03 Jul 2019

Data source: DNRME: Cadastre, Wetland Mapping (2018); Vegetation Management Wetlands, Vegetation Watercourses, Regional Ecosystems v10.1 (2019); FSC: Infrastructure (2019); GE: Imagery extracted 7/9/2018. Created by: tngavranic

4.1.11 Natural hazards risk and resilience

4.1.11.1 Flooding

Flinders catchment coastal areas regularly flood over large areas of land which may extend long distances inland (CSIRO, 2013). Queensland Government State Planning Policy (SPP) mapping indicates the site is within the flood hazard – level 1 Queensland floodplain, developed for use by local governments as a potential flood hazard area and representing an estimate of areas potentially at threat of inundation by flooding however, not reflecting a particular event i.e. 100 year annual recurrence interval (ARI). CSIRO (2013) identifies that flooding can be catastrophic to agricultural production in terms of loss of stock, fodder and topsoil and damage to crops and provides the following general guidance with respect to inundation:

- Where pastures are inundated with stagnant water for > 5 days the above-ground biomass may die however, this may extend to two weeks if the water is aerated.
- Where inundation is >20 days the entire plant may die (this varies between pasture species).

While the Flinders River on a whole is prone to extensive flooding (CSIRO, 2013), the site for the proposed development is not identified in areas with a significant history of flood inundation between 2000 and 2010 and is not susceptible to long periods of inundation via stagnant water (i.e. > 5 days). Buildings and infrastructure would need to be developed to comply with applicable design requirements for flood immunity as relevant to the site.

NRA (2019) considered flooding as a limitation within the land suitability study. NRA (2019) field observations indicated areas of the site (i.e. swales and backplains) likely received regular inundation which was supported by anecdotal evidence collected from neighbouring landholders who indicated that the river frontage had not been flooded in the past 50 years, however regular overflows from the Flinders River do affect the back of the property. Based on a review of local relief, NRA (2019) concluded that the river frontage area would be above the major flood level with adjacent plains at a slightly lower elevation likely affected by major flood levels.

NRA (2019) included discussion with Council representatives following early 2019 flood events which indicated the following:

- The site drained well after the initial rain event.
- Due to downstream flooding and inability for the upstream catchment to drain, the whole of the project area was inundated.
- This inundation on higher ground did not last more than one day.

4.1.11.2 Bushfire

Queensland Government (2018c) SPP mapping indicates the site is within a bushfire prone area as follows:

- Medium potential bushfire intensity
- Potential impact buffer (i.e. within 100 m of a bushfire prone area).

4.1.12 Air

4.1.12.1 Climate and meteorology

The site is located approximately 12 km north, north-west of Hughenden and the climate is typical of north-west Queensland, cool and dry during winter and hot and dry with the potential for isolated rain events during summer.

The nearest Bureau of Meteorology (BoM) weather station is located at the Hughenden Post Office Station (site number 30024). A summary of climate statistics for this location is provided in Table 4-3.

Mean rainfall data indicates a wet season occurring between December and March and a dry season between April and November. Average annual rainfall for the town is 492 mm.

The mean monthly maximum temperatures in the area range from 25.0 °C (June/July) to 36.9 °C (December) and the mean monthly minimum temperatures range from 8.8 °C (July) to 22.5 °C (January).

The mean monthly 9 am wind speed in the area ranges from 7.9 km/h (February and December) to 10.5 km/h (September) and the mean monthly 3 pm wind speed ranges from 8.1 km/h (June) to 9.4 km/h (April and September). Wind direction is predominantly from the north east at 9 am but tends the east by 3 pm (Figure 4-2).

CSIRO (2013) states that overall, the climate of the Flinders catchment generally suits the growing of a wide range of crops, though in most years rainfall would need to be supplemented with irrigation.

4.1.12.2 Noise/vibration, light and air quality

Current sources of noise/vibration, light, particulate matter and odour in the project area are limited to those associated with existing land use(s) and natural process (i.e. fire, rain, etc.) of the site and surrounding properties. Rural (pasturage) features dominate the setting of the immediate project area and are indicative of the primary land use for the Shire (i.e. beef cattle production). Primary sources of noise and vibration, light, particulate matter and odour in the immediate project area as follows:

- Old Richmond Road traffic inclusive of local traffic and heavy vehicles servicing properties west of the site.
- Local traffic and heavy vehicle traffic and heavy vehicles passing through the site via the local road off Old Richmond Road providing access to properties and a residence/farming building and infrastructure approximately 350 m north of the Flinders River.
- Beef cattle on the site and adjacent properties inclusive of those grazing, using the Stock Route Network and its associated facilities and being transported to and from the general area.

Table 4-3 BoM (2017) Hughenden climate statistics - monthly averages (station. 30024)[4]

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean rainfall (mm)	114.5	98.0	58.2	26.0	17.8	18.6	11.6	7.9	9.0	22.3	36.0	71.1	492.2
Mean maximum temperature (°C)	35.8	34.7	33.7	31.4	27.9	25.0	25.0	27.5	31.1	34.5	36.1	36.9	31.6
Mean minimum temperature (°C)	22.5	22.1	20.5	17.0	13.2	9.8	8.8	10.4	14.0	18.0	20.5	22.0	17.5
Mean 9am wind speed (km/h)	8.1	7.9	8.3	9.5	8.4	8.0	8.2	9.5	10.5	9.6	8.4	7.9	8.7
Mean 3pm wind speed (km/h)	9.1	8.2	8.9	9.4	8.4	8.1	8.2	8.8	9.4	8.8	8.4	9.0	8.

[4] Note: At time of issue of this report, BoM were carrying out maintenance to repair issues with their data extraction system and as such the most recent data for the station was not available. Data was source from GHD Report dated Jul 2017 for subject: Hughenden Effluent Reuse Strategy STP Environmental Approval - Application for ERA 63 1(a)(i) Sewage Treatment.

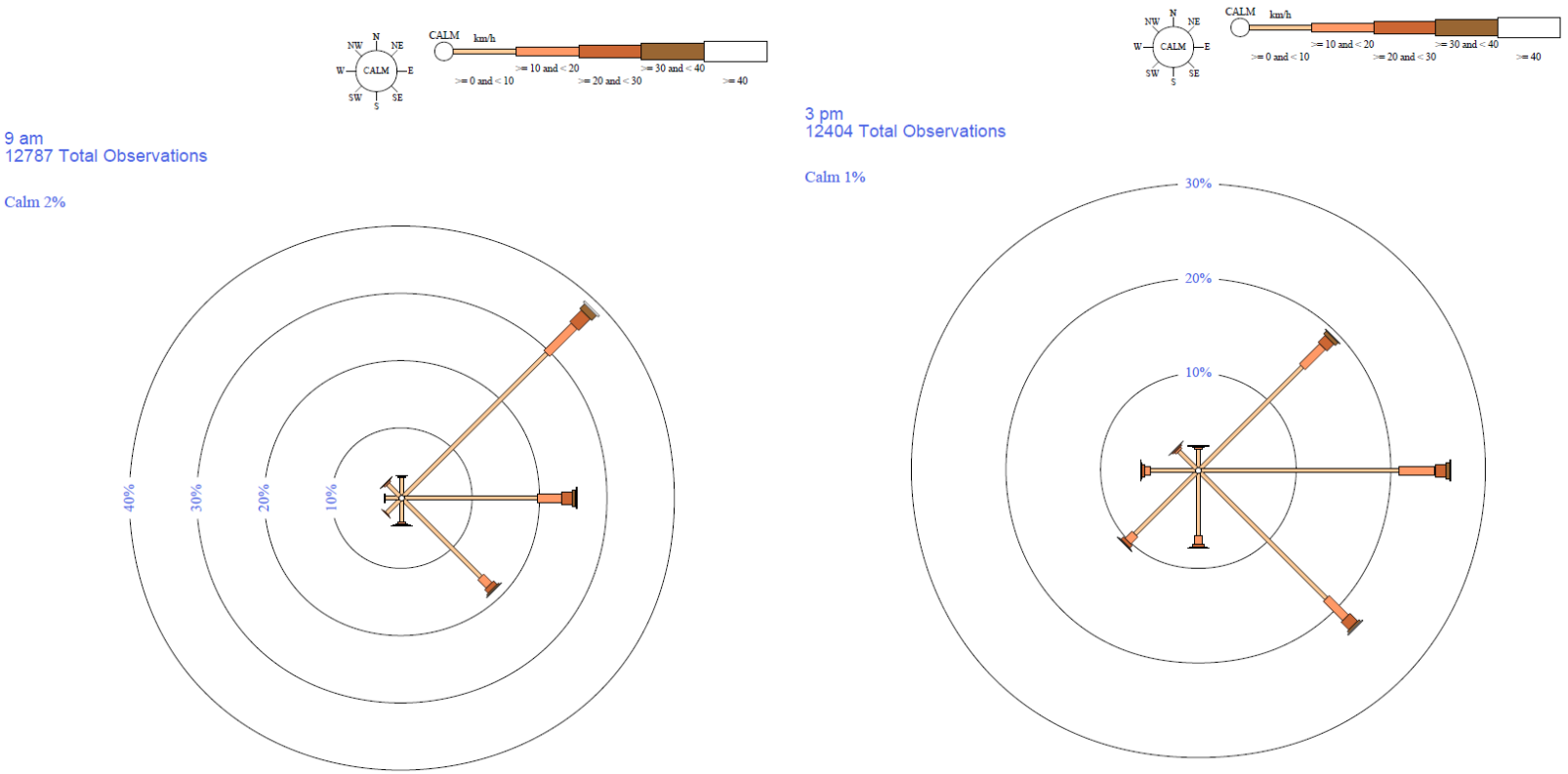


Figure 4-2 BoM (2017) Hughenden rose of 9 am wind direction versus wind speed in km/h and 3 pm wind direction versus wind speed in km/h (station. 30024)

4.2 Social and economic environment

4.2.1 Major demographic indicators

CSIRO (2013) provided a review of major demographic indicators for the Flinders Shire. The following provides an update with consideration to QGSO (2018) which provides a regional profile for the Shire inclusive of 2016 Census and other more recent data sources. Comparison to Queensland averages is provided where data was readily available.

The Estimated Residential Population (ERP) was 1,521 persons in 2017 down from 2,191 persons in 2001 being a 30.5% decrease. The ERP average annual growth rate was -3.2% over the 5-year period from 2012 to 2017 compared to Queensland's 1.5% over the same period. The ERP average annual growth rate was -1.9% over the 5-year period 2007 to 2017 compared to Queensland's 1.8% over the same period.

The population was projected to decrease by 0.5% per year over 25 years from 1840 people in 2011 to 1624 people in 2036 compared to Queensland's 1.7% increase over the same period. The percentage of the population identifying as Indigenous was 6.4% (99) in 2016 similar to the 6.2% reported in 2011 compared to the 4% of the population identifying as Indigenous in Queensland. The Median age was 44.6 in 2016 compared to Queensland's reported median age of 37. The median age has increased by 8.9 years from 35.7 in 2006 compared to Queensland's 1.0 year increase over the same period. The median age was projected to increase by 6.6 years in 2036 to 50.8 years from 2016 compared to Queensland's projected 2.6 year increase over the same period.

Unemployment in the Flinders shire was 4.5% (37 unemployed persons) as of 2018 compared to Queensland's reported 6%. This was an increase from 2.9% reported in 2011. Although lower than the state average, this may in fact be reflective of the ageing population and population decrease whereby people (including young people) are relocating for work opportunities outside of the Shire.

The median total house income in 2016 was $1,109/week compared to Queensland's reported $1,402/week. This was an increase from $935/week reported in 2011.

CSIRO (2013) summarised the Flinders catchment as being similar to many other non-mining regions of rural Australia, showing an aging and declining population. The Flinders Shire is below Queensland averages in all major demographic indicators except the official unemployment rate. Although there a number of complicated social factors driving this, population decline is likely one aspect whereby persons relocate for better employment opportunities.

4.2.2 Community infrastructure

CSIRO (2013) provided a review of community infrastructure in the Flinders Shire. The following provides an update with consideration to QGSO (2018) which provides a regional profile for the Shire inclusive of 2016 Census and other more recent data sources.

There are two Schools in Hughenden, St. Francis Catholic School (Prep to Year 6) and Hughenden State School (Prep to Year 12). Enrolments at Hughenden State School have decreased significantly from 214 in 2009 (CSIRO, 2013) to 118 in 2018 (DoE, 2018). No historical data was available for St Francis Catholic School however, at one time enrolments were up to 175 students (SFCS, 2018) and is currently in the order of 41 students (GSG, 2018).

There is one hospital in the Flinders Shire, the Hughenden Multipurpose Health Service. The facility provides a range of services including:

- 24-hour accident and emergency hospital with a 15-bed acute facility.

- General medical and four long-stay nursing home-type beds.
- Visiting services including Royal Flying Doctors Service, female GP, paediatrician and chest physician.
- Women's clinics.
- Allied health service such as visiting dental clinic, school oral health, dietetics, podiatry, physiologist, occupational therapy, speech therapy, psychologist and diabetes educator.
- Community health service including an Aboriginal and Torres Strait Islander health worker, community nurse and school based youth health nurse.
- Alcohol, tobacco and other drugs (ATODs), community mental health and social workers through outreach services (Queensland Health, 2018).

