



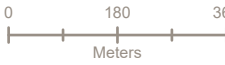
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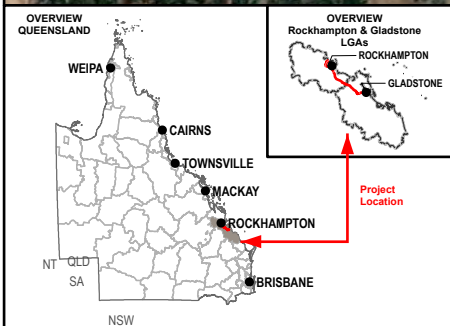
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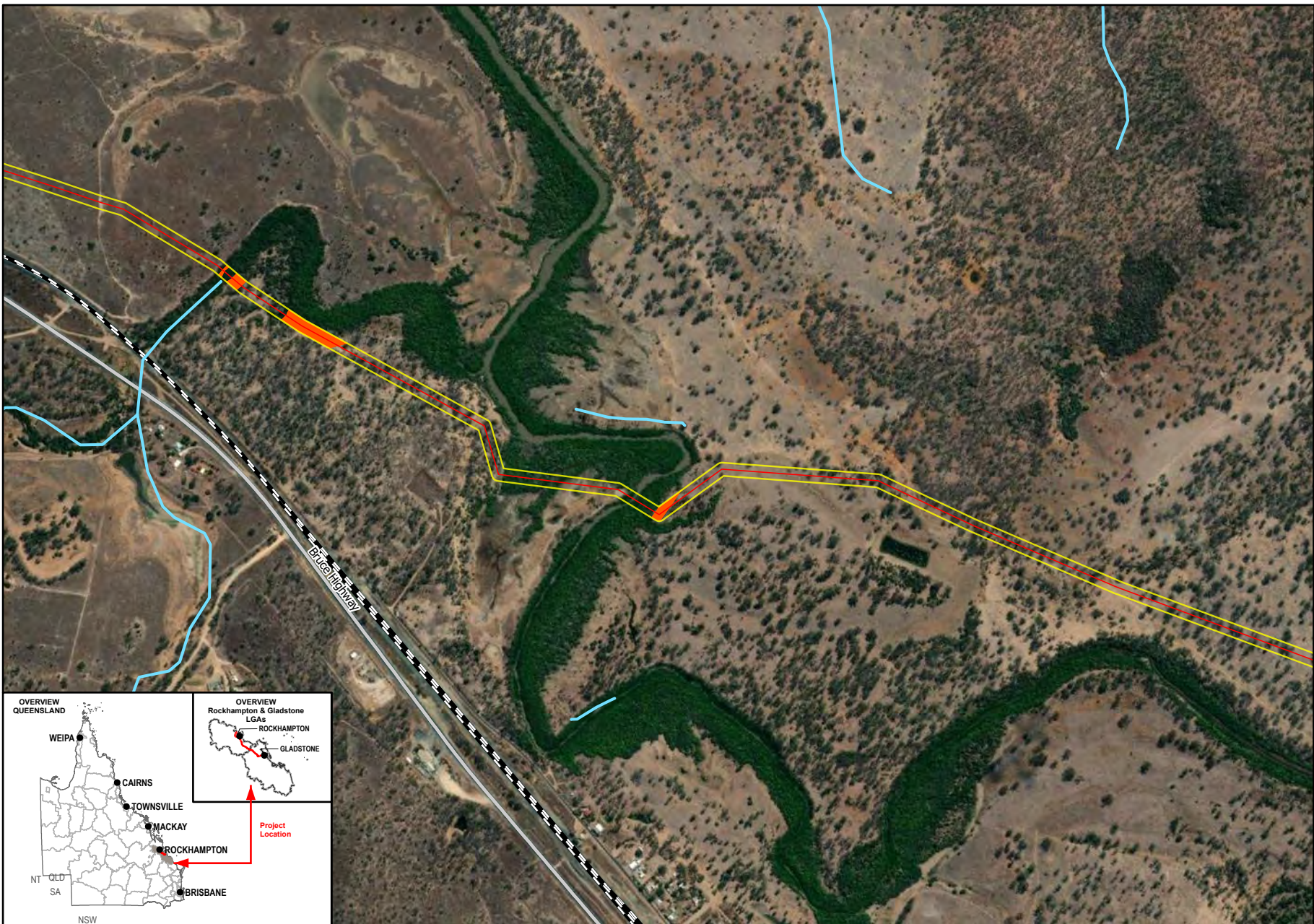
- Legend**
- GSDA Pipeline Alignment
 - Study Area
 - Raglan Pump Station and Reservoir Layout
 - Waterways

Data Sources:

1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
2. Imagery @ Esri, Maxar, GeoEye, Earthstar Geographics, CNES-Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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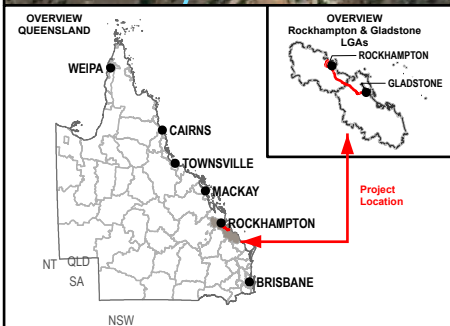
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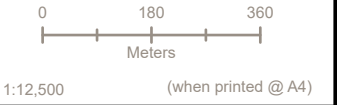
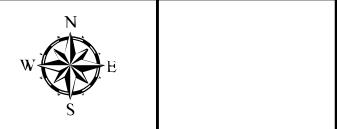
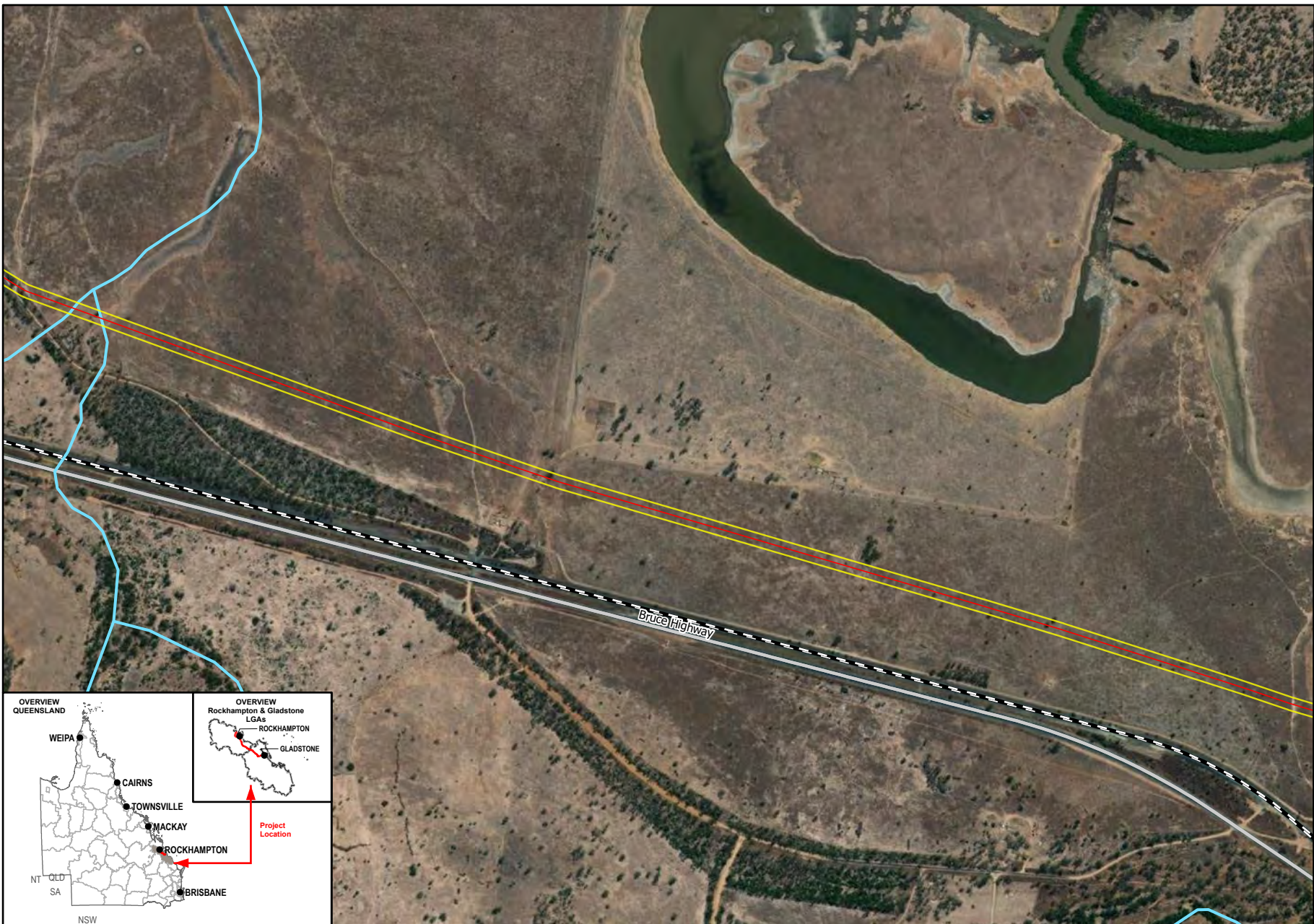
- Legend**
- GSDA Pipeline Alignment
 - Study Area
 - Predicted Squatter Pigeon (Southern) Habitat**
 - Habitat Type**
 - Potential Foraging Habitat
 - Waterways
 - Main Roads
 - Railways

Data Sources:

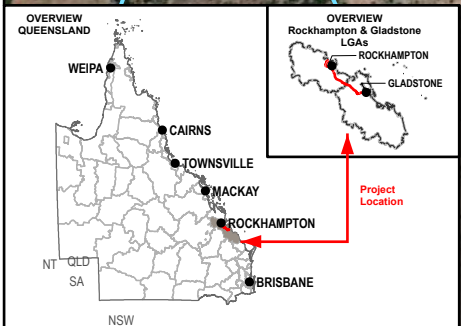
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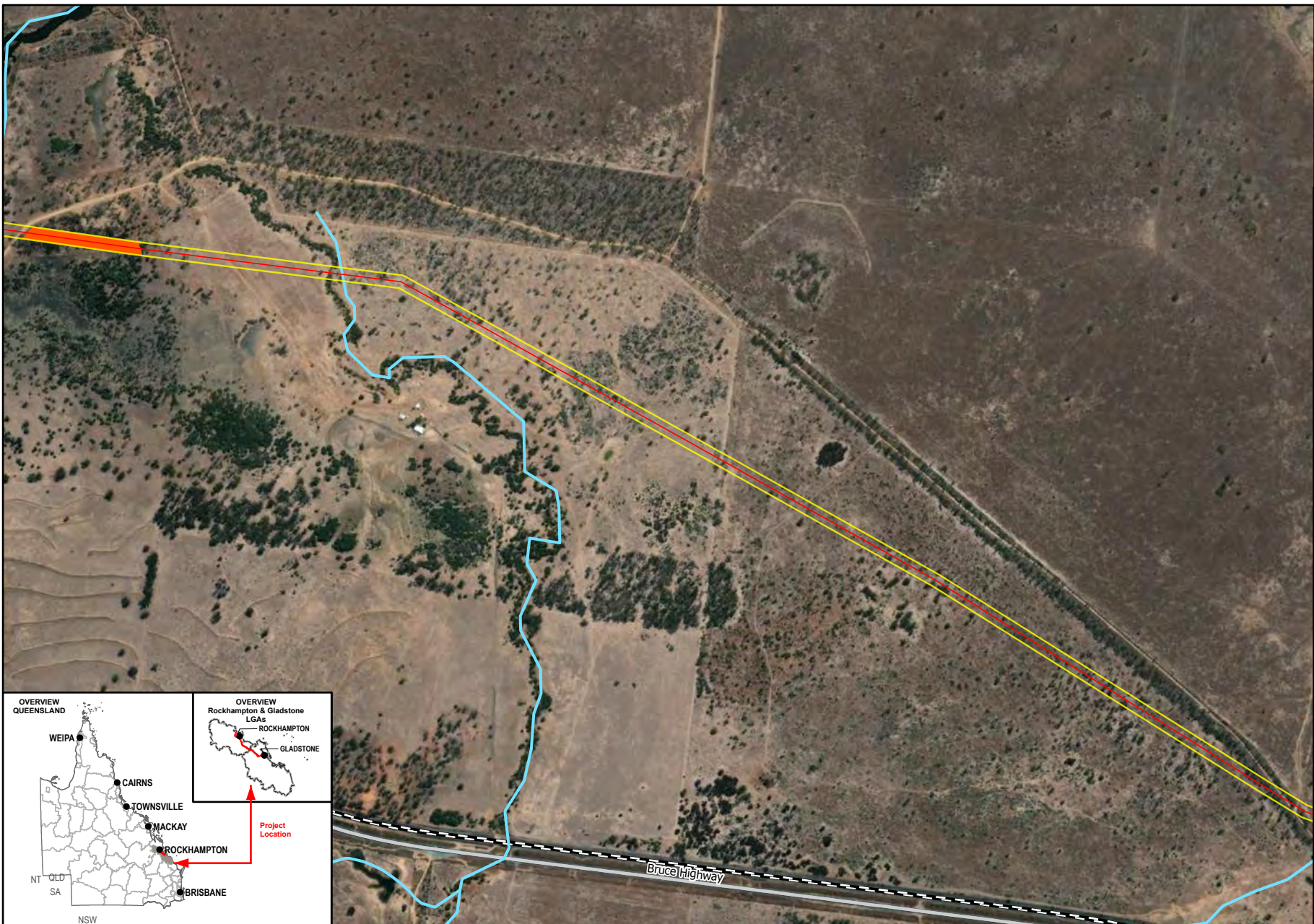
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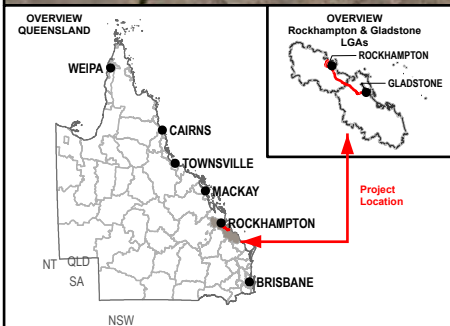
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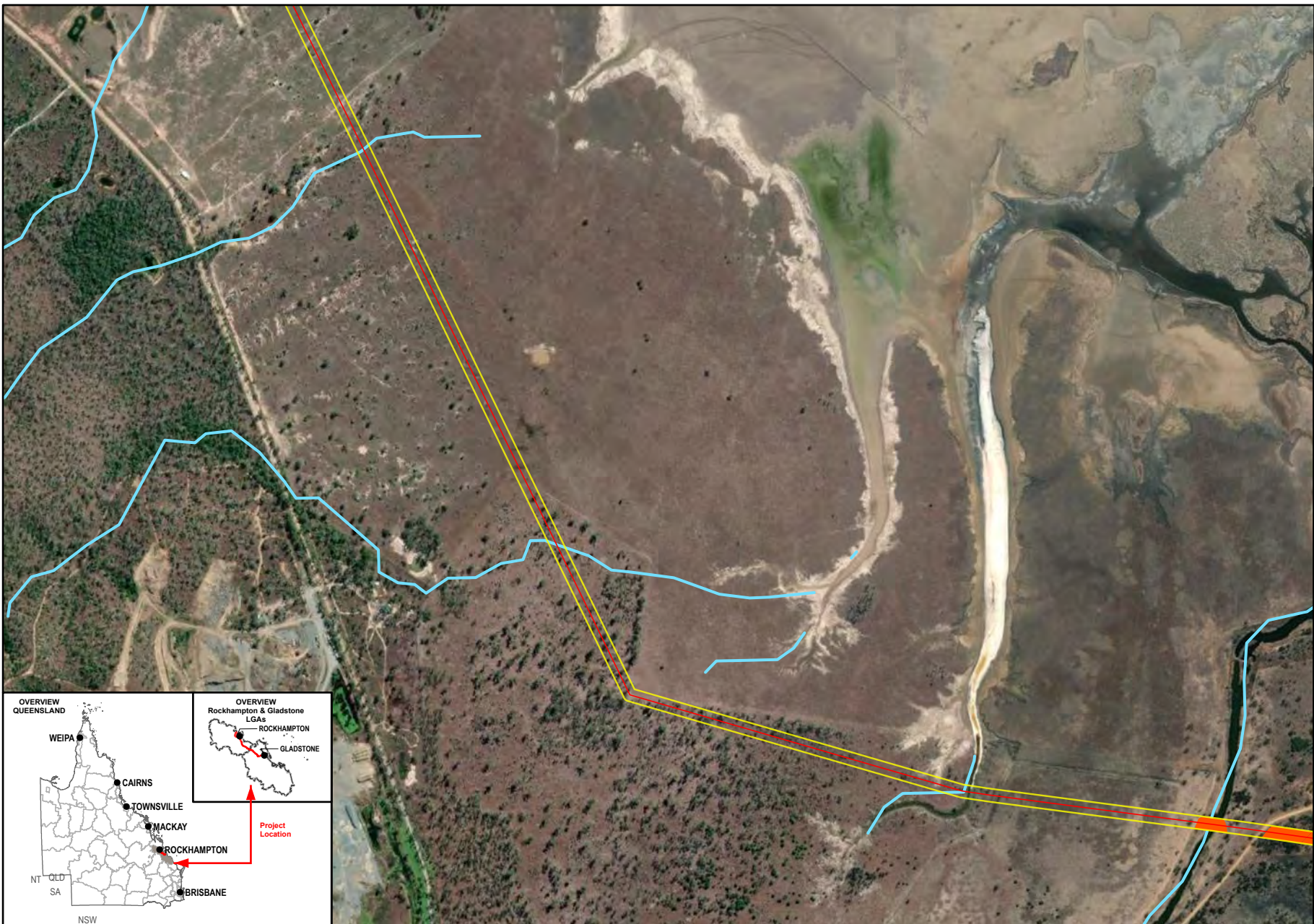
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- GSDA Pipeline Alignment
 - Study Area
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- Habitat Type**
- Potential Foraging Habitat
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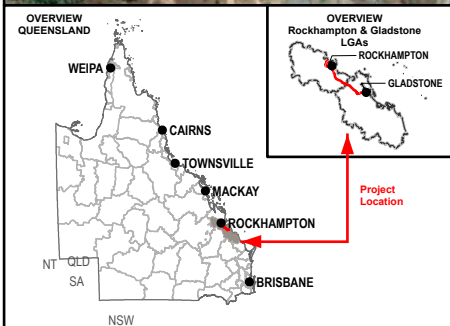
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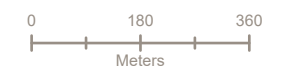
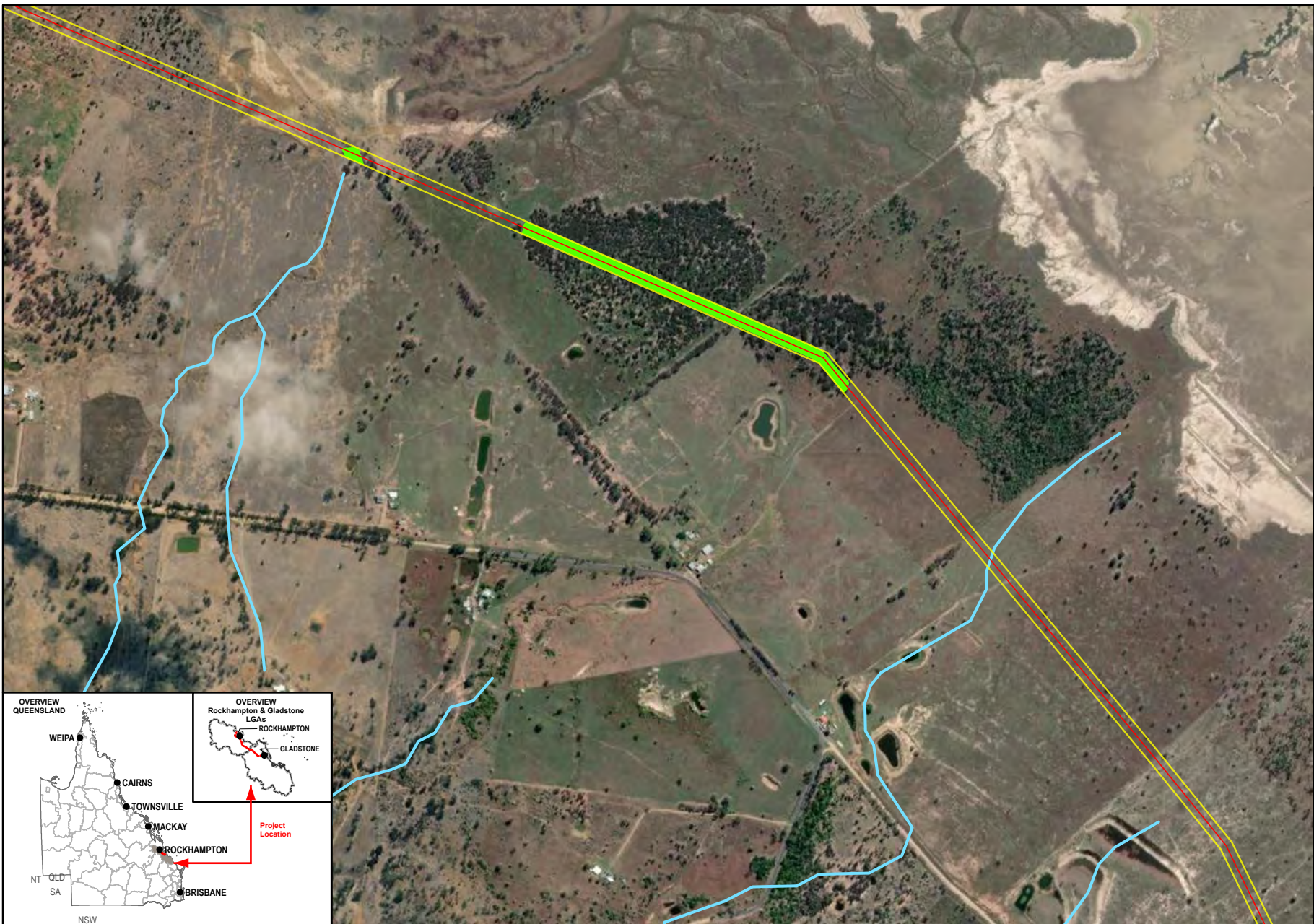
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- GSDA Pipeline Alignment
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 - Habitat Type**
 - Potential Foraging Habitat
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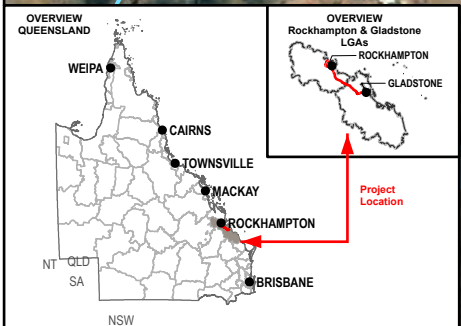




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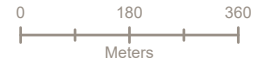
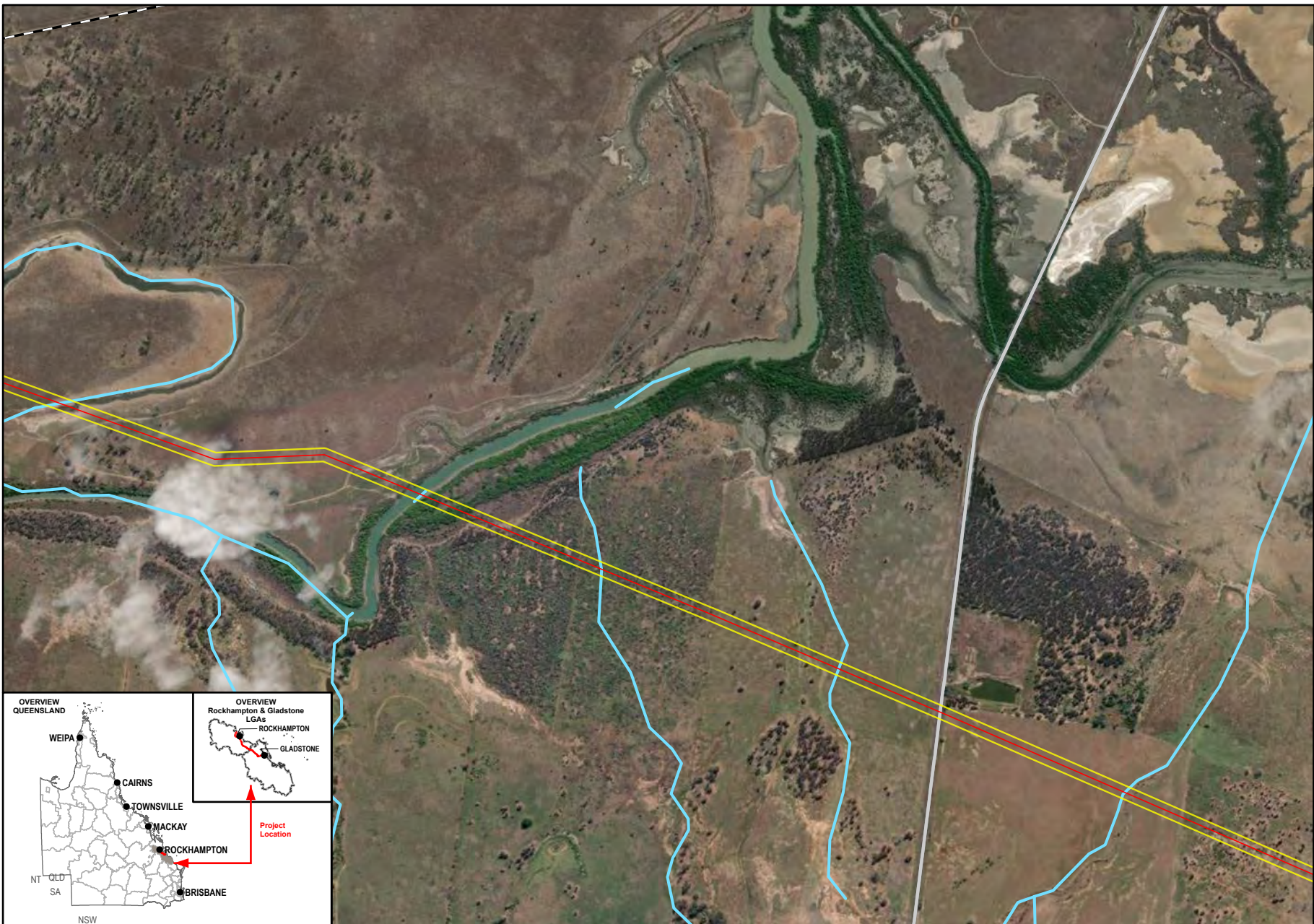
Legend

- GSDA Pipeline Alignment
- Study Area
- Predicted Squatter Pigeon (Southern) Habitat**
- Habitat Type**
- Potential Breeding Habitat
- Waterways



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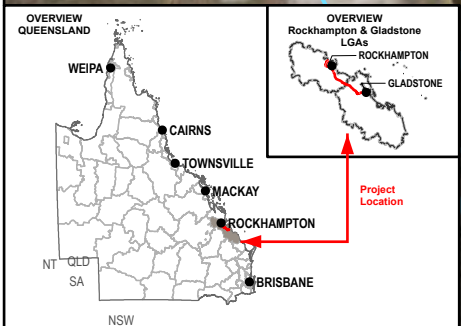
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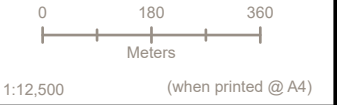
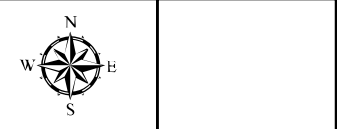
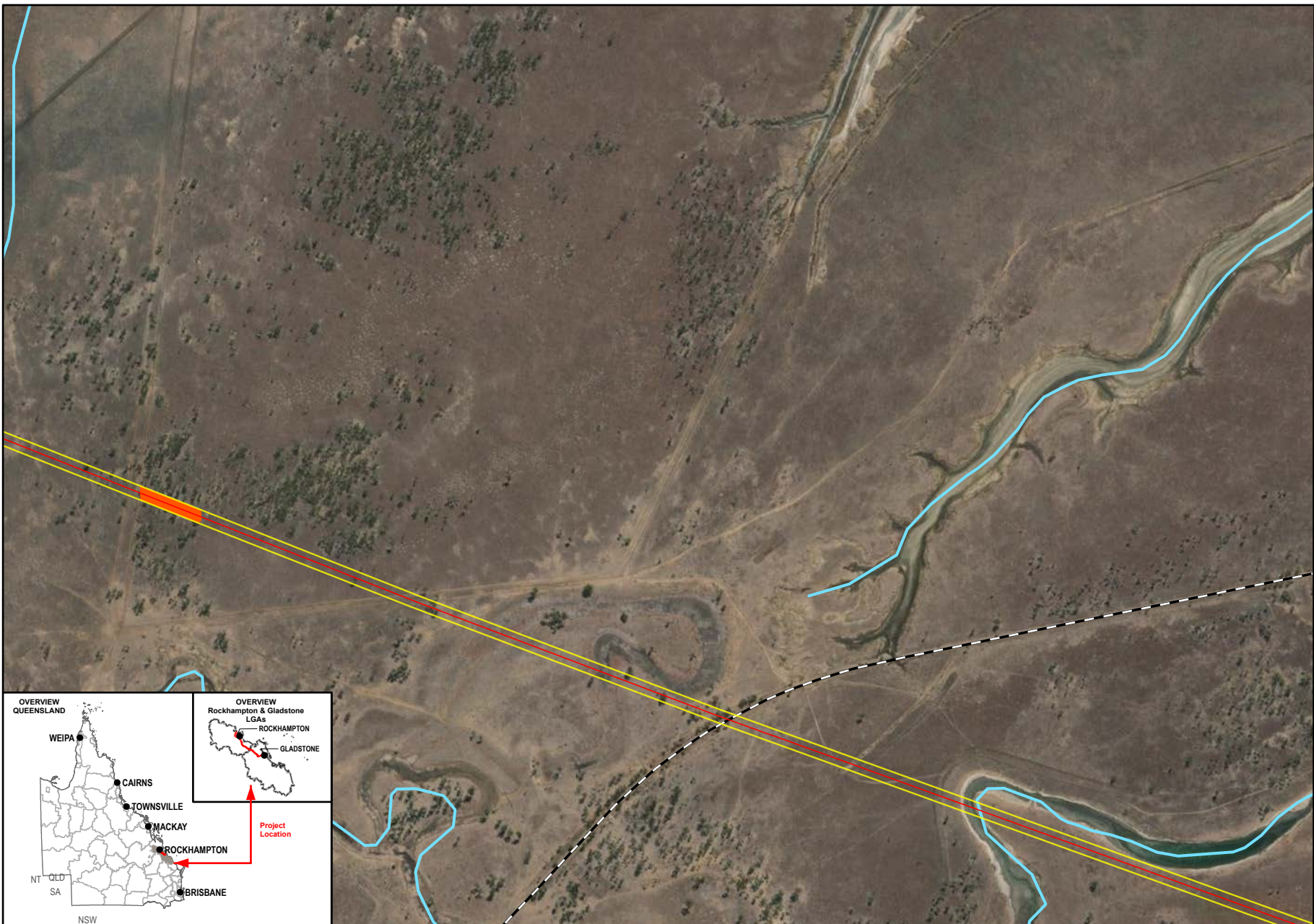
Legend

- GSDA Pipeline Alignment
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- Waterways
- Main Roads
- Railways

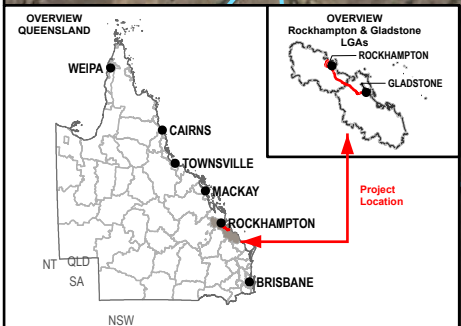
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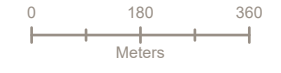
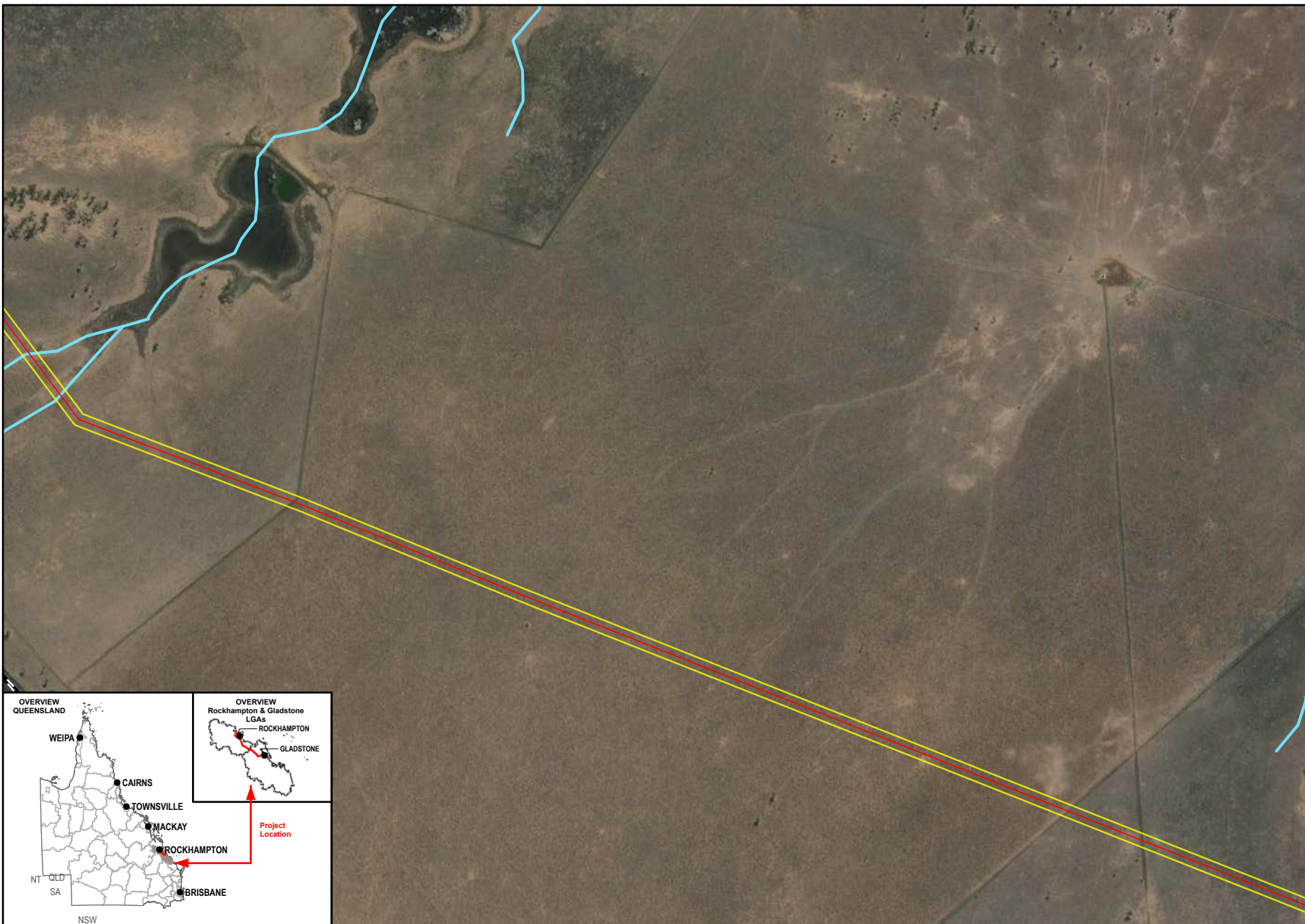
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 - Habitat Type**
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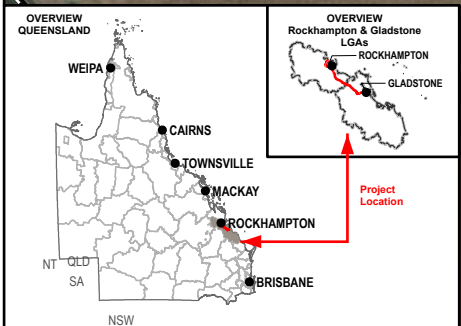
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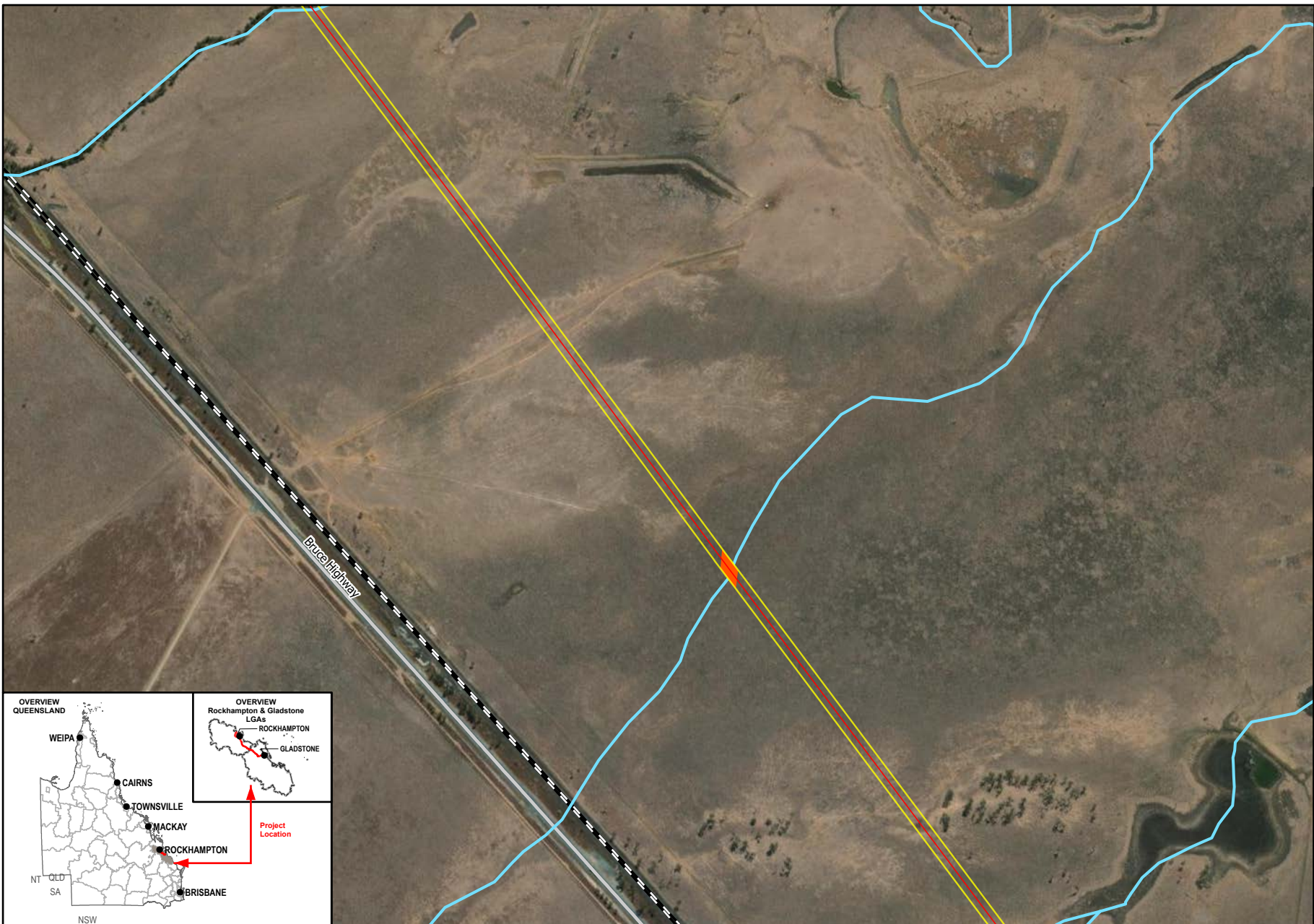
Legend




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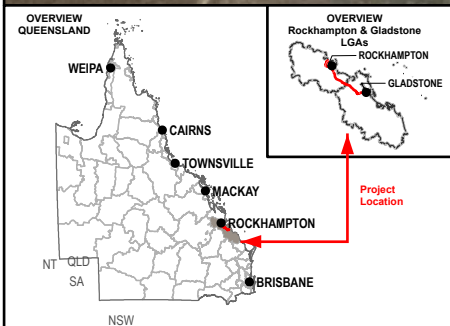

 
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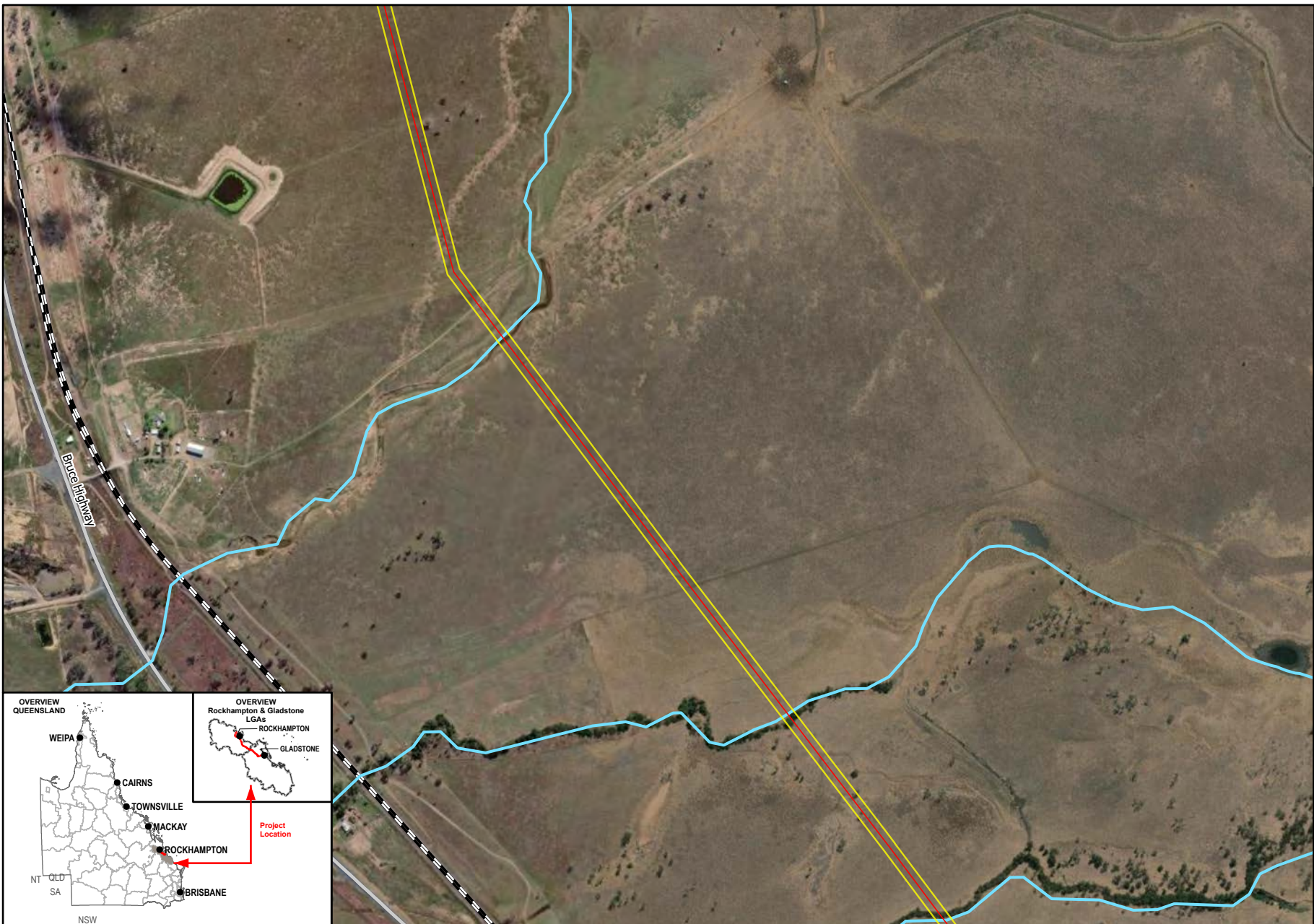
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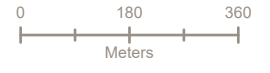
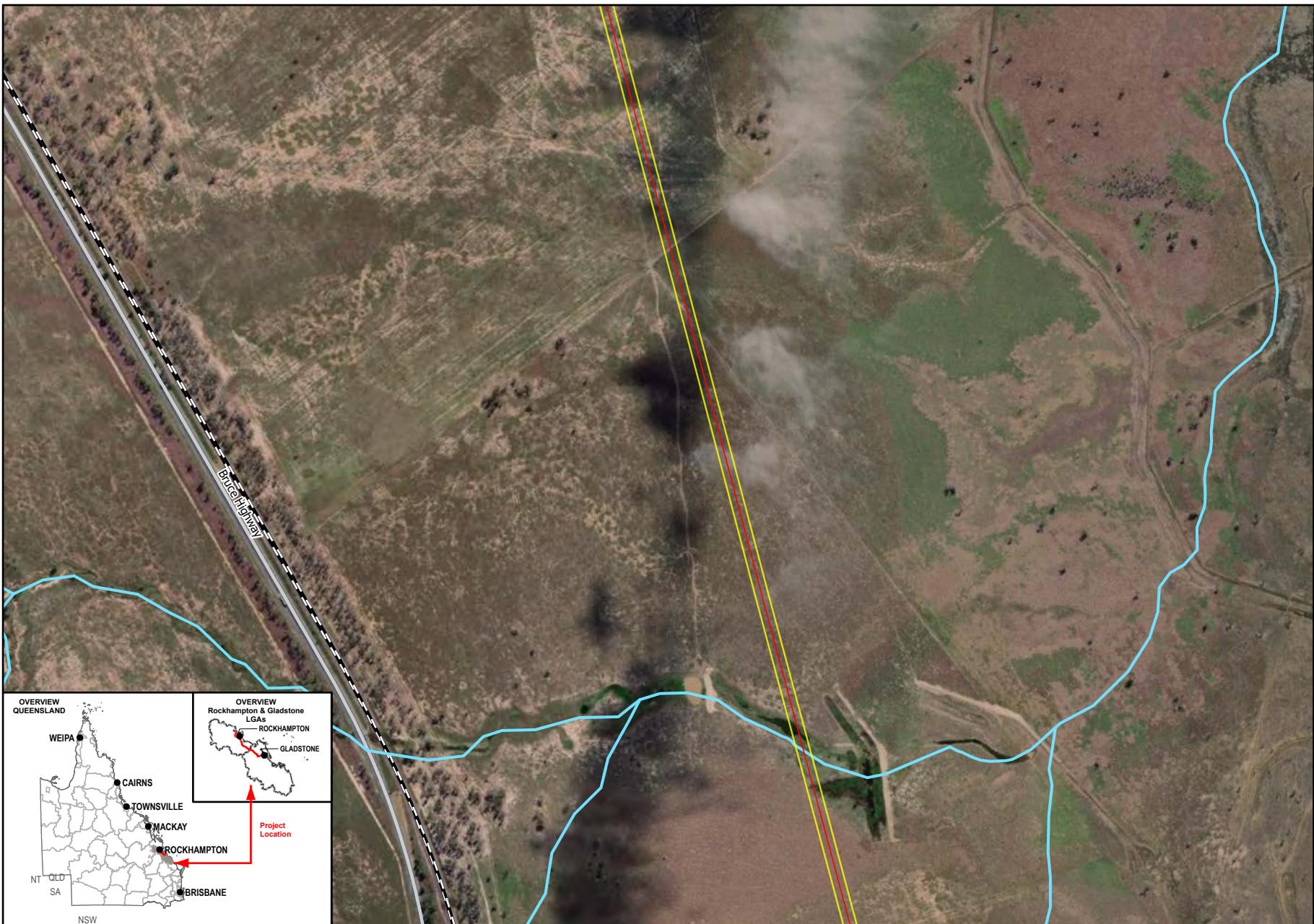
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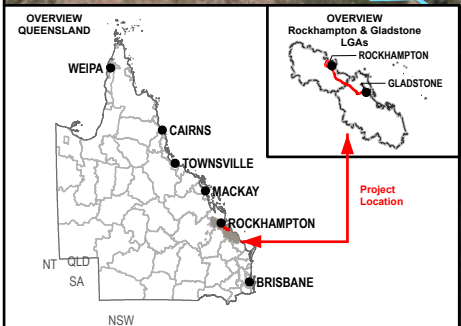
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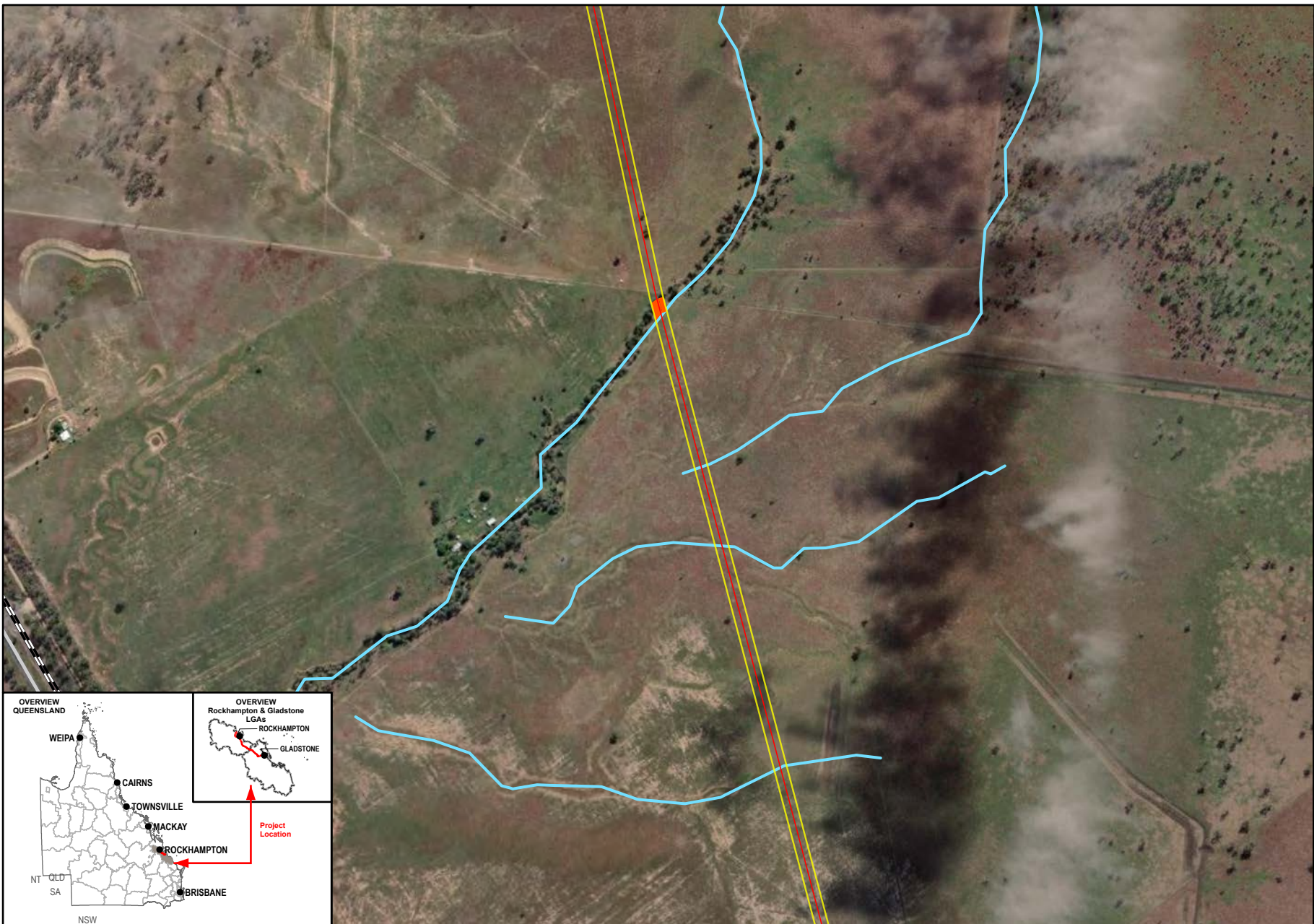
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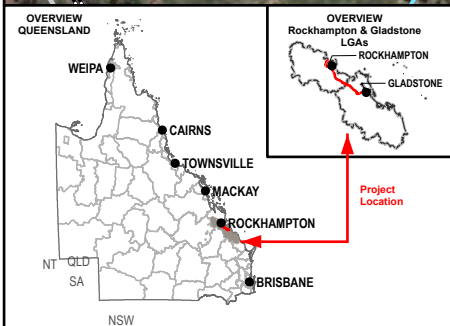
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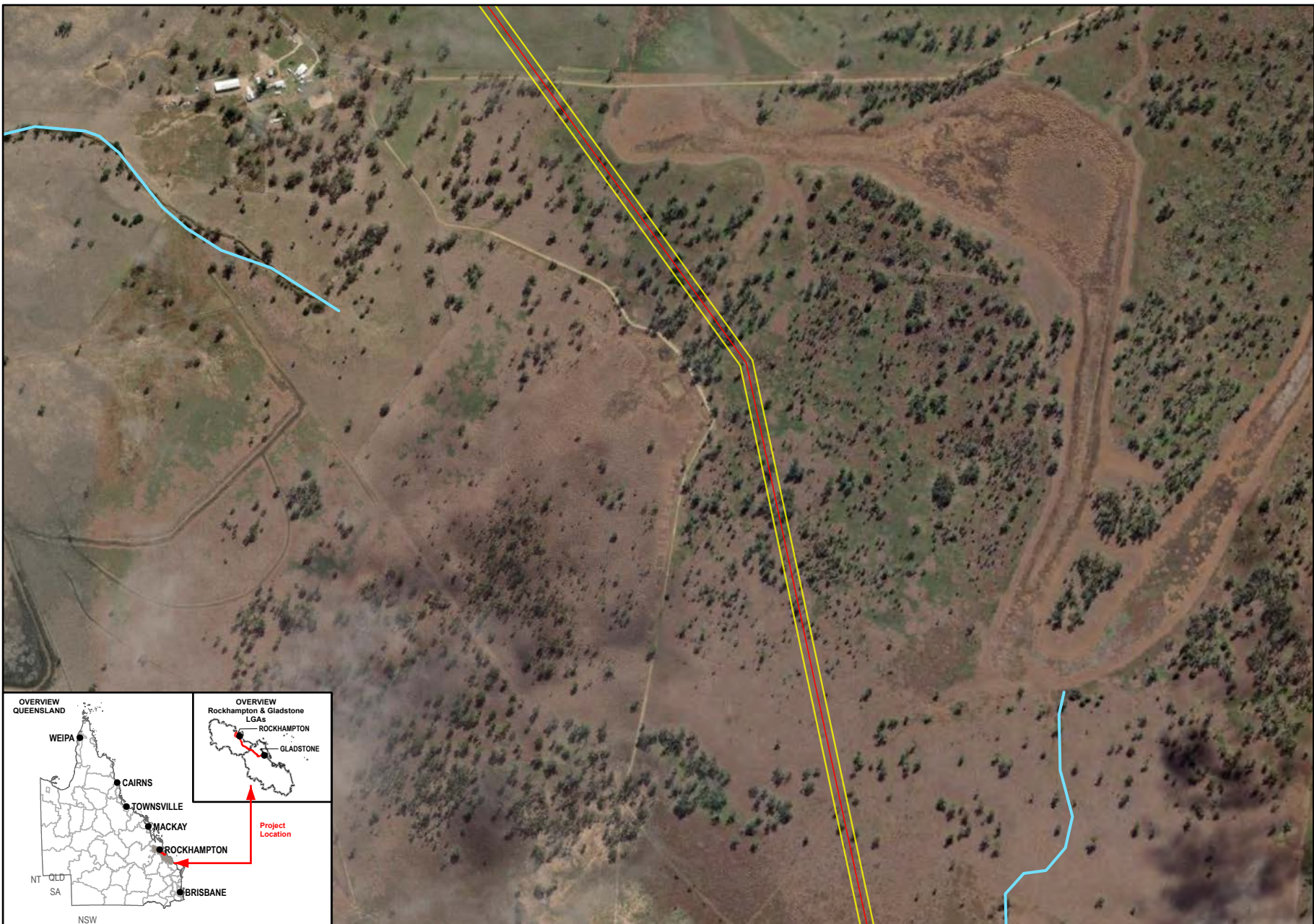
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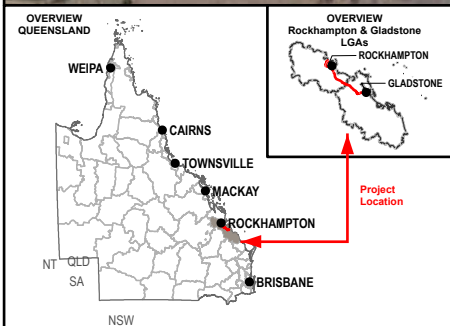
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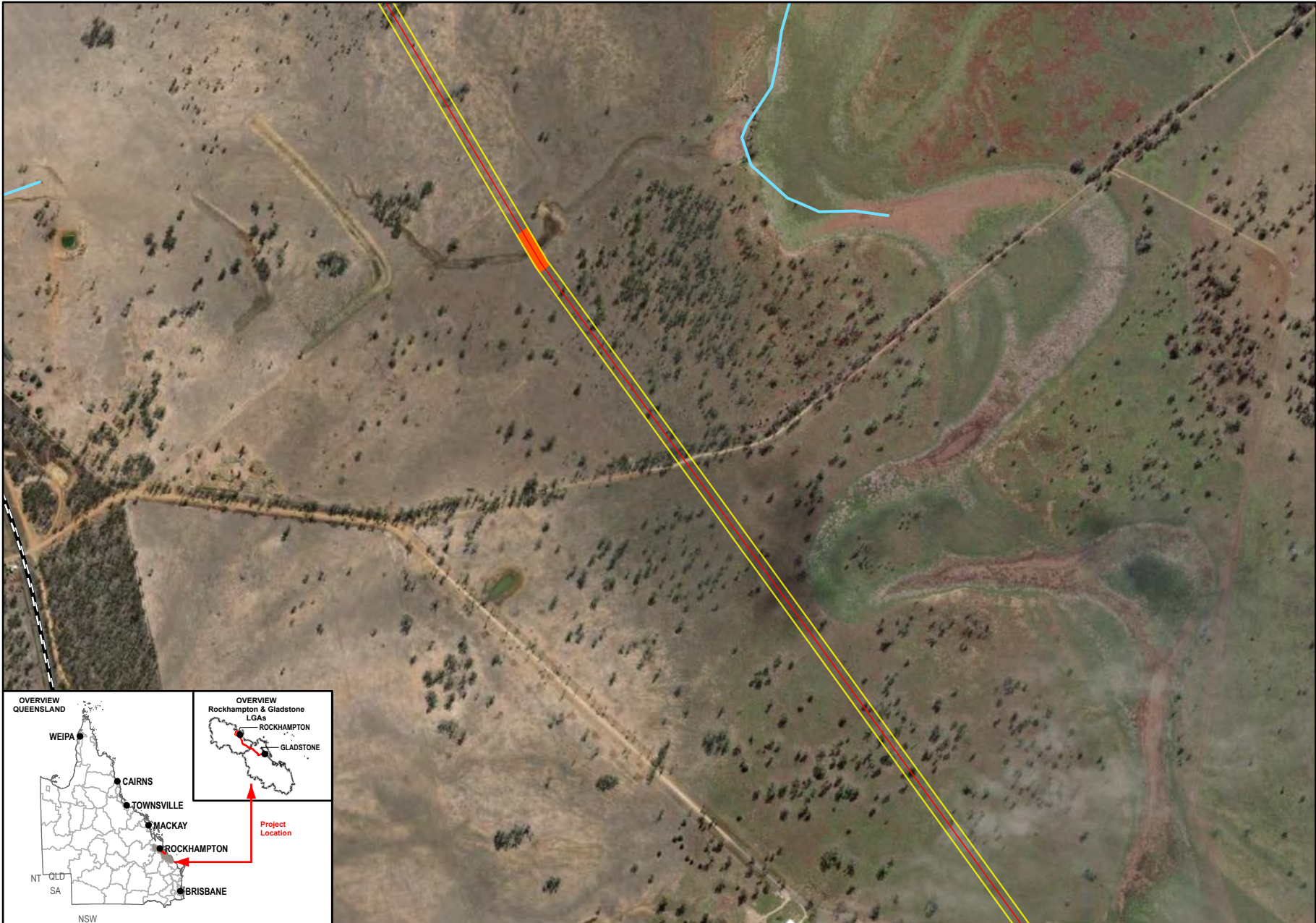
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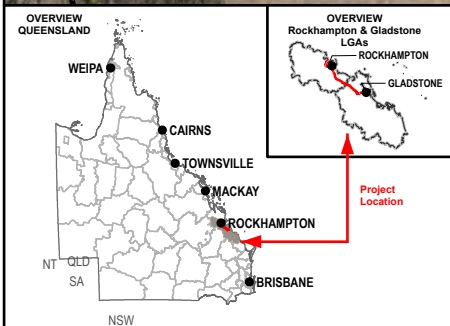
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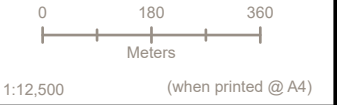
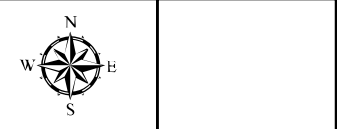
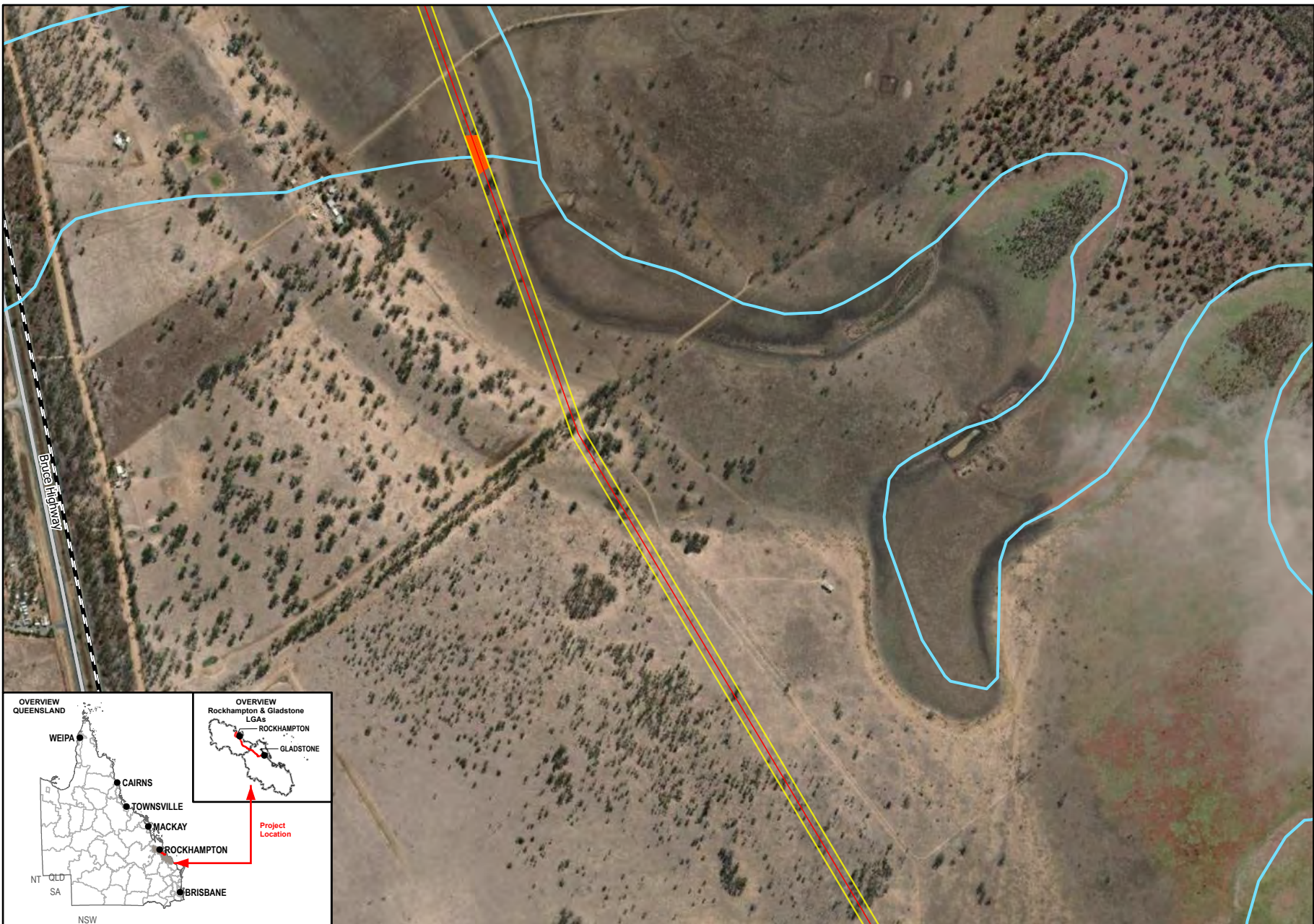
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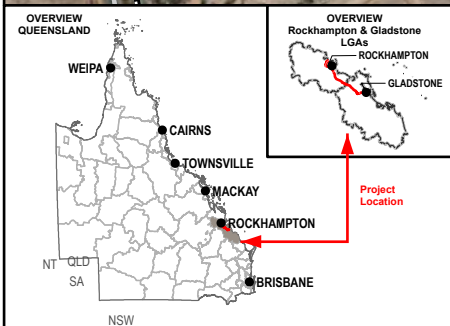


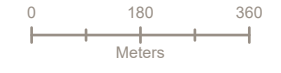
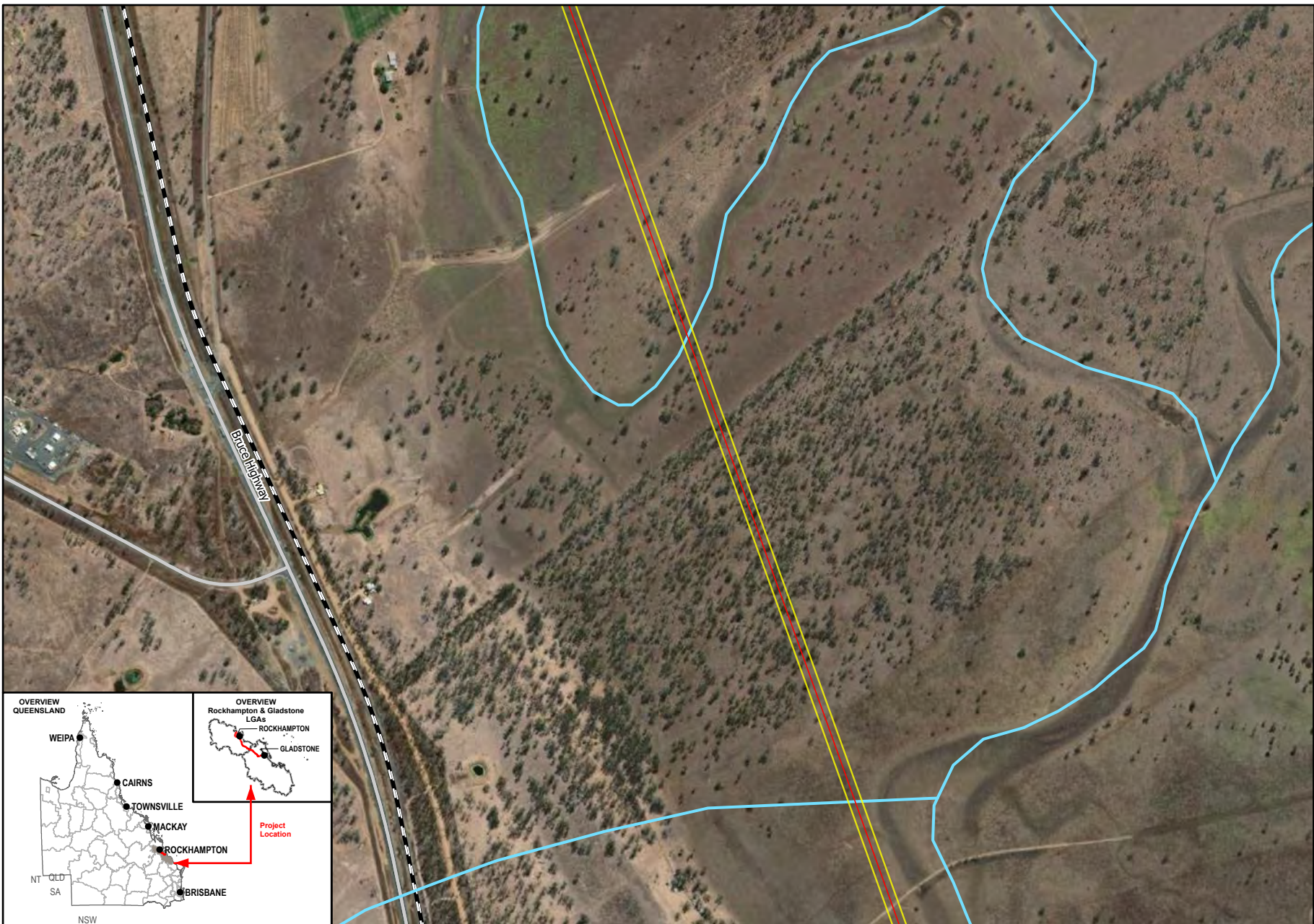
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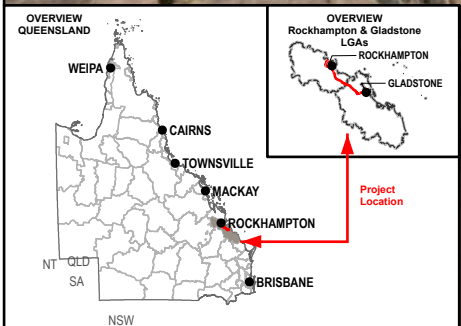
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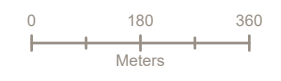
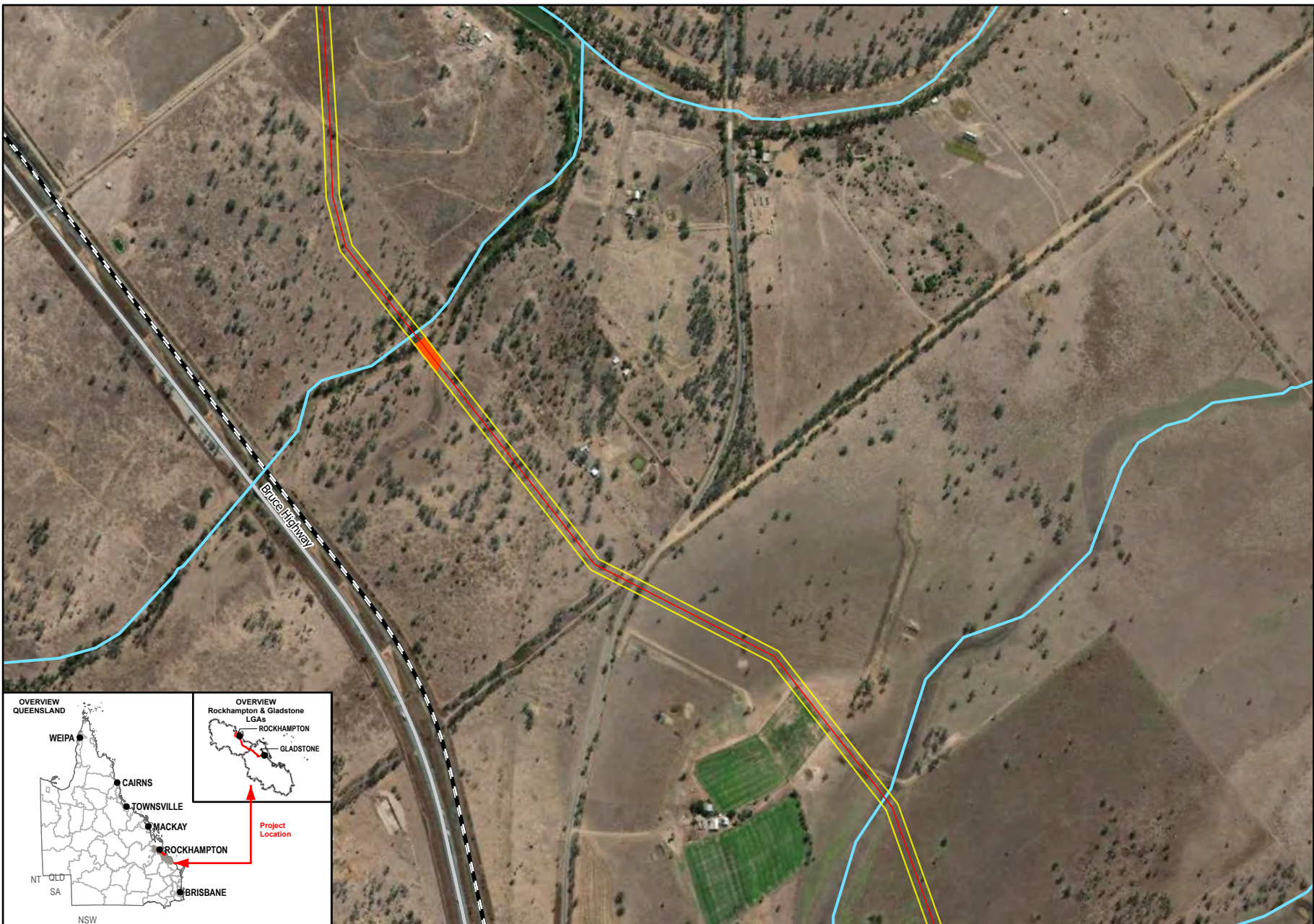
Legend

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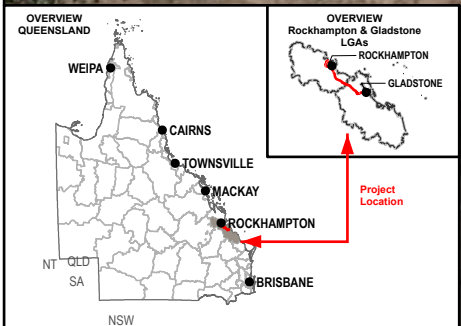




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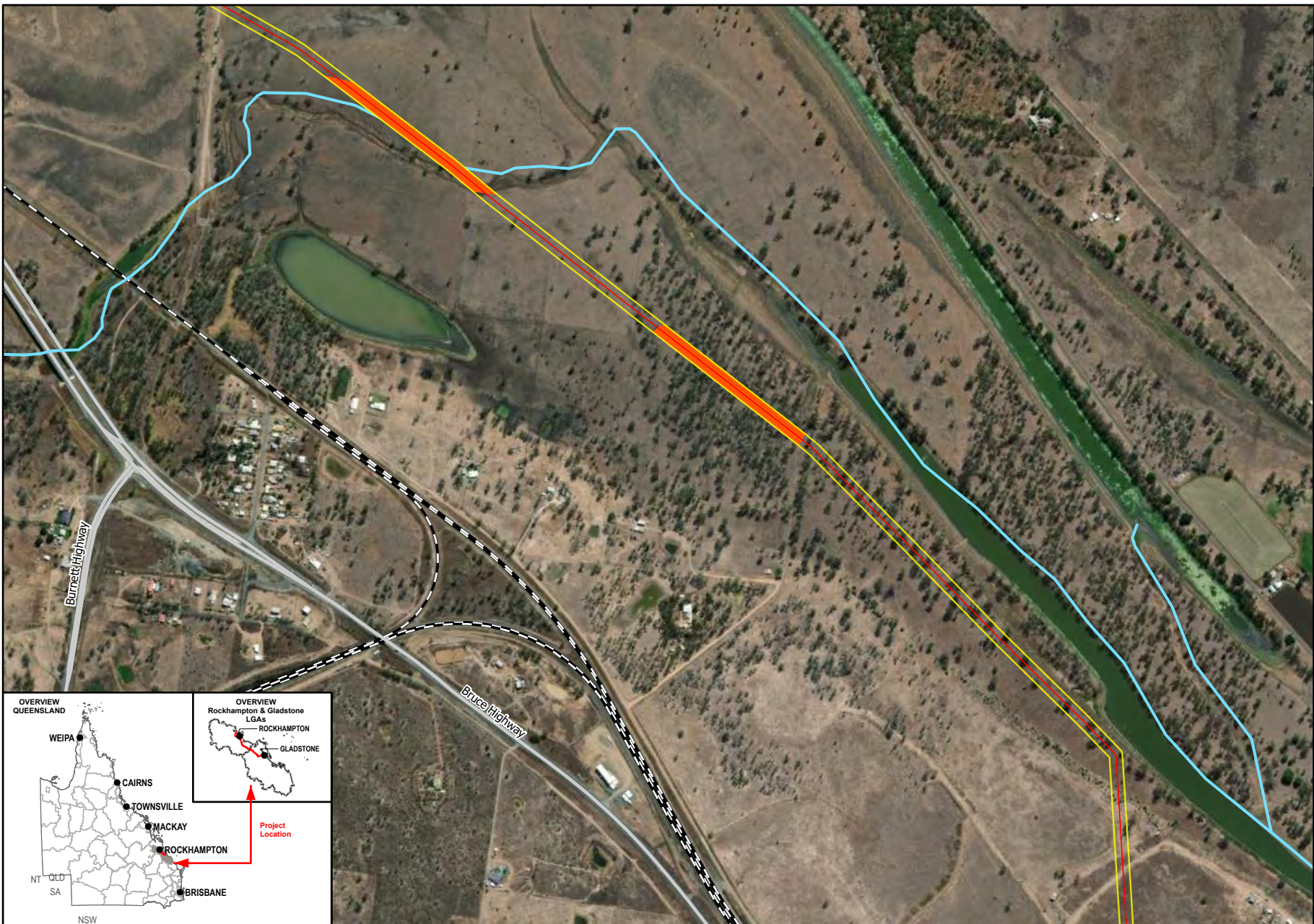
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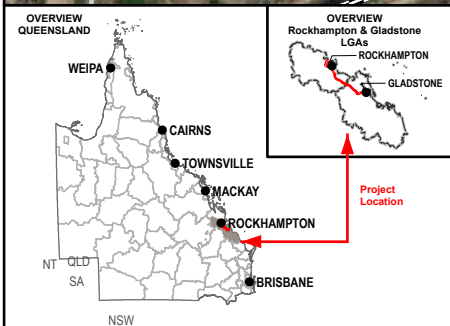
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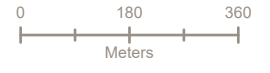
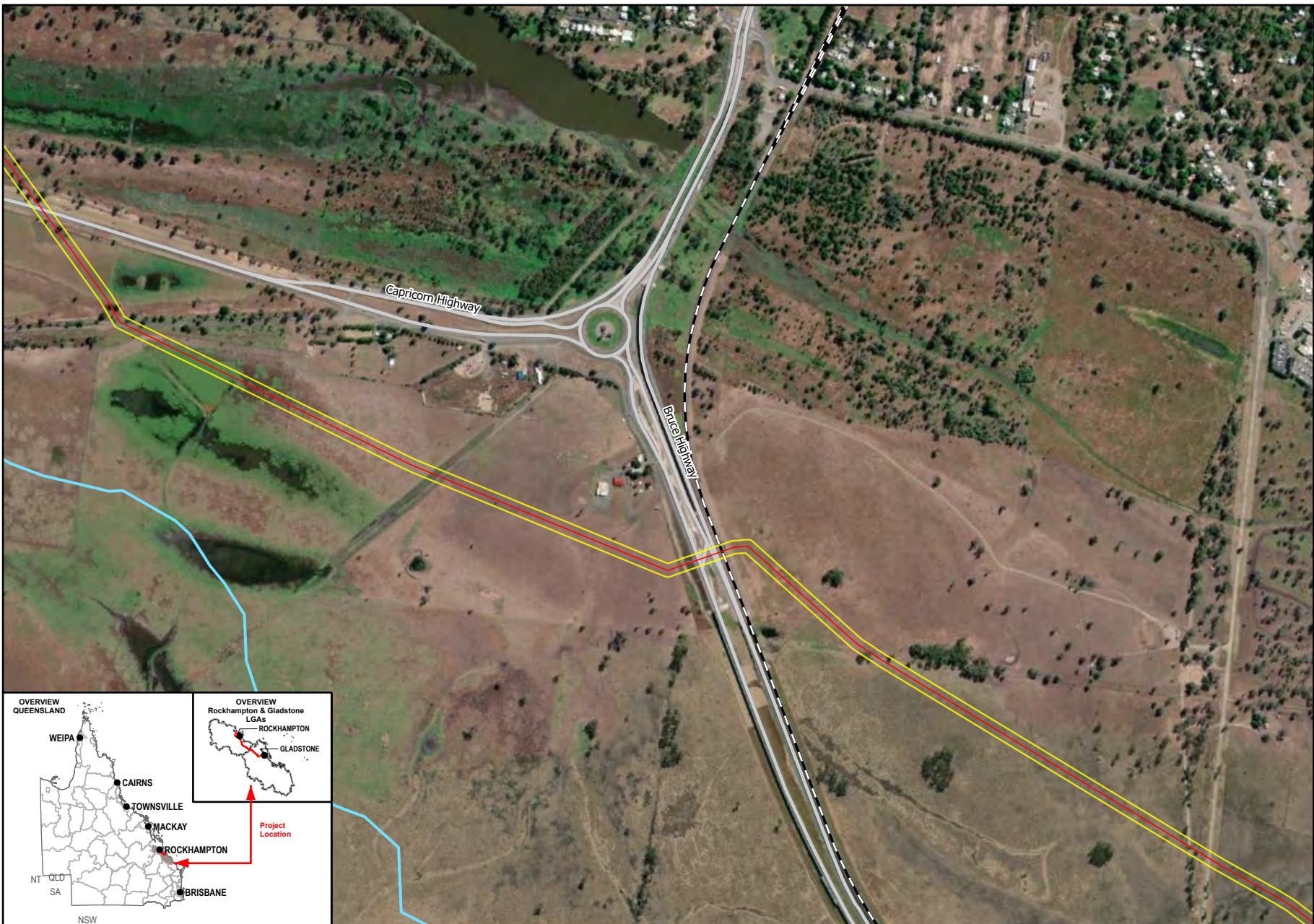
- Legend**
- GSDA Pipeline Alignment
 - Study Area
 - Predicted Squatter Pigeon (Southern) Habitat**
 - Habitat Type**
 - Potential Foraging Habitat
 - Waterways
 - Main Roads
 - Railways

Data Sources:

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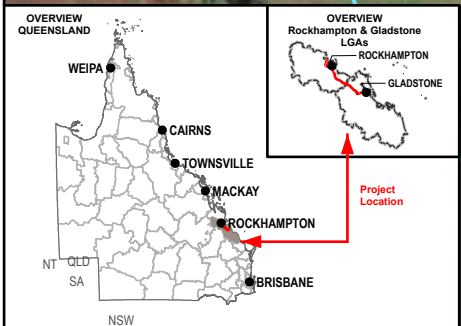




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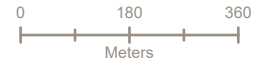
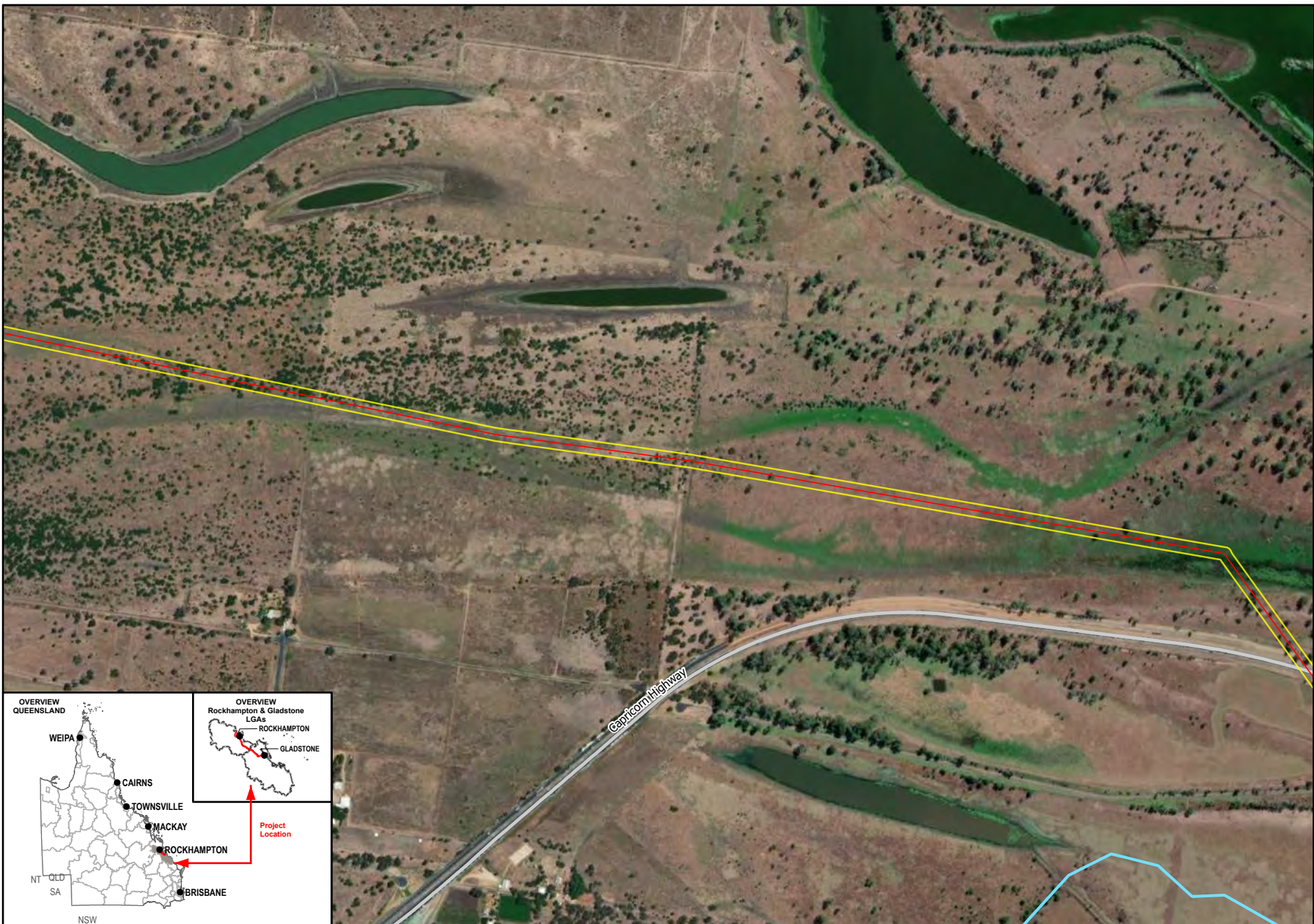
Legend

- GSDA Pipeline Alignment
- Study Area
- Waterways
- Main Roads
- Railways



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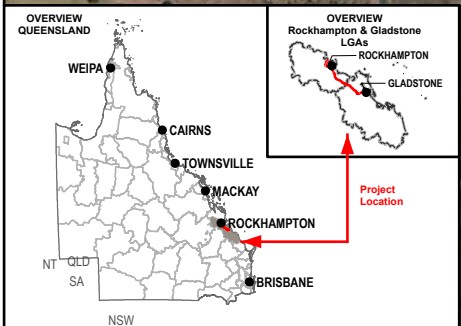
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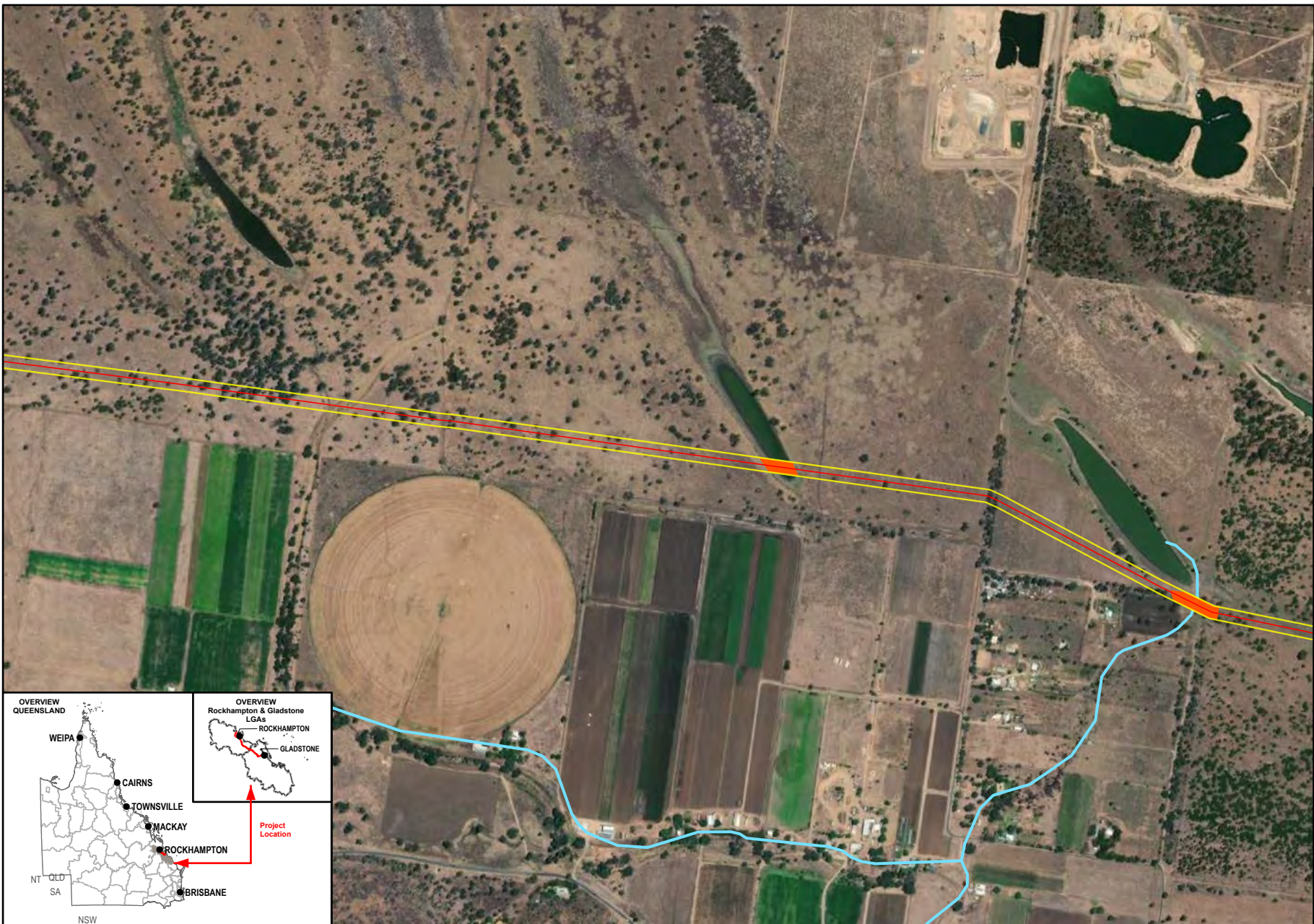
Legend

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- Legend**
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7.2.2.6 Grey snake

Conservation status and species ecology

The grey snake (*Hemiaspis damelii*) is listed as endangered under the NC Act. The species prefers woodland habitat (typically brigalow and belah woodlands), favouring heavier cracking clay soils associated with gullies, ditches and water bodies (Rowland 2012). Within the woodland habitat this species takes shelter in seasonally moist habitat such as in soil cracks, abandoned burrows, or under flood debris, logs and rocks (Rowland 2012). Frogs almost exclusively make up the diet of this species (Rowland 2012). The core distribution of this species within Queensland is in the Brigalow Belt, south of the Great Dividing Range between Glenmorgan and Dalby (Rowland 2012).

