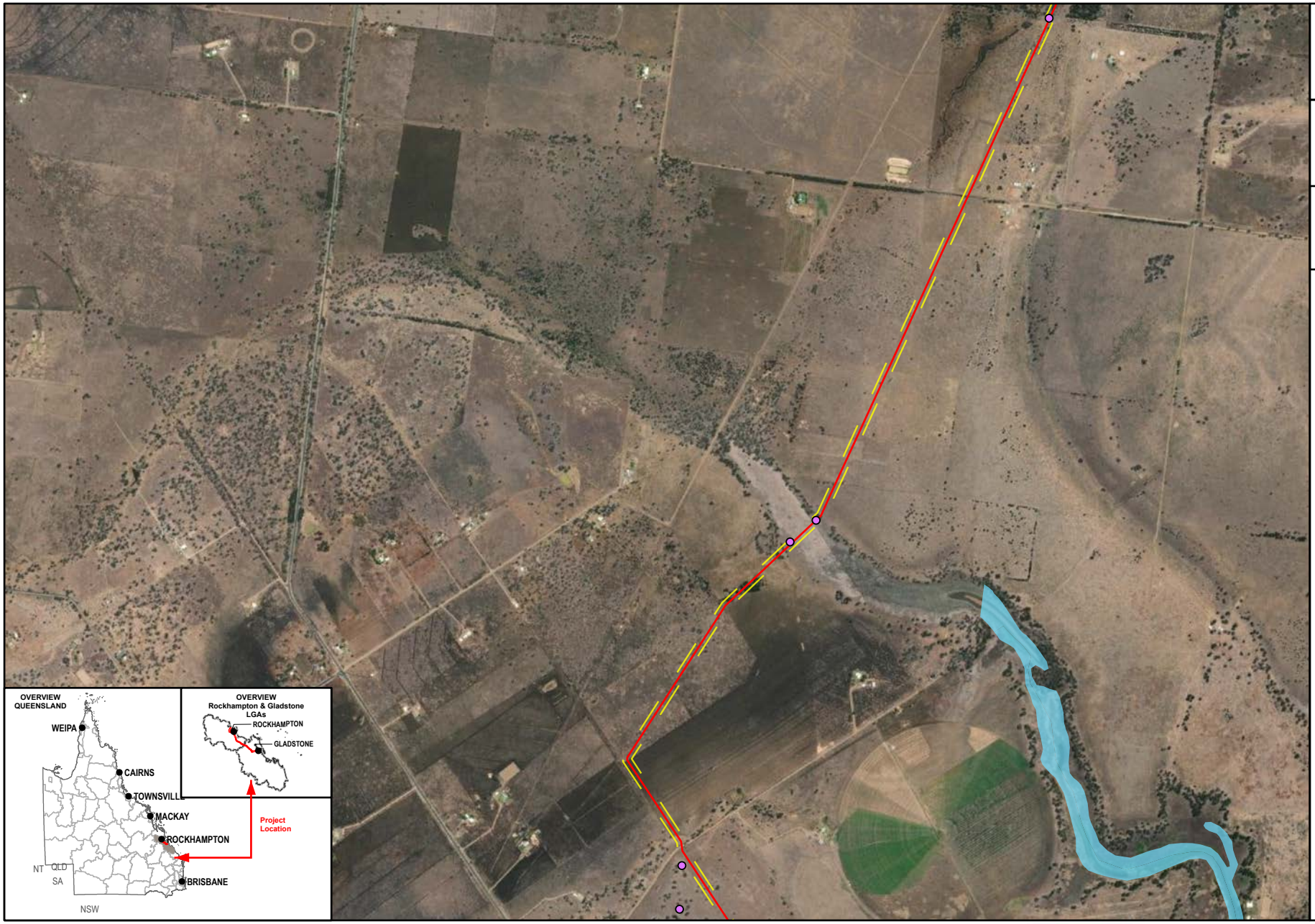

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Legend

Flora Survey Type

- Quaternary Assessment Site
- Study Area
- Fitzroy to Gladstone Pipeline Alignment
- Waterbody

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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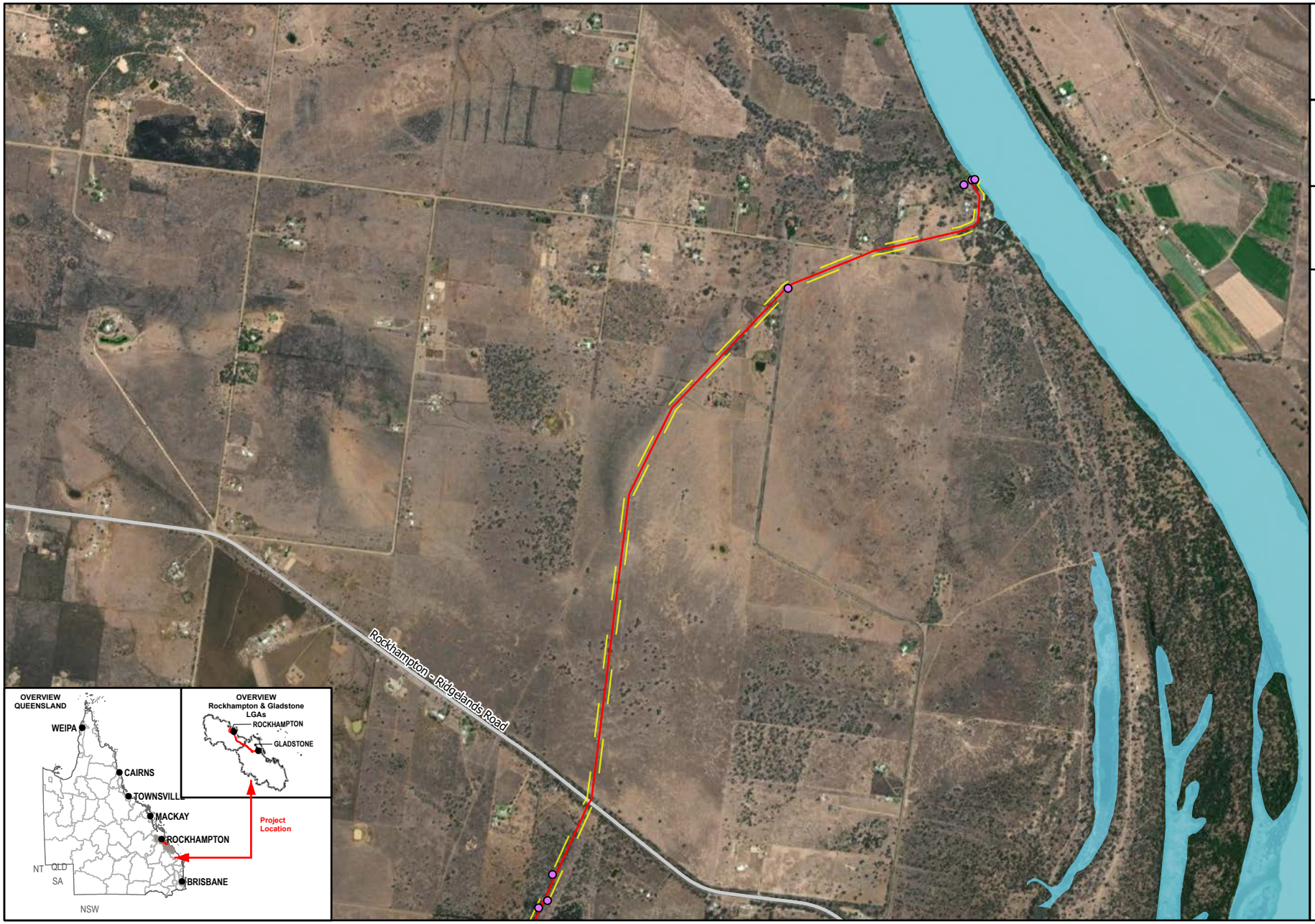
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 2-1u
Distribution of Vegetation and Flora Survey Sites Within the Study Area
000-G-MAP-2401 Version:0 Date: 7/07/2022



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Flora Survey Type

- Quaternary Assessment Site
- Study Area
- Fitzroy to Gladstone Pipeline Alignment
- Main Roads
- Waterbody

Data Sources:

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Figure 2-1v
Distribution of Vegetation and Flora Survey Sites Within the Study Area
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2.4.3 Terrestrial fauna survey methods

A total of 145 fauna field survey sites were assessed during the ecological field surveys as presented in Figure 2-2. To supplement the targeted species searches, habitat assessments were undertaken to determine the suitability of habitat types for fauna species of conservation significance. The habitat assessments characterised vegetation communities into broad habitat types based on shared ecological characteristics such as (1) the structure and composition of vegetation at canopy, shrub and ground layers; (2) the presence of foraging, nesting and refuge resources; and (3) key habitat features such as rocky outcrops, leaf litter, woody debris and hollow-bearing trees.

Targeted searches were undertaken for conservation significant fauna species that were considered as potentially occurring within the study area based on the desktop search results including the PMST and WildNet results (Table 3-6, Table 4-9 and Table 5-6), previous field survey results provided in the EIS undertaken by Arup in 2007 (Arup 2008) and Detailed Assessment undertaken by SMEC (2021). Fauna surveys were undertaken in accordance with relevant Commonwealth and Queensland guidelines during the ecological field surveys. The fauna survey methods that were applied within the study area are outlined in Table 2-5. Further details of how each survey methods targeted each threatened species predicted and recorded to occur within the study area is outlined in Table 2-6.

Table 2-5 Fauna survey methods used within the study area

Assessment	Survey methods
Habitat assessments	Targeted surveys were conducted at each habitat assessment site. Targeted surveys assessed the suitability of habitat for conservation significant species - with active searches (described below) conducted in areas of high habitat quality. As part of the targeted surveys, conservation significant species reported within the desktop assessment were considered at each habitat assessment site to assist with determining potential habitat mapping. The assessment involved documenting the presence / abundance of habitat features (e.g. hollow-bearing trees, certain vegetation communities, etc.) which are often utilised by multiple conservation significant species.
Bird surveys	Surveys for birds were undertaken through a series of standardised 2 hectares (ha) area searches using the Birds Australia census method. All birds seen and heard calling were recorded. Opportunistic bird surveys were also undertaken throughout the study area, recording birds seen or heard that had not been recorded during standardised 2 ha searches.
Active searches	Active searches were undertaken to detect reptile and amphibian species by actively searching beneath rocks, logs, bark, leaf litter and other suitable microhabitats.
Anabat detectors	Anabat detectors were deployed at six different locations and were left overnight for nine nights to record calls from Microchiroptera bat species. The data from the Anabat detectors were analysed by Greg Ford (Balance Environmental) to confirm species present. Greg is a terrestrial ecologist with more than 25 years' experience in ecological research and is an active member of the Australasian Bat Society (Appendix C).
Remote cameras	Remote cameras were baited with a mixture of rolled oats, peanut butter, honey and sardines and set at six locations and were left overnight for a total of nine nights. The remote cameras were used to detect fauna, with particular focus on threatened species.
Large tree density assessment	Suitable greater glider habitat assessments were undertaken in accordance with the *Guide to greater glider habitat in Queensland* (Eyre 2022). Large tree counts were undertaken to assess the density of large trees within an area. This involved measuring the diameter at breast height (DBH) of trees within a 1 ha plot. Large tree benchmarks were determined based on the Brigalow Belt bioregion, as being greater than 46.5 ± 7.5 cm DBH, with a density of more than 20 large trees.
Hollow-bearing tree counts	Hollow-bearing tree count transects (200 m x 50 m) were undertaken within suitable glider habitat to assist in the mapping of predicted habitat for the species. Hollow size and number of total hollows within the transect were recorded.
Nocturnal searches and spotlighting	Nocturnal active searches and spotlighting surveys involved active searches with head torches Surveys were conducted in the most suitable woodland environments for nocturnal species, where access and terrain permitted. Spotlighting was undertaken over four nights, with 2-3 hours spent spotlighting each night.
Opportunistic searches	All incidental records of fauna observed during the ecological field surveys were recorded. Bones, feather, skulls, sloughed skins, faecal pellets, tracks, burrows, scratchings and other wildlife traces were also recorded.

Table 2-6 Threatened fauna species survey methods

Species	Habitat requirements	Survey guidelines	Survey effort	Pipeline Section
Birds				
Calidris ferruginea Curlew sandpiper	– Mainly occurs on intertidal mudflats in sheltered coastal areas (DoE 2022) – Forages mainly on invertebrates in tidal and non-tidal habitats, such as mudflats, sandy shores, flooded paddocks and inundated saltflats (DoE 2015a) – Roosts around coastal or near-coastal lagoons and other wetlands on open substrates. Recorded roosting in mangroves (DoE 2015a) – Breeding range is restricted to the Arctic of northern Siberia (DoE 2015a).	Surveys for the curlew sandpiper were undertaken in accordance with the *EPBC Act Policy Statement 3.21 – Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species* (DotEE 2017): – Surveys for roosting shorebirds in suitable habitat – Surveys for foraging shorebirds in suitable habitat.	Survey effort for the curlew sandpiper included: – Fauna habitat assessments at 39 sites – Bird census surveys were undertaken at two roosting habitat sites and six foraging habitat sites.	SGIC SDA
Calyptorhynchus lathami Glossy black-cockatoo	– Occur in forest and open woodland areas of south-east Queensland and coastal New South Wales (Glossy Black Conservancy 2010). – Feeds selectively on cones of *Casuarina* and *Allocasuarina* (Glossy Black Conservancy 2010). – Key food tree species include *Allocasuarina littoralis* (black she-oak), *Allocasuarina torulosa* (forest she-oak) and to a lesser extent, *Casuarina equisetifolia* (coastal she-oak), *Casuarina cunninghamiana* (river she-oak) and *Casuarina cristata* (belah) (Glossy Black Conservancy 2010). – Nest in large living or dead hollow-bearing trees, typically in vertical chimneys 10 – 20 m above ground-level (Glossy Black Conservancy 2010).	Surveys for the glossy black-cockatoo were undertaken in accordance with the *Glossy black-cockatoo – targeted species survey guidelines* (Hourigan 2012): – Diurnal bird survey – Search for foraging and nesting signs.	Survey effort for the glossy black-cockatoo included: – Fauna habitat assessments at 35 sites – Bird census at 11 sites for 20 minutes.	GSDA

Species	Habitat requirements	Survey guidelines	Survey effort	Pipeline Section
Denisonia maculata Ornamental snake	– Occurs in vegetation communities dominated by brigalow (*Acacia harpophylla*), gidgee (*Acacia cambagei*), blackwood (*A. argyrodendron*) or coolibah (*Eucalyptus coolabah*), or grassland associated with gilgais (Brigalow Belt Reptile Workshop 2010) – Species prefer moist areas; however, species have been recorded from riparian areas (Brigalow Belt Reptile Workshop 2010) – Species has been commonly recorded from RE 11.4.3, 11.4.6, 11.4.8 and 11.4.9. Other REs the species has also been recorded in include, 11.3.3 and 11.5.16 – Occurs in shallow water where some aquatic vegetation is present, and shelters in deep-cracking soils and ground timber (DAWE 2020).	Surveys for the ornamental snake were undertaken in accordance with the *Survey guidelines for Australia's threatened reptiles* (Commonwealth of Australia 2011c) and *Draft Referral guidelines for the nationally listed Brigalow Belt reptiles* (Commonwealth of Australia 2011a): – Surveys to be undertaken during the wet weather/season – Active searches under sheltering sites within suitable habitat – Opportunistic surveys of roads – Nocturnal spotlighting within suitable habitat (particularly after wet weather when frogs are active) – Pitfall and funnel trapping (likely to yield low returns).	Survey effort for the ornamental snake included: – Fauna habitat assessments at 64 sites – Active searches at 16 sites for 20 minutes – Spotlighting whilst driving along nearby roads and on foot within suitable habitat. Spotlighting occurred after recent rainfall, with two people over two nights, with 2-3 hours spotlighting each night (total of 12 person hours). Spotlighting was undertaken during wet weather	– SGIC SDA – Northern Section
Epthianura crocea macgregori Yellow chat (Dawson)	– Inhabits marine wetlands that are subjected to extensive seasonal inundation (DoE 2022) – occupy marine plains that have a network of shallow drainage channels with a large variety of vegetation (DoE 2022) – Nests are often found close to the ground in grasses and/or rushes while supporting a small cup shape (DoE 2022) – Diet consists of invertebrates and are often targeted from surface of shallow water, stems of rushes, grasses and occasionally low shrubs (DoE 2022).	Surveys for the yellow chat (Dawson) were undertaken in accordance with the *Survey guidelines for Australia's threatened birds* (Commonwealth of Australia 2010b): – Area searches or transect-point surveys of all suitable habitat, preferably in the early morning or late afternoon.	Survey effort for the yellow chat (Dawson) included: – Fauna habitat assessments at 39 sites – Area searches/bird census within suitable habitat at five sites.	SGIC SDA

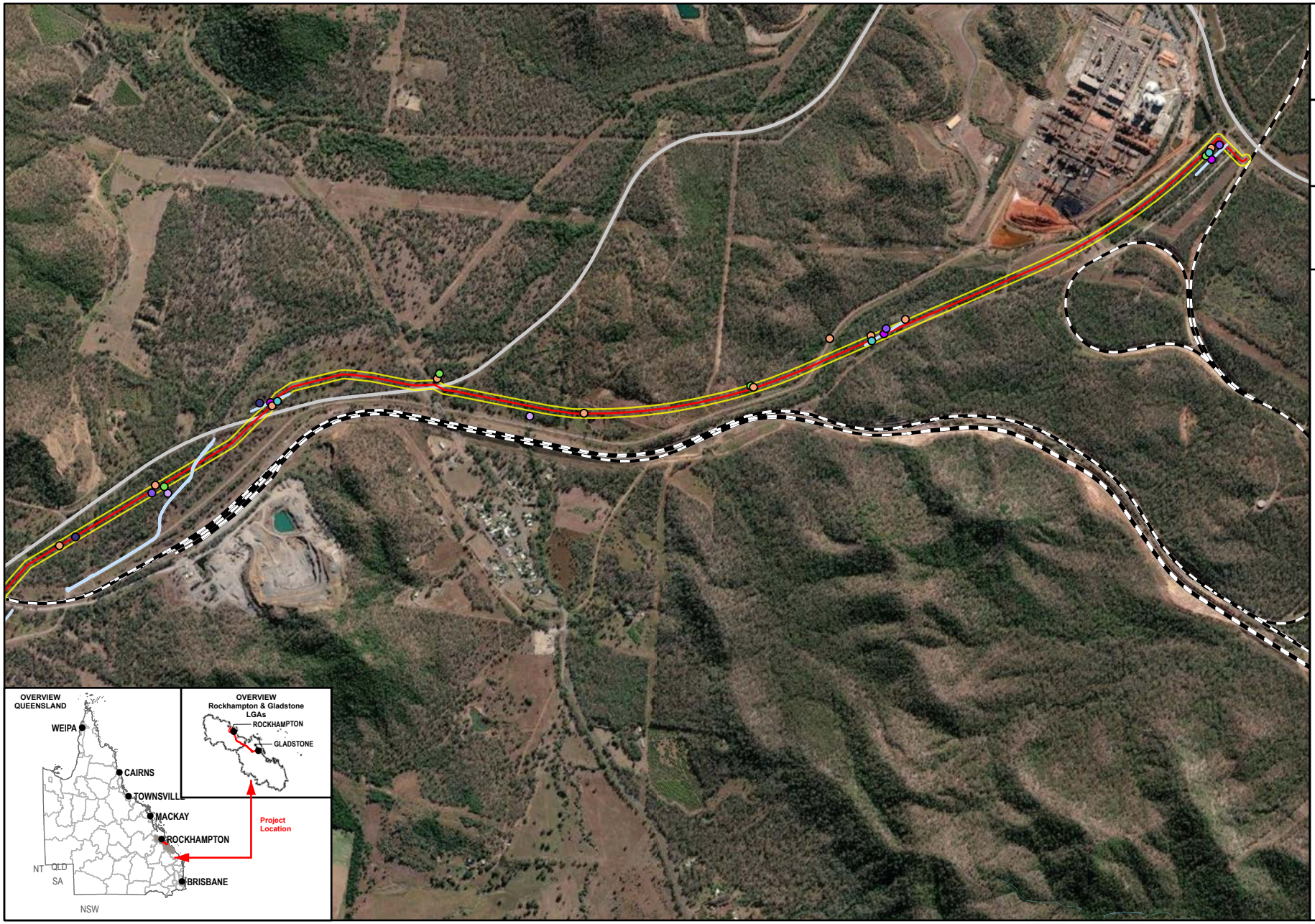
Species	Habitat requirements	Survey guidelines	Survey effort	Pipeline Section
Geophaps scripta scripta Squatter pigeon (southern)	– Occurs in remnant and regrowth open forest and woodland dominated by *Eucalyptus*, *Corymbia*, *Acacia* and *Callitris* species with tussock grassy understorey within 3 km of water sources (DoE 2022) – In Queensland, the Commonwealth approved conservation advice specifically nominates RE Land Zone 5 (well-draining, sandy or loamy soils on low, gently sloping, flat to undulating plains and foothills) and RE Land Zone 7 (lateritic (duplex) soils on low 'jump-ups' and escarpments) as suitable foraging and breeding habitat for the subspecies (DoE 2022) – Waterbodies that are suitable for the squatter pigeon (southern) occur on RE Land Zones 10, 3 and 4 (DoE 2022) – Restricted to well-draining, gravelly, sandy or loamy soils (Squatter Pigeon Workshop 2011) – Breeding habitats are typically on stony rises within 1 km of permanent water (Squatter Pigeon Workshop 2011) – Individuals may be found foraging in or moving across modified or degraded environments within 3 km of permanent water (Squatter Pigeon Workshop 2011).	Surveys for the squatter pigeon (southern) utilised methods consistent with those recommended for the species in the Commonwealth Survey Guidelines for Australia's Threatened Birds (Commonwealth of Australia 2010b). These methods include: – Area searches or transect surveys – Flushing surveys.	Survey effort for the squatter pigeon (southern) included: – Fauna habitat assessments at 99 sites – Bird census at 27 sites for 20 minutes – Area searches and driving / flushing surveys were undertaken within suitable habitat for a minimum of 100 km.	– GSDA – SGIC SDA – Northern Section