Other community facilities in Hughenden include the Queensland Police Station, Queensland Ambulance Station and Queensland Fire Station (Auxiliary).

The percent of unoccupied dwellings was 23.8% (184 dwellings) as of 2016 compared to Queensland's reported 10.6%. This was an increase from 21.1% reported in 2011.

CSIRO (2013) concluded that based on the availability of community infrastructure, small changes in population growth could be absorbed by existing facilities in the Flinders Catchment. Hughenden was further identified as an area where social and transport infrastructure is underutilised (CSIRO, 2013). As of 2019, Hughenden maintains the critical community services and housing to provide for an increasing population.

4.2.3 Industry

CSIRO (2013) provided a review of major industries for the Flinders catchment (i.e. Flinders, Richmond, McKinlay, Cloncurry and Carpentaria) which included agriculture, commercial fisheries, tourism and mining. The Flinders Shire is less accessible to the inland mineral wealth and is primarily dependent on the agricultural industry with approximately 230 rural grazing properties with a gross agricultural production value of $73.5 M within the Shire (MITEZ, 2018).

QGSO (2018) provides a regional profile for the Shire inclusive of 2016 Census and other more recent data sources. ABS (2018) identifies the top five industries for employment for Flinders Shire in 2016 and 2011 as described in Table 4-4.

Table 4-4 ABS (2018) Flinders Shire employment by industry

2011			2016		
Industry	**No.***	**%**	**Industry**	**No.***	**%**
Sheep, Beef Cattle and Grain Farming	292	32.5	Beef Cattle Farming (Specialised)	244	32.2
Local Government Administration	84	9.4	Local Government Administration	86	11.4
Rail Freight Transport	56	6.2	Hospitals	26	3.4
School education	48	5.3	Accommodation	21	2.8
Accommodation	26	2.9	Rail Freight Transport	21	2.8

*No. = Number.

This is indicative of the primary land use for the Shire being beef cattle production. CSIRO (2013) identified that the livestock (cattle) industry in the Flinders Shire generates approximately $90 million/year.

The drop off in education as a major employer in the region is considered likely as a result of reduced school enrolments.

4.3 Built environment

There is limited built infrastructure on the site and within the immediate transport and Stock Route Network with the exception of the one residence/farming building and infrastructure on the northern adjacent property. Hughenden with its associated community services and agricultural/industrial infrastructure is located approximately 12 km to the east, south-east of the site.

4.3.1 Roads

Hughenden is located at the convergence of two major State-controlled roads, the Kennedy Development Road and the Flinders Highway. The Kennedy Development Road linking north to Cairns (approx. 730 km) is predominantly sealed and dual lane with the remaining sections to be completed by 2020 (TMR, 2018). The Kennedy Development Road linking south to Winton is sealed and dual lane and provides access onto Longreach (approx. 390 km) via the Landsborough Highway and Melbourne (approx. 2,300 km) via the Mitchel Highway. The Flinders Highway is sealed and dual lane linking east to Townsville (approx. 380 km) and west to Mt Isa (approx. 520 km).

There are no significant road infrastructure requirements for the site. Access to the site is via Old Richmond Road (managed by Council) which is sealed and dual lane and links directly to the Flinders Highway. An unsealed local road off Old Richmond Road passes through the site providing access to properties and a residence/farming building and infrastructure approximately 350 m north of the Flinders River. Council has drafted a survey plan and is in the process of finalising approval for simultaneous opening and closing of the road traversing the site. The layout for the new road is shown on Council's proposed reconfiguration plan (refer Figure 3-5).

The existing Council and State-controlled road network will likely be the main mode of transporting machinery and infrastructure during construction and products to market from the proposed co-use cooling, packaging and logistics facility after development of the site.

4.3.2 Rail

The Mount Isa line services Hughenden and extends from Townsville to Mount Isa. The line is the major link between the north west Queensland mineral deposits and the Port of Townsville which exports the majority of bulk products (QR, 2018). The line is used for the conveyance of mineral concentrates, fertiliser, acid, fuel, refined metals, cattle, general freight and passenger transport (QR, 2018). Options for access to the rail network for distribution of products may be considered in the future under agreement with Queensland Rail however, at this stage all transport of goods will be via road.

4.3.3 Airport

The Hughenden Aerodrome was upgraded in 2014 which include reconstruction of the runway, apron and taxiway as well installation of an LED aeronautical ground lighting system (FSC, 2018e). Hughenden Aerodrome is capable of DASH 8-300 (50 passengers) and is serviced by REX Airlines flying every Monday, Wednesday and Friday from Townsville to Mount Isa, with stop over's in Hughenden (FSC, 2018e). There are no anticipated impacts associated with air infrastructure. At this stage all transport of goods will be via road.

4.4 Cultural heritage (Indigenous and non-Indigenous)

4.4.1 Indigenous

A search of the Aboriginal and Torres Strait Islander Cultural Heritage Database and Register DATSIP (2018) indicates that there are no known features of indigenous cultural heritage located on the site.

Council maintain a Duty of Care as prescribed under the *Aboriginal Cultural Heritage Act 2003* Duty of Care Guidelines and will undertake further mitigation in conjunction with the Yirendali Traditional Owner group.

4.4.2 Non-indigenous

Queensland Government mapping sources including Queensland Globe (2018a), State Planning Policy Interactive Mapping (2018c) and Development Assessment Mapping (2019a) along with the Shire of Flinders Planning Scheme Overlay Map H-001 (Heritage) indicate that there are no areas of non-indigenous state or local heritage located on the site or within the wider project area.

4.5 Native title

There are no outstanding Native Title issues to be addressed. As outlined in section 4.5, Council purchased the site (Lot 168 on Plan SP262319) from the Queensland Government in 2016 in accordance with State legislation and Queensland Government policies, procedures and guidelines relevant to the purchase of State land that require Native Title issues to be addressed prior to legal transfer. Through this process, it was determined that no Native Title rights exist over the site.

5. Impacts and mitigation

5.1 Natural environment

CSIRO (2013) identified a number of risks to the natural environment associated with irrigated agricultural development in the Flinders catchment with key issues deemed relevant to the project identified as follows:

- The risk of rising water table levels (e.g. salinity).
- The risk for increased groundwater discharge to rivers in the Flinders catchment.
- The risk of increases in sediment, nutrients and pesticide loads from irrigation to the Flinders River.
- The ecological implications of altered groundwater and surface water flow regimes on riparian ecology.

These can be further developed and expanded on with respect to the project site environmental values as follows:

- Risk of loss of biodiversity as a result of clearing regional ecosystems, fauna habitat destruction and loss of connectivity.
- Direct impacts to conservation significant flora and fauna.
- Soil erosion and degradation from broad scale clearing.
- Over abstraction of groundwater aquifer and associated flow on ecological and social impacts.
- Introduction of invasive species and diseases.

The primary mitigation measure associated with these risks has been through incorporating natural features (i.e. watercourses, wetlands and regulated vegetation) with vegetated buffers of 'Least Concern' regional ecosystems generally in accordance with applicable State Codes as well as the outcomes of the NRA (2019) land suitability study into the precinct master plan (refer Figure 3-1).Other impacts associated with farming operations will be mitigated through the implementation of widely practised, easily applicable standard conditions, guidelines and codes.

The following provides an overview of potential environmental impacts and proposed mitigation measures associated with natural environmental features.

5.1.1 Sustainable use of groundwater (Flinders River Alluvium)

The bore network will produce the full allocation from existing water licence 609134 for abstraction of 450 ML/yr from < 1 km from the Flinders River as well as the long-term, safe annual yield from the production bores located >1 km from the Flinders River being 1,038 ML for which no Water Licence is required.

Investigations have recommended sustainable pumping schedules for production bores (i.e. sustainable pumping rates and 10-hour pumping, 14-hour recovery schedule which will be adopted). Monitoring will include monthly water levels at adjacent monitoring bores and automatic water level loggers installed to production bores to confirm that there are no impacts to the groundwater aquifer and associated ecosystems. This will also include regular reviews of monitoring data to confirm groundwater predictions and refine pumping schedules.

Council will require that all development within the precinct implements best practice water management techniques (i.e. soil moisture testing, trickle irrigation, leak detection, etc.). Council will develop a Water Management/Efficiency Plan inclusive of water inventory for end users as

they come online and monitor actual usage against forecasts. The Water Management/Efficiency Plan will outline the guiding principles to be adopted by all third party investors/growers within the precinct.

5.1.2 Sustainable use of groundwater (Great Artesian Basin)

A water licence is required for the take of underground water from the Great Artesian Basin. DNRME have advised that their current groundwater impact assessments required as part of the fixed price sale indicated a sustainable allocation of 720 ML/yr from the Hutton formation. These Terms of Sale have been accepted by Council.

In accordance with the *Great Artesian Basin and Other Regional Aquifers Water Management Protocol* (the Protocol) and associated water licence conditions, a meter which complies with the standards approved by DNRME will be used to measure the volume of water taken. DNRME will monitor, assess and report on the sustainable use of Great Artesian Basin water.

5.1.3 Soil conservation and water quality (run-off)

Council intend that any development within the precinct is undertaken in accordance with current best practice farming techniques. Examples of best practice that will be implemented are as follows:

- Implement guiding soil conservation and water quality management principles (Creighton et al, 2012 and Carey et at, 2015) including:
    - Reduce risk of soil loss from cropping areas by minimising soil disturbance to the minimum required area and by decreasing run-off quantity and velocity.
    - Implement practices that promote soil health considering physical, chemical and biological indicators.
    - Reduce run-off carrying fertiliser, herbicides and sediment, with a view to capturing and recycling and enhancing profitability.
    - Protect and enhance riparian vegetation to maintain ecological function and minimise erosion.
    - Maximise water use efficiency and promote natural recharge and drainage from both rain and irrigation to match plant and catchment water needs.
- Implement guiding nutrient principles (Creighton et al, 2012) including:
    - Test soil and apply fertiliser at sustainable rates in a way that promotes production and profitability and minimises the risk of loss to the environment (tailoring fertiliser application to crop and soil requirements).
- Implement guiding weed and chemical principles (Creighton et al, 2012) including:
    - Reduce current site weeds and potential for new weeds through integrated weed management (i.e. develop controls relevant to weed species, apply chemical and non-chemical controls, implement hygiene procedures to minimise spread).
    - Application of herbicides in a manner that minimise the likelihood of movement beyond the target area with consideration to application rates for weed species and timing.
    - Apply controls that minimise herbicide use to reduce the likelihood of losses off-farm.

Each third party investor will need to develop implementation plans relevant to proposed cropping addressing these guiding principles to the satisfaction of Council and to meet any conditions of approval. This is expected to include the following key issues:

- Soil conservation management.
- Soil health and nutrient management considering physical, chemical and biological indicators.
- Irrigation and drainage management including salinity and sodicity mitigation (refer 5.1.6).
- Weed, pest and disease management.

Plans will be developed in the context of the findings of the land suitability statement (NRA, 2019). Council are committed to ensuring that appropriate provisions are in place for regulatory review. To achieve this, Council propose the Coordinator General include as a condition of approval the requirement for Council to develop an overarching:

- Construction phase Erosion and Sediment Control Plan.
- Operational phase Soil Conservation Management Plan.

Plans will be developed by a suitably qualified and experienced person and submitted to the State for review prior to the commencement of clearing.

Generally, all temporary construction works will be managed in accordance with the International Erosion Control Association Best Practice Erosion & Sediment Control Guidelines and Catchment & Creeks *Construction Site Managers Field Guide* and *Builders Field Guide*, *Environmental Protection (Water) Policy 2009* (EPP Water) and any other relevant approval and statutory requirement. These include requirements for:

- Vegetation management.
- Soil management.
- Site rehabilitation.
- Drainage control (i.e. catch drains, diversion banks chutes, etc.).
- Erosion control (i.e. mulching, dust suppression, geo-fabrics and cellular confinement systems).
- Sediment control (i.e. stockpiles, entry/exit, filter dams, weirs and basins).

Ultimately, a Soil Conservation Management Plan will be developed for the site in accordance with the above referenced guidelines (as applicable) and more specifically Carey et al (2015) *Soil conservation guidelines for Queensland*. This will focus on the implementing best practice soil conservation measures for the life of the project. This is expected to include such measures as prescribed within Chapter 12 (Soil conservation in horticulture) for maintaining ground cover, managing run-off and environmental monitoring.

If considered appropriate by the State, a consolidated construction phase Erosion and Sediment Control Plan and operational phase Soil Conservation Management Plan may be provided.

5.1.4 Sewage and wastewater

Wastewater generated will be from limited staff (1 cabin) and caretaker accommodation (1 cabin) and associated workforce amenities only, with no requirement for process water within the packaging process. In accordance with the Flinders Shire Planning Scheme, development not having reasonable access to the reticulated sewerage network are serviced by an on-site waste water treatment in accordance with Water Services Association of Australia (WSAA)

Sewerage Code of Australia. This will form part of the conditions of approval for the subsequent initial development Reconfiguration of a Lot application (refer section 6 of this IAR) that will be finalised following the Coordinator-Generals assessment of the project.

5.1.5 Vegetation clearing

Project clearing requirements in relation to regulated vegetation are shown on Figure 5-1 through Figure 5-2 and detailed in Table 5-1 and Table 5-2.