Field survey results and distribution of suitable habitat

The species was not recorded during the field surveys within the SGIC SDA study area. However, the species is considered likely to occur due to the presence of suitable habitat (i.e. brigalow woodland) within the SGIC SDA study area. The SGIC SDA pipeline alignment intersects four patches of brigalow woodland, one occurring just south of Inkerman Creek and the other three occurring near Bills Road. The species has been historically recorded at 22 locations within the desktop search extent (10 km buffer), with the closest record approximately 2.7 km from the SGIC SDA pipeline alignment. Suitable habitat for the grey snake was recorded in brigalow woodlands retaining seasonally inundated habitats (i.e. gilgais) within the SGIC SDA study area. These brigalow woodland habitats have been largely cleared for agricultural purposes, which now remain as fragmented, isolated and modified remnants within the SGIC SDA study area and broader landscape. Suitable ground-level microhabitats such as cracking clays, ground logs, woody debris and rocks occurred infrequently within remnant brigalow areas; however, these ground-level microhabitats are very sparse to absent within regrowth brigalow areas, and are heavily altered by intensive agriculture, and cattle grazing and trampling. The distribution of predicted habitat and the location of historical records of the grey snake is mapped in Figure 7-12.

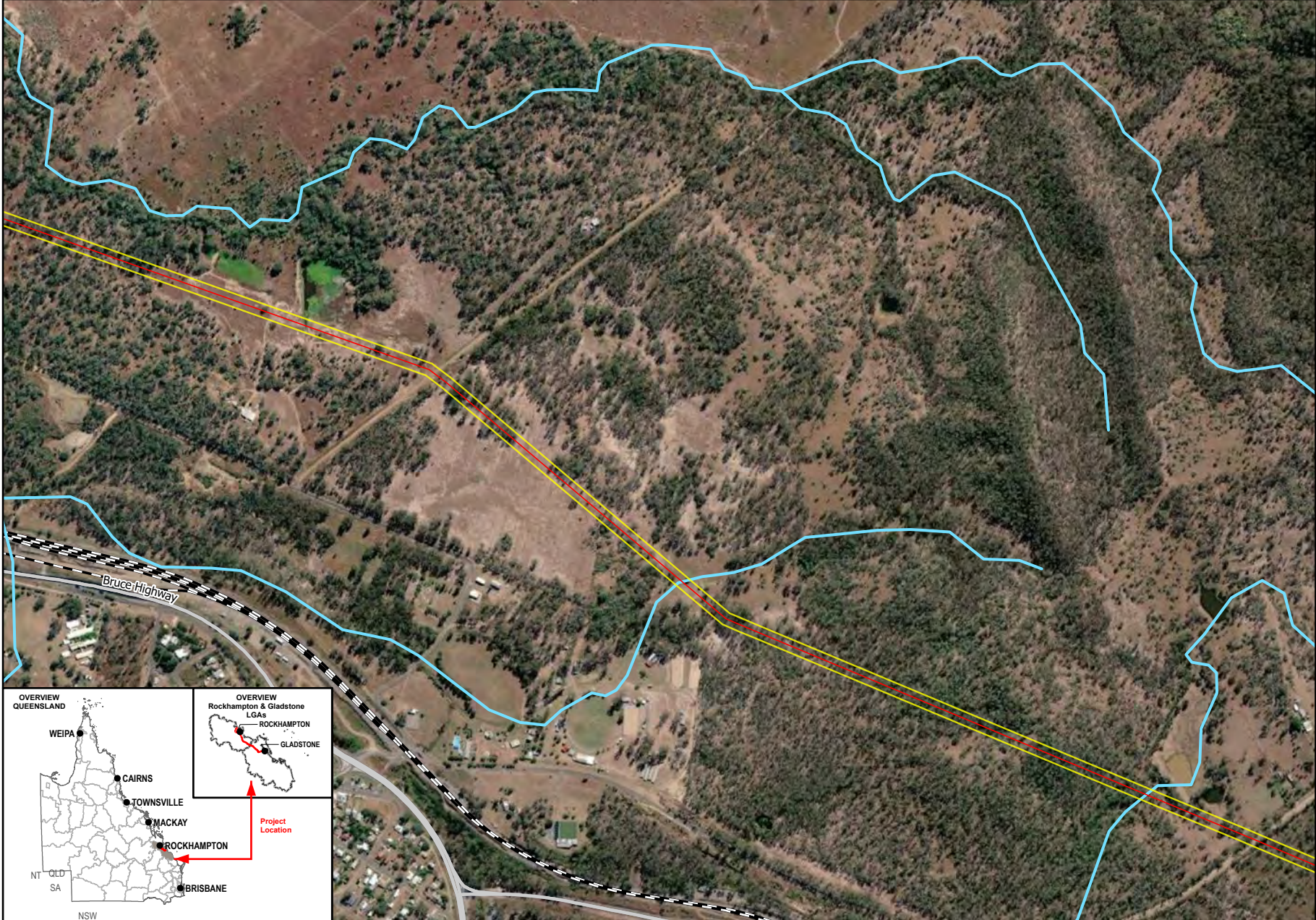
Significance of impact assessment

The project is considered unlikely to result in a significant residual impact on the grey snake. A significance of impact assessment of the project on the grey snake (endangered under the NC Act) is provided in Table 7-24.

Table 7-24 Significance of impact on the grey snake

Significant residual impact criteria	Potential to occur
A long-term decrease in the size of a local population	<p>Unlikely</p> <p>The grey snake has been historically recorded at 22 locations within the desktop search extent (10 km buffer), the closest record is approximately 2.7 km from the SGIC SDA pipeline alignment. The project will result in the clearing of 4.41 ha of predicted habitat for the species, representing 2.00% of habitat available within a 5 km buffer. The species prefers woodland habitats retaining brigalow and belah, on heavier, cracking clay soils, particularly in association with waterbodies or gilgais (Rowland 2012). The SGIC SDA pipeline alignment intersects brigalow woodland retaining seasonally inundated habitats (i.e. gilgais). These areas have been largely cleared for agricultural purposes, which now remain as fragmented, isolated and modified remnants within the SGIC SDA study area and broader landscape. Suitable ground-level microhabitats such as cracking clays, ground logs, woody debris and rocks were recorded infrequently within remnant brigalow areas and were very sparse to absent within regrowth brigalow areas. Due to the lack of suitable ground-level microhabitats within the SGIC SDA study area, these habitats are considered suboptimal habitat for the species. Preclearance surveys will be undertaken to minimise the impact of clearing and reduce the likelihood of fauna mortality during construction. Noting all of the above, the project is not considered to lead to a long-term decrease in the size of the grey snake local population.</p>
Reduce the extent of occurrence of the species	<p>Unlikely</p> <p>The SGIC SDA pipeline alignment intersects 4.41 ha of predicted habitat for the grey snake, representing 2.00% of suitable habitat for the species at a local scale (5 km buffer). The surrounding landscape has been largely cleared and heavily altered by intensive cultivation, and cattle grazing and trampling, with a small proportion of potentially suitable habitat occurring within the SGIC SDA pipeline alignment.</p>

Significant residual impact criteria	Potential to occur
	<p>A maximum width of 30 m will be cleared for construction of the SGIC SDA pipeline alignment. Suitable ground-level microhabitats such as ground logs, woody debris and rocks are to be retained during the construction works and to be placed on the SGIC SDA pipeline alignment after the pipeline has been installed and buried. Regardless, the localised impacts experienced through loss of habitat or direct collision mortality is unlikely to result in a localised reduction in the extent of occurrence of the species, especially noting the definition of extent of occurrence per the Queensland <i>Significant Residual Impact Guideline</i> (DEHP 2014b): <i>Extent of occurrence is defined as the area contained within the shortest continuous imaginary boundary which can be drawn to encompass all the known, inferred or projected sites of present occurrence of a taxon,</i></p>
Fragment an existing population	<p>Unlikely</p> <p>The grey snake has been historically recorded at 22 locations within the desktop search extent (10 km buffer). The closest record occurs approximately 2.7 km west of the SGIC SDA pipeline alignment. This record is located within a patch of brigalow woodland just south of Inkerman Creek. This patch of vegetation is largely fragmented from vegetation occurring within the SGIC SDA study area. The magnitude of impact is unlikely to present a permanent barrier to movement. The maximum width of clearing required for construction of the SGIC SDA pipeline alignment is 30 m. Once the pipeline has been installed and buried, a maximum width of 10 m will be permanently cleared with the remaining 20 m to be rehabilitated. Construction activities will be planned to minimise the period of time the trench is open and the length of open trench. Where the trench remains open overnight or for extended length, the ends of the trench left open will be ramped to a gentle include (< 50%) to allow fauna to escape and sawdust filled hessian bags (shelter sites) will be placed at regular intervals. If mitigation measures are implemented correctly, the project is unlikely to fragment the existing local population.</p>
Result in genetically distinct populations forming as a result of habitat isolation	<p>Unlikely</p> <p>As detailed above, the species' capacity to move locally is unlikely to be limited by any localised land clearing or trenching necessary to construct the SGIC SDA pipeline alignment. As a result, the project is not considered to cause any form of genetic isolation at a population level.</p>
Result in invasive species that are harmful to a endangered species becoming established in the endangered species' habitat	<p>Unlikely</p> <p>As this species feeds almost exclusively on frogs, the grey snake is considered to be at risk from lethal ingestion of cane toads (Phillips <i>et al.</i> 2003). Cane toads are already known to occur within the SGIC SDA study area, and the project works are unlikely to exacerbate the risks. The project is therefore expected to have negligible impact on the species due to the influence of cane toads or other pest species.</p>
Introduce disease that may cause the population to decline	<p>Unlikely</p> <p>There are no known diseases that could be introduced by the construction or operation of the project.</p>
Interfere with the recovery of the species	<p>Unlikely</p> <p>The project is unlikely to interfere substantially with the recovery of the species. The impacts of the SGIC SDA pipeline alignment are expected to be relatively benign, as the project is expected to remove 4.41 ha of suboptimal habitat due to the moderately low abundance of ground-level microhabitats occurring within the SGIC SDA study area.</p> <p>The risk of individual mortality or injury during construction will be addressed via the mitigation measures in the CEMP and the use of an experienced fauna spotter-catcher during clearing and grading, and to undertake open trench inspections along the SGIC SDA pipeline alignment and relocate any encountered species.</p>
Result in disruption to ecologically significant locations (breeding, feeding or nesting sites) of a species	<p>Unlikely</p> <p>Due to the operational and logistic constraints associated with undertaking construction during the wet season, works will take place in dry season months (where practicable) and therefore avoid the species' peak period of breeding and foraging activity (i.e. the wet season). Through spatial and temporal avoidance, the project is expected to have minimal impact on breeding cycles and feeding resources of the grey snake.</p>
Conclusion	<p>The project is unlikely to result in a significant residual impact on the grey snake. The project will result in a small loss (4.41 ha) of potentially suitable foraging and breeding habitat for the grey snake; however, given suitable habitat will persist within the area immediately adjacent to the SGIC SDA pipeline alignment, clearing a 30 m wide corridor for the SGIC SDA pipeline alignment is not expected to impact the species. An experienced fauna spotter-catcher is to be present during clearing and grading, and to undertake open trench inspections along the SGIC SDA pipeline alignment and relocate any encountered individuals.</p>



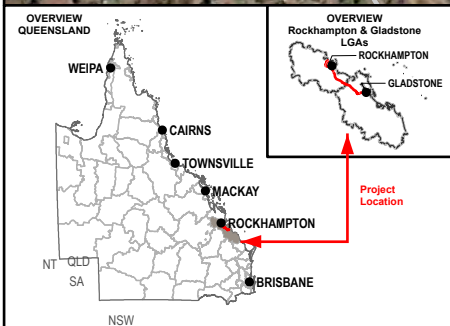
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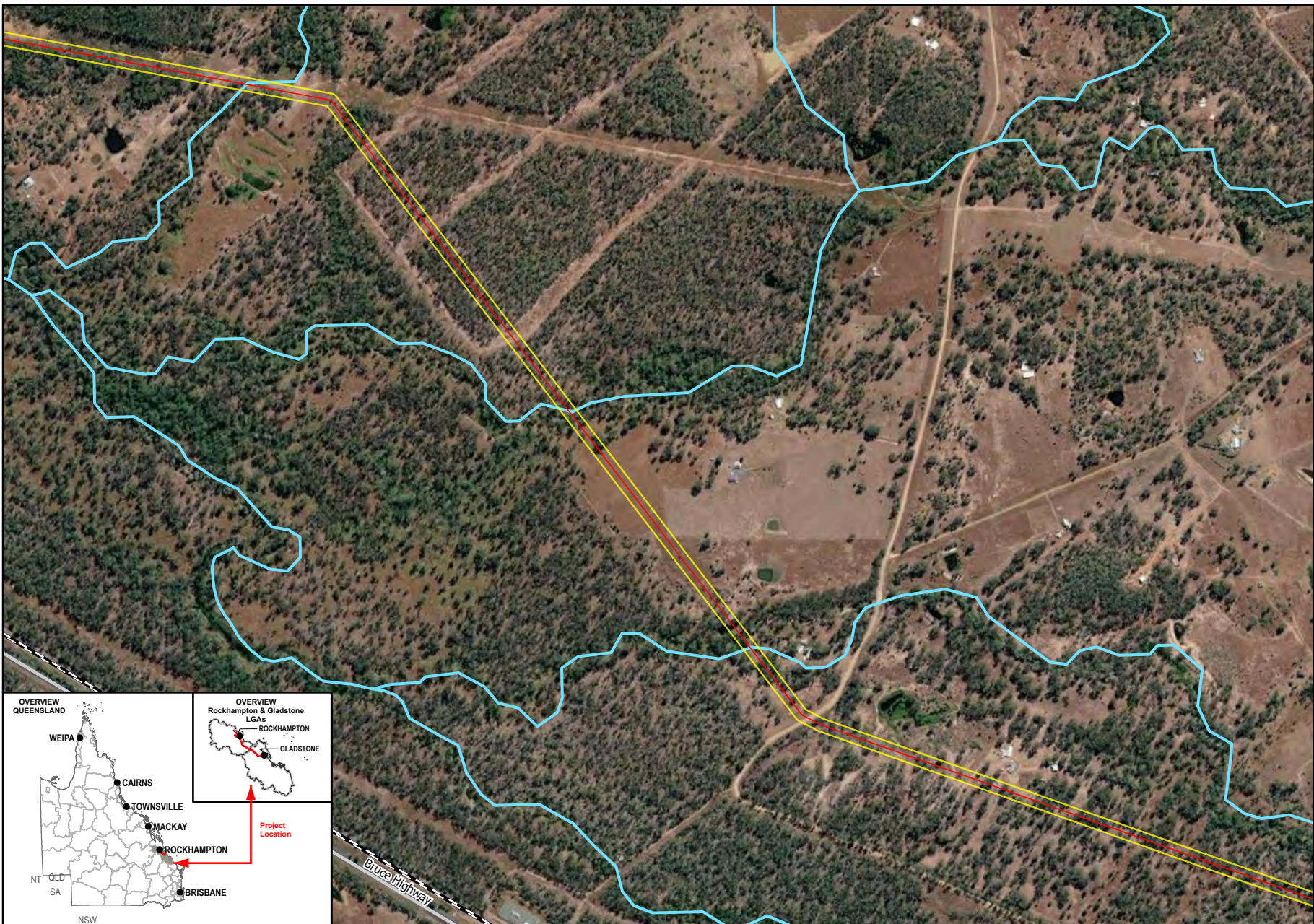
- Legend**
- SGIC SDA Pipeline Alignment
 - Study Area
 - Waterways
 - Main Roads
 - Railways




Data Sources:


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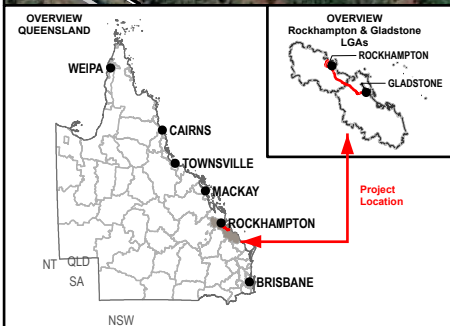
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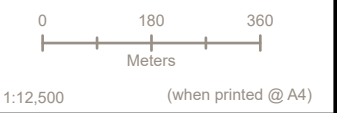
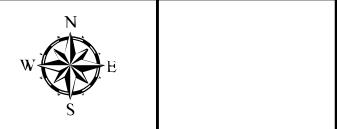
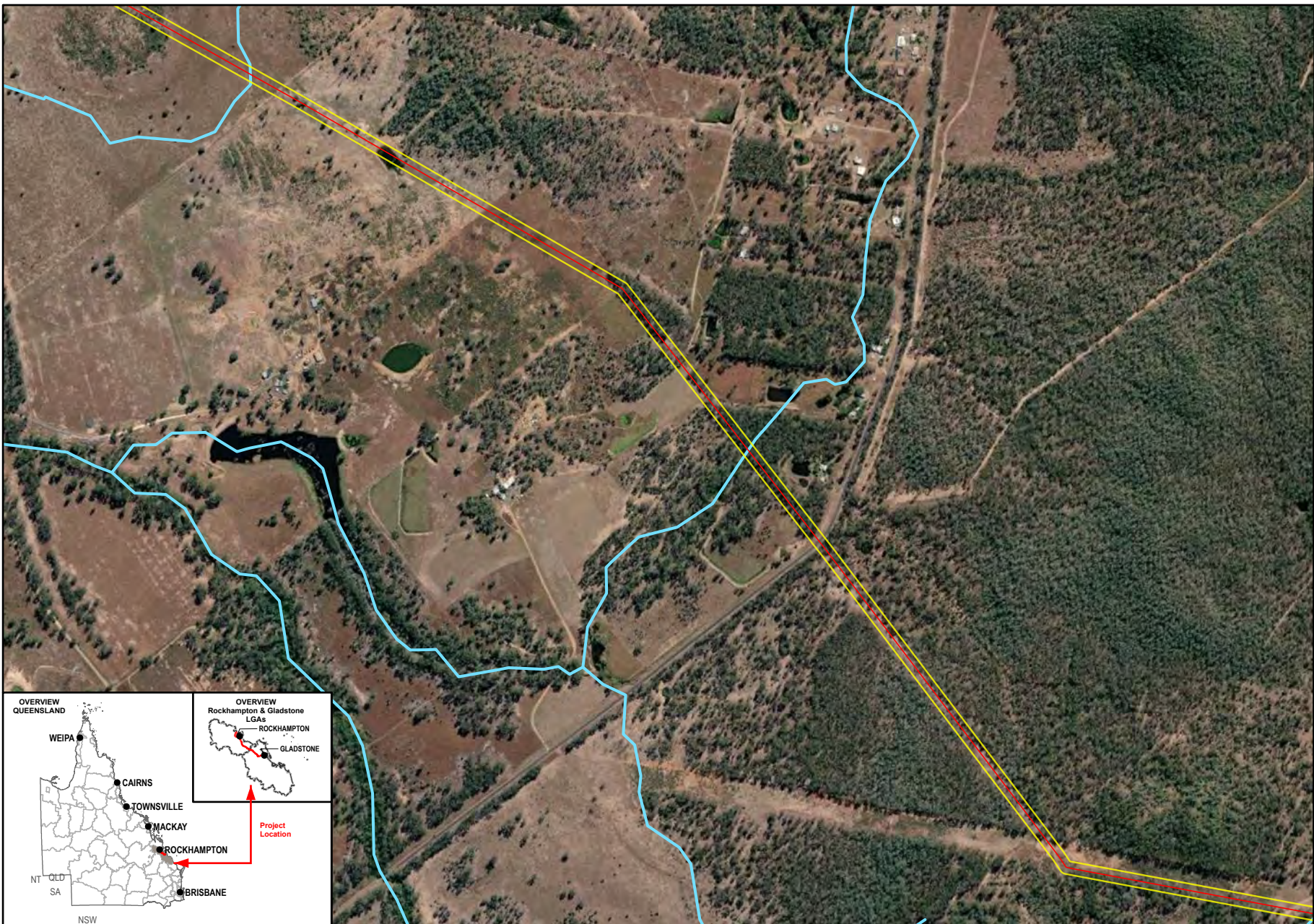
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 - Main Roads
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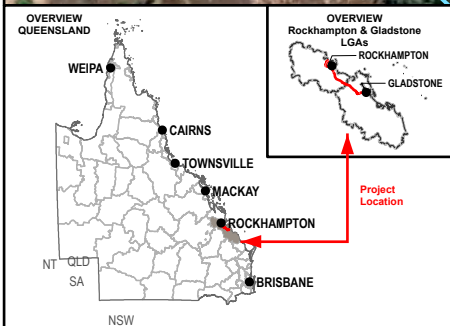
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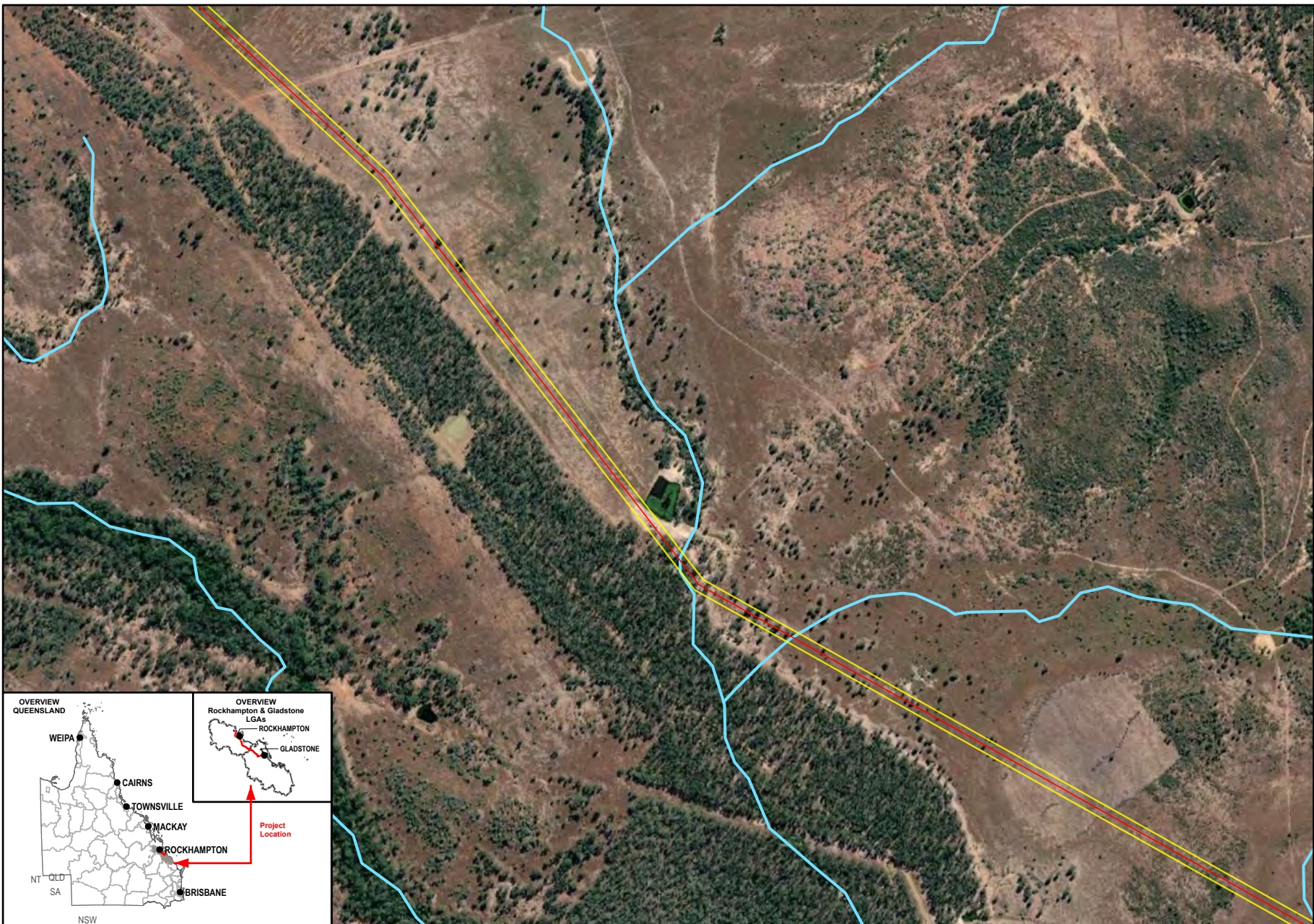
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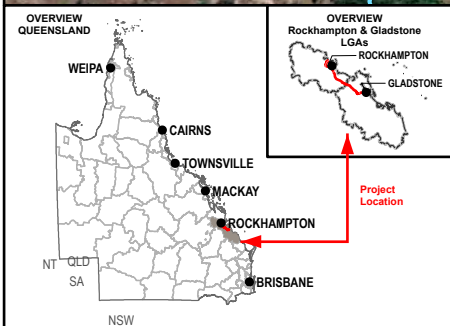
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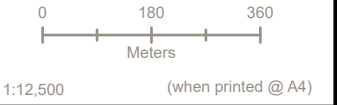
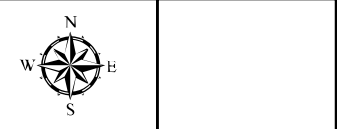
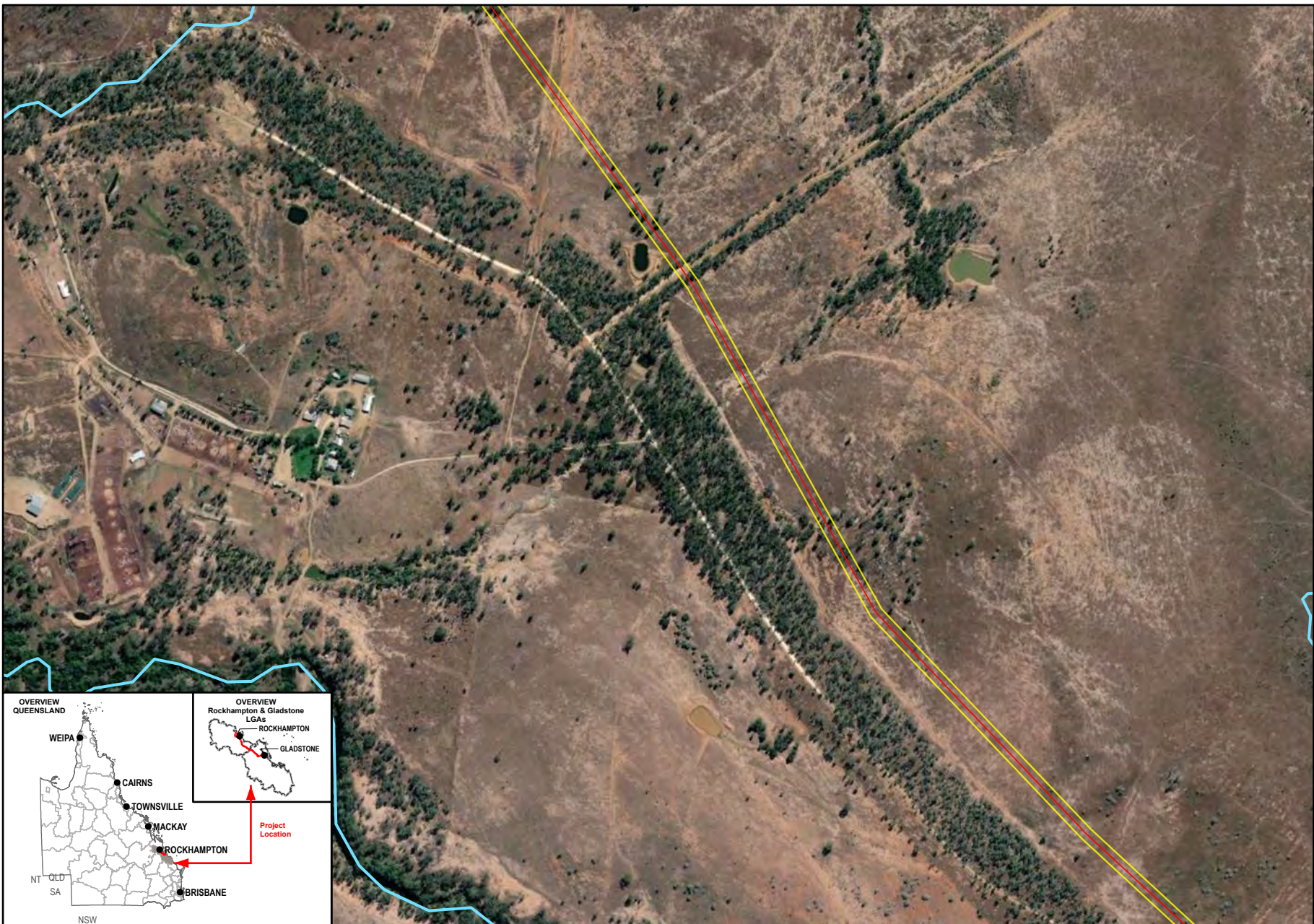
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 - Study Area
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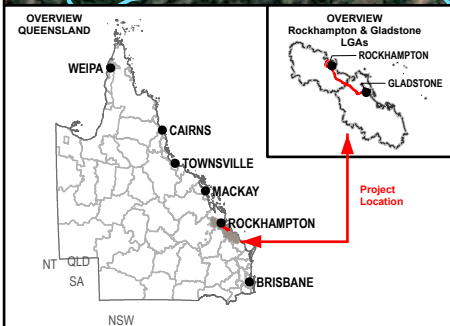
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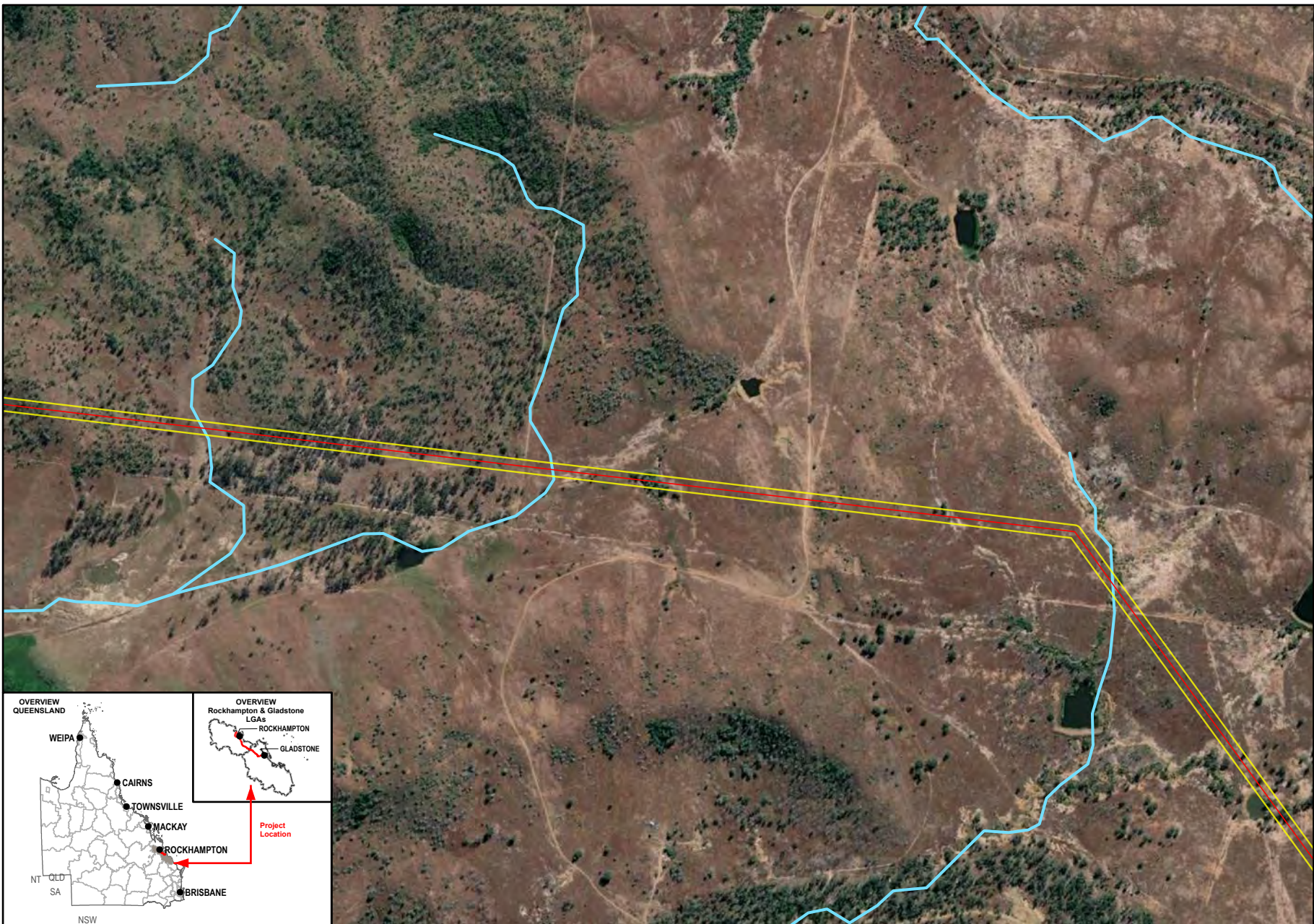
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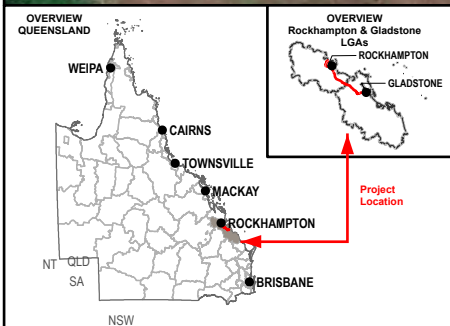
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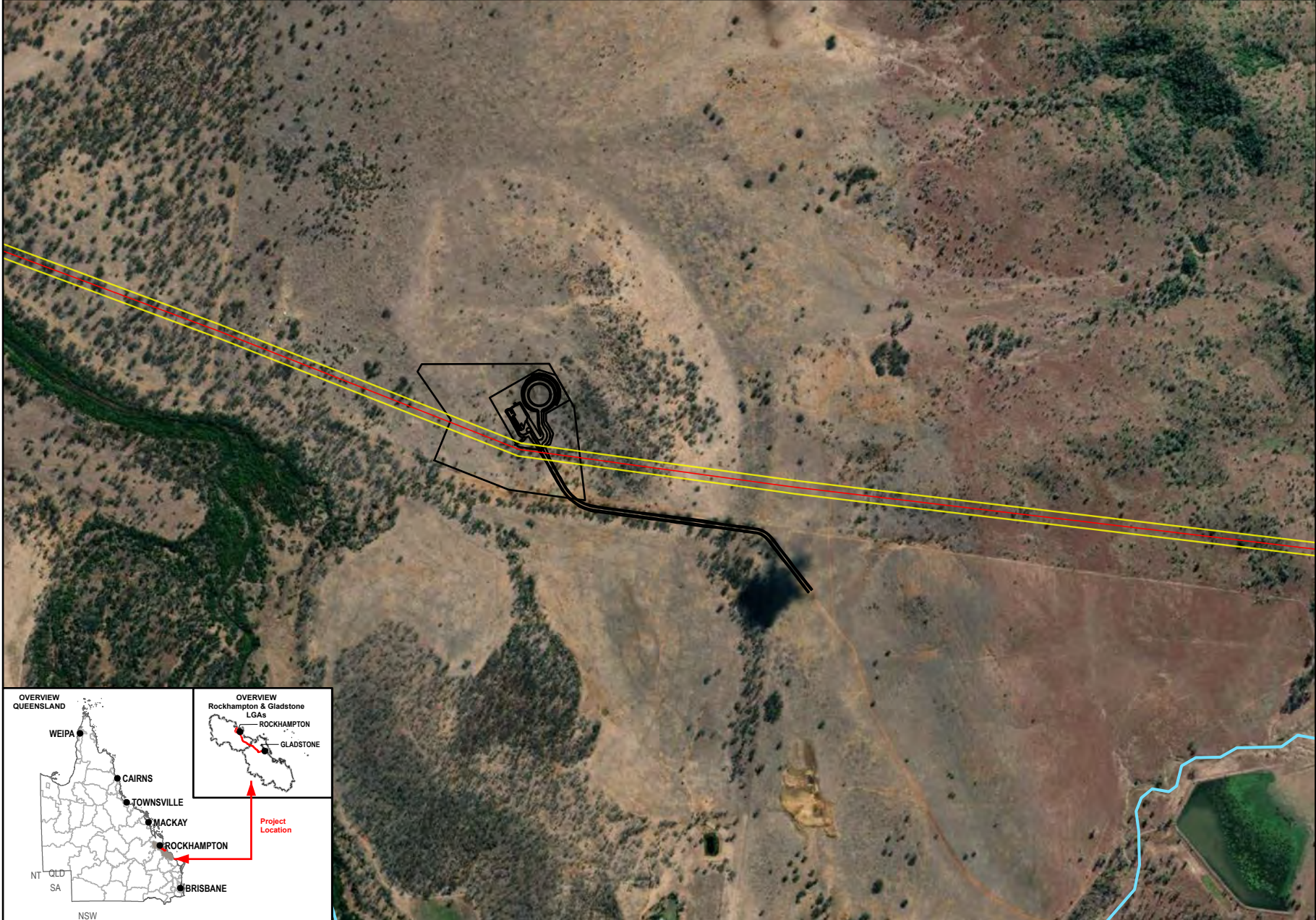
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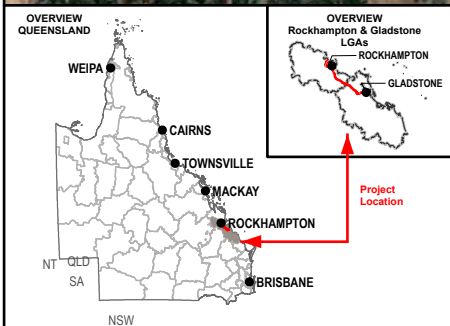
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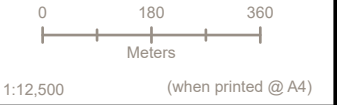
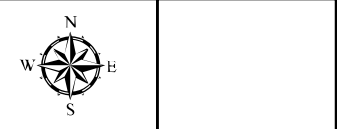
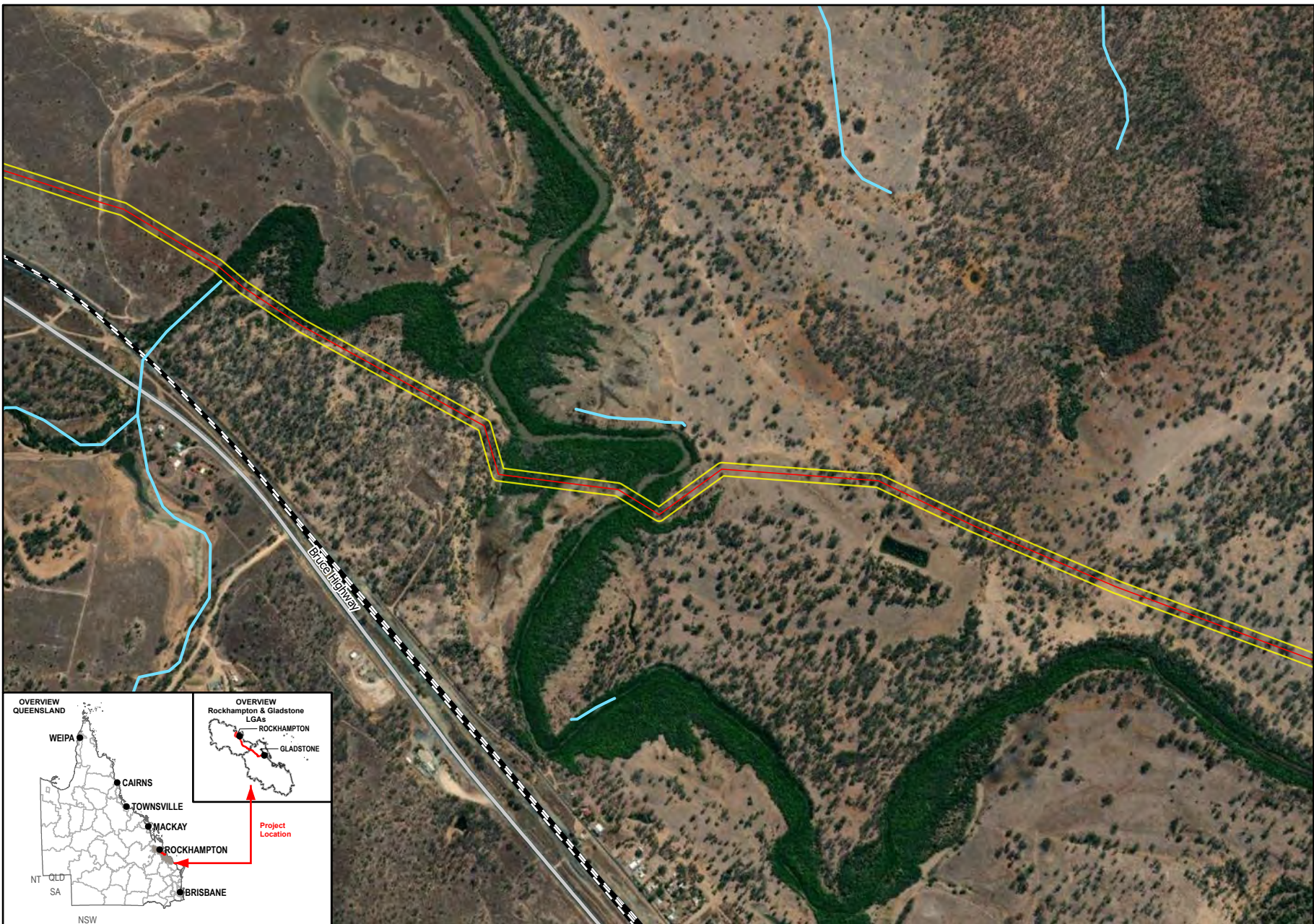
- Legend**
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 - Study Area
 - Raglan Pump Station and Reservoir Layout
 - Waterways

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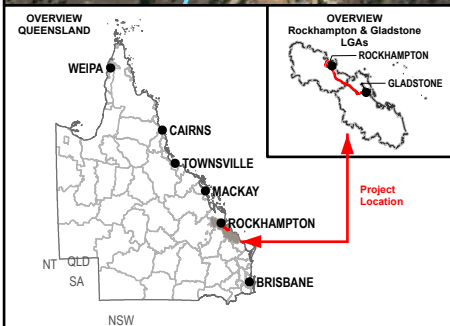
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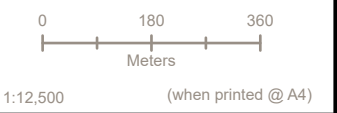
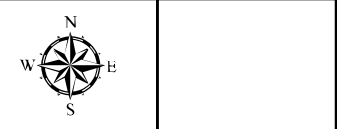
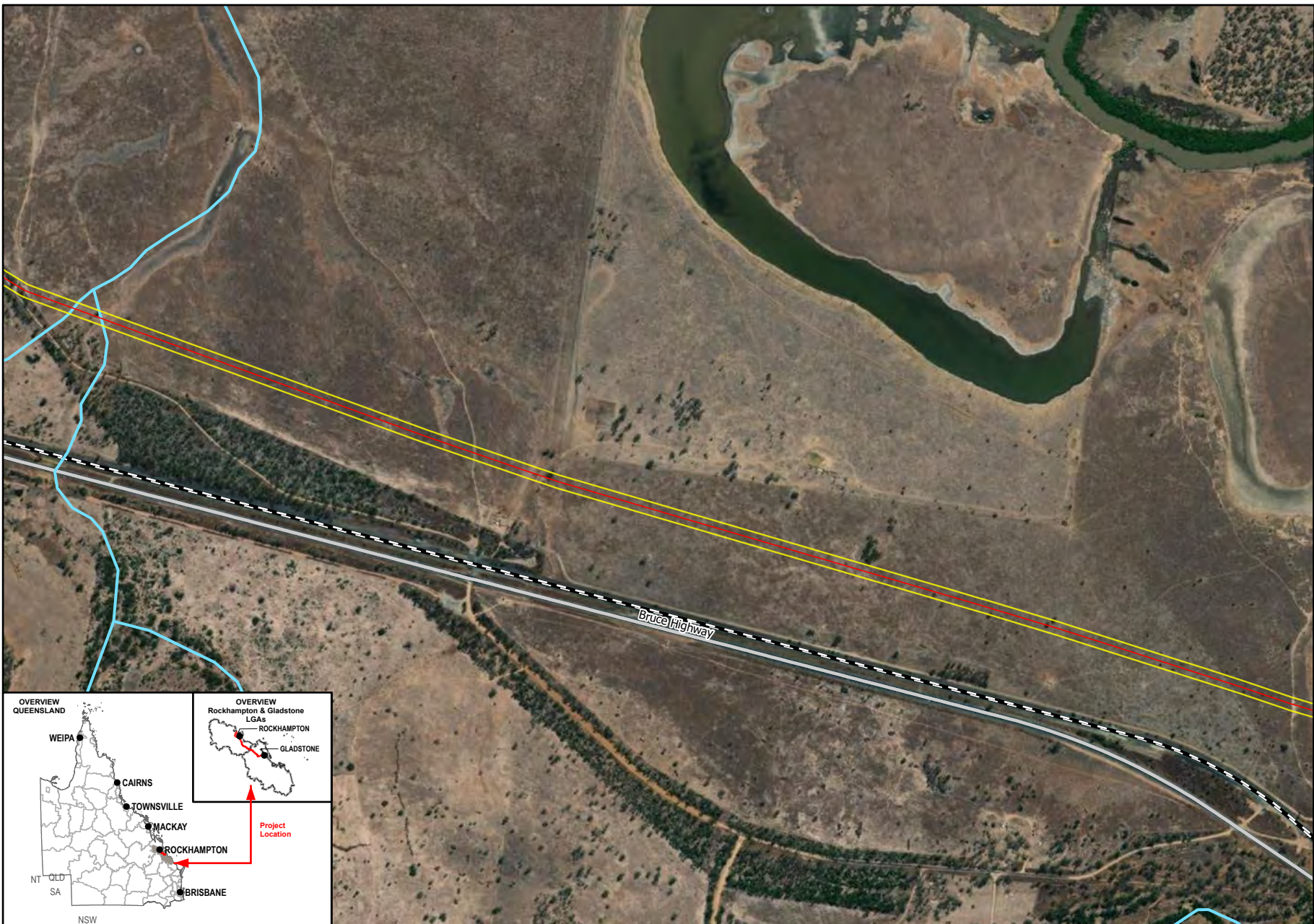
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 - Main Roads
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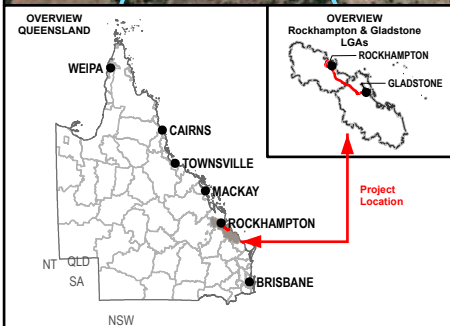
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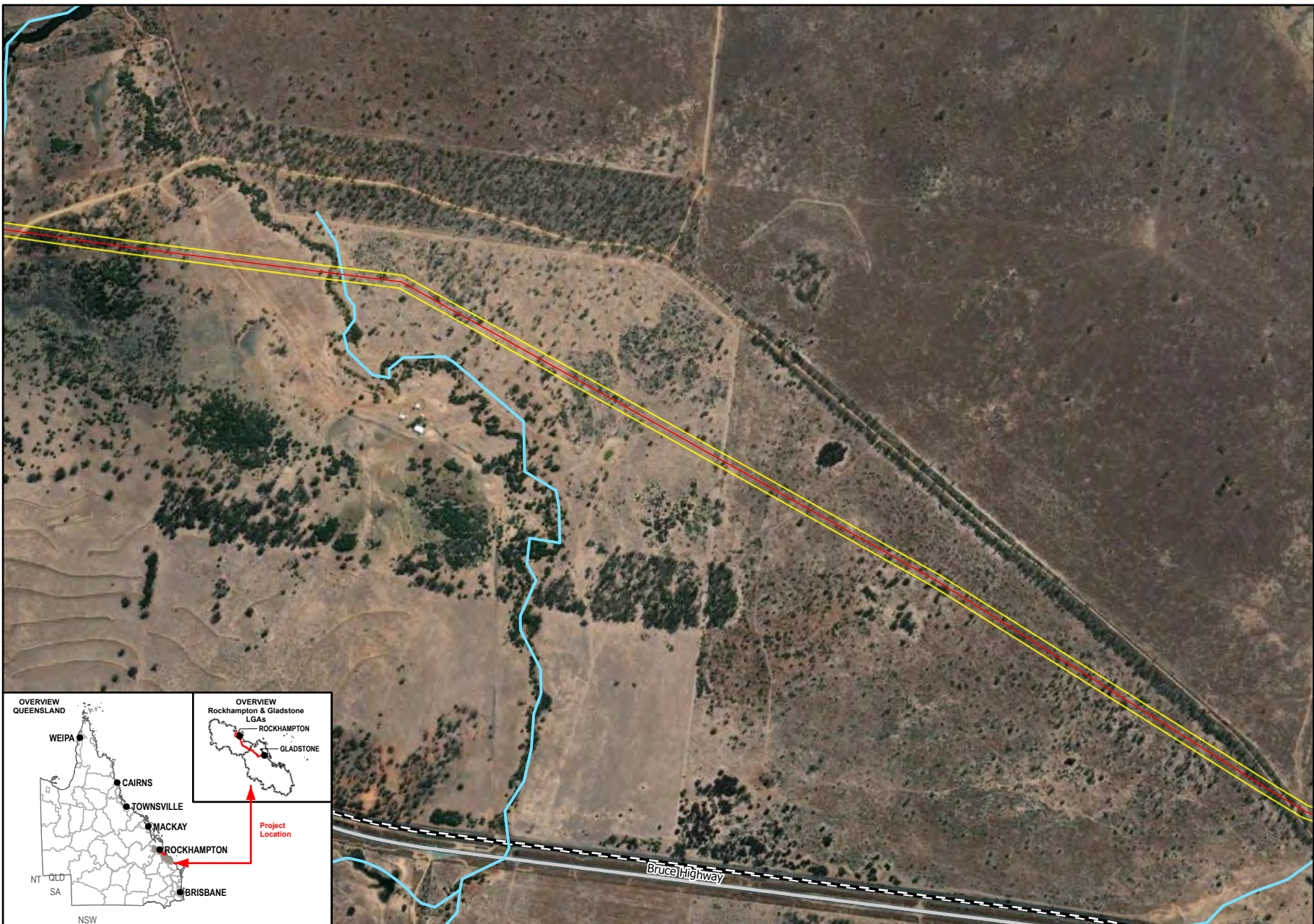
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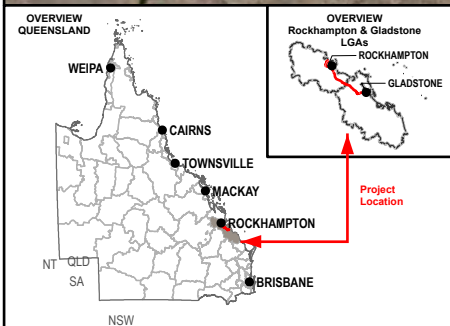
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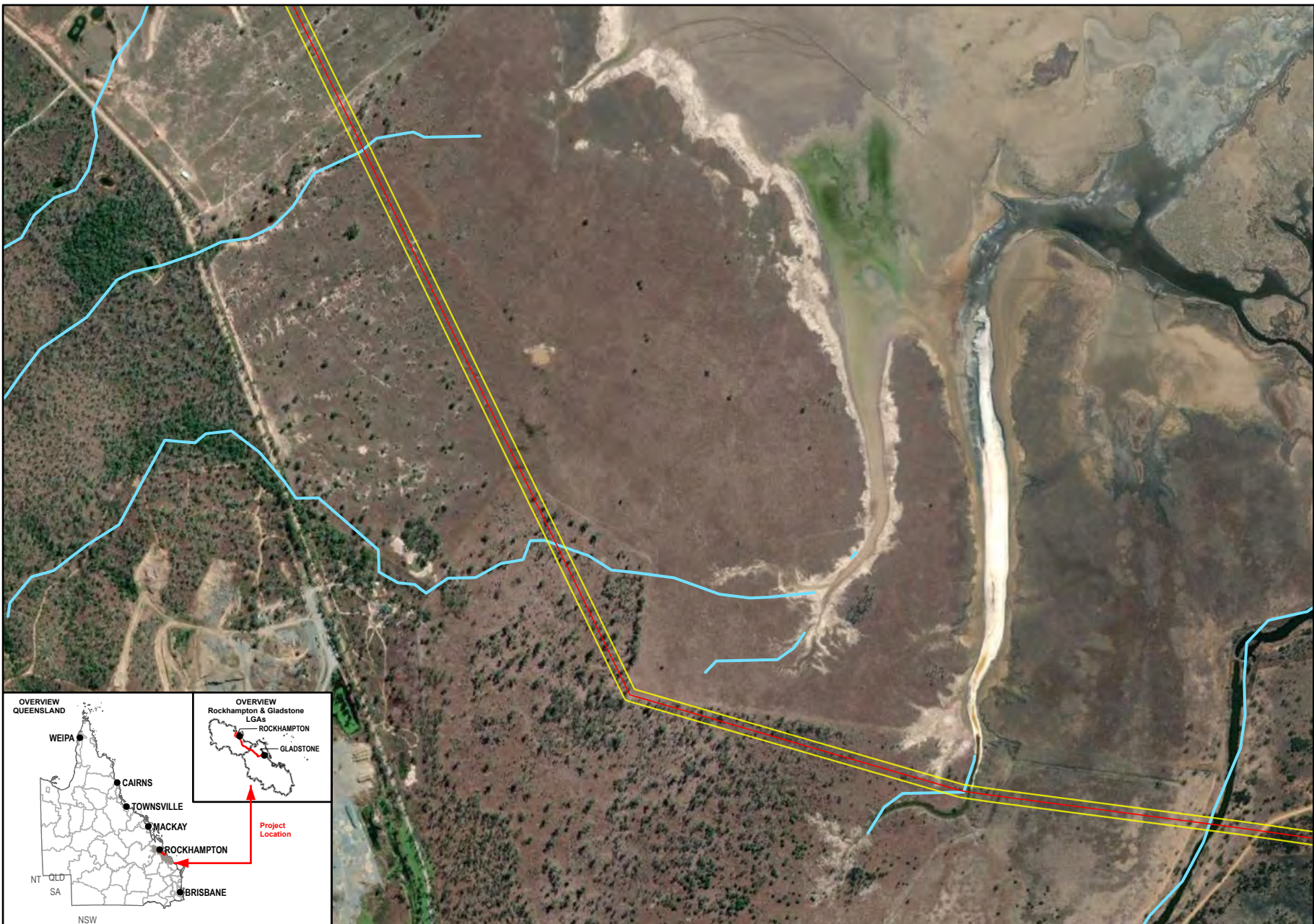
- Legend**
- SGIC SDA Pipeline Alignment
 - Study Area
 - Waterways
 - Main Roads
 - Railways

Data Sources:

1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
2. Imagery @ Esri, Maxar, GeoEye, Earthstar Geographics, CNES-Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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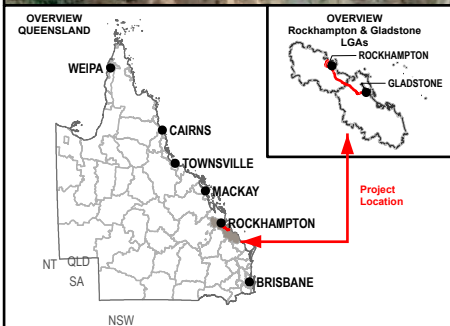
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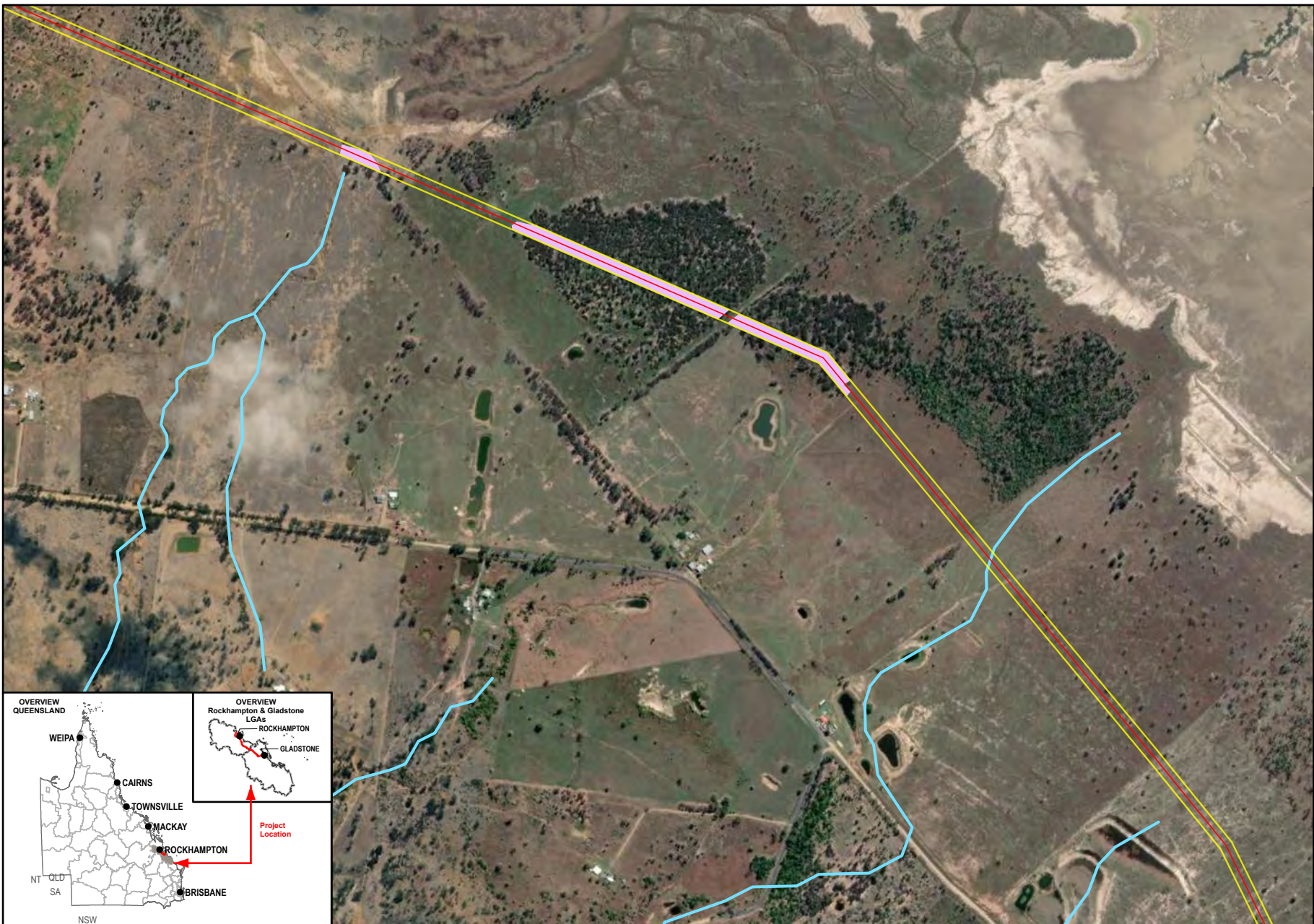
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- SGIC SDA Pipeline Alignment
 - Study Area
 - Waterways

Data Sources:

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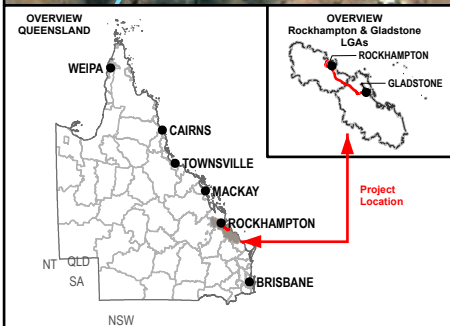
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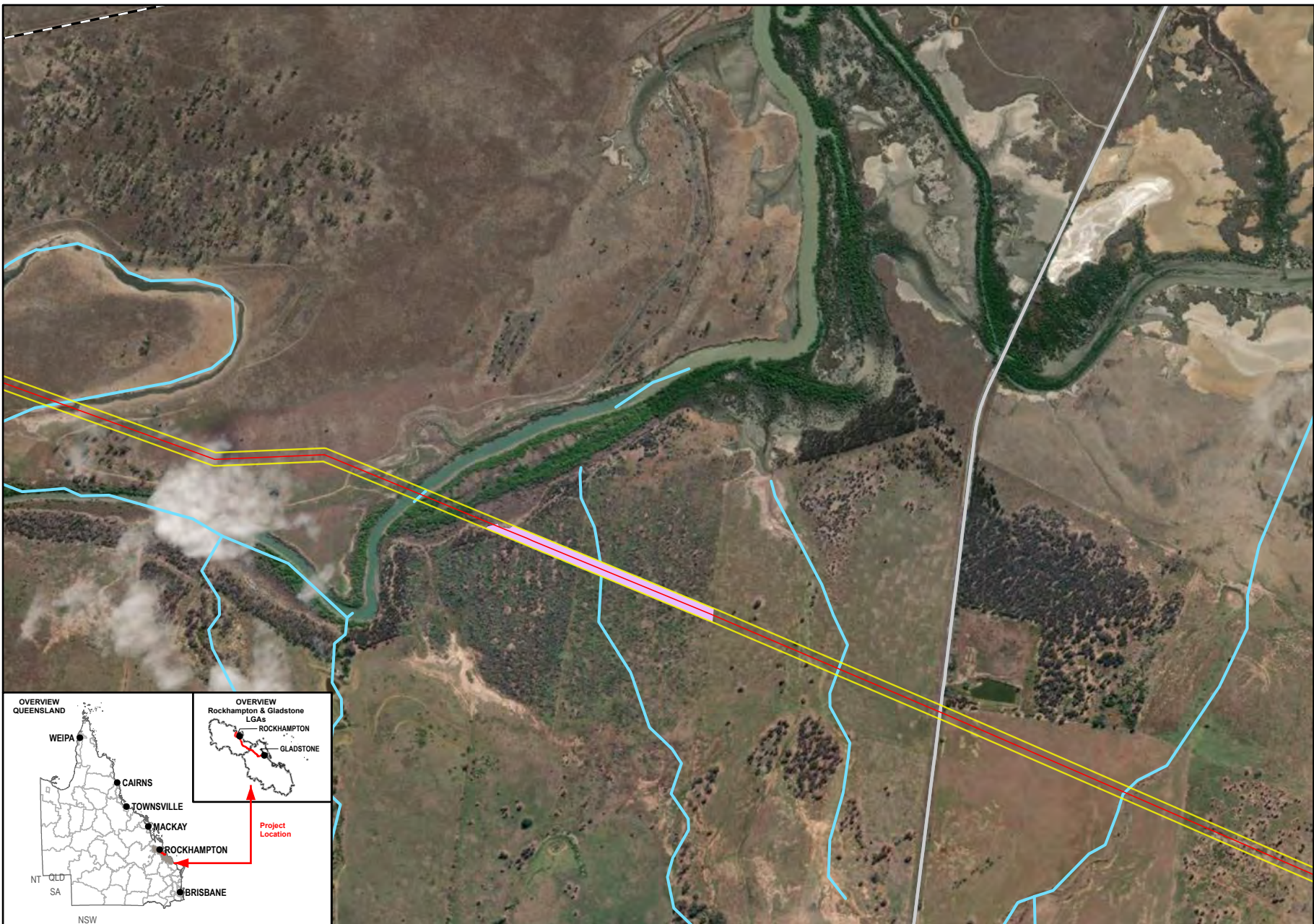
- Legend**
- SGIC SDA Pipeline Alignment
 - Study Area
 - Predicted Grey Snake Habitat
 - Waterways



Data Sources:

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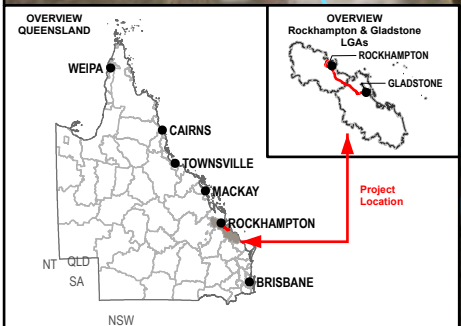
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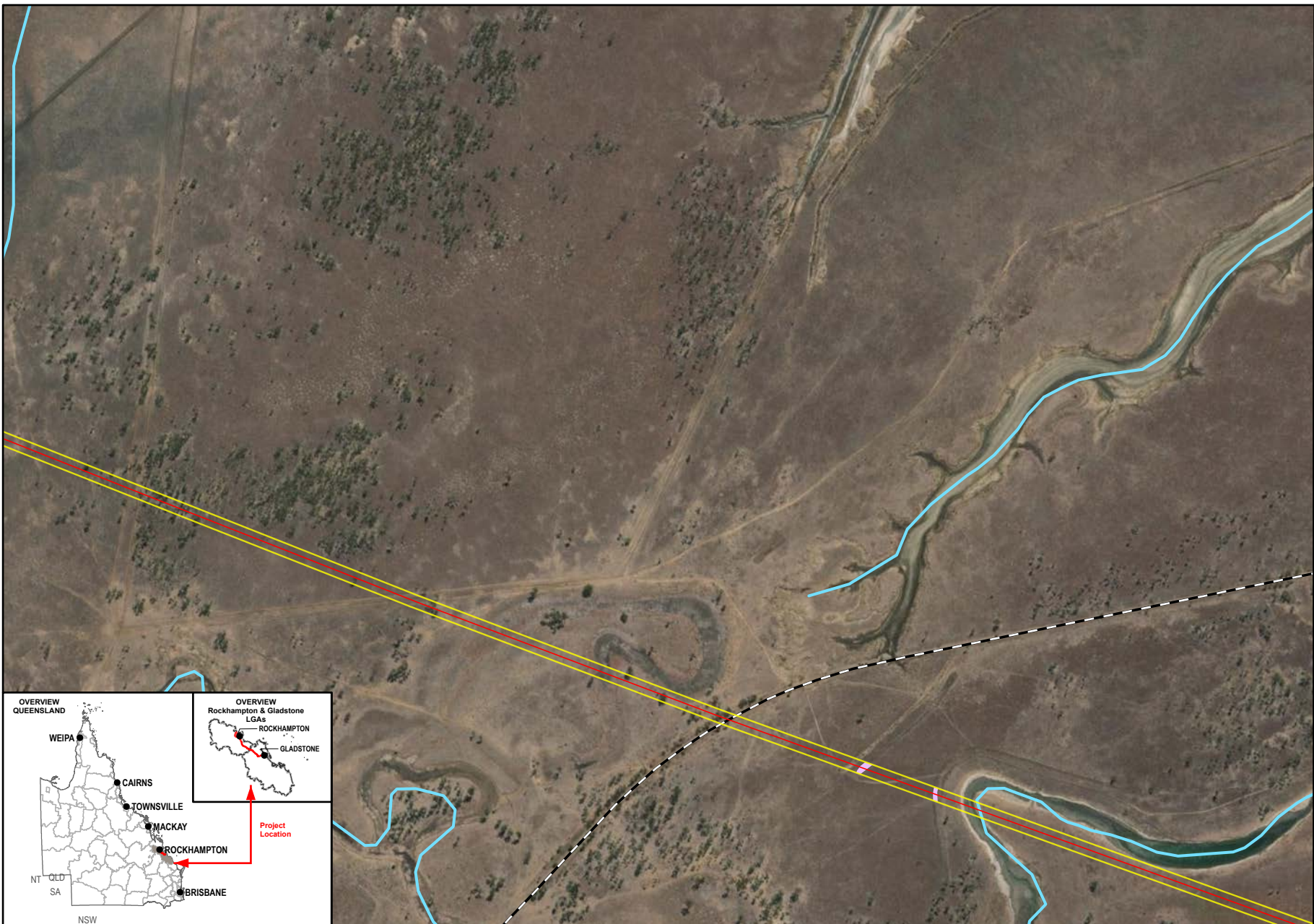
- Legend**
- SGIC SDA Pipeline Alignment
 - Study Area
 - Predicted Grey Snake Habitat
 - Waterways
 - Main Roads
 - Railways

Data Sources:

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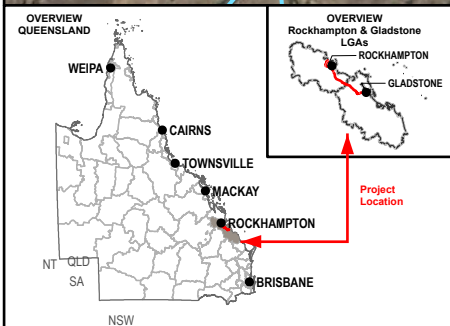
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- Legend**
- SGIC SDA Pipeline Alignment
 - Study Area
 - Predicted Grey Snake Habitat
 - Waterways
 - Railways

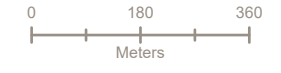
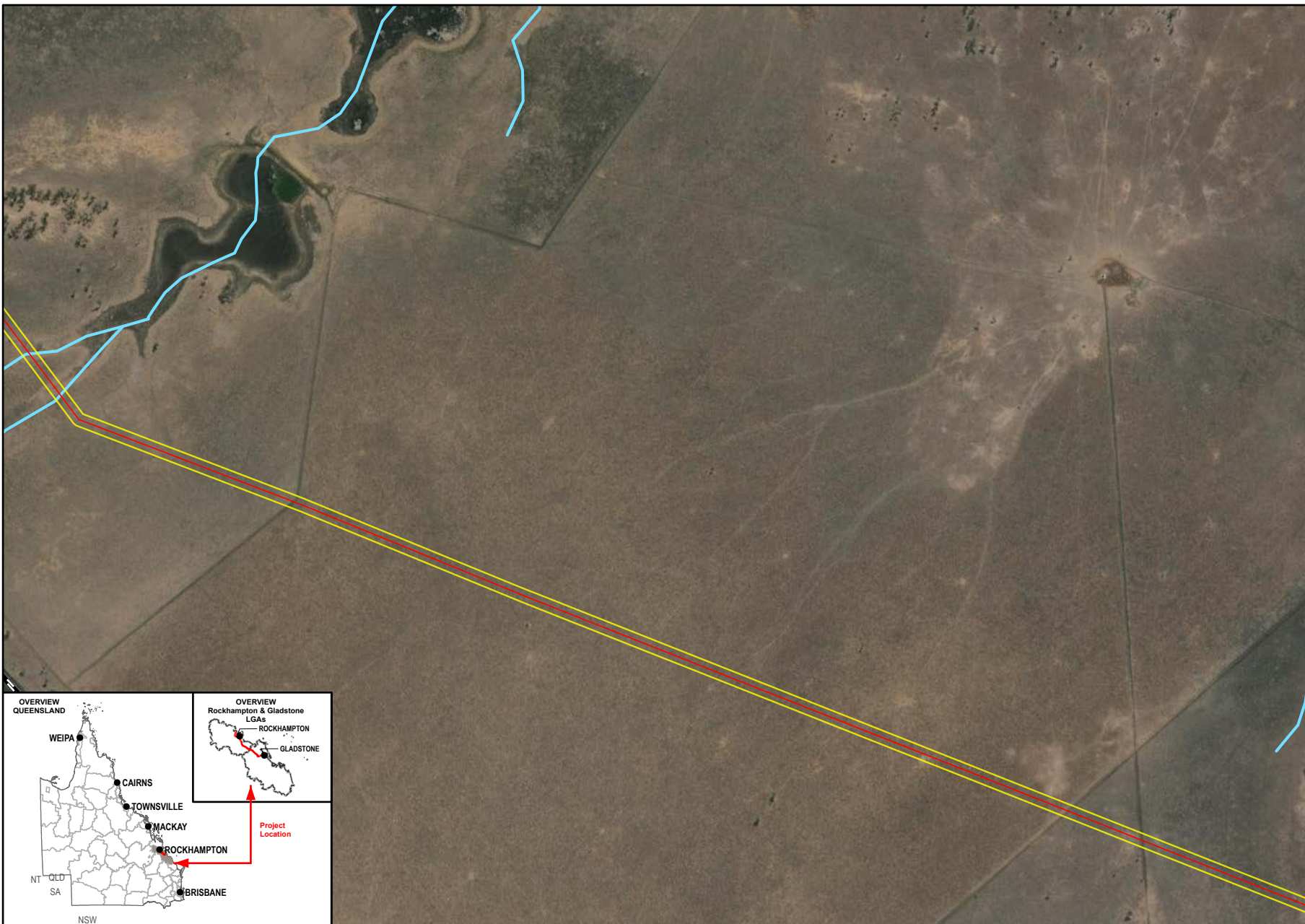


Data Sources:

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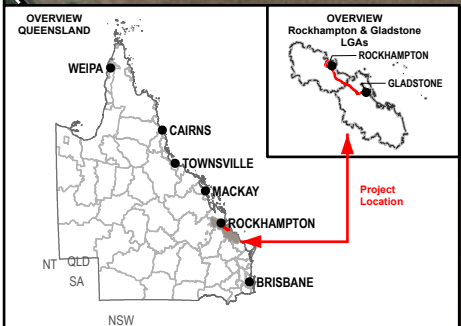
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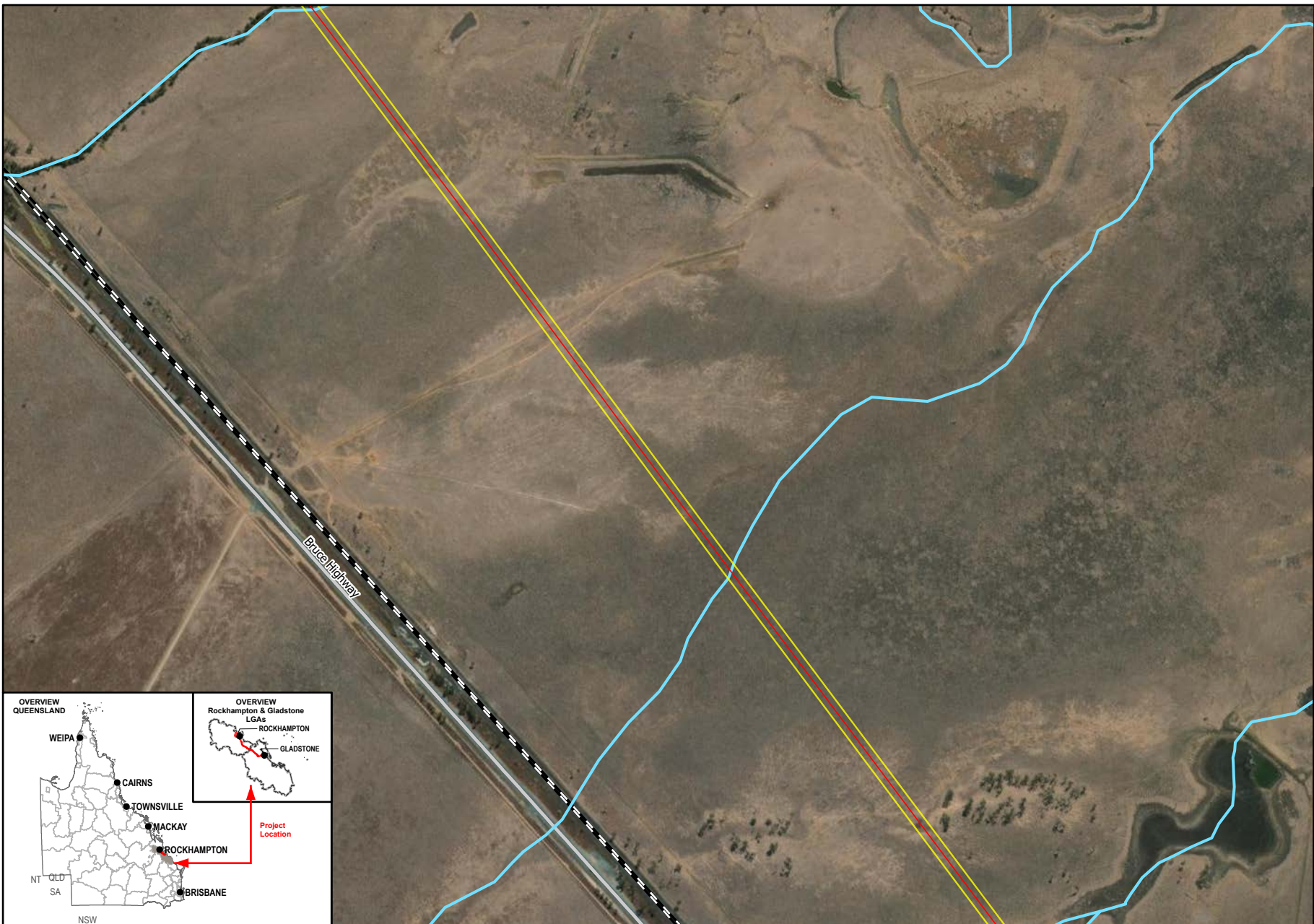
Legend




- SGIC SDA Pipeline Alignment
- Study Area
- Waterways
- Railways



Data Sources:
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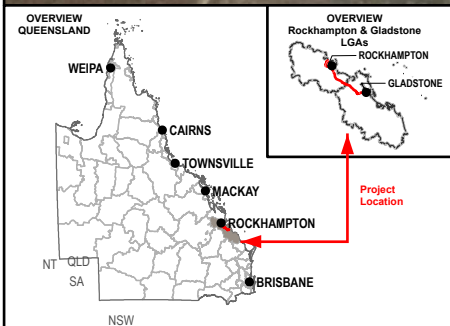

 
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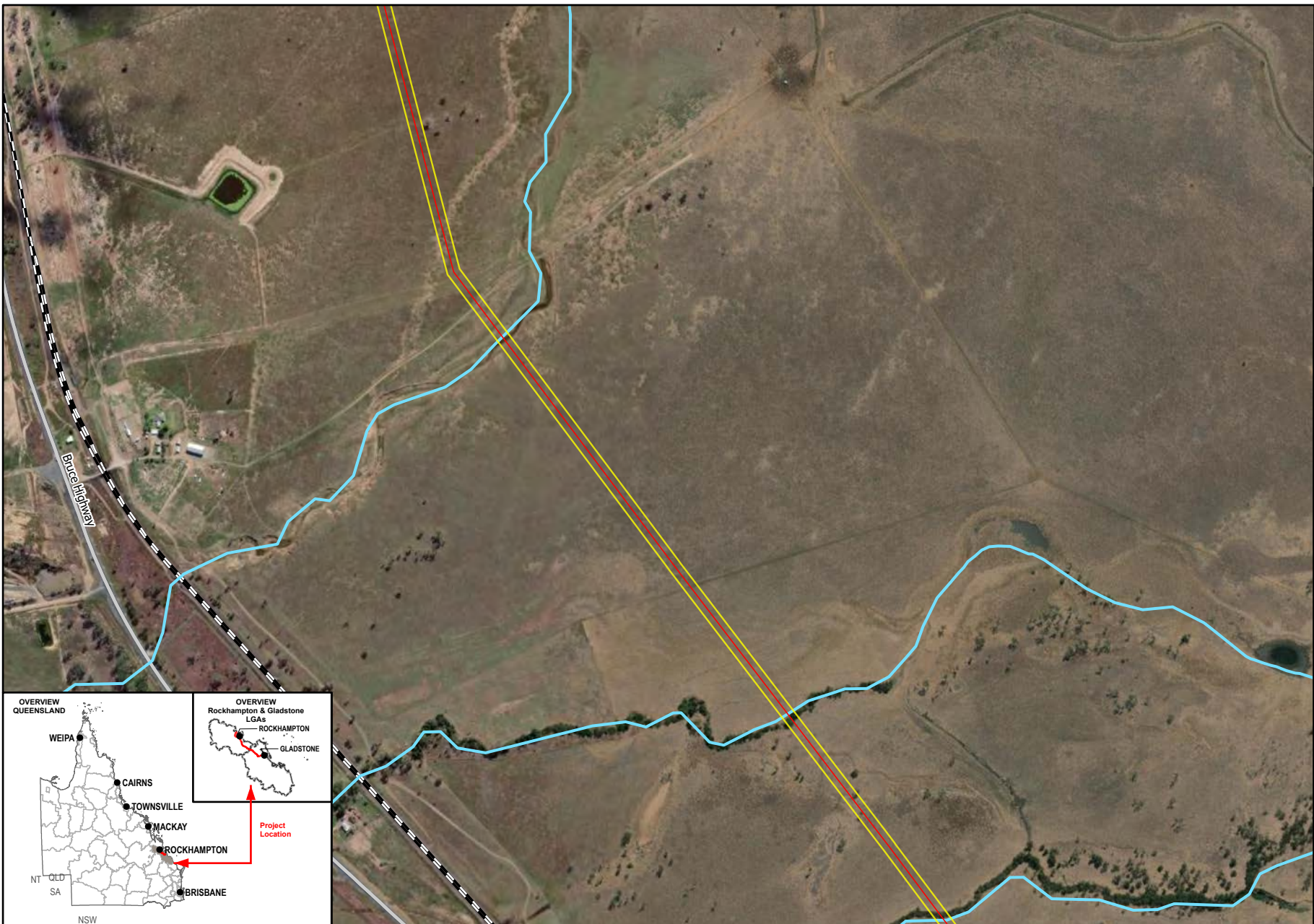
- Legend**
- SGIC SDA Pipeline Alignment
 - Study Area
 - Waterways
 - Main Roads
 - Railways