Species	Habitat requirements	Survey guidelines	Survey effort	Pipeline Section
Hemiaspis damelii Grey snake	– Prefers woodlands, generally brigalow and belah, on cracking clay soils near waterbodies (DES 2011) – Shelter under rocks, logs and flood debris, as well as in soil cracks or abandoned burrows in moist/seasonally inundated habitats (DES 2011) – Feeds exclusively on frogs (DES 2011).	Surveys for the grey snake were undertaken in accordance with the *Targeted species survey guidelines* (DES 2021): – Nocturnal spotlighting within suitable habitat during optimal conditions (spring/summer months, preferably after rainfall) – Nocturnal spotlighting via vehicle on roads – Active searches under sheltering sites within suitable habitat – Pitfall and funnel trapping.	Survey effort for the grey snake included: – Fauna habitat assessments at 64 sites – Active searches at 16 sites – Spotlighting whilst driving along nearby roads and on foot within suitable habitat. Spotlighting occurred after recent rainfall, with two people over two nights, with 2-3 hours spotlighting each night (total of 12 person hours). Spotlighting was undertaken during wet weather	– SGIC SDA – Northern Section
Hirundapus caudacutus White-throated needletail	– Almost exclusively aerial, foraging at heights up to cloud height (DCCEEW 2022) – Occurs over most types of habitats, but are most often above wooded areas (DCCEEW 2022) – Roosts in trees amongst dense foliage in the canopy or in hollows (DCCEEW 2022).	Survey guidelines for the white-throated needletail are detailed in the SPRAT database (DCCEEW 2022): – Surveys to be undertaken between October and April in northern and eastern Australia.	Survey effort for the white-throated needletail: – Bird census at 27 sites for 20 minutes.	– GSDA – SGIC SDA – Northern Section
Ninox strenua Powerful owl	– Wet and dry tall open eucalypt forest (*Eucalyptus pilularis, E. acmenoides, E. tereticornis, E. camaldulensis, E. crebra, E. melliodora, Corymbia citriodora* and *C. intermedia*) (DoR 2022a) – Roosts in dense foliage of closed forest and forages in open forest and woodland (DoR 2022a) – Nests in large hollows (DoR 2022a) – Presence of mature, hollow-bearing trees which provide den sites for the hollow-dwelling arboreal mammals which form the bulk of its prey (DoR 2022a).	Surveys for the powerful owl were undertaken in accordance with the *Approved Survey Standards: Powerful Owl* Ninox strenua (DSE 2011a): – Call playback of 2 to 5 minutes of continuous calls – Dusk or dawn watches – Daytime searches of the species roosting among the foliage and signs on the ground.	Survey effort for the powerful owl included: – Fauna habitat assessments at 74 sites – Bird surveys at dusk at three sites for 20 minutes – Bird census at 23 sites for 20 minutes Opportunistic searches for the species and indirect traces including faeces and owl pellets in suitable habitat.	– GSDA – SGIC SDA

Species	Habitat requirements	Survey guidelines	Survey effort	Pipeline Section
Petauroides volans Greater glider (southern and central)	– Restricted to mature eucalypt forests and woodlands with a high density of mature hollow-bearing trees (DCCEEW 2022a) – Species dens in large hollows (diameter >10 cm) in mature trees (DCCEEW 2022a) – Species requires a diversity of suitable foraging trees. Species forages on eucalypt leaves and occasionally flowers (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) – 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).	In the absence of Commonwealth survey guidelines, survey methods were designed to align with the following guidelines and recommended survey approaches: – The Action Plan for Australian Mammals 2012 (Woinarski *et al*. 2014) – The Survey Guidelines for Australia's Threatened Mammals: Guidelines for detecting mammals listed under the EPBC Act (Commonwealth of Australia 2010c) – Survey Standards: Greater Glider, *Petauroides volans* (MacHunter *et al*. 2011) – Terrestrial Vertebrate Survey Guidelines for Queensland (Eyre *et al*. 2018).	Survey effort for the greater glider included: – Faecal pellet searches at 21 sites to detect species presence – Fauna habitat assessments at 74 sites – Nocturnal spotlighting transects within suitable woodland environments, where access and terrain permitted. Spotlighting was undertaken by two people over four nights, with 2-3 hours spotlighting each night, equating to a total of 24 person hours. Spotlighting transects are considered to be the most effective and efficient method for identifying the greater glider (Lindenmayer *et al*. 2001) – Large tree density assessment using the *Guide to greater glider habitat in Queensland* (Eyre 2022) at eight sites – Hollow-bearing tree count transects were undertaken at 15 sites within suitable glider habitat to assist in the mapping of predicted habitat for the species.	– GSDA – SGIC SDA

Species	Habitat requirements	Survey guidelines	Survey effort	Pipeline Section
Petaurus australis australis Yellow-bellied glider (south-eastern)	– Inhabits eucalypt dominated woodlands and forests, including wet and dry sclerophyll (DAWE 2022a) – Subspecies prefers large patches of mature old growth forests as well as forests retaining a high proportion of winter-flowering and smooth-barked eucalypts (DAWE 2022a) – Require floristic diversity – species are unlikely to persist in forests dominated by only one to two tree species (DAWE 2022a) – During the day, the species shelters in hollows of large, old trees, typically more than one metre in diameter (DAWE 2022a).U	Surveys for the yellow-bellied glider were undertaken in accordance with the *Approved Survey Standards: Yellow-bellied Glider* Petaurus australis (DSE 2011b): – Spotlighting transects (minimum 1 km) after dusk – Listening periods (10 minutes) – Call playback of predator calls to elicit response (three minutes broadcast of powerful owl, two minutes listening period).	Survey effort for the yellow-bellied glider included: – Faecal pellet searches at 21 sites to detect species presence – Fauna habitat assessments at 74 sites – Nocturnal spotlighting transects within suitable woodland environments, where access and terrain permitted. Spotlighting was undertaken by two people over four nights, with 2-3 hours spotlighting each night, equating to a total of 24 hours. – Hollow-bearing tree count transects were undertaken at 15 sites within suitable glider habitat to assist in the mapping of predicted habitat for the species.	– GSDA – SGIC SDA
Phascolarctos cinereus Koala	– Feeds on the leaves of select species of *Eucalyptus*, *Lophostemon*, *Corymbia*, *Angophora* and occasionally *Melaleuca* and *Leptospermum* (DAWE 2022c) – Coastal koala habitat includes forest and woodland mostly dominated by *Eucalyptus* species (or those of related genera) and also those dominated by *Melaleuca* or *Casuarina* species (with emergent food trees). It also includes small, isolated patches of native vegetation in rural areas, windbreaks and narrow areas of native vegetation along riparian areas or linear infrastructure, and isolated koala food trees in open landscapes (DoE 2014).	Surveys for the koala were undertaken using methods recommended in Section 5 of the 'Referral guidelines for the vulnerable koala' (DoE 2014).	Survey effort for the koala included: – Faecal pellet searches using the SAT survey method (Phillips and Callaghan 2011) at 25 sites – Fauna habitat assessments at 99 sites – Nocturnal spotlighting transects within suitable woodland environments, where access and terrain permitted. Spotlighting was undertaken by two people over four nights, with 2-3 hours spotlighting each night, equating to a total of 24 hours.	– GSDA – Northern Section – SGIC SDA

Species	Habitat requirements	Survey guidelines	Survey effort	Pipeline Section
Pteropus poliocephalus Grey-headed flying-fox	– Highly colonial species (DAWE 2021) – Forests and woodland vegetation communities providing roosting opportunities, with foraging resources within foraging distance (40 km) (DAWE 2022b; DAWE 2021) – Forage on fruit and blossom of myrtaceous and rainforest species, diet is supplemented with leaves (DAWE 2021) – Roost in large aggregations (camps) used as day refuges to rest between foraging in surrounding areas, and refuge for significant stages of the species lifecycle (DAWE 2021).	Surveys for the grey-headed flying-fox were undertaken in accordance with the *Survey guidelines for Australia's threatened bats* (Commonwealth of Australia 2010a). – Desktop review of known flying-fox camps prior to the field survey – Daytime searches for flying-fox camps – Surveys of vegetation communities and food plants – Night time surveys to detect species	Survey effort for the grey-headed flying-fox included: – Desktop review of the National flying-fox monitoring viewer (DAWE 2020) as well as WildNet and ALA – Fauna habitat assessments at 74 sites – Nocturnal spotlighting transects within suitable woodland environments, where access and terrain permitted. Spotlighting was undertaken by two people over four nights, with 2-3 hours spotlighting each night, equating to a total of 24 hours.	– GSDA – SGIC SDA
Rostratula australis Australian painted snipe	– Inhabits shallow terrestrial freshwater and brackish wetlands, including temporary and permanent lakes, swamps and claypans. The Murray Darling Basin is considered a stronghold for the species (DCCEEW 2022) – Species requires specific breeding habitat – shallow wetlands with areas of bare wet mud and nearby canopy cover (DCCEEW 2022) – Species is more active at dawn, dusk and during night, and shelters under grass, reeds or other dense vegetation during the day (DCCEEW 2022).	Surveys for the Australian painted snipe were undertaken in accordance with the *Survey guidelines for Australia's threatened birds* (Commonwealth of Australia 2010b): – Area searches or transects through suitable wetlands – Dawn and dusk stationary bird surveys – Brief spotlight search just after dusk.	Survey effort for the Australian painted snipe included: – Fauna habitat assessments at 102 sites – Area searches and flushing surveys in suitable wetland habitats for a minimal of 30 km – Bird census at 22 sites for 20 minutes.	– SGIC SDA – Northern Section
Key to table: (*) – introduced flora species.				



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Terrestrial Fauna Assessment Site

- Active Searches
- Anabat Detector Location
- Bird Surveys
- Remote Camera Location
- SAT Survey Site
- Terrestrial Fauna Assessment Site
- Hollow-bearing Tree Counts
- Spotlighting Transect
- Study Area
- Fitzroy to Gladstone Pipeline Alignment
- Main Roads
- Railways
- Waterbody

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Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 2-2a
Distribution of Terrestrial Fauna Survey Sites Within the Study Area
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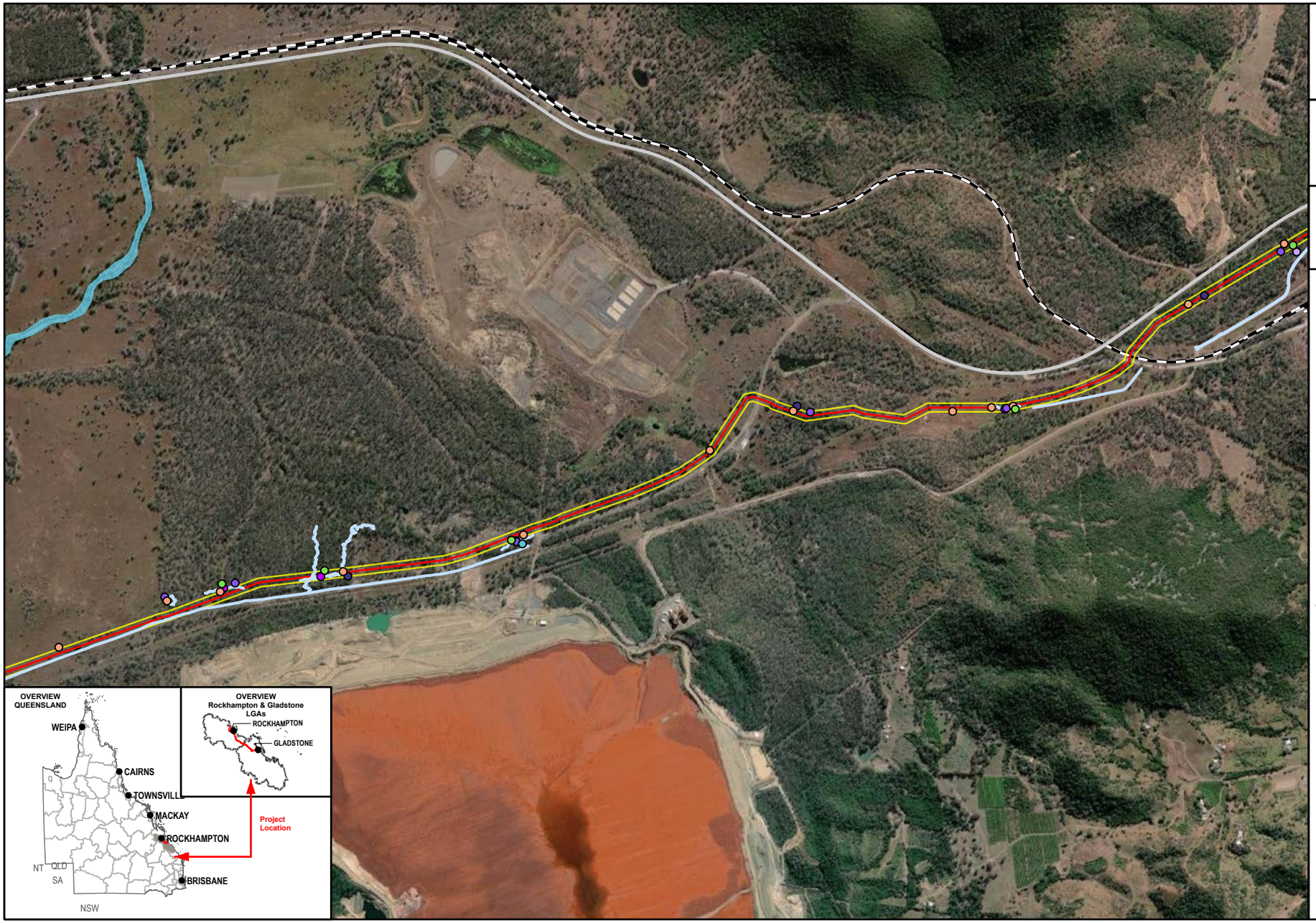

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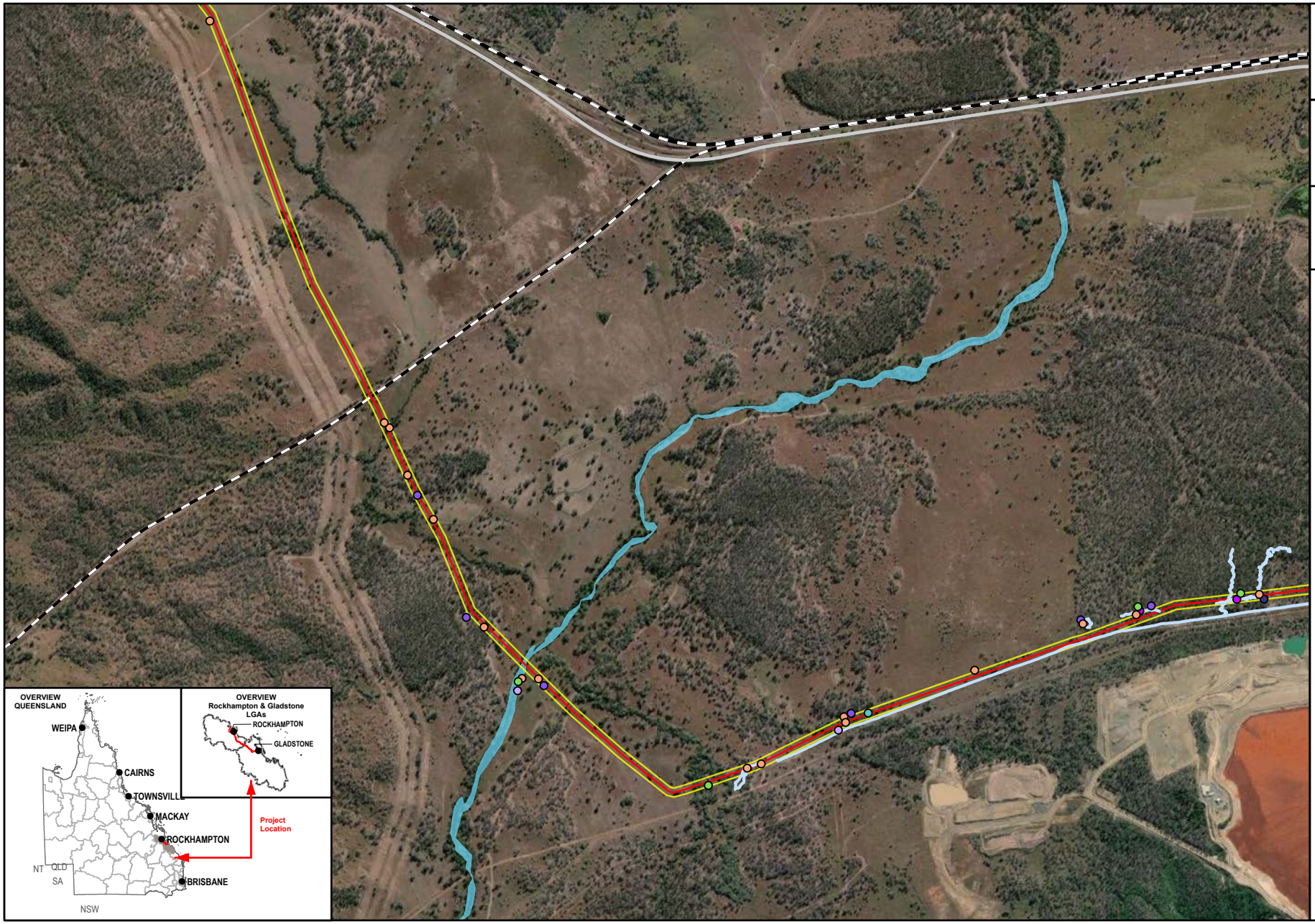

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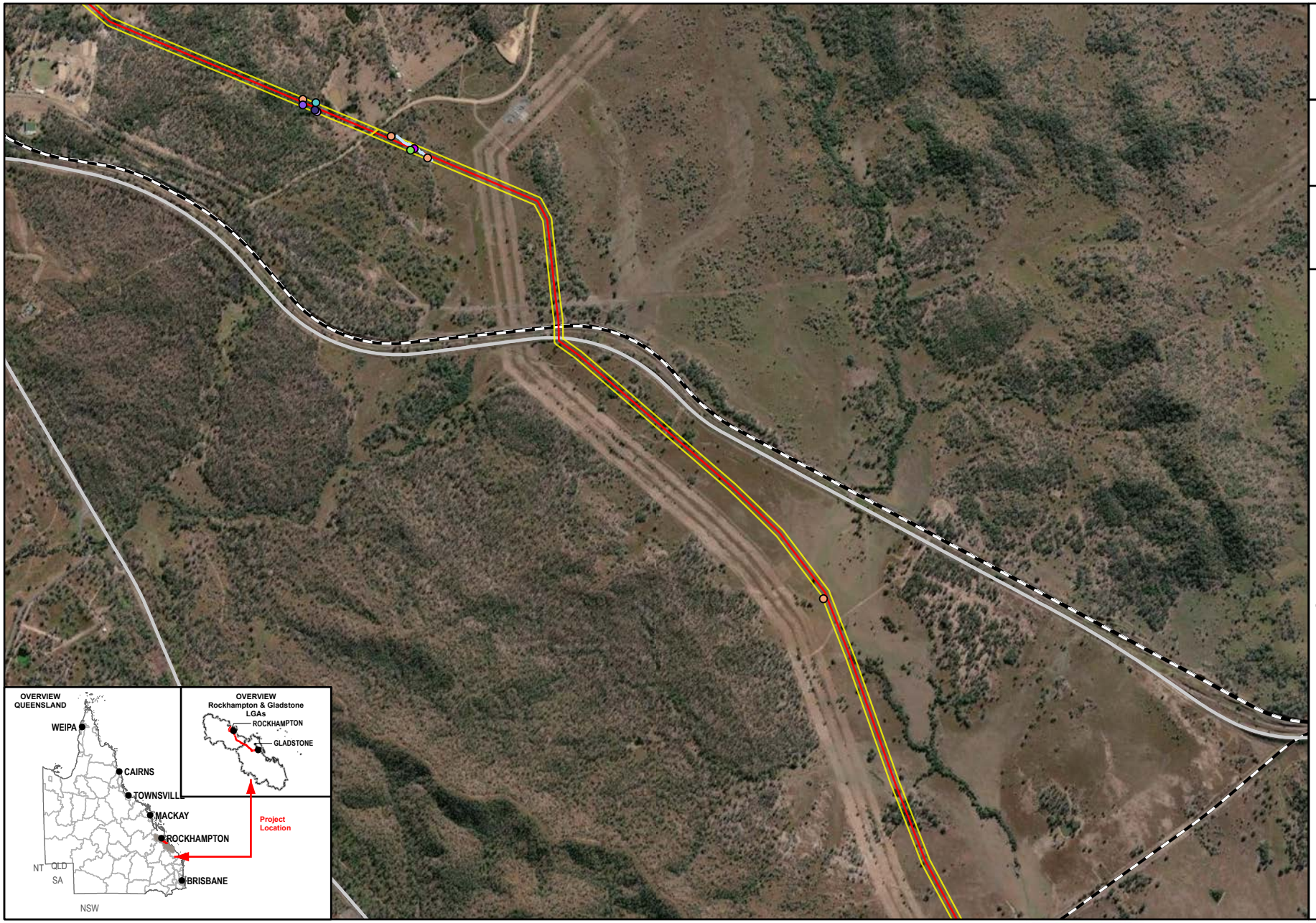
Distribution of Terrestrial Fauna Survey Sites Within the Study Area
000-G-MAP-2402 Version:2 Date: 3/08/2022