Table 5-1 Clearing requirements (regulated vegetation)

Development aspect	Clearing requirement (ha)
High value irrigated agriculture	305.7 ha
Farming infrastructure (excluding water storage)	64.7 ha
Water storage	91.9 ha
Total	**462.3**

Table 5-2 Clearing requirements (regulated vegetation associated with watercourse and wetlands)

Development aspect	Clearing requirement
Regulated Vegetation – Intersecting a Watercourse (within 100 and 50 m buffers)	1.9 km
Regulated Vegetation – within 100 m of a Vegetation Management Wetland.	2.3 ha

5.1.5.1 Measures to avoid and mitigate clearing impacts

The primary mitigation measure to minimise the potential for impacts to vegetation has been through incorporating existing natural features (i.e. watercourses and wetlands) with vegetated buffers of 'Least Concern' regional ecosystems generally in accordance with applicable State Codes into the precinct master plan (refer Figure 3-1). By retaining natural features and vegetated buffers clearing impacts will be primarily limited to "Least Concern" vegetation groups while maintaining key habitat features and connectivity through the site to larger vegetation groups.

Clearing for supporting farming and water infrastructure will be required in addition to that required to develop land identified as being suitable for irrigated agriculture. This can be summarised in the following key areas:

- Eastern water infrastructure (i.e. ring tank 1a and 1b).
- Eastern farming infrastructure.
- Realigned access road.
- Central ring tank (i.e. ring tank 2).
- Overland flow dam.
- Western farm infrastructure and hillside dam.

As far as reasonably practical the development and master plan has been located within grassland regional ecosystems whereby clearing exemptions apply. This is primarily reflected in the placement of the western farm infrastructure and hillside dam which is almost exclusively located within regional ecosystem 4.9.1c. Although it appears that there is a similar opportunity

to locate the eastern farming infrastructure and / or eastern water infrastructure (ring tank 1a and 1b) within regional ecosystem 4.3.15, this is not feasible for a number of reasons. For the eastern water infrastructure (ring tank 1a and 1b), the proposed location has been selected as it provides the greatest opportunity to take advantage of existing topographical and insitu soils for construction of the facilities. It is anticipated that this location will minimise costs associated with construction through making use of readily available materials and reducing requirements for imported fill. It has also been selected so as to minimise the requirement for construction of lengthy pipelines from the drainage feature where pumps will be installed.

For eastern farm infrastructure, the proposed location has been selected given its close proximity to the existing bore infrastructure and suitable agricultural land thereby minimising costs associated with construction of power and other utility services. There are also some concerns with the topographical and insitu soil characteristics for infrastructure construction within the area mapped as regional ecosystem 4.3.15.

As with the ring tank 1a and 1 b, the central ring tank (i.e. ring tank 2) has been located so as to provide the greatest opportunity to take advantage of existing topographical and insitu soils for construction of the facility. It is anticipated that this location will minimise costs associated with construction through making use of readily available materials and reducing requirements for imported fill. It has also been selected so as to minimise the requirement for construction of lengthy pipelines from the Flinders River where pumps will be installed.

The location of the overland flow dam is a necessary requirement for its purpose of storing water. There are no feasible alternatives on the site that would result in a reduced impact to vegetation or land identified as being suitable for irrigated agriculture. Impacts of the overland flow dam have been minimised by avoiding wetland and regulated vegetation within 100 m off a wetland.

The realigned access road will have provision for a 12 m reserve and unsealed road off which direct access to site facilities will be provided with the alternative being direct access off Old Richmond Road. The width of the proposed road corridor as mapped is limited to 20 m. In accordance with the Flinders Shire Planning Scheme, the road will be constructed per Institute of Public Works Engineers of Australia (IPWEA) Standard Drawings generally including 7-8 m formation, 75 mm wearing course and table drains. Impacts have been avoided by diverting the realigned access road around the central wetland and regulated vegetation buffer as far as reasonably practicable while minimising impacts to suitable agricultural land and maintaining manageable block sizes.

5.1.5.2 Significant residual impact assessment

Appendix B provides an assessment of the project against the provisions of the *Significant Residual Impact Guideline For matters of state environmental significance and prescribed activities assessable under the Sustainable Planning Act 2009* (Significant Residual Impact Guideline).

Prescribed environmental matters relevant to the project for regulated vegetation are as follows:

- Remnant vegetation within the defined distance of a watercourse identified on the vegetation management watercourses map.

Prescribed environmental matter relating to connectivity areas are as follows:

- Connectivity areas are areas of remnant vegetation outside urban areas containing prescribed regional ecosystems that are required for ecosystem functioning (a connectivity area).

There is no expectation of a significant residual impact to MSES (regulated vegetation) associated with the project.

5.1.5.3 Construction phase environmental controls (clearing)

A construction phase Environmental Management Plan (Planning) will also be developed for the project providing necessary guidance to third party investors/growers to ensure best practice construction phase management controls are implemented as follows:

- All clearing works are to be undertaken in accordance with a Council approved Clearing Plan incorporating all conditions of approval and addressing all legal requirements. The Clearing Plan will include:
    - Clearing to be in line with development of the site. No broad scale clearing of development lots will be permitted until all agreements between third party/investors and Council are in place.
    - Development lots shall be surveyed and flagged to indicate the boundary of clearing works. Where development lots are within 50 m of buffer areas separate flagging and delineation shall be installed identifying these as no go areas.

5.1.6 Salinity and sodicity

Existing issues with soil salinity and sodicity within the precinct have been considered in site planning through the completion of the land suitability assessment (NRA, 2019). Clearing for irrigated agriculture is limited to those areas identified as having characteristics as follows:

- Root zone salinity: Median salinity levels that are very low (Cl<50 mg/kg) throughout and effective rooting depth (ERD) > 1.5 m. Salinity curves in these area do not demonstrate a “salt bulge” and salinity characteristics confirm the landscape is subject to regular leaching and deep drainage towards the incised stream channel of the Flinders River (NRA, 2019).
- Soil profiles: Profiles are non-saline [electrical conductivity (EC_e) < ds/m, Cl<50 mg/kg], non-sodic [exchangeable sodium (ESP) <1%] moderately well-drained and moderately permeable.

However, salinity and sodicity risks may be exacerbated through the application of poor quality irrigation water and/or accumulation of salts within the root zone as a result of the low volume trickle irrigation. To mitigate this issue, Council intend on developing a site specific Salinity Management Plan for the precinct. Council are committed to ensuring that appropriate provisions are in place for regulatory review. To achieve this, Council propose the Coordinator General include as a condition of approval the requirement for a Salinity Management Plan to be developed by a suitably qualified and experienced person and submitted to the State for review prior to the commencement of clearing. The Salinity Management Plan will be developed with reference to relevant guidance material including but not limited to the *Salinity management Handbook* (DERM, 2011).

Notwithstanding this requirement, based on currently available information the risk of salinity to the project is considered low. Existing site soil conditions (i.e. not saline or sodic and moderately well-drained and permeable) and groundwater characteristics (with gradient of 0.008 northwards to the Flinders River) provide opportunity for leaching through well planned irrigation management and during rainfall events. The primary mitigation will be application of good quality irrigation water to cropping sourced from the Flinders River Alluvium and Flinders River during flow events supplemented in the dry season from the GAB Hutton formation.

Water samples obtained from the recently constructed production bores and observation bores for water quality determination with results of laboratory analysis demonstrating that water quality (conductivity) varies from 332 - 960 µS/cm-1, (approximately 212 - 614 mg/l for total dissolved salts) and pH is in the neutral range of 6.3 to 7.5 (NAWS, 2019).

This quality water would generally be considered low to medium salinity water (DPIF, 2005) as follows:

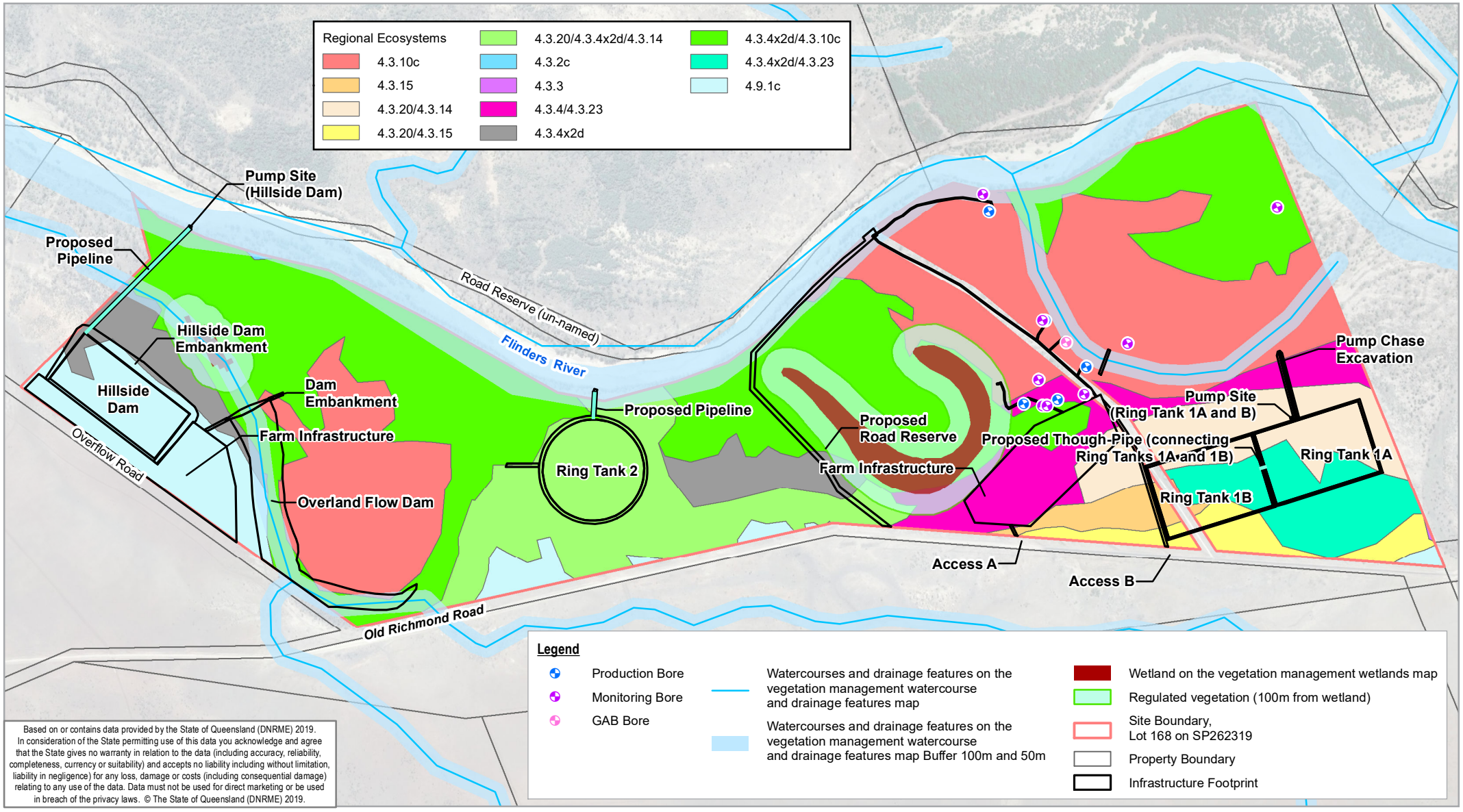
- Low (EC <650 µS/cm-1) - generally suitable for use on all crops with all methods of water application, with little probability of salinity problem developing.
- Medium (EC 650-1,300 µS/cm-1) - suitable for use on all but very low salt tolerance crops. Water can be used if a moderate amount of leaching occurs. Plants with medium salt tolerance can be grown, usually without special practices for salinity control.

There is a slightly elevated risk with respect to water quality within the GAB Hutton formation. NAWS (2019) included a review of literature and found that water is typically less than 1,000 mg/l total dissolved salts. It is intended the water from the GAB bore will be mixed with the better quality alluvial or river water sources to produce irrigation water supply of acceptable quality for the intended crops (NAWS, 2019).

Managing irrigation water quality will be an important aspect of the Salinity Management Plan however, further investigative work including additional Flinders River Alluvium groundwater and subsequent GAB Hutton formation sampling and analysis will be required to inform any specific irrigation management requirements (i.e. blending water sources). Other key factors that will require consideration in developing irrigation management protocols within the Salinity Management Plan will include (DERM, 2017):

- Considering characteristics of the soils in the area proposed for irrigation—in particular, soil structural stability and permeability. This information has been collated within the land suitability assessment (NRA, 2019).
- Consider characteristics of plant species proposed for the irrigated area—in particular, salt tolerance. Some of this information has been collated within the land suitability assessment (NRA, 2019) including salinity thresholds for proposed cropping however, further analysis may be required to inform specific management options with respect to potential productivity decreases [per dS/m increase (%)] and percent (%) yields at various soil salinity (EC_{se}) values.
- Determine the likely leaching fraction of the soil and the consequent root zone salinity and amount of drainage below the root zone. This will inform the requirements for specific management options with respect to preventing excessive salt accumulation in the root zone. This may be achieved through application of excess good quality irrigation water following large rain events.
- Estimate the effects of irrigation water sodicity on soil behaviour. RLA (2017) includes some one-off major ion analysis of Flinders River Alluvium groundwater. Sodium Adsorption Ratio (SAR) and Residual Alkalinity (RA) calculations should also be considered within the Salinity Management Plan to inform requirements for the management of the accumulation of sodium in soil and potential impacts to physical properties and cropping requirements.
- Develop a comprehensive soil and groundwater monitoring program including
    - Soil quality (physical, chemical and biological indicators) inclusive of, soil moisture pH, EC and major ions.
    - Groundwater at existing production and monitoring wells (refer Table 3-8) inclusive of pH, EC and major ions.

