Report

TCW00435 – Lansdown Eco-Industrial Precinct - Infrastructure Master Plan

Prepared for Townsville City Council

16 February 2022

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PIE Solutions
PLANNING INFRASTRUCTURE ECONOMICS

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DOCUMENT CONTROL

ISSUE	DATE	ISSUE DETAILS	AUTHOR	CHECKED	APPROVED
0	16/02/2022	Issue for Use	D Russell et al	A McPhail	E Tadros

PSA.RPT.MP.02.21-000239 MP_Rev 0.Docx

Executive summary

Purpose

The purpose of the Lansdown Eco-Industrial Precinct (TCW00435) – Infrastructure Planning and Design and Documentation project (the Project) is to define a pathway to enable the controlled and sustainable development of Lansdown Eco-Industrial Precinct (LEIP) in the Townsville City Council (or Council or TCC) local government area, including the preparation of a Infrastructure Master Plan (or Master Plan or MP) and supporting Asset Infrastructure Plan (or AIP) for the LEIP.

The LEIP is intended as Northern Australia's first eco-industrial precinct for advanced manufacturing and processing, technology, and emerging industries. Activation of the LEIP will result in significant economic benefit to the local, regional, and Queensland economy.

As the LEIP has the potential to support more than 5,000 construction jobs, around 1,600 initial jobs and more than 9100 indirect jobs, the project met the objectives of the Townsville City Deal, which is a 15 year commitment between Australian and Queensland Governments and the Townsville City Council to a collective program of planning, reform and investment for Townsville. This includes a commitment from the Queensland Government and all levels of government to activate industry and export growth for Townsville and its regional partners.

To meet projected industrial land demand, and following a planning scheme amendment process, including environmental assessment and consultation, the Townsville City Plan was amended in 2020 to include the LEIP. The LEIP is primarily included in the High Impact Industry Zone, but also includes an area of Sport and Recreation Zone for a motor sport precinct. An existing lease and development approvals are in effect over the Sport and Recreation Zone for use by Drive It NQ, which has recently commenced construction.

Since the amendment to the Townsville City Plan, the Townsville City Council has received significant proponent interest from several key industrial operators that align with the eco-industrial intent of the LEIP.

Through a public tender process in 2019, the Townsville City Council provisionally reserved land in the LEIP to the following initial proponents:

- Queensland Pacific Metals for the purpose of developing a battery feedstock refinery complex.
- Imperium3 Townsville to develop a lithium-ion battery manufacturing facility.
- Edify Energy to develop a hydrogen facility as well as a future substation.

In accordance with the identification of the LEIP for industrial land uses, several development proposals from initial proponents have been progressed to various stages with the Townsville City Council. This has brought forward the need to finalise a preliminary aspirational master plan to guide the controlled activation of the LEIP, prioritising eco-industrial principles and efficient and sustainable infrastructure development.

Scope

Townsville City Council is seeking to provide a leading eco-industrial precinct in the LEIP, and to do this requires a detailed infrastructure assessment and master plan. With consideration of background reports and requirements of initial and future proponents, the following documents have been prepared:

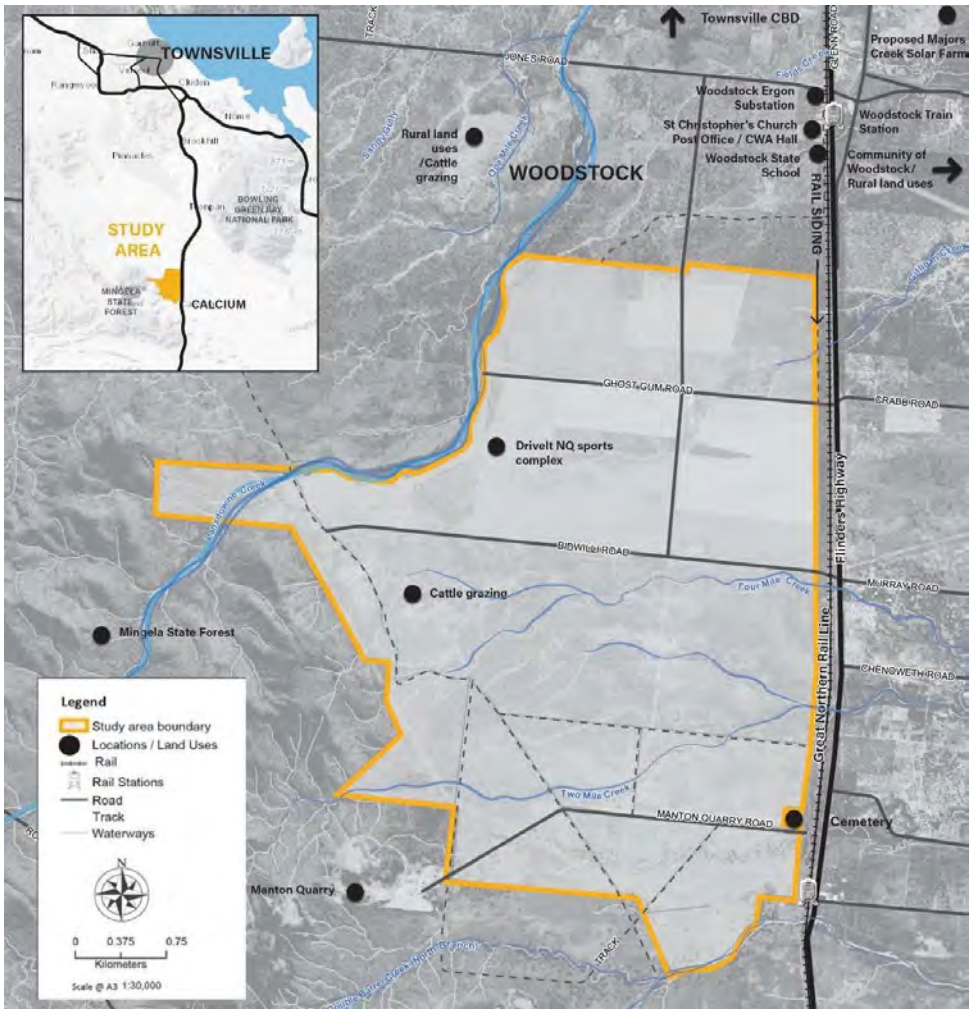
- Infrastructure Master Plan (or Master Plan or MP).
- Asset Infrastructure Plan (AIP).

The scope of work for the Project is separated into two components: the MP (this report) and the AIP.

Study area

The study area is defined as the LEIP, located within the suburb of Calcium of the Townsville City Council local government area in the Far North Queensland Region (refer **Figure 0-1**). The LEIP has an area of approximately 2,200ha extending east from Mingela State Forest and Lansdown Creek to the Flinders Highway, 40km south of the Townsville CBD.

Figure 0-1 Study area



Economic assessment

Townsville has the potential to provide future industrial businesses with a location that allows them to access local, regional, national, and international markets .

An economic assessment has been undertaken to determine the following:

- current 'state of play' of industrial development and employment in Townsville;
- forward trends in modern industrial development;
- current industrial land supply in Townsville;
- demand locally and regionally;
- potential take up of industrial land in the LEIP.

The 'knowledge intensity' of the industrial workforce is increasing. Hence, advanced manufacturers will require higher levels of worker amenity and access to business support services (e.g., industrial design, research laboratories, specialist financiers, etc) in industrial areas than traditional manufacturers have demanded in the past. Facilitating an outward looking industrial sector is imperative to the ongoing economic sustainability of Townsville and the Far North Queensland region. However, competition by its nature is dynamic and susceptible to changes in market conditions (e.g. the price of materials that the advanced manufacturers use), and therefore demand cannot be guaranteed based on an outlook and plan

Industrial land demand within the Townsville region has been subdued in recent years due to lower base metals prices. However, despite the economic downturn in base metals prices, there has been significant interest in the LEIP. The LEIP, which is intended to be Northern Australia's first eco-industrial precinct for advanced manufacturing and processing, technology, and emerging industries, offers opportunity for land extensive industries which require access to the Port of Townsville (rail and road) but not immediate proximity. This area provides the opportunity for the development of an industry cluster, with access to locally generated energy from the approved 200-megawatt Majors Creek Solar Farm.

Infrastructure gap and options analysis

To further inform the master planning, as agreed with the Townsville City Council, infrastructure demands of specific proponents were used. The primary driver is to collate information that would accommodate the preparation of long term infrastructure planning for the LEIP based on the current Townsville City Plan zoning and assumptions, but which takes into account known proponent demands and a preliminary aspirational master plan to support practical delivery of the enabling infrastructure works.

Infrastructure investigations have been undertaken by Calibre for the following types of infrastructure:

- Roads.
- Rail loop.
- Water supply (raw/ potable)
- Wastewater
- Electrical supply
- Gas supply
- Telecommunications
- Stormwater.

The infrastructure investigations considered both the infrastructure necessary for the initial proponent development (enabling infrastructure works) as well as the infrastructure required to service the LEIP at full development.

The results of this assessment are incorporated into and detailed within the preliminary aspirational master plan and development sequencing and staging plan.

Constraints, dependencies, and risk analysis

To identify the constraints, dependencies and risks associated with the provision and staging of infrastructure and land uses for the LEIP, a review of regulatory requirements, planning and environmental assessment, infrastructure assessment and risk analysis was undertaken. Potentially developable areas were identified and considered in the land use plan within the master planning process. The constraints informed the proposed land uses and location of infrastructure and access. Land use constraints assessed include the following:

- Habitat
- Vegetation
- Tenure
- Mining
- Slope
- Major Waterways
- Flood
- Water Catchments
- Heritage
- Bushfire Hazard
- Buffer to Sensitive Uses.

The assessment considered several amendments to constraints used in previous master planning, that had the potential to provide additional potential development areas to the original land use plan[1], including:

- Consideration of detailed assessment findings from the previous Environmental Study[2], including ground truthing of vegetation value. The previous study found that the ground truthed remnant vegetation and habitat areas patches had lower value than mapping suggested. As a result, these areas were included in potential development areas for the potential location of lower impact or temporary uses.
- This assessment recognises that some moderately constrained areas may have suitability for lower impact forms of development, consistent with some activities expected within an eco-industrial precinct, e.g., solar panels, biomass production etc. As a result, they were not ruled out of potential development areas.
- The boundary of the water resource Ross River Dam Catchment area located to the west of the LEIP was amended from that within the Townsville City Plan overlay to reflect impact assessment undertaken in the assessment.
- The assessment provided a 25m buffer to waterways in accordance with the Townsville City Plan stream hierarchy as this was considered sufficient to incorporate associated vegetation.
- The Drive It NQ development application submission was considered. The accepted plans included minor development over the mapped environmental overlay area of the Townsville City Plan. As a result, this area was included in the potentially developable area and management of environmental impacts will be required over the area.

This assessment identified 207.7 ha of additional potentially developable land from the previous master plan.

It is noted that the Townsville City Council has not endorsed these changes to the Townsville City Plan. Until the Townsville City Council has resolved to proceed with a planning scheme amendment and finalised the planning scheme amendment, the Townsville City Plan is to be complied with.

[1] GHD, Infrastructure, Traffic, Transport & Air Quality Integrated Master Plan Report, May 2019
[2] Earth Environmental 2018, Lansdown Station Environmental Study: Final Report, prepared for Townsville City Council, Townsville

Elphinstone
Four Mile Creek
Sandy Gully
One Mile Creek
ROAD
ROWE ROAD
TRACK
GHOST GUM ROAD
Gilliga n Creek
FLINDERS HIGHWAY
ROAD
TRACK
Lansdowne Creek
BIDWILLI ROAD
Four Mile Creek
TRACK
Wyoming
Two Mile Creek
TRACK
ROAD
Manton
MANTON QUARRY ROAD
UNCONSTRUCTED ROAD
ROAD
ROAD
Calcium
Double Barrel Creek (North Branch)
ROAD
TRACK
Double Barrel Creek (North Branch)
Double Barrel Creek
UNCONSTRUCTED ROAD
ROAD
ROAD
TRACK

DATA SOURCE
Data Provided By Townsville City Council
Base Imagery Sourced From ESRI ©

N

0 0.275 0.55
Kilometers

Scale @ A3 1:22,500
Date: 10/02/22
Drawn: Stuart B

Legend

- LEIP boundary
- Locations
- Railway
- Road
- Waterways

LEIP MCA Ranking

- Highly Constrained
- Moderately Constrained
- Minimally Cantrained

Figure 0-2 Constraint assessment results

calibre

CDM Smith

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Preliminary Aspirational Master Plan

The intent of the preliminary aspirational master plan is to address the physical constraints of the study area, provide a sustainable land use framework that accommodates the location of the early proponents, provides for the longer-term emergence of industry clusters and circular economy activities consistent with eco-industrial outcomes. The aspirational master plan aims to:

- Accommodate the requirements of early proponents.
- Provide for the accommodation of longer-term industrial opportunities consistent with the principles of a sustainable eco-industrial precinct and the environmental suitability of the LEIP.
- Provide for the planning and efficient staging of municipal infrastructure to meet short term and ultimate requirements.
- Enable the early establishment of industry clusters or precincts.
- Provide for efficient and effective access and movement networks, linking to the wider region.
- Protect and enhance environmental values of the area and allow for appropriate management measures.
- Make provision for future circular economy activities that reinforce the bona fides of LEIP as a leading eco-industrial precinct.
- Generate a positive identity for the LEIP through the careful consideration of industry location and the need to make provision for a suitable gateway precinct as the long term "front door" to the LEIP.

The preliminary aspirational master plan provides for the general layout of the LEIP, showing the delineation of sub-precincts and the higher order elements including the transport network, open space network and methods incorporated to manage reverse amenity. Proposed sub-precincts are flexible and subject to the needs of industry as the LEIP expands. Ultimately, each proposed development will be assessed against the Townsville City Plan provisions applicable to High impact industry uses and the High Impact Industry Zone.

It should be noted that the preliminary aspirational master plan is aspirational only and development of the LEIP is currently subject to the requirements of the Townsville City Plan including zoning. To realise the full development potential described in the preliminary aspirational master plan, the Townsville City Plan would require formal amendment. Until the Townsville City Council has resolved to proceed with a planning scheme amendment and finalised the planning scheme amendment, the Townsville City Plan is to be complied with.

The location and mix of **land uses** proposed are based on the following considerations:

- Environmental features and topographical characteristics
- Infrastructure requirements and costing
- Accessibility and exposure requirements
- Existing surrounding land uses and sensitive receptors
- Proposed land uses siting and infrastructure requirements
- Forecast industry requirements and industry location considerations
- State, regional and local statutory and policy priorities.

The location and design of the proposed **road layout** and access strategy are based on the following considerations:

- Existing road alignments and easements
- Development constraints (operational, cost, environmental, and land use) impacting siting requirements of road construction and emergency access
- Connectivity between precincts across the study area (north–south and east-west)
- Progressive consolidation and improvement of railway crossings to provide east-west connectivity between Lansdown and the Flinders Highway
- Staging and sequencing of development and enabling works in 5-year increments from 2021 to 2041 and any works required to support the Ultimate arrangement for the LEIP beyond 2041.

Proposed sub-precincts are described as follows and shown on Figure 0-3 on next page:

Gateway/ education precinct	Provides identity, amenity, and visual presentation to the Flinders Highway. Publicly accessible education / information centre, showcasing the LEIP as a nationally significant example of an eco-industrial, renewable energy and circular economy development.
Mineral processing precinct	Proposed QPM nickel processing plant and associated uses. Initial primary access to the LEIP from the Flinders Highway via Jones Road to the north.
Special recreation precinct	Drive It NQ driving facility and associated uses. Potential industrial expansion area in long term.
Advanced manufacturing precinct	Advanced manufacturing establishments typified by bespoke high-quality premises in high amenity settings. Imperium lithium battery manufacturing is the catalyst activity in this precinct.
Specialised agriculture / food processing / research and warehousing precinct	Provides for a wide range of large footprint activities to support those leading economic sectors within the region: food processing, value adding to agricultural products and supporting research and development activities.
Renewables/ bio-energy precinct	Focus for renewable energy production or bio futures cluster (industrial biotechnology and bioproducts sector). Edify hydrogen production plant is the catalyst proponent in this precinct.
Resource recovery precinct	Intended for a range of resource recovery and recycling activities, whether directly related to other activities within the precinct. In the long term, cessation of quarrying operations may provide a suitable area for the stockpiling, processing or blending of materials as a resource recovery operation.
Intermodal precinct	Notionally provided for the adjacent rail corridor to provide an alternative means of transport to and from the precinct and to the Townsville port. The need for this precinct will be subject to further investigations.
Advanced offsets area/ biomass production precinct	Centred on the less suitable land within the LEIP for industrial development. This precinct could be used to produce plantations for biomass production or as an advanced offsets area to achieve environment objectives.
Greenspace	The greenspace and biodiversity network has been integrated into the preliminary aspirational master plan to perform the following important functions: • Accommodate flood inundation areas, overland flow paths, and associated ecological corridors along prominent drainage lines and waterways. • Protect water quality of both surface and ground waters and the ecological and hydrological processes of catchments. • Provide ecological linkages to areas adjoining the LEIP to ensure the ongoing viability of the significant area and associated ecological functions and ecosystem services. • Provide a buffer and screening opportunity. • Enhance the amenity and attractiveness of the development though the provision of gateways and landscaped corridors to define land use precincts wherever practicable. • Enhance existing character. • Ensure the development area will not encroach on remnant vegetation. • Provide additional opportunity to meet the principles of sustainable eco-industrial development. • Prevents erosion and sedimentation impacts.

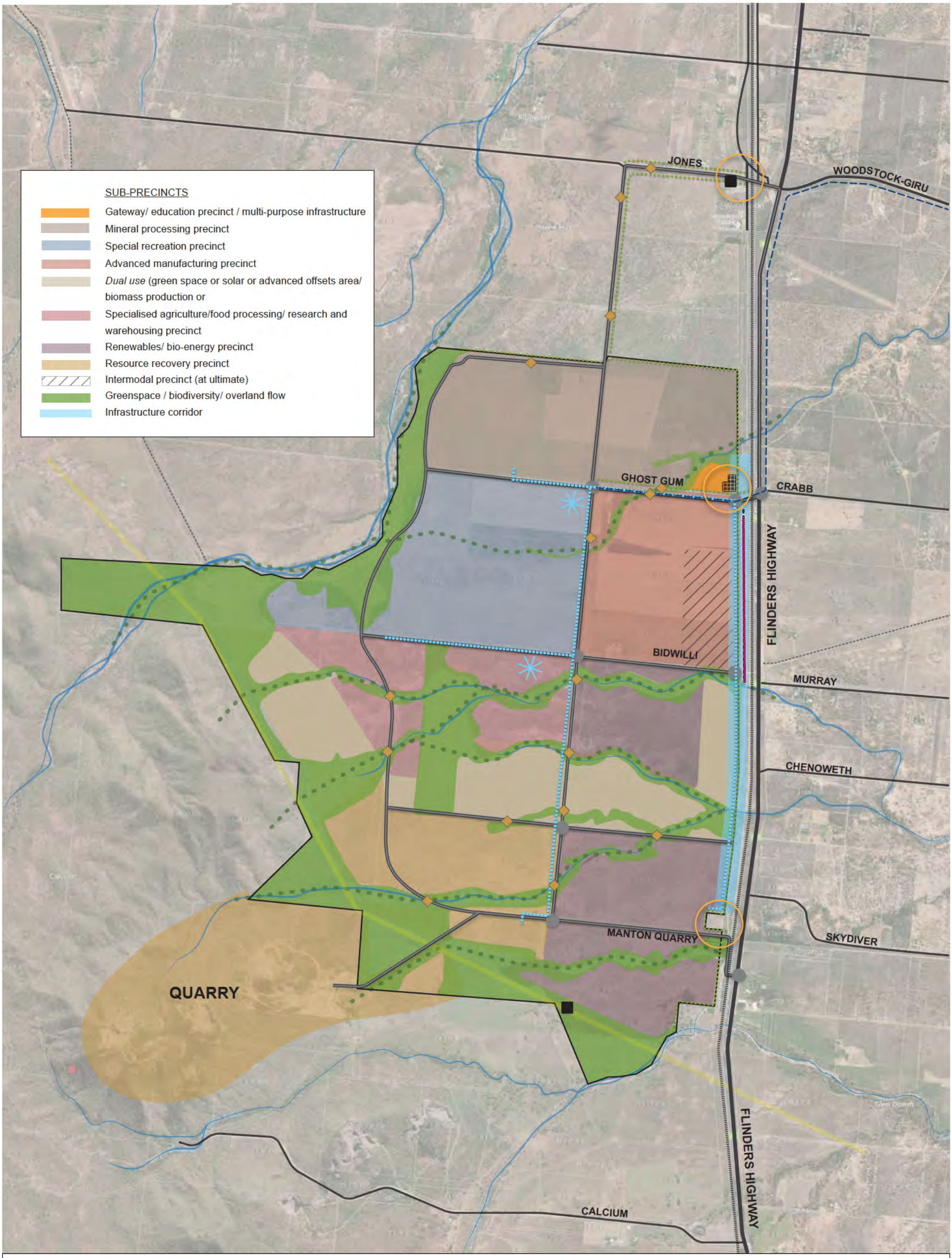

Figure 0-3

Preliminary aspirational master plan
Lansdown Eco-Industrial Precinct

(subject to Council adoption and finalisation of a planning scheme amendment)

Development Sequencing

The sequencing and spatial extent of the stages is largely driven by the location preferences and requirements of the early proponents and by acknowledgement of the long lead times typically associated with the establishment of major industries such as those proposed along with the proposed stages of infrastructure provision.

Subsequently development is proposed to be sequenced to align with the following stages:

- **Stage 0 (Enabling works)** – The northern part of the LEIP and initial access road for initial proponents.
- **Stage 1 (2021-2025)** – The eastern area between Ghost Gum Road and Bidwilli Road.
- **Stage 2 (2026-2030)** – Progressively moving south following the provision of the grade separated rail crossing at Ghost Gum Road and extension of the new sub-arterial road from Bidwilli Road.
- **Stage 3 (2031-2035)** – The southern and western areas in the LEIP.
- **Stage 4 (2036 to 2041)** – Infill and expansion areas within the LEIP not initially provided with infrastructure.

Infrastructure Mapping And Scheduling

Constructing new infrastructure will unlock developable land within the LEIP. The responsibility for constructing this infrastructure will be shared between multiple entities and is identified as core infrastructure, proponent led infrastructure, and aspirational infrastructure. Consistent with the supporting AIP, asset infrastructure categories have been described as follows:

- **Core infrastructure:** Roads and raw water supply, delivered by the Townsville City Council subject to Council resolution and funding commitments, and satisfactory agreements with the proponents.
- **Proponent led infrastructure:** Individual on-site sewage treatment, stormwater quality and quantity mitigation, power supply, communications connections, gas supply completely provided by proponents based on their needs.
- **Aspirational infrastructure:** Rail siding and intermodal facility, LEIP-wide effluent recycling and reuse scheme, etc are subject to further analysis and commitments by the relevant infrastructure authority and proponents.

The proposed infrastructure is summarised in the table below and detailed in **Figure 0-4** (Development staging and core and proponent-led infrastructure staging).

Summary of proposed infrastructure

Infrastructure	Detail
Transport Infrastructure - Roads	• The LEIP will be serviced by an internal road hierarchy consisting of new major collector roads and local industrial service roads and streets to connect to individual landholdings in the LEIP. • Export of value-added product from the LEIP to the Port of Townsville is expected via road-based transport to minimise lead-time or lag-time delays from double-handling product. • The proposed traffic and transport access strategy for the LEIP is based on the progressive consolidation and improvement of railway crossings to provide east-west connectivity between the LEIP and the Flinders Highway. • The access strategy is based on staging and sequencing of development and enabling works in 5-year increments from 2021 to 2041 and any works required to support the Ultimate arrangement for the LEIP beyond 2041. • **Primary access** to the LEIP is proposed to be via a new grade separated crossing near Ghost Gum Road, with **secondary access** via the upgraded railway level crossings at Woodstock Giru Road. • Manton Quarry Road will provide **tertiary access** to the southern development areas in the Ultimate arrangement. The existing railway level crossings at Bidwilli Road and Ghost Gum Road will be decommissioned to support the development to its Ultimate arrangement.

Infrastructure	Detail
	• Prior to the rail crossing upgrade at Ghost Gum Road, access to the LEIP will initially be from Jones Road in the north with a link to Ghost Gum Road. • From Ghost Gum Road access to the central and southern precincts will be by a central spine road, with development areas off this being serviced by future industrial collectors. This spine road will connect all the precincts and become the main North-South Major Collector road within the LEIP. The current rail crossing of Ghost Gum Road is not sufficient for the proposed volume and nature of heavy vehicles from QPM. • Manton Quarry Road will continue to be used by the quarry and provide a secondary access point for precincts in the southern end of the LEIP. Due to the distance between the railway and highway alignment, insufficient queuing space is available for multi-combination vehicles (e.g., B-Doubles and Road Trains) • Land release along the southern-end of the LEIP near Manton Quarry Road is scheduled for release during Stage 3 of the development between 2031 and 2035. Therefore, access arrangements and connections in this area are deferred until this period of the Master Plan. Any works brought forward in this area would be to service the needs of individual developments only and be proponent led infrastructure. This crossing needs further consultation and resolution with QR for maintaining access at Manton Quarry Road, as a third access to the LEIP has many planning benefits and is considered beneficial for safety if the internal road network is compromised. • The Ultimate arrangement will include the construction of a full western ring road developed to collector road standard in approximately 40-years and a series of intersections with the internal road network around the LEIP (subject to on-going monitoring of travel demands and behaviours during operation). This will unlock development potential around the periphery of the LEIP for long-term development. The final alignment will be informed over time in the future stages as further certainty is reached within the development of potential sites based on proponent requirements.
Transport infrastructure - rail	• Rail access is available to the LEIP by the Mount Isa Railway Line located on the eastern boundary of the LEIP. The existing 1.2km passing loop commencing at Glenn Road will be relocated in line with the development of a signal-controlled level crossing at Jones Road toward the south. The loop will relocate to the south of Ghost Gum Road. • Additional works are proposed for the rail siding where a business case can support demand for the associated Intermodal Hub facility.
Water supply	• As described in the AIP the initial proponents water demands are significantly higher than the standard practice water demands for High impact industry. Therefore, infrastructure sizing was based on the initial four proponents demand with standard practice water demands applied for other areas in the LEIP. • Due to the constraints associated with water supply and the use of raw water there is a large enabling works requirement to provide raw water to the LEIP. Core water infrastructure also includes LEIP-wide storage and internal LEIP distribution network of the raw water. • To provide raw water to the LEIP enabling works requires a DN500 Pipeline from the DN900 Haughton Pipeline to the LEIP with a booster pump station. Duplication of the pipeline with a DN400 pipeline and pump station upgrade is required in Stage 3. • It is not proposed to treat raw water to a potable quality and distribute to each proponent, like a standard development area. As such potable water supply to each proponent is considered as proponent led infrastructure. • Beyond the initial enabling works, there is a relatively small impact to subsequent stages until Stage 3 (2031 to 2041 planning horizons) in which there is a new pump station to account for the raw water demand increases.
Wastewater	• It is proposed that each proponent is to provide their own site-based wastewater treatment facilities and as such is considered to be proponent led infrastructure.
Electrical reticulation	• Enabling works should secure a point of supply and services into the LEIP. • As this is proponent led infrastructure final network configures are subject to on-going liaison with power supplier and proponents.
Gas	• Enabling works should include suitable land dedications for a gas let-down station and micro-LNG facility. • Road network augmentations will also facilitate the delivery of a road-mounted LNG, should this option be preferable to proponents.

Infrastructure	Detail
Telecommunications	• Enabling works are not required for telecommunications as the NBN Co. fixed-wireless array is already established in the vicinity of the LEIP. • Upgrades to the existing fixed-wireless array, or satellite connection, could be considered by individual proponents.
Stormwater	• For infrastructure planning, the investigation has primarily focused on the preliminary sizing of major culvert structures where waterway crossings are required for the proposed road network. • No bridge structures have been proposed. • No specific drainage infrastructure is specified in the current LGIP; instead, drainage infrastructure is summarised under transport infrastructure. • Stormwater drainage works within the roadways are considered core road infrastructure. • Stormwater management items are considered as proponent led infrastructure. • The preferred peak flow mitigation option is to defer the design, construction and maintenance of detention basins to the proponents throughout the LEIP, which can then be managed by the Townsville City Council through the development approval process. Likewise, for stormwater quality treatment devices such as bioretention devices. • The cash flow analysis of drainage infrastructure is limited to the culvert crossings associated with the proposed road network, as well as major/minor road drainage elements such as kerb and channel, gully pits, table drains, and stormwater quality treatment devices such as bioretention swales located within the road reserve. • Provisions for stormwater quality treatment devices and peak flow mitigation (detention basins) to service additional impervious surfaces within proponent held land throughout the LEIP are excluded from the cash flow analysis, as well as from the definition of drainage infrastructure and are proponent led infrastructure.

It is noted that the asset infrastructure identified as core infrastructure to be provided by the Townsville City Council is subject to Council resolution and funding commitments, and satisfactory agreements with the proponents, whilst the asset infrastructure identified as aspirational infrastructure is subject to further analysis and commitments by the relevant infrastructure authority and proponents. Furthermore, nothing in this report is intended in any way to restrain or otherwise affect the unfettered discretion of the Townsville City Council to exercise any of its rights as an owner of the land in the LEIP or any of its powers or functions as a local government.

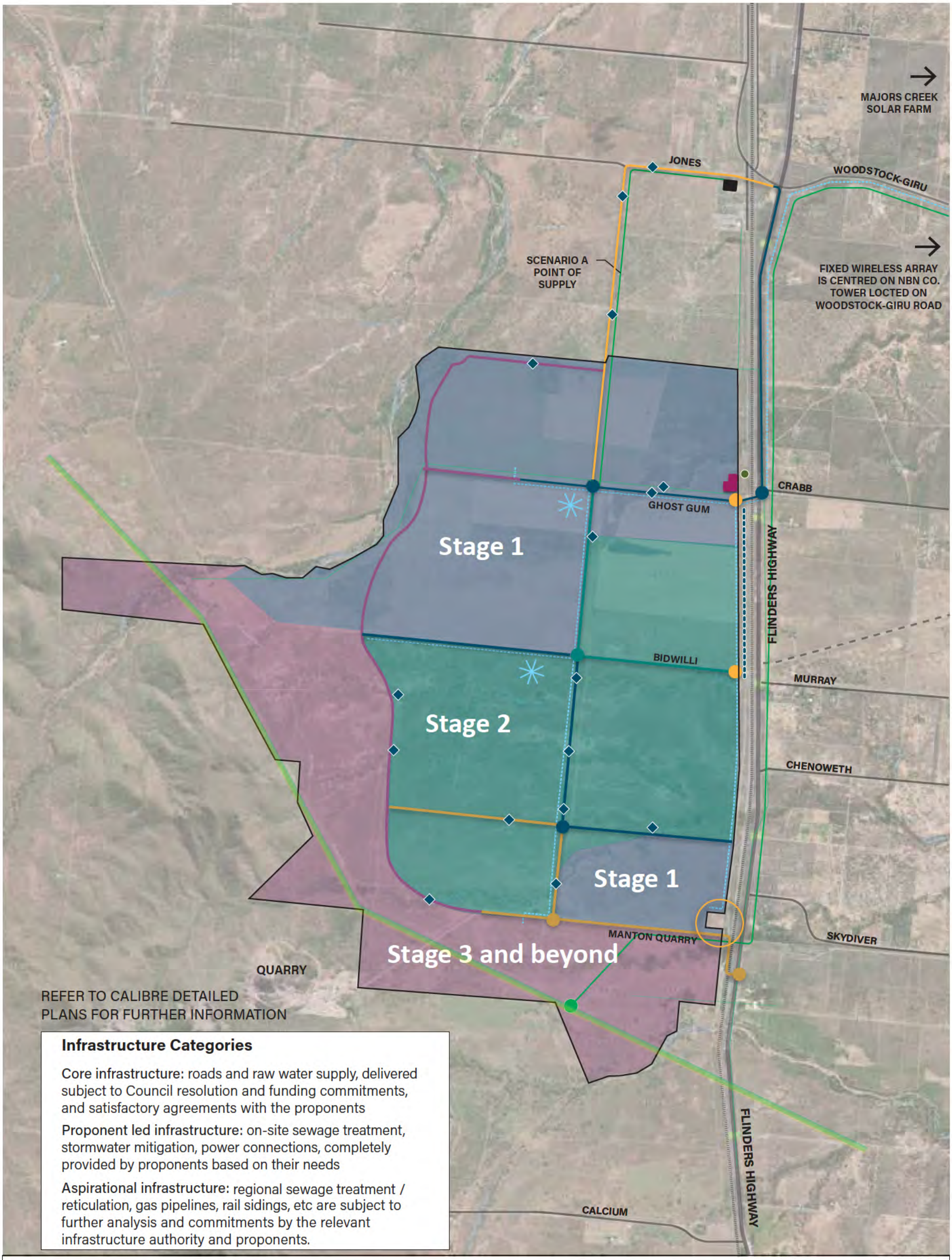

Figure 0-4

Development Staging and Core and Proponent-Led Infrastructure Staging
Lansdown Eco-Industrial Precinct

Recommended actions

Successful implementation of a regional scale development such as the LEIP requires consideration of several factors including:

- Engagement with local landholders and the wider community.
- Promotion to, and interest from potential catalytic development operators.
- Alignment with Queensland Government initiatives to gain ongoing funding, planning support and potential partnership.
- A beneficial and appropriate delivery mechanism.
- Appropriate and feasible infrastructure funding including proponent funding and granting funding.

The following table describes the recommended actions required for the LEIP to be implemented successfully.

LEIP recommended actions

Item	Recommendations
Cash Flow Analysis	• Townsville City Council reconsiders the suitability of the LEIP for small-scale, low intensity or low impact industrial uses as these uses are unlikely to be willing or able to do the heavy lifting in terms of funding and delivering the infrastructure. • Townsville City Council refocus the LEIP as a location for high impact industries that have limited opportunity to relocate, and which can justify the significant investment in up-front infrastructure required to service the LEIP. • The preliminary aspirational master plan for the LEIP could be reconsidered in the future having regard to confirmed proponents. This could include a review of the scope of infrastructure, for example the road layout of the LEIP could be rationalised. If larger proponent sites, with limited access points, are proposed the western ring-road could be unnecessary and be removed. These changes would reduce the cost of infrastructure required to service the LEIP. • Townsville City Council, as owner of the LEIP land, actively seek other high impact industries like QPM to locate to the LEIP. If successful, this would enable the cost of the infrastructure to be apportioned across a greater number of users likely to be willing to make a significant upfront contribution to the funding and delivery of the required infrastructure. This would improve the financial attractiveness of the LEIP for each of the high impact industries.
Enabling Infrastructure Works (Enabling Works)	Accommodating early proponents As indicated earlier in the report there is identified enabling infrastructure works to service the initial proponents for the LEIP. The enabling works are the minimum road infrastructure and raw water pipeline requirements needed to unlock the development potential of the LEIP's northern area for construction and occupation. The majority of these works are expected to commence in 2022 and include: • Proposed upgrade of the Great Northern Rail Line level crossing to active control at Jones Road including signalisation. • Relocating the railway passing loop, away from the northern level crossing. • Construction of a new major collector road to connect the Jones Road railway level crossing to Ghost Gum Road. • Decommissioning of the Bidwilli Road and Ghost Gum Road existing level crossings. • Provision of a raw water pipeline DN500 (ID500mm), associated booster pump station, raw water storage lagoon and raw water connection points. • Underground electrical conduits should be installed between Woodstock Substation and Ghost Gum Road, via Jones Road and No-name Road. These would be installed within the road reserve of respective road alignments and position inside a conduit bank. Each proponent will be required to negotiate with power suppliers for relevant network and substations to supply their site.

Item	Recommendations
Stage 1 Infrastructure	Stage 1 infrastructure is defined as the infrastructure needed by the end of the 2026 horizon. Subject to the ongoing take up and demands from the proponents in stage 1 the following infrastructure is required: • Extension of the North-South Major Collector road from Ghost Gum Road to Bidwilli Road. • Proposed new major collector road for the eastern end of Bidwilli Road. • Development of a new major cross-junction at the intersection of Bidwilli Road and the North-South Major Collector Road in a priority-controlled configuration. • Internal raw water network connections. • Expand the electricity network and substation with proponent led infrastructure as required. • Provision of communication network conduits with proponent led infrastructure as required. • Provision of gas reticulation conduits with road construction as core infrastructure, and a supply reticulation system as required and provided by proponent led infrastructure.
Future Infrastructure	Identification of thresholds Each different infrastructure type has a different demand threshold. These are detailed in the AIP 2021 and summary of these types of infrastructure has been included in the AIP, in addition to a summary in Section 9.1 of this report.
Master Plan Refinement Activities	Eco-industrial and sustainability assessment • Undertake a review of eco-industrial, circular economy and sustainability initiatives that could be adopted in the planning, management, and ongoing development within the LEIP for it to be recognised as a leading eco-industrial precinct and highly desirable location for industry attraction. • Revise and update relevant sections of the Master Plan in line with the agreed findings from this assessment. Market opportunities assessment • Undertake additional industry market opportunities assessment to understand the nature and likelihood of future industry proponents that could be attracted to the LEIP. • This assessment should focus on those sectors for which Townsville has recognised comparative advantages at the regional, national, and global level, together with those upstream and downstream activities associated with the initial proponents. • Revise and update relevant sections of the Master Plan in line with the agreed findings from this assessment. Business case for rail facility • Undertake a business case for the provision of a future rail siding/intermodal or other rail related infrastructure building on the outcomes of the above assessments. • The business case should establish the likely need and best location for rail facilities in view of potential proponent requirements, recognised freight handling principles, capacity and availability of facilities at the Port of Townsville and input from other relevant stakeholders, including QR.
Future Delivery Funding and Planning Activities	• It will be necessary to advance agreements with stakeholders and the development approvals process for enabling works in relation to the following: – **Road network** ○ Land acquisitions and approvals for land and road works from the Flinders Highway, via Woodstock-Giru Road and Jones Road intersection, to the northern boundary of QPM. ○ Agreement with QPM to continue a road network through to the Ghost Gum Road intersection with the unnamed road reserve that heads south. This will be either along the existing north-south aligned unnamed road reserve, or via the less desirable western alternative alignment at the cost of QPM. ○ Maintain conditions 16 and 17 of the Drive It NQ Development Approval to construct a rural standard road via the unnamed road to the north, and the pavement assessment and upgrade works as required.

Item	Recommendations
	○ Impose similar road network conditions above on Edify Energy from the Manton Quarry Road site access to the north. It is noted that solutions are required for drainage/waterway crossings. – **Water** ○ Provision of a supply pipeline to stage 1 land comprising the initial proponents in the northern part of the LEIP (QPM and Imperium3), and to Edify Energy in the southern part of the LEIP, sized for demands of existing known proponents, and balance of land in Stage 1 based on the High Impact Industry land use assumptions. ○ Investigate alternative site allocation options for Edify Energy closer to the northern LEIP Stage 1 area, and which can utilise higher constrained land for the ancillary solar facility. – **Gas** ○ Progress a retailer agreement (e.g., APA) and provision of a let-down area off the North Queensland Gas Pipeline, which provides connections along Ghost Gum Road to proponents within Stage 1 northern precinct (in particular for use by QPM and Imperium3). **Infrastructure Agreements with proponents** • It will be necessary as part of any agreement between a proponent and the Townsville City Council for land in the LEIP for the proponent to enter into a satisfactory Infrastructure Agreement with Council to provide for infrastructure contributions for the enabling infrastructure works which are necessary to service the proposed development and the rest of the LEIP. • The Townsville City Council may wish to give consideration to undertaking a review of the Townsville City Plan to consider proposed planning scheme amendments which align with the preliminary aspirational master plan.

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Abbreviations and Terms of Reference

ABS	Australian Bureau of Statistics
ALC	Agricultural Land Classification
AIP	Asset Infrastructure Plan
BCR	benefit-cost ratio
Calibre	Calibre Professional Services Pty Ltd
CDM Smith	CDM Smith Australia Pty Ltd
CPM	CPM Advisory and Project Management Pty Ltd
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CTM	Cairns; Townsville; Mackay
DAMS	Development Assessment Mapping System (Queensland Government)
Energy Q	Queensland Energy
EP	equivalent person
ERP	estimated resident population
Fisheries Act	Fisheries Act 1994
FNQ	Far North Queensland
FWA	fixed wireless array
GIS	geographical information systems
GNRL	Great Northern Rail Line
Ha	hectares
HII	High impact industry
HSEQ	Health, Safety, Environment and Quality
HV	high voltage
IAA	Important agricultural areas
IAR	Impact Assessment Report, prepared for the Infrastructure, Traffic, Transport and Air Quality Integrated Master Plan Report GHD May 2019
IPOL	Internet Provider of Last Resort
LEIP	Lansdown Eco-Industrial Precinct
LGA	Local government area
LGIP	Local government infrastructure plan in the Townsville City Plan
LIE	Lansdown Industrial Estate referred to for the IAR
LNG	liquefied natural gas
Master Plan	Land Use and Infrastructure Master Plan
MCA	Multi-criteria analysis
MCSF	Major Creek Solar Farm
MP	Preliminary Land Use and Infrastructure Master Plan or Preliminary Master Plan
MSES	Matters of State Environmental Significance

NBN Co	National Broadband Network
NDA	net developable area
NEIR	National Institute of Economic and Industry Research
NQGP	North Queensland Gas Pipeline
ONRSR	Office of National Rail Safety Regulator
PEA	Peter Eustace and Associates Pty Ltd
Planning Act or PACT	Planning Act 2016
Planning Regulation or PRegs	Planning Regulation 2017
PMT	pad-mounted transformer
PO	performance outcome in Townsville City Plan
Project	Lansdown Eco-Industrial Precinct (TCW00435) – Infrastructure Planning and Design and Documentation project
PSMA	Planning Scheme Major Amendments made in 2020 to the Townsville City Plan for the LEIP
QGSO	Queensland Government Statistician's Office
QPM	Queensland Pacific Metals
QR	Queensland Rail
QUDM	Queensland Urban Drainage Manual
Ranbury	Ranbury Management Group Pty Ltd
Regional Plan	North Queensland Regional Plan 2020
SA	statistical area
S & R	Sport and Recreation Zone
SDA	Townsville State Development Area
SEQ Code or SEQ WSOS Code	South-East Queensland Water and Sewer Design and Construction Code – Urban Utilities
SOW	schedule of works
SPP	State Planning Policy (Queensland Government)
SQID	Stormwater quality improvement devices
State Government	Queensland Government
Study area	The Lansdown Eco-Industrial Precinct as defined in Section 1.3
TCC	Townsville City Council
TECH	Townsville Energy Chemicals Hub
TMR or DTMR	Department of Transport and Main Roads
TOB	top of bank
Townsville City Plan	Townsville City Plan which commenced 27 October 2014
UU	Urban Utilities
VMA	Vegetation Management Act 1999
Water Act	Water Act 2000
WUSD	water sensitive urban design

1. Introduction

1.1 Purpose

The purpose of the Lansdown Eco-Industrial Precinct (TCW00435) – Infrastructure Planning and Design and Documentation project (the Project) is to define a pathway to enable the controlled and sustainable development of Lansdown Eco-Industrial Precinct (LEIP) in the Townsville City Council (Council or TCC) local government area, including the preparation of an Infrastructure Master Plan (or Master Plan or MP) and supporting Asset Infrastructure Plan (AIP) for the LEIP.

The LEIP is intended as Australia's first eco-industrial precinct for advanced manufacturing and processing, technology, and emerging industries. Activation of the LEIP will result in significant economic benefit to the local, regional, and Queensland economy.

1.2 Background

Townsville City Council acquired land for the LEIP in 2001. The LEIP, formerly the Commonwealth Scientific and Industrial Research Organisation (CSIRO) 'Lansdown Station' pasture research site, is approximately 2,200 ha in area, located 40km south of Townsville at Calcium.

As the LEIP had the potential to support more than 5,000 construction jobs, around 1,600 initial jobs and more than 9100 indirect jobs, the project met the objectives of the Townsville City Deal. This included a commitment from the Queensland Government as part of a broad agreement spanning 15 years and all levels of government, to activate industry and export growth for Townsville and its regional partners.

To meet projected industrial land demand, and following a planning scheme amendment process, including environmental assessment and consultation, the Townsville City Plan was amended in 2020 to include the LEIP. The LEIP is zoned for high impact industry and includes a Sport and Recreation zone for a motor sport precinct. An existing lease and development approvals are in effect over this zone for use by Drive It NQ, which has recently commenced construction. Since the amendment to the Townsville City Plan, Townsville City Council has received significant proponent interest from several key industrial operators that align with the eco-industrial intent of the development. Through a public tender process in 2019, the Townsville City Council provisionally reserved land in the LEIP to the following initial proponents:

- Queensland Pacific Metals for the purpose of developing a battery feedstock refinery complex.
- Imperium3 Townsville to develop a lithium-ion battery manufacturing facility.
- Edify Energy to develop a hydrogen facility as well as a future substation.

In accordance with the identification of the LEIP for industrial land uses, several development proposals from proponents have been progressed to various states with Townsville City Council. Existing and proposed industrial uses within and surrounding the LEIP are detailed in Section 3.2. Several other proponents have also been in discussions with Townsville City Council for land within the LEIP. This has brought forward the need to finalise a comprehensive master plan to facilitate the controlled activation of the LEIP, prioritising eco-industrial principles and efficient and sustainable infrastructure development.

1.3 Scope

Townsville City Council is seeking to provide a leading eco-industrial precinct in the LEIP, and to do this, a detailed infrastructure assessment and master plan is required. With consideration of background reports and the requirements of initial and future proponents, the following documents have been prepared:

- Infrastructure Master Plan (or Master Plan or MP).
- Asset Infrastructure Plan (or AIP).

The scope of work for the Project is separated into two components: the MP (this report) and the AIP. The scope of the Project is defined below.

- **Component 1 – Master Plan**
  - **Regulatory review** – to understand the rules applying to the land, provision of infrastructure and related development envisaged by the master plan. This should include, but not be limited to the Townsville City Plan, LGIP, development manual, water supply strategies, effluent reuse strategies, transport strategies, etc.
  - **Review of relevant studies** – to understand the water, sewerage, transport, stormwater, economic, community, cultural and environmental situation relevant to the LEIP and/or land uses applied for, approved or envisaged for the LEIP. This will assist in the understanding of constraints (e.g., bulk water access, dam catchment overlay), opportunities (e.g., The City Deal), assumptions (e.g., demand, densities, growth) and feasibility of options (e.g., recent transport study).
  - **Development review** – to understand the situation with respect to development applications and approvals relevant to the LEIP, early staging requirements of development proponents, and how they may influence the master plan.
  - **Assumptions** – evidence-based assumptions about: type, scale and location of development; growth trends and forecasts (i.e., by 5 year census increments to 2041 and 'ultimate') for population, housing and employment; infrastructure demand rates; costs; sequencing of development, etc.
  - **Constraints, dependencies, and risk analysis** – to understand and demonstrate how the infrastructure planning complies with and/or considers the needs and issues with respect to relevant constraints and dependencies. The Townsville City Plan provisions, and conditions of development approvals are now relevant constraints. Integration with the early stage enabling works in the Asset Infrastructure Plan are also relevant dependencies and risks.
  - **Infrastructure gap and options analysis** – reflective of relevant constraints dependencies and risks (including early stage enabling works programs), identify the LEIP impacts on existing and planned infrastructure, identify infrastructure planning options, and rationalise optimal solutions. This should involve suitable modelling consistent with standard development application requirements, the consideration of the growth assumptions, and analysis of early stage enabling works horizons and 5yr increments to the 2041 and then 'ultimate' horizons. It should consider the 'whole of life cycle' costs in rationalising.
  - **Infrastructure mapping, scheduling, costing** – should be provided consistent with LGIP protocols, mapping relevant infrastructure and land requirements, using unique identifiers, and timing indicators, grouping by project associations and cross referencing in timing/staging schedules. Costings should be consistent with the schedule of works (SOW) model within the LGIP. Identify infrastructure delivery modes (i.e., Townsville City Council or proponents).
  - **Cash flow analysis** – identify the LEIP infrastructure cashflow forecast by modelling infrastructure charges and subsidy revenues, Townsville City Council contributions etc against program expenditure. Consider alternative modes of cash flow management (i.e., separate infrastructure charge, infrastructure agreements, etc).
  - T**he Master Plan** is to include a land use and infrastructure master plan for development between 'existing' and 2041 and for the planning scheme 'ultimate'. Infrastructure to be considered includes:
    - Raw water supply.
    - Sewerage.
    - Road network.
    - Rail siding and internal network.
    - Internal gas micro-grid network.
    - Stormwater management.
    - Electrical network easements.
    - Communications and CCTV network.
- **Component 2 – Asset Infrastructure Plan**

- Detailed design and documentation for enabling infrastructure works. This scope of works is to be refined during the Master Plan phase and are subject to change based on the findings.

It is noted that nothing in the Master Plan or Asset Infrastructure Plan is intended in any way to restrict or otherwise affect the unfettered discretion of the Townsville City Council to exercise any of its rights as owner of the land in the LEIP or any of its powers or functions as a local government. Thus, in the case of the preliminary land use aspirational master plan, until Council has resolved to proceed with a planning scheme amendment and finalised the planning scheme amendment, the Townsville City Plan including the LGIP, is to be complied with.

1.4 Study area

The study area is defined as the LEIP, located within the suburb of Calcium of the Townsville City Council local government area (LGA) in the Far North Queensland Region (refer to Figure 1-1). The LEIP has an area of approximately 2,200 ha extending east from the Ross River to the Flinders Highway, 40 km south of the Townsville CBD. Study area lot and registered plan references are detailed in Table 1-1.

The study area historically operated as a CSIRO Pasture Research Station and for cattle grazing. The physical characteristics of the study area are listed below.

- **Topography** - The study area is relatively flat with an average slope of 2%. The LEIP slopes toward the foothills of the Mingela State Forest to the west reaching between 10%-20% slope. A steep bund is also present along the eastern boundary of the study area buffering the rail corridor.
- **Waterways** - The area gently undulates to accommodate several creeks and drainage systems flowing east-west across the LEIP. Waterways or internal drainage lines within the study area include (from north to the south) Gilligan Creek, Four Mile Creek, Two Mile Creek and a northern tributary of Double Barrel Creek. All tributaries of Majors Creek, flowing into the Haughton River in the east. Lansdown Creek forms part of the western boundary.
- **Vegetation** - The LEIP is generally cleared of significant vegetation. Remaining vegetated areas contain small, fragmented patches of native woodland remnant and regrowth vegetation and essential habitat. However, according to previous studies, the ecological values are compromised by exotic species invasion.
- **Roads/ access** - Internal roads include Ghost Gum Road, Bidwilli Road, Manton Quarry Road, Rowe Road Track, and several other unnamed tracks. Access to the Flinders Highway bordering the study area to the east is from Ghost Gum Road in the north and Manton Quarry Road in the south.

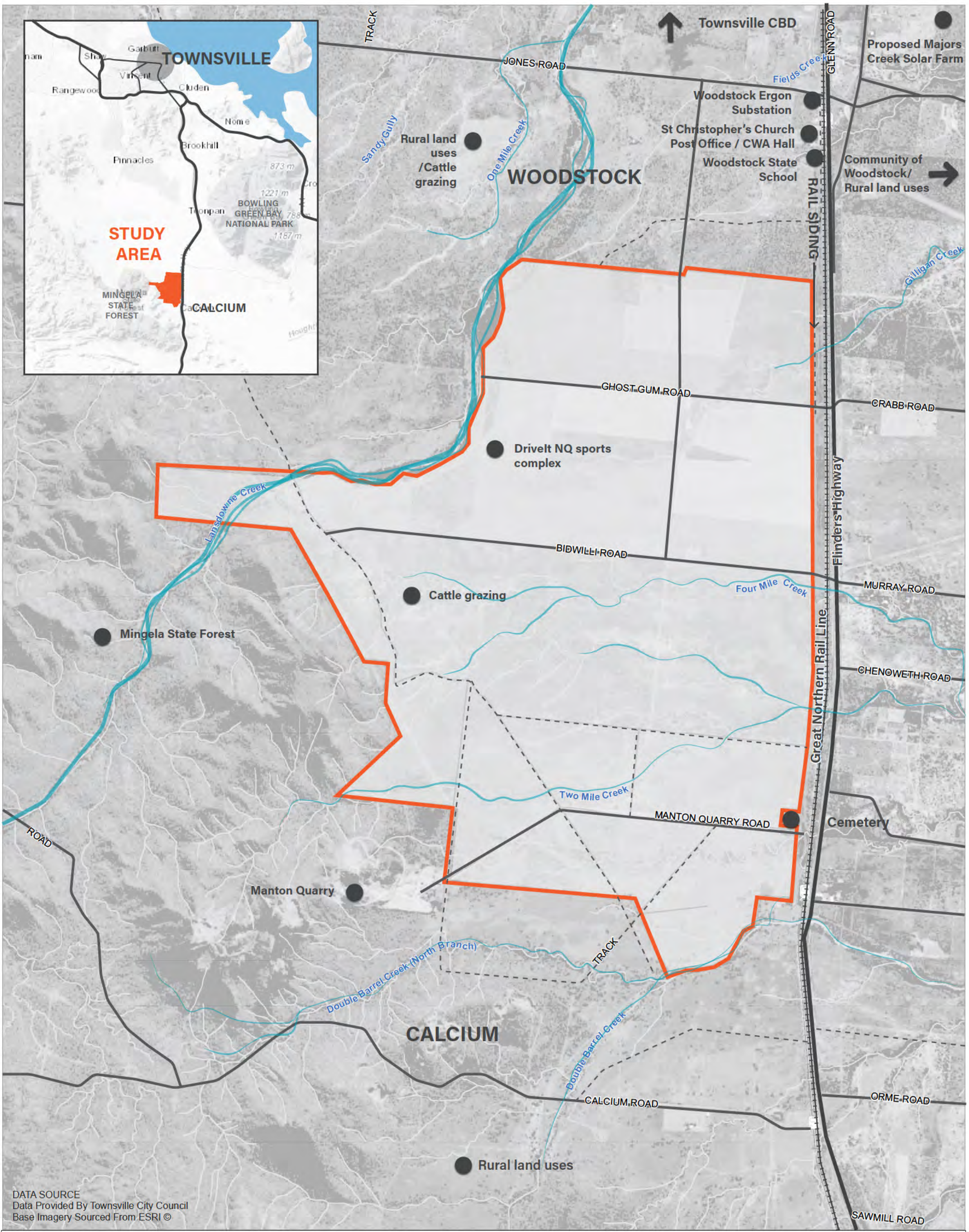
Townsville has a variety of industrial development areas, contributing to the economic success of the region. Townsville is a focus for major industrial development due to the Port of Townsville, connectivity to the North West Minerals Province (via the Great Northern Rail Line), connectivity to the national road network and access to a significant workforce.

Significant areas for future industrial development have been identified around Townsville including the Townsville Port, the Townsville State Development Area (Townsville SDA) and the LEIP, which together are referred to as the Townsville Southern Industrial Corridor. Each of these areas offers different attributes that suit differing activities.

Table 1-1 Study area Lot/RPs*

Lot	Plan	Area (ha)	Tenure
34	E124243	64.8	Freehold
31	E124247	64.8	Freehold
38	E124269	67.1	Freehold
39	E124247	64.9	Freehold
20	E124189	162.3	Freehold
19	RP901592	356.8	Freehold
51	E124242	107.3	Freehold
417	E12421	65.1	Freehold
55	E124248	64.8	Freehold
65	E124264	46.8	Freehold
104	E124279	1.1	Freehold
64	E124248	43.7	Freehold
87	RP911426	479.8	Freehold
500	E12466	66.6	Freehold
41	E124381	125.0	Freehold
44	SP260018	168.4	Freehold

*Excludes roads, waterways and easements.



N

0 0.375 0.75

Kilometers

Scale @ A3 1:30,000

Date: 08/02/22

Drawn: Stuart B

Legend

- LEIP Boundary
- Locations / Land Uses
- Railway
- Road
- Track
- Waterways

Figure 1-1

Study Area and Surrounding Land Uses

calibre CDM Smith

1.5 Vision

The overall vision of the LEIP is to provide Northern Australia's first eco-industrial precinct for advanced manufacturing and processing, technology, and emerging industries. Townsville City Council sees this vision being achieve through the following initiatives:

- Encouraging the attraction of best-practice, low-emission, renewable energy-focussed and ecologically sensitive industrial development.
- Catering for and attracting innovative and dynamic enterprises that support the creation of new sustainable job opportunities for Townsville residents.
- Provision for the co-location of industrial uses, such as advanced manufacturing and processing, and technology, with supporting and complementary enterprises that grow the domestic and international profile of Townsville.
- Minimising adverse amenity impacts upon lands outside the LEIP through the adoption of eco-industrial planning principles and practices.

It is envisaged the LEIP will cater for regional and national scale enterprises drawn to the strong economic growth sectors of the Townsville region, access to world class infrastructure and supportive local and Queensland Government planning and economic development frameworks.

The strategic location of the LEIP comprising some 2,200ha of relatively constraint free land adjacent to the Flinders Highway, Western Railway corridor and less than 40 kilometres to the Townsville Port, is highly suited to large footprint industrial activities. The size of the study area has the potential to accommodate several industry clusters and the formation of circular economy activities where synergies between activity clusters are identified and promoted.

1.6 Project Team

This report has been produced as part of a collaboration between Calibre Professional Services Pty Ltd (Calibre) and various subconsultants. Calibre are the lead consultants for the delivery of the Master Plan and AIP for the LEIP.

Critical to the delivery of the Project is Calibre partner CDM Smith Australia Pty Ltd (CDM Smith). CDM Smith are recognised leaders in strategic planning, regulatory planning and approvals, and economic review. Their primary focus for this project has been the delivery of the Master Plan.

Other teams involved in the preparation of the Master Plan include:

- PIE Solutions are infrastructure planning and charging advisors which has delivered the cash flow analysis presented in the Master Plan.
- Peter Eustace and Associates which has provided electrical design and stakeholder engagement services for the point of supply and internal reticulation network concept design.
- CPM Advisory and Project Management Pty Ltd, which has provided the telecommunications and surveillance, and stakeholder engagement services for network adaptations and internal layout optioneering for concept design.

2. Master Plan Process

2.1 Intent of the Master Plan

The intent of the Master Plan is to develop a framework that:

- Reflects requirement of early proponents.
- Has been prepared with input from all relevant stakeholders.
- Provides for the accommodation of longer-term industrial opportunities consistent with the principles of a sustainable eco-industrial precinct.
- Provides for the planning and staging of municipal infrastructure to meet short term and ultimate requirements.
- Enables the coordination of other infrastructure agencies responsible for the provision of services or access to the LEIP.

2.2 Development of the Master Plan

The purpose of this report is to establish a future vision, understand the LEIP capability and suitability, highlight relative economic opportunities in current and future markets, and determine the best option for planning and infrastructure required to successfully guide development outcomes in the LEIP. The report includes a preliminary aspirational master plan, staging plan, and recommendations of further planning and investigations that may be required in the future.

The process for developing the Master Plan has evolved as the Project has progressed, considering ongoing consultation with stakeholders including proponents, service providers and Townsville City Council.

The Master Plan was developed over the following steps:

1. Initial review of legislation, approvals, and previous studies.
2. Meeting with Townsville City Council and targeted stakeholders to validate alignment with any existing infrastructure planning.
3. Undertake a review of the current development applications and approvals.
4. Meeting with Townsville City Council (planning workshop).
5. Develop planning and infrastructure demand scenarios and assumptions.
6. Meetings with Townsville City Council.
7. Targeted industry engagement has been carried out to capture relevant information on industry characteristics relating to infrastructure demands and employment densities.
8. Multi-criteria analysis of potential uplift and informing a preliminary aspirational master plan for the LEIP “future proofing” which are reliant on future changes to the Townsville City Plan that Council would have to decide to proceed with.
9. Development sequencing.
10. Infrastructure planning, mapping, cash flow assessment and recommendations.

A review of existing relevant studies relating to the development of the study area has been undertaken in the context of the Townsville City Plan which has already been amended to apply the High Impact Industry Zone to the majority of the LEIP area, and the initial proponents' proposals and demand information on infrastructure networks. Accordingly, many of the assumptions and information within the previous studies is now not current. However, the following sections of this report discuss the relevant information and how the master planning of the LEIP relies on it or varies from it.

2.3 Review of previous studies

2.3.1 Infrastructure, Traffic, Transport and Air Quality Integrated Master Plan Report, GHD, May 2019

2.3.1.1 Scope of report

This report included an Impact Assessment Report (IAR) to inform the Planning Scheme Major Amendment (PSMA) for the Lansdown Industrial Estate (LIE). Specifically, GHD was engaged to undertake an assessment of traffic and transport, infrastructure and air quality impacts that have the potential to occur as a result of the use of the LIE for medium and heavy industrial purposes.

The findings of GHD's studies were supplemented with additional reports, including:

- Ranbury Management Group Pty Ltd (Ranbury) Lansdown Opportunities Assessment Masterplan and Infrastructure Strategy.
- Earth Environmental Lansdown Station Environmental Study: Final Report (discussed in further detail in Section 2.3.2).
- Converge Heritage and Community Lansdown Station Cultural Heritage Study.
- AECOM Pty Ltd Lansdown Station Flood Study.
- Department of Transport and Main Roads (TMR) Lansdown Industrial Precinct – Flinders Highway Connection Options Analysis.

GHD undertook the following scope of works in development of the report:

- Review and establish baseline environmental constraints.
- Review and establish essential infrastructure constraints.
- Review and establish management constraints.
- Identify developable area for the LIE.
- Develop high-level Integrated Master Plan for the LIE to support the PSMA.

2.3.1.2 Site constraints assessment

Site constraints were considered as three levels, based on the impact they would have on potential development with the LIE as follows:

- **Environmental constraints** – These constraints are hard constraints and their adoption results in the creation of areas that cannot be utilised for industrial development.
- **Existing and potential infrastructure** – The location of existing infrastructure and its capacity to facilitate development within the LIE has been a core consideration in developing the internal road layout and will guide future development.
- **Management constraints** – These constraints are those that could be managed through engineering or other mitigation measures on a case-by-case basis subject to Townsville City Council development assessment process. The constraints include the potential for air and noise impacts expected from development within the LIE on nearby sensitive receptors and 1% AEP flooding across the LIE.

The constraints assessment established by Earth Environmental was proposed to be adopted for the LIE. Environmental constraints have been adopted as a hard constraint for the LIE Integrated Master Plan. Environmental constraints established by Earth Environmental are included in this assessment.

2.3.1.3 Developable area

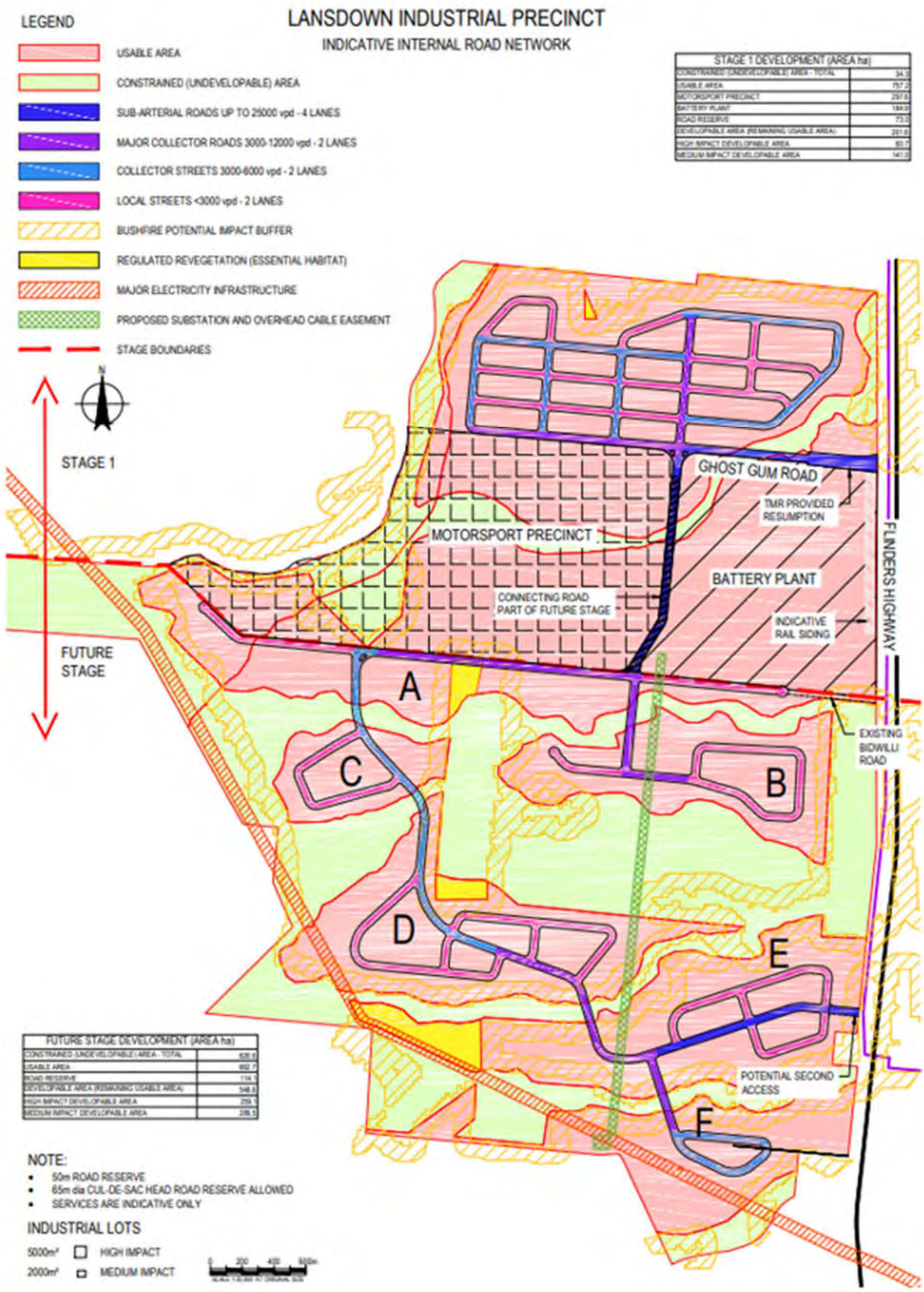
The developable area is the land remaining after consideration of impacts from constraints mapping and the internal road network road reserve. A further reduction in usable area of 40% has been allowed for consideration of unusually shaped blocks, potential buffer zones and other minor road networks that may be required.

Table 2-1 shows the estimated developable area of the LIE considering constraints and already apportioned areas to development proponents in 2019. It can be surmised that the total developable area remaining after constrained areas including 645 ha are removed totals approximately 1,420 ha.