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Legend

Terrestrial Fauna Assessment Site

- Active Searches
- Anabat Detector Location
- Bird Surveys
- Remote Camera Location
- SAT Survey Site
- Terrestrial Fauna Assessment Site
- Hollow-bearing Tree Counts
- Spotlighting Transect
- Study Area
- Fitzroy to Gladstone Pipeline Alignment
- 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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(Datum GDA2020)

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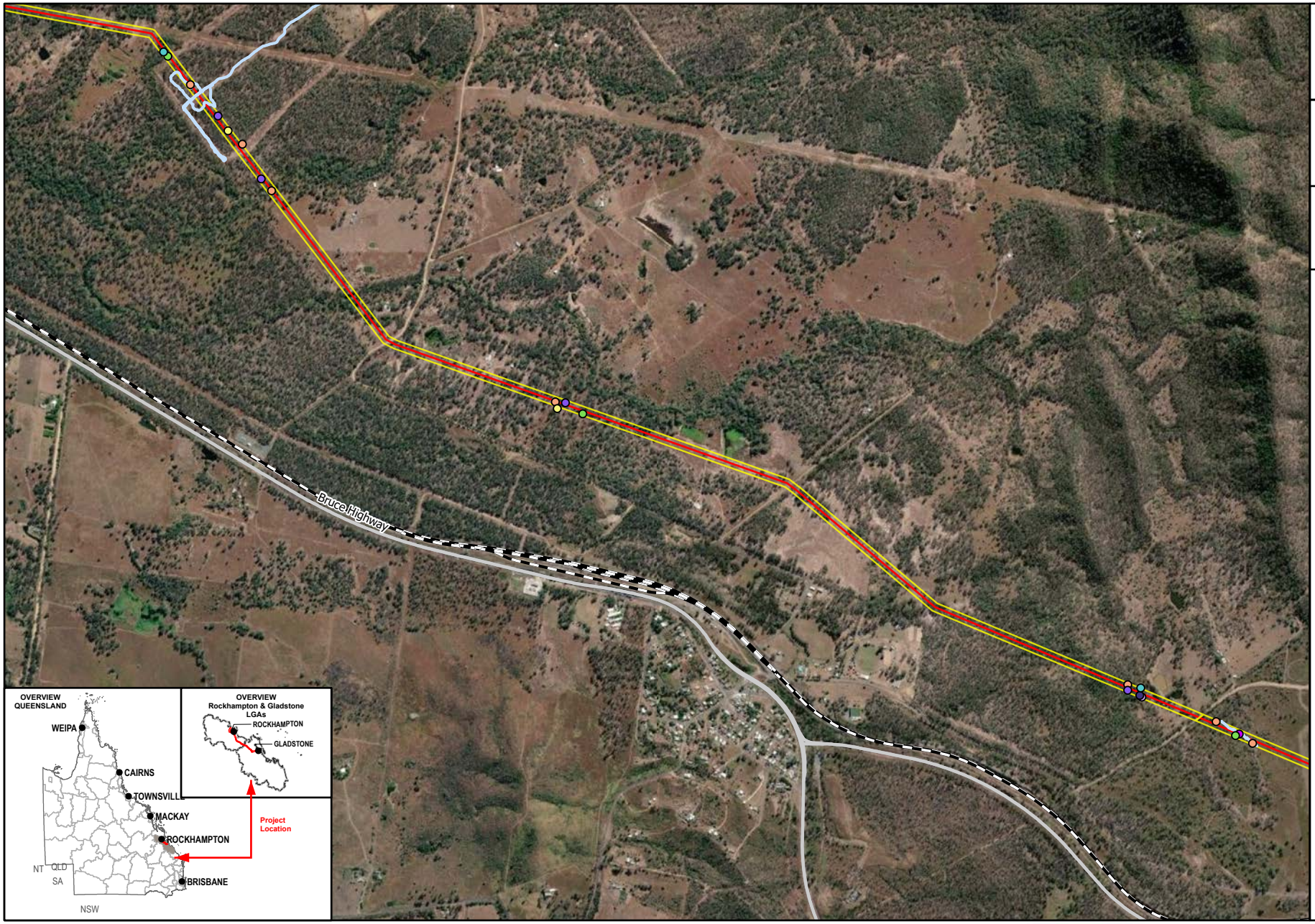
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 2-2d
Distribution of Terrestrial Fauna Survey Sites Within the Study Area
000-G-MAP-2402 Version:2 Date: 3/08/2022



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Terrestrial Fauna Assessment Site

- Active Searches
- Anabat Detector Location
- Bird Surveys
- Large Tree Density Assessment
- Remote Camera Location
- SAT Survey Site
- Terrestrial Fauna Assessment Site
- Hollow-bearing Tree Counts
- Spotlighting Transect
- Study Area
- Fitzroy to Gladstone Pipeline Alignment
- Main Roads
- Railways

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(Datum GDA2020)

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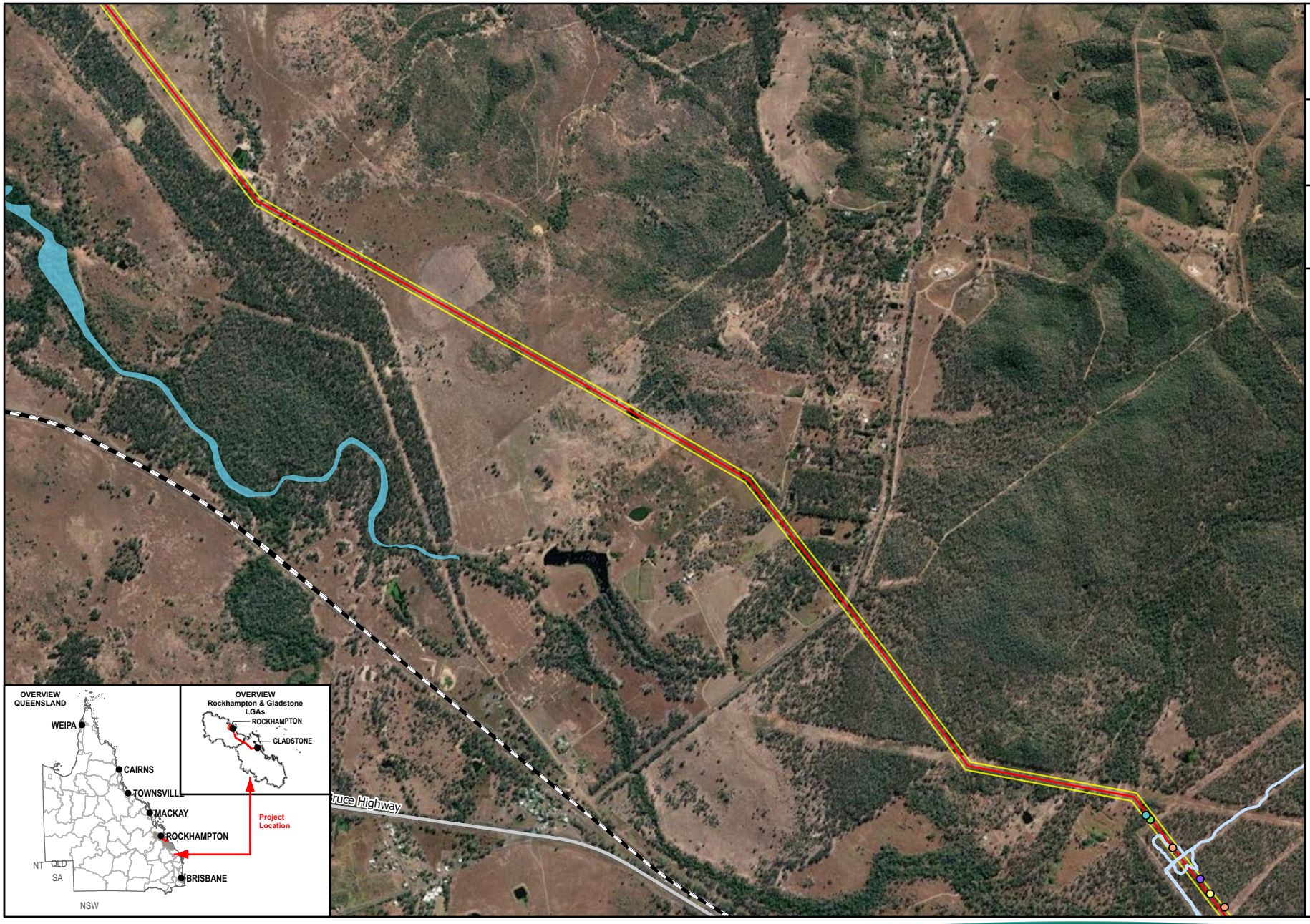
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 2-2e
Distribution of Terrestrial Fauna Survey Sites Within the Study Area
000-G-MAP-2402 Version:2 Date: 3/08/2022



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Terrestrial Fauna Assessment Site

- Active Searches
- Bird Surveys
- Large Tree Density Assessment
- SAT Survey Site
- Terrestrial Fauna Assessment Site
- Spotlighting Transect
- Study Area
- Fitzroy to Gladstone Pipeline Alignment
- Main Roads
- Railways
- Waterbody

Data Sources:

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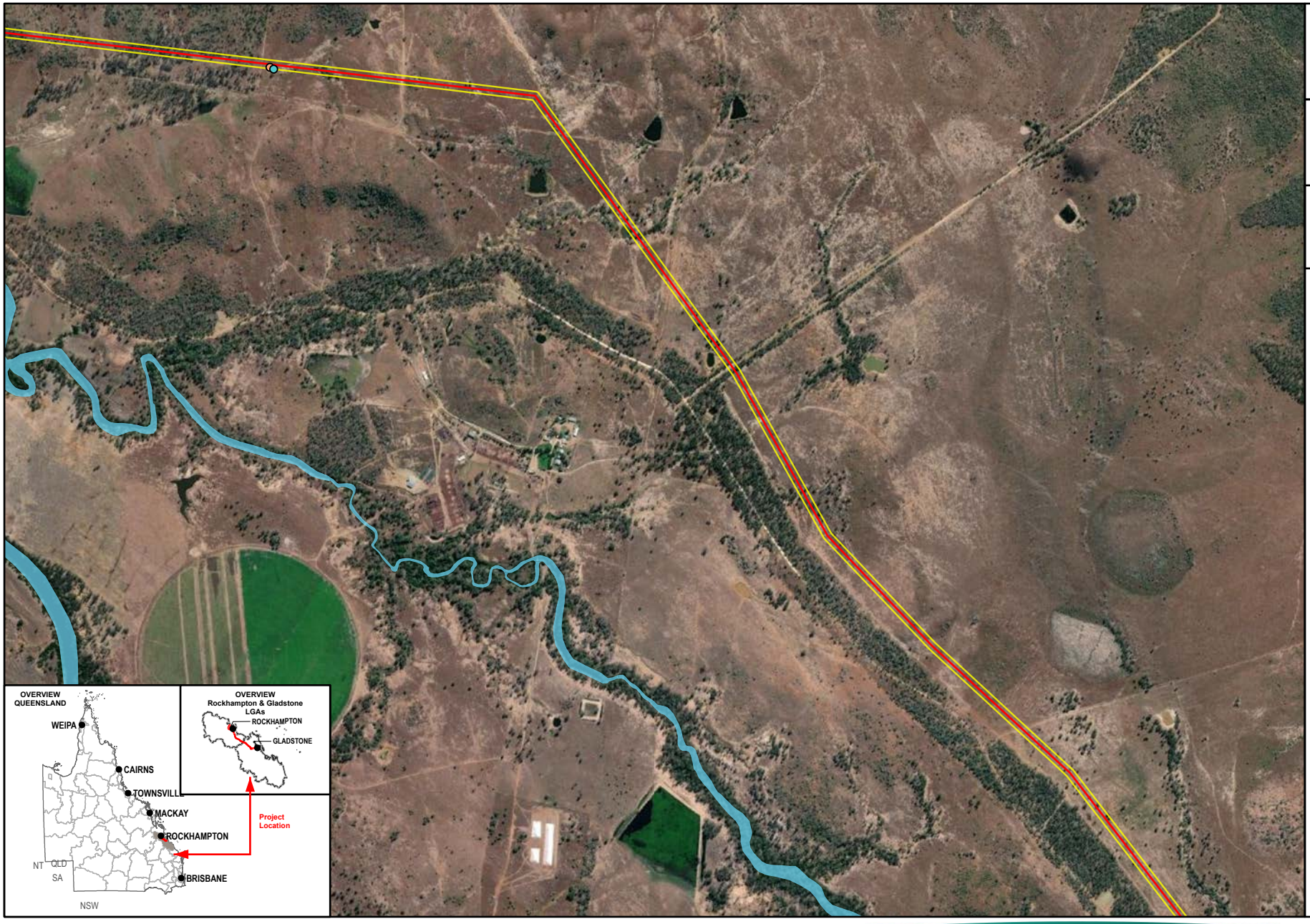
Fitzroy to Gladstone Pipeline Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 2-2f
Distribution of Terrestrial Fauna Survey Sites Within the Study Area
000-G-MAP-2402 Version:2 Date: 3/08/2022



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Terrestrial Fauna Assessment Site

- Active Searches
- Terrestrial Fauna Assessment Site
- Study Area
- Fitzroy to Gladstone Pipeline Alignment
- Main Roads
- Railways
- Waterbody

Data Sources:

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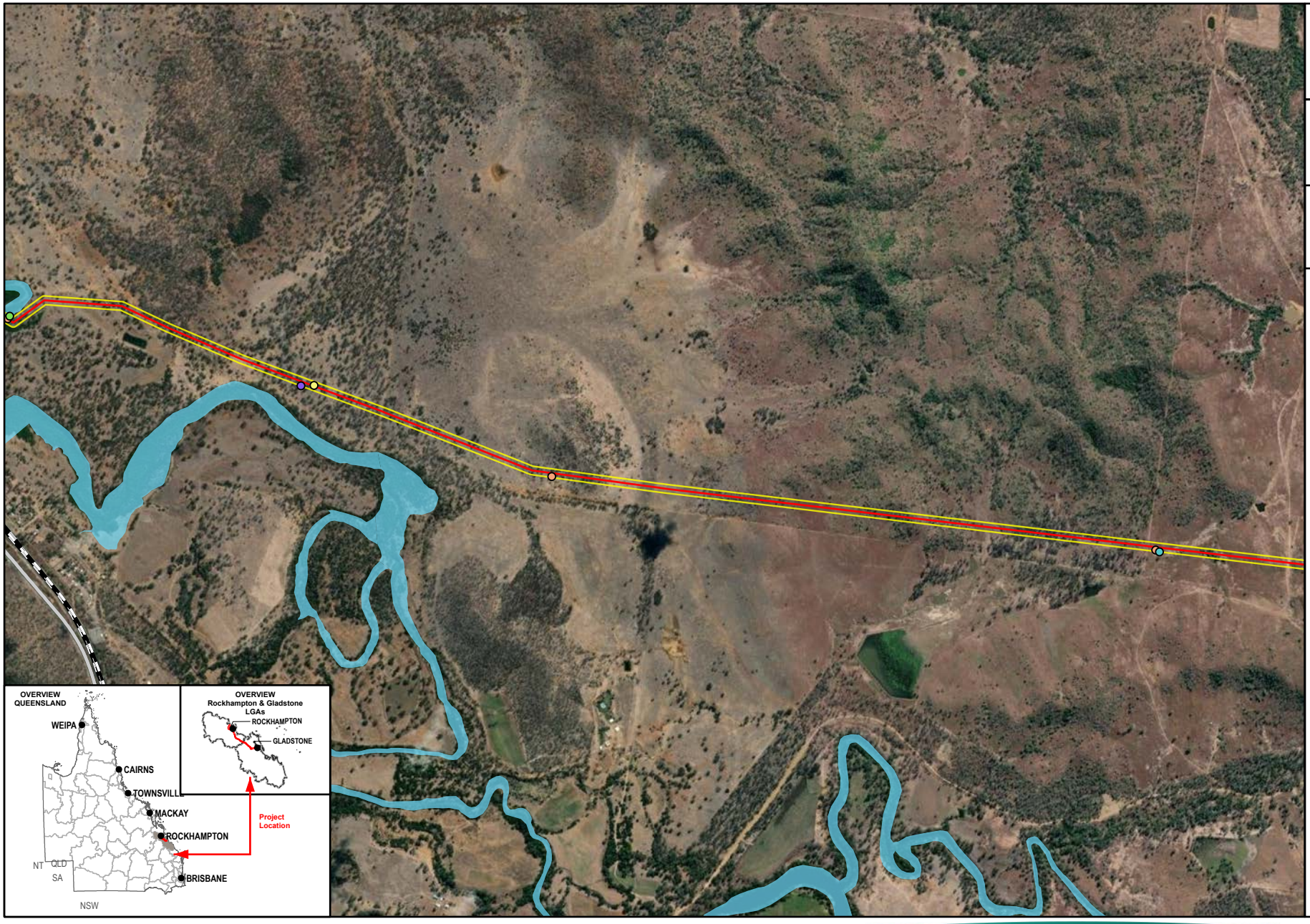
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 2-2g
Distribution of Terrestrial Fauna Survey Sites Within the Study Area
000-G-MAP-2402 Version:2 Date: 3/08/2022



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Terrestrial Fauna Assessment Site

- Active Searches
- Bird Surveys
- Large Tree Density Assessment
- SAT Survey Site
- Terrestrial Fauna Assessment Site
- Study Area
- Fitzroy to Gladstone Pipeline Alignment
- Main Roads
- Railways
- Waterbody

Data Sources:
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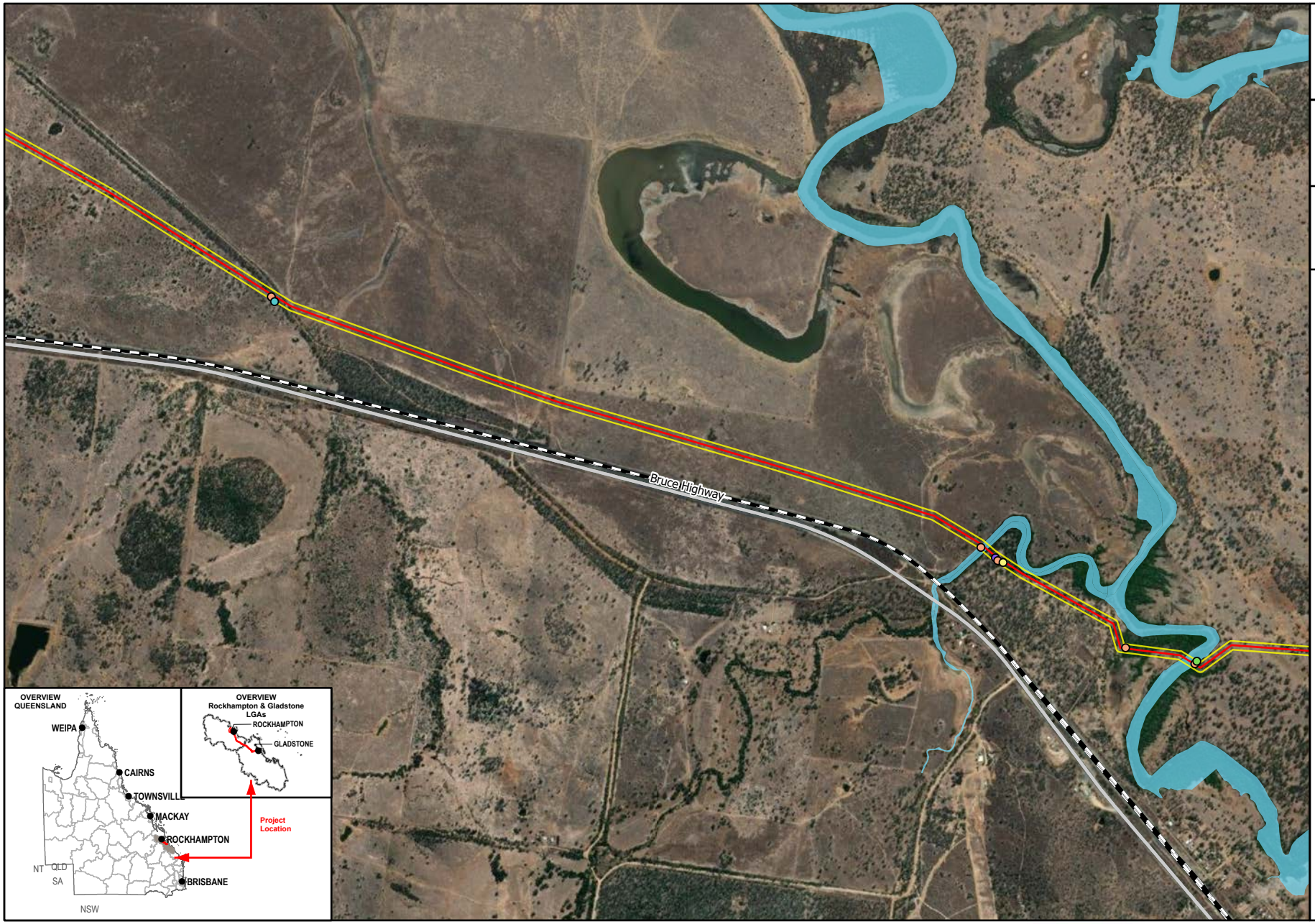
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 2-2h
Distribution of Terrestrial Fauna Survey Sites Within the Study Area
000-G-MAP-2402 Version:2 Date: 3/08/2022