Consideration of these factors will provide for a comprehensive and integrated Salinity Management Plan in accordance with best environmental and agricultural practice.



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Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

Flinders Shire Council
15 Mile Project

Infrastructure footprint and clearing requirements

Project No. **42-20851**
Revision No. **B**
Date **03 Jul 2019**

FIGURE 5-1

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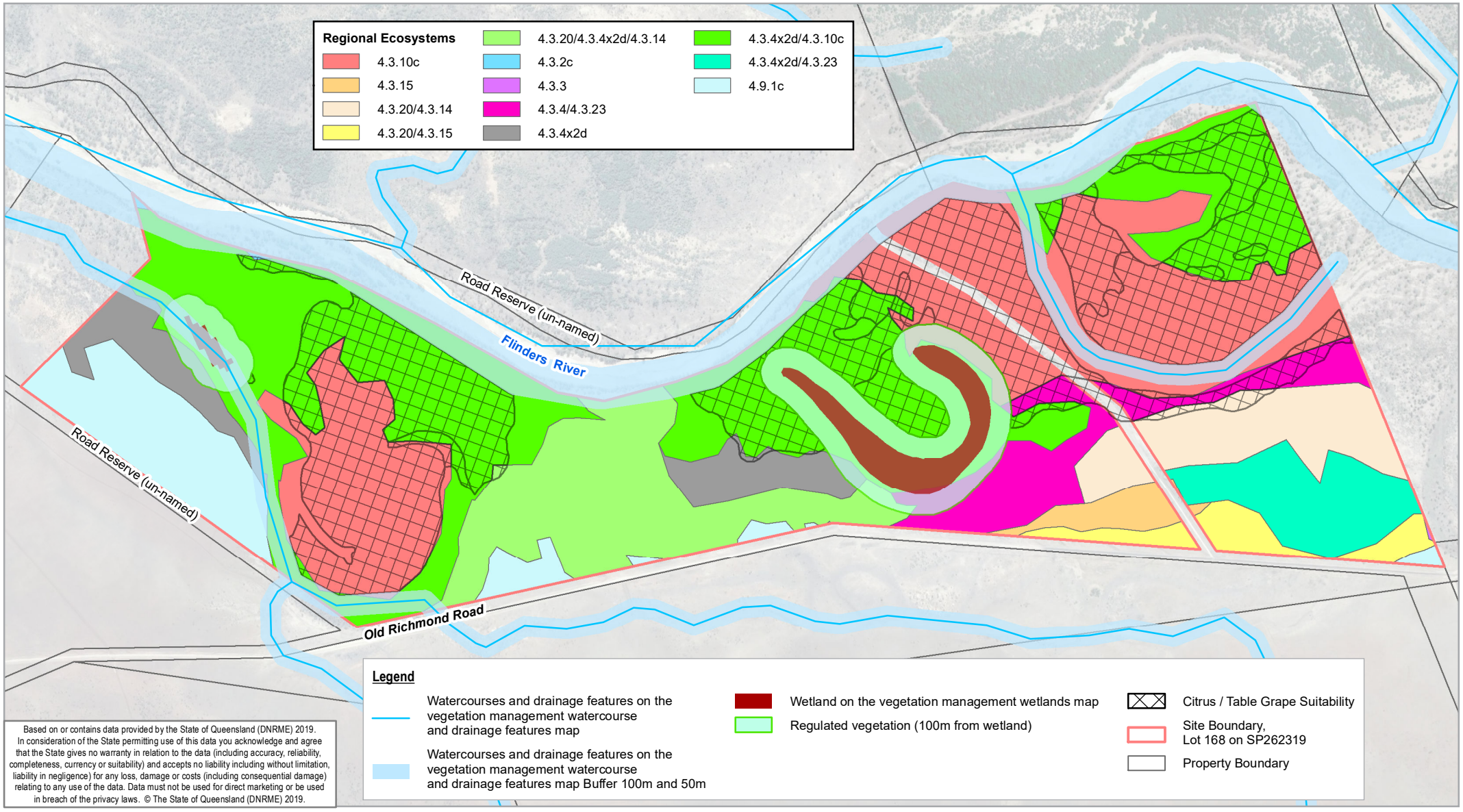
Print date: 03 Jul 2019

Data source: DNRME: Cadastre, Wetland Mapping (2018); Vegetation Management Wetlands, Vegetation Watercourses, Regional Ecosystems v10.1 (2019); FSC: Infrastructure (2019); GE: Imagery extracted 7/9/2018. Created by: tngavranic



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Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Flinders Shire Council
15 Mile Project

High value cropping and clearing requirements

Project No. **42-20851**
Revision No. **B**
Date **03 Jul 2019**

FIGURE 5-2

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Print date: 03 Jul 2019

Data source: DNRME: Cadastre, Wetland Mapping (2018); Vegetation Management Wetlands, Vegetation Watercourses, Regional Ecosystems v10.1 (2019); GHD: Citrus and Grape Suitability (2019); GE: Imagery extracted 7/9/2018. Created by: tngavranic

5.1.7 Flora

Based on all currently available information, there is not anticipated to be any impact on conservation significant flora (refer Appendix A). Although not identified in field surveys, Pink Gidgee has the potential to occur on the site and seasonal and pre-clearance surveys should be completed in line with development of the site along with any other recommendations resulting from the GHD (2019) EPBC significant impact assessment or subsequent field investigations adopted.

5.1.8 Fauna

Based on all currently available information, there is not anticipated to be a significant impact on protected fauna (refer Appendix A). A construction phase Environmental Management Plan (Planning) will be developed for the project providing necessary guidance to third party investors/growers to ensure best practice construction phase management controls are implemented.

Key items to be included are as follows:

- All clearing works to be undertaken in accordance with Council approved Clearing Plan incorporating all conditions of approval and addressing all legal requirements. The clearing plan will include:
    - A fauna spotter/catcher shall be engaged for the duration of all clearing activities.
    - Conduct pre-clearing survey (e.g. using a fauna spotter/catcher) of trees and surrounds to be undertaken to determine presence of nests and tree hollows. Active nests are to be retained until occupants vacate.
    - Breeding places (i.e. tree hollows) are to be conserved where possible.
    - Species Management Programs (generic and/or species-specific) conditions shall be implemented.

5.1.9 Invasive species

Council intend that any development within the precinct is undertaken in accordance with current best practice farming techniques. Examples of best practice that will be implemented are as follows:

- Implement guiding weed and chemical principles (Creighton et al, 2012) including:
    - Reduce current site weeds and potential for new weeds through integrated weed management (i.e. develop controls relevant to weed species, apply chemical and non-chemical controls, implement hygiene procedures to minimise spread).
    - Application of herbicides in a manner that minimise the likelihood of movement beyond the target area with consideration to application rates for weed species and timing.
    - Apply controls that minimise herbicide use to reduce the likelihood of losses off-farm.

Each third party investor will need to develop implementation plans relevant to proposed cropping addressing these guiding principles to the satisfaction of Council. This will include provisions for Weed, Pest and Disease Management.

5.1.10 Natural hazard risks and resilience

5.1.10.1 Flooding

Risk of flooding has been considered within the NRA (2019) land suitability study. In accordance with the provisions of the Planning Scheme, the development will maintain the safety of people on the site from flood events and minimise the potential damage from flooding to property. A site specific risk assessment will be required to ensure that proposed buildings and essential infrastructure are protected from flooding and that the proposed development does not result in adverse flooding impacts off site. This will be completed during the detailed engineering (i.e. operational and building works) phases of the project on completion of the IAR.

5.1.10.2 Bushfire

Vegetation clearing includes provisions for firebreaks to infrastructure and cropping generally being 20 metres or 1.5 times the height of the tallest adjacent tree or as prescribed within the Planning Scheme bushfire overlay code (whichever is the greater). Council acknowledge the dangers associated with the agricultural industry and will promote a culture of safety within the precinct. However, ultimate responsibility will fall to third party investors/growers in accordance with legislative requirements.

5.1.11 Amenity, including noise, air quality, vibration, lighting, urban design and visual aesthetics

Activities to be completed within the construction and operational phases of the project have the potential to generate impacts to amenity through noise and vibration (machinery and heavy vehicles), air quality (dust) and visual aesthetics (vegetation clearing and changed landscape). However, there are limited sensitive receptors in the wider project area and these can be mitigated through standard construction phase environmental controls. The project is remote with significance buffers to be retained to key environmental features present on the site. The development is not expected to have a significant impact on the amenity of the area.

5.1.12 Impact mitigation management plans commitments

The following provides a summary of Council's key commitments with respect to impact mitigation plans:

- Construction phase Environmental Management Plan (Planning) including:
    - Clearing Plan
    - Construction phase Erosion and Sediment Control Plan.
- Operational phase Soil Conservation Management Plan.
- Salinity Management Plan
- Water Management / Efficiency Plan.

Council propose the Coordinator General include as a condition of approval the requirement for these plans to be developed by a suitably qualified and experienced person and submitted to the State for review prior to the commencement of clearing.

5.2 Social and economic environment

5.2.1 Social environment – potential beneficial and adverse impacts

The project has potential to generate in the order of 165 FTEs/annum for the life of the enterprise along with 15 FTEs/annum during the construction and establishment phase. Although these are significant when compared to the current population of the Shire

(approximately 1,500 people), employment opportunities will be staged in line with initial development (including 3-5 years for cropping establishment and initial production) and as subsequent third party investors/growers develop the remainder of the precinct.

Once full development were realised (likely over 5-10 years), this would make the precinct one of the largest employers in the Shire. The benefit of this staged approach, being a necessary outcome of the development type (i.e. varying timeframes for crops to mature and reach full production) is that employment opportunities will be generated incrementally providing opportunities for local employment initially (which will be encouraged through Council policy and dealings with third party investors) then supplemented by seasonal works as required in the future. This staged approach will reduce the risk of social and economic impacts often experienced during immediate and short-term influxes of large construction and seasonal workers whereby already disadvantaged populations are most impacted through housing shortages and increases in the cost of living.

As outlined within this IAR, the Shire has capacity to absorb increases population in the readily available community infrastructure and housing market. The bulk of the workforce would be on a part time basis in line with the cropping harvest seasons (which are generally nearly all year round given cropping types) however, with pre-existing industries in the Shire that complement the development, opportunities for long term employment of highly skilled labour will likely develop. Council will encourage investors to promote local and indigenous employment opportunities including skilled labours and will plan to mitigate any social and economic impacts that may arise through ultimate development of the precinct.

5.2.2 Economic effects

Initial development of the precinct will require significant expenditure outside of the Shire (i.e. Interstate) in the provision of the necessary infrastructure required for irrigated agricultural development. This will be primarily due to the requirement for infrastructure that current industry does not service/supply. However, opportunities for existing complimentary industries within the Shire including transport services, building and concrete supplies, irrigation pump supplies and repairs (FSC, 2018f) to be involved in the project. Total capital costs for initial development are expected to be in the order of $20 million.

As the remaining areas of the precinct are developed by subsequent third party investors/growers, it is expected that existing industries will have matured and would be in a better position to service/supply subsequent developments. Further capital costs for full development of the precinct is expected to be in the order of $27 million.

The annual value of the development at full production will be market dependent and crop dependent however, could feasibly be in the order of $3.3 million (gross/farm gate value) for initial development and a further $9.4 million (gross/farm gate value) if full development of the precinct is realised. Though not directly comparable, this is significant when compared to the annual value of the livestock (cattle) industry to the Flinders Shire (approximately $87.1 million in 2012). As the precinct will likely service markets in Queensland, interstate and potentially internationally, benefits of this will not be limited to the Shire and advances State Policy for the economic development of north western Queensland.

Flow on value will be to other industries associated with agricultural supplies (i.e. pumps, fertilisers and chemical suppliers, machinery supply and service industries) and transport. The establishment the industry will also provide opportunity other employment opportunities through research and development of agricultural practices and water management.

5.3 Built environment

CSIRO (2013) concluded that based on the availability of community infrastructure, small changes in population growth associated with this type of irrigated agricultural development could be absorbed by existing facilities in the Flinders catchment. Hughenden was further identified as an area where social and transport infrastructure is underutilised (CSIRO, 2013). As of 2018, Hughenden maintains the critical community services and housing to provide for an increasing population. There are also a range of existing industries located at Hughenden including transport services, building and concrete supplies, irrigation pump supplies and repairs (FSC, 2018f) that would be complementary to the project.

The existing Council and State-controlled road network will likely be the main mode of transporting machinery and infrastructure during construction and products to market from the proposed co-use cooling, packaging and logistics facility after development of the site. This will involve la limited number of vehicles travelling to and from the site that will be easily accommodated on the new access road and existing Old Richmond Road and Flinders Highway.