Table 2-1 Estimated developable area

Proportion of the Total Area	Area (ha)
Total LIE Site Area	**2,074.8**
Constrained Area (undevelopable)	654.9
Total developable area	1,419.9
Already Apportioned Area (Motorsport Precinct only)	297.6
Total remaining developable area	1,122.3
Already Apportioned Area (Motorsport Precinct - Battery Plant - Road reserve)	669.6
Total Remaining Developable Area	750.3

Figure 2-1 GHD Proposed Lansdown Industrial Precinct Master Plan 2019

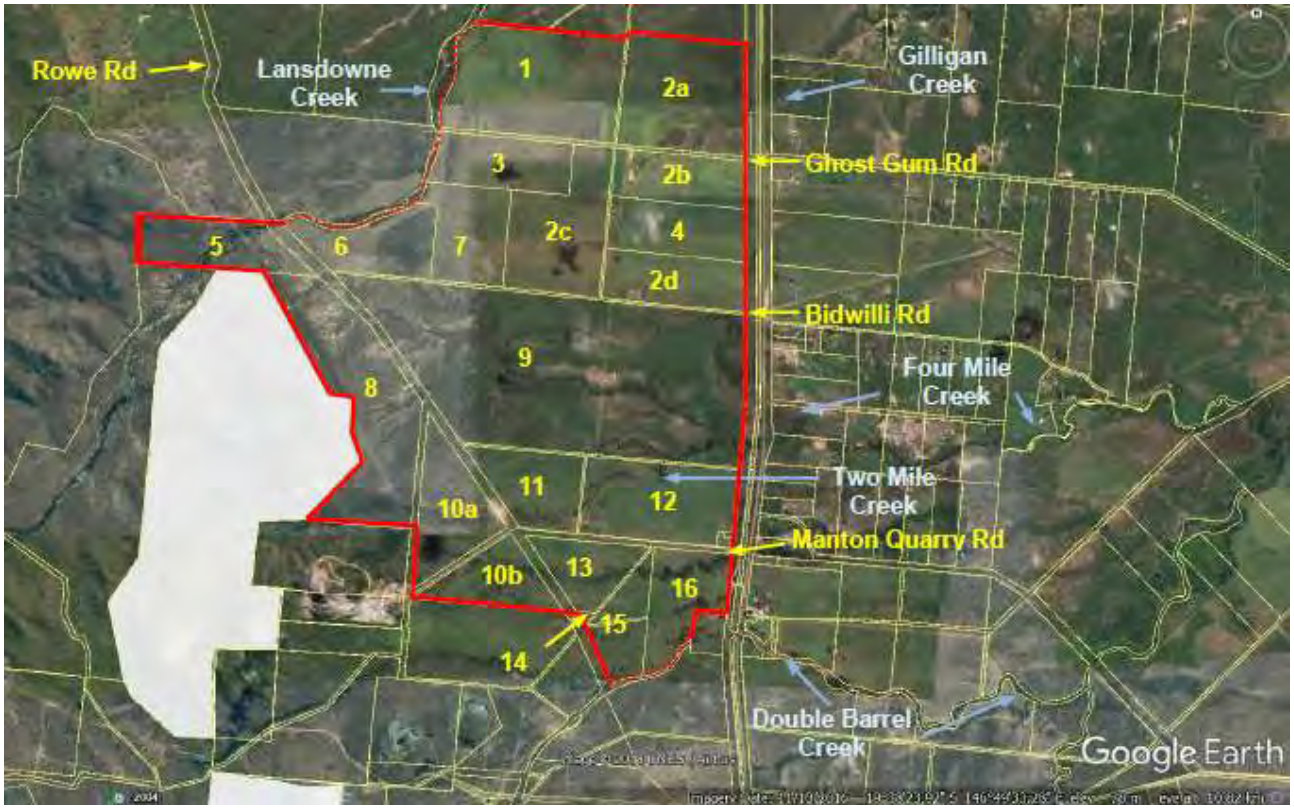


2.3.2 Lansdown Station Environmental Study Final Report, Earth Environmental, 2018

An environmental study and associated report were undertaken for the Lansdown Station Site by Earth Environmental in 2018[3]. This report was used to prepare the Infrastructure, Traffic, Transport and Air Quality Integrated Master Plan Report (GHD 2019) discussed in Section 2.3.1. Refer to Figure 2-2 for the location and extent of Lansdown Station referred to as the Site, which was the focus of the environmental study. The Lansdown Station property is comprised of 16 lots and several road reserves (105 hectares) with a total land area of approximately 2,070 hectares (Earth Environmental 2018).

A review of literature and available mapping was undertaken and is summarised in the report. This included a review of information supplied by the CSIRO.

Figure 2-2 Lansdown Station



Source: Earth Environmental 2018

The following Site visits were completed and are discussed in the report.

- Reconnaissance visit no.1 on 12 May 2018 – Undertaken to determine road access and driving/walking strategy for field work.
- Reconnaissance visit no.2 on 30 May 2018 – Undertaken to meet the property manager i.e., holder of the grazing lease, gather background information about the Site, and make arrangements for detailed Site assessment.
- Detailed Site assessment, including:
    - Site survey on 1 and 2 June 2018. Included survey of northern and western portion of the Site, including Lansdown Creek and the foothills.
    - Site survey on 14 June 2018. Included survey of central and southern section south of Bidwilli Road.

[3] Earth Environmental 2018, Lansdown Station Environmental Study: Final Report, prepared for Townsville City Council, Townsville

The report included a results and discussion section – see below main items:

- The vegetation communities observed on the Site were generally different to those shown on the regional ecosystem mapping.
- Duricrusts were observed in several creeks i.e., bed and banks, and displayed characteristics inconsistent with 'pure' alluvial material i.e., transported and deposited by rivers/streams.
- Essential habitat is linked to the vegetation communities present on the Site and as such cannot be an accurate representation. It was suggested that further targeted, detailed work should be undertaken to delineate the actual extent of essential habitat on the Site following the reclassification of RE codes.
- The potential extent of threatened species habitat would need to be assessed as a separate targeted study.

The following conclusions were made regarding industrial zoning for the Site:

- The section of the Site north of Bidwilli Road was the most appropriate area to rezone for industrial land use from an environmental perspective.
- The area north of the Manton Quarry Road and south of Lot 87 RP911426 appeared to be a potential area for rezoning to industrial land use due to minimal environmental constraints and relatively large areas.
- The area south of Manton Quarry Road to the buffered edge of the Double Barrel Creek tributary appeared to be relatively devoid of important environmental features and another potential area for rezoning to industrial land use.
- The area between Double Barrel Creek tributary and Double Barrel Creek (the southernmost section), was not investigated and no firm opinion was provided for that area. It was noted that it may be suitable for industrial purposes however it was identified as being a potential flooding area of Double Barrel Creek which may have limiting hydrological constraints.

2.4 Implications

Based on the available forecasts during the reporting, it was noted there was capacity of existing infrastructure to service some new load. However, as the development grows it is likely that more capacity will be required. It was noted the LIE does not contain nor is connected to existing or planned trunk infrastructure (water, wastewater, stormwater, internal roads, pathways, and open space). Implications and recommendations obtained from the above-mentioned studies are summarised below:

Additional investigations required such as:

- Infrastructure investigation to facilitate providing water, wastewater, and electrical infrastructure.
- Additional cultural heritage investigations.
- The establishment of appropriate planning requirements to be included in the LEIP to manage operational noise/vibration and air emissions from potential proponents.

It is also suggested additional ecological assessments be undertaken, particularly in locations not previously accessed.

3. Development Review

3.1 Summary of industry engagement

3.1.1 Electricity

Calibre completed stakeholder engagement through Peter Eustace and Associates Pty Ltd (PEA) as a sub-contractor. PEA approached the following entities for input based on the RFQ.

- Energy Queensland.
- CuString Pty Ltd.
- Powerlink Queensland Pty Ltd.
- Edify Energy Pty Ltd.
- Drive It NQ.

3.1.2 Gas supply

Calibre engaged directly with the bulk gas supplier to ascertain the capability for reticulated gas within the LEIP. The meeting was coordinated and attended by Townsville City Council as the owner of the LEIP land.

The North Queensland Gas Pipeline is the bulk gas supply closest to the LEIP.

3.1.3 Telecommunications

Calibre engaged with telecommunications stakeholders through CPM Advisory and Construction Management Pty Ltd (CPM) to ascertain feasible providers for the LEIP. CPM confirmed the following providers were available and undertook liaison with them on behalf of Calibre.

- National Broadband Network Co. Pty Ltd.
- Telstra Broadband Network.
- Nextgen Network.
- Optus Network.

3.1.4 Department of Transport and Main Roads

Calibre engaged with team members from the Department of Transport and Main Roads (DTMR) Northern District via meetings and phone calls during the master planning phase including a formal meeting on 23 July 2021 to discuss the roads and traffic aspects of the Project.

DTMR confirmed the following considerations with regards to the LEIP:

- The proposal should provide at least one access for multi-combination vehicles up to 53.5m.
- The proposal should lead to an overall reduction of railway level crossings and ad-hoc interim access arrangements.
- The proposal should not materially impact access arrangements or operation of the existing Hy-Tec quarry.
- DTMR will commence a Business Case for the proposed grade separated crossing at Ghost Gum Road once the interim access arrangement via Jones Road approaches capacity.
- DTMR supports the development of a rail siding in the LEIP and encourages proponents to consider opportunities for rail connectivity.

On the 21 October 2021 another meeting was held with DTMR Officers. It was confirmed that an Infrastructure type agreement should be prepared confirming trigger points for each upgrade and connection with the Flinders Highway. This agreement should also consider Queensland Rail crossings.

Further liaison with DTMR is required regarding servicing, for example the alignment of the raw water pipeline needs to be confirmed and located to minimise impact with future grade separated crossing of the railway line at Ghost Gum Road.

3.1.5 Queensland Rail

Calibre engaged with officers from Queensland Rail (QR) via meetings and phone calls during the master planning phase including a formal meeting on 21 July 2021 to discuss the railway interfaces of the Project.

QR confirmed the following considerations with regards to the LEIP:

- Upgrades to the road network in the vicinity of Glenn Road means the existing passing loop needs to be modified or relocated.
- A new passing loop is proposed south of Ghost Gum Road to maintain the capacity on the Mt Isa Line.

During August 2021, QR's confirmation of maintaining and upgrading the level crossing at Manton Quarry Road to accommodate 19m semi-trailer design vehicle was not resolved.

Townsville City Council had been advised that ultimately QR would be seeking closure of Manton Quarry Road level crossing once the Ghost Gum Road grade separate bridge has been provided for the LEIP and the internal road network is connected to Manton Quarry Road.

On 25 October 2021 another meeting was held with QR and the following items were noted:

- The future grade separated crossing at Ghost Gum Road will be the primary access for the LEIP.
- Once the grade separated crossing is provided Manton Quarry Road at grade crossing is likely to be closed, based on current legislation. There may be grounds to consider the crossing being maintained based on reduced risk due to less access via this route.
- Event traffic is not to use Manton Quarry Road at grade crossing.

Further liaison with QR is required during the detailed design phases regarding all works on QR property. Access via Manton Quarry Road is to be resolved in future stages of the LEIP.

3.1.6 City of Townsville - Townsville Water and Waste

Calibre engaged with team members from Townsville City Council via meetings and phone calls during the master planning stage including a formal meeting on 24 June 2021 to discuss potential raw water strategies and associated constraints to enable to the development of the LEIP.

Through continued consultation with Townsville City Council, the following assumptions were adopted for the raw water strategy development:

- The DN900 Haughton Pipeline has been identified as one of two potential options for supply of raw water to LEIP. Information regarding the DN900 Haughton Pipeline was provided by Townsville City Council on 21 July 2021 which included the following:
  - DN900 Haughton pipeline pump details (McIntyre and Associates dated 1994).
  - System details (McIntyre and Associates dated 1994).
  - System pressure recordings dated 2018.
  - Site water quality historical information from 2006 to 2021 information.
- The documents provided by Townsville City Council have been used to inform the current operating capacity and philosophy of the pipeline. Generally, the key operational assumptions adopted for the purpose of the development and assessment of options are:
  - DN900 Haughton Pipeline is shut down several times a year, for up to two-weeks while weed clearing and maintenance is undertaken within the Upper Haughton Irrigation Channel.
  - No capacity constraints are associated with additional offtake for the dedicated LEIP supply.
  - Cost of raw water was adopted as $30/ML.

- Cost of the DN900 Haughton Pipeline intake pumps are $20,000 per day (24 hour period) for maximum transfer.
- This has been adopted for the specific demand requirements of the LEIP, with no consideration given to reduced rates based on lower flow requirements (when Ross Dam does not require water).
- Minimum available pressure of 60 m Head (588 kPa) is available at the proposed connection.

For the purpose of this report no amendments are proposed to the operational philosophy of the DN900 Haughton Pipeline, however recommendations are provided to supplement known shortfalls.

The documents provided by Townsville City Council have been used to inform the current operating capacity and philosophy of the pipeline.

3.1.7 Queensland Pacific Metals

A meeting was held with QPM on Wednesday 23 June 2021. The information discussed has been taken into consideration for the land use master planning, including in particular road network options at the northern end of the precinct, and infrastructure demands referred to in Scenario B of the land use and infrastructure demands spreadsheet located at **Appendix A** and discussed in Section 6 of this Report. The following provides a summary of the information discussed and relevant to the Master Plan:

- **Project Status**
  - QPM are preparing a development application, lodgement is imminent, with the view to commence works in the first quarter of 2022.
- **Land Use**
  - The proposal is generally consistent with the LEIP intent. It does however involve proposing high impact industry within part of the Rural Zone land in the west of the LEIP. This will be subject to impact assessment via a development application. However, it is considered there is merit to that aspect of the proposal on the basis that the potential impacts of the development do not affect the Ross Dam water catchment. It will result in increased developable area within the LEIP, and therefore potentially higher demands on infrastructure networks than assumed in the current LGIP (e.g., water supply requirements).
- **Road Network**
  - Townsville City Council have secured funding to deliver specific trunk works within the LEIP, but not all. This involves the access from the north to the northern boundary of QPM via Jones Road. This will form early enabling works. Design needs to consider the design of a 40m wide reserve (resulting in land acquisition from neighbouring properties to the north).
  - Separate information on traffic rates have been obtained from QPM (refer to Scenario B assumptions as referenced above). Ultimately the use requires a road network that accommodates B-triple trucks and possibly quad-trucks.
  - To increase efficiency and safety for the proposal, QPM propose to realign the north-south road system i.e., move it from the central unnamed road reserve. However, this results in inefficiency of the road network within the LEIP. It is understood QPM are happy to undertake required land and works at no cost to Townsville City Council. It is understood this will be subject to assessment, including options to cross the central unnamed road reserve (as the preferred LEIP road network alignment) e.g., raised conveyer system across the road to link the plant to the west to the residue storage area to the east of the north-south unnamed road reserve, and the provision of a safety management plan for employees.
- **Water**
  - QPM require water supply by the end of 2023. The water supply options are identified as early enabling works and concept design is in progress as part of this project. QPM has a significantly higher demand for water supply than the current LGIP assumptions (refer to Scenario B in AIP Chapter 5).
- **Sewer**
  - An on-site solution is proposed.
- **Gas**

  - Intend to connect to the North Queensland Gas Pipeline. The master planning therefore seeks to provide for a gas let-down and local pipeline along Ghost Gum Road for multiple proponents, including QPM. This requires a retailer (e.g., APA) agreement, and additional infrastructure which will be considered as proponent led infrastructure.
- **Electricity Supply**
  - Discussions with Edify Energy (hydrogen for power, but also water by-product as input to create steam power at site), Imperium3 and Energy Queensland substation to identify synergies and agreements. On-site thermal and solar power options were also considered. The master planning seeks consideration to infrastructure corridors through the LEIP to enable connectivity and shared inputs/outputs between proponents. The current Edify Energy location on Manton Quarry Road is a second growth front, some distance from QPM and is recommended to consider alternative site locations closer to the northern part of the LEIP to obtain synergies and efficient infrastructure delivery for the first stage.
- **Rail Siding**
  - Not intended to be utilised, not viable at 1.5M tpa production capacity and location factors.
- **Sustainability**
  - The residue may provide a building material. It is recommended further information is obtained to inform potential use within the LEIP for infrastructure (e.g., road base) and synergies with other proponents.

It is noted that since this meeting QPM has subsequently proceeded with a development application within the High Impact Industry Zone which involves a realignment of the north-south road system, which is to be at QPM's cost.

3.1.8 Edify Energy

Edify Energy met with the Future Cities officers of the Townsville City Council, as well as Calibre Professional Services and CDM Smith on 23 June 2021 to discuss Edify Energy's requirements for the LEIP. A summary of the outcomes of this meeting are presented as follows.

- Edify presented their development plan and highlighted site constraints to the west due to flooding and ecological overlays. The site is also constrained by flooding in the south-east corner.
- Edify confirmed no further development is proposed for the site after this plan.
- A water demand table is available but there is no certainty around the numbers presented i.e., 30MW hydrogen plant is forecast for 2030, but this could come forward if the market picks up. The pilot program is proposed as a 10MW facility with solar farm.
- The Traffic Impact Assessment is not available, due to uncertainty around the market timing.
- Edify may truck in water to supply the site if required. On-site wastewater treatment plant will service administration building, will include saline hydrogen by-product of water (to go to sewer).
- LEIP land use synergies.
- Edify offered to supply water (as a hydrogen by-product), electricity and hydrogen to other parts of the LEIP if necessary.
- Edify explained their preferred ultimate development plan is to construct a hydrogen pipeline towards Townsville and an oxygen pipeline toward Cleveland.
- Edify advised construction and ultimate site access is proposed via Manton Quarry Road and the uncontrolled level crossing.
- Calibre raised questions about queueing around level crossing. Edify advised water truck numbers will drop-off as the raw water pipeline is delivered (estimate four (4) 20kL tankers per day).
- Edify advised they will rely on 275kV electrical easements that run to the Lansdown substation. CDM Smith question easement widths and Edify advise 50m-wide.

Since this meeting, the Edify development application was approved by a Townsville City Council Decision Notice dated 21 September 2021.

3.1.9 Imperium3

Imperium3 met with the Future Cities officers of the Townsville City Council, as well as Calibre Professional Services and CDM Smith on 7 July 2021 to discuss Imperium3's requirements for the LEIP. A summary of the outcomes of this meeting are presented as follows.

- Imperium3 outlined their intention to construct a Lithium-ion Battery Manufacturing Facility at the LEIP.
- Imperium3 advised that their development application will be submitted in three separate parts, reflecting their development plan for staged construction and expansion.
- Imperium3 confirmed they will require connections to reticulated sewerage, water, and gas at their site. Sizing was not specified.
- Imperium3 advised their intention to operate B-double trucks through the LEIP.
- Imperium3 confirmed their preferred method of electrical power to the site is via Edify Energy's Majors Creek Solar Farm, which is proposed as a behind-the-meter arrangement.

Calibre Professional Services received the information requested at the meeting from the Future Cities officers of the Townsville City Council via e-mail on 8 July 2021. Further information requests were made on 14 July 2021, which were responded to by Imperium3 via e-mail on 26 July. No additional information was requested from Imperium3 after 26 July 2021. The combined proponent meeting on 28 September 2021 concluded engagement with Imperium3 for this report.

3.1.10 Drive It NQ

Drive It NQ met with the Future Cities officers of the Townsville City Council, as well as Calibre Professional Services to ascertain the Drive It NQ requirements for the LEIP. A summary of discussions is provided below.

- Townsville City Council has given a development approval to Drive It NQ.
- Road networks servicing the Drive It NQ site should account for B-double trucks as a minimum.
- Drive It NQ do not require a connection to the municipal services initially. However, it may request a connection ultimately.
- Drive It NQ offered to conditionally accept grey water from neighbouring allotments to maintain their grassed area.
- Drive It NQ is a sports and recreation precinct, which hosts motor sports events on occasion. Drive It NQ will be preparing an event management plan that could have use in the larger development plan.

Calibre Professional Services followed-up the actions of the meeting with Drive It NQ via e-mail and phone call on 20 July 2021. This additional information was received in full on 28 July 2021.

Calibre again made a request for information through their sub-consultant Peter Eustace & Associations Pty Ltd regarding the anticipated electricity demand for Drive It NQ in August. Drive It NQ advised their demand would likely not exceed 100kVA, which concluded coordination between Calibre and Drive It NQ.

At the combined proponent meeting on 28 September 2021 it was confirmed that Drive It NQ had a new layout and sought to have the western ring road to be relocated to avoid the proposed track. During future phases of the design development Drive It NQ are also open to considering provision of a raw water inground reservoir site within their lease, however suitable arrangements will be required to integrate with the existing Drive It NQ dam and enable Drive It NQ some use rights to the stored raw water.

3.2 Summary of proposed proponent development

3.2.1 Status of works/approvals

3.2.1.1 Initial proponents

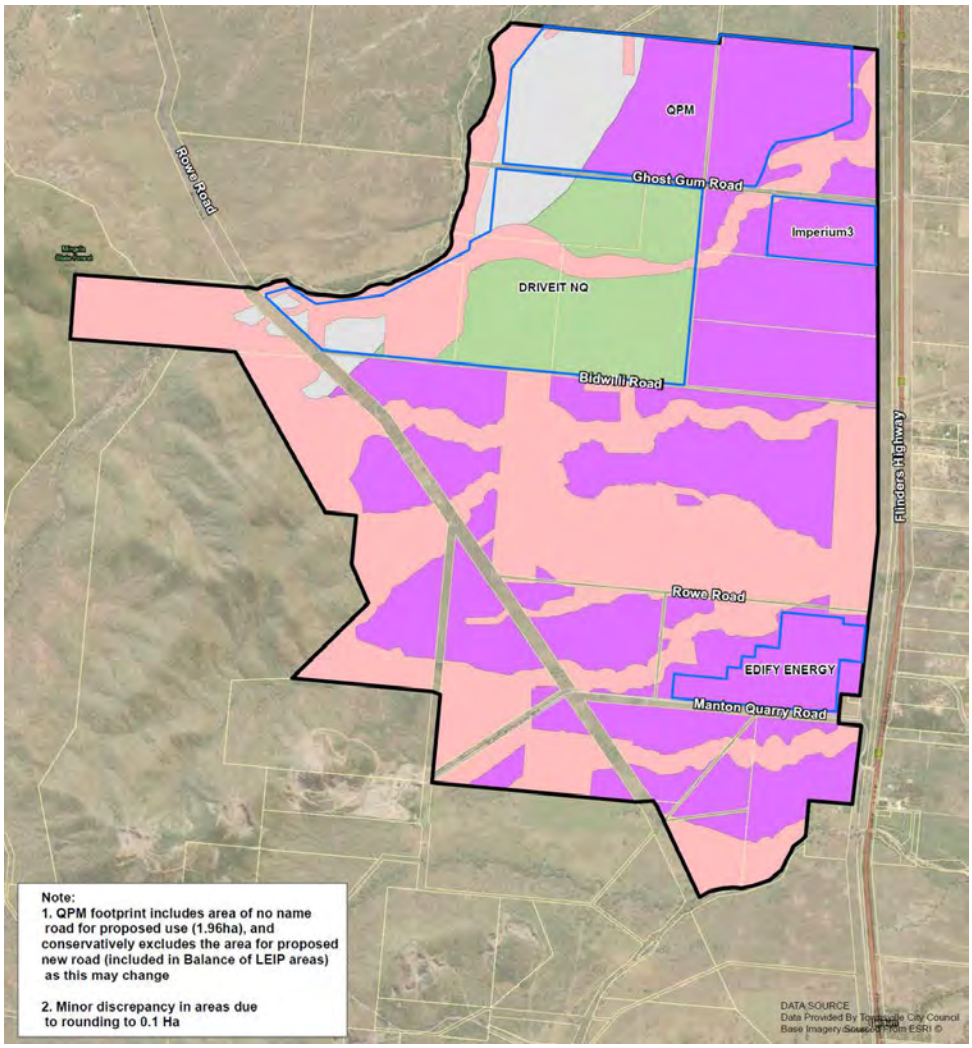
Identified as stakeholders above, the known current proponents include the following:

- Queensland Pacific Metals (QPM).
- Edify Energy.
- Imperium3.
- Drive It NQ.

It is acknowledged Townsville City Council are also in discussions with other potential proponents, however they are not stakeholders and information has been limited to potential site areas and demands on infrastructure networks. This information is incorporated in the land use and infrastructure demand assumptions spreadsheet (**Appendix A**) and discussed within Section 6 of this report.

The location of the identified initial proponent's projects within the LEIP are identified on the Scenario B Land Use Plan (**Appendix A**), of which an extract is provided in Figure 3-1.

Figure 3-1 Extract of Scenario B Land Use Plan



Source: CDM Smith

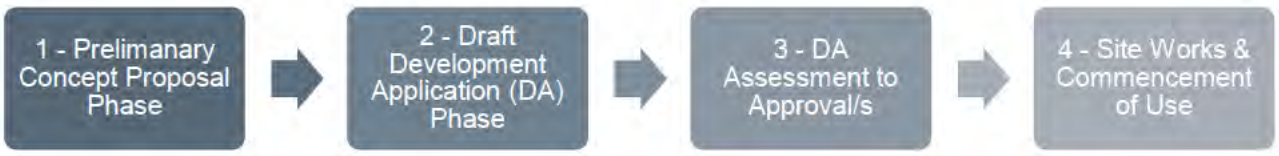
The following Table 3-1 provides a brief overview of the nature of each proposal and the land it relates to.

Table 3-1 Proponent proposal summary

Proponent	Brief Description of Proposal	Relevant Land and Areas*
Queensland Pacific Metals	Townsville Energy Chemicals Hub Project; nickel refinery, producing 1.5M saleable product for battery production, involving a significant residue storage area, and realignment of the road network.	Corner Flinders Highway and Ghost Gum Road, Calcium Qld 4816 Lot 19 on RP901592 and Lot 20 on E124189 Footprint ~225.3ha
Edify Energy	Hydrogen plant: production of 600MW (potentially 1GW), powered by behind-the-meter solar panel facility (initially 10MWdc, up to ~40MWdc/ 1GW) to produce "green hydrogen", located in a separate growth front to other proponents being in the south-eastern portion of the LEIP adjacent to Manton Quarry Road.	132 Bidwilli Road, Calcium Qld 4816 Lot 51 on E124242 Footprint ~53.7ha
Imperium3	Lithium-ion battery advanced manufacturing facility; producing 18GWh (over 3 stages; 6 GWh per stage to full capacity by 2030), with battery life of 8-10+ years.	132 Bidwilli Road, Calcium Qld 4816 Lot 19 on RP901592 Footprint ~32.6ha
Drive It NQ	Motor sport and driver education facility; including a race circuit, speedway, dragway, off road and rally circuits, and associated amenities, to be completed over three stages.	132 Bidwilli Road, Calcium Qld 4816 Lot 31 on E124247, Lot 39 on E124247, Lot 38 on E124269, Part Lot 19 on RP901592 Footprint (includes off-track areas) ~285.1ha

Figure 3-2 below clarifies the stages of a project development approval pathway, which is then used to relate the status of each proponent's project to further below.

Figure 3-2 Proponent project status



The following Table 3-2 clarifies the status of the proponent's stage in the development approval pathway, including their land interest, and site works.

Table 3-2 Status of proponent approvals, land interest and site works

Proponent	Approvals	Land Interest	Site Works
Queensland Pacific Metals	2 - Draft Development Application (DA) Phase (Aiming to start works first quarter 2022)	No lease or freehold title (Memorandum of Understanding)	Nil
Edify Energy	3 - DA approved by a Decision Notice dated 21 September 2021 (MCU21/0040)	No lease or freehold title (Memorandum of Understanding)	Nil
Imperium3	1 - Preliminary Concept Proposal Phase (Aiming to lodge DA late 2021/early 2022)	No lease or freehold title (Memorandum of Understanding)	Nil
Drive It NQ	4 - Staged Approval granted (MI17/0015)	Lease agreement (40 years)	Commenced Stage 1.

A review of the currently granted approvals have been undertaken, and a summary of the relevant requirements set out in the sections below.

3.2.1.2 Edify Energy

- **Road Network** –
  - *Stage 1* - a) Safe access to the site must be secured:
    - Option 1: via an internal access road through the LEIP and north to the Jones Road/Flinders Highway intersection, if available

      Or
    - Option 2: via the Manton Quarry Road/Flinders Highway intersection (as per condition 28, 29 and 30 of the Development Approval)
  - Stage 2 and Stage 3 - b) Traffic Impact Assessments for Stage 2 and Stage 3 of the development must be submitted as part of an application for operational works for each relevant stage.
  - DTMR approval must be obtained for any works within the Flinders Highway State controlled road corridor or within the rail corridor of the Great Northern Rail Line.
- **Stormwater** – Site-based stormwater management plan prepared. Project involves utilising roadways and natural drainage channels to manage overland flow.
- **Electricity and Telecommunications** – Provision of an appropriate level of services prior to commencement of use.
- **Water** – On-site water supply solution, not required to connect to reticulated network unless available.
- **Sewer** – On-site sewage system.

3.2.1.3 Drive It NQ

- **Planning Assumptions** – The facility will operate for the life of the planning horizon (2041+) as the operator has a 40-year lease.
- **Road Network** – Construction of a rural standard road from the site entrance, heading east along Ghost Gum Road, north via the unnamed road reserve, through to Jones Road and Woodstock-Giru Road, and associated intersections. Pavement impact assessment on the external network access intersections and works if required. Restricted access from Flinders Highway via Ghost Gum Road.

- **Stormwater** – Site-based stormwater management plan prepared. Project involves the retention of a small water dam and construction of a large water dam which will capture overland flow prior to discharge to the east off-site, which will also provide water on site for e.g., dust suppression.
- **Electricity and Telecommunications** – Provision of an appropriate level of services prior to commencement of use.
- **Water** – On-site water supply solution, not required to connect to reticulated network.
- **Sewer** – On-site sewage system.

3.2.2 Key issues of proponents

3.2.2.1 Queensland Pacific Metals (QPM)

- **Road network** – The proposed alternative local road alignment is an improvement to the layout and efficiency of the facility; however, it has a negative impact on the efficiency of the road network within the LEIP. Public road reserve access is required from Jones Road through the QPM site to the other areas within the LEIP. The use of B-triple trucks (possibly quad-trucks), with reliance on access to Jones Road to the north requires a high standard of road e.g., 27.3m wide road reserve. Accordingly, local road network upgrades will involve land acquisition and need to be advanced as early enabling infrastructure. Enabling works will be suitably constructed within the Jones Road Reserve approx. 30m and the existing north-south unnamed road reserve (current reserve widths appear ~20m), however only one footpath verge will be initially constructed on the western side. At a future stage road widening will occur and the eastern footpath verge will be constructed.
- **Ross Dam Water Catchment** – The initial proposal sought to utilise Rural Zoned land within the Ross Dam Catchment Overlay of the Townsville City Plan. It is noted most of the facility (except for part of the proposed road and amenities) is located outside of the flood and stormwater catchment of Ross Dam, will be constructed to 1 in 1,000-year event stormwater bund, and therefore is technically not of concern. Additional demand on infrastructure networks because of using Rural Zone land for high impact industry uses is considered in the land use and infrastructure demand assumptions spreadsheet (**Appendix A**) and is discussed in Section 6 of this report. A new layout in November 2021 has removed the proposed works from the Ross Dam Water Catchment overlay.
- **Residual Storage Area (RSA) Use and Location** – Additional information is required to understand if the residue can be neutralised and used for other purposes, otherwise if the RSA (~63ha) is landfilled, capped, and rehabilitated with vegetation, it will render land unusable which otherwise will benefit from a high level of infrastructure services. Further if usable, it may provide an input into other industries (e.g., building or fill material) in the LEIP or infrastructure (e.g., road base). Alternatively, end of life land use options should also be planned for, such as using the capped RSA for recycling and resource recovery, or recreation purposes.
- **Water** – QPM's demands of raw water supply are significantly higher than the assumptions for high impact industry uses. Accordingly, supply of raw water needs to be advanced as early enabling infrastructure.
- **Rail siding** – The proposed site location is not located adjacent to the Queensland Rail (QR) preferred location, which generally involves the closure of Bidwilli Road further to the south-east within the LEIP. It is instead proposed to truck product between the Port of Townsville. Accordingly, QPM do not provide demand for the rail siding.
- **Gas** – QPM is seeking a private connection to the North Queensland Gas Pipeline, however this will not add value to other land in the LEIP. Further investigations are required to provide a let-down station and alignment along Ghost Gum Road through to QPM that can be used by other proponents.

3.2.2.2 Edify Energy

- **Second Growth Front** – The location of the proposal is within the south-eastern portion of the LEIP and is creating a second growth front that requires early enabling infrastructure, such as road network upgrades and raw water supply.

- **Site Location** – The solar panels consume potentially up to 63ha of land, that will be highly serviced with infrastructure and free of majority of constraints. Further consideration should be given to use of moderately constrained land in the LEIP instead, to free up this land for more productive industrial land use.
- **Road network** - Should access to Flinders Highway (via Manton Quarry Road and rail crossing) not be supported by QR and Transport and Main Roads (TMR), or supported subject to high value upgrade requirements, alternative access through the LEIP is required. Moreover, TMR option analysis recommends ultimate closure of Manton Quarry Road onto Flinders Highway. Further investigations are required to require a rural standard road through the LEIP up to Ghost Gum Road, as per conditions on Drive It NQ, to provide interim solution that is not an inefficient delivery of infrastructure. However, it is noted this alignment may require stormwater culvert and fisheries waterway crossing solutions which are more costly than the Drive It NQ alignment and extent of works.

  It is noted that a Decision Notice dated 21 September 2021 (MCU21/0040) has been issued for Edify Energy's current proposal. Access and serviceability arrangements for Edify Energy will be as per Council's development conditions (item 14, 28, 29 and 30) and any third-party agreements (e.g., development contributions or infrastructure agreements).

  Ultimately, the future grade separated crossing at Ghost Gum Road will be the primary access for the LEIP, including Edify. Once the grade separated crossing is provided Manton Quarry Road at grade crossing is likely to be closed, based on current legislation. There may be grounds to consider the crossing being maintained based on reduced risk due to less access via this route. Event traffic is not to use the Manton Quarry Road at grade crossing.
- **Water** – Edify Energy's demands of raw water supply are significantly higher than assumptions for high impact industry uses. Accordingly, the supply of raw water needs to be advanced as early enabling infrastructure works.

3.2.2.3 Imperium3

- **Site Location and Sub-Precinct Planning** – The proposal is in an appropriate area, as it is for advanced manufacturing and will be near the entrance to the LEIP from the ultimate entry grade separated access overpass at Ghost Gum Road onto Flinders Highway. Accordingly, a sub-precinct can be envisaged to co-locate other advanced manufacturing facilities adjacent to Imperium3.
- **Gas** – QPM are seeking to utilise the North Queensland Gas Pipeline. Further investigations are required to provide a let-down station and alignment along Ghost Gum Road through to QPM's site that can be used by other proponents.

3.2.2.4 Drive It NQ

- **Land Use Interface** – The facility introduces many members of the public into the LEIP, and as such signage and safe road networks are required to avoid incidents which may impact on neighbouring high impact industry uses.
- **Road network** – QPM is seeking to close off public access through the north-south unnamed road reserve. Condition 16 and associated plans require Drive It NQ to construct a rural standard road through this alignment. To avoid inefficient infrastructure delivery, QPM will be required to provide alternative safe and suitable access.

3.2.3 Demand on infrastructure networks

The land use and infrastructure demand assumptions from the proponents have been obtained via the stakeholder the engagement process and is contained in the spreadsheet contained in **Appendix A** and is discussed within Section 6 of this report.

3.2.4 Summary of early infrastructure requirements

The following is a summary of early infrastructure requirements for the proponents:

- **Road network** – Road works are required from Flinders Highway, via Woodstock-Giru Road and Jones Road intersection, to Ghost Gum Road, unless QPM is desired alignment is conditioned to continue the road through to Ghost Gum Road intersection with unnamed road reserve that heads south (e.g., conditioned on QPM). A rural standard road is also required to service Edify (e.g., conditioned on Edify).
- **Water** – The proponents' demands of raw water supply are significantly higher than assumptions for high impact industry uses, and early enabling works need to provide a solution to both growth fronts i.e., QPM and Imperium3 to the north and separately Edify to the south. As Edify have other issues, such as access onto Flinders Highway via Manton Quarry Road and use of land for solar production, further investigations are required into possible land allocation further north in the LEIP to reduce the extent of water supply early enabling infrastructure.
- **Gas** – A let-down station off the North Queensland Gas Pipeline, and gas retailer agreement (e.g., APA), is required to provide for connections along Ghost Gum Road to the QPM and Imperium3 sites.

3.3 Implications

Given that the extent of early enabling works are substantial in scale and costs, the proponents require the services in a short period of time, the works involve multiple stakeholders and approval processes, and Townsville City Council is the owner of the LEIP land and future asset infrastructure holder, it is logical for the Townsville City Council to deliver and/or coordinate the delivery of early infrastructure works as enabling works, subject to the completion of satisfactory agreements with the proponents.

Therefore, it will be necessary as part of any agreement between a proponent and the Townsville City Council for land within the LEIP for the proponent to enter into a satisfactory Infrastructure Agreement with the Council to provide for infrastructure contributions for the early enabling infrastructure works which are necessary to service the proposed development and the rest of the LEIP.

4. Economic Assessment

4.1 Current economic environment in Townsville

The nature of industry in the Australian market, that is high wage, regulated and domestically small, forces businesses to build on their own internal capacity by collaborating with other businesses and increasingly, with research institutions. As global competition increases, the need for more complex and nimble supply chains will increase. Individual businesses might partner with several different businesses from project to project to deliver bespoke products and integrated solutions that respond directly to customer needs rather than simply making a standard product sold into a mass market and competing on lowest price.

In addition to the need for more sophisticated and nimble supply chains, companies will increasing need to embrace emerging technologies and automation and increase their focus on design and research and development.

There is clear evidence that the level of sophistication and educational attainment of the industrial workforce as a whole, and particularly in advanced manufacturing, is rising. Or put another way, the 'knowledge intensity' of the industrial workforce is increasing. Hence, advanced manufacturers will require higher levels of worker amenity and access to business support services (e.g., industrial design, research laboratories, specialist financiers, etc) in industrial areas than traditional manufacturers have demanded in the past.

The rising knowledge intensity throughout the economy and within the industrial sectors directly challenges the traditional notion that advanced manufacturing is limited to a collection of sectors (e.g., bio-medical, pharmaceutical, etc), to advanced manufacturing being an approach whereby innovative technology is applied to improve products and processes. Effectively there is a growing school of thought that all manufacturers can and must transition to think and behave as advanced manufacturers; to compete on price in Australia's high-cost business environment is no longer viable.

With this evolution of manufacturing, which comprises one third of all full-time employment in Queensland, will come changes in the way manufacturers will seek to utilise industrial areas. Increased automation will impact site footprint and land size requirements and configuration and design of manufacturing facilities, more knowledge-based workforces and work practices will allow more flexible workforces which could impact car parking requirements whilst increased collaboration will drive demands for clustering of businesses and co-location with research institutions. A move from products to design, ideas and solutions will impact freight requirements.

Facilitating an outward looking industrial sector is imperative to the ongoing economic sustainability of Townsville and the Far North Queensland region. However, competition by its nature is dynamic. Business approaches and models must change rapidly to stay ahead of their competition, who is not simply the business in the next suburb, but a whole network of businesses globally. Townsville has the potential to provide future businesses with a location that allows them to access local, regional, national, and international markets.

Industrial land demand within the Townsville region has been subdued in recent years due to lower base metals prices. However, despite the economic downturn in base metals prices, there has been significant interest in the LEIP. The LEIP, which is intended to be Northern Australia's first eco-industrial precinct for advanced manufacturing and processing, technology, and emerging industries, offers opportunity for land extensive industries which require access to the Port of Townsville (rail and road) but not immediate proximity. This area provides opportunity for the development of an industry cluster around the proposed QPM facility, with access to locally generated energy from the approved 200-megawatt Majors Creek Solar Farm.

The following section of the report provide a summary of economic supply and demand factors influencing development of the LEIP.

4.2 Assumptions

4.2.1 Population and housing

Population and household projections have been prepared for the Townsville local government area (LGA) and Townsville Statistical Area Level 4 (SA4) for the 2020 to 2041 period. The approach utilised to derive population estimates and household estimates for Townsville LGA and Townsville SA4 is outlined below:

- **Population**
  - Derive estimated resident population (ERP) from the latest Australia Bureau of Statistics (ABS) catalogue.
  - Derive 2018 projections from the Queensland Government Statistician's Office (QGSO).
  - Rebase QGSO population projections (medium, low and high growth projection scenarios) to reflect latest ERP from the ABS (i.e., apply the population growth rates from the QGSO projections to the latest ABS ERP to derive rebased population projections).
- **Household Projections**
  - Derive the average household size of Townsville LGA and Townsville SA4 from the 2016 Census.
  - Assume that the average household size of a study area will continue to decline marginally (at a rate of 0.015% per annum) between 2016 and 2041.
  - Apply the average household size estimates of the Townsville LGA and Townsville SA4 to the respective total population projections of the Townsville LGA and Townsville SA4 to derive household projections.

4.2.2 Historic and projected population

Table 4-1 summarises projected population growth in five-year intervals for the Townsville LGA, remainder of LGAs in Townsville SA4 and Townsville SA4 for the 2016 to 2041 period, under the low, medium, and high growth scenarios.

Table 4-1 Population Growth, Five Year Intervals, Townsville LGA and Townsville SA4, 2016 to 2041

	2016-21	2026-31	2031-36	2036-41
Low				
Townsville LGA	9,547	13,398	13,248	12,568
Remainder of LGAs within SA4	-230	-974	-1,408	-1,575
Townsville SA4	9,317	12,476	12,851	12,386
Medium				
Townsville LGA	12,204	18,022	19,748	20,074
Remainder of LGAs within SA4	-85	-53	-139	-313
Townsville SA4	11,986	17,758	19,396	19,562
High				
Townsville LGA	15,116	23,402	26,617	27,534
Remainder of LGAs within SA4	73	341	301	287
Townsville SA4	15,189	23,743	26,919	27,821

Source: ABS (2021), Regional Population, Cat. No. 3218.0, Australian Bureau of Statistics, Canberra and QGSO (2018), Queensland Government population projections: Regions, 2016 to 2041, Queensland Treasury, Brisbane

Table 4-2 details the population projections for the Townsville LGA and the Townsville SA4. The LGIP states that ultimately the population of Townsville City will reach 404,346 residents. Based on the remaining LGAs in the Townsville SA4 the total number of residents in the Townsville SA4 is expected to reach 464,531 persons ultimately.

Table 4-2 Population Estimates, Average Household Size and Household Projections, Townsville LGA and Townsville SA4, 2020 to 2041 and Ultimate

	2020	2021	2026	2031	2036	2041	Ultimate
Townsville LGA							
Population (Low)	196,800	198,719	211,438	224,644	237,702	250,090	404,346
Population (Medium)	196,800	199,240	216,819	236,081	255,661	275,341	404,346
Population (High)	196,800	199,805	222,374	248,045	274,600	302,170	404,346
Townsville SA4							
Population (Low)	238,813	241,169	253,483	266,167	278,392	290,091	464,531
Population (Medium)	238,813	241,966	259,557	278,754	298,100	317,508	464,531
Population (High)	238,813	242,788	265,825	291,943	318,937	346,721	464,531

Source: ABS (2021), Regional Population, Cat. No. 3218.0, Australian Bureau of Statistics, Canberra; QGSO (2018), Queensland Government population projections: Regions, 2016 to 2041, Queensland Government, Brisbane; and ABS (2017), 2016 Census of Population and Housing, Australian Bureau of Statistics, Canberra

4.2.3 Household projections

In 2011, Townsville LGA and Townsville SA4 had an average of 2.6 persons per household. In 2016, the Townsville LGA had an average of 2.6 persons per household (identical to the 2011 average) whilst Townsville SA4 had an average of 2.5 persons per household (slightly lower than the 2011 average). Based on these historical datasets and the prevailing national trend of decreasing household sizes, this assessment has assumed that household growth will decline at a rate of 0.015% per annum in both the Townsville LGA and Townsville SA4.

4.3 Drivers of industrial land demand

4.3.1 Purpose

The purpose of this section is to provide a brief overview of the changes in the broader economic environment that have impacted the Townsville regional economy in recent years, and the implications for industrial land demand in Townsville. Unlike many of Queensland's regions, Townsville is a relatively broad-based regional economy supported by a large economic hinterland based around agriculture and base metals mining. Townsville itself is a major administrative and service hub for northern Queensland. While Townsville does not have a major reliance on tourism, hospitality and accommodation, these sectors are still significant contributors to the regional economy. Despite this sectoral diversity, the Townsville regional economy, like many other parts of regional Queensland, remains heavily exposed to commodity price fluctuations.

4.3.2 Unemployment

The unemployment rates for the Townsville LGA and Townsville SA4 have been following a downward trend since March Quarter 2017, where the unemployment rate peaked at 10.8% in the Townsville LGA and 11.3% in Townsville SA4. As at March Quarter 2021, the unemployment rate was 6.2% in the Townsville LGA and 6.4% in Townsville SA4. Between December Quarter 2010 and March Quarter 2021, unemployment rates in the Townsville LGA and Townsville SA4 were lowest in the March Quarter 2013.

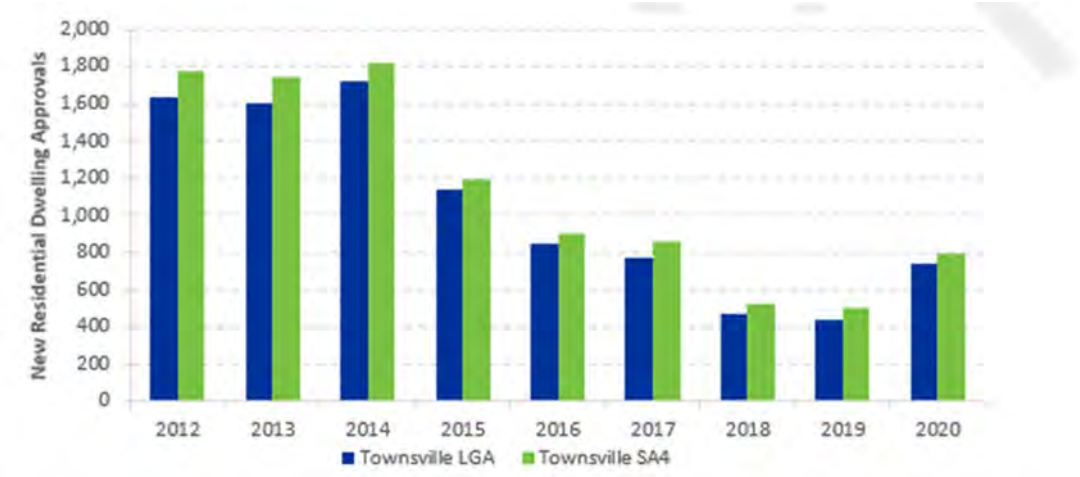
In any event, a rising trend unemployment rate combined with labour market volatility is likely to influence or be reflective of business confidence. The highly volatile and rising unemployment rate between late 2010 and 2013 would imply softening economic conditions during this period.

4.3.3 Dwelling approvals

Dwelling approval data was extracted using Statistical Area Level 2 (SA2) geographies for the Townsville LGA. Dwelling approvals in a regional economy as diverse as Townsville can be a useful measure of household and investor confidence. New house construction signifies investment either on behalf of a household or an investor. Declining approvals are reflected of softening confidence among households and investors. Between 2012 and 2019, new residential dwelling approvals in the Townsville LGA and Townsville SA4 have been following an overall downward trend, with new residential dwelling approvals increasing for both geographies analysed between 2019 and 2020.

Between 2012 and 2020, the Townsville LGA recorded an average of 1,039 dwelling approvals, whilst the Townsville SA4 recorded an average of 1,124 dwelling approvals. As a proportion of dwelling approvals, the Townsville LGA accounted for approximately 91.8% of all dwelling approvals in Townsville SA4 between 2012 and 2020. As demonstrated in these historic dwelling approvals, the Townsville LGA underpins population and dwelling growth within the Townsville SA4.

Figure 4-1 New residential dwelling approvals, Townsville LGA and Townsville SA4, 2012 to 2020

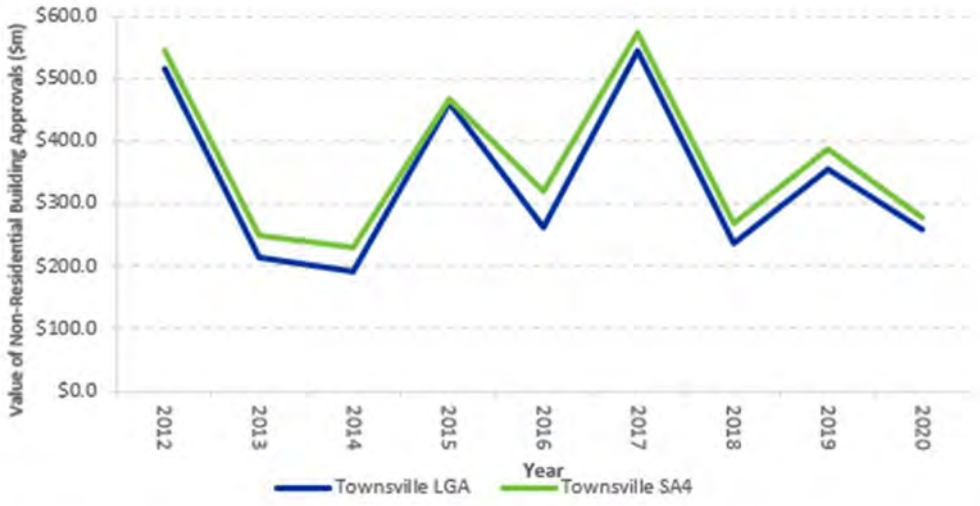


Source: ABS (2021), Building Approvals, Australia, Cat. No. 8731.0, Australian Bureau of Statistics, Canberra

4.3.4 Non-residential approvals

Figure 4-2 below illustrates the annual value of non-residential building approvals for the Townsville region (Townsville SA4 and Townsville LGA) between 2012 and 2020. There has been significant volatility in the value of non-residential building approvals between 2012 and 2020. In 2020, the value of non-residential building approvals in the Townsville LGA was $259.5 million, with this figure being $279.4 million for the Townsville SA4. The impact on the non-residential building market within the Townsville region appeared to lag a year behind the residential building market. This could be attributable to the typically longer contract term for non-residential construction. However, the very significant declines in the value of non-residential approvals in 2016 and 2018 are indicative of a major pull back in business investment. This significant withdrawal of investment could have profoundly dampened broader business confidence across the region.

Figure 4-2 Value of non-residential building approvals ($m) for Townsville Region, 2012 to 2020



Source: ABS (2021), Building Approvals, Australia, Cat. No. 8731.0, Australian Bureau of Statistics, Canberra

Between 2012 and 2020, the Townsville LGA recorded an average value of $337.3 million in non-residential building approvals, whilst Townsville SA4 recorded an average of $368.7 million in non-residential building approvals.

As a proportion of non-residential building approvals, the Townsville LGA accounted for approximately 90.2% of all dwelling approvals in the Townsville SA4 between 2012 and 2020. As demonstrated in these non-residential building approval values, the Townsville LGA underpins non-residential building growth within the Townsville SA4.

4.3.5 Commodity prices

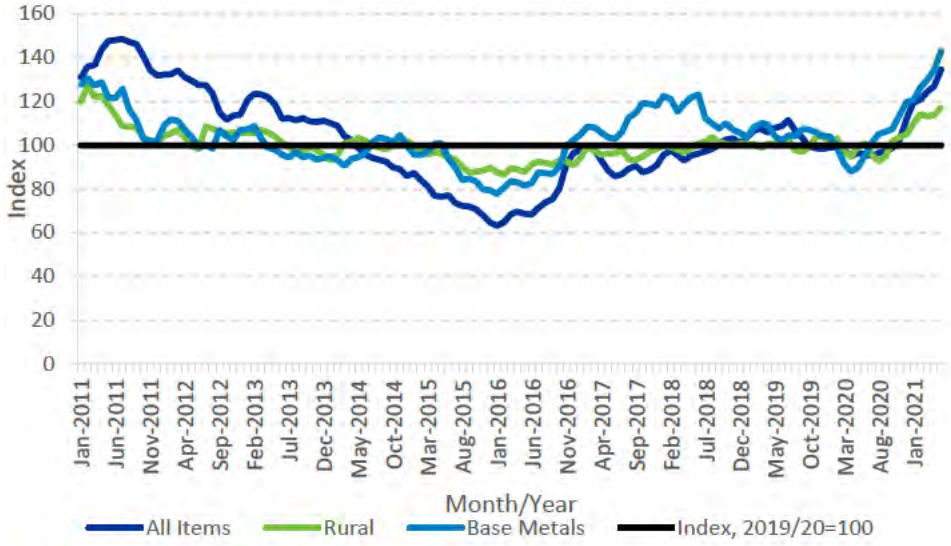
The Townsville regional economy has a material reliance on commodity exports; most notably base metals and agriculture (most significantly beef). This reliance comes from the Townsville region being the major service hub for the Northern Economic Triangle, which has significant base metals, mining, and agricultural activities. Townsville itself is host to several minerals and metal processing operations (e.g., Yabulu Nickel Refinery and Sun Metals Zinc Refinery) and animal processing (JB Swift abattoir). Major processing operations have extensive supply chains. Hence, a downturn in the operations of these major enterprises can have flow-on effects through their supply chains.

As such, fluctuations in commodity prices will have the potential to significantly influence the economic prosperity of the Townsville region. The Reserve Bank of Australia publishes a commodity price index, which tracks changes in commodity prices over time.

Figure 4-3 below shows that commodity prices generally (All Items) experienced a generally upward trend from 2016 onwards, although there was a drop in the index in 2017 and 2019. Post 2021, the All Items index has shown a steady increase. This is in stark contrast to trends observed between 2011 and 2016, where the All Items index followed a steady decline. As at May 2021, the All Items index is still below the levels observed in mid-2011.

Townsville's exposure to commodity prices is largely related to base metals and agriculture. While agricultural commodity prices have broadly followed the All Items (average) index from 2017 onwards, the base metals index followed a different path between 2017 and 2019. As at May 2021, base metals commodity prices are at a historical high (based on the assessment timeframe). Meanwhile, rural commodity prices are still below levels observed in early 2011 and the commodity prices for All Items (average) has almost recovered to levels observed in mid-2011.

Figure 4-3 Commodity prices indices, January 2011 to May 2021 (in SDR terms[4])



Source: RBA (2021), Index of Commodity Prices, Reserve Bank of Australia, Sydney

4.4 Employment projections

4.4.1 Purpose

This section details employment projections for the Townsville SA4 and Townsville LGA, which represent a key input into the assessment of industrial floor space demand.

Employment projections throughout this section have been derived based on the Queensland Government Statistician's Office (QGSO) employment projections. However, these employment projections are only available at the SA4 level and are not published at the local government area or SA2 level. As such, employment projections for the Townsville LGA as of the last two Censuses have been rebased to align with Townsville SA4 employment projections. However, to establish employment projections for the Townsville LGA, several assumptions have been made regarding the proportion of employment in the Townsville SA4 attributable to the Townsville LGA. These assumptions include an assessment of the working population, built form and major economic activities in the region.

Additionally, QGSO employment projections for the Townsville SA4 are published at the single digit ANZSIC[5] level. To ensure a comprehensive analysis of the Townsville SA4, and subsequently the Townsville LGA workforce, these projections have been disaggregated to the two-digit ANZSIC level based on historic workforce growth by industry.

4.4.2 Townsville SA4

Queensland Government Statistician's Office (QGSO) undertook employment projections for Queensland for five-year intervals to 2041 at the local government area level for SEQ and at the SA4 level for the remainder of Queensland. This assessment found that in the 2016 to 2041 period, the number of employed persons in the Townsville SA4 is anticipated to increase from 116,404 persons in 2016 to 168,523 persons in 2041, or by 1.5% per annum. At the single-digit level, employment growth in the Townsville SA4 is anticipated to be highest in the following sectors:

[4] SDR-Special Drawing Right. Used as an international reserve asset to settle transactions between countries and help balance international liquidity. The value of the SDR is calculated by the International Monetary Fund (IMF) on the basis of a weighted basket of four currencies: US dollar; euro; Japanese yen; and UK pound. The IMF publishes the value of the SDR each day in terms of US dollars and the Reserve Bank of Australia provides an equivalent value in Australian Dollars.
[5] Australian and New Zealand Standard Industrial Classification

- Rental, Hiring and Real Estate Services: anticipated to increase at a rate of 3.0% per annum over the projection period, growing from 1,427 workers in 2016 to 2,973 workers in 2041.
- Professional, Scientific and Technical Services: anticipated to increase from 5,263 workers in 2016 to 10,303 workers in 2041, representing an average annual growth rate in the order of 2.7% between 2016 and 2041.
- Electricity, Gas, Water and Waste Services: increase from 1,465 workers in 2016 to 2,786 workers in 2041, or at an average annual growth rate of 2.6% per annum.

4.4.3 Townsville LGA

In preparing employment projections for the Townsville LGA, the following approach has been utilised:

- Working population employment by industry as a share of the Townsville SA4 employment in the Townsville LGA is anticipated to increase at the same rate recorded between 2011 and 2016 in the 2016 to 2026 period (e.g. if agriculture employment within the Townsville LGA as a share of the total Townsville SA4 employment increased by 6.2% points between 2011 and 2016, then it is assumed agriculture will grow at this rate between 2016 and 2026). Where appropriate, adjustments have been made to reflect that certain events between 2011 and 2016 represented one time shocks to the Townsville economy to avoid results being skewed in the projection series (e.g. closure of the Yabulu Nickel refinery, Aurizon job cuts).
- From 2026, working population employment by industry as a share of the Townsville SA4 employment within the Townsville LGA is anticipated to continue to increase, but at a slower rate relative to the 2016 to 2026 period.

To disaggregate to the two-digit ANZSIC level, consideration was given to the two-digit ANZSIC employment estimates as of the 2011 and 2016 Census for the Townsville LGA. In undertaking employment projections at the two-digit level, two-digit employment by industry share is anticipated to increase at the same rate recorded between 2011 and 2016 in the 2016 to 2026 period. Employment by industry share is anticipated to gradually increase at a slower rate from 2026 onwards.

The working population of the Townsville LGA, based on the two previous Censuses, totalled 71,161 workers in 2011 and 78,931 workers in 2016. Based on this, total employment in the Townsville LGA accounted for 81.3% and 83.2% of total employment within the Townsville SA4 as of the 2011 and 2016 Censuses respectively.

The Townsville LGA proportion was then applied to the Townsville SA4 QGSO employment projections. Based on this, total employment within the Townsville LGA was 92,107 workers in 2011 and 96,744 workers in 2016. The most significant one-digit ANZSIC sectors (in terms of proportion of total employment in the Townsville SA4) were:

- **Information Media and Telecommunications**: 92.7% and 94.8% of employment in Townsville SA4 in 2011 and 2016 (1,288 employed persons in 2011, increasing to 1,306 employed persons in 2016).
- **Arts and Recreation Services**: 92.9% and 92.1% of employment in Townsville SA4 in 2011 and 2016 (1,246 employed persons in 2011, increasing to 1,235 employed persons in 2016).
- **Public Administration and Safety**: 89.7% and 91.6% of employment in Townsville SA4 in 2011 and 2016 (11,515 employed persons in 2011, increasing to 12,333 employed persons in 2016).

Employment estimates calculated using the above methodology have also been rebased to reflect the 2020 National Institute of Economic and Industry Research (NIEIR) estimated employment in the Townsville LGA at the two-digit ANZSIC level.

As such, the working population of the Townsville LGA is anticipated to increase from 98,018 workers in 2020, reaching 143,164 workers by 2041. This increase represents an average annual growth rate in the order of 1.8% per annum over the projection period.

Based on single-digit ANZSIC categories, employment growth (with respect to the number of workers) is anticipated to be most significant in the following industries:

- **Manufacturing**: anticipated to increase at a rate of 3.2% per annum over the projection period, growing from 5,756 workers in 2020 to 11,144 workers in 2041.

- **Agriculture, forestry and fishing**: anticipated to increase from 816 workers in 2020 to 1,493 workers in 2041, representing an average annual growth rate in the order of 2.9% between 2016 and 2041.
- **Mining**: increase from 1,191 workers in 2020 to 2,176 workers in 2041, or at an average annual growth rate of 2.9% per annum.

Table 4-3 reports employment projections by single-digit ANZSIC category for Townsville City Council between 2016 and 2041.

Table 4-3 Employment Projections by Industry – Townsville City Council, 2016 to 2041

Industry sector	2019-20	2020-21	2025-26	2030-31	2035-36	2040-41	AAGR (%)
Agriculture, Forestry and Fishing	816	862	1,090	1,290	1,419	1,493	2.9%
Mining	1,191	1,185	1,369	1,619	1,895	2,176	2.9%
Manufacturing	5,756	5,674	7,408	8,401	9,668	11,144	3.2%
Electricity, Gas, Water and Waste Services	1,437	1,467	1,685	2,024	2,338	2,588	2.8%
Construction	7,912	8,275	9,351	10,052	10,559	10,936	1.6%
Wholesale Trade	2,899	2,924	3,032	3,148	3,261	3,378	0.7%
Retail Trade	9,672	9,735	9,979	10,147	10,196	10,110	0.2%
Accommodation and Food Services	6,835	6,963	7,617	8,225	8,750	9,167	1.4%
Transport, Postal and Warehousing	4,959	5,049	5,387	5,725	5,997	6,236	1.1%
Information Media and Telecommunications	2,209	2,236	2,432	2,611	2,756	2,898	1.3%
Financial and Insurance Services	1,685	1,677	1,580	1,545	1,619	1,736	0.1%
Rental, Hiring and Real Estate Services	1,503	1,562	1,842	2,138	2,426	2,743	2.9%
Professional, Scientific and Technical Services	4,527	4,673	5,359	6,087	6,835	7,722	2.6%
Administrative and Support Services	2,934	2,995	3,419	3,881	4,357	4,891	2.5%
Public Administration and Safety	11,956	12,155	13,388	14,640	15,871	17,016	1.7%
Education and Training	9,358	9,587	10,911	12,298	13,598	14,737	2.2%
Health Care and Social Assistance	16,409	16,843	19,264	21,826	24,355	26,679	2.3%
Arts and Recreation Services	2,330	2,347	2,430	2,534	2,662	2,799	0.9%
Other Services	3,631	3,704	4,006	4,296	4,535	4,716	1.3%
Total persons employed	**98,019**	**99,913**	**111,548**	**122,487**	**133,096**	**143,164**	**1.8%**

Source: QGSO Employment Projections by Region (2014) and CDM Smith Analysis (2021)

4.5 Projected industrial land demand

This chapter of the report estimates the future demand for industrial demand within Townsville LGA under three alternative approaches, these being:

- **Per capita ratios**: This represents a simple method of applying an assumed land take-up rate per 1,000 persons. This method is not an appropriate approach to be used on its own but does provide context to other estimates.
- **Forward projection of historical take-up rates**: This approach takes into consideration past performance in assuming likely future performance.
- **Employment projection-based approach**: This approach estimates future industrial land demand, based on projected employment in industrial sectors (at the two digit ANZSIC level) and assumed employment density ratios.

Industrial land demand in this section is detailed in terms of net and gross industrial land demand. Where net industrial land demand represents allotment demand. Gross industrial land demand represents allotment demand plus an allowance for roads, service corridors and buffers. The requirement for roads and service reserves varies between regions and type of land use. The Department of Business, Industry and Regional Development's (DBIRD)[6] information paper on *Establishing Future Business and Industry Land Requirements and Identifying Strategically Important Sites* indicates that industrial areas require the equivalent of between 5% and 10% of total allotment area for the provision of road and service corridors, and the equivalent of between 30% and 40% of total allotment area for open space and buffers[7].

4.6 Previous industrial land demand studies

The Lansdown Opportunities Assessment Masterplan and Infrastructure Strategy, prepared by Ranbury on behalf of the Department of State Development in 2017, refers to two Industrial Land Demand Studies prepared for Townsville City Council, namely:

- Townsville Industrial Land Demand Study – AEC Group – May 2008.
- Townsville Industrial Land Use Study – Arup – April 2011.

The Townsville Industrial Land Demand Study as prepared by AEC Group in 2008 adopted a per capita approach to industrial land demand based on a heavy industrial land requirement of 190.3 square metres per capita. AEC Group used low, medium and high population growth scenarios in order to determine a lower, middle and upper projected demand for heavy industrial land. This calculation yielded a cumulative additional heavy industrial land demand of between 670 hectares (low population scenario) and 1,500 hectares (high population growth scenario).

[6] The Department of Business, Industry and Regional Development was a predecessor to the Department of State Development, Manufacturing, Infrastructure and Planning
[7] Consultations with the Department of Infrastructure & Planning's Industrial Land Planning Group

Table 4-4 summarises the results of AEC Group's industrial land demand assessment for Townsville (published in 2008) and also calculates the growth in population anticipated by AEC Group based on the heavy industrial land requirement of 190.3 square metres per capita.

Table 4-4 Additional Heavy (on 2006 levels) Industrial Land Demand – Townsville City, AEC Group, 2006 to 2026

	2006	2011	2016	2021	2026
Additional Industrial Land Demand (ha)					
Low Population Growth	-	240	410	540	670
Medium Population Growth	-	340	620	840	1,070
High Population Growth	-	420	810	1,150	1,500
Derived Population Growth					
Low Population Growth	-	12,612	21,545	28,376	35,208
Medium Population Growth	-	17,867	32,580	44,141	56,227
High Population Growth	-	22,070	42,564	60,431	78,823

Note: these estimates do not include any contingency for roads, waterway and other infrastructure required for industrial developments. These estimates represent allotment size only.
Source: AEC Group (2008)

As of May 2008, AEC Group were under the assumption that the population of the Townsville LGA would increase by at least 35,208 persons between 2006 and 2026. However, it is likely that this assessment (and the assumptions used throughout the assessment) was formulated before the impacts of the global financial crisis were fully realised in regional Queensland.

ERP data published by the Australian Bureau of Statistics (2020) details that the actual population growth in the Townsville LGA, between 2006 and 2011, was approximately 20,632 new residents. Compared to projections from AEC Group, the growth over this period would fall between the medium and high growth population scenarios. However, in the 2011 and 2016 period, population growth in the Townsville LGA slowed significantly. Actual population growth in the Townville LGA between 2006 and 2016 reached 31,866 new residents to the region, which is lower than the medium population projections from AEC Group, but remains above the low population growth scenario.

Additionally, the ERP published for 2020, demonstrates that between 2016 and 2020 population growth in the Townsville LGA has only reached 5,452 additional residents (or 1,363 per annum). If this growth trend continues to 2021, the total growth in the Townsville LGA between 2006 and 2021 would be 38,681 additional residents. This estimate is above the low population growth scenario from AEC Group's industrial land demand calculations, but almost 20.0% less than the medium population growth scenario.

Table 4-5 details the variance between the population growth scenarios derived from AEC Group's addition heavy industrial land demand projections and the actual growth in population for the Townsville LGA between 2006 and 2021.

Table 4-5 Comparison of Actual Population Growth and Projected Population Growth – Townsville LGA, AEC Group, 2006 to 2021

	2006	2011	2016	2020	2021 -Est.
Actual Population Growth (on 2006 levels)	0	20,632	31,866	37,318	38,681
Derived Population Growth AEC Group					
Low Population Growth	0	12,612	21,545	27,010	28,376
Medium Population Growth	0	17,867	32,580	41,829	44,141
High Population Growth	0	22,070	42,564	56,858	60,431
Variance					
Low Population Growth	0	8,020	10,321	10,308	10,305
Medium Population Growth	0	2,765	-714	-4,511	-5,460
High Population Growth	0	-1,438	-10,698	-19,540	-21,750

Note: negative variances mean actual population growth in Townsville City was lower than estimated by AEC Group in 2008. AEC Group (2008) did not provide 2020 population estimates as such the 2020 figure has been interpolated.
Source: AEC Group (2008) and Australian Bureau of Statistics (2020)

The main implication of the divergence between estimates and actual population growth is the resulting shift in industrial land demand projections. For example, under the high population growth scenario (and assuming 190.3 square metres per hectare), the actual additional demand for heavy industry industrial land would be in the order of 736 hectares by 2021, as opposed to the 1,150 additional hectares anticipated by AEC Group over the 2006 to 2021 period.