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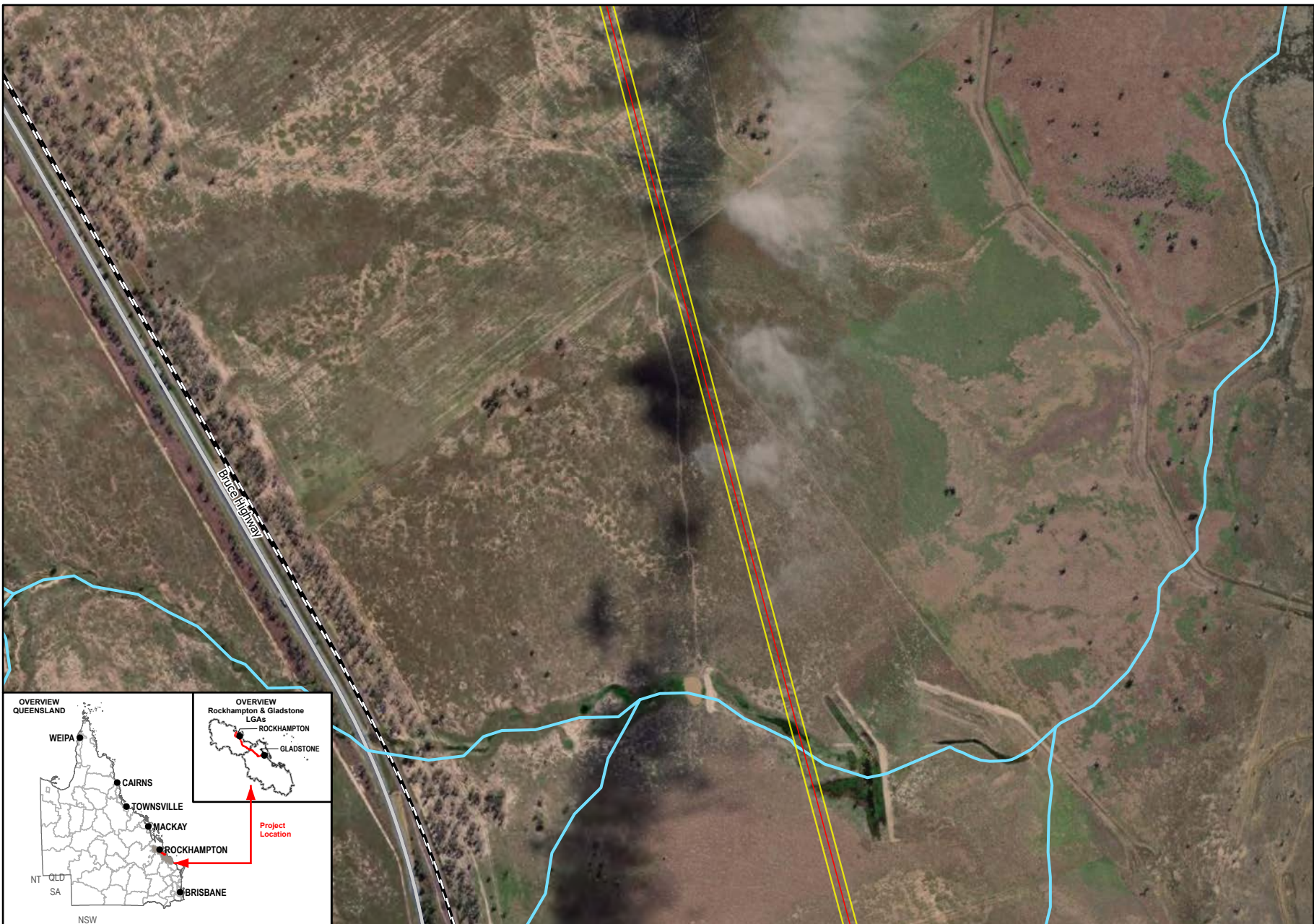
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- Legend**
- SGIC SDA Pipeline Alignment
 - Study Area
 - Waterways
 - Main Roads
 - Railways

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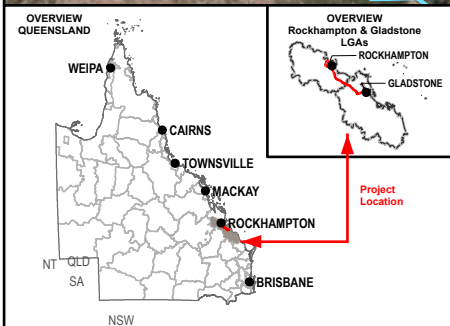
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- SGIC SDA Pipeline Alignment
 - Study Area
 - Waterways
 - Main Roads
 - Railways

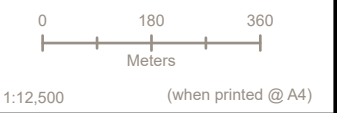
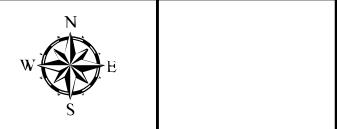
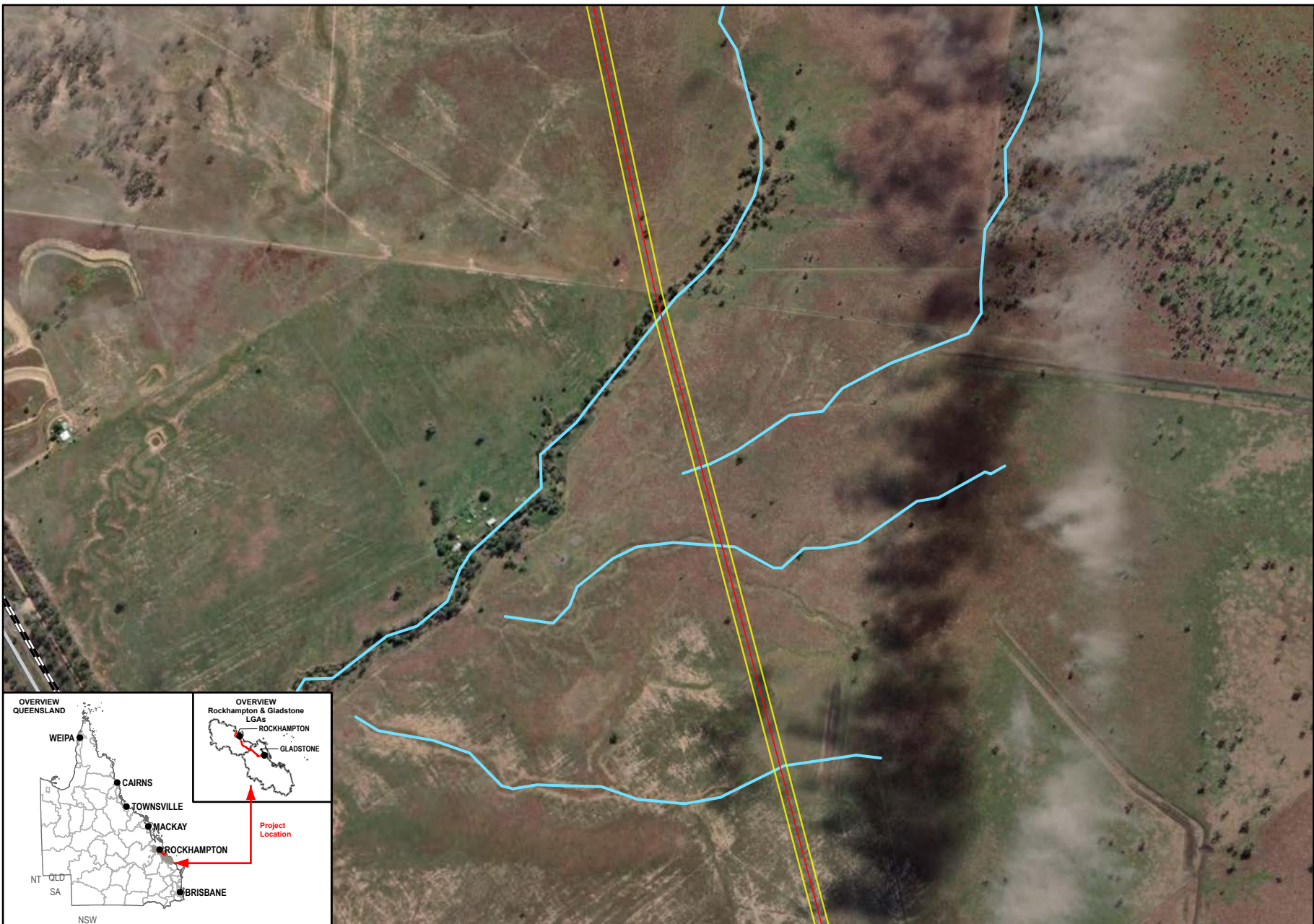
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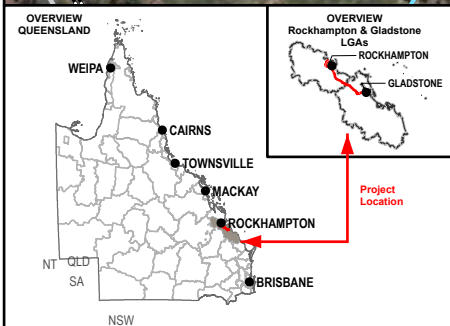


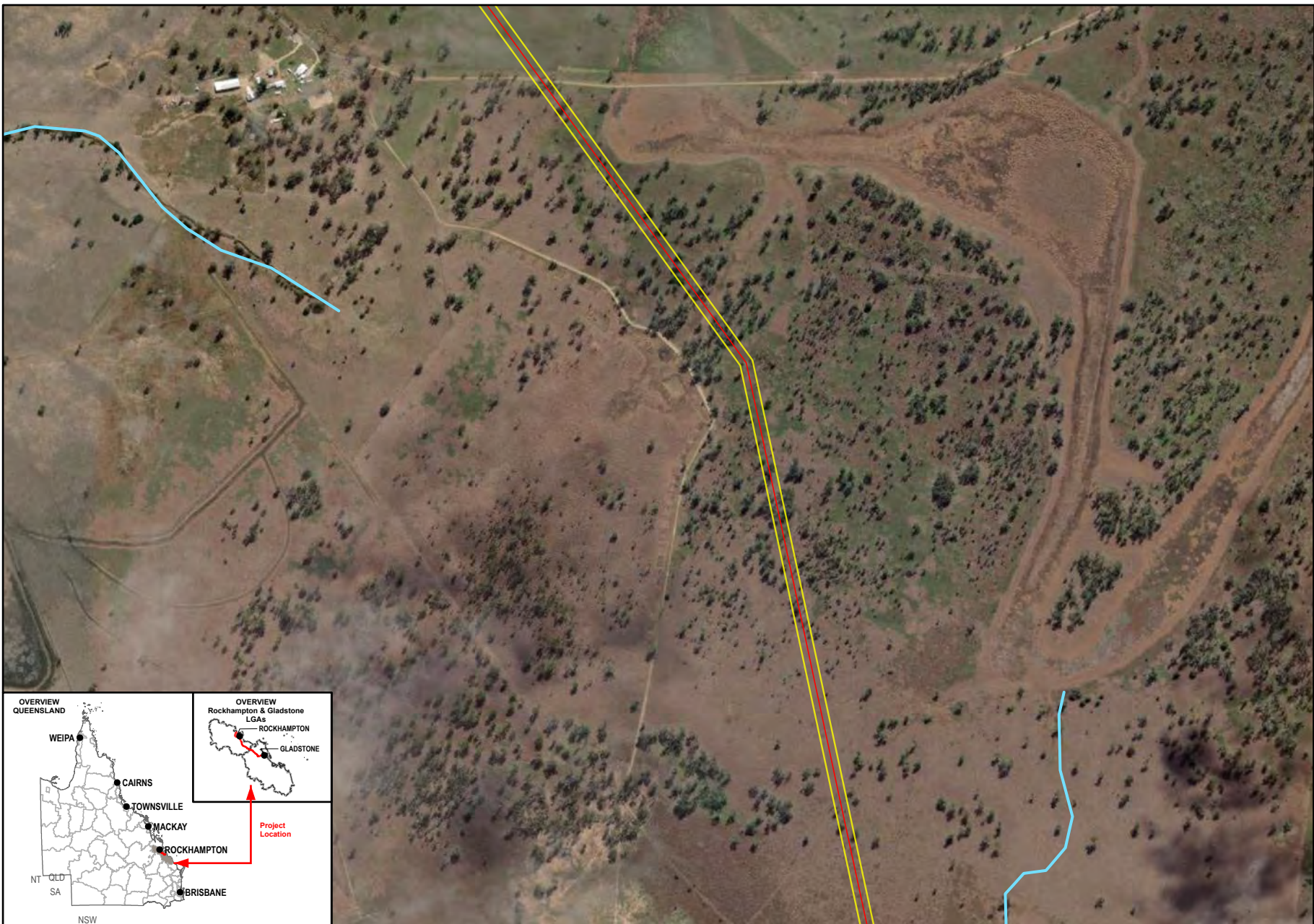
- Legend**
- SGIC SDA Pipeline Alignment
 - Study Area
 - Waterways
 - Main Roads
 - Railways

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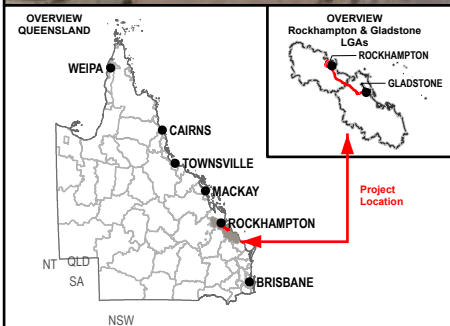
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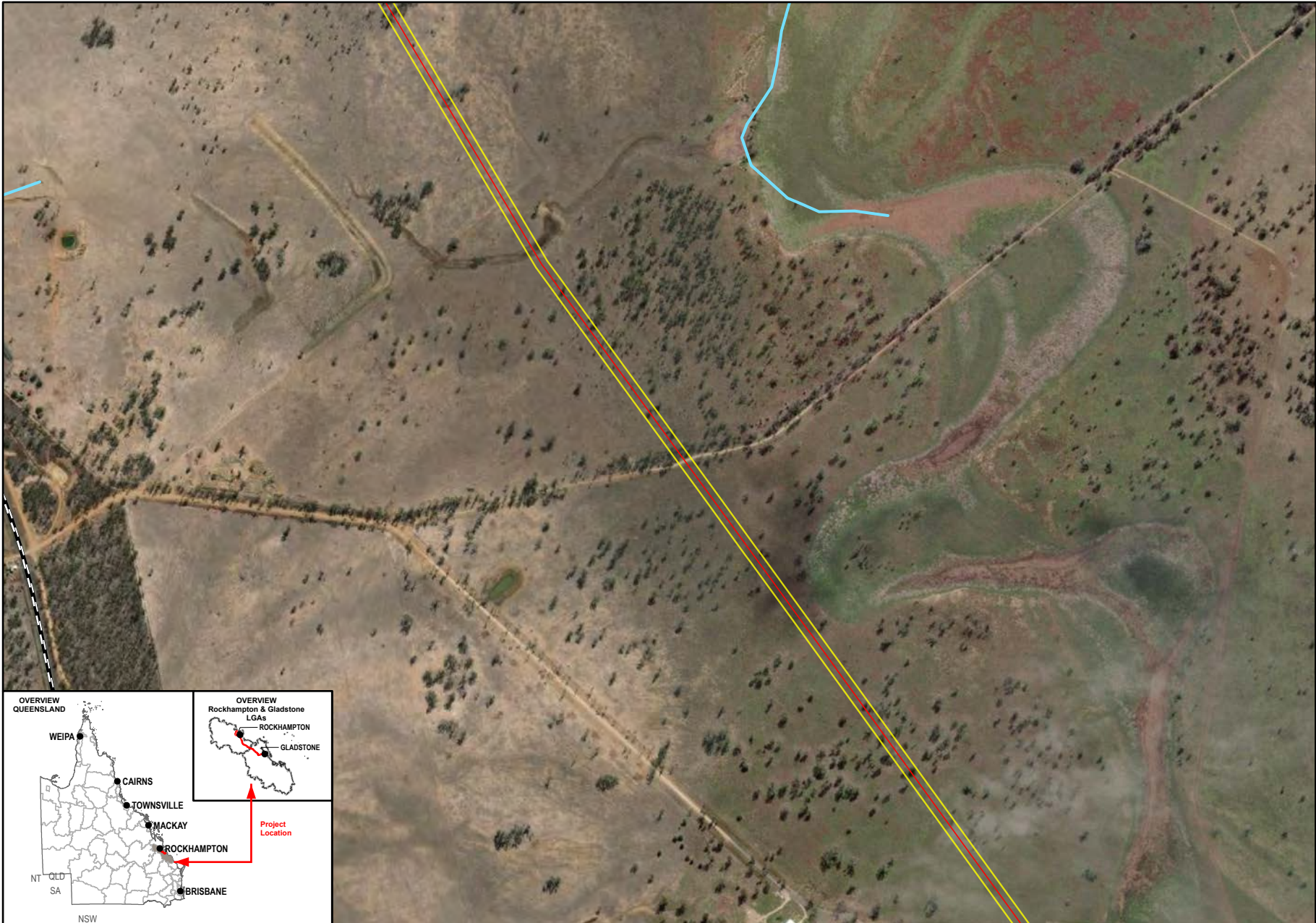
- Legend**
- SGIC SDA Pipeline Alignment
 - Study Area
 - Waterways

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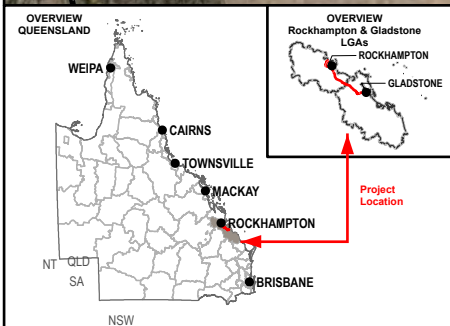
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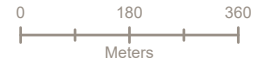
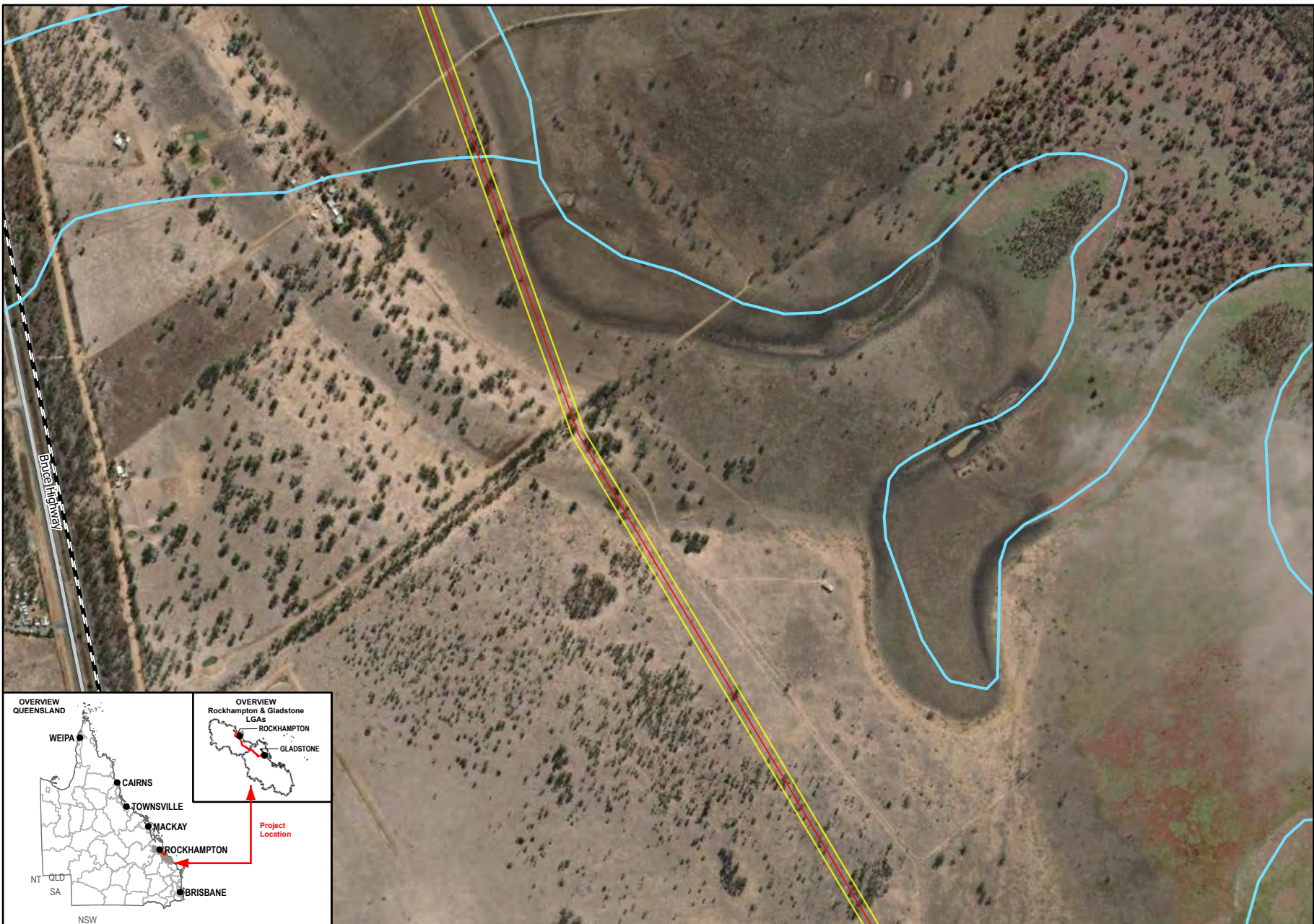
- Legend**
- SGIC SDA Pipeline Alignment
 - Study Area
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 - Railways

Data Sources:

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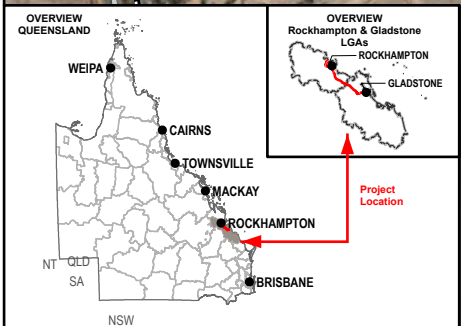




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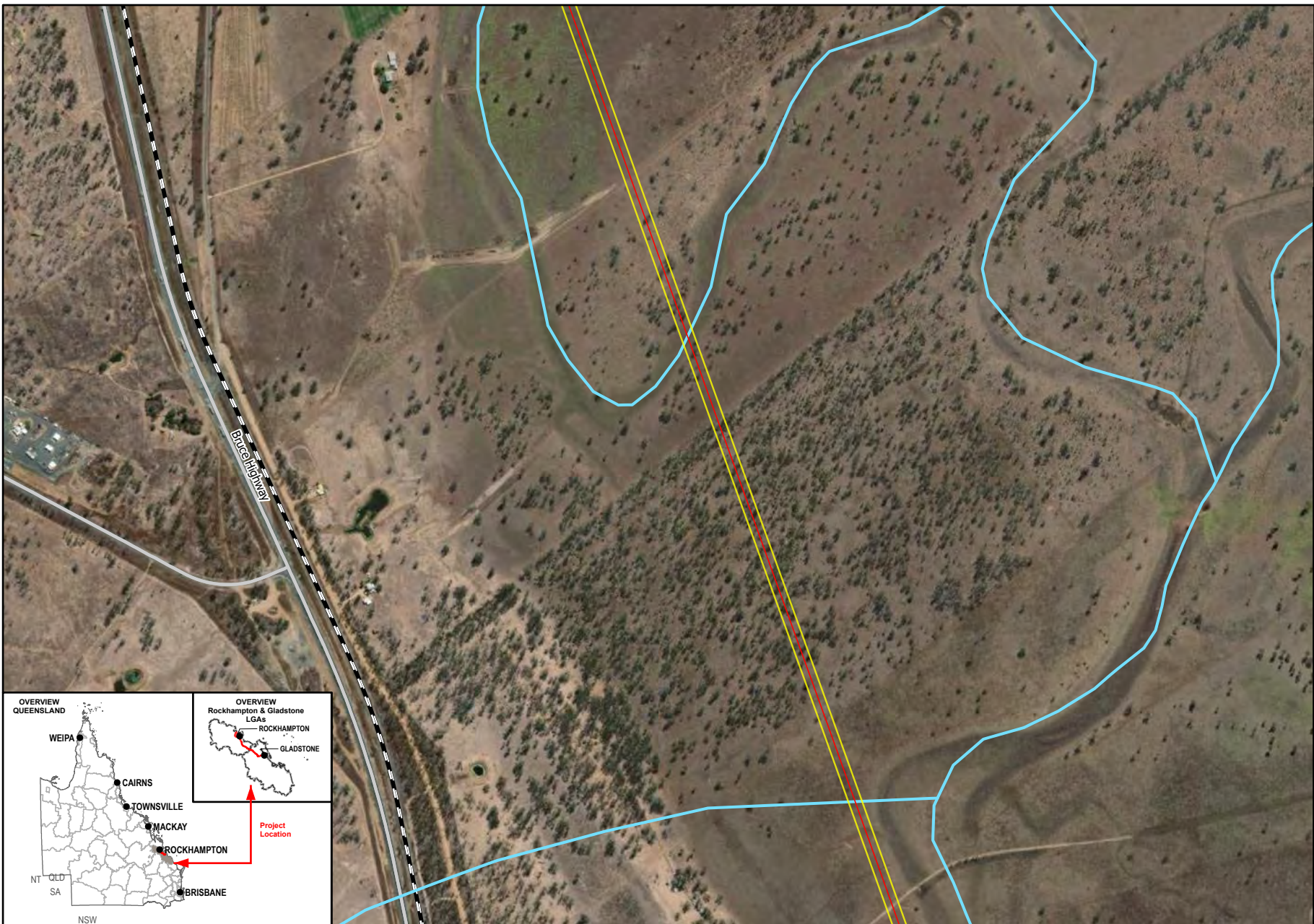
Legend




- SGIC SDA Pipeline Alignment
- Study Area
- Waterways
- Main Roads
- Railways



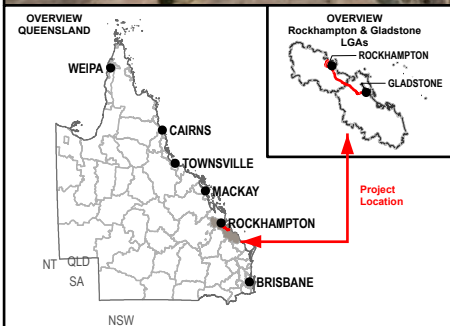
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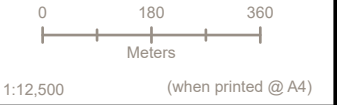
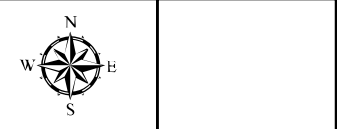
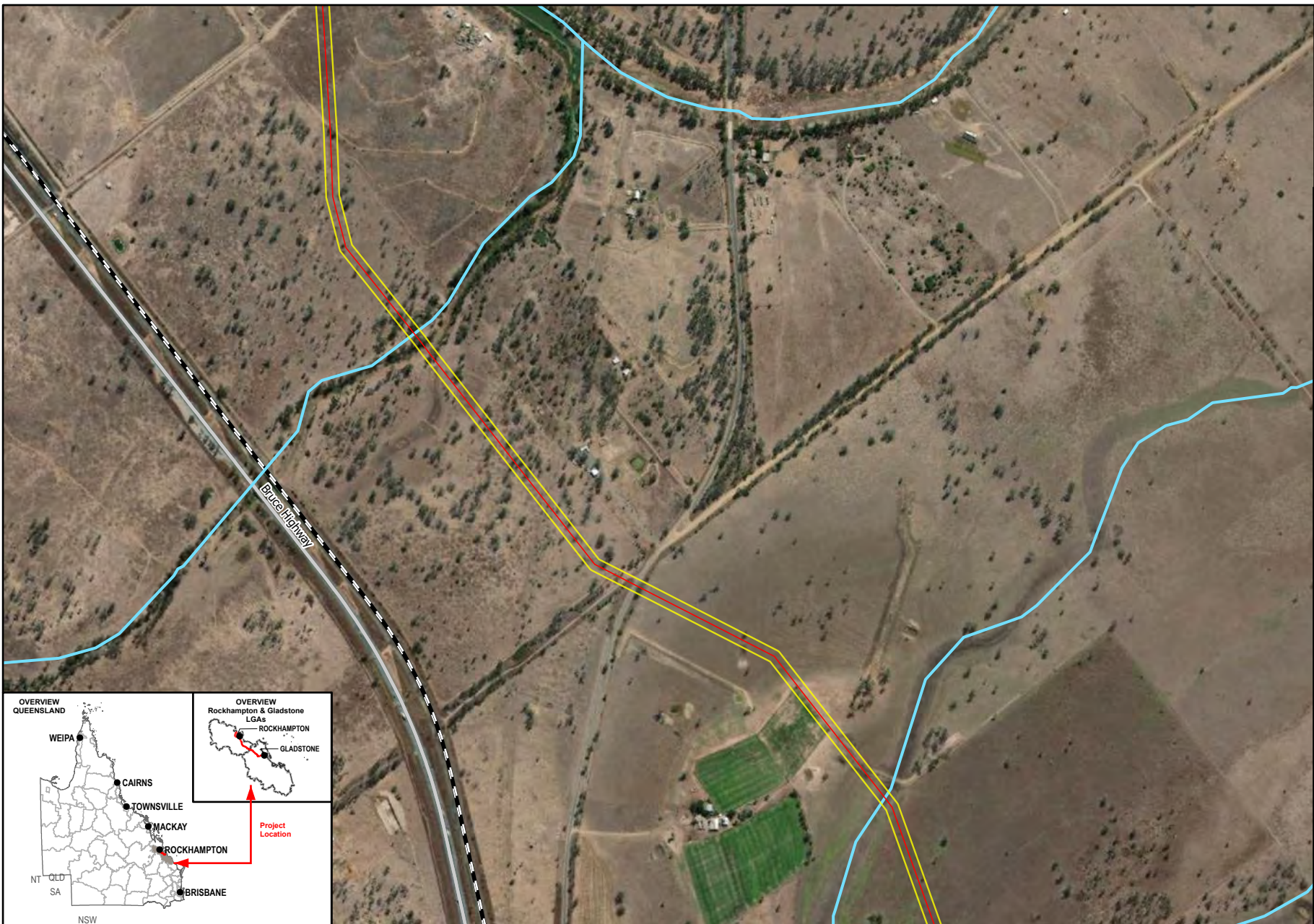
- Legend**
- SGIC SDA Pipeline Alignment
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 - Waterways
 - Main Roads
 - Railways



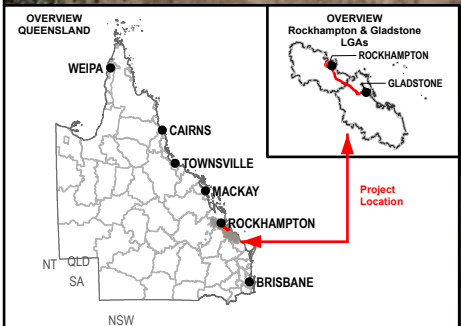
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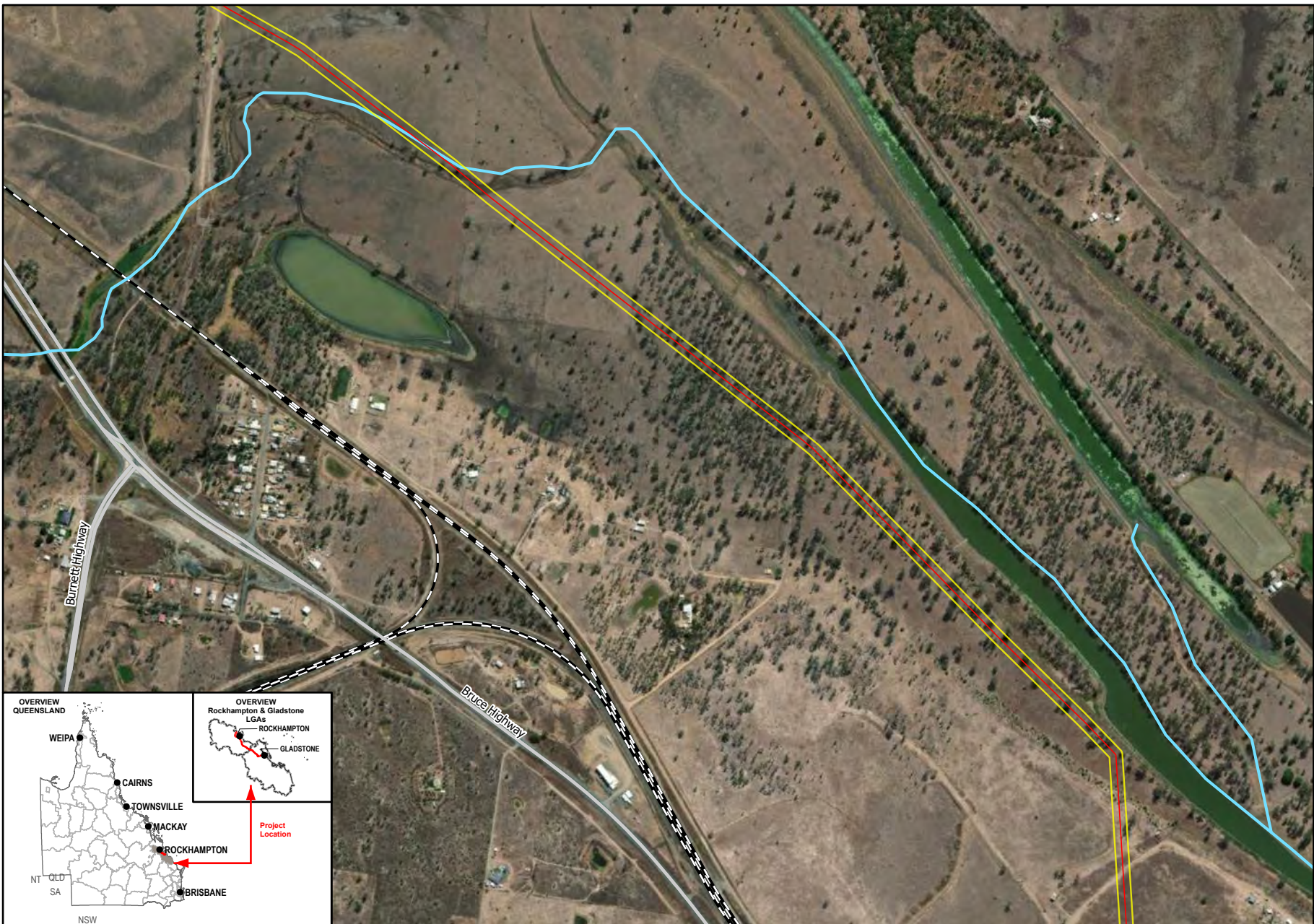


- Legend**
- SGIC SDA Pipeline Alignment
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 - Waterways
 - Main Roads
 - Railways



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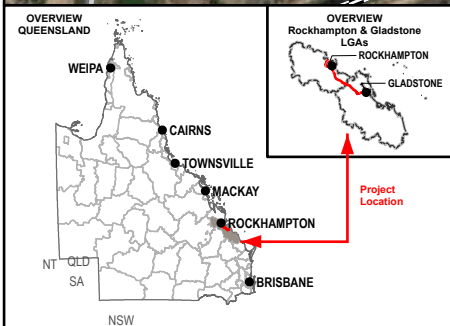
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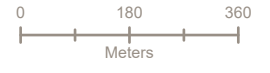
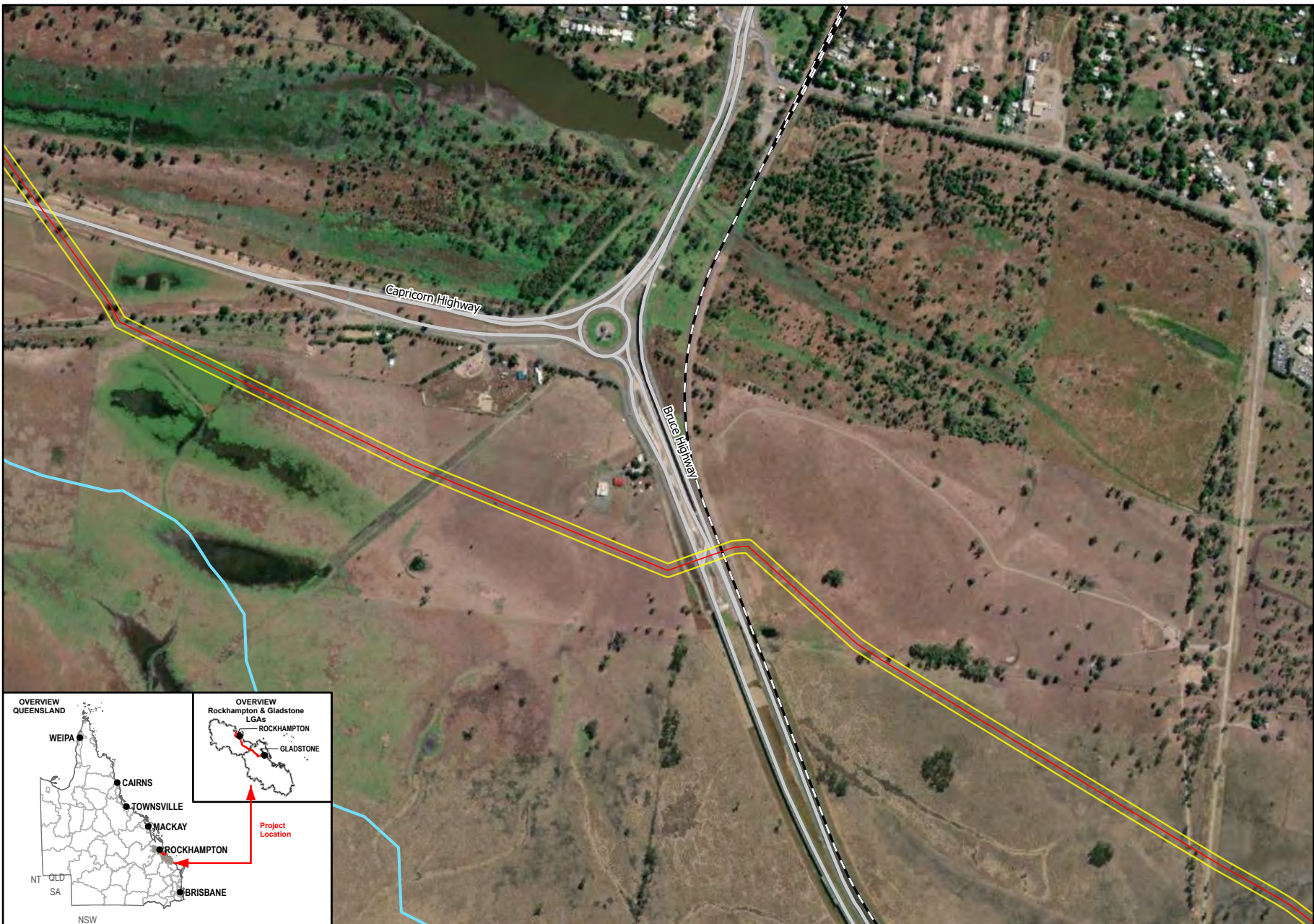
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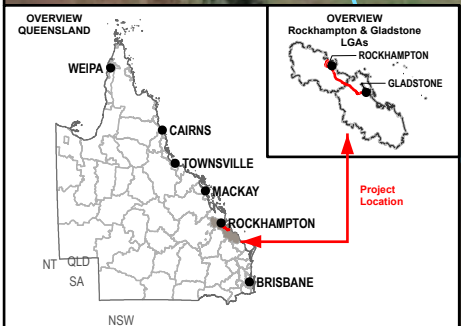
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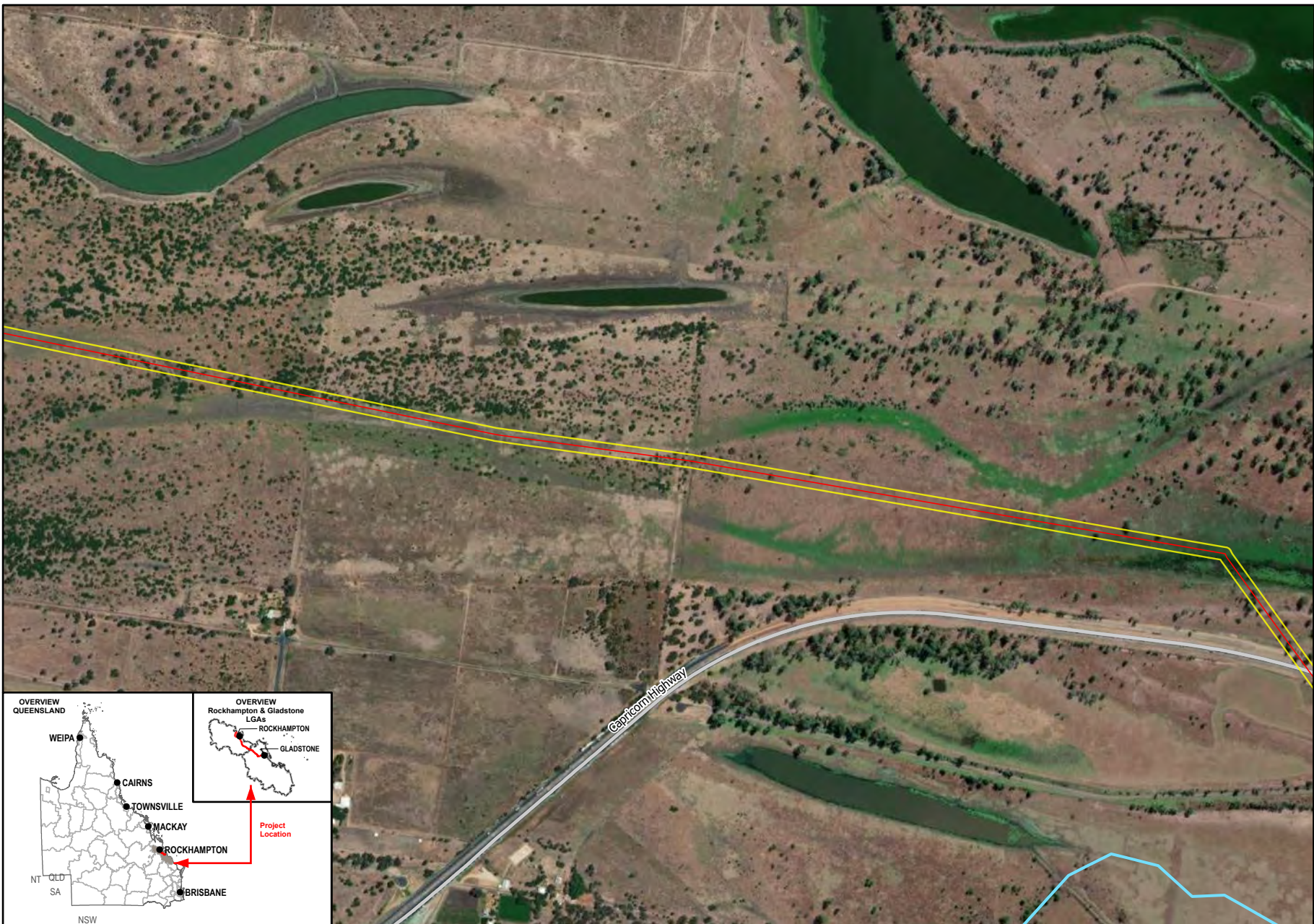
Legend


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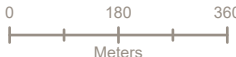




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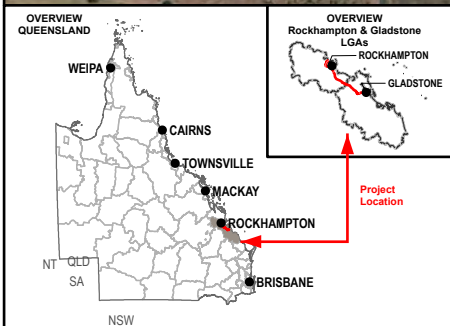
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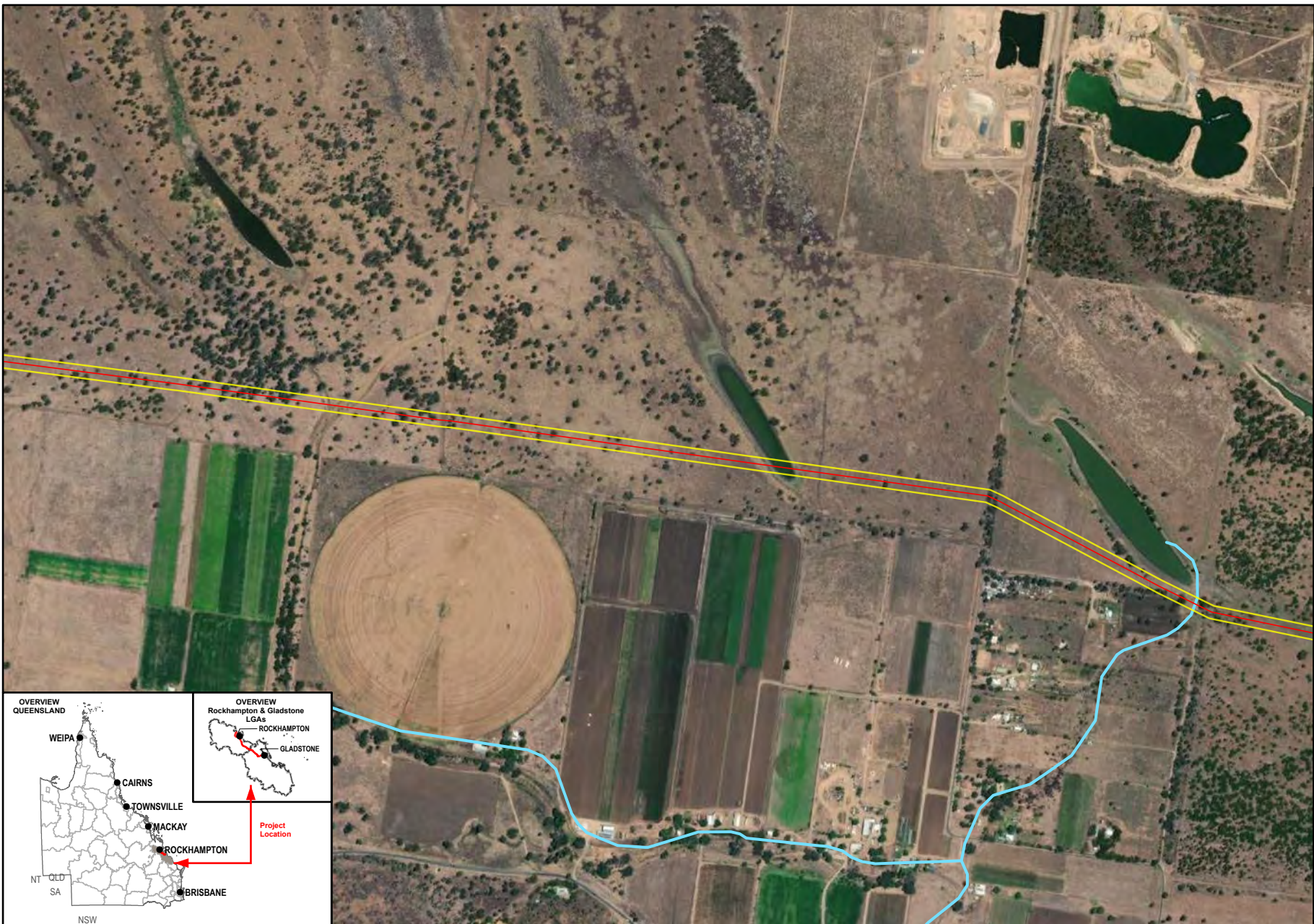
- Legend**
- SGIC SDA Pipeline Alignment
 - Study Area
 - Waterways
 - Main Roads


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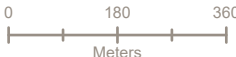
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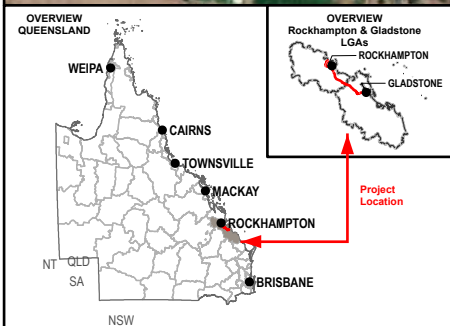
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7.2.2.7 White-throated needletail

Conservation status and species ecology

The white-throated needletail is listed as vulnerable and migratory under the EPBC Act and vulnerable under the NC Act but was not listed as MNES at the time of the approval. The species is almost exclusively aerial, occurring from heights of less than 1 m up to more than 1000 m above the ground (TSSC 2019). Recent research has shown that while the species is predominantly aerial, the white-throated needletail does roost on land at least occasionally, with roosts typically located in tall woodland on ridgelines and clifftops, where the birds can easily alight (Tarburton 2021). The species forages at heights up to cloud height over a range of habitat types including woodland, open forest, rainforest, heathland and partly cleared pasture and agricultural land (TSSC 2019). The species does not breed in Australia but occurs widely throughout Australia during the non-breeding period (TSSC 2019).

Field survey results and distribution of suitable habitat

The species was not recorded in field surveys but is considered likely to occur due to the presence of nearby historical records and the species' wide-ranging nature. Areas of potential roosting habitat are located on ridgetops adjacent to the southern extent of the SGIC SDA study area. No suitable roosting habitat occurs within or immediately adjacent to the SGIC SDA study area. The species has the potential to forage across the entire SGIC SDA study area at heights between 15 m and 1000 m.

Significance of impact assessment

The project is unlikely to result in a significant residual impact on the white-throated needletail. A significance of impact assessment of the project on the white-throated needletail (vulnerable and migratory under the EPBC Act and vulnerable under the NC Act) is provided in Table 7-25.

Table 7-25 Significance of impact on the white-throated needletail

Significant residual impact criteria	Assessment
A long-term decrease in the size of a local population	Unlikely The white-throated needletail has been historically recorded at two locations within the desktop search extent (10 km buffer), the closest record occurring approximately 9.3 km from the SGIC SDA pipeline alignment. The species is regarded as a transient visitor of the SGIC SDA study area, as the species moves through the region in response to climatic conditions (e.g. bushfires, wind fronts and storm fronts). Given the species capacity for large-scale migration and its enigmatic patterns of movement and occurrence, the concept of 'localised populations' is difficult to ascribe to this bird. The species is predominantly aerial and is generally not reliant on terrestrial habitats (DCCEE 2022h). While the species does occasionally utilise terrestrial roosting sites, all nearby terrestrial roosting habitats are located on ridgetops away from the project is unlikely to be directly or indirectly impacted by the construction and operation of the project.
Reduce the extent of occurrence of the species	Unlikely No potential habitat for the white-throated needletail will be directly or indirectly impacted by the project. The species has an extensive capacity for movement and is unlikely to experience any localised decline that would cause the species to no longer persist within the area. The project is likely to be relatively benign in its impact on the species during the operational phase.
Fragment an existing population	Unlikely The white-throated needletail is highly nomadic and can form large, mixed-species feeding flocks. This near-exclusively aerial, migratory species is capable of long-distance flight. The species' movements unlikely to be restricted by the project. As such, the project is unlikely to fragment the existing population.
Result in genetically distinct populations forming as a result of habitat isolation	Unlikely The species' capacity to move locally and regionally is unlikely to be limited by any localised land clearing necessary to construct the SGIC SDA pipeline alignment. As a result, the project is considered to be unlikely to cause any loss of gene transfer that would cause genetically distinct populations to form.

Significant residual impact criteria	Assessment
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat	<p>Unlikely</p> <p>No invasive species are identified as threats to the white-throated needletail. The extent of clearing for the SGIC SDA pipeline alignment may increase the accessibility of introduced predators including dogs and foxes into the site. Pest fauna management practices will be implemented throughout the construction and operations periods and are anticipated to decrease the abundance of invasive predators, further reducing the species vulnerability within the SGIC SDA pipeline alignment.</p>
Introduce disease that may cause the population to decline	<p>Unlikely</p> <p>Disease is not identified as a key threat to the white-throated needletail. This species' almost exclusively aerial habit means it is unlikely to have many opportunities to contract diseases that could threaten the viability of individuals and populations. The project is therefore unlikely to introduce disease that cause the species to decline.</p>
Interfere with the recovery of the species	<p>Unlikely</p> <p>The proposed works are considered unlikely to negatively impact the species, let alone interfere with the recovery of the species.</p>
Result in disruption to ecologically significant locations (breeding, feeding or nesting sites) of a species	<p>Unlikely</p> <p>The species is predominantly aerial, foraging at heights up to cloud height over a range of habitat types (TSSC 2019). The white-throated needletail is a non-breeding visitor to Australia, and breeds between October and April throughout Siberia, China, Japan and Mongolia (DCCEEW 2022h). As such, habitats within the SGIC SDA pipeline alignment is not considered ecologically significant.</p>
Conclusion	<p>The project is unlikely to result in a significant residual impact on the white-throated needletail. The species is predominantly aerial and all nearby terrestrial roosting habitats are located on ridgetops away from the project and are unlikely to be directly or indirectly impacted by the construction and operation of the project.</p>

7.2.2.8 Powerful owl

Conservation status and species ecology

The powerful owl is listed as vulnerable under the NC Act. The species occurs in a range of habitats with mature hollow-bearing trees including mountain forests and woodlands, coastal forests, woodlands, pine plantations and urban areas (Higgins 1999). Preferred habitat includes forests and woodlands with a high abundance of large trees. Mating pairs occupy a large home range (Higgins 1999). The species typically nests in large hollow-bearing trees in unlogged, unburnt gullies and lower slopes within 100 m of streams or minor drainage lines (Schodde and Mason 1980; Higgins 1999). The species typically roosts in dense groves of mid-storey vegetation within closed forest, including rainforest, wet sclerophyll forest, mangrove forest, *Melaleuca*, *Acacia* and *Casuarina* in sheltered gullies typically on wide creek flats and at the heads of minor drainage lines, but also adjacent to cliff faces and below dry waterfalls. The species typically does not occur within fragmented forest remnants <200 ha (Kavanagh and Stanton 2002). The species relies on the presence of mature, hollow-bearing trees for nesting sites and also to provide den sites for the hollow-dwelling arboreal mammals which form the bulk of its prey (Davey 1993; Milledge *et al.* 1991; Higgins 1999). Despite the species' reliance on old growth forest, it does appear to be tolerant of some levels of selective logging, with owls persisting in areas that have been exposed to light, moderate and heavy logging. Nesting appears to be restricted to unlogged areas (Kavanagh and Peake 1993; Kavanagh and Bamkin 1995; Kavanagh 1997).

Field survey results and distribution of suitable habitat

The powerful owl was not recorded during the field surveys within the SGIC SDA study area. Survey effort for the powerful owl included one night of 2-3 hours of spotlighting within potentially suitable habitat in the GSDA study area. The species is considered likely to occur due to the presence of suitable habitat and the species has been historically recorded at seven locations within the desktop search extent (10 km buffer). The closest record is approximately 7 km southeast from the SGIC SDA pipeline alignment. Suitable habitat for the species was observed within an area retaining remnant, mature vegetation within the SGIC SDA study area, approximately 3.5 km northwest of Mount Larcom. This area was identified as suitable habitat for the species as it retains large, mature hollow-bearing trees, and suitable denning habitat for the arboreal mammals upon which the powerful owl preys. No suitable nesting habitat was recorded within the SGIC SDA study area. The distribution of predicted powerful owl habitat is mapped in Figure 7-13.

Significance of impact assessment

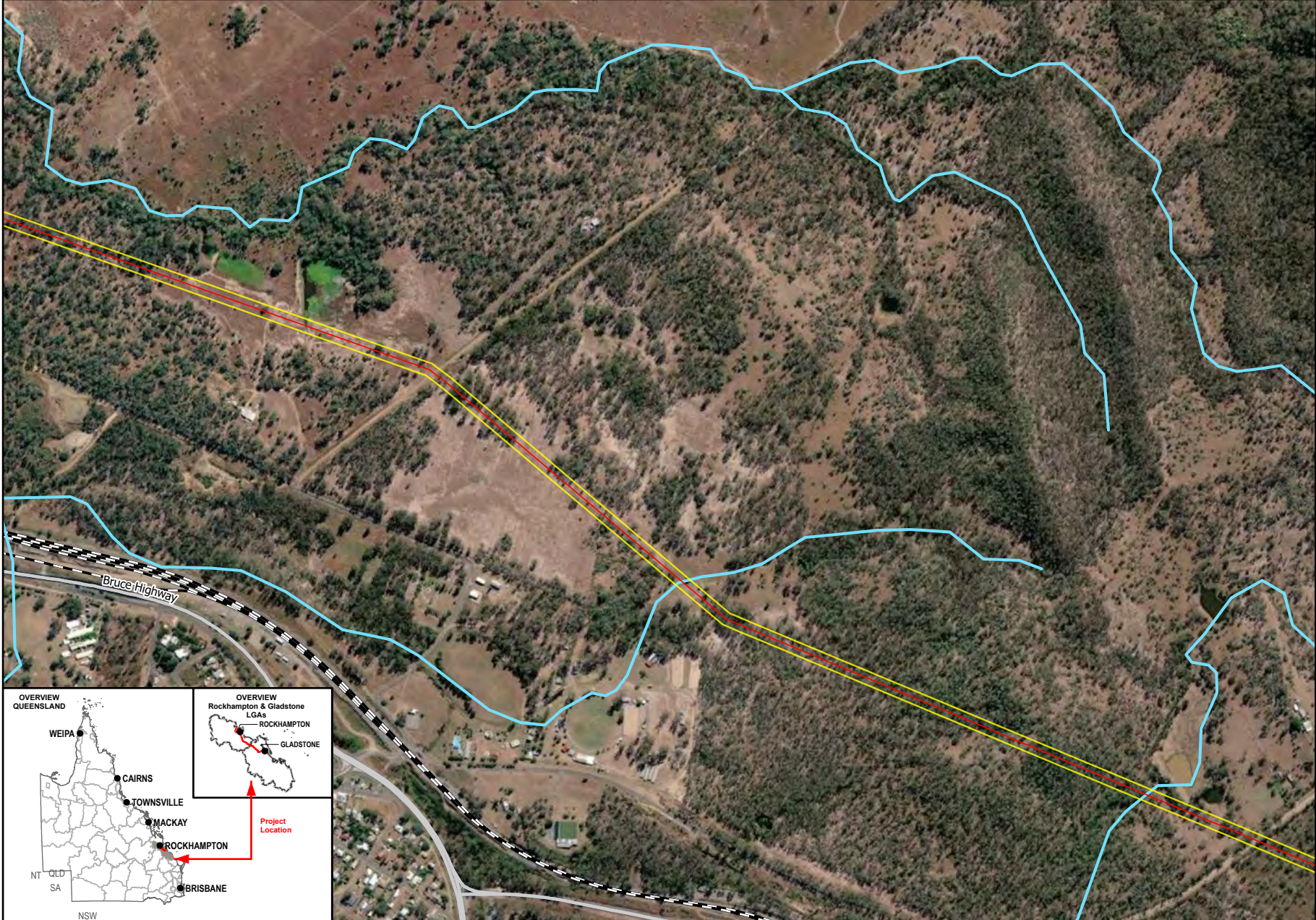
The project is unlikely to result in a significant residual impact on the powerful owl. A significance of impact assessment of the project on the powerful owl (vulnerable under the NC Act) is provided in Table 7-26.

Table 7-26 Significance of impact on the powerful owl

Significant residual impact criteria	Potential to occur
A long-term decrease in the size of a local population	<p>Unlikely</p> <p>The project is not expected to result in a long-term decrease in the size of the local powerful owl population. The project will result in loss of 3.25 ha of potential foraging habitat. This represents 0.05 % of the potential habitat available within a 5 km buffer. The powerful owl has been historically recorded at seven locations within the desktop search extent (10 km buffer), the closest record occurring approximately 7 km from the SGIC SDA pipeline alignment. Given the low density at which powerful owls typically occur, and the availability of potential habitat that will remain available within their home range, the impacts of clearing on the powerful owl are anticipated to be negligible. Clearing of vegetation has the potential to cause direct injury or mortality of roosting or nesting individuals. However, this risk will be mitigated by undertaking targeted pre-clearance surveys prior to construction to identify nesting habitat and engaging suitably qualified and experienced fauna spotter catchers to supervise all clearing of predicted breeding habitat. This will reduce the risk of individual injury or mortality during construction. This species is not considered to be at risk of vehicle strikes. The loss of vegetation within the Northern Section pipeline alignment is unlikely to (1) limit movement of resident or transient individuals; nor (2) affect the availability of resident or transient individuals to acquire key resources (especially noting that the species is highly mobile and has ability to disperse over relatively cleared landscapes). Overall, the species is unlikely to experience a long-term decrease in the size of a local population.</p>

Significant residual impact criteria	Potential to occur
Reduce the extent of occurrence of the species	<p>Unlikely</p> <p>The loss of woodland habitat is seen as the primary factor influencing the decline of the powerful owl (Webster <i>et al.</i> 1999, NSW Scientific Committee 2008). Due to their nesting requirements, powerful owls are reliant on large patches of remnant woodlands with trees from 100 to 500 years old (Kavanagh 1997; Loyn <i>et al.</i> 2001). The SGIC SDA pipeline alignment is proposed to traverse a small area of remnant vegetation that retains large, mature hollow-bearing trees. In contrast, much of the remainder of areas within the SGIC SDA pipeline alignment support regrowth vegetation, younger remnant vegetation or cleared open landscapes. The maximum width of clearing required for construction of the SGIC SDA pipeline alignment is 30 m. Once the pipeline has been installed and buried, a maximum width of 10 m will be permanently cleared with the remaining 20 m to be rehabilitated. The project will result in a loss of 3.25 ha of potential habitat for the powerful owl. This represents only a small percentage of the predicted habitat available within a 5 km buffer (0.05 %). Clearing along the SGIC SDA pipeline alignment is unlikely to impact the species' ability to move nor access resources in adjacent habitats, as the proposed clearing extent is narrow (30 m) and mostly linear, and unlikely to generate edge effects or impact ecosystem structure and functioning. The nature of the project is unlikely to result in substantial indirect disturbance to the species that would inhibit the species' capacity to utilise adjacent habitat areas. The powerful owl typically maintains large territorial home ranges and occurs in low local densities. Regardless, the localised impacts experienced through loss of habitat or direct collision mortality is unlikely to result in a localised reduction in the extent of occurrence of the species, especially noting the definition of extent of occurrence per the Queensland <i>Significant Residual Impact Guideline</i> (DEHP 2014b): <i>Extent of occurrence is defined as the area contained within the shortest continuous imaginary boundary which can be drawn to encompass all the known, inferred or projected sites of present occurrence of a taxon.</i></p>
Fragment an existing population	<p>Unlikely</p> <p>Fragmentation of habitat throughout the east coast of Australia has meant the powerful owl has contracted from a single continuous population to a series of isolated residual populations (DSE 2004). While the powerful owl is reliant on large, interconnected remnants of woodland habitat, only utilising remnants larger than 200 ha (Kavanagh 1997; Kavanagh and Stanton 2002), the species can tolerate low level disturbances, persisting in disturbed woodland provided it is connected to more extensive woodland (Debus and Chafer 1994). Given the species' large home range, about 1,000 ha per pair (Schodde and Mason 1980), and ability to disperse over relatively cleared landscapes (NSW Scientific Committee 2008), the SGIC SDA pipeline alignment is not expected to result in fragmentation of the local powerful owl population. The SGIC SDA pipeline alignment has largely been placed within or adjacent to areas that have been previously cleared; however, the SGIC SDA pipeline alignment is proposed to traverse through areas retaining remnant vegetation. Within the area that is considered suitable habitat for the powerful owl, the proposed SGIC SDA pipeline alignment is expected to clear intact remnant vegetation. However, this area has been exposed to historical clearing for fence lines and access tracks. Habitat losses projected for the project represent 0.05% of the predicted habitat available within a 5 km buffer. As such, this represents a relatively localised impact within the context of the species' home range and is not anticipated to fragment an existing population.</p>
Result in genetically distinct populations forming as a result of habitat isolation	<p>Unlikely</p> <p>As detailed above, the species' capacity to move locally and regionally is unlikely to be limited by any localised land clearing necessary to construct the SGIC SDA pipeline alignment. As a result, the project is not considered to cause any loss of gene transfer that would cause genetically distinct populations to form.</p>
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat	<p>Unlikely</p> <p>Invasive pest species such as foxes and wild dogs represent a potential threat to powerful owl fledglings (McNabb 1987) and are known to occur within the SGIC SDA pipeline alignment. The implementation of a site-specific Weed and Pest Management Plan will help in limiting the impact that these species have on the local powerful owl population.</p>
Introduce disease that may cause the population to decline	<p>Unlikely</p> <p>Powerful owls are not subject to high disease risks (Debus 1997). Beak and feather disease virus, which causes psittacine beak and feather disease has been reported to occur within the species (Sarker <i>et al.</i> 2015; DoE 2015). However, this has not been recorded within Queensland. Individuals have been known to have contracted botulism from ingestion of affected roadkill (CSIRO 1996). Regardless, the project is not anticipated to introduce new diseases that may cause the species to decline.</p>

Significant residual impact criteria	Potential to occur
Interfere with the recovery of the species	<p>Unlikely</p> <p>The project will remove 3.25 ha of potentially suitable habitat, equating to 0.05% of habitat available within a 5 km buffer. Adjacent, remaining habitat is connected to an extensive network of suitable habitat well in excess of the 200 ha that is considered to be needed for the species. Targeted pre-clearance surveys will be undertaken by a suitably trained fauna spotter catcher to identify and retain (where possible) trees with large hollows within the SIGC SDA pipeline alignment. Therefore, the project is unlikely to cause a loss of habitat during the construction phase. Noting the above points relating to very limited if any effects on local populations (e.g. declines), extent of occurrence, fragmentation, invasive species, and disease, the project is not considered likely to interfere with the recovery of the powerful owl.</p>
Result in disruption to ecologically significant locations (breeding, feeding or nesting sites) of a species	<p>Unlikely</p> <p>The project will require the clearing of 3.25 ha of potentially suitable foraging habitat for the powerful owl. While old-growth remnant woodland with mature hollow-bearing trees were identified within the SGIC study area, the SGIC pipeline alignment area has been exposed to historical clearing for fence lines and access tracks, and therefore, a large proportion of hollow-bearing trees will be avoided during clearing. Trees retaining large hollows within the SGIC pipeline alignment, will be identified and marked by a suitably trained fauna spotter catcher during the pre-clearance surveys. These marked trees will be retained (where possible) during the construction phase of the project to reduce the loss of potentially suitable breeding places. Provided this is undertaken, disruption to significant feeding and nesting sites is considered unlikely.</p>
Conclusion	<p>The project is unlikely to result in a significant residual impact on the powerful owl. The project will result in a loss (3.25 ha) of potentially suitable foraging and breeding habitat for the powerful owl; however, given the low density at which powerful owls typically occur, and the availability of potential habitat that will remain available within their home range, the impacts of clearing on the powerful owl are anticipated to be negligible. Pre-clearance surveys will be undertaken to retain (where possible) suitable nesting habitat, to further reduce the impact to potential breeding places within the SGIC SDA pipeline alignment.</p>



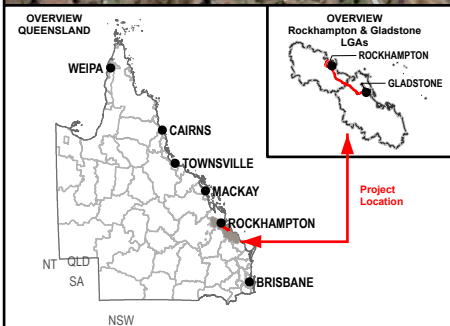
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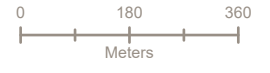
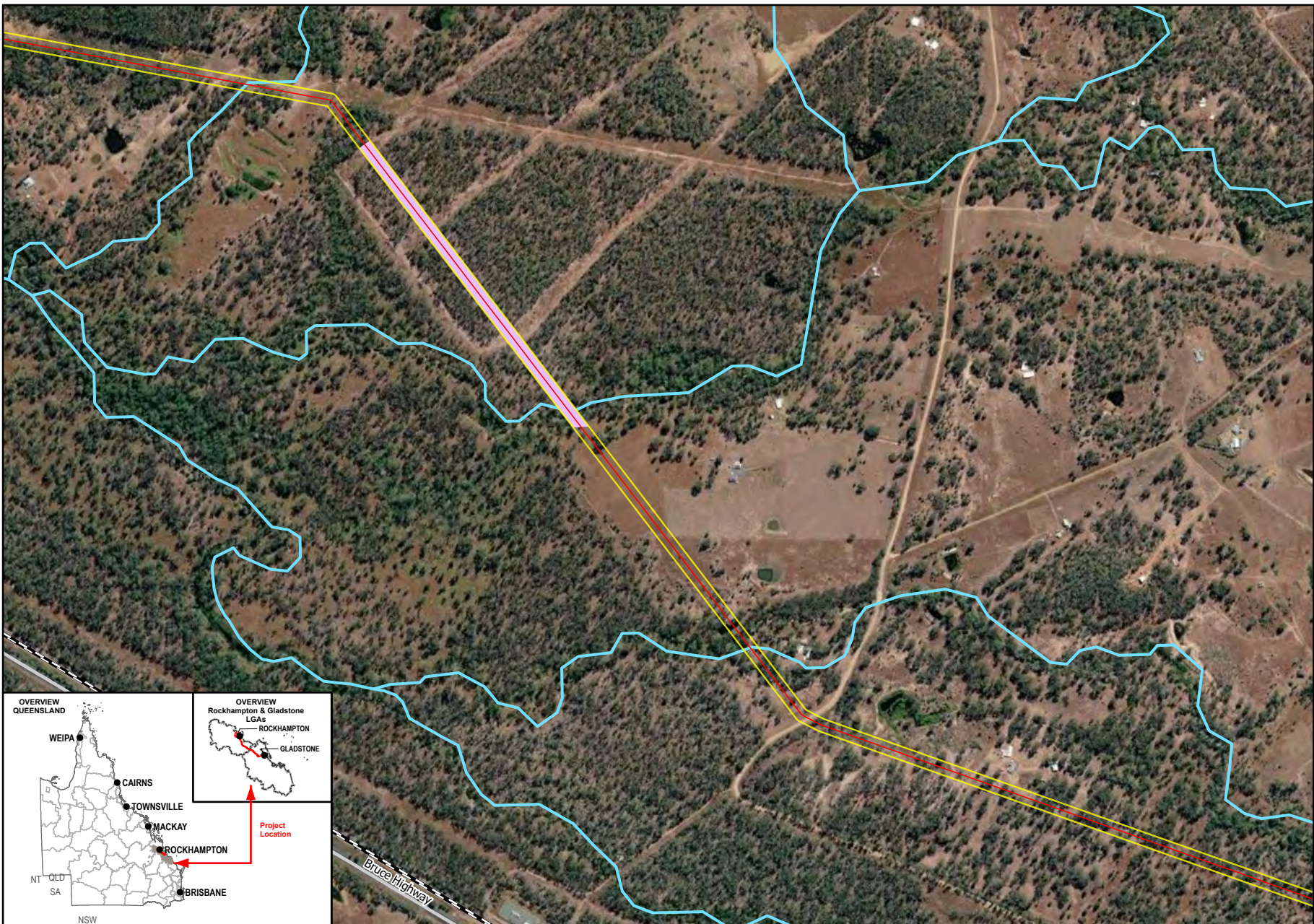
- Legend**
- SGIC SDA Pipeline Alignment
 - Study Area
 - Waterways
 - Main Roads
 - Railways



Data Sources:

1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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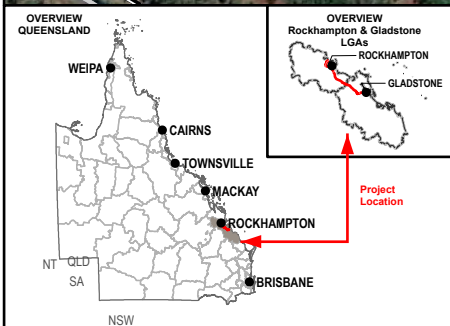
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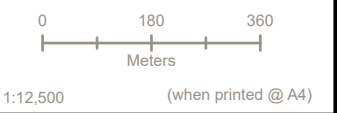
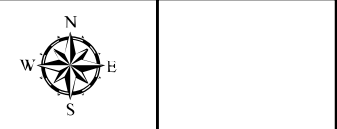
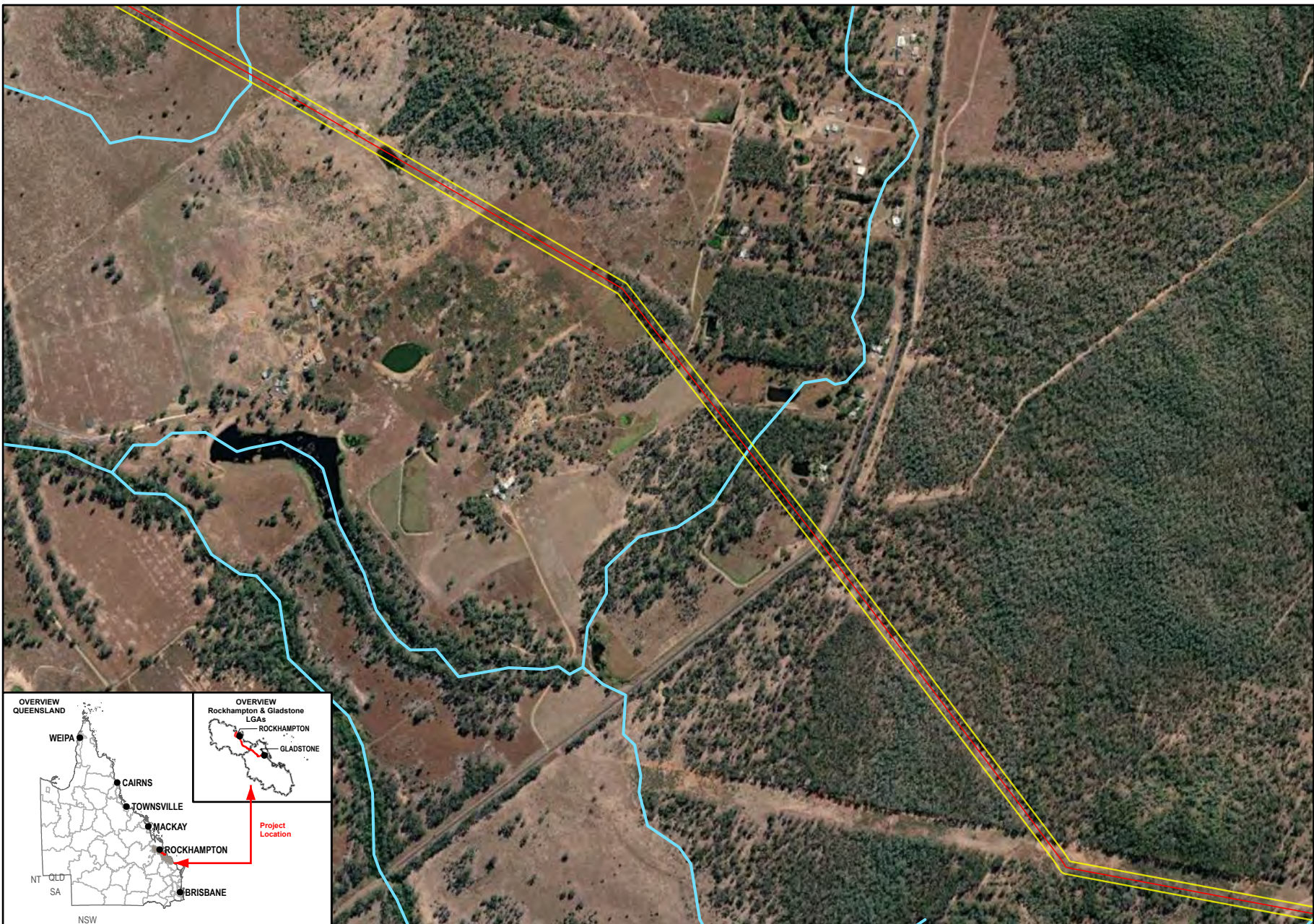
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- SGIC SDA Pipeline Alignment
- Study Area
- Predicted Powerful Owl Habitat
- Waterways
- Main Roads
- Railways

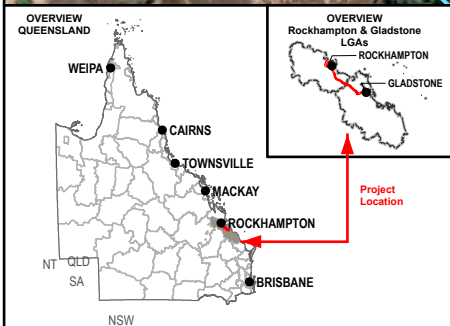


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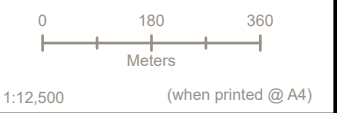
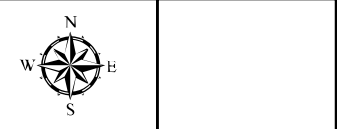
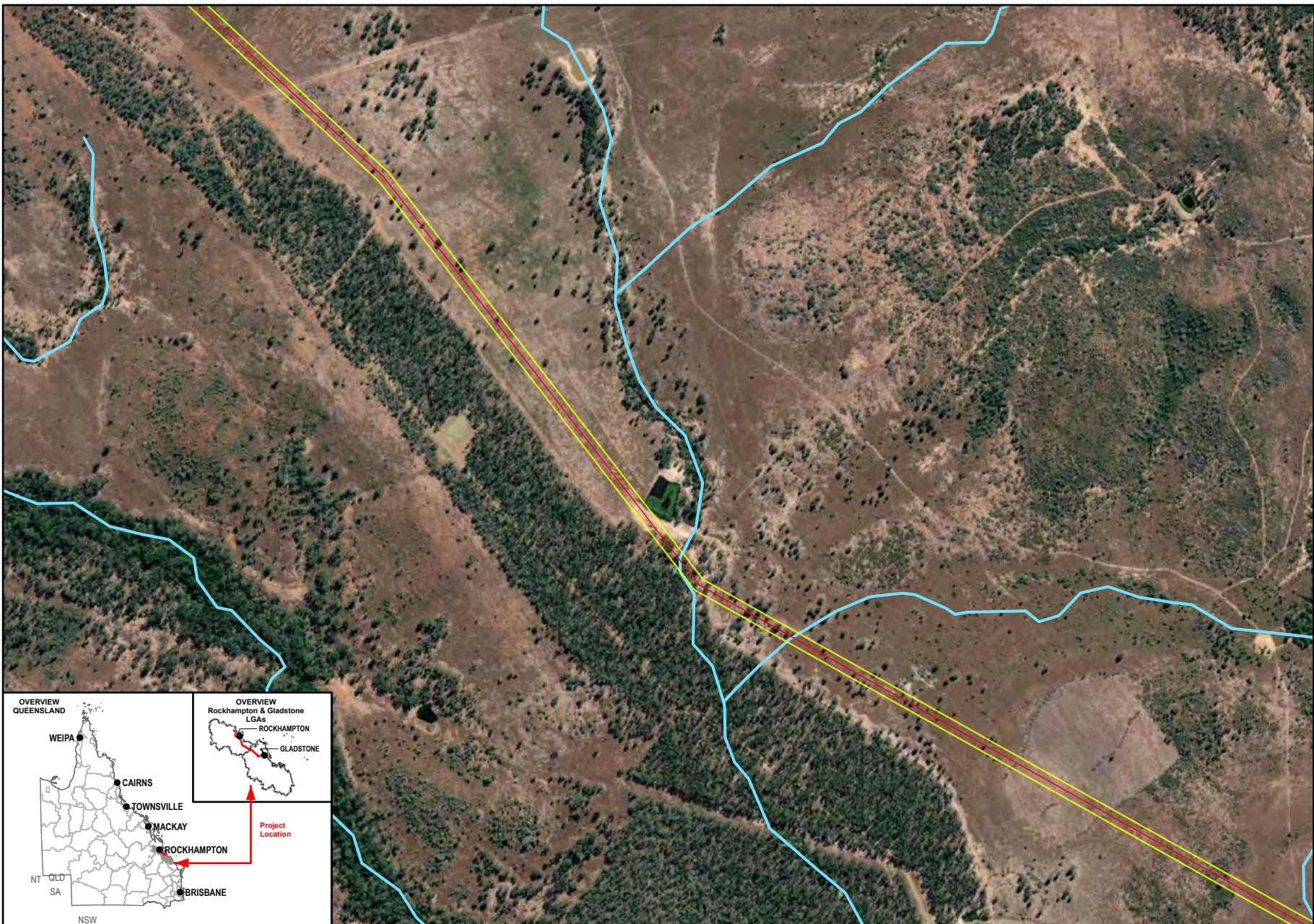
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- SGIC SDA Pipeline Alignment
 - Study Area
 - Waterways



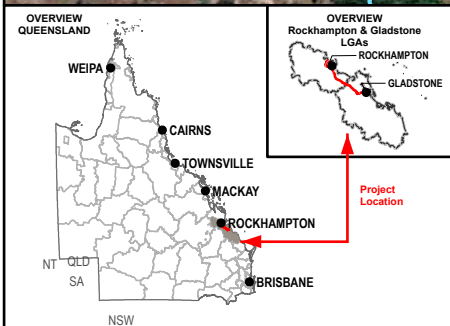
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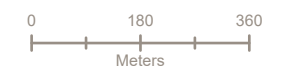
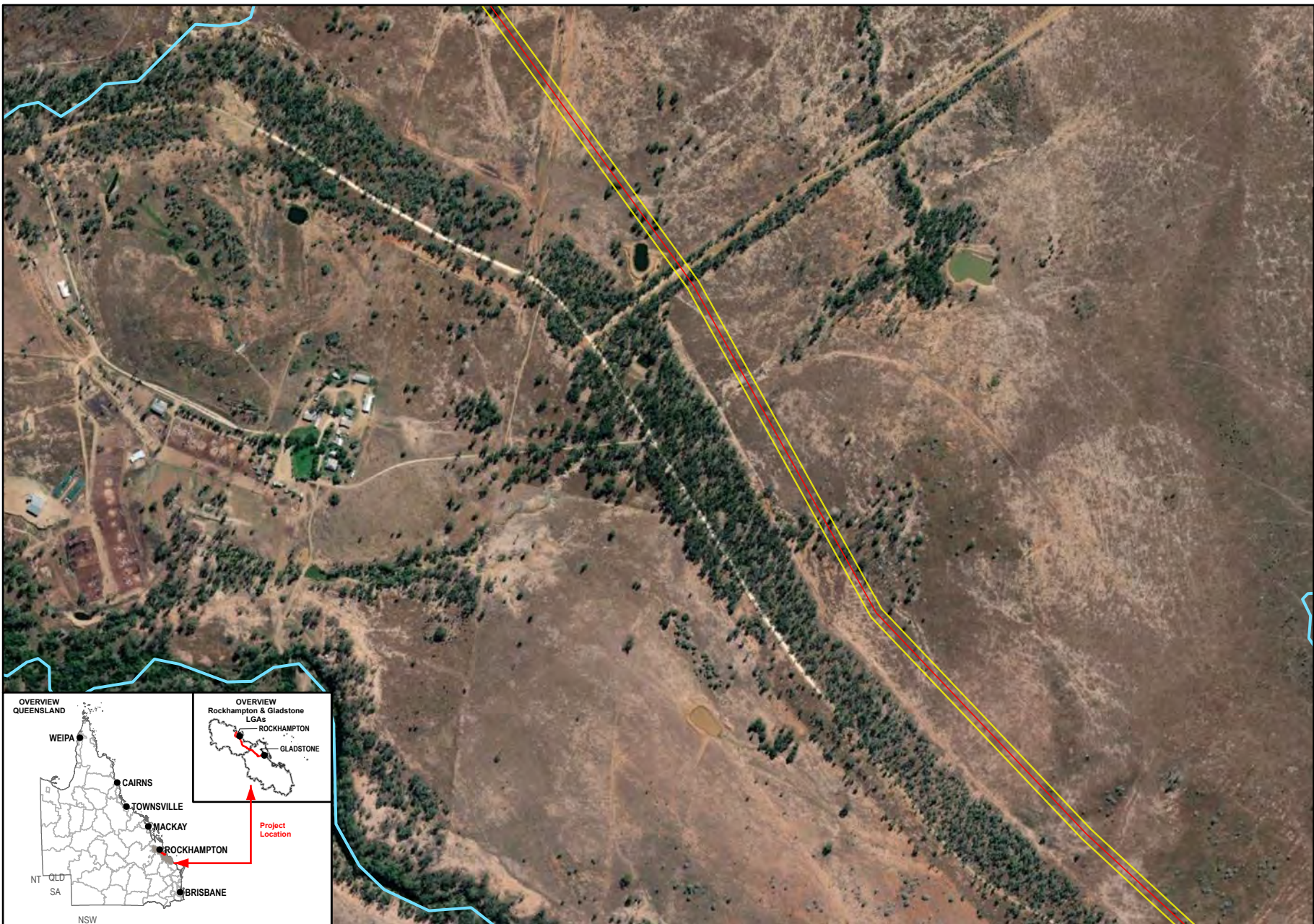
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 - Study Area
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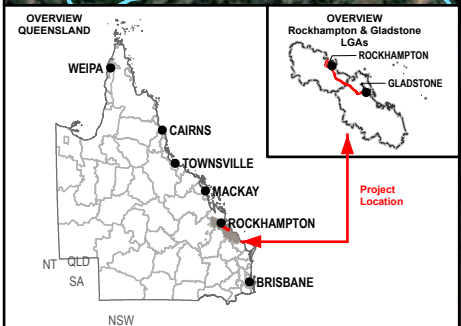
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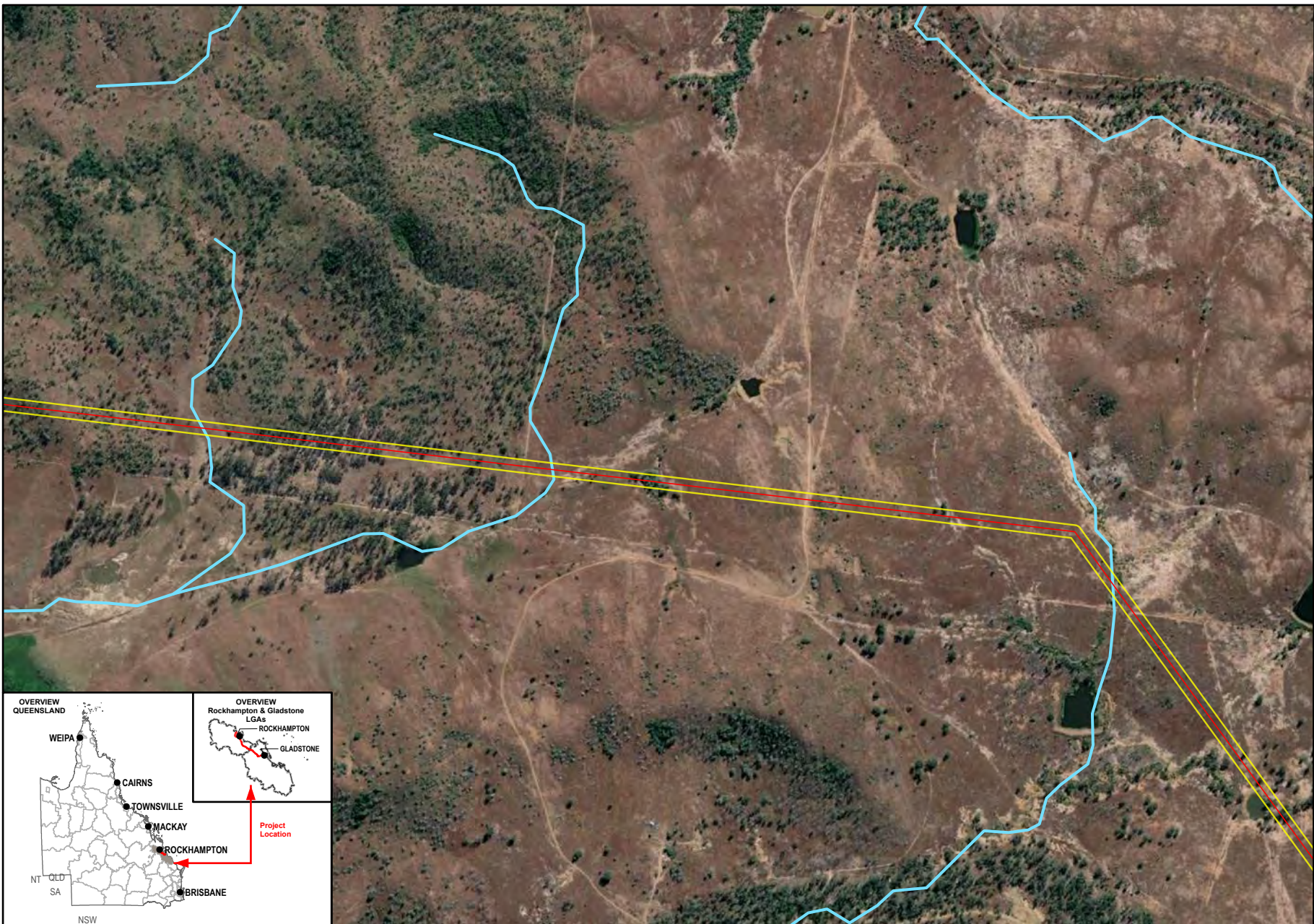
Legend