Access to the site is via Old Richmond Road (managed by Council) which is sealed and dual lane and links directly to the Flinders Highway. An unsealed local road off Old Richmond Road passes through the site providing access to properties and a residence/farming building and infrastructure approximately 350 m north of the Flinders River. Council has drafted a survey plan and is in the process of finalising approval for simultaneous opening and closing of the road traversing the site. The layout for the new road is shown on Council's proposed reconfiguration plan (refer Figure 3-5).

The realignment will have provision for a 12 m wide footprint and unsealed road off which direct access to site facilities will be provided with the alternative being direct access off Old Richmond Road. The width of the proposed road corridor is limited to 20 m. In accordance with the Flinders Shire Planning Scheme, the road will be constructed per Institute of Public Works Engineers of Australia (IPWEA) Standard Drawings generally including 7-8 m formation, 75 mm wearing course and table drains. Access to each property off the realigned road (or Old Richmond Road) (refer Figure 3-5) will be constructed in accordance with IPWEA Standard Drawings for rural driveways.

Initial development of the site will is planned to be serviced with 3 phase power via connection to the reticulated electricity infrastructure network. Power supply will be the responsibility of third party investors/growers as required.

The site will not be connected to the reticulated sewerage network. In accordance with the Flinders Shire Planning Scheme, development not having reasonable access to the reticulated sewerage network are serviced by an on-site waste water treatment in accordance with WSAA Sewerage Code of Australia.

These will form part of the conditions of approval for the subsequent initial development Reconfiguration of a Lot application (refer section 6 of this IAR) that will be finalised following the Coordinator-Generals assessment of the project.

No significant impacts to existing infrastructure, community services and/or housing are anticipated.

5.4 Cultural heritage (Indigenous and non-Indigenous)

There are no known features of Indigenous or non-Indigenous cultural heritage located on the site. Council maintain a duty of care as prescribed under the *Aboriginal Cultural Heritage Act 2003* and will undertake the ground disturbing work (i.e. vegetation clearing and grubbing) in

accordance with the *Cultural Heritage Duty of Care Guidelines* and in consultation with the Yirendali Traditional Owner group. This will likely include:

- Pre-disturbance Traditional Owner site walkover(s).
- Traditional owner presence during ground disturbance activities.

This will be undertaken to ensure any potential unidentified or unmapped Aboriginal cultural heritage features are identified, reported and handled in accordance with the *Cultural Heritage Duty of Care Guidelines* and *Aboriginal Cultural Heritage Act 2003*.

Cultural heritage requirements will be outlined within a Cultural Heritage Management Plan which will be developed for the site and apply to all third party investors/growers.

There are no specific requirements for mitigation of impacts to non-Indigenous cultural heritage.

5.5 Native title

There are no outstanding Native Title issues to be addressed. As outlined in section 4.5, Council purchased the site (Lot 168 on Plan SP262319) from the Queensland Government in 2016 in accordance with State legislation and Queensland Government policies, procedures and guidelines relevant to the purchase of State land that require Native Title issues to be addressed prior to legal transfer. Through this process, it was determined that no Native Title rights exist over the site.

6. Approvals

6.1 Project approvals framework summary

Table 6-1 provides a summary of the primary approvals framework applicable to the project that fall within the scope of this IAR. Table 6-2 provides a summary of the approvals framework applicable to the project that are outside the scope of this IAR (i.e. separate application process that have already commenced, or are secondary approvals which will be finalised following the Coordinator-Generals assessment of the project).

Note: Operational Works approvals are not included under section 37 of SDPWO Act and as such the Coordinator-General's report is not taken to be the concurrence agency response for these aspects of the project.

Table 6-1 Project approvals framework summary (within scope of this IAR)

Authority Legislation	Aspect of development Trigger	Role Level of assessment & assessment benchmark
Coordinator-General SDPWO Act	Coordinated Project Part 4, section 26(1) (b) of the SDPWO Act.	Manage State evaluation Impact Assessment Report
Coordinator-General on behalf of State advisory agencies *Planning Act 2016* (Planning Act) and Regulation *Vegetation Management Act 1999* (VMA) and Regulation	Vegetation clearing Material change of use: • Clearing native vegetation.	Referral Agency Code assessable: • State code 16: Native vegetation clearing.
Council Planning Scheme	Material change of use Material change of use in Rural zone for: • Rural Industry • Cropping • Caretaker's Accommodation.	Assessment Manager • Rural zone code • Biodiversity overlay code • Bushfire hazard overlay code • Flood hazard overlay code • Major infrastructure overlay code • Wetland and waterway corridor overlay code • Residential activities code • Rural activities code.

Table 6-2 Project approvals framework summary (outside scope of this IAR)

Authority Legislation	Aspect of development Trigger	Role Level of assessment & assessment benchmark
Council Planning Scheme	Reconfiguration of Lot and excavation and filling Reconfiguring a lot: • Reconfiguring Lot 168 on SP262319. Operational work: • Excavation and filling >10,000 tonnes.	Assessment Manager • Rural zone code • Reconfiguring a lot code • Operational works code.
DNRME *Land Act 1994* (Land Act)	Road opening and closure Simultaneous opening and closure of a road Ring tank 2 and Hillside dam pump sites within Flinders River Permit to occupy	Administering Authority • Land Act
DNRME Planning Act and Regulation *Water Act 2000* (Water Act) and Regulation Water Plan (Great Artesian Basin and Other Regional Aquifers) 2017 (GABORA Plan)	Flinders Alluvium Bores > 1 km from Flinders River Operational work: • Taking or interfering with water. GAB Bore 1 Operational work: • Taking or interfering with water. Water licence.	Assessment Manager (via SARA) • State code 10: Taking or interfering with water. Administering Authority • Great Artesian Basin and Other Regional Aquifers Water Management Protocol.

6.2 Notifiable approvals

Per section 34G (2) of the SDPWO Act, an IAR must contain a statement about whether or not any of the following approvals (each of which is a notifiable approval) is required for the project:

- A development approval if the development application for the approval would, under the Planning Act, require impact assessment;
- An environmental authority if the application for the authority would, under the *Environmental Protection Act 1994* (EP Act), chapter 5, part 4, require public notification;
- Another approval under an Act if—
    - The application for the approval requires, other than under the Planning Act or the EP Act, chapter 5, an EIS or a similar statement to address the environmental effects of the approval.
    - The application for, or the granting of, the approval requires public notification under the relevant Act.

Table 6-1 provides a summary of approvals applicable to the project in accordance with these requirements. There are no notifiable approvals as listed within the scope of this IAR.

6.3 Regulatory assessment

Further details relevant to specific regulatory requirements are described in Table 6-3. This includes an assessment of all matters identified within the IAS which have subsequently been determined to be not applicable or accepted development (i.e. not requiring development approval) following further refinement of the project, and operational works not within the scope of this IAR. The purpose of Table 6-3 is to provide a comprehensive regulatory assessment of the project and inform the determination of approvals within scope of this IAR and guide subsequent secondary approval (i.e. operational works and water licences) and design requirements for any accepted development and / or exemptions.

Table 6-3 Regulatory assessment

Authority Legislation	Aspect of development Trigger	Applicability and role Level of assessment & assessment benchmark
Commonwealth		
DEE EPBC Act	Land development and clearing Actions that have, or are likely to have, a significant impact on a MNES.	**Not applicable – No role** Council engaged GHD (2019) to undertake an EPBC significant impact assessment with respect to conservation significant flora and fauna species identified on the site (refer Appendix A). The assessment was completed in accordance with the *Significant Impact Guidelines 1.1 - Matters of National Environmental Significance* and associated Guidelines for EPBC Act listed species as relevant to the site. The EPBC significant impact assessment confirmed that the project will not have an impact on MNES and there is no requirement for referral to the Commonwealth DEE.
State		
SDPWO Act		
Coordinator-General SDPWO Act	**Coordinated Project** The project was declared a 'coordinated project requiring an impact assessment report' by the Coordinator-General under Part 4, section 26(1) (b) of the SDPWO Act on 24 August 2018.	**Applicable – Manage State evaluation** The requirements for an IAR are set out in section 34G (2) of the SDPWO Act. Where the IAR process is used, a draft IAR is prepared by the project proponent (Council). Government advisory agencies are invited to make a submission on the draft IAR. Comments are sought on the project's potential environmental effects and whether the measures proposed by the proponent will effectively manage the project's impacts. After considering the draft IAR, the Coordinator-General may request a revised draft IAR. Alternatively, if the Coordinator-General is satisfied that additional information is not required, the draft IAR will then be as accepted final. Advisory agencies are invited to comment on the adequacy of the final IAR in addressing matters raised in their submissions on the draft IAR and recommend

Authority Legislation	Aspect of development Trigger	Applicability and role Level of assessment & assessment benchmark
		conditions for the Coordinator-General to consider in preparing the Report on the final IAR. After evaluating the project's IAR the Coordinator-General prepares a report on the IAR and recommends the project either: • Proceed subject to conditions and recommendations designed to ensure the project's environmental impacts are properly managed • Be refused on the grounds its environmental impacts cannot be adequately addressed. The report is not an approval in itself. The conditions of approval stated in the report only gain legal effect when they are attached to a statutory approval given under other specific legislation (i.e. the Planning Act).
Planning Act and Planning Regulation approvals		
DNRME (via Coordinator-General) *Vegetation Management Act 1999* (VMA) Vegetation Management Regulation 2012 Planning Act and Planning Regulation	**Vegetation clearing** **Stage 1** Planning Regulation Schedule 10, Part 3, Division 1 The clearing of native vegetation is prohibited development unless it is for a relevant purpose under section 22A of the VMA.	**Applicable – Administering Authority** Vegetation management laws only allow development applications to be made for a relevant purpose. A relevant purpose includes a project declared to be a 'coordinated project' under the SDPWO Act. Application required to be made prior to submission of a development application under the Planning Act and Regulation via the Relevant Purpose Determination Application Form Section 22A of the VMA. *Application for a relevant Purpose determination under section 22A of the VMA for the clearing of native vegetation on Lot 168 on Plan SP262319, Flinders Shire* Council was approved on 1 November 2018 (refer Appendix C).
	Vegetation clearing **Stage 2** Planning Regulation Schedule 10, Part 3, Division 4, Table 3. Material change of use:	**Applicable (Assessable Development) – Advisory agency for IAR** Application is usually referred to the State Assessment and Referral Agency (SARA) for a material change of use involving native vegetation clearing. Development will require assessment against the applicable requirements of *State code 16: Native vegetation clearing*.

Authority Legislation	Aspect of development Trigger	Applicability and role Level of assessment & assessment benchmark
	• Clearing native vegetation.	However, section 37 of the SDPWO Act provides that the Coordinator-General's report is taken to be the concurrence agency response for the application. As such, the Coordinator-Generals' report on the IAR may be taken as the State response on vegetation clearing. DNRME *State Development Assessment Provisions Guidance Material: State code 16: Native vegetation clearing* outlines the supporting documents and level of detail required in reports, plans or other documentation to suitably assess certain types of development. Guidance material for PO 29 Clearing for agriculture (coordinated project) indicates a land suitability assessment is required to meet the land suitability and economic viability requirements for high value and irrigated high value agriculture applications. A copy of the NRA (2019) land suitability study is provided at Appendix A. An assessment of the project against *State code 16: Native vegetation clearing* is provided at section 8.2.2 and Appendix E of this IAR. Required DA Forms (refer Appendix C): • DA Form 1: Development application details. It should be noted that section 8 of the VMA and Schedule 5 of the Vegetation Management Regulation 2012 (Schedule 5, Part 7) precludes regional ecosystems 4.3.15, 4.3.14 and 4.9.1c being defined as vegetation. As such, development within these regional ecosystems is considered exempt development under Schedule 21 (Part 1, Section 1, Subsection 19) of the Planning Regulation 2017 (Planning Regulation) and development within these areas do not form part of the clearing application.
DNRME (via SARA) *Water Act 2000* (Water Act) and Water Regulation 2016 (Water Regulation)	**GAB Bore 1** Planning Regulation Schedule 10, Part 19, Division 1, Subdivision 3, Table 1. Operational work for:	**Applicable (Assessable Development) – Assessment Manager** Applications are made to the State Assessment and Referral Agency (SARA) for operational work involving taking or interfering with water. Development will require assessment against the applicable requirements of *State code 10: Taking or interfering with water*.