The difficult nature of estimating population growth in regional Queensland means that deviation between estimates and actual growth is common. However, the second report referred to in Ranbury's Lansdown Opportunities Assessment Masterplan and Infrastructure Strategy, published by Arup in 2011 has adopted AEC Group's estimates for the high population growth scenario in order to inform their scenario testing (i.e., an assumed additional heavy industry industrial land demand of 1,500 hectares by 2026).

Overall, ARUP's scenario testing revealed the following key points:

- Townsville City is in immediate need of 1,500 hectares of heavy industry land, and it appears there is little to none currently available.
- ARUP recommends an additional 606 hectares of land be made available for industrial development to ensure adequate supply past 2026, in addition to a further investigation into 2,020 hectares around the Bohle and Black River Areas.
- Applying a 50.0% loss factor to raw land supplies to account for a more conservative land supply figure requires an additional 3,368 hectares of industrial land (2,160 hectares of heavy industry and 1,208 hectares of general industry).

Overall, ARUP's methodology appears sound, however, it is based on grossly inflated estimates of population growth in Townsville City between the 2006 to 2026 period. The estimates detailed in ARUP's report were then used to inform Ranbury's Lansdown Opportunities Assessment Masterplan and Infrastructure Strategy (2017), which states that the net area required for high impact industrial land in the City totals 1,504.6 hectares as of 2026 (net of any area required for infrastructure). Ranbury makes an allowance of 45.0% of industrial land will be required to facilitate roads, waterways, and other essential infrastructure. As such, this increases the gross industrial land demanded to 2,190.5 hectares as of 2026.Table 4-6 below details Ranbury's net and gross industrial land demand estimates based on AEC Group's original industrial land demand projections from 2008 and ARUP's 2011 Industrial Land Use Study.

Table 4-6 Additional Industrial Land Demand (Ha) – Townsville LGA, Ranbury, 2006-2026

	Gross Area	Net Area
High Impact Industry Zone	1,475	1,043
Medium Impact Industry Zone	336	269
Rural Zone	377	197
Total Gross and Net Developable Area	**2,188**	**1,509**

Source: Ranbury (2017), ARUP (2011) and AEC Group (2008)

The gross industrial land demand as of 2026 under the Ranbury estimates were significantly higher than the gross industrial land demand detailed in Section 5. Ranbury's estimates anticipated that between 2006 and 2026, total industrial land demand would be in the order of 2,188 hectares or 109.4 hectares per annum over the projection horizon. This is significantly higher than all three industrial land demand projections from Section 5. Based on a projection timeline of 2020 to 2041, the annual industrial land demand for the Townsville LGA is anticipated to be between 5.6 hectares per annum (per capita approach) and 15.2 hectares per annum (employment-based demand).

The highest industrial land demand estimates for the Townsville LGA detailed that employment in the service industries would be a significant driver of demand, equating to 15.2 hectares per annum (on average) between 2020 and 2026. Despite this being the largest annual demand estimate detailed in this report, it remains more than seven times lower than the estimated average annual take-up detailed in the Ranbury Report. Table 4-7 compares the industrial land demand estimates as average annual values from Ranbury's 2017 estimates based on AEC Group's original industrial land demand projections for 2026 to CDM Smith's assessment of industrial land demand as detailed in Section 5 of this report.

Table 4-7 Comparison of Gross Incremental Industrial Land Demand – Townsville LGA, CDM Smith Analysis and Ranbury, 2026

	Per Annum Demand Over Projection Period
Ranbury	109.4
Per Capita	
2.2ha / 1,000 persons	5.6
3.0ha / 1,000 persons	7.6
4.0ha / 1,000 persons	10.2
Historic Take up Based	
One-year average	4.8
Three-year average	5.6
Five-year average	10.5
Ten-year average	11.0
Employment Based	
TOTAL	15.2

Source: Ranbury (2017), ARUP (2011) and CDM Smith Analysis

Based on the estimates and projections undertaken by AEC Group and adopted by Ranbury, the Townsville LGA should have seen 1,150 hectares of take up between 2006 and 2021, but this has not eventuated. If this projected take-up did not occur due to supply constraints, we should have seen significant increase in industrial land price within the Townsville LGA.

4.7 Implications

The Townsville LGA economy and the broader region (Townsville SA4) appear to have recovered and strengthened post 2017, with:

- unemployment rates falling; and
- the All Items, rural and base metals indices recovering to or exceeding previous peaks.

Despite some softening in dwelling approval activity between 2014 and 2018, dwelling approval activity has increased in 2020. Contrastingly, non-residential building approvals have declined in 2020 in the Townsville LGA and Townsville SA4, with non-residential building activity appearing to lag behind dwelling approval activity for both regions. From this economic assessment, it is clear that most population driven demand in the Townsville LGA is for low and medium impact type activities, of which there appears generous provision. High impact regional industry areas limited to Yabulu, SDA and the LEIP. Of these, the LEIP has the most developable land, at reasonable cost suitable for industries that don't need proximity to the Port of Townsville.

Take up of land within LEIP is unlikely to be greatly influenced by local population driven industry demand. Demand for industries of the nature and scale envisaged within the LEIP will be more dependent on regional, national, and global trends, particularly those aligning with Townsville's comparative advantages and economic development initiatives. Demand will also be influenced by the initiatives of State government, such as the waste reduction strategy, hydrogen strategy and bio-futures strategy. While the LEIP can cater for a wide range of these industry opportunities, it is difficult to determine actual annual take up rates. However, it only takes one or two industry proponents to consume a very large supply of industrial land, highlighting the need for early identification of site opportunities and planning for these industries.

5. Constraints, Dependencies, and Risk Analysis

5.1 Summary of constraints, dependencies and risks

To identify the constraints, dependencies and risks associated with the provision and staging of infrastructure and land uses for the LEIP, a review of regulatory requirements, planning and environmental assessment, infrastructure assessment and risk analysis was undertaken. The detail and purpose of these assessments is summarised in Table 5-1.

Table 5-1 Summary of constraints, dependencies, and risk analysis

Assessment	Detail	Purpose	Implications
Planning opportunities and constraints analysis	Regulatory review.	Considers Townsville City Plan and LGIP requirements and possible approval conditions that may constrain development within the LEIP, identify development aspects that may impact staging.	Identifies constraints to provision of infrastructure from the LGIP. Provides input into staging. Identifies potential planning scheme amendments to Townsville City Plan (e.g., catchment characteristics). Identifies elements that may require additional site investigations or stakeholder/ state agency engagement.
	Site suitability and identification of potential development areas.	Considers the opportunities available for industrial development on unallocated land whether consistent with current Townsville City Plan requirements or not.	Identification of additional potentially developable land. Identifies an updated and fit for purpose constraint overlay.
Infrastructure opportunities and constraints analysis	Review of current infrastructure capacity and future requirements for sustainable development of the LEIP.	Considers network providers current strategic planning intentions. Considers existing infrastructure capacity and potential constraints to upgrade. Considers nature of proponent and industry infrastructure requirements.	Identifies infrastructure thresholds and trigger points for programmed or required network augmentation. Identifies the nature and timing of enabling and early infrastructure and integration with existing infrastructure assets.
Risk analysis	Analysis of risks that may impact the development feasibility of the LEIP.	Summarises risks from the planning and infrastructure assessments and identified mitigation and management measures. Targeted engagement with agencies captures available information on existing and proposed infrastructure networks relevant to the LEIP.	Identifies inherent risks which will need to be managed associated with the development of the LEIP regarding planning, environmental impact, infrastructure provision and staging. Identifies possible management and mitigation measures for inclusion in the Master Plan.

5.2 Planning opportunities and constraints analysis

5.2.1 Regulatory review

5.2.1.1 Scope of review

A review of applicable local, regional, and State planning policies has been undertaken to establish the framework which guides infrastructure in the region and locally. The North Queensland Regional Plan and State Planning Policy (SPP) together with the Townsville City Plan were considered in this review.

This section provides comment on the planning context relevant to development of the LEIP. A review of the existing statutory planning matters identifies elements that:

- impact the development potential of the LEIP; and
- potentially require additional site investigations or stakeholder/ state agency engagement.

The Queensland planning system is framed by the *Planning Act 2016* (Planning Act) and the subordinate *Planning Regulation 2017* (Planning Regulation). The legislation establishes the framework of planning instruments that support the planning system. The framework and components relevant to the LEIP as discussed below.

5.2.1.2 Planning Act 2016

The *Planning Act 2016* is Queensland's principal planning legislation and comprises of three main elements: plan making, development assessment and dispute resolution. The Planning Act recognises two state planning instruments:

- State Planning Policy (SPP).
- Regional plans.

The Planning Act also recognises three statutory local planning instruments:

- Planning schemes.
- Temporary local planning instruments.
- Planning scheme policies.

The Planning Act also provides supporting statutory instruments, these include:

- Minister's Guidelines and Rules.
- Development Assessment Rules.
- State Development Assessment Provisions.

5.2.1.3 State Planning Policy

The SPP is a state planning statutory instrument developed by the Queensland Government to detail matters of state interest in land use planning which enables development, protects our natural environment, and allows communities to grow and prosper. The SPP promotes state interests through plan making. A state interest is defined under the Planning Act as an interest that the Planning Minister considers:

- Affects an economic or environmental interest of the state or a part of the state; and
- Affects the interest of ensuring that the purpose of the Act is achieved.

Under the Planning Act, each local government planning scheme needs to set out integrated state, regional and local planning and development assessment policies for an entire local government area. The SPP supports this by setting down the state interests that apply to plan making, and that should be given effect through each local government planning scheme. The SPP outlines 17 state interests, arranged under five broad themes. The following assessment addressed the State interests relevant to the LEIP including the following:

- Agriculture.
- Biodiversity.
- Water Quality.
- Emissions and Hazardous Activities (High Pressure Gas Pipeline).
- Natural Hazards and Resilience.
- Energy and Water Supply.
- Transport infrastructure.

State Interest – Agriculture

This area of interest addresses the conservation of Important Agricultural Areas (IAA) and land containing Agricultural Land Classification (ALC) - Class A and Class B. The LEIP is mapped as ALC - Class A and Class B. ALC Class A and ALC Class B land is considered the most productive agricultural land in Queensland, with soil and land characteristics that allow successful crop and pasture production.

The SPP recommends supporting the long-term viability of agriculture, enabling increased agricultural production by avoiding locating non-agricultural development on or adjacent to ALC land.

Any development in these mapped areas should include measures to manage potential adverse impacts on and adjacent agricultural land. Matters to be considered include stormwater run-off and the movement of sediments, pollutants and other contaminants. Consideration must also be made regarding impacts of development on road networks, major freight routes and points of departure for interstate markets.

State Interest – Biodiversity

This area of interest ensures that matters of environmental significance are valued and protected, and the health and resilience of biodiversity is maintained or enhanced to support ecological integrity.

The following Matters of State Environmental Significance (MSES) affects the LEIP:

- MSES – Wildlife habitat (endangered or vulnerable).
- MSES – Wildlife habitat (special least concern animal).
- MSES – Regulated vegetation (Category R).
- MSES – Regulated vegetation (essential habitat).
- MSES – Regulated vegetation (intersecting a watercourse).
- MSES – Regulated vegetation (wetland).
- MSES – Regulated vegetation (intersecting a watercourse).
- MSES – High ecological significance wetlands.

The SPP employs a ‘maintain and enhance’ approach to managing MSES values. The SPP advises that development should not proceed in areas mapped as MSES until a site investigation establishes what values are present on the LEIP. Where values are confirmed as present on the LEIP, the SPP requires that development maintains or enhances these values through minimising potential impacts on these values.

Where development does occur, and offsets are required for MSES, they will be administrated by the State government and they must be in accordance with the *Environmental Offsets Act 2014.*

State Interest - Water quality

Development in areas not connected to municipal sewerage systems has the potential to discharge wastewater to waterways if not appropriately managed. This area of interest ensures the environmental values and quality of Queensland waters are protected and enhanced. The SPP ensures that development:

- with the potential to harm water quality is triggered for assessment against relevant water quality codes;
- is located in areas without environmental constraints such as high-risk soils, high groundwater tables, groundwater dependent ecosystems, natural drainage lines and steep slopes;
- responds sympathetically to topography rather than significantly modifying the landscape, and will generally deliver better water quality outcomes; and
- maintains natural drainage lines to convey stormwater also delivers water quality benefits.

State Interest – Emissions and hazardous activities

This area of interest ensures that community health and safety, sensitive land uses, and the natural environment are protected from potential adverse impacts of emissions and hazardous activities, while ensuring the long-term viability of industrial development, and sport and recreation activities.

A high-pressure gas pipeline runs north south along the Flinders Highway. Any development in the LEIP must locate industrial land uses in areas that avoid, mitigate, and manage the adverse impacts of emissions on sensitive land uses. This can include but is not limited to management plans, buffer zones and design requirements.

State Interest – Natural hazards, risk and resilience: bushfire, flood

This area of interest ensures the risks associated with natural hazards are avoided or mitigated to protect people and property and enhance the community's resilience to natural hazards. Development should employ adequate risk management plans and mitigation measures to avoid loss of function and access during and after a natural hazard event. The development must also directly, indirectly and cumulatively avoid an increase in the severity of the natural hazard and the potential for damage on the LEIP or to other properties.

- **Flood**

  The LEIP is affected by the Flood hazard area - Level 1 - Queensland floodplain assessment overlay. The SPP requirements for flood are triggered by the flood mapping contained within that local government's planning scheme.

- **Bushfire**

  The LEIP is also affected by all levels of bushfire hazard, including High Potential Bushfire Intensity and Medium Potential Bushfire Intensity. The SPP requirements for bushfire are triggered by mapping contained within that local government's planning scheme.

State Interest – Energy and water supply

Major electricity infrastructure (Energy Queensland) runs north-south along the Flinders Highway. An electricity substation (Energy Queensland) is located in proximity to the Woodstock Train Station.

This area of interest ensures that planning timely, safe, affordable and reliable provision and operation of electricity and water supply infrastructure. A strong and resilient network of electricity and water supply underpins the standard of living and economic development in Queensland. The reliability and operational integrity of major electricity infrastructure must be maintained. The function and access to this infrastructure must be maintained by any future development.

State Interest – State transport infrastructure

This area of interest ensures that planning enables the safe and efficient movement of people and goods across Queensland and encourages land use patterns that support sustainable transport. The following transport infrastructure is identified in and within proximity to the LEIP:

- The Flinders Highway and Woodstock-Giru Road are State Controlled Roads.
- Railway corridor.

These existing corridors should be protected from development that may adversely affect the safety and efficiency of the infrastructure, corridors and networks.

5.2.1.4 North Queensland Regional Plan 2020

The LEIP is located within the North Queensland Regional Plan 2020 (the Regional Plan). The Regional Plan covers the local government areas of Townsville, Burdekin, Charters Towers, Hinchinbrook, and Palm Island.

The Regional Plan notes that '*there is an opportunity to activate new industrial land south of Townsville – the southern industrial corridor along the Flinders Highway at Woodstock (Lansdown)*' (DSDMIP 2020). The Regional Plan, regarding the Townsville City Deal notes a commitment for a Woodstock Intersection Upgrade, to capitalise on an initiative for an industry powerhouse for the north.

5.2.1.5 Townsville City Plan 2014

The LEIP is located within the Townsville LGA, regulated by the Townsville City Plan (Amendment Package 2020/03) sets out the vision for how Townsville should grow over the next 25 years, and is the Townsville City Council's key document for determining development applications. The Townsville City Plan regulates development in the region.

The LEIP is partly located in the Lansdown high impact industry precinct, which is a precinct which is included in the High Impact Industry Zone. As per Part 6, Section 6.5.3 (4) of the Townsville City Plan:

- *The purpose of the zone will also be achieved through the following additional overall outcomes for particular precincts:*
    - *Lansdown high impact industry precinct:*
        - *medium and high impact industrial uses are accommodated in this precinct;*
        - *development provides adequate new infrastructure to support new uses, including roads, stormwater, water and sewer infrastructure; Editor's note - Conditions of approval or infrastructure agreements will be used (as appropriate) to ensure that infrastructure is provided.*
        - *development is avoided in environmental corridors and the water resource catchment area to maintain ecological processes, biodiversity values and the quality of waterways;*
        - *development avoids impacts on groundwater;*
        - *development provides strong landscape amenity to all boundaries fronting a road and land external to the zone;*
        - *development minimises impacts on surrounding land uses, including existing sensitive land uses; and*
        - *development does not compromise petroleum pipeline infrastructure, and the risks and hazards to people and property associated with petroleum* pipeline infrastructure are not further increased through development.

Performance outcomes (POs) specific to the Lansdown High Impact Industry Precinct are provided in 6.5.3.3 of the Townsville City Plan and include –

- *PO17: Development areas are to be created generally in accordance with Figure - 6.164 Lansdown concept plan.*

- *PO18: To maintain the natural environmental values ecological processes and the quality of waterways development does not establish within the areas identified as 'environmental corridors' and 'water resource catchment area' as shown on Figure - 6.164 Lansdown concept plan.*
- *PO19: Development does not discharge wastewater into the Ross River Dam catchment.*

  Editor's note - Applicants should also refer to the Healthy waters code, and the Natural assets overlay code and Water catchment overlay code for additional requirements regarding water and waterway related matters.
- *P020: Development is supported by adequate infrastructure, including:*
  - *connection to reticulated water and sewerage networks;*
  - *provision of stormwater quality and quantity management systems;*
  - *constructed roads; and*
  - *on-site water quality treatment infrastructure or water detention basins located outside environmental corridors.*

    Editor's note - Applicants should also have regard to Section 9.3.7 Works code and Section 9.3.2 Healthy waters code.
- *PO21: Development does not:*
  - *affect the long-term operation of a high-pressure gas pipeline; and*
  - *adversely impact the safety of people and property.*
- *PO22: Development protects the water quality, ecological values, hydrological processes and other environmental values of any surface water or groundwater.*
- *PO23: Landscaping is provided to mitigate the visual impact of development and screen unsightly components and creates streetscapes which contribute positively to the city image, particularly along roads and land in another zone.*

  Editor's Note – Applicants will need to address 9.3.3 Landscaping Code and SC6.4.3.6 Landscape Policy.
- *PO24: In addition to meeting PO5, development in the Lansdown high impact industry precinct maintains a high level of noise amenity for nearby rural zoned land and sensitive land uses.*

The LEIP is also affected by several planning overlays under the Townsville City Plan. The overlays are discussed below and will require consideration in planning for any future development.

- **OM-0.20 – Development Constraints Bushfire Hazard**

  There are patches of Medium Bushfire Hazard mapped over the LEIP. Development must maintain the safety of people and property, including the function of community infrastructure, during and immediately after bushfire events.
- **OM-04.1 – Cultural Heritage**

  The LEIP adjoins a heritage area and is also subject to a heritage area. Areas adjacent this heritage area will involve assessment of the merits of a proposal.
- **OM-05.0 Natural Areas Extract Resources**

  A mining lease is identified to be in close proximity of the LEIP. The Manton Quarry mining lease is outside of the LEIP and does not have a separation buffer but is to be identified on the plans for context.
- **OM-06.1 Development Constraints Flood Hazard**

  A high hazard area is identified in the LEIP. A recent Flood Study for LEIP has prepared by AECOM and is to be utilised instead of this overlay mapping.
- **OM-0.80 Natural Assets Environmental Importance**

Areas of high environmental importance are identified in the available land of the LEIP. These are generally associated with waterways which run through the LEIP.

- **OM-09.0 - Natural Assets Water Resource Catchments**

  The water resource catchment area – Ross River Dam is located to the north-west of the LEIP. The water resource catchment area is not reflective of on ground values evidenced by the flood model, and stormwater catchments based on the water shed on the land. It is recommended that this overlay map is excluded, and instead reliance is placed on the flood layer, and stormwater catchment layer.

- **OM-10.1 Infrastructure Road Noise Corridors**

  The LEIP is located to the east of Flinders Highway which falls within a Category 1, 2, 3 and 4 road noise corridors. Potential road or rail noise issues are not considered further as industrial uses are proposed and on-site mitigation measures can be adopted via development application assessment if required.

5.2.2 Site suitability and identification of development areas

5.2.2.1 Purpose

The purpose of this assessment is to optimise developable areas within the LEIP by reviewing the suitability of the LEIP based on a set of physical criteria, and mindful of the land requirements of the initial proponents. This assessment considers the possibility of a potential scheme amendment to include the LEIP Master Plan, which will require a Council resolution in respect of the planning scheme amendments and finalisation of the planning scheme amendments.

The assessment was used to identify additional potentially developable land that may be excluded from the Townsville City Plan and identify the suitability of different areas within the LEIP for different industrial land use types.

5.2.2.2 Criteria

The site suitability assessment is based on physical and environmental characteristics and high-level consideration of the ability to provide access for development. These characteristics were developed into criteria for use in a geographical information systems (GIS) site suitability model enabling the initial identification of those areas which may have greater suitability for industrial development.

The criteria used consider the amount of intervention likely to be required to 'unlock' the study area to enable development. This may involve the construction of new access roads, road upgrades, access to the highway (on/off ramps), connection to infrastructure or infrastructure upgrades and environmental approvals /permits /offsets.

For each of the criteria, a range of suitability (or "ratings") are assigned with a corresponding colour. The outcome of the assessment is a thematic 'traffic light map' highlighting the most developable land within each potential development area. Areas determined to be reasonably feasible for industrial development being primarily green and orange, were then grouped into potential development areas. Potential development areas are then subjected to a more detailed analysis with a second-sieve assessment, based on a separate set of criteria to further consider site feasibility and suitability for different industrial land use types. This is then used as the basis for the land use master planning. The criteria are summarised below and detailed in **Appendix B**.

Table 5-2 Sieve 1 assessment criteria

Criteria	Justification
Habitat	Loss or degradation of essential habitat for rare, vulnerable, and endangered species is minimised.
Vegetation	Avoid loss or degradation of significant vegetation that requires approval for "clearing" and provision of vegetation offsets. Considers detailed assessment findings from the previous Environmental Study[8], including ground truthing of vegetation value. Areas not considered to have high value may be included in potential development areas for lower impact or temporary uses e.g., solar panels.
Tenure	Excludes reserved land, easements and (any separation distance requirements). Major infrastructure corridors (easements) are considered highly constrained (HV power, gas) and may also require separation distances.
Mining	Ensures mining and exploration activities are not impacted on.
Slope	Minimise development cost and earthworks so that the risk of erosion and slope stability issues can be minimised. Ensure the LEIP is accessible and serviceable. Consideration of the Townsville City Plan.
Major Waterways	Impacts on waterways are minimised.
Flood	Avoid extensive areas that are subject to flooding.
Water Catchments	Avoid areas of high value catchment. Alternative uses of affected land may be identified (the water resource catchment area – Ross River is located to the west of the LEIP, this catchment boundary was amended from the Townsville City Plan catchment overlay to take account of the more detailed impact assessment.
Heritage	Preserve listed heritage sites.
Bushfire Hazard	Consider the Townsville City Plan Bushfire Risk Area Overlay.
Buffer to Sensitive Uses	Minimise amenity impacts from residential areas, community use areas and primary roads.

The assessment considered several amendments to constraints used in previous master planning studies, that had potential to provide additional uplift areas to the original land use plan[9], including:

- Consideration of detailed assessment findings from the previous Environmental Study[3], including ground truthing of vegetation value. The previous study found that the ground-truthed remnant vegetation and habitat areas patches had lower value than mapping suggested. As a result, these areas were included in potential development areas for the potential location of lower impact or temporary uses.
- This assessment recognises that some moderately constrained areas may have suitability for lower impact forms of development, consistent with some activities expected within an eco-industrial precinct, e.g., solar panels, biomass production etc. As a result, they were not ruled out of potential development areas.
- Lessening of the impact of the water resource Ross River Dam Catchment area located to the west of the LEIP. This catchment boundary was amended from that within the Townsville City Plan overlay having regard to the greater accuracy of the impact assessment which has been undertaken.
- This assessment provided a 25m buffer to waterways in accordance with the Townsville City Plan stream hierarchy – this was considered sufficient to incorporate associated vegetation.
- The Drive It NQ Development Approval was considered. The approved plans included minor development over mapped environmental overlay area. As a result, this area was included in the potentially developable area and it to manage environmental impacts over this area on-site.

[8] Earth Environmental, Lansdown Station Environmental Study: Final Report, June 2018
[9] GHD, Infrastructure, Traffic, Transport & Air Quality Integrated Master Plan Report, May 2019

5.2.2.3 Potential development areas

Table 5-3 shows the outcomes of the site suitability assessment. Figure 5-1 provides a summary of the model outputs for the LEIP and the area considered potentially developable, subject to more detailed assessments. For the purposes of this assessment, potentially developable areas have been assumed as land mapped as unconstrained and constrained, with those areas identified as highly constrained excluded.

The original area of land assessed as potentially developable in the previous master plan (GHD 2019[10]) was approximately 1902.4ha including proponent sites but excluding proposed road reserves.

Table 5-3 Site suitability assessment results

Source	Total area (ha)	Unconstrained (ha)	Constrained (ha)	Highly constrained (ha)	Total potentially developable area^ (ha)
LEIP	2056.5	836.5	791.1	428.9	1627.6
		1627.6			
LIE (GHD Master Plan)	2074.8	1419.9		654.9	1419.9
Additional potentially developable land /uplift from previous master plan					207.7

^Total potentially developable area equates to the combined area of constrained and unconstrained land. This area suggests that the land identified is potentially developable with some physical intervention. The type and amount of intervention required will vary.

[10] Infrastructure, Traffic, Transport & Air Quality Integrated Master Plan Report (GHD 2019)

Four Mile Creek
ROAD
Sandy Gully
One Mile Creek
ROWE ROAD
TRACK
Elphinstone
GHOST GUM ROAD
Gilliga n Creek
FLINDERS HIGHWAY
ROAD
TRACK
Lansdowne Creek
ROAD
BIDWILLI ROAD
Four Mile Creek
ROAD
TRACK
Wyoming
Two Mile Creek
TRACK
ROAD
Manton
MANTON QUARRY ROAD
UNCONSTRUCTED ROAD
ROAD
ROAD
Calcium
Double Barrel Creek (North Branch)
ROAD
TRACK
Double Barrel Creek (North Branch)
Double Barrel Creek
UNCONSTRUCTED ROAD
ROAD
ROAD
TRACK

DATA SOURCE
Data Provided By Townsville City Council
Base Imagery Sourced From ESRI ©

N

0 0.275 0.55
Kilometers

Scale @ A3 1:22,500
Date: 10/02/22
Drawn: Stuart B

Legend

- LEIP boundary
- Locations
- Railway
- Road
- Waterways

LEIP MCA Ranking

- Highly Constrained
- Moderately Constrained
- Minimally Cantrained

Figure 5-1
Constraint assessment results

calibre
CDM Smith

shoae P:\Project\1001100 - Landsdown\02 MXD\Report maps\Figure 5-1.mxd 26-Aug-21

5.3 Infrastructure Opportunities and Constraints Analysis

5.3.1 Transport infrastructure – Roads and Traffic

The LEIP provides access opportunities for multi-combination vehicles including Type 2 Road Trains up to 53.5m long via the Flinders Highway connecting Townsville to the Northern Territory via Hughenden, Richmond, Julia Creek, Cloncurry and Mount Isa. The Flinders Highway links the LEIP directly to the Port of Townsville and its import and export markets. A detailed description of the existing and future transport environment is provided in Section 3.1 of the AIP.

The LEIP provides an opportunity for railway connectivity to provide a critical import opportunity to bring primary product into Lansdown from northern Queensland for value-added services. Export of value-added product from the LEIP to the Port of Townsville is expected via road-based transport to minimise lead-time or lag-time delays from double-handling product.

The LEIP is located on the western side of the Great Northern Rail Line and therefore requires railway crossings to connect to the Flinders Highway and broader road transport network. There are currently four railway level crossings with passive control servicing the LEIP. Railway level crossings present a number of inherent safety risks and traffic efficiency constraints under passive control. The primary access is proposed via a grade separated crossing of the railway line at Ghost Gum Road and the LEIP will aim to progressively consolidate the number of railway level crossings in this area and upgrade railway level crossings to active control where appropriate in accordance with the DTMR, QR and Office of National Rail Safety Regulator (ONRSR) policy positions.

Other constraints associated with the location of the LEIP include the potential relocation of railway passing loops, short stacking between the Flinders Highway and Great Northern Rail Line and heavy vehicle restrictions on Woodstock Giru Road. A detailed description of the existing transport constraints is provided in Section 3.2 of the AIP.

5.3.2 Transport Infrastructure – Rail

Along the eastern edge of the LEIP is the Great Northern Rail Line. North of the LEIP an existing passing loop is located close to the existing Glenn Road at grade passive level crossing. Upgrades to the road network in the vicinity means the passing loop needs to be modified or relocated. The overall constraints for modification of the existing passing loop to allow enabling works at Jones Road level crossing and potential rail siding include the following:

- Railway line is crossed by 6 main flow paths.
- Embankment height is typically less than 1m, accept at waterway crossings.
- Existing passing loop is located close to the existing Glenn Road at grade passive level crossing.
- Glenn Road / Jones Road upgraded level crossing requires the passing loop to be modified or relocated.
- QR has indicated a minor shift in the passing loop has road traffic safety and has flooding issues.
- Relocating the passing loop to minimize conflicts with existing level crossings.
- The LEIP is approximately 45km from the Port of Townsville and as such is considered a short, if not mini, haul route. Rail transport is likely to have lower efficiency when compared to truck transport on shorter routes if the degree of double handing of cargo cannot be minimised.

There were several alternatives considered for the new passing loop (refer to AIP Chapter 4). Based on the AIP investigations it is considered that the QR 2021 passing loop starting south of Ghost Gum Road is the preferred solution. This passing loop location provides an opportunity for a Rail Siding and Intermodal Hub. Based on the initial proponents' needs and location within the LEIP, the rail siding is not identified as early enabling infrastructure works and is considered to be aspirational infrastructure.

5.3.3 Water Servicing

Due to the limited available water supply, there are two primary raw water supply options that are beneficial to support the demand requirement associated with the LEIP. This includes connection to the DN900 Haughton Pipeline and new intake pump station from Ross Dam.

The DN900 Haughton Pipeline, is a dedicated pipeline that transfers water from the Upper Haughton Irrigation Channel to Ross Dam as drought mitigation. The pipeline also includes multiple offtakes for irrigation and agricultural uses. The DN900 Haughton Pipeline is capable of conveying a maximum of 122 ML/day to Ross Dam and forms part of the drought resilience infrastructure for Townsville and its surrounds. The pipeline is situated 12.5km east of the LEIP and is the closest available general water source.

Ross Dam is the main body of water which supplies Townsville and has a maximum storage capacity of 233,000 ML. It is situated 25km north-west of the LEIP and has been identified as a potential alternative raw water supply to the DN900 Haughton Pipeline.

A detailed description of the water supply servicing consideration is provided in Section 5 of the AIP.

5.3.4 Wastewater

Due to no available facilities or wastewater network within 30km of the LEIP, it was considered that an on-site solution would be required. This onsite solution considered a centralised treatment facility with a single gravity catchment or split catchment to alleviate deep gravity sewers.

An alternative option are treatment plants which are owned and operated by each proponent within the LEIP. This would remove the need for large trunk infrastructure throughout the development as well as a centralised treatment facility requiring discharge licensing.

A detailed description of the existing and future wastewater servicing considerations is provided in Section 5 of the AIP.

5.3.5 Electrical Reticulation

The LEIP is proposed for the suburb of Calcium approximately 40km south of Townsville. The area is serviced by the Energy Queensland network via the Woodstock Substation located on Jones Road.

There is ample supply at the Woodstock Substation to supply the LEIP under Development Scenario A, but insufficient capacity for Development Scenario B. Scenario A estimates that land use will require up to 30kVA at Node (individual development site) to enable high impact industry to operate. Site demand larger than 30kVA requires a Wholesale Supply Agreement

The proposed development of the LEIP also introduces the opportunity for photovoltaic cells to produce solar energy to power development sites. This option is tied to the development of Edify Energy within the LEIP, which is being considered under Planning Scenario B. Powering the LEIP is constrained by the available spare capacity at the Woodstock Substation.

Alternative power supplies such as gas peaking stations, and solar energy may be able to replace or supplement power to the LEIP. However, each option will require further analysis to prove the concept is viable. Other points of supply include the Powerlink and Copper String 275kV transmission lines, pending feasible substations to transform voltage down to useable levels.

5.3.6 Gas Supply

Bulk gas supply is available to the LEIP via the NQGP, which is aligned with the eastern boundary of the LEIP. The NQGP, as the proprietor of wholesale gas nearest to the LEIP, is open to constructing a gas let-down station and micro-LNG facility that would be able to supply the LEIP with consumable LNG.

The primary requirement for this option is land acquisition for the facility. This option should be negotiated with the Townsville City Council as owner of the LEIP land, to ensure the needs of the LEIP are properly considered.

Demand for gas reticulation or alternative methods of supply are detailed in Section 8 of the AIP.

5.3.7 Telecommunications Infrastructure

The National Broadband Network (NBN Co.) is the Internet Provider of Last Resort (IPOL) in the Woodstock, Lansdown, and Manton areas. NBN Co. services these areas through a Fixed Wireless Array (FWA), which sends and receives information via microwave transmission towers.

NBN Co. advise that signals strength at microwave transmission towers is only guaranteed up to 8km from the base of the tower. As a result, the LEIP will not be covered by the FWA entirely. NBN Co. has advised that a direct satellite connection is the alternative point of supply for proponents located in areas not covered by the FWA.

NBN Co. does not operate an underground fibre network in the vicinity of the LEIP. However, there are other retail suppliers who could offer a fibre connection to proponents within the LEIP. Telstra and Nextgen both own and operate large diameter fibre cables located on the eastern boundary of the LEIP. Telstra and Nextgen have responded to service enquiries and confirm their availability to supply the LEIP.

Individual telecommunications needs should be negotiated by proponents directly with a retail suppler. The Townsville City Council, as the owner of the LEIP land, is only required to ensure at least one form of telecommunications network is available at the LEIP, which is the NBN Co. FWA.

5.4 Risk Analysis

A review of potential regulatory, environmental and infrastructure risks was undertaken for the LEIP. Refer to Table 5-4 for a brief analysis.

Refer to **Appendix C** for detail of rating system.

Table 5-4 Risk analysis

Risk Type	Risk / Consequence	Risk Matrix			Potential Mitigation Measures	Revised Rating
		Likelihood	Consequence	Rating		
Regulatory	Negatively impacting required external approvals for LEIP.	Possible	Moderate	Medium	• Ensure appropriate approvals and permits are in place.	Low
Regulatory	Breach of regulatory and compliance obligations.	Possible	Moderate	Medium	• Ensure appropriate approvals and permits are in place. • Implementation of approvals and condition register.	Low
Regulatory	Regulator intervention (show cause action or stop work intervention).	Possible	Moderate	Medium	• Ensure appropriate approvals and permits are in place.	Low
Environmental	Result in environmental harm as a result of the LEIP.	Possible	Major	Medium	• Implementation of approvals and condition register. • Ensure appropriate approvals and permits are in place. • Ensure appropriate ecological surveys are undertaken.	Low

Risk Type	Risk / Consequence	Risk Matrix			Potential Mitigation Measures	Revised Rating
		Likelihood	Consequence	Rating		
Environmental	Damage to environmental reputation as a result of the LEIP.	Possible	Major	Medium	• Liaison with relevant stakeholders. • Appropriate notification.	Low
Planning	New or unidentified site constraints: There may be some unexpected constraints identified during initial review phases which may change previous master planning assumptions	Possible	Major	High	• During the initial review phases, we will be seeking to determine all constraints whether identified or not in past studies, to address during our investigations. • Calibre will conduct an effective gap analysis of the principal supplied data and raise missing or partially missing information in the RFI Register in a timely manner. • Townsville City Council and CDM Smith will address land fragmentation from a planning standpoint. Land fragmentation is not conducive to larger-lot subdivisions as proposed by the Project.	Medium
Economic	Lower yield realisation after master planning and addressing constraints: Economic viability of any infrastructure depends on sufficient demand and timing of developments	Possible	Major	High	• Calibre Team will seek to provide a cash flow analysis and delivery strategy to address requirements of infrastructure and the expected development phasing over the 5-year horizons. • Separate yield out of risk matrix. Calibre can estimate developable area for advice of Townsville City Council (for prior data see GHD Report).	Low
Program	Project program delay due to approval processes: Delay in program can affect development timing in the LEIP and ongoing impact on employment potential.	Possible	Major	High	• Calibre Team has allowed specific approval assessment process as part of the AIP deliverable. This is to identify all approval processes required prior to detailed design commencing. • Calibre Team will raise approval items with relevant agencies. Townsville City Council will commence investigations into Aboriginal Cultural Heritage.	Low
Environmental	Flooding risks: The eastern edge of the LEIP includes significant downstream infrastructure, railway and highway. The key constraint of no adverse flood impact is to be addressed.	Possible	Moderate	Medium	• Specific flood instigation will be undertaken and consideration of flood mitigation measures or strategies, including flood detention basins will be investigated. • Details around immunity at railway and highway zones/crossings are lacking (ref. Baseline Flooding Assessment report). • Flood detention basins will be investigated by Calibre Team. Proponents may be required to detain and treat SWD on-site. GHD/Ranbury Report may have details.	Low

Risk Type	Risk / Consequence	Risk Matrix			Potential Mitigation Measures	Revised Rating
		Likelihood	Consequence	Rating		
Funding	**Delivery and funding of infrastructure not fairly apportioned between proponents, Townsville City Council and other parties causing delivery of infrastructure delays whilst issue is resolved.**	Unlikely	Major	Medium	• Calibre to prepare a detailed infrastructure delivery and funding strategy to ensure that the financial risk for all stakeholders is transparent.	Medium
Infrastructure	Infrastructure Risk Assessment and Mitigations are included in **Appendix C**.					

6. Scenario Development

6.1 Scenario Description and Rationale

To align with multiple purposes, several scenarios using different land use and infrastructure demand assumptions have been created. These include:

a. Current Planning Scheme (Townsville City Plan) and LGIP assumptions.

b. Current proponent variations.

c. Review of Current Planning Scheme and LGIP assumptions and current proponent variations.

The planning assumptions and infrastructure demand spreadsheet (**Appendix A**) relates the land use assumptions to demand rates and economic forecasting within the various scenarios to support differing purposes. The purpose and rationale for each assumption is outlined within the following table.

Table 6-1 Scenario description and rationale

Scenario	Purpose | Rationale	Assumptions	Main Outcomes
A	• Provides a base case set on the current Townsville City Plan framework. • The Townsville City Plan has allocated urban zones (HII and S&R) to the LEIP. • Development such as high impact industry, is code assessable, and if an application is compliant Townsville City Council must approve it. • Accordingly, the Townsville City Plan s.4.2 planning assumptions are utilised to inform demand.	• HII (broad-hectare) and S&R (broad-hectare) zoned land, less Natural Areas Environmental Overlay. • Exclude Rural Zone from demand i.e., do not assume to service residential demand. • Given Drive It NQ has a lease, assumes the S&R zoned land has been taken up. • Includes a variation to transport network rates (trip ends per day) based on industry standard rates as the current LGIP assumptions are not appropriate to the proposed land use.	• 857.5 NDA (Ha) of land in High Impact Industry Zoned. • The demand for land take up would be 49.8 NDA (Ha) in 2021-2026, with a balance of 704 NDA (Ha) in 2041+. • Traffic (trip ends per day) revised from 687 in LGIP down to 26.5 = total 27,764. • Water (EPs/NDA Ha) is 48,020.
B	• This provides for an analysis of what infrastructure is required to service the proponents, and a point of comparison to the other scenarios. • The comparison between Scenario A and B identifies the additional demand on networks (e.g., raw water supply) by the known proponents. • Also informs the early enabling infrastructure planning.	• Variations to land identified as potential development areas as below. • S&R Zone land as S&R, given Drive It NQ utilise all of the S&R zoned land and has a 40-year lease (beyond the planning horizon 2041+). • Land within the Natural Areas Environmental Overlay, but considered to have development potential, is identified HII (broad hectare). • Land in the Rural Zone and Water Resource Catchment Overlay code, but >100m	• Factoring in potential uplift in "developable area" by proponents, total NDA (Ha) forhHigh impact industry uses increased 73.7ha to 931.2. • The demand for land take-up would be 517.1 NDA (Ha) in 2021-2026, with a balance of 152.6 NDA (Ha) in 2041+. • Traffic Scenario B1 (trip ends per day) revised downwards

Scenario	Purpose | Rationale	Assumptions	Main Outcomes
		from Top of Bank (TOB), and not subject to flood or within the stormwater catchment to the west, identified as HII (broad hectare).	based on proponents' demand (with balance area at 26.5 rate) reducing 5,417 trips = total 22,347. • Water Scenario B2 (EPs/NDA Ha) significantly increased (640%) based on proponent demands by 28,102 = total 76,122.
C	• To identify areas of potential uplift, or industry standard demand rates for infrastructure servicing, to base potential amendment to the Townsville City Plan. • An application within the Rural Zone for high impact industry is subject to Impact assessment and against the whole of the Townsville City Plan and other relevant matters. • An application within the HII Zone and subject to assessment against the Natural Areas Environmental Overlay is subject to Code assessment and performance based. • As such, considerations to potential meritorious/performance-based applications should be considered based on best available information. • The Townsville City Plan would need to be amended to accommodate this scenario.	• Based on the multi-criteria analysis contained at **Appendix B** and proposing industry standard infrastructure demand rates (nb; no variation to the LGIP Broad-Hectare Density - Floorspace per NDA rates).	• Factoring in potential uplift based on the MCA (excluding difficult to service potential development areas), total NDA (Ha) for high impact industry increased 304.8 (compared to Scenario A) and 231.1 (Scenario B) to = total 1162.3 NDA (ha). • The demand for land take up is the same as Scenario A (given assumed no proponents) but with a balance of 1008.8 NDA (Ha) in 2041+. • Traffic (trip ends per day) increased due to greater potential development area, increasing by 12,577 (compared to Scenario A) = total 37,341. • Water (rate of 56 EPs/day) is more aligned with proponent demands (Scenario B) = total 78,902 for the LEIP.
C1	• A plan to broadly identify the LEIP area and the outcomes of the multi-criteria analysis what is constrained and developable (minimally and moderately constrained).	• Based on the multi-criteria analysis contained at **Appendix B**.	

Scenario	Purpose | Rationale	Assumptions	Main Outcomes
C2	• A plan to relate the above C1 broad outcomes to the initial proponent areas (QPM, Edify, Drive It NQ and Imperium3).	• Utilising proponent areas from Scenario B and the multi-criteria analysis clipped to the land and areas calculated based on the multi-criteria analysis.	
C3	• A plan to identify potential sub-precincts of developable area regardless of existing proponents.	• As per Scenario	

Regarding the variation of infrastructure demand per scenario, please refer to **Appendix A**.

6.2 Master planning assumptions

To inform the master planning, as agreed with Townsville City Council, a combination of Scenario A (incorporating the proposed traffic demand rates) and the proponent demand information within Scenario B for the immediate/short term 2021-26 are utilised.

This includes lessening of the impact of the water resource Ross River Dam Catchment area located to the west of the LEIP within the QPM site. This catchment boundary was amended from that within the Townsville City overlay for greater accuracy of impact assessment. The catchment boundary also aligns with the existing Rural Residential Zone.

It is also assumed a proposed gateway facility will be located at the main access to the LEIP, which at ultimate is proposed to be Ghost Gum Road. Consideration needs to be given to the co-location of an infrastructure let-down station and the QPM reserved land.

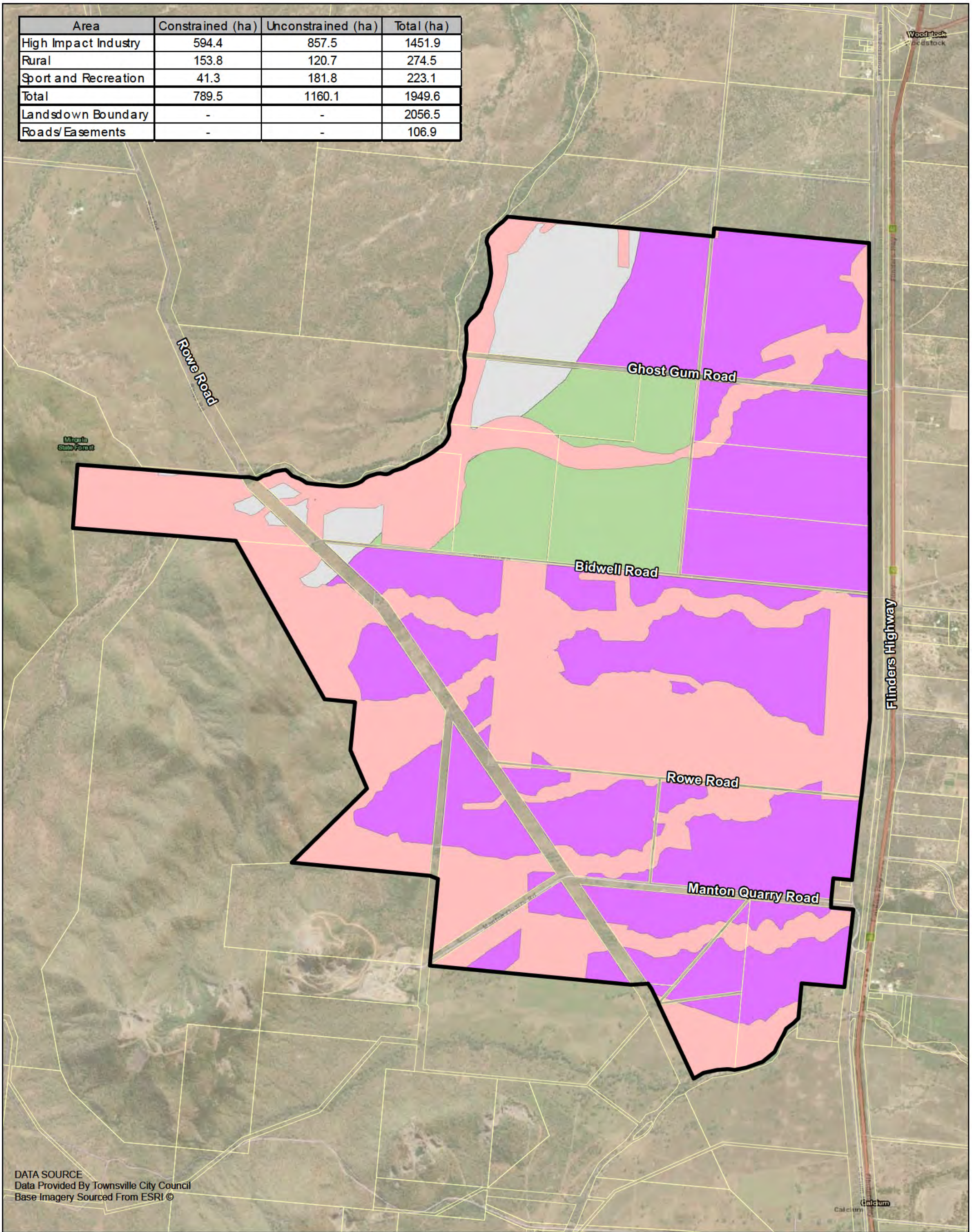
The reasons for this are discussed in the above section, however the primary driver is to collate information which takes into account initial proponent demands to support practical delivery of the enabling infrastructure works. At time of reporting, initial proponent includes QPM, DriveIt NQ, Edify and Imperium 3.

6.3 Implications

It is recommended further consideration is given to the following matters:

- Location of Edify Energy hydrogen plant to be further north to reduce costs associated with a second growth front within the initial phase of works (2021-26).
- Review of the proposed industry standard rates for the LEIP which is different from the current LGIP assumptions (e.g., traffic end trips per day rate of 26.5).
- Alternative land use options, within sub-precincts, based on eco-industrial precinct principles and regional economic opportunities (agri-industry, mineral processing, etc.) to support the achievement of the eco-industrial precinct objectives and more broadly circular economy objectives for Townsville.
- Consider amendment of the OM-09.0 - Natural Assets Water Resource Catchments to reflect the actual catchment boundary having regard to the greater accuracy of the impact assessment undertaken as part of this report.
- Consideration of the location of the gateway facility regarding proposed infrastructure let-down station and QPM reserved land.

Area	Constrained (ha)	Unconstrained (ha)	Total (ha)
High Impact Industry	594.4	857.5	1451.9
Rural	153.8	120.7	274.5
Sport and Recreation	41.3	181.8	223.1
Total	789.5	1160.1	1949.6
Landsdown Boundary	-	-	2056.5
Roads/Easements	-	-	106.9



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Kilometers

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Legend

- Cadastre Boundaries
- LEIP Boundary
- Constrained

Unconstrained

- High Impact Industry
- Rural
- Sport and Recreation

Figure 6-1
Scenario A -
Development Plan
(current planning scheme)

calibre CDM Smith

shooe P:\Project\1001100 - Landsdown\02 MXD\Report maps\Figure 6-1.mxd 26-Aug-21

Area	Total Area (ha)	Constrained Industrial (ha)	Constrained Rural (ha)	Constrained Sport and Recreation (ha)	Unconstrained Industrial (ha)	Unconstrained Rural (ha)	Unconstrained Sport and Recreation (ha)
Proponents							
QPM	225.3	3.0	3.1	0.0	145.2	74.0	0.0
Edify	53.7	0.0	0.0	0.0	53.7	0.0	0.0
DRIVEIT	285.1	0.0	31.5	41.3	0.0	30.6	181.4
Imperium 3	32.6	0.5	0.0	0.0	32.2		0.0
Balance of LEIP	1354.8	593.0	119.2	0.0	626.1	16.1	0.4
Total (Lansdown Boundary)	2056.5	-	-	-	-	-	-
Roads/ Easements	104.9	-	-	-	-	-	-

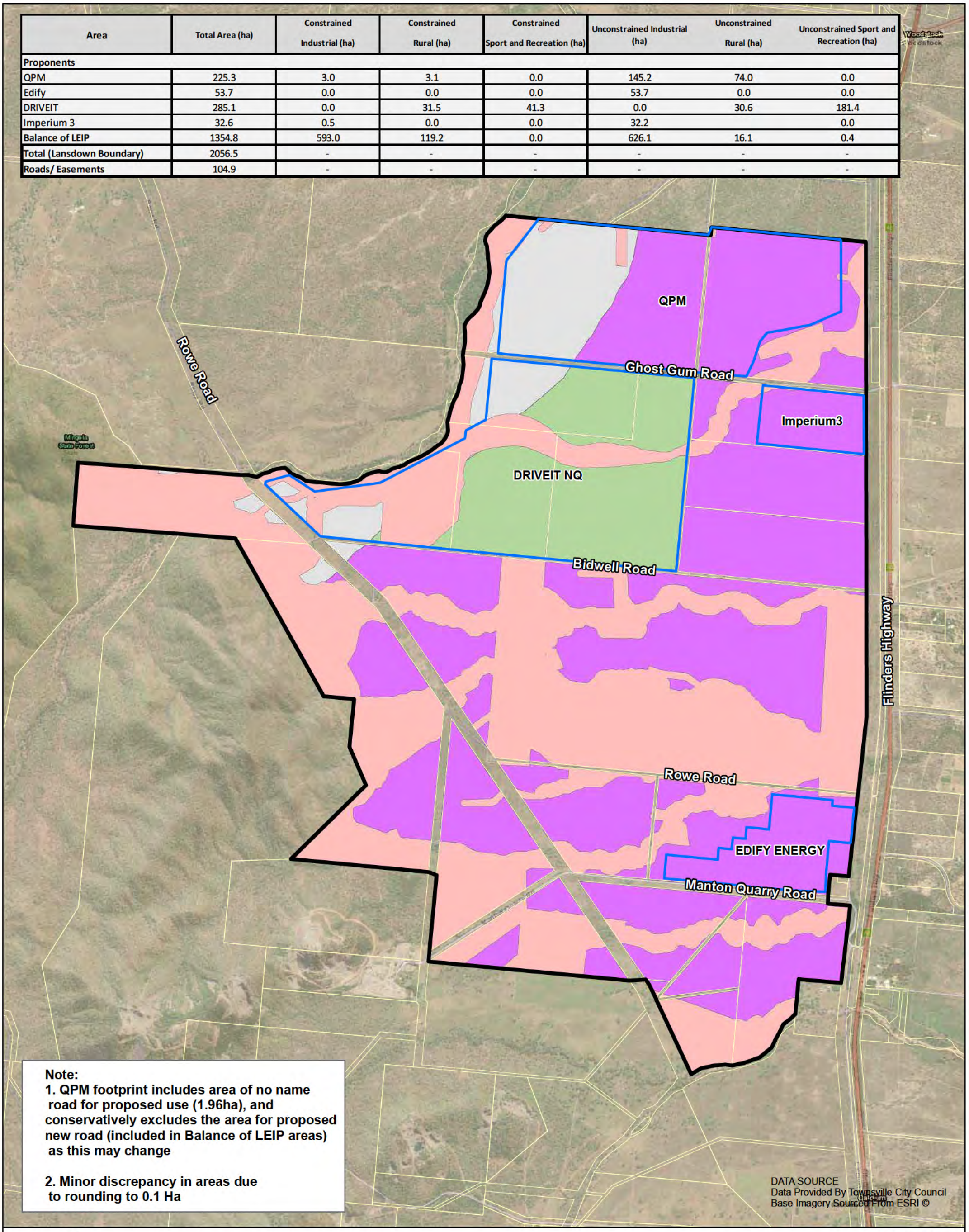

Figure 6-2

Scenario B - Development Plan (with proponents and current planning scheme)

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Area	Total Area (ha)	Constrained (ha)	Moderately Constrained (ha)	Minimally Constrained (ha)	Developable (ha) (minimally plus moderately constrained)
Total (Lansdown Boundary)	2056.5	428.9	791.1	836.5	1627.6

Rowe Road
Ghost Gum Road
Bidwell Road
Rowe Road
Manton Quarry Road
Flinders Highway

DATA SOURCE
Data Provided By Townsville City Council
Base Imagery Sourced From ESRI ©

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Meters

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Date: 08/02/22
Drawn: Andrew Barker

Legend

LEIP Boundary
Cadastre Boundaries

LEIP MCA Ranking

Highly Constrained
Moderately Constrained
Minimally Cantrained

Figure 6-3
C1 - Development Plan
(without proponents)

calibre
CDM Smith

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Area	Total Area (ha)	Constrained (ha)	Moderately Constrained (ha)	Minimally Constrained (ha)	Developable (ha) (minimally plus moderately constrained)
Proponents					
QPM	225.6	3.4	79.4	142.6	222
Edify	53.7	0	9.1	44.6	53.7
DRIVEIT	285.1	42.5	88.2	156.3	244.5
Imperium 3	32.6	0.1	11.6	20.9	32.5
Balance of LEIP	1459.5	382.9	602.76	472.05	1074.81
Total (Lansdown Boundary)	2056.5	428.9	791.06	836.45	1627.51

QPM

Ghost Gum Road

Imperium3

DRIVEIT NQ

Bidwell Road

Western Collector

Flinders Highway

Rowe Road

EDIFY ENERGY

Manton Quarry Road

Rowe Road

Note:
1. The area for existing roads/easements is included, and would be reduced based on the master plan options e.g. likely to reduce a minimum of 106.9ha as indicated in base case Scenario A

2.The area for DriveIt NQ takes up all of the Sport and Recreation Zone land, and therefore the balance Developable area is assumed to be High Impact Industry

DATA SOURCE
Data Provided By Townsville City Council
Base Imagery Sourced From ESRI ©

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Meters

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Date: 08/02/22
Drawn: Andrew Barker

Legend

- Proponent Sites
- LEIP Boundary
- Proposed Roads
- Cadastre Boundaries

LEIP MCA Ranking

- Highly Constrained
- Moderately Constrained
- Minimally Cantrained

Figure 6-4
C2 - Development Plan
(with proponents)

calibre

CDM Smith

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Area	Total Area (ha)	Constrained (ha)	Moderately Constrained (ha)	Minimally Constrained (ha)	Developable (ha) (minimally plus moderately constrained)
Precincts					
1	275.4	8.4	112.5	154.2	266.7
2	249.3	2.5	89.1	157.6	246.7
3	188.9	3.2	82.9	102.9	185.8
4	56.4	0.8	15.2	40.4	55.6
5	48.5	1.4	22.7	24.26	46.96
6	68.8	1	26.6	41.1	67.7
7	132.5	0.7	62.2	69.3	131.5
8	91.1	0.8	89.6	0.6	90.2
9	151.8	2	50.4	99.4	149.8
10	152.8	1.3	27.3	99.8	127.1
11	59.2	1.1	3.5	30.4	33.9
12	7.8	0.7	3.5	3.5	7
Balance of LEIP	574	405	205.6	13.04	218.64
Total (Lansdown Boundary)	2056.5	428.9	791.1	836.5	1627.6

Rowe Road
Ghost Gum Road
Bidwell Road
Western Collector
Flinders Highway
Rowe Road
Manton Quarry Road
1
2
3
4
5
6
7
8
9
10
11
12

Note:
1. Precinct 2 is fully taken up by DriveIt NQ

DATA SOURCE
Data Provided By Townsville City Council
Base Imagery Sourced From ESRI ©

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Meters

Scale @ A3 1:22,500
Date: 08/02/22
Drawn: Andrew Barker

Legend

- Precincts
- LEIP Boundary
- Proposed Roads
- Cadastre Boundaries

LEIP MCA
Ranking
- Highly Constrained
- Moderately Constrained
- Minimally Cantrained

Figure 6-5
C3 - Development Plan (with proponents and considering sustainability)

calibre CDM Smith

7. Infrastructure Gap and Options Analysis

7.1 Transport Infrastructure – Roads and Traffic

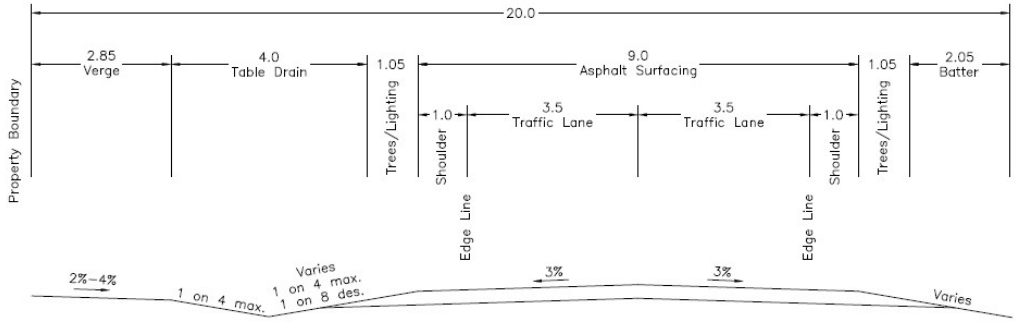
The proposed road corridors and cross sections have been adopted from the Council's Standard Drawings and Townsville City Plan; generally consisting of major sub-arterial roads and minor industrial roads servicing the internal network of the LEIP (refer Figure 3-4). The internal road network will be designed to facilitate efficient access for heavy vehicles and freight, which includes multi-combination vehicles consisting of Type 2 Road Trains (53.5m) via the grade separated crossing at Ghost Gum Road. Smaller vehicle combinations including B-Doubles (26.5m) and Type 1 Road Trains (36.5m) will access the LEIP via the Jones Road railway level crossing. QR approvals are being sought to upgrade the Manton Quarry Road rail crossing for use by general access vehicles including semi-trailers or truck and dog (19.0m). Intersection functional layouts are expected to have a large footprint to accommodate the turn path requirements of articulated vehicles.

The minimum road reserve width of 20.0m is proposed for the minor internal roads and is also to be adopted to provide the corridor for the interim road section before finalisation of land acquisitions, and prior to upgrade justification based on the traffic modelling. The ultimate nominal 40.0m road reserve width is proposed for a modified Type C Major Collector, with swales provided for longitudinal drainage in place of kerb and channel to allow for water treatment of road run-off.

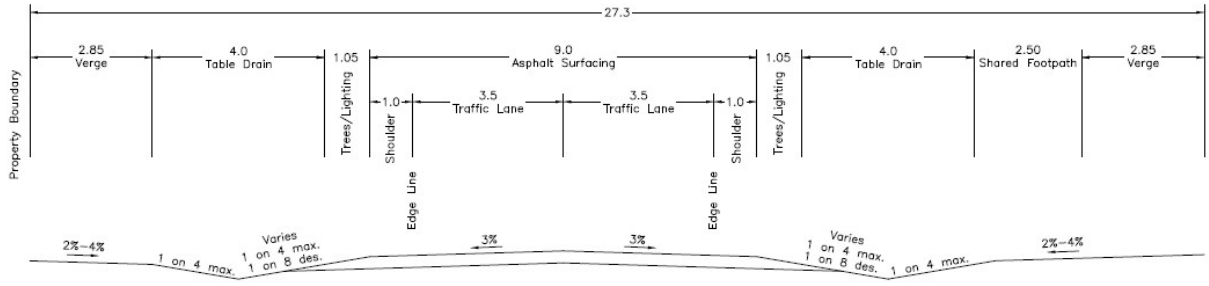
Figure 7-1 Section A is based on a Major Collector Road (Townsville City Council Type C) with side swales to fit into the narrowest available road reserve. Section B is an upgraded section with swales on both side and a shared footpath within one road reserve, subject to land acquisitions. Section C is based on the Townsville City Council Sub-Arterial Road Type B and is to be incorporated pending traffic flow triggers being exceeded. Acoustic fences are subject to site specific assessment. Shared footpath is subject to active transport strategy on industrial site.

For further details refer to Section 3.4.2 of the AIP.

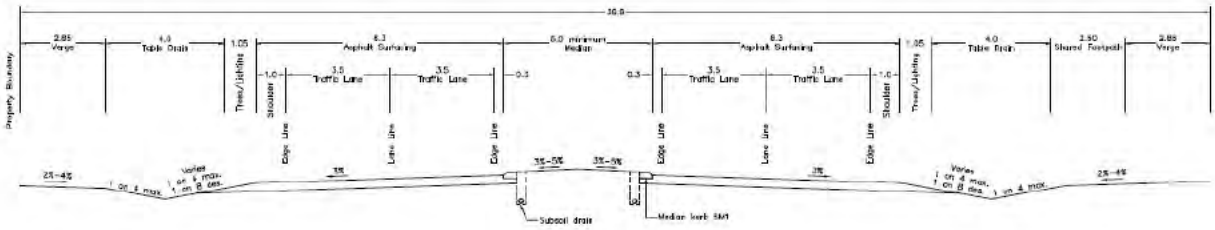
Figure 7-1 Typical cross sections (Adapted from Townsville City Council, 2014)



Typical Cross Section A
Interim Enabling works within 20m corridor



Typical Cross Section B
Modified Major Collector Road Configuration



Typical Cross Section C - Ultimate Sub-Arterial Road Configuration

7.2 Transport Infrastructure – Rail

As indicated in Section 5.2.2, the enabling road infrastructure involves the removal of the existing Glenn Road at grade passive level crossing and construction of a new Jones Road active level crossing protection. This in turn leads to the relocation of the existing passing loop on the Mount Isa Railway Line (Great Northern Rail Line).

While there is the need to relocate the passing loop there also is the opportunity to consider the provision of a rail siding and intermodal transport hub. There are many considerations to be made before adopting a rail siding, refer to Table 7-1 below.

Table 7-1 Rail siding master planning considerations

Item	Issues	Recommended Action
Eco-Industrial Precinct	For an eco-industrial precinct there is an aspiration for a rail siding to undertake transportation with lower greenhouse gases and can assist with circular economy in a sustainable precinct.	Preliminary land use master plan has indicated a possible area and opportunity to have a future rail siding and intermodal precinct.
Demand	The LEIP is considered large enough to accommodate uses that may generate usage of the siding. That is opportunity for industries that import large quantities of raw materials and export of final products. However, the demand for a siding will be very proponent driven and subject to other viability factors. Development of the overall LEIP may also take greater than 30 years, as such demand for an intermodal hub may only increase slowly.	To be addressed in future business case.
Economic Viability for Intermodal Hub / Siding	Is a siding economically viable for users? Level of double handling at the Port of Townsville and LEIP impacts economic viability. Having access to suitable facilities at the Port of Townsville is critical to economic viability. Anecdotal evidence via QR has indicated access is limited and needs agreements between the Port of Townsville facility operators and LEIP proponents. Short (or mini) haul rail and use of an intermodal hub verses truck transfers viability is considered further below in note (b).	To be addressed in future business case

Item	Issues	Recommended Action
Port Facilities	Are there available and complimentary facilities at the Port of Townsville?	To be addressed in future business case
Multi-User And Multi Product Type Rail Siding Facility	Area of property required for handling facilities varies depending on product being shipped. A small container facility may be as small as 20 hectares, but an ore handling facility can be 10 to 20 times greater in size, subject to number if stockpiles required, frequency of rail haulage and handling methods.	Preliminary aspirational master plan has indicated a possible area and opportunity to have a future rail siding and intermodal precinct. Area identified in the preliminary aspirational master plan is approximately 50 ha.
Intermodal Hub	Who would manage the multi-user rail siding facility?	To be addressed in future business case
Private Spurs	There is potential for a single proponent provide a dead-end spur for private use, subject to location of passing loop?	Private spurs could be considered off the passing loop, but will require further negotiation and agreement with QR
LEIP Proponent Benefits	Having this opportunity has the potential to draw different proponents to the LEIP.	Preliminary aspirational master plan has indicated a possible area and opportunity to have a future rail siding and intermodal precinct.
Long Term Land Use	While the proposed location may be the most efficient and economically feasible it may or may not be the best in terms of the long-term land use aspirations. There could be potential to introduce a rail spur to move the intermodal facility away from the highway frontage and advanced manufacturing precinct. A rail spur connecting to the resource recovery or minerals processing areas maybe an alternative to consider in the business case. Further assessment of intermodal/ rail options focussed on transport bulky goods for specific proponents is required.	To be addressed in future business case

Note:

a. These are preliminary investigations only to identify possible facility location. A full business case would need to be undertaken to determine the feasibility, economic viability and sizing of facilities required. All opinions of cost and estimates are subject to detailed design and market forces relation to transport costs.

b. Further notes regarding these considerations are outlined in the AIP.

Based on the initial proponents needs and location within the LEIP, the rail siding is not identified as early enabling infrastructure. A business case needs to be prepared based on the potential demand of proponents for a rail siding, and the type of arrangement (e.g., access both sides or only from the west, spur siding to a particular proponent, etc). In the interim, any proponents' interest in the land allocated for the rail siding should be temporary in nature and not encumber the land to remove the ability for a proponent or authority to deliver the infrastructure as need arises or if to be advanced as catalyst infrastructure to attract the investment of a proponent.

7.3 Electrical Reticulation

All electrical supply for the LEIP is provided by Woodstock Substation under Development Scenario A, however not for Development Scenario B.

During the enabling works, the underground electrical cables should be installed between Woodstock Substation and Ghost Gum Road, via Jones Road and No-name Road. These would be installed within the road reserve of respective road alignments and position inside a conduit bank.

In Development Scenario B, Edify Energy will become a potential supplier of electrical energy via the Majors Creek Solar Farm (MCSF). Edify Energy has received approval to construct a 200MW facility to meet power demands at their proposed hydrogen production and storage facility and have considered synergies with the rest of the LEIP.

The point of supply would be driven by private investment and would be subject to electricity demand from other LEIP proponents. Edify Energy have engaged with the initial proponents to discuss a point of supply.