- SGIC SDA Pipeline Alignment
- Study Area
- Waterways



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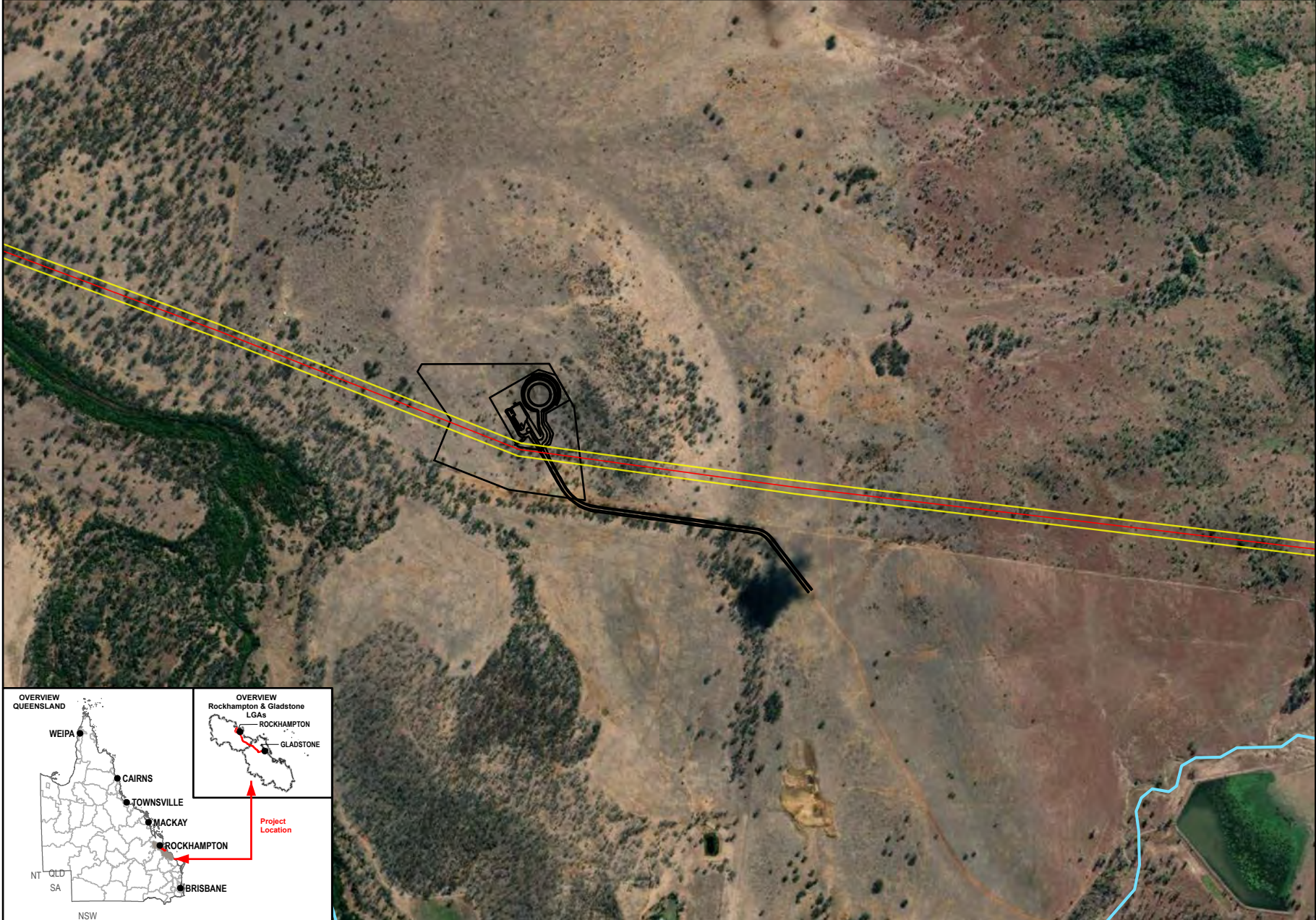
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- Legend**
- SGIC SDA Pipeline Alignment
 - Study Area
 - Waterways



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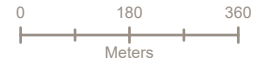
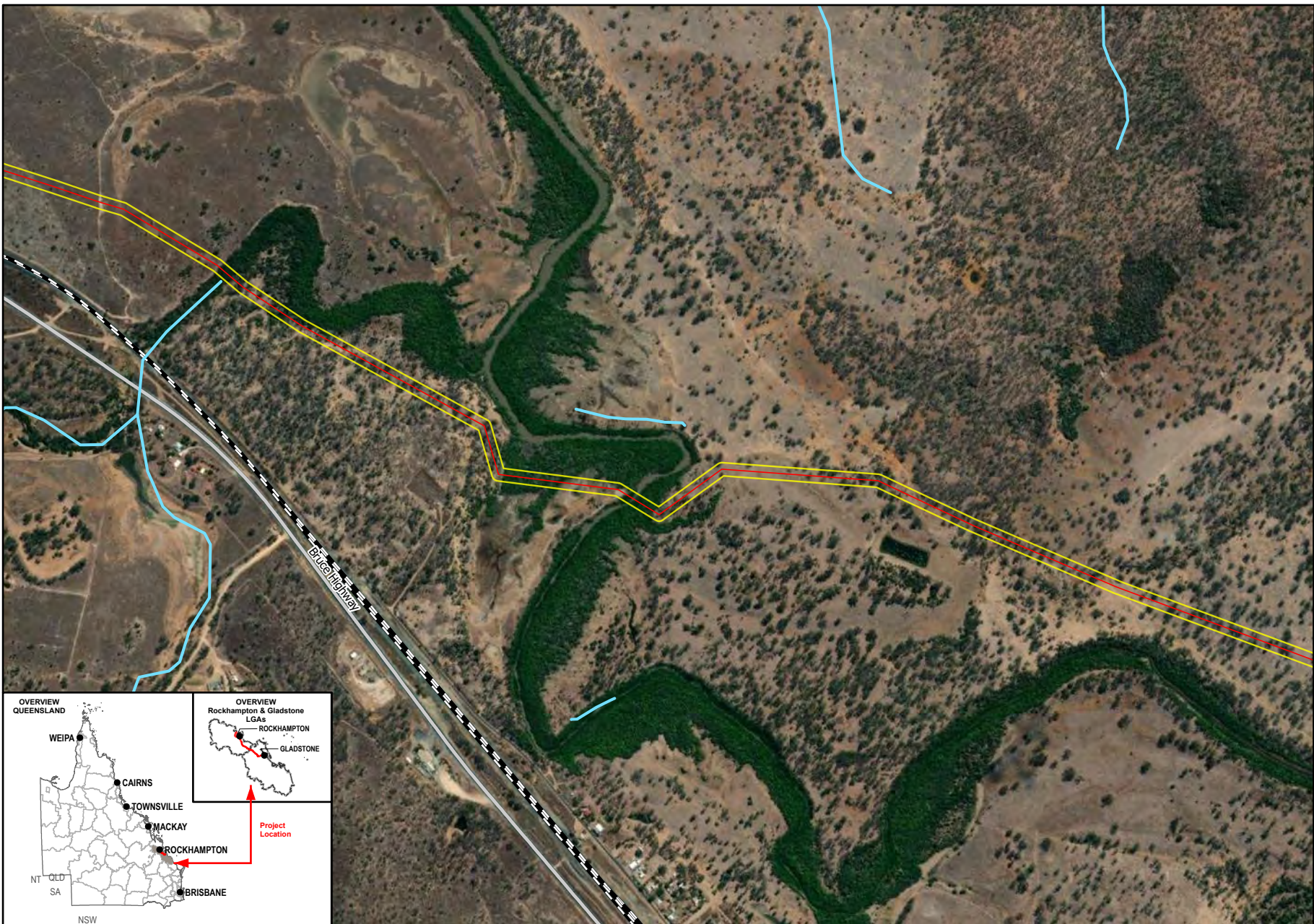
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- Legend**
- SGIC SDA Pipeline Alignment
 - Study Area
 - Raglan Pump Station and Reservoir Layout
 - Waterways

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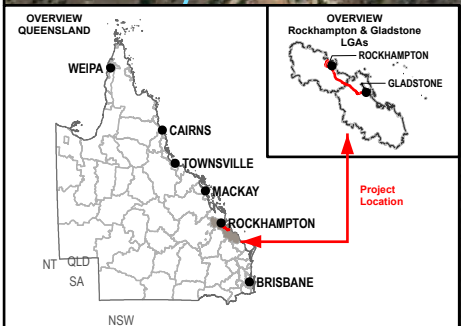
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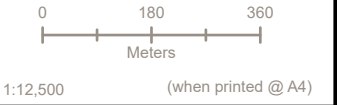
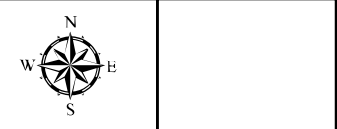
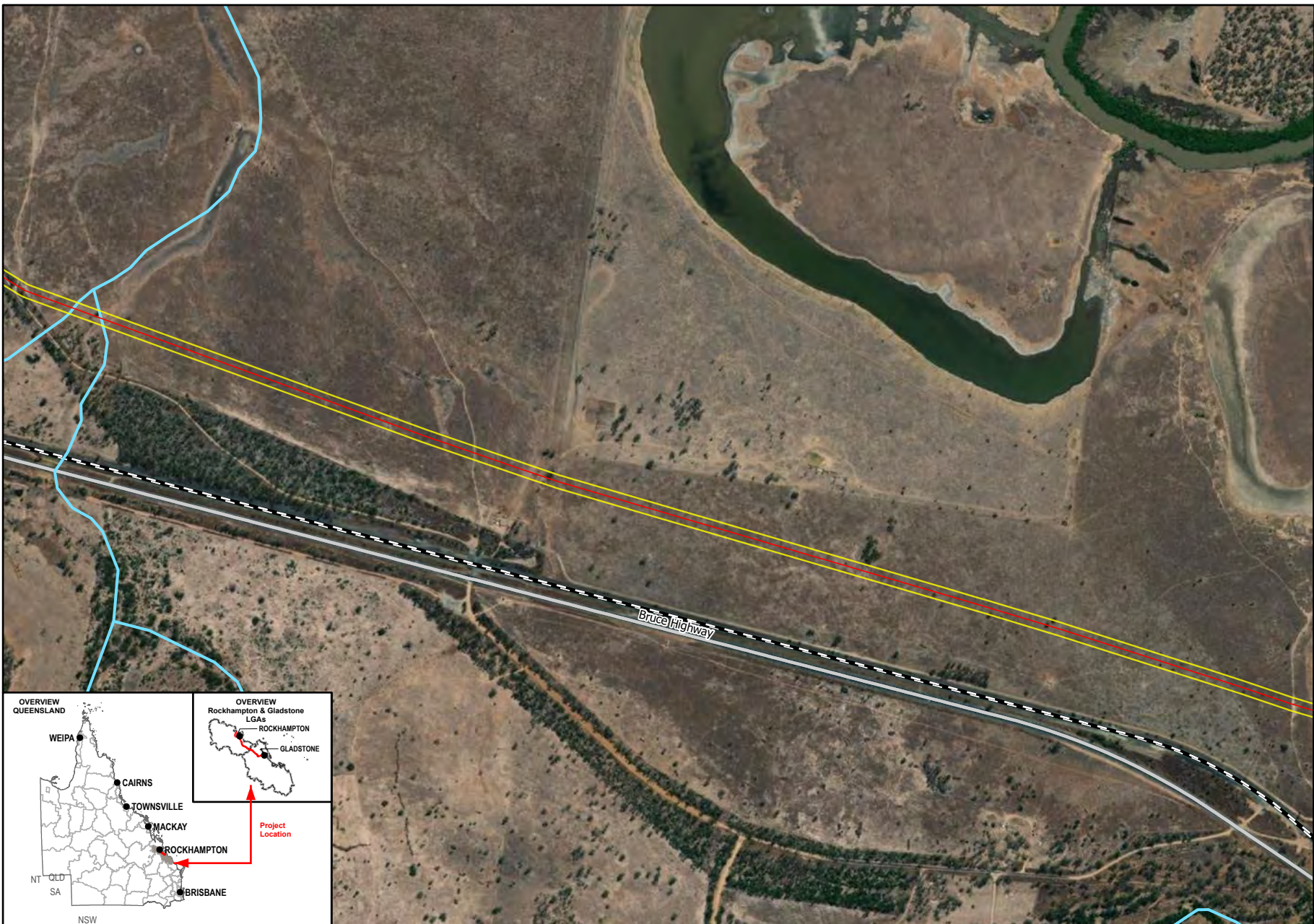
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- SGIC SDA Pipeline Alignment
- Study Area
- Waterways
- Main Roads
- Railways

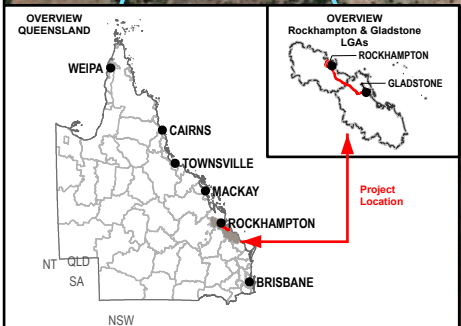


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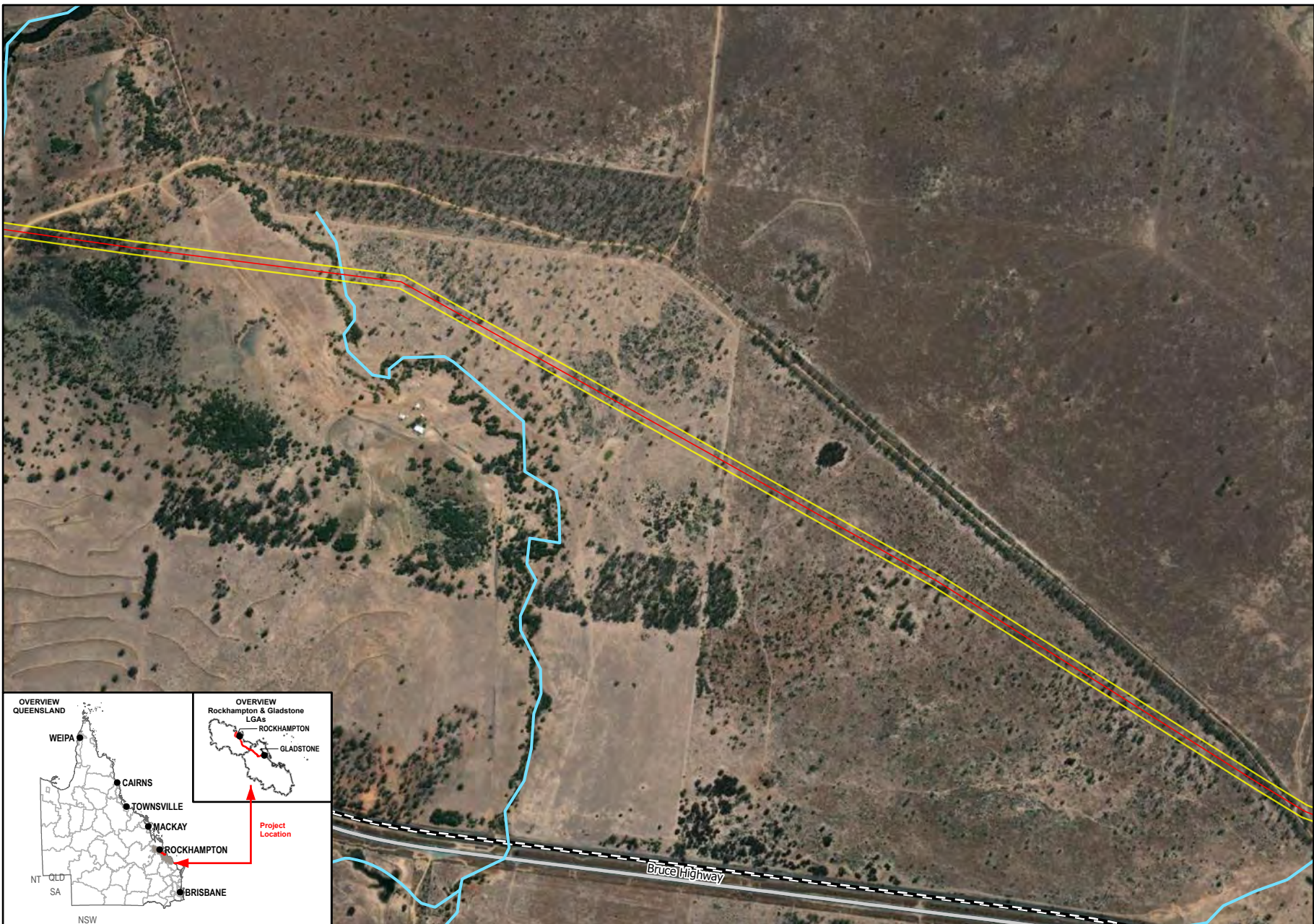
- Legend**
- SGIC SDA Pipeline Alignment
 - Study Area
 - Waterways
 - Main Roads
 - Railways



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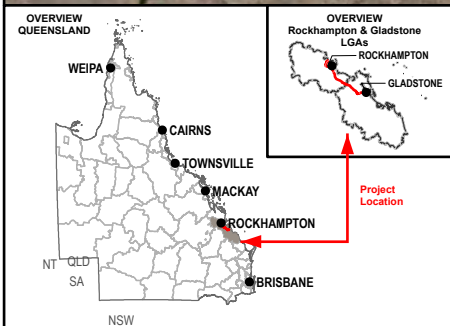
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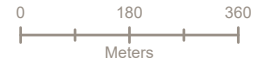
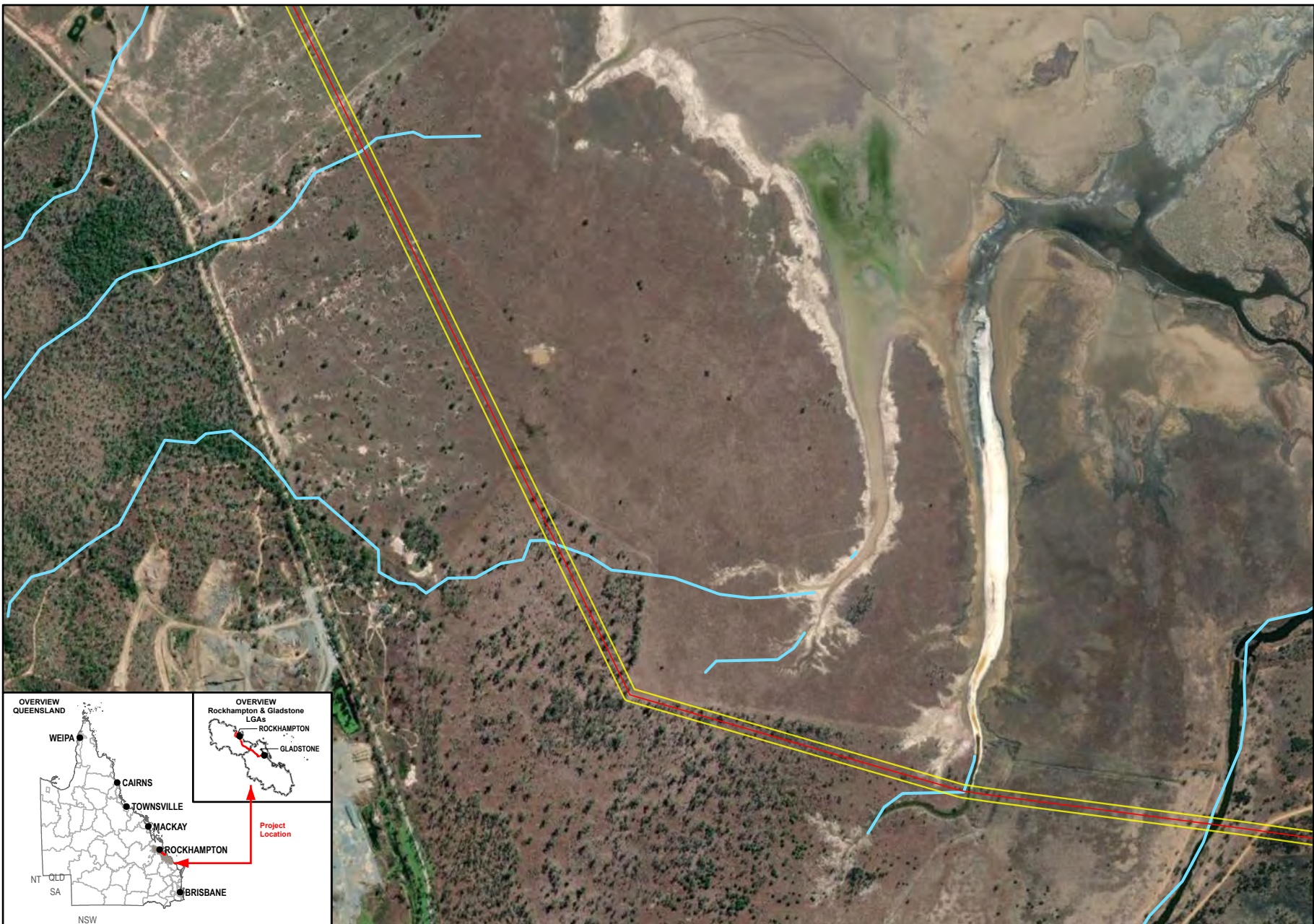
- Legend**
- SGIC SDA Pipeline Alignment
 - Study Area
 - Waterways
 - Main Roads
 - Railways

Data Sources:

1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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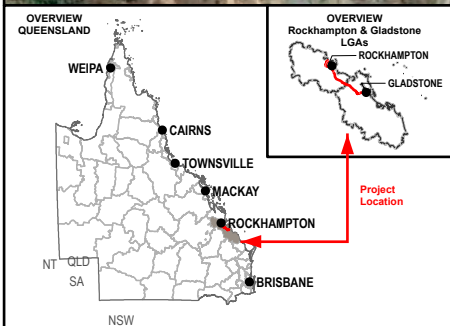




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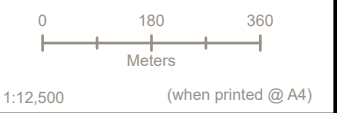
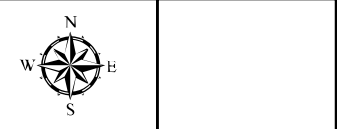
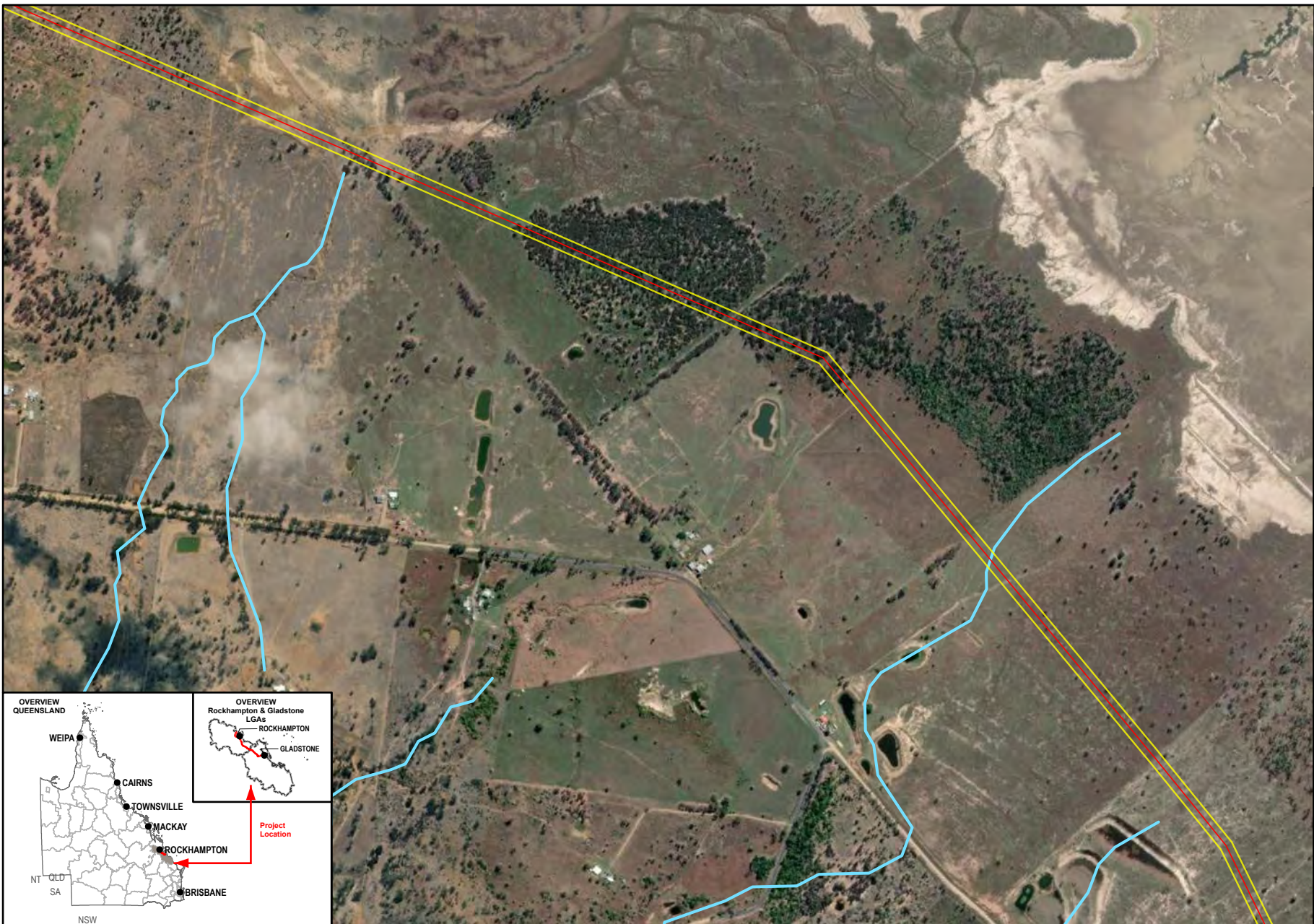
Legend

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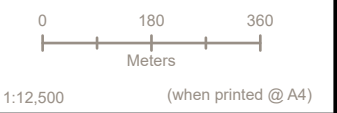
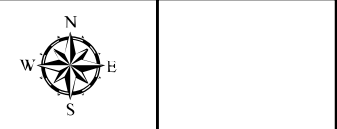
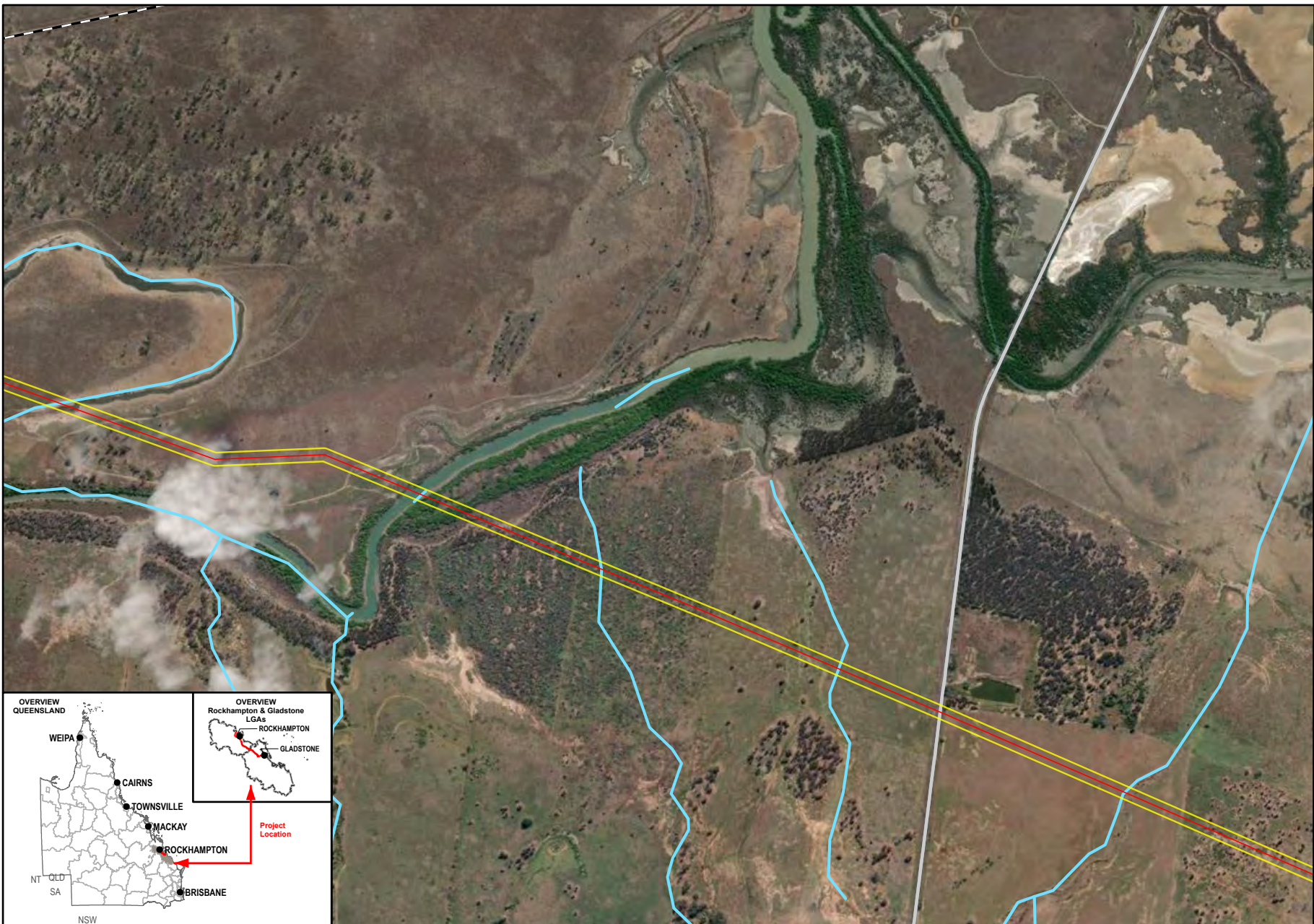


- Legend**
- SGIC SDA Pipeline Alignment
 - Study Area
 - Waterways

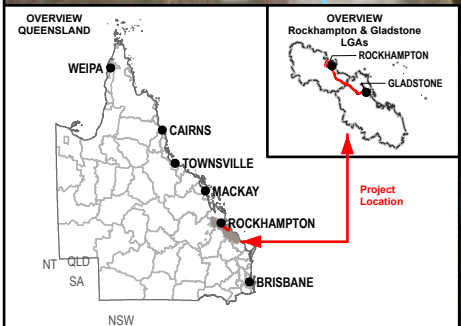
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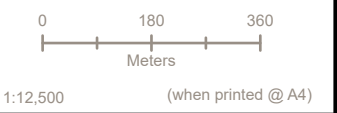
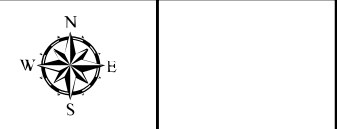
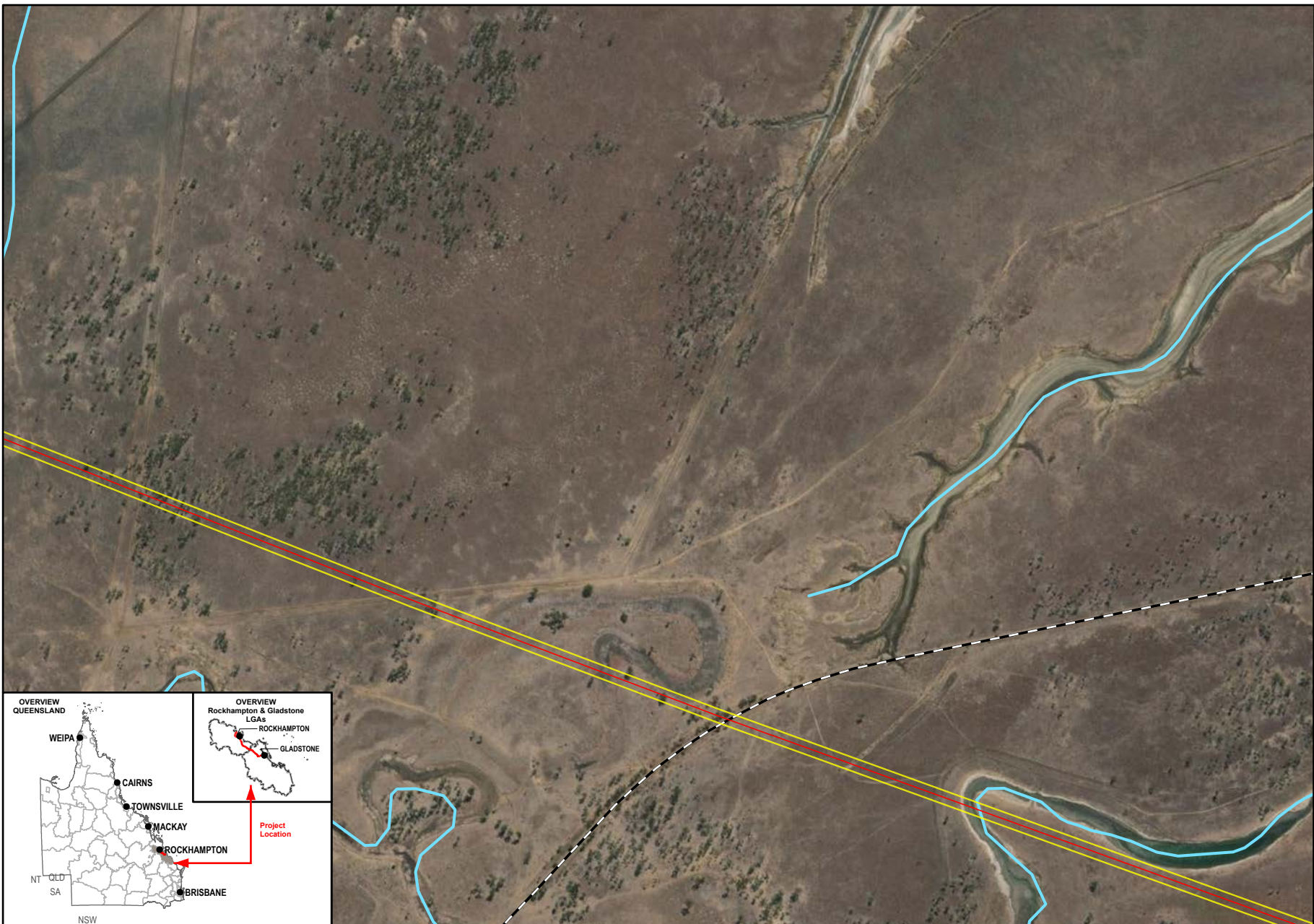
- Legend**
- SGIC SDA Pipeline Alignment
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 - Railways



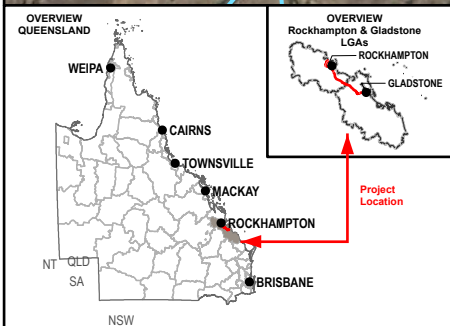
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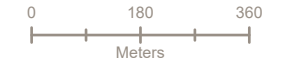
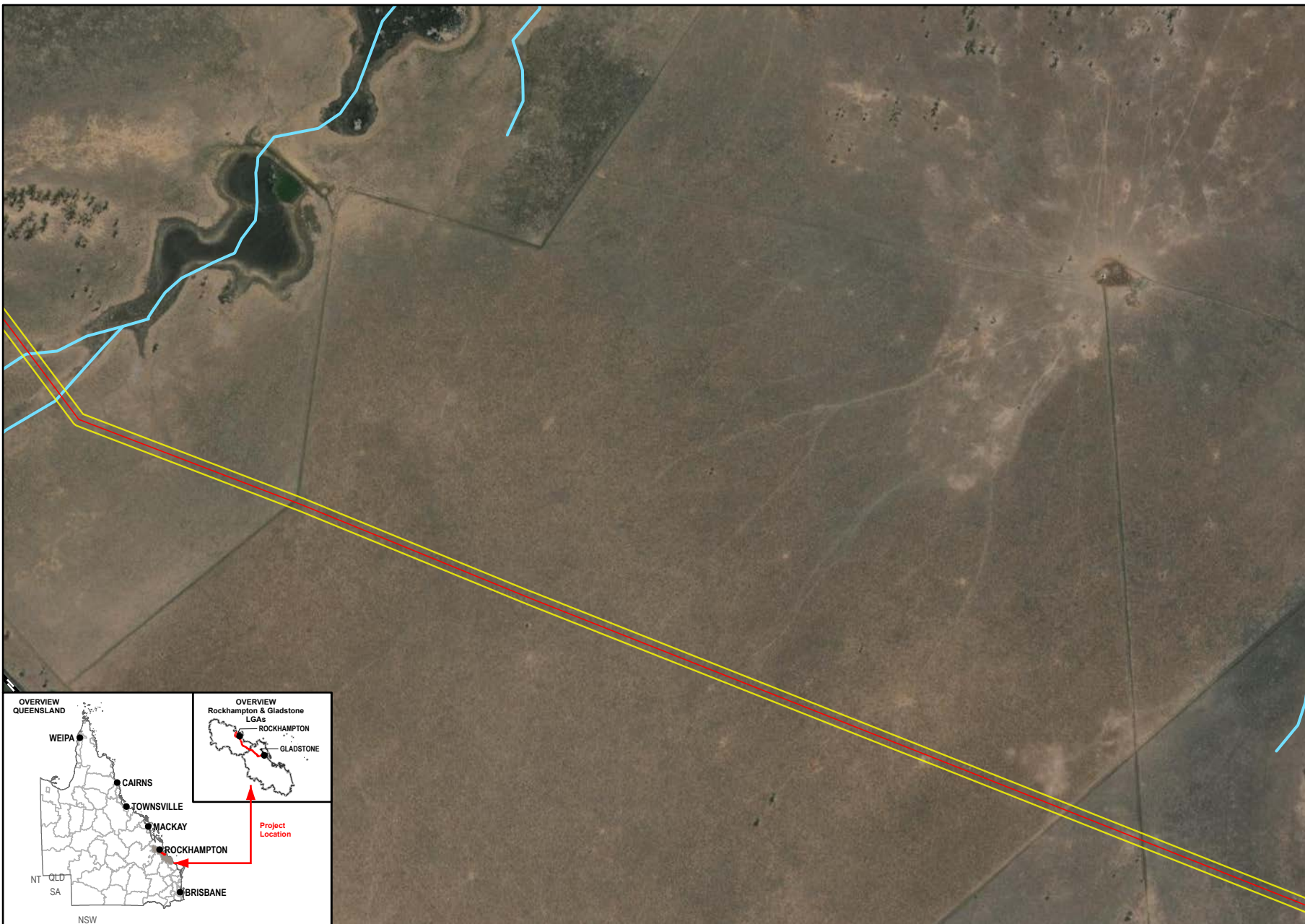
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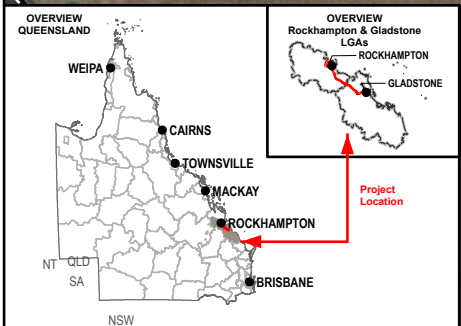
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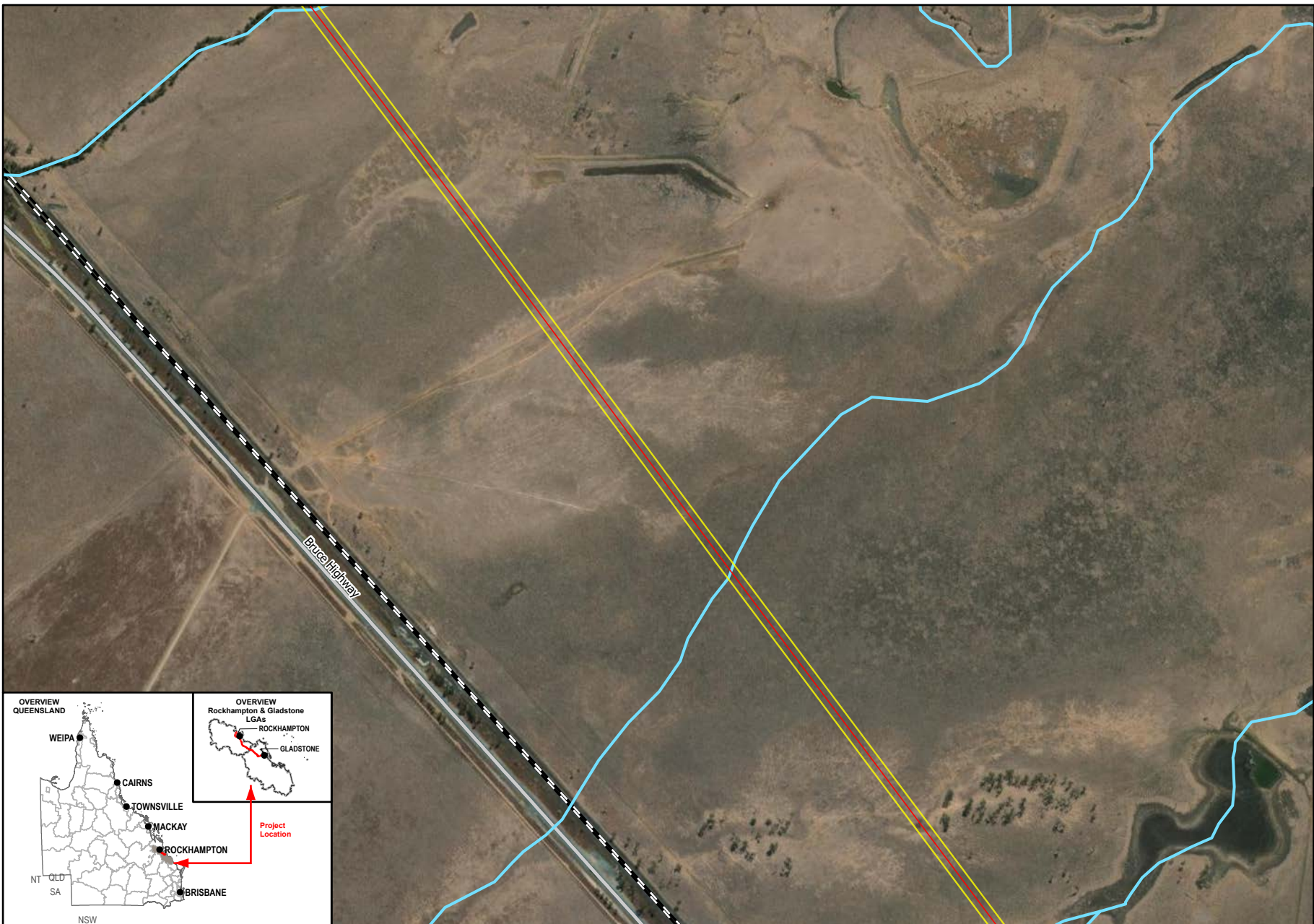
Legend




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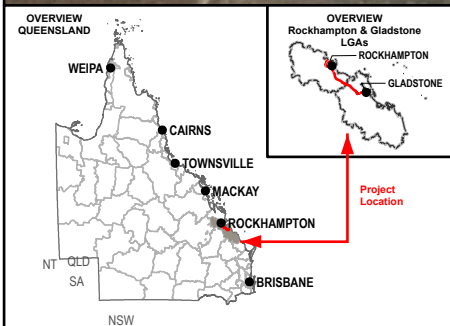

 
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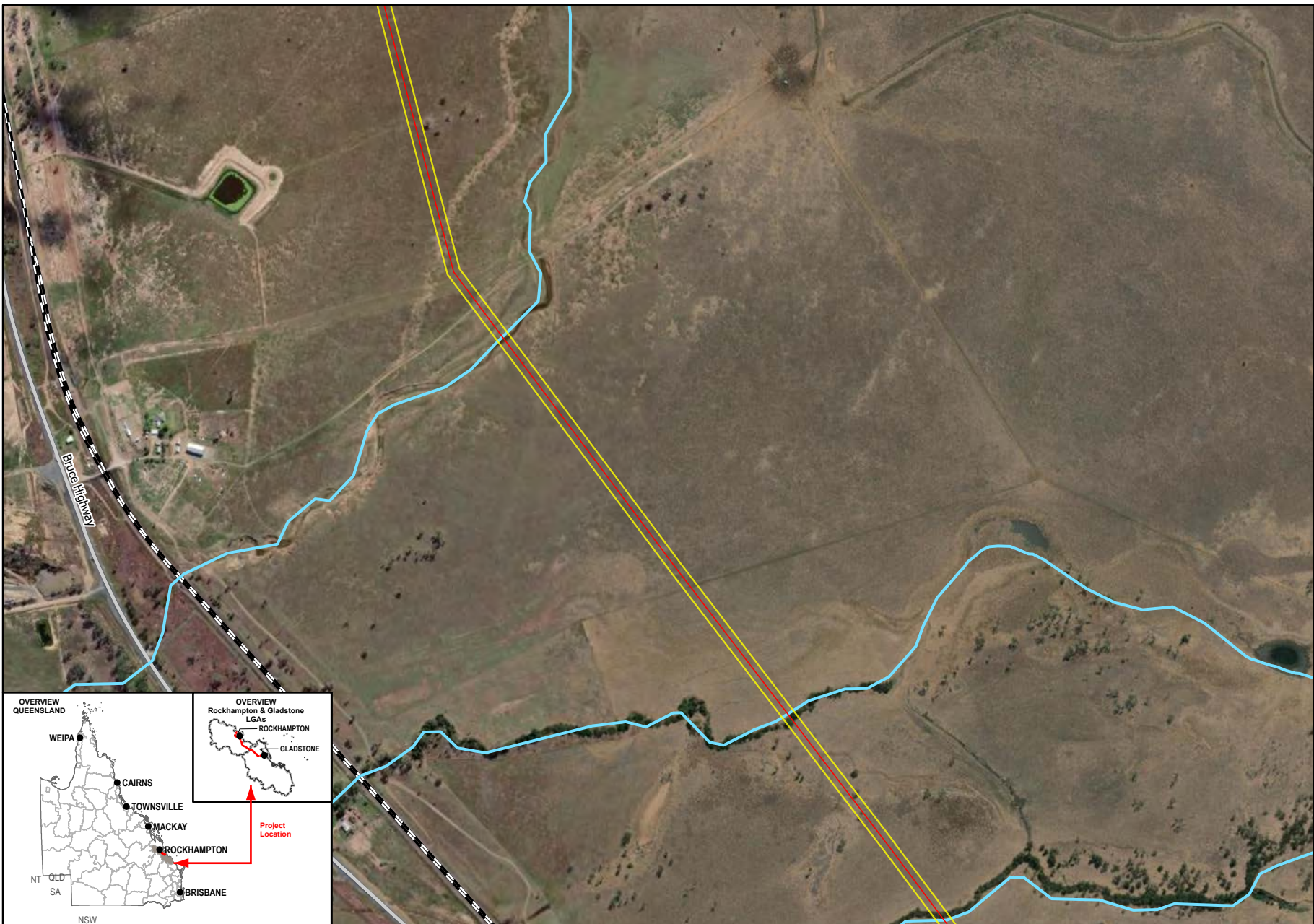
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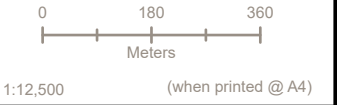
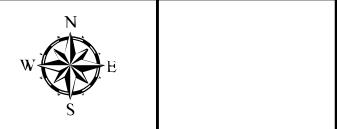
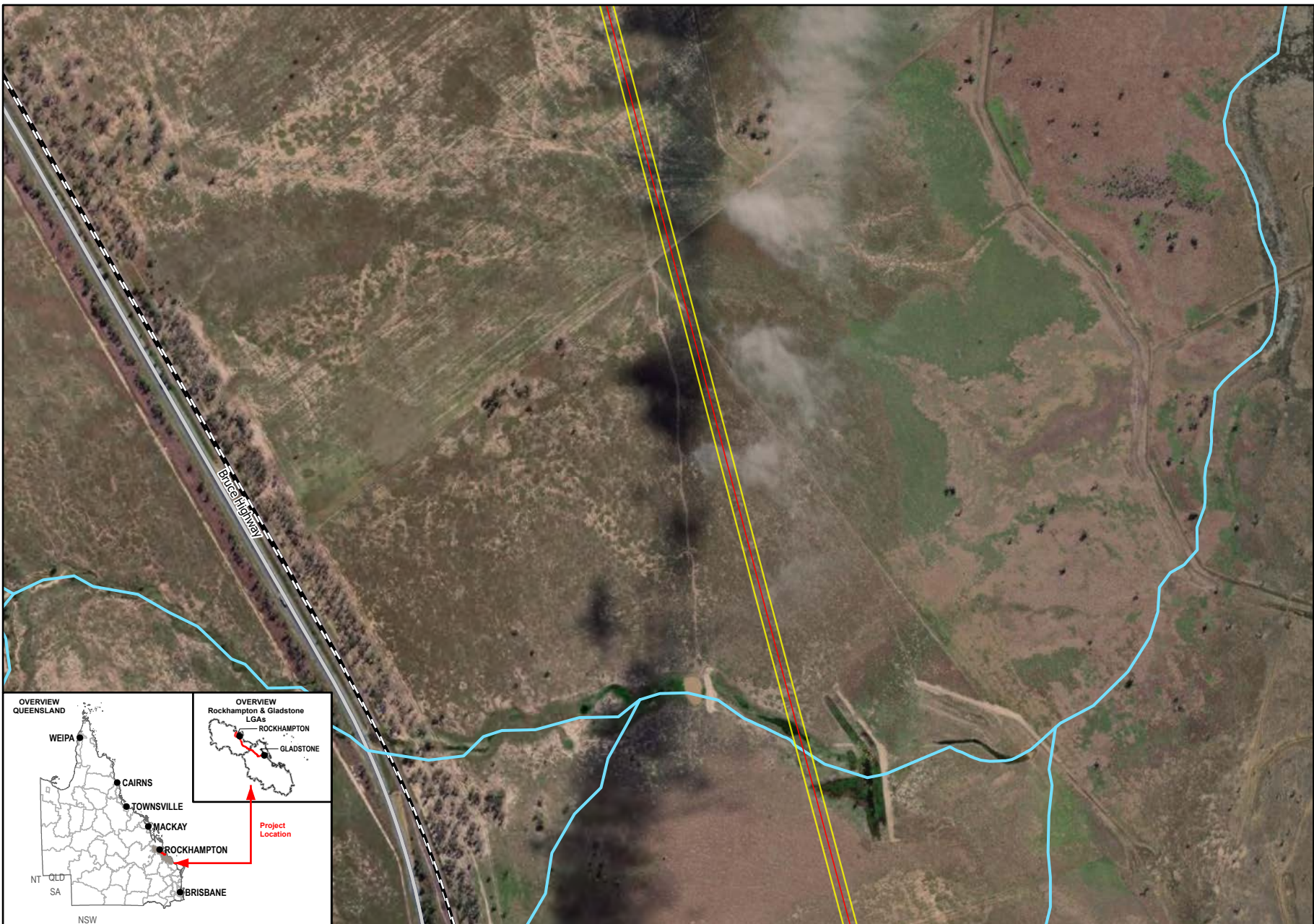
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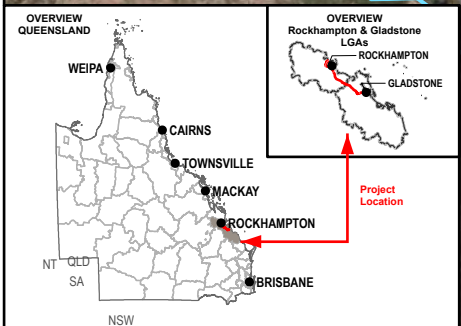
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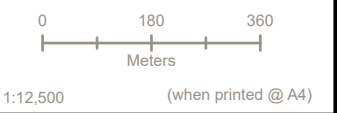
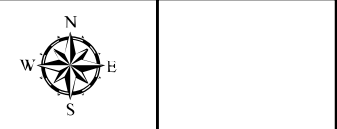
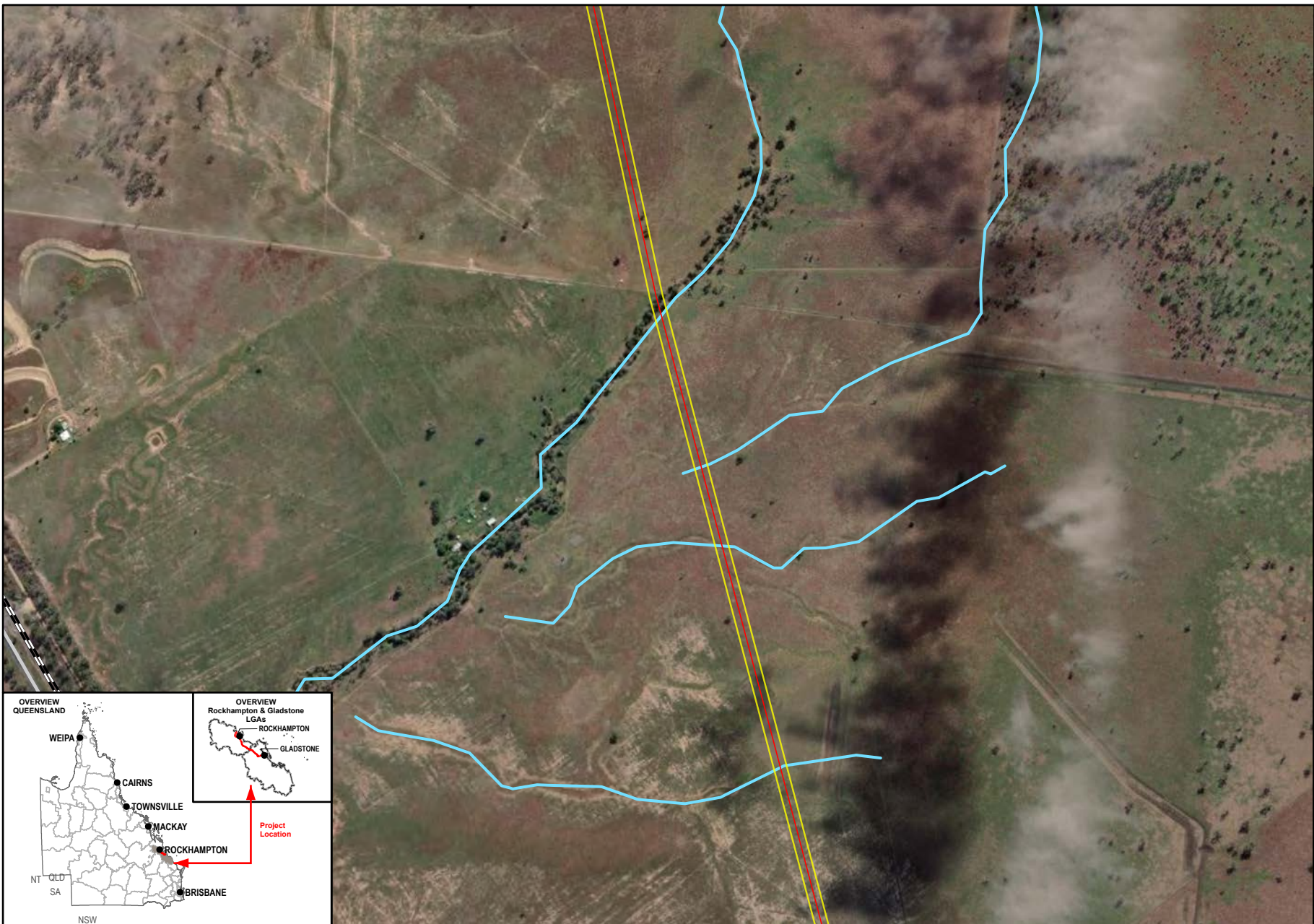
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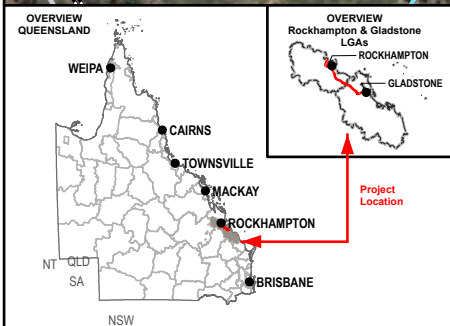
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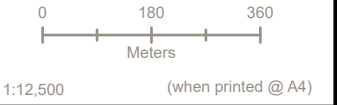
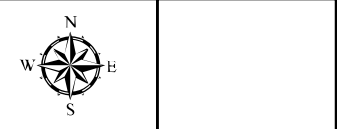
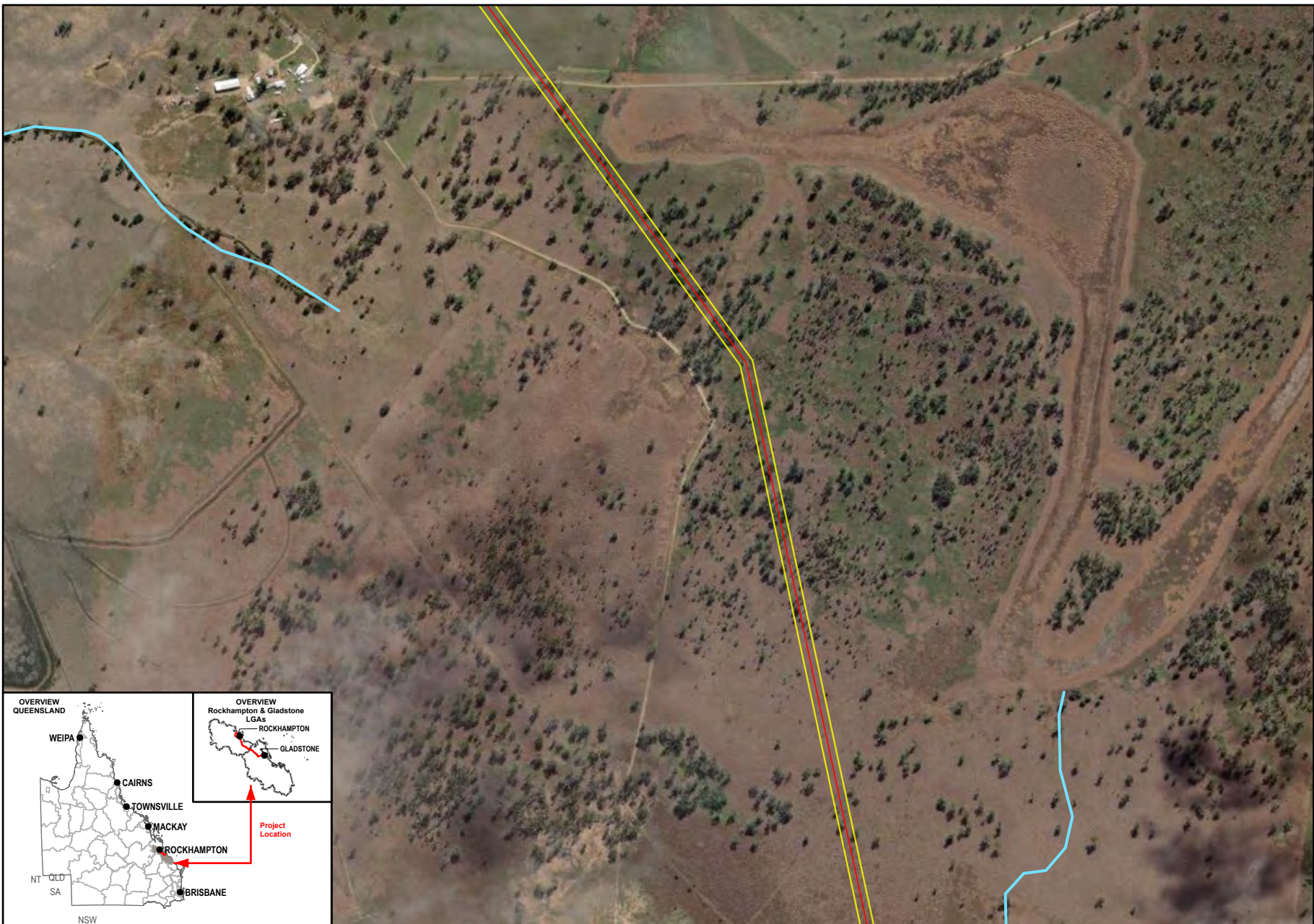
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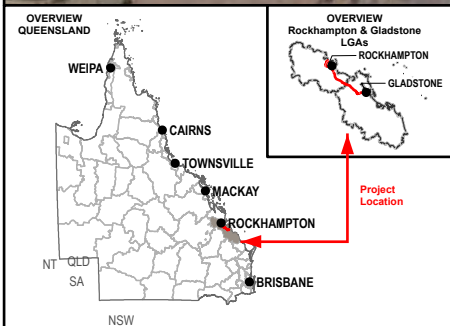


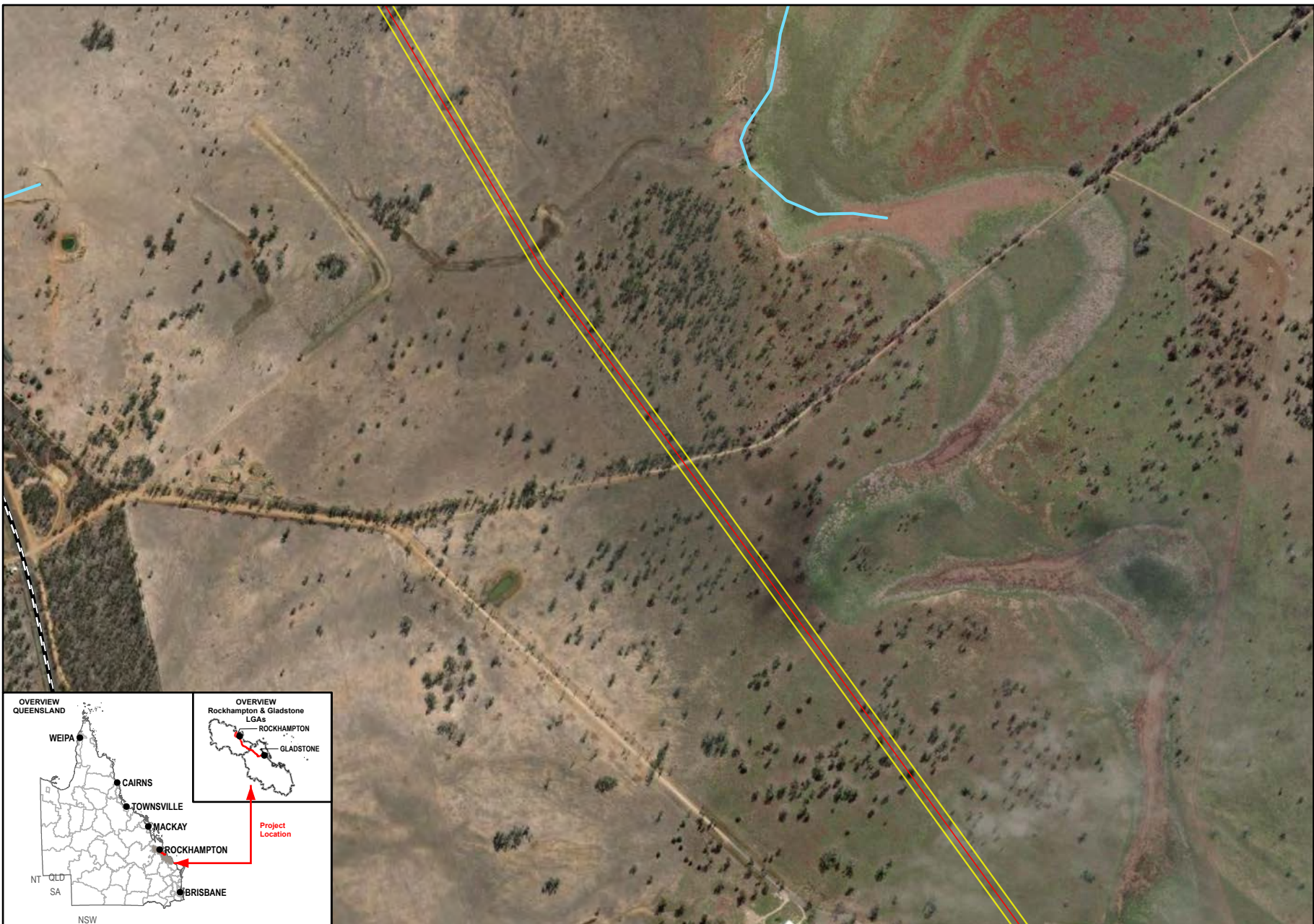
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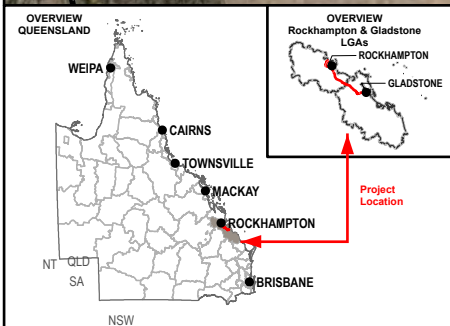
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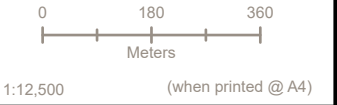
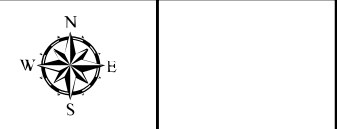
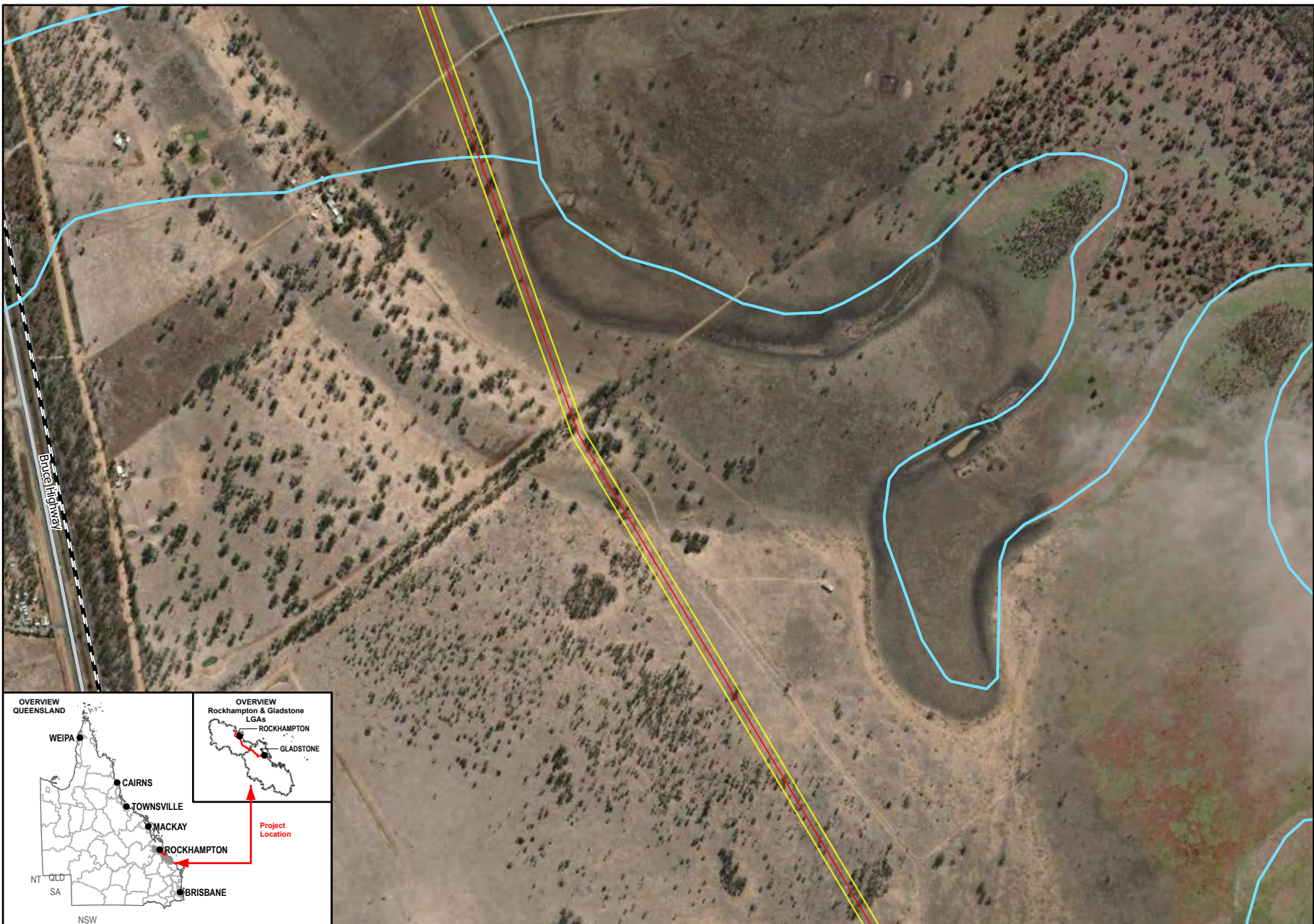
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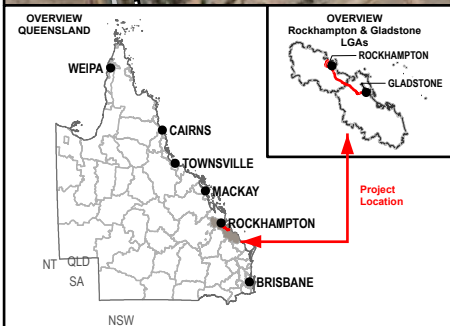
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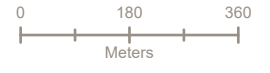
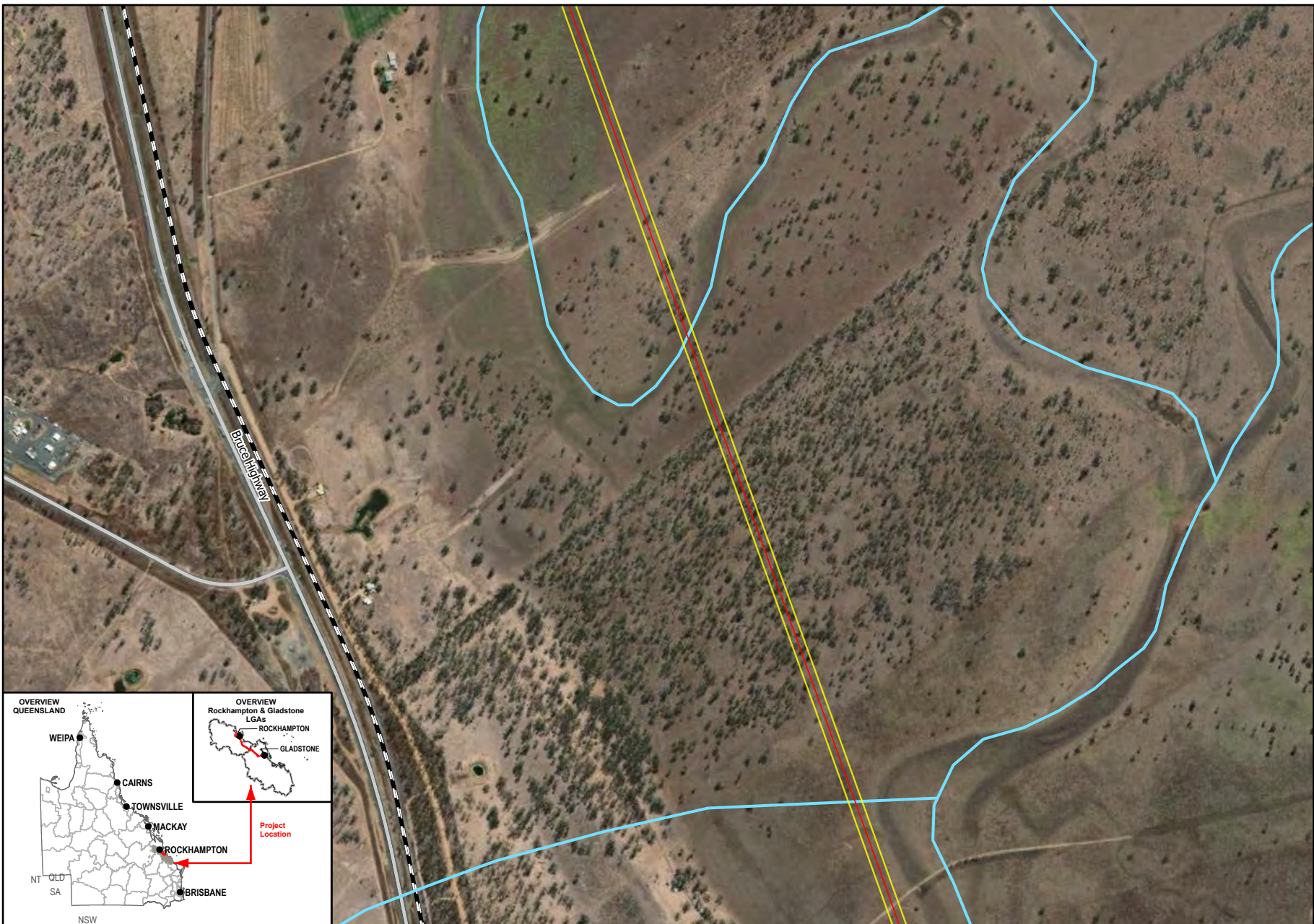
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Legend

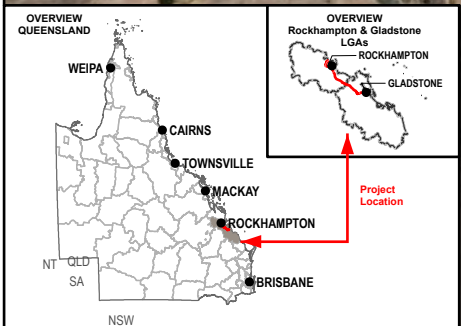
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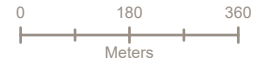
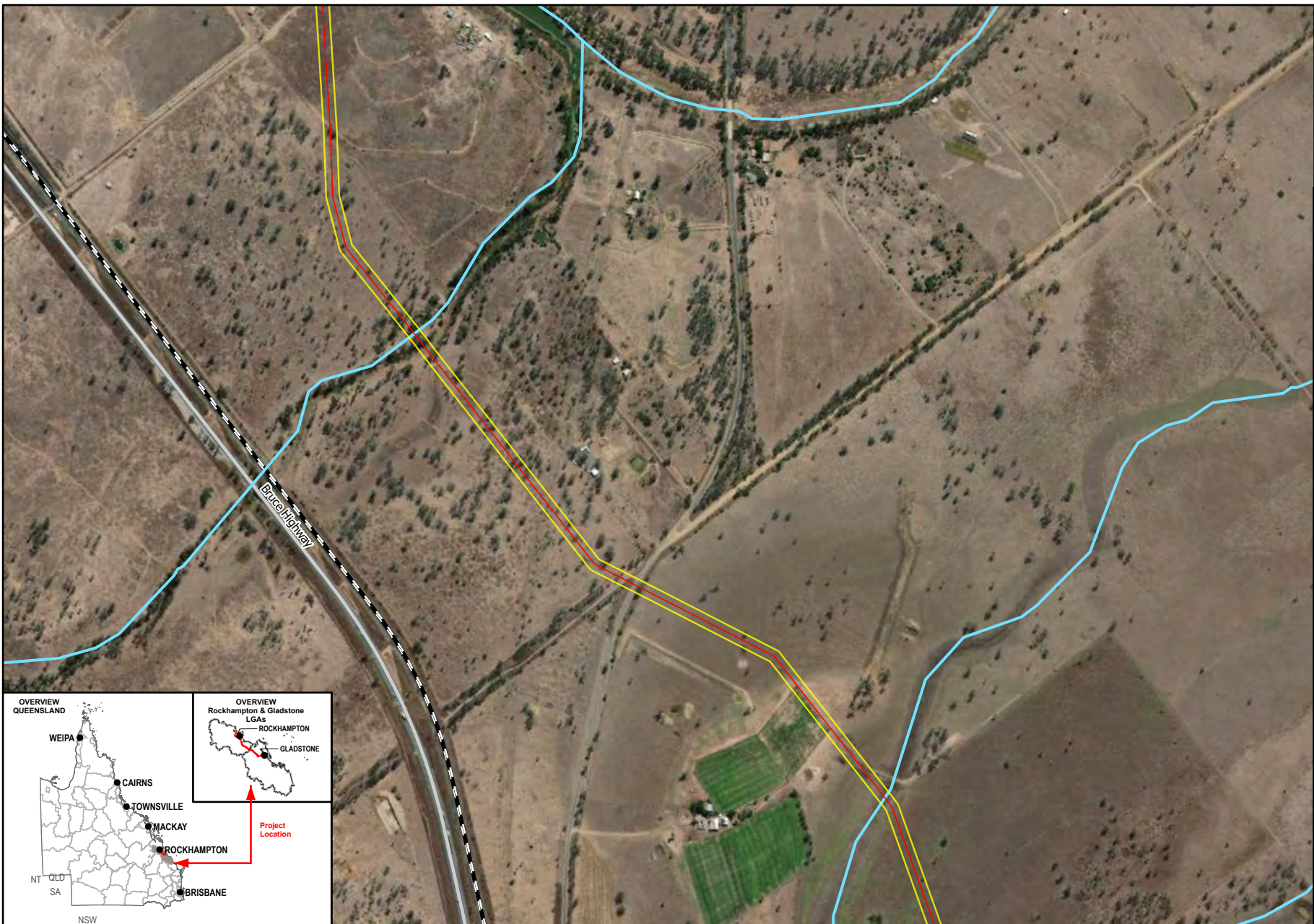
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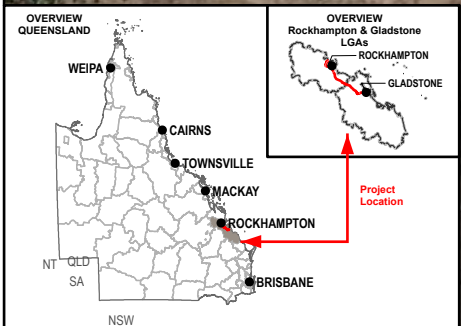




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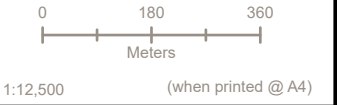
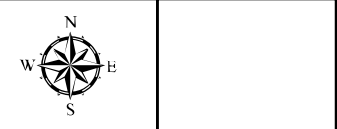
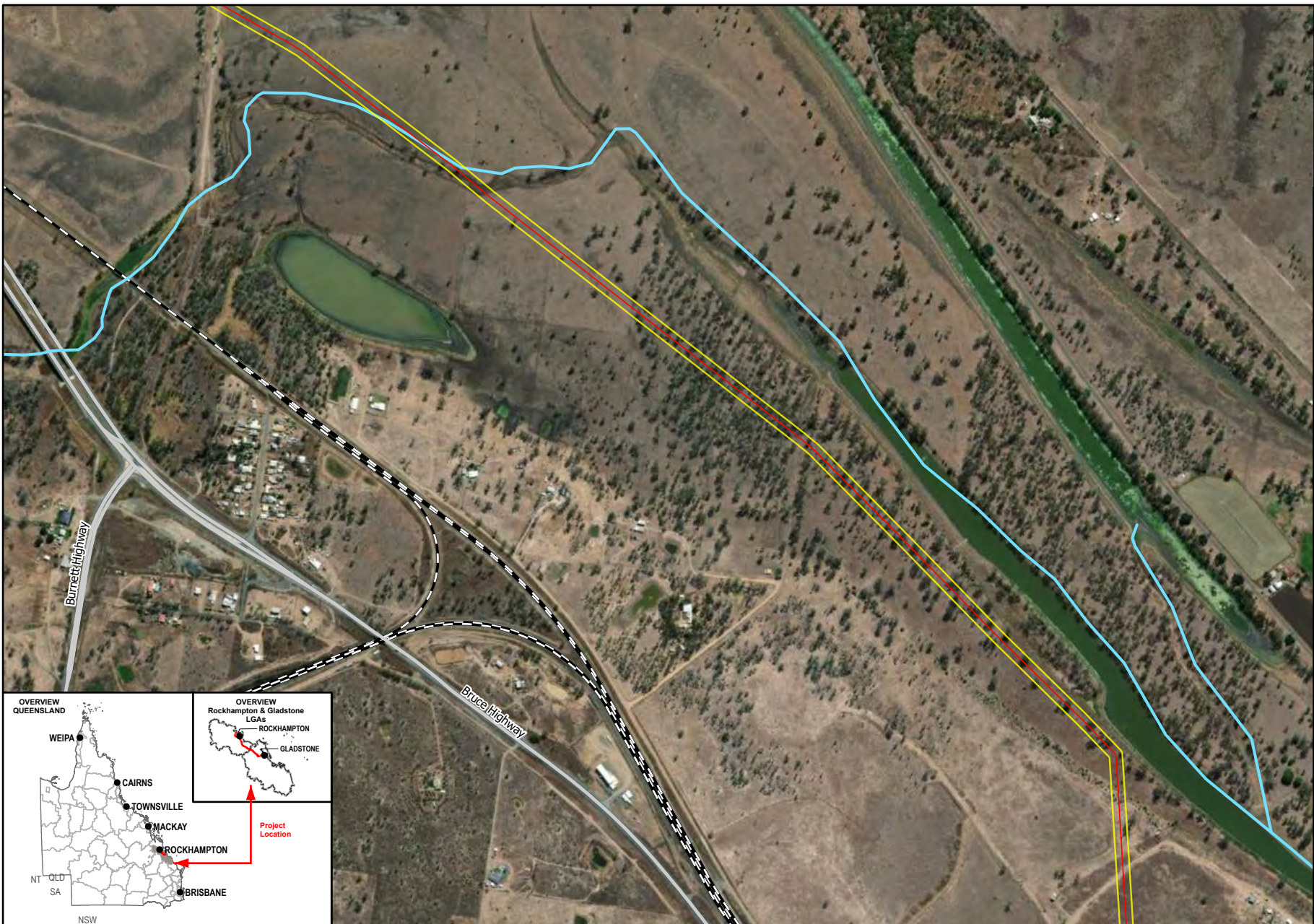
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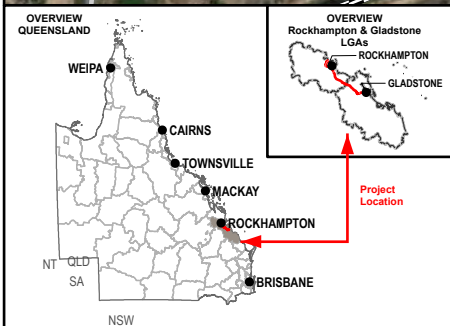


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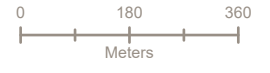
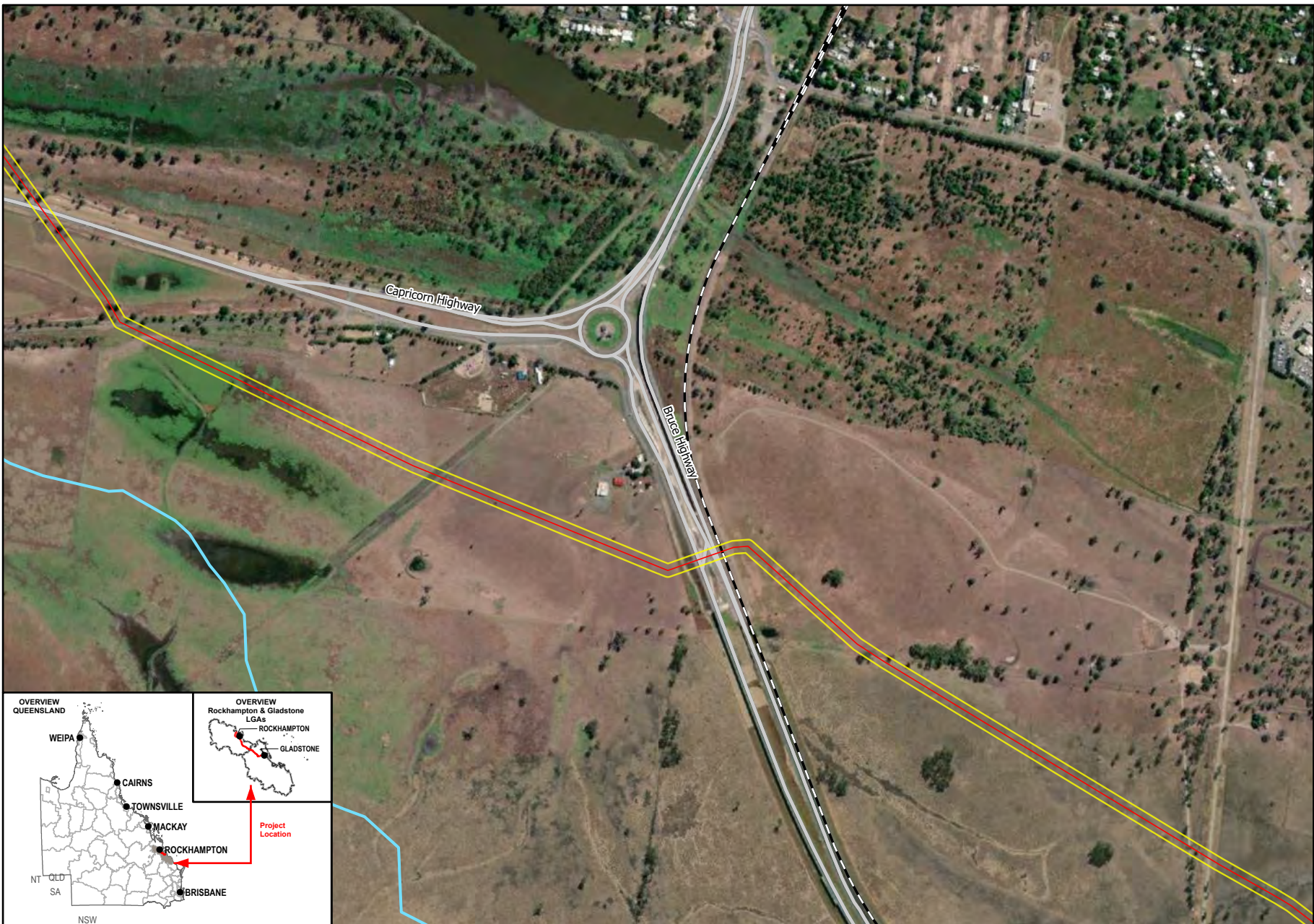


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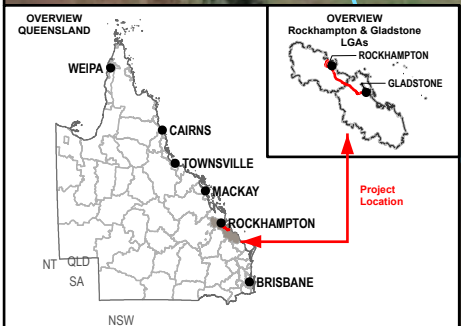
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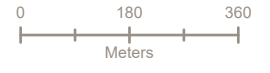
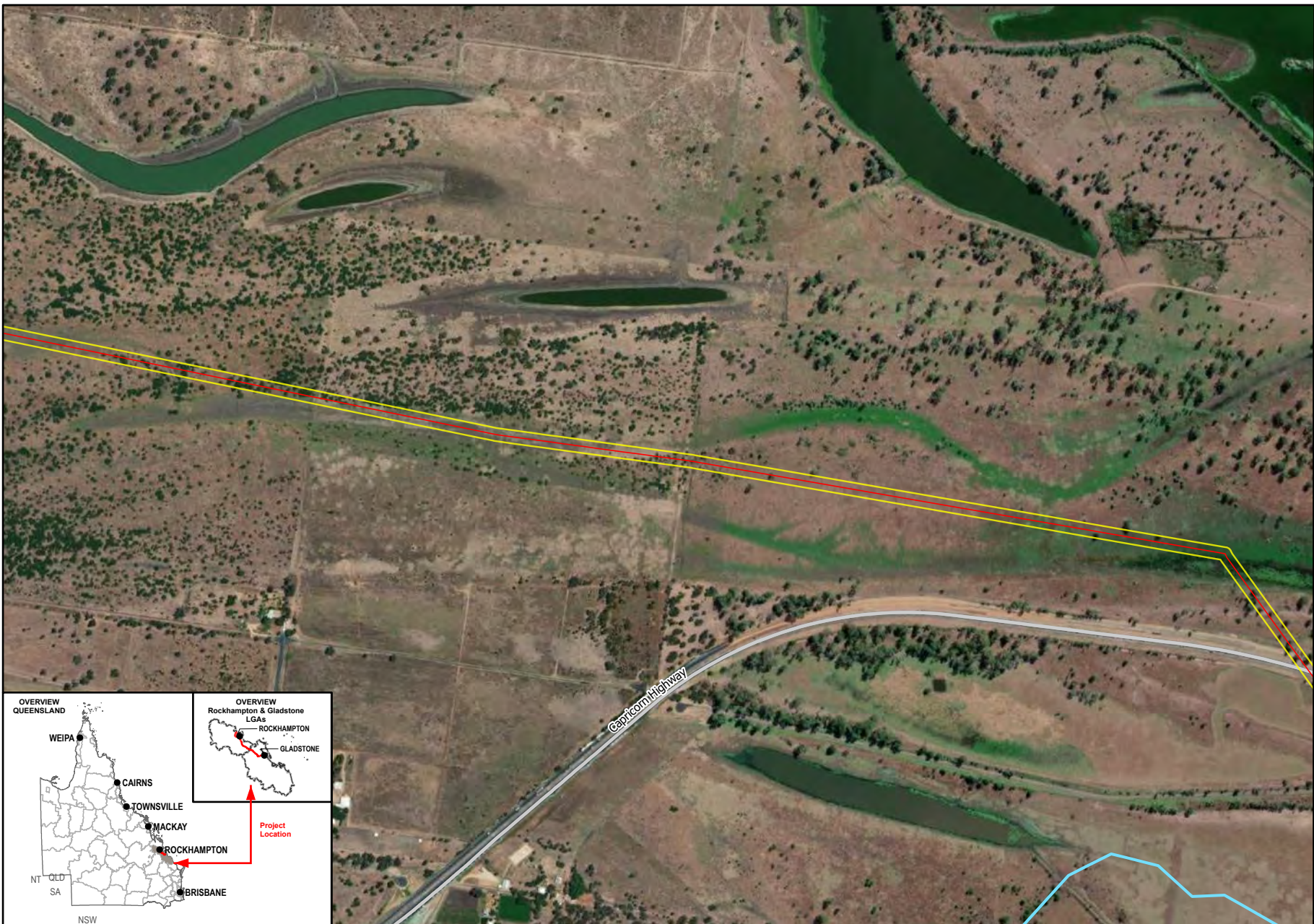
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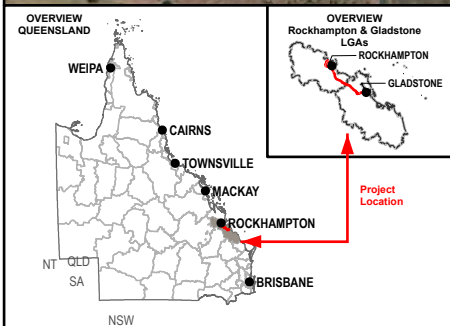
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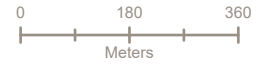
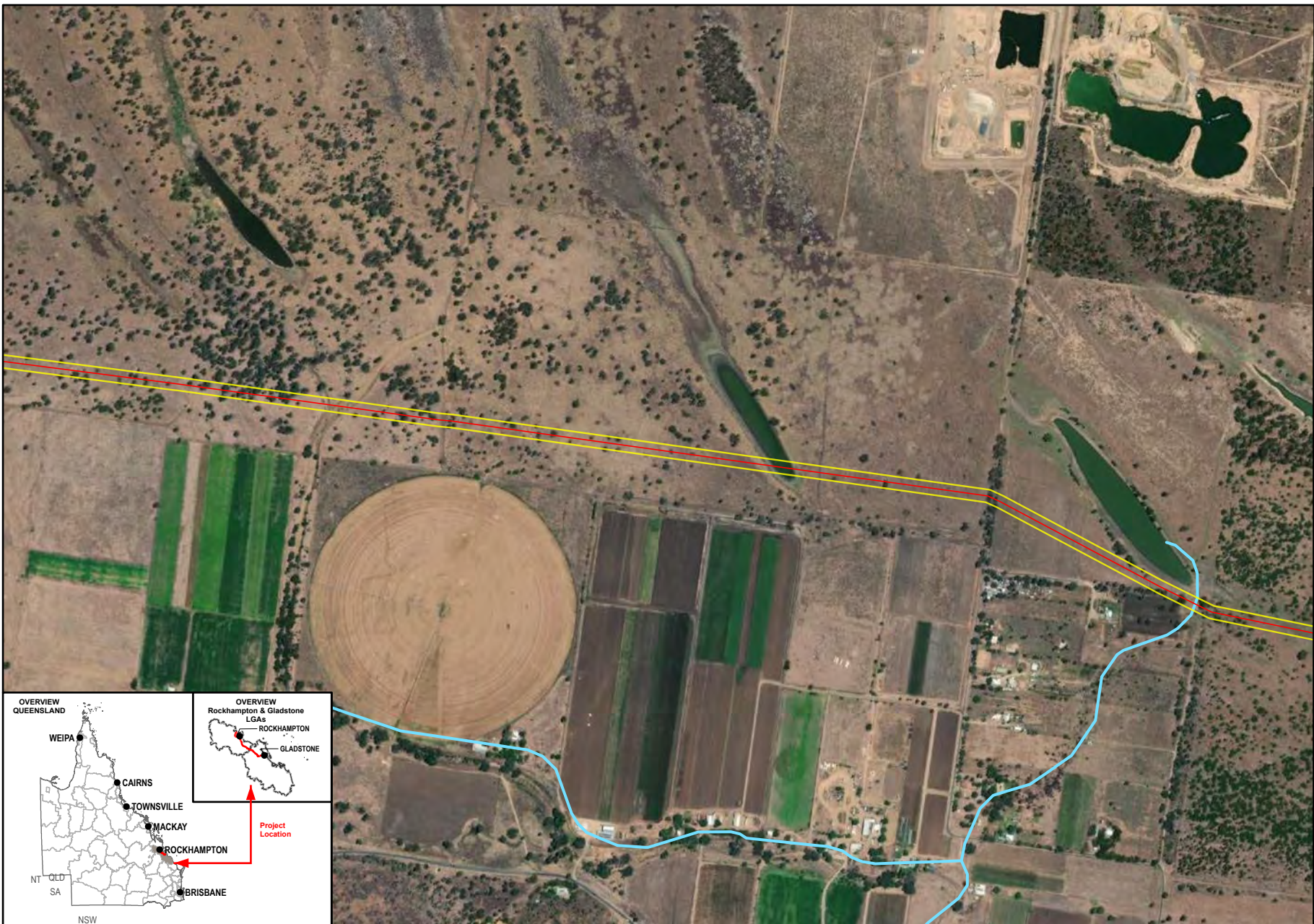
Legend

- SGIC SDA Pipeline Alignment
- Study Area
- Waterways
- Main Roads



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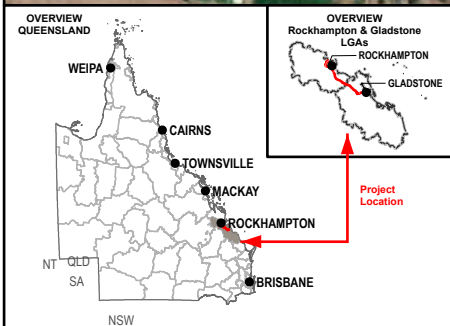
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Legend

- SGIC SDA Pipeline Alignment
- Study Area
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7.2.2.9 Greater glider (southern and central)

Conservation status and species ecology

The greater glider (southern and central) is listed as endangered under the EPBC Act and NC Act but was not listed as an MNES at the time of the approval. The species is restricted to tall eucalypt forests and woodlands with relatively old trees and abundance of hollow-bearing trees (DCCEEW 2022a). The species has a specialist folivorous diet, mostly comprising of eucalypt leaves (Eyre *et al.* 2022) and displays seasonal food preferences. As a result, the species requires access to forests with a diversity of eucalypt species to provide a consistent food source throughout the year (DCCEEW 2022a). The species has been most frequently recorded feeding on trees including *Corymbia citriodora*, *C. intermedia*, *Eucalyptus fibrosa*, *E. moluccana* and *E. portuensis*, with *C. citriodora* and *E. tereticornis* being important species in greater glider habitat (Eyre *et al.* 2022).