Authority Legislation	Aspect of development Trigger	Applicability and role Level of assessment & assessment benchmark
Water Plan (Gulf) 2007 (Gulf Water Plan) Water Plan (Great Artesian Basin and Other Regional Aquifers) 2017 (GABORA Plan) Planning Act and Planning Regulation	• Taking or interfering with water.	DNRME *State Development Assessment Provisions guidance material: State code 10: taking or interfering with water* outlines the supporting documents and level of detail required in reports, plans or other documentation to suitably assess certain types of development. An assessment of the project against *State code 10: Taking or interfering with water* is provided at section 8.2.1 and Appendix E of this IAR. Required DA Forms (refer Appendix C): • DA Form 1: Development application details. • Template 1: Taking or interfering with artesian or subartesian water.
	Flinders Alluvium Bores < 1 km from Flinders River and Flinders River water Planning Regulation Schedule 10, Part 19, Division 1, Subdivision 3, Table 1. Planning Regulation Schedule 7, Part 3, Item 5. Operational work for: • Taking or interfering with water	**Applicable (Accepted Development)** The proposed development is located within the Water Plan (Gulf) 2007 (Gulf Water Plan). The Gulf Water Plan regulates surface water (being water in a watercourse and overland flow) and underground water that is not Great Artesian Basin water. As per section 8(1) of the Gulf Water Plan, groundwater in an aquifer under a prescribed watercourse, or under land within 1 km of a prescribed watercourse, is declared to be water in the watercourse. As per section 8(4) (f) of the Gulf Water Plan, the Flinders River is a prescribed watercourse. Council hold existing water entitlements associated with Lot 168 on SP262319 as follows: • Water licence 609134 for the take of 450 ML from the Flinders River on or adjacent to Lot 168 on SP262319, Lot 167 on SP262319, Lot 22 on DG137 and Lot 60 on DG209. • Water licence 618019 for the take of 5,000 ML from the Flinders River on or adjacent to Lot 168 on SP262319, limited to when the flow of water in the Flinders River at GS915008A exceeds 1,500 ML per day. This water licence also authorises the taking of overland flow water on land described as Lot 168 on SP262319.

Authority Legislation	Aspect of development Trigger	Applicability and role Level of assessment & assessment benchmark
		Under Schedule 7 of the Planning Regulation, works that take water from a watercourse (i.e. Flinders River) is considered accepted development when: • Works involve the installation of a pump to take water that is authorised under a water entitlement. • The entitlement states the rate at which water may be taken. The proposed Flinders Alluvium Bores < 1 km from Flinders River and infrastructure for take of Flinders River water is accepted development.
	Flinders Alluvium Bores > 1 km from Flinders River Planning Regulation Schedule 10, Part 19, Division 1, Subdivision 3, Table 1. Planning Regulation Schedule 7, Part 3, Item 5. Water Regulation, Schedule 9, Part 2 Operational work for: • Taking or interfering with water.	**Applicable (Assessable Development) – Assessment Manager** For the purposes of the Gulf Water Plan, Schedule 9 of the Water Regulation prescribes works for installation of a bore as works that are not assessable development where the works are: • For an exempt bore or • Located more than: ○ 200 m from a property boundary and ○ More than 400 m from another water bore and ○ In an area to which water licence transfer rules under water sharing rules do not apply. Schedule 19 of the Water Regulation defines exempt bore as including (but not limited to) (b) for taking or interfering with water that is not Great Artesian Basin plan related water the water bore is used for testing the water production capacity, water production quality or hydraulic properties of an aquifer. Existing Flinders Alluvium Bores > 1 km from Flinders River as considered to be works that are not assessable development. However, the ongoing use of the bores as production bores for the provision irrigation water does not comply with the exempt bore definition, nor do the existing bores comply with the critical distances prescribed (i.e. bores are greater than 200 m from property boundary (including proposed lot reconfiguration) however, are within 400 m of each other).

Authority Legislation	Aspect of development Trigger	Applicability and role Level of assessment & assessment benchmark
		There is no requirement for a water entitlement (i.e. Licence) for the take of water from the Flinders River Alluvium > 1 km from the Flinders River. DNRME *State Development Assessment Provisions guidance material: State code 10: taking or interfering with water* outlines the supporting documents and level of detail required in reports, plans or other documentation to suitably assess certain types of development. Although Operational Works approvals are not included under section 37 of SDPWO Act and the Coordinator-General's report will not be taken to be the concurrence agency response for these aspects of the development, an assessment of the project against *State code 10: Taking or interfering with water* is provided at section 8.2.1 and Appendix E of this IAR. This assessment has been completed to demonstrate that potential environmental impacts associated with project are appropriately mitigated in line with regulatory best practice, given access to water is critical to successful delivery of the project. Formal application to the SARA will be required following the Coordinator General's assessment of this IAR. Formal application will be need to include the following DA Forms: • DA Form 1: Development application details. • Template 1: Taking or interfering with artesian or subartesian water.
	Overland Flow Storage Dam Planning Regulation Schedule 10, Part 19, Division 1, Subdivision 3, Table 1. Planning Regulation Schedule 7, Part 3, Item 5. Water Regulation, Schedule 9, Part 1 Operational work for:	**Applicable (Accepted Development)** For the purposes of the Gulf Water Plan, Schedule 9 of the Water Regulation prescribes works for taking overland flow as works that are accepted development where they comply with the *Code for self-assessable development for taking overland flow water using limited capacity works.* The proposed overland flow dam will not exceed the limitation on storage volume (250 ML) and will be designed to meet the performance outcomes and acceptable outcomes with respect to minimising physical impacts of overland flow works on neighbouring properties and as such will be considered accepted development.

Authority Legislation	Aspect of development Trigger	Applicability and role Level of assessment & assessment benchmark
	• Taking or interfering with water.	
DNRME (via SARA) *Water Supply (Safety and Reliability) Act 2008* (Water Supply Act) Planning Act and Planning Regulation	**Hillside Dam, Ring Tank 1 and 2** Planning Regulation Schedule 10, Part 19, Division 3, Subdivision 3, Table 1. Water Supply Act Chapter 4, Part 1, Division 2, Section 243. Water Supply Act Chapter 4, Part 1, Division 2, Section 242A. Operational works for: • Referrable dams.	**Not applicable – Confirmation of DNRME's intention under Section 242A of the Water Supply Act** Section 343 of the Water Supply Act, a proposed or existing dam will need to be failure impact assessed if the dam is more than 10 metres in height and has either: • A storage capacity of more than 1,500 ML; or • A storage capacity of more than 750 ML and a catchment area that is more than 3 times its maximum surface area at full supply level. The proposed ring tanks are not anticipated to meet these criteria and as such are considered not assessable development. However, section 242A of the Water Supply Act includes provisions for the executive of DNRME to give notice to the owner of any existing dam or dam being constructed to have the dam failure impact assessed if there is reasonable belief that the existing dam, or the dam after construction, would have a category 1 or category 2 failure impact rating. Dams determined to have a category 1 or category 2 failure impact rating are considered referable dams and require development approval under the Planning Act and associated regulation. Note: the definition of population at risk for a dam failure excludes people at workplaces on which the dam is situated. Council will make individual proponents aware of their obligations under the *Work Health and Safety Act 2011* in relation the site facilities in relation to the failure impact path of storage dams.
Department of Agriculture and Fisheries (DAF) (via SARA) *Fisheries Act 1994* (Fisheries Act) and Fisheries Regulation 2008 (Fisheries Regulation)	**Overland flow dam** Planning Regulation Schedule 10, Part 6, Division 4, Subdivision 3, Table 1. Planning Regulation Schedule 7, Part 3, Item 6.	**Applicable (Accepted Development)** Section 23 of the Fisheries Act and Section 703 of the Fisheries Regulation prescribe the *Accepted development requirements for operational work that is constructing or raising waterway* (accepted development requirements). Section 5.3 of the accepted development requirements prescribes construction, raising or replacement of a dam or weir on a low impact (green) waterway, such

Authority Legislation	Aspect of development Trigger	Applicability and role Level of assessment & assessment benchmark
Planning Act and Planning Regulation	Fisheries Act Part 4, Section 23. Operational works for: • Waterway barrier works.	as that proposed for the overland storage dam, as accepted development subject to the duration and spillway design criteria being achieved. Council propose to adopt the duration and spillway design criteria for accepted development and as such the proposed overland flow dam on the low impact (green) waterway are considered not assessable development.
Department of Transport and Main Roads (TMR) *Transport Infrastructure Act 1994* (TIA) Planning Act and Planning Regulation	**Vehicle Movements** Planning Regulation Schedule 10, Part 9, Division 4, Subdivision 1 Schedule 20 Development impacting on State transport infrastructure and thresholds.	**Not applicable – No role** Development does not include aspects defined within Column 1 (purpose) that exceed Column 3 threshold for local government area 2.
DNRME (via Coordinator-General) *Environmental Offsets Act 2014* (EO Act) and Environmental Offsets Regulation Planning Act and Planning Regulation	**Vegetation Clearing** An offset may be required if the activity will, or is likely to have a significant residual impact (SRI) on a prescribed environmental matter that is a MSES.	**Applicable (Assessable Development) – Advisory agency for IAR** Under the EO Act, an environmental offset is defined as an activity undertaken to counterbalance a SRI of a prescribed activity on a prescribed environmental matter. The *Significant Residual Impact Guideline For matters of state environmental significance and prescribed activities assessable under the Sustainable Planning Act 2009* (Significant Residual Impact Guideline) is used for consideration of all potential offset requirements for MSES, for applications made under Planning Act. An assessment of the project against the Significant Residual Impact Guideline has been completed at section 5.1.5.2. The project is not expected to result in a significant residual impact to any MSES.
Council Shire of Flinders Planning Scheme Planning Act and Planning Regulation	**Development assessable against planning scheme** Refer section 8 of this IAR. Material Change of Use Reconfiguring a Lot	**Applicable – Assessment Manager** The Planning Scheme provides a framework for managing development and land use within Flinders Shire. The following provides a summary of the Planning Scheme codes applicable to the proposed development: Rural zone code, Biodiversity overlay code, Bushfire hazard overlay code, Major infrastructure overlay code, Wetland and waterway

Authority Legislation	Aspect of development Trigger	Applicability and role Level of assessment & assessment benchmark
	Operational Work	corridor overlay code, Residential activities code, Rural activities code, Operational works code and Reconfiguring a lot code. An assessment of the project against *the Planning Scheme* is provided at section and Appendix E of this IAR. Required DA Forms (refer Appendix C): • DA Form 1: Development application details. Council have processed an application for the proposed reconfiguration against relevant overall outcomes and performance outcomes (and associated acceptable outcomes) and is considered to comply. Council will finalise the Reconfiguration of a Lot application following the Coordinator-Generals assessment of the project. Although Operational Works approvals are not included under section 37 of SDPWO Act and the Coordinator-General's report will not include Council conditions for these aspects of the development, the project has been evaluated against relevant overall outcomes and performance outcomes (and associated acceptable outcomes) (refer Appendix D) and is considered to comply. This assessment has been completed to demonstrate that relevant planning provisions have been considered, given the requirement for significant water infrastructure storage is critical to successful delivery of the project.
Non Planning Act and Regulation approvals		
DATSIP *Aboriginal Cultural Heritage Act 2003* and *Cultural Heritage Duty of Care Guidelines* *Torres Strait Islander Cultural Heritage Act 2003*	**Carrying out land disturbing activity** Duty of care to not harm cultural heritage sites or items of significance	**Applicable – No formal role** Section 23(1) of the *Aboriginal Cultural Heritage Act 2003* states that a person who carries out an activity must take all reasonable and practicable measures to ensure the activity does not harm Aboriginal cultural heritage (the "cultural heritage duty of care"). Section 23 of the *Aboriginal Cultural Heritage Act 2003* provides that a person who carries out an activity is taken to have complied with the cultural heritage

Authority Legislation	Aspect of development Trigger	Applicability and role Level of assessment & assessment benchmark
		duty of care in relation to Aboriginal cultural heritage if the person is acting in compliance with gazetted cultural heritage duty of care guidelines.
DNRME Land Act	**Road opening and closure** Land Act Section 109A *Guideline Roads under the Land Act 1994* (SLM/2013/725). Simultaneous opening and closure of a road.	**Applicable – Administering Authority** Section 109A of the Land Act allows a registered owner to apply for a simultaneous road opening and closure through that owner's freehold land. Under section 420B of the Land Act DNRME prescribe guidelines about the making of applications. Application must include: Form LA00 Part A – contact and land details, Form LA20 Part B – application for a simultaneous opening and closure of a road, a drawing (minimum size A4) which includes the following information general location including your land, area of road to be closed, lot on plan information, a north point, scale, dimensions and application fee. Council have submitted an application for the proposed simultaneous opening and closure of a road which is currently under assessment by DNRME.
DNRME Land Act	**Ring tank 2 and Hillside dam pump sites within Flinders River** Land Act Section 177 *Guideline Permit to Occupy* (SLM/2013/7482).	**Applicable – Administering Authority** Section 177 of the Land Act states that the Chief Executive may issue a permit to occupy over unallocated state land (USL), reserve or a road. A permit to occupy gives personal permission to use the land; it does not create an interest in land – the base tenure remains USL, reserve or road. Applications must include: LA00—Application form part A, LA03—Application for a permit to occupy, LA30—Statement in relation to an application under the Land Act, water licence, application fee and any additional attachments, as requested. Council will submit applications for permits to occupy when required to facilitate the pump sites within the Flinders River.
DNRME Water Act and Water Regulation	**Low-level river crossing (Flinders River)** *Riverine protection permit exemption requirements* (WSS/2013/726)	**Applicable (Exempt Development)** The *Riverine protection permit exemption requirements* (exemption requirements) outline when it is permitted to excavate, place fill or destroy vegetation in a watercourse, lake or spring without the need for a riverine protection permit under the Water Act. The proposed low-level river crossing between the 15 Mile project

Authority Legislation	Aspect of development Trigger	Applicability and role Level of assessment & assessment benchmark
		site and Lot 61 on D15732 to the north of the Flinders River is expected to meet the limits and minimum requirements for the exemption requirements and as such will be considered exempt development.
DNRME Water Act and Water Regulation GABORA Plan SDPWO Act	**GAB Bore 1** Water Act Division 2 *Great Artesian Basin and Other Regional Aquifers Water Management Protocol*	**Applicable – Administering Authority** As the project has been declared a coordinated project under the SDPWO Act, Council is eligible to apply for unallocated water from State Reserve under the GABORA Plan. DNRME releases unallocated water from the State Reserve typically through a Terms of Sale which specifies the assessment criteria and the price of the water as decided by DNRME. Water allocated from the State Reserve is available for the life of the project and then returns to the State when the project has concluded. A water licence would be required for the take of underground water from the Great Artesian Basin. Any application would be assessed against criteria within the Terms of Sale, including the minimum separation distances and cumulative spring drawdowns as outlined in the *Great Artesian Basin and Other Regional Aquifers Water Management Protocol* (the Protocol). If the effect of the proposed volume does not meet the criteria in the Protocol, then the applicant will need to undertake studies providing an alternative method of assessment to meet the GABORA Plan outcomes in regard to impacts on other users and groundwater dependent ecosystems. Council registered an interest in unallocated water under cover of letter dated 5 October 2018 and on 2 February 2019 provided further information in response to DNRME's offer under cover of *Release of unallocated water held in State reserve in the Water Plan (Great Artesian Basin and Other Regional Aquifers) 2017 Water Plan area – Flinders Shire Council 15 Mile Irrigated Agricultural Development Project: Fixed Price Terms of Sale*. Council has made application for an entitlement of 1,020 ML per year from the Great Artesian Basin (GAB). DNRME have advised that their current groundwater

Authority Legislation	Aspect of development Trigger	Applicability and role Level of assessment & assessment benchmark
		impact assessments required as part of the fixed price sale indicate a sustainable allocation of 720 ML/yr from the Hutton formation.