Townsville City Council (as the owner of the LEIP land) will install UGE conduit banks that can house up to 110kV transmission cables. Beyond this, above ground electrical transmission is required and is subject to additional approvals. Overhead lines require exclusion zones as detailed in AIP Chapter 7. Townsville City Council (as the owner of the LEIP land) could make allocations for exclusions zones as depicted on Drawing 21-000239 – FU01 and AIP and Figure 7-5.

7.4 Gas Supply

The NQGP is located adjacent the eastern boundary of the LEIP and is accessible via a let-down station and on-site micro-LNG facility. The facilities require a land acquisition to accommodate the supply.

Gas supply and reticulation will then be subject to negotiations between proponents and retail suppliers of the gas. Retailed gas will be supplied via dedicated gas mains within the LEIP. However, these mains will be housed inside conduiting installed with the roadworks.

The Let-down station and Micro-LNG facility require 24 months from inception to commissioning. Therefore, they are likely required as early enabling infrastructure works to ensure they are available for completion of Stage 1. At the time of this report, there are no known alternative bulk gas supply lines in the vicinity of the LEIP.

Proponents may elect to receive trucked-LNG to their site where reticulated gas is not available.

7.5 Telecommunications Infrastructure

NBN Co. as the IPOL in the vicinity of the LEIP is the recommended network connection for proponents under Planning Scenario A. As proponents are announced and their demands become clearly identified under Planning Scenario B, it is likely that network upgrades will be required to the NBN Co. FWA to service new customers. It is recommended then, that the Council (as owner of the LEIP land) engage with NBN Co. as soon as practical once proponent demands are understood to secure a suitable network connection.

Based on this outcome, it is recommended that enabling works either include or exclude upgrades to the NBN Co. network. That is, under Planning Scenario A the network is sufficient, and no upgrades are required. Under Planning Scenario B, the network may need upgrading based on the level of demand from known proponents inside the LEIP. This decision should be proponent led infrastructure.

Alternative points of supply via the Telstra and Nextgen networks should also be considered by proponents.

7.6 Water Infrastructure

Numerous options were considered regarding the water supply strategy for the LEIP. This included two primary external options and three internal options. Additional raw water supply options (bore water, stormwater harvesting etc.) were considered, however due to the uncertainty in supply and demand required these are not considered as primary options.

The proposed options identified and associated infrastructure are summarised below:

- Two raw water supply options have been identified, which include:
  - **Option 1** - Connection to existing DN900 Haughton Pipeline and new 13km pipeline to the LEIP.
  - **Option 2** - New intake, pump station from Ross Dam and 28km DN700 pipeline to LEIP with additional DN400 duplication required in future stages.
- Three storage options were identified, which include:
  - Standard Storage – Storage requirements as per the CTM Code.
  - Two weeks storage – Double standard storage requirements.
  - Proponent owned storage – Proponent responsibility to manage water requirements.
- Three internal serving option were identified, which include:
  - **Option A** – Core infrastructure – Council owns raw water storage and distribution.
  - **Option B** – Proponent led infrastructure – Council owns distribution only with proponent managing storage and treatment.
  - **Option C** – Aspirational infrastructure – Council owns potable water treatment facility, storage and reticulated network (dual network) but funded by proponents.

As per the recommendations in the AIP Section 5.10, the infrastructure rollout is based on **Option 1** – Connection to the DN900 Haughton Pipeline and **Option A** with Townsville City Council to provide dedicated storage lagoon and pump station, with the treatment and storage requirements (2 days' supply and firefighting requirements provided by each individual proponent).

Potable water supply has been assessed as aspirational water infrastructure, due to constraints associated with providing servicing for the large volumes of water and treatment and previous Townsville City Council commitments, and as such it is anticipated that the potable water will be managed by each proponent. Further details are provided in the AIP Chapter 5.

7.7 Wastewater Infrastructure

Due to the distance from existing wastewater infrastructure and demands associated with the LEIP an onsite solution was considered the only means to enable development of the LEIP. From these three potential options were considered that includes:

- **Option 1** – Centralised treatment facility with single gravity catchment.
- **Option 2** – Centralised treatment facility with split gravity catchment.
- **Option 3** – Proponent funded, developed and managed wastewater treatment.

In accordance with the recommendations in the AIP Section 6.7, the infrastructure rollout is based on the proponents funding, developing and managing their own wastewater treatment and the relevant licensing.

7.8 Stormwater Management

7.8.1 Drainage Infrastructure

This section provides a summary of the stormwater management strategy to support the proposed LEIP. Further details of the planning assumptions and engineering undertaken to inform the strategy are in Section 10 of the AIP.

For drainage network infrastructure, no specific drainage infrastructure is specified in the LGIP; instead, drainage infrastructure is summarised under road network infrastructure. As such, drainage infrastructure is limited to bridge and culvert crossings associated with the proposed road network, as well as major/minor road drainage elements such as kerb and channel, gully pits and table drains, etc.

The provisions for stormwater quality treatment devices and peak flow mitigation (detention basins) to service additional impervious surfaces throughout the LEIP are therefore excluded from the definition of drainage infrastructure (unless installed as part of the road network). For infrastructure planning, the investigation has focused on the preliminary sizing of major culvert structures where waterway crossings are required for the proposed road network. No bridge structures have been proposed.

Generally, the key design assumptions adopted for the purpose of options development and assessment of drainage infrastructure are:

- Culvert crossings designed for 2% AEP flood immunity for major roads and 10% AEP flood immunity for minor roads in accordance with Section 7.3.1 of QUDM (2016) and the Townsville City Plan, Section 8.2.6 Flood Overlay Code.
- Major roads taken to be sub-arterial (40m wide corridor) and distributor (32m wide corridor) roads.
- Minor roads include the collector roads (28m wide corridor) and lower road typology.
- Preliminary culvert sizing calculations carried out in accordance with Section 10.4.6 of QUDM (2016).

The preliminary culvert sizing and location has been presented in the Transport Infrastructure section of this report.

7.8.2 Peak Flow Mitigation (Detention Basins)

The proposed development will change flood conditions (i.e., increase peak flows, flood levels and velocities) on the downstream state-controlled rail (GNRL) and road (Flinders Highway) corridors. To determine the requirements for peak flow mitigation (i.e., detention basins) for the LEIP, two peak flow mitigation options were identified:

- **Option 1:** LEIP-wide detention as an end-of-line solution to mitigate increases in peak flows reporting to each of the six downstream LEIP boundary locations.
- **Option 2**: Proponent site-based detention provided as off-line detention basins within the land parcels of each proponent, to mitigate increases in peak flows reporting to each proponent's downstream site boundary locations(s).
- **Option 3:** A third option was explored during initial investigations which proposed no detention basins, and instead proposed to upgrade the existing cross drainage infrastructure downstream of the LEIP at both the GNRL and Flinders Highway to cater for predicted increases in peak flows from the LEIP. This option was discounted based on increased flood risk to downstream infrastructure and rural properties. No further consideration to this option is provided in this report.

[redacted]

Table 7-2 Storage options CAPEX and OPEX summary

Mitigation Option	Scenario A NDA (ha)	Eq. Detention Volume (m^3/ha NDA)	Eq. Detention Cost ($/ha NDA)	CAPEX Cost	OPEX Cost (Annually)[11]
LEIP-wide	1,031.2	1,221	[redacted]	[redacted]	[redacted]
Proponent site-based		1,087	[redacted]	[redacted]	[redacted]

The ultimate CAPEX cost for a LEIP-wide detention solution is estimated to be approximately 17% more expensive than adopting a site-based detention solution for each proponent.

A multi-criteria analysis was undertaken to assess the two peak flow mitigation infrastructure options proposed for the LEIP. The fundamental criteria identified indicated that the Safety as well as Statutory Risk and Approvals were the primary focus for beneficial options. With consideration to the CAPEX costs and benefits associated with each option, the most desirable option was identified as Option 2 in comparison to Option 1 for the following reasons:

1. Option 1 CAPEX is born by Townsville City Council upfront, whereas Option 2 CAPEX is born by individual proponents, resulting in a reduction in upfront costs to Townsville City Council.
2. A reduction in overall basin size and minimised ecological impact and disturbance to existing watercourses.
3. A minimum of six detention basins would be required upfront if Option 1 is adopted. Option 2 allows basin sizing to be more flexible and can be optimised to proponent land use, potentially increasing the LEIP yield.
4. Stormwater detention requirements can be managed by Townsville City Council through the development approval process.

7.8.3 Stormwater quality treatment

The following is a summary of the assumptions adopted for stormwater quality treatment considerations for the LEIP. The stormwater quality management criteria have been adopted from the comprehensive guidelines provided in the Townsville City Plan SC6.4.3.9 (Water sensitive urban design guidelines). Holistically, water sensitive urban design (WSUD) promotes the integration of stormwater, water supply and sewage management at the development scale. The key principles of WSUD espoused by the Townsville City Council are to:

- protect existing natural features and ecological processes;
- maintain the natural hydrologic behaviour of catchments;
- protect water quality of surface and ground waters;
- minimise demand on the reticulated water supply system;
- minimise sewage discharges to the natural environment; and
- integrate water into the landscape to enhance visual, social, cultural and ecological values.

Where possible, the LEIP should be designed to promote these WSUD principles. As such, the following planning assumptions have been adopted:

- Selection of preferred stormwater quality management measures may include a mixture of treatment devices throughout the LEIP which shall be designed with consideration for the specific site constraints in accordance with Townsville City Plan Table SC6.4.3.9.3 (Site constraints for WSUD measures for runoff quality and quality management).
- According to Townsville City Plan Table SC6.4.3.9.1 (Scale of WSUD application in urban catchments) and Table SC6.4.3.9.2 (Effectiveness of WSUD measures for runoff quality and quality management), the most appropriate and effective treatment devices for the LEIP are:
  - Bioretention basins (end of line treatment used in combination with swales).

[11] Operational and Maintenance costs based on 8% of CAPEX value.

  - Bioretention swales (incorporated into streetscape and road design).
  - Constructed wetlands (not preferred unless high water table constrains design of bioretention systems).

- Stormwater quality management and associated pollutant load-based reduction targets are limited to reductions in TSS, TN, TP and GP only, and the stormwater quality management strategy does not take into consideration the management of contaminants associated with hazardous substances (e.g., as defined under the *Environmental Protection Act 1994*) or other ERA site requirements.

An assessment of the stormwater quality improvement devices (SQIDs) required throughout the LEIP in order to meet water quality objectives has been undertaken using MUSIC modelling for the LEIP net developable areas (NDA) within each of the six waterway catchments.

According to the MUSIC modelling undertaken, the resultant bioretention area requirements for the proposed NDA for the LEIP under Scenario A conditions are summarised in Table 7-3. Bio Retention basin sizing on each individual site is in order of 1.5% of the net developable area, plus any other management measure to address specific contaminants associated with hazardous substances.

Table 7-3 MUSIC Model results

Catchment	LS27	LS26	LS25	LS1	LS3	LS5	Overall
Net Developable Area (ha)	86.2	250.0	62.7	287.9	183.3	161.1	**1031.2**
Assumed Roof Area (ha)	43.1	125.0	31.4	144.0	91.7	80.6	**515.6**
Assumed Road Area (ha)	25.9	75.0	18.8	86.4	55.0	48.3	**309.4**
Total Bioretention Area (m^2)	15,600	45,100	11,300	52,000	33,000	29,000	**186,000**
Bioretention Swale area (m^2)	3,900	11,300	2,900	13,000	8,300	7,300	**46,700**
Bioretention Basin area (m^2)	11,700	33,800	8,400	39,000	24,700	21,700	**139,300**
No. bioretention basins[12]	15	43	11	49	31	28	**177**

Subject to the approved development layout of each proponent, the degree of percentage imperviousness and land use breakdown may differ, and the total bioretention area and subsequent number of basins may be different. The purpose of this report is to provide an indication of possible solutions, but overall outcomes are ultimately dependant on how each proponent demonstrates compliance with *Townsville City Plan SC6.4.3.9 for Water Sensitive Urban Design* (WSUD).

Within the road corridors stormwater quality treatment measures should comprise bioretention areas by adopting a mixture of roadside swales and basins which are integrated into the LEIP to enhance amenity and achieve design objectives for the coastal dry tropics.

The location of stormwater quality improvement devices (SQIDs) throughout the LEIP is assumed to be a combination of the following;

- Council owned and maintained bioretention swales are to be located in the verge of Council controlled roads only. Where possible, these would drain to end-of-line bioretention basins prior to discharging to waterways.
- Proponent owned and maintained SQIDs are to be located within the proponent land. These are to be designed and constructed to meet the Townsville City Council's Water Quality Objectives as part of each proponent's approved plans of development. The approval mechanism is assumed to be through the Townsville City Council's regular development approval process.

[12] The number of required bioretention basins per catchment has been calculated based on a maximum basin size of 800m^2 in accordance with Water by Design (2018).

8. Preliminary Aspirational Master Plan

8.1 Intent Consistent with Vision

The intent of the preliminary aspirational master plan is to address the physical constraints of the LEIP, provide a sustainable land use framework that accommodates the location of the early proponents, and provide for the longer-term emergence of industry clusters and circular economy activities consistent with eco-industrial outcomes. Importantly the preliminary aspirational master plan also provides a basis for the planning and provision of development and other enabling infrastructure.

The preliminary aspirational master plan has been prepared on the underlying consideration of Scenario C3 outlined above and is consistent with the overall vision for the LEIP outlined in Section 1.5.

The preliminary aspirational master plan will be defined in terms of early proponent requirements, land use precincts, access and movement and environmental management considerations. The preliminary aspirational master plan aims to:

- Accommodate the requirements of the initial proponents.
- Provide for the accommodation of longer-term industrial opportunities consistent with the principles of a sustainable eco-industrial precinct and the environmental suitability of the LEIP.
- Provide for the planning and efficient staging of development and other infrastructure to meet short term and ultimate requirements of the LEIP.
- Enable the early establishment of industry clusters or sub-precincts.
- Make provision for future circular economy activities that reinforce the bona fides of the LEIP as a leading eco-industrial precinct.
- Generate a positive identity for the LEIP through the careful consideration of industry location and the need to make provision for a suitable gateway precinct as the long term “front door” to the LEIP.

Based on the outcomes of investigations detailed in Section 8, the preliminary aspirational master plan in Figure 8-1 has been prepared.

8.2 Sub-Precinct Intents

The preliminary aspirational master plan provides for the general layout of the LEIP, showing the delineation of sub-precincts and the higher order elements including the transport network, open space network and methods incorporated to manage reverse amenity. Proposed sub-precincts are intended to be flexible and subject to the needs of industry as the LEIP expands. Ultimately, each development proposed will be assessed against the Townsville City Council provisions applicable to the high impact industry uses and the High Impact Industry Zone.

Based upon existing and anticipated future land uses, there are nine sub-precincts proposed within the LEIP that have a defined role and function. The sub-precincts align with the broad category of uses identified in the Economics Assessment chapter 4 and operations that may be attracted to an eco-industrial precinct or anticipated catalyst developments. The definition of these uses is considered important to encourage the co-location of mutually supportive land uses and encourage general synergies of use (refer to Table 8-1).

The location and mix of land uses proposed are based on the following factors:

- Environmental features and topographical characteristics.
- Infrastructure requirements and costing.
- Accessibility and exposure requirements.
- Existing surrounding land uses and sensitive receptors.
- Proposed land uses siting and infrastructure requirements.

- Forecast industry requirements and industry location considerations.
- State, regional and local statutory and policy priorities.

The intent and intended use of each sub-precinct is provided in Table 8-1.

A landscape buffer is provided to screen or soften the appearance of development from the highway. A similar buffer would also be incorporated along the northern and southern boundaries of the development area to screen development from adjoining rural areas.

A gateway node is identified at the main entry point to the development at Ghost Gum Road. Uses, building designs, landscaping and signage will be used here to ensure that the LEIP's amenity and visual presentation to signify a quality location for eco-industrial and business development. This area acts as gateway into the LEIP and may provide an additional location for amenities, employee services and other supporting commercial activities.

Additional constraints identified along the highway alignment can be managed within the development (i.e., buffering, earthworks, drainage works, infrastructure). The predominant characteristics of development in each of the sub-precincts is likely to differ and will therefore require differing building and site design considerations. Considerations for each of sub-precincts are defined in Table 8-1.

Table 8-1 Sub-Precinct Intents

Sub-Precinct	Objectives	Compatible land uses
Gateway/ education precinct	The intent of the gateway node is to ensure that the LEIP amenity and visual presentation to the Flinders Highway signify a quality location for industry and business development with uses, building designs, landscaping and signage showcasing the identity of the development. This precinct provides for a publicly accessible education / information centre, showcasing the LEIP as a nationally significant example of the eco-industrial, renewable energy and circular economy development. The 7Ha gateway node located adjacent the advanced manufacturing precinct and separated from the QPM by a green corridor.	• Commercial • Training and education • Professional offices
Mineral processing precinct	This 221Ha precinct at the northern end of the LEIP is fully taken up by the proposed QPM nickel processing plant and associated uses. Initially the primary access to the LEIP from the Flinders Highway will be via Jones Road to the north of this precinct and an extension of the road around the western perimeter of the QPM site linking with Ghost Gum Road. Ultimately, the main entrance to the LEIP will more appropriately be via an overpass of the railway at Ghost Gum Road.	• Mineral processing
Special recreation precinct	This 240Ha precinct is for the Drive It NQ driving facility and associated uses. It the long term and depending on demand for industrial land within the region, this area may transition as an extension area for some of the other industrial precincts, however it is expected that the motor sports facility will remain within the precinct for the long term.	• Motor sports • Driver training • Related recreational uses
Advanced manufacturing precinct	This 123Ha precinct is intended for advanced manufacturing establishments typified by bespoke high-quality premises in high amenity settings. Imperium lithium battery manufacturing is the catalyst activity in this precinct and opportunity is provided within the precinct for the colocation of supply chain activities.	• Advanced manufacturing activities • Associated supply chain and supporting business and industry activities
Specialised agriculture/food processing/ research and warehousing precinct	This 121Ha precinct is intended to provide for a wide range of large footprint activities to support those leading economic sectors within the region. Food processing, value adding to agricultural products and supporting research and development activities could be suitable in this location.	• Food processing • Agri-industrial activities • Storage and warehousing

Sub-Precinct	Objectives	Compatible land uses
Renewables/ bio-energy[13] precinct	The 275Ha precinct is intended as the focus for renewable energy production or bio futures cluster (industrial biotechnology and bioproducts sector), being located on a major infrastructure corridor along the highway, having sufficient area for expansion or the addition of solar collectors and being able to provide adequate separation distance from other forms of industry. The proposed Edify hydrogen production plant is the catalyst proponent in this precinct. The nature and characteristics of these plants (which could be regarded as major hazard facilities) suggest a location separated from other industrial enterprises would be appropriate.	• Renewal energy plants • Solar farms • Waste to energy plants • Utilities
Resource recovery precinct	This 155Ha precinct is intended for a range of resource recovery and recycling activities, whether or not directly related to other activities within the LEIP. In the long term, cessation of quarrying operations may provide a suitable area for the stockpiling, processing or blending of materials as a resource recovery operation.	• Resource recovery • Waste processing • Waste to energy plants • Biomass processing
Intermodal precinct	This 50Ha has notionally been provided adjacent the rail corridor to provide an alternative means of transport to and from the LEIP and to Townsville port. The need for this precinct will be subject to further investigations.	• Intermodal facility • Transport and warehousing
Advanced offsets area/ biomass production precinct	This 250Ha precinct is centred on the less suitable land within LEIP for industrial development by virtue of the nature of constraints or inability to provide cost effective access or services. This precinct could be used for the production of plantations for biomass production or as an advanced offsets area to achieve environment objectives.	• Timber plantation or other biomass production • Environmental offsets area.

Detailed precinct-level planning would include further consideration of design requirements over and above those of the current Townsville City Plan applicable to development in the LEIP. These would typically relate to ensuring high levels of amenity across the LEIP addressing the above considerations together with LEIP-wide matters such as streetscaping and wayfinding treatments to create amenity and legibility within the development.

8.3 Greenspace network

The greenspace and biodiversity network has been integrated into the Master Plan design to the following several important functions:

- Accommodate flood inundation areas, overland flow paths, and associated ecological corridors along prominent drainage lines and waterways.
- Protect water quality of both surface and ground waters and the ecological and hydrological processes of catchments.
- Provide ecological linkages to areas adjoining the LEIP to ensure the ongoing viability of the significant area and associated ecological functions and ecosystem services.
- Provide a buffer and screening opportunity.

[13] According to the State Development, Manufacturing, Infrastructure and Planning (2019), bioenergy or bio futures refers to the industrial biotechnology and bioproducts sector and focuses on developing and manufacturing products from sustainable organic or waste resources, rather than fossil fuels. It encompasses a range of innovative scientific and industrial technologies designed to convert sustainable feedstocks or waste into bioproducts.
Bio futures is currently identified by the Queensland State Government as a 'priority industry'. Its vision is to promote a sustainable and export-oriented industrial biotechnology and bioproducts sector, attracting significant international investment and creating regional, high-value and knowledge-intensive jobs.

- Enhance the amenity and attractiveness of the development though the provision of gateways and landscaped corridors to define land use precincts wherever practicable.
- Enhance existing character.
- Ensure the development area will not encroach on remnant vegetation.
- Provide additional opportunity to meet the principles of sustainable eco-industrial development.
- Prevent erosion and sedimentation impacts.

A landscaped buffer has been provided around the perimeter of the LEIP, including frontage to Flinders Highway. The greenspace and biodiversity network may be publicly accessible, and form a significant component of the LEIP's environmental, social and recreation opportunities throughout the development. This includes environmental protection and restoration, recreation, flood mitigation, riverine protection and pedestrian and cycle networks. A network of cycle and walking tracks may be incorporated throughout the greenspace areas providing recreational opportunities and links between precincts and to the adjacent state forest.

More detailed precinct level planning would be required to integrate green infrastructure requirements with the network, including opportunities for stormwater management infrastructure, screen planting and /or vegetation rehabilitation, buffering and recreational facilities.

It should be noted that the greenspace network differs from the proposed advanced offsets area/ biomass production precinct area on the preliminary aspirational master plan (Figure 8-1), although both areas are considered to be constrained by environmental values

8.4 Transport networks and access

The proposed traffic and transport access strategy for the LEIP is based on the progressive consolidation and improvement of railway crossings to provide east-west connectivity between the LEIP and the Flinders Highway. The access strategy is based on staging and sequencing of development and enabling works in 5-year increments from 2021 to 2041 and any works required to support the Ultimate arrangement for the LEIP beyond 2041.

Chapter 3 of the AIP makes recommendations on the proposed major road infrastructure. We have considered expected demands from the development of the precincts and recommended a road network to service the LEIP. However, there are many variables in land use, road usage, different transport modes, percentage of heavy vehicles and traffic generation that will change overtime. That is, there are uncertainties overtime that are harder to predict which lead to potentially conservative recommendations in this chapter. Therefore, it is recommended that regular traffic monitoring occurs to validate whether traffic triggers have been reached before upgrades, such as duplications, occur.

Primary access to the LEIP is proposed to be via a new grade separated crossing near Ghost Gum Road, with secondary access via the upgraded railway level crossings at Woodstock Giru Road. Manton Quarry Road will provide tertiary access to the southern development areas in the Ultimate arrangement. The existing railway level crossings at Bidwilli Road and Ghost Gum Road will be decommissioned to support the development to its Ultimate arrangement.

Prior to the rail crossing upgrade at Ghost Gum Road, access to the LEIP will initially be from Jones Road in the north with a link to Ghost Gum Road. From Ghost Gum Road access to the central and southern precincts will be by a central spine road, with development areas off this being serviced by future industrial collectors. This spine road will connect all the precincts and become the North-South Major Collector road within the LEIP. The current rail crossing of Ghost Gum Road is not sufficient for the proposed volume and nature of heavy vehicles from QPM.

Manton Quarry Road will continue to be used by the quarry and provide a secondary access point for precincts in the southern end of the LEIP. Due to the distance between the railway and highway alignment, insufficient queuing space is available for multi-combination vehicles (e.g., B-Doubles and Road Trains)

Land release along the southern-end of the LEIP near Manton Quarry Road is scheduled for release during Stage 3 of the development between 2031 and 2035. Therefore, access arrangements and connections in this area are deferred until this period of the Master Plan. Any works brought forward in this area would be to service

the needs of individual developments only. This crossing needs further consultation and resolution with QR for maintaining access at Manton Quarry Road. As a third access to the LEIP thus has many planning benefits and considered beneficial for safety, if internal road network is compromised.

The Ultimate arrangement will include the construction of a full western ring road developed to collector road standard in approximately 40-years and a series of intersections with the internal road network around the LEIP (subject to on-going monitoring of travel demands and behaviours during operation). This will unlock development potential around the periphery of the LEIP for long-term development. The final alignment will be informed over time in the future stages as further certainty is reached within the development of potential sites based on proponent requirements.

The LEIP will be serviced by an internal road hierarchy consisting of new major collector roads and local industrial service roads and streets to connect to individual landholdings in the LEIP. The future transport environment will be likely to include railway connectivity subject to design and feasibility assessments with a railway siding proposed near the passing loops on the Great Northern Rail Line between Ghost Gum Road and Bidwilli Road (By Others). Railway connectivity is expected to provide a critical import opportunity to bring primary product into Lansdown from northern Queensland for value-added services. Export of value-added product from the LEIP to the Port of Townsville is expected via road-based transport to minimise lead-time or lag-time delays from double-handling product.

8.5 Environmental Management

8.5.1 Types of Measures

Greenspace in the LEIP consists of a variety of features to achieve a range of environmental, amenity and recreation opportunities. The proposed greenspace and biodiversity network can also include areas set aside for conservation and rehabilitated and revegetated riparian areas. The management of environmental values within the LEIP development sites are to be addressed through site-based management measures and LEIP-wide management measures as described below.

8.5.2 LEIP-wide measures

8.5.2.1 Scope

The objectives and potential measures for managing environment impacts within the LEIP would adopt sustainable development approaches. Examples of the LEIP-wide objectives and measures would include the following:

8.5.2.2 Stormwater Management

Objective: To minimise the impacts of development on the quality and quantity of surface water runoff, ground water quality and flood levels within and external to the LEIP.

This would include measures such as:

- Preliminary modelling to determine the minimum width requirements for the main overland flow paths through the development area.
- Adoption of a treatment train approach to managing on-site stormwater and include LEIP-wide WSUD measures include the provision of gross pollutant traps, swales within the road reserves, detention/ water quality management basins (these could include constructed wetlands, and bio-filtration elements) together with natural (un-engineered) overland flow paths. The Master Plan strategy has been indicated in Section 9.1.9.
- The above stormwater management infrastructure would be incorporated as green infrastructure within the open space network throughout the LEIP.
- The development of a Surface Water Management Plan to prioritise options to alleviate the impact of surface water movement through the area and determine the earthwork requirements to implement the surface water management system. Impacts to groundwater are also to be considered.

8.5.2.3 Noise/air Quality

Objective: To ensure development minimises noise and air emission impacts both within and external to the LEIP.

This would include measures such as:

- Provision of, and adherence to, land use allocation measures that provide for a logical separation of incompatible industrial activities.
- Require and monitor the adoption of best practice siting and operational management of on-site activities.
- Prevent the encroachment any land use activities that could be impacted by off-site emissions or that could result in reverse amenity impacts on the LEIP industry proponents.

8.5.2.4 Natural Environment

Objective: To preserve the LEIP's biodiversity and landscape values and minimise the removal of remnant vegetation where not part of a development site.

This would include measures such as:

- Areas of environmental significance have generally been avoided in the preliminary aspirational master plan and where required, such as along riparian corridors or drainage lines, buffers have been indicated.
- The preliminary aspirational master plan features approximately 539 hectares of greenspace, the majority of which has been retained to protect remnant vegetation through the centre of the LEIP.
- Linear greenspace / screen planting buffers have also been provided around the perimeter of the LEIP which could be incorporated with remnant vegetation areas where possible.

8.5.2.5 Bushfire Management

Objective: To ensure any development in bushfire prone areas is designed to minimise risk to property and life.

Measures would include the following:

- Lots adjoining natural vegetation areas would be required to maintain an internal buffer between onsite infrastructure, outdoor storage or stockpile areas and the boundary.
- A fire trail would be provided around the western perimeter of the LEIP for emergency vehicle access and to the reduce fuel load on adjoining the lots.
- Each proponent is to provide emergency firefighting water.

8.5.2.6 Waste Management

Objective: To minimise the generation of solid, liquid and gaseous wastes within the LEIP.

Measures would include the following:

- Industries that contribute to a circular economy by minimising wastes through the use or transformation of by-products from other industries are specifically catered for within the LEIP.
- Targeted marketing and LEIP promotion to industry sectors capable of providing circular economy activities.
- Designation of suitable land precincts and infrastructure corridors to facilitate circular economy activities. These types of measures are subject to the degree of take up of eco-industrial principles as identified in Section 8.6 and **Appendix F**.

8.5.3 Site Based Management Measures

Site based measures are included in the relevant Townsville City Plan provisions which would apply to each of the sub-precincts. These would deal with issues such as stormwater harvesting and treatment, visual screening, air, noise and lighting emissions. In particular, as part of the stormwater treatment requirements, individual lots will also provide on-site stormwater treatment and smaller bio-basins along the road corridors to reduce the size of end of line treatment.

End-of-line treatment devices would be located within the 'green' areas currently nominated. In addition, for some uses additional on-site measures may be required such as wastewater treatment, inclusion of separation or safety distances (for some hazardous industry activities). These are typically dealt with in on-site operational management plans which are required under various legislation including the Queensland Work Health and Safety Act, 2011.

8.6 Eco-Industrial Principles

Eco-industrial development, including cleaner production, bioproducts or waste interchange, and infrastructure sharing, is key to improving an industrial development's environmental quality and sustainability. The development model of circular economy, which integrates cleaner production and industrial ecology (including industrial operations, supply chains, eco-industrial developments, and regional infrastructure to support and promote sustainable development) is the key to future sustainable industrial development. To do this, an industrial precinct must be established with LEIP-wide solutions, not just site-based management measures.

An eco-industrial precinct is typically a community of manufacturing and service businesses located together on a common property. Member businesses seek enhanced environmental, economic, and social performance through collaboration in managing environmental and resource issues.

An eco-industrial precinct is to incorporate to the maximum extent possible the following elements:

- Resource efficiency in energy, materials, water, and transportation, with the cost savings gained through higher efficiency.
- Cleaner production through good housekeeping, reduction and substitution of toxic materials, strict control of emissions, separation of by-products or residual materials.
- Use of renewable energy and materials to replace fossil fuel sources and finite material supplies.
- Rehabilitation of existing buildings to higher energy and environmental standards and use of green architecture and engineering in new facility and infrastructure design.
- Enhancement of quality of life and economic development in neighbouring communities through projects between industry and community government and community-based organisations.
- Ecological site planning and utilisation based upon clear understanding of the carrying capacity of air, water, and ground systems and the nature of remaining native ecological systems.
- Establishment of environmental management systems with objectives and indicators informed by eco-industrial development, not only compliance with regulations.

Opportunity exists at the early planning phase of the LEIP to consider the extent eco-industrial principles should be applied to the LEIP, what measures and approaches are most relevant to the Townsville City Council and proponent aspirations and better understand the merits and implications of establishing a leading eco-industrial precinct.

Depending on the engineering initiatives that the Townsville City Council may decide to implement, certain aspects would benefit from consideration in the preliminary aspirational master plan. This is particularly relevant to water infrastructure but also for energy distribution and potential transport options. Some examples include, but are not limited to the following:

- Allowing for on-site wastewater storage and reuse.
- Allowing for mains and recycled water networks, and or cross connections between recycled water and raw water pipe networks.

- Water efficiency is recommended to be demonstrated by a LEIP-wide Water Cycle Management Study and Water Balance Investigation to determine the potential of supplementary water supplies.
- Sufficient green infrastructure incorporated into the preliminary aspirational master plan to minimise heat island effects.
- Infrastructure for waste heat / energy exchange.
- Selection of the most effective locations for proposed industries (for industrial synergy purposes and minimising unnecessary distance between shared networks).

Importantly, initiatives with sustainability benefits are not limited to the incorporation of in site infrastructure elements. Opportunities can be implemented post-construction, and during the engagement and establishment phases for proponents on site. The Sustainability Assessment Section 11 (included within **Appendix F**) describes the application of the UNIDO Framework, which would contribute to improved sustainability outcomes for the LEIP. Planning ahead has obvious benefits, however it is noted that successes in other eco-industrial precincts have often been organic and developed after establishment.

The Sustainability Assessment (**Appendix F**) concluded that application of the UNIDO Framework on the LEIP would aid in driving the sustainable delivery and management of the LEIP. The framework has international credibility and could assist in marketing the LEIP as world-leading from a sustainability perspective.

Whilst there are structural elements that may be necessary to realise some sustainability outcomes, crucially, the most important aspects to implementing the framework are centred on:

- Establishment of a Townsville City Council team responsible for site sustainability management. The Townsville City Council is in a unique and optimal position to establish this role in the early stages as owner of the LEIP land. However moving forward there are a range of options for how this function could be undertaken including:
    - Continued Townsville City Council self-management.
    - Management by independent external operator / contractor.
    - Self-managed by a tenants / proponent's association.
- The importance of using legal agreements with proponents to drive performance and proponent behaviour.

8.7 Development Sequencing

The economic assessment undertaken for this Project focussed on determining the requirements for industrial land within Townsville based on traditional industrial land forecasting approaches, population drivers, the projection of historical trends and employment-based forecasting. However, it was found that these approaches are unable to predict the likely demand for industries which rely on regional, national, and global economic trends and therefore could be used as the basis for determine possible development sequencing within the LEIP.

Thus, the sequencing and spatial extent of the stages is largely driven by the location preferences and requirements of the initial proponents and by the acknowledgement of the long lead times typically associated with the establishment of major industries such as those proposed along with the proposed stages of infrastructure provision. Figure 8-2 indicates the development staging and core and proponent land infrastructure staging.

Development has been sequenced to align with the following stages:

- **Stage 0 (Enabling works)** – The northern part of the LEIP and initial access road for early proponents.
- **Stage 1 (2021-2025)** – The eastern area between Ghost Gum Road and Bidwilli Road.
- **Stage 2 (2026-2030)** – Progressively moving south following the provision of the grade separated rail crossing at Ghost Gum Road and extension of the new sub-arterial road from Bidwilli Road.
- **Stage 3 (2031-2035)** – The southern and western areas in the LEIP.
- **Stage 4 (2036 to 2041)** – Infill and expansion areas within the LEIP not initially provided with infrastructure.

The gateway/ commercial precinct would be included in Stage 2, following the provision of the Ghost Gum Road rail overpass. Ideally this precinct should be established as early as possible in the life of the LEIP to provide an appropriate entry and promote the eco-industrial credentials of the estate.

It should be noted that the final alignment of the proposed western ring road is subject to the development layout of the sub-precincts. All development within the preliminary aspirational master plan is subject to a proposed planning scheme amendment to the Townsville City Plan being resolved and finalised by the Townsville City Council. Until the Townsville City Council has resolved to proceed with a planning scheme amendment and finalised the planning scheme amendment, the Townsville City Plan is to be complied with.

8.8 Comparison with Townsville City Plan

To compare the preliminary aspirational master plan (Figure 8-1) to the existing land use zoning under the Townsville City Plan, Figure 8-3 below overlays the current zoning over the preliminary aspirational master plan to illustrate the comparison.

As discussed above, there are options for realising an additional development area in the extent of land use for a proponent, which relevantly include the proponent lodging a development application for an assessment based on the merits, or alternatively the Townsville City Council may consider resolving and finalising a planning scheme amendment to the Townsville City Plan zoning and overlays to align with the preliminary aspirational master plan.

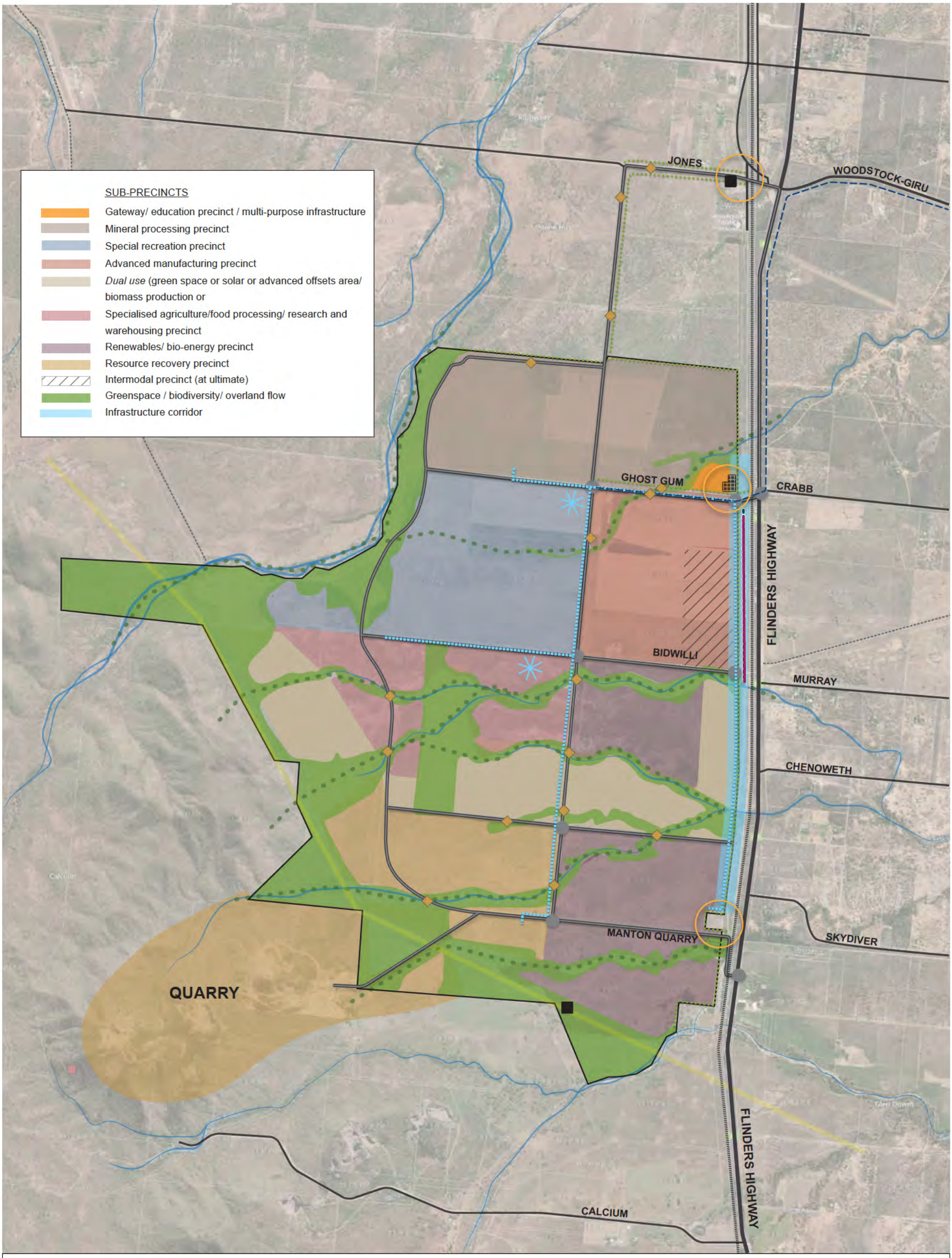


Figure 8-1

Preliminary aspirational master plan
Lansdown Eco-Industrial Precinct

(subject to Council adoption and finalisation of a planning scheme amendment)

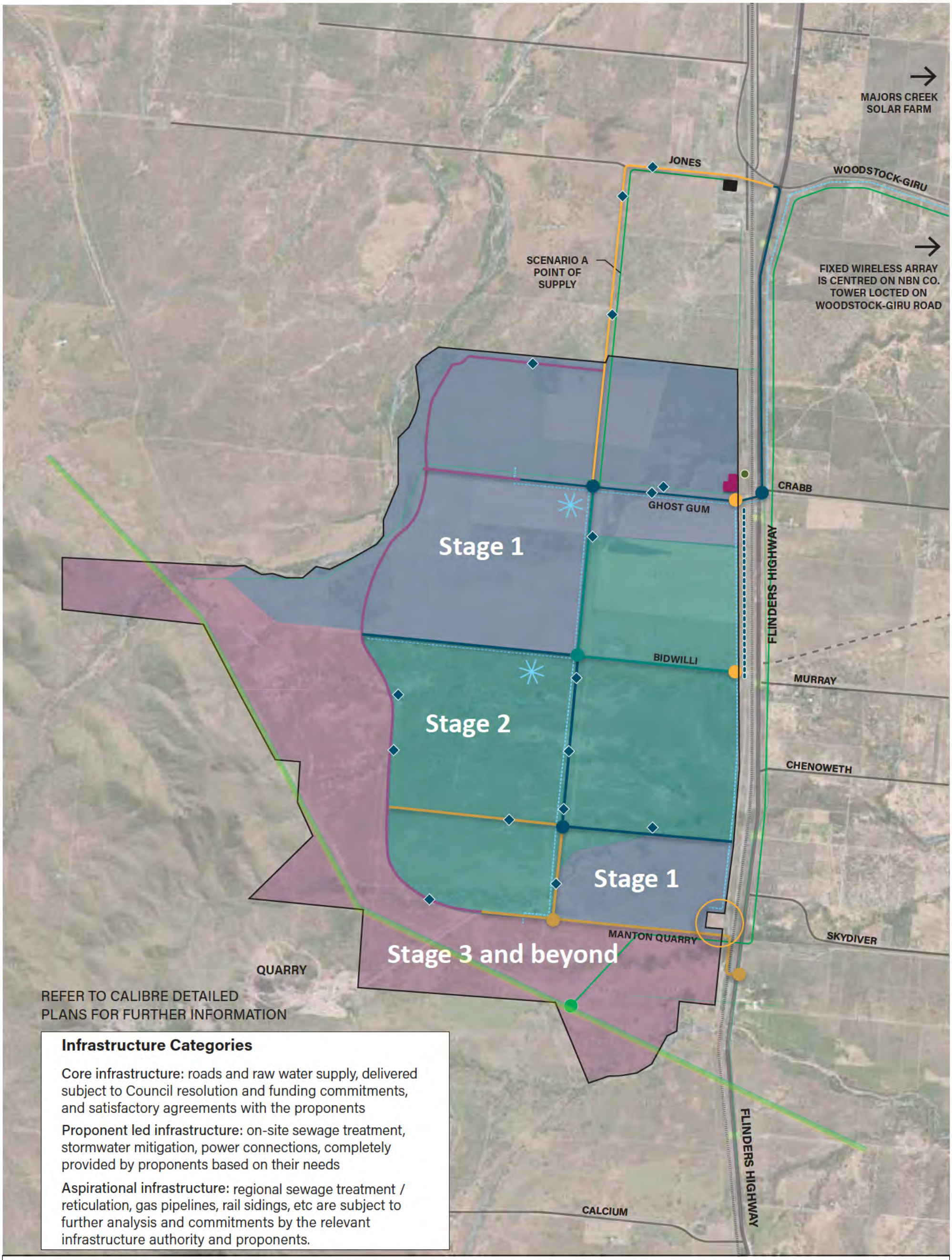


Figure 8-2

Development Staging and Core and Proponent-Led Infrastructure Staging
Lansdown Eco-Industrial Precinct

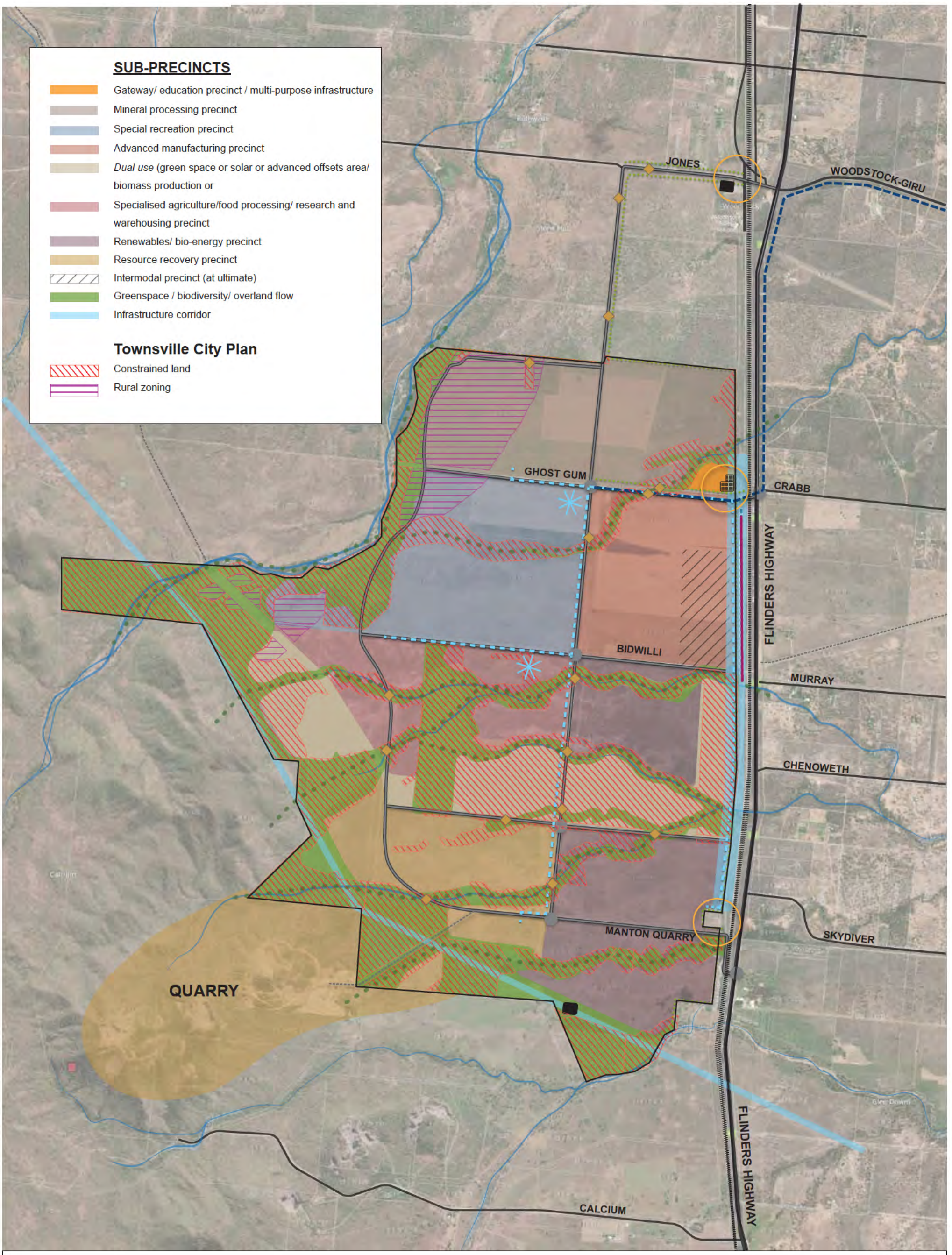


Figure 8-3

Constrained Preliminary Aspirational Master Plan – Comparison with Townsville City Plan
Lansdown Eco-Industrial Precinct

9. Infrastructure Mapping, Scheduling, Costing

9.1 Infrastructure staging strategy

9.1.1 Infrastructure delivery categories

Constructing new infrastructure will unlock developable land within the LEIP. The responsibility for constructing this infrastructure will be shared between multiple entities and is identified as core, proponent led, or aspirational infrastructure.

The supporting AIP is based on the preliminary aspirational master plan, economic assessment, and constraints assessment. Section 9.1 of the Master Plan provides a summary of the outcomes of the AIP and incorporates recommendations. Infrastructure descriptions have been described as such:

- **Core infrastructure:** Roads and raw water supply, delivered by Townsville City Council is subject to Council resolution and funding commitments, and satisfactory agreements with the proponents.
- **Proponent led infrastructure:** Individual on-site sewage treatment, stormwater quality and quantity mitigation, power supply, communications connections, gas supply completely provided by proponents based on their needs.
- **Aspirational infrastructure**: Rail siding and intermodal facility, LEIP-wide effluent recycling and reuse scheme, etc are subject to further analysis and commitments by the relevant infrastructure authority and proponents.

Core infrastructure is infrastructure to be delivered by the Townsville City Council as the owner of the LEIP land. These works are predominately enabling works and major stage works to support the primary function and development stage within the LEIP. Proponent led infrastructure is infrastructure to be provided by proponents to construct under Planning Scenario B. These works will primarily support the development stages where the interests of initial proponents are held.

Aspirational infrastructure is infrastructure to be provided by the relevant infrastructure authority and proponents on an as-needs basis. Aspirational infrastructure will improve the function of the LEIP but is not necessary to meet the basic standards of service within the LEIP.

Delivering all forms of infrastructure is subject to the staging strategy. Staging is intended to support effective investment in infrastructure by all entities and will follow the development staging proposed in Section 8.7 of this report. Infrastructure maps illustrating the location, type, and scale of proposed Infrastructure, as well as relevant staging are presented in this Section 8.7 of this report.

9.1.2 Transport infrastructure - traffic

The proposed traffic and transport access strategy for the LEIP under Scenario A is based on the progressive consolidation and improvement of railway crossings to provide east-west connectivity between the LEIP and the Flinders Highway. The enabling works stage under Scenario A provide compatibility to accommodate the expected traffic demands in the initial stage of development for the initial proponents in the northern development areas. Primary access to the LEIP is proposed to be via a new grade separated rail crossing near Ghost Gum Road, with secondary access via the upgraded railway level crossings at Woodstock Giru Road. Manton Quarry Road will provide tertiary access to the southern development areas in the Ultimate arrangement. The existing railway level crossings at Bidwilli Road and Ghost Gum Road will be decommissioned to support the development to its Ultimate arrangement. A detailed description of the traffic and transport access strategy including traffic modelling outputs is provided in Section 3.4 to Section 3.8 of the AIP.

Land release along the southern end of the LEIP near Manton Quarry Road is scheduled for release during Stage 3 of the development between 2031 and 2035. Therefore, access arrangements and connections in this area are deferred until this period of the preliminary aspirational master plan. Any works brought forward in this area would be to service the needs of individual proponent developments only and may cost in the order of $1.3 million (2021$). This would not be considered necessary as part of the broader Master Plan. It is noted

that a Decision Notice dated 21 September 2021 (MCU21/0040) has been issued for Edify Energy's current proposal. Access and serviceability arrangements for Edify Energy will be as per Council's development conditions (item 14, 28, 29 and 30) and any third-party agreements (e.g., development contributions or infrastructure agreements). These elements are By Others and are not subject to the broader master planning arrangements under Scenario A for the LEIP.

All major roads presented in the Master Plan are core roads. A minor road is only created in order to accommodate a proponent development of the LEIP land. As such a minor road is proponent led infrastructure. **Appendix D** incorporates Figure 21-000239 T01 that diagrammatically presents the proposed core road infrastructure.

The infrastructure staging strategy for the core transport infrastructure is summarised below.

- **Stage 0 – Enabling works**

  The enabling works are the minimum road infrastructure requirements needed to unlock development potential of the northern area in the LEIP for construction and occupation. Generally, these works are expected to commence in 2022 and include:

  – Upgrade of the railway level crossing to active control at Jones Road including signalisation, as well as associated road realignments to Flinders Highway to accommodate the new level crossing location.

  – Relocation of the existing 1.2km rail passing loop (currently located approximately 100m south of the existing intersection with Glenn Road) approximately 1.0km south and onto the western side of Mount Isa Rail Line including the decommissioning of the Bidwilli Road and Ghost Gum Road railway level crossings. Advice received from QR confirmed that they do not support any road access to the LEIP via the existing Bidwilli Road and Ghost Gum Road railway level crossings.

  – Construction of a new major collector road to connect the Jones Road railway level crossing to Ghost Gum Road. Enabling works to be confined to existing road reserve (refer Section 7.1).

- **Stage 1 – 2021 to 2025**

  The first stage of the road infrastructure works is needed to unlock the eastern area in the LEIP from Ghost Gum Road to Bidwilli Road. Generally, these works are expected to occur in 2024 and include:

  – Finalisation of the North-South Major Collector road from Jones Road to Ghost Gum Road with increased road reserve width (refer Section 7.1 cross section B).

  – Extension of the North-South Major Collector road from Ghost Gum Road to Bidwilli Road.

  – Proposed new major collector road for the eastern end of Bidwilli Road.

  – Development of a new major cross-junction at the intersection of Bidwilli Road and the North-South Major Collector Road in a priority-controlled configuration. That is, the North-South Major Collector Road will have priority through traffic lights and turning lanes to ensure connectivity through the LEIP.

- **Stage 2 – 2026 to 2030**

  The second stage of the road infrastructure works is focussed on the construction of the new grade separated crossing at Ghost Gum Road as the primary access point to the LEIP in the Ultimate arrangement. This stage also includes the extension of the new North-South Major Collector road from Bidwilli Road to Rowe Road to unlock the next parcel of land in the eastern area of the LEIP. These works are expected to be commissioned between 2026 and 2030 and include:

  – Commissioning the new grade separated crossing at Ghost Gum Road including its external connection to the Flinders Highway. Advice received from QR confirmed that they do not support any road access to the LEIP via this railway level crossing. The new grade separated crossing must be commissioned prior to Drive It NQ - Stage 3 [traffic generation rate of 350veh/hr] or Imperium 3 - Stage 2 [traffic generation rate of 1,050veh/day and 146veh/hr]. Proponent data suggests that Imperium 3 – Stage 2 will be commissioned between 2025 and 2028.

  - Development of a new major cross-junction at the intersection of Ghost Gum Road and the North-South Major Collector in a priority-controlled configuration. Ghost Gum Road is to be extended to the west to provide access to Drive It NQ.
  - Extension of the North-South Major Collector road from Bidwilli Road to Rowe Road.
  - Construction of the eastern end of Rowe Road and development of a new major cross-junction at the intersection of Rowe Road and the North-South Major Collector in a priority-controlled configuration.
  - Signalisation and augmentation works at the intersection of Ghost Gum Road and the North-South Major Collector Road.
  - Possible duplication works on the Flinders Highway from Ghost Gum Road to Jones Road including the relevant northern and southern intersection approaches. No duplications to occur before confirmation that traffic volumes warrant upgrade and further liaison with DTMR has occurred. Work on Flinders Highway to be determined by DTMR and will be limited to widening to allow for the overpass connection.

- **Stage 3 – 2031 to 2035**

  The third stage of the road infrastructure works is required to unlock the southern and western areas in the LEIP and includes the first round of major augmentation works required to accommodate internal traffic growth from the first ten-years of industrial development. Generally, these works are expected in 2035 (with some minor exception) and include the following:

  - Extension of the North-South Major Collector Road to connect to Manton Quarry Road as a major collector.
  - Extension of Rowe Road and Bidwilli Road alignments to connect with the western areas.
  - Proposed upgrades to Manton Quarry Road to major collector road standard including the proposed upgrade to the Manton Quarry Road railway level crossing to provide active controls including signalisation in accordance with Queensland Government requirements identified via the State Assessment and Referral Agency.
  - Signalisation at the intersection of Bidwilli Road and the North-South Major Collector Road.

- **Stage 4 – 2036 to 2041**

  The final stage of the road infrastructure works is required to support the development of the LEIP within the specified design period to 2041.

  - The Ultimate arrangement will include the construction of a western ring road developed to collector road standard with a series of intersections with the internal road network around Lansdown (subject to on-going monitoring of travel demands and behaviours during operation). The western ring road through the Drive It NQ site is subject to completion or modification of the existing lease.
  - Should traffic modelling indicate over time that Ghost Gum Road east of the North-South Major Collector require duplication, then this will occur during Stage 4.

9.1.3 Transport infrastructure - rail

Rail access is available to the LEIP by the Great Northern Rail Line located on the eastern boundary of the LEIP. The existing 1.2km passing loop commencing at Glenn Road will be relocated in line with the development of signal-controlled level crossing at Jones Road toward the south. The loop will relocate to the south of Ghost Gum Road.

Additional works are proposed for the rail siding where a business case can support demand for the associated intermodal hub facility. Details of possible business case considerations are presented in Section 7 of this report. Staging of the railway works are proposed as follows.

- **Stage 0** – **Enabling works** – Core rail infrastructure

  - Mount Isa Rail Line passing loop relocated from Glenn Road to south of Ghost Gum Road. These works enable provision of signal-controlled level crossing at Jones Road and upgrades to Woodstock-Giru Road intersection to commence.

- **Ultimate – beyond 2041** - Aspirational rail infrastructure
  - Pending business case support an expansion of the railway and construction of a siding and intermodal terminal off the proposed passing loop.

This assessment relies on information current at the date of this report.

9.1.4 Water supply

As described in the AIP the initial proponents' water demands are significantly higher than the standard practice water demands for high impact industry. Therefore, infrastructure sizing was based on Scenario B2, which is based on the initial four proponents demand with standard practice water demands applied for other areas in the LEIP. Due to the constraints associated with water supply and the use of raw water there is a large enabling works requirement to provide raw water to the LEIP. Core water infrastructure also includes the LEIP-wide storage and the internal LEIP distribution network of the raw water.

The treatment of raw water to a potable quality and distribution to each proponent's land, like a standard development area, is aspirational infrastructure. As such the provision of potable water supply to each proponent is considered as to be proponent led infrastructure. Beyond the enabling works, there is a relatively small impact to subsequent stages until the Stage 3 to Stage 4 (2031 to 2041) in which there is a new pump station to account for the raw water demand increases.

Staging of the water infrastructure will be provided in line with projected development sequencing. Core water infrastructure is outlined as per the following stages:

- **Stage 0 – Enabling works**
  - A ID500mm pipeline connected to the existing DN900 Haughton Pipeline located approximately 12.2km east of the development. The proposed alignment is outlined on Drawing No. 21-000239-SK2960 within **Appendix D**.
  - Booster pump station associated with the ID500mm connection to the DN900 Haughton Pipeline as outlined on Drawing No. 21-000239-SK2960 within **Appendix D**.
  - Initial portions of the internal transfer raw water mains to proponent storages, as required, the proposed alignment is outlined on Drawing No. 21-000239-SK2963 within **Appendix D**.
  - In ground lagoon storage accounting for 12 days' supply, 306ML capacity and pump station to account for DN900 Haughton Pipeline shutdown.
- **Stage 1 to Stage 2 – 2021 to 2030**
  - Extension of internal transfer raw water main to proponent storages as required.
- **Stage 3 to Stage 4 - 2031 to 2041**
  - Upgrade of external booster pump station to account for increased demands. If Stage 3 and beyond demands never eventuate this requirement of the raw water pump station is to be revisited.
  - DN400 Duplication of external DN500 pipeline.
  - Extension of internal transfer raw water main to proponent storages as required.
  - Expand raw water lagoon storage.
- **Ultimate – 2041 onwards**
  - No upgrades are anticipated beyond the ultimate stage.

For a detailed breakdown of the water infrastructure requirements refer to Section 5 of the AIP.

Proponent led water infrastructure is outlined below:

- Individual on-site 2-day storage from the total 14 days (2 weeks) storage required due to the shutdown of the DN900 Haughton Pipeline.
- Fire fighting pumps and storage.

- Provision of potable water for individual site usage.

Aspirational water infrastructure is outlined below:

- Internal water treatment plant and booster pump station south of Ghost Gum Road and Finders Highway.
- Potable water pipe reticulation as part of a dual water supply scheme from the treatment facility.

9.1.5 Wastewater

Calibre's recommendation is that proponents are to provide their own site-based wastewater treatment facilities, such that it is proponent led infrastructure. Refer to AIP Section 6 for further details.

Aspirational wastewater infrastructure is indicated below.

- New wastewater treatment plant.
- Gravity mains for future extension.
- "Third pipe" reticulated treated water pipeline.
- Treated effluent disposal/irrigation area (subject to a sighting study).

9.1.6 Electrical reticulation

Enabling works should secure a point of supply and services into the LEIP as described in Section 7.3 of this report. As this is a proponent led infrastructure the final network configurations are subject to on-going liaison with the power supplier and proponents. The following roll-out will apply for staged works thereafter:

- **Planning Scenario A and B Stage 1 to 4 – 2021 to 2041**
  - Conduit banks installed with roadworks construction with suitable truncations to allow network augmentations.
  - 500kVA PMT sites required on each allotment (due to distance between sites) (development Scenario A only).
  - Pad-mounted transformer (PMT) sites for each proponent to be confirmed with distributor after consultation of power demands are finalized for Development Scenario B.
  - Cabling installed by Energy Queensland Authority or proponent led contractor prior to practical completion for each stage.
  - If a 132kV overhead powerline is pursued by proponents' additional easements will be required. Overhead transmission requires exclusion zones in accordance with the regulatory authority guidelines. One option proposed in the AIP is for a central overhead power line aligned with the north-south unnamed road reserve. Poles, rather than towers, can be located at the eastern side of the proposed road reserve and an easement of 20m extends into the adjoining site, refer to AIP Section 7.4.3 for further details.

Power is to be delivered to each development site after authority handover and Energy Queensland or asset approval for private reticulation. Retail customers and proponents are to establish accounts with the approved suppliers. This report does not consider works beyond the ultimate horizon in the year 2041.

9.1.7 Gas supply

Enabling works should include suitable land dedications for a gas let-down station and micro-LNG facility. Road network augmentations will also facilitate the delivery of road-mounted LNG, should this option be preferable to proponents.

The following roll-out will apply for staged works thereafter:

- **Planning Scenario A and B Stages 1 to 4 – 2021 to 2041**
  - Conduit banks are to be installed with roadworks construction and connected to the previous stage conduit, as core infrastructure.

- Gas mains are to be installed by the retailer prior to practical completion of each stage, as proponent led infrastructure.
- Gas supply is to be provided to proponents holding retail contracts with the gas supplier. Overall demand is managed by the retailer and wholesaler, as proponent led infrastructure.

This report does not consider works beyond the ultimate horizon in the year 2041.

9.1.8 Telecommunications infrastructure

Enabling works are not required for telecommunications as the NBN Co. fixed-wireless array is already established in the vicinity of the LEIP. Upgrades to the existing fixed-wireless array (FWA), or satellite connection, could be considered by individual proponents.

Stage works will depend on the type of network upgrade, but an alternative to FWA could include Fibre to the Premises roll-out plans as per the following:

- **Planning Scenario A and B Stages 1 to 4 – 2021 to 2041**
  - Conduit banks installed with roadworks construction.
  - Fibre installed by wholesale provider prior to practical completion for each stage.
  - Bandwidth provided to proponents holding retail contracts with their selected retail supplier. Overall demand is managed by the retailer and wholesaler.

This report does not consider works beyond the ultimate horizon in the year 2041.

9.1.9 Stormwater infrastructure

For infrastructure planning, the investigation detailed in the AIP report has primarily focused on the preliminary sizing of major culvert structures where waterway crossings are required for the proposed road network. No bridge structures have been proposed.

It is noted that there is no specific drainage infrastructure specified in the LGIP; instead drainage infrastructure is summarised under transport infrastructure. As such, the cash flow analysis of drainage infrastructure is limited to the culvert crossings associated with the proposed road network, as well as major/minor road drainage elements such as kerb and channel, gully pits, table drains, and stormwater quality treatment devices such as bioretention swales located within the road reserve. These elements have been factored into the overall transport infrastructure costs. These stormwater drainage works within the roadways are considered core road infrastructure.

The provision for stormwater quality treatment devices and peak flow mitigation (detention basins) to service additional impervious surfaces within proponent land throughout the LEIP have therefore been excluded from the cash flow analysis, as well as from the definition of drainage infrastructure. These stormwater management items are considered as proponent led infrastructure.

Under Planning Scenario A, the preferred peak flow mitigation option is to defer the design, construction and maintenance of detention basins to the proponents throughout the LEIP, which can then be managed by the Townsville City Council through the development approval process. This is also the case for stormwater quality treatment devices such as bioretention devices.

9.2 Cash flow analysis

9.2.1 Purpose of Section

This section of the report assesses the financial implications and proposed strategy to deliver the Master Plan. This analysis was undertaken by PIE Solutions.

9.2.2 Revenue sufficiency analysis

9.2.2.1 Planned infrastructure

Infrastructure investigations have been undertaken by Calibre for the following types of infrastructure:

- Roads.
- Rail loop.
- Water supply (raw and potable).
- Wastewater.
- Electrical supply.
- Gas supply.
- Telecommunications.
- Stormwater.

The infrastructure investigations considered both the infrastructure necessary to enable the initial proponent development (enabling infrastructure works) as well as the infrastructure required to service the LEIP at full development. The infrastructure investigations are summarised in Section 9.1 and Table 9-1. A summary of the cost of the preferred core infrastructure is given in **Appendix E**.