During the day, the species dens in tree hollows, with particular preference for large hollows (diameter >10 cm) in large, mature trees (DCCEEW 2022). Both live and standing dead hollow-bearing trees provide suitable denning habitat for the species; however, they are known to prefer live hollow-bearing trees (DCCEEW 2022a). The availability of mature, hollow-bearing trees is a limiting factor. In southern Queensland, the species require at least 2 to 4 live den trees within 2 ha of suitable habitat, whereas in NSW, the species has been found to be absent from forests with fewer than six hollow-bearing trees per ha (DCCEEW 2022a). The greater glider (southern and central) have also been recorded in regrowth forests, where hollow-bearing trees are sufficient (DCCEEW 2022a).

The species has a relatively small home range, typically 1 – 4 ha (DCCEEW 2022a). Studies revealed that the occupation of a small (< 3 ha) home range is consistent throughout the species Australian geographic range (Eyre *et al.* 2022). Given the species' limited capacity for dispersal, and reluctance to cross vegetation gaps, it is sensitive to habitat fragmentation (DCCEEW 2022). However, small or fragmented habitat patches that are connected to larger habitat patches can facilitate dispersal of the species and/or enable recolonization.

Field survey results and distribution of suitable habitat

The greater glider (southern and central) was not recorded during the field surveys within the SGIC SDA study area. Survey effort for the greater glider (southern and central) included one night of 2-3 hours of spotlighting and faecal pellet searches at nine locations within potentially suitable habitat in the SGIC SDA study area. Suitable habitat is widely distributed within the region and the species has been historically recorded at 14 locations within the desktop search extent (10 km buffer), the most recent recorded in 2011. Many of these records have been historically recorded in riparian habitats, in close proximity to drainage lines and watercourses, as well as elevated areas.

Suitable foraging habitat was recorded in eucalypt woodland areas retaining preferred tree species at numerous locations within the southern proportion of the SGIC SDA pipeline alignment. Suitable denning habitat was less widespread, restricted within an area retaining of remnant, mature vegetation within the SGIC SDA study area, approximately 3.5 km northwest of Mount Larcom. This woodland retains large, mature eucalypt trees supporting suitable hollows, and is connected to large patches of remnant woodland. The *Guide to greater glider habitat in Queensland* (Eyre 2022) states that an area containing more than 20 trees that are greater than 46.5 ± 7.5 cm DBH (DBH threshold for the Brigalow bioregion) within 1 ha represents suitable habitat for the species. This assessment was undertaken within the open woodland area identified as suitable denning habitat (diameter >10 cm), and 28 trees larger than DBH threshold were recorded within 1 ha of this area. Based on these results, this area represents suitable habitat for the species due to the high density of suitably large trees. The distribution of predicted greater glider (southern and central) habitat is mapped in Figure 7-14.

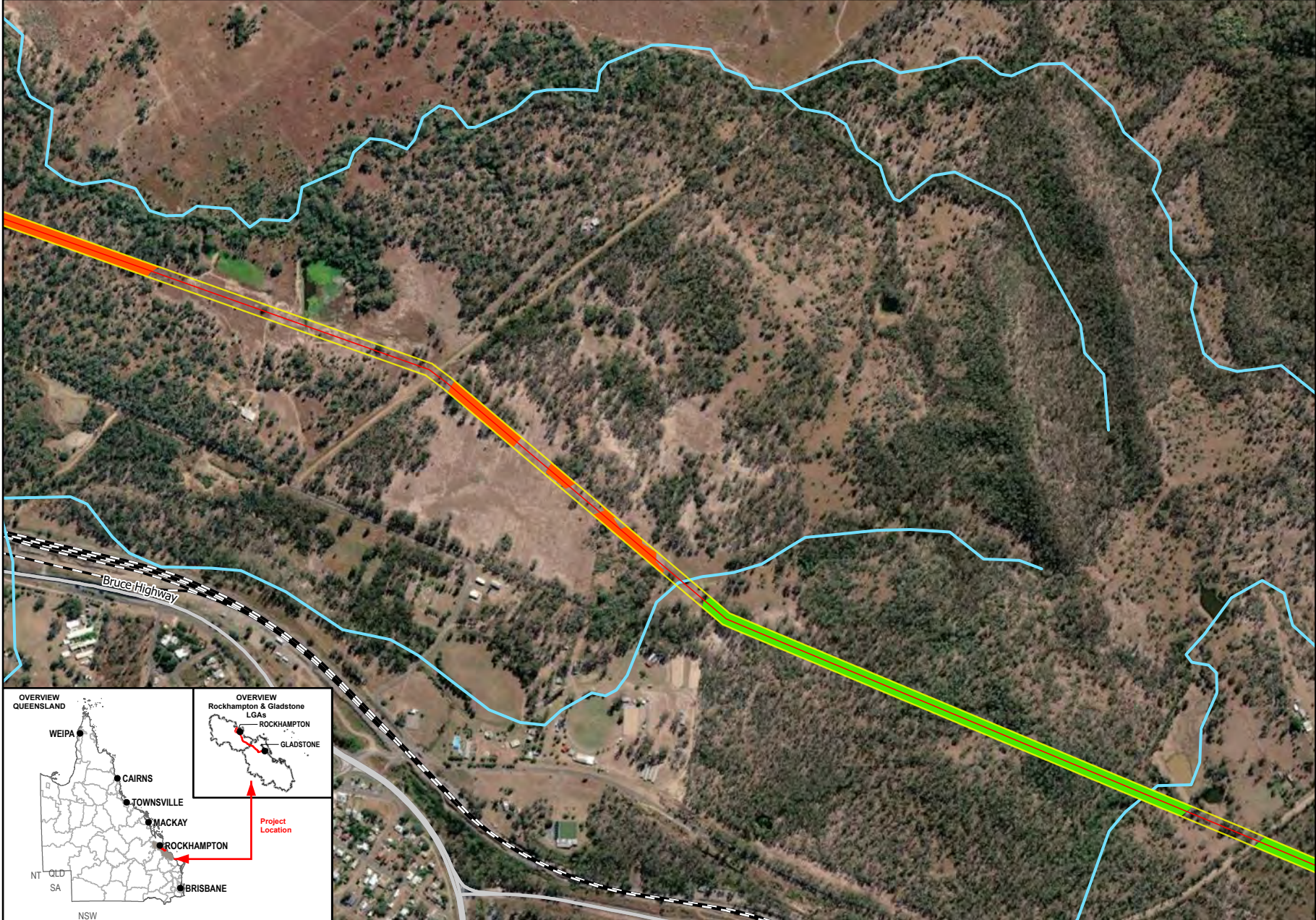
Significance of impact assessment

The project is likely to result in a significant residual impact on the greater glider (southern and central). A significance of impact assessment of the project on the greater glider (southern and central) (endangered under the EPBC Act and NC Act) is provided in Table 7-27.

Table 7-27 Significance of impact on the greater glider (southern and central)

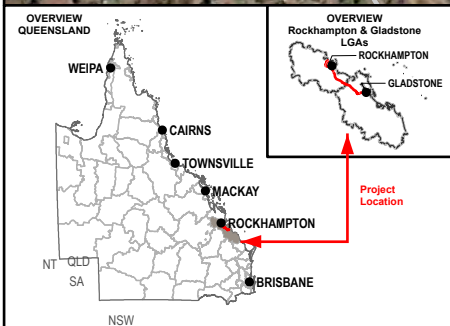
Significant residual impact criteria	Potential to occur
A long-term decrease in the size of a local population	<p>Unlikely</p> <p>The greater glider (southern and central) has been historically recorded at 14 locations within the desktop search extent (10 km buffer). At a national level, all populations of the greater glider (southern and central) are considered important populations (DCCEEW 2022a). The project will result in the clearing of 3.63 ha of predicted foraging habitat and 26.29 ha of denning habitat for the species, representing 0.22% of habitat available within a 5 km buffer. The SGIC SDA pipeline alignment largely supports regrowth vegetation (retaining few hollow-bearing trees), younger remnant vegetation or open landscapes that have been previously cleared for agricultural practices. The remaining areas support remnant vegetation, providing suitable foraging and denning sites for the greater glider (southern and central). Clearing has the potential to cause direct mortality and injury of individuals. This risk will be mitigated by the employment of a fauna spotter-catcher during clearing to check hollows in large fallen trees and relocate any encountered individuals. Sequential clearing will also be adopted to allow species to self-disperse and tree felling will occur towards cleared areas, rather than towards standing vegetation. The project is not considered likely to lead to a long-term decrease in the size of the greater glider (southern and central) local population. Considering the greater glider (southern and central) has been recorded extensively within the surrounding landscape, the local population of the species is anticipated to remain largely unaffected due to the availability of habitat within the surrounding landscape. The loss of vegetation within the SGIC SDA pipeline alignment is unlikely to (1) limit movement of resident or transient individuals; nor (2) affect the availability of resident or transient individuals to acquire key resources. The project is unlikely to lead to a long-term decrease in the size of a local population.</p>
Reduce the extent of occurrence of the species	<p>Unlikely</p> <p>The project will result in a loss of 29.92 ha of predicted habitat for the greater glider (southern and central); however, much of this lacks key resources – namely mature, hollow-bearing <i>Eucalyptus</i> trees. Suitable denning habitat within the SGIC SDA pipeline alignment is located within an area retaining remnant, mature vegetation within the SGIC SDA study area, approximately 3.5 km north west of Mount Larcom.</p> <p>The maximum width of clearing required for construction of the SGIC SDA pipeline alignment is 30 m. Once the pipeline has been installed and buried, a maximum width of 10 m will be permanently cleared with the remaining 20 m to be rehabilitated. Clearing along the SGIC SDA pipeline alignment is unlikely to impact the species' ability to move nor access resources in adjacent habitats, as the proposed clearing extent is narrow (30 m) and mostly linear, and unlikely to generate edge effects or impact ecosystem structure and functioning. Given the minimal loss of 29.92 ha of suitable habitat, negligible impact of local and landscape connectivity, and low levels of disturbance during the operation phase, it is unlikely to have any significant indirect impact on the species. While there will be a localised loss of habitat for the greater glider (southern and central) (including ecological significant locations), this will not have a bearing on the species' extent of occurrence. Accordingly, the project is unlikely to reduce the extent of occurrence of the species, especially noting the definition of extent of occurrence per the Queensland <i>Significant Residual Impact Guideline</i> (DEHP 2014b): <i>Extent of occurrence is defined as the area contained within the shortest continuous imaginary boundary which can be drawn to encompass all the known, inferred, or projected sites of present occurrence of a taxon.</i></p>
Fragment an existing population	<p>Unlikely</p> <p>Greater gliders have been recorded gliding up to 100 m (Menkhorst and Knight 2011), but it is more widely accepted that their typical maximum gliding distance is 60 m (Weston 2003), and an average glide length is typically 25 to 35 m (with a launch height of 20 to 25 m) (Australian Museum Business Service 2001). The ability to glide at these distances enables gliders to traverse relatively open habitat providing that the distance between trees does not exceed the species' gliding capability (references within Ball and Goldingay 2008). Even when the distance between trees exceeds the maximum gliding distance, some glider species will glide some of the distance and then move across the ground to the next tree for the remaining short distance (van der Ree <i>et al.</i> 2003).</p> <p>The maximum width of clearing required for construction of the SGIC SDA pipeline alignment (i.e. 30 m) is not considered to exceed the volplane distance of the species (>100 m). As such, habitat loss within the SGIC SDA pipeline alignment is not expected to impact connectivity with surrounding greater glider (southern and central) habitat retained on either side of the corridor as the habitat losses will be localised and is unlikely to create large gaps that present new barriers to greater glider (southern and central) movement.</p>

Significant residual impact criteria	Potential to occur
	Connectivity to extensive areas of suitable habitat will persist in the surrounding landscape allowing opportunities for movement. Furthermore, large areas of remnant habitat are located within Mount Stowe State Forest, Calliope Conservation Park and Mount Larcom. Therefore, the SGIC SDA pipeline alignment is unlikely to fragment an existing greater glider (southern and central) population.
Result in genetically distinct populations forming as a result of habitat isolation	Unlikely As detailed above, the species' capacity to move locally and regionally is unlikely to be limited by any localised clearing necessary to construct the SGIC SDA pipeline alignment. As a result, the project is unlikely to cause any form of genetic isolation at a population level.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat	Unlikely The project is unlikely to result in the introduction or spread of invasive species beyond current levels. The implementation of a site-specific Weed and Pest Management Plan will further reduce potential impacts of invasive species. As such, the project is not expected to result in invasive species that are harmful to the greater glider (southern and central) becoming established in the species' habitat.
Introduce disease that may cause the population to decline	Unlikely Disease is not a known threat to the species; however, greater glider habitat is susceptible to <i>Phytophthora cinnamomi</i> due the soil fungus's ability to infect eucalypt species. Clearance of vegetation will engage standard hygiene protocols to limit the potential for introduction or spread of phytophthora throughout the SGIC SDA pipeline alignment (i.e. beginning works with clean vehicles and undertaking clearing works during dry conditions). Considering the implementation of strict biosecurity protocols, the project is unlikely to introduce a disease that may cause the species to decline.
Interfere with the recovery of the species	Unlikely The project is unlikely to interfere with the recovery of the species. The greater glider (southern and central) has been widely recorded within region, with large, contiguous patches of suitable habitat located adjacent to the project. Although the project will remove 29.92 ha of predicted habitat, equating to 0.22 % of habitat available within a 5 km buffer, the remaining habitat is connected to an extensive network of suitable habitat to facilitate dispersal of the species and enable recolonization. The project is expected to clear a maximum corridor width of 30 m, that is well below the species maximum volplane distance (> 100 m) and is unlikely to produce fragmentation or habitat isolation. The risk of individual mortality or injury during construction will be addressed via the mitigation measures in the CEMP and the use sequential clearing and an experienced fauna spotter-catcher during clearing. Noting the above points relating to very limited if any effects on local populations (e.g. declines), extent of occurrence, fragmentation, invasive species, and disease, the project is not considered likely to interfere with the recovery of the greater glider (southern and central).
Result in disruption to ecologically significant locations (breeding, feeding or nesting sites) of a species	Likely The project will require the clearing of 3.63 ha of potentially suitable foraging habitat and 26.29 ha of potentially suitable denning habitat for the greater glider (southern and central). Although the SGIC SDA pipeline alignment has largely been placed within or adjacent to areas that have been previously cleared, the project will result in a loss of species preferred feed and den tree species, including <i>Corymbia citriodora</i> , <i>Eucalyptus moluccana</i> , <i>E. tereticornis</i> and <i>E. crebra</i> . Four tree species have been identified as frequently used foraging trees (Eyre <i>et al.</i> 2022), two of which were recorded within the SGIC SDA study area, including <i>C citriodora</i> and <i>E moluccana</i> . In some months, the species has also been identified to favour <i>E. tereticornis</i> and <i>E. crebra</i> (Eyre <i>et al.</i> 2022), which were both observed throughout the SGIC SDA study area. A study undertaken by Smith <i>et al.</i> 2007, found that greater gliders within the Brigalow Belt bioregion preferred certain tree species, including <i>E. fibrosa</i> , <i>E. moluccana</i> and <i>C citriodora</i> , for denning and foraging. While the project is not expected to cause a long-term decline in the local population, reduce its extent of occurrence, cause adverse habitat fragmentation effects nor interfere with the recovery of the species, the loss of suitable greater glider (southern and central) habitat within the SGIC SDA pipeline alignment is likely to result in disruption to ecological significant foraging and breeding locations.
Conclusion	A conservative assessment has identified that the project is likely to result in a significant residual impact on the greater glider (southern and central). Although the GSDA pipeline alignment has been located within areas that have been previously cleared for agricultural practices and linear infrastructure such as railways, roads, access tracks and pipelines, the project will require the clearing of 2992 ha of woodland areas retaining preferred food trees and suitable denning habitat (diameter > 10 cm) within the SGIC SDA pipeline alignment.



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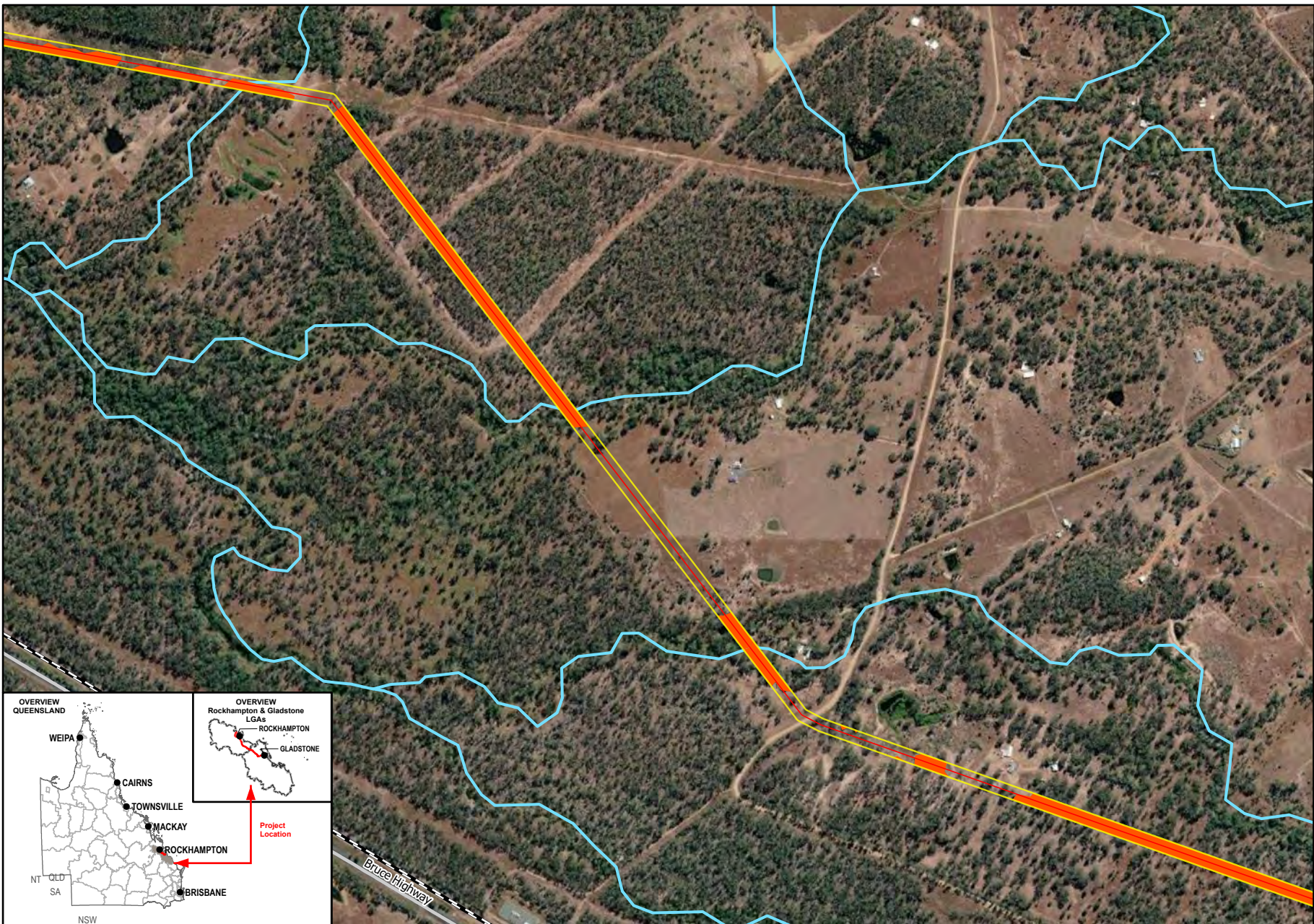
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- SGIC SDA Pipeline Alignment
 - Study Area
 - Predicted Greater Glider Habitat**
 - Habitant Type**
 - Potential Foraging Habitat
 - Potential Denning Habitat
 - Waterways
 - Main Roads
 - Railways



Data Sources:

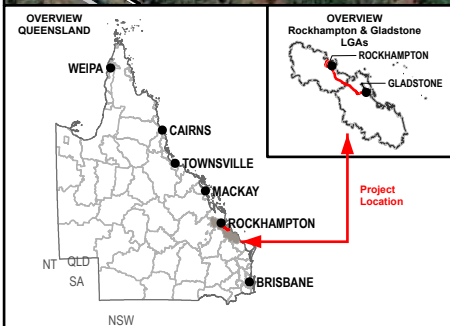
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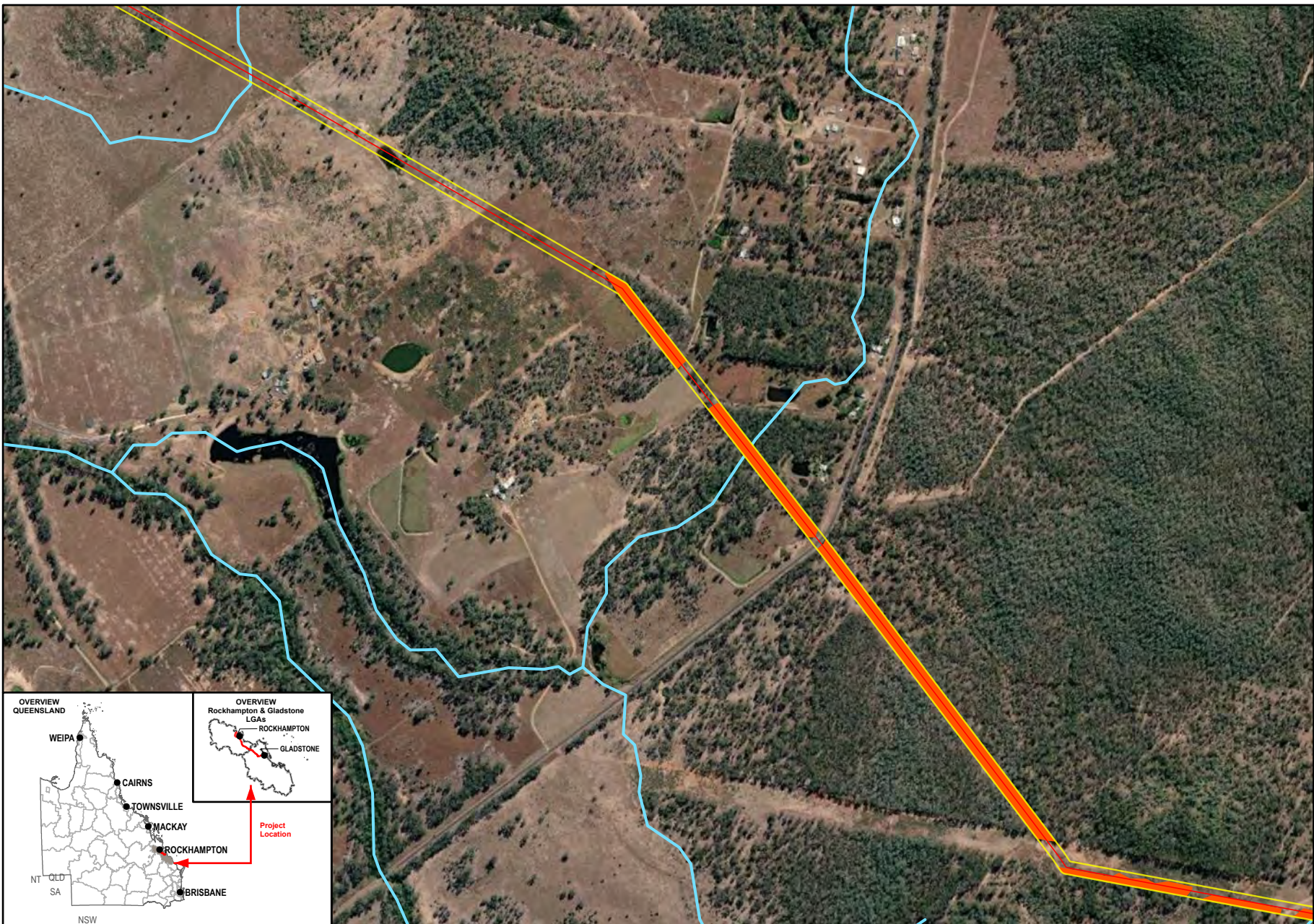
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 - Study Area
 - Predicted Greater Glider Habitat**
 - Habitant Type**
 - Potential Denning Habitat
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 - Main Roads
 - Railways



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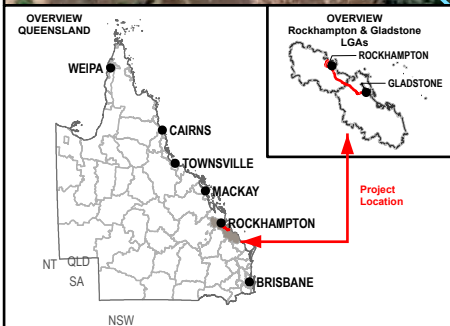
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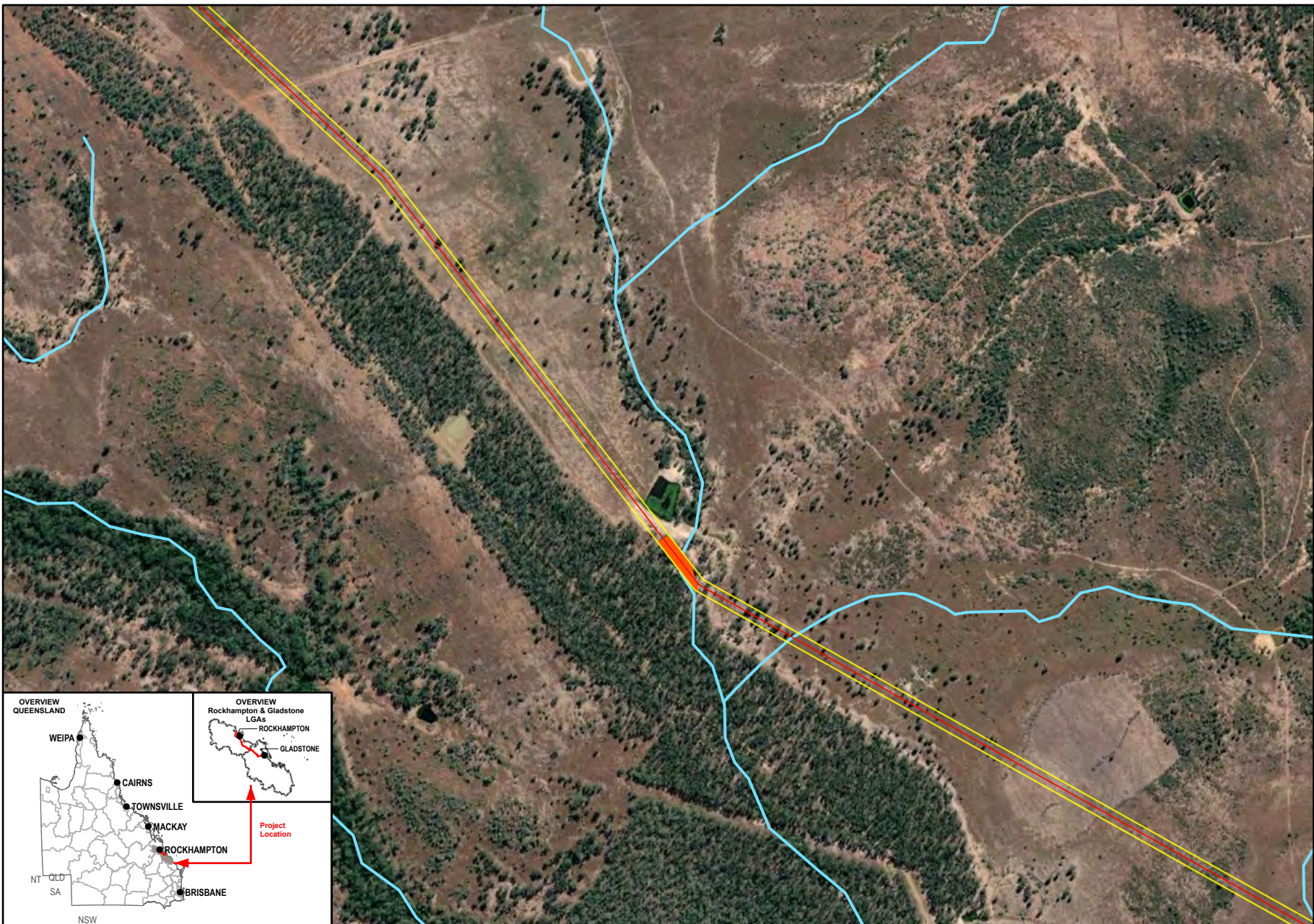
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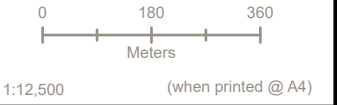
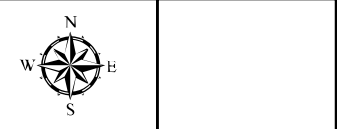
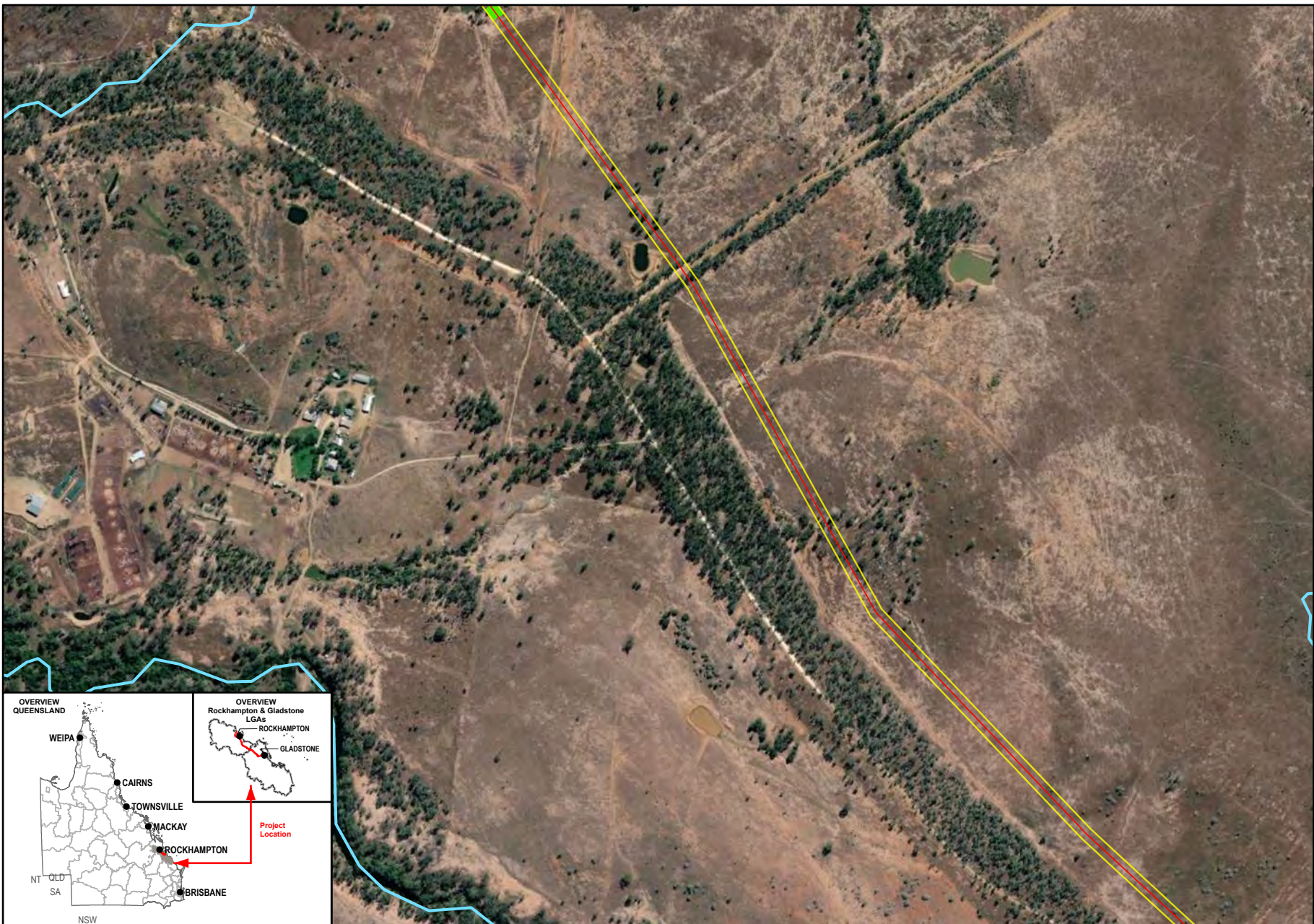
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- Legend**
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 - Study Area
 - Predicted Greater Glider Habitat**
 - Habitant Type**
 - Potential Denning Habitat
 - Waterways

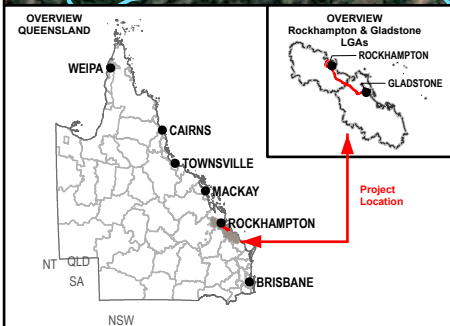
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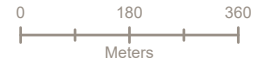
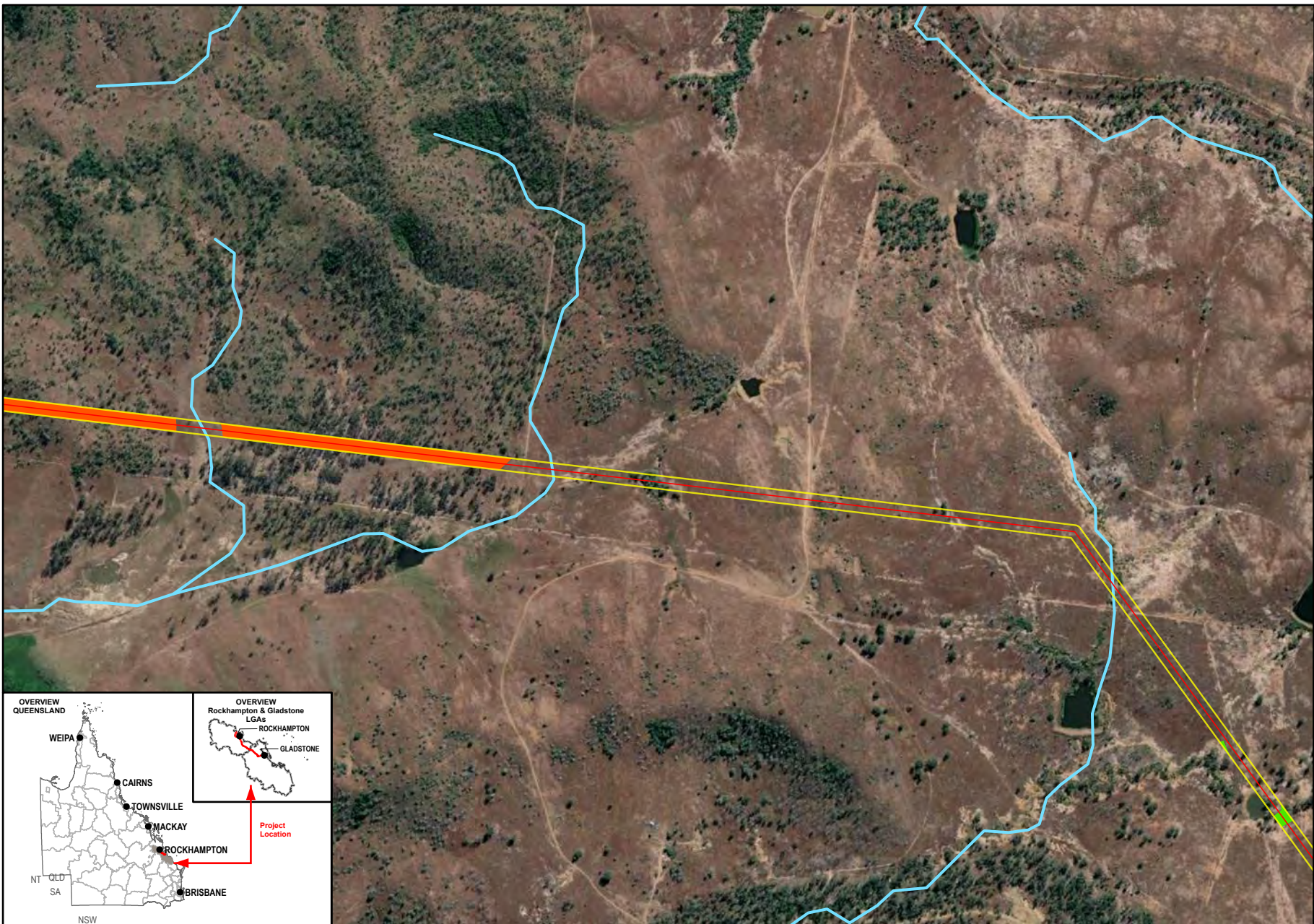
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- SGIC SDA Pipeline Alignment
 - Study Area
 - Predicted Greater Glider Habitat**
 - Habitant Type**
 - Potential Foraging Habitat
 - Waterways



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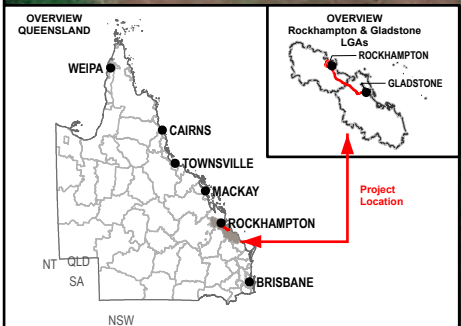
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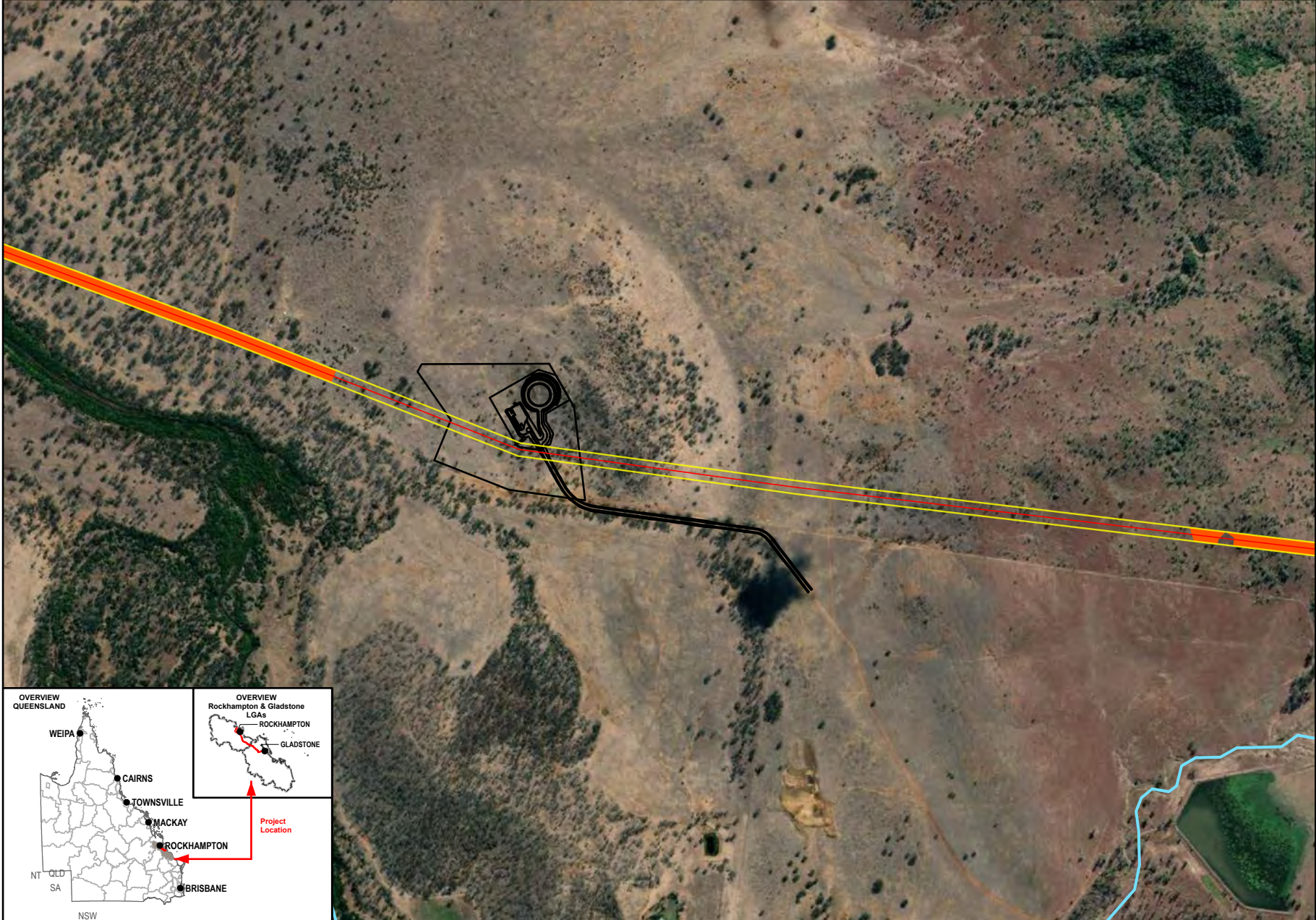
Legend

- SGIC SDA Pipeline Alignment
- Study Area
- Predicted Greater Glider Habitat**
- Habitant Type**
- Potential Foraging Habitat
- Potential Denning Habitat
- Waterways



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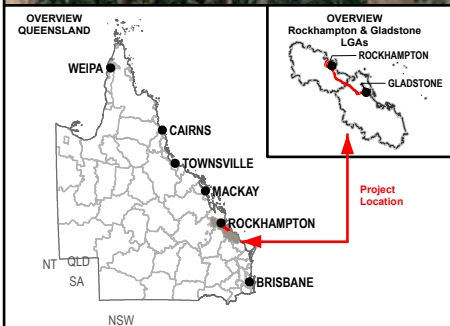
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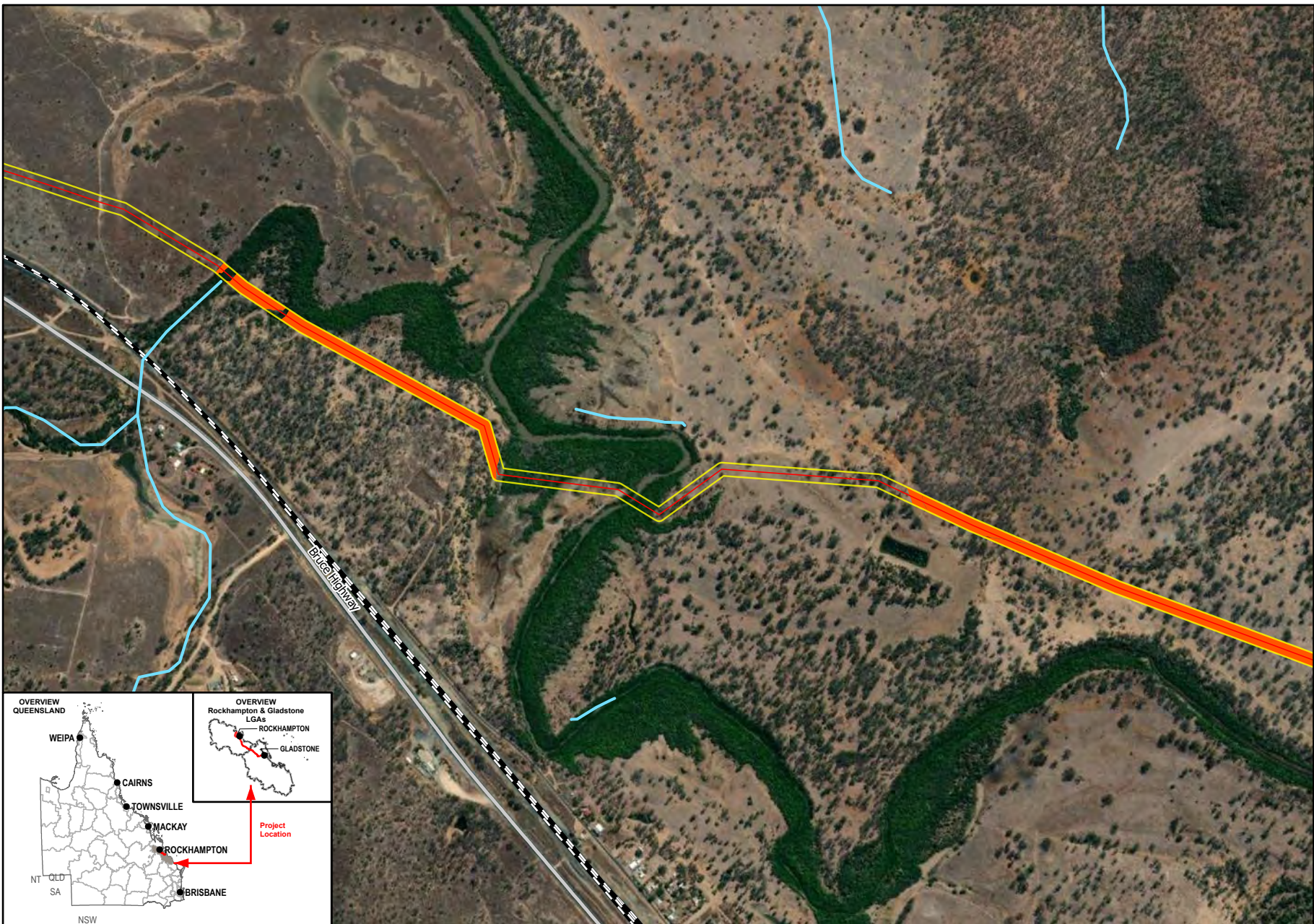
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 - Study Area
 - Predicted Greater Glider Habitat**
 - Habitant Type**
 - Potential Denning Habitat
 - Raglan Pump Station and Reservoir Layout
 - Waterways



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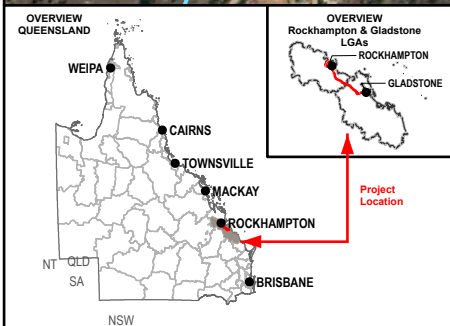
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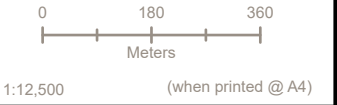
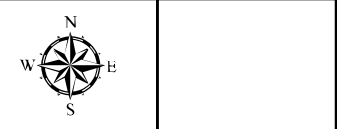
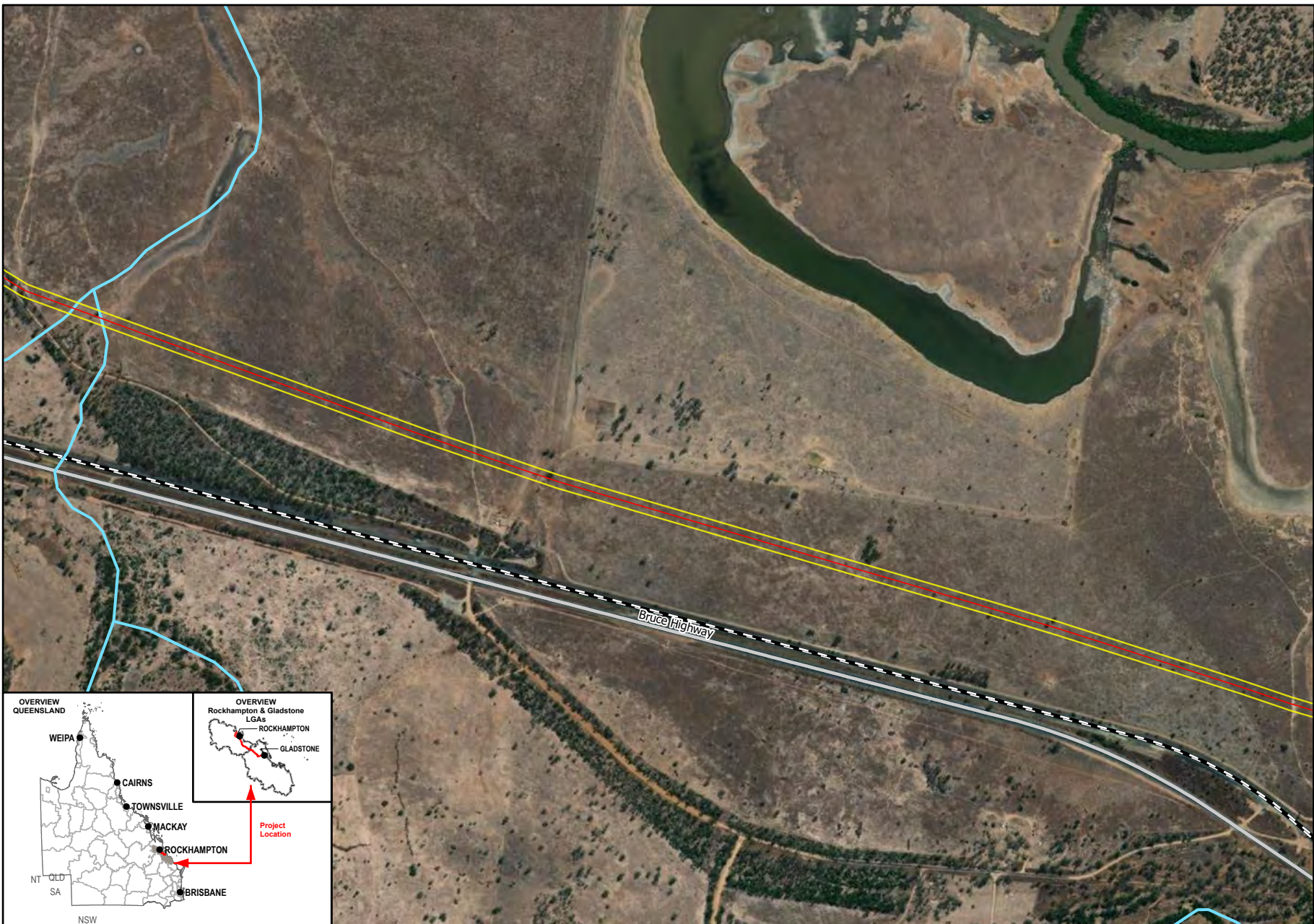
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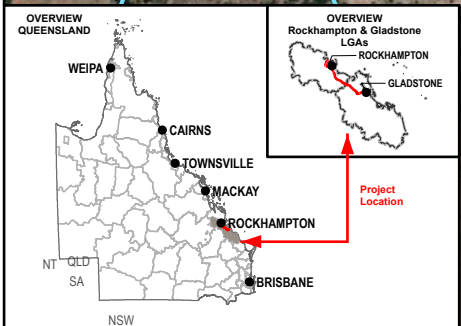
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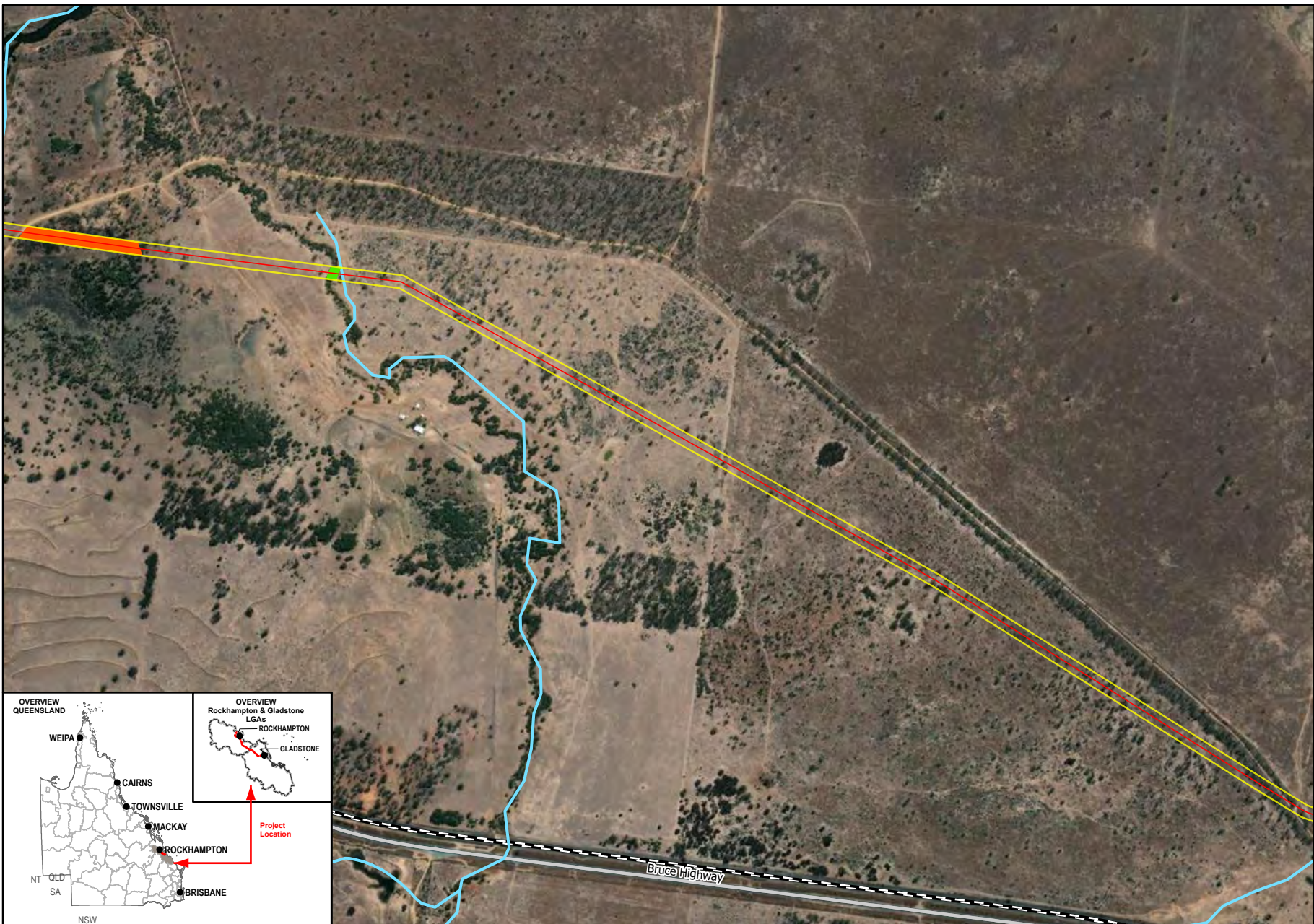
- Legend**
- SGIC SDA Pipeline Alignment
 - Study Area
 - Waterways
 - Main Roads
 - Railways



Data Sources:

1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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Meters

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- Legend**
- SGIC SDA Pipeline Alignment
 - Study Area
 - Predicted Greater Glider Habitat**
 - Habitant Type**
 - Potential Foraging Habitat
 - Potential Denning Habitat
 - Waterways
 - Main Roads
 - Railways

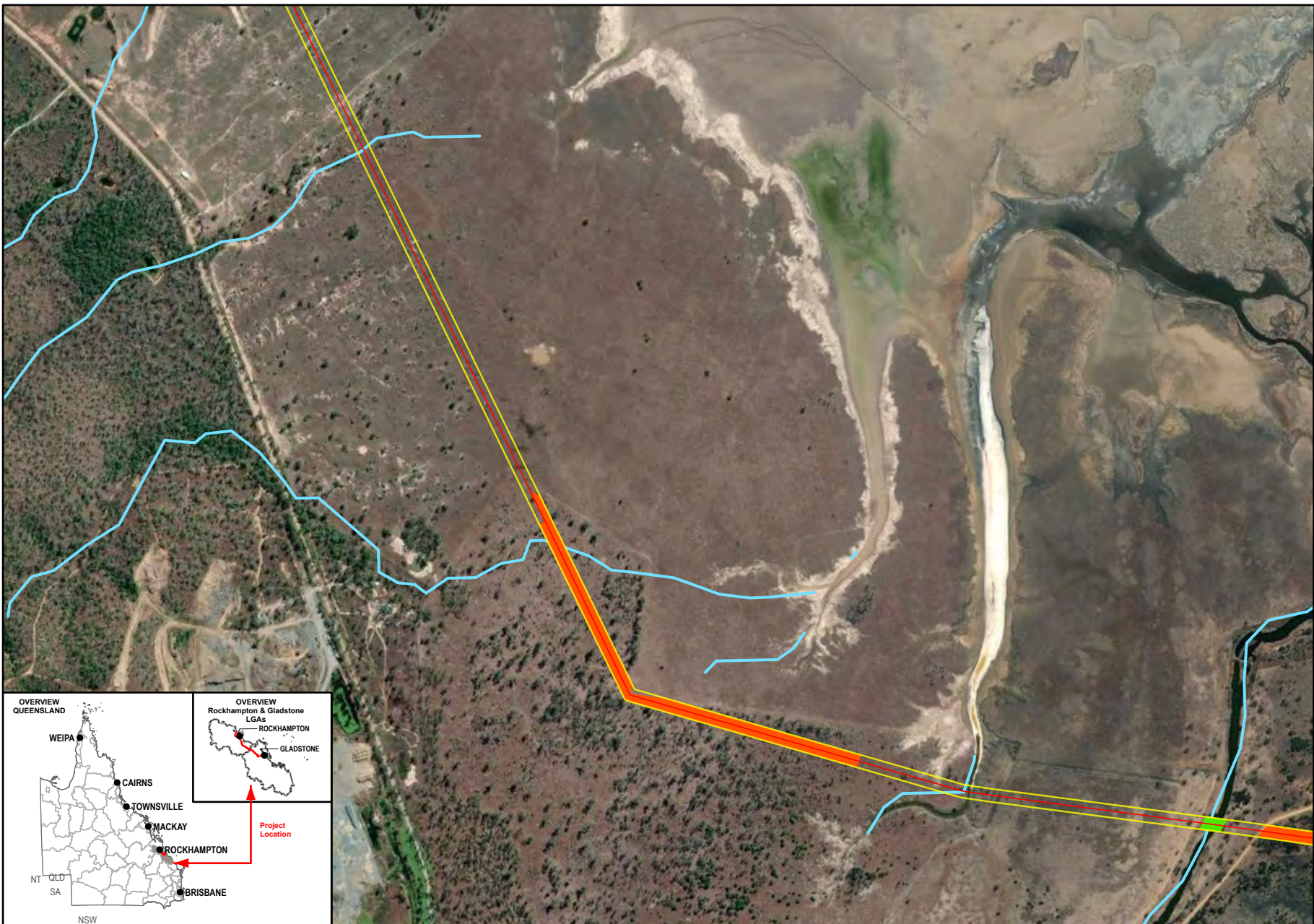
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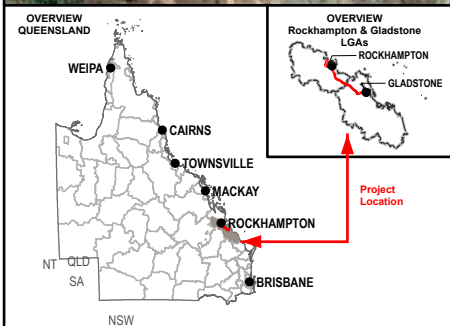
OVERVIEW QUEENSLAND

OVERVIEW Rockhampton & Gladstone LGAs



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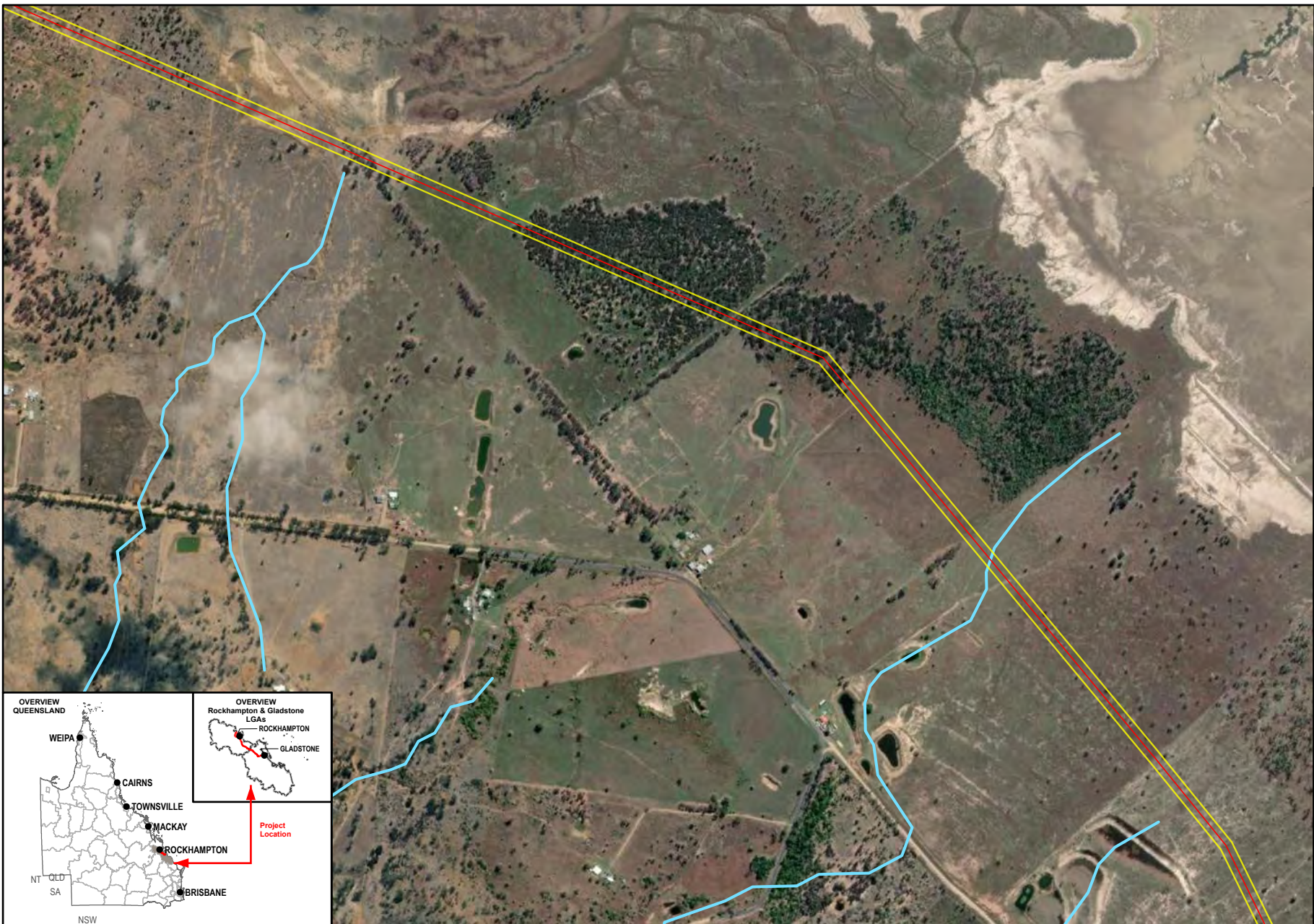
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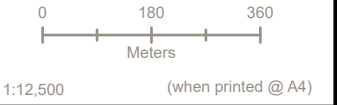
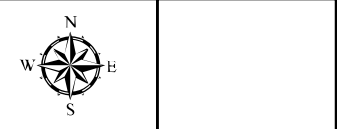
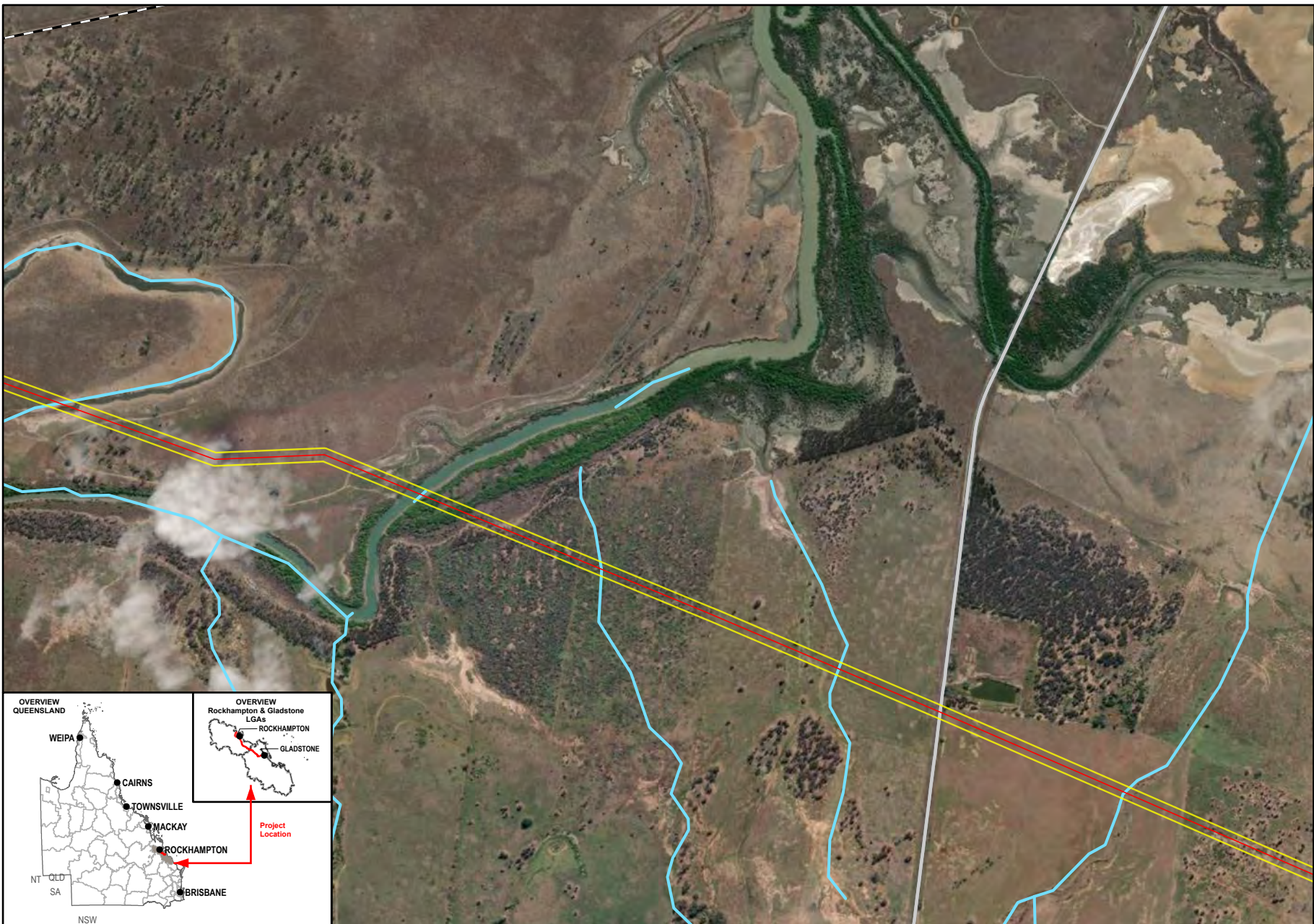
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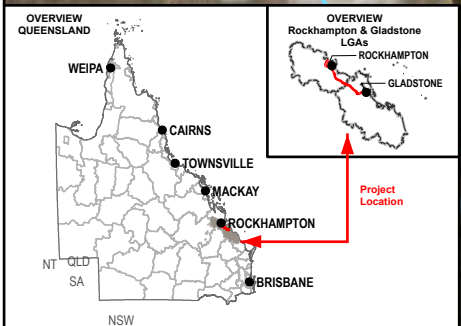


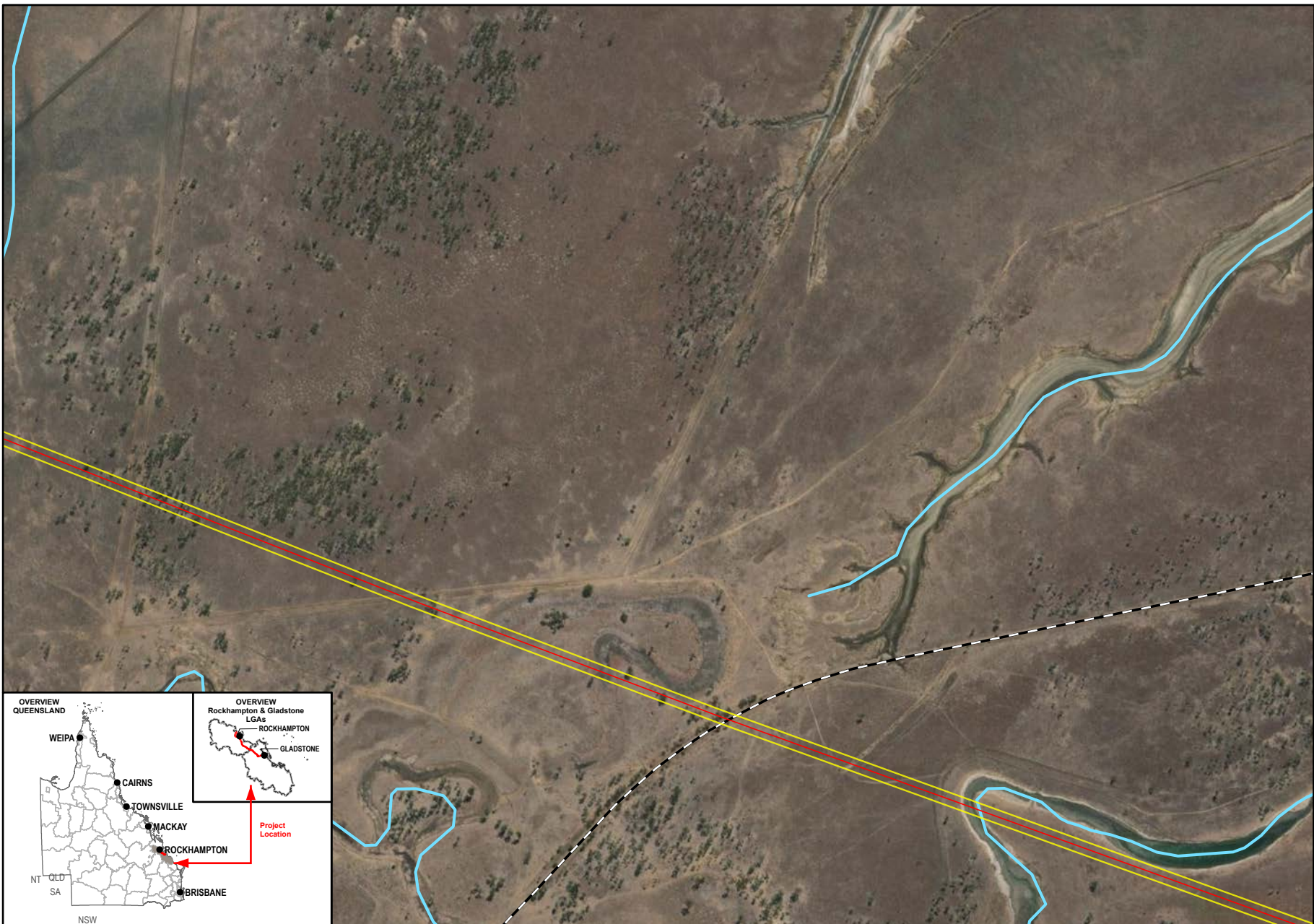
- Legend**
- SGIC SDA Pipeline Alignment
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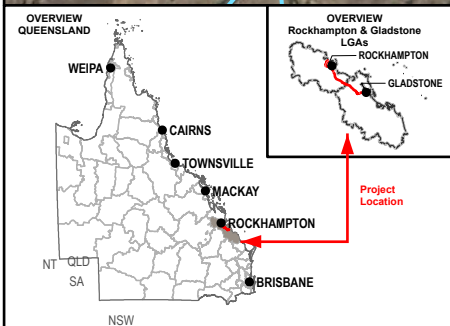
Queensland Government

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0 180 360
Meters

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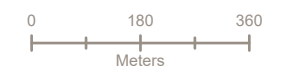
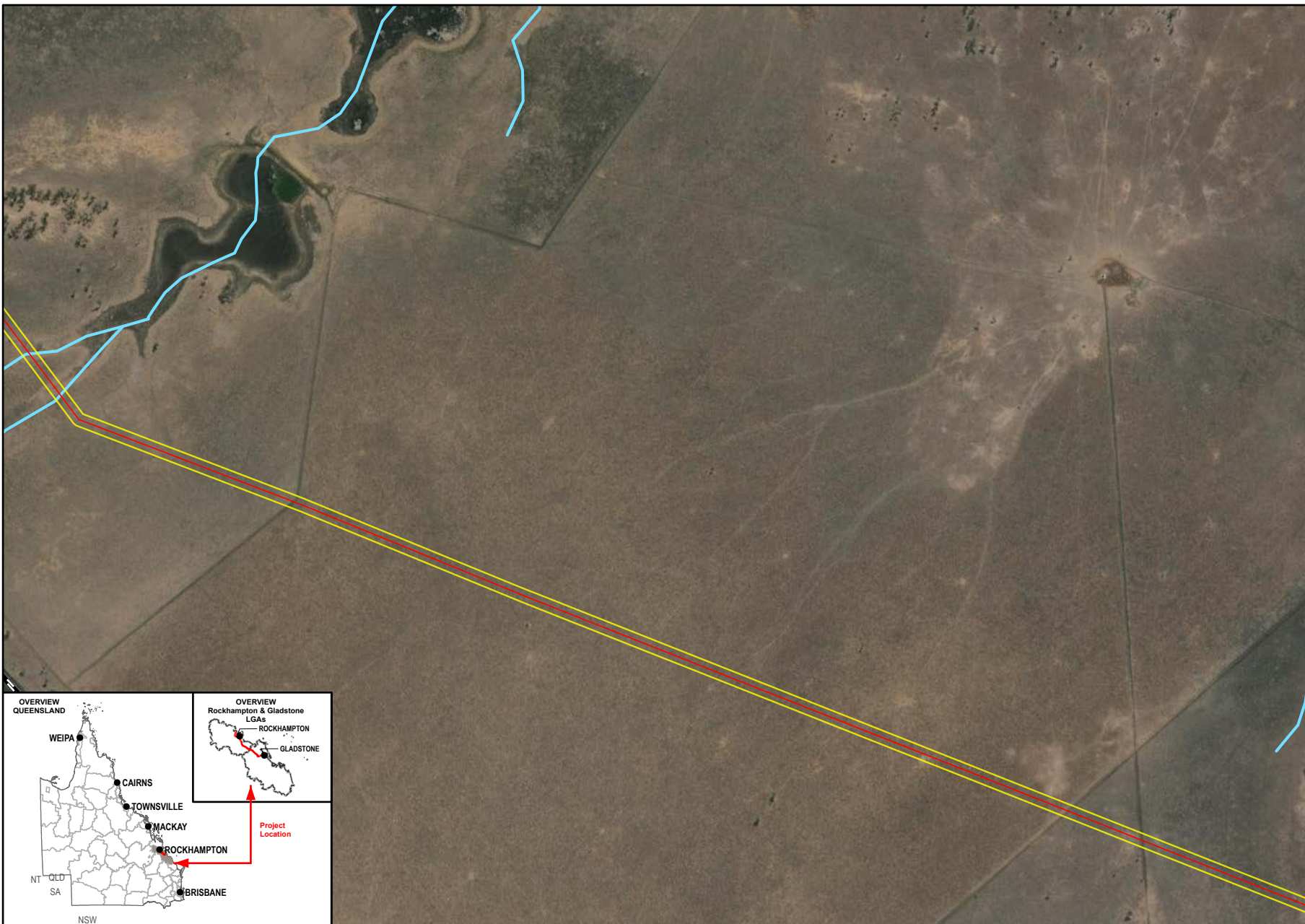
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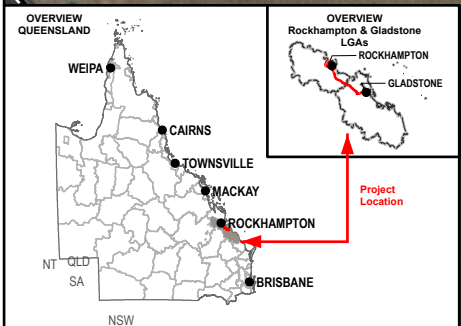
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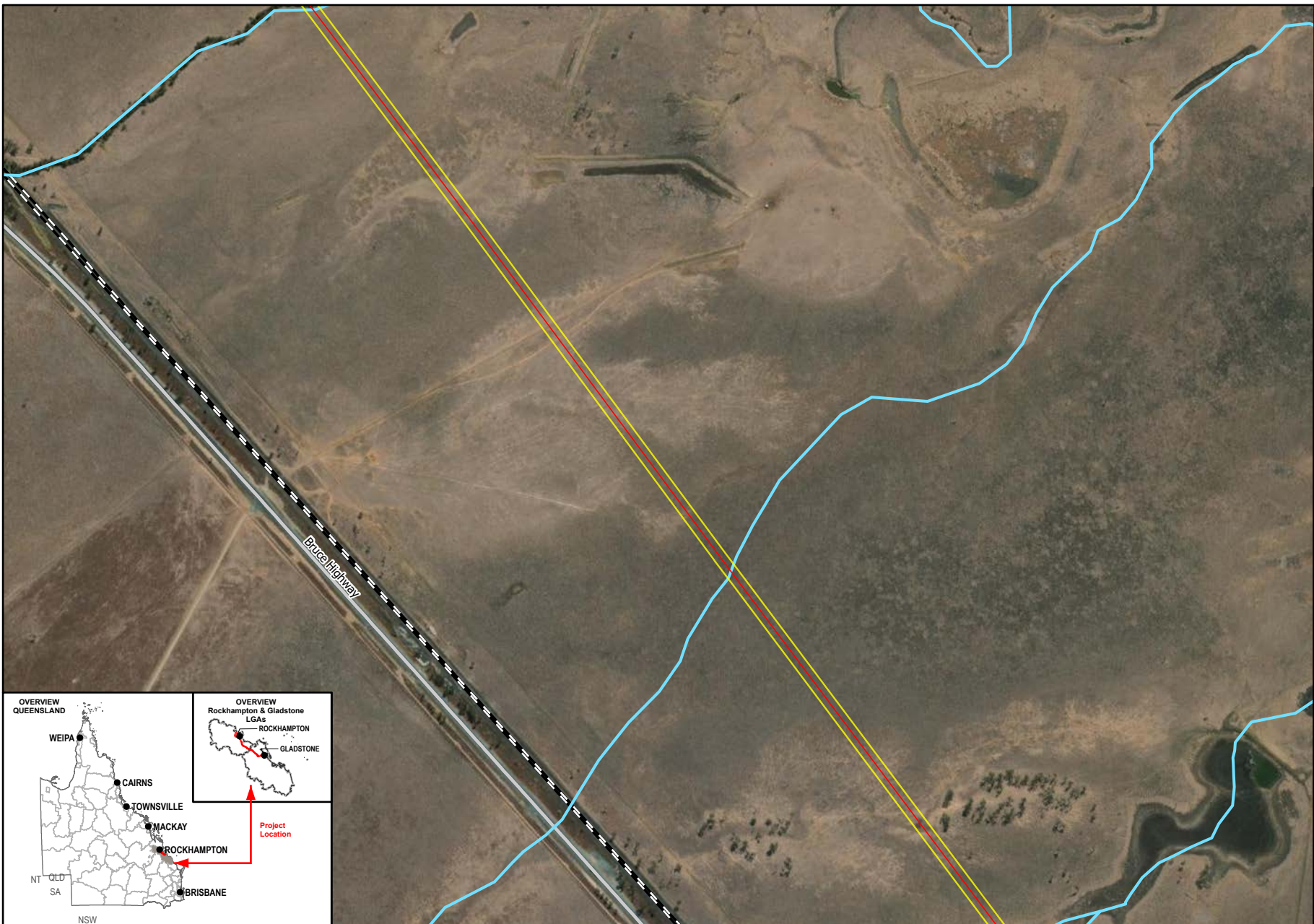
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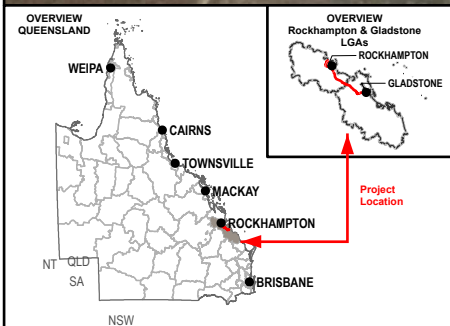