7. Planning framework assessment

7.1 North West Regional Plan

The purpose of regional planning is to ensure that the diversity of Queensland's natural resources and state interests are considered in the growth and development of the State. Local governments in a region must consider the regional plan when preparing their local planning schemes (Queensland Government, 2018b). The North West Regional Plan incorporates the Shire of Flinders and identifies the Hughenden area as having potential for irrigated farming and associated agricultural industries.

The Minister for State Development, Manufacturing, Infrastructure and Planning has identified that the Flinders Shire Planning Scheme, specifically the strategic framework (refer section 7.2 of this report), appropriately advances the North West Queensland Regional Plan as it applies to the area.

The project promotes irrigation based agriculture and will realise the potential for such development in accordance with the North West regional Plan.

7.2 Local planning instrument (Planning Scheme)

Council adopted the current Planning Scheme on 19 September 2017. The Planning Scheme commenced from the 2 October 2017 and replaced the Flinders Shire Council Planning Scheme 2005.

The existing Planning Scheme was initially prepared in accordance with the framework of the now superseded *Sustainable Planning Act 2009* however, was subsequently amended to be consistent with the provisions of the Planning Act. The Planning Scheme provides a framework for managing development and land use within Flinders Shire and was developed to support Council's vision for North West Queensland, while preserving the friendly nature and strong community spirit Flinders Shire is known for (FSC, 2018d).

7.2.1 Strategic Intent

The Planning Scheme has been developed with reference to the CSIRO (2013) report and is supportive of irrigated agricultural development within the Rural zone. Development of irrigation based intensive agricultural industries to take advantage of the Shire's water and soil resources forms part of the "Strategic Intent" of the Planning Scheme.

The Planning Scheme states *"The Planning Scheme outlines that the Flinders River location provides huge potential for the development of irrigation based intensive agriculture. Flinders Shire Council is actively working to support the economy of the Shire and to encourage new business and industry to establish. In particular, with respect to the development of meat processing and irrigation based intensive agricultural industries in the Shire. The Council is also investing in facilities to enhance the quality of life for the Flinders Shire community such as a recreational lake near Hughenden.*

This planning Scheme is a key tool to facilitate this vision with an emphasis on providing an environment to promote economic development while also preserving the Shire's liveability and sense of place".

The project promotes the advancement of economic development in the Shire through development of irrigation based intensive agriculture in the line with the Planning Scheme Strategic Intent.

7.2.2 Strategic Framework

The Strategic Framework sets the policy direction for the Planning Scheme and forms the basis for ensuring appropriate development occurs within the Shire. Section 3.4.5 outlines the Strategic Outcomes, Specific Outcome and Land Use Strategies of the Planning Scheme with respect to the Strategic Framework for Economic Development: Element 4 Development of Agriculture.

One of the Strategic Outcomes for Economic Development: Element 4 Development of Agriculture is that "*Irrigation based rural activities are developed to take advantage of the Shire's water and soil resources*". Specific outcomes and Land Use Strategies set under the Planning Scheme to support this are shown in Table 7-1.

Table 7-1 Agriculture Development Specific Outcomes and Land Use Strategies

Specific outcomes	Land use strategies
SO2 The development of irrigation based rural activities is supported and protected from incompatible development.	**LS 2.1** Irrigation based rural activities are supported in the Rural zone where appropriate.
SO3 The lot size of land utilised for irrigation based rural activities allows for development of an appropriate scale to maximise potential economic viability.	**LS 3.1** On sites within the Rural zone where the majority of the site is being utilised for irrigation based rural activities, smaller allotment sizes may be accommodated where appropriate.

The project promotes the advancement of economic development in the Shire through development of irrigation based intensive agriculture in the line with the Planning Scheme Strategic Intent.

7.2.3 Assessment framework

7.2.3.1 Zone and overlays

The site is located within the Rural zone under the Planning Scheme. Planning Scheme overlay mapping also indicates the site is located within the following overlays:

- Biodiversity overlay via SPP mapping – MSES regulated vegetation.
- Bushfire hazard overlay via SPP mapping – MSES medium (potential intensity) and potential bushfire impact buffer.
- Major infrastructure overlay (stock routes).
- Wetland and waterway corridor overlay via SPP mapping – MSES regulated vegetation (intersecting a watercourse).

7.2.3.2 Material change of use

Aspects of the proposed development, associated use definitions and level of assessment in the Rural Zone (Material Change of Use) under the Planning Scheme are shown in Table 7-2.

Table 7-2 Planning Scheme use definitions and level of assessment in the Rural zone – Material change of use

Aspect of development	Planning Scheme use definition	Level of assessment	Assessment benchmarks
High value irrigated agriculture	Cropping	Accepted development	Rural zone code Rural activities code
Limited staff accommodation (2 cabins for caretaker and land owner).	Caretaker's accommodation	Code assessment	Rural zone code Residential activities code
Co-use cooling, packaging and logistics facility (co-use facility) and associated workforce amenities.	Rural industry	Code assessment	Rural zone code Rural activities code

7.2.3.3 Reconfiguring a lot

Aspects of the proposed development and level of assessment in the Rural zone (Reconfiguring a Lot) under the Planning Scheme are shown in Table 7-3.

Table 7-3 Planning Scheme level of assessment in the Rural zone – Reconfiguration of a Lot

Aspect of development	Level of assessment	Assessment benchmarks
Reconfiguring Lot 168 on SP262319.	Code assessment	Rural zone code Reconfiguring a lot code

7.2.3.4 Operational work

Aspects of the proposed development and level of assessment in the Rural zone (Operational Work) under the Planning Scheme are shown in Table 7-4.

Table 7-4 Planning Scheme level of assessment in the Rural zone – Operational work

Aspect of development	Level of assessment	Assessment benchmarks
Overland flow dam and ring tank(s) where excavation and filling exceeds 10,000 tonnes.	Code assessment	Operational works code

7.2.3.5 Overlays

Aspects of the proposed development level of assessment in the Rural zone (Operational Work) under the Planning Scheme are shown in Table 7-5.

Table 7-5 Planning Scheme level of assessment – Overlays

Development	Category of development and assessment	Assessment benchmarks for assessable development and requirements for accepted development
Biodiversity		
Material change of use	Code assessment	Biodiversity overlay code
Reconfiguration of a lot or Operational works	No change	Biodiversity overlay code
Bushfire hazard overlay		
Material change of use	No change	Bushfire overlay code
Reconfiguration of a lot	No change	Bushfire overlay code
Major infrastructure overlay		
Material change of use or Reconfiguration of a lot (adjoining Stock routes)	No change	Major infrastructure overlay code
Wetland and waterway corridor overlay		
Material change of use within 25 metres from a waterway or wetland as identified in the Wetland and waterway corridor overlay	Code assessment	Wetland and waterway corridor overlay code
Reconfiguration of a Lot within 25 metres from a waterway or wetland as identified in the Wetland and waterway corridor overlay.	No change	Wetland and waterway corridor overlay code
Operational work for filling or excavation within 25 metres from a waterway or wetland as identified in the Wetland and waterway corridor overlay.	Code assessment	Wetland and waterway corridor overlay code

7.2.3.6 Assessment framework summary

The following provides a summary of the Planning Scheme codes applicable to the proposed development:

- Zones:
  - Rural zone code
- Overlays:
  - Biodiversity overlay code
  - Bushfire hazard overlay code
  - Flood hazard overlay code
  - Major infrastructure overlay code
  - Wetland and waterway corridor overlay code

- Use codes:
    - Residential activities code
    - Rural activities code
- Other development codes:
    - Operational works code
    - Reconfiguring a lot code.

The following sections provide an overview of compliance with the applicable Planning Scheme codes. Detailed assessment are provided in Appendix D.

7.2.4 Rural zone code

This code applies to assessing material change of use and reconfiguring a lot for development in the Rural zone.

The purpose of the Rural zone is to:

- Provide for rural uses and activities.
- Provide for other uses and activities that are compatible with:
    - Existing and future rural uses and activities
    - The character and environmental features of the zone.
- Maintain the capacity of land for rural uses and activities by protecting and managing significant natural resources and processes.

The Planning Scheme achieves the purpose of the code through 17 overall outcomes. The project has been evaluated against relevant overall outcomes (refer Appendix D) and is considered to comply. Through compliance with the overall outcomes, the project complies with the purpose of the code.

7.2.5 Biodiversity overlay code

The purpose of the Biodiversity overlay code is to avoid or minimise the impacts of development on MSES.

The Planning Scheme achieves the purpose of the code through 2 overall outcomes and 2 performance outcomes (and associated acceptable outcomes).

The project has been evaluated against relevant overall outcomes and performance outcomes (and associated acceptable outcomes) (refer Appendix D) and is considered to comply. Through compliance with the overall outcomes and performance outcomes (and associated acceptable outcomes), the project complies with the purpose of the code.

7.2.6 Bushfire hazard overlay code

The purpose of the Bushfire hazard overlay code is to avoid or risks from bushfire throughout the Flinders Shire Local Government Area.

The Planning Scheme achieves the purpose of the code through 3 overall outcomes and 5 performance outcomes (and associated acceptable outcomes).

The project has been evaluated against relevant overall outcomes and performance outcomes (and associated acceptable outcomes) (refer Appendix D) and is considered to comply. Through compliance with the overall outcomes and performance outcomes (and associated acceptable outcomes), the project complies with the purpose of the code.

7.2.7 Flood hazard overlay code

The purpose of the flood hazard overlay code is to manage development outcomes in the floodplain so that risk to life, property, community and the environment during future flood events is minimised.

The Planning Scheme achieves the purpose of the code through 2 overall outcomes and 7 performance outcomes (and associated acceptable outcomes).

The project has been evaluated against relevant overall outcomes and performance outcomes (and associated acceptable outcomes) (refer Appendix D) and is considered to comply. Through compliance with the overall outcomes and performance outcomes (and associated acceptable outcomes), the project complies with the purpose of the code.

7.2.8 Major infrastructure overlay code (Stock Route Network)

The purpose of the Major infrastructure overlay code is to ensure development in close proximity to major infrastructure, does not result in any negative impact on their function.

The Planning Scheme achieves the purpose of the code through 1 overall outcome and 1 performance outcome (and associated acceptable outcomes) relevant to protection of the Stock Route Network.

The project has been evaluated against relevant overall outcomes and performance outcomes (and associated acceptable outcomes) (refer Appendix D) and is considered to comply. Through compliance with the overall outcomes and performance outcomes (and associated acceptable outcomes), the project complies with the purpose of the code.

7.2.9 Wetland and waterway corridor overlay code

The purpose of the Wetland and waterway corridor overlay code is to avoid or minimise the impacts of development on waterways and wetlands throughout the Flinders Shire Local Government Area.

The Planning Scheme achieves the purpose of the code through 4 overall outcomes and 6 performance outcomes (and associated acceptable outcomes).

The project has been evaluated against relevant overall outcomes and performance outcomes (and associated acceptable outcomes) (refer Appendix D) and is considered to comply. Through compliance with the overall outcomes and performance outcomes (and associated acceptable outcomes), the project complies with the purpose of the code.

7.2.10 Residential activities code

The purpose of the Residential activities code is to ensure that residential activities are appropriately located, meet the needs of the community, are designed to be consistent with the intended character and amenity of the locality, and do not adversely impact on surrounding land uses and the natural environment.

The Planning Scheme achieves the purpose of the code through 10 overall outcomes and 16 performance outcomes (and associated acceptable outcomes).