Table 9-1 Summary of infrastructure cost estimates

Infrastructure	Summary of cost
Roads	Investigations for the road network have identified initial access to the LEIP from Jones Road (90% of trips) and Manton Quarry Road (10% of trips). The timing and standard to which these works will be provided will be dependent on the timing and amount of development within the LEIP, however it is anticipated that all works will be complete by 2041. The cost of the road works to service Stage 0 development of the LEIP is estimated to be [redacted]. The cost of the road works to service future stages of development of the LEIP is estimated to be a further [redacted]. Major culverts have been incorporated into the costs of the appropriate road link.
Rail loop and siding	Queensland Rail (QR) has advised that the proposed upgrade to the Jones Road / Glenn Road railway level crossing will impact on the existing passing loop, requiring its relocation. The preferred passing loop location is approximately 2.7km south of Jones Road / Glenn Road railway level crossing. The cost of the rail loop relocation as part of the enabling works for the LEIP is estimated by QR to be [redacted]. The rail siding is not identified as being required by the proponents. Calibre has recommended that a business case for the rail siding be developed before further investigations and costings are undertaken. For this reason, the cost of the **rail siding will not be considered** further in this analysis.
Water supply	Investigations for the water supply networks revealed that the preferred source of raw water is from the DN900 Haughton Pipeline approximately 12.2km to the east of the LEIP. A DN500 transfer pipe and pump station is proposed to be constructed to transfer the raw water to the LEIP. The investigations also considered options for the treatment, storage and distribution of raw water once received at the LEIP. • If Townsville City Council decides to treat raw water to potable standard, it will cost approximately [redacted] to construct a plant with capacity to treat up to 1.44 ML per day

Infrastructure	Summary of cost
	(Stage 0 and Stage 1 – 2021 to 2025). It would cost a further [redacted] to augment the plant to treat 8.07 ML per day (required for ultimate development). • If Townsville City Council decides to provide a shared Townsville City Council owned raw water storage facility at the LEIP, it will cost approximately [redacted] to provide a 306 ML storage at Stage 0 and a further [redacted] to augment the storage to provide an additional 711 ML of storage capable of servicing all future stages to ultimate development. • The cost of providing a connection to the DN900 Haughton Pipeline to supply the LEIP with raw water will cost approximately [redacted] to service Stage 0 development and a further [redacted] to provide additional pumping capacities and duplication of the pipeline to service development beyond Stage 3. • The distribution of raw water within the LEIP would cost approximately [redacted] to service Stage 0 development and a further [redacted] to service all future stages to ultimate development. The preferred water storage option is to provide a shared Townsville City Council owned storage facility at the LEIP and draw raw water from the DN900 Haughton Pipeline. For enabling works the estimate total CAPEX is estimated at [redacted] for the DN900 Haughton Pipeline supply and water reservoir.
Wastewater	Investigations for the wastewater network revealed that it would be possible, though not preferable, to provide a shared (Townsville City Council owned and operated) wastewater service to the LEIP using gravity sewers and a central treatment plant. Treated wastewater would be used to spray irrigate land within the LEIP or adjacent rural land. An alternative option to providing shared wastewater service is a proponent led infrastructure model. Under this model each proponent would be responsible for treating wastewater on-site. This is the preferred option presented in the AIP. If Townsville City Council decides to provide a shared wastewater network, it would cost approximately [redacted] to construct a treatment plant with capacity to treat up to 0.81 ML per day (Stage 0 development). It would cost a further [redacted] to augment the plant to treat 3.8 ML per day to service future stages up to ultimate development. The cost of gravity mains to provide sewerage reticulation within the LEIP would be approximately [redacted] to service Stage 0 development and a further [redacted] to service all future stages to ultimate development.
Electrical supply	Initial electricity supply to the LEIP can be acquired from the Woodstock Substation for the typical LGIP planning assumptions (i.e., Planning Scenario A), however not for all the initial four proponents. Servicing the LEIP from Woodstock requires an underground electrical cable locatable in the road reserve from Woodstock to Lansdown via Jones Road. Underground electrical cable throughout the LEIP will be located within new road augmentations. The cost of the Woodstock substation electrical supply works to service the initial development of the LEIP is estimated to be [redacted] for the Woodstock to Lansdown cable (Stage 0 development) and approximately [redacted] for internal reticulation (Stage 0 and future stages). The initial four proponents whose energy mix is larger than the typical planning conditions (i.e., Planning Scenario B) would be serviced via a new substation at Calcium. The new substation would be constructed connected to a private transmission line that received solar power from the Majors Creek Solar Farm. The cost of the new Calcium substation that will service the initial proponents (Stage 0 development) is [redacted]. The cost for temporary overhead electrical transmission cables from Calcium to Ghost Gum Road is [redacted]. Internal reticulation will be

Infrastructure	Summary of cost
	placed underground and is locatable in the road reserve with future road augmentations, which will cost is [redacted] (Stage 0 and future stages). Electricity supply conduits within the LEIP will be provided as part of the construction of the road network. The transmission cable from either the Woodstock Substation or Major Creek Solar Farm will be provided and funded by the proponents requiring electricity supply.
Gas supply	Liquefied Natural Gas (LNG) is available to the LEIP via the North Queensland Gas Pipeline (NQGP). The NQGP is located along the eastern boundary of the LEIP and is available after constructing a let-down station and micro-facility adjacent the pipeline (with a footprint of approximately 4,200m^2). LNG received from the NQGP will require an initial investment of [redacted] to construct the let-down station. LNG may be reticulated through the LEIP by gas mains installed in future road augmentations. LNG may also be trucked throughout the LEIP at the request of individual proponents and let-down at their individual sites. It is noted that the AIP identifies all initial proponents and three additional interested parties as having a need for gas supply. The AIP recommends that gas supply infrastructure be provided and funded by the first proponent within the LEIP to require LNG. Investment for a micro-LNG facility, reticulated gas mains, and/or trucked LNG will be by agreement between supplier and the proponents requiring LNG.
Telecommunications	The LEIP is partly located within the existing National Broadband Network (NBN Co.) fixed wireless array. The balance of the LEIP not covered by the fixed wireless array can be serviced by direct satellite connection through a retail carrier. If fibre to the premises was to be provided, it could be done by extending the NBN network which currently terminates at Roseneath which is located 33km north of Woodstock. The estimated cost of the extension is [redacted] Alternatively, a direct connection could be provided from the existing Telstra or Nextgen fibre cables located beside the LEIP. The cost to connect the initial proponents (Stage 0) by Telstra has been quoted as [redacted] The cost to connect by Nextgen has been quoted as [redacted] The investigations undertaken for the AIP ascertained that those proponents who require a network connection would need to negotiate a retail contract with a provider. For this reason, further planning of telecommunications infrastructure has not been undertaken and, as such, will not be considered further in this analysis.
Stormwater	Most of the LEIP is within the upper reaches of the Major Creek catchment, which drains east across Queensland Rail's Great Northern Rail Line, then across the DTMR controlled Flinders Highway, then ultimately to the Haughton River. A small portion of the north-west area of the LEIP drains to Lansdown Creek, a tributary of the Ross River dam reservoir to the north. Investigations for the stormwater network have identified that proponent site-based detention to mitigate increases in peak flows is preferred. Water quality treatment is recommended to be achieved through proponent site-based bioretention basins as well as bioretention swales incorporated into the road design. Townsville City Council has advised that proponents will be required to provide site-based detention and stormwater bio-retention infrastructure (other than road culverts) to address stormwater quantity and quality requirements. For this reason, **the cost of stormwater quantity and stormwater quality infrastructure will not be considered further** in this analysis.

9.2.3 Infrastructure charges revenue

A local government may, by resolution, adopt charges for providing trunk development infrastructure to service growth. Development infrastructure is defined in the Planning Act to include water supply, sewerage, roads, stormwater, cycleways, public parks and land for community facilities.

An adopted charge may be made for development if the charge is prescribed by the Planning Regulation for the development and is not more than the maximum adopted charge for providing trunk infrastructure for the development. Schedule 16 of the Planning Regulation states the prescribed amount of infrastructure charges. The prescribed amount for industrial uses is reproduced in Table 9-2.

These amounts are current on 1 July 2021 and republished each twelve months to take account of inflation. A local government may also adjust the adopted charges for inflation if an automatic increase provision is included in a local government's charges resolution consistent with the Planning Act. The Prescribed infrastructure charge rates are stated in Table 9-2.

Table 9-2 Prescribed infrastructure charge rates

Use	Prescribed Amount (July 2021)
High Impact Industry	1. $76.75 for each square metre of gross floor area 2. $10.95 for each square metre impervious area (stormwater charge)
Special Industry	
Low Impact industry	1. $54.80 for each square metre of gross floor area 2. $10.95 for each square metre impervious area (stormwater charge)
Medium impact industry	
Research and technology industry	
Rural industry	
Warehouse	
Marine industry	

The Townsville City Council's Infrastructure Charges Resolution 2021/22 (charges resolution) states its adopted infrastructure charge rates. It is noted that these are slightly below the prescribed amounts in the Planning Regulation. It is also noted that the charges resolution:

- does not state a charge rate for high impact industry consistent with the one stated in the Planning Regulation; and
- uses a location factor to reduce the charge rates in areas where the full suite of development infrastructure networks is not provided.

The purpose of this analysis is to estimate the maximum future infrastructure charges revenue that may be levied on development of the LEIP by the Townsville City Council over time. This anticipates that the Townsville City Council may revise its charges resolution to better align its adopted infrastructure charge rates with those stated in the Planning Regulation. Given that the estimate is to be calculated for development that is largely yet to be applied for, it is necessary to make several further assumptions. These assumptions are as follows:

- Infrastructure charges for development proposed as part of Stage 0 have been calculated as follows:
  - The infrastructure charge for the QPM site will be calculated using the charge rate for the High impact industry use type of $76.15 per m^2 as prescribed in the Planning Regulation for High impact industry.
  - The infrastructure charge for the Imperium 3 and Edify sites will be calculated using the charge rate for the Low impact industry, Medium impact industry or Research and technology industry use types of $54.80 per m^2 as prescribed in the Planning Regulation.
  - The relevant locational factor stated in the charges resolution has not been applied to the infrastructure charge rates as the Townsville City Council has yet to decide which development infrastructure networks will be provided to service the LEIP.

  - The infrastructure charge for the Drive It NQ site will be the amount stated in the existing infrastructure charges notice.
  - The GFA for each development has been calculated from the proponent plans. No infrastructure charge for the stormwater network will be calculated for development in the LEIP as this network is not provided and is not proposed to be provided by the Townsville City Council.
- Infrastructure charges for the remaining developable land (future stages) to be calculated as follows:
  - Scenario A – 100% High impact industry use of future stages (using an assumed plot ratio of 0.01).
  - Scenario B – 100% Low impact industry/medium impact industry use of future stages (using an assumed plot ratio of 0.2).

It is estimated that the infrastructure charges revenue which could be received from development within the LEIP ranges between [redacted] and [redacted] at full development depending on the type of future industrial development allowed in the LEIP by the Townsville City Council as the owner of the LEIP land. Full development of the LEIP is not expected to be attained for several decades. A summary of the estimated infrastructure charges for each scenario is provided in **Appendix E**.

If the four existing proponents (QPM, Imperium 3, Edify and Drive It NQ) proceed, the estimated infrastructure charges that can be levied on these initial developments will be approximately [redacted] These infrastructure charges will be received after the enabling infrastructure required to facilitate Stage 0 has been constructed. These estimates of infrastructure charges revenue provide upper and lower figures for use in the subsequent revenue sufficiency analysis.

9.2.4 Grants revenue

The Townsville City Council has advised that it has secured grants of approximately $16 million and has a reasonable level of confidence that it is likely to secure further grants of approximately $12 million toward the cost of constructing the enabling infrastructure required to service Stage 0. Grants have not been secured for the cost of infrastructure required to service future stages of development.

9.2.5 Revenue sufficiency

The revenue sufficiency analysis has been performed for both cost of enabling infrastructure required to service Stage 0 as well as the infrastructure required to service all other stages up to ultimate development (refer to Table 9-3).

Table 9-3 Revenue sufficiency

Stage	Infrastructure	Estimated Infrastructure Cost ($2021)	Estimated Grants Revenue ($2021)	Estimated Infrastructure Charges ($2021)	Revenue Shortfall ($2021)
Stage 0 (Enabling Works)	Roads	[redacted]	[redacted]	[redacted]	[redacted]
	Rail				
	Potable Water Supply				
	Sewage				
	Sub-total				
Future Stages	Roads	[redacted]	[redacted]	[redacted]	[redacted]
	Rail	$0.0 m			
	Potable Water Supply	[redacted]			
	Sewage	[redacted]			
	Sub-total	[redacted]			
All Stages	***Grand Total***	[redacted]	[redacted]	[redacted]	[redacted]

* Denotes costing supplied by QR

The immediate focus for the Townsville City Council is to ensure that the enabling infrastructure planned to service Stage 0 of the LEIP can be funded. The timing of the enabling infrastructure is fixed to the extent that development within Stage 0 cannot be undertaken before the enabling infrastructure has been constructed. Therefore, if Stage 0 development is to occur between 2021-2025 as sought by the Townsville City Council, the enabling infrastructure must be provided immediately.

Having regard to Table 9-3, it can be observed that the combination of grants revenue and infrastructure charges levied on Stage 0 development will be insufficient to fund the cost of the enabling infrastructure planned to service Stage 0 of the LEIP. The estimated shortfall for the enabling infrastructure is approximately [redacted]. The fact that the infrastructure charges revenue will only be received after the enabling infrastructure is constructed and development of Stage 0 has completed further compounds the liquidity problem for the Townsville City Council.

It can also be seen that the infrastructure charges levied on subsequent stages of development within the LEIP will be insufficient to fund the cost of the shared infrastructure planned to service future stages of the LEIP. The estimated revenue shortfall for these future stages is approximately [redacted] This has been calculated using the higher estimate of future infrastructure charge revenue. If the lower estimate was used, the shortfall for the future stages would be even greater.

It can therefore be concluded that:

- Infrastructure charges levied on development within the LEIP will not be adequate to fund the shared infrastructure planned to service Stage 0 of the LEIP as well as all future stages of the LEIP.
- Infrastructure charges levied on development within the LEIP should therefore be considered to be a contribution toward the use of existing and future trunk infrastructure external to the LEIP (i.e. roads) as identified in the LGIP. The Townsville City Council could, however, by agreement with a proponent offset the cost of shared development infrastructure provided by a proponent against the infrastructure charges that are levied on the development.

The Townsville City Council must therefore find another means of funding the planned infrastructure, reduce the scope and cost of the planned infrastructure or implement a combination of the two.

Alternative funding/delivery mechanisms are discussed in the following section of this report.

9.2.6 Infrastructure funding and delivery strategy

9.2.6.1 Introduction

This section discusses and recommends an appropriate strategy to fund and deliver the infrastructure required to service the LEIP. The funding and delivery strategy considers the following matters:

- alternative methods to fund the infrastructure;
- an appropriate scope of infrastructure to provide an appropriate sequence for the delivery of infrastructure;
- the appropriate party to fund /deliver the infrastructure.

9.2.6.2 Alternative methods of funding infrastructure

Accepting that infrastructure charges levied under the Planning Act 2016 will not deliver sufficient revenue to fund the cost of the identified infrastructure, it is necessary to consider alternative funding methods that could be used by the Townsville City Council. Two potential alternatives have been identified as follows:

- **Agreements** - The Townsville City Council enters into an agreement with each proponent to have the proponent fund/deliver infrastructure which is necessary to service their proposed development and the rest of the LEIP.
- **User Charges** - The Townsville City Council funds the infrastructure through borrowings and repays the loan over time through the imposition on proponents of user charges for that infrastructure network.

9.2.6.3 Appropriate scope of infrastructure

Infrastructure provided to the LEIP must be prudent (necessary) and efficient (cost effective). The provision of infrastructure is prudent if there is a reasonable expectation that the demand for the infrastructure is sufficient to justify the cost of its provision. The provision of infrastructure is efficient if it is the least cost option to deliver an appropriately defined scope and standard of works. The majority of proponents within Stage 0 do not need potable water or reticulated sewerage to enable their respective activities to be undertaken. This would suggest the following:

- The initial proponents are unlikely to fund/deliver the upfront cost of the infrastructure by agreement as it is not essential to their operations.
- If the Townsville City Council pays for the upfront cost of the infrastructure, there is a high risk that a number of the initial proponents may not use the service that has been provided. If this was to occur, it would prevent the Townsville City Council from recovering the cost of the infrastructure through user charges.

The removal of water treatment and reticulated sewerage from the scope of works provided to the LEIP would significantly reduce the cost of the infrastructure required to be funded by agreements or user charges with proponents, refer to **Table 9-4**. By removing this cost, the revenue sufficiency analysis (Table 9-3) can be revised to show a revenue shortfall for the enabling infrastructure of [redacted] compared to a shortfall of [redacted] if treated water and reticulated sewage was to be provided.

Table 9-4 Revised Revenue Sufficiency: Excluding potable water and reticulated sewage

Stage	Infrastructure	Estimated Infrastructure Cost ($2021)	Estimated Grants Revenue ($2021)	Estimated Infrastructure Charges ($2021)	Revenue Shortfall ($2021)
Stage 0 (Enabling Works)	Roads	[redacted]	[redacted]		
	Rail	[redacted]		[redacted]	[redacted]
	Raw Water Supply	[redacted]			
	Sub-total	[redacted]			
Future Stages	Roads	[redacted]	[redacted]		
	Rail	[redacted]		[redacted]	[redacted]
	Raw Water Supply	[redacted]			
	Sub-total	[redacted]			
All Stages	***Grand Total***	[redacted]	[redacted]	[redacted]	[redacted]

9.2.7 Infrastructure funding and delivery plan

The funding and delivery plan only considers the enabling work for Stage 0. With limited ability to determine the real timing future stages development and the actual infrastructure necessary to service that development, any recommendations for the funding and delivery of this infrastructure would be highly speculative.

Instead, it is recommended that if there is ongoing proponent interest that triggers the need for additional infrastructure, the Townsville City Council require that proponent to fund the required infrastructure by agreement. If the infrastructure that is triggered cannot be funded by the proponent, the Townsville City Council could then consider alternative funding mechanisms considering its financial position at that time. The starting position for the funding of the enabling works is that infrastructure is funded and delivered by proponents to the greatest extent possible via an agreement with the Townsville City Council. This minimises the financial risk to the Townsville City Council of unused or underutilised infrastructure being funded/delivered in advance of development. However, given the cost of the enabling works, the limited grants revenue available to defray this cost and the small number of proponents reasonably able to fund/deliver the infrastructure, it is concluded that the Townsville City Council may need to fund some of the enabling works.

Having regard to the location of initial proponent development sites, the cost and location of the enabling works and the likely capacity of the proponents to fund/deliver the infrastructure, the recommended funding and delivery of these is provided in **Table 9-4.**

Without detailed knowledge of the Townsville City Council's and the initial proponents' ability to fund the infrastructure, this plan is intended to provide a starting point for negotiations with the proponents.

Table 9-4 LEIP enabling works funding and delivery plan

Infrastructure Description	ID	Party to deliver	sequence/ dependencies	Party to fun d and funding mechanism	Cost ($2021)	Notes
DN375 Water Main	OPB-4	QPM	Prior to use commencing requires raw water transfer main and storage	QPM – Infrastructure Agreement	[redacted]	
DN450 Water main	OPB-3	Imperium3	Prior to use commencing requires raw water transfer main and storage	Imperium 3 – Infrastructure Agreement	[redacted]	
DN250 Water main	OPB-2	Edify Energy	Prior to use commencing requires raw water transfer main and storage	Edify Energy – Infrastructure Agreement	[redacted]	Edify may not require raw water.
Major Collector Road (North- South) - Jones Road to Ghost Gum Road incorporating INF-17	INF-2	QPM or Council	Prior to use commencing requires Jones Road level crossing upgrade	Agreement/ Existing or likely grant	[redacted]	The cost of diverting this road around the QPM site is estimated to cost an additional $5 million which ought to be borne by QPM. Townsville City Council should contribute available grant money of $2 million toward cost. Townsville City Council could consider offsetting the cost against infrastructure charges levied on QPM development for existing and future trunk infrastructure external to the LEIP (ie roads).
				SUB-TOTAL	[redacted]	
DN500 Haughton Pipeline Transfer Main	OP1b-1	Proponents or Council	Immediate	Proponent or Council – Up-front cost recouped through User Charges	[redacted]	
Transfer Pump Station (600kW)	OP1b-2	Proponents or Council	Immediate	Proponent or Council – Up-front cost recouped through User Charges	[redacted]	
Enabling Water Storage	OP1b-3	Proponents or Council	Immediate	Proponent or Council – Up-	[redacted]	The water storage has two possible locations: south of Ghost Gum Road or south of Bidwilli.

Infrastructure Description	ID	Party to deliver	sequence/ dependencies	Party to fun d and funding mechanism	Cost ($2021)	Notes
				front cost recouped through User Charges		If located south of Bidwilli a water main (OPB-5) would need to be constructed.
Regional Transfer Pump Station (150kW)	OPB-1	Proponents or Council	Immediate	Proponent or Council – Up-front cost recouped through User Charges	[redacted]	
DN450 Water Main	OPB-5	Proponents or Council	Dependent on location of OP1b-3 being located south of Bidwilli Road	Proponent or Council – Up-front cost recouped through User Charges	[redacted]	It is anticipated that this item would only be required if the enabling water storage (OP1b-3) was to be located south of Bidwilli Road.
Decommission existing rail crossing - Ghost Gum Road	INF-37	Council	Immediate	Existing of likely grant	[redacted]	
Decommission existing rail crossing- Bidwilli Road	INF-38	Council	Immediate	Existing or likely grant	[redacted]	
Jones Road Rail Level Crossing Upgrade, including road connections to east, and Jones Road to Major Collector Road (North- South)	INF-1	Council	Immediate	Existing or likely grant	[redacted]	
				SUB-TOTAL	[redacted]	
Passing Loop and Jones Road Level Crossing (QR provided Costing)	RWY-1	Council	Immediate	Existing Grant	[redacted]	
				GRAND TOTAL	[redacted]	

10. Recommendations and Next Steps

10.1 Introduction

Successful implementation of a regional scale development, such as the LEIP, requires consideration of several factors including:

- Buy-in / cooperation from local landholders and the wider community.
- Promotion to and interest from potential catalytic development operators.
- Alignment with Queensland Government initiatives to gain ongoing funding, planning support, and potential partnership.
- A beneficial and appropriate delivery mechanism.
- Appropriate and feasible infrastructure funding.

The following section describes the recommended actions required for the LEIP to be implemented successfully.

10.2 Cash Flow Analysis

It is recommended that:

- The Townsville City Council reconsiders the suitability of the LEIP for small-scale, low intensity or low impact industrial uses as these uses are unlikely to be willing or able to do the heavy lifting in terms of funding and delivering the infrastructure.
- The Townsville City Council refocus the LEIP as a location for high impact industries that have limited opportunity to relocate, and which can justify the significant investment in up-front infrastructure required to service the LEIP.
- The preliminary land use aspirational master plan for the LEIP could be reconsidered in the future having regard to confirmed proponents. This could include a review of the scope of infrastructure, for example the road layout of the LEIP could be rationalised. If larger proponent sites, with limited access points, are proposed the western ring-road could be unnecessary and be removed. These changes would reduce the cost of infrastructure required to service the LEIP.
- The Townsville City Council, as owner of the LEIP land, actively seek other high impact industries like QPM to locate to the LEIP. If successful, this would enable the cost of the infrastructure to be apportioned across a greater number of users likely to be willing to make a significant upfront contribution to the funding and delivery of the required infrastructure. This would improve the financial attractiveness of the LEIP for each of the high impact industries.

10.3 Enabling Infrastructure

As indicated earlier in the report there is identified enabling infrastructure works to service the initial proponents for the LEIP. The enabling works are the minimum road infrastructure and raw water pipeline requirements needed to unlock development potential of the northern area in the LEIP for construction and occupation. Generally, these works are expected to commence in 2022 and include the following:

- Proposed upgrade of the Great Northern Rail Line level crossing to active control at Jones Road including signalisation.
- Relocating the railway passing loop, away from the northern level crossing.
- Construction of a new major collector road to connect the Jones Road railway level crossing to Ghost Gum Road.
- Decommissioning of the Bidwilli Road and Ghost Gum Road existing level crossings.

- Provision of a raw water pipeline DN500 (ID500mm), associated booster pump station, raw water storage lagoon and raw water connection points.
- Underground electrical cables and connection point between should be installed between Woodstock Substation and Ghost Gum Road, via Jones Road and No-name Road. These would be installed within the road reserve of respective road alignments and position inside a conduit bank. Each proponent will require relevant substations required to maintain the network.

10.4 Stage 1 Infrastructure

Stage 1 infrastructure is defined as the infrastructure needed by the end of the 2026 horizon. Subject to the ongoing take up and demands from the proponents in stage 1 the following infrastructure is required:

- Extension of the North-South Major Collector road from Ghost Gum Road to Bidwilli Road.
- Proposed new major collector road for the eastern end of Bidwilli Road.
- Development of a new major cross-junction at the intersection of Bidwilli Road and the North-South Major Collector Road in a priority-controlled configuration.
- Internal raw water network connections.
- Expand the electricity network and substations, as proponent led infrastructure, as required.
- Provision of communication network conduits, as proponent led infrastructure, as required.
- Provision of gas reticulation conduits with road construction, and as required and provided by proponents, a supply reticulation system.

10.5 Future Infrastructure Identification

Each different infrastructure type has a different demand threshold. These are detailed in the AIP 2021 and a summary of these types of infrastructure has been included in the AIP, in addition to a summary in Section 9.1 of this report.

10.6 Master Plan Refinement Activities

10.6.1 Eco–Industrial and Sustainability Assessment

- Undertake a review of eco-industrial, circular economy and sustainability initiatives that could be adopted in the planning, management, and ongoing development within the LEIP for it to be recognised as a leading eco-industrial precinct and highly desirable location for industry attraction.
- Revise and update relevant sections of the Master Plan in line with the agreed findings from this assessment.

10.6.2 Market Opportunities Assessment

- Undertake additional industry market opportunities assessment to understand the nature and likelihood of future industry proponents that could be attracted to the LEIP.
- This assessment should focus on those sectors for which Townsville has recognised comparative advantages at the regional, national, and global level, together with those upstream and downstream activities associated with the initial or future proponents.
- Revise and update relevant sections of the Master Plan in line with the agreed findings from this assessment.

10.6.3 Business Case for Rail Facility

- Undertake a business case for the provision of a future rail siding/intermodal or other rail related infrastructure building on the outcomes of the above assessments.
- The business case should establish the likely need and best location for rail facilities in view of potential proponent requirements, recognised freight handling principles, capacity and availability of Port facilities and input from other relevant stakeholders, including QR.

10.7 Future Delivery, Funding and Planning Activities

10.7.1 Enabling Works Delivery

It will be necessary to advance agreements with stakeholders and the development approval process for the enabling works in relation to the following:

- **Road Network**
  - Land acquisition and approvals for land and road works from the Flinders Highway, via Woodstock-Giru Road and Jones Road intersection, to the northern boundary of QPM.
  - Agreement with QPM to continue a road network through to Ghost Gum Road intersection with the unnamed road reserve that heads south. This will be either along the existing north-south aligned unnamed road reserve, or via the less desirable western alternative alignment at the cost of QPM.
  - Maintain conditions 16 and 17 of the Drive It NQ Development Approval to construct a rural standard road via the unnamed road to the north, and pavement assessment and upgrade works as required.
  - Impose the similar road network conditions above on Edify Energy from the Manton Quarry Road site access to north. It is noted that solutions are required for drainage/waterway crossings.
- **Water**
  - Provision of a supply pipeline to stage 1 land comprising the initial proponents in the northern part of the LEIP (QPM and Imperium3), and to Edify Energy in the southern part of the LEIP, sized for demands of existing known proponents, and balance of land in Stage 1 based on the High Impact Industry land use assumptions.
  - Investigate alternative site allocation options for Edify Energy closer to the northern LEIP Stage 1 area, and which can utilise higher constrained land for the ancillary solar facility.
- **Gas**
  - Progress a retailer agreement (e.g., APA) and provision of a let-down area off the North Queensland Gas Pipeline, which provides connections along Ghost Gum Road to proponents within Stage 1 northern precinct (in particular for use by QPM and Imperium3).

10.7.2 Infrastructure Agreements with Proponents

It will be necessary as part of any agreement between a proponent and the Townsville City Council for land in the LEIP for the proponent to enter into a satisfactory Infrastructure Agreement with Council to provide for infrastructure contributions for the enabling infrastructure works which are necessary to service proposed development and the rest of the LEIP.

10.7.3 Consider Review of Townsville City Plan

The Townsville City Council may wish to give consideration to undertaking a review of the Townsville City Plan to consider proposed planning scheme amendments which align with the preliminary aspirational master plan.

TW00435 – LANSDOWN ECO-INDUSTRIAL INFRASTRUCTURE PRECINCT - INFRASTRUCTURE MASTER PLAN

Appendix A Infrastructure Demand and Scenario Assumptions Spreadsheet

Scenario	Name	Detail | Assumptions
A	Current Planning Scheme	HII (broad-hectare) and S&R (broad-hectare) zoned land, less Natural Areas Environmental Overlay.
		Exclude Rural zone from demand i.e. do not assume to service residential demand.
		Given DriveIt NQ has a lease, assumes the S&R land has been taken up.
B	Current Proponents	Utilising Scenario A assumptions as a base case, and then varied with proponent's areas and advised demands.
C	Review of Scheme	Variations to land identified as potential development areas as below.
		S&R zoned land as S&R.
		Land within the Natural Areas Environmental Overlay but considered to have development potential identified HII (Broadhectare).
		Land in the Rural Zone and Water resource catchment overlay code, but >100m from Top of Bank (TOB), and not subject to flood or within the stormwater catchment to the west, identified as HII (broad-hectare).
Abbreviations & other assumnptions:		
HII	High Impact Industry Zone	
HII (Uplift)	High Impact Industry Zone (Uplift) - Potential Development Areas identified within Rural zone and outside revised Ross Dam Stormwater Catchment, or within Natural Areas Environmental Overlay.	
HII (Eco)	High Impact Industry Zone (Eco-Industrial Precinct) - Land use and demand assumptions based on existing Eco-Industrial Precincts.	
S&R	Sport & Recreation Zone	
LGIP	Local Government Infrastructure Plan (10 years to 2032)	
LTIP	Long Term Infrastructure Planning (10+ years from 2032)	
NDA	Net Developable Area	
Proponents	QPM, Imperium 3, Edify, DriveIt NQ & Potential Proponents Information	
Land take up rate	50% take up rate of projected demand factoring in competition (e.g. Townsville SDA)	
Land use density under LGIP	HII broad-hectare.	
Network demand under LGIP	HII lots less than threshold assumptions.	
Scope of intrastructure networks:		
Water	LGIP	Included in LEIP project scope
Sewer	LGIP	Included in LEIP project scope
Roads	LGIP	Included in LEIP project scope
Footpaths	LGIP	Not included in LEIP project scope
Parks, land for community facilities	LGIP	Not included in LEIP project scope
Fibre Optic	LEIP	Assumed all developable land to be required to be serviced by fibre optic - 1Gbps download speed /600Mbps upload speed/Traffic Class 2/Enterprise Ethernet 100% guaranteed bandwidth.
Rail Siding	LEIP	Assumed rail siding demand based on amount of developable area and potential scale of high impact industrial uses
Water and Wastewater Demand Rates		
Other Water & Wastewater Rates	High Impact Industry Uses	Review of other planning schemes and associated demand rates nominated a range for high impact industry between 20.6 EP (Urban Utilities) and 400 EP (Unitywater). Summary of rates listed below: Urban Utilities Water (Brisbane) - 20.6 EP/Ha Urban Utilities Wastewater (Brisbane) - 30 EP/Ha Urban Utilities Water (Lockyer Valley) - 24.7 EP/Ha Urban Utilities Wastewater (Lockyer Valley) - 36 EP/Ha Unitywater - 400 EP/Ha (developable floor area)
W&WW Adopted rate	High Impact Industry Uses	Scenario A adopted rates: Water - 56 EP/Ha Wastewater - 9.7 EP/Ha Scenario B & C adopted rates (unless Proponet Demands Applied): Water - 56 EP/Ha Wastewater 40.8 EP/Ha Adopted rates based on similar industrial uses i.e. refineries location in Gladstone (CMDG demand rates).
Scenario B2	Water and Watsewater additional o	Scenario B2 only relates to water and wastewater
Traffic		
Trip-ends	High Impact industry	Initial demand rates adopted from Council's Planning Scheme (LGIP); however noting these appeared high compared to industry rates
Trip-ends	High Impact Industry	Pragmatic demand rates were prepared based on Industry Rates from TDB-TRICS, RTA & DTMR sources; pramatic rates were compared against industry report for trips demands in QLD
		Adopted rate of 26.5 trip-ends per Hectare of NDA each day
Stormwater		
Fraction Imperviousness by zoning (City Plan SC6.4.4.4 - Attachment A)	90%	High Impact Industry Zone
	20%	Sports & Recreation
	10%	Rural
Fraction Impervious by Development Category (QUDM 2016, Table 4.5.1)	70%	Existing Road/Emt
Adopted Fraction Impervious from received TCC xpRAFTS model	0%	Existing undeveloped land
Fraction Impervious for Proposed Roads (based on corridor widths and typical road sections)	70%	Sub-arterial road (40m wide corridor, approx. 28m total pavement/compacted width)
	75%	Distributor road (32m wide corridor, approx. 24m total pavement/compacted width)
	60%	Collector road (28m wide corridor, approx. 16m total pavement/compacted width)

Industrial employment and land demand projections for Townsville LGA.							**29-Jul-21**
These figures are for industrial land demand as a whole, across the region as a whole.							
The 15ha/annum number is for industrial land demand as a whole (see the total).							
Given the above, the demand may be taken up by competitor areas that can accommodate this demand (eg Townsville SDA).							
Industry Type	**2020**	**2021**	**2026**	**2031**	**2036**	**2041**	**Totals**
Employment							
Large Footprint and General Industry	5,289	5,224	6,875	7,845	9,017	10,397	
Service Industry	7,617	7,870	8,805	9,426	9,968	10,404	
Warehousing & Storage	3,119	3,152	3,315	3,477	3,637	3,797	
Transport Uses	5,158	5,228	5,431	5,646	5,790	5,900	
Sub-Total	**21,183**	**21,475**	**24,426**	**26,395**	**28,412**	**30,498**	
Increase			***2,951***	***1,969***	***2,017***	***2,086***	
50% Take Up Rate of Increase			***1,476***	***985***	***1,009***	***1,043***	**4,512**
Net Industrial Land Demand							
Large Footprint and General Industry	177.7	175.3	230.6	261.7	299.8	344.6	
Service Industry	238	246.6	277.1	297.7	314.7	327.9	
Warehousing & Storage	145.5	147.1	155.7	164.1	172.1	179.8	
Transport Uses	232.7	235.7	236.1	243	244.8	244.8	
Non-industrial land uses (5%)	39.7	40.2	45	48.3	51.6	54.9	
Total	**833.7**	**845**	**944.5**	**1,014.90**	**1,083.00**	**1,151.90**	
Incremental Net Industrial Land Demand							**Annual Incremental Demand 2021-41**
Large Footprint and General Industry		-2.5	52.8	83.9	122.1	166.8	8.3
Service Industry		8.6	39.1	59.7	76.7	89.9	4.5
Warehousing & Storage		1.6	10.2	18.6	26.6	34.3	1.7
Transport Uses		2.9	3.4	10.3	12.1	12.1	0.6
Non-industrial land uses (5%)		0.5	5.3	8.6	11.9	15.2	0.8
Total		11.3	110.8	181.2	249.3	318.2	15.9
Annual demand for the five year increments is below							
	2020-21	2021-26	2026-31	2031-36	2036-41	Total	
Incremental Net Industrial Land Demand							
Large Footprint and General Industry	-2.5	11.1	6.2	7.6	8.9	31.3	
Service Industry	8.6	6.1	4.1	3.4	2.6	24.8	
Warehousing & Storage	1.6	1.7	1.7	1.6	1.5	8.1	
Transport Uses	2.9	0.1	1.4	0.4	0	4.8	
Non-industrial land uses (5%)	0.5	0.9	0.7	0.6	0.7	3.4	
Sub-Total p/a	11.3	19.9	14.1	13.6	13.8	72.7	
Sub-Total for 5 year period		99.5	70.5	68	69	307	
50% Take Up Rate (Factoring Competition)		49.75	35.25	34	34.5	153.5	
Sub-Total p/a at 50%		9.95	7.05	6.8	6.9	30.7	

Proponent Demand Summary

1-Dec-21

Proponent	Water (ML/a)	Traffic (Vh/hr)	Energy (MW/a)	Gas	Telecom (Gb Speed)	Gross Area (ha)	Fraction Impervious (ha)	Slope (%)
Drive It NQ (Sports and Rec.)								
2021	0	250	0.1	0	?			
2026	0	1177	0.1	0	?			
2031	0	1177	0.1	0	?			
2036	0	1177	0.1	0	?			
2041	Connect to Grid?	1177	0.1	0	?			
Queensland Pacific Metals (Mineral Processing Plant)								
2021	4380	2.5	40	12PJ/a	1GB D/L , 0.6GB U/L speed			
2026	4380	4.08	40	12	1GB D/L , 0.6GB U/L speed			
2031	4380	4.08	40	12	1GB D/L , 0.6GB U/L speed			
2036	4380	4.08	40	12	1GB D/L , 0.6GB U/L speed			
2041	4380	4.08	40	12	1GB D/L , 0.6GB U/L speed			
Edify Energy (Hydrogen Producer)								
(potential delay in commencing)	350	15.95833333	0	0 (Use Proponent Hydrogen)	?			
2026	350	15.95833333	0	0	?			
2031	350	15.95833333	0	0	?			
2036	350	15.95833333	0	0	?			
2041	350	15.95833333	0	0	?			
Imperium3 (Lithium-Ion Battery Manufacturing Plant)								
2021	1420.8	148	15	5.3TJ/day	?			
2026	2841.5	148	29.7	5.3	?			
2031	4262.3	148	44.4	5.3	?			
2036	4262.3	148	44.4	5.3	?			
2041	4262.3	148	44.4	5.3	?			
Interested Project #1								
2021	0	?	2.5	0	?	0		
2026	11680	?	2.5	0	?	150-200		
2031	14600	?	2.5	0	?	150-200		
2036	14600	?	2.5	0	?	150-200		
2041	14600	?	2.5	0	?	150-200		
Interested Project #2								
2021	0	0	0.03	0	0	0		
2026	?	?	0	0	?	250		
2031	?	?	0	0	?	250		
2036	?	?	0	0	?	250		
2041	?	?	0	0	?	250		
Interested Project #3								
2021	0	?	12	0	?	0		
2026	25	?	12	12000m3/a	?	5		
2031	25	?	12	12000m3/a	?	5		
2036	25	?	12	12000m3/a	?	5		
2041	25	?	12	12000m3/a	?	5		

Sequencing	Zone	Scenario A Current Scheme																			
		Total Areas (Ha)	NDA (Ha)	Broad-Hectare Density - Floorspace per NDA										Employment		Raw Water ==> 56EP/ha					
				Retail (Ha)	Retail (m2)	Services (Ha)	Services (m2)	Profess. (Ha)	Profess. (m2)	Industry (Ha)	Industry (m2)	Other (Ha)	Other (m2)			LGIP	Industry Std				
																EPs		AD, ML/day	AD, ML/a	PD, ML/day	PD, ML/a	PH, ML/day
Ultimate	HII	1451 9	857.5	0.08575	857.5	1.372	13720	1 372	13720	136.514	1365140	0	0	4,512		48,020.0		28 8	10,516.4	54 0	19,718.2	81 0
	S&R	223.1	181.8	0	0	0	0	0	0	0	0	0	0									
	Rural	274 5	120.7	0	0	0	0	0	0	0	0	0	0									
	Roads/Emt	106 9	0.0	0	0	0	0	0	0	0	0	0	0									
Total	***Total***	***2056.4***	**1160.0**	0.08575	857.5	1.372	13720	1.372	13720	136.514	1365140	0	0									
LGIP (5 yrs; Immediate) 2021 - 2026	HII		49.8	0 004975	49.75	0 0796	796	0.0796	796	7.9202	79202	0	0	1,476		2,786.0		1.7	610.1	3.1	1,144.0	4.7
	S&R		181.8	0	0	0	0	0	0	0	0	0	0									
	Rural		39.8	0	0	0	0	0	0	0	0	0	0									
Sub-total	***Sub-total***		**271.4**	0 004975	49.75	0 0796	796	0.0796	796	7.9202	79202	0	0			2,786.0		1.7	610.1	3.1	1,144.0	4.7
LGIP (5-10 yrs; short term) 2026 - 2031	HII		35.3	0 003525	35.25	0 0564	564	0.0564	564	5.6118	56118	0	0	985		1,974.0		1 2	432.3	2.2	810.6	3 3
	S&R		0.0	0	0	0	0	0	0	0	0	0	0									
	Rural		0.0	0	0	0	0	0	0	0	0	0	0									
Sub-total	***Sub-total***		**35.3**	0 003525	35.25	0 0564	564	0.0564	564	5.6118	56118	0	0			1,974.0		1 2	432.3	2.2	810.6	3 3
LTIP (10-15 yrs; medium term) 2031 - 2036	HII		34.0	0.0034	34	0 0544	544	0.0544	544	5.4128	54128	0	0	1,009		1,904.0		1.1	417.0	2.1	781.8	3 2
	S&R		0.0	0	0	0	0	0	0	0	0	0	0									
	Rural		0.0	0	0	0	0	0	0	0	0	0	0									
Sub-total	***Sub-total***		**34.0**	0.0034	34	0.0544	544	0.0544	544	5.4128	54128	0	0			1,904.0		1.1	417.0	2.1	781.8	3 2
LTIP (15+ yrs; long term) 2036 - 2041	HII		34.5	0.00345	34.5	0 0552	552	0.0552	552	5.4924	54924	0	0	1,043		1,932.0		1 2	423.1	2.2	793.3	3 3
	S&R		0.0	0	0	0	0	0	0	0	0	0	0									
	Rural		0.0	0	0	0	0	0	0	0	0	0	0									
Sub-total	***Sub-total***		**34.5**	0.00345	34.5	0 0552	552	0.0552	552	5.4924	54924	0	0			1,932.0		1 2	423.1	2.2	793.3	3 3
LTIP (15+ yrs; ultimate horizon) 2041+	HII		704.0	0.0704	704	1.1264	11264	1.1264	11264	112.0768	1120768	0	0			39,424.0		23.7	8,633.9	44.4	16,188.5	66 5
	S&R		0.0	0	0	0	0	0	0	0	0	0	0									
	Rural		80.9	0	0	0	0	0	0	0	0	0	0									
Sub-total	***Sub-total***		**784.9**	0.0704	704	1.1264	11264	1.1264	11264	112.0768	1120768	0	0			39,424.0		23.7	8,633.9	44.4	16,188.5	66 5
Total	***Total***		**1160.0**													48,020.0						

											26.5	687	171.7									
$ 29,500,000		Sewer							$ 18,000,000	Road (Industry Rates)	Road (Less Than Threshold)	Road (Greater Than Thresho	Gas			Electrical (MW)			Stormwater		
$/ML		EPs	ADWF, ML/day	ADWF, ML/a	PDWF, ML/day	PDWF, ML/a	PWWF 1, ML/day	PWWF 2, ML/day	$/ML	trip-ends/ha-NDA	Trip ends/day	Trip ends/day	PJ/a			MW/a			Impervious area (Ha)		
$ 1,496		8,317.8	1.9	698.3	3.5	1,272.1	9.6	6.9	14,149.7	22725.00	589102.5	147232.75							771.75		
										2040.00									36.36		
																			12.07		
																			74.83		
		9,149.5	plus 10%																895.01		
$ 25,787		482.6	0.1	40.5	0.3	99.5	0.6	0.6	180,868.7	1320	34178 25	8542.075							44.775		
										1020									36.36		
																			3 9831		
$ 25,787		482.6	0.1	40.5	0.3	99.5	0.6	0.6	180,868.7		34178 25	8542.075	0	0	0	0	0		85.1181	0	0
$ 36,394		341.9	0.1	28.7	0.2	73.1	0.4	0.5	246,198.7	935	24216.75	6052.425							31.725		
										1020									0		
																			0		
$ 36,394		341.9	0.1	28.7	0.2	73.1	0.4	0.5	246,198.7		24216.75	6052.425	0	0	0	0	0		31.725	0	0
$ 37,732		329.8	0.1	27.7	0.2	70.8	0.4	0.5	254,284.3	901	23358	5837.8							30.6		
																			0		
																			0		
$ 37,732		329.8	0.1	27.7	0.2	70.8	0.4	0.5	254,284.3		23358	5837.8	0	0	0	0	0		30.6	0	0
$ 37,185		334.7	0.1	28.1	0.2	71.7	0.4	0.5	250,983.5	914	23701.5	5923.65							31.05		
																			0		
																			0		
$ 37,185		334.7	0.1	28.1	0.2	71.7	0.4	0.5	250,983.5		23701.5	5923.65	0	0	0	0	0		31.05	0	0
$ 1,822		6,828.8	1.6	573.3	2.9	1,066.2	7 9	5.8	16,881.7	18656	483648	120876.8							633.6		
																			0		
																			8 0869		
$ 1,822		6,828.8	1.6	573.3	2.9	1,066.2	7 9	5.8	16,881.7		483648	120876.8	0	0	0	0	0		641.6869	0	0
		8,317.8								24766											
		9,149.5	plus 10%																		

Scenario A

Sequencing	Zone	Scenario B Current Proponents																		
		Total Area (ha)	NDA (Ha)	Broad-Hectare Density - Floorspace per NDA										Employment	Raw Water ==> 56EP/balance						
				Retail (Ha)	Retail (m2)	Services (Ha)	Services (m2)	Profess. (Ha)	Profess. (m2)	Industry (Ha)	Industry (m2)	Other (Ha)	Other (m2)		EPs	AD, ML/day	AD, ML/a	MDMM, ML/day	MDMM, ML	PD, ML/day	PD, ML/a
Total	Developable (HII)	221.1	221.1	0.02211	221.1	0.35376	3537.6	0 35376	3537.6	35.19912	351991 2	0	0	4,512	12,381.6	7.4	2711.6	11.1	4067.4	13.9	5084.2
	QPM	225.3	219.2	0.02192	219.2	0.35072	3507.2	0 35072	3507.2	34.89664	348966.4	0	0		20,000.00	12	4380	18	6570	22.5	8212.5
	Imperium 3	32.6	32.2	0.00322	32.2	0.05152	515.2	0 05152	515.2	5.12624	51262.4	0	0		19,500.00	11.7	4262.3	17 5	6393.5	21.9	7991.8
	Edify	53.7	53.7	0.00537	53.7	0.08592	859.2	0 08592	859.2	8.54904	85490.4	0	0		1,666.67	1	350	1.4	525	1.8	656.3
	Drivelt NQ (S&R)	285.1	212	0	0	0	0	0	0	0	0	0	0		-	0 0	0.0	0 0	0.0	0.0	0.0
	Interested Party 1#	250.0	250.0	0.025	250	0.4	4000	0.4	4000	39.8	398000	0	0		66,666.7	40	14600	60	21900	75	27375
	Interested Party 2#	150.0	150.0	0.015	150	0.24	2400	0.24	2400	23 88	238800	0	0		1,425 0	0 9	312.1	1 3	468.1	1.6	585.1
	Interested Party 3#	5.0	5.0	0 0005	5	0.008	80	0.008	80	0.796	7960	0	0		60 9	0.0	13.3	0.1	20.0	0.1	25.0
	Rural	16.1	0.0	0	0	0	0	0	0	0	0	0	0								
	Roads/Emt	104.9	0.0	0	0	0	0	0	0	0	0	0	0								
	Not Developable	712.6	0.0	0	0	0	0	0	0	0	0	0	0								
	Total	***2056.4***	**1143.2**	**0.09312**	**931.2**	**1.48992**	**14899.2**	**1.48992**	**14899.2**	**148.24704**	**1482470.4**	**0**	**0**		**121,701**						
LGIP (5 yrs; Immediate) 2021 - 2026	HII (Balance)		0.0	0	0	0	0	0	0	0	0	0	0	1,476	-	0 0	0.0	0 0	0.0	0.0	0.0
	QPM		219.2	0.02192	219.2	0.35072	3507.2	0 35072	3507.2	34.89664	348966.4	0	0		10,666.7	6.4	2336.0	9.6	3504.0	12.0	4380.0
	Imperium 3		32.2	0.00322	32.2	0.05152	515.2	0 05152	515.2	5.12624	51262.4	0	0		3,460 0	2.1	757.7	3.1	1136.6	3.9	1420.8
	Edify		53.7	0.00537	53.7	0.08592	859.2	0 08592	859.2	8.54904	85490.4	0	0		852.4	0 5	186.7	0 8	280.0	1.0	350.0
	Drivelt NQ (S&R)		212 0	0.0212	212	0.3392	3392	0.3392	3392	33.7504	337504	0	0		-	0 0	0.0	0 0	0.0	0.0	0.0
	Interested Party 1#		0.0	0	0	0	0	0	0	0	0	0	0		60 9	0.0	13.3	0.1	20.0	0.1	25.0
	Interested Party 2#		0.0	0	0	0	0	0	0	0	0	0	0		-	0 0	0.0	0 0	0.0	0.0	0.0
	Interested Party 3#		0.0	0	0	0	0	0	0	0	0	0	0		-	0 0	0.0	0 0	0.0	0.0	0.0
	Rural		0.0	0	0	0	0	0	0	0	0	0	0								
	Sub-total		**517.1**	**0.1**	**517.1**	**0.8**	**8273.6**	**0.8**	**8273.6**	**82.3**	**823223.2**	**0.0**	**0**								
LGIP (5-10 yrs; short term) 2026 - 2031	HII (Balance)		0.0	0	0	0	0	0	0	0	0	0	0	985	-	0 0	0.0	0 0	0.0	0.0	0.0
	QPM		0.0	0	0	0	0	0	0	0	0	0	0		10,666.7	6.4	2336.0	9.6	3504.0	12.0	4380.0
	Imperium 3		0.0	0	0	0	0	0	0	0	0	0	0		6,920 0	4 2	1515.5	6 2	2273.2	7.8	2841.5
	Edify		0.0	0	0	0	0	0	0	0	0	0	0		852.4	0 5	186.7	0 8	280.0	1.0	350.0
	Drivelt NQ (S&R)		0 0	0	0	0	0	0	0	0	0	0	0		-	0 0	0.0	0 0	0.0	0.0	0.0
	Interested Party 1#		250.0	0.025	250	0.4	4000	0.4	4000	39.8	398000	0	0		-	0 0	0.0	0 0	0.0	0.0	0.0
	Interested Party 2#		150.0	0.015	150	0.24	2400	0.24	2400	23 88	238800	0	0		1,425 0	0 9	312.1	1 3	468.1	1.6	585.1
	Interested Party 3#		5.0	0 0005	5	0 008	80	0.008	80	0.796	7960	0	0		-	0 0	0.0	0 0	0.0	0.0	0.0
	Rural			0	0	0	0	0	0	0	0	0	0								
	Sub-total		**405.0**	**0.0**	**405**	**0.6**	**6480**	**0.6**	**6480**	**64.5**	**644760**	**0.0**	**0**								
LTIP (10-15 yrs; medium term) 2031 - 2036	HII (Balance)		34.0	0 0034	34	0.0544	544	0.0544	544	5.4128	54128	0	0	1,009	323 0	0 2	70.7	0 3	106.1	0.4	132.6
	QPM		0.0	0	0	0	0	0	0	0	0	0	0		10,666.7	6.4	2336.0	9.6	3504.0	12.0	4380.0
	Imperium 3		0.0	0	0	0	0	0	0	0	0	0	0		10,380 0	6 2	2273.2	9 3	3409.8	11.7	4262.3
	Edify		0.0	0	0	0	0	0	0	0	0	0	0		852.4	0 5	186.7	0 8	280.0	1.0	350.0
	Drivelt NQ (S&R)		0 0	0	0	0	0	0	0	0	0	0	0		-	0 0	0.0	0 0	0.0	0.0	0.0
	Interested Party 1#		0.0	0	0	0	0	0	0	0	0	0	0		-	0 0	0.0	0 0	0.0	0.0	0.0
	Interested Party 2#		0.0	0	0	0	0	0	0	0	0	0	0		-	0 0	0.0	0 0	0.0	0.0	0.0
	Interested Party 3#		0.0	0	0	0	0	0	0	0	0	0	0		-	0 0	0.0	0 0	0.0	0.0	0.0
	Rural			0	0	0	0	0	0	0	0	0	0								
	Sub-total		**34.0**	**0.0**	**34**	**0.1**	**544**	**0.1**	**544**	**5.4**	**54128**	**0.0**	**0**								
LTIP (15+ yrs; long term) 2036 - 2041	HII (Balance)		34.5	0.00345	34.5	0.0552	552	0.0552	552	5.4924	54924	0	0	1,043	327 8	0 2	71.8	0 3	107.7	0.4	134.6
	QPM		0.0	0	0	0	0	0	0	0	0	0	0		10,666.7	6.4	2336.0	9.6	3504.0	12.0	4380.0
	Imperium 3		0.0	0	0	0	0	0	0	0	0	0	0		10,380 0	6 2	2273.2	9 3	3409.8	11.7	4262.3
	Edify		0.0	0	0	0	0	0	0	0	0	0	0		852.4	0 5	186.7	0 8	280.0	1.0	350.0
	Drivelt NQ (S&R)		0 0	0	0	0	0	0	0	0	0	0	0		-	0 0	0.0	0 0	0.0	0.0	0.0
	Interested Party 1#		0.0	0	0	0	0	0	0	0	0	0	0		-	0 0	0.0	0 0	0.0	0.0	0.0
	Interested Party 2#		0.0	0	0	0	0	0	0	0	0	0	0		-	0 0	0.0	0 0	0.0	0.0	0.0
	Interested Party 3#		0.0	0	0	0	0	0	0	0	0	0	0		-	0 0	0.0	0 0	0.0	0.0	0.0
	Rural			0	0	0	0	0	0	0	0	0	0								
	Sub-total		**34.5**	**0.0**	**34.5**	**0.1**	**552**	**0.1**	**552**	**5.5**	**54924**	**0.0**	**0**		**22226.80632**	**13.3360838**	**4867.6706**				
LTIP (15+ yrs; ultimate horizon) 2041+	HII (Balance)		152.6	0.01526	152.6	0.24416	2441.6	0 24416	2441.6	24.29392	242939 2	0	0		1,449.7	0 9	317.5	1 3	476.2	1.6	595.3
	QPM		0.0	0	0	0	0	0	0	0	0	0	0		10,666.7	6.4	2336.0	9.6	3504.0	12.0	4380.0
	Imperium 3		0.0	0	0	0	0	0	0	0	0	0	0		10,380 0	6 2	2273.2	9 3	3409.8	11.7	4262.3
	Edify		0.0	0	0	0	0	0	0	0	0	0	0		852.4	0 5	186.7	0 8	280.0	1.0	350.0
	Drivelt NQ (S&R)		0 0	0	0	0	0	0	0	0	0	0	0		-	0 0	0.0	0 0	0.0	0.0	0.0
	Interested Party 1#		0.0	0	0	0	0	0	0	0	0	0	0		-	0 0	0.0	0 0	0.0	0.0	0.0
	Interested Party 2#		0.0	0	0	0	0	0	0	0	0	0	0		-	0 0	0.0	0 0	0.0	0.0	0.0
	Interested Party 3#		0.0	0	0	0	0	0	0	0	0	0	0		-	0 0	0.0	0 0	0.0	0.0	0.0
	Rural		0.0	0.01526	152.6	0.24416	2441.6	0 24416	2441.6	24.29392	242939 2	0	0		23348.75632	14.0092538	5113 3776				
	Sub-total		**152.6**	**0.0**	**305.2**	**0.5**	**4883.2**	**0.5**	**4883.2**	**48.6**	**485878.4**	**0.0**	**0**								
	Total		**1143.2**																		

											26.5	687	171.7									
		Sewer									Road (Industry Rates)	Road (Less Than Threshold)	Road (Greater Than Threshold)		Gas		Electrical (MW)			Stormwater		
PH, ML/day		EPs		ADWF, ML/d	ADWF, ML/a	PDWF, ML/d	PDWF, ML/a	PWWF 1, ML	PWWF 2, ML/day		trip-ends/ha-NDA	Trip ends/day	Trip ends/day		PJ/a		MW/a			Impervious area (Ha)		
20.9		2144.7		0.5	180.0	1.0	378.2	2.5	2.2		5859.15	151895.7								198.99		
33.8		2126 2		0.5	178.5	1.0	375.3	2.4	2.2		203	150590.4	37636.64							197.28		
32.8		312 3		0.1	26.2	0.2	67.4	0.4	0.4		3150	22121.4	5528.74							28.98		
2.7		520 9		0.1	43.7	0.3	106.6	0.6	0.7		48	36891 9	9220.29							48.33		
0.0		2056.4		0.5	172.6	1.0	364.2	2.4	2.1		2354	145644	36400.4							190.8		
112.5		2425 0		0.6	203.6	1.2	422.1	2.8	2.4		6625	171750	42925							225		
2.4		1455 0		0.3	122.1	0.7	267.2	1.7	1.6		3975	103050	25755							135		
0.1		48 5		0.0	4.1	0.0	12.7	0.1	0.1		132.5	3435	858.5							4.5		
																				0		
																				73.43		
																				0		
											22347									1102.31		
0.0																				0		
18.0																				197.28		
5.8																				28.98		
1.4																				48.33		
0.0																				190.8		
0.1																				0		
0.0																				0		
0.0																				0		
																				0		
																				465.39		
0.0																				0		
18.0																				0		
11.7																				0		
1.4																				0		
0.0																				0		
0.0																				225		
2.4																				135		
0.0																				4.5		
																				0		
																				364.5		
0.5																				30.6		
18.0																				0		
17.5																				0		
1.4																				0		
0.0																				0		
0.0																				0		
0.0																				0		
0.0																				0		
																				0		
																				30.6		
0.6																				31.05		
18.0																				0		
17.5																				0		
1.4																				0		
0.0																				0		
0.0																				0		
0.0																				0		
0.0																				0		
																				0		
		0									0	0	0		0	0	0	0	0	31.05	0	0
2.4																				137.34		
18.0																				0		
17.5																				0		
1.4																				0		
0.0																				0		
0.0																				0		
0.0																				0		
0.0																				0		
		0									0	0	0		0	0	0	0	0	0	0	0
																				137.34		

Sequencing	Zone	Scenario B Current Proponents												Raw Water			
				Broad-Hectare Density - Floorspace per NDA									Employmer	Industry std			
		Total Area (ha)	NDA (Ha)	Retail (Ha)	Retail (m2)	Services (H	Services (m	Profess. (H	Profess. (m	Industry (H	Industry (m	Other (Ha)	Other (m2)	EPs	AD, ML/da	AD, ML/a	MDMM, M
Total	Developable (HII)	626.1	626.1	0.06261	626.1	1.00176	10017.6	1.00176	10017.6	99.67512	996751.2	0	0	4,512	35061.6	21.0	7678.5	31.6
	QPM	225.3	219.2	0.02192	219.2	0.35072	3507.2	0.35072	3507.2	34.89664	348966.4	0	0		20000.0	12.0	4380.0	18.0
	Imperium 3	32.6	32.2	0.00322	32.2	0.05152	515.2	0.05152	515.2	5.12624	51262.4	0	0		19462.6	11.7	4262.3	17.5
	Edify	53.7	53.7	0.00537	53.7	0.08592	859.2	0.08592	859.2	8.54904	85490.4	0	0		1598.2	1.0	350.0	1.4
	DriveIt NQ (S&R)	285.1	212.0	0	0	0	0	0	0	0	0	0	0					
	Rural	16.1		0	0	0	0	0	0	0	0	0	0					
	Roads/Emt	104.9		0	0	0	0	0	0	0	0	0	0					
	Not Developable	712.6		0	0	0	0	0	0	0	0	0	0					
	Sub-total	***2056.4***	***1143.2***	**0.09312**	**931.2**	**1.48992**	**14899.2**	**1.48992**	**14899.2**	**148.247**	**1482470**	**0**	**0**		***76122.3***	***45.7***	***16670.8***	***68.5***
LGIP (5 yrs	HII (Balance)			0	0	0	0	0	0	0	0	0	0	1,476				
	QPM		219.2	0.02192	219.2	0.35072	3507.2	0.35072	3507.2	34.89664	348966.4	0	0		20000.0	12.0	4380.0	18.0
	Imperium 3		32.2	0.00322	32.2	0.05152	515.2	0.05152	515.2	5.12624	51262.4	0	0		6487.5	3.9	1420.8	5.8
626.1	Edify		53.7	0.00537	53.7	0.08592	859.2	0.08592	859.2	8.54904	85490.4	0	0		1598.2	1.0	350.0	1.4
	DriveIt NQ (S&R)		212.0	0.0212	212	0.3392	3392	0.3392	3392	33.7504	337504	0	0					
	Rural			0	0	0	0	0	0	0	0	0	0					
	Sub-total		517.1	0.1	517.1	0.8	8273.6	0.8	8273.6	82.3	823223.2	0	0		28085.6	16.9	6150.8	25.3
LGIP (5-10	HII (Balance)		35.3	0.00353	35.3	0.05648	564.8	0.05648	564.8	5.61976	56197.6	0	0	985	1976.8	1.2	432.9	1.8
	QPM			0	0	0	0	0	0	0	0	0	0					
	Imperium 3			0	0	0	0	0	0	0	0	0	0		6487.6	3.9	1420.8	5.8
	Edify			0	0	0	0	0	0	0	0	0	0			-		
	DriveIt NQ (S&R)			0	0	0	0	0	0	0	0	0	0					
	Rural			0	0	0	0	0	0	0	0	0	0					
	Sub-total		35.3	0	35.3	0.1	564.8	0.1	564.8	5.6	56197.6	0	0		8464.4	5.1	1853.7	7.6
LTIP (10-15	HII (Balance)		34.0	0.0034	34	0.0544	544	0.0544	544	5.4128	54128	0	0	1,009	1904.0	1.1	417.0	1.7
	QPM			0	0	0	0	0	0	0	0	0	0					
	Imperium 3			0	0	0	0	0	0	0	0	0	0		6487.5	3.9	1420.8	5.8
	Edify			0	0	0	0	0	0	0	0	0	0					
	DriveIt NQ (S&R)			0	0	0	0	0	0	0	0	0	0					
	Rural			0	0	0	0	0	0	0	0	0	0					
	Sub-total		34.0	0	34	0.1	544	0.1	544	5.4	54128	0	0		8391.5	5.0	1837.7	7.6
LTIP (15+ y	HII (Balance)		34.5	0.00345	34.5	0.0552	552	0.0552	552	5.4924	54924	0	0	1,043	1932.0	1.2	423.1	1.7
	QPM		0.0	0	0	0	0	0	0	0	0	0	0					
	Imperium 3		0.0	0	0	0	0	0	0	0	0	0	0					
	Edify		0.0	0	0	0	0	0	0	0	0	0	0			-		
	DriveIt NQ (S&R)		0.0	0	0	0	0	0	0	0	0	0	0					
	Rural			0	0	0	0	0	0	0	0	0	0					
	Sub-total		34.5	0	34.5	0.1	552	0.1	552	5.5	54924	0	0		1932.0	1.2	423.1	1.7
LTIP (15+ y	HII (Balance)		522.3	0.05223	522.3	0.83568	8356.8	0.83568	8356.8	83.15016	831501.6	0	0		29248.8	17.5	6405.5	26.3
	QPM			0	0	0	0	0	0	0	0	0	0					
	Imperium 3			0	0	0	0	0	0	0	0	0	0					
	Edify			0	0	0	0	0	0	0	0	0	0					
	DriveIt NQ (S&R)			0	0	0	0	0	0	0	0	0	0					
	Rural			0.05223	522.3	0.83568	8356.8	0.83568	8356.8	83.15016	831501.6	0	0			-		
	Sub-total		522.3	0.1	1044.6	1.7	16713.6	1.7	16713.6	166.3	1663003	0	0		29248.8	17.5	6405.5	26.3
	Total		1143.2												76122.3	45.7	16670.8	68.5

					Sewer							
					Industry std							
MDMM, M	PD, ML/day	PD, ML/a	PH, ML/day		EPs	ADWF, ML/	ADWF, ML/	PDWF, ML/	PDWF, ML/	PWWF 1, M	PWWF 2, ML/day	
11517.7	39.4	14397.2	59.2		25544.9	5.9	2144.5	9.5	3472.6	29.4	17.6	
6570.0	22.5	8212.5	33.8		8943.4	2.1	750.8	3.7	1357.4	10.3	7.3	
6393.5	21.9	7991.8	32.8		1313.8	0.3	110.3	0.7	243.9	1.5	1.5	
525.0	1.8	656.3	2.7		2191.0	0.5	183.9	1.1	385.5	2.5	2.2	
					8649.6	2.0	726.1	3.6	1317.4	9.9	7.1	
25006.2	***85.6***	***31257.7***	***128.5***		***46642.6***	***10.7***	***3915.6***	***18.6***	***6776.8***	***53.6***	***35.6***	
6570.0	22.5	8212.5	33.8		8943.4	2.1	750.8	3.7	1357.4	10.3	7.3	
2131.1	7.3	2663.9	10.9		1313.8	0.3	110.3	0.7	243.9	1.5	1.5	
525.0	1.8	656.3	2.7		2191.0	0.5	183.9	1.1	385.5	2.5	2.2	
					8649.6	2.0	726.1	3.6	1317.4	9.9	7.1	
9226.1	31.6	11532.7	47.4		21097.7	4.9	1771.2	9.1	3304.2	24.3	18.0	
649.4	2.2	811.7	3.3		1440.2	0.3	120.9	0.7	264.8	1.7	1.6	
2131.1	7.3	2663.9	10.9									
2780.5	9.5	3475.7	14.3		1440.2	0.3	120.9	0.7	264.8	1.7	1.6	
625.5	2.1	781.8	3.2		1387.2	0.3	116.5	0.7	256.1	1.6	1.5	
2131.1	7.3	2663.9	10.9									
2756.6	9.4	3445.8	14.2		1387.2	0.3	116.5	0.7	256.1	1.6	1.5	
634.7	2.2	793.3	3.3		1407.6	0.3	118.2	0.7	259.4	1.6	1.5	
634.7	2.2	793.3	3.3		1407.6	0.3	118.2	0.7	259.4	1.6	1.5	
9608.2	32.9	12010.3	49.4		21309.8	4.9	1789.0	8.1	2952.6	24.5	15.1	
9608.2	32.9	12010.3	49.4		21309.8	4.9	1789.0	8.1	2952.6	24.5	15.1	
25006.2	85.6	31257.7	128.5		46642.6	10.7	3915.6	19.3	7037.0	53.6	37.8	

Sequencing	Zone	Scenario C Review of Scheme																	
		Total Area (ha)	NDA (Ha)	Broad-Hectare Density - Floorspace per NDA										Employment		Raw Water			
				Retail (Ha)	Retail (m2)	Services (Ha)	Services (m2)	Profess. (Ha)	Profess. (m2)	Industry (Ha)	Industry (m2)	Other (Ha)	Other (m2)			EPs	AD, ML/day	AD, ML/a	PD, ML/day
Total	Developable (HII)	1233.2	1162.3	0.116226	1162.26	1.859616	18596.16	1.859616	18596.16	185.031792	1850317.92	0	0	4,512		65,087	39.1	14254.0	73.2
	Committed (DriveiT NQ)	249.3	246.7	0	0	0	0	0	0	0	0	0	0			13,815			
	Not Developable	574.0	0.0	0	0	0	0	0	0	0	0	0	0						
	Total	***2056.5***	**1409.0**	**0.116226**	**1162.26**	**1.859616**	**18596.16**	**1.859616**	**18596.16**	**185.031792**	**1850317.92**	**0**	**0**			**78,902**			
LGIP (5 yrs; Immediate) 2021 - 2026	Developable (HII)		49.8	0.004975	49.75	0.0796	796	0.0796	796	7.9202	79202	0	0	1,476		2,786	1.7	610.1	3.1
	Committed (DriveiT NQ)		0.0	0	0	0	0	0	0	0	0	0	0						
	Not Developable		0.0	0	0	0	0	0	0	0	0	0	0						
	Sub-total		**49.8**	**0.004975**	**49.75**	**0.0796**	**796**	**0.0796**	**796**	**7.9202**	**79202**	**0**	**0**						
LGIP (5-10 yrs; short term) 2026 - 2031	Developable (HII)		35.3	0.003525	35.25	0.0564	564	0.0564	564	5.6118	56118	0	0	985		1,974	1.2	432.3	2.2
	Committed (DriveiT NQ)		0.0	0	0	0	0	0	0	0	0	0	0						
	Not Developable		0.0	0	0	0	0	0	0	0	0	0	0						
	Sub-total		**35.3**	**0.003525**	**35.25**	**0.0564**	**564**	**0.0564**	**564**	**5.6118**	**56118**	**0**	**0**						
LTIP (10-15 yrs; medium term) 2031 - 2036	Developable (HII)		34.0	0.0034	34	0.0544	544	0.0544	544	5.4128	54128	0	0	1,009		1,904	1.1	417.0	2.1
	Committed (DriveiT NQ)		0.0	0	0	0	0	0	0	0	0	0	0						
	Not Developable		0.0	0	0	0	0	0	0	0	0	0	0						
	Sub-total		**34.0**	**0.0034**	**34**	**0.0544**	**544**	**0.0544**	**544**	**5.4128**	**54128**	**0**	**0**						
LTIP (15+ yrs; long term) 2036 - 2041	Developable (HII)		34.5	0.00345	34.5	0.0552	552	0.0552	552	5.4924	54924	0	0	1,043		1,932	1.2	423.1	2.2
	Committed (DriveiT NQ)		0.0	0	0	0	0	0	0	0	0	0	0						
	Not Developable		0.0	0	0	0	0	0	0	0	0	0	0						
	Sub-total		**34.5**	**0.00345**	**34.5**	**0.0552**	**552**	**0.0552**	**552**	**5.4924**	**54924**	**0**	**0**						
LTIP (15+ yrs; ultimate horizon) 2041+	Developable (HII)		1008.8	0.100876	1008.76	1.614016	16140.16	1.614016	16140.16	160.594592	1605945.92	0	0			56,491	33.9	12371.4	63.6
	Committed (DriveiT NQ)		246.7	0	0	0	0	0	0	0	0	0	0			13,815			
	Not Developable		0.0	0	0	0	0	0	0	0	0	0	0						
	Sub-total		**1255.5**	**0.100876**	**1008.76**	**1.614016**	**16140.16**	**1.614016**	**16140.16**	**160.594592**	**1605945.92**	**0**	**0**			**70305.8**			
	Total		**1409.0**													**78901.8**			