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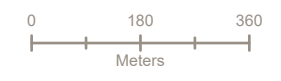
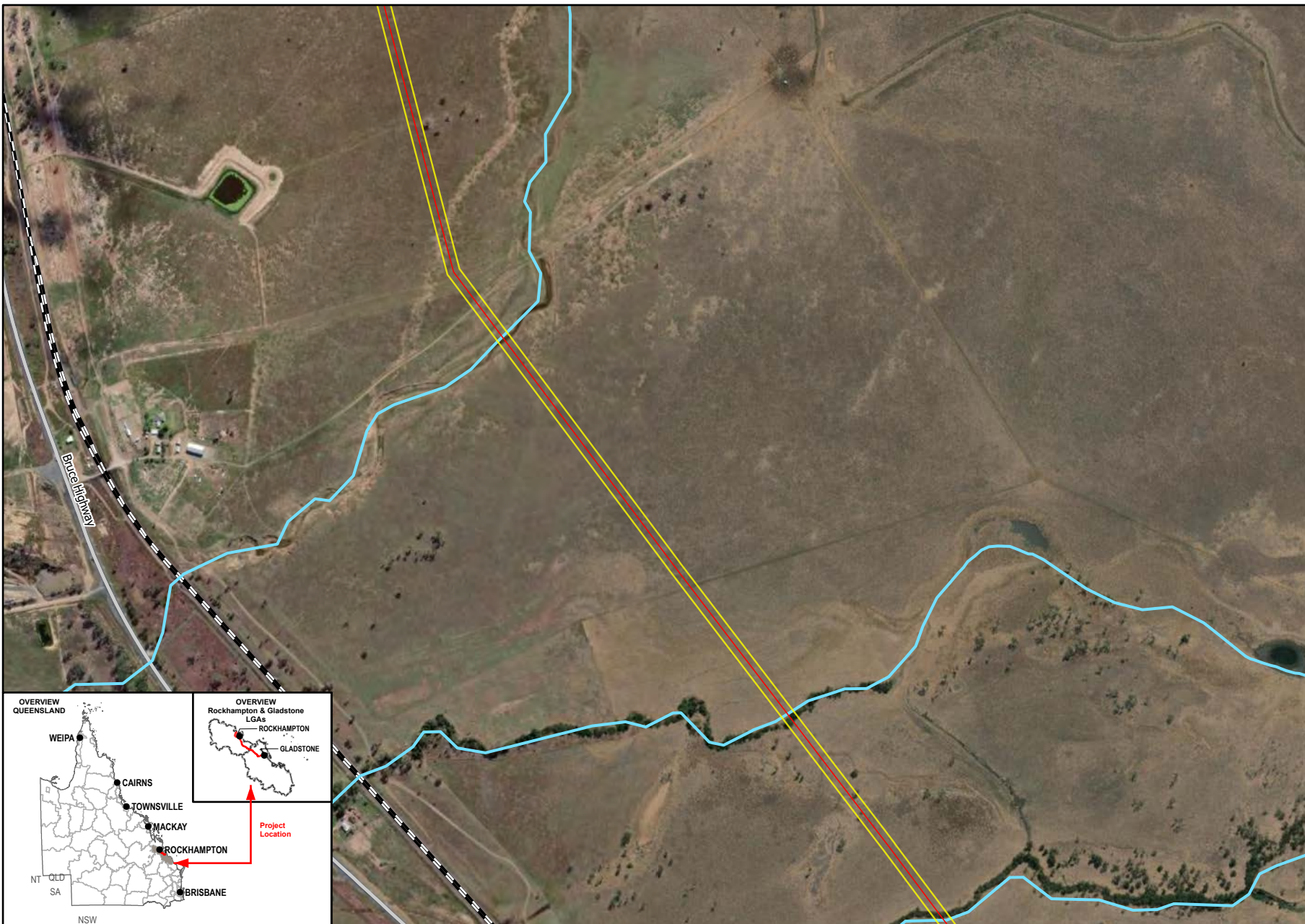
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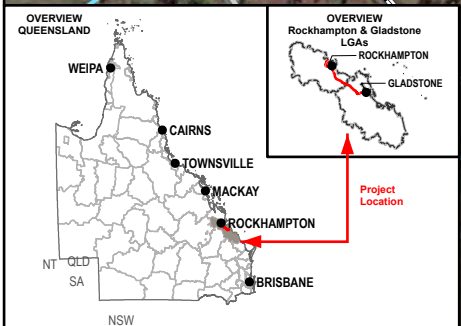
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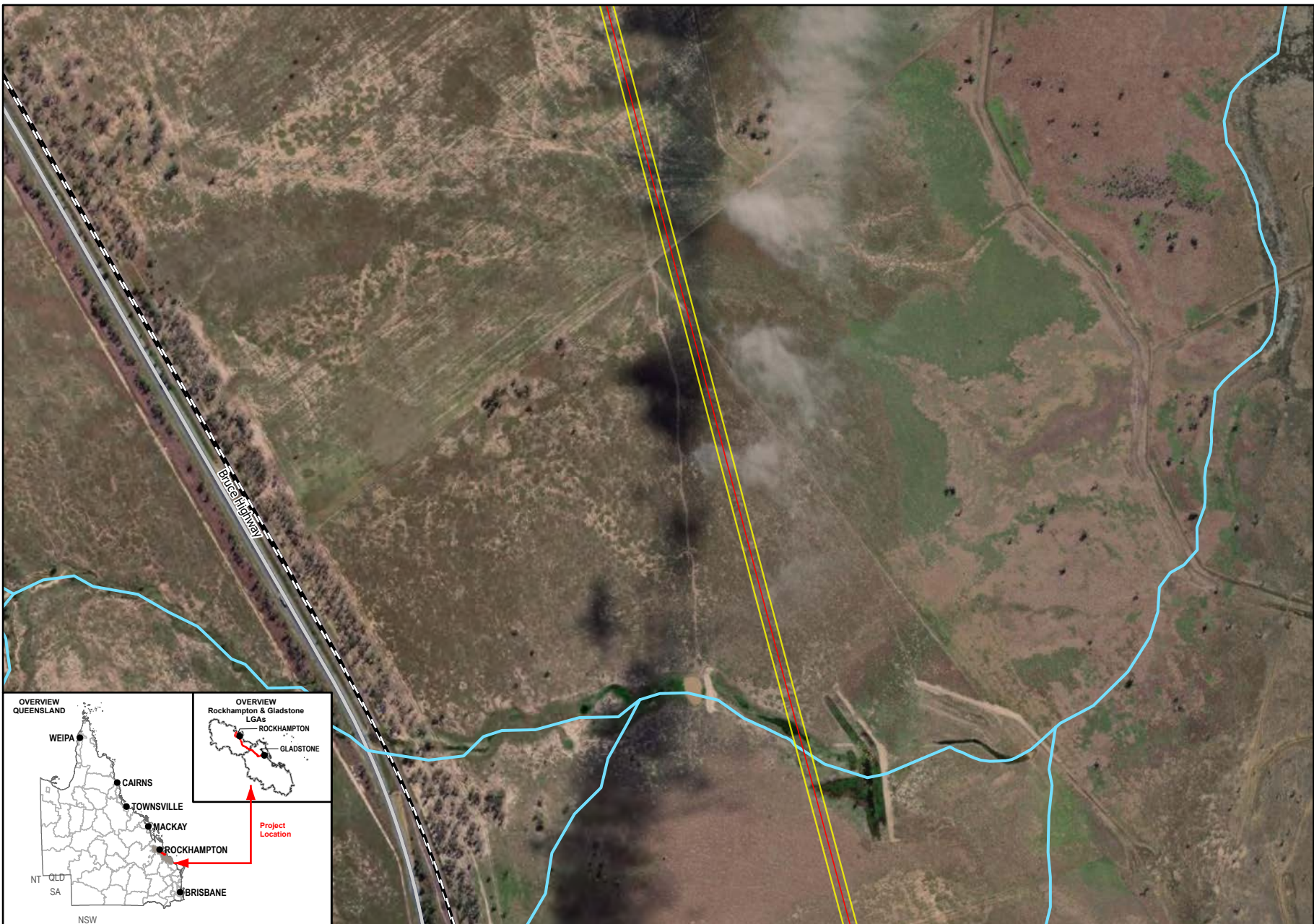
Legend

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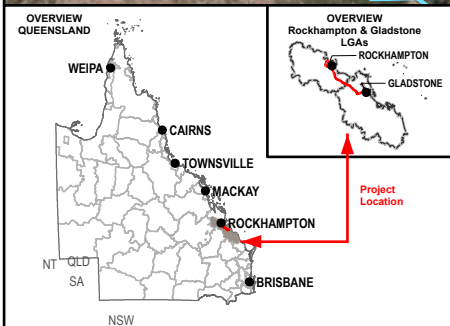
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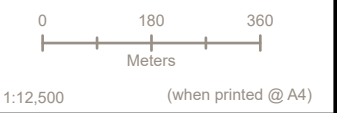
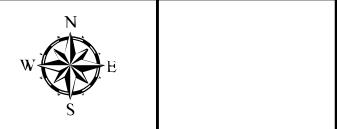
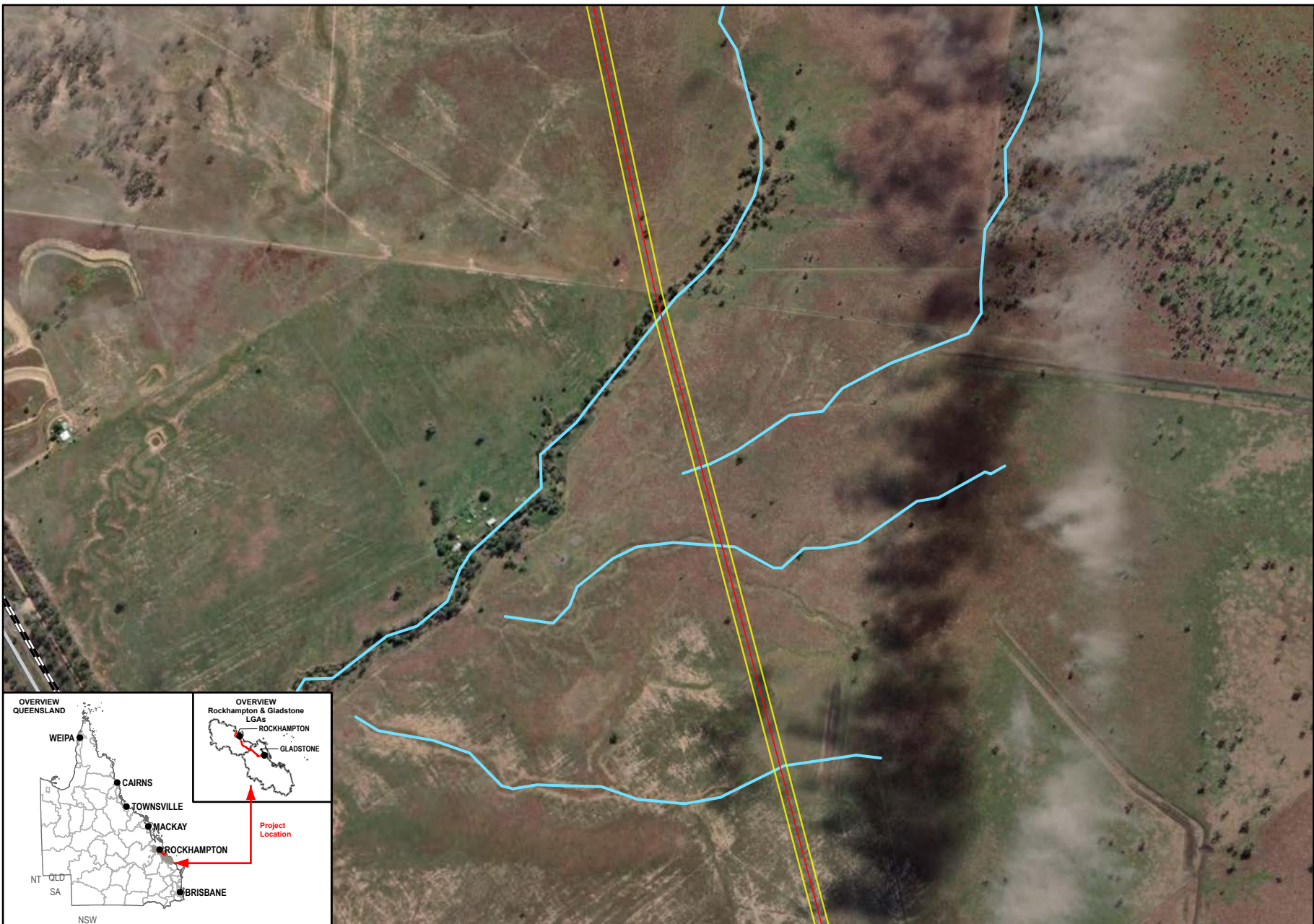
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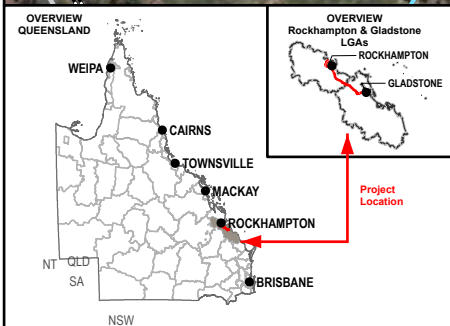


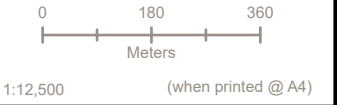
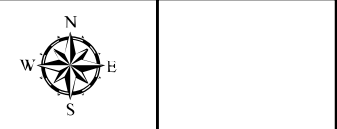
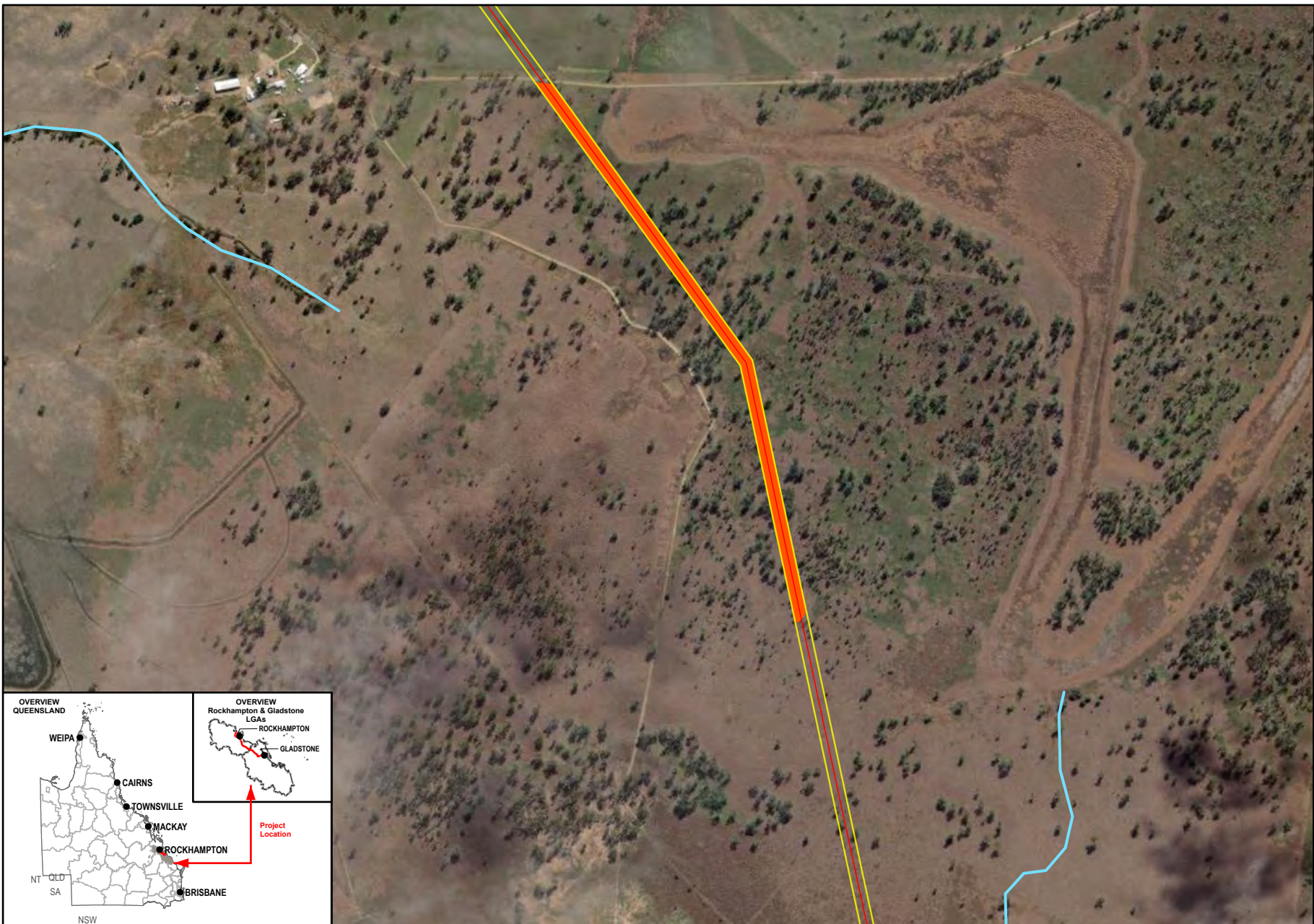
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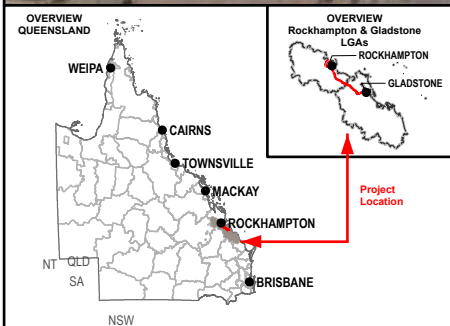
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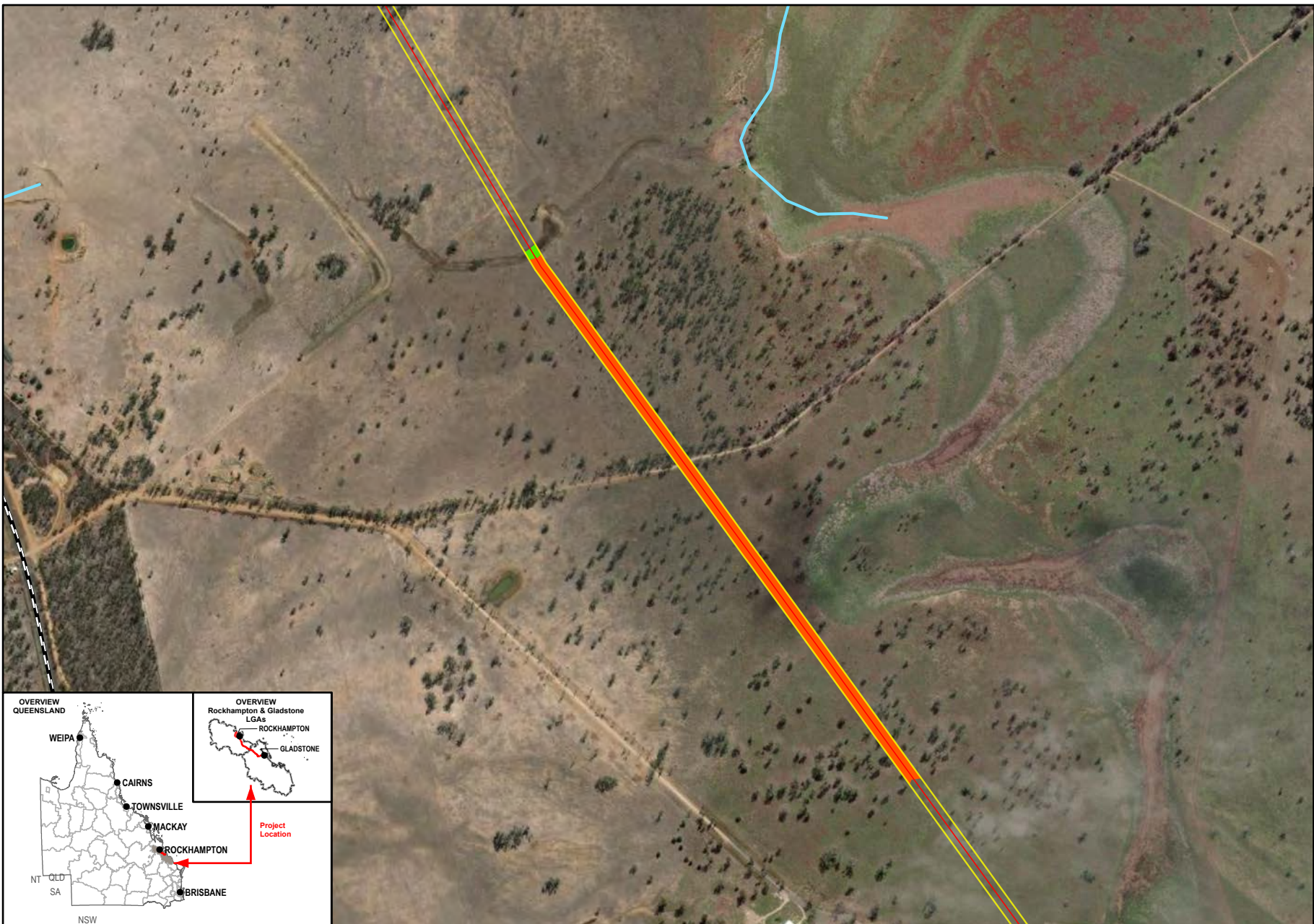
- Legend**
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 - Habitant Type**
 - Potential Denning Habitat
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Data Sources:

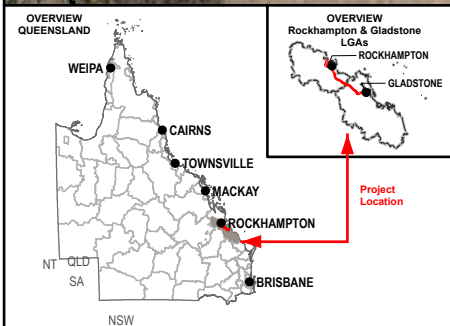
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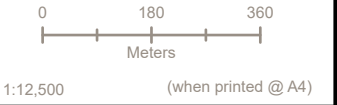
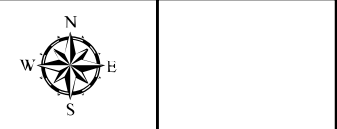
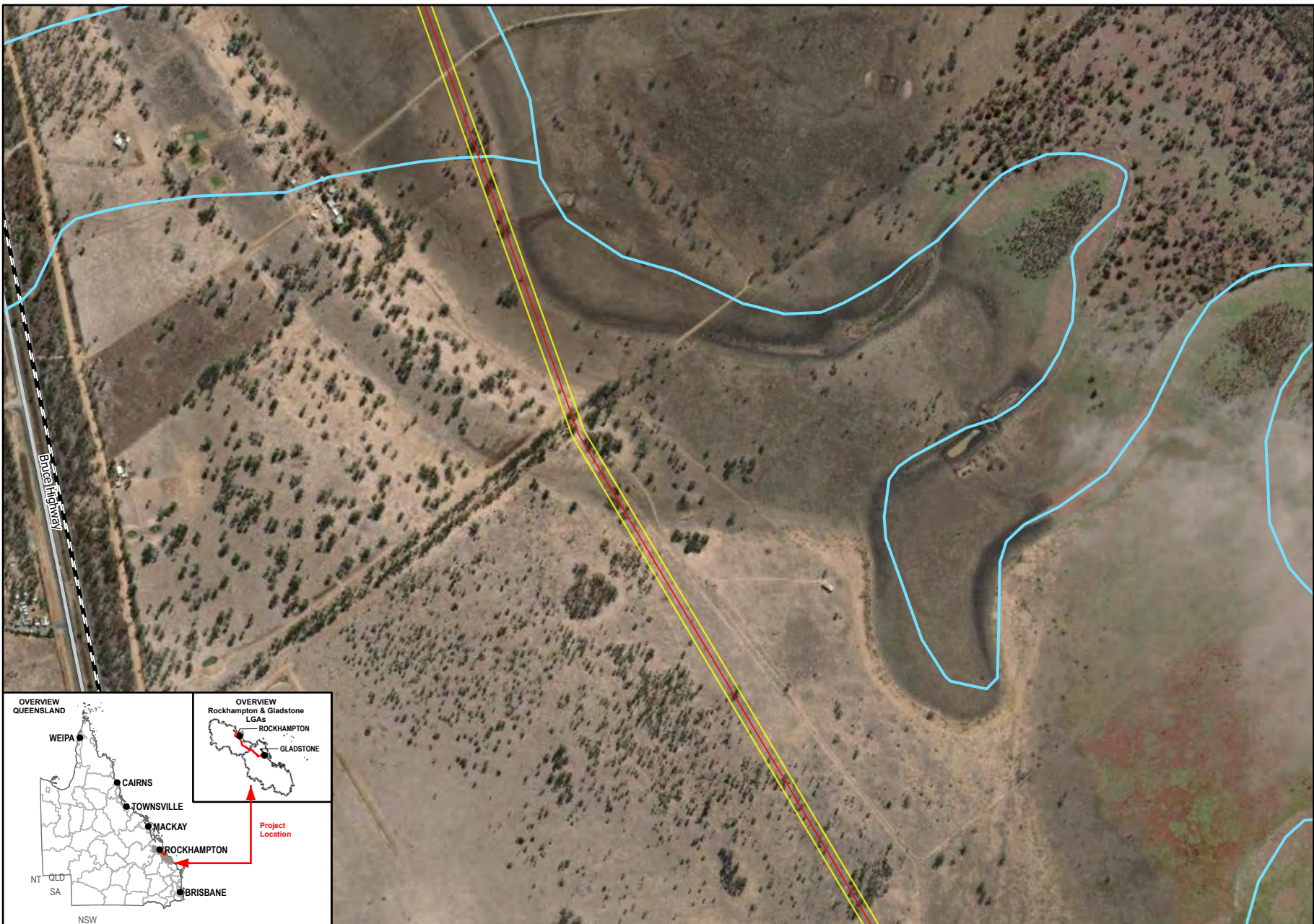
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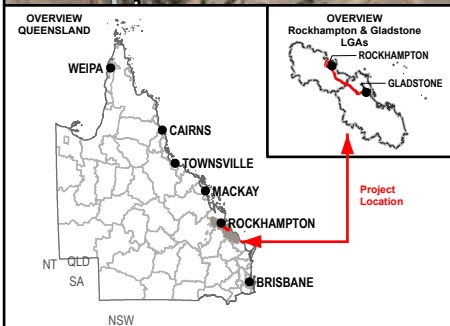
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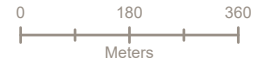
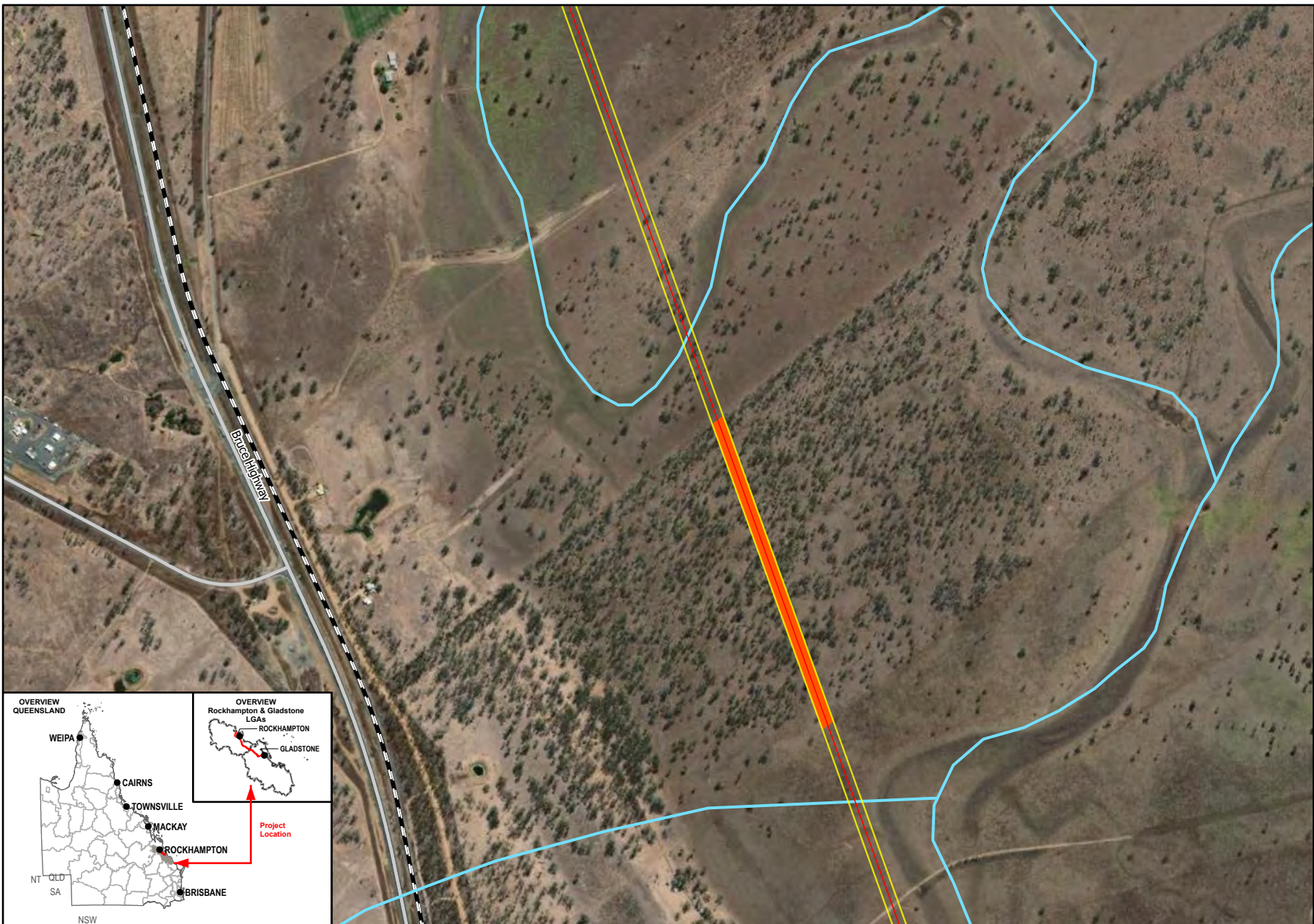
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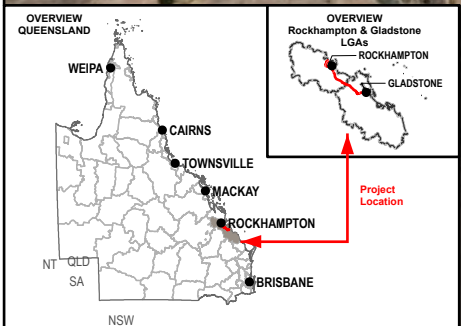
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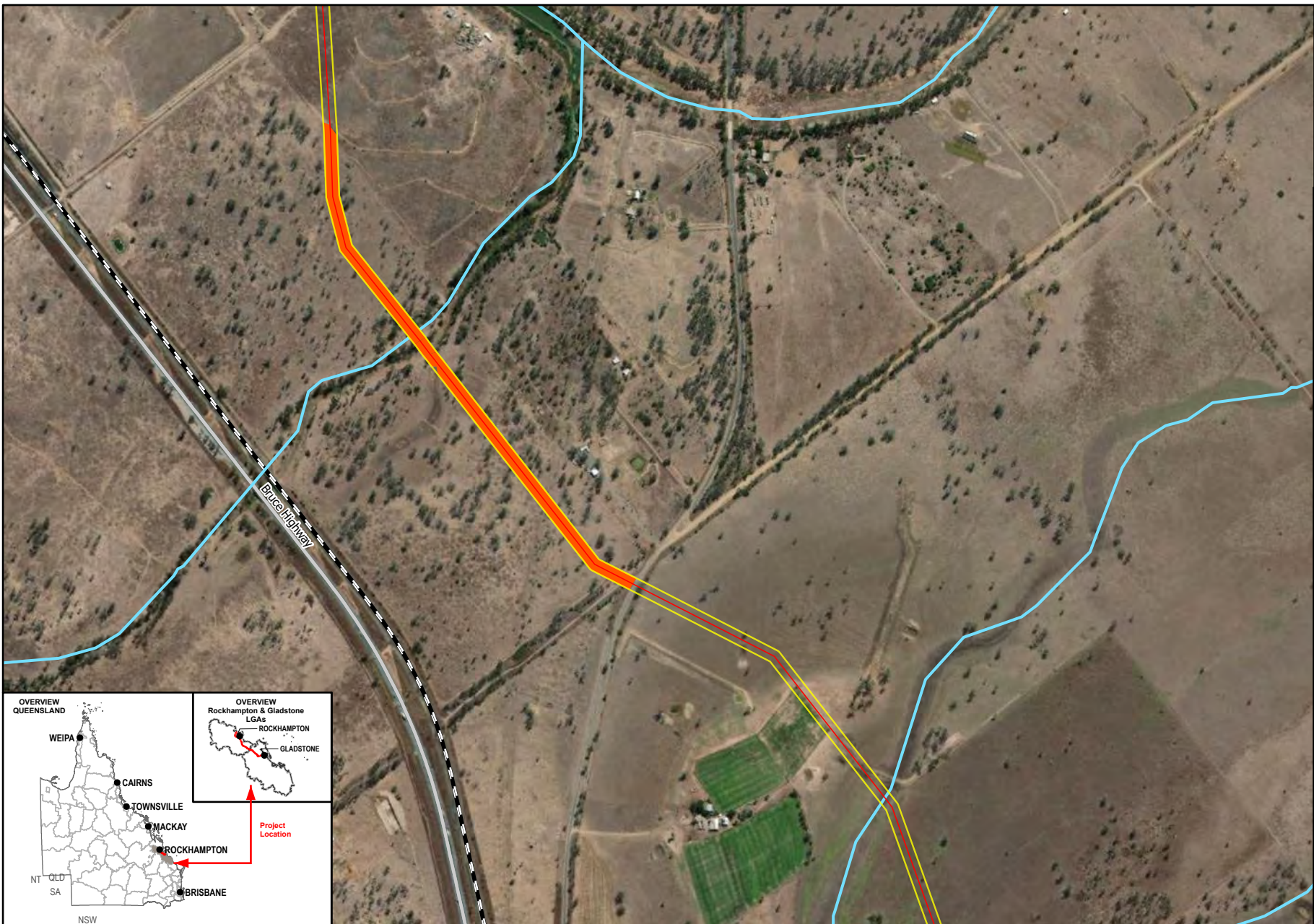
Legend

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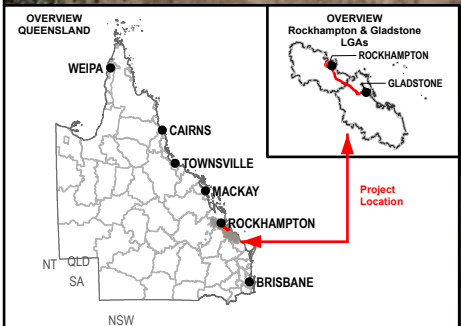
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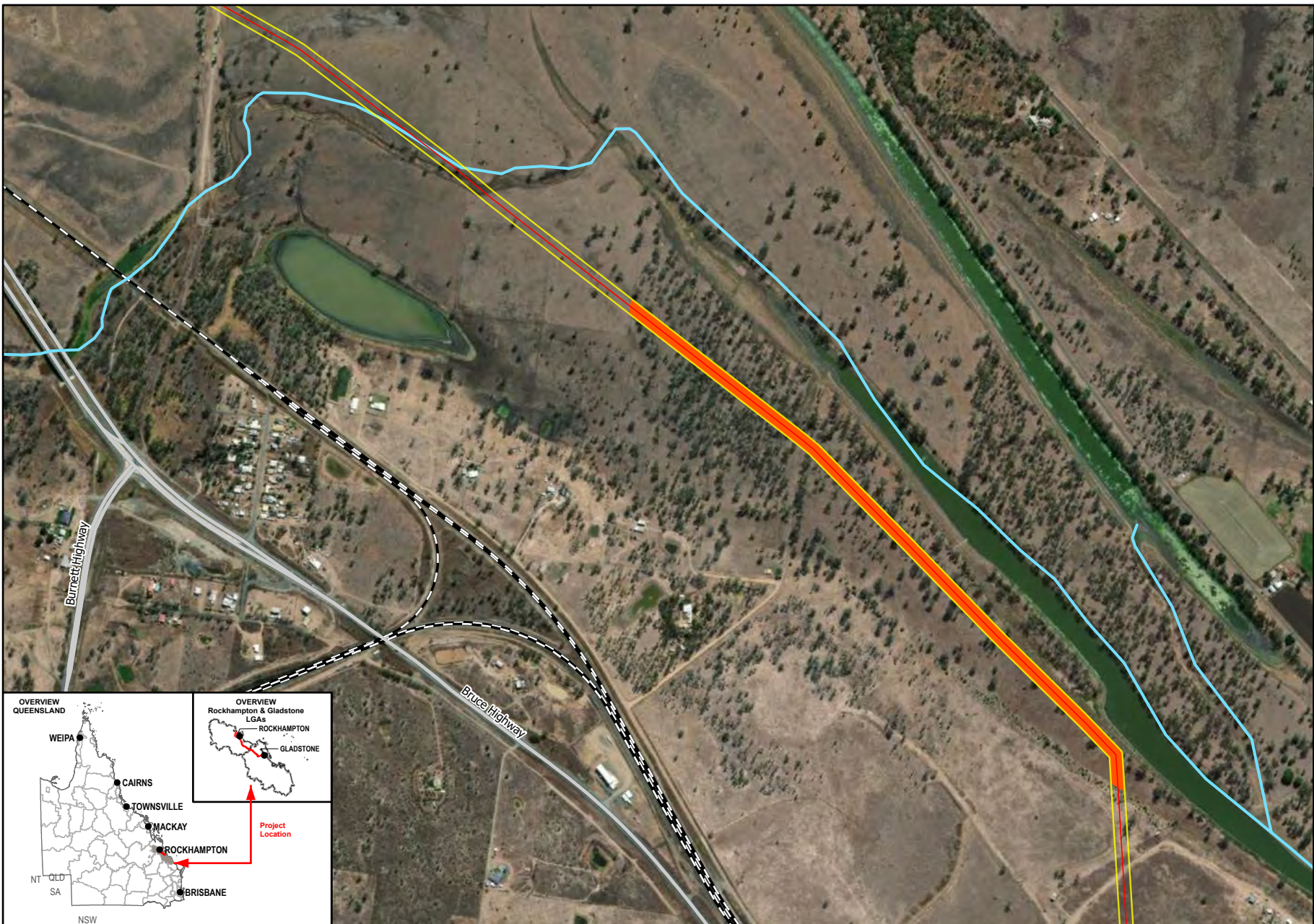
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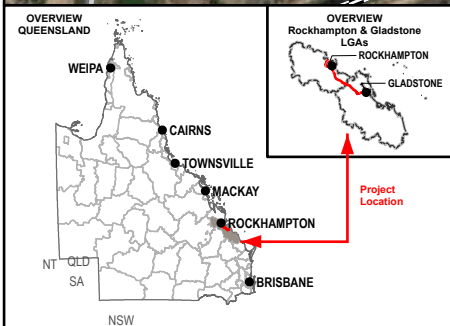
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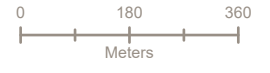
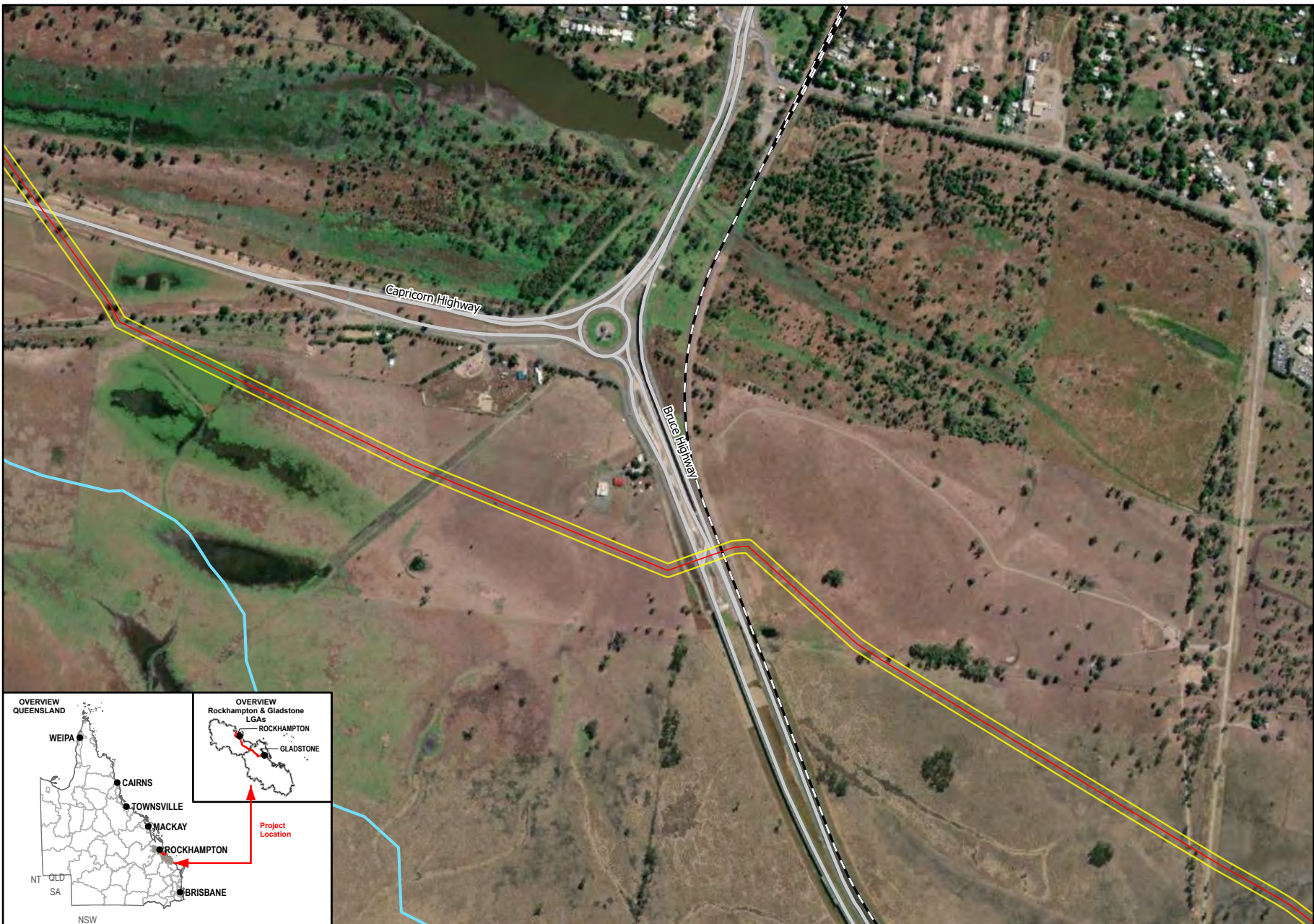
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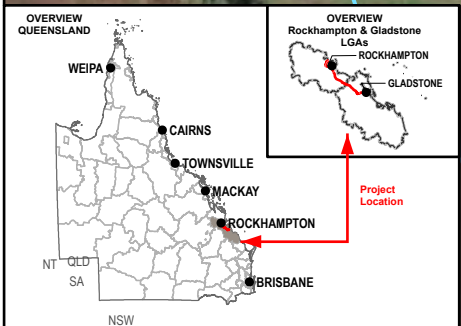




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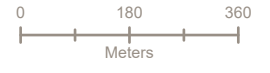
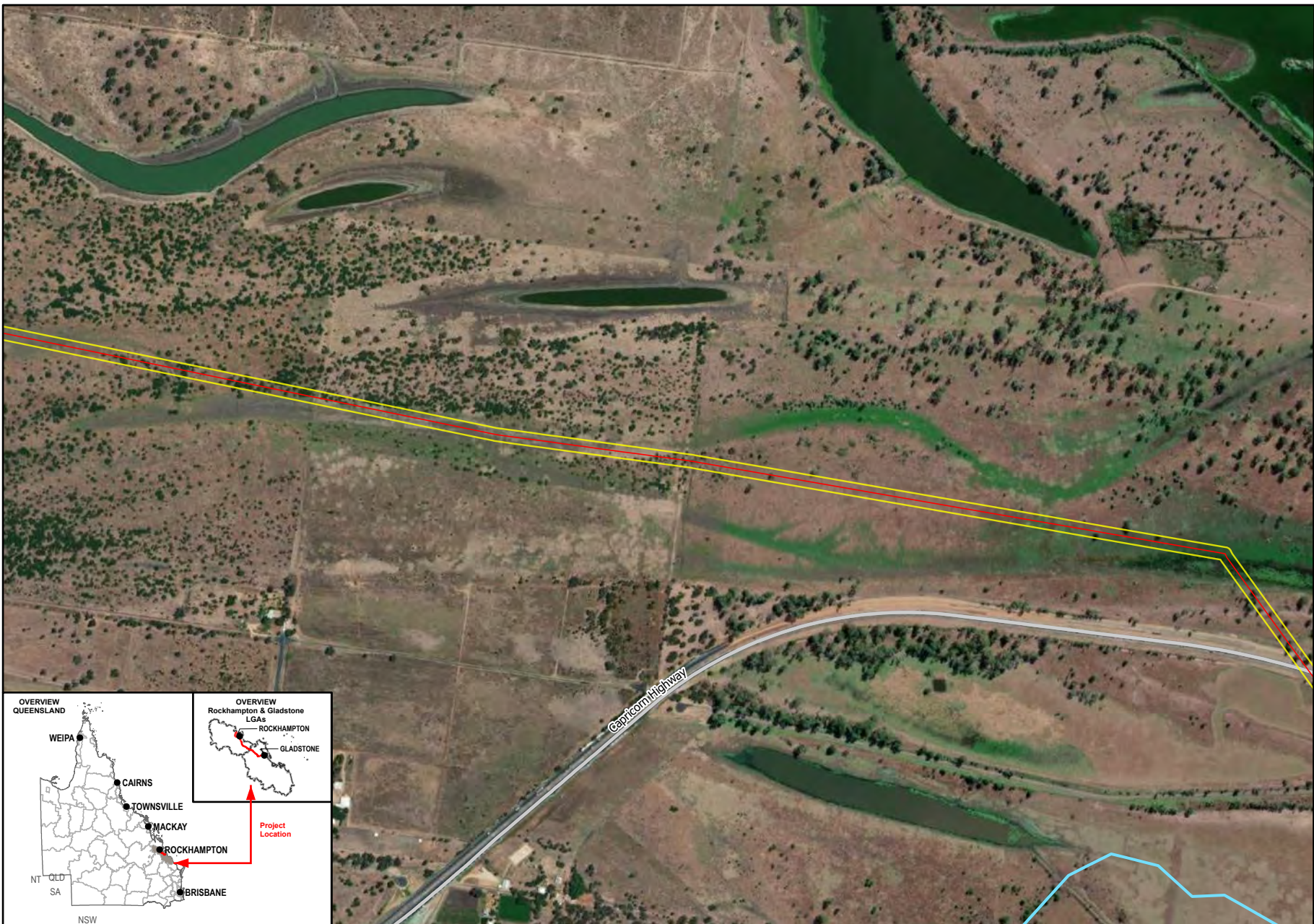
Legend

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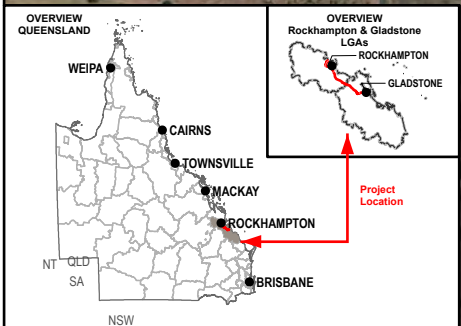
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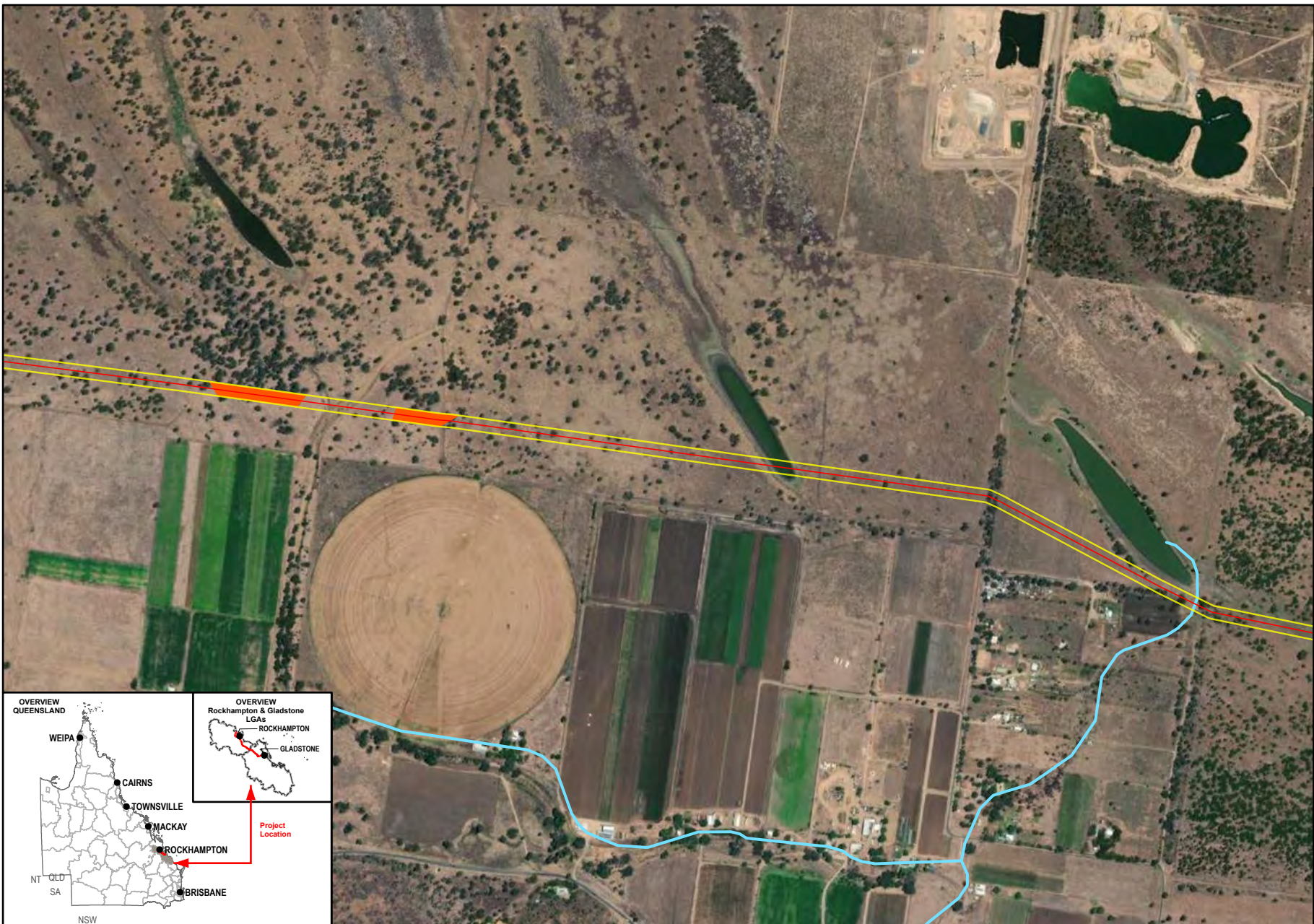
Legend

- SGIC SDA Pipeline Alignment
- Study Area
- Waterways
- Main Roads



Data Sources:
 1. Base Layers (Roads, waterway, locality, LGA etc) @ QSPatial, 2021
 2. Imagery @ Esri, Maxar, GeoEye, Earthstar Geographics, CNES-Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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- Legend**
- SGIC SDA Pipeline Alignment
 - Study Area
 - Predicted Greater Glider Habitat**
 - Habitant Type**
 - Potential Denning Habitat
 - Waterways

Data Sources:

1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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7.2.2.10 Yellow-bellied glider (south-eastern)

Conservation status and species ecology

The yellow-bellied glider (south-eastern) (*Petaurus australis australis*) is listed as vulnerable under the EPBC Act and NC Act but was not listed as an MNES at the time of the approval. The subspecies occurs in eucalypt-dominated forest and woodland (DAWE 2022a). The subspecies can occur in dry and wet sclerophyll, with abundance highly dependent on forest age and floristics. The subspecies prefers large tracts of mature, old growth forest that are able to provide suitable habitat for foraging and denning requirements. These requirements include floristic diversity, high proportion of winter-flowering and smooth-barked gums to provide year-round foraging resources. The subspecies is nocturnal, during the day yellow-bellied glider (south-eastern) dens in hollow-bearing trees, usually over one meter in diameter, primarily, living hollow-bearing smooth-barked eucalypts are used (DAWE 2022a). The subspecies occurs in family groups of between two to six individuals, covering a home range of approximately 50-65 ha, large home-ranges are required to maintain subpopulation viability (DAWE 2022a).

Field survey results and distribution of suitable habitat

No yellow-bellied glider (south-eastern) individuals or V-shaped incisions on smooth-barked eucalypts were recorded during the field surveys within the SGIC SDA study area. Survey effort for the yellow-bellied glider (south-eastern) included one night of 2-3 hours of spotlighting within potentially suitable habitat in the SGIC SDA study area. Suitable habitat was recorded within the SGIC SDA study area, and the species has been historically recorded at 10 locations within the desktop search extent, the most recent record recorded in 2014. Many of these records have been historically recorded in riparian habitats, in close proximity to drainage lines and watercourses, as well as elevated areas.

Suitable foraging habitat occurs in numerous locations within the southern proportion of the SGIC SDA pipeline alignment and suitable denning habitat was observed within an area retaining of remnant, mature vegetation within the SGIC SDA study area, approximately 3.5 km northwest of Mount Larcom. This woodland retains large, mature eucalypt trees supporting suitable hollows, and is connected to large patches of remnant woodland (> 200 ha²). The distribution of predicted yellow-bellied glider (south-eastern) habitat is mapped in Figure 7-15.

Significance of impact assessment

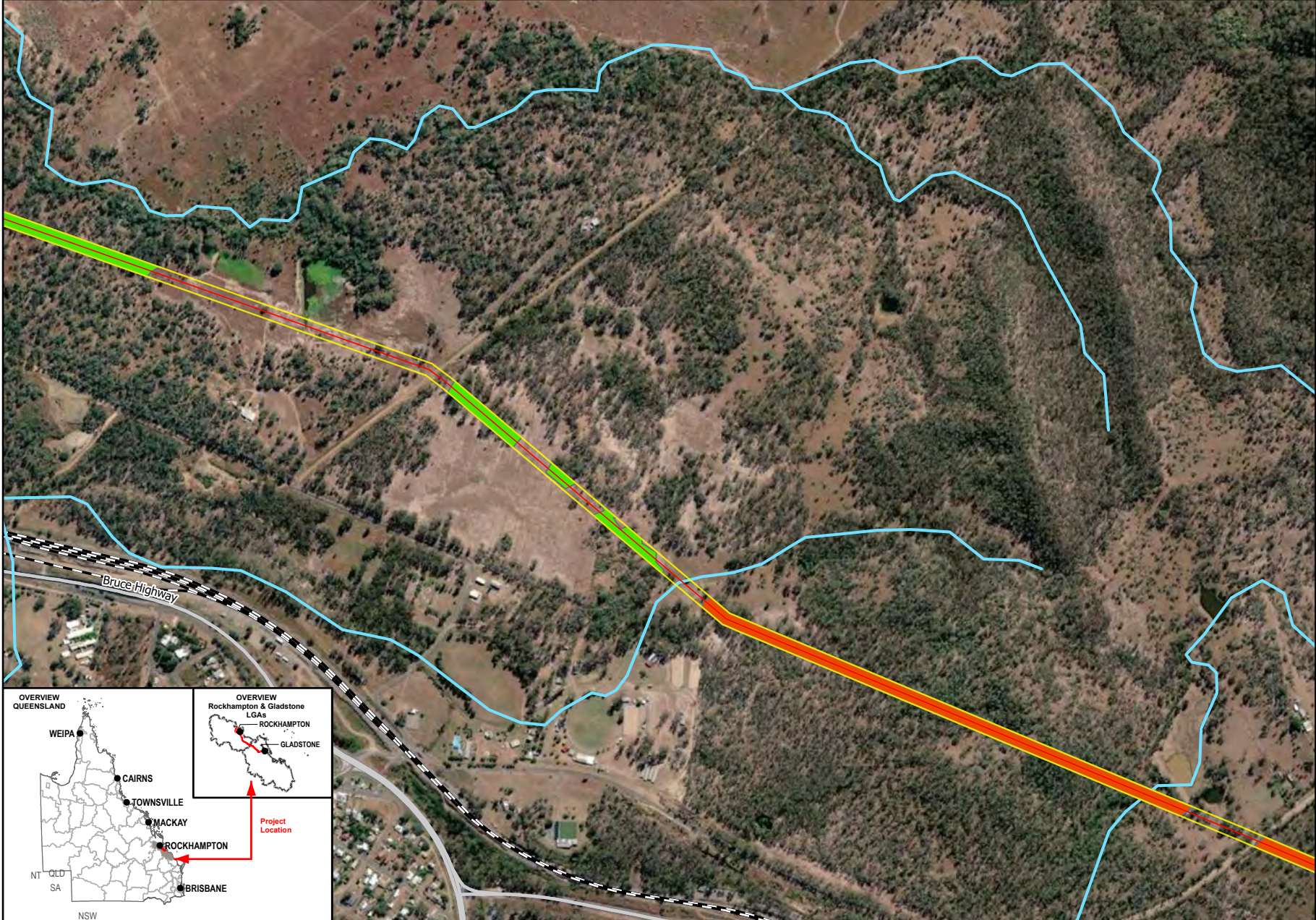
The project is likely to result in a significant residual impact on the yellow-bellied glider (south-eastern). A significance of impact assessment of the project on the yellow-bellied glider (south-eastern) (vulnerable under the EPBC Act and NC Act) is provided in Table 7-28.

Table 7-28 Significance of impact on the yellow-bellied glider (south-eastern)

Significant residual impact criteria	Potential to occur
A long-term decrease in the size of a local population	<p>Unlikely</p> <p>The yellow-bellied glider (south-eastern) has been historically recorded at 10 locations within the desktop search extent (10 km buffer). Due to a lack of population information, all local yellow-bellied glider (south-eastern) population are considered important populations (DAWE 2022a). The project will result in the clearing of 3.61 ha of predicted foraging habitat and 26.29 ha of denning habitat for the species, representing 0.22% of habitat available within a 5 km buffer. The species is reliant on smooth-barked eucalypts for foraging given its tendency to acquire sap by incising directly into the bark. Mature smooth-barked eucalypt trees are moderately abundant within the SGIC SDA pipeline alignment; however, a low abundance of suitable denning habitat were recorded. The SGIC SDA pipeline alignment largely supports regrowth vegetation (retaining few hollow-bearing trees), younger remnant vegetation and open landscapes that have been previously cleared for agricultural practices. The remaining areas support remnant vegetation, which were identified as suitable denning sites for the yellow-bellied glider (south-eastern). Clearing has the potential to cause direct mortality and injury of individuals. This risk will be mitigated by the employment of a fauna spotter-catcher during clearing to check hollows in large fallen trees and relocate any encountered individuals. Sequential clearing will also be adopted to allow species to self-disperse and tree felling will occur towards cleared areas, rather than towards standing vegetation. The project is not considered likely to lead to a long-term decrease in the size of the yellow-bellied glider (south-eastern) local population. Considering the species has a large capacity for movement and can periodically move to access areas of foraging habitat, the species' local population is</p>

Significant residual impact criteria	Potential to occur
	<p>anticipated to remain largely unaffected due to the availability of habitat within the surrounding landscape. The loss of vegetation within the SGIC SDA pipeline alignment is unlikely to (1) limit movement of resident or transient individuals; nor (2) affect the availability of resident or transient individuals to acquire key resources. The project is unlikely to lead to a long-term decrease in the size of a local population.</p>
<p>Reduce the extent of occurrence of the species</p>	<p>Unlikely</p> <p>The species is reliant on access to smooth-barked hollow-bearing trees (i.e. <i>Eucalyptus tereticornis</i> and <i>Corymbia citriodora</i>) for denning and foraging. As mentioned above, mature smooth-barked eucalypt trees are moderately abundant within the SGIC SDA pipeline alignment, with low densities of suitable denning habitat. Suitable denning sites were observed in mature woodland within the SGIC SDA study area, approximately 3.5 km northwest of Mount Larcom. The maximum width of clearing required for construction of the SGIC SDA pipeline alignment is 30 m. Once the pipeline has been installed and buried, a maximum width of 10 m will be permanently cleared with the remaining 20 m to be rehabilitated.</p> <p>Clearing along the SGIC SDA pipeline alignment is unlikely to impact the species as the proposed clearing extent is narrow (30 m) and mostly linear, and unlikely to generate edge effects or impact ecosystem structure and functioning.</p> <p>Given the loss of 29.90 ha of suitable habitat, negligible impact of local and landscape connectivity, and low levels of disturbance during the operation phase, it is unlikely to have any significant indirect impact on the species. While there will be a localised loss of habitat for the yellow-bellied glider (south-eastern) (including ecological significant locations), this won't have a bearing on the species' extent of occurrence. Accordingly, the project is unlikely to reduce the extent of occurrence of the species, especially noting the definition of extent of occurrence per the Queensland <i>Significant Residual Impact Guideline</i> (DEHP 2014b): <i>Extent of occurrence is defined as the area contained within the shortest continuous imaginary boundary which can be drawn to encompass all the known, inferred or projected sites of present occurrence of a taxon.</i></p>
<p>Fragment an existing population</p>	<p>Unlikely</p> <p>Linear impacts along the SGIC SDA pipeline alignment is not considered to exceed the species' volplane distance and are unlikely to cause any fragmentation in the species habitat, as yellow-bellied gliders (southern) has been recorded to glide to a maximum distance of 140 m (DAWE 2022a). Connectivity to extensive areas of suitable habitat will persist in the surrounding landscape allowing opportunities for movement. Furthermore, large areas of remnant habitat are located within Mount Stowe State Forest, Calliope Conservation Park and Mount Larcom. Therefore, the SGIC SDA pipeline alignment is unlikely to fragment an existing yellow-bellied glider (south-eastern) population.</p>
<p>Result in genetically distinct populations forming as a result of habitat isolation</p>	<p>Unlikely</p> <p>As detailed above, the species' capacity to move locally and regionally is unlikely to be limited by any localised land clearing necessary to construct the SGIC SDA pipeline alignment. As a result, the project is unlikely to cause any form of genetic isolation at a population level.</p>
<p>Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat</p>	<p>Unlikely</p> <p>The predation by European red foxes (<i>Vulpes vulpes</i>) and feral cats (<i>Felis catus</i>) are listed as a threat to the yellow-bellied glider (south-eastern). It has been shown that European red foxes are able to climb trees where to can predate on living gliders, with feral cats likely eating the subspecies through scavenging (DAWE 2022a). The project is not considered likely to increase the incidence of any invasive species (particularly European red foxes and feral cats) that could threaten the yellow-bellied glider (south-eastern), especially noting mitigation measures in place to manage invasive species.</p>
<p>Introduce disease that may cause the population to decline</p>	<p>Unlikely</p> <p>The yellow-bellied glider (south-eastern) is potentially susceptible to adverse impact from <i>Phytophthora cinnamomi</i> due the soil fungus's ability to infect <i>Eucalyptus</i> species. Biosecurity requirements (e.g. weed and seed declarations) will be implemented throughout the project, and thus, this risk has been assessed as low.</p>
<p>Interfere with the recovery of the species</p>	<p>Unlikely</p> <p>The project is unlikely to interfere substantially with the recovery of the species. The yellow-bellied glider (south-eastern) has been widely recorded within region, with large, contiguous patches of suitable habitat located adjacent to the southern section of the SGIC SDA pipeline alignment. Although the project will remove 39.56 ha of predicted habitat, equating to 0.22 % of habitat available within a 5 km buffer, the remaining habitat is connected to an extensive network of suitable habitat.</p>

Significant residual impact criteria	Potential to occur
	<p>The impacts of the SGIC SDA pipeline alignment are expected to be relatively benign, as the maximum corridor width (30 m) is well below the species maximum volplane distance (> 100 m) and is unlikely to produce fragmentation or habitat isolation. The risk of individual mortality or injury during construction will be addressed via the mitigation measures in the CEMP and the use of sequential clearing and an experienced fauna spotter-catcher during clearing. Noting the above points relating to very limited if any effects on local populations (e.g. declines), extent of occurrence, fragmentation, invasive species, and disease, the project is not considered likely to interfere with the recovery of the yellow-bellied greater glider (south-eastern).</p>
<p>Cause disruptions to ecologically significant locations of a species</p>	<p>Likely</p> <p>The project will require the clearing of 29.92 ha of potentially suitable foraging and denning habitat for the yellow-bellied glider (south-eastern). Although the SGIC SDA pipeline alignment has largely been placed within or adjacent to areas that have been previously cleared, the project will result in a loss of species preferred trees species, including <i>Corymbia citriodora</i>, <i>Eucalyptus moluccana</i> and <i>E. tereticornis</i>, for foraging and denning. While the project is not expected to cause a long-term decline in the local population, reduce its extent of occurrence, cause adverse habitat fragmentation effects nor interfere with the recovery of the species, the loss of suitable yellow-bellied glider (south-eastern) habitat within the GSDA pipeline alignment is likely to result in disruption to ecologically significant foraging and breeding locations.</p>
<p>Conclusion</p>	<p>A conservative assessment has identified that the project is likely to result in a significant residual impact on the yellow-bellied glider (south-eastern). Although the SGIC SDA pipeline alignment has been located within areas that have been previously cleared for agricultural practices and linear infrastructure such as railways, roads, access tracks and pipelines, the project will require the clearing of 29.92 ha of woodland areas retaining preferred food trees and suitable denning habitat within the SGIC SDA pipeline alignment.</p>



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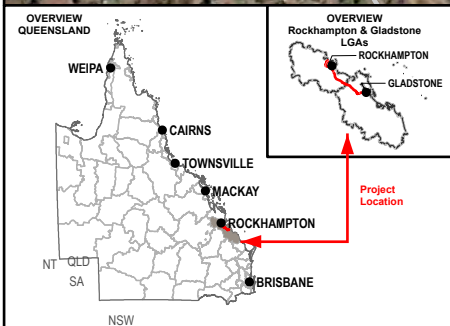
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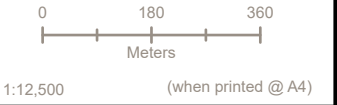
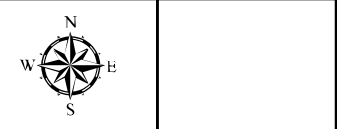
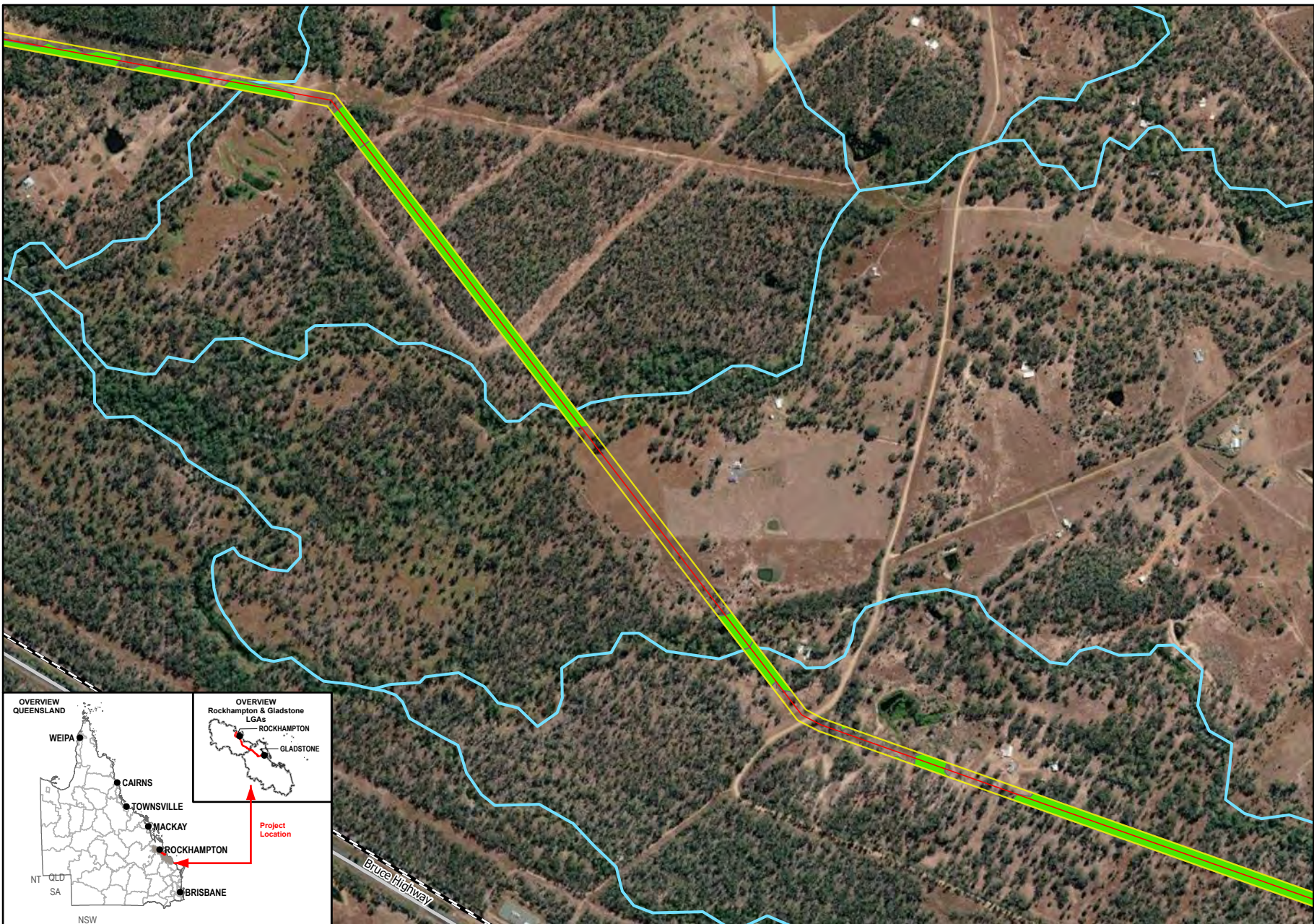
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- SGIC SDA Pipeline Alignment
 - Study Area
 - Predicted Yellow-bellied Glider (South-eastern) Habitat**
 - Habitat Type**
 - Potential Denning Habitat
 - Potential Foraging Habitat
 - Waterways
 - Main Roads
 - Railways

Data Sources:

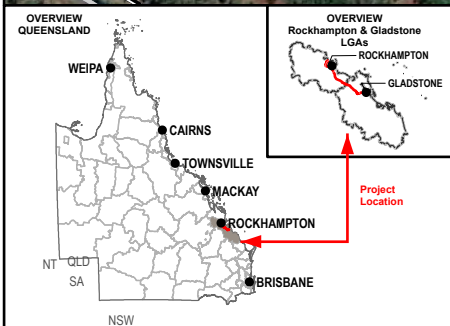
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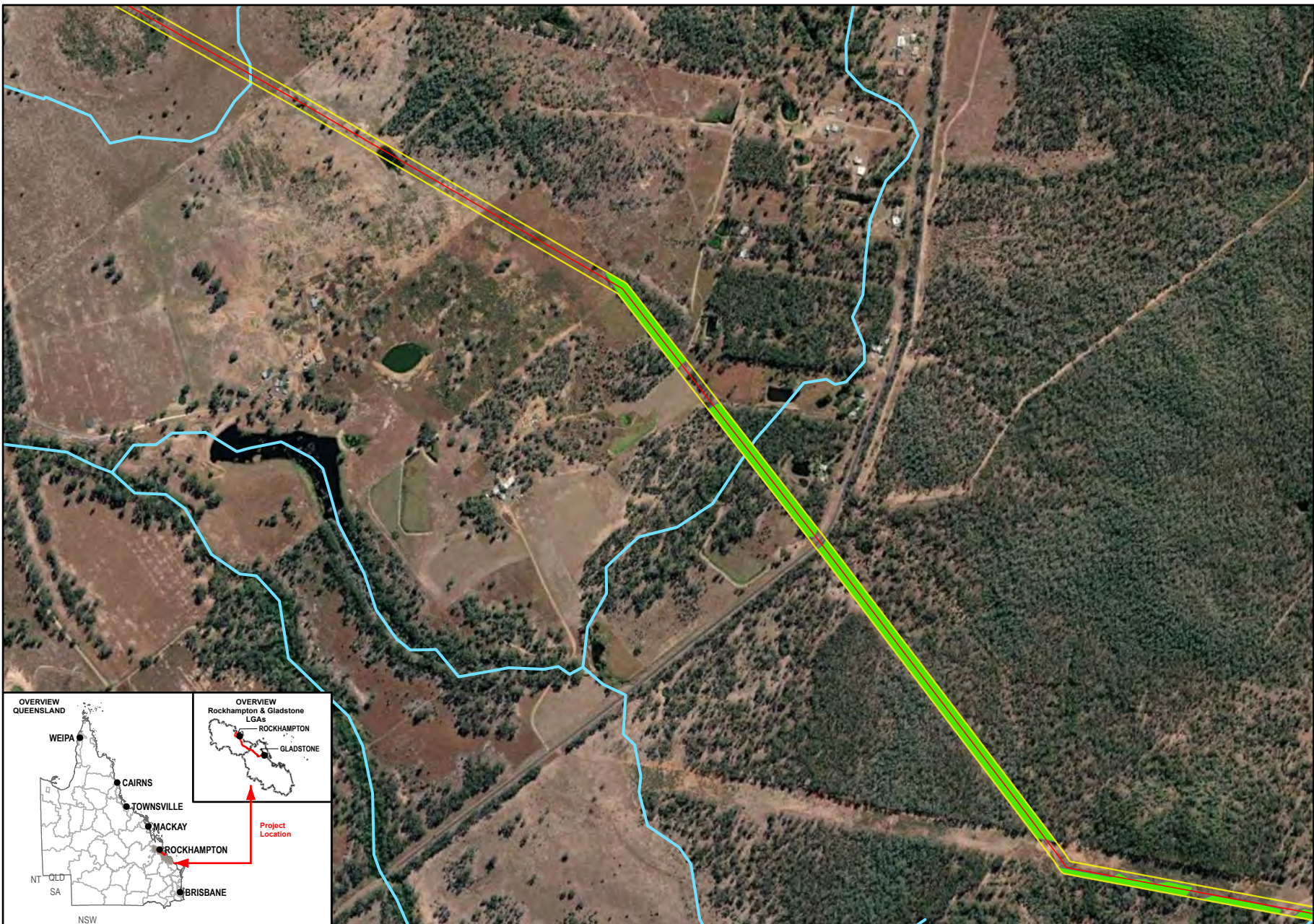
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- SGIC SDA Pipeline Alignment
 - Study Area
 - Predicted Yellow-bellied Glider (South-eastern) Habitat**
 - Habitat Type**
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 - Waterways
 - Main Roads
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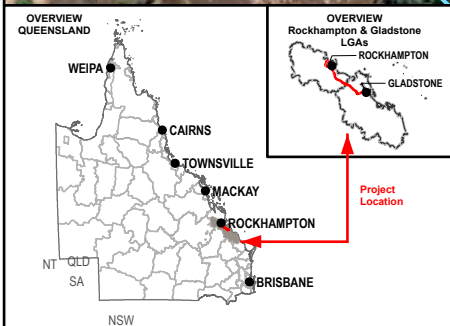
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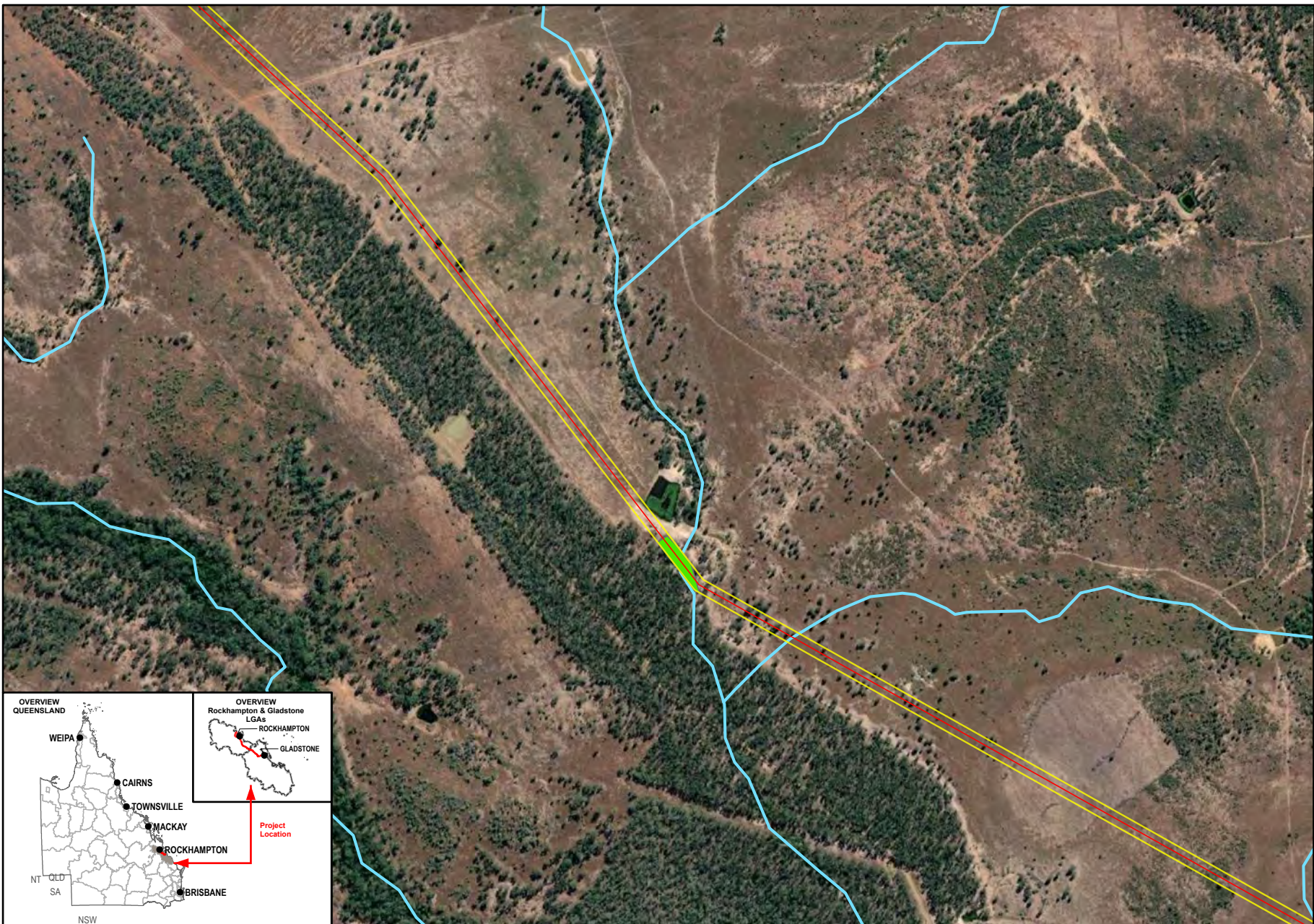
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 - Study Area
 - Predicted Yellow-bellied Glider (South-eastern) Habitat**
 - Habitat Type**
 - Potential Denning Habitat
 - Potential Foraging Habitat
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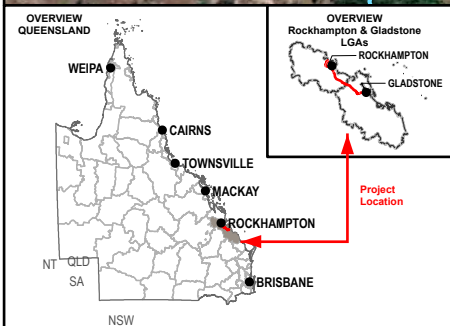
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 - Study Area
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 - Habitat Type**
 - Potential Denning Habitat
 - Waterways

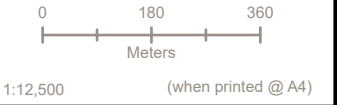
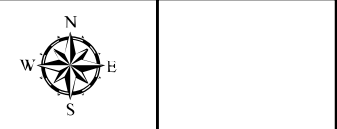
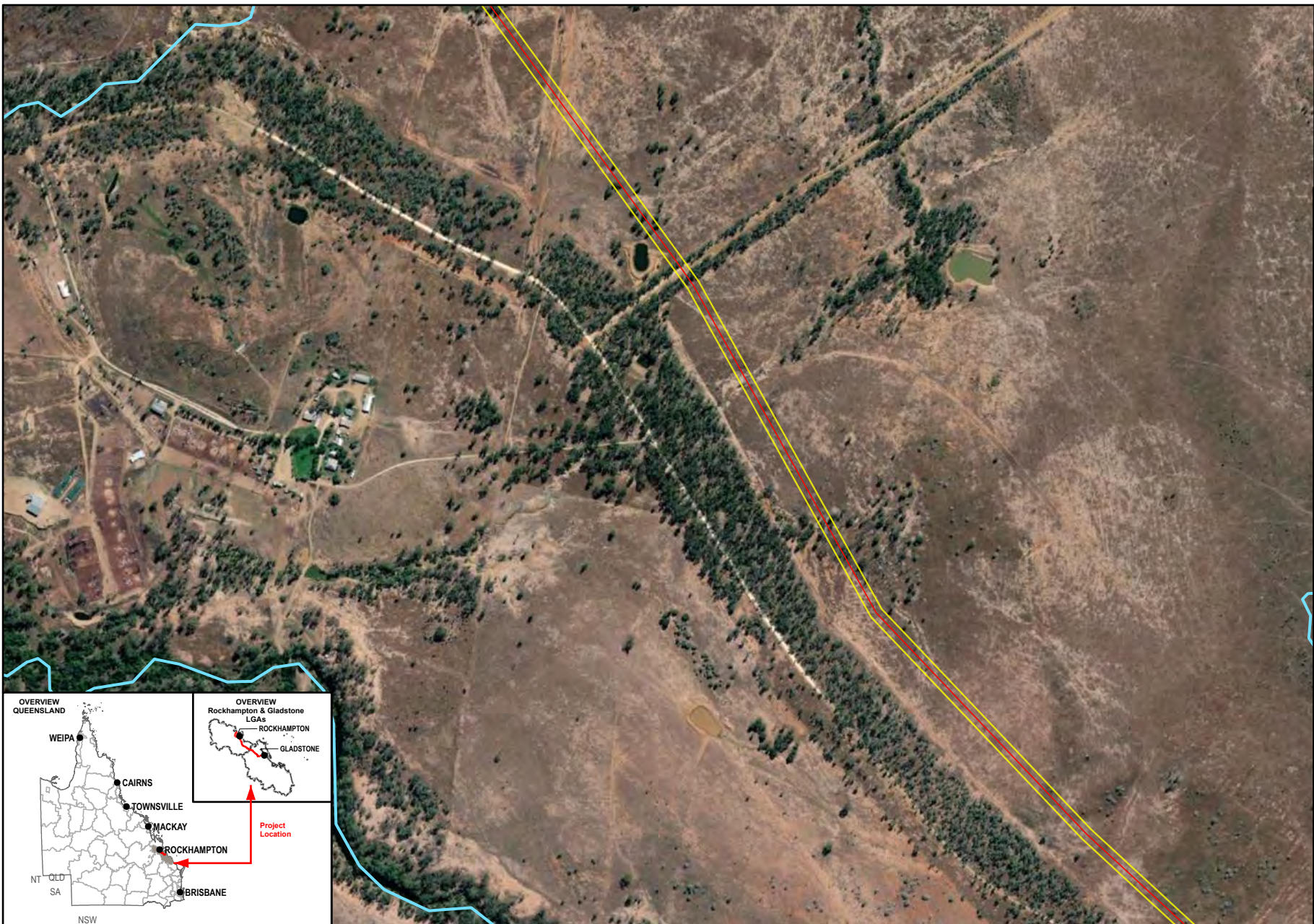
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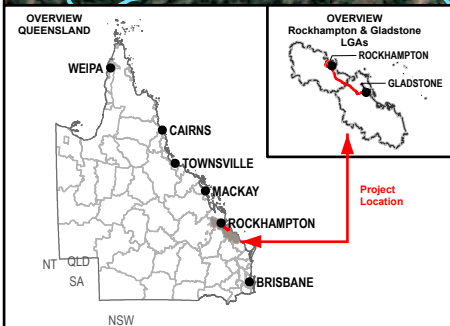
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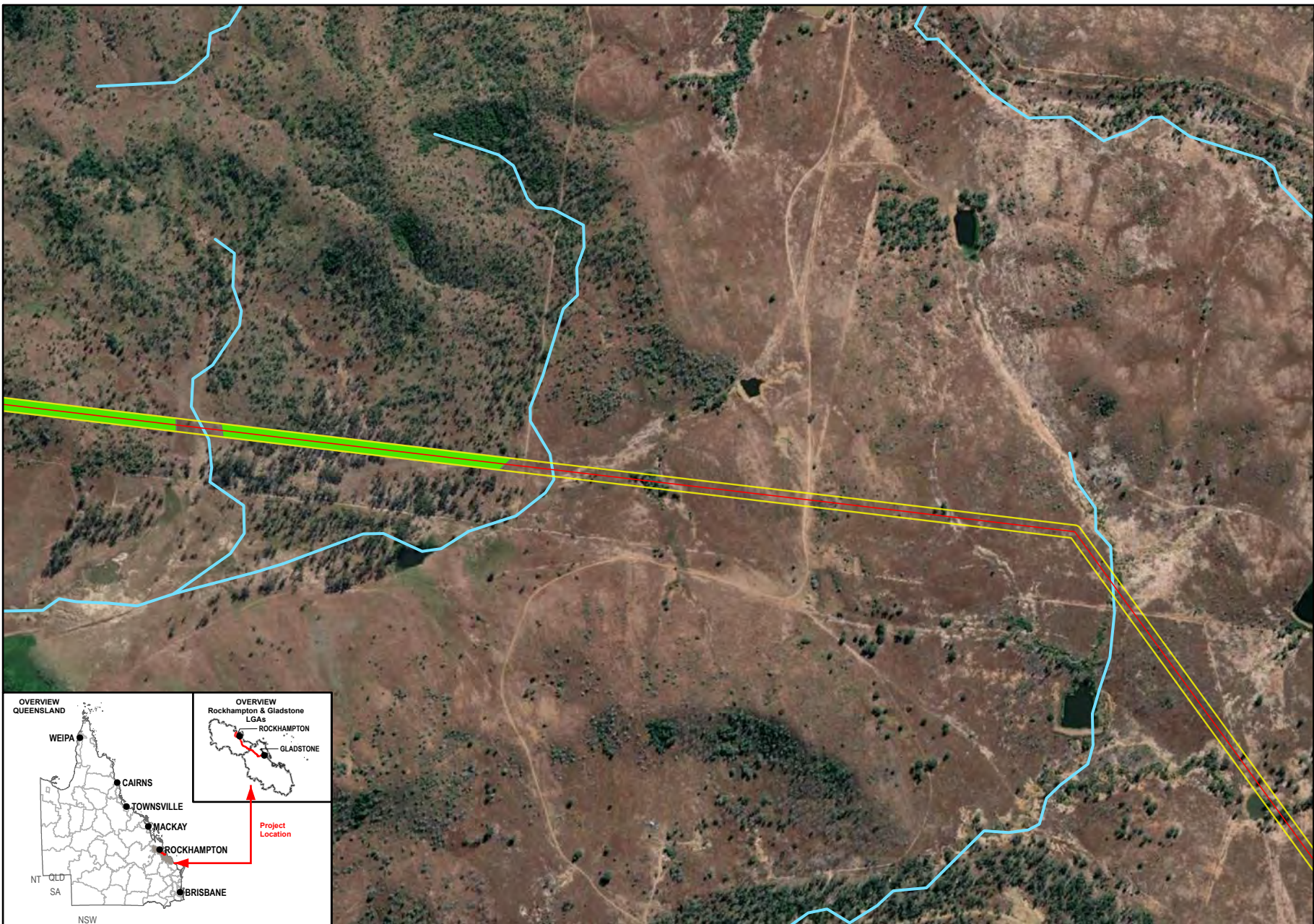
- Legend**
- SGIC SDA Pipeline Alignment
 - Study Area
 - Waterways