The project has been evaluated against relevant overall outcomes and performance outcomes (and associated acceptable outcomes) (refer Appendix D) and is considered to comply. Through compliance with the overall outcomes and performance outcomes (and associated acceptable outcomes), the project complies with the purpose of the code.

7.2.11 Rural activities code

The purpose of the Rural activities code is to ensure that rural activities are appropriately located, meet the needs of the community, are designed to be consistent with the intended character and amenity of the locality and do not adversely impact on surrounding land uses and the natural environment.

The Planning Scheme achieves the purpose of the code through 5 overall outcomes and 12 performance outcomes (and associated acceptable outcomes).

The project has been evaluated against relevant overall outcomes and performance outcomes (and associated acceptable outcomes) (refer Appendix D) and is considered to comply. Through compliance with the overall outcomes and performance outcomes (and associated acceptable outcomes), the project complies with the purpose of the code.

7.2.12 Operational works code

The purpose of the Operational works code is to regulate operational works throughout the Flinders Shire local government area; in particular, excavation and filling and advertising devices.

The Planning Scheme achieves the purpose of the code through 7 overall outcomes and 7 performance outcomes (and associated acceptable outcomes) relevant to excavation and filling.

Although Operational Works approvals are not included under section 37 of SDPWO Act and the Coordinator-General's report will not include Council conditions for these aspects of the development, the project has been evaluated against relevant overall outcomes and performance outcomes (and associated acceptable outcomes) (refer Appendix D) and is considered to comply. Through compliance with the overall outcomes and performance outcomes (and associated acceptable outcomes), the project complies with the purpose of the code.

This assessment has been completed to demonstrate that relevant planning provisions have been considered, given the requirement for significant water infrastructure storage is critical to successful delivery of the project.

7.2.13 Reconfiguring a lot code

The purpose of the Reconfiguring a lot code is to:

- Ensure that new lots are configured to address site constraints, protect important natural features and economic resources.
- Ensure that lots are created that have access to appropriate infrastructure, services, transport connections and open space.
- Ensure that the uses intended for the created lots are compatible with existing or proposed development on adjacent land.

The Planning Scheme achieves the purpose of the code through 6 overall outcomes and 18 performance outcomes (and associated acceptable outcomes).

Council have processed an application for the proposed reconfiguration against relevant overall outcomes and performance outcomes (and associated acceptable outcomes) and it is considered to comply. Council will finalise the Reconfiguration of a Lot application following the Coordinator-Generals assessment of the project.

8. Assessment of State interests

8.1 State Planning Policy

The State Planning Policy July 2017 (SPP) defines State interests in land use planning and development. The following State interests have been identified through Queensland Government (2018c) SSP interactive mapping as being relevant to the site:

- Agriculture:
  - Stock Route Network
- Biodiversity:
  - MSES - Regulated vegetation (Category B)
  - MSES - Regulated vegetation (Wetland)
  - MSES - Regulated vegetation (intersecting a watercourse)
- Natural Hazards Risk and Resilience
  - Flood hazard area - level 1 - Queensland floodplain assessment overlay
  - Bushfire prone area.

As outlined within section 2.1 of the Flinders Shire Planning Scheme, the State minister has identified that the SPP dated April 2016 has been appropriately integrated. Although this has subsequently been superseded, the Planning Scheme adopts SPP interactive mapping in the following overlay maps:

- Biodiversity overlay (MSES – Regulated vegetation)
- Major infrastructure overlay (Stock Route Network)
- Bushfire hazard overlay (Hazards and Safety – Bushfire).

With respect to flood hazard, Planning Scheme 100 year ARI peak water surface level mapping does not extend to the subject site. To address the requirements of the SPP and Planning Scheme, a site specific risk assessment will be required to ensure that proposed buildings and essential infrastructure are protected from flooding and that the proposed development does not result in adverse flooding impacts off site. This will be completed during the detailed engineering (i.e. operational and building works) phases of the project on completion of the IAR.

8.2 State Development Assessment Provisions

The State Development Assessment Provisions (SDAP) are a statutory instrument prescribed under the Planning Regulation. The SDAPs define the State's interest in development assessment, and includes the assessment benchmarks or matters that an application will be assessed against. The following provisions of the SDAPs are applicable to the project:

- State Code 10: Taking or interfering with water
- State code 16: Clearing native vegetation.

The following sections provide an overview of compliance with the applicable State codes. Detailed assessment are provided in Appendix E.

8.2.1 State code 10: Taking or interfering with water (operational works)

The purpose of this code is to provide for the sustainable management of water by ensuring that development for taking or interfering with water:

- Maintains and where reasonably possible reverses degradation of:
    - Natural ecosystem processes
    - Riverine environment
    - Underground water systems
    - Physical integrity of watercourses.
- Minimises adverse impacts on the:
    - Connectivity between underground water and water in a watercourse, lake or spring
    - Property of others.
- Is consistent with the requirements of water planning instruments and authorities to take or interfere with water under the Water Act.
- Does not adversely impact the water security of other users and their access to the water resource.
- Minimises the volume of overland flow water taken, consistent with the purpose of the development.

Aspects of the development and relevant provisions of the code applicable to the project are described in Table 8-1.

Table 8-1 Aspects of development and relevant provisions of State Code 10

Development	Relevant provisions of code
For works that take or interfere with underground water	Table 10.2.2 – General: PO1 – PO4 Table 10.2.2 – Underground water: PO5 – PO6

Although Operational Works approvals are not included under section 37 of SDPWO Act and the Coordinator-General's report will not be taken to be the concurrence agency response for these aspects of the development, the project has been evaluated against relevant performance outcomes (and associated acceptable outcomes) (refer Appendix E) and is considered to comply. Through compliance with the overall outcomes and performance outcomes (and associated acceptable outcomes), the project complies with the purpose of the code. This assessment has been completed to demonstrate that potential environmental impacts associated with project are appropriately mitigated in line with regulatory best practice, given access to water is critical to successful delivery of the project.

8.2.2 State code 16: Native vegetation clearing (material change of use)

The purpose of this code is to ensure development:

- Is consistent with any notice requiring compliance on the land subject to the development application unless a better environmental outcome can be achieved.
- Is consistent with vegetation management requirements for particular regulated areas unless a better environmental outcome can be achieved.
- Minimises contributions to greenhouse gas emissions.
- Avoids clearing, or where avoidance is not reasonably possible, minimises clearing to:
    - Conserve vegetation
    - Avoid land degradation

- Avoid the loss of biodiversity
- Maintain ecological processes.

- Avoids impacts on vegetation that is a MSES, and where avoidance is not reasonably possible, minimises and mitigates impacts and provides an offset for any acceptable significant residual impacts where appropriate. An offset is only appropriate for any acceptable significant residual impacts on vegetation that forms a connectivity area for development that is a coordinated project or for necessary environmental clearing (natural channel diversion and contaminants removal).

Aspects of the development and relevant provisions of the code applicable to the project are described in Table 8-2.

Table 8-2 Aspects of development and relevant provisions of State Code 16

Development	Relevant provisions of code
Material change of use and/or reconfiguring a lot – coordinated project	Table 16.2.2 – PO1 – PO4 Table 16.2.3 – PO7, PO11, PO17, PO20, PO22 – PO24, PO27 If involving clearing for agriculture, then also table 16.2.3 – PO29 – PO30

The project has been evaluated against relevant performance outcomes (and associated acceptable outcomes) (refer Appendix E) and is considered to comply. Through compliance with the performance outcomes (and associated acceptable outcomes), the project complies with the purpose of the code.

9. Conclusions

The scope of this IAR is for all aspects of the proposed 15 Mile Irrigation Project on Lot 168 Plan SP262319. This IAR has been prepared provide the information necessary to assist the Coordinator-General making a recommendation to progress with the project subject to conditions and recommendations designed to ensure the project's environmental impacts are properly managed.

As outlined within the following sections, the project has potential to generate significant social and economic benefits to the shire, while taking advantage of existing yet underutilised community infrastructure.

It is requested that the Coordinator-General and Sate advisory agencies support the activity, subject to reasonable and relevant conditions in accordance with information contained within this report.

9.1 Social and built environments

The social setting for the Shire shows a declining and aging population. The project has potential to provide greater local employment opportunities and attract skilled workers and labourers to the area. The establishment of this new industry may also provide for other employment opportunities through research and development of agricultural practices and sustainable water management. Ultimately, this type of development is required in the Shire to allow more efficient use of the readily available Local and State significant community and transport infrastructure along with the existing local housing supply.

9.2 Local, state and national economies

Analysis of the direct and flow on economic and employment opportunities potentially generated through the development of the project indicate significant contributions to the economic development of the Shire and wider region.

The project has potential to generate in the order of 165 FTEs/annum for the life of the enterprise along with 15 FTEs/annum during the construction and establishment phase. These will be staged in line with initial development and as subsequent third party investors/growers develop the precinct. If full development were realised, this would make the precinct one of the largest employers in the Shire.

Development of the precinct will require significant expenditure within the Shire and wider region through the provision of the necessary infrastructure required for irrigated agricultural development. There will be opportunities for existing complimentary industries within the Shire including transport services, building and concrete supplies, irrigation pump supplies and repairs to benefit from the estimated $47 million in capital investment. As areas of the precinct are developed, it is expected that existing industries in the Shire will have matured and would be in position to service/supply more aspects of subsequent developments.

The annual value of the development at full production could feasibly be in the order of $3.4 million (gross/farm gate value) for initial development and a further $8-9 million (gross/farm gate value) if full development of the precinct is realised. Though not directly comparable, this is significant when compared to the annual value of the livestock (cattle) industry to the Flinders Shire (approximately $87.1 million in 2012). As the precinct will likely service markets in Queensland, interstate and potentially internationally, benefits of this will not be limited to the Shire and advances State Policy for the economic development of the north western Queensland.

9.3 Natural environments

No MNES and/or MSES are expected to be significantly impacted by the project. The project has been designed to accommodate key natural features in the master plan and will be constructed and operated in accordance with best practice environmental controls and farming techniques.

The SPP and SDAPs define the State's interest in land use planning and development assessment, and includes the assessment benchmarks or matters that an application is assessed against. The following provisions of the SPP are applicable to the project:

- Agriculture:
  - Stock Route Network
- Biodiversity:
  - MSES - Regulated vegetation (Category B)
  - MSES - Regulated vegetation (Wetland)
  - MSES - Regulated vegetation (intersecting a watercourse)
- Natural Hazards Risk and Resilience
  - Flood hazard area - level 1 - Queensland floodplain assessment overlay
  - Bushfire prone area.

The SPP has been integrated into the Flinders Shire Planning Scheme and the project has been evaluated against the relevant performance outcomes (and associated acceptable outcomes) and is considered to comply. Further consideration will be required to fully address risks associated with flooding during the detailed engineering (i.e. operational and building works) phases of the project on completion of the IAR.

The following provisions of the SDAPs are applicable to the project:

- *State Code 10: Taking or interfering with water*
- *State code 16: Clearing native vegetation*.

The project has been evaluated against the relevant performance outcomes (and associated acceptable outcomes) and is considered to comply.

9.4 Planning framework

The project promotes the advancement of economic development in the Shire through development of irrigation based intensive agriculture in the line with the objectives of the Planning Scheme and North West Regional Plan. The project is code assessable under the Planning Scheme for development involving a material change of use, reconfiguration of a lot and operational works. For the purpose of this IAR, the project has been evaluated against the relevant provisions of the Planning Scheme including the Rural zone code, relevant overlay codes, use codes and other development codes and is considered to comply.

10. References and data sources

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Appendices

Appendix A - Technical reports

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Appendix B – Significant Residual Impact Guideline Assessment

Remnant vegetation within the defined distance of a watercourse SRI assessment

Connectivity areas SRI assessment

Appendix C - DA Forms & supporting documentation

DA Form 1: Development application details

DNRME Section 22A determination

Appendix D - Planning scheme assessment

Rural zone code

Biodiversity overlay code

Bushfire hazard overlay code

Flood hazard overlay code

Major infrastructure overlay code

Wetland and waterway corridor overlay code

Residential activities code

Rural activities code

Operational works code

Reconfiguring a lot code

Note: At the request of the Coordinator General, Performance Outcomes of the above referenced codes deemed not applicable to the proposed development have not be included within the following assessment tables.

Appendix E - SDAP State Code assessment

State code 10: Taking or interfering with water

State code 16: Native vegetation clearing

Note: At the request of the Coordinator General, Performance Outcomes of the above referenced codes deemed not applicable to the proposed development have not be included within the following assessment tables.

Note: SDAP version 2.5 commenced on 1 July 2019. The majority of changes included in SDAP version 2.5 were made to State Code 16: native vegetation clearing. However, SDAP 2.5 code response template: State code 16 were not released at time of issue of this report. SDAP 2.4 code response template: State code 16 has been used with 2.5 amendments as follows Amended provisions: AO11, AO20, AO27, PO7, PO11, PO20. No changes to SDAP 2.4 code response template: State Code 10 were made as no changes to State Code 10: Taking or interfering with water were made as a result of the release of SDAP version 2.5.

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42-SO1-857553920-1/https://projects.ghd.com/oc/NQOC2/15mileiarfinalsubmis/Delivery/Documents/4221213-REP-15 Mile Irrigation Project-Impact Assessment Report.docx

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