Scenario C

												Pragmatic Rate	26.5								
				Sewer									Road (Industry Rates)	Gas		Electrical (MW)				Stormwater	
PD, ML/a	PH, ML/day			EPs	ADWF, ML/d	ADWF, ML/a	PDWF, ML/d	PDWF, ML/a	PWWF 1, ML	PWWF 2, ML/day			trip-ends/ha-NDA	PJ/a		MW/a				Impervious area (Ha)	
26726.2	109.9			47,420	10.9	3980.9	16.6	6041.0	54.5	29.6			30800							1046.034	
				10,065	2	845	4	1,509	12	8			2040								
				57,486									**37341**							**1046.034**	
1144.0	4.7			2,030	0.5	170.4	1.0	360.0	2.3	2.1			1320							44.775	
													2040								
																				44.775	
810.6	3.3			1,438	0.3	120.7	0.7	264.5	1.7	1.6			935							31.725	
																				31.725	
781.8	3.2			1,387	0.3	116.5	0.7	256.1	1.6	1.5			901							30.6	
																				30.6	
793.3	3.3			1,408	0.3	118.2	0.7	259.4	1.6	1.5			914							31.05	
																				31.05	
23196.4	95.3			41,157	9.5	3455.2	14.6	5321.7	47.3	26.3			26733							907.884	
				10,065									4498								
				51222.8																**907.884**	
				57485.6																	

Scenario C

TW00435 – LANSDOWN ECO-INDUSTRIAL INFRASTRUCTURE PRECINCT - INFRASTRUCTURE MASTER PLAN

Appendix B Site Assessment Criteria

MCA CRITERIA MATRIX - Townsville INDUSTRIAL DEVELOPMENT LAND FEASIBILITY

FIRST SIEVE SITE SELECTION CRITERIA

Issue		Habitat	Vegetation	Tenure	Mining	Slope	Major Waterways	Flood	Water Catchments	Heritage	Bushfire Hazard	Buffer to Sensitive Uses
Objectives		Loss or degradation of essential habitat for rare, vulnerable and endangered species is minimised	Avoid loss or degradation of significant vegetation that requires approval for "clearing" and provision of vegetation offsets	Excludes reserved land, easements and (any separation distance requirements) Major infrastructure corridors (easements) are considered highly constrained (HV power, gas) and may also require separation distances.	Ensures mining and exploration activities are not impacted on Avoids areas of know mineral or extractive resource Overlay areas Considers Planning Scheme Mining Influence Areas Overlay areas Considers Planning Scheme KRA, Buffers and Haul Routes Overlay areas Some industrial uses may be permitted over land previously used for mining activities and can manage, mitigate or re-purpose associated constraints. As a result, most mining related criteria are not considered fatal flaws to industrial development. Impacts of undermining in particular should also be assessed on a site-by site basis.	Minimise development cost and earthworks Risk of erosion and slope stability issues can be minimised Ensure the site is accessible and serviceable Consideration of Planning Scheme Overlay	Impacts on waterways are minimised.	Avoid extensive areas that are subject to flooding	Avoid areas of high value catchment. Alternative uses of affected land may be identified. The water resource catchment area – Ross River Dam is located to the east of the Eco-Industrial Precinct.	Preserve listed heritage sites	Consider Planning Scheme Bushfire Risk Area Overlay	Minimise amenity impacts from residential areas, community use areas and primary roads
Measures		Avoid Habitats classified under the Nature Conservation Act 1993 and Environmental Protection and Biodiversity Conservation Act 1999 Koala habitat values mapping applicable under the Planning Act 2016, (and previously applied to the South East Queensland Koala Conservation State Planning Regulatory Provisions [Koala SPRP]).	Regional Ecosystems: Endangered Of concern ecosystems, Not of concern ecosystems Note that groundtruthing is required for this dataset	Avoidance of reserve land and easements	Avoidance of designated mineral or extractive resources.	Avoid land with excessive slopes	Distance from water bodies and water ways	Extent of flooding	Extent of catchment areas	Listed on Queensland Heritage Register or Register of the National Estate	Extent of bushfire hazard areas	Distance to sensitive uses
Data Source		Essential Habitat for Endangered, Rare and Vulnerable Species Version Koala Conservation areas; Biodiversity Planning Assessment Version	SEQ Remnant vegetation communities and regional ecosystems 2001 including Certified Amendments to October 2007. and Planning Scheme Overlay OM-0.80 Natural Assets Environmental Importance	DCDB	Dept Mines and Energy/ Mining tenure from NRM Planning Scheme overlay OM-05.0 Natural Areas Extract Resources	Lidar data (from flood model)	Waterways	Flood Study for LEIP has prepared by AECCOM and this data is to be utilised - is the same as the current overlay mapping (Planning Scheme OM-06.1 Development Constraints Flood Hazard)	The water resource catchment area in the overlay - OM-09.0 - Natural Assets Water Resource Catchments is not reflective of on ground values evidenced by the flood model, and stormwater catchments based on the water shed on the land.	Queensland Heritage Register Register of the National Estate Planning Scheme Overlay OM-04.1 – Cultural Heritage	Planning Scheme Bushfire Overlay OM-0.20 – Development Constraints Bushfire Hazard	DCDB / Planning Scheme zoning
Suitability	**Ratings**											
Undevelopable	Fatal Flaw = 999	none	none	none	none	Slope exceeds 15% (9999)	Water ways (Moderate and Major – flood constraint)(9999)	none	none	Listed item on the Queensland Heritage Register or Register of the National Estate Within 100m of listed item Planning Scheme Overlay OM-04.1 – Cultural Heritage (local heritage) (9999)	none	none
Highly Constrained long-term potential availability	Poor = 3	Presence of essential habitat: OR Koala Conservation Area (40)	Endangered or Conservation Areas, OM-0.80 Natural Assets Environmental Importance (Very High Area) (40)	Easement Reserve High Pressure Pipelines High Voltage Electricity Transmission Lines (40)	Within Planning Scheme OM-05.0 Natural Areas Extract Resources (40)	Slope between 7% and 15% (40)	waterways Buffer for Stream Order: 1 - 25m buffer 2 - 25m buffer 3 - 50 m buffer 5 - 100m buffer (40)	Q100 OM-06.1 Development Constraints Flood Hazard - High Hazard (40)	Ross River Dam stormwater catchment area (corrected alignment) (40)	none	none	<500m of Residential, character housing, township or community use zone (40)
Moderately Constrained mid-term potential availability	Moderate = 2	Koala Sustainability Area; Urban Koala Area OR BPA State Wildlife Corridor (20)	Of Concern Regional Ecosystem Protected Plants Flora Survey Trigger Area MSES Regulated Vegetation (Category B/C) OM-0.80 Natural Assets Environmental Importance (High Area) (20)	High Pressure Pipelines Buffer <50m from High Voltage Electricity Transmission Lines (20)	Within a Key Resource Area (KRA) separation area Exploration Permit Mining claim /lease Petroleum lease Pipeline /Mineral development licence Planning Scheme Known Resources area Planning Scheme Mining Influence Constrained Areas, Area Affected by Underground Mining (20)	Slope between 3% and 7% (20)	none	OM-06.1 Development Constraints Flood Hazard - Medium Hazard (20)	none	none	Affected by Planning Scheme Bushfire Risk Area Overlay (20)	500m to 1000m Residential, character housing, township or community use zone (20)
Minimally Constrained short-term potential availability	Good = 1	No essential habitat present. AND No Koala Habitat (10)	Least Concern Regional Ecosystem Non-remnant / Regrowth High Value Regrowth Area not categorised (10)	Not affected by Easement or Reserve (10)	Not within a mineral or extractive resource area (10)	Slope less than 3% (10)	Outside 100m to permanent waterway (10)	OM-06.1 Development Constraints Flood Hazard - Low Hazard (10)	none	All else including Planning Scheme Overlay OM-04.1 – Cultural Heritage (areas adjacent to heritage) (10)	none	More than 1000m from Residential, character housing, township or community use zone (10)
	Weighting (%)											

Appendix C Risk Rating System

Table D Key Project Risks

Risk Description	Risk Matrix: Likelihood	Risk Matrix: Consequence	Risk Matrix: Rating	Counter measures	Revised Rating
Program of works: Stage 0 Enabling Works (e.g., Raw Water and Road) must rapidly progress with construction commencement in the 2022 calendar year. There is a risk to the project program, stakeholders and public perception with possible financial and legal ramifications if this is not achieved.	Likely	Major	Very High (16)	• From the initial inception meeting for the Project this will be a focus. All planning and phasing of infrastructure undertaken will consider delivery of the enabling works infrastructure as part of SP2 of the Project. • Calibre Team has allowed for specific approvals assessment required for the project during the AIP deliverable. This is to identify all approval processes required prior to detailed design commencing. • During the commencement of SP2 the Calibre Team also proposes to keep CDM Smith as part of the delivery team to ensure all approval matters are being addressed appropriately.	Moderate (8)
Stakeholder engagement: Availability and responsiveness will have direct impact on the delivery timeframe for this project. There will also be implications if the current stakeholder advice is not consistent with past advice. Unwarranted infrastructure demands (e.g., vehicle sizes, pressure demands, extended investigations) may impact deliverables.	Likely	Major	Very High (16)	• Calibre Team has worked together on previous master planning and design projects, which ensures the Calibre Team is familiar with each other. • At the initial project inception meeting / workshop, Calibre Team will highlight the Communication Protocols and associated design processes. • Calibre would expect all Project team protocols to adhere to this communication strategy for the project duration. • The Townsville City Council has pre-allocated Assessment Officers to the Project. The Townsville City Council will advise who these officers are (including sustainability and pre-lodgement personnel). The Townsville City Council will advise who are the Future Cities personnel.	Moderate (8)
Proposed Great Northern Rail Line level crossing (Jones Road) for Stage 0 Enabling works will require ongoing monitoring to confirm adequacy of the design solution.	Possible	Major	High (12)	• The safety, adequacy, and trigger points for upgrade of this level crossing will be assessed during of the Project. • Relocate rail siding away from level crossing. • During SP2 of the Project investigate passive controls to achieve desire safety risk.	Moderate (8)

Risk Description	Risk Matrix			Counter measures	Revised Rating
	Likelihood	Consequence	Rating		
Interaction of proposed Great Northern Rail Line level crossing (Jones Road) for Stage 0 Enabling works queuing distance / large vehicles and the Flinders Highway Intersection.	Possible	Major	High (12)	• Functional layout assessment and modelling of the Project. • Detailed design development will progress after receipt of site-specific survey.	Moderate (8)
Project program delay due to approval processes: Delay in programme can affect development timing in the LEIP and ongoing impact on employment potential.	Possible	Major	High (12)	• Calibre Team has allowed specific approval assessment process during the AIP deliverable. This is to identify all approval processes required prior to detailed design commencing. • Calibre Team will raise approval items with relevant Agencies. The Townsville City Council will commence investigations into Aboriginal Cultural Heritage.	Moderate (8)
Low permeability of current site, north-south, while relying on several low-grade passive level crossings	Possible	Moderate	Moderate (9)	• In early stages of the development look to provide north-south inter-connectors. • Upgrade and where possible replace level crossings. • Grade separated crossing of the Great Northern Rail Line and the Flinders Highway be provided as future infrastructure.	Moderate (6)
Raw water pipelines – shutdowns for maintenance periods, in particular the DN900 Haughton Pipeline connection options.	Possible	Moderate	Moderate (9)	• Provision for a level of on-site water storage on each lot or a LEIP-wide storage. • Additional back up storage to be provided if connection to DN900 Haughton Pipeline.	Moderate (6)
Level crossings with short stacking distance within the road network, reducing safety at crossing and capacity at intersections	Possible	Moderate	Moderate (9)	• A site-specific risk assessment is required at locations where short stacking occurs to determine eliminate or manage the problem with appropriate mitigations (e.g. heavy vehicle detour routes, installing traffic signals on the roadway, providing emergency escapes / refuges / slip-lanes, changing the priority of roadways or road realignment etc) (refer AS 1742.7:2016).	Moderate (6)

Risk Description	Risk Matrix			Counter measures	Revised Rating
	Likelihood	Consequence	Rating		
Safety risk of short sight distances between passing loop and at grade level crossings and potential that view of an oncoming train are impacted when trains are parked in or operating in the passing loop (vision masking). Safety also impacted by distance between facilities and simplicity of the signalling systems.	Possible	Moderate	Moderate (9)	• During the AIP assessment consider the most suitable location of a passing loop on the rail network in vicinity of the LEIP.	Moderate (6)
LEIP-wide wastewater treatment and risk of impact to surrounding environment.	Possible	Moderate	Moderate (9)	• Centralised treatment owned and operated by the Townsville City Council provides lowest risk to environment. • MCA to be undertaken for wastewater treatment proposals and reticulation systems. The benefit of the single catchment treatment is the reduced risk to the environment with a known operator of existing treatment plants such as the Townsville City Council. Additionally, if there is a single gravity catchment, this also reduces the requirement to manage more intensive assets like a pump station and rising main.	Moderate (6)
Wastewater treatment plants which are proponent owned and managed impose a higher risk to the surrounding environment.	Possible	Moderate	Moderate (9)	• Development sites will need all relevant approvals and monitoring to minimise the chance of mismanagement of effluent. • Treatment to be managed and operated by suitably qualified organisations. • Provider of last resort to be identified in the event of privately operated treatment facilities becoming insolvent	Moderate (6)
Delivery and funding of infrastructure not fairly apportioned between proponents, Townsville City Council and other parties: Delivery of infrastructure delayed whilst issue is resolved.	Unlikely	Major	Moderate (8)	• Calibre Team to prepare a detailed infrastructure delivery and funding strategy to ensure that the financial risk for all stakeholders is transparent.	Moderate (6)
Infrastructure is not integrated with wider infrastructure plans including early stage enabling infrastructure associated with the Infrastructure Asset Plan: Infrastructure may not be delivered or may require re-work and delays.	Possible	Catastrophic	High (15)	• Ensure network modelers are familiar with existing network planning and models undertaken for the AIP and other relevant planning exercises. • Calibre will address as part of the Project.	High (10)

Risk Description	Risk Matrix			Counter measures	Revised Rating
	Likelihood	Consequence	Rating		
High groundwater levels across the site may preclude the use of bio retention basins and swale WSUD devices, and limit available storage capacity of detention basins – impact on types of measure available and available effective storage	Possible	Moderate (Financial)	Moderate (9)	• Townsville City Council to confirm geotechnical advice and design accordingly. • Adopt wetlands for WSUD, rather than Bio Basins. Will have implications in the road reserves. • Proponents could consider lines storages or tanks for detention storage.	Moderate (9)
Current under capacity culverts at the Great Northern Rail Line and the Flinders Highway (as well as some existing local roads). In future extreme events it could be perceived that the LEIP is causing the flooding or afflux impacts at the Great Northern Rail Line and adjacent sites.	Likely	Major	High (16)	• All future proponents will need to model flood impacts to demonstrate no adverse impacts following their detention measures. Also address possible backwater impacts from downstream Great Northern Rail Line and Flinders Highway infrastructure. • Document what culverts have insufficient capacity pre-development. • Alternative for the specific proponent.	Moderate (4)
Multiple detention basins could have cumulative impacts if staging does not occur as expected.	Possible	Catastrophic	High (15)	• Minimum detention sizes be provided, but each proponent will need to finalise design to demonstrate no adverse impact. • Townsville City Council to assess and approve each proponent's Site Based Stormwater Management Plan in conjunction with other proponents' plans.	Moderate (4)
Road culverts and fish passage and riverine protection permits requirements i. On waterways with specific WWBW requirements limit the ability of on-line detention basins or using road embankment for storage ii. Road network formations will need to address minimum culvert sizes and cover requirements Wide roadway formation – up to 40m reserves – will limit fish movement.	Likely	Moderate	High (12)	• Identify and map waterways and watercourses as per Water Act and Fisheries Act. • Cost estimates need to consider WWBW and RPP requirements. • Regulate against on-line detention basins along mapped waterways. • Accommodate minimum culvert lengths in road geometric design.	Low (4)

Risk Description	Risk Matrix			Counter measures	Revised Rating
	Likelihood	Consequence	Rating		
Lansdown high industry precinct may have many constraints that limit the ability to provide at source water quality controls – assumed 1.5% of road reserve. Therefore, increased risk of deteriorating water quality discharging to receiving waterways.	Almost certain	Moderate	High (15)	• Mitigation to propose end-of-line WSUD devices that do not rely on bioretention swales alone, i.e. a mix of treatment devices to be explored and implemented. • Townsville City Council to assess and approve each proponent's Site Based Stormwater Management Plan to ensure Townsville City Council Water Quality Objectives are met.	Moderate (6)
Preliminary culvert sizing was based on previous flood study for Townsville City Council. Development scenarios only addressed in hydrological sense. Risk of under sizing culverts at this level of design is primarily a planning risk impacting on funding estimates, i.e. under-estimating funding required (assumes detailed culvert design to be undertaken prior to construction).	Possible	Moderate	Moderate (9)	• Full hydraulic modelling of Developed scenarios to be undertaken in association with proponent applications and/or road design. • 40% cost estimate contingency adopted to account for the margin of error inherent in the available data used for hydraulic calculations.	Moderate (6)
Master Plan and AIP are focussing on major road and stormwater networks. Local road minor drainage and minor cross drainage have not been addressed. Isolated flood risk within minor roads may be present.	Possible	Catastrophic	High (15)	• Design of minor (i.e. non-trunk) roads to be assessed and approved by Townsville City Council upon operational work applications for future design stages to ensure road drainage requirements are met and flood risk is mitigated.	Moderate (4)
North-South Major Collector roads will have cross drainage design to a 1% AEP capacity. However, in the PMF storm event there is potential to cut off southern precincts from flood evacuation routes. In lower AEP events the Manton Quarry Road has existing impacts currently flood impacted, which is not earmarked for upgrade to increase flood immunity until later Stage 3 of the planning horizons, which will mean existing flood risk to evacuation routes remains. Jones Road and Glenn Road (north of the LEIP) may also have existing minor local drainage that is under the design capacity and does not provide adequate flood immunity for evacuation – to be confirmed (outside of AECOM flood model extents).	Almost certain	Catastrophic	Very High (25)	• PMF management measures to be developed for the LEIP. • Ultimate connector road could have culverts sized on the smaller catchment to comply with a Higher Immunity constraint and link to the ultimate Ghost Gum Road Bridge. • Provide additional culverts at Manton Quarry Road. • Many Flinders Highway flood prone areas that would limit evacuation opportunities beyond the LEIP. • Hydraulic analysis scope to extend north of the LEIP to capture Jones Road and Glenn Road, including validation of existing culvert size / capacity.	High (15)

Risk Description	Risk Matrix: Likelihood	Risk Matrix: Consequence	Risk Matrix: Rating	Counter measures	Revised Rating
Raw water supply pipeline sized to suit proponent projected demands, actual demands may differ from projections i.e. pipe is over sized or under sized.	Likely	Moderate	High (12)	• A range of demand scenarios assessed and presented for consideration. • Demand projections for pipeline sizing to be continuously reviewed through project lifecycle.	Moderate (6)
Water quality / treatment – raw water quality may not be suitable for end users. A level of treatment may be required.	Possible	Catastrophic	High (15)	• On site treatment by end users or the Townsville City Council centralised treatment to meet end user requirements • Corrosion of planned infrastructure to be considered.	High (10)
Drought / water availability – unable to meet water demands during drought periods.	Almost Certain	Major	Very High (20)	• Drought resilience planning required for the LEIP as part of wider regional strategy and mitigation measures.	High (15)
Wastewater treatment and disposal – insufficient space or unsuitable disposal conditions.	Almost Certain	Catastrophic	Very High (25)	• Identification of effluent discharge volume and quality required. • Approvals and licencing requirements to be identified.	High (15)
Total water cycle management – water balance impacted by wastewater disposal.	Almost Certain	Major	Very High (20)	• Mass balance of water and nutrients to be investigated.	High (15)

Risk Description	Risk Matrix			Counter measures	Revised Rating
	Likelihood	Consequence	Rating		
Raw water pump station location (Ross River or Haughton) – location, approvals, access, flood immunity, power.	Almost Certain	Major	Very High (20)	• Raw water pump station to be progressed to identify opportunities, constraints, and risks.	High (15)
Procurement of materials and local market capacity to deliver infrastructure. Restricted supply chains to provide materials and services within project timeframes.	Almost Certain	Major	Very High (20)	• Develop a procurement strategy to delivery project and identify high risk items. • Develop project schedule / program of works.	High (15)
Capital and Operational Expenditure accuracy – low accuracy impact project feasibility.	Almost Certain	Major	Very High (20)	• Refine level of detail of infrastructure design and update estimates with increased information.	High (15)
Asset management and renewal – assets likely to require renewal during life span of the LEIP.	Almost Certain	Moderate	High (15)	• Whole of life asset costing to be investigated.	High (12)
Poor Return on Investment in assets dependent upon demand uptake and costs of operation.	Likely	Moderate	High (12)	• Business case for infrastructure investment to be reviewed at each project milestone.	High (12)

Risk Description	Risk Matrix			Counter measures	Revised Rating
	Likelihood	Consequence	Rating		
Firefighting – unable to provide sufficient flow, pressure, and quality.	Almost Certain	Catastrophic	Very High (25)	• Storage required to meet firefighting requirements.	High (15)
Trade Waste – volumes of toxic waste. Unsuitable for treatment and disposal on site.	Likely	Moderate	High (12)	• Investigate likely by-products / wastes generated by proponent. • Develop trade waste agreement for proponents as required.	Moderate (8)
Proposed access management strategies for the LEIP are no longer viable due to changes in Queensland Government policy directives regarding railway level crossings.	Possible	Moderate	Moderate (9)	• The proposed upgrades of railway level crossings are to be supported by risk assessment in the form of ALCAM assessments. ONRSR accepts use of ALCAM as a tool to help prioritise investment (when used in conjunction with other relevant factors, such as recent occurrence history). • The project will provide an upgrade to active controls at the Jones Road railway level crossing and a new grade separated crossing at Ghost Gum Road leading to an overall reduction in the number of railway level crossings with passive controls and improving safety. • The project proposes the permanent closure of the Bidwilli Road railway level crossing and Ghost Gum Road railway level crossing leading to an overall reduction in the number of railway level crossings in accordance with ONRSR policy. • The Master Plan recommends that on-going consultation with Queensland Rail, Department of Transport and Main Roads and Department of State Development, Infrastructure, Local Government and Planning is conducted throughout the project development and delivery phase.	Moderate (6)

Risk Description	Risk Matrix			Counter measures	Revised Rating
	Likelihood	Consequence	Rating		
Traffic generation rates associated with the development of the LEIP exceeds the forecast rates in the Master Plan resulting in localised congestion and a reduction of effective design life of assets.	Possible	Moderate	Moderate (9)	• The recommended traffic generation rates have been developed based on robust analysis and tested using sensitivity analysis including a survey of similar sites around Queensland to reduce the risk of errors in this input. • The recommended traffic generation rates have been workshopped with the Townsville City Council during the preparation of the preliminary aspirational master plan and endorsed for use on the project. • The preliminary aspirational master plan recommends that the Townsville City Council establishes a system to monitor and evaluate traffic demands at the LEIP in the Interim arrangement by installing permanent traffic counters between the railway level crossings and the Flinders Highway to confirm engineering assumptions about traffic generation and demand. • The preliminary aspirational master plan recommends that the Townsville City Council periodically reviews the traffic and transport engineering reports at 5-yearly intervals to confirm the traffic engineering assumptions and recommendations contained within.	Low (4)
Traffic demands for special events in the Sports and Recreation Zone in the LEIP creates regular unacceptable delays for proponents and congestion around the LEIP.	Possible	Moderate	Moderate (9)	• The preliminary approval for Stage 3 of development in the Sports and Recreation Zone in the LEIP is to be supported by a traffic engineering assessment considering robust assumptions for critical inputs such as reasonable allowances for shared transport arrangements and incentives to assist progressive arrival of patrons to minimise surges in traffic volumes. • Special event traffic management plans are to be developed in partnership between DTMR, Townsville City Council, the proponent, and its contractors.	Moderate (6)

Risk Description	Risk Matrix			Counter measures	Revised Rating
	Likelihood	Consequence	Rating		
The proposed access arrangements for the LEIP materially impacts the operation of the existing Hy-Tec Quarry and results in commercial impacts to this business.	Possible	Moderate	Moderate (9)	• The preliminary aspirational master plan recommends that Manton Quarry Road be retained as per the existing arrangement in the Interim arrangement and is upgraded to provide active controls in the Ultimate arrangement to support the release of land in the southern development areas. • The preliminary aspirational master plan recommends that an on-going stakeholder engagement process with Hy-Tec as the operator of Manton Quarry should be conducted regarding access and serviceability in the Interim and Ultimate arrangements.	Low (4)
The development of the QPM Western Access Road is selected as the primary connection between Ghost Gum Road and the Jones Road railway level crossing resulting in an inefficient road network with poor permeability, poor connectivity and a reduction of effective design life of assets including the proposed grade separated crossing at Ghost Gum Road.	Possible	Moderate	Moderate (9)	• The preliminary aspirational master plan recommends that the proposed North-South Major Collector road should be selected as the primary connection between Ghost Gum Road and the Jones Road railway level crossing. • A supplementary Technical Memo has been prepared by the Project Team to provide a quantitative evidence base to support the selection of the proposed North-South Major Collector road as the primary connection between Ghost Gum Road and the Jones Road railway level crossing.	Moderate (6)
Electricity point of supply is insufficient to meet LEIP demand.	Possible	Major	High (12)	• Early identification of proponent demand and available supply to the LEIP. • Targeted consultation with Energy Queensland and Powerlink Queensland to secure supply from these entities as the Supplier of Last Resort (statutory body).	Moderate (6)

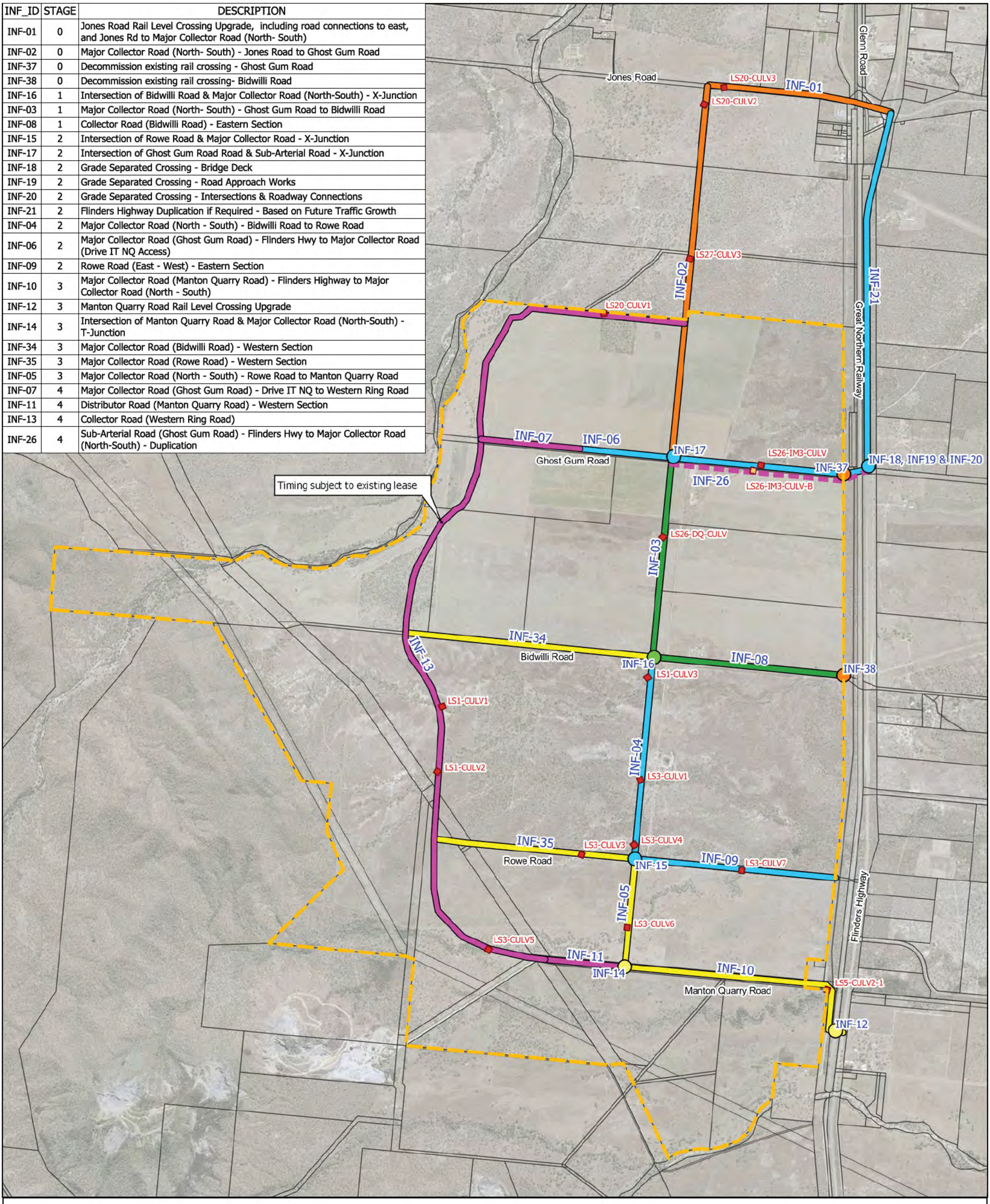
Risk Description	Risk Matrix			Counter measures	Revised Rating
	Likelihood	Consequence	Rating		
Electricity transmission cables require land resumption that is constrained by environmental corridors, unwanted by the Townsville City Council, or otherwise unachievable.	Possible	Major	High (12)	• Early identification of corridors, hold-points and constraints imposed on land by stakeholders in the development. • Facilitate discussions with parties who desire larger transmission voltages about using no larger than 110kV lines. • Consider alternative alignments and proponent led infrastructure that could achieve the desired outcomes.	Moderate (6)
Information pertaining to electricity point of supply, transmission and distribution is covered by commercial in confidence.	Likely	Major	High (16)	• Early stakeholder engagement with electricity suppliers. • Issue letters of support from the Townsville City Council to demonstrate the objectives of the LEIP are community driven. • Enter into non-disclosure agreements to protect information that is commercial in confidence.	Moderate (6)
Underground electricity cables (up to 110kV) are not large enough to offer sufficient supply to proponents.	Possible	Major	High (12)	• Early identification of proponent demands and engagement with technical personnel to discuss limitations. • Propose alternative alignments or resolve through proponent led infrastructure mechanism.	Moderate (9)
Powerlink Queensland do not offer a point of supply connection to their transmission network.	Unlikely	Moderate	Moderate (6)	• Provide early estimates of proponent demand to demonstrate actionable market position for Powerlink. • Issue letters of support from the Townsville City Council to demonstrate the objectives of the LEIP are community driven.	Moderate (6)

Risk Description	Risk Matrix			Counter measures	Revised Rating
	Likelihood	Consequence	Rating		
Available telecommunications network is insufficient to support business operations.	Possible	Major	High (12)	• Early identification of proponent demands and engagement with technical personnel to discuss limitations. • Early stakeholder engagement with NBN Co. and other suppliers to identify available bandwidth and limits of service. • Rely on Internet Providers of Last Resort to provide minimum service connections to the LEIP (Statutory Authority).	Moderate (9)
Development triggers telecommunications network requires upgrading to deliver minimum service to business.	Possible	Moderate	Moderate (9)	• Early identification of proponent demands and engagement with technical personnel to discuss limitations. • Early stakeholder engagement with NBN Co. and other suppliers to identify available bandwidth and limits of service.	Moderate (9)
Insufficient or inaccessible gas supply from the North Queensland Gas Pipeline.	Possible	Moderate	Moderate (9)	• Early Stakeholder engagement with the North Queensland Gas Pipeline to identify pinch-points in business case. • Issue letters of support from the Townsville City Council to demonstrate the objectives of the LEIP are community driven. • Provide early estimates of proponent demand to demonstrate actionable market position for North Queensland Gas Pipeline.	Moderate (6)
Inadequate road augmentations to facilitate road-mounted LNG deliveries.	Unlikely	Moderate	Moderate (6)	• LEIP stage plans promote co-location of proponents to reduce infrastructure costs to supply remote sites. Road access is considered in this plan. • Existing road network comprises unsealed / private roads. Remediation works can be provisioned to improve access with lower cost implications.	Low (4)

Risk Description	Risk Matrix			Counter measures	Revised Rating
	Likelihood	Consequence	Rating		
Insufficient demand to support a business case to supply reticulated gas within the LEIP (i.e., gas main construction inside the LEIP).	Unlikely	Moderate	Moderate (6)	• Early identification of proponent demands and engagement with technical personnel to discuss limitations. • Construct spare conduit banks locatable within the road reserve to future proof gas reticulation.	Low (4)
Incompatibility with alternative gas / hydrogen products co-located in the road reserve.	Possible	Moderate	Moderate (9)	• Early identification of proponent demands and engagement with technical personnel to discuss limitations. • Construct spare conduit banks locatable within the road reserve to future proof gas reticulation.	Low (4)

Appendix D Infrastructure Mapping

INF_ID	STAGE	DESCRIPTION
INF-01	0	Jones Road Rail Level Crossing Upgrade, including road connections to east, and Jones Rd to Major Collector Road (North- South)
INF-02	0	Major Collector Road (North- South) - Jones Road to Ghost Gum Road
INF-37	0	Decommission existing rail crossing - Ghost Gum Road
INF-38	0	Decommission existing rail crossing- Bidwilli Road
INF-16	1	Intersection of Bidwilli Road & Major Collector Road (North-South) - X-Junction
INF-03	1	Major Collector Road (North- South) - Ghost Gum Road to Bidwilli Road
INF-08	1	Collector Road (Bidwilli Road) - Eastern Section
INF-15	2	Intersection of Rowe Road & Major Collector Road - X-Junction
INF-17	2	Intersection of Ghost Gum Road Road & Sub-Arterial Road - X-Junction
INF-18	2	Grade Separated Crossing - Bridge Deck
INF-19	2	Grade Separated Crossing - Road Approach Works
INF-20	2	Grade Separated Crossing - Intersections & Roadway Connections
INF-21	2	Flinders Highway Duplication if Required - Based on Future Traffic Growth
INF-04	2	Major Collector Road (North - South) - Bidwilli Road to Rowe Road
INF-06	2	Major Collector Road (Ghost Gum Road) - Flinders Hwy to Major Collector Road (Drive IT NQ Access)
INF-09	2	Rowe Road (East - West) - Eastern Section
INF-10	3	Major Collector Road (Manton Quarry Road) - Flinders Highway to Major Collector Road (North - South)
INF-12	3	Manton Quarry Road Rail Level Crossing Upgrade
INF-14	3	Intersection of Manton Quarry Road & Major Collector Road (North-South) - T-Junction
INF-34	3	Major Collector Road (Bidwilli Road) - Western Section
INF-35	3	Major Collector Road (Rowe Road) - Western Section
INF-05	3	Major Collector Road (North - South) - Rowe Road to Manton Quarry Road
INF-07	4	Major Collector Road (Ghost Gum Road) - Drive IT NQ to Western Ring Road
INF-11	4	Distributor Road (Manton Quarry Road) - Western Section
INF-13	4	Collector Road (Western Ring Road)
INF-26	4	Sub-Arterial Road (Ghost Gum Road) - Flinders Hwy to Major Collector Road (North-South) - Duplication



0 0.5 1 km

Scale: 1:25,000 (A3)
Author: JC

LEGEND

- LEIP BOUNDARY
- CADASTRE
- DUPLICATED CULVERT
- PROPOSED CULVERT

PROPOSED ROAD

- Stage 0 - Major Collector Road
- Stage 1 - Major Collector Road
- Stage 2 - Major Collector Road
- Stage 3 - Major Collector Road
- Stage 4 - Major Collector Road
- Stage 4 - Sub Arterial Road

PROPOSED INTERSECTION

- Stage 0
- Stage 1
- Stage 2
- Stage 3

Proposed Transport Infrastructure

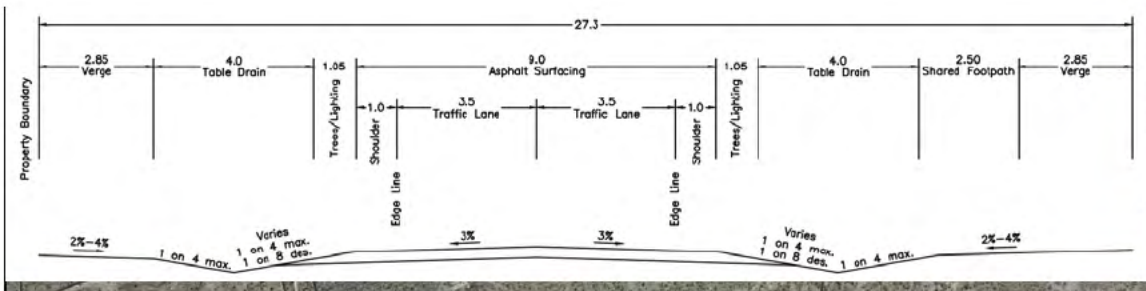
Stage 0 to 4

Lansdown Eco-Industrial Precinct

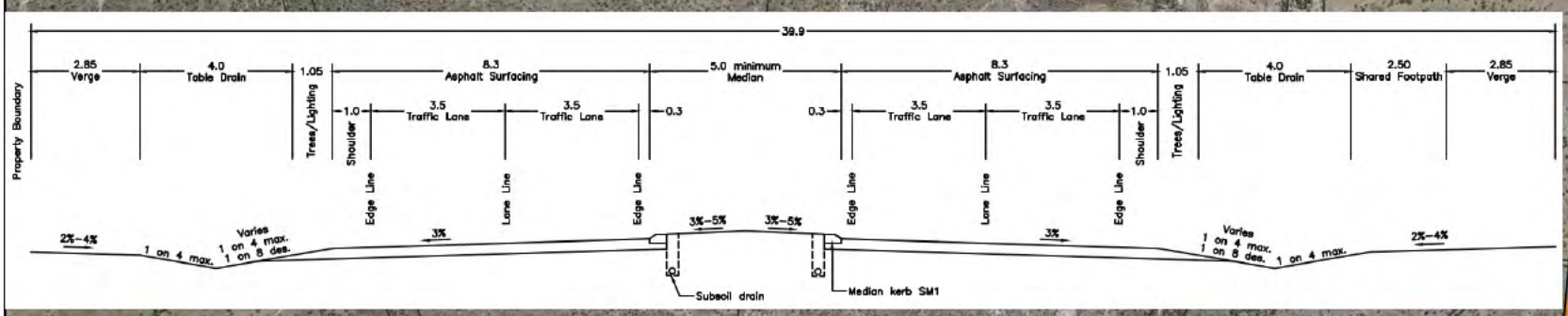
21-000239 Figure T01

Rev 0 - 3.02.22

calibre



Typical Cross Section B
Modified Major Collector Rd Configuration



Typical Cross Section C
Ultimate Sub-Arterial Rd Configuration

Jones Road
Glenn Road
Great Northern Railway
Ghost Gum Road
Bidwilli Road
Rowe Road
Manton Quarry Road
Flinders Highway

0 0.5 1 km

Scale: 1:25,000 (A3)
Author: JC

LEGEND

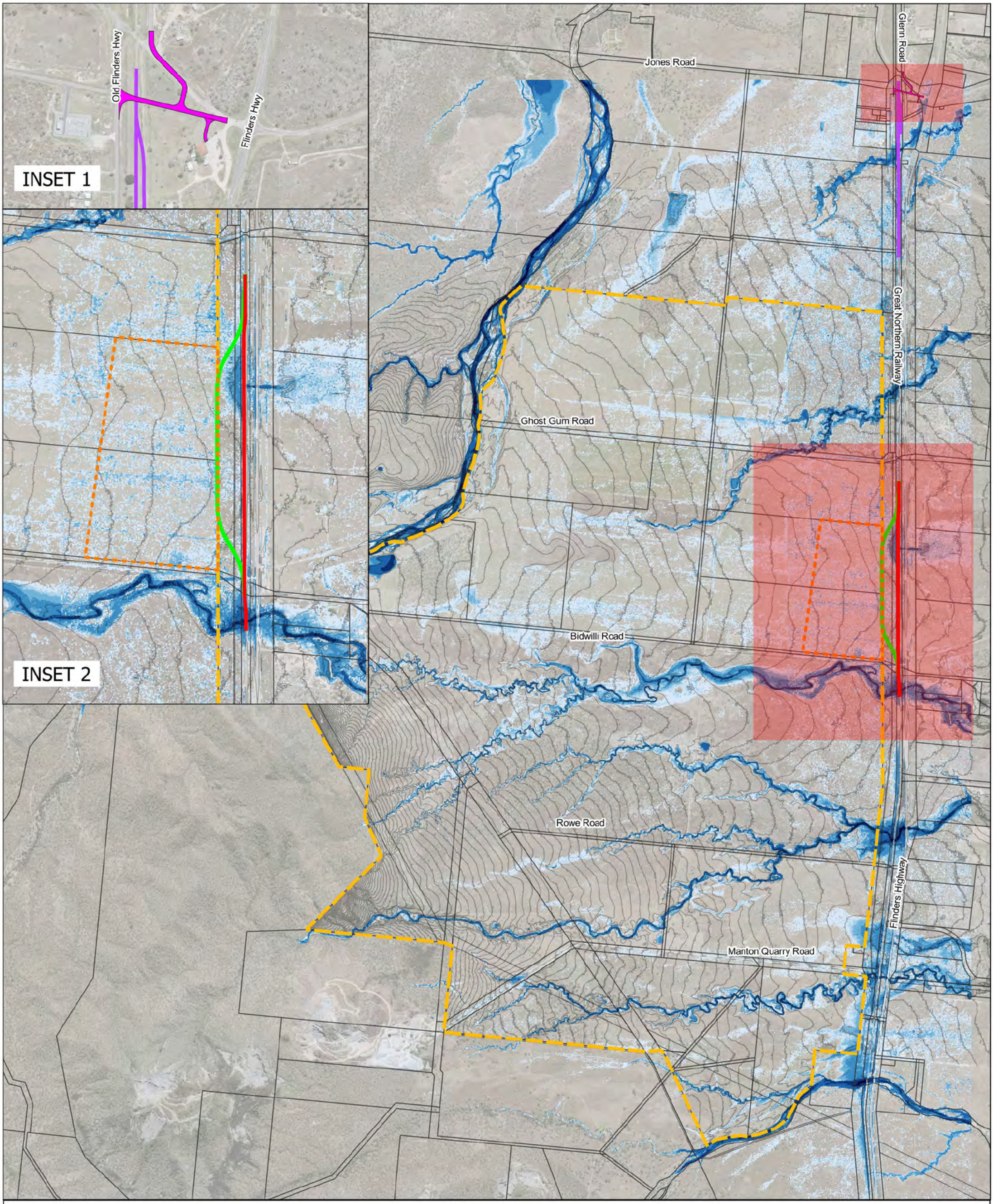
- LEIP BOUNDARY
- CADASTRE

PROPOSED ROAD HIERARCHY

- Major Collector Road
- Sub Arterial Road
- Flinders Highway Duplication

Proposed Road Hierarchy
Stage 0 to 4
Lansdown Eco-Industrial Precinct
21-000239 Figure T02
Rev 0 - 3.02.22

calibre



N
W E
S

0 1 2 km

Scale: 1:25,000
Date: 20.10.21
Author: JC

LEGEND

- SITE BOUNDARY
- CADASTRE
- CONTOURS_1m
- GLENN RD LEVEL CROSSING UPGRADE
- EXISTING PASSING LOOP
- PROPOSED PASSING LOOP
- POSSIBLE RAIL SIDING
- POSSIBLE INTERMODAL HUB

DEVELOPED 1% AEP FLOOD DEPTH (m)

Band 1 (Gray)

- < 0.1
- 0.1 TO 0.2
- 0.2 TO 0.3
- 0.3 TO 0.5
- 0.5 TO 1.0
- 1.0 TO 2.0
- 2.0 TO 3.0

Overall Site & Rail Infrastructure

Lansdown Eco-Industrial Precinct
21-000239 Figure R01

calibre

N

FLINDERS HIGHWAY

OP1b-1 and OP1b-6

OP1b1-2 and OP1b-5

WOODSTOCK GIRU ROAD

MAJOR CREEK ROAD

GHOST GUM ROAD

CRABB ROAD

OP1-3 & OP1-4
(ALTERNATIVE LOCATION)

BIDWILLI ROAD

MURRAYS ROAD

OP1-3 & OP1-4

0 0.5 1 km

Date: 18.11.2021
Author: JG

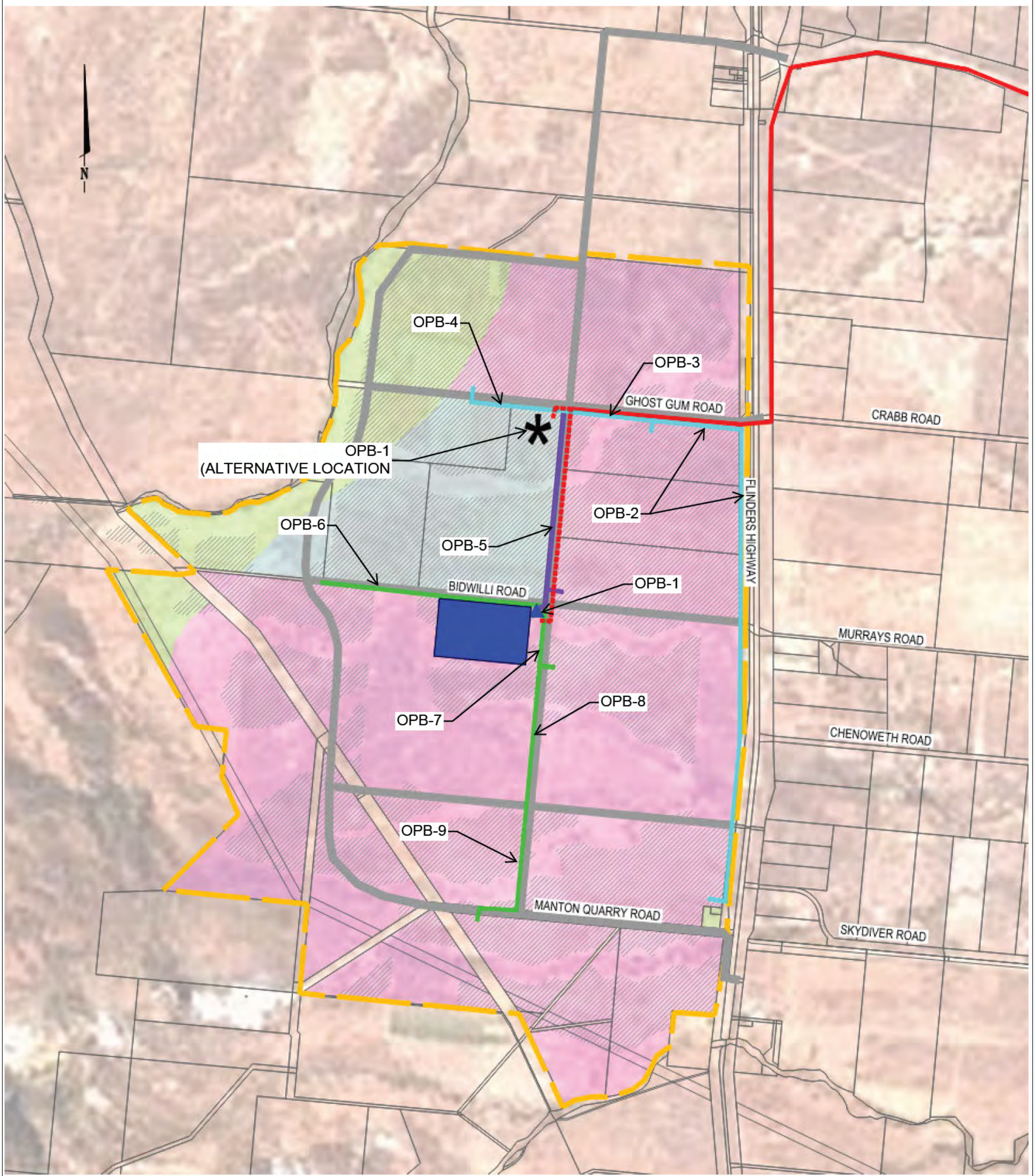
LEGEND:

- SITE BOUNDARY
- EXISTING CADASTRE
- EXISTING DN900 HAUGHTON PIPELINE
- PROPOSED FUTURE ROADS
- ZONING - INDUSTRIAL
- ZONING - SPORTS/RECREATION
- ZONING - RURAL
- DEVELOPMENT POTENTIAL (SCENARIO C)
- PROPOSED WATER MAIN
- ALTERNATIVE ALIGNMENT
- PROPOSED BOOSTER PUMP STATION
- PROPOSED INGROUND STORAGE
- ALTERNATIVE STORAGE AND BOOSTER PUMP STATION LOCATION

LANSDOWN ECO-INDUSTRIAL PRECINCT

EXTERNAL WATER SUPPLY
INFRASTRUCTURE OPTION 1
21-000239-SK2960

calibre



LEGEND:

0 0.5 1 km

Date: 18.11.2021
Author: JG

- SITE BOUNDARY
- EXISTING CADASTRE
- EXISTING DN900 HAUGHTON PIPELINE
- PROPOSED FUTURE ROADS
- ZONING - INDUSTRIAL
- ZONING - SPORTS/RECREATION
- ZONING - RURAL
- DEVELOPMENT POTENTIAL (SCENARIO C)
- PROPOSED EXTERNAL WATER MAINS
- STAGE 0 INTERNAL WATER MAIN
- STAGE 2 INTERNAL WATER MAIN
- STAGE 3 INTERNAL WATER MAIN
- PROPOSED RAW WATER STORAGE (INDICATIVE LOCATION)
- PROPOSED BOOSTER PUMP STATION

LANSDOWN ECO-INDUSTRIAL PRECINCT

INTERNAL WATER SUPPLY
INFRASTRUCTURE OPTION A
21-000239-SK2960

calibre

INFRASTRUCTURE ID	DETAILS
MAJORS CREEK SOLAR FARM	Solar (behind the meter)
POWERLINK TRANSMISSION LINE (NORTH)	275kV transmission line
POWERLINK TRANSMISSION LINE (SOUTH)	275kV transmission line
PROPOSED COPPER STRING 2.0 TRANSMISSION LINE (40KM SOUTH - NOT SHOWN ON PLAN)	275kV transmission line
WOODSTOCK SUBSTATION	Woodstock 66/11kV Sub-station

MAJORS CREEK SOLAR FARM

WOODSTOCK SUBSTATION

POWERLINK TRANSMISSION LINE

Ghost Gum Road

Bidwilli Road

Rowe Road

Manton Quarry Road

Manton Quarry Road

Flinders Highway

POWERLINK TRANSMISSION LINE

N

W E

S

0 1 2 km

Scale: 1:50,000
Date: 13.10.21
Author: MC

LEGEND

- SITE BOUNDARY
- CADASTRE
- POINT OF SUPPLY
- MAJOR ELECTRICITY INFRASTRUCTURE
- PROPOSED MAJOR TRANSMISSION LINE
- LAND DEDICATION NEW SUBSTATION
- MAJORS CREEK SOLAR FARM
- ENABLING 132kV OHE LINE (EXCLUSION ZONE NTS)
- ENABLING 110kV UGE LINE

NOTE:
1. REFER TO 21-000239 - SK003 FOR INTERNAL ELECTRICAL RETICLUATION
2. INTERNAL ELECTRICAL RETICULATION TO FOLLOW ROAD AUGMENTATION PLAN. REFER 21-000239 TU1 FOR ALIGNMENT.

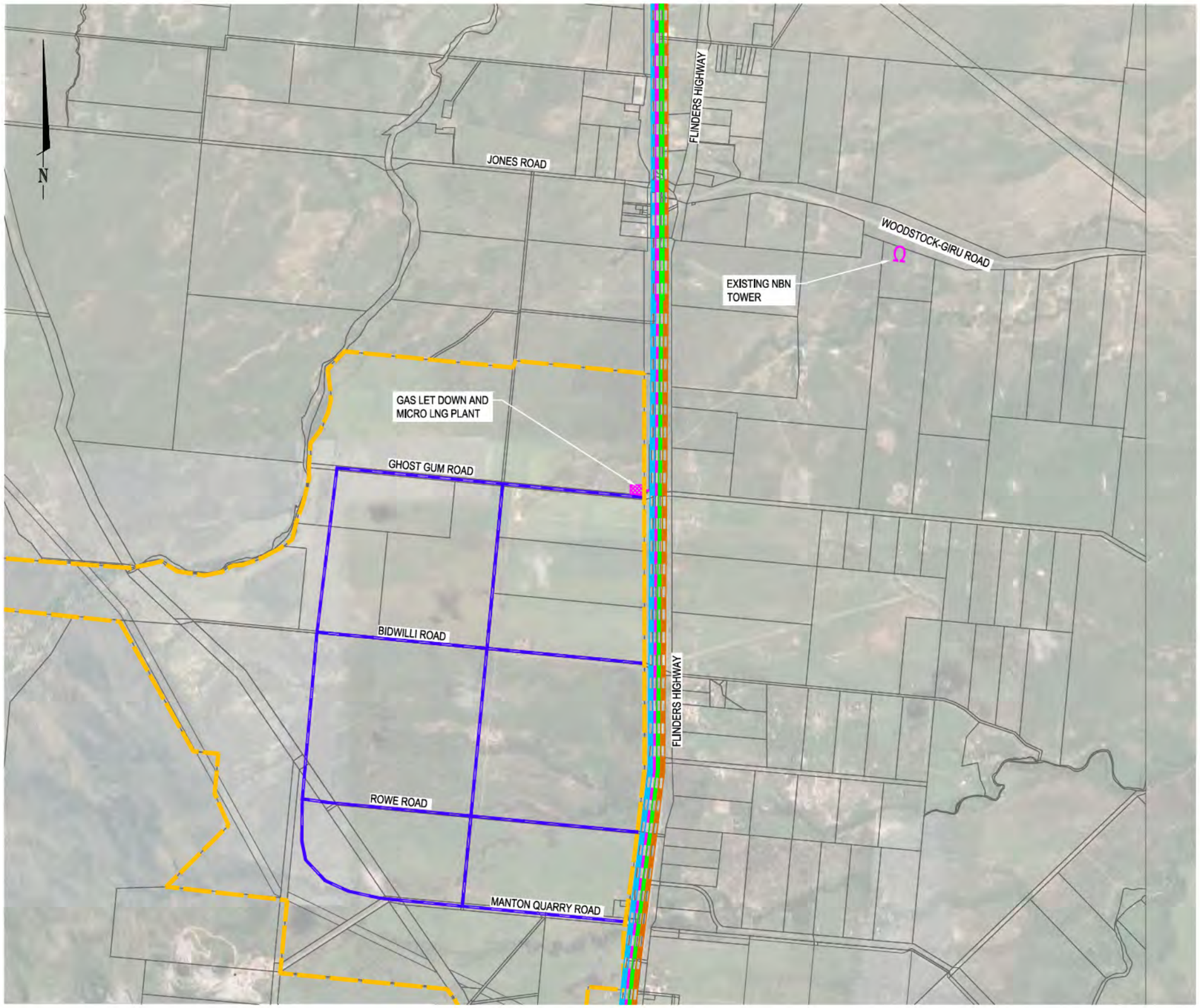
Electricity Infrastructure Options

Planning Scenario A & B

Lansdown Eco-Industrial Precinct

21-000239 Figure U01

calibre



calibre

LEGEND:

- SITE BOUNDARY
- EXISTING CADASTRE
- PROPOSED NBN ALIGNMENT (INDICATIVE ALIGNMENT)
- EXISTING TELSTRA ALIGNMENT (INDICATIVE ALIGNMENT)
- EXISTING NEXTGEN ALIGNMENT (INDICATIVE ALIGNMENT)
- EXISTING NORTH QUEENSLAND GAS PIPELINE (INDICATIVE ALIGNMENT)
- PROPOSED INTERNAL UTILITIES NETWORK
- Ω EXISTING NBN FIXED WIRELESS TOWER

NOTES:

1. INFRASTRUCTURE SHOWN IS INDICATIVE ONLY AND IS SUBJECT TO DETAIL DESIGN.
2. THIS DRAWING IS CONCEPTUAL AND HAS BEEN PRODUCED FOR DISCUSSION PURPOSES.

1:20000 200 0 200 400 600 800 1000 A1
1:40000 A3

PROJECT:
LANSDOWN ECO-INDUSTRIAL PRECINCT

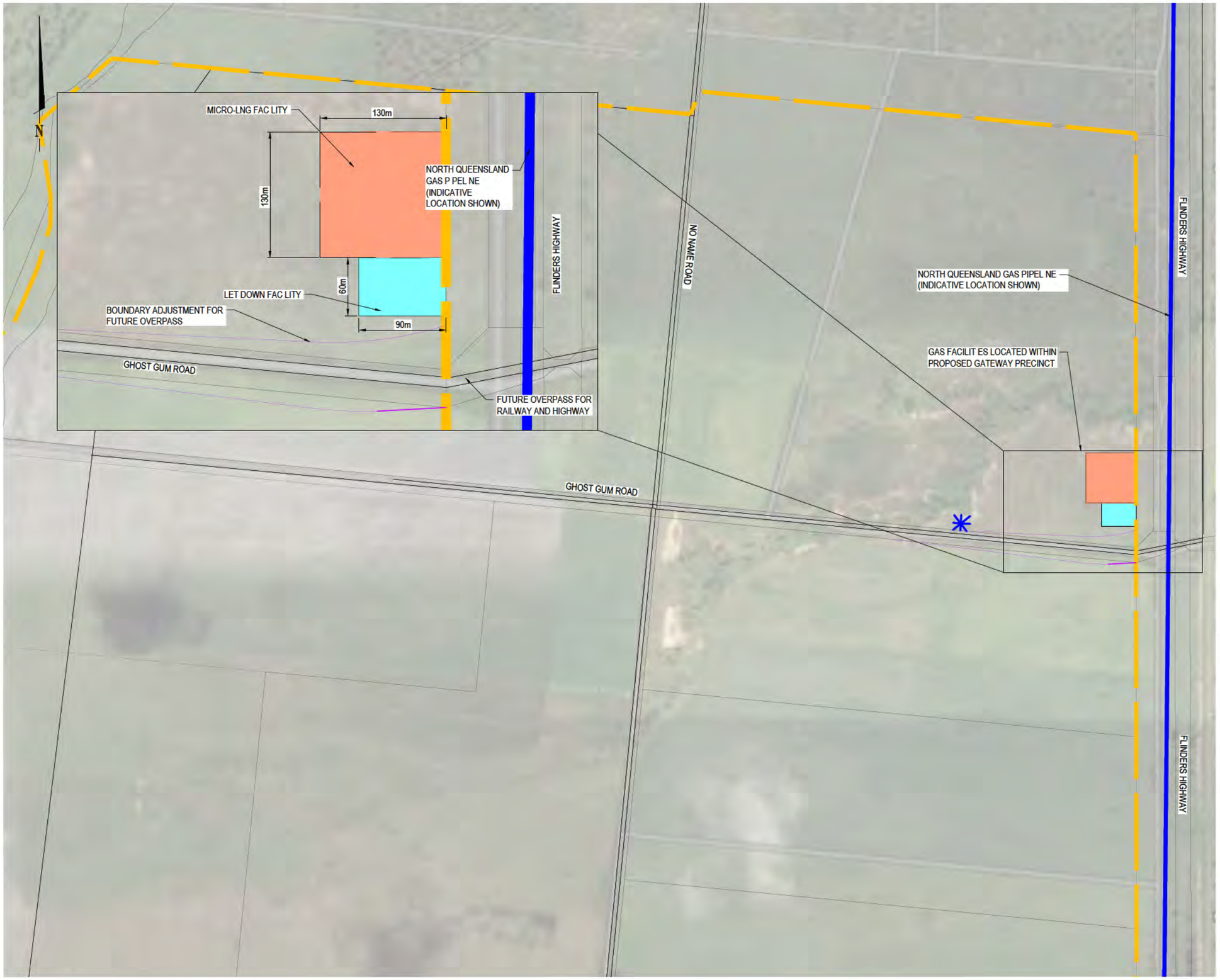
CLIENT:
TOWNSVILLE CITY COUNCIL

DRAWING TITLE:
GAS AND TELECOMMUNICATIONS PLAN

DRAWING NUMBER: 21-000239-SK004

ISSUE: A

ISSUE	BY	CHK	DATE	DETAILS
A	JB	JB	19.10.21	ORIGINAL ISSUE
B				
C				
D				
E				
F				
G				



calibre

LEGEND:

- SITE BOUNDARY
- EXISTING CADASTRE
- GAS LET-DOWN STATION (0.54ha)
- LNG MICRO-FACILITY (1.69ha)
- NDICATIVE ACCESS LOCATION (SUBJECT TO SIT NG STUDY)

NOTES:

1. INFRASTRUCTURE SHOWN IS INDICATIVE ONLY AND IS SUBJECT TO DETA L DESIGN.
2. THIS DRAW NG IS CONCEPTUAL AND HAS BEEN PRODUCED FOR DISCUSSION PURPOSES.
3. F NAL SITING TO BE CONFIRMED WITH PROPONENTS

1:5000 100 50 0 100 200 A1
1:10000 A3

PROJECT:

LANSDOWN ECO-INDUSTRIAL PRECINCT

CLIENT:

TOWNSVILLE CITY COUNCIL

DRAWING TITLE:

GAS LETDOWN AND MICRO FACILITY LAND ACQUISITION PLAN

DRAWING NUMBER: 21-000239-SK001

ISSUE: 0

ISSUE	BY	CHK	DATE	DETAILS
A	UM	AM	31.01.22	ISSUE FOR USE
B				
C				
D				
E				
F				
G				

Appendix E Revenue Sufficiency Analysis Tables

Table E1 – Summary Costs for LEIP Preferred Core Infrastructure

Stage	Network	Total Cost	Sub Total
Enabling	Roads (including major stormwater culverts)	[redacted]	
	Rail	[redacted]	[redacted]
	External Raw Water Supply	[redacted]	
	Internal Raw Water Reticulation	[redacted]	
Stage 1	Roads (including major stormwater culverts)	[redacted]	
	Rail	[redacted]	[redacted]
	External Raw Water Supply	[redacted]	
	Internal Raw Water Reticulation	[redacted]	
Stage 2	Roads (including major stormwater culverts)	[redacted]	
	Rail	[redacted]	[redacted]
	External Raw Water Supply	[redacted]	
	Internal Raw Water Reticulation	[redacted]	
Stage 3	Roads (including major stormwater culverts)	[redacted]	
	Rail	[redacted]	[redacted]
	External Raw Water Supply	[redacted]	
	Internal Raw Water Reticulation	[redacted]	
Ultimate Development	Roads (including major stormwater culverts)	[redacted]	
	Rail	[redacted]	[redacted]
	External Raw Water Supply	[redacted]	
	Internal Raw Water Reticulation	[redacted]	
		TOTAL COST	[redacted]

Table E2 – Roads Schedule of Works (including major stormwater culverts)

ID	Network	Description	Stage	Roads Cost	Culverts Cost	Base Cost	On Costs	Contingency	Opinion of Cost
INF-1	Roads	Jones Road Rail Level Crossing Upgrade, including road connections to east, and Jones Rd to Major Collector Road (North- South)	0	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
INF-2	Roads	Major Collector Road (North- South) - Jones Road to Ghost Gum Road incorporating INF-17	0	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
INF-37	Roads	Decommission existing rail crossing - Ghost Gum Road	0	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
INF-38	Roads	Decommission existing rail crossing- Bidwilli Road	0	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
INF-3	Roads	Major Collector Road (North- South) - Ghost Gum Road to Bidwilli Road incorporating portion of INF-16	1	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
INF-8	Roads	Collector Road (Bidwilli Road) - Eastern Section incorporating portion of INF-16	1	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
INF-18	Roads	Grade Separated Crossing - Bridge Deck	2	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
INF-19	Roads	Grade Separated Crossing - Road Approach Works	2	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
INF-20	Roads	Grade Separated Crossing - Intersections & Roadway Connections	2	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

ID	Network	Description	Stage	Roads Cost	Culverts Cost	Base Cost	On Costs	Contingency	Opinion of Cost
INF-21	Roads	Flinders Highway Duplication if Required - Based on Future Traffic Growth	2	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
INF-4	Roads	Major Collector Road (North - South) - Bidwilli Road to Rowe Road incorporating portion of INF-15	2	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
INF-6	Roads	Major Collector Road (Ghost Gum Road) - Flinders Hwy to Major Collector Road (North-South)	2	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
INF-6A	Roads	Major Collector Road (Ghost Gum Road) - From Major Collector Road (North-South) Intersection to Drive It NQ entry	2	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
INF-9	Roads	Rowe Road (east - West) - Eastern Section incorporating portion of INF-15	2	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
INF-10	Roads	Major Collector Road (Manton Quarry Road) - Flinders Highway to Major Collector Road (North - South) incorporating portion of INF-16	3	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
INF-12	Roads	Manton Quarry Road Rail Level Crossing Upgrade	3	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
INF-34	Roads	Major Collector Road (Bidwilli Road) - Western Section	3	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
INF-35	Roads	Major Collector Road (Rowe Road) - Western Section	3	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

ID	Network	Description	Stage	Roads Cost	Culverts Cost	Base Cost	On Costs	Contingency	Opinion of Cost
INF-5	Roads	Major Collector Road (North - south) - Rowe Road to Manton Quarry Road incorporating portion of INF-14	3	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
INF-11	Roads	Distributor Road (Manton Quarry Road) - Western Section	4	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
INF-13	Roads	Collector Road (Western Ring Road)	4	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
INF-26	Roads	Sub-Arterial Road (Ghost Gum Road) - Flinders Hwy to Major Collector Road (North-South) - Duplication	4	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
INF-7	Roads	Major Collector Road (Ghost Gum Road) - DriveIT to Western Ring Road	4	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Table E3 – Rail Schedule of Works

ID	Network	Description	Stage	Base Cost	On Costs	Contingency	*Opinion of Cost*
RWY-1	Rail	Passing Loop & Jones Rd Level Crossing (QR provided Costing)	0	[redacted]	[redacted]	[redacted]	[redacted]

Table E4 – External Water Supply Schedule of Works

ID	Network	Description	Stage	Base Cost	On Costs	Contingency	Opinion of Cost
OP1b-1	External Water Supply	DN500 Water Main	0	[redacted]	[redacted]	[redacted]	[redacted]
OP1b-3	External Water Supply	Enabling works storage (306 ML)	0	[redacted]	[redacted]	[redacted]	[redacted]
OP1b-2	External Water Supply	Transfer Pump Station (600kW)	0	[redacted]	[redacted]	[redacted]	[redacted]
OP1b-5	External Water Supply	Transfer Pump Station Upgrade (1200kW)	2	[redacted]	[redacted]	[redacted]	[redacted]
OP1b-4	External Water Supply	Storage Upgrade (Additional 711 ML)	3	[redacted]	[redacted]	[redacted]	[redacted]
OP1b-6	External Water Supply	DN400 Water Main Duplication	3	[redacted]	[redacted]	[redacted]	[redacted]

Table E5 – Internal Water Reticulation Schedule of Works

ID	Network	Description	Stage	Base Cost	On Costs	Contingency	Opinion of Cost
OPB-1	Internal Water Reticulation	Regional Transfer Pump Station	0	[redacted]	[redacted]	[redacted]	[redacted]
OPB-2	Internal Water Reticulation	DN250 Water Main	0	[redacted]	[redacted]	[redacted]	[redacted]
OPB-3	Internal Water Reticulation	DN450 Water Main	0	[redacted]	[redacted]	[redacted]	[redacted]
OPB-4	Internal Water Reticulation	DN375 Water Main	0	[redacted]	[redacted]	[redacted]	[redacted]
OPB-5	Internal Water Reticulation	DN450 Water Main	0	[redacted]	[redacted]	[redacted]	[redacted]
OPB-6	Internal Water Reticulation	DN300 Water Main	3	[redacted]	[redacted]	[redacted]	[redacted]
OPB-7	Internal Water Reticulation	DN375 Water Main	3	[redacted]	[redacted]	[redacted]	[redacted]
OPB-8	Internal Water Reticulation	DN300 Water Main	3	[redacted]	[redacted]	[redacted]	[redacted]
OPB-9	Internal Water Reticulation	DN200 Water Main	3	[redacted]	[redacted]	[redacted]	[redacted]

Table E6 – Estimated Infrastructure Charges – Proponent development (Stage 0) plus Scenario A for future stages

Site	Stage	Use	Land Area (Ha)	Net Developable Area (Ha)	Assumed Plot Ratio	GFA m^2	Charge rate[14]	Est. Charges
Driveit NQ	Stage 0	Sport & Recreation	285.1	212	NA	NA	ICN	[redacted]
QPM	Stage 0	High Impact Industry	225.3	219.2	0.0039	8590	[redacted]	[redacted]
Imperium 3	Stage 0	Low Impact Industry	32.6	32.2	0.3	102,989	[redacted]	[redacted]
Edify	Stage 0	Low Impact Industry	53.7	53.7	0.0008	1400	[redacted]	[redacted]
Balance Developable Land	Future stages	High Impact Industry	1140.3	552.4	0.01	55,240	[redacted]	[redacted]
							TOTAL	[redacted]

Table A7 – Estimated Charges – Proponent development (Stage 0) plus Scenario B for future stages

Site	Stage	Use	Land Area	Net Developable Area	Assumed Plot Ratio	GFA	Charge rate[14]	Est. Charges
DriveIT NQ	Stage 0	Sport & Recreation	285.1	212	NA	NA	ICN	[redacted]
QPM	Stage 0	High Impact Industry	225.3	219.2	0.0039	8590	[redacted]	[redacted]
Imperium 3	Stage 0	Low Impact Industry	32.6	32.2	0.3	102,989	[redacted]	[redacted]
Edify	Stage 0	Low Impact Industry	53.7	53.7	0.0008	1400	[redacted]	[redacted]
Balance Developable Land	Future stages	Low Impact Industry	1140.3	552.4	0.2	1,104,800	[redacted]	[redacted]
							TOTAL	[redacted]

[14] Unless otherwise stated, charge rates as per the Planning Regulation 2017

TW00435 – LANSDOWN ECO-INDUSTRIAL INFRASTRUCTURE PRECINCT - INFRASTRUCTURE MASTER PLAN

Appendix F Sustainability Assessment Section

Report

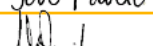
Lansdown Eco-Industrial Precinct Sustainability Assessment

Prepared for Townsville City Council

4 February 2022

Calibre Professional Services Pty Ltd
55 070 683 037

QUALITY ASSURANCE STATEMENT

TASK	NAME	SIGNATURE
Project Manager	Chris Arrington	
Prepared by	Lucas Aidar	
Reviewed by	Jon Panic	
Approved for Issue by	Andrew McPhail	

DOCUMENT CONTROL

ISSUE	DATE	ISSUE DETAILS	AUTHOR	CHECKED	APPROVED
A	10/02/2022	Issue for Use	LA	JP	CA / AMcP

PSA.RPT.MP.03.21-000239 Sustainability

Executive Summary

Calibre and Malo Sustainability Consulting (Malo) were engaged by Townsville City Council (Council) to provide recommendations on:

- How to define an "Eco-Industrial Precinct" (EIP)
- Identifying and assessing potentially suitable sustainability and eco – industry frameworks and recommending an appropriate framework for adoption within the Lansdown Eco-Industrial Precinct (LEIP)
- A method to assess whether proponents and precinct-wide infrastructure are achieving sustainability obligations set out in the framework
- To review the sustainability performance and establish management measures for the LEIP

A definition for an EIP was developed in consultation with Council:

> *A dedicated area for industrial use that is managed within an economic, social and environmental sustainability framework. The framework is designed to exceed regulatory compliance and – wherever possible – encourage industrial synergy processes at all levels of operation, and decommissioning. Businesses within this area should work collaboratively and be managed and supported by a single entity that facilitates stakeholder dialogue, risk management and leading practice sustainability outcomes. EIPs may also seek to bridge the gap between cities and industries by making a significant contribution to the local community.*

This report has assessed a range of sustainability rating tools and frameworks and, again in consultation with Council, has ultimately selected *An International Framework for Eco-Industrial Parks Version 2.0* (the UNIDO Framework or the Framework) for detailed investigation.