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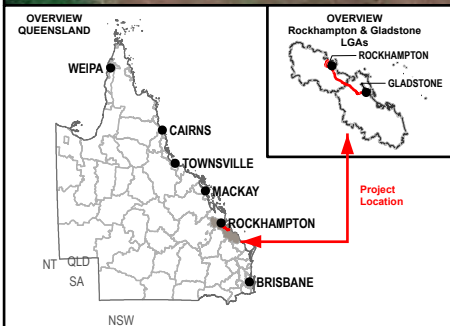
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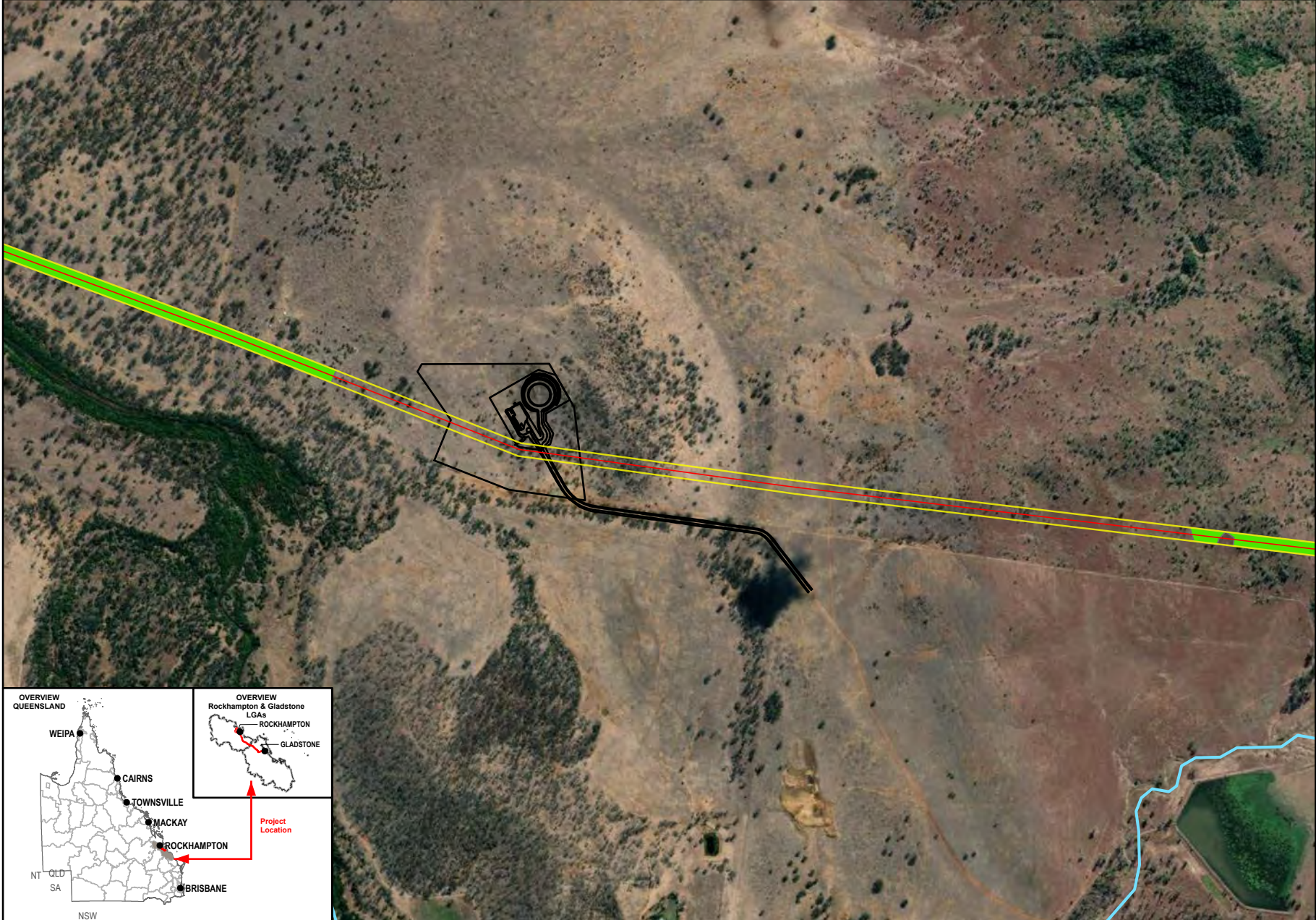
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- SGIC SDA Pipeline Alignment
 - Study Area
- Predicted Yellow-bellied Glider (South-eastern) Habitat**
- Habitat Type
- Potential Denning Habitat
 - Waterways




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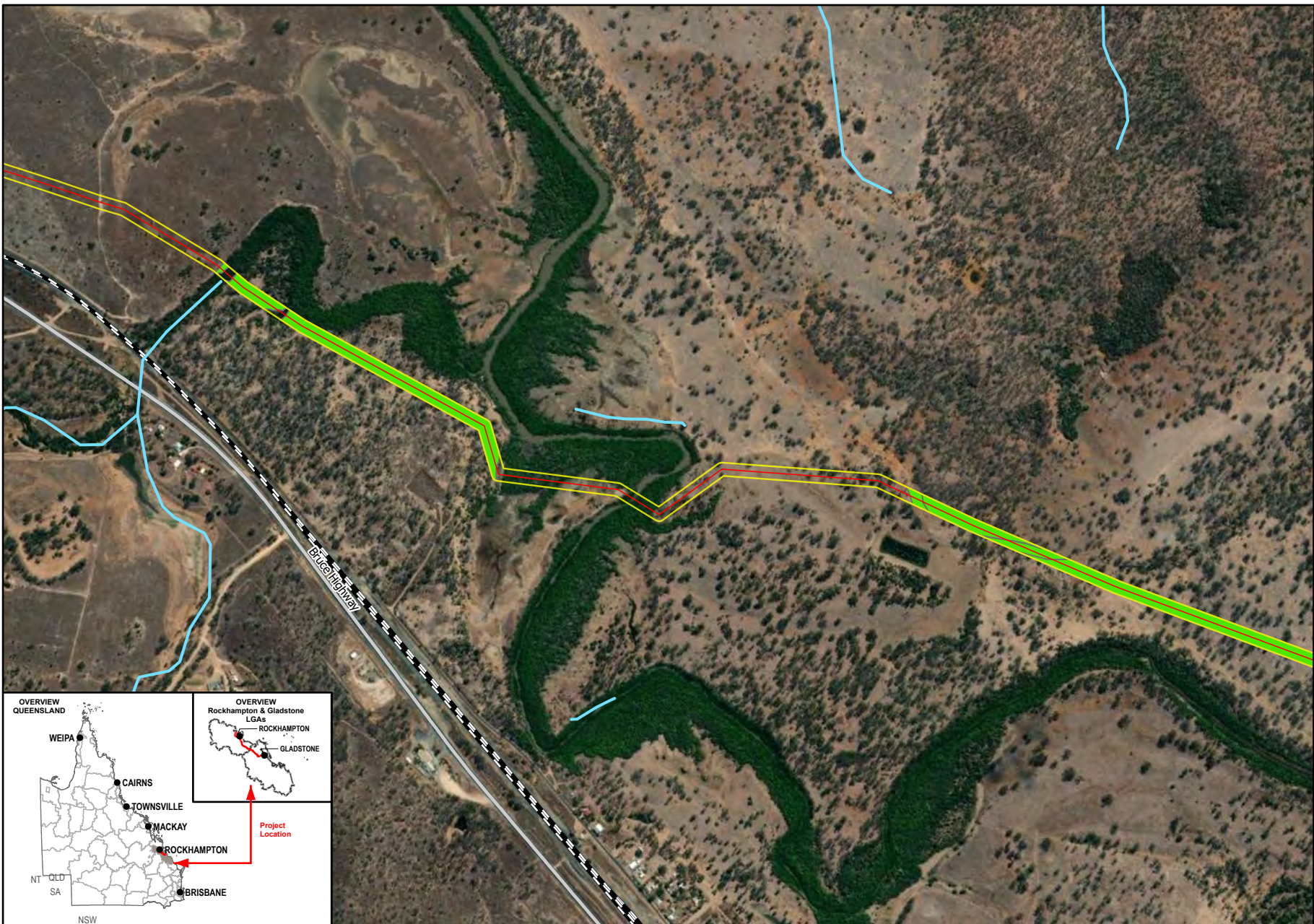

 
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- Legend**
- SGIC SDA Pipeline Alignment
 - Study Area
 - Predicted Yellow-bellied Glider (South-eastern) Habitat**
 - Habitat Type**
 - Potential Denning Habitat
 - Raglan Pump Station and Reservoir Layout
 - Waterways

Data Sources:

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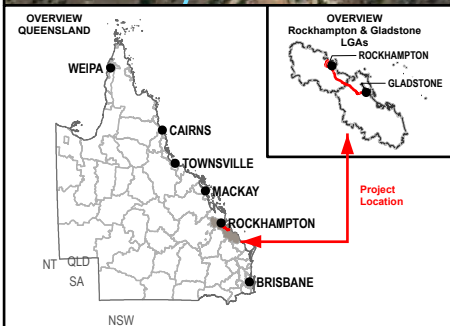
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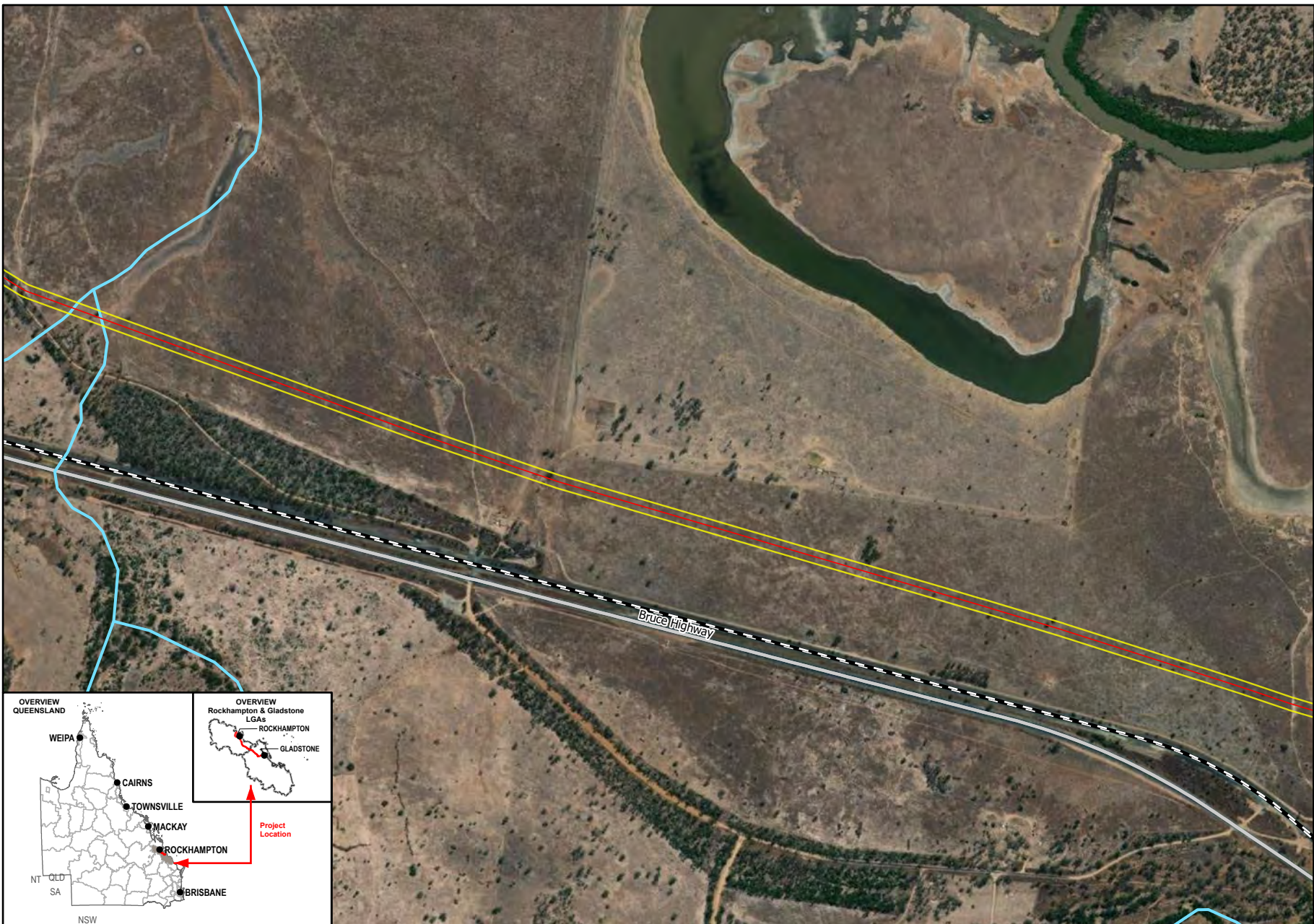
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 - Study Area
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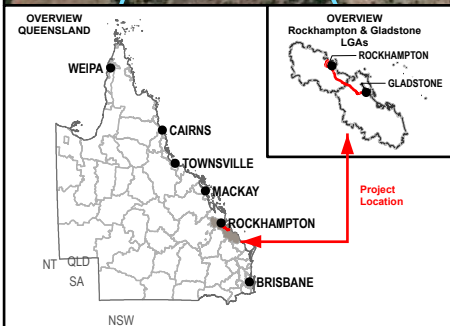
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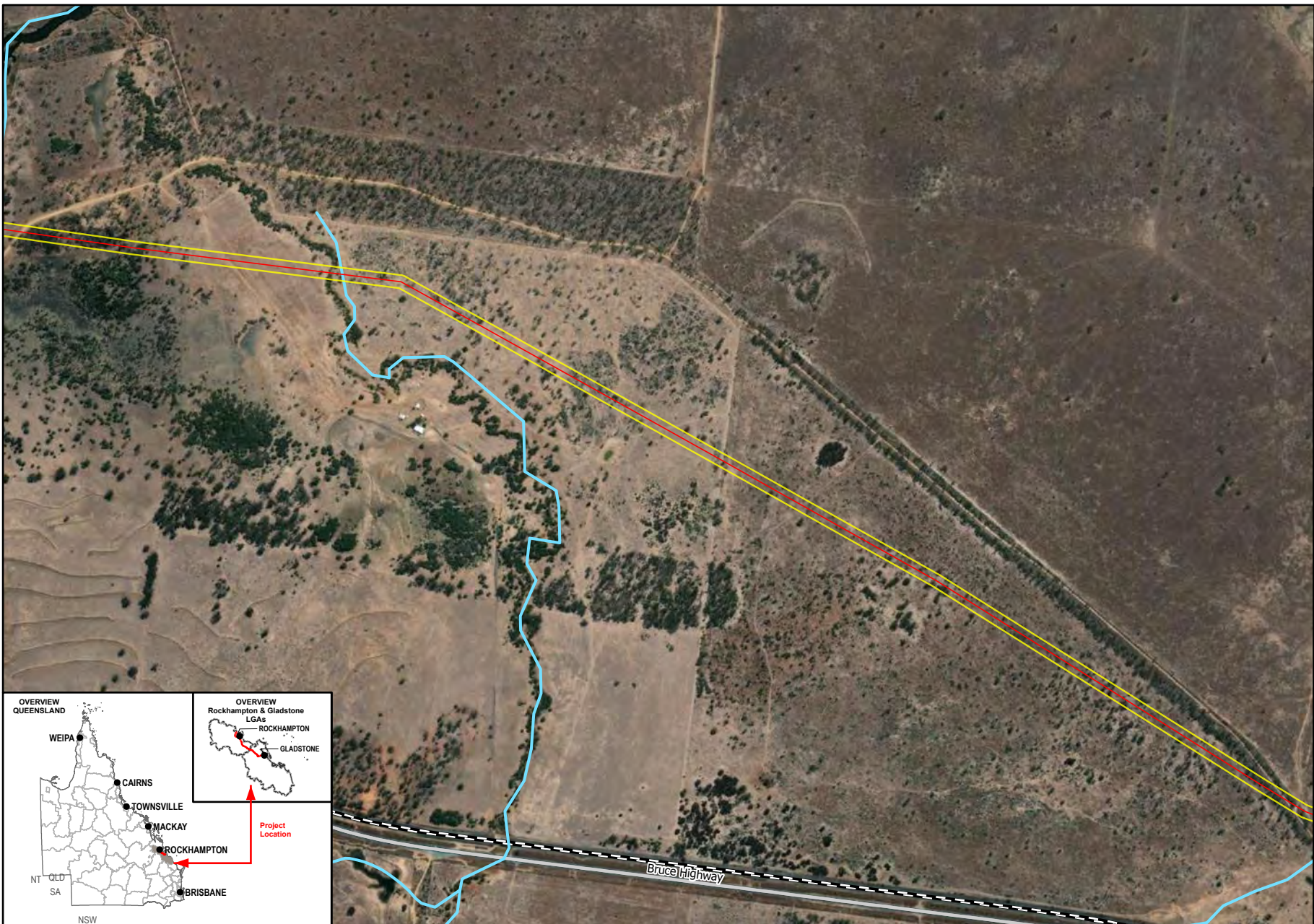
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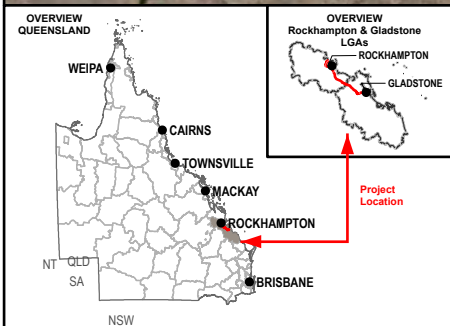
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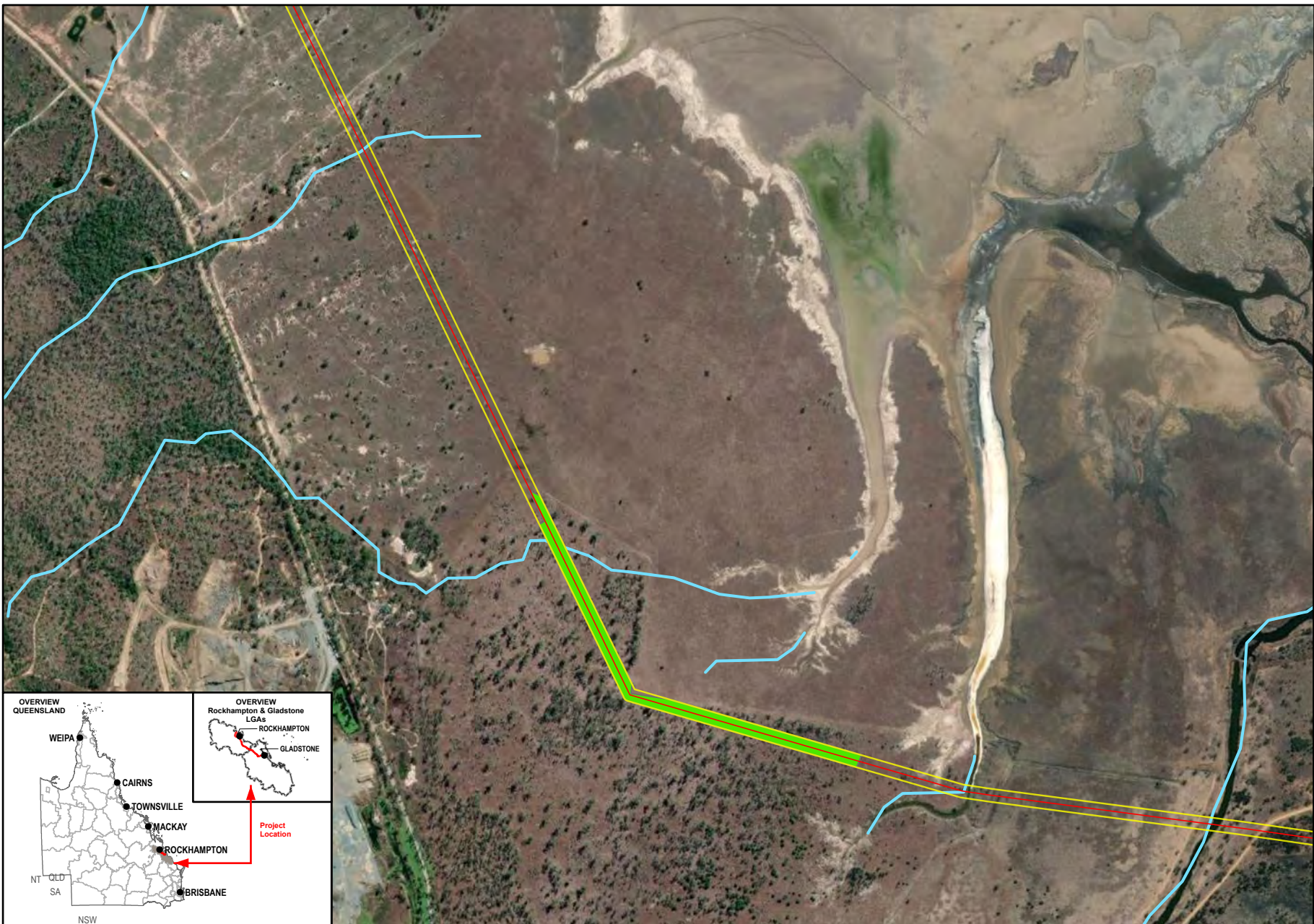
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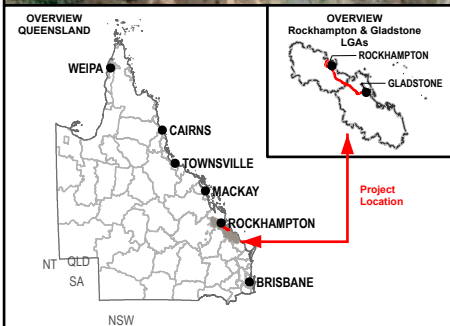
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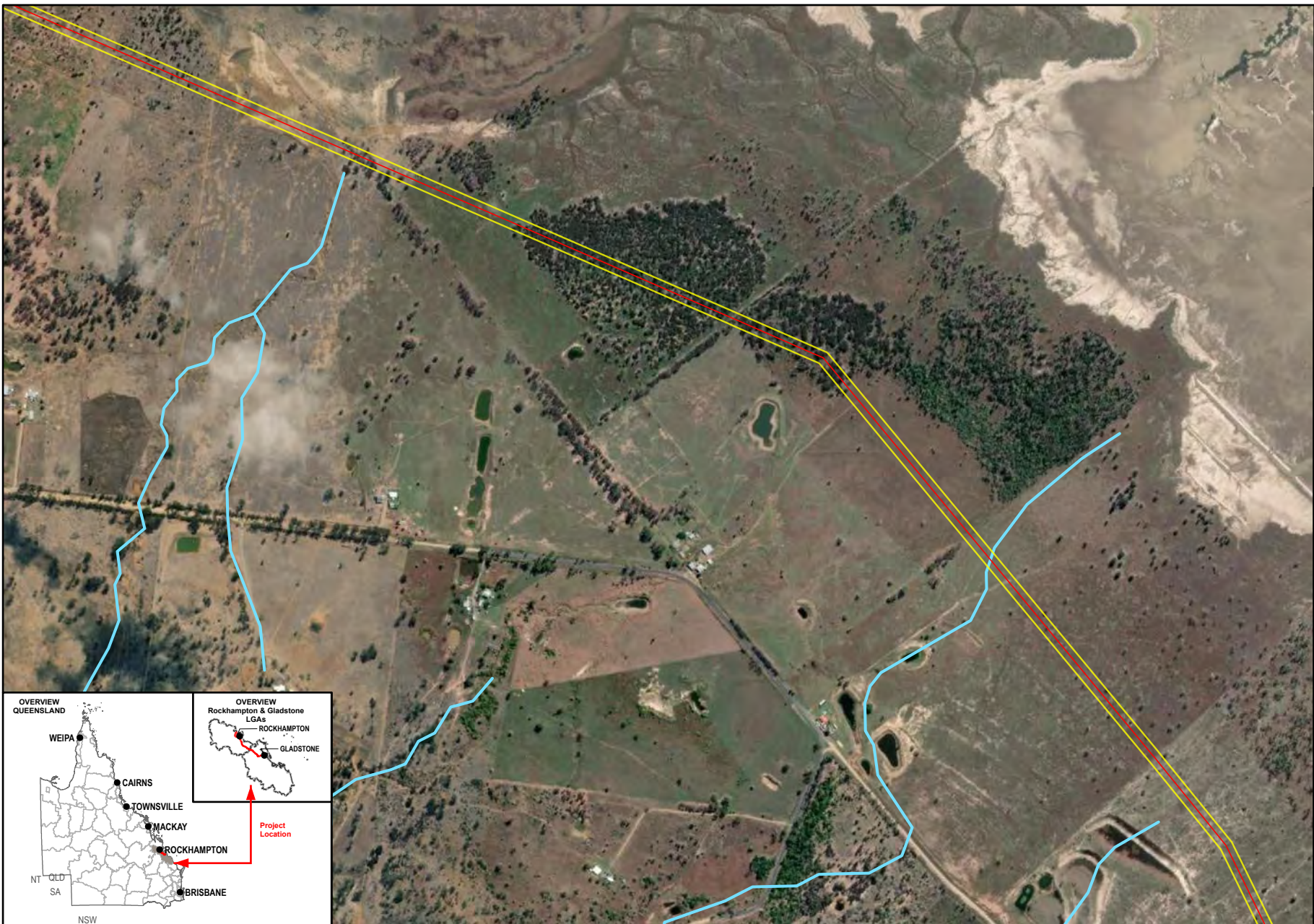
- Legend**
- SGIC SDA Pipeline Alignment
 - Study Area
 - Predicted Yellow-bellied Glider (South-eastern) Habitat**
 - Habitat Type**
 - Potential Denning Habitat
 - Waterways

Data Sources:

1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
2. Imagery @ Esri, Maxar, GeoEye, Earthstar Geographics, CNES-Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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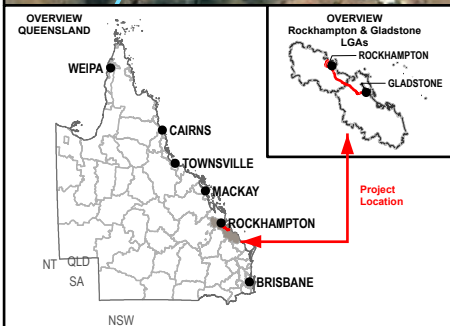
- Legend**
- SGIC SDA Pipeline Alignment
 - Study Area
 - Waterways

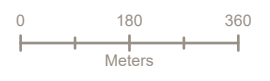
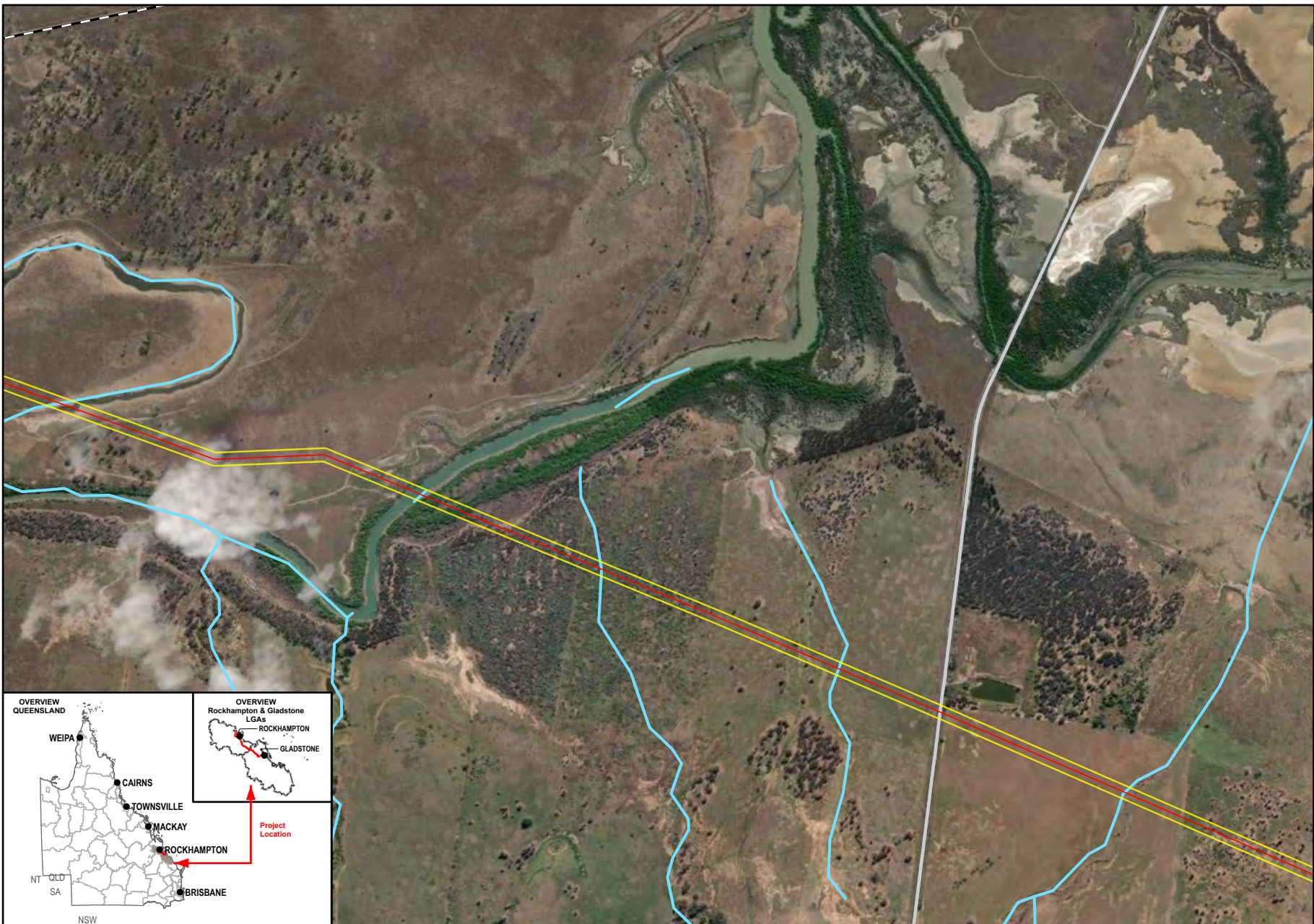
Data Sources:

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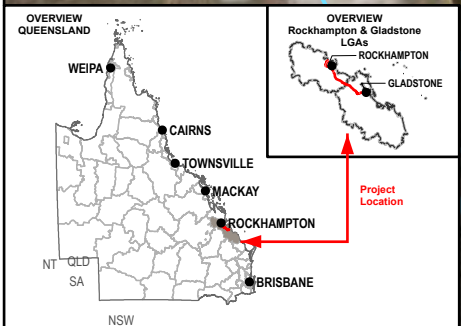




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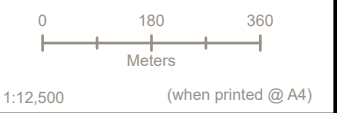
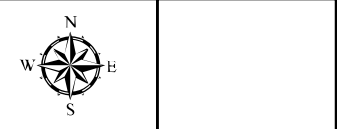
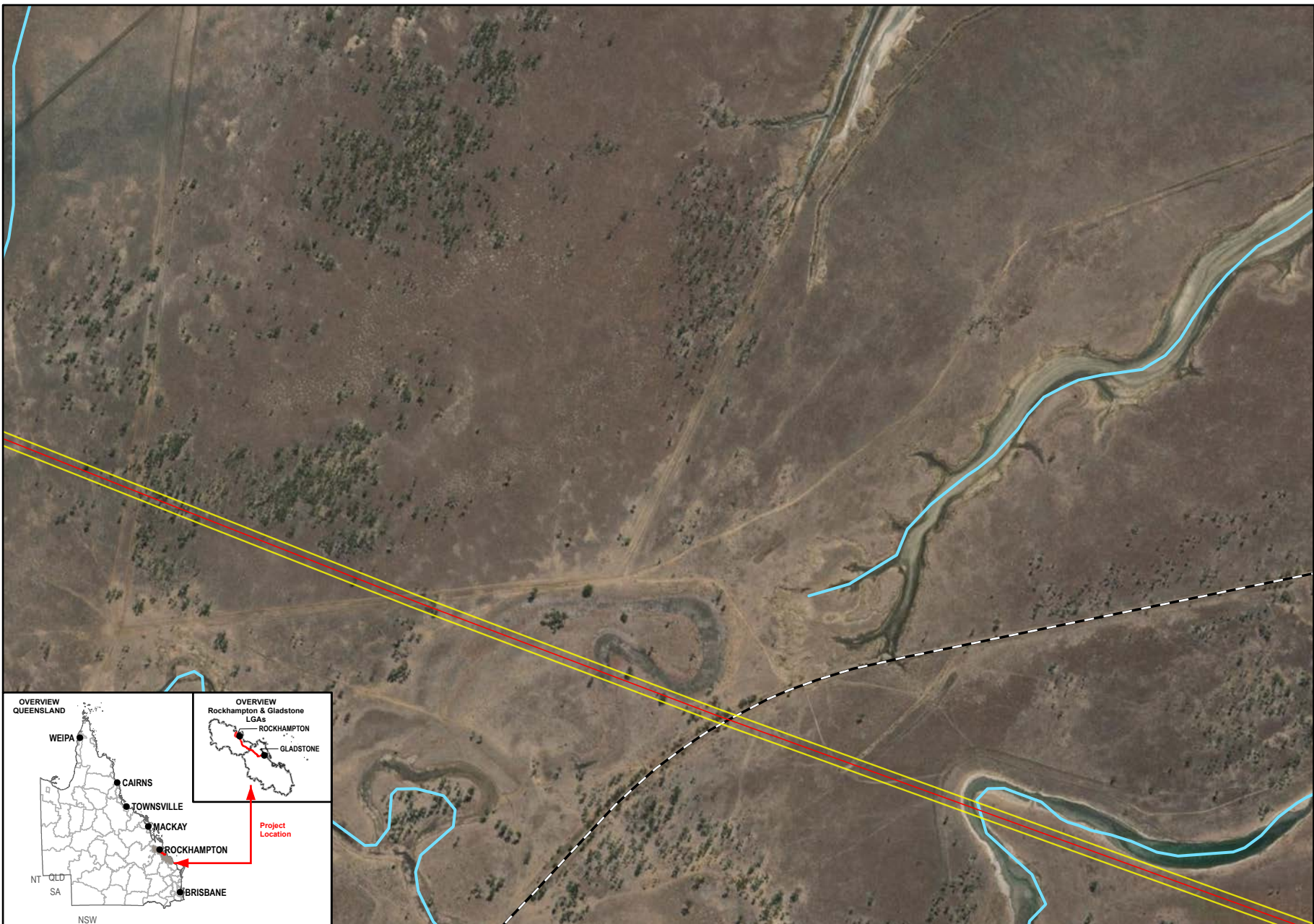
Legend

- SGIC SDA Pipeline Alignment
- Study Area
- Waterways
- Main Roads
- Railways

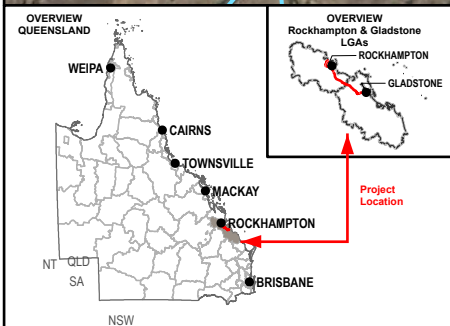


Data Sources:
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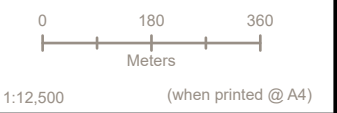
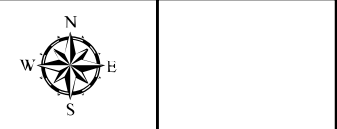
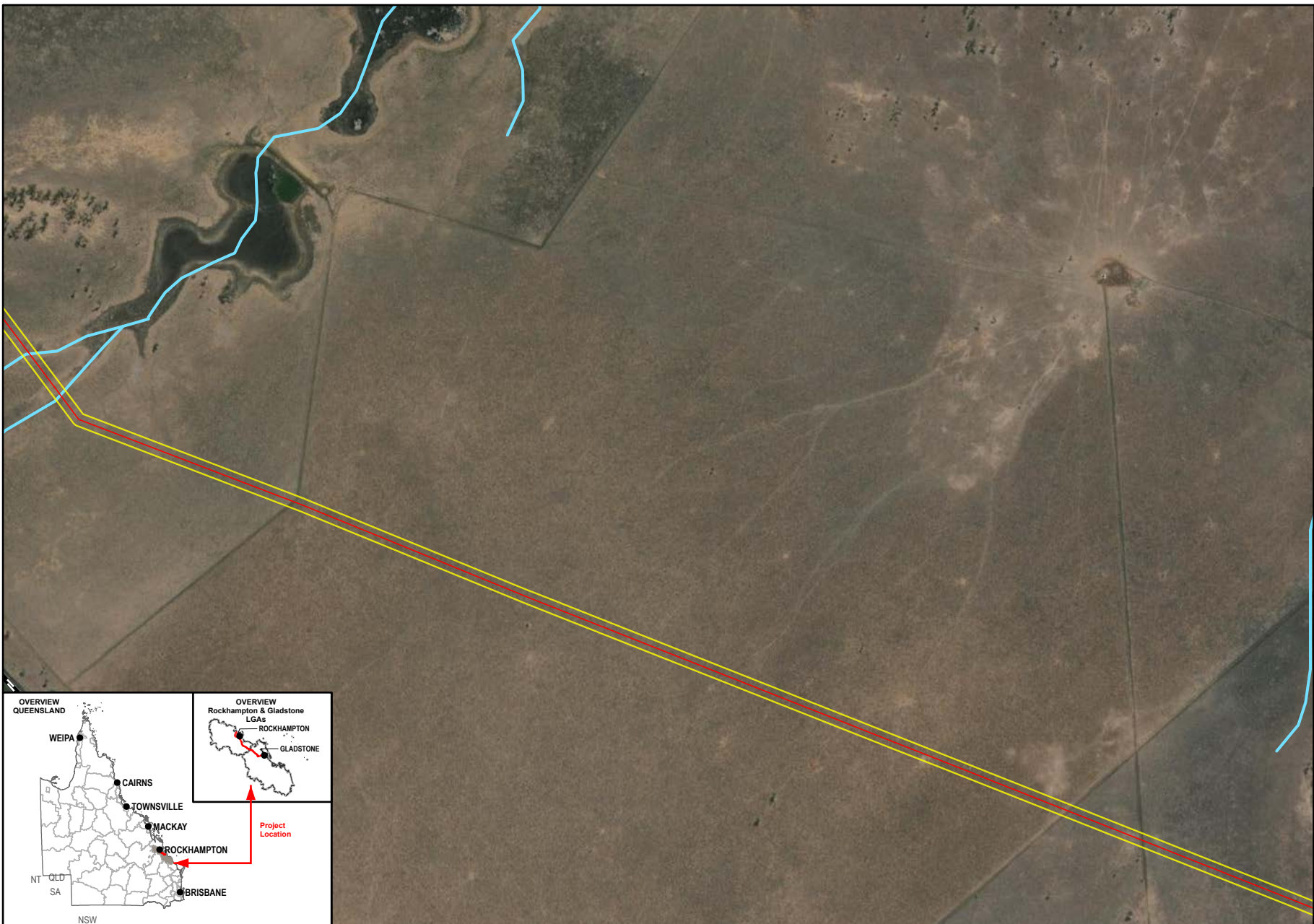
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- SGIC SDA Pipeline Alignment
 - Study Area
 - Waterways
 - Railways



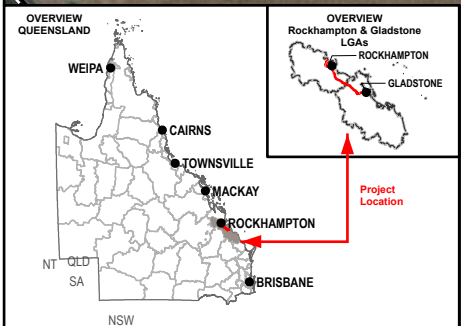
Data Sources:

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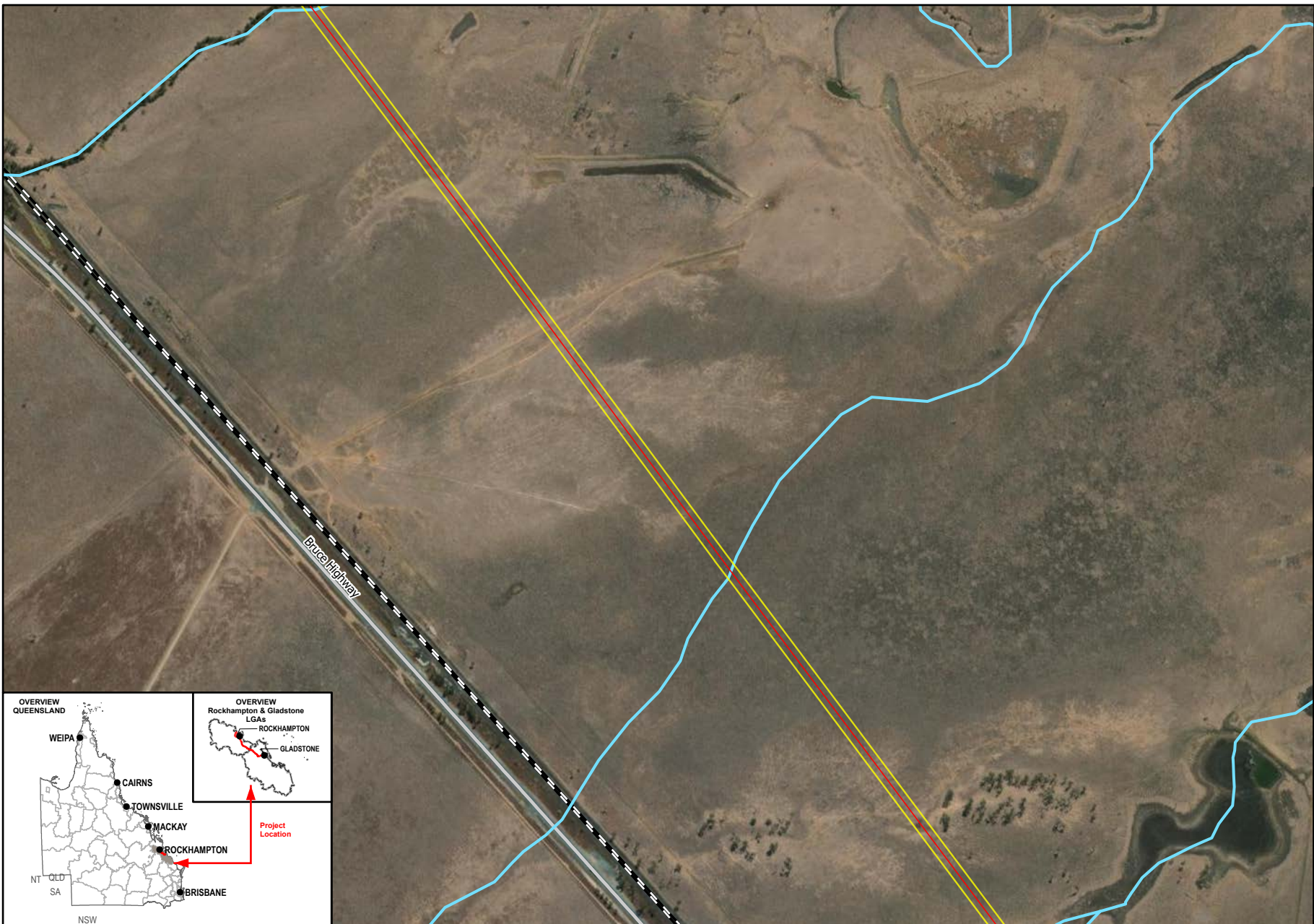
- Legend**
- SGIC SDA Pipeline Alignment
 - Study Area
 - Waterways
 - Railways



Data Sources:

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- Legend**
- SGIC SDA Pipeline Alignment
 - Study Area
 - Waterways
 - Main Roads
 - Railways

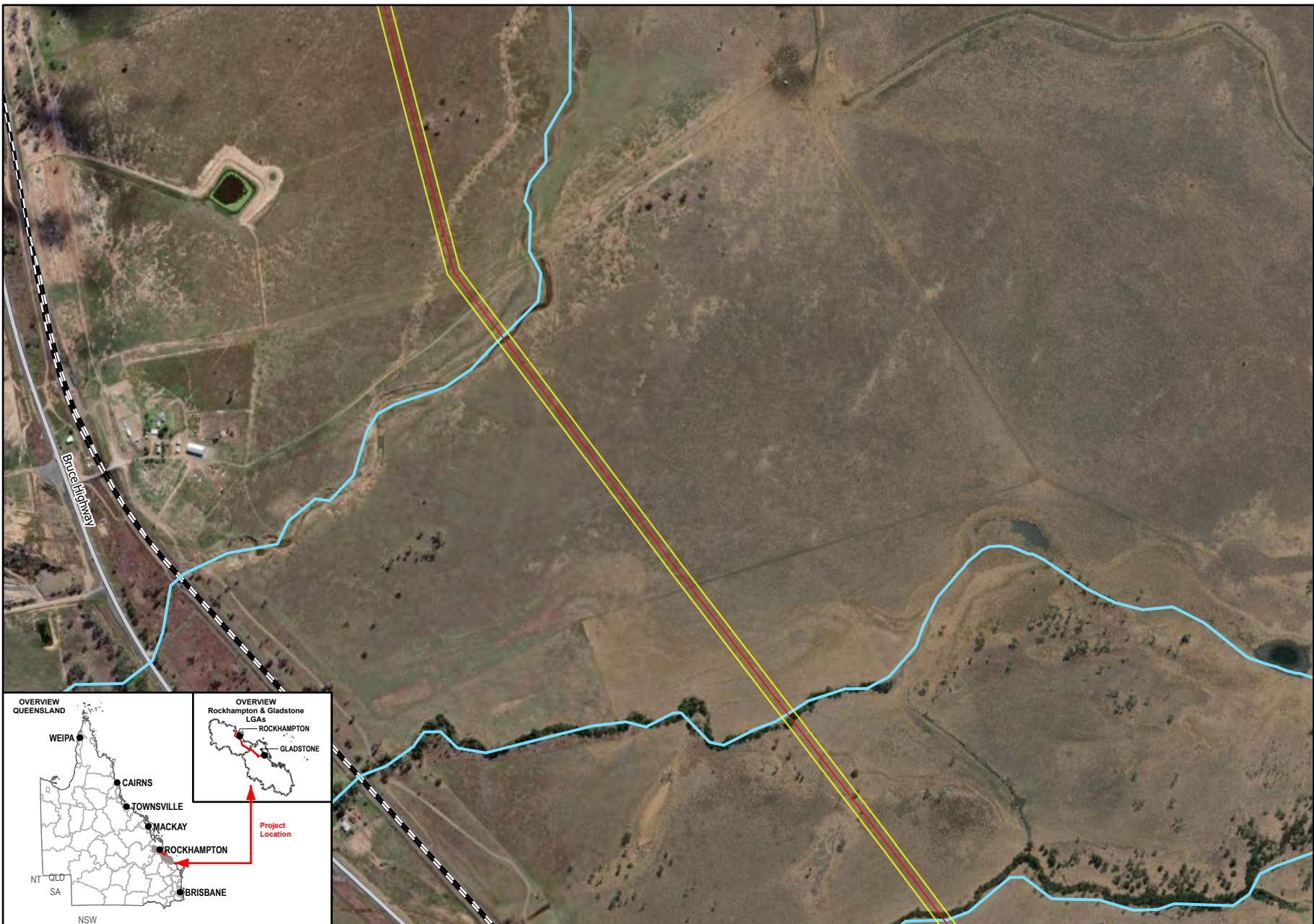
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OVERVIEW QUEENSLAND

OVERVIEW Rockhampton & Gladstone LGAs



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Meters

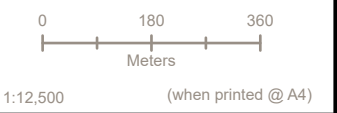
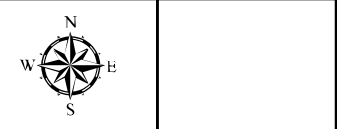
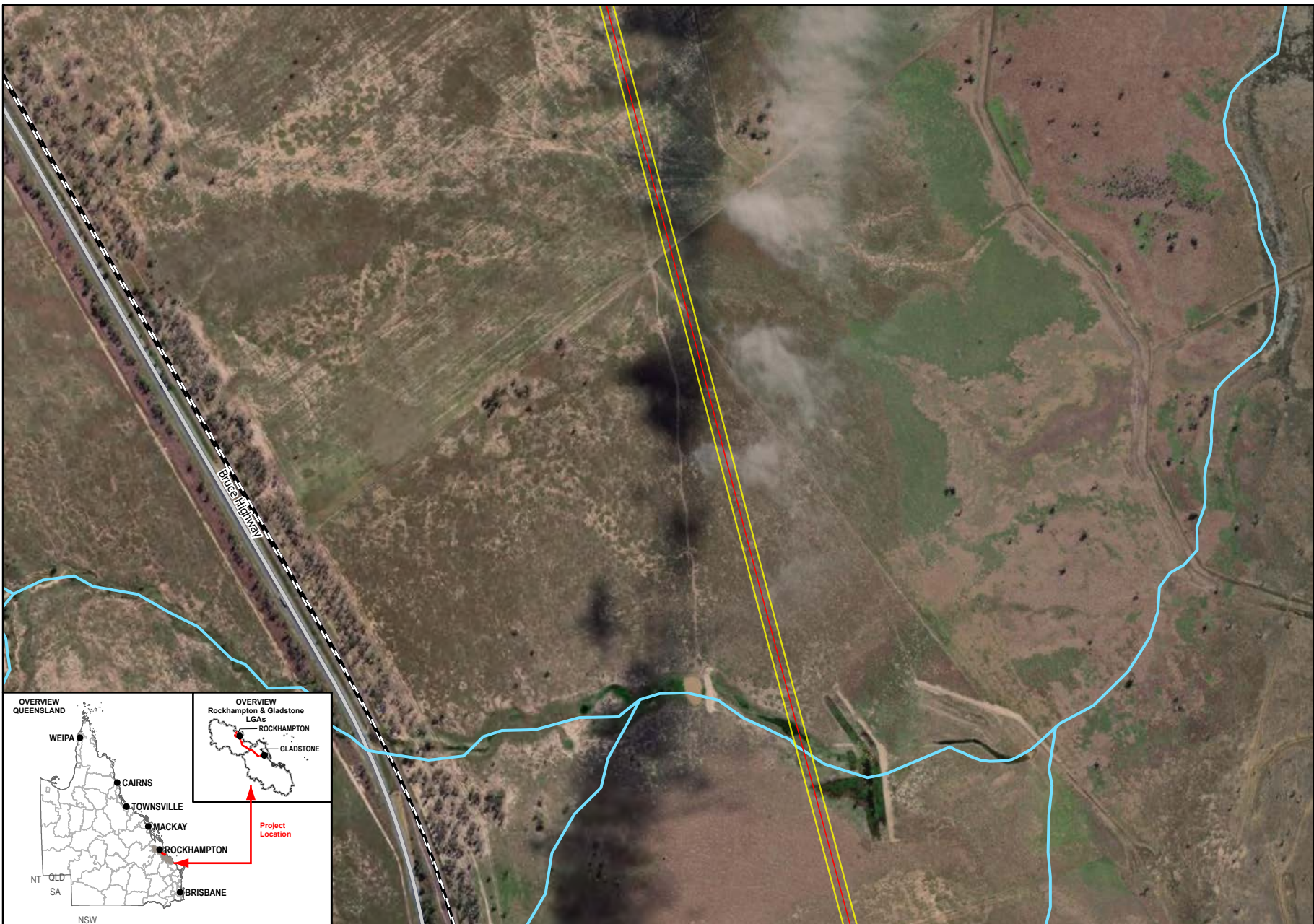
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- Legend**
- SGIC SDA Pipeline Alignment
 - Study Area
 - Waterways
 - Main Roads
 - Railways

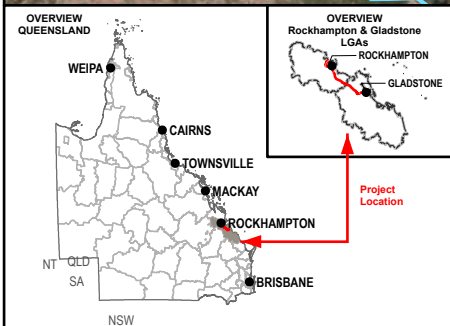
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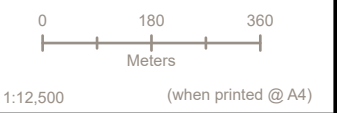
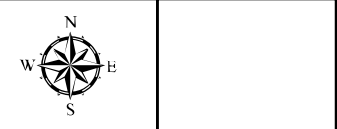
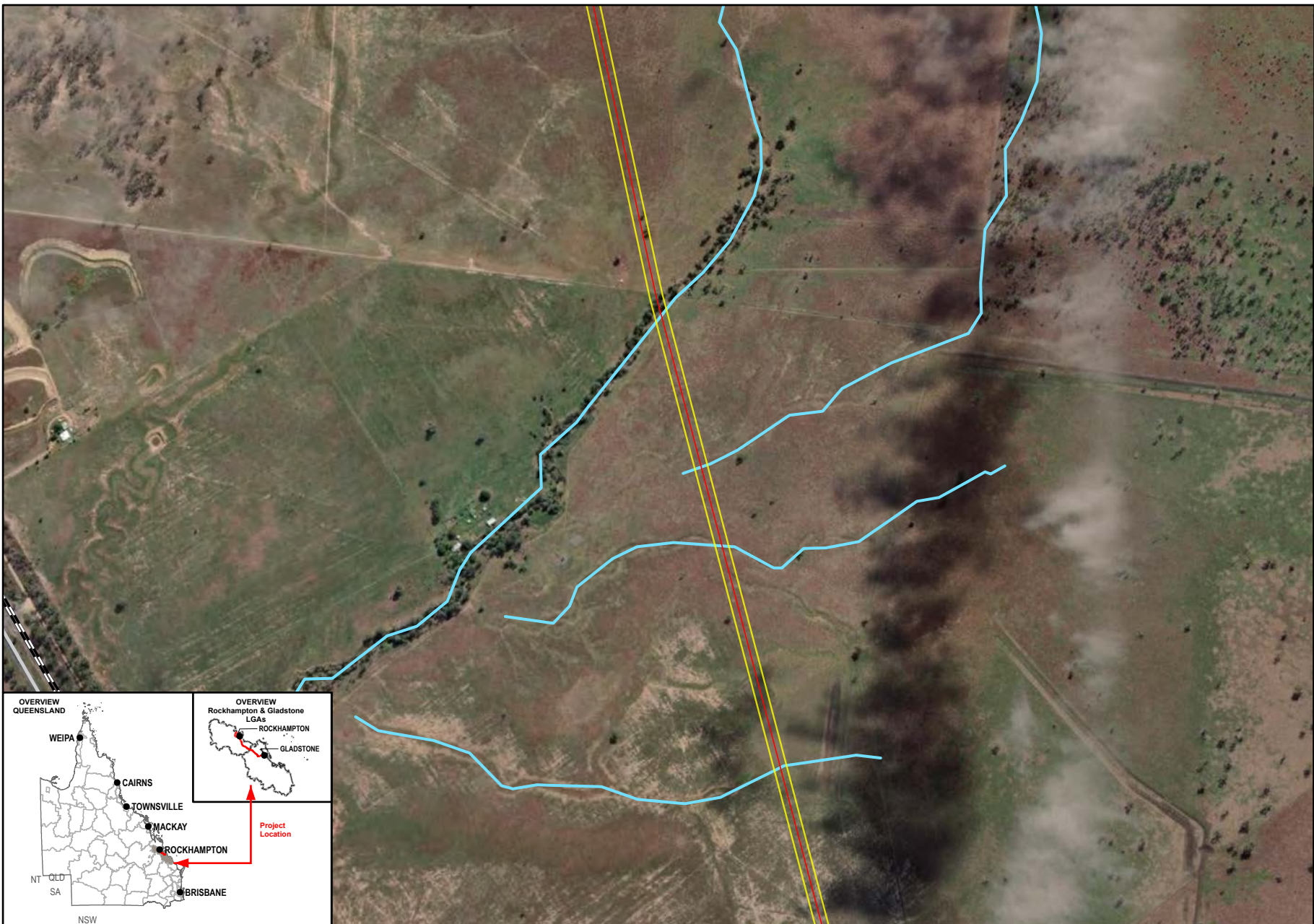
- Legend**
- SGIC SDA Pipeline Alignment
 - Study Area
 - Waterways
 - Main Roads
 - Railways



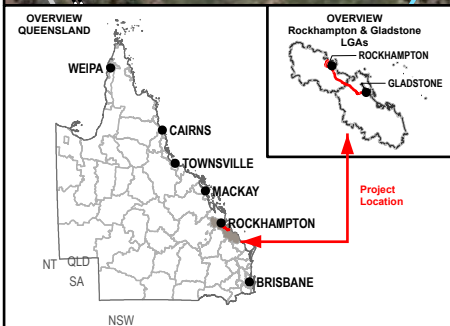
Data Sources:

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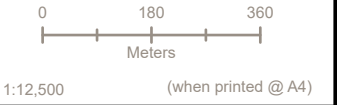
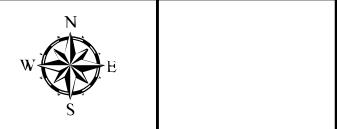
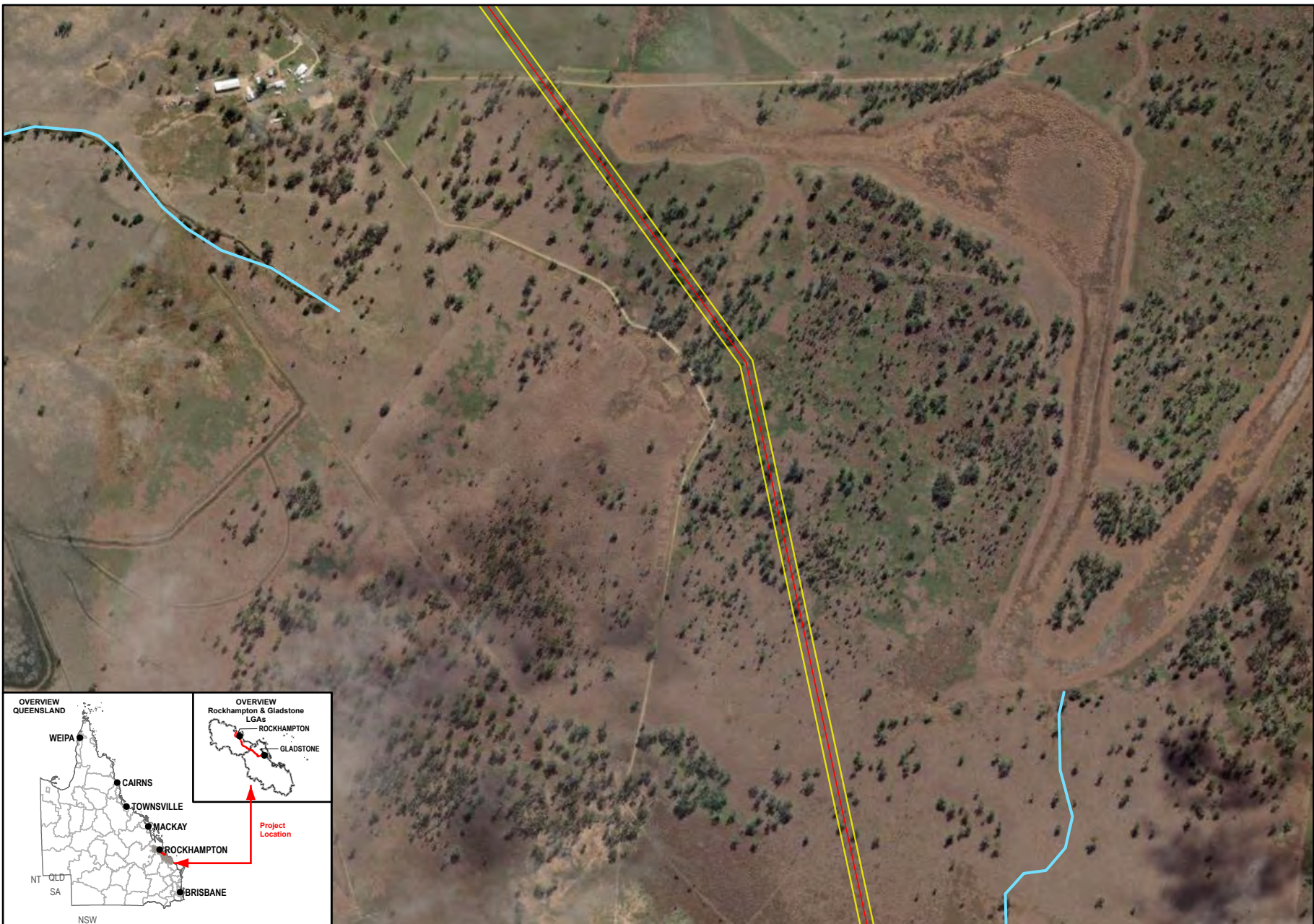
- Legend**
- SGIC SDA Pipeline Alignment
 - Study Area
 - Waterways
 - Main Roads
 - Railways



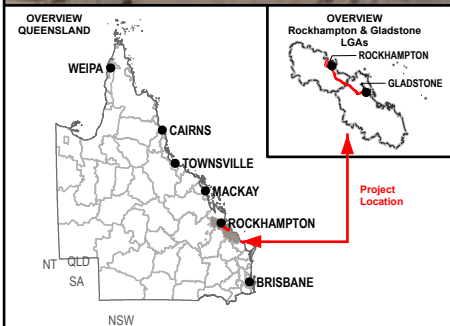
Data Sources:

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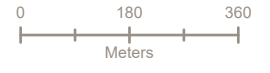
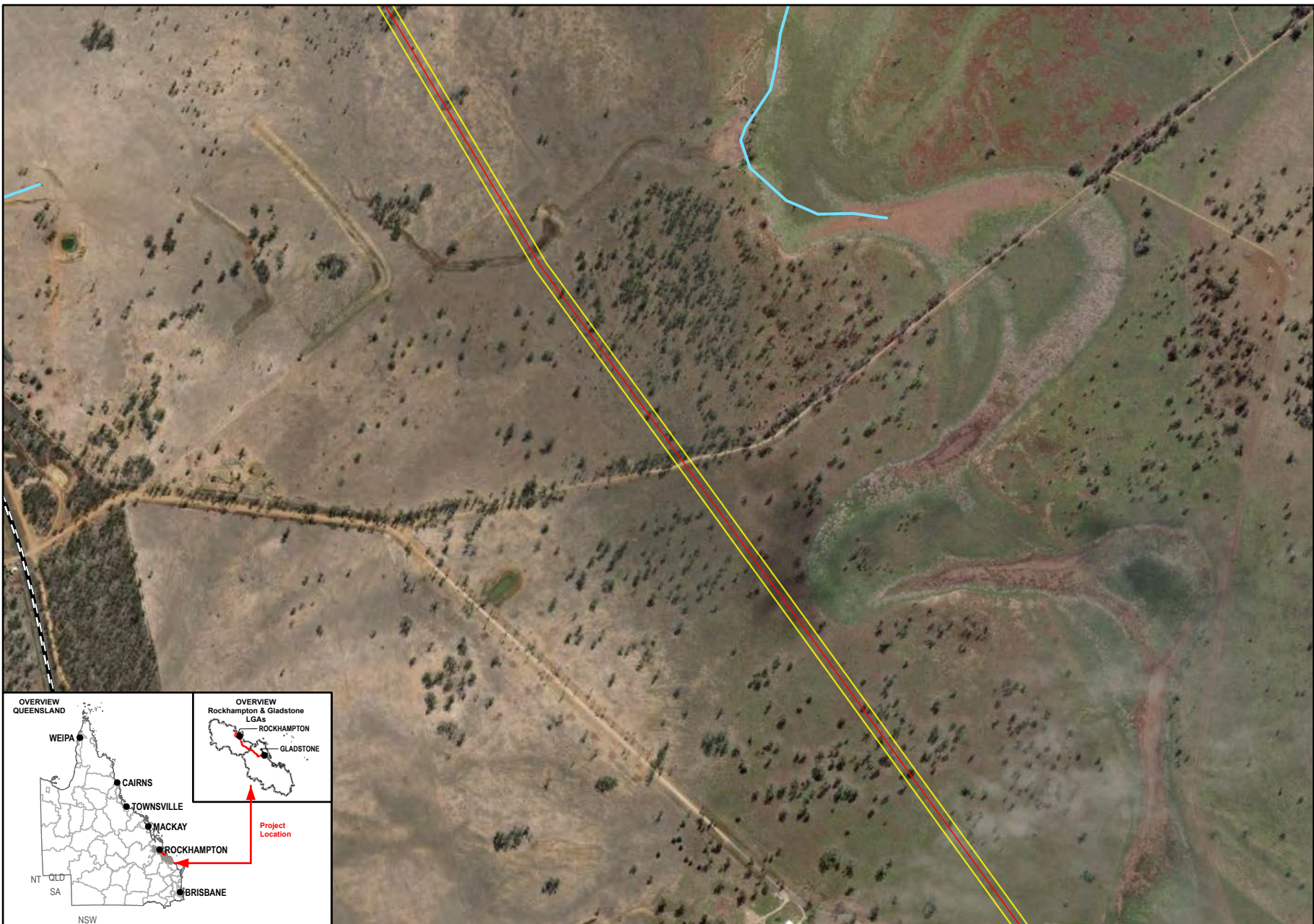
- Legend**
- SGIC SDA Pipeline Alignment
 - Study Area
 - Waterways



Data Sources:

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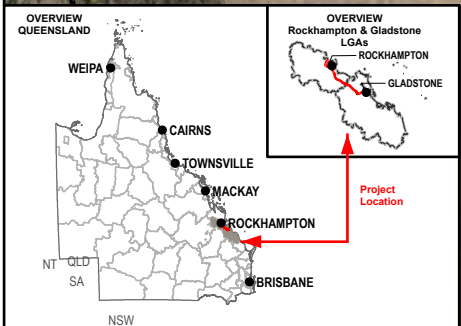
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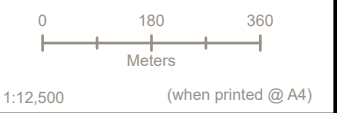
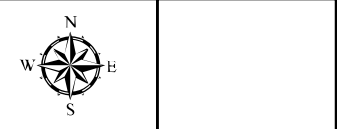
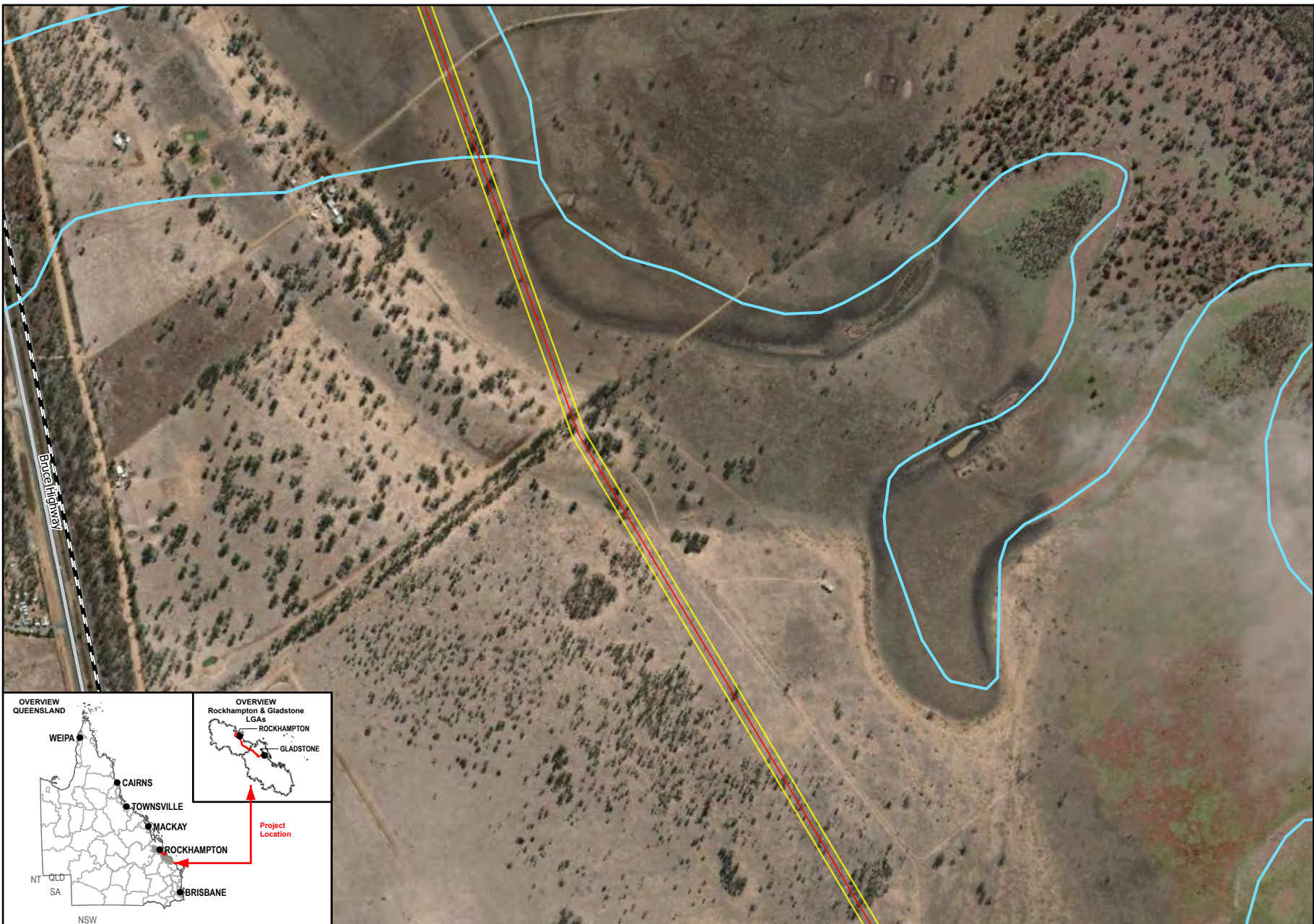
Legend

- SGIC SDA Pipeline Alignment
- Study Area
- Waterways
- Railways

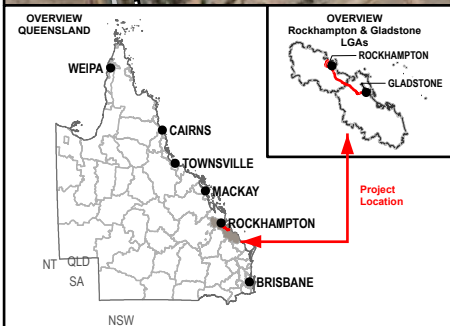


Data Sources:
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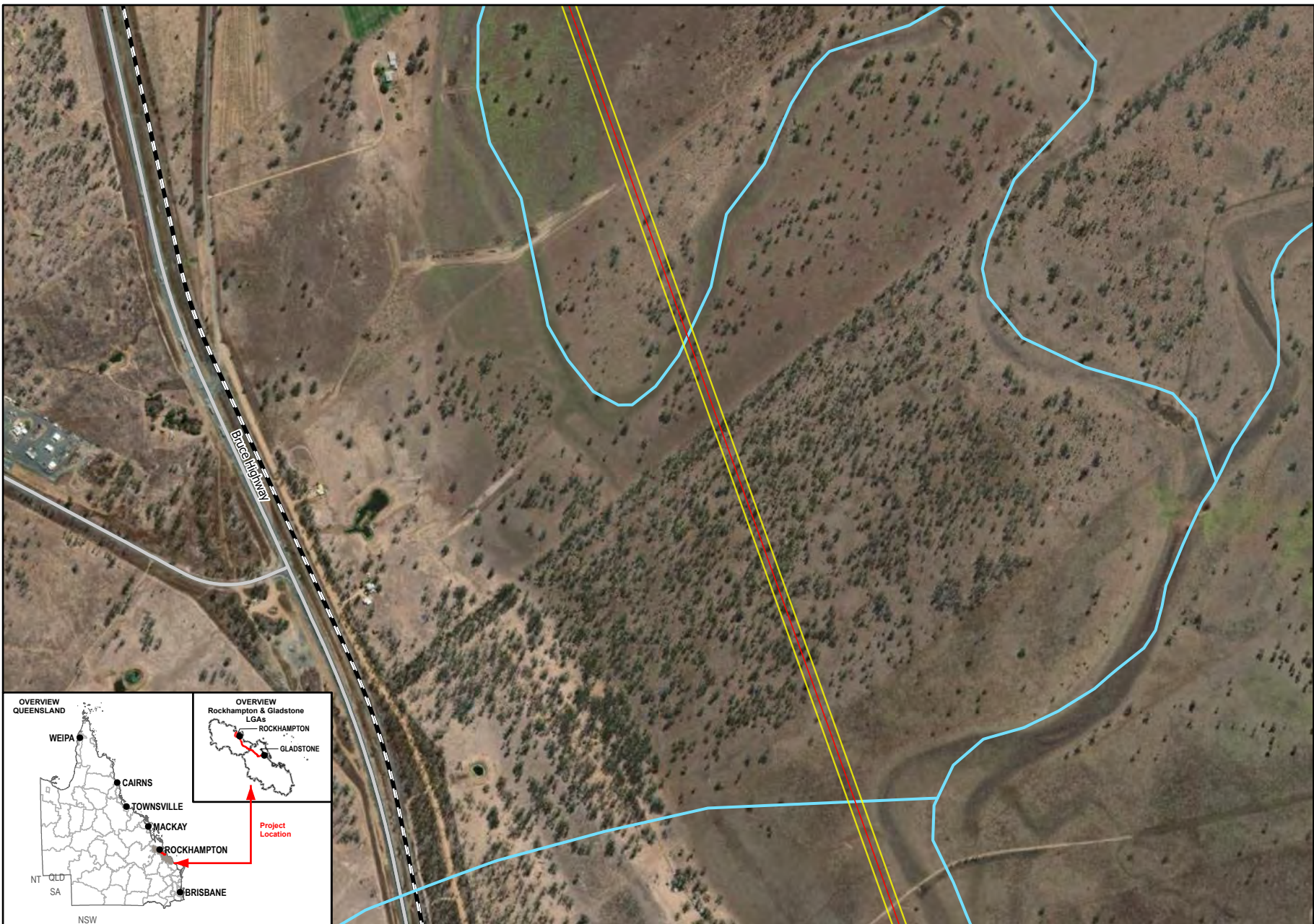
- Legend**
- SGIC SDA Pipeline Alignment
 - Study Area
 - Waterways
 - Main Roads
 - Railways




Data Sources:


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Meters

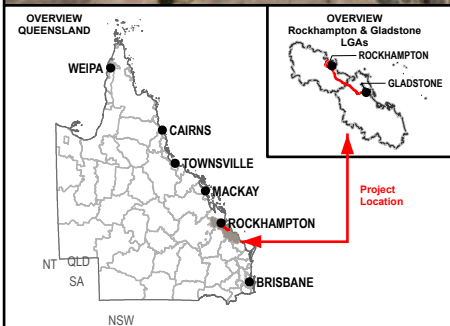
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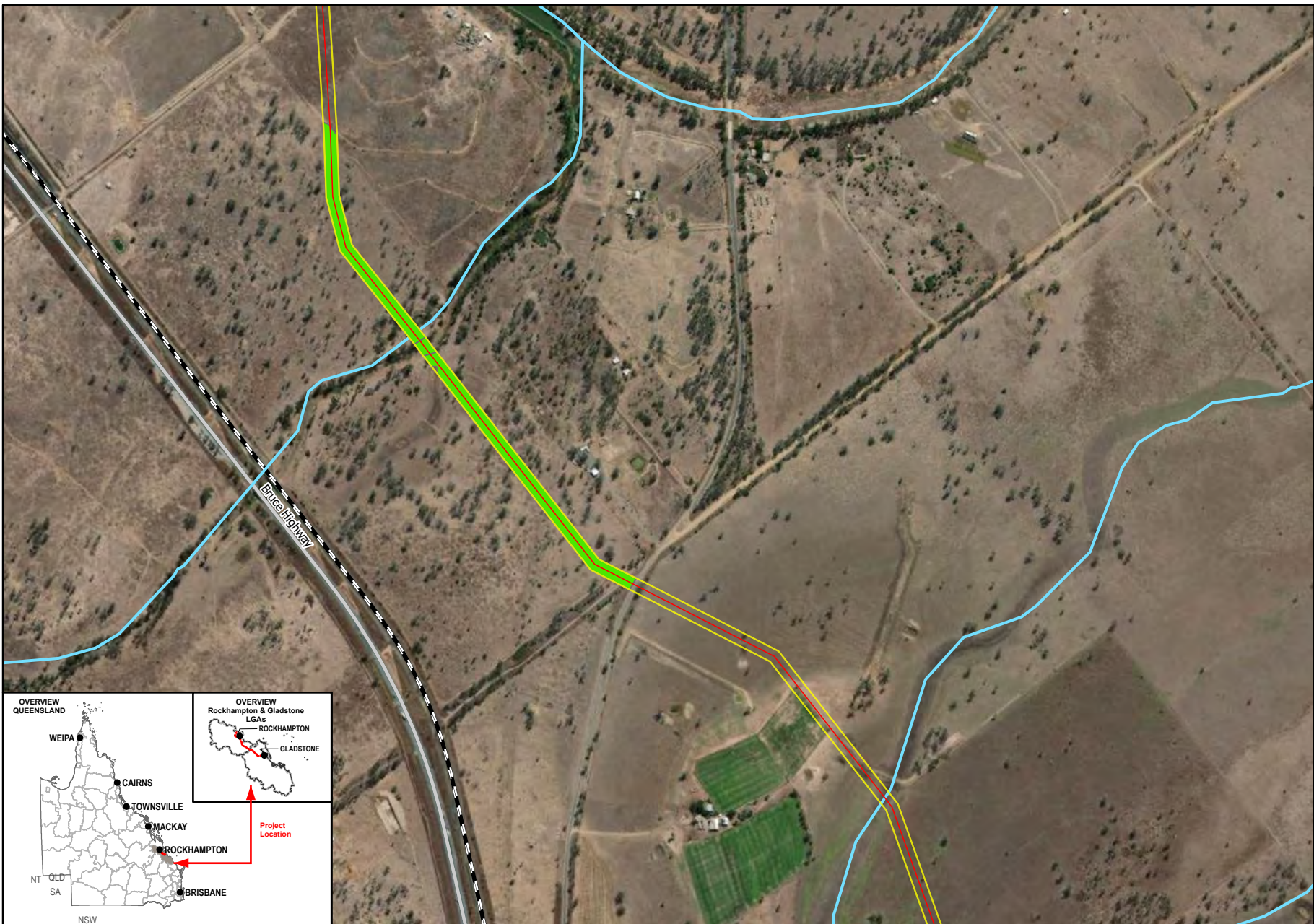
- Legend**
- SGIC SDA Pipeline Alignment
 - Study Area
 - Waterways
 - Main Roads
 - Railways

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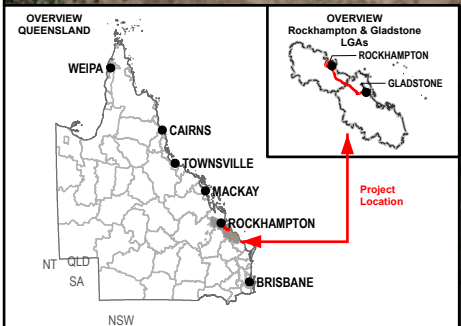
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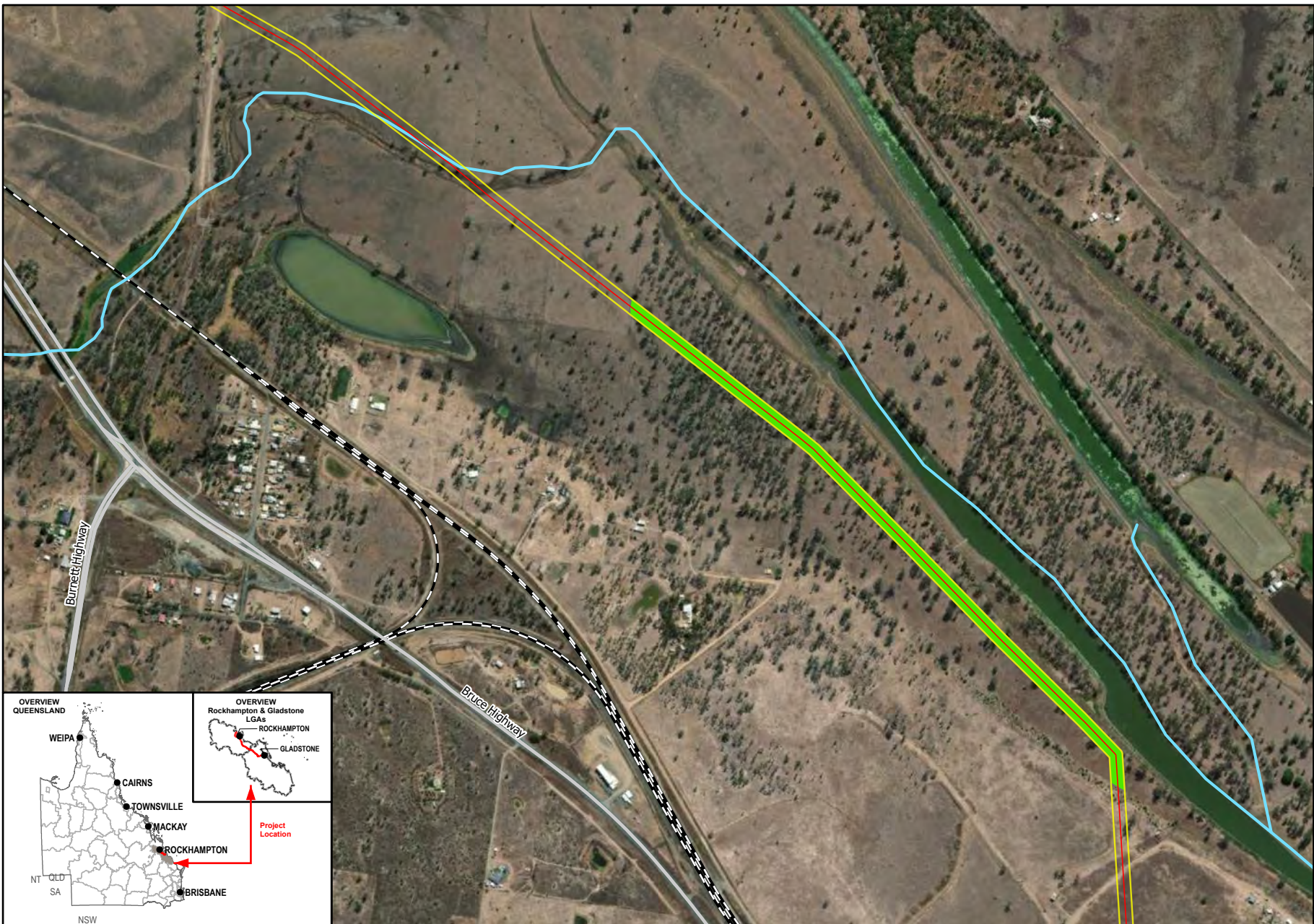
- Legend**
- SGIC SDA Pipeline Alignment
 - Study Area
 - Predicted Yellow-bellied Glider (South-eastern) Habitat**
 - Habitat Type**
 - Potential Denning Habitat
 - Waterways
 - Main Roads
 - Railways