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Terrestrial Fauna Assessment Site

- Active Searches
- Bird Surveys
- Large Tree Density Assessment
- SAT Survey Site
- Terrestrial Fauna Assessment Site
- Study Area
- Fitzroy to Gladstone Pipeline Alignment
- Main Roads
- Railways
- Waterbody

Data Sources:

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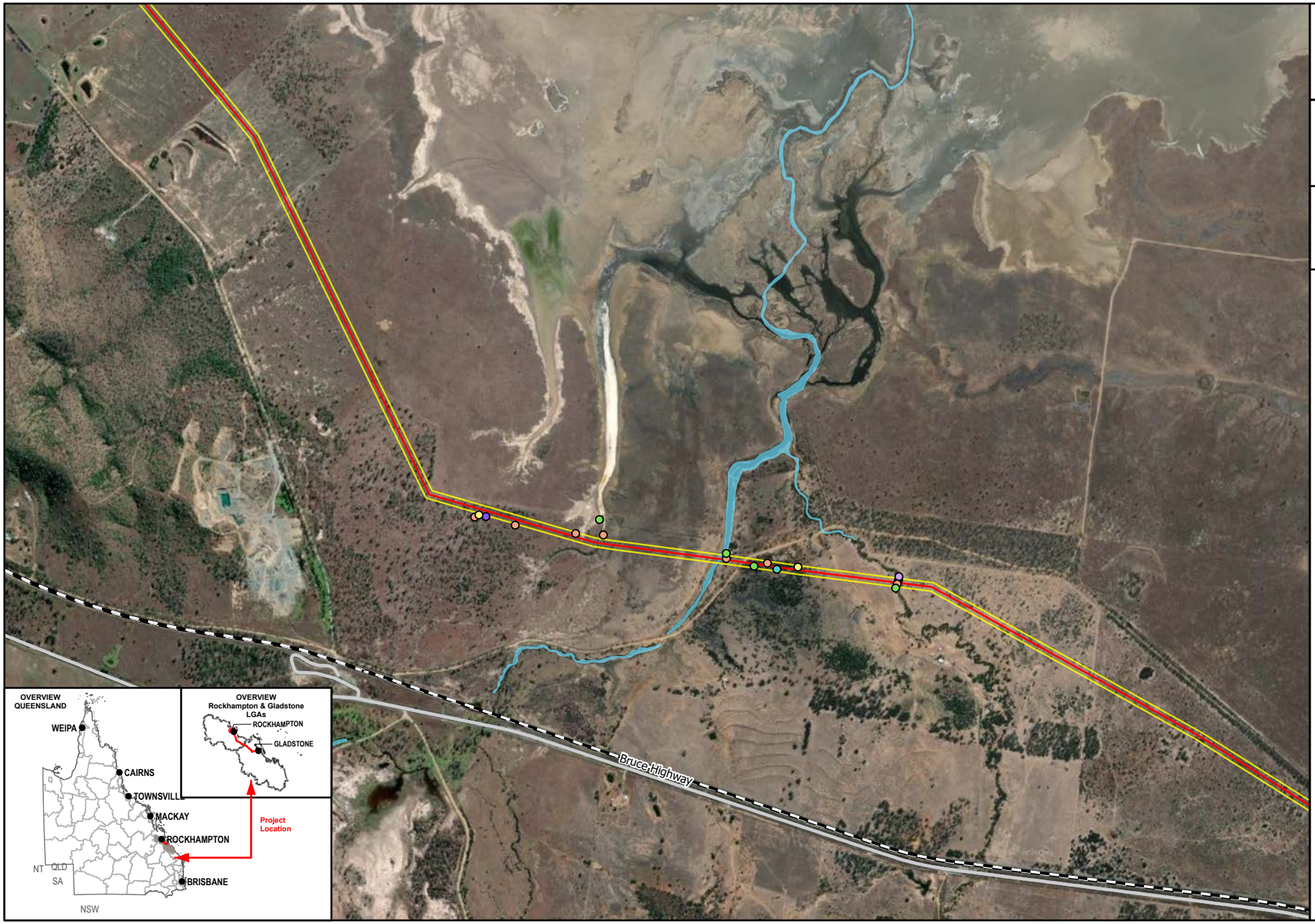
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 2-2i
Distribution of Terrestrial Fauna Survey Sites Within the Study Area
000-G-MAP-2402 Version:2 Date: 3/08/2022



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Terrestrial Fauna Assessment Site

- Active Searches
- Anabat Detector Location
- Bird Surveys
- Large Tree Density Assessment
- Remote Camera Location
- SAT Survey Site
- Terrestrial Fauna Assessment Site
- Study Area
- Fitzroy to Gladstone Pipeline Alignment
- Main Roads
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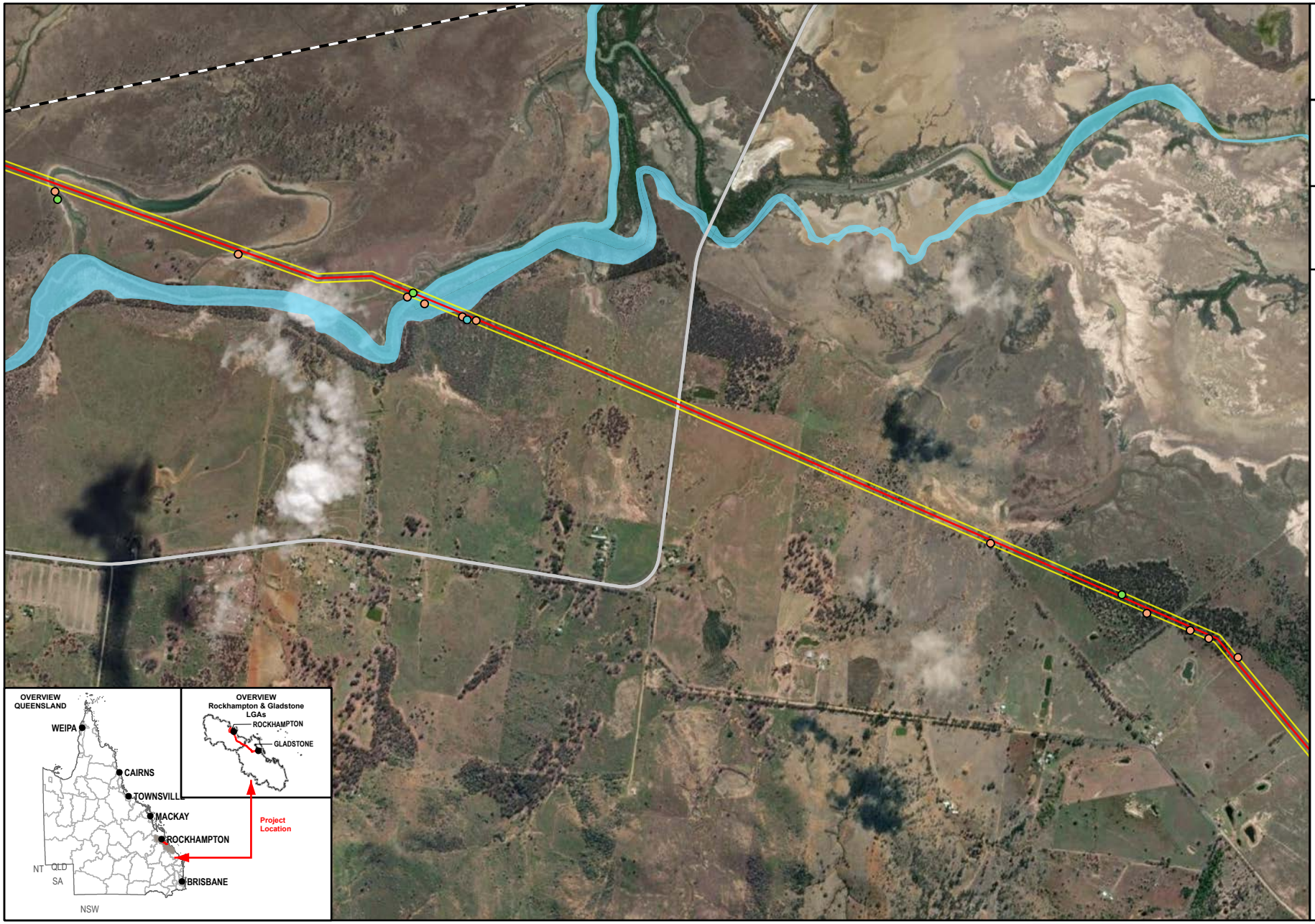
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 2-2j
Distribution of Terrestrial Fauna Survey Sites Within the Study Area
000-G-MAP-2402 Version:2 Date: 3/08/2022



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Terrestrial Fauna Assessment Site

- Active Searches
- Bird Surveys
- Terrestrial Fauna Assessment Site
- Study Area
- Fitzroy to Gladstone Pipeline Alignment
- Main Roads
- Railways
- Waterbody

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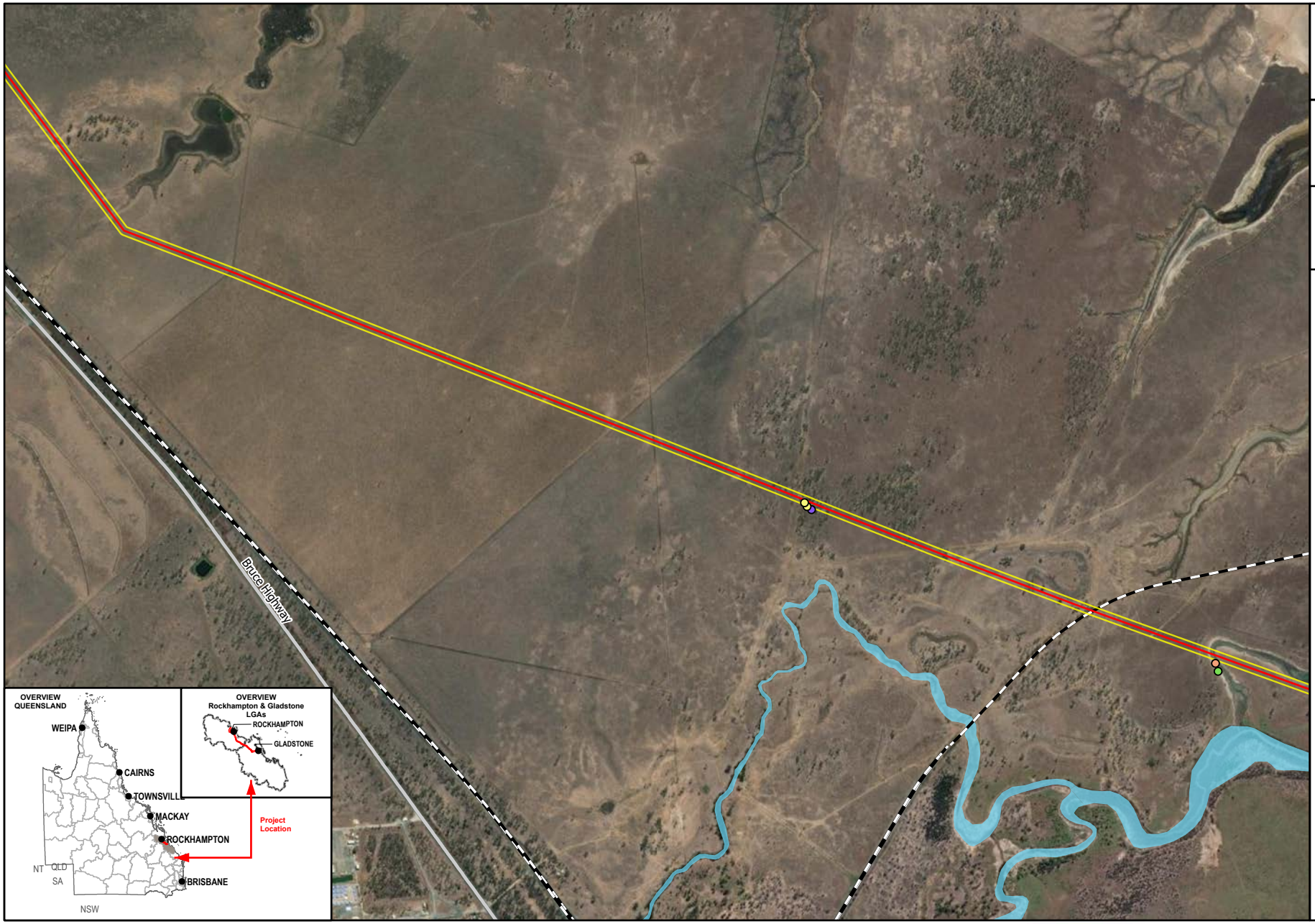
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 2-2k
Distribution of Terrestrial Fauna Survey Sites Within the Study Area
000-G-MAP-2402 Version:2 Date: 3/08/2022



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Terrestrial Fauna Assessment Site

- Bird Surveys
- Large Tree Density Assessment
- SAT Survey Site
- Terrestrial Fauna Assessment Site
- Study Area
- Fitzroy to Gladstone Pipeline Alignment
- Main Roads
- Railways
- Waterbody

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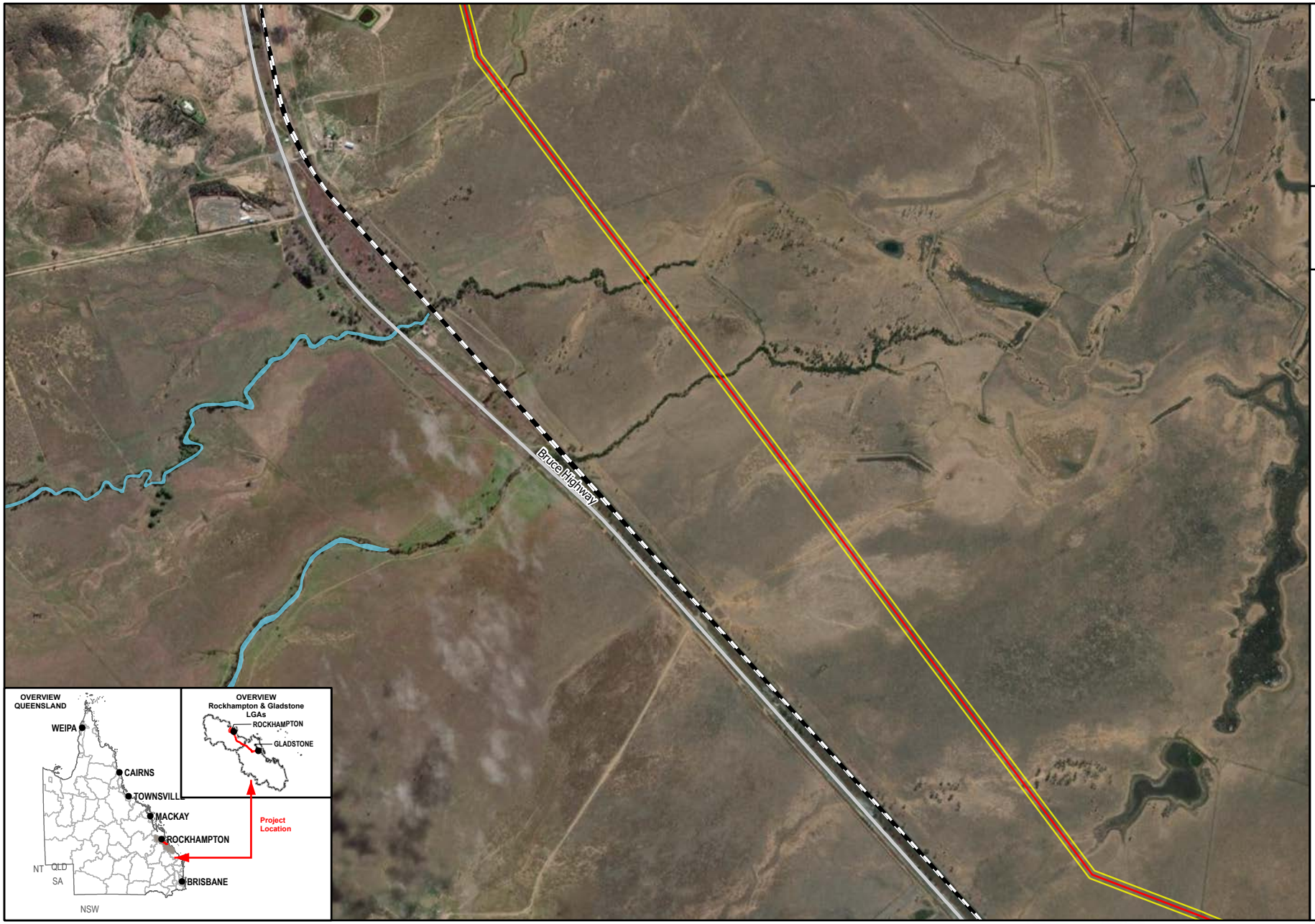
Figure 2-2l
Distribution of Terrestrial Fauna Survey Sites Within the Study Area
000-G-MAP-2402 Version:2 Date: 3/08/2022



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- Study Area
- Fitzroy to Gladstone Pipeline Alignment
- Main Roads
- Railways
- Waterbody

Data Sources:
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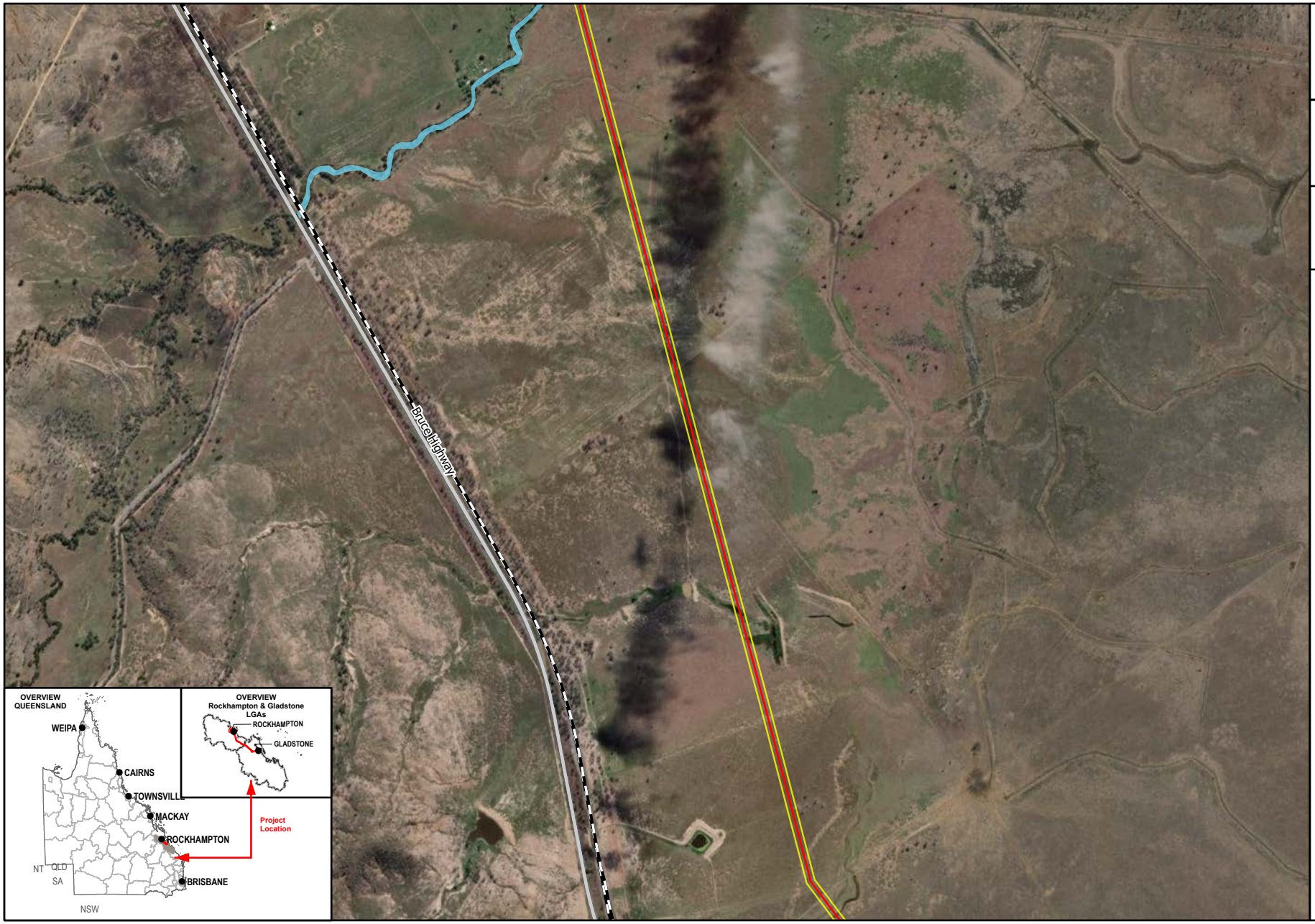
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 2-2m
Distribution of Terrestrial Fauna Survey Sites Within the Study Area
000-G-MAP-2402 Version:2 Date: 3/08/2022