This report has concluded that application of the UNIDO Framework on the LEIP would aid in driving the sustainable delivery and management of the LEIP. The Framework has international credibility and could assist in marketing the LEIP as world-leading from a sustainability perspective.

Whilst there are structural elements that may be necessary to realise some sustainability outcomes, crucially, the most important aspects to implementing the Framework are centred on:

- Establishment of a Council team responsible for site sustainability management. Council are in a unique and optimal position to establish this role in the early stages of the LEIP however moving forward there are a range of options for how this function could be undertaken including:
    - Continued Council self-management
    - Management by independent external operator / contractor
    - Self-managed by a proponents association
- The importance of using proponent agreements to drive performance and proponent behaviour

Other relevant aspects to implementing the Framework include:

- Developing awareness raising campaigns for stakeholders (to attract well-suited proponents and encourage collaboration with various stakeholders)
- Developing a structured approach for implementing industrial synergy practices in the LEIP (e.g., creating a questionnaire for proponents to assesses relevant industrial synergy parameters)
- Developing sustainability performance indicators to drive performance improvements
- Incorporating locally relevant targets and drivers into the system and performance indicators (e.g. the Townsville Corporate Plan 2021-2026 targets)

Implementation of these aspects is summarised below with respect to:

- Park management
- Environmental management
- Social management
- Economic management

Aspect	Requirements
Park Management	• Council appoints person / team to undertake managing • Responsible person / team develops monitoring plan as part of overall management system • Climate change risk assessment undertaken and reviewed every seven years • Responsible person / team develops regulatory requirements checking procedure as part of overall management system • Master plan developed and reviewed every seven years
Environmental Management	• Responsible person / team develops environmental management system • Responsible person / team develops records management procedure as part of overall environmental management system • Energy efficiency strategy is developed • Responsible person / team develops energy management procedure as part of overall environmental management system • Proponents only accepted where commitments to reduce Business as Usual (BAU) energy demand are provided • Industrial heat recovery strategy is developed • Infrastructure for waste heat / energy exchange built into master plan • Infrastructure for on-site storage and reuse built into master plan • Water efficiency and reuse strategy is developed • Responsible person / team develops records waste management procedure as part of overall environmental management system • Requirement for minimising hazardous materials use written into agreements with proponents • Identify synergy opportunities for proponents that have hazardous material outputs • Engagement with all proponents includes requirement to nominate opportunities for circular economy opportunities • Responsible person / team develops environmental management plans as part of environmental management system
Social Management	• Responsible person / team develops social quality standards as part of overall precinct management system
Economic Management	• Responsible person / team develops engagement procedures that maximise opportunities for local small-to-medium enterprises (SME) • Responsible person / team develops market demand and feasibility study, supported by a business plan for specific “green" infrastructure and services • Operational costs for park management are passed down onto proponents in agreements

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1. Introduction

Calibre and Malo Sustainability Consulting (Malo) were engaged by Townsville City Council (Council) to provide recommendations on:

- How to define an “Eco-Industrial Precinct”
- Identifying and assessing potentially suitable sustainability and eco – industry frameworks and recommending an appropriate framework for adoption within the Lansdown Eco-Industrial Precinct (LEIP)
- A method to assess whether proponents and precinct-wide infrastructure are achieving sustainability obligations set out in the framework
- To review the sustainability performance and establish management measures for the LEIP

1.1 Background

Council is looking to establish the LEIP as Australia’s first environmentally sustainable, advanced manufacturing, technology processing hub. The current master planning process being undertaken by Calibre and CDM Smith requires additional work to address sustainability considerations consistent with such a designation. To do this, a review of the LEIP’s sustainability and circular economy opportunities is required to provide a basis to establish the environmental management and performance of each operation and the LEIP.

1.2 Methodology

To meet the objectives of the brief, Calibre and Malo delivered the following methodology:

1. Local planning regulation review
2. Literature review
3. Case study review
4. Stakeholder engagement
5. Draft Report
6. Workshop / presentation with Council
7. Final report

1.2.1 Report development and consultation

Sections 1 to 8 of this report were developed and issued for Council comment as part of an interim report. Review and discussion of that report informed developed of Sections 9 and 10 which were submitted as part of the draft report.

The draft report was discussed in a workshop with Council on 30 September 2021. During that workshop the weightings for the scored assessment were finalised and the UNIDO Framework was identified as the preferred framework for further investigation. The outcomes of that investigation are presented as the final section in this report (Section 11).

2. Developing a definition for an Eco-Industrial Precinct

The United Nations Industrial Development Organisation (UNIDO) defines an Eco-Industrial Precinct (EIP) as:

> *a dedicated area for industrial use that supports sustainability through the integration of social, economic, and environmental quality aspects into its siting, planning, management and operations*

Common features of EIPs can include:

- by-product synergies (e.g., waste-to-feed exchanges)
- shared logistics for shipping and receiving facilities
- shared green technology infrastructures (e.g., renewable energy sources)
- service synergies (e.g., joint maintenance contractors between proponents)
- multi-partner green building retrofit

To date there has been no consistency in the way EIPs have been developed and managed either internationally or locally.

2.1 A definition for LEIP

During development of this work a definition for EIPs was proposed and refined through the workshop and engagement processes (refer Section 9.1).

3. Local Planning and Regulations, and Sustainability Frameworks Review

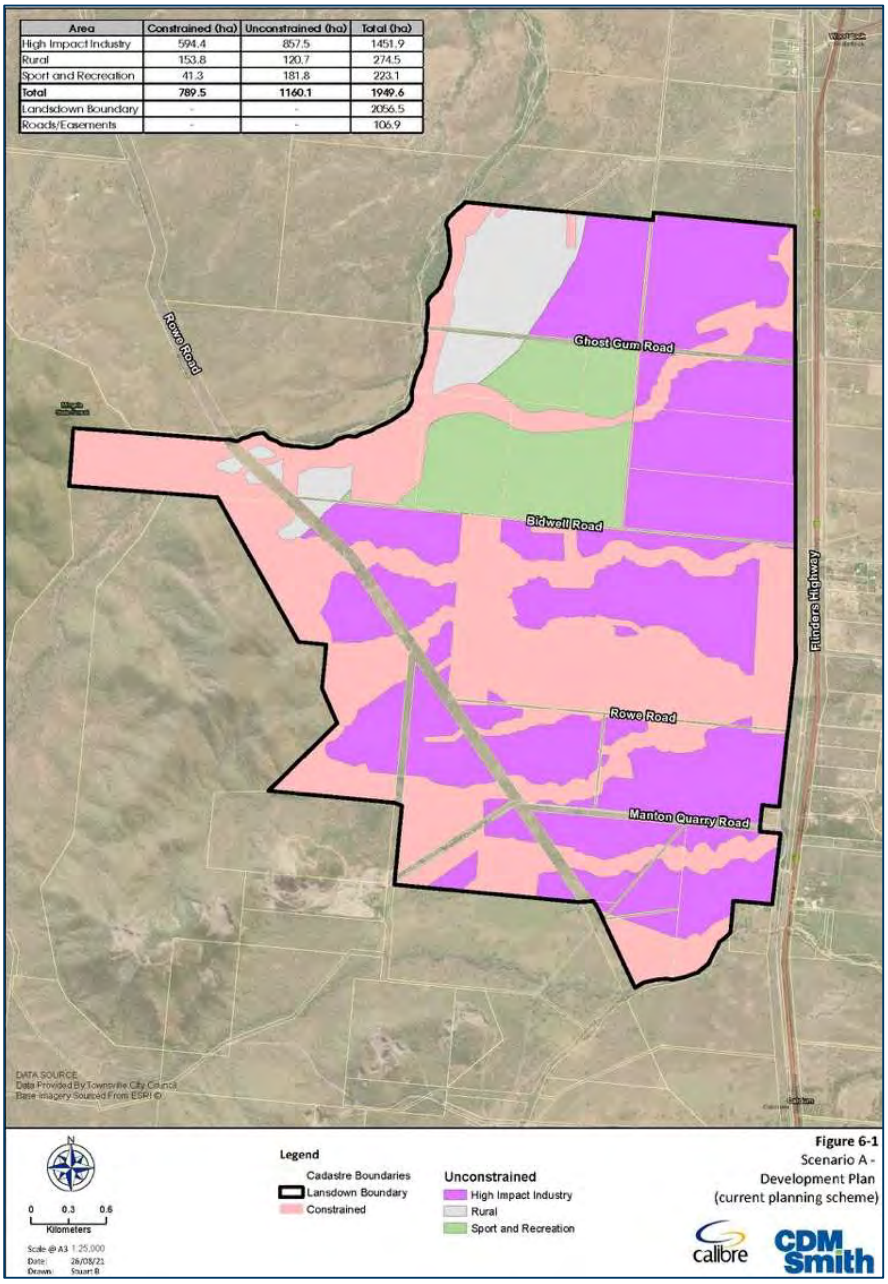
The following plans and strategies have been reviewed:

- Townsville City Plan
- Townsville Corporate Plan 2021-2026
- Townsville Environmental Policy (Doc # 1411)
- Townsville City Deal
- Townsville Smart Infrastructure and Sustainable Energy (SISE) Framework

3.1 Townsville City Plan

The LEIP footprint is currently zoned in a mix of:

- High Impact Industry
- Rural
- Sport and Recreation



3.1.1 High Impact Industry

The purpose of the High Impact Industry zone code is to provide for High Impact Industry uses.

It may include non-industrial and business uses that support the industrial activities where they do not compromise the long-term use of the land for industrial purposes.

3.1.1.1 Implications for the LEIP

The High Impact Industry zone has been specifically developed to enable the LEIP. Accordingly, at this stage of this work there are not anticipated to be any constraints to sustainable development in the areas zoned High Impact Industry. This will continue to be explored as the framework for sustainable development and management is refined.

3.1.2 Sport and Recreation

The purpose of the Sport and Recreation zone code is to provide for a range of organised activities that include sport, cultural and educational activities where the uses require a level of built infrastructure.

It includes built structures, such as clubhouses, gymnasiums, public swimming pools and tennis courts, and infrastructure to support the activities, safe access, and essential management, where required to meet community needs.

3.1.2.1 Implications for the LEIP

The Sport and Recreation zone is limited to a small parcel within the LEIP – the *Lansdown motor sport facility precinct*. The area has already been established as a driver education and motorsport facility. Whilst there are likely to be considerations with respect to the interface with the High Impact Industry zone (e.g., public access), it is not anticipated that the existence of this parcel will impact on the broader LEIP enabling sustainable development. Again, this will continue to be explored as the framework for sustainable development and management is refined.

3.1.3 Rural

The purpose of the Rural zone code is to:

1. provide for a wide range of rural uses including cropping, intensive horticulture, intensive animal industries, animal husbandry, animal keeping and other primary production activities;
2. provide opportunities for non-rural uses that are compatible with agriculture, the environment, and the landscape character of the rural area where they do not compromise the long-term use of the land for rural purposes; and
3. protect or manage significant natural features, resources, and processes, including the capacity for primary production.

3.1.3.1 Implications for the LEIP

The Rural zone is limited to a small area within LEIP, one of the areas broadly defined in the Grazing Precinct. Importantly, the code for this zone states:

> *Development does not prejudice the long-term potential of the Lansdown high impact industry precinct and the Lansdown motor sport facility precinct to accommodate development consistent with the relevant zone code*

Accordingly, the existence of this area of land zoned Rural is not anticipated to limit the potential for sustainable development in the LEIP.

3.2 Townsville Corporate Plan 2021-2026

A sustainably managed LEIP has the potential to contribute to goals 2, 3, 4 and 5 of the Townsville Corporate Plan 2021-2026.

Table 1 Townsville Corporate Plan 2021-2026

Goal	Objective	Target	Potential Alignment
Goal 2 A circular economy that advances business and moves towards zero waste	Divert 60% of material from landfill by 2026	Reduce by 20% the commercial waste quantities in landfill by 2026	A key aspect of EIPs are strategies to reduce resource inputs – and associated waste – via circular economy principles (e.g., by-product exchange).
	Have circular economy requirements embedded in specification and contracts	By 2022, Council standards and documentation amended to enable circular economy principles	
Goal 3 The hub for modern industry	Identification of high value economic sites to facilitate industry growth	Facilitate the master planning for Council led industrial precincts (supporting studies and/or infrastructure) to pre-emptively support attraction of modern industry to Townsville by 2022/23	This goal underpins the Council's drive for an EIP
	Generation of green energy and fuels for	By 2026, businesses and residents to have a choice to purchase locally produced green energy - including via waste to energy - at a	

Goal	Objective	Target	Potential Alignment
	use within the region and export	comparable or cheaper price than current energy options, including competitive network and demand charges. By 2026, Townsville is a globally recognised green energy export hub	
	Attraction of support industries for co-location to maximise local value chain	Year on year increase in Gross Regional Product of at least 3.5%	
	Map and support behind the meter energy opportunities to attract industry to the region	Support creation of a major industrial precinct with behind the meter energy solution and attraction of three new advanced manufacturers through the economic attractiveness of the low-cost localised green energy provision	
	Establish Townsville as a future business technology hub that attracts private investment and business start-ups	Attraction of private investment into new local technology businesses Investment and support to upscale local businesses and to introduce to new markets	
Goal 4 A sustainable destination that embraces and participates in the arts, sports, events and recreational activities	Enhancing existing tourism offerings and creating new landmark tourism destinations (built, cultural and natural environment)	Maintain Eco-Certified Sustainable Destination status	A successful EIP would contribute to meeting this goal
Goal 5 A leading centre of education, training and research commercialisation	Economic strategies between all levels of government, Indigenous organisations and the private sector to target future growth areas	By 2026, attraction of high value future industries to create 2,500 jobs	A successful EIP would contribute to meeting this goal

3.3 Townsville Environmental Policy

A sustainably managed LEIP would meet the intent of the Townsville Environmental Policy to:

> *…continually improve its environmental performance, seeking opportunities to achieve positive environmental outcomes, reduce impact and encourage a culture of sustainability among its Workers and the community.*

3.4 Townsville City Deal

Townsville City Council, the State of Queensland and the Commonwealth of Australia have signed a 15-year collaborative agreement for improving sustainable economic growth via:

- investment in renewable energy facilities
- sustainable water management
- creation of new jobs in the 'green' sector

A sustainably managed LEIP has the potential to contribute to each of these strategies for improving sustainable growth.

3.5 Townsville Smart Infrastructure and Sustainable Energy (SISE) Framework

The SISE Framework fosters, facilitates and builds a circular system of sustainable and resilient supply, distribution and consumption of energy, information, finance and products and services between residents, businesses, schools and universities and government within a local region.

The system is built on a base of:

- Integrated energy efficiency, demand management, behaviour change, renewable supply, optimised distribution and energy storage and redistribution
- Local distributed integrative networks of energy, community, schools, businesses, technology and industry
- Energy and environmental data collection, integration, visualisation, intelligence and communications systems
- Sustainable energy research, prototyping, solutioning and demonstrating
- New sustainable business creation
- New energy and ecosystem regenerative financial systems
- Reinvestment models back into the local integrative networks
- Distributed energy, environmental and natural resource management, optimisation and restoration

A sustainably managed LEIP has the potential to contribute to each of these strategies for improving sustainable growth.

3.6 Additional strategies and frameworks

A range of other documents/frameworks exist with commitments to aspect-specific targets and visions that align with the sustainable benefits of EIPs, including:

- Townsville City Council Water Demand Management Strategy 2015-2025
- Townsville Smart Infrastructure and Sustainable Energy FrameworkQueensland Climate Adaptation Strategy 2017-2030 – Pathway to a climate resilient Queensland

4. Literature Review

4.1 Overview of UNIDO

The UNIDO Framework is a joint effort between the United Nations Industrial Development Organization (UNIDO), the World Bank Group, and the Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH to:

> *provide an international framework which defines the basic requirements and performance criteria needed for an industrial park to qualify as an Eco-Industrial Park (EIP)*

The Framework is a response to requests from countries and relevant industries for a more standardised structure for assessing and developing EIPs. It builds off previous studies and reports on EIPs in an attempt to synthesize key EIP facets. Some of these previous works include:

- Green Growth Indicators (Organisation for Economic Co-operation and Development 2017)
- Guidelines for Multinational Enterprises: Responsible Business Conduct Matters (OECD 2013)
- Mainstreaming Eco-Industrial Parks (World Bank 2016)
- Guide to Corporate Sustainability (United Nations Global Compact 2017)

The UNIDO Framework is informed in part by a case-study of over 50 EIPs worldwide. From this framework, an '*Implementation Handbook for Eco-Industrial Parks*' guide has also been published. The implementation steps from this handbook are outlined in Section 11.1.

4.1.1 Scope of the UNIDO Framework for EIPs

A major aim of the UNIDO Framework is to encourage industrial parks to exceed compliance with local and national regulations with respect to environmental and social issues ("*Compliance Plus*").

The UNIDO Framework focuses on four key categories (see Figure 1):

- park management performance
- environmental performance
- social performance
- economic performance

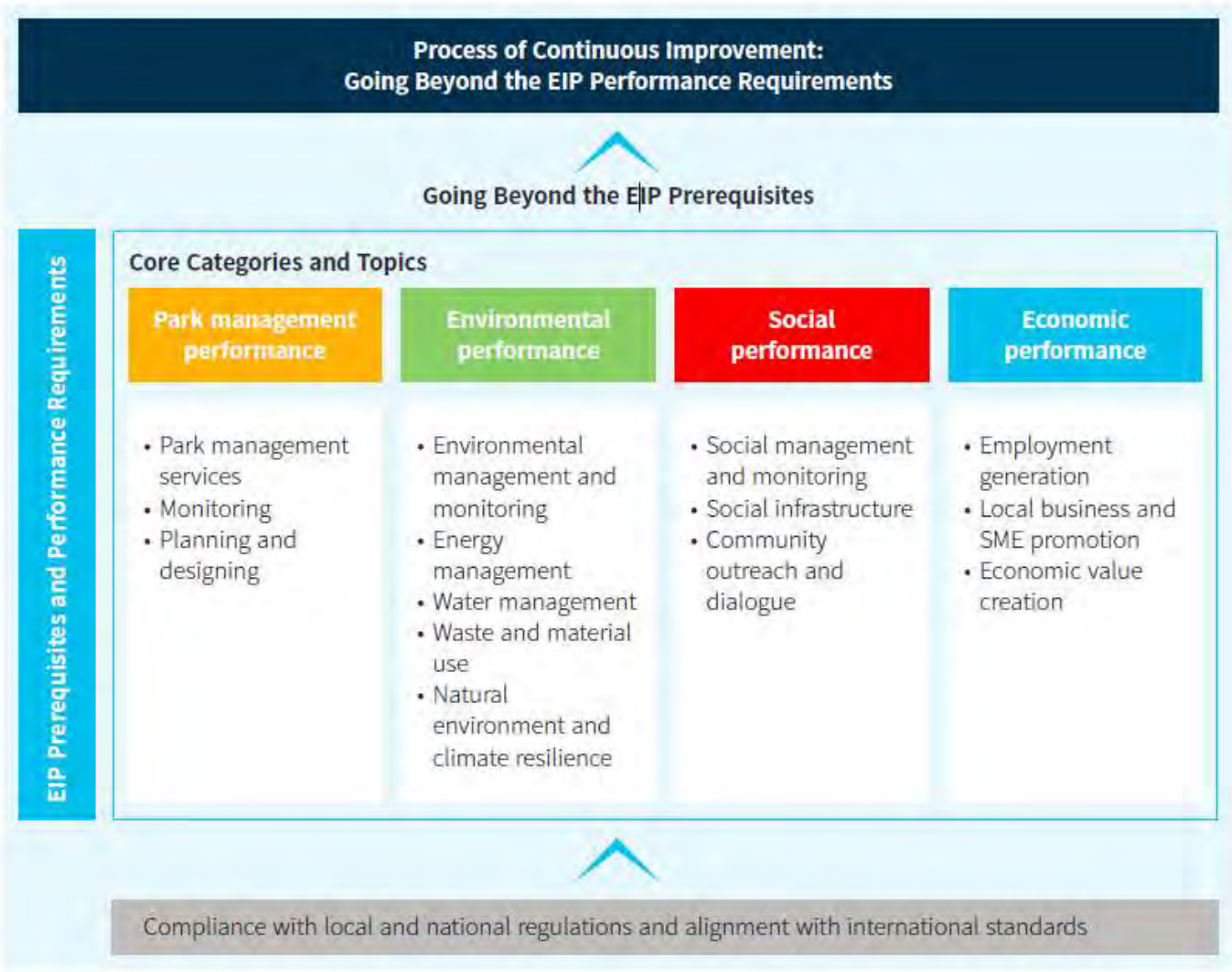


Figure 1 UNIDO's overarching framework for defining EIPs

4.1.2 Categories

4.1.2.1 Park Management

To meet this requirement, a formalised management structure should be implemented and managed by an empowered entity that is able to:

- mediate stakeholder discussions
- mitigate risks
- facilitate industrial synergies strategies (e.g., sharing of infrastructure and by-product exchanges)
- monitor sustainability performance of the proponents

Precinct managers are not mandated to police day-to-day compliance with EIP framework. Rather, codes of conduct and signed agreements should outline mandates that facilitate the day-to-day monitoring of proponent activities.

4.1.2.2 Environmental

EIPs should move beyond environmental compliance and implement sustainability initiatives that set them apart from traditional industrial parks. Aspects to manage include:

- Energy
- Water supply and wastewater
- Waste and material use
- Climate change and the natural environment

4.1.2.3 Social

Eco-Industrial Precincts should ensure implementation of good social management practices, including decent work, social and community infrastructure, and good relationships with the local community. The social performance of the EIP is an indicator of its inclusiveness, local employee/community welfare, and equal opportunities.
Customized and fit-for-purpose management systems are required at the precinct and firm levels to address relevant social, Occupational Health and Safety (OH&S) and grievance procedures and impacts.

In general, precinct management must ensure that the EIP reflects good international standards regarding social management practices across its resident firms and activities. In addition, it should comply with Occupational Health and Safety Standards, and auditing and transparency expectations. Finally, it should apply social safeguards to both its upstream and downstream value chains.

4.1.2.4 Economic

Industrial precincts are an important vehicle used by governments to boost manufacturing sectors and add value to economies.

This requirement states that EIPs should maximise:

- Local employment generation (with longer-term employment contracts)
- Linkages with local businesses.
- Economic value creation
- Financial viability

EIPs should develop a comprehensive financial model to minimise economic risks for their proponents, and to improve and accelerate decision making.

4.1.3 Applicability to LEIP

The UNIDO Framework can provide Council with an overarching structure for the development and delivery of an EIP. Achieving sustainable outcomes across the four categories within the tool would align with Council's broader corporate vision and strategic planning.

Although the UNIDO Framework does not provide a formal certification, credibility stems from the internationally recognized agencies that have developed the Framework and the range of EIPs that have implemented the UNIDO Framework to date:

- Industrial Zone NÖ-Süd, Austria
- Ulsan Mipo and Onsan Industrial Park, South Korea
- Hoa Khanh Industrial Zone, Vietnam
- Izmir Ataturk Organized Industrial Zone, Turkey

5. Certifications and Rating Tools

The UNIDO Framework is currently the most comprehensive international effort to establish the definitional boundaries for EIPs. However, there is no internationally recognized *certification* for such precincts, and the UNIDO Framework does not provide official EIP certification. This section provides an overview of several rating tools that may be applicable for the LEIP in obtaining different types of certification :

- EnviroDevelopment
- Green Star – Communities
- ISCA

5.1 EnviroDevelopment

EnviroDevelopment is an initiative of the Urban Development Institute of Australia (UDIA). EnviroDevelopment's marketing material states that:

> *EnviroDevelopment is a scientifically-based assessment scheme that independently reviews development projects and awards certification to those that achieve outstanding performance across four or more of the provided elements – Ecosystems, Waste, Energy, Materials, Water and Community.*

Successful certifications must meet at least four of these categories. Following certification, projects can display their awarded icons on future marketing and promotion material (see Figure 2).

Figure 2 EnviroDevelopment Leaves

5.1.1 Application process and cost

Implementation of this rating tool can begin to occur at any time after the development approval has been issued. The cost for applying the EnviroDevelopment tool is project-specific and ranges from $10,000 - $17,000. This includes registration and application fees, workshop meetings and consultations, and final certification. There is also a recurring annual fee of 20% of the certification that is payable until practical completion.

5.1.2 Utility and relevance to the LEIP

There have been six EnviroDevelopment certifications for EIPs in Australia to date. Four have been publicly stated and are listed below. Personal communication with the national EnviroDevelopment manager (Taylor Hood) revealed that the remaining two EIPs will be listed in their directory in the near future. The four listed EIPs are:

- Rockingham Industrial Zone
- Coolum Eco-Industrial Park
- New Gen Business Park
- Mitchell Environ Industrial Estate

Certification with EnviroDevelopment is guided by a technical manual that outlines the specific actions required to meet various criteria (e.g., including 10% reclaimed asphalt pavement content in construction and so on). However, EnviroDevelopment recognizes some criteria are project-specific and developers can formally request to scope out non-relevant criteria from their projects.

EnviroDevelopment may be a cost-effective avenue for acknowledging and certifying LEIP's sustainability commitments.

It is perhaps the only tool in Australia to have certified / rated the sustainability credentials of industrial precincts to date.

However, some key aspects of EIPs – namely industrial synergies; and circular economy considerations are not covered in the scheme. Additionally, given the very small number of certified projects the scheme is yet to gain the broad credibility of other rating schemes (e.g., Green Star, ISCA).

5.2 Green Star – Communities

Green Star – Communities is one of the subsets of the Green Star rating scheme that focuses on precinct, neighbourhood, and community scale projects. The areas assessed under this subset are:

- Governance (e.g., corporate responsibility, sustainability awareness, community participation)
- Liveability (e.g., sustainable buildings, walkable access to amenities, safe places)
- Economic prosperity (e.g., employment and economic resilience, return on investment, incentive programs)
- Environment (e.g., greenhouse gas strategy, materials, waste management)
- Innovation (e.g., implementing new initiatives)

Each of these areas are assessed via specific credits related to various sustainability impacts. Certification for Green Star - Communities requires meeting a minimum of four out of six stars (minimum 45 points).

Certified projects are approved for the use of the Green Star Logos for their promotional and marketing material.

5.2.1 Application process and cost

The cost of using Green Star – Communities is $37,990 for Green Star members and $43,990 for non-members. There is a recertification fee of $15,980 for members and $20,980 for non-members if the project is not fully built within 5 years (and every 5 years thereafter until project is finalised).

Projects can apply during design phase, partially built, or fully built.

There are four categories projects must meet to use this rating tool:

1. **Space use** (note, the examples are not exhaustive and represent a general guideline):
    - Project will result in significant extra burden on public transport systems
    - Development could create opportunities for community-level provision of utilities such as energy, water, and waste
    - Project is likely to have significant impact on existing communities

2. **Spatial differentiation**:
    - Project must be distinct
    - Development must have a clear site boundary
    - Project must be managed by a government, private sector, or community-owned entity

3. **Conditional requirements**:
    - Achieve minimal four-star rating.
    - Receive approval, in cases where the project is subject to approval under the Environmental Protection and Biodiversity Conservation Act 1999 as a controlled action

4. **Timing of certification**:
    - Initial project certification must be achieved within three years of registration.
    - Recertification must be achieved within five years of certification, and every five years thereafter until project is finished.

5.2.2 Utility and relevance to the LEIP

Personal discussion with Green Star representatives (Maxim Pash) has indicated that Green Star - Communities can be applied to EIPs. However, no examples of previous EIP projects ratings were provided and it is noted that this rating tool is typically applied to non-industrial precincts (e.g., airports, wharfs, retail outlets and other general businesses). Discussions with Green Star will continue throughout this work where applicable.

An alternative consideration would be the application of the 'Design & As Built' tool (which awards ratings to buildings) to individual proponents. This approach is in planning on the Parkes Special Activation Precinct, which has opted to apply building-specific ratings to their development (among other initiatives). This could be explored further but would apply significant cost and resource-burden to the proponent developments.

The scheme is well-established and has significant credibility in the commercial building industry.

5.3 Infrastructure Sustainability Council (ISC)

The Infrastructure Sustainability Council (ISC) (formerly *Infrastructure Sustainability Council of Australia*) is an industry-led rating scheme evaluating economic, social, and environmental performance of infrastructure across the planning, design, construction, and operational phases of infrastructure assets. 119 Projects have been certified to date

ISC has increasingly been adopted by private sector and government projects in Australia and New Zealand. The scheme is currently developing international capacity and ratings.

5.3.1 Application process and cost

There are four stages to the process:

1. Registration
2. Assessment
3. Verification
4. Certification

The scheme can be applied as early as the planning stage of a project and as late as the operational stage.

Fees for a Design and As Built rating are between $50k to $100k depending on project size. Fees for a three-year Operations rating are approximately $60k to $80k.

5.3.2 Utility and relevance to the LEIP

The scheme is comprehensive in its evaluation of a very broad range of environmental, social, and economic aspects. Additionally, the scheme has been in place for several years and has gained credibility in the industry and beyond (including recent commercial television coverage).

However, ISC has not previously certified an EIP. There would likely be some complexity in defining the footprint and the boundary between the Council and the proponents.

Notwithstanding, the scheme is flexible, and the organisation is typically keen to engage with new industries and infrastructure types.

6. Comparing the schemes

This section provides a preliminary comparison of the rating schemes against the four main components of the UNIDO Framework.

The table is not a scored assessment, but a preliminary look at the key factors that the LEIP may have to consider when selecting a sustainability tool and general approach.

Table 2 Comparison of UNIDO Framework and relevant aspects against sustainability rating tools

UNIDO Framework	Rating tools		
	EnviroDevelopment	**Green Star – Communities**	**ISC**
Park Management Performance	**NO** The rating scheme does not specifically account for management systems. This UNIDO requirement would have to be met independently.	**YES** Green Star – Communities has systems in place which are likely to be aligned with this UNIDO requirement.	**YES** ISC has systems in place which are likely to be aligned with this UNIDO requirement.
Environmental Performance	**YES** EnviroDevelopment has systems in place which are likely to be aligned with this UNIDO requirement.	**YES** Green Star – Communities has systems in place which are likely to be aligned with this UNIDO requirement.	**YES** ISC has systems in place which are likely to be aligned with this UNIDO requirement.
Social Performance	**YES** EnviroDevelopment has systems in place which are likely to be aligned with this UNIDO requirement.	**YES** Green Star – Communities has systems in place which are likely to be aligned with this UNIDO requirement.	**YES** ISC has systems in place which are likely to be aligned with this UNIDO requirement.
Economic Performance	**SOMEWHAT YES** This rating tool assesses 'community prosperity' which relates to economic performance. However, it is limited/narrow as a holistic economic assessment. This UNIDO requirement may have to be met independently.	**YES** Green Star – Communities has systems in place which are likely to be aligned with this UNIDO requirement.	**YES** ISC has systems in place which are likely to be aligned with this UNIDO requirement.
Cost for registration and application	Overall fees are project-specific and vary between **$10 to $17k**. There is also a recurring annual fee of **20% of the certification** that is payable until practical completion	**$37,990** for Green Star members and **$43,990** for non-members. **$15,980** recertification fee members and **$20,980** for non-members if the project is not fully built within 5 years (and every 5 years thereafter until project is finalised).	Design and As Built rating fees are **$50k to $100k** depending on project size. Fees for a three-year Operations rating are approximately **$60k to $80k**.

7. Stakeholder Engagement

Two of the four site proponents have provided feedback for this report (*DriveIt NQ* and *Edify Energy*). Below is a summary of their comments on possible industrial synergy practices and eco-industrial management measures.

Report authors have attempted to reach the remaining two proponent via emails and phone calls and – at the time of writing this report – no response has yet been received.

Table 3 Stakeholder engagement

Aspect	Feedback
Expectations from being in an EIP	• Greater communication and collaboration with other industries • Lower emissions regulations
Applying for sustainability certification	• Some willingness to apply for eco-certification though resources are an issue
Industrial synergy opportunities	• Proponents have already discussed industrial synergy opportunities in meeting • Supply of green energy is leading initiative discussed thus far • Potential for Queensland Pacific Metals to use proponent wastewater in production • Potential for use of proponent wastewater for irrigation • Potential for proponent open spaces to be used/rented for solar farming • Potential for hydrogen to be used as input in other industries
Eco-industrial management and operation	• Proponents seemed enthusiastic about industry synergy opportunities but difficult to establish collaboration (indication that a management entity may need to help 'push' initiatives) • Some concern over difficulty in adding sustainability-related procedures to already time-consuming construction phase • One proponent requested more guidance and involvement from EIP management on how to implement sustainability opportunities

8. Case Study Review

8.1 Coolum Eco-Industrial Park

Coolum Eco-Industrial Park (CEIP) is zoned as a high-impact industry allotment that operates under the Sunshine Coast Regional Council authority. The CEIP hosts 35 lots, all which are currently sold or under contract. Some of the current industries on the park include:

- concrete manufacturer
- milk factory
- transport warehouse

8.1.1 Certification

The CEIP has been awarded six EnviroDevelopment leaves (highest rating). Personal conversation with the CEIP Manager (Nick Dowling) revealed that the original plan for the park was not to develop into an EIP. However, high-standard local environmental regulations and guidelines were sufficiently aligned with EnviroDevelopment's performance requirements to enable to CEIP to apply for certification (after some adjustments to the design plan).

The CEIP has not directly followed the guidelines from the UNIDO Framework; its *eco* labelling stems from its EnviroDevelopment rating. To achieve this rating, the CEIP would have adhered to EnviroDevelopment sustainability targets such as:

- reducing greenhouse gas (GHG) emissions by at least 20% compared to Federal and State government regulations
- reusing or recycling at least 80% of demolition, land clearing and civil works materials
- using asphalt with at least 10% reclaimed asphalt pavement (RAP) content for road construction
- mulching and reusing 100% of vegetative debris from landscaping

8.2 Parkes Special Activation Precinct

Parkes Special Activation Precinct (Parkes SAP) is a NSW Government venture to create a strategically placed industrial precinct near the only junction between the Inland Rail and Trans-Australia Railway. Parkes SAP is currently in design phase with initial plans to incorporate industries from the mining, agriculture and e-waste and plastic recycling sectors.

8.2.1 Certification

Parkes SAP has proclaimed it will be Australia's first UNIDO EIP. Although the UNIDO Framework does not provide formal certification or labelling, Parkes SAP has made a public commitment to follow UNIDO's EIP framework. The Parkes SAP has also committed to aligning with *the United Nations Sustainable Development Goals*, the *NSW Climate Change Policy Framework,* and the *NSW EPA Circular Economy Policy*.

Parkes SAP also aims to incorporate certified rating tools into its UNIDO Framework, namely *Green Star – Design & As Built* and *ISC*. These rating tools will be applied to context-specific projects within the Parkes SAP and will be managed by either the developer or the proponents:

> *All infrastructure projects that are eligible to be rated using the IS Rating Scheme should be required to seek a certified rating (whether it is being delivered by the Development Corporation or a Land Developer/owner).*
>
> *The outcomes of individual certifications will complement and feed into any performance reporting required under the UNIDO Framework (Parkes EDS, p 48).*

This mixed-method approach by Parkes SAP (with the UNIDO Framework as the overarching structure allowing for input from national rating tools), gives the project flexibility to match the most relevant rating tool to a given context.

8.3 Trade Coast Central

Trade Coast Central is an industrial community located in Brisbane that predominantly houses head offices and small manufacturing plants. This business centre also has a Heritage Park Interpretive Centre, which includes a small cinema, and Indigenous and World War 2 artefacts.

8.3.1 Certification

Trade Coast Centre has not publicly claimed it has received any formal environmental certifications, nor does it describe itself as an EIP. However, it claims to have become "the benchmark for Ecological Sustainable Development" via initiatives such as:

- eco-efficient construction materials
- water sensitive urban design and
- waste management and efficiency.

Due to a lack of information online, and inability to contact Trade Coast Central management to date, no further detail on these claims can be provided.

8.4 Kwinana Strategic Industrial Area

Kwinana Strategic Industrial Area (Kwinana SIA) is a heavy-industry precinct specialising in chemical and resourced-based processing. Management of the Kwinana SIA is a joint effort by The Department of Jobs, Tourism, Science and Innovation and DevelopmentWA. A key feature of this industrial area is its well-established buffer zones to environmentally sensitive areas and residential areas.

8.4.1 Certification

Kwinana SIA has not publicly claimed it has received any formal environmental certifications, nor does it use the term '*eco*-industrial' to describe itself. However, it is the only operational industrial precinct reviewed (in Australia) that has comprehensively planned for and implemented synergy strategies in its operations.

8.5 Onsan Industrial Park (South Korea)

The Onsan Industrial Park (OIP) is the largest industrial area in Korea, hosting 1,052 companies currently in operation. The largest of these companies are in the petrochemicals, automobiles, shipbuilding, and nonferrous material industries.

The OIP is a joint initiative by the Ministry of Trade, Industry and Economy (MOTIE) and the Korea Industrial Complex Corporation (KICOX) to promote innovative industrial development in South Korea.

A UNIDO case study, the information available suggests that collaborative efforts by the MOTIE and KICOX, and well-defined management responsibilities have played a significant factor in the OIP's success (refer

Figure 3).

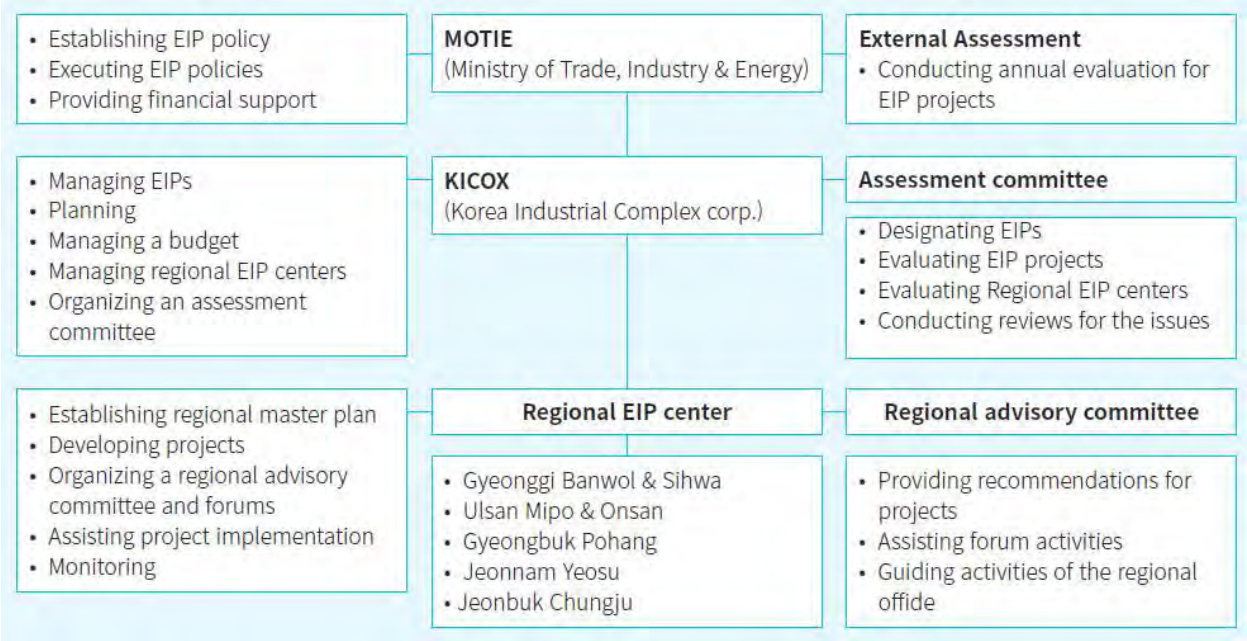


Figure 3 Management and Governance Structure of Onsan Industrial Park

8.5.1 Certification

South Korea's *Act to Promote Environmentally Friendly Industrial Structure 1995* developed a certificate program for environmental management systems (based on ISO 14001) and this certification was awarded to the OIP. However, no specific '*eco-industrial'* certification has been granted for the OIP.

The OIP's standing as an EIP stems from national government recognition and from acknowledgements by UNIDO (which references the OIP as an EIP) regarding the OIP's sustainability efforts.

With reference to the LEIP, it is worth noting that the OIP has not intentionally followed UNIDO's Framework (the OIP was developed before the Framework). Nonetheless, there were sufficient overlaps between the four components of the Framework (management, economic, social, and environmental performances) to award a post-construction recognition.

8.6 Industrial Zone NÖ-Süd (Austria)

The Industrial Zone NÖ-Süd (IZNS) is Austria's largest industrial area at around 280 hectares. It hosts 390 companies and around 11,300 employees. The industrial zone is managed by the privately owned company *Ecoplus*. A unique attribute of IZNS is that Ecoplus owns the properties on site and "*plans and builds custom rental properties*" for its tenants. As such, Ecoplus is responsible for the sustainability decisions on infrastructure and can retain more control over the activities of its tenants (compared to other EIPs).

IZNS hosts mostly small-to-medium enterprises such as offices, storage, and production. The site also provides several social infrastructures such as postal offices, restaurants, hotels, shopping malls and a childcare facility. The manufacturing facilities produce energy and technical components.

8.6.1 Certification

IZNS does not hold a general precinct-wide certification. Nonetheless, due to the range of sustainable initiatives (e.g., roof top solar plant and efficient water reuse) and social contributions, it is regarded by UNIDO as an EIP. Additionally, some facilities on site hold individual certifications - the on-site kindergarten, for example, holds a 'gold status' (highest ranking) by the Austrian Green Building Standard '*kilmaaktiv'*.

9. Discussion Report and Scored Assessment

This section includes:

- Further development of a definition of an EIP
- A scored assessment of the three rating schemes (*ISC, Green Star – Communities and EnviroDevelopment*) and the UNIDO Framework. Each scored assessment is followed by a summary analysis of the major 'pros and cons' of each tool.

9.1 Proposed Definition of Eco-Industrial Precinct

The following common themes were described or discussed in the literature:

- Collaboration between proponents (e.g., at a minimum, businesses communicate with each other and/or precinct managers to try and find synergy solutions)
- Economic, social and environmental strategies form part of sustainability framework
- Sustainability initiatives go beyond compliance with regional and national regulations
- Industrial synergy practices
- A designated precinct area
- A precinct management entity (however the level of influence and management roles vary significantly between EIPs and management can take the form of a board of members, government department, semi-government bodies and other decision-making entities)
- Shared on-site facilities

Given that EIPs operate under very different regional and national contexts, the extent to which the above themes are applied (e.g., the level of industrial synergy practices, social contributions and so on) are unique to each EIP.

Based on the above, a proposed definition of an EIP, building on the UNIDO definition (for an Australian context), and consultation with Council is:

> *A dedicated area for industrial use that is managed within an economic, social and environmental sustainability framework. The framework is designed to exceed regulatory compliance and – wherever possible – encourage industrial synergy processes at all levels of operation, and decommissioning. Businesses within this area should work collaboratively and be managed and supported by a single entity that facilitates stakeholder dialogue, risk management and leading practice sustainability outcomes. EIPs may also seek to bridge the gap between cities and industries by making a significant contribution to the local community.*

9.2 Scored Assessment Guidelines

Table 4 Comparison table - description of categories and rating guide

Category	Rating guide	Description/rationale
Overall Direct Cost	High-cost scores low 1= $130k+ 5= $65k 10= free	Direct costs relate to registration and application fees
Overall Indirect Cost	High-cost scores low 1= $200k/p.a 5= $100k/p.a. 10= free	Indirect costs relate to: • administrative costs of managing and implementing the tool including managing/monitoring performance • writing/developing contractual agreements with proponents • implementing sustainability target initiatives (e.g. purchasing more eco-friendly materials, building green infrastructure, developing community infrastructure and/or events, etc.)
Costs to Council	High-cost scores low 1=all costs to Council 5= some of the cost borne by Council 10= no costs borne by Council	Costs incurred by Council (cannot readily be passed on by Council)
Costs to proponents	High-cost scores low 1=all costs to proponents 5= some of the cost borne by proponents 10= no costs borne by proponents	Costs incurred by proponents (where they can be passed on by Council in proponent agreements)
Does it provide formal project-wide formal certification?	Definitely no = 1 to Definitely yes = 10	This scaled rating is based on personal conversations with rating tool managers and the literature reviewed that revealed varying levels of assurance/confidence regarding a project-wide certification
Extent it influences estate design	High-potential to influence design scores high 1= tool cannot drive design optimisation 5= tool can drive some design optimisation 10= tool drives design optimisation well	A '10' score applies to tool/framework that actively influences sustainability in design. A '1' score applies to tool/framework that does not actively influence sustainability in design.

Category	Rating guide	Description/rationale
Extent of ongoing need for management/involvement by Council	High-involvement scores low 1= highest need for on-going involvement 5= moderate ongoing involvement 10= no need for on-going involvement, or can be passed on to proponents	'Ongoing', in this context, relates to post-construction and certification.
Extent of ongoing need for involvement/management by current/future proponents	High-involvement scores low 1= highest need for on-going involvement 5= moderate ongoing involvement 10= no need for on-going involvement	As above. Proponent involvement is dependent on conditions built into proponent agreements and how Council decides to develop overarching framework.
Difficulty in implementation/management of tool/framework	High-difficulty scores low 1= most time/resource/labour intensive to implement 5= somewhat difficult to implement 10= least time/resource/labour intensive to implement	Difficulty is based on: • extent of Council involvement needed to during certification process • minimum requirements of tool/framework • comprehensiveness of the criteria (e.g., how many factors have to be included/covered for rating) • evidence required for certification • general application/submission/certification process
Does it address the Townsville Corporate Plan 2021-2026?	High-overlap with Townsville Corporate Plan 2021-2026 scores high 1= does not address any relevant goals 5= addresses half of the relevant goals 10= addresses all of the relevant goals	This category relates to the extent that the tool/framework can help meet the goals in the Townsville Corporate Plan 2021-2026 'Relevant goals' in this case, refers to those outlined in Section 3.2
Does it restrict future changes to the Townsville Corporate Plan 2021-2026?	High-restriction scores low 1= does not allow for changes 5= uncertain 10= no restrictions upon changes	This category relates to the extent that the tool/framework can impede or restrict future changes to the Townsville Corporate Plan 2021-2026
Precinct management performance (e.g. accounting for a comprehensive management structure, clearly establishing organisational roles, etc.)	Comprehensive precinct management performance requirements score high 1= zero consideration given to management structure 5= decent consideration given to management structure	This category relates to the extent that the tool/framework accounts for a formalised management structure, which may include establishing an empowered entity that is able to: • mediate stakeholder discussions • mitigate risks

Category	Rating guide	Description/rationale
	10= comprehensive consideration given to management structure	• facilitate industrial synergies strategies (e.g., sharing of infrastructure and by-product exchanges) and monitor sustainability performance of the proponents
Social performance (e.g. accounting for community involvement/contributions, fair employment and so on)	Comprehensive social performance requirements score high 1= no consideration given to social performance 5= some consideration given to social performance 10= comprehensive consideration given to social performance	This category relates to the extent that the tool/framework accounts for good social management practices and initiatives such as: • local employee/community welfare • equal opportunities • engagement with community • addressing community concerns
Economic performance (e.g. accounting for linkages with local business/employment, economic value creation and so on)	Comprehensive economic performance requirements score high 1= no consideration given to economic performance 5= some consideration given to economic performance 10= comprehensive consideration given to economic performance	This category relates to the extent that the tool/framework accounts for: • local employment generation (with longer-term employment contracts) • linkages with local businesses • economic value creation • financial viability
Comprehensiveness of environmental factors included	Higher scores relate to a more holistic/comprehensive environmental approach 1= very narrow assessment of environmental factors 5= some assessment of environmental factors 10= comprehensive assessment of environmental factors	Holistic/comprehensive, in this sense, relates to the amount and diversity of environmental factors considered (e.g. climate resilience energy efficiency, green infrastructure, waste management, water efficiency and so on)
Extent of international recognition/marketability	More recognition/marketability scores high 1= no international recognition 5= some international recognition 10= widely regarded internationally	Self-described in category
Extent of national recognition/marketability	More recognition/marketability scores high 1= no national recognition 5= some national recognition 10= widely regarded nationally	Self-described in category

9.2.1 Weightings development

The weightings for the categories were developed in a workshop with Council on 30 September 2021. Weightings were scaled from 1 = lowest importance to 5 = highest importance. See Table 5 below.

Table 5 Category weightings

Category	Weighting
Overall Direct Cost	5
Overall Indirect Cost	3
Costs to Council	5
Costs to proponents	4
Does it provide formal project-wide formal certification?	4
Extent it influences estate design	3
Extent of ongoing need for management/involvement by Council	5
Extent of ongoing need for involvement/management by current/future proponents	4
Difficulty in implementation/management of tool/framework	4
Does it address the Townsville Corporate Plan 2021-2026?	5
Does it restrict future changes to the Townsville Corporate Plan 2021-2026?	5
Precinct management performance (e.g. accounting for a comprehensive management structure, clearly establishing organisational roles, etc.)	4
Social performance (e.g. accounting for community involvement/contributions, fair employment and so on)	3
Economic performance (e.g. accounting for linkages with local business/employment, economic value creation and so on)	5
Comprehensiveness of environmental factors included	5
Extent of international recognition/marketability	3
Extent of national recognition/marketability	3

9.3 ISC – Scored Assessment

Table 6 ISC - Scored Assessment

Categories	ISC	
	Summary	Score (/10)
Overall Direct Cost	Fees for a Design and As Built rating are between $50k to $100k depending on project size. Fees for a three-year Operations rating are approximately $60k to $80k.	4
Overall Indirect Cost	ISC is a comprehensive rating tool that requires the development of well defined management procedures along with the implementation of a broad range of sustainable initiatives. The tool also requires input from suitably qualified professionals to review/audit several processes. The costs of writing and developing ISC-specific management plans, external audits and implementing green initiatives/infrastructure/materials incurs indirect costs. Note, costs can potentially be reduced if a lower rating is sought	3
Cost to Council	Council would need to manage the cost at precinct level	3
Cost to proponents	There are no direct costs to proponents, there would likely be costs passed down in proponent agreements	5
Does it provide *formal project-wide* certification?	Yes	10

Categories	ISC	
	Summary	Score (/10)
Extent it influences estate design	Has the potential to drive performance (as designers and stakeholders are encouraged to try to "find ISC points") but unless a target score is mandated, there is no official requirement for design to be a certain level	10
Extent of ongoing need for management/involvement by Council	Implementing ISC requires heavy involvement / resource intensity in the design/construction phases. Council involvement is reduced after certification is awarded.	5
Extent of ongoing need for involvement/management by current/future proponents	Proponent involvement is dependent on conditions built into proponent agreements and how Council decides to develop overarching framework. Submission for certification is not proponents' responsibility, however proponents may have to report/monitor performance during construction phase.	5
Difficulty in implementation/management of tool	ISC is a comprehensive tool and several aspects of a project need to be considered and managed for a high rating. Due to its rigorousness (if a high rating is desired), there is a high level of involvement required during its implementation	3
Extent it addresses the Townsville Corporate Plan 2021-2026	The credits are well-aligned to the Townsville Corporate Plan 2021-2026's general environmental vision and several specific targets (e.g. reducing commercial waste by 20%)	10
Does it restrict future changes to the Townsville Corporate Plan 2021-2026?	ISC has no foreseen restrictions regarding future changes to the Townsville Corporate Plan 2021-2026	10
Precinct management performance (e.g. accounting for a comprehensive management structure, clearly establishing organisational roles, etc.)	ISC has seven credits related to management systems of a project. These credits assess how: • a project manages risks and opportunities • clearly defined the organisational structure, roles and responsibilities are • effectively a project shares knowledge and makes decisions • well-established the auditing and review schedules for the project's performance/processes are • a project has incorporated sustainability commitments into its central policies	10

Categories	ISC	
	Summary	**Score (/10)**
	Although the management approach by ISC is quite comprehensive, the tool does not specifically mandate that an 'empowered entity' maintain responsibility during the precinct's operation phase. This suggested UNIDO guideline would have to be met independently.	
Social performance (e.g. accounting for community involvement/contributions, fair employment, etc.)	There are credits for local workforce engagement and diversity. There are also credits for 'addressing community concerns' and social legacy	10
Economic performance (e.g. accounting for linkages with local business/employment, economic value creation, etc.)	There are credits for Options Assessment and Benefits mapping. The tool also assesses procurement of local suppliers	9
Comprehensiveness of environmental factors included	There are credits for all major expected environmental aspects. For example: • *Climate change*: ISC has two credits for climate change risk assessment and adaptation measures. These credits require a climate change risk assessment plan to be developed and assessed and that appropriate risk-mitigation measures are implemented • *Energy efficiency*: ISC requires that projects model (e.g. make estimates for the future) and monitor their projected and actual energy usage and GHG emissions. Higher points are scored for implementing energy saving initiatives. One of the ISC energy credits focuses particularly on the use of renewable energy • *Green infrastructure:* One of the credits from ISC requires that green infrastructure elements are planned for, incorporated and performance tested • *Waste management*: Waste management is assessed via three credits in ISC. These credits require that waste management plans be developed and reviewed by a suitable qualified professional, that waste diversion from landfills hits specified targets, and that deconstruction plans (focusing on waste) be developed for a project. • *Water efficiency*: ISC assesses water efficiency via two credits. These credits require water use to be monitored and modelled and that potable water is replaced by non-potable water wherever possible. Points are awarded on a sliding scale based on the extent of water reduction and non-potable water use.	10
Extent of international recognition/marketability	The tool is currently used extensively in Aus/NZ, however is commencing an expansion to other markets	5

Categories	ISC	
	Summary	Score (/10)
Extent of national recognition/marketability	This tool is well utilised on major infrastructure projects in Australia	10

9.3.1 ISC Summary – Pros and Cons

- Pros:
  - Rewards well-developed management systems, plans for the future
  - Very comprehensive sustainability assessment
  - Credible rating scheme with good national reputation

- Cons:
  - Expensive
  - Difficult to get high rating, certification process is time intensive

9.4 EnviroDevelopment – Scored Assessment

Table 7 EnviroDevelopment – Scored Assessment

Categories	EnviroDevelopment	
	Summary	**Score (/10)**
Overall Direct Cost	Overall fees are project-specific and vary between $10 to $17k. There is also a recurring annual fee of 20% of the certification that is payable until practical completion	6
Overall Indirect Cost	As with ISC, EnviroDevelopment incurs costs related to hiring suitably qualified professionals to review/audit processes, implementing environmentally friendly materials and processes (e.g. purchasing cement with higher supplementary cementitious material (SCM) percentage, constructing a community garden, etc.) and writing and developing sustainability-related plans.	4
Cost to Council	Council would need to manage the cost at precinct level	6
Cost to proponents	Unless fees are "passed on" by Council there are no direct costs to proponents	5
Does it provide *formal project-wide* certification?	Yes. The tool has been applied to different EIP projects in the past	10
Extent it influences estate design	Unless a target score is mandated, there is no official requirement for estate design to be a certain level	10

Categories	EnviroDevelopment	
	Summary	Score (/10)
Extent of ongoing need for management/involvement by Council	Implementing EnviroDevelopment requires heavy involvement / resource intensity in design/construction phases. Council involvement is significantly reduced after certification is awarded	5
Extent of ongoing need for involvement/management by current/future proponents	Proponent involvement is dependent on conditions built into proponent agreements and how Council decides to develop overarching framework. Submission for certification is not proponents' responsibility, however proponents may have to report/monitor performance during construction phase	5
Difficulty in implementation/management of tool	The tool provides flexibility in how each criterion is met. To illustrate, the tool provides *four* choices of environmentally responsible materials for road construction and allows the project to select *three* that it deems most suitable. This same 'choice-based approach' is applied to several other criteria.	4
Extent it addresses the Townsville Corporate Plan 2021-2026	The credits are well-aligned to the Townsville Corporate Plan 2021-2026's general environmental vision and several specific targets (e.g. reducing commercial waste by 20%)	8
Does it restrict future changes to the Townsville Corporate Plan 2021-2026?	EnviroDevelopment has no foreseen restrictions regarding future changes to the Townsville Corporate Plan 2021-2026	10
Precinct management performance (e.g. accounting for a comprehensive management structure, clearly establishing organisational roles, etc.)	This rating scheme does not specifically account for management systems. This requirement would have to be met independently.	1
Social performance (e.g. accounting for community involvement/contributions, fair employment, etc.)	There are credits that assess the extent of community consultation (and proper consideration of feedback), suitability of employee parking and other facilities and local employment ratios	10
Economic performance (e.g. accounting for linkages with local business/employment,	There are credits for assessing 'community prosperity', which consider the socio-economic profile of a project. However, lacking a more holistic economic assessment	8

Categories	EnviroDevelopment	
	Summary	**Score (/10)**
economic value creation, etc.)		
Comprehensiveness of environmental factors included	There are credits for all major expected environmental aspects. However, this rating scheme is perhaps less rigorous than the others reviewed. For example: • *Climate change*: This tool has one credit for 'climate responsive design', which assesses the extent that projects implement a positive passive design based on solar orientation to maximise heat/cold retention • *Energy efficiency*: This tool requires that projects reduce GHG emissions by at least 20% more than required under relevant Federal and State government regulations. An undisclosed amount of renewable energy must also be used for this rating scheme • *Green infrastructure:* This tool does not have a credit directly attributable to green infrastructure. But the use of reflective roofs, renewable energy sources, green walls, fauna bridges, etc., are initiatives related the broader *ecosystems* category of this rating scheme • *Waste management*: This tool requires that at least 80% (by volume) of demolition, land clearing and civil works materials be recycled or reused. The tool also requires a comprehensive waste management plan, which appears to be largely based around meeting existing regional/national regulations. • *Water efficiency*: There are three credits that assess water efficiency. These credits relate to reduction in potable water use, ensuring each proponent is sub-metered, and minimising irrigation water demand via various initiatives.	7
Extent of international recognition/marketability	The tool is currently used only in Australia and likely not recognized on an international level	2
Extent of national recognition/marketability	The tool is less recognised than ISC and Green Star within Australia	6

9.4.1 EnviroDevelopment Summary – Pros and Cons

- Pros:
  - Easier to implement than other rating tools
  - Inexpensive
  - Scheme has assessed EIPs in the past, perhaps more familiar with the process

- Cons:
  - Does not specifically account for circular economy or industrial synergy practices
  - Not as widely recognised as other tools
  - Sustainability assessment is less comprehensive (e.g. management systems and economic performance processes would have to be done independently)

9.5 UNIDO Framework – Scored Assessment

Table 8 UNIDO Framework – Scored Assessment

Categories	UNIDO Framework	
	Summary	**Score (/10)**
Overall Direct Cost	There are no direct costs associated with implementing this framework	10
Overall Indirect Cost	This framework incurs costs related to: • implementing sustainability initiatives (e.g. green infrastructure/materials) to meet UNIDO's performance requirements • managing/monitoring performance • writing/developing contractual agreements with proponents Given that the performance requirements prescribed by this framework are not binding, there is *potentially* more flexibility regarding the associated costs of its application	5

Categories	UNIDO Framework	
	Summary	Score (/10)
Cost to Council	Council would need to manage the cost at precinct level	10
Cost to proponents	Council can choose, to a large degree, the extent that costs are "passed on" to proponents via contractual agreements. Otherwise, there are no direct costs to proponents	5
Does it provide *formal project-wide* certification?	This tool framework does not provide a *formal* certification. Public commitments to honour its performance guidelines may provide sufficient marketing credibility for the LEIP. One option worth exploring is contacting UNIDO for a collaborative partnership (and public exposure). At least one other EIP (Onsan Industrial Park in South Korea) has taken this approach. Alternatively, UNIDO suggests applying for formal recognition from the EIP's national government	1
Extent it influences estate design	Under this framework, estate design would fall under the discretion of Council	8
Extent of ongoing need for management/involvement by council	One of the requirements of this framework is for EIPs to establish an 'empowered entity' to manage ongoing park operations. Council can choose to assume this responsibility or assign it to another organisation	5
Extent of ongoing need for involvement/management by current/future proponents	As above. Proponent involvement is dependent on conditions built into proponent agreements and how Council decides to develop overarching framework. Because the UNIDO Framework is not a formal certification process, there is some degree of flexibility as to how Council can allocate management responsibilities	5
Difficulty in implementation/management of tool	There is good foundational work by UNIDO to help guide the development of EIPs. Given that this framework does not require a formal submission/application process, implementation of this framework is likely to be more flexible than the rating schemes	4

Categories	UNIDO Framework	
	Summary	**Score (/10)**
Extent it addresses the Townsville Corporate Plan 2021-2026	The Framework is well-aligned to the Townsville Corporate Plan 2021-2026's general environmental vision and several specific targets (e.g. reducing commercial waste by 20%). But specifically 'goal 3' of the Townsville Corporate Plan 2021-2026	10
Does it restrict future changes to the Townsville Corporate Plan 2021-2026?	The UNIDO Framework has no foreseen restrictions regarding future changes to the Townsville Corporate Plan 2021-2026	10
Precinct management performance (e.g. accounting for a comprehensive management structure, clearly establishing organisational roles, etc.)	The Framework requires that an empowered entity manages and maintains the industrial park property, common infrastructure, and services as prescribed in the proponent agreement. This should include at least the following: • property management, including plot allotments, re-allotments, development, land use monitoring • utilities, roads, security (including IT security) and emergency response services/facilities and wastewater treatment plants and operations, including waste heat/energy recovery and distribution networks • environmental monitoring and advisory activities • common landscaping, buffer zones, street lighting, security surveillance and street cleaning • provide facilitating services to and between proponents (for example, networking, collaboration and training opportunities) • engagement with the park's stakeholders and business representatives • public relations and community participation centre/platform/activities	10
Social performance (e.g. accounting for community involvement/contributions, fair employment, etc.)	There are credits for local workforce engagement and diversity	10
Economic performance (e.g. accounting for linkages with local business/employment, economic value creation, etc.)	There are credits for 'community prosperity', however lacking a more holistic economic assessment compared to other tools	10

Categories	UNIDO Framework	
	Summary	**Score (/10)**
Comprehensiveness of environmental factors included	The Framework covers most expected environmental aspects. However, the requirements are not binding and are up to the developer's discretion. Examples of UNIDO's environmental requirements include: • *Climate change*: Establishing a program/plan with clear evidence of how the project will monitor, mitigate and/or minimize GHG emissions. Maintaining that at least 50% of proponents have pollution prevention and emission reduction strategies to reduce the intensity and mass flow of pollution/emission releases which exceed national regulations • *Energy efficiency*: Establishing an industrial heat recovery strategy to investigate opportunities for heat and energy recovery for the major thermal energy-consuming firms in the park (if applicable). Maintaining total renewable energy use for electricity and heat production at levels equal to or greater than the renewable energy share in the annual national electricity mix in the grid • *Green infrastructure:* This tool does not have a requirement directly attributable to green infrastructure • *Waste management*: Ensuring at least 20% of proponents are involved in circular economy practices that minimise waste (e.g. repurposing by-products). Establishing a waste management plan with a program/mechanism in place to promote and encourage reuse and recycling of materials by firms in the park • *Water efficiency*: Ensuring 25% of waste water is reused within or outside the precinct. Establishing a mechanism with clear evidence to monitor water consumption across the park, and establish demand management practices in case of water stress	8
Extent of international recognition/marketability	This framework is internationally recognised, but does not provide formal labelling	8
Extent of national recognition/marketability	The tool is less recognised than ISC and Green Star within Australia. However UNIDO is a reputable organisation, which contributes toward marketability	5

9.5.1 UNIDO Framework Summary – Pros and Cons

- Pros:

- No direct costs
- More flexibility in how sustainability can be incorporated into the project
- Considers industrial synergy practices into its guidelines

- Cons:
  - Does not provide formal certification
  - Lack of binding requirements runs risk of initiatives not being implemented.