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Meters

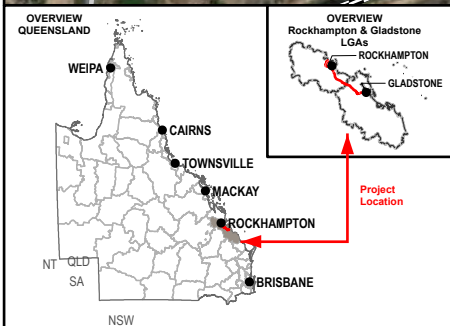
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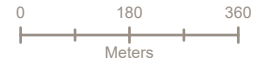
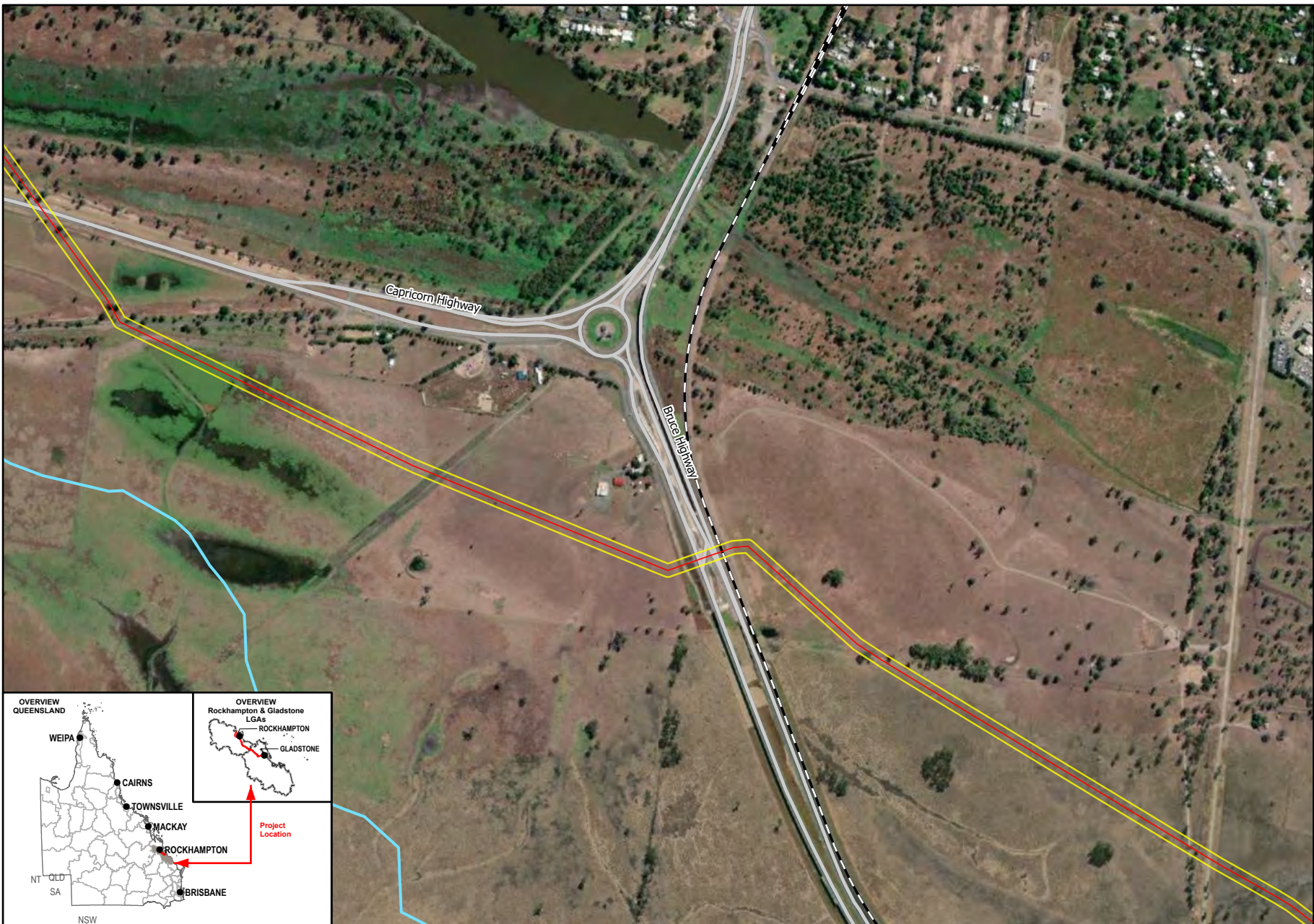
- Legend**
- SGIC SDA Pipeline Alignment
 - Study Area
 - Predicted Yellow-bellied Glider (South-eastern) Habitat**
 - Habitat Type**
 - Potential Denning Habitat
 - Waterways
 - Main Roads
 - Railways

Data Sources:

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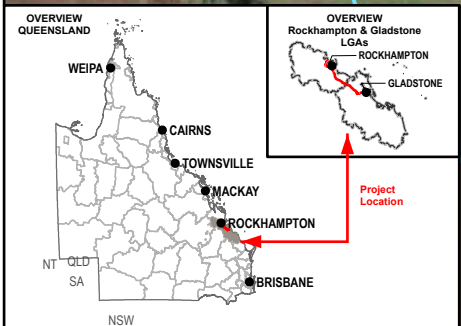




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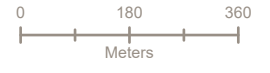
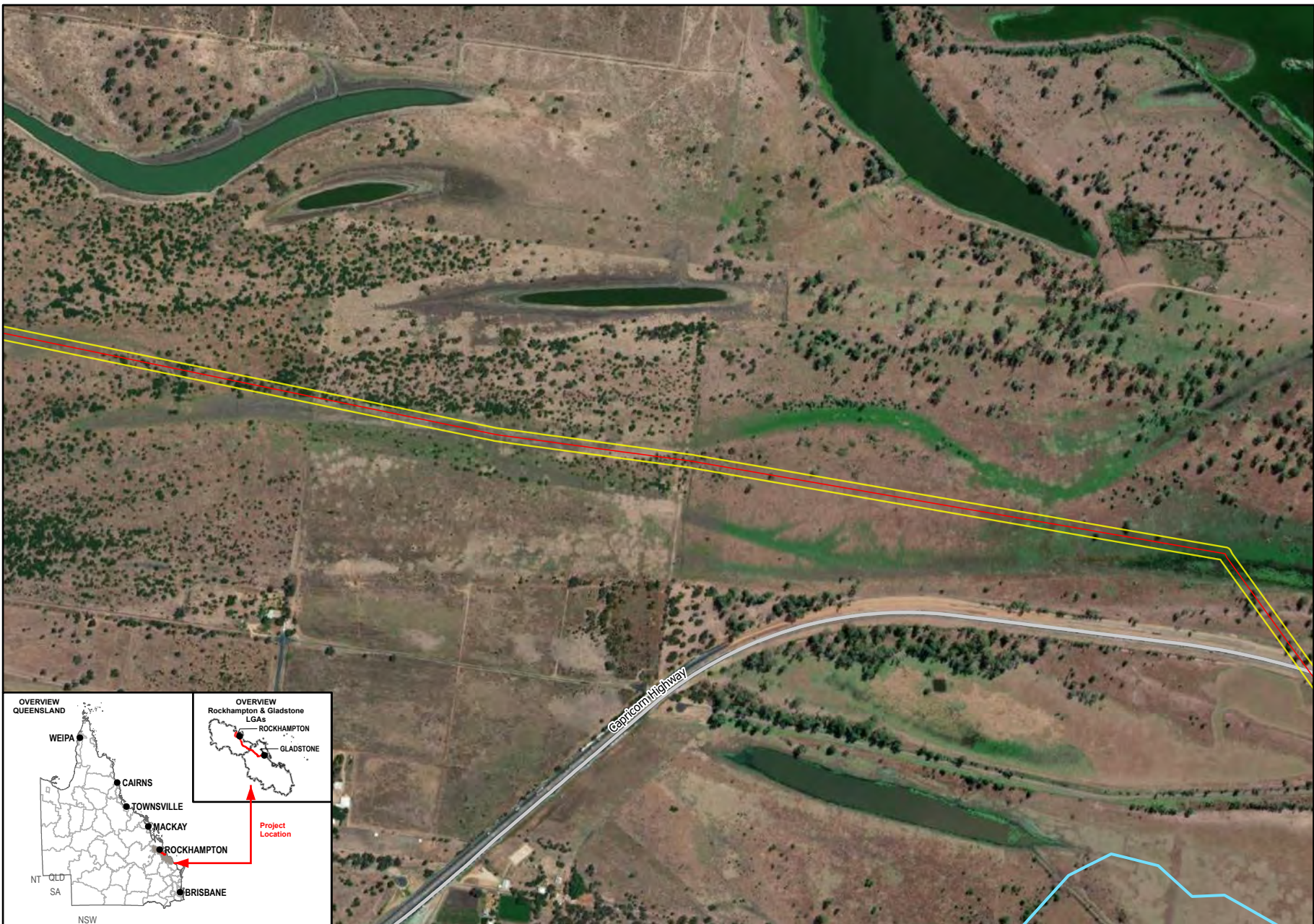
Legend

- SGIC SDA Pipeline Alignment
- Study Area
- Waterways
- Main Roads
- Railways



Data Sources:
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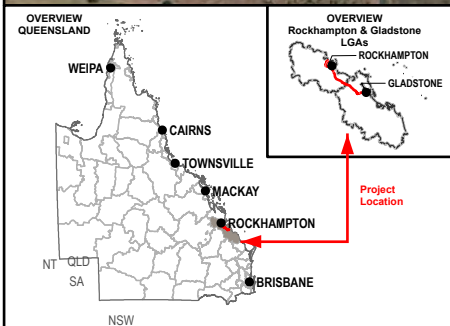
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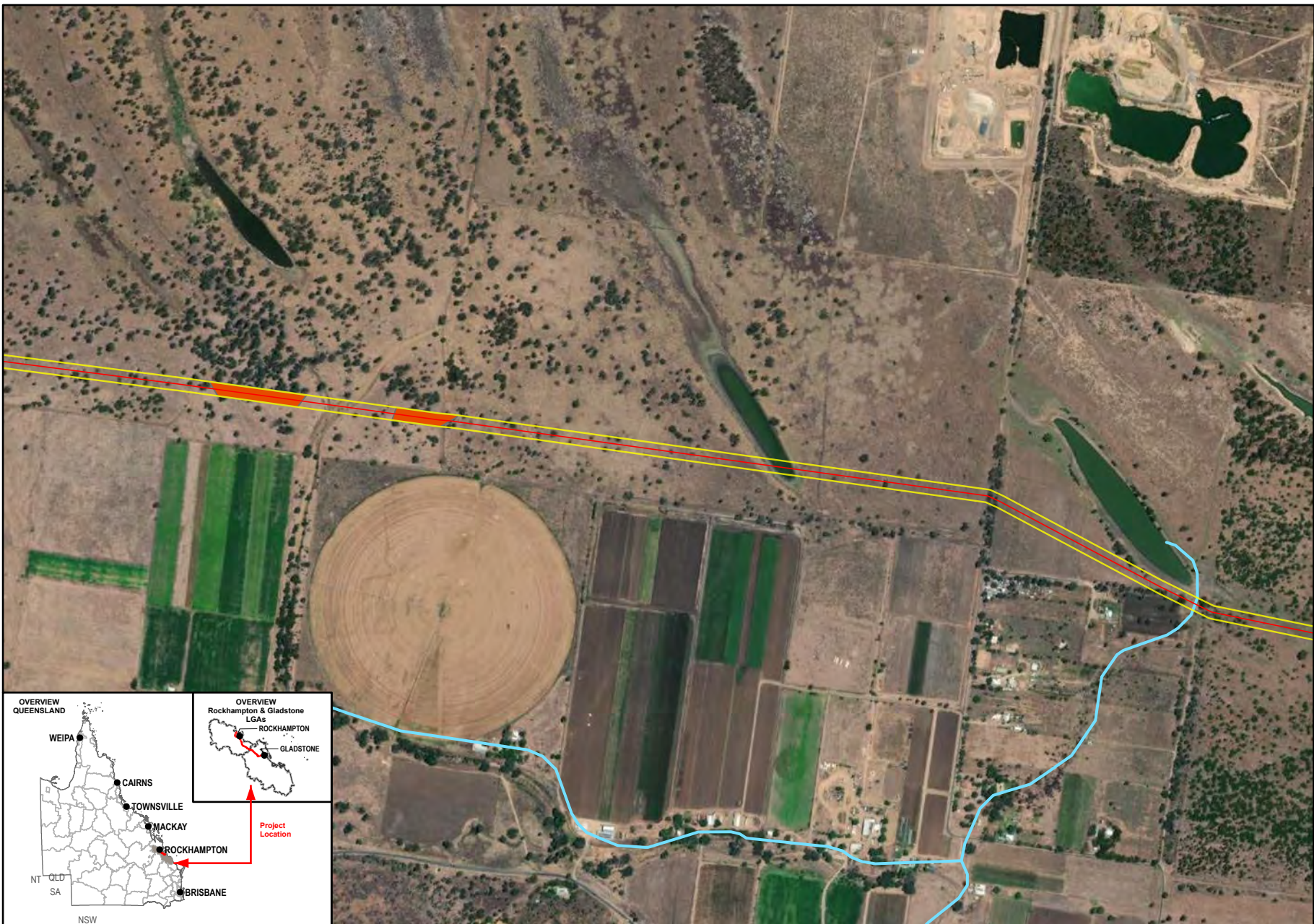
Legend

- SGIC SDA Pipeline Alignment
- Study Area
- Waterways
- Main Roads

Data Sources:
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Meters

1:12,500 (when printed @ A4)

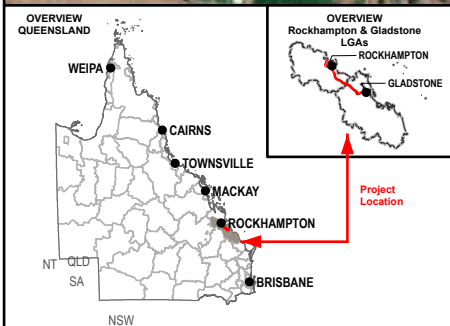
- Legend**
- SGIC SDA Pipeline Alignment
 - Study Area
 - Predicted Yellow-bellied Glider (South-eastern) Habitat**
 - Habitat Type**
 - Potential Foraging Habitat
 - Waterways

Data Sources:

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7.2.2.11 Koala

Conservation status and species ecology

The koala is listed as endangered under the EPBC Act and NC Act but was not listed as an MNES at the time of the approval. The koala occurs in Queensland, New South Wales, the Australian Capital Territory, Victoria and South Australia. The species' occurrence is discontinuous across its distribution with several subpopulations separated by cleared lands and unsuitable habitat (DAWE 2022b). They are a wide-ranging species, typically occurring in forests and woodlands dominated by *Eucalyptus* species (DAWE 2022b). The species occurs in coastal and inland habitats – in Queensland this spans north Queensland to the Herberton area, westwards into semi-arid parts of central Queensland, and south into New South Wales (DAWE 2022b). The koala's range is restricted by food, habitat and environmental requirements, resulting in highly variable home range sizes. In Queensland and New South Wales, home ranges vary from 3 to 500 ha (DAWE 2022b), with home range increasing as trees become more widely spaced (DAWE 2022b; Youngentob 2021). Males typically have larger home ranges than females, and in general, home ranges are larger in semi-arid woodlands than in mesic coastal forests (DAWE 2022b). Since European colonisation, the koala's distribution and population size has declined significantly as a result of vegetation clearance and climate change drivers (DAWE 2022b).

In Queensland, koala inhabit moist coastal forests, southern and central western subhumid woodlands and eucalypt woodlands adjacent to waterbodies in semi-arid western parts of the state (Youngentob 2021). The species' occurrence is patchy, fragmented and often occurs in low-density populations across a number of bioregions including north to Einasleigh Uplands and Wet Tropics, Desert Uplands, Central Mackay Coast, Mitchell Grass Downs, Mulga Lands, Brigalow Belt North, Brigalow Belt South, and Southeastern Queensland where they are most frequently sighted (DAWE 2022b; Youngentob 2021).

The koala is an obligate folivore and its highly specialised diet is defined by the availability and palatability of a limited variety of *Eucalyptus*, *Corymbia* and *Angophora* species (Youngentob 2021). Primary food species differ across the species' range – koalas have been recorded to feed on more than 120 species of *Eucalyptus*, *Corymbia* and *Angophora* species. The koala is a relatively sedentary species, with movement increasing during the breeding period (September to February) (DAWE 2022b).

In the assessment of habitat quantity and quality, the National Recovery Plan for the koala (DAWE 2022c) highlights the importance of considering landscape patch size, form, and spatial configuration within the context of the wider landscape, which can vary among landscapes and varies regionally (DAWE 2022c). Research has shown that koalas move very differently through different landscapes, depending on the level of habitat connectivity that has been retained (DAWE 2022c). In contiguous landscapes with high connectivity, koalas move slowly between koala habitat trees along vegetated watercourses, roadsides, and other areas of functional connectivity. This increases their energetic efficiency and reduces their susceptibility to predation (DAWE 2020c). In more fragmented landscapes, koalas follow more direct movement pathways and demonstrate an increased willingness to cross open areas at ground level to move between isolated patches of vegetation (DAWE 2022c) albeit their safety is at risk and the open and exposed landscape proves to be a hostile environment (DAWE 2022c). In the context of a contiguous landscape, where high levels of linear habitat connectivity are retained along watercourses, vegetated roadsides and fence lines and where dog attacks on livestock have been reported by local landholders, large open paddocks are expected to receive low levels of utilisation by koalas.

Field survey results and distribution of suitable habitat

Koala scratches (on smooth-barked trees) and faecal pellets were recorded at one location adjacent to Boat Landing Creek during the Arup (2008) field surveys. The species was not recorded during the 2022 field surveys. Survey effort for the koala included two nights of 2-3 hours of spotlighting and faecal pellet searches at nine locations within potentially suitable habitat in the SGIC SDA study area. Historical records for the species' have been recorded at 14 locations within the desktop search extent (10 km buffer), the closest record approximately 930 m from the SGIC SDA pipeline alignment. Many of these records have been historically recorded within woodland habitats.

Potential habitat for this species' is predominately located within the southern extent of the SGIC SDA study area, within woodland habitats and fringing riparian vegetation retaining koala food trees (i.e. *Melaleuca*, *Eucalyptus*, *Corymbia* and *Acacia* species). The northern extent of the SGIC SDA pipeline alignment is largely cleared for agricultural purposes; however, fringing riparian vegetation and highly fragmented patches of remnant vegetation

retaining koala food trees persist within the area. The distribution of predicted koala habitat was based on criteria detailed in Appendix F and is mapped in Figure 7-16. Habitat assessments undertaken within the SGIC SDA study area involved taking representative photos of the vegetation and general habitat. 18 habitat assessment sites within the SGIC SDA study area were selected to illustrate suitable habitat for the koala, as well as presenting photos of areas that do not represent suitable habitat due to the lack of koala food and shelter trees. Each survey photo reference number refers to the photo that was taken at that habitat assessment site and is presented in Appendix G. Of those 18 habitat assessment site photos, nine photos (photo number 10, 11, 14, 15, 17, 21, 23, 24 and 25) represent suitable koala habitat.

Significance of impact assessment

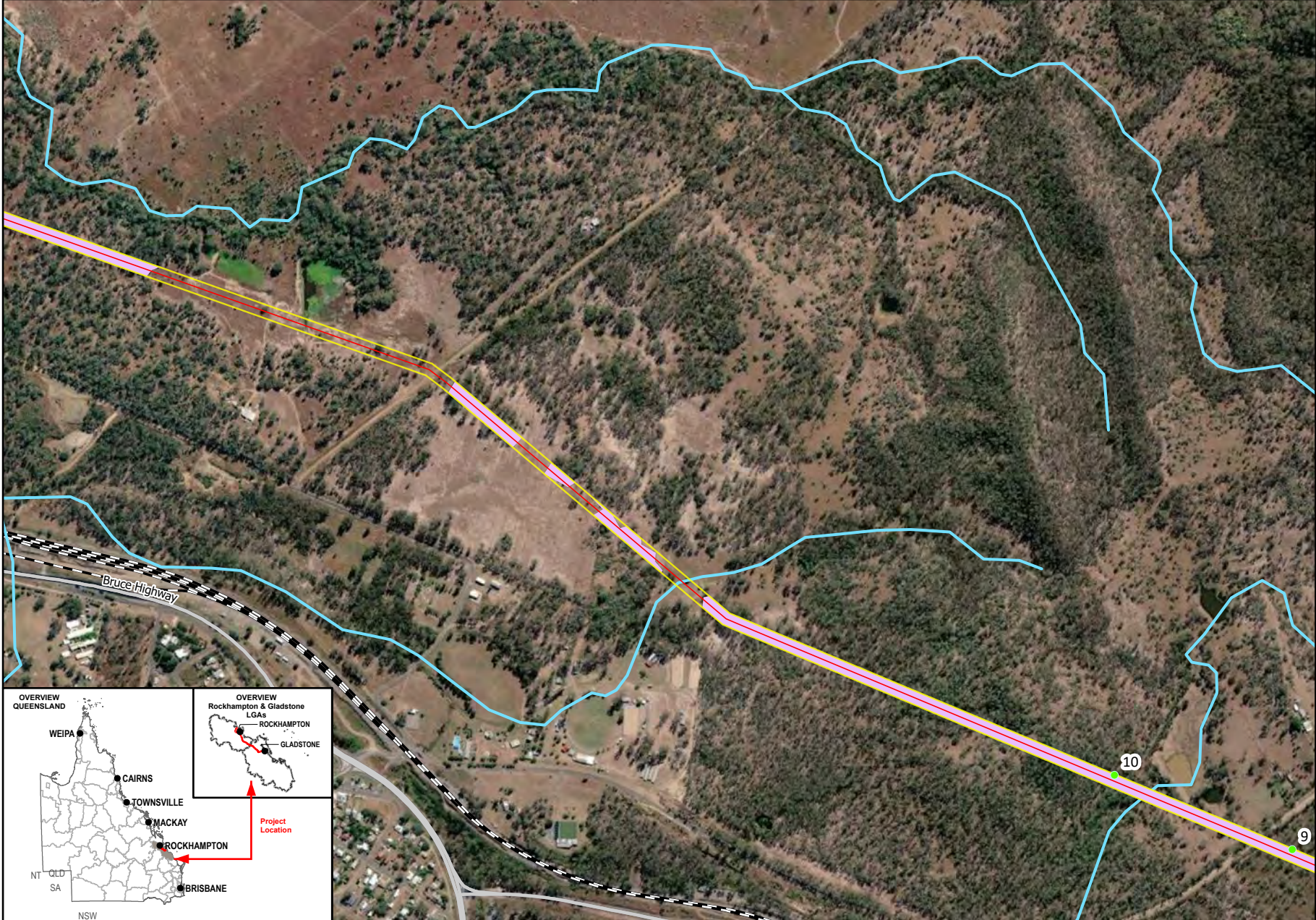
The project is likely to result in a significant residual impact on the koala. A significance of impact assessment of the project on the koala (endangered under the EPBC Act and NC Act) is provided in Table 7-29.

Table 7-29 Significance of impact on the koala

Significant residual impact criteria	Potential to occur
A long-term decrease in the size of a local population	<p>Unlikely</p> <p>The koala population within the SGIC SDA study area is considered an important population in the accordance with the Commonwealth approved conservation advice. The koala has been historically recorded at 14 locations within the desktop search extent (10 km buffer), the closest record approximately 930 m from the SGIC SDA pipeline alignment. Koala scratches and faecal pellets were recorded during the Arup (2008) field surveys within the SGIC SDA study area; however, no individuals or evidence of presence was recorded during the 2022 field surveys. Based on the ecological field surveys and species ecology, koalas are predicted to occur at low densities within the GSDA pipeline alignment. The project is anticipated to result in the loss of 49.25 ha of suitable koala habitat. This represents 0.36 % of regional habitat (i.e. available within a 5 km buffer). The maximum width of clearing required for construction of the SGIC SDA pipeline alignment is 30 m. Once the pipeline has been installed and buried, a maximum width of 10 m will be permanently cleared with the remaining 20 m to be rehabilitated. The SGIC SDA pipeline alignment largely supports remnant and regrowth vegetation in the southern extent, and open landscapes with fringing riparian vegetation in the northern extent. However, the northern and southern areas of the SGIC SDA pipeline alignment retain suitable koala food trees (i.e. <i>Melaleuca</i>, <i>Eucalyptus</i>, <i>Corymbia</i> and <i>Acacia</i> species). Relatively large areas of suitable habitat will persist in the surrounding landscape within the southern extent, and patches of woodland areas and riparian corridors within the northern extent, allowing opportunities for movement.</p> <p>Construction and operation impacts associated with the project are unlikely to have permanent impacts on the persistence of local and regional koala populations. Based on the scarcity of historical records and lack of koala traces in field surveys, koalas are likely to occur in low local densities. While the loss of 49.25 ha of suitable habitat will reduce the local availability of koala food and shelter trees, this is unlikely to lead to excessive competition for resources, given the low koala densities. The local loss of resources is therefore likely to be absorbed within remaining habitat in areas adjacent to the GSDA pipeline alignment. Therefore, the local koala population is not expected to experience a significant reduction in foraging and breeding success due to any increase in competition for resources.</p>
Reduce the extent of occurrence of the species	<p>Unlikely</p> <p>The project is anticipated to result in the loss of 49.25 ha of suitable koala habitat. This represents 0.36 % of regional habitat (i.e. available within a 5 km buffer). A maximum width of 30 m will be cleared for construction of the SGIC SDA pipeline alignment, with 20 m to be rehabilitated after the pipeline has been installed and buried. The SGIC SDA pipeline alignment has been largely placed in landscapes that have been previously cleared (open grass paddocks and regrowth vegetation) and has largely avoided areas retaining intact and fragmented remnant vegetation. Much of the surrounding landscape is similar to the landscape present within the GSDA pipeline alignment, such as cleared open landscapes, riparian corridors, and regrowth and remnant vegetation. The project is unlikely to disrupt connectivity to the extent that movement between remnant patches will be disrupted. As such, there will be not expected to be a change in the extent of occurrence of the species, especially noting the definition of extent of occurrence per the Queensland <i>Significant Residual Impact Guideline</i> (DEHP 2014b): <i>Extent of occurrence is defined as the area contained within the shortest continuous imaginary boundary which can be drawn to encompass all the known, inferred or projected sites of present occurrence of a taxon.</i></p>

Significant residual impact criteria	Potential to occur
Fragment an existing population	<p>Unlikely</p> <p>A maximum width of 30 m will be cleared for construction of the SGIC SDA pipeline alignment, with 20 m to be rehabilitated after the pipeline has been installed and buried. The SGIC SDA pipeline alignment has been largely placed in landscapes that have been previously cleared and in areas that retain regrowth vegetation. Habitat loss within the SGIC SDA pipeline alignment is not expected to impact connectivity with surrounding koala habitat as the habitat losses will be localised and is not considered to create large gaps to disrupt koala movement. Large areas of suitable koala habitat will persist within woodland and riparian corridor habitats immediately adjacent to the SGIC SDA pipeline alignment. Therefore, the project is unlikely to fragment an existing koala population. It is noted that the local koala population in the landscape is likely to be very low, noting the low number of historic records and no contemporary records from 2022 field surveys.</p>
Result in genetically distinct populations forming as a result of habitat isolation	<p>Unlikely</p> <p>As detailed above, the species' capacity to move locally and regionally is unlikely to be limited by any localised land clearing necessary to construct the SGIC SDA pipeline alignment. As a result, the project is not considered to cause any form of genetic isolation at a population level.</p>
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat	<p>Unlikely</p> <p>Invasive species including wild dogs already occur throughout the area. Predatory species are attracted to prey opportunities presented by cleared corridors or prey moving away from disturbance areas. While new infrastructure has the potential to increase the risk of wild dog attack on koala by facilitating regional movement of dogs, these threats are already present within the receiving environment and are not likely to be exacerbated by the project. Feral animal control measures will be implemented throughout the duration of the project and have been designed to mitigate such risks. There is also potential for the spread of invasive weeds during the construction and operation phase. This potential will be addressed within the CEMP and could provide the opportunity to enhance the quality of the environment utilised by the koala by providing mitigation measures to combat introduced species. The eradication of ground-covering weeds could enhance local koala movement. If mitigation measures are implemented correctly, the project is unlikely to result in the introduction of invasive species that are harmful to the koala.</p>
Introduce disease that may cause the population to decline	<p>Unlikely</p> <p>The project is not anticipated to introduce new diseases that may cause the species to decline. Stress may lead to an increase in the expression of chlamydia in koalas; however, the implementation of mitigation measure such as sequential clearing, site speed limits, use of experienced spotter-catchers during clearing and the requirement to allow koalas to self-disperse will reduce disturbance-related stress and risk of disease. Additionally, the species is susceptible to <i>Phytophthora cinnamomi</i> due the soil fungus's ability to infect <i>Eucalyptus</i> species. Biosecurity requirements (e.g. weed and seed declarations) will be implemented for the project, and thus, this risk has been assessed as low.</p>
Interfere with the recovery of the species	<p>Unlikely</p> <p>The project is expected to be relatively benign with no substantial long-term increase in mortality or any substantial barrier effects due to loss of habitat connectivity. All impacts are expected to be localised. Impacts along the SGIC SDA pipeline alignment are expected to be consistent with existing levels of impact from habitat fragmentation and exposure to road noise and traffic. The risk of koala mortality of injury will be managed by the mitigation measures contained within the CEMP, and an experienced and suitably qualified fauna spotter-catcher will be employed during all clearing works. Accordingly, the project is unlikely to substantially interfere with the recovery of the species.</p>
Result in disruption to ecologically significant locations (breeding, feeding or nesting sites) of a species	<p>Likely</p> <p>The project will require the clearing of 49.25 ha of potentially suitable foraging and breeding habitat for the koala. Although the SGIC SDA pipeline alignment has been largely placed within or adjacent to areas that have been previously cleared, the project will result in a loss of koala food and shelter trees (i.e. <i>Melaleuca</i>, <i>Eucalyptus</i>, <i>Corymbia</i> and <i>Acacia</i> species). While the project is not expected to cause a long-term decline in the local population, reduce its extent of occurrence, cause adverse habitat fragmentation effects nor interfere with the recovery of the species, the loss of suitable koala habitat within the SGIC SDA pipeline alignment is likely to result in disruption to ecologically significant locations.</p>

Significant residual impact criteria	Potential to occur
Conclusion	The project is likely to result in a significant residual impact on the koala. Although the SGIC SDA pipeline alignment has been largely placed within or adjacent to areas that have been previously cleared, the project will require the clearing of 49.25 ha of suitable foraging habitat (.e. <i>Melaleuca</i> , <i>Eucalyptus</i> , <i>Corymbia</i> and <i>Acacia</i> species) and breeding habitat.



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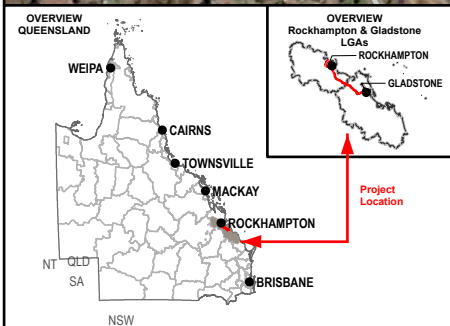
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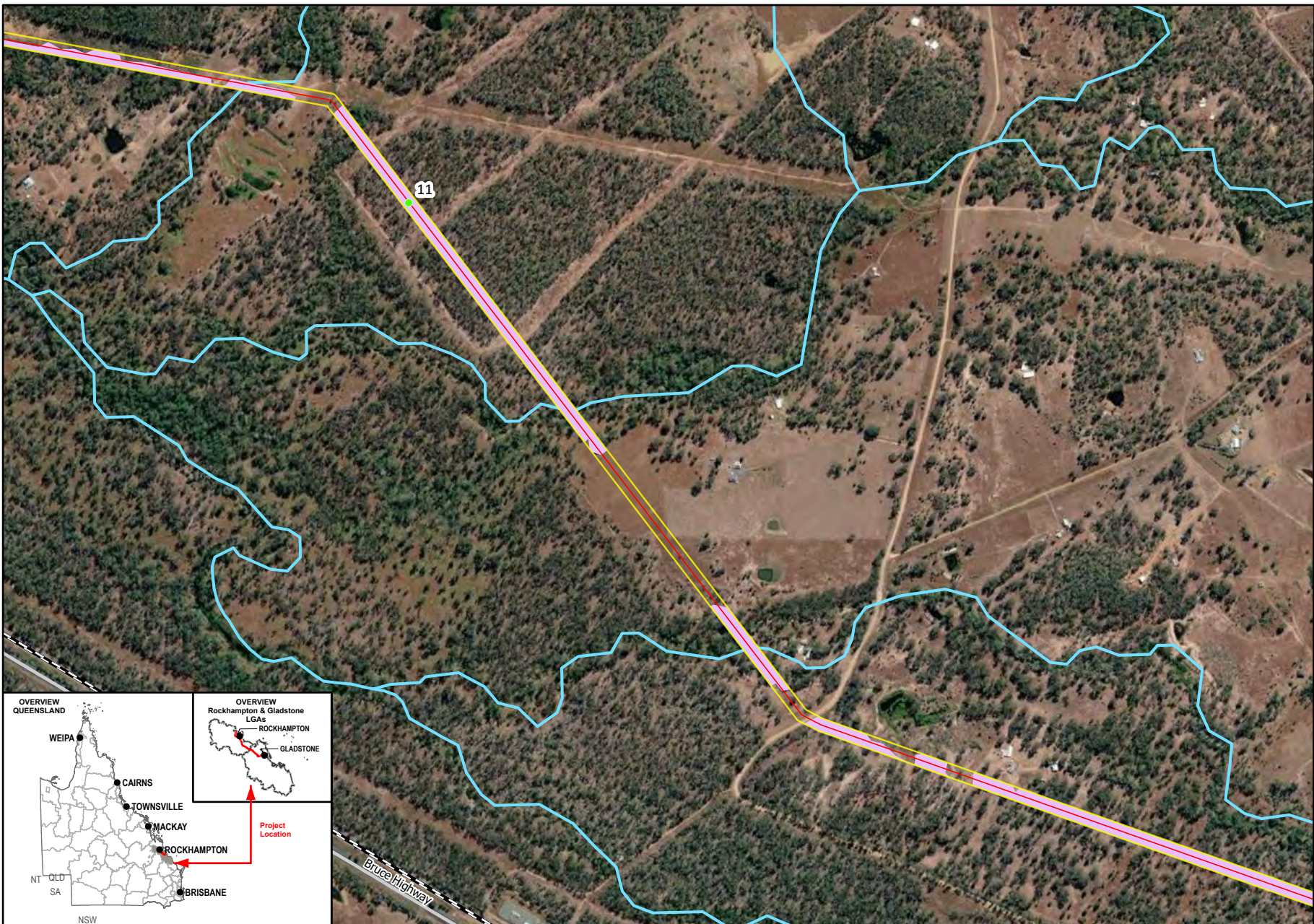
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 - Study Area
 - Survey Photo Reference Number
 - Predicted Koala Habitat
 - Waterways
 - Main Roads
 - Railways

Data Sources:

1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
2. Imagery @ Esri, Maxar, GeoEye, Earthstar Geographics, CNES-Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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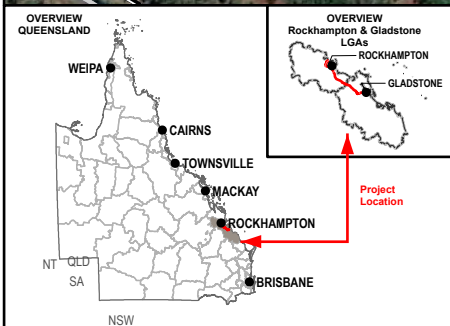
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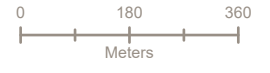
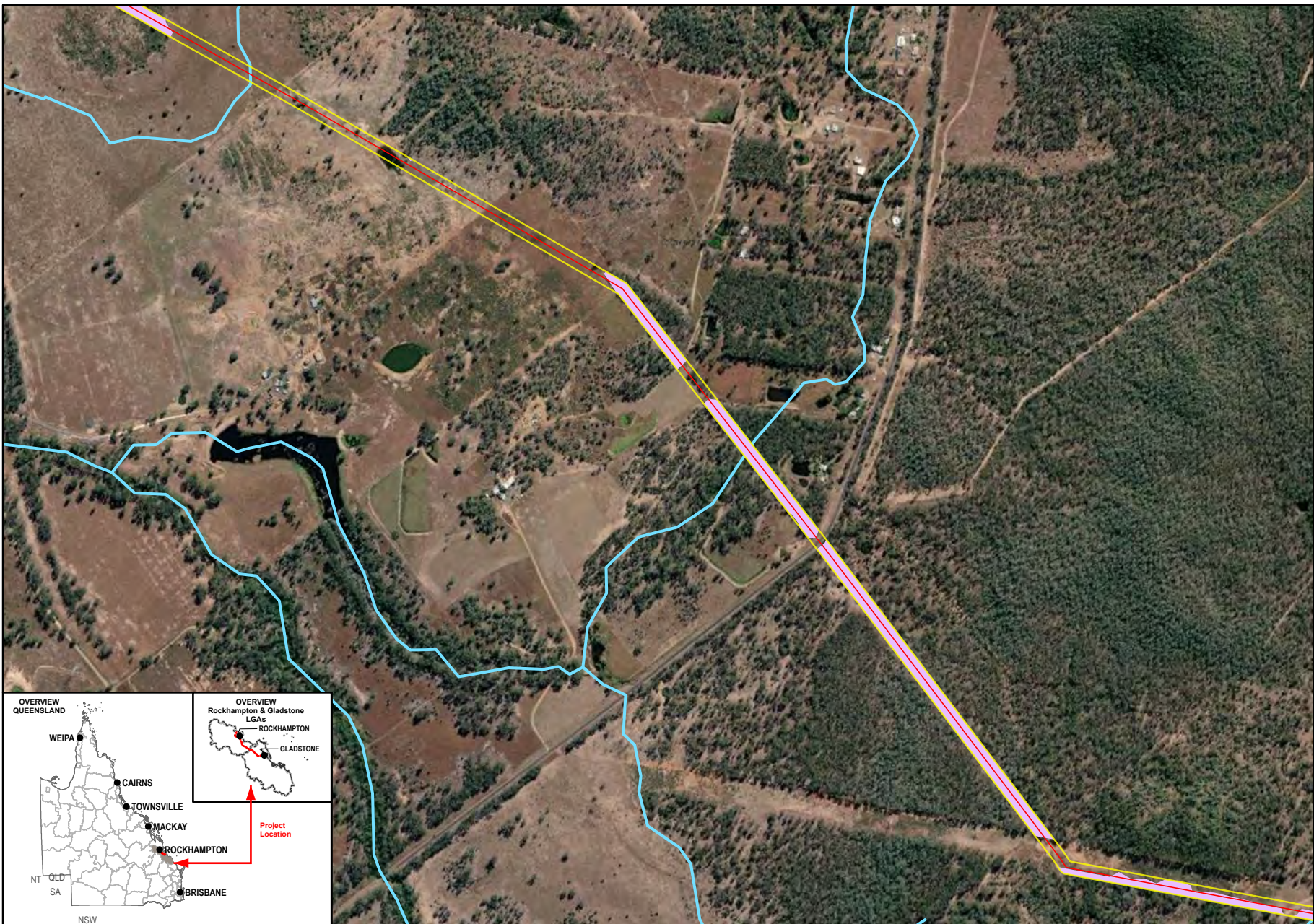
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 - Survey Photo Reference Number
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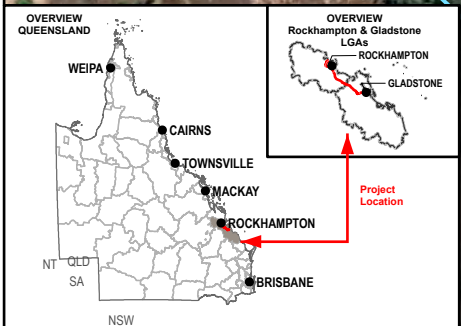




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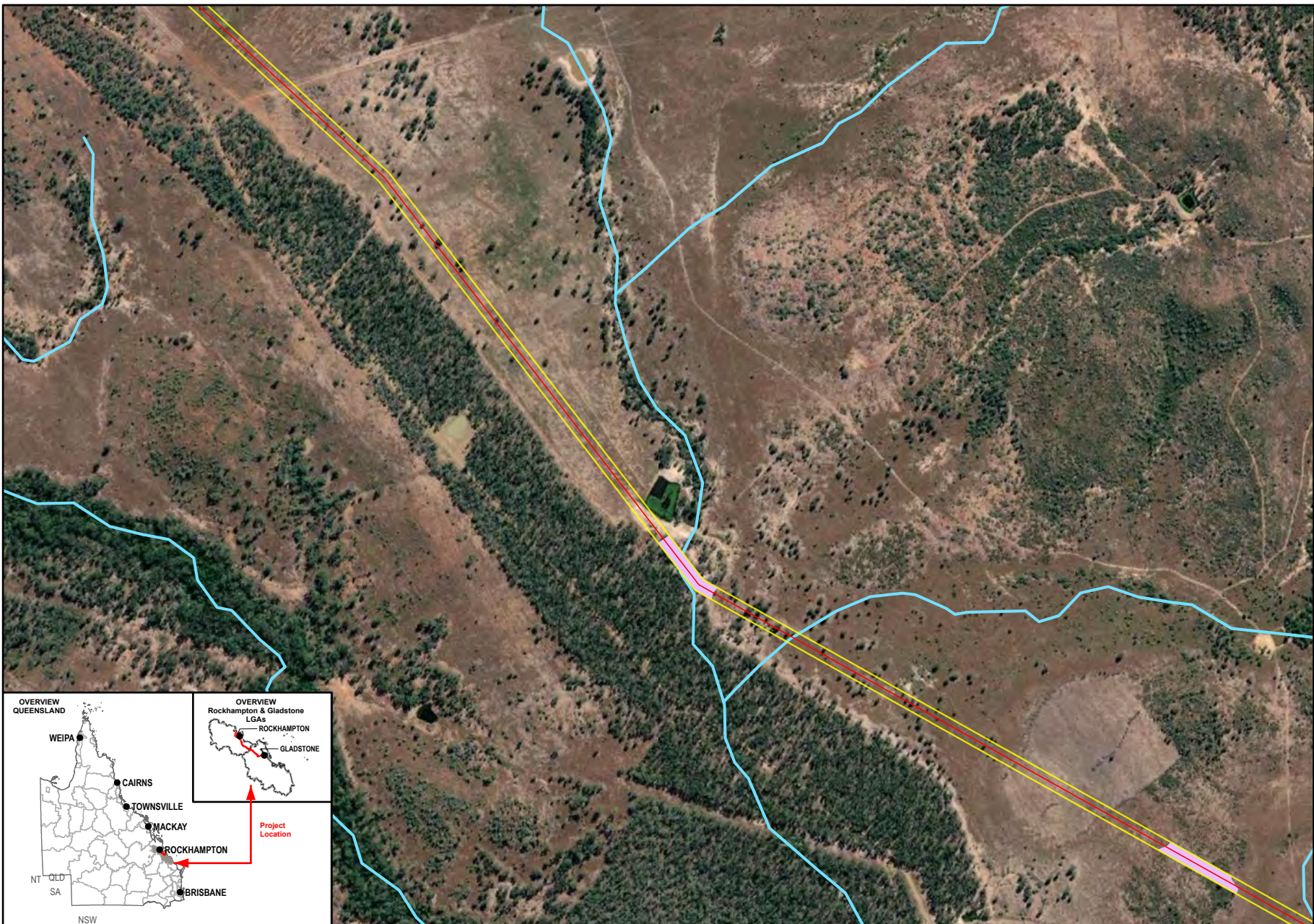
Legend

- SGIC SDA Pipeline Alignment
- Study Area
- Predicted Koala Habitat
- Waterways



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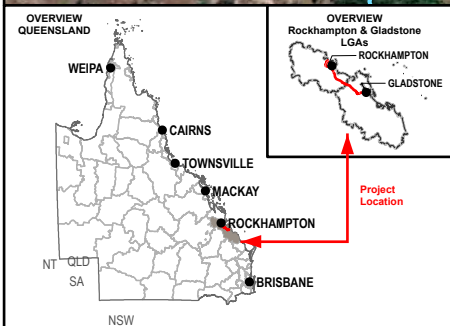
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 - Study Area
 - Predicted Koala Habitat
 - Waterways

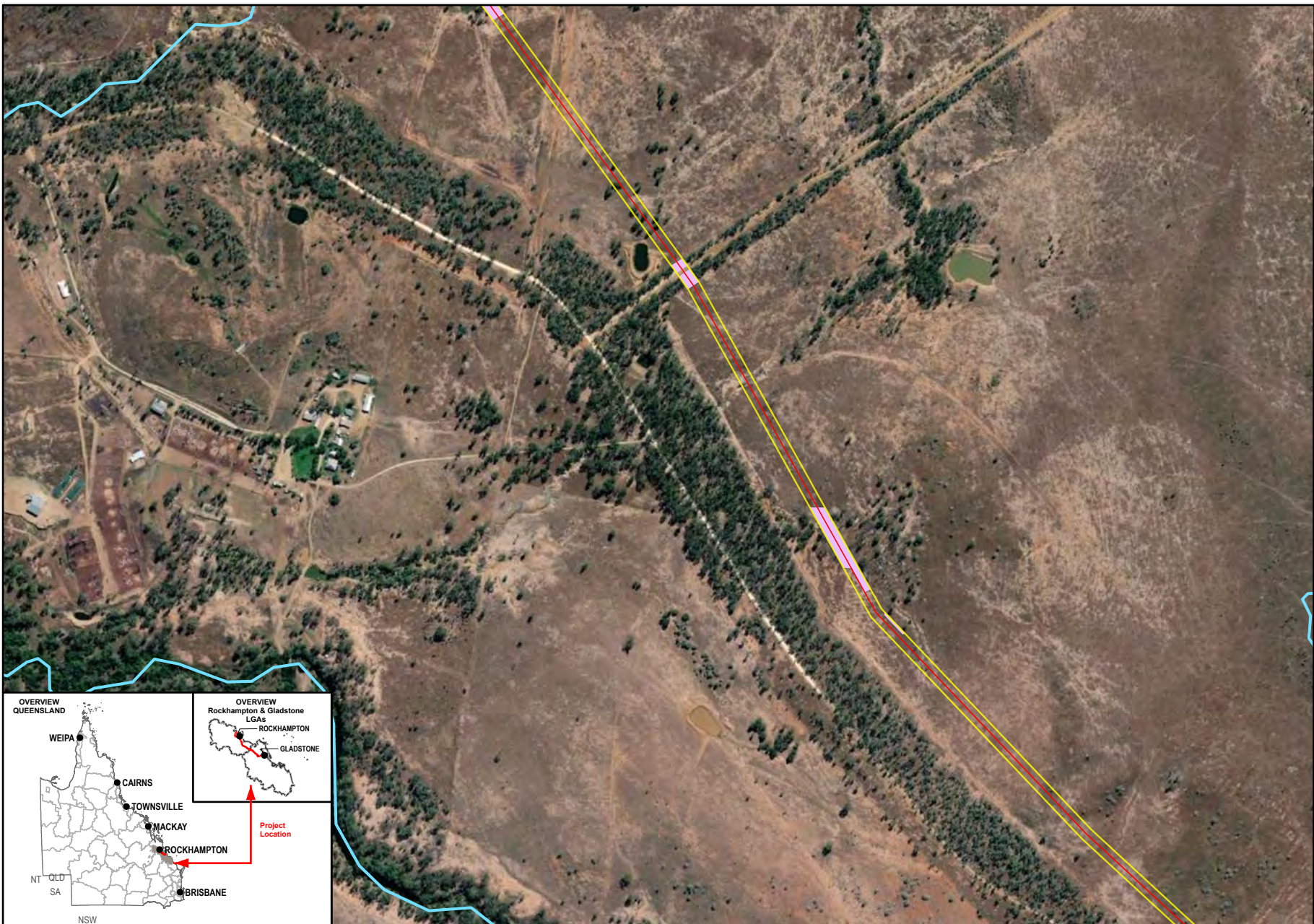
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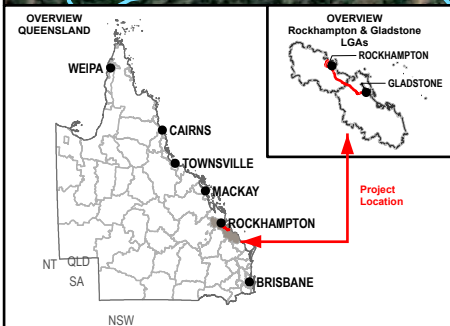
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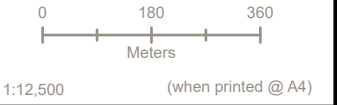
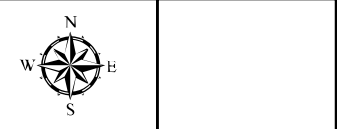
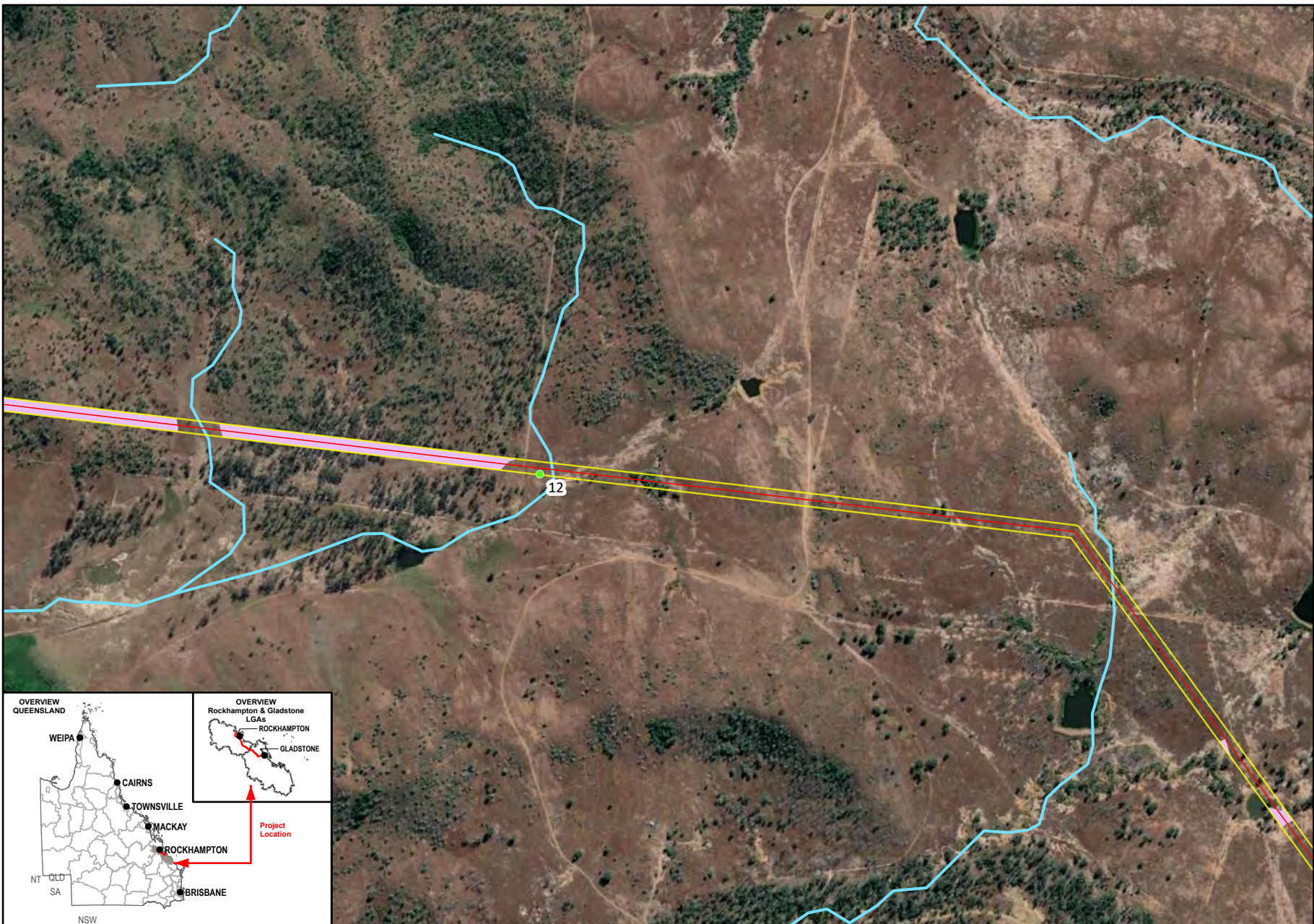
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 - Study Area
 - Predicted Koala Habitat
 - Waterways

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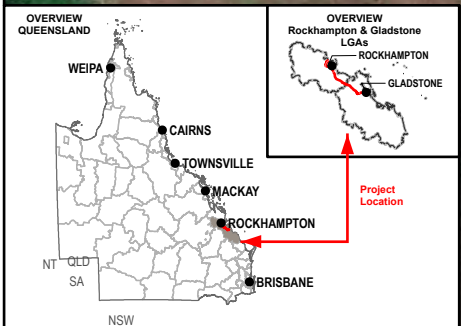
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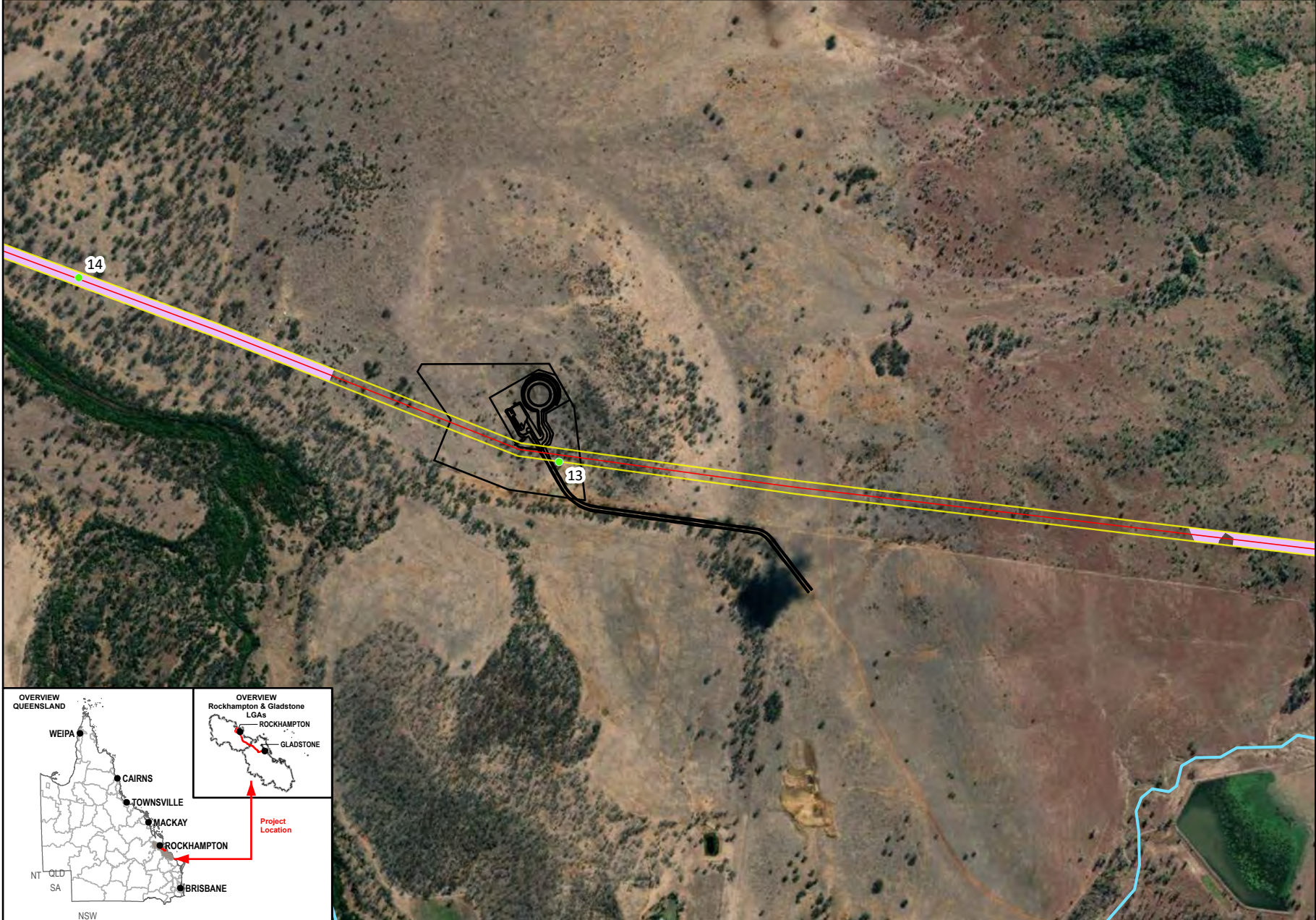
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 - Study Area
 - Survey Photo Reference Number
 - Predicted Koala Habitat
 - Waterways






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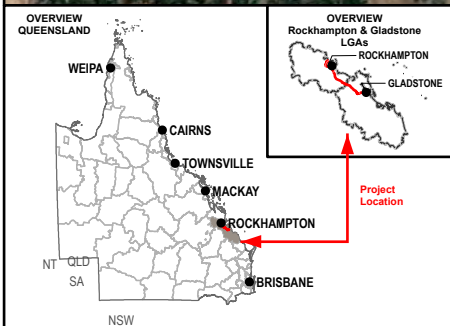
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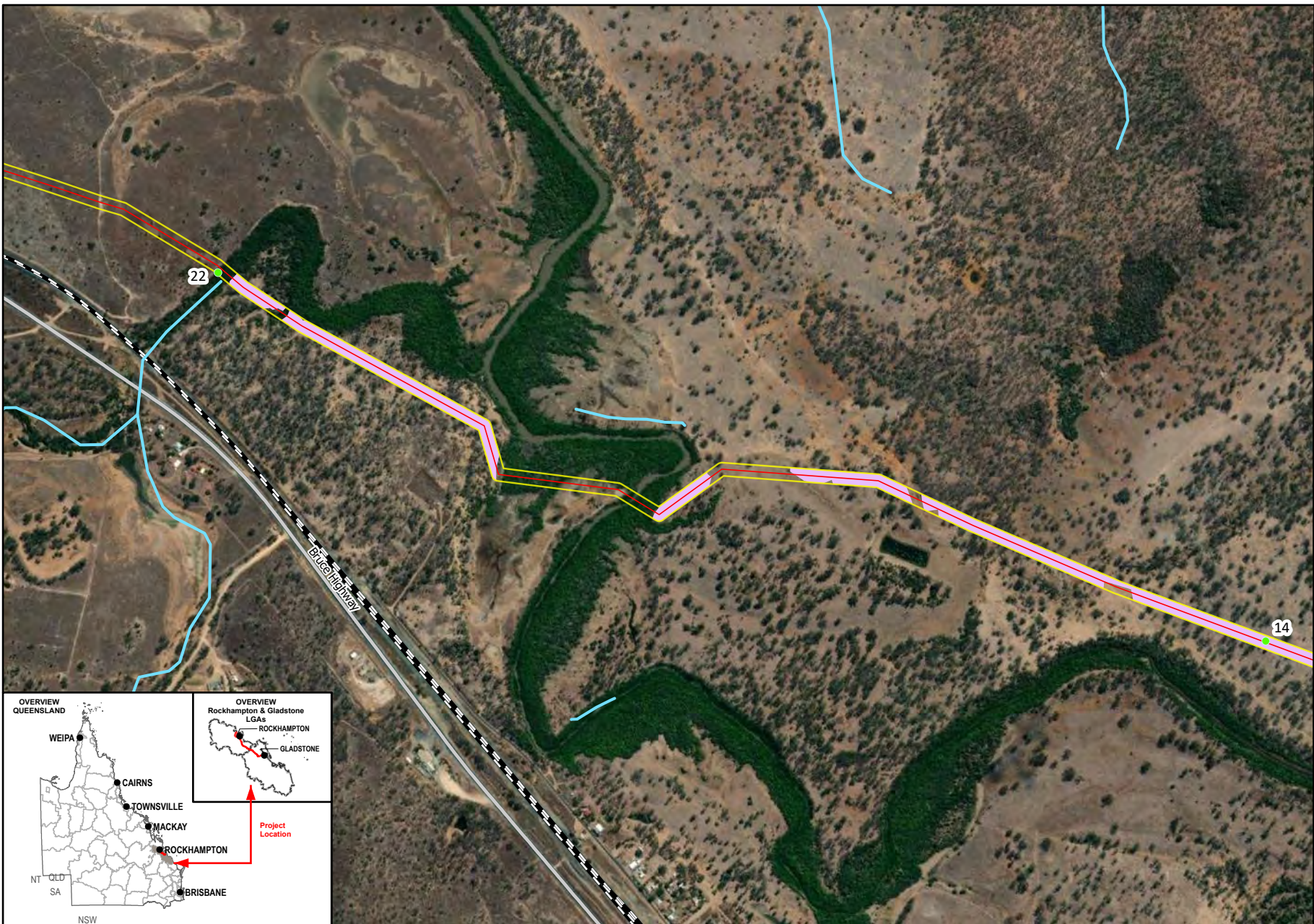
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 - Raglan Pump Station and Reservoir Layout
 - Waterways




Data Sources:


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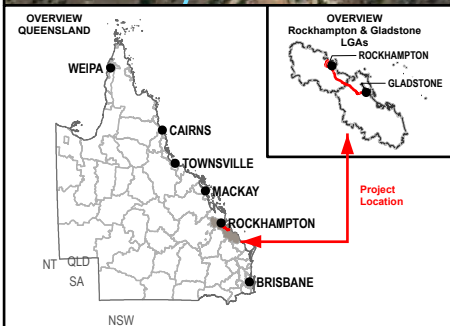
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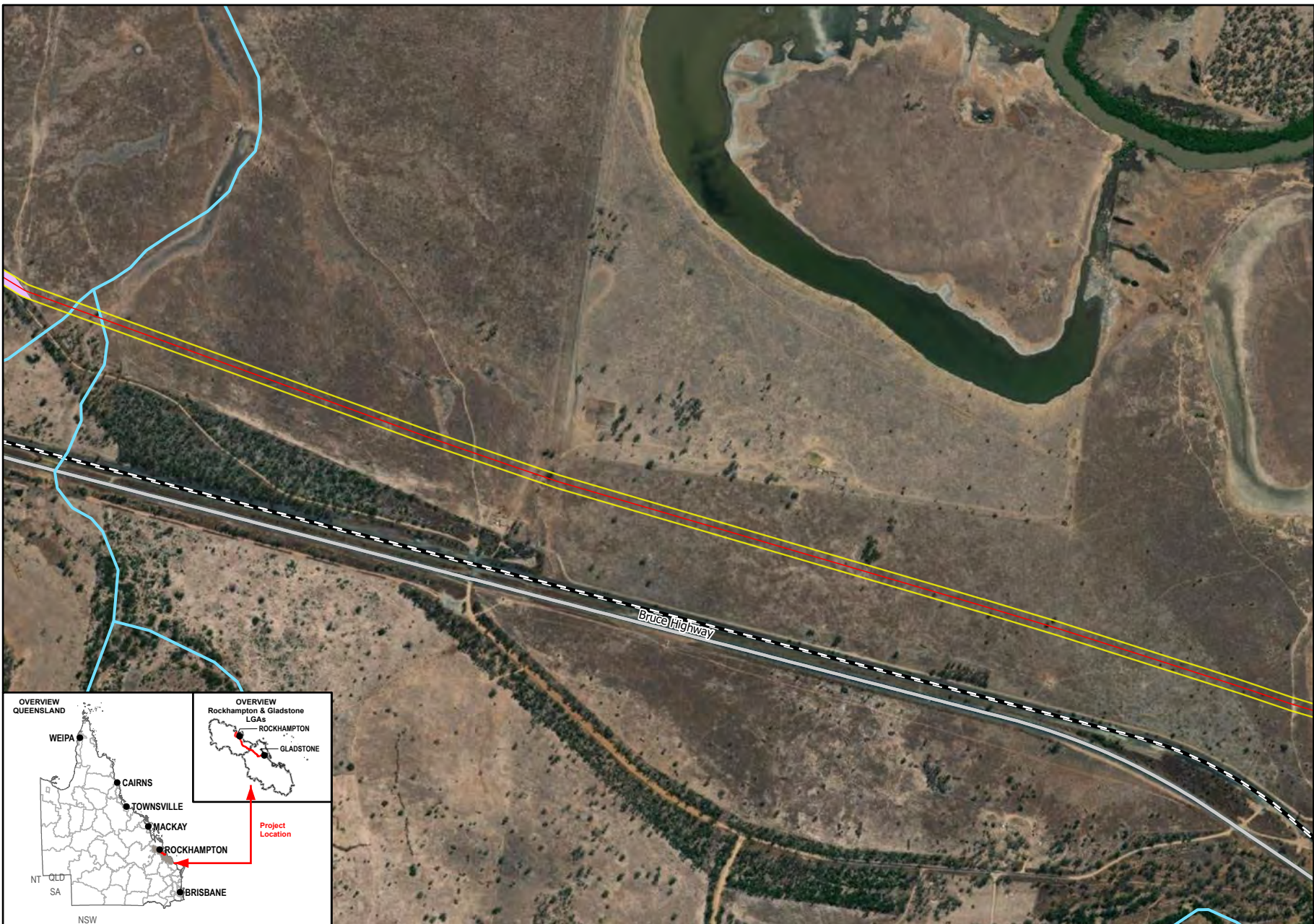
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 - Study Area
 - Survey Photo Reference Number
 - Predicted Koala Habitat
 - Waterways
 - Main Roads
 - Railways

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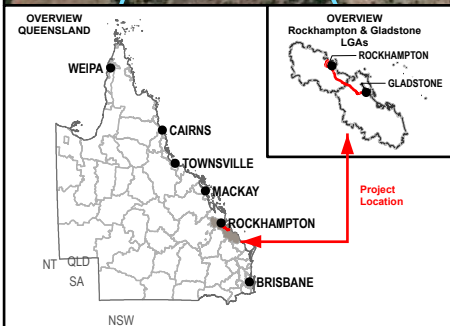
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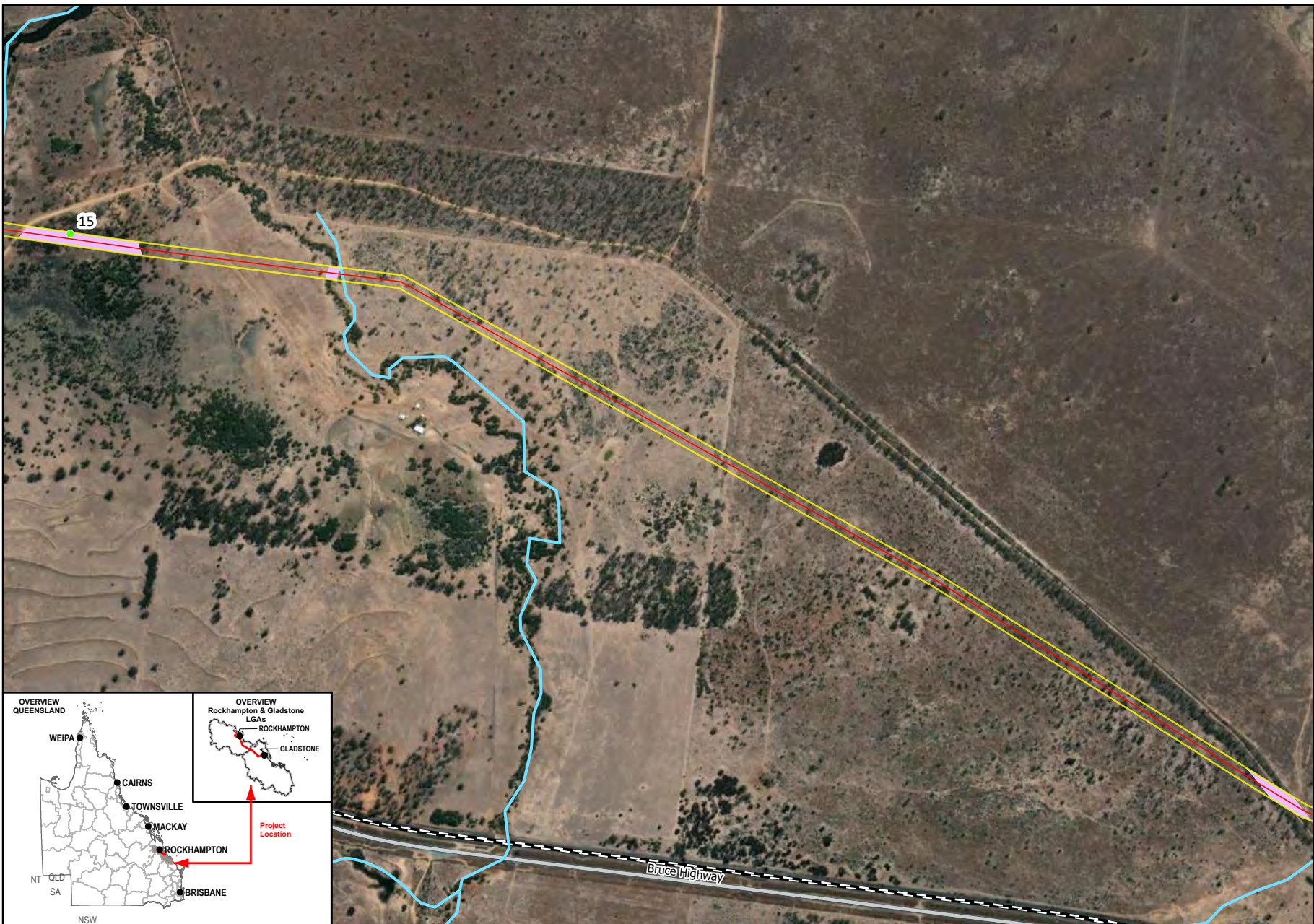
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 - Waterways
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 - Railways

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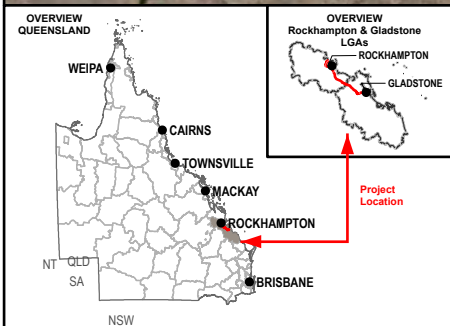
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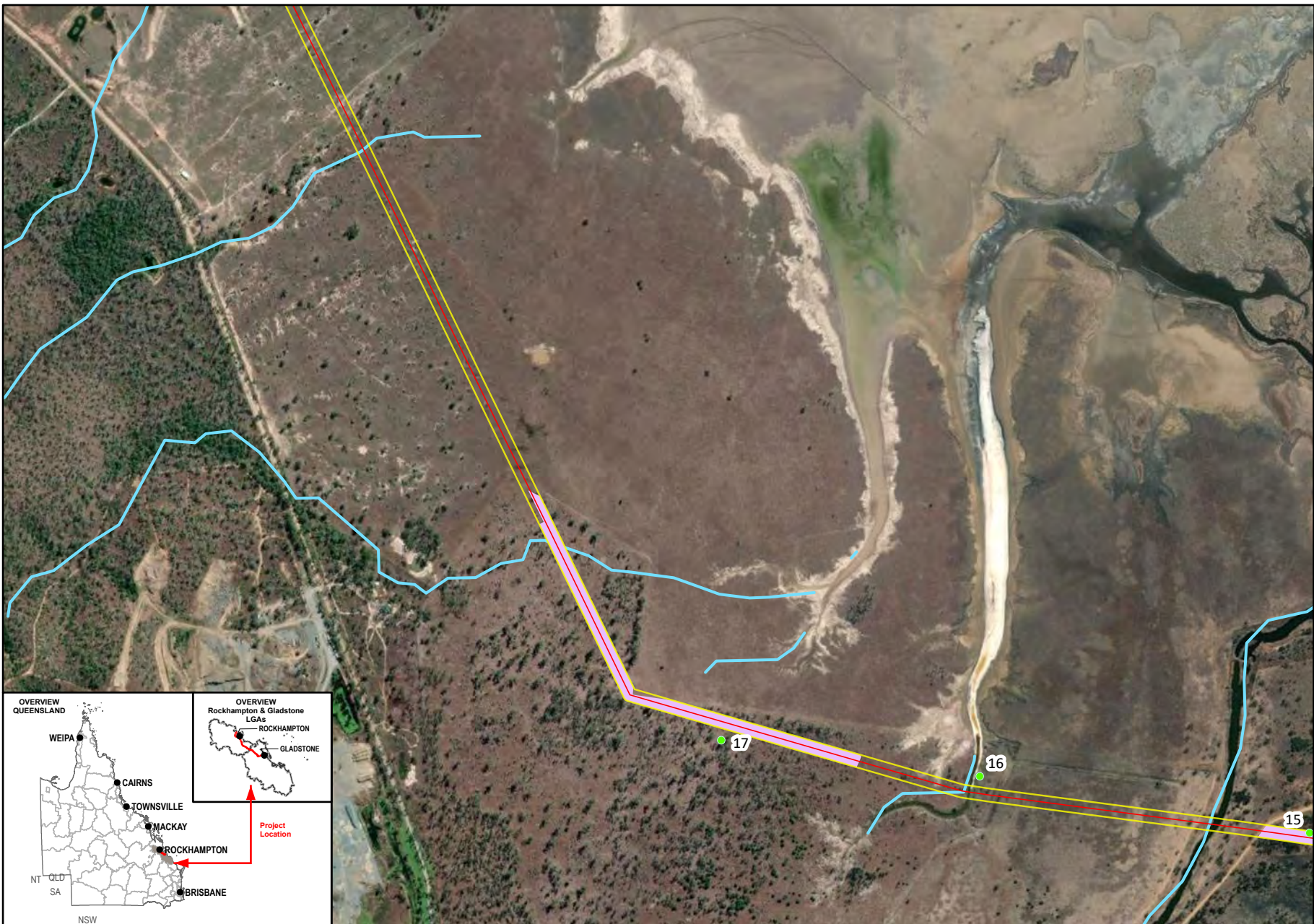
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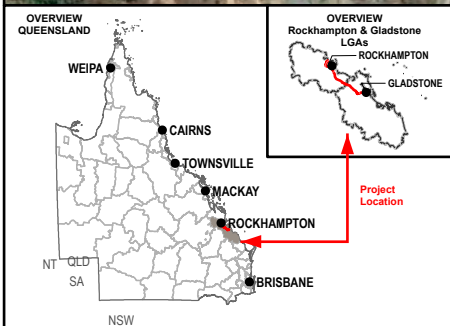
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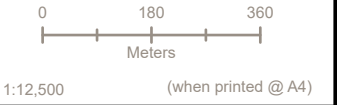
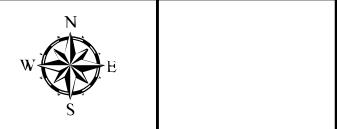
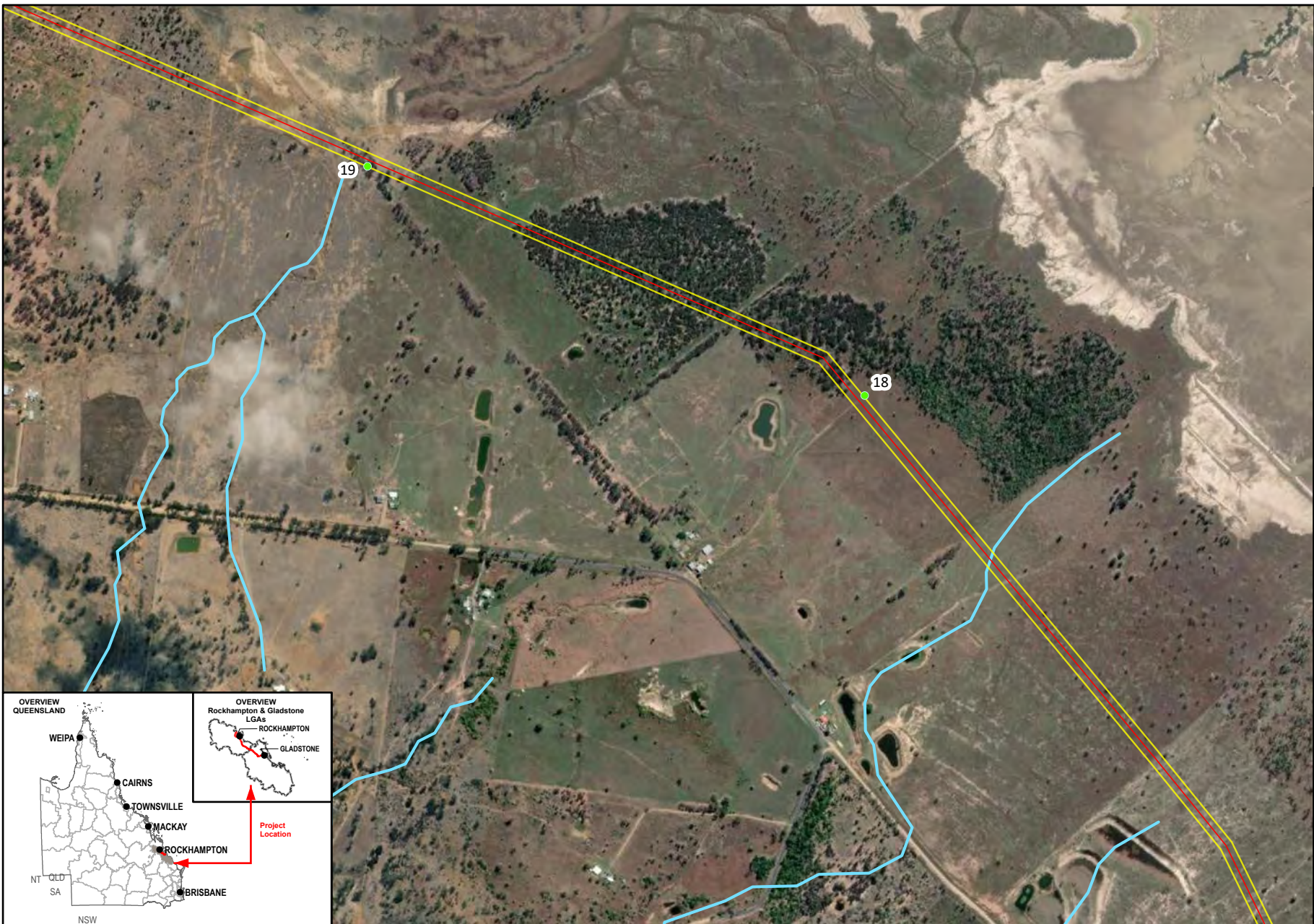
- Legend**
- SGIC SDA Pipeline Alignment
 - Study Area
 - Survey Photo Reference Number
 - Predicted Koala Habitat
 - Waterways



Data Sources:

1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
2. Imagery @ Esri, Maxar, GeoEye, Earthstar Geographics, CNES-Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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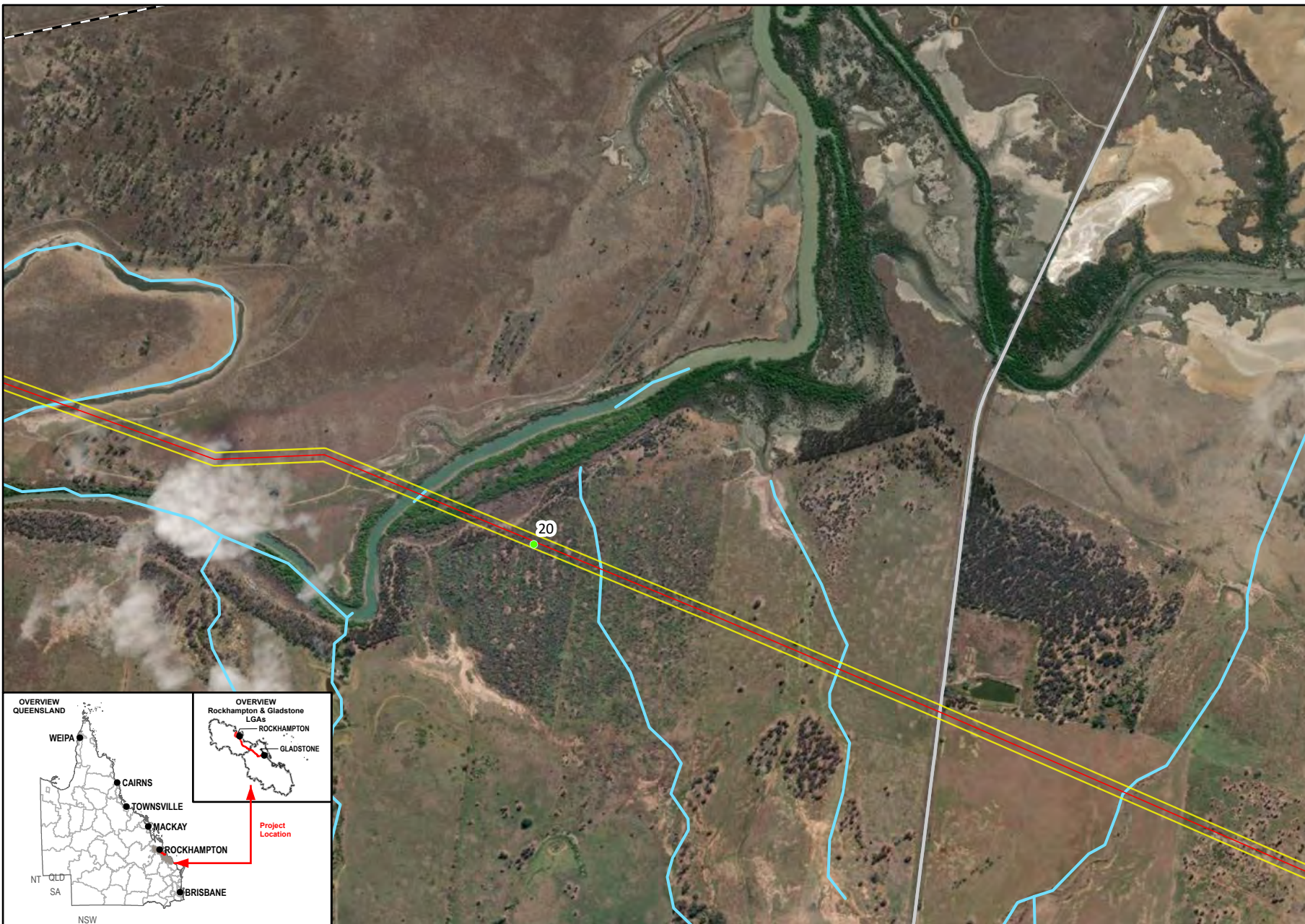


- Legend**
- SGIC SDA Pipeline Alignment
 - Study Area
 - Survey Photo Reference Number
 - Waterways

Data Sources:

1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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Meters

1:12,500 (when printed @ A4)

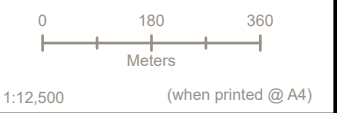
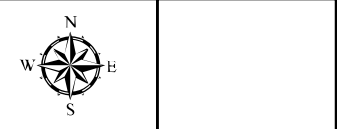
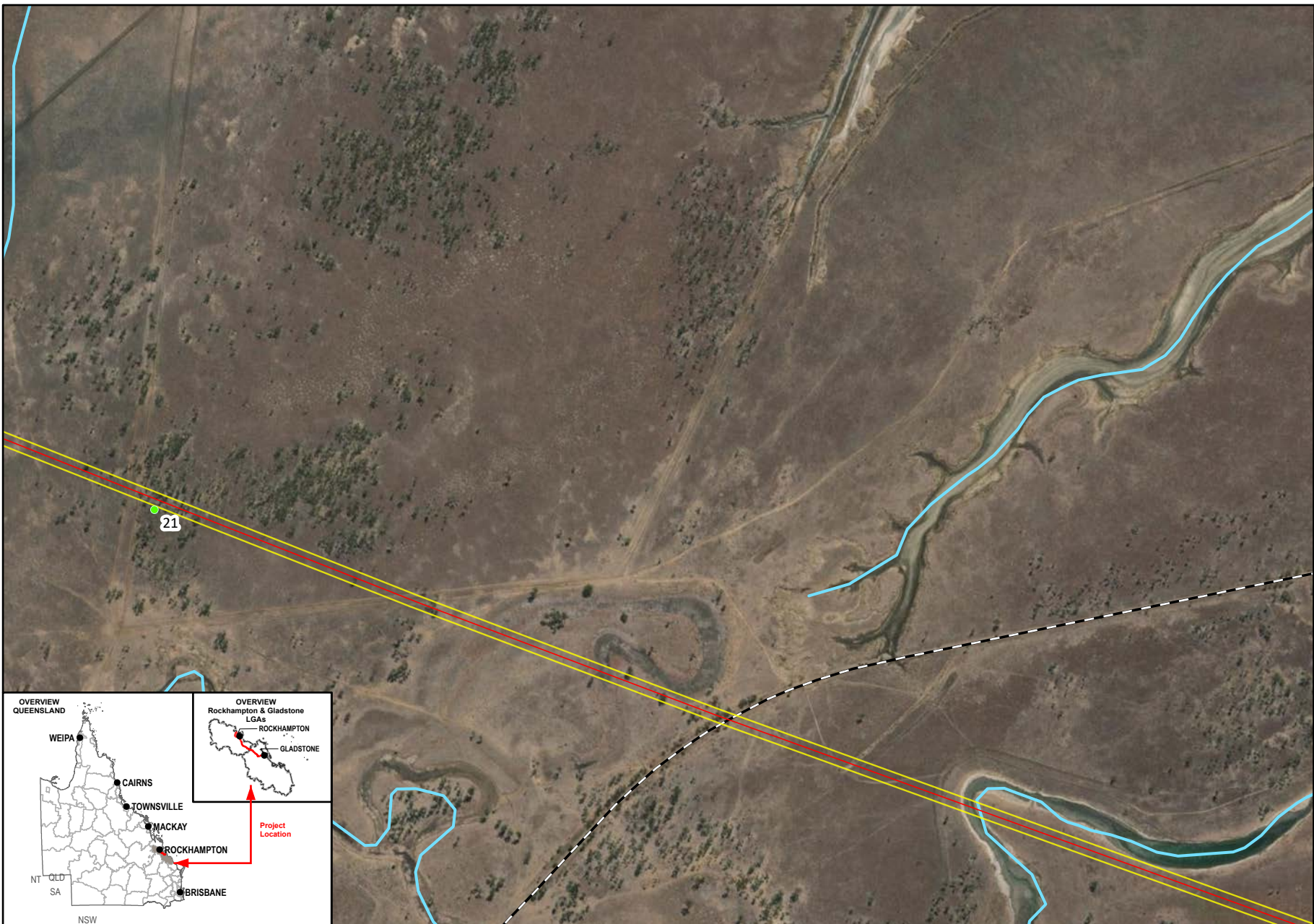
- Legend**
- SGIC SDA Pipeline Alignment
 - Study Area
 - Survey Photo Reference Number
 - Waterways
 - Main Roads
 - Railways

Data Sources:

1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
2. Imagery @ Esri, Maxar, GeoEye, Earthstar Geographics, CNES-Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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- Legend**
- SGIC SDA Pipeline Alignment
 - Study Area
 - Survey Photo Reference Number
 - Waterways
 - Railways

Data Sources:

1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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