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- Study Area
- Fitzroy to Gladstone Pipeline Alignment
- Main Roads
- Railways
- Waterbody

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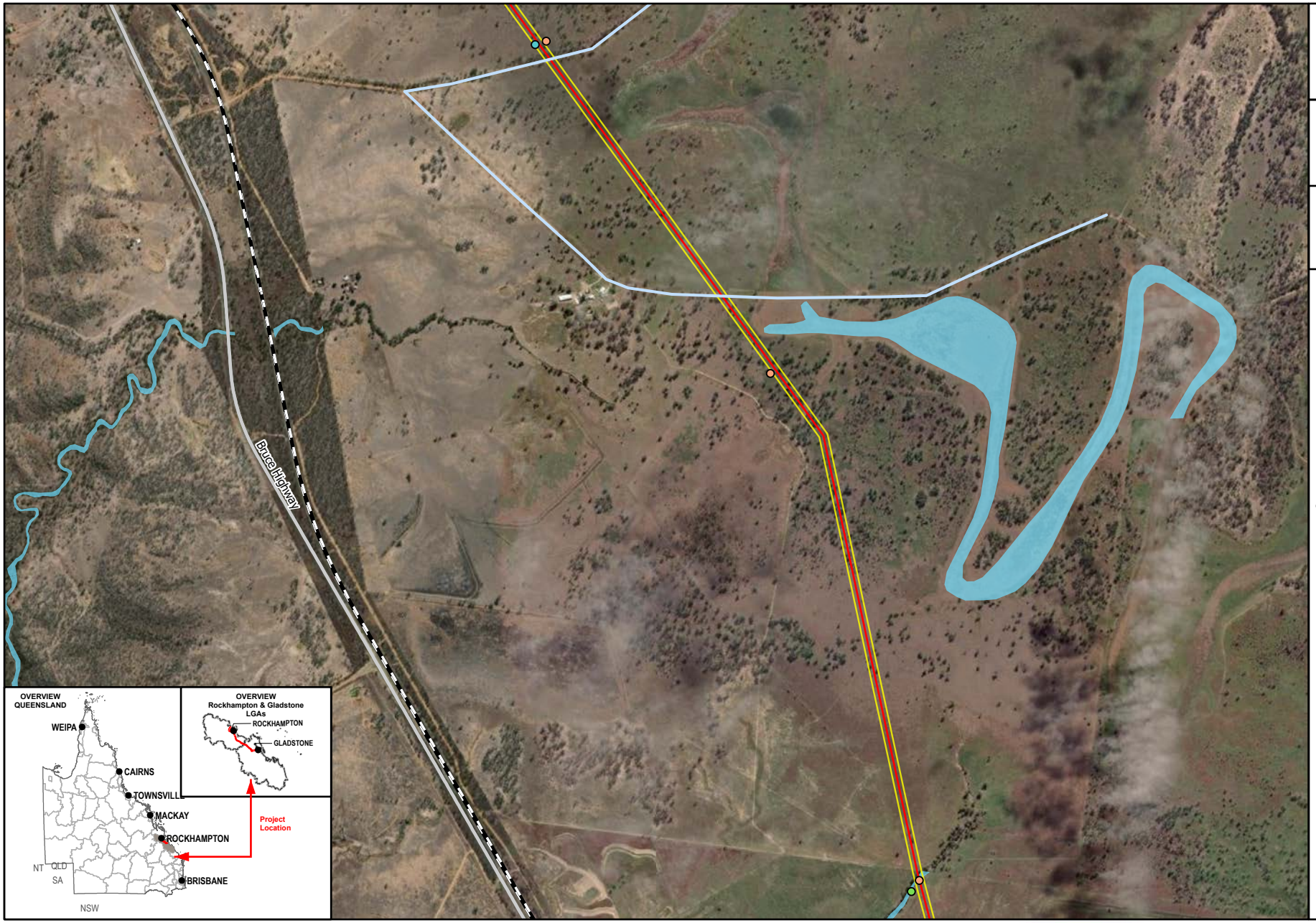
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 2-2n
Distribution of Terrestrial Fauna Survey Sites Within the Study Area
000-G-MAP-2402 Version:2 Date: 3/08/2022



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Terrestrial Fauna Assessment Site

- Active Searches
- Bird Surveys
- Terrestrial Fauna Assessment Site
- Spotlighting Transect
- Study Area
- Fitzroy to Gladstone Pipeline Alignment
- Main Roads
- Railways
- Waterbody

Data Sources:

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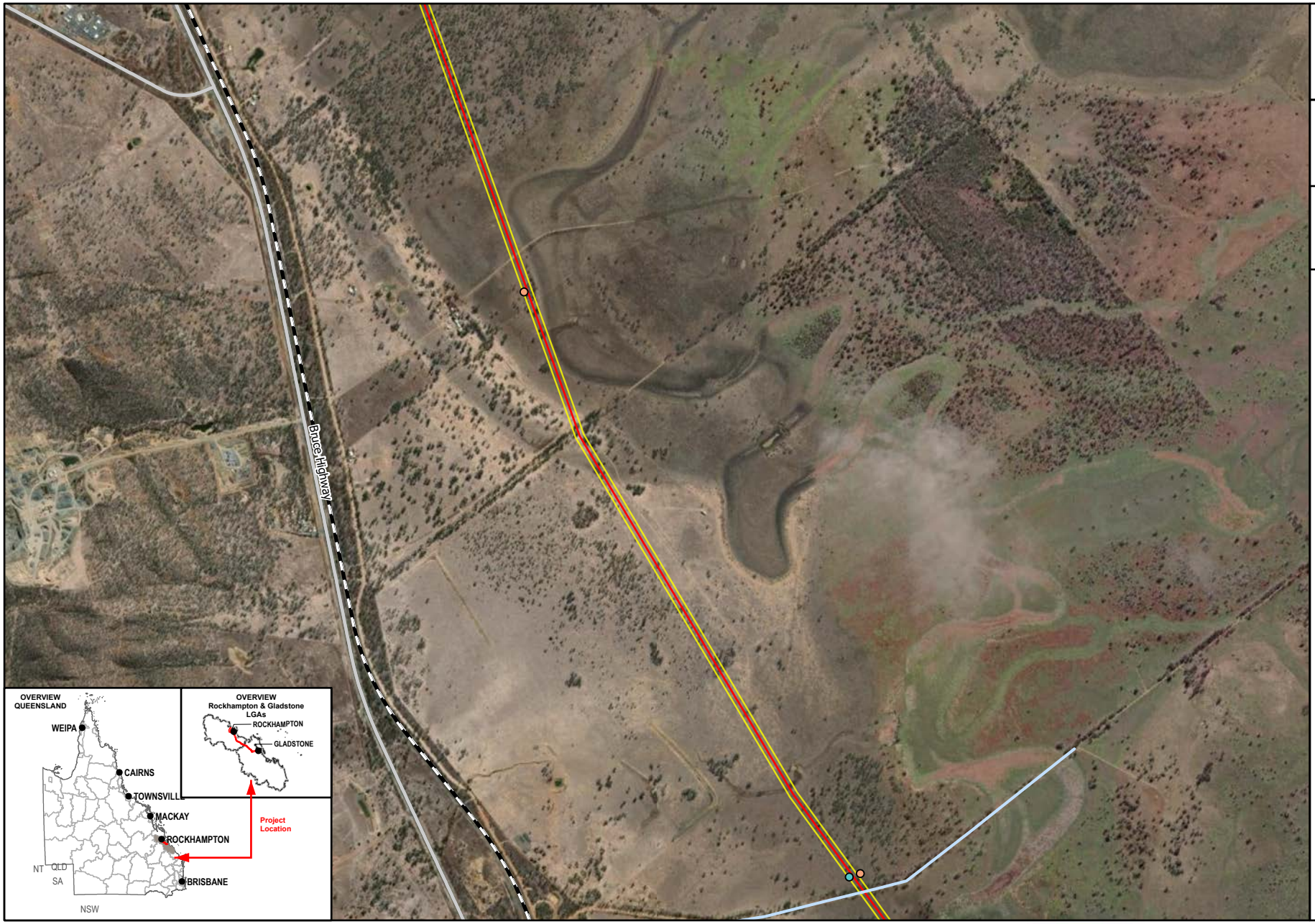
Figure 2-2o
Distribution of Terrestrial Fauna Survey Sites Within the Study Area
000-G-MAP-2402 Version:2 Date: 3/08/2022



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Terrestrial Fauna Assessment Site

- Active Searches
- Terrestrial Fauna Assessment Site
- Spotlighting Transect
- Study Area
- Fitzroy to Gladstone Pipeline Alignment
- Main Roads
- Railways

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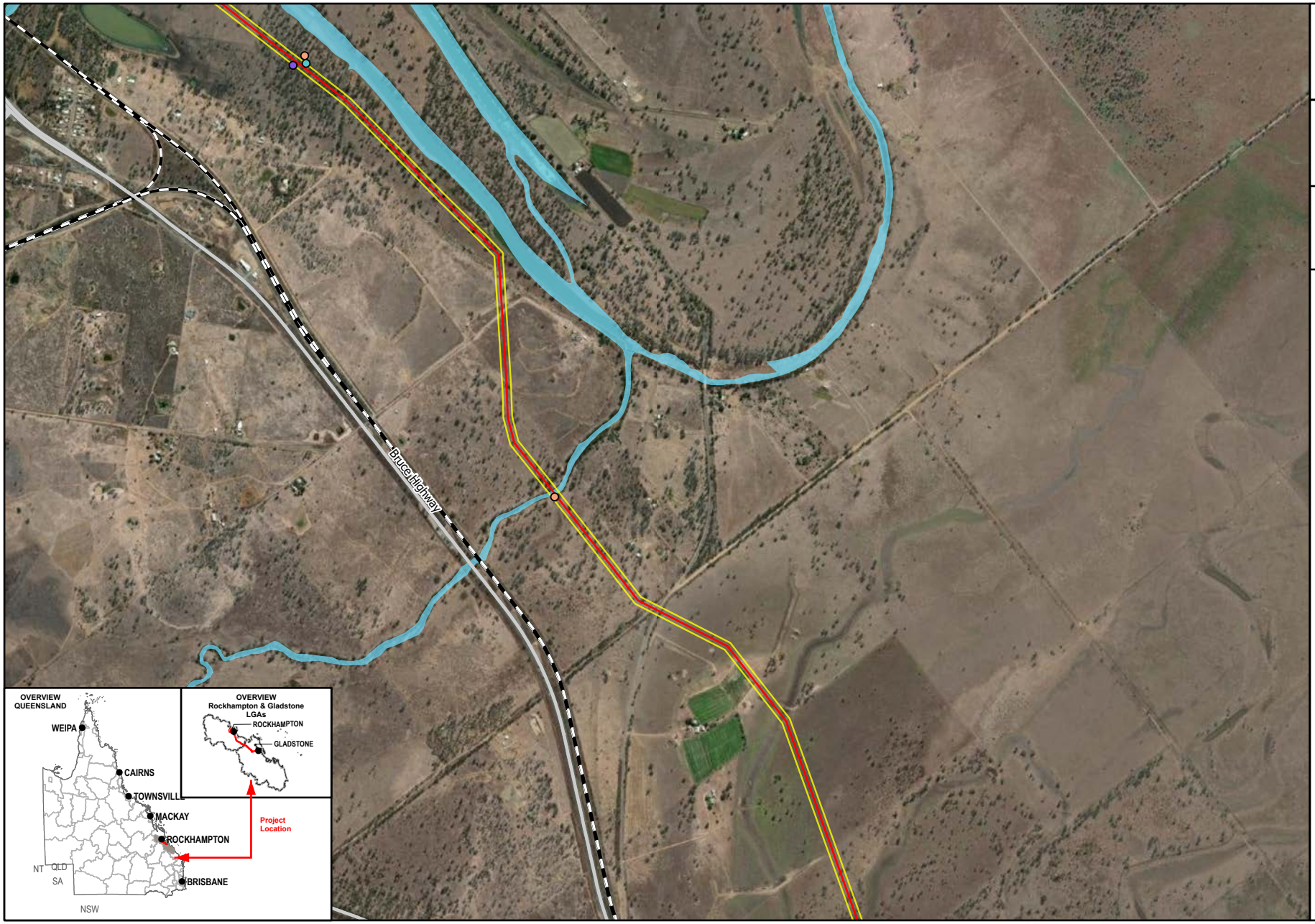
Figure 2-2p
Distribution of Terrestrial Fauna Survey Sites Within the Study Area
000-G-MAP-2402 Version:2 Date: 3/08/2022



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Terrestrial Fauna Assessment Site

- Active Searches
- SAT Survey Site
- Terrestrial Fauna Assessment Site
- Study Area
- Fitzroy to Gladstone Pipeline Alignment
- Main Roads
- Railways
- Waterbody

Data Sources:
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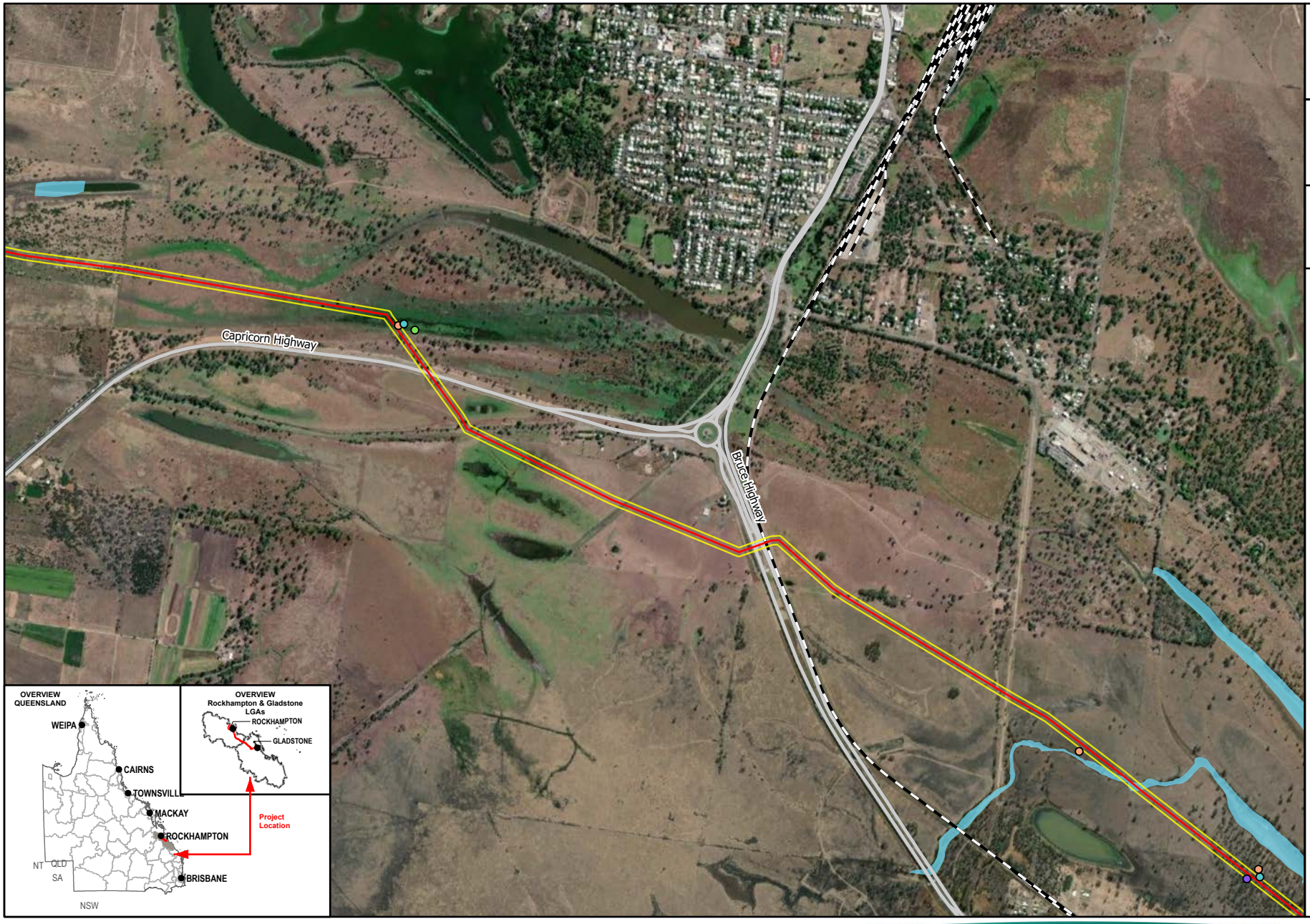
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 2-2q
Distribution of Terrestrial Fauna Survey Sites Within the Study Area
000-G-MAP-2402 Version:2 Date: 3/08/2022



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Terrestrial Fauna Assessment Site

- Active Searches
- Bird Surveys
- SAT Survey Site
- Terrestrial Fauna Assessment Site
- Study Area
- Fitzroy to Gladstone Pipeline Alignment
- Main Roads
- Railways
- Waterbody

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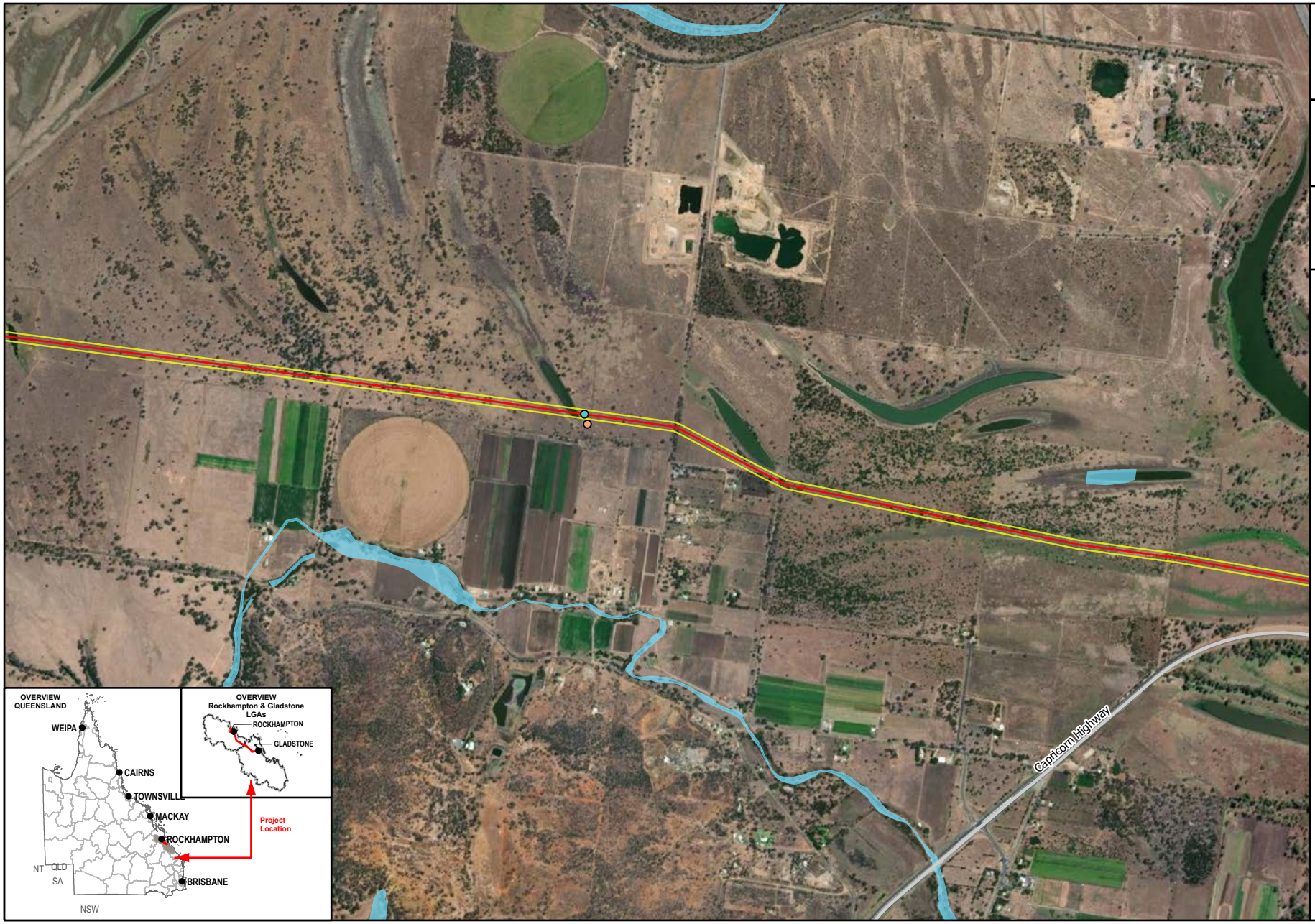
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 2-2r
Distribution of Terrestrial Fauna Survey Sites Within the Study Area
000-G-MAP-2402 Version:2 Date: 3/08/2022



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Terrestrial Fauna Assessment Site

- Active Searches
- Terrestrial Fauna Assessment Site
- Study Area
- Fitzroy to Gladstone Pipeline Alignment
- Main Roads
- Waterbody

Data Sources:

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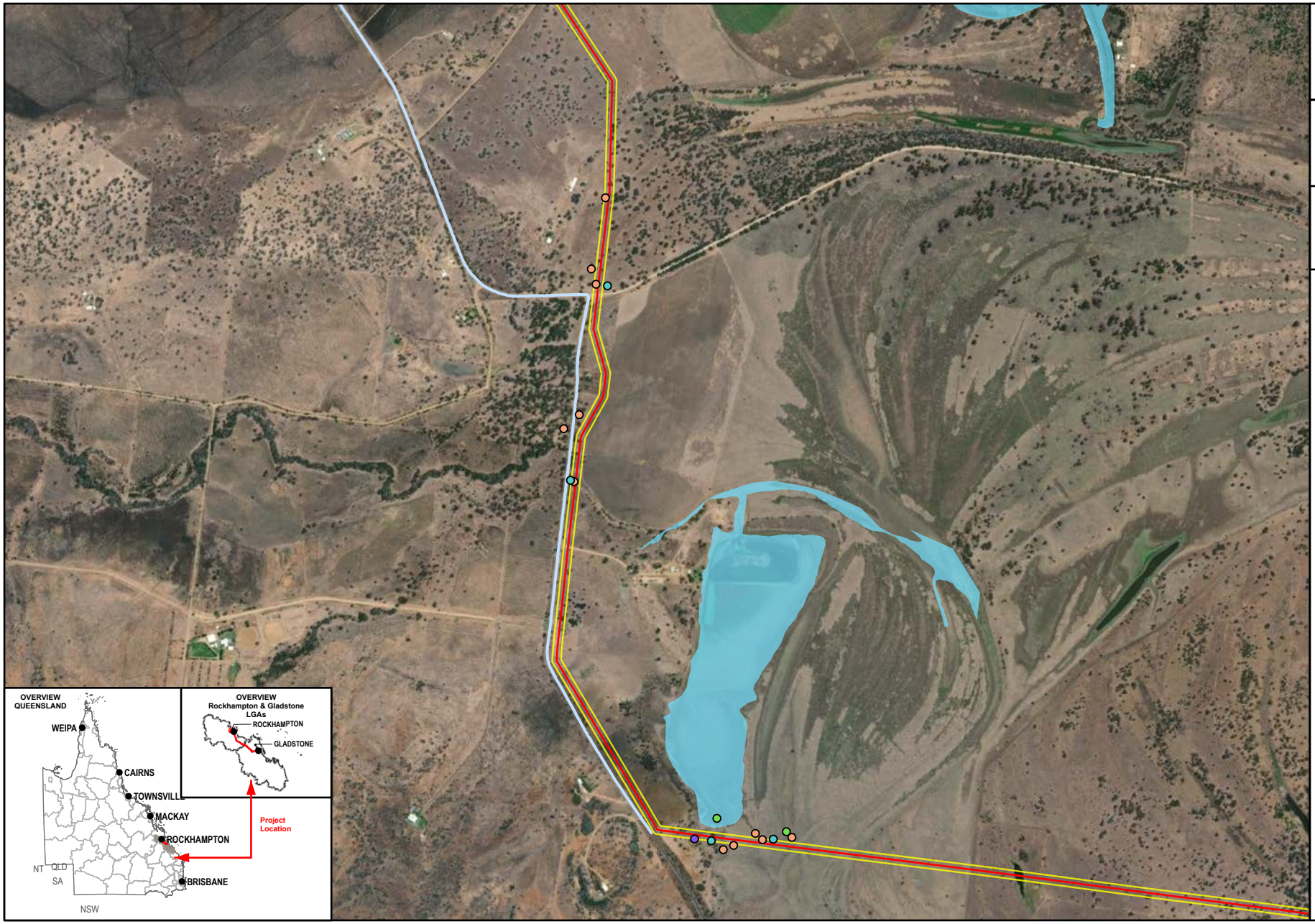
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 2-2s
Distribution of Terrestrial Fauna Survey Sites Within the Study Area
000-G-MAP-2402 Version:2 Date: 3/08/2022



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Terrestrial Fauna Assessment Site

- Active Searches
- Bird Surveys
- SAT Survey Site
- Terrestrial Fauna Assessment Site
- Spotlighting Transect
- Study Area
- Fitzroy to Gladstone Pipeline Alignment
- Waterbody

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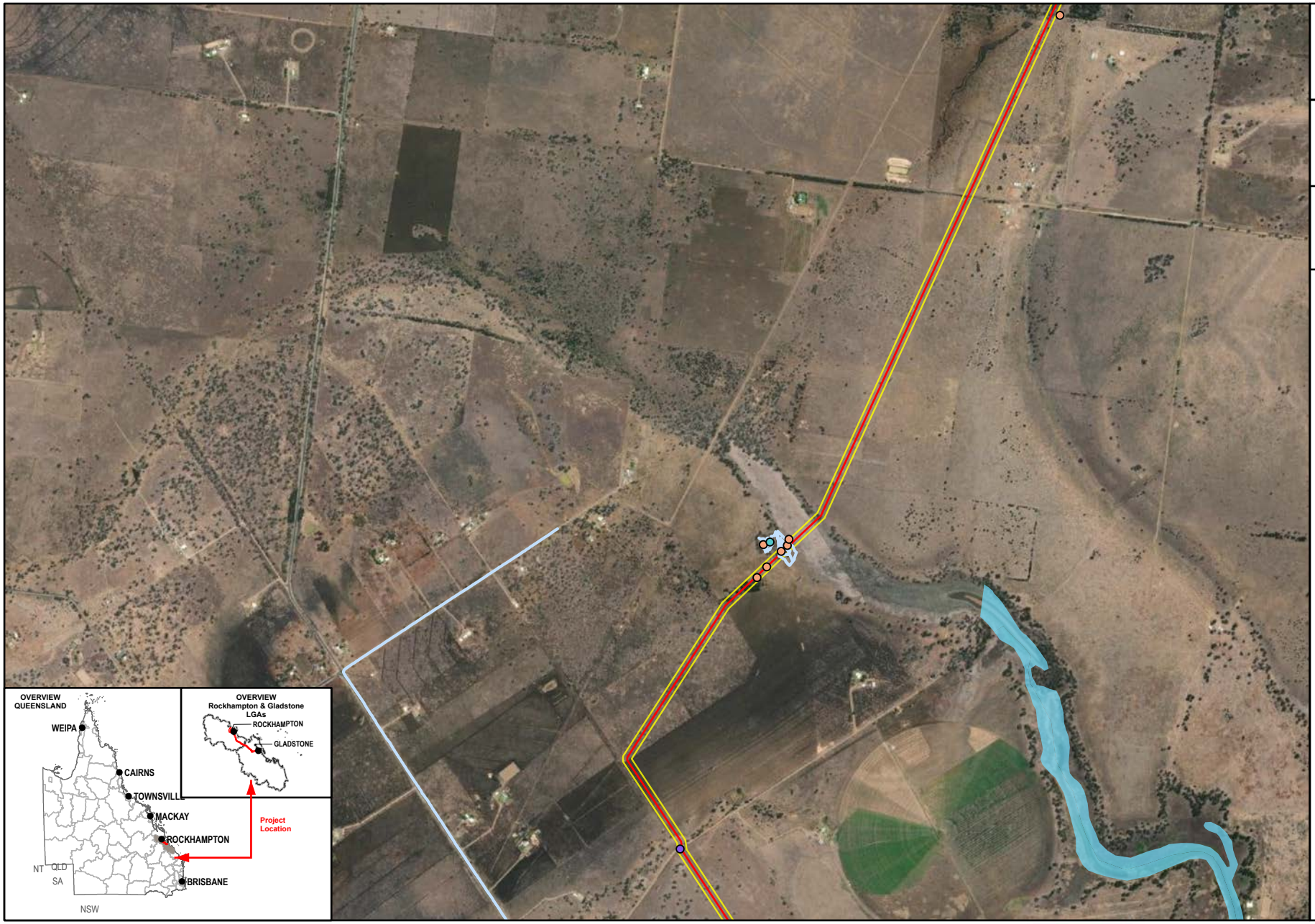
Figure 2-2t
Distribution of Terrestrial Fauna Survey Sites Within the Study Area
000-G-MAP-2402 Version:2 Date: 3/08/2022



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Terrestrial Fauna Assessment Site

- Active Searches
- SAT Survey Site
- Terrestrial Fauna Assessment Site
- Spotlighting Transect
- Study Area
- Fitzroy to Gladstone Pipeline Alignment
- Waterbody

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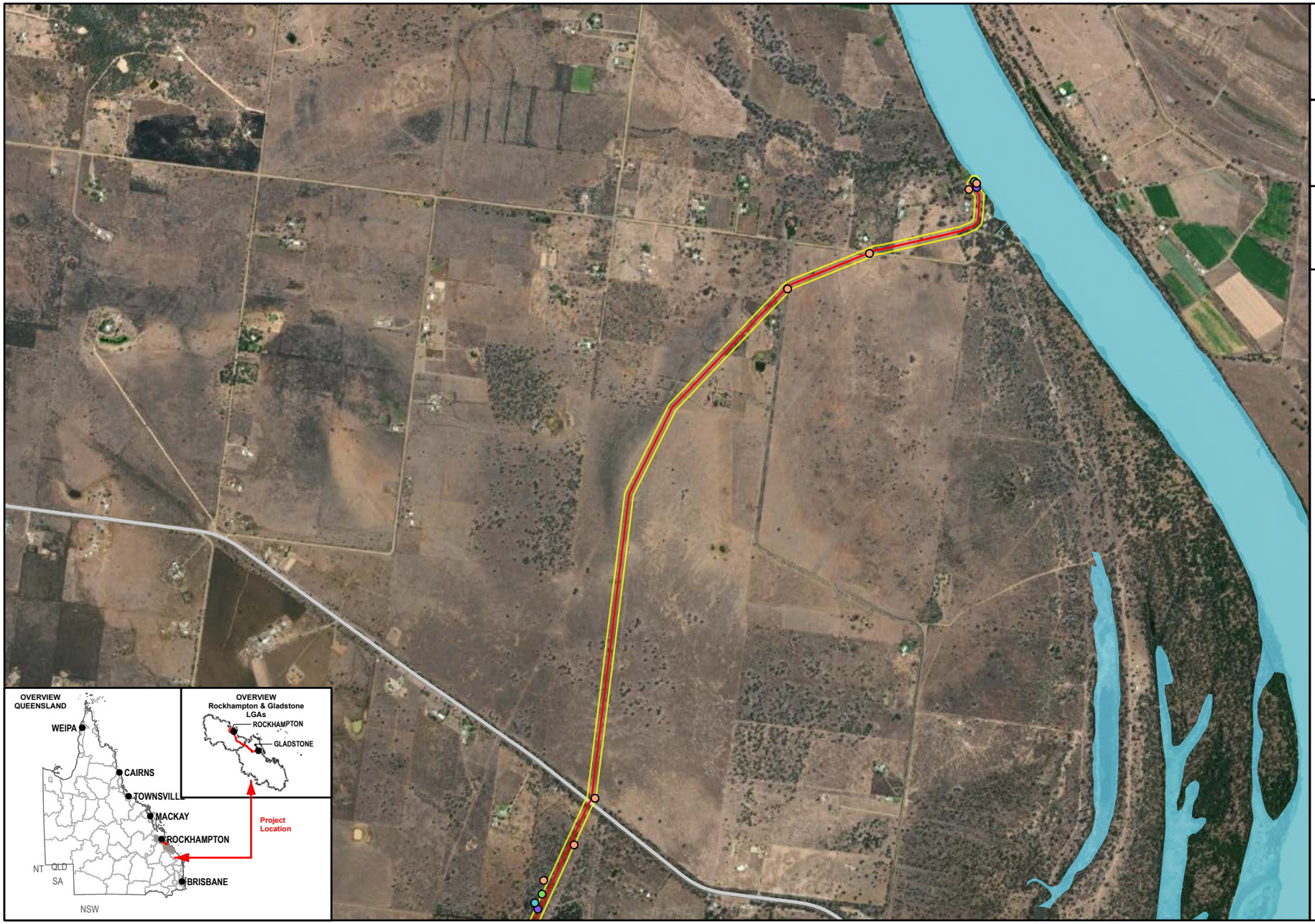
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 2-2u
Distribution of Terrestrial Fauna Survey Sites Within the Study Area
000-G-MAP-2402 Version:2 Date: 3/08/2022



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Terrestrial Fauna Assessment Site

- Active Searches
- Bird Surveys
- SAT Survey Site
- Terrestrial Fauna Assessment Site
- Study Area
- Fitzroy to Gladstone Pipeline Alignment
- Main Roads
- Waterbody

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Figure 2-2v
Distribution of Terrestrial Fauna Survey Sites Within the Study Area
000-G-MAP-2402 Version:2 Date: 3/08/2022

2.4.4 Aquatic survey methods

Field surveys were conducted during post-wet season conditions to identify and describe the existing aquatic ecological values within the study area. Post-wet conditions provide the opportunity to capture the highest diversity of flora and fauna species as waterways tend to be in good condition after flow.

Two tiers of field assessment were conducted to efficiently describe the aquatic ecological values throughout the large extent of the study area. The assessment included:

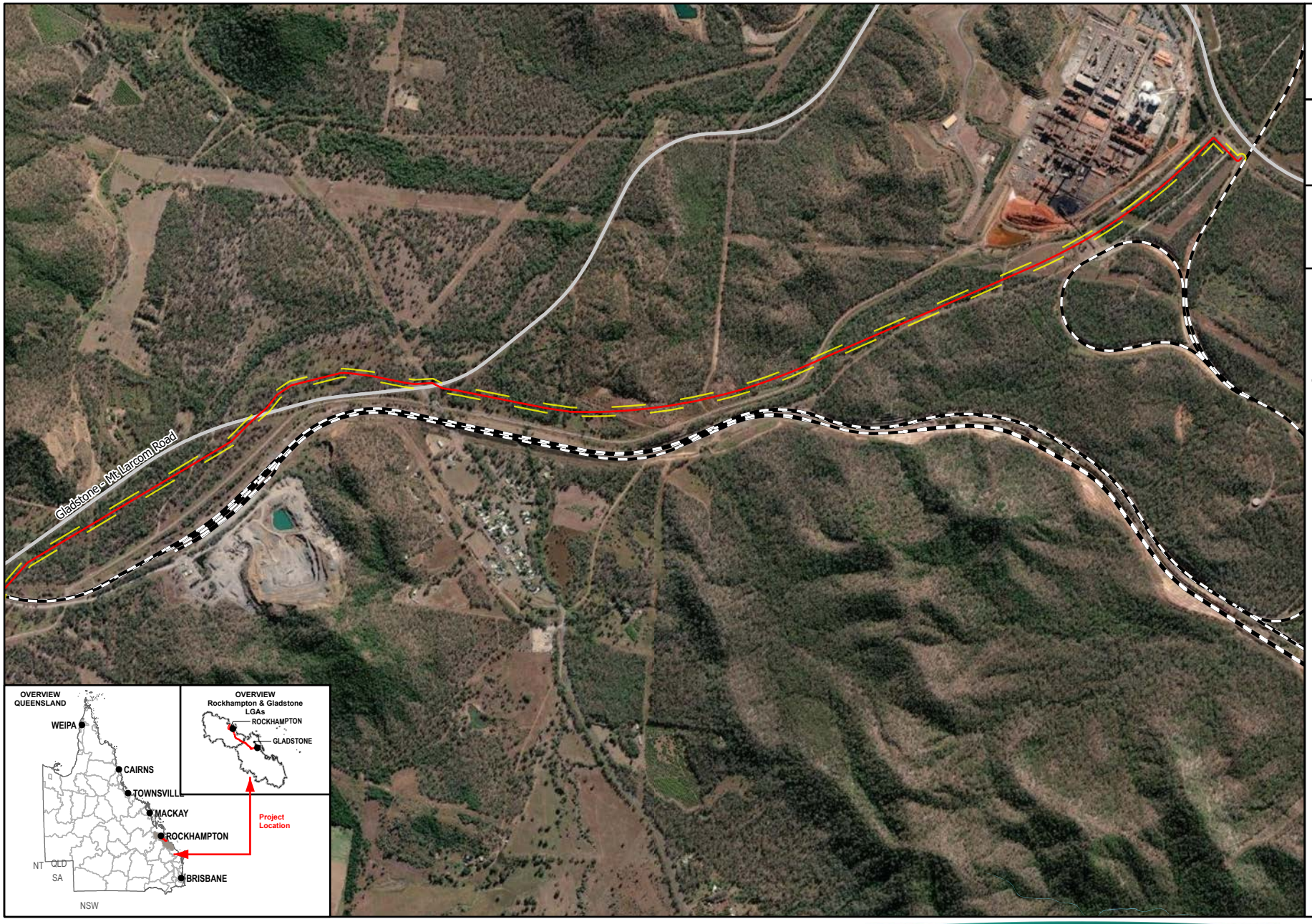
– Rapid assessments – AusRivAS habitat assessment, including *in-situ* water quality and aquatic macrophyte inventory. All riverine sites also included AusRivAS bioassessments.
– Detailed assessments – all rapid assessments techniques and detailed biotic assessment including fish and macrocrustacean surveys, freshwater turtle surveys, platypus habitat assessments and crocodile habitat assessments.

A summary of the site description, survey techniques and survey effort conducted at each site from the February and May surveys are detailed in Table 2-7. A detailed description of each survey technique is located in Sections 2.4.4.1 to 2.4.4.3. Survey locations are shown in Figure 2-3.

Table 2-7 Aquatic survey details for all sites sampled

Site	Date	District	Habitat and condition	*In-situ* water quality	Survey effort
Rapid assessment					
22	21/02/2022	Northern section	Yes	N/A – dry	N/A – rapid assessment site
23	22/02/2022	Northern section	Yes, including additional platypus and crocodile habitat assessment	N/A – dry	N/A – rapid assessment site
25	21/02/2022	Northern section	Yes	N/A – dry	N/A – rapid assessment site
31	21/02/2022	Northern section	Yes	N/A – dry	N/A – HES wetland site
32	22/02/2022	Northern section	Yes	N/A – dry	N/A – HES wetland site
2	08/05/2022	SGIC SDA	Yes, including additional crocodile assessment	N/A – dry	N/A – rapid assessment site
4	07/05/2022	SGIC SDA	Yes, including additional crocodile assessment	N/A – dry	N/A – rapid assessment site
6	04/05/2022	SGIC SDA	Yes, including additional platypus and crocodile assessment	Yes	N/A – rapid assessment site
7	10/05/2022	SGIC SDA	Yes	N/A – dry	N/A – rapid assessment site
8	10/05/2022	SGIC SDA	Yes	N/A – dry	N/A – rapid assessment site
9	09/05/2022	SGIC SDA	Yes	N/A – dry	N/A – rapid assessment site
10	09/05/2022	SGIC SDA	Yes	N/A – dry	N/A – rapid assessment site
11	08/05/2022	SGIC SDA	Yes	Yes	N/A – rapid assessment site
12	09/05/2022	SGIC SDA	Yes	N/A – dry	N/A – rapid assessment site
13	04/05/2022	SGIC SDA	Yes	N/A – dry	N/A – rapid assessment site
14	07/05/2022	SGIC SDA	Yes	N/A – dry	N/A – rapid assessment site

Site	Date	District	Habitat and condition	*In-situ* water quality	Survey effort
15	07/05/2022	SGIC SDA	Yes	N/A – dry	N/A – rapid assessment site
16	05/05/2022	SGIC SDA	Yes	N/A – dry	N/A – rapid assessment site
17	05/05/2022	SGIC SDA	Yes	N/A – no suitable access to river	N/A – rapid assessment site
18	06/05/2022	SGIC SDA	Yes	N/A – dry	N/A – rapid assessment site
19	06/05/2022	SGIC SDA	Yes	N/A – dry	N/A – rapid assessment site
21	04/05/2022	SGIC SDA	Yes	N/A – dry	N/A – rapid assessment site
24	05/05/2022	SGIC SDA	Yes	N/A – dry	N/A – rapid assessment site
26	08/05/2022	SGIC SDA	Yes	N/A – dry	N/A – HES wetland site
27	06/05/2022	SGIC SDA	Yes	N/A – dry	N/A – rapid assessment site
28	04/05/2022	SGIC SDA	Yes	N/A – dry	N/A – HES wetland site
29	06/05/2022	SGIC SDA	Yes	N/A – dry	N/A – HES wetland site
30	06/05/2022	SGIC SDA	Yes, including additional crocodile assessment	N/A – not suitable for safety reasons	N/A – HES wetland site
Detailed assessment					
1	22/02/2022	GSDA	Yes	Yes	Fyke nets (1 large mesh, 1 small mesh) Box traps (4)
3	08/05/2022	SGIC SDA	Yes, including additional platypus and crocodile assessment	Yes	Cathedral trap (1) Bait traps (7)
5	05/05/2022	SGIC SDA	Yes	Yes	Fyke nets (1 large mesh, 1 small mesh) Cathedral trap (1) Bait traps (5)



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- Fitzroy to Gladstone Pipeline Alignment
- Main Roads
- Railways
- Waterbody

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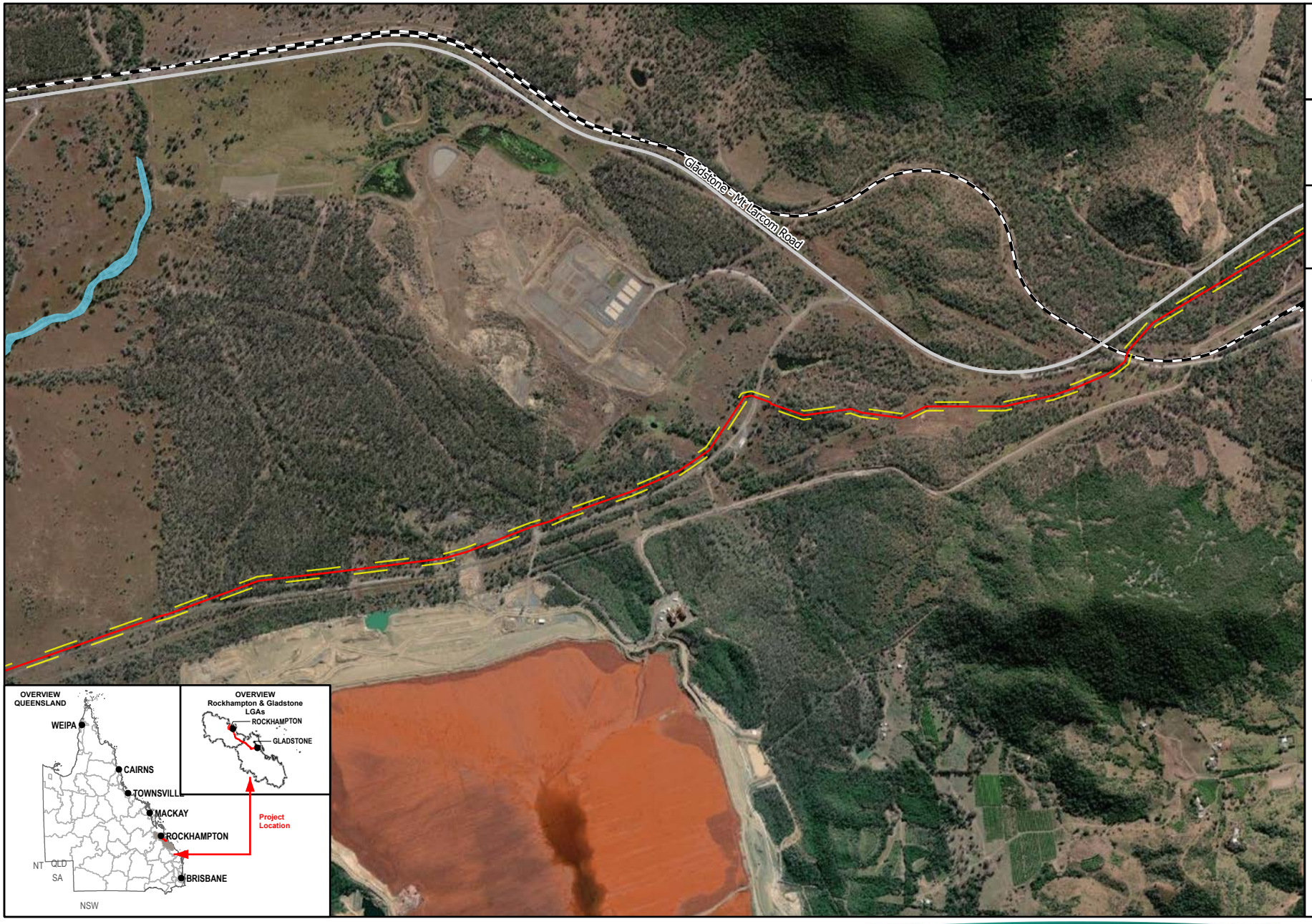
Fitzroy to Gladstone Pipeline Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 2-3a
Distribution of Aquatic Survey Sites Within the Study Area
000-G-MAP-2403 Version:0 Date: 7/07/2022



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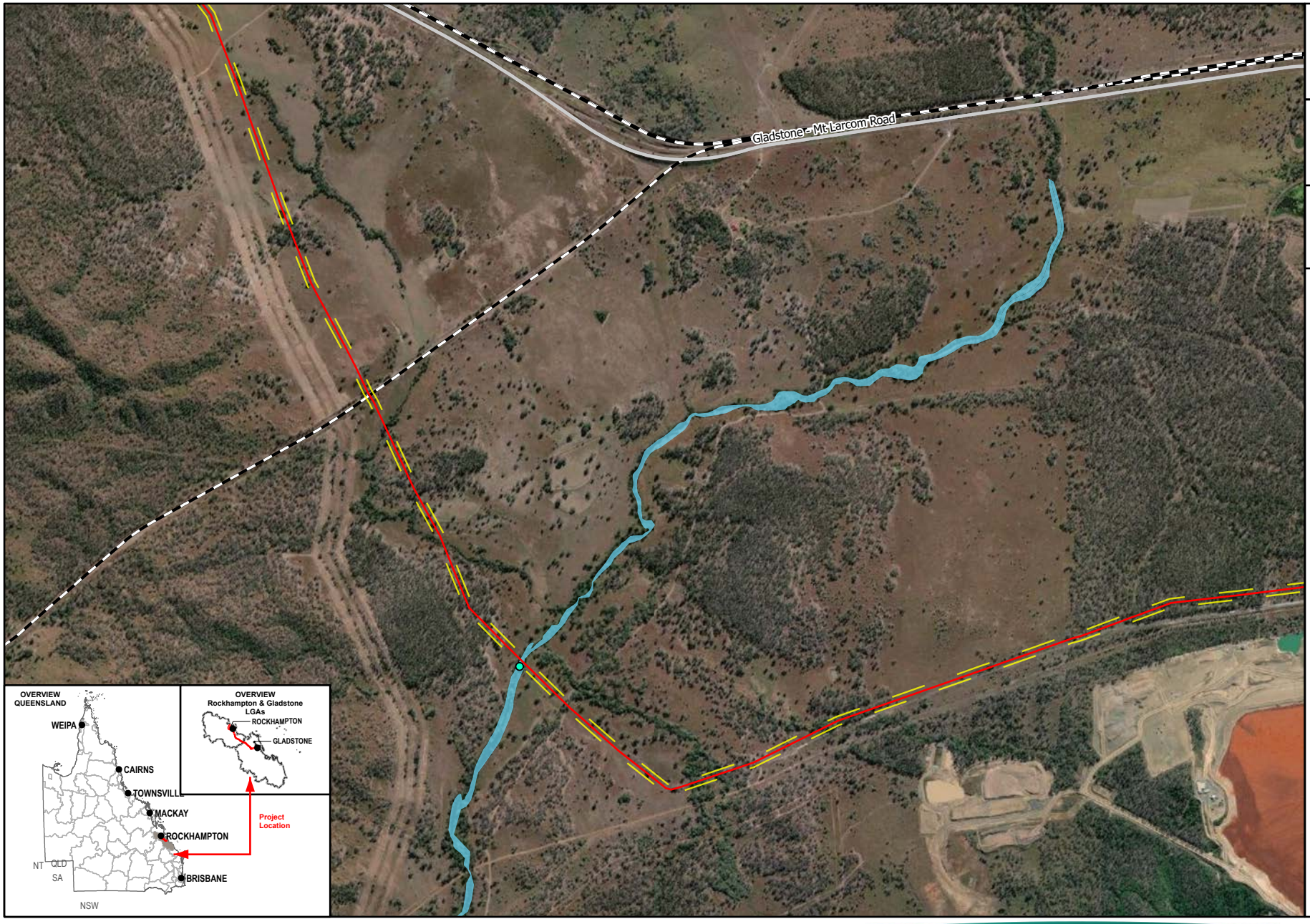
Fitzroy to Gladstone Pipeline Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 2-3b
Distribution of Aquatic Survey Sites Within the Study Area
000-G-MAP-2403 Version:0 Date: 7/07/2022



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Survey Corridor

- GSDA
- Study Area
- Fitzroy to Gladstone Pipeline Alignment
- Main Roads
- Railways
- Waterbody

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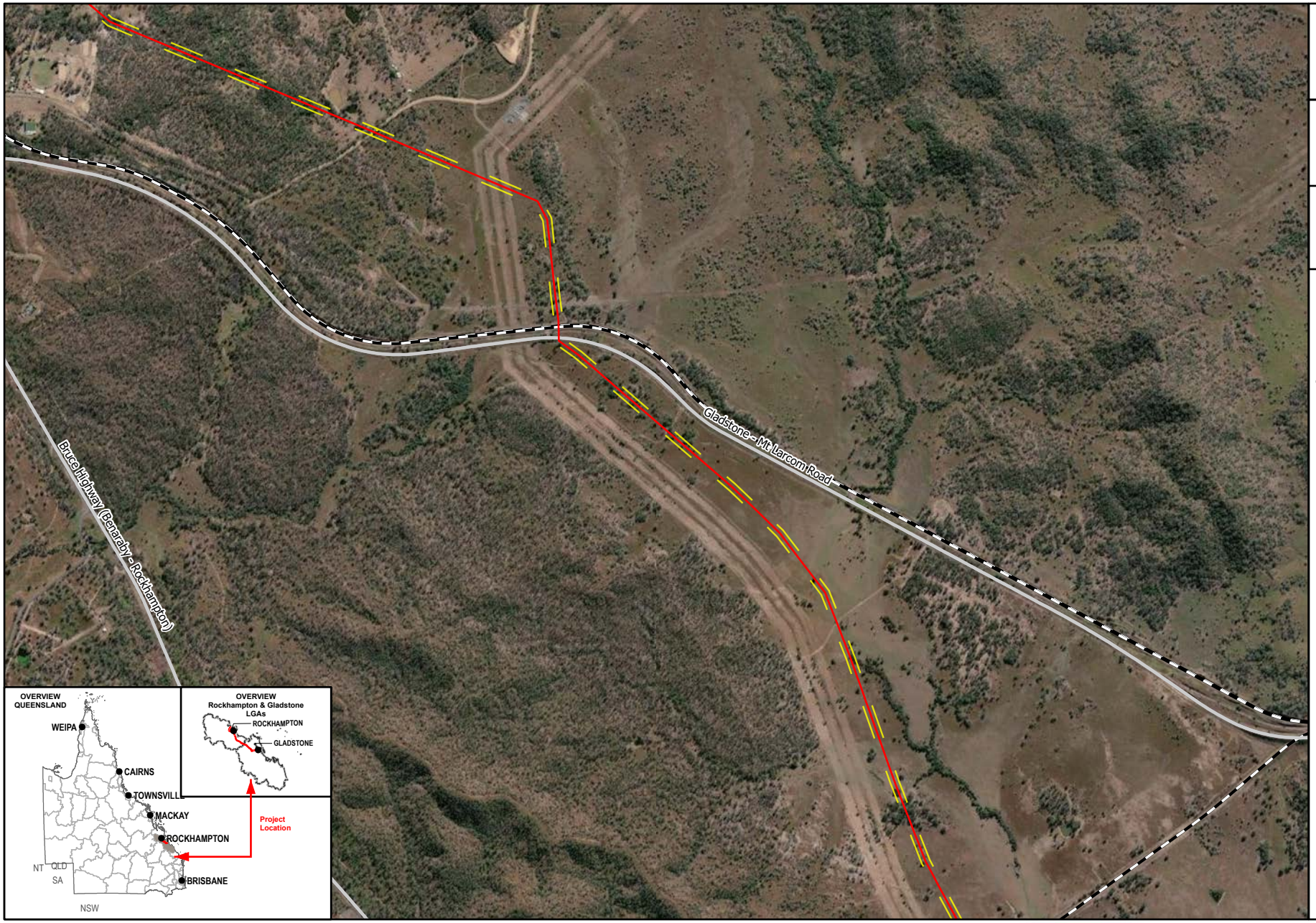
Fitzroy to Gladstone Pipeline Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 2-3c
Distribution of Aquatic Survey Sites Within the Study Area
000-G-MAP-2403 Version:0 Date: 7/07/2022



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- Study Area
- Fitzroy to Gladstone Pipeline Alignment
- Main Roads
- Railways

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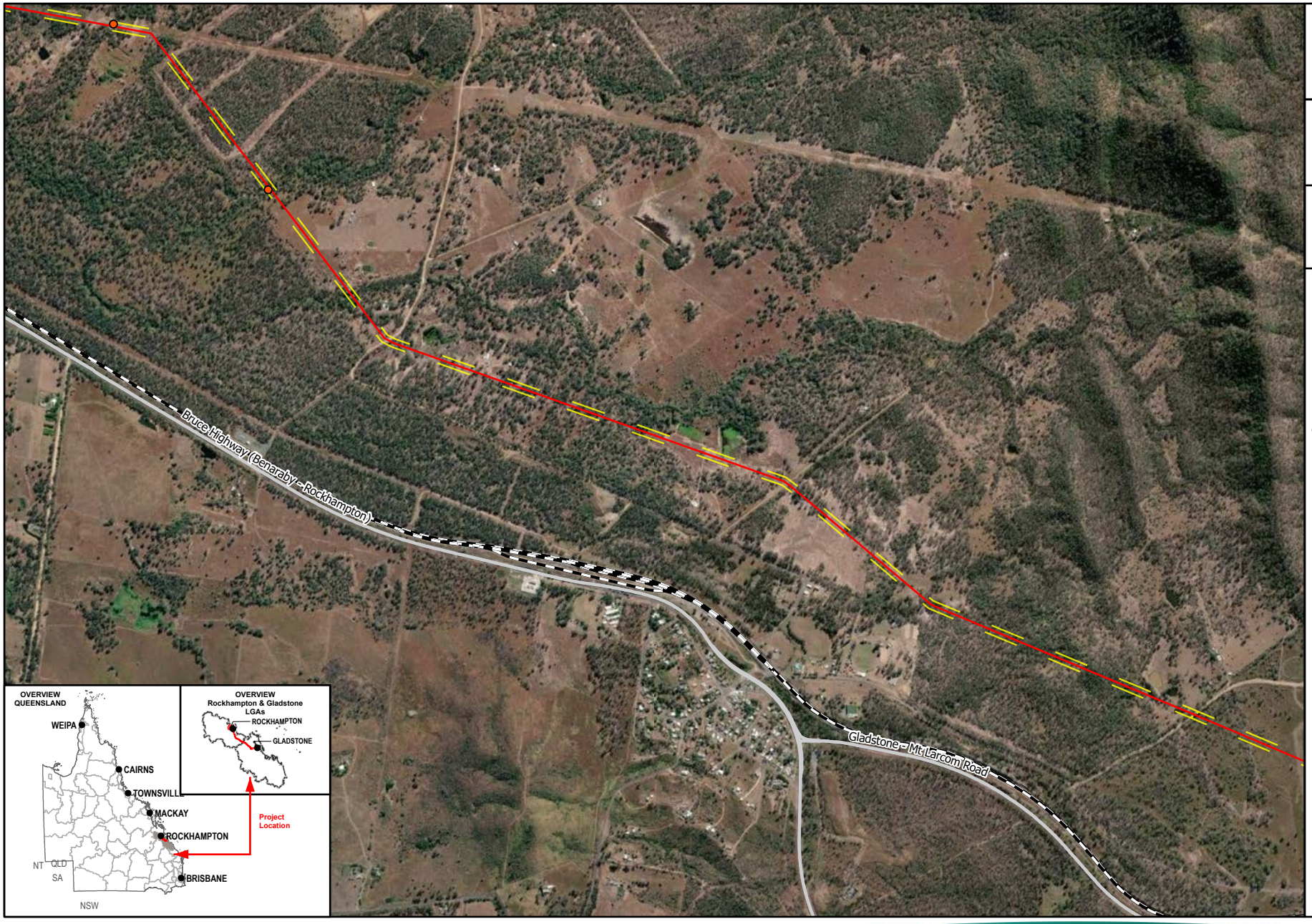
Figure 2-3d
Distribution of Aquatic Survey Sites Within the Study Area
000-G-MAP-2403 Version:0 Date: 7/07/2022



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Survey Corridor

- SGIC SDA
- Study Area
- Fitzroy to Gladstone Pipeline Alignment
- Main Roads
- Railways

Data Sources:

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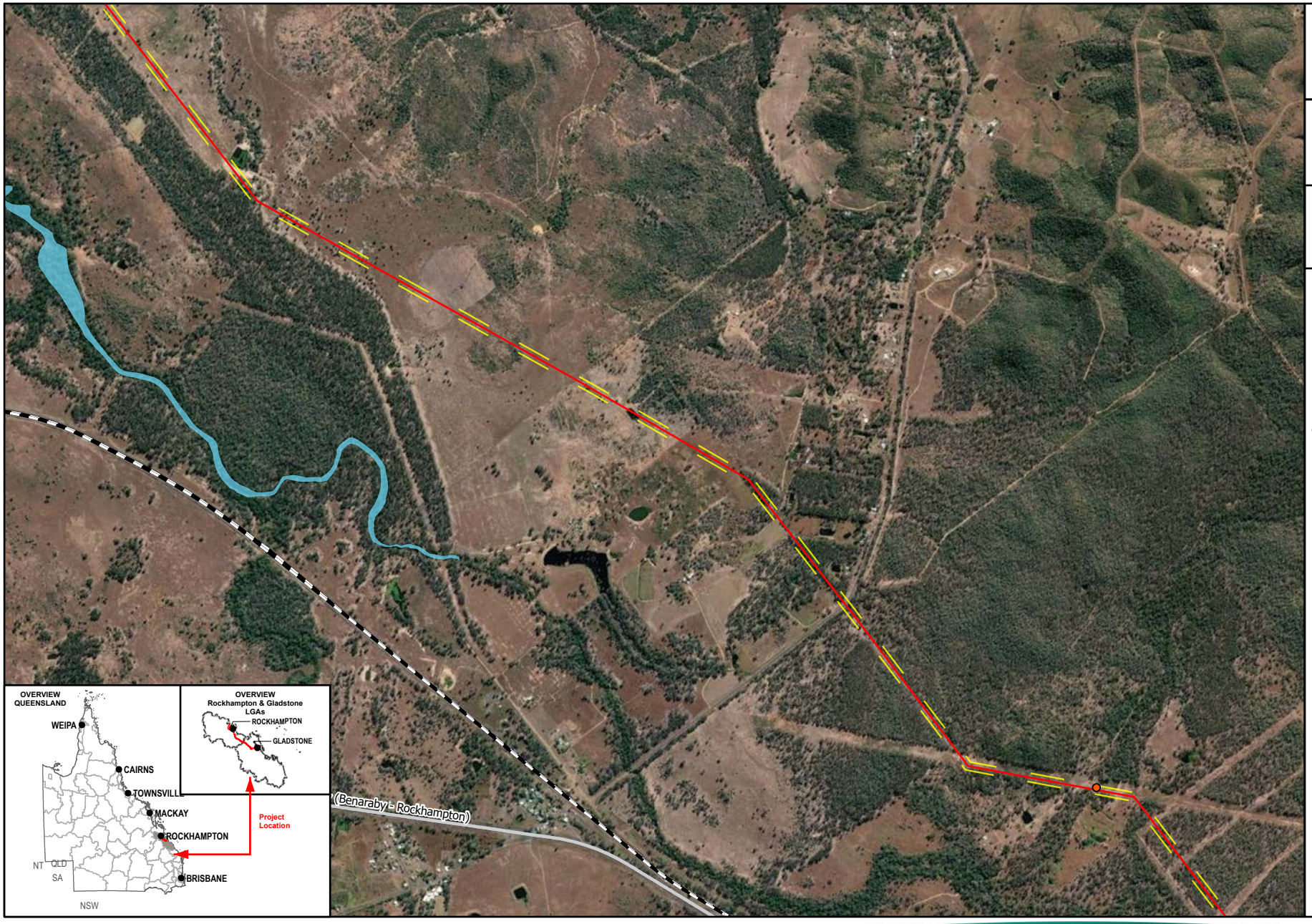
Fitzroy to Gladstone Pipeline Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 2-3e
Distribution of Aquatic Survey Sites Within the Study Area
000-G-MAP-2403 Version:0 Date: 7/07/2022



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Survey Corridor

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- Study Area
- Fitzroy to Gladstone Pipeline Alignment
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Figure 2-3f
Distribution of Aquatic Survey Sites Within the Study Area
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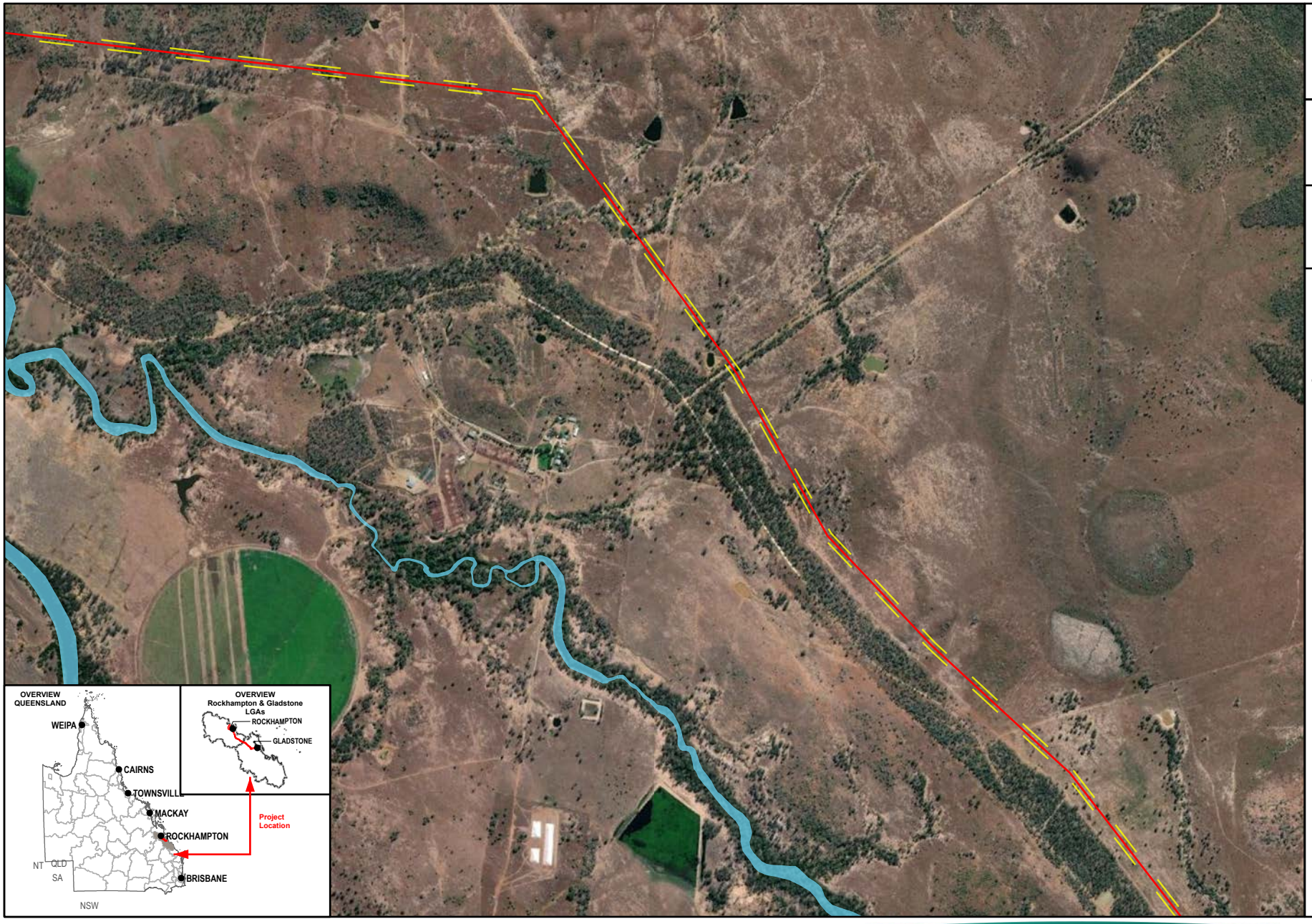

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- Study Area
- Fitzroy to Gladstone Pipeline Alignment
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- Railways
- Waterbody

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Figure 2-3g
Distribution of Aquatic Survey Sites Within the Study Area
000-G-MAP-2403 Version:0 Date: 7/07/2022

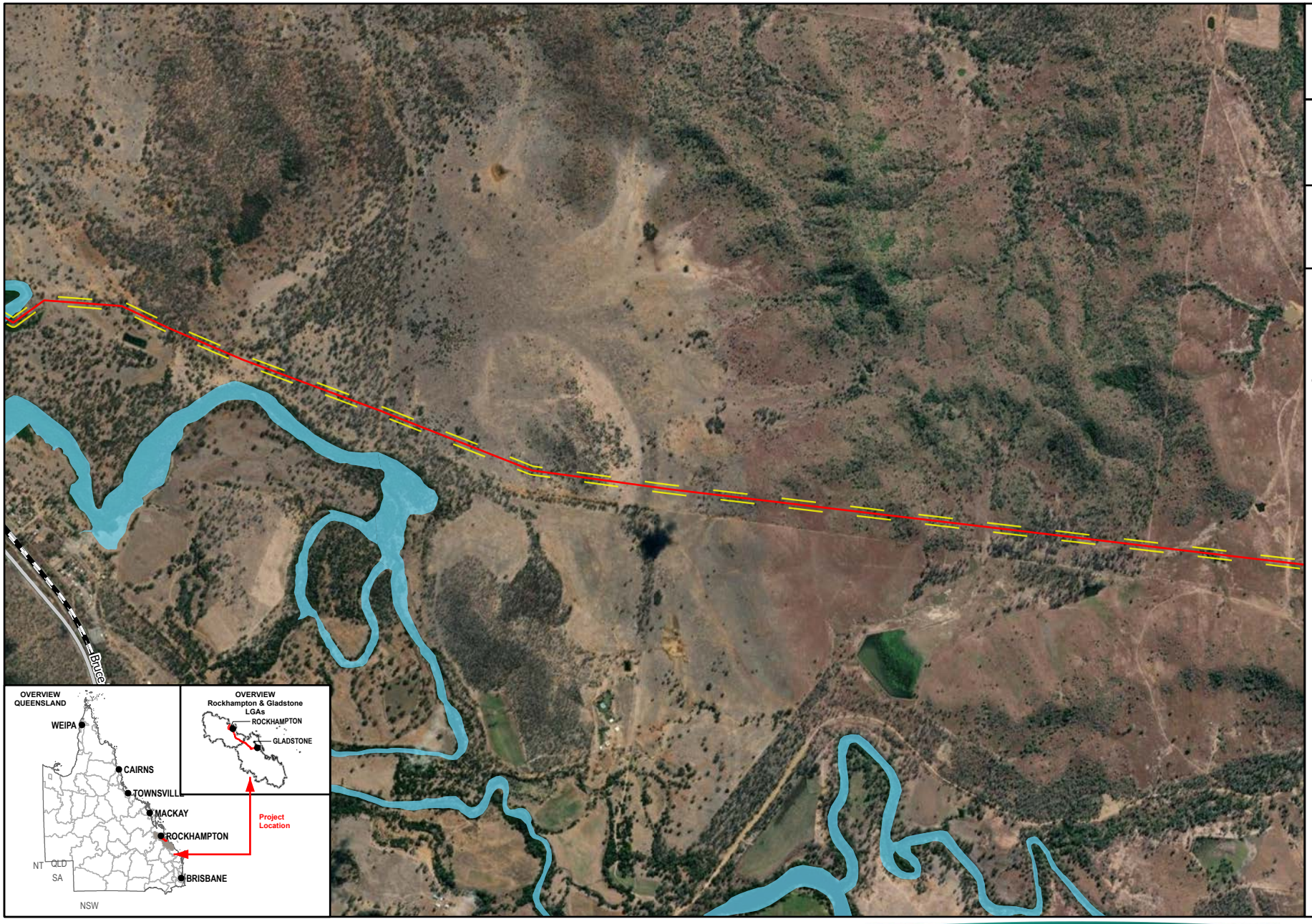

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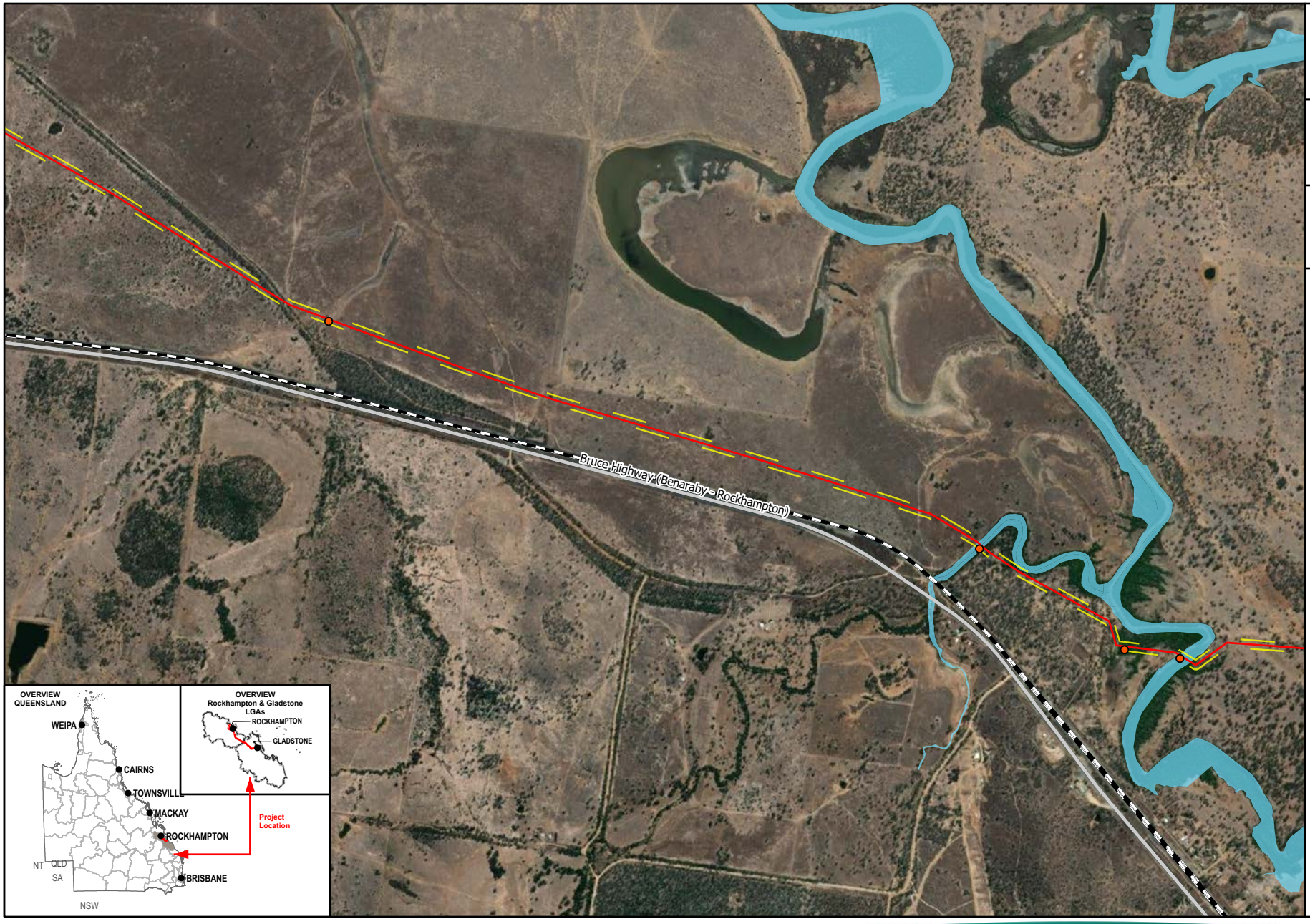
Figure 2-3h
Distribution of Aquatic Survey Sites Within the Study Area
000-G-MAP-2403 Version:0 Date: 7/07/2022



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Survey Corridor

- SGIC SDA
- Study Area
- Fitzroy to Gladstone Pipeline Alignment
- Main Roads
- Railways
- Waterbody

Data Sources:

1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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Figure 2-3i
Distribution of Aquatic Survey Sites Within the Study Area
000-G-MAP-2403 Version:0 Date: 7/07/2022

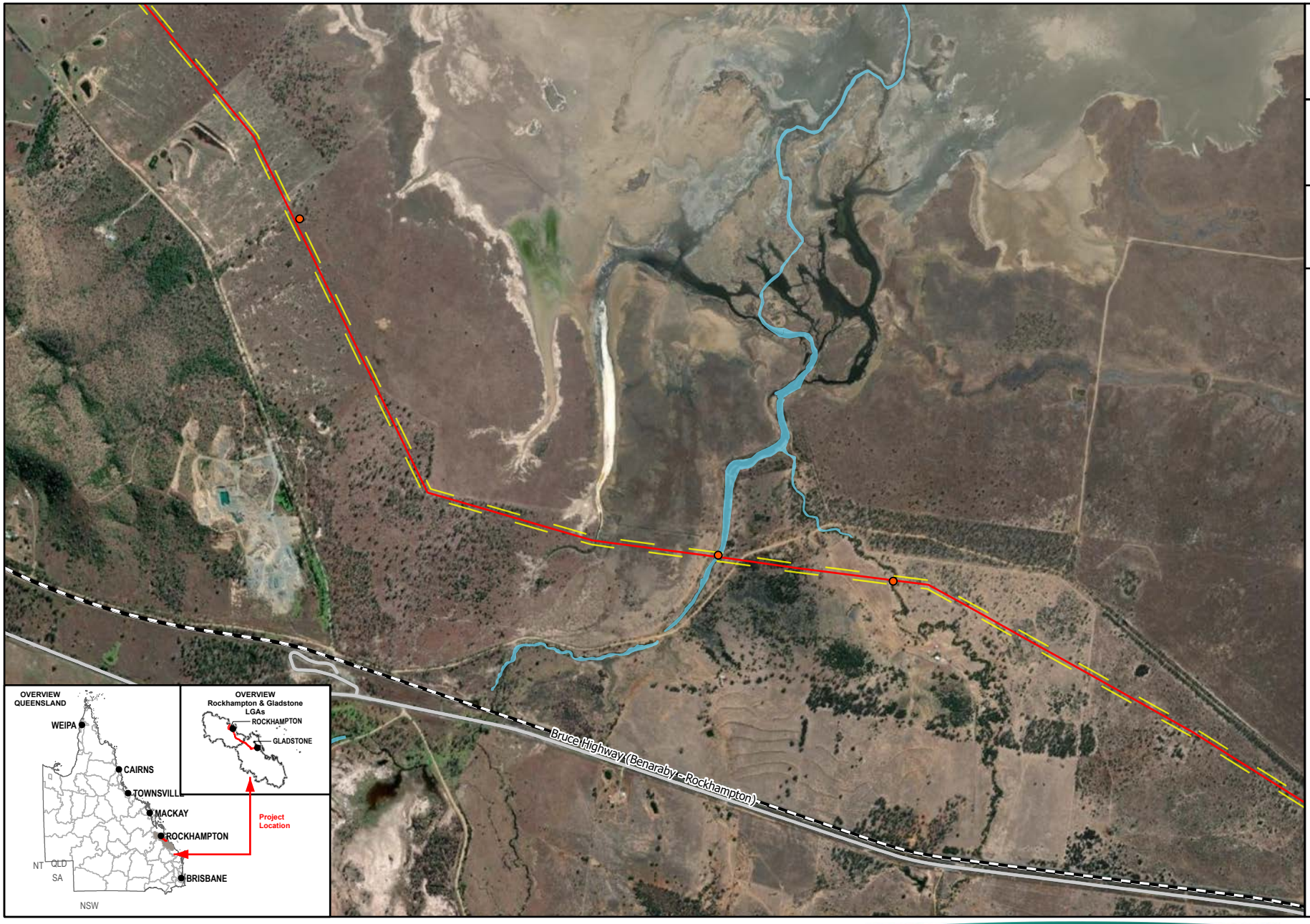

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Figure 2-3j
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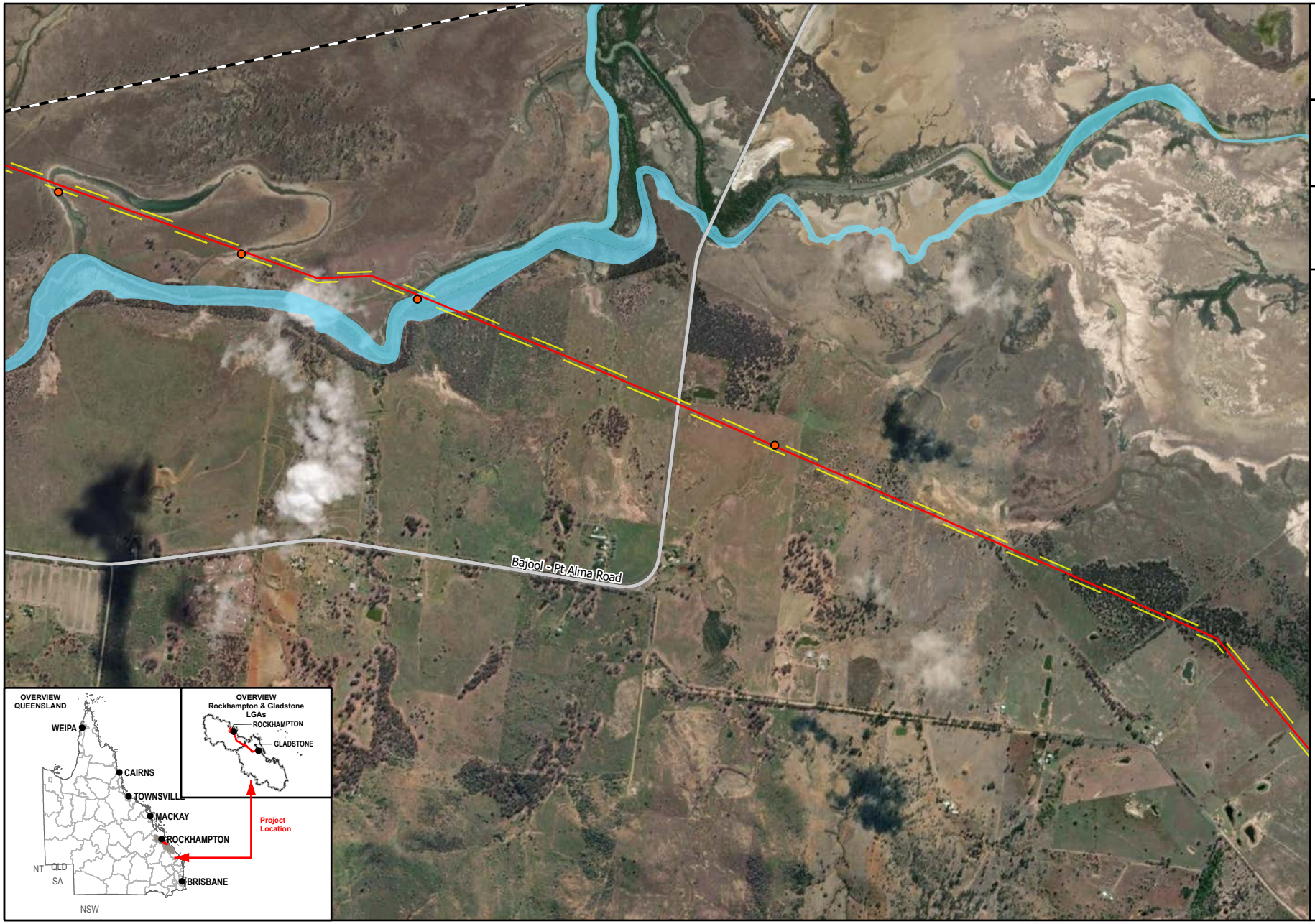

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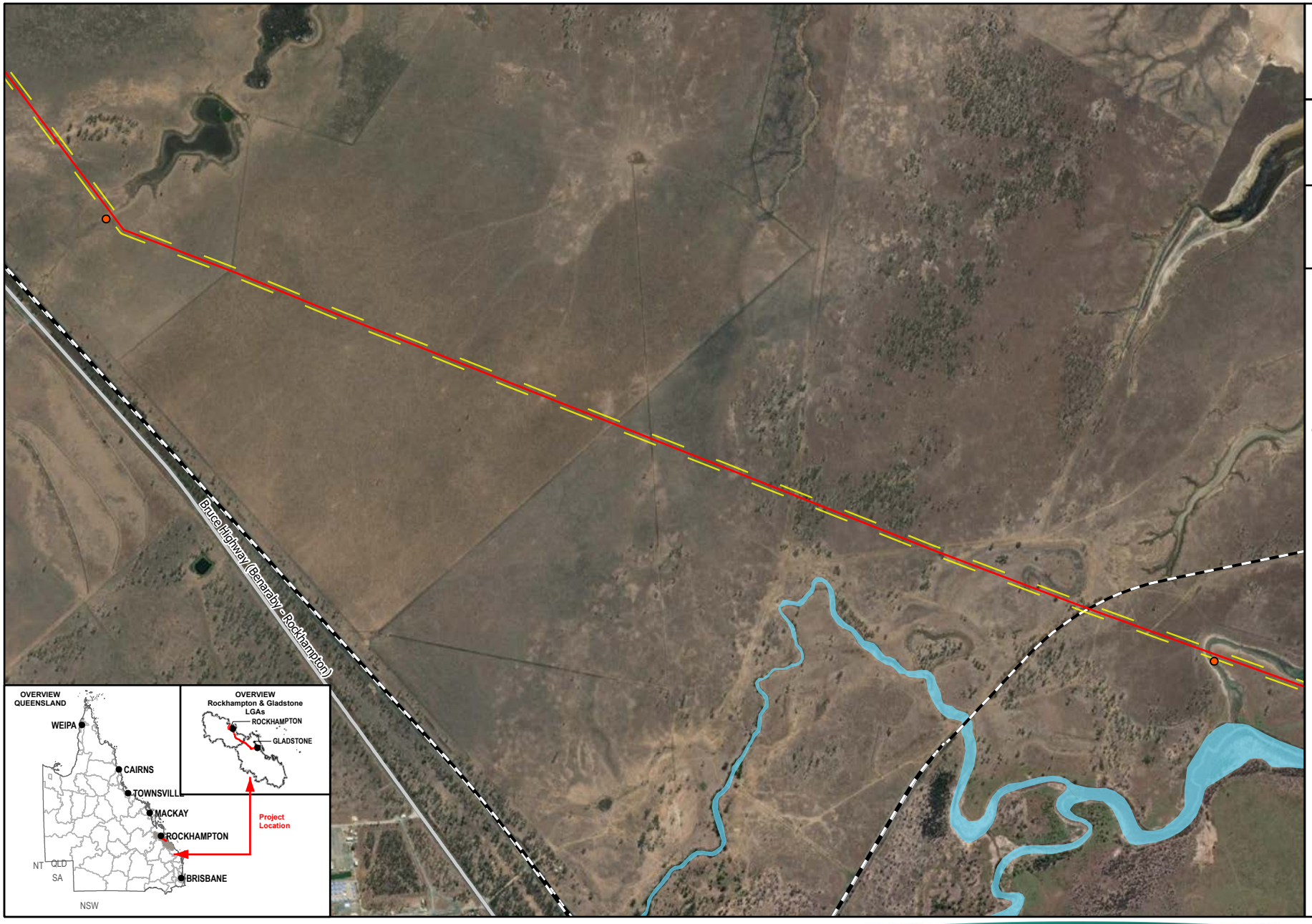

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