9.6 Green Star Communities – Scored Assessment

Table 9 Green Star Communities - Scored Assessment

Categories	Green Star – Communities	
	Summary	Score (/10)
Overall Direct Cost	The cost of using Green Star – Communities is $37,990 for Green Star members and $43,990 for non-members. There is a recertification fee of $15,980 for members and $20,980 for non-members if the project is not fully built within 5 years (and every 5 years thereafter until project is finalised).	5
Overall Indirect Cost	As with ISC, Green Star - Communities is a comprehensive rating tool that requires well-defined management procedures to be developed along with the implementation of a range of sustainable initiatives. The tool also requires input from suitably qualified professionals to review/audit several processes. The costs of writing and developing management plans, external audits and implementing green initiatives/infrastructure/materials incurs indirect costs.	3
Cost to Council	Council would need to manage the cost at precinct level	4

Categories	Green Star – Communities	
	Summary	**Score (/10)**
Cost to proponents	There are no direct costs to proponents, there would likely be costs passed down in proponent agreements	5
Does it provide *formal project-wide* certification?	As mentioned in Section 5.2.2, personal discussion with Green Star representatives (Maxim Pash) has indicated that Green Star - Communities can be applied as single precinct-wide certification. . However, no examples of previous EIP projects ratings were provided and it is noted that this rating tool is typically applied to non-industrial precincts (e.g., airports, wharfs, retail outlets and other general businesses)	10
Extent it influences estate design	Has the potential to drive performance (as designers and stakeholders are encouraged to try to "find Green Star points") but unless a target score is mandated, there is no official requirement for design to be a certain level	10
Extent of ongoing need for management/involvement by Council	Implementing Green Star- Communities requires heavy involvement / resource intensity in the design/construction phases. Council involvement is reduced after certification is awarded	5
Extent of ongoing need for involvement/management by current/future proponents	Proponent involvement is dependent on conditions built into proponent agreements and how Council decides to develop overarching framework. Submission for certification is not proponents' responsibility, however proponents may have to report/monitor performance during construction phase	5
Difficulty in implementation/management of tool	Green Star - Communities is a comprehensive tool and several aspects of a project need to be considered and managed for a high rating	3
Extent it addresses the Townsville Corporate Plan 2021-2026	The credits are well-aligned to the Townsville Corporate Plan 2021-2026's general environmental vision and several specific targets (e.g. reducing commercial waste by 20%)	10
Does it restrict future changes to the Townsville Corporate Plan 2021-2026?	Green Star – Communities has no foreseen restrictions regarding future changes to the Townsville Corporate Plan 2021-2026	10

Categories	Green Star – Communities	
	Summary	**Score (/10)**
Precinct management performance (e.g. accounting for a comprehensive management structure, clearly establishing organisational roles, etc.)	Green Star – Communities has 6 credits related to the management systems of a project. These credits assess: • the extent that sustainability reporting is made public and how it is evaluated • the comprehensiveness of the Environmental Management Plan, which is reviewed by a suitably qualified professional • how effectively management engages with stakeholders • how management provides sustainability guidance/education to stakeholders on the project site Although the management approach by Green Star - Communities is comprehensive, the tool does not specifically mandate that an 'empowered entity' maintain responsibility during the precinct's operation phase. This suggested UNIDO guideline would have to be met independently.	8
Social performance (e.g. accounting for community involvement/contributions, fair employment, etc.)	This tool has credits that assess: • stakeholder engagement strategy of projects (e.g. public participation in decision making, proper consideration of community feedback) • how effectively local cultural values are upkept • the safety, comfortability, and accessibility of on-site infrastructure	10
Economic performance (e.g. accounting for linkages with local business/employment, economic value creation, etc.)	Economic performance is assessed via: • community investment practices • the development of an affordability strategy plan (e.g. giving preferences/aid to start-up businesses) • demonstrating that the project increases jobs for locals • contribution to educational programs to upskill local workers	10
Comprehensiveness of environmental factors included	There are credits for all major expected environmental aspects. For example: • *Climate change*: Green Star - Communities requires that a project-specific Climate Adaptation Plan be implemented and reviewed by a suitably qualified professional. The plan should identify climate risks and suggest a list of actions to mitigate those risks. The tool also awards points for the development of a Green House Gas Strategy Plan, which compares the predicted emission reduction of a project (when operating with GHG minimising initiatives) against its BAU operation	10

Categories	Green Star – Communities	
	Summary	**Score (/10)**
	• *Energy efficiency*: Energy efficiency measures are incorporated into a project's Green House Gas Plan (mentioned above). Points can be awarded by applying **one** of these two approaches: 1. Provide clear evidence of the proposed energy saving initiatives and infrastructures (if project in design), which are modelled by a suitably qualified professional to assess the extent of energy savings. 2. If post-design, points are awarded based on the existing energy saving processes and infrastructure. • *Green infrastructure:* Green Star – Communities awards points based on the percentages of buildings within a precinct that achieve a sustainability rating (Green Star or external rating) • *Waste management*: There is one 'waste management' credit that is awarded when projects: 1. Develop and implement a Waste Management Plan and recycle or reuse at least 60% of construction and demolition waste 2. Implement measures to reduce overall impacts associated with operational waste (e.g., public space recycling scheme, 'pay as you throw' scheme, composing scheme, etc.) • *Water efficiency*: There is one credit for 'integrated water cycle' that is awarded via applying **one** of these two approaches (note, not all the examples below have to be met, however more points are awarded if they are): 1. Ensuring peak Average Recurrence Internal water discharge is at a suitable level and reducing potable water use via a Water Sensitive Urban Design plan 2. Ensuring 100% of water in public spaces is sourced form alternative sources; ensuring all buildings in the project site have access to alternative water; ensuring peak Average Recurrence Internal water discharge is at a suitable level; reducing key water pollutants discharged in stormwater	
Extent of international recognition/marketability	Green Star Australia is part of the World Green Building Council, which is recognised on an international level	8

Categories	Green Star – Communities	
	Summary	Score (/10)
Extent of national recognition/marketability	This tool is applied extensively on building projects in Australia	10

9.6.1 Green Star Communities Summary – Pros and Cons

- Pros:
  - Internationally recognised
  - Comprehensive sustainability criteria
  - Suitable for precinct-scale developments

- Cons:
  - Does not account for circular economy or industrial synergy practices
  - Expensive
  - Difficult to get high rating, certification process is time intensive

9.7 Weighted Scored Assessment Summary Table

Table 10 compiles the scores from the UNIDO Framework and each rating tool. The UNIDO Framework scored highest on both the weighted and unweighted final scores.

Table 10 Scored Assessment Summary

Tools/Framework	Weights (1-5)	Categories							
		EnviroDevelopment		ISC		Green Star – Communities		UNIDO Framework	
		Rating	Weighted	Rating	Weighted	Rating	Weighted	Rating	Weighted
Overall Direct Cost	5	6	30	4	20	5	25	10	50
Overall Indirect Cost	3	4	12	3	9	3	9	5	15
Cost to Council	5	6	30	3	15	4	20	10	50
Cost to proponents	4	5	20	5	20	5	20	5	20
Does it provide formal project-wide certification?	4	10	40	10	40	10	40	1	4
Extent it influences estate design	3	10	30	10	30	10	30	8	24
Extent of ongoing need for management/involvement by Council	5	5	25	5	25	5	25	5	25
Extent of ongoing need for involvement/management by current/future proponents	4	5	20	5	20	5	20	5	20
Difficulty in implementation/management of tool	4	4	16	3	12	3	12	4	16
Extent it addresses the Townsville Corporate Plan 2021-2026 (flexibility if change to plan?)	5	8	40	10	50	10	50	10	50

Tools/Framework	Weights (1-5)	Categories							
		EnviroDevelopment		ISC		Green Star – Communities		UNIDO Framework	
		Rating	Weighted	Rating	Weighted	Rating	Weighted	Rating	Weighted
Does it restrict future changes to the Townsville Corporate Plan 2021-2026?	5	10	50	10	50	10	50	10	50
Precinct management performance (e.g. accounting for a comprehensive management structure, clearly establishing organisational roles, etc.)	4	1	4	10	40	8	32	10	40
Social performance (e.g. accounting for community involvement/contributions, fair employment, etc.)	3	10	30	10	30	10	30	10	30
Economic performance (e.g. accounting for linkages with local business/employment, economic value creation, etc.)	5	8	40	9	45	10	50	10	50
Comprehensiveness of environmental factors included	5	7	35	10	50	10	50	8	40
Extent of international recognition/marketability	3	2	6	5	15	8	24	8	24
Extent of national recognition/marketability	3	6	18	10	30	10	30	5	15
TOTAL SCORE		107	446	122	501	126	517	124	523

10. Engineering Considerations

10.1 Framework selection and implications for engineering

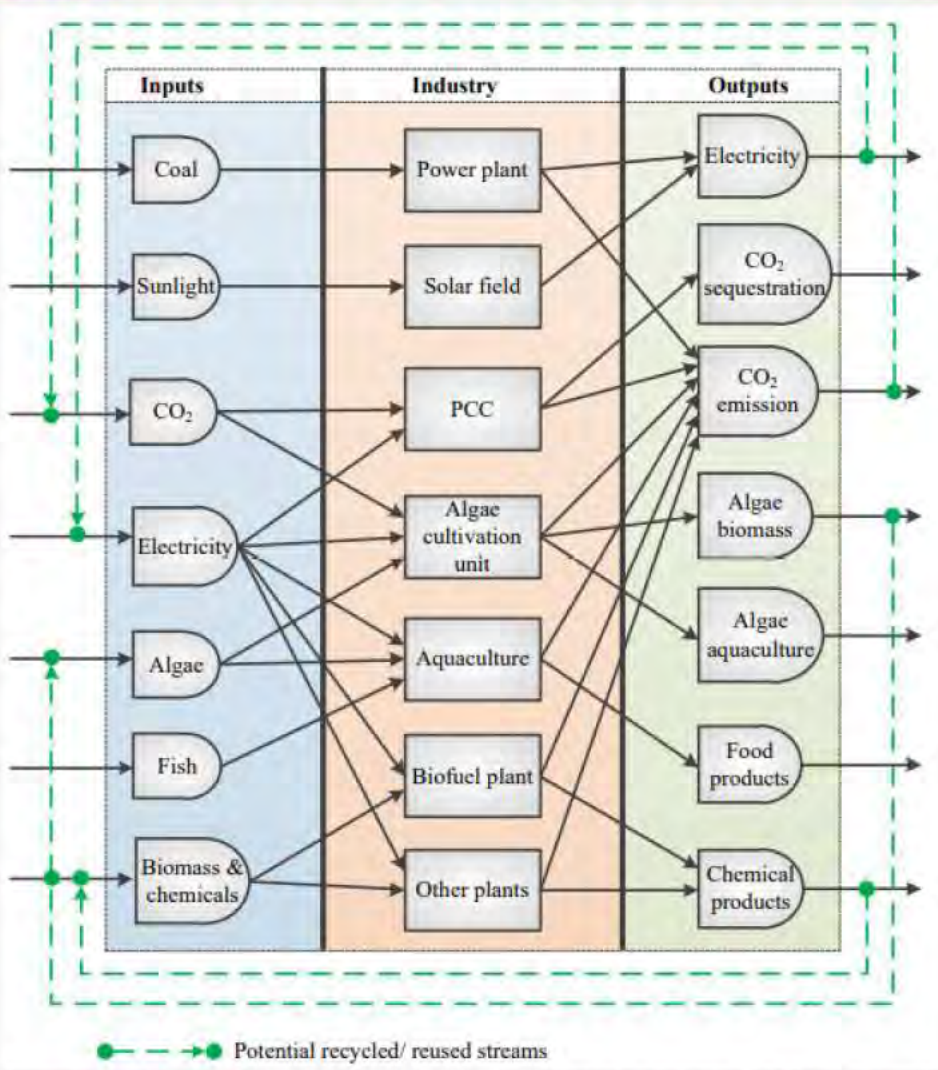
The are no direct implications for engineering opportunities in applying the UNIDO Framework or any of the rating schemes reviewed. The schemes do not prevent implementation of engineering opportunities, rather they reward initiatives with sustainability benefit. In practice, the tools and frameworks tend to become *drivers for better performance* as projects seek to maximise the points awarded to them. This is elaborated on in Section 11 and Appendix A.

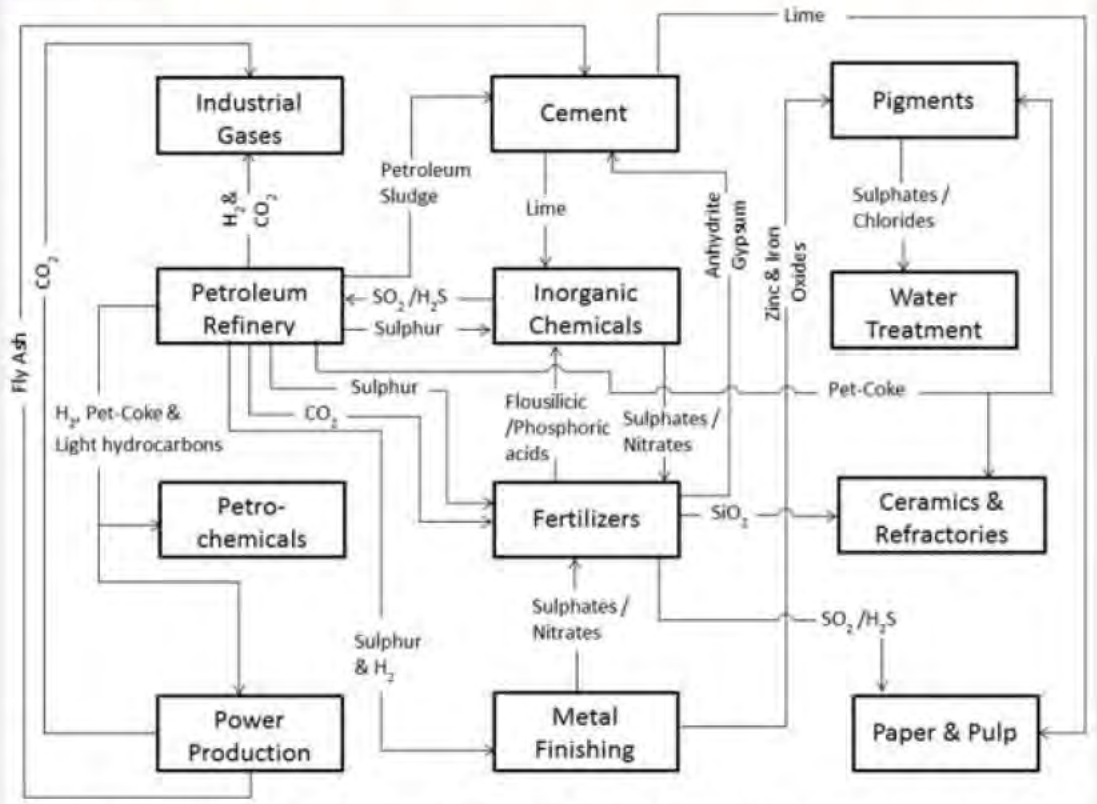
10.2 Possible engineering initiatives / opportunities

Table 11 outlines *some* example engineering opportunities for the LEIP. The range of potential initiatives that could be implemented in an EIP is extensive and not the scope of this report, rather, these examples are presented with the intention to demonstrate the type of initiatives that might help achieve the targets presented in Section 11.2.1.

Table 11 Engineering opportunities for LEIP

Engineering opportunity	Description	Examples
Heat Island	Building green infrastructure into design of master plan	Green roofs, wide-spread trees and vegetation on-site, cool roofs (e.g. made of materials or coatings that reflect more sunlight) and cool pavements (e.g. using paving materials that absorb less heat)
Wastewater storage	Building on site detention or storage capacity for wastewater (for reuse) in master plan	
Recycled water network	Building in recycled water network to ensure no requirement for retrofit	
Wastewater irrigation network	Building irrigation network from wastewater	Wastewater from Edify's hydrogen electrolyser can be diverted to Drive It NQ's open grass spaces via irrigation networks
Biogas production	Building composting plant for biogas production	Using organic waste from nearby agricultural lands and/or municipal organic waste.

Engineering opportunity	Description	Examples
Algae cultivation unit	Building an algae cultivation unit (ACU) that captures CO_2 emissions from other industries, treats wastewater and generates usable outputs (e.g. aquaculture feed, biofuel, lipids and nutraceuticals) The figure shown illustrates ACU and other synergy opportunities	 *Source:* Tumilar, A. S., Milani, D., Cohn, Z., Florin, N., & Abbas, A. (2021). A Modelling Framework for the Conceptual Design of Low-Emission Eco-Industrial Parks in the Circular Economy: A Case for Algae-Centered Business Consortia. *Water,* 13(1), 69.

Engineering opportunity	Description	Examples
Waste heat/steam diversion	Building waste heat/steam diversion networks	Waste heat/steam can be used for factory-sized greenhouses, wastewater treatment and general heating of building facilities
General opportunities	Included in the example column is the schematic of a well-regarded generic industrial symbiotic relationship The schematic is meant to illustrate the types of industries that can be grouped together in the LEIP, and how they benefit one another	 *Source:* Mohammed, F. A., Biswas, W. K., Yao, H. M., & Tadé, M. O. (2013). Assessment of industrial by–product synergies from process engineering and sustainability principles. *Progress in Industrial Ecology, an International Journal*, 8(3), 156-165

10.3 Implications for current master plan

The master planning process assesses the areas that can and can't be developed and identifies the infrastructure necessary to enable this development. Depending on the engineering initiatives that Council may decide to implement, certain aspects would benefit from consideration in the master plan. This is particularly relevant to water infrastructure but also for energy distribution and potential transport options. Some examples include, but are not limited to:

- Allowing for on-site wastewater storage and reuse
- Allowing for mains *and* recycled water networks, and or cross connections between recycled water and raw water pipe networks
- Water efficiency is recommended to be demonstrated by a EIP wide Water Cycle Management Study and Water Balance Investigation to determine the potential of supplementary water supplies.
- Sufficient green infrastructure incorporated into the master plan to minimise heat island effects
- Infrastructure for waste heat / energy exchange
- Selection of the most effective locations for proposed industries (for industrial synergy purposes and minimising unnecessary distance between shared networks).

Importantly, initiatives with sustainability benefits are not limited to incorporation in site infrastructure elements. Opportunities can be implemented post-construction, and during the engagement and establishment phases for proponents on site. Section 11 describes the application of the UNIDO Framework, which would contribute to improved sustainability outcomes for the LEIP.

Planning ahead has obvious benefits, however it is noted that successes in other EIPs have often been organic and developed after establishment (e.g. Kwinana SIA developed synergies after construction).

11. Recommendations

Based on the scored assessment, workshop meeting, stakeholder engagement and desktop research, the UNIDO Framework was selected as the preferred framework for the LEIP.

This section outlines how the Framework could be applied to the LEIP and provides suggested actions for implementation, with the following considered key takeaway points:

- Establishment of a Council team responsible for site sustainability management
- The importance of using proponent agreements to drive performance and proponent behaviour

11.1 Applying the UNIDO Framework to the LEIP

UNIDO has developed an *Implementation Handbook for Eco-Industrial Parks* with the aim to assist with the "*practical implementation of eco-industrial park concepts*" to new and existing precincts.

UNIDO nominates six steps for implementation:

1. Scoping EIP interventions
2. EIP awareness raising
3. Creating policy support
4. Developing precinct management models
5. Upscaling resource efficiency and industrial synergies
6. Performance monitoring and benchmark

11.1.1 Scoping EIP interventions

Table 12 below outlines the initial actions that the LEIP should consider.

Table 12 Implementation Step 1 - Scoping EIP interventions

Category	Description
Aim	To identify and prioritize EIP activities which are most suitable and most effective for stakeholder groups to work on

Implementation Steps	• Understand the local and national context of EIP
	  ○ Identify existing national legal framework and linkages to EIP developments (if any)
	  ○ Account for geographical specificities and local social conditions (e.g. is the precinct located near environmentally sensitive land? will the precinct impact negatively upon local communities?)
	• Engage with key stakeholders
	  ○ Identify stakeholders' expectations and interests
	  ○ Develop engagement strategy and action plan (e.g. define how to involve stakeholders)
	• Scope EIP interventions
	  ○ Planning for industrial synergies, shared infrastructures, defining precinct management's responsibilities

11.1.1.1 Relevance to LEIP

The LEIP is already underway in completing this first step as local environmental conditions have been considered and stakeholder engagement (with proponents) has begun. Suggested next steps would be to further develop industrial synergy plans and commence defining precinct management responsibilities.

11.1.2 EIP awareness raising

Table 13 outlines how the LEIP can begin raising awareness about the benefits of industrial synergies and the benefits of EIPs in general.

EIPs processes are relatively unknown and awareness raising can inspire new opportunities and stakeholder collaboration.

Table 13 Implementation Step 2 - EIP awareness raising

<table>
<tr><th>Category</th><th>Description</th></tr>
<tr><td>Aim</td><td>To raise awareness among key stakeholder groups in private and public sectors of the benefits and added value of EIPs and associated implementation processes</td></tr>
<tr><td>Implementation Steps</td><td>

Identify stakeholders who require awareness raising at the beginning of the process
Inform all stakeholders potentially involved or affected by the EIP development about its implications, challenges and opportunities
Understand current awareness levels and leverages of change
Develop customized awareness raising activities
These activities can be developed via meetings, workshops, website and newsletter, etc.
Awareness raising activities are to continue during operational phase to ensure stakeholders are updated on developing EIP processes
Implement awareness raising activities
Suggested topics to increase awareness are illustrated below:

<table>
<tr><th>STAKEHOLDERS</th><th>IMPORTANT ITEMS THAT STAKEHOLDERS SHOULD BE AWARE OF</th></tr>
<tr><td>Park operator and management</td><td>• Advantages of EIPs (economic, social and environmental) and international trends
• Pollution issues that can be caused by poorly designed and operated industrial parks
• Problems that could be potentially faced when operating an EIP</td></tr>
<tr><td>Companies</td><td>• Advantages and business case for EIPs, including mitigating environmental and social risks
• Practical approaches to implementing RECP and industrial synergies</td></tr>
<tr><td>Governments and regulators</td><td>• Advantages and business case for EIPs
• Interest from government agencies will depend on their specific function (e.g. energy and climate change, industrial development, job creation, OH&S)
• Characteristics of EIPs and possible challenges related to industrial regulations</td></tr>
<tr><td>Local communities</td><td>• Advantages of EIPs include well-being of local communities, avoidance of odor disturbance, etc.
• New infrastructure or services that will be constructed and could be used by local communities</td></tr>
<tr><td>Financial institutions</td><td>• Advantages of EIPs (mainly economic, but also environmental and social, because a sound business case also entails mitigating environmental and social risks).
• Financing mechanism requirements for EIPs</td></tr>
</table>
</td></tr>
</table>

11.1.2.1 Relevance to LEIP

Engagement with proponents is taking place, which includes some awareness raising about EIP benefits and implications.

Informing the local community (including local businesses) about the LEIP can gain early support and expose unforeseen benefits (e.g. collaboration with local farms that may wish to contribute organic waste for biogas production).

11.1.3 Creating policy support

Table 14 outlines policy support initiatives for EIPs.

Table 14 Implementation Step 3 – Creating policy support

Category	Description
Aim	To translate the EIP concept and associated practices into national policies and government decision-making processes
Implementation Steps	• EIP high-level vision setting • Baseline setting and benchmarking • Prioritizing intervention areas and goal setting • Policy domains and policy instruments • Policy implementation

11.1.3.1 Relevance to the LEIP

This implementation step by UNIDO calls for an EIP to lobby for and develop EIP-relevant policies at various levels of government.

11.1.4 Developing precinct management models

Table 15 discusses precinct management structures and provides some examples of management models that could be adopted by LEIP.

Table 15 Implementation Step 4 – Developing precinct management models

Category	Description
Aim	Develop a precinct management structure to take care of a range of topics required to develop and operate an industrial park sustainably, to attract investments and to provide attractive working conditions

Implementation Steps	• Establish management model
	  ○ No universal model, context dependent
	  ○ Suggestions for models are presented in the figure below:

Eco-industrial park leadership	The leadership role in an EIP is usually represented by a board, committee or shareholders' group united by common interests that provide the vision and hold the EIP accountable to its overall goals. The goals should be aligned with EIP standards but also with the country's development goals.
Eco-industrial park management	The EIP management takes care of the operationalization of the park and the most effective ways to reach its goals measured through KPIs. It is accountable to the EIP leadership.
Tenants' association	A tenant association is a union of all or most of the companies that are property owners or leasers in an EIP. When the association is legally formalized, it can act as EIP management. Informal tenant associations can represent tenants' interests through joint lobbying activities.
EIP management models	
Associative management model	In this model, EIP tenant companies organize themselves in an association with the mandate to manage usually one and sometimes several industrial parks. In this model, there is no distinction between park leadership and management and little or no intervention from government.
Government management model	The government ensures the management of the EIP through a dedicated team issued from a designated national, regional or municipal authority (for example trade ministry). It is often the case for special economic zones requiring high government investment. It is possible to have a government managed EIP model whereby the park operation may be subcontracted to one or several private operators (refer to EIP private management model in this case).
Mixed public-private management model	This model refers to a government managed EIP where assistance from a private contractor is required in addition to government employees. This partnership can be permanent (e.g. a government liaison officer is a permanent staff member while the private company provides the other park management positions) or temporary (e.g. as part of a capacity building process until the government can perform all park management functions itself). An NGO or foundation can be set up by a mix of tenant companies and local authorities to manage the EIP by facilitating a cooperative approach to service provision, shared between a city and private sector.
Private company or individual management model	In this model, the park management is run by a private operator or real estate agent.

- Clearly establish management entity's functions/roles, some examples:
  - environmental monitoring and recording
  - facilitating collaboration between companies
  - maintaining facilities and infrastructure
  - facilitating establishment of new companies
  - representing the precinct at public level
- Mobilize resources and ensure financial sustainability
- Design and roll-out of EIP plans
- Adaptation to change and scaling-up

Category	Description
	○ Management models can be phase-specific for a development project (e.g. management model/entity for initial operation stage can be restructured/replaced during more well-established phases)

11.1.4.1 Relevance to the LEIP

A formalised management entity for the design and construction phases of development would help drive sustainability outcomes in these phases.

Initially, Council is likely to be the most suited to manage the LEIP. UNIDO case studies show that governments who launch EIPs can, in some cases, transfer management to another entity post-construction.

11.1.5 Upscaling resource efficiency and industrial synergies

Table 16 outlines industrial synergy planning and implementation.

Table 16 Implementation Step 5 - Upscaling resource efficiency and industrial synergies

Category	Description
Aim	To upscale resource efficiency and industrial synergies and reduce risk to humans and the environment
Implementation Steps	• Planning and organization ○ Initially, focus primarily on proponents that have already stated they are willing/suitable to participate in synergy (e.g. easier to plan with committed proponents and – once synergy practices have been established – can attract other industries) • Preliminary assessment and opportunity identification ○ Collect baseline data from proponents and other EIPs, generate list of desired synergy practices ○ There are software programs that can help visualise synergy practices (e.g. SYNERGie®) • Detailed assessments ○ Based on previous steps, filter out proponents that are not a good match for synergy purposes ○ Conduct in-depth feasibility study (e.g. assessing the extent that chosen synergy practices are economically, socially and environmentally feasible and outlining the potential risks and benefits from their implementation) • Implementation and continuation ○ EIPs are continually evolving, above steps should be repeated periodically

11.1.5.1 Relevance to the LEIP

The LEIP is in the very early stages of planning for industrial synergy practices. Awareness raising about synergy opportunities should be a critical element of communication with current/potential future proponents.

Council may consider workshops and visits to prospective proponents to convey synergy opportunities and assess their level of enthusiasm for participating in these processes.

This step is a natural opportunity to encourage promotion and awareness of the principles of biomimicry to proponents, a concept identified as important by key stakeholders at Council.

11.1.6 Performance monitoring and benchmark

Table 17 outlines the steps an EIP can take to establish baseline data, enabling quantifiable performance monitoring.

Table 17 Implementation Step 6 - Performance monitoring and benchmark

Category	Description
Aim	To track progress of EIPs against set objectives and thus demonstrate environmental, economic and social outcomes

Implementation Steps	• Prioritize issues and define performance indicators
	  ○ Examples are provided in Appendix A
	• Establish baseline and performance target levels
	  ○ Baseline is an estimated point of reference from which to track performance, and can be established as a result of first time application/measurement of sustainability target along with modelling assessments
	  ○ In the long-term benchmarks and baselines are recalculated as project develops
	• Establish most suitable monitoring system
	• Performance monitoring and continuous improvement

11.1.6.1 Relevance to the LEIP

The UNIDO Framework provides a list of performance targets and indicators (outlined in Appendix A) to help EIPs develop clearer sustainability objectives and processes.

Unlike the sustainability rating tools reviewed for this report (e.g. ISC, Green Star - Communities and EnviroDevelopment), UNIDO does not include *binding targets*. The EIP developer has flexibility to determine the level of effort applied to each aspect.

The flexibility of this approach ensures that the LEIP can tailor its sustainability targets to correspond to the Townsville Corporate Plan 2021-2026's goals and other regional sustainability policy objectives.

11.2 Establishing a management system

Establishment of an integrated management system is a critical step in application of the UNIDO Framework to the LEIP.

Appendix A outlines the management system elements required to respond to the broad range of aspects in the UNIDO Framework. This outline assumes that Council has appointed a person / team to be responsible for management of delivery and operation of the LEIP. The management system elements are summarised in Table 18. Additionally, this table shows how proponent agreements could be used to ensure performance of proponents.

Table 18 Management system requirements

Aspect	Requirements
Park Management	• Council appoints person / team to undertake managing • Responsible person / team develops monitoring plan as part of overall management system • Climate Change Risk Assessment undertaken and reviewed every seven years • Responsible person / team develops regulatory requirements checking procedure as part of overall management system • Master plan developed and reviewed every seven years

Aspect	Requirements
Environmental Management	• Responsible person / team develops environmental management system • Responsible person / team develops records management procedure as part of overall environmental management system • Proponent agreements used to ensure management system compliance by proponents • Energy efficiency strategy is developed • Energy efficiency requirements written into proponent agreements • Responsible person / team develops energy management procedure as part of overall environmental management system • Proponents only accepted where commitments to reduce BAU energy demand are provided • Industrial heat recovery strategy is developed • Infrastructure for waste heat / energy exchange built into master plan • Infrastructure for on-site storage and reuse built into master plan • Water efficiency and reuse strategy is developed • Water efficiency requirements written into proponent agreements • Responsible person / team develops records waste management procedure as part of overall environmental management system • Waste minimisation requirements written into proponent agreements • Requirement for minimising hazardous materials use written into proponent agreements • Identify synergy opportunities for proponents that have hazardous material outputs • Engagement with all proponents includes requirement to nominate opportunities for circular economy opportunities • Responsible person / team develops environmental management plans as part of environmental management system
Social Management	• Responsible person / team develops social quality standards as part of overall precinct management system • Social requirements written into proponent agreements
Economic Management	• Responsible person / team develops engagement procedures that maximise opportunities for local SMEs • Responsible person / team develops market demand and feasibility study, supported by a business plan for specific “green" infrastructure and services • Operational costs for park management are passed down to proponents in proponent agreements

11.2.1 Sustainability targets and performance indicators

A critical part of the management system development is establishment of sustainability targets / performance indicators. Appendix A summarises a set of proposed targets in response to the UNIDO Framework. Where possible these have been aligned to the targets in the Townsville Corporate Plan 2021-2026. Two sets of targets have been proposed:

- Business as usual (BAU): These targets align to the Townsville Corporate Plan 2021-2026 where relevant or other typical industry practice
- Beyond BAU: These targets are nominal and provide a *stretch* option for the BAU targets

Table 19 summarises the proposed targets.

Table 19 Sustainability targets and performance indicators

Aspect	BAU targets	Beyond BAU targets
Park Management	• 100% of proponents have signed a residency contract/park charter/code of conduct that empowers the park management • entity to perform its responsibilities and tasks, and charge fees (sometimes absorbed in rental fees) for common services • 75% of proponents satisfied with regard to the provision of services and common infrastructure	• 100% of proponents satisfied with regard to the provision of services and common infrastructure
Environmental Management	• 20% of proponent energy consumption is covered by an energy management system • 20% of proponents have energy metering • National grid emission factor </= the combined CO2 emissions intensity as per unit of produced and purchased heat and electricity for use by EIP firms • 10% of proponents are certified with Climate Active • Zero incidents of pollution to local waterways per year • 10% of industrial wastewater on site treated for reuse • 60% of industrial wastes on site reused within the site • 100% of proponents on site appropriately handle, store, transport and dispose of toxic and hazardous materials • 10% of proponents on site implementing circular economy practices • All waste that cannot be reused on site is collected for off site recycling or disposal in line with regulations • 20% of the precinct footprint is reserved for open space / environmental uses • All proponents are required to have relevant environmental management plans in place to manage potential impacts to the environment • All proponents are required to have risk management framework in place to manage potential impacts to the environment	• 50% of proponent energy consumption is covered by an energy management system • 100% of proponents have energy metering • National grid emission factor >/= the combined CO2 emissions intensity as per unit of produced and purchased heat and electricity for use by EIP firms • 50% of proponents are certified with Climate Active • 50% of industrial wastewater on site treated for reuse • 75% of industrial wastes on site reused within the precinct • 50% of proponents on site implementing circular economy practices • 40% of the precinct footprint is reserved for open space / environmental uses • All proponents are required to comment and input on other proponent risk management frameworks

Aspect	BAU targets	Beyond BAU targets
Social Management	• Proponents required to develop a 18001-aligned OH&S management system. • Responsible person / team develops stakeholder management procedure as part of overall precinct social management system • 25% of proponents have a harassment prevention and response system in place as part of 18001-aligned social management system • Surveys reveal 80% of men and 80% of women believe employment conditions at proponent organisations are fair and secure and recognise worker rights • Surveys reveal 80% of men and 80% of women believe social infrastructure is satisfactory • 100% of safety and security issues are addressed within 30 days • 25% of proponents have a program for skills/vocational training and development	• Proponents required to develop a 18001-certified OH&S management system. • Proponents required to develop a code of conduct as part of 18001-certified OH&S management system. • All proponents required to develop a harassment prevention and response system in place as part of 18001-certified social management system. • Surveys reveal 100% of men and 100% of women believe employment conditions at proponent organisations are fair and secure and recognise worker rights • Surveys reveal 100% of men and 100% of women believe social infrastructure is satisfactory • 75% of proponents have a program for skills/vocational training and development
Economic Management	• 65% of workers are in direct employment • 90% of proponents use local SME suppliers or service providers for at least 25 percent of their total procurement value • 65% of space rented or used by proponents compared to the total amount of available space earmarked for firms within the park	• 95% of workers are in direct employment • 100% of proponents use local SME suppliers or service providers for at least 25 percent of their total procurement value • 100% of space rented or used by proponents compared to the total amount of available space earmarked for firms within the park

11.3 Implications for estate design and infrastructure provision

As previously stated, the UNIDO Framework has no direct implications for estate design or infrastructure provision given that specific mandates or guidelines are not a part of the Framework. The Framework's influence over these aspects is limited to striving to implement the industrial synergies and other environmental management practices that it recommends.

However, an EIP applying the UNIDO Framework is more likely to identify opportunities for improved sustainability outcomes.

11.4 Marketing the UNIDO Framework

The UNIDO Framework does not provide formal certification or labelling. However, UNIDO has an international reputation, which would contribute towards the marketability of the LEIP as an '*eco*' precinct.

Based on previous case studies and the literature reviewed, some suggestions for marketing can include:

- Making public commitments regarding application of the UNIDO Framework

- Publicising industrial synergy practices to the wider industrial community
- Considering lobbying state and federal governments regarding EIPs

11.5 Implications for future proponents

EIPs include beyond-BAU sustainability objectives that can drive improved performance in proponent operations.

Charters, codes of conduct and signed proponent agreements should outline mandates that facilitate the day-to-day monitoring of proponent activities.

UNIDO suggests that:

> "*residency contracts should include the minimum environmental and social performance requirements expected of resident firms*".

Note, where UNIDO uses the terms "*residency*" and "*resident firms*" it is referring to the proponents operating in the precinct. Some examples of these 'minimum requirements' can include:

- Engaging with industrial synergy practice with at least one other industry on-site
- Reporting monthly energy, water and waste data
- Utilising on site recycled water networks
- Utilising on site renewable energy supply

12. Conclusion

Application of the UNIDO Framework on the LEIP would aid in driving the sustainable delivery and management of the LEIP. The Framework has international credibility and could assist in marketing the LEIP as world-leading from a sustainability perspective.

Whilst there are structural elements that may be necessary to realise some sustainability outcomes, crucially, the most important aspects to implementing the Framework are centred on:

- Establishment of a Council team responsible for site sustainability management. Council are in a unique and optimal position to establish this role in the early stages of the LEIP however moving forward there are a range of options for how this function could be undertaken including:
    - Continued Council self-management
    - Management by independent external operator / contractor
    - Self managed by a proponents association
- The importance of using proponent agreements to drive performance and proponent behaviour

Other relevant aspects to implementing the Framework include:

- Developing awareness raising campaigns for stakeholders (to attract well-suited proponents and encourage collaboration with various stakeholders)
- Developing a structured approach for implementing industrial synergy practices in the LEIP (e.g., creating a questionnaire for proponents to assesses relevant industrial synergy parameters)
- Developing sustainability performance indicators to drive performance improvements
- Incorporating locally relevant targets and drivers into the system and performance indicators (e.g. the Townsville Corporate Plan 2021-2026 targets)

Appendix A – LEIP UNIDO Framework Application

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1. Application of the UNIDO Framework

This Appendix presents a detailed investigation of the UNIDO framework with respect to the implications for:

- estate design,
- infrastructure provision,
- Council responsibility and
- obligations for future tenants / proponents

Application of the framework is defined by development of a management approach and set of performance indicators for four themes:

1. Park Management
2. Environmental Management
3. Social Management
4. Economic Management

1.1 Park Management

Table 1 EIP Prerequisites for Park Management

EIP Prerequisites for Park Management				
Topic	Sub topic	Description / requirement	Prerequisites / evidence	Action
Park management services	Park management Entity	A park management entity (or alternative agency, where applicable) exists to handle park planning, operations and monitoring.	A distinct park management entity (or agency, where applicable) exists to handle park planning, operations, management, and monitoring.	Council appoints position / team to undertake managing entity role
	Park property, common infrastructure and services	The park management entity provides and facilitates common services and infrastructure to resident firms to ensure smooth operations.	Park management entity to manage and maintain the industrial park property, common infrastructure, and services as prescribed in the tenant contract. This should include at least the following: • Property management, including plot allotments, re-allotments, development, land use monitoring. • Utilities, roads, security (including IT security) and emergency response services/facilities and wastewater treatment plants and operations, including waste heat/energy recovery and distribution networks • Environmental monitoring and advisory activities • Common landscaping, buffer zones, street lighting, security surveillance and street cleaning. • Provide facilitating services to and between tenant firms (for example, networking, collaboration and training opportunities). • Engagement with the park's stakeholders and business representatives. • PR and community participation center/platform/activities.	
Monitoring and risk management	Monitoring performance and risks	The park management entity has established and maintains a system for monitoring achievement of threshold EIP performance targets and management of critical risk factors within the park.	Park management entity maintains an EIP framework monitoring system in place, tracking and reporting: • Progress on environmental, social and economic performance at the park level annually. • Critical risk factors and related responses, at least for: o Risk points for the accidental release of hazardous solid, liquid and gaseous effluents, including during transportation and disposal when fire hazards are possible; and o Applicable natural disaster risks (for example, earthquakes); o Environmental performance; o Social performance; o Economic performance; and o Critical risk management at the level of the park. • Acts as monitoring and pre-clearing institution for environmental issues on behalf of the regulatory bodies, as delegated. • May operate a central environment control unit with an emergency alert system for environmental and other hazards.	Responsible person / team develops monitoring plan as part of overall management system
		The park management establishes measures to	Park management has a plan, to be updated every seven years, in place to react to possible negative impacts due to climate change (heat waves and droughts, storms and floodwater events). All	

EIP Prerequisites for Park Management				
Topic	Sub topic	Description / requirement	Prerequisites / evidence	Action
		deal with climate change adaptation and disaster preparedness.	adaption needs for infrastructure and services are identified and in place for the industrial park to protect against climate change and potential damages. Park management entity and resident firms have plans and measures to ensure continued operation of critical infrastructure systems within the park (e.g., wastewater treatment plants, power plants, recycling facilities, etc.) that can be activated even in emergencies.	Climate Change Risk Assessment undertaken and reviewed every seven years
	Climate risk assessment	The park management entity collects, assesses, and reviews comprehensive climate risk information specific to the location of the park.	Park management entity investigates risks due to climate change and updates this information on a regular basis.	
	Information on applicable regulations and standards	Park management has a good understanding of regulations and international standards applicable to industrial park compliance and enforces them in the park.	Park management entity has a system to collect, register and comply with local/national regulations and international standards applicable to the industrial park. Park management enforces compliance by resident firms and requests and collects compliance information that firms share with the park management entity.	Responsible person / team develops regulatory requirements checking procedure as part of overall management system
Planning and park design	Master plan	A master plan for the EIP is developed by park developers and is applicable to both planning and operations by park managers.	A master plan (or equivalent planning document) for any new and existing industrial park has been developed and is reviewed periodically (minimum every seven years) and updated if required, including the following core elements: • Based on various risk analyses; essential and efficient infrastructure (onsite and offsite, in particular ensuring access to decent housing), utilities, transportation network; environmental and social issues; buffer zone around the park; procedure to safely locate high risk industries; and cluster synergistic industries and similar. • Integration into master plan of relevant requirements specified in this EIP framework.	Master plan developed and reviewed every seven years

Table 2 EIP Performance Indicators for Park Management

Performance Indicators for Park Management					
Topic	Sub topic	Description / requirement	Performance Indicator	BAU Unit [Target value]	Beyond BAU
	Park management Empowerment	Distinct park management entity is empowered to provide and charge fees through	Proportion of firms in the industrial park to have signed a residency contract/park charter/code of conduct (depending on what is legally binding on park firms according to the existing legislation in the country14) and additional legally binding arrangements that empower the park management	100% of tenants have signed a residency contract/park charter/code of	NA

Performance Indicators for Park Management					
Topic	Sub topic	Description / requirement	Performance Indicator	BAU Unit [Target value]	Beyond BAU
Park management services		a legally binding instrument.	entity to perform its responsibilities and tasks, and charge fees (sometimes absorbed in rental fees) for common services. This may include transparent fees for services pertaining to the achievement of EIP performance targets.	conduct that empowers the park management entity to perform its responsibilities and tasks, and charge fees (sometimes absorbed in rental fees) for common services	
	Park management entity property and common infrastructure operations	The park management entity provides and facilitates efficient common services and infrastructure to resident firms.	Proportion of satisfied resident firms with regard to the provision of services and common infrastructure by the park management's entity (or agency, where applicable) out of total respondents.	75% of proponents satisfied with regard to the provision of services and common infrastructure	100% of proponents satisfied with regard to the provision of services and common infrastructure

1.2 Environmental Management

Table 3 EIP Prerequisites for Environmental Management

Environment EIP Prerequisites				
Topic	Sub topic	Description / requirement	Prerequisites / evidence	Action
Management and monitoring	Environmental and Energy Management Systems (EMS and EnMS, respectively)	The park has appropriate, functioning EMS and EnMS systems (for example, ISO 14001 Environmental Management Standard and ISO 50001 Energy Management Standard) in place to set and achieve targets, and covering key issues (for example, energy waste and material use; water; point-source emissions; carbon footprint; and the natural environment).	• Park management entity operates an environmental/energy management system in line with internationally certified standards, monitoring park performance and supporting resident firms in the maintenance of their own firm-level management systems. For this purpose it records all relevant data, preferably managed by a dedicated environmental monitoring and recording unit/group.	Responsible person / team develops environmental management system Proponent / tenancy agreements used to ensure management system compliance by proponents
		The park actively supports and facilitates industrial synergies and symbiosis.	• Park management entity keeps updated records on energy, water, waste products, and materials inefficiencies and needs at tenant firms to provide a basis for industrial synergies development.	Responsible person / team develops records management procedure as part of overall environmental management system Proponent / tenancy agreements used to ensure management system compliance by proponents
Energy	Energy efficiency	Energy efficiency strategies are in place for the park management infrastructure and major energy-consuming resident firms.	Supporting programs (e.g., energy efficiency networks) are in place to improve the energy efficiency of major energy-consuming businesses in the park.	Energy efficiency strategy is developed Energy efficiency requirements written into proponent / tenancy agreements
	Energy network and waste heat recovery	A program/mechanism is in place to identify opportunities for common energy and heat exchange networks to be established. The park management will provide the required physical network and offers support programs to assist resident firms with implementation.	An industrial heat recovery strategy is in place to investigate opportunities for heat and energy recovery for the major thermal energy-consuming firms in the park. (Typically, these are firms that individually use at least 10–20 percent of total firm level energy consumption).	Industrial heat recovery strategy is developed
			Park management provides the physical network for waste heat/energy exchange at park level, and assists firms to connect to the network. A commonly accepted rewards system for waste heat/energy provision/use is in place.	Infrastructure for waste heat / energy exchange built into master plan
Water supply and wastewater	Water efficiency, reuse and recycling	Water-saving and re-use plans are important to reduce total water consumption and manage water use. The industrial park may face challenges related to climate and nonclimate related uncertainties that can shock and/or stress a system (land use changes, demographics, shifts in demand, etc). The park and firms should have systems in place to increase water savings and reuse.	Park management entity has operational plans to increase water reuse in next five years. This would be achieved by either reuse of industrial effluents, or by rainwater/storm water collection.	Infrastructure for on site storage and reuse built into master plan
			Park management entity provides the physical network for water reuse/cascading of water.	Water efficiency and reuse strategy is developed Water efficiency requirements written into proponent / tenancy agreements
Waste and material use	Dangerous and toxic material	Tenant firms are obliged to make as little use as possible of hazardous materials in their production process; to generate as little hazardous waste as possible, and to seek	Obeying the principles of good practices for the management of hazardous materials and waste as part of legally binding agreements.	Requirement for minimising hazardous materials use written into tenancy agreements

Environment EIP Prerequisites				
Topic	Sub topic	Description / requirement	Prerequisites / evidence	Action
		alternative materials.		Identify synergy opportunities for tenants that have hazardous material outputs
	Resource conservation	The park management and firms are obliged to consider circular economy principles and practices (e.g. circular products, using as little virgin raw material as possible, reuse and remanufacturing of components and parts and making extensive use of secondary/ recycled materials generated in the park).	Obeying the principles of circular economy is part of the Parks Code of Conduct, and any legally binding agreement between tenant firms and the park authority.	Engagement with all tenants includes requirement to nominate opportunities for circular economy opportunities
	Treatment of waste	Waste generated in the production process is recovered, as far as possible, through sorting, cleaning, conditioning etc., so that it can be used as raw material for other firms in and outside of the park.	A central park facility or other mechanism is in place to treat waste that cannot be processed by individual firms.	Responsible person / team develops records waste management procedure as part of overall environmental management system Waste minimisation requirements written into proponent / tenancy agreements
	Disposal of waste	Waste/secondary raw materials (including hazardous waste) leaving the park is being monitored to check that the material is either reused or further processed by authorised firms outside of the park, or disposed of according to legal and environmental standards.	A monitoring system is in place that controls and registers origin, type, mode and route of transport, and final destination of waste/secondary raw material leaving the park.	
Climate change and the natural environment	Air, GHG emissions and pollution prevention	The park seeks to limit and mitigate pollution and GHG emissions, including air, waterway, and ground pollution. A set of measures at the park level is introduced (for instance, low-carbon technologies, energy efficiency measures, circular economy practices, waste heat recovery) to reduce GHG emissions.	A program is established with clear evidence of steps taken to monitor, mitigate and/or minimize GHG emissions such as carbon dioxide (CO_2), methane (CH_4), and nitrogen oxides (NO_x).	Responsible person / team develops energy management procedure as part of overall environmental management system Proponents / tenants only accepted where commitments to reduce BAU energy demand are provided
			•Reducing CO_2 emissions is an integral part of the park's code of conduct, which urges firms to reduce their carbon footprint. The park acknowledges actions in this regard through an awards and incentive system.	
	Environmental assessment and ecosystem services	The industrial park demonstrates an understanding of the potential impact of park activities on priority ecosystem services in and around the vicinity of the park, and takes needed actions.	The park management entity has a plan in place to assess operational environmental impacts, and aims to limit these impacts on prioritized local ecosystem services.	Responsible person / team develops environmental management plans as part of environmental management system
			The park management implements measures to protect biodiversity, and protects or creates natural/recreational areas in and surrounding the park.	

Table 4 EIP Performance Indicators for Environmental Management

Performance Indicators for Environment					
Topic	Sub topic	Description / requirement	Performance Indicator	BAU	Beyond BAU
Management and monitoring	Environmental and Energy Management Systems (EMS and EnMS, respectively)	Firms have functioning and fit-for-purpose EMS/EnMS systems. Summary information from these management systems is provided to park management, who aggregate and report on data at the park level.	Proportion of a firms energy consumption that is covered by an energy management system.	20% of proponent energy consumption is covered by an energy	50% of proponent energy consumption is covered by an energy

Performance Indicators for Environment					
Topic	Sub topic	Description / requirement	Performance Indicator	BAU	Beyond BAU
				management system	management system
Energy	Energy consumption	The industrial park has adequate metering and monitoring systems in place to measure thermal energy and electricity consumption at both the park and firm levels.	Proportion of the park management and tenant firms that have a metering system in place. Proportion of firm-level energy consumption that is monitored.	20% of proponents have energy metering	100% of proponents have energy metering
	Renewable and clean energy	The industrial park leverages available renewable energy with plans to increase its contribution for shared services (for example, solar streetlamps).	Total renewable energy use for electricity and heat production in the industrial park is equal to or greater than the renewable energy share in the annual national electricity mix in the grid.	National grid emission factor </= the combined CO2 emissions intensity as per unit of produced and purchased heat and electricity for use by EIP firms	National grid emission factor >/= the combined CO2 emissions intensity as per unit of produced and purchased heat and electricity for use by EIP firms
	Energy efficiency	Energy efficiency opportunities should be identified at the park and firm levels to reduce energy use and associated greenhouse gas emissions. EIPs should identify and promote technological and process-related interventions in their own and resident business operations.	The equivalent of at least 10% of the total CO2 emissions (Scope 1 and 2) at park level is covered by the percentage of firms that have a qualified energy efficiency certification (LEED, Industry EDGE, DGNB or ISO 50001 or their national equivalent).	10% of proponents are certified with Climate Active	50% of proponents are certified with Climate Active
Water supply and wastewater	Water consumption	A mechanism is in place to monitor water consumption across the park, and establish demand management practices in case of water stress. Extraction from water sources (such as rivers and groundwater sources) should take place at sustainable levels.17	Total water demand from firms in industrial park that does not negatively impact local water sources or communities.	Zero incidents of pollution to local waterways per year	
	Wastewater treatment	The industrial park has provisions to treat, recycle and reuse treated wastewater. No effluents significantly impact potable water resources, or the health of local communities or nearby ecosystems.	Proportion of industrial wastewater generated by industrial park and resident firms which is treated in accordance with appropriate environmental standards.	10% of industrial wastewater on site treated for reuse	50% of industrial wastewater on site treated for reuse
	Water efficiency, reuse and recycling	The park and firms have systems in place to increase water savings and reuse.	• Proportion of total industrial wastewater from firms that is reused responsibly within or outside the industrial park.		
	Waste/by-products re-use and recycling	A waste management plan with a program/mechanism in place to promote and encourage reuse and recycling of materials by firms in the park (for example, raw materials for process and non-process applications).	• Proportion of non-hazardous, solid industrial waste generated by firms that is reused-recycled by other firms, neighbouring communities, or municipalities.	60% of industrial wastes on site reused within the precinct	75% of industrial wastes on site reused within the precinct

Performance Indicators for Environment					
Topic	Sub topic	Description / requirement	Performance Indicator	BAU	Beyond BAU
Waste and material use	Dangerous and toxic materials	Program/mechanism in place with clear targets to reduce, and avoid the use of, dangerous and hazardous materials by firms in the park.	• Proportion of firms in park which appropriately handle, store, transport and dispose of toxic and hazardous materials.	100% of proponents on site appropriately handle, store, transport and dispose of toxic and hazardous materials	
	Resource conservation	Circular economy practices (e.g., Industrial Symbiosis Networks, Exchange Platforms for waste and secondary raw materials, for reuse and recycling, etc.) are in place and used by firms. Circular economy practices consist of a) redesigning products for ease of reuse, remanufacturing, disassembly and recycling; b) reuse of waste and/or byproduct within its own operations; c) collecting back and remanufacturing products or parts and components of products.	• Proportion of manufacturing firms adopting circular economy practices, including engagement in Industrial Symbiosis Networks in the park; or actively exchanging secondary raw materials, or waste, or other circular economy practices.	10% of proponents on site implementing circular economy practices	50% of proponents on site implementing circular economy practices
	Waste Disposal	A waste management system with a systematic approach to collection, treatment, recycling and disposal of waste, and which correctly manages unusable waste materials (e.g., disposed of in proper landfills, burned in proper incinerator).	• Waste generated by firms in the industrial park which is safely disposed of. Open burning of waste generated in an EIP is prohibited.	All waste that cannot be reused on site is collected for off site recycling or disposal in line with regulations	
Climate change and the natural environment	Flora and fauna	Native flora and fauna are important to maintain the proportion of natural areas. They are integrated within the industrial park and natural ecosystem where possible.	• Proportion of open space18 in the park for native flora and fauna.	20% of the precinct footprint is reserved for open space / environmental uses	40% of the precinct footprint is reserved for open space / environmental uses
	Air, GHG emissions and pollution prevention	A mechanism is in place to avoid, minimize, and/or mitigate significant point-source pollution and GHG emissions. Covering GHG gases (CO_2, methane (CH_4), nitrous oxide (N_2O), and hydrofluorocarbons (HFCs)), local particulate and air pollution emissions such as PM 2.5, heavy metals (Hg, Cd, Pb and other relevant heavy metals), selected unintentional toxic organic pollutants (dioxins, PCDD/Fs). Program for on-site chemical management.	• Proportion of firms in park which have pollution prevention and emission reduction strategies to reduce the intensity and mass flow of pollution/emission releases which exceed national regulations.	All proponents are required to have relevant environmental management plans in place to manage potential impacts to the environment	
			• Proportion of firms in industrial park which have a risk management framework in place that: (a) identifies activities which have an impact on the environment, and;	All proponents are required to have risk	All proponents are required to comment and

Performance Indicators for Environment					
Topic	Sub topic	Description / requirement	Performance Indicator	BAU	Beyond BAU
			(b) assigns a level of significance to each activity, and; (c) have appropriate mitigation measures in place.	management framework in place to manage potential impacts to the environment	input on other proponent risk management frameworks

1.3 Social Management

Table 5 EIP Prerequisites for Social Management

Social EIP Prerequisites				
Topic	Sub topic	Description / requirement	Prerequisites / evidence	Action
Social management services	Management team	Functioning system(s) are in place for ensuring social infrastructure provisioning, operations and performance, as well as collecting, monitoring, and managing key social information and impacts relevant to the industrial park.	• Dedicated personnel exist (as part of the park management entity) to plan, manage and enforce social quality standards.	Responsible person / team develops social quality standards as part of overall precinct management system Social requirements written into proponent / tenancy agreements
Social Infrastructure	Primary social infrastructure	Social Infrastructure addresses different aspects to improve the living and working conditions of employees and neighbouring communities. Provision of primary social infrastructure is vital for employees' health and welfare, paying special attention to the needs of women. Primary social infrastructure covers inter alia adequate medical services, educational and training institutions, separate toilets and washing facilities, and provision of cafeterias and recreational areas.	• Essential primary social infrastructure has been adequately provided in the site master plan and is fully operational in the park. Gender perspectives are incorporated in the formulation, management and monitoring of plans and programs. A particular entity (e.g. planning unit or facilitated group of interested firm representatives) exists, which investigates and plans for future developments/challenges to the social environment due to the introduction of new technologies such as "Industry4.0"and AI controlled production processes.	Responsible person / team develops social quality standards as part of overall precinct management system Social requirements written into proponent / tenancy agreements

Table 6 EIP Performance Indicators for Social Management

Social Performance Indicators					
Topic	Sub topic	Description / requirement	Performance Indicator	BAU Unit [Target value]	Beyond BAU
Social management services	OH&S management system	Firms should have an OH&S management system in place (based on ISO 18001 standard) to record occupational diseases, absenteeism, and numbers of work-related injuries and fatalities..	• Proportion of firms with more than 250 employees that have an OH&S management system in place.	Proponents required to develop a 18001-aligned OH&S management system.	Proponents required to develop a 18001-certified OH&S management system.
	Grievances management	A grievance mechanism to receive and address grievances from within and outside the park. Examples include help desks, complaint boxes, and hotlines (phone booths) located inside and outside of the industrial park.	• Proportion of grievances received by the park management entity which are responded to with statements of reasons within 14 days. • Proportion of grievances received by the park management entity which are concluded within 60 days. • Proportion of firms with more than 250 employees that have a code of conduct system in place to deal with grievances.	Responsible person / team develops stakeholder management procedure as as part of overall precinct social management system	Proponents required to develop a code of conduct as part of 18001-certified OH&S management system.
	Discrimination and harassment prevention and response	Employees of the park management and resident firms should have a working environment free of violence, harassment, discrimination, exploitation or intimidation.	• Proportion of firms with more than 250 employees that have a harassment prevention and response system in place.	25% of proponents have a harassment prevention and response system in place as part of	All proponents required to develop a harassment prevention and

Social Performance Indicators					
Topic	Sub topic	Description / requirement	Performance Indicator	BAU Unit [Target value]	Beyond BAU
		A discrimination and harassment prevention and response system with clear complaint and response procedures should be in place.		18001-aligned social management system.	response system in place as part of 18001-certified social management system.
	Decent work	Conditions of employment should meet the following work criteria: • a fair income with security and social protection which allows access to decent housing. • recognition of contractually agreed rights of workers and employees including - but not limited to - working hours, leave and maternity leave. • establish and join organizations, of their own choosing, and without prior authorization, to represent workers.	• At least 80 percent of women and 80 percent of men of the surveyed workers agree that each of these decent work criteria are met.	Surveys reveal 80% of men and 80% of women believe employment conditions at proponent organisations are fair and secure and recognise worker rights	Surveys reveal 100% of men and 100% of women believe employment conditions at proponent organisations are fair and secure and recognise worker rights
Social infrastructure	Primary social infrastructure	Social infrastructure should meet the norms and requirements of the workforce, and client expectations, paying special attention to the needs of female workers.	• Proportion of surveyed employees reporting satisfaction with social infrastructure.	Surveys reveal 80% of men and 80% of women believe social infrastructure is satisfactory	Surveys reveal 100% of men and 100% of women believe social infrastructure is satisfactory
	Industrial Park security	The industrial park has security systems and services that are fully operational and fit-for-purpose, taking the particular security needs for women into consideration. Examples include, among others: appropriate lighting systems in and around the park, closed circuit television (CCTV) systems, a centralized security office, and provision of transport at night.	• Proportion of reported security and safety issues that are adequately addressed within 30 days.	100% of safety and security issues are addressed within 30 days	
	Capacity building	Programs for skills training and development at park management and firm level are in place, emphasizing equal opportunities for skills training and career development, and addressing new technologies and changes in the labour market. Examples include skills development programs, and women entrepreneurship development programs.	• Proportion of firms in park with more than 250 employees with a program for skills/vocational training and development. • Proportion of underrepresented genders in workforce in the park management and firms who benefit from skills development programs.	25% of proponents have a program for skills/vocational training and development	75% of proponents have a program for skills/vocational training and development

1.4 Economic Management

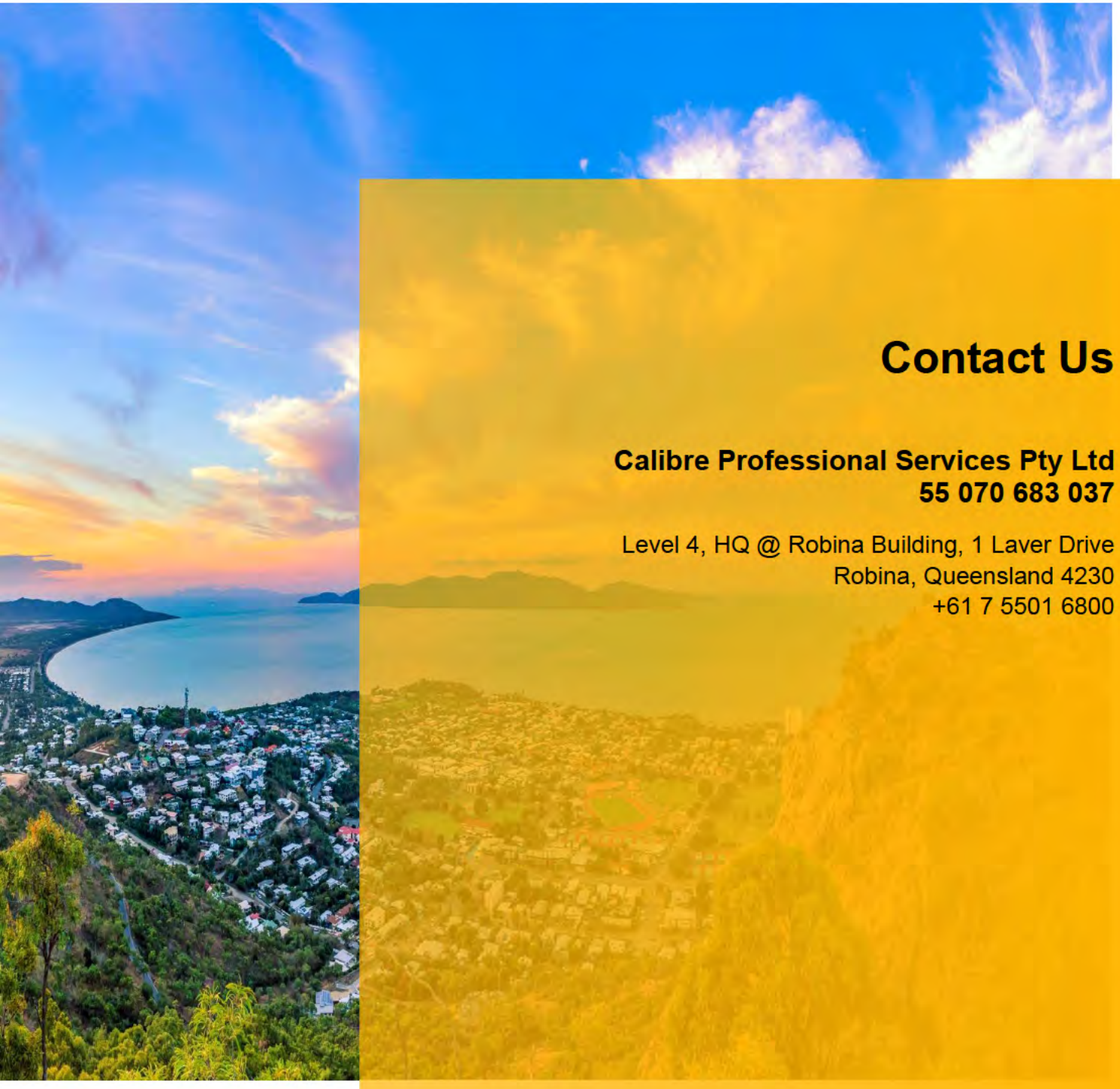
Table 7 EIP Prerequisites for Economic Management

Economic EIP Prerequisites				
Topic	Sub topic	Description / requirement	Prerequisites / evidence	Action
Local business and SME promotion	SME development	An EIP provides opportunities for local, regional, and national SMEs, enabling them to benefit from EIP activities.	• Park management entity allows and promotes the establishment of SMEs that provide services and add value to park residents.	Responsible person / team develops engagement procedures that maximise opportunities for local SMEs
Employment generation	Maximizing local benefits	An EIP must generate employment opportunities in the areas in which it operates to ensure revenue linkages and development opportunities.	• Park management entity has a strategy in place to maximize local benefits.	Responsible person / team develops engagement procedures that maximise opportunities for local SMEs
Economic value creation	Market demand for EIP services and infrastructure	The development of an EIP, including green infrastructure and services, must be based on realistic market and industry demands to ensure economic feasibility.	• A market demand and feasibility study, supported by a business plan for specific "green" infrastructure and services has been undertaken to justify planning and implementation in the industrial park.	Responsible person / team develops market demand and feasibility study, supported by a business plan for specific "green" infrastructure and services
			• Park management is financially solvent to operate/provide park infrastructure and services.	
			• The park management should be economically viable in terms of contributing to jobs, technology, and acting as a catalyst to development of local industry.	
			• Park management entity is responsible for marketing the park and park concepts (EIP concept) to potential national and international investors.	
Park entity's financial viability	Service delivery pricing	A dedicated financial model capturing EIP salient features must be used to set pricing levels and anticipated revenues in order to enhance financial viability of EIP investments.	• The park management should render its services at realistic costs to cover operational expenditures.	Operational costs for park management are passed down onto proponents in tenancy agreements

Table 8 EIP Performance Indicators for Economic Management

Economic Performance Indicators					
Topic	Sub topic	Description / requirement	Performance Indicator	BAU Unit [Target value]	Beyond BAU
Employment generation	Park management Entity	The EIP provides longer-term employment contracts to employees.	• Proportion of total firm workers in industrial park employed through direct employment (that is, not employed on a fee-for-output basis or provided through a labour supply firm) and permanent contracts.	65% of workers are in direct employment	95% of workers are in direct employment
Local business and SME promotion	Local value added	An EIP must use local suppliers where possible. EIPs provide local businesses with opportunities to grow.	• Proportion of resident firms using local SME suppliers or service providers for at least 25 percent of their total procurement value.	90% of proponents use local SME suppliers or service providers for at least 25 percent of their total procurement value.	100% of proponents use local SME suppliers or service providers for at least 25 percent of their total procurement value.
			Proportion of procurement budget paid to local service providers within 100 km radius by the park management entity.		
Economic value creation	Investment-ready park for firms	An EIP should be "investment ready" so that it offers lower economic risks and better investment	• Percentage of space rented or used by resident firms compared to the total amount of available space earmarked for firms within the park.	65% of space rented or used by resident	100% of space rented or used by

Economic Performance Indicators					
Topic	Sub topic	Description / requirement	Performance Indicator	BAU Unit [Target value]	Beyond BAU
		opportunities to firms. Infrastructure should be offered, including water, energy, roads and service corridors.		firms compared to the total amount of available space earmarked for firms within the park	resident firms compared to the total amount of available space earmarked for firms within the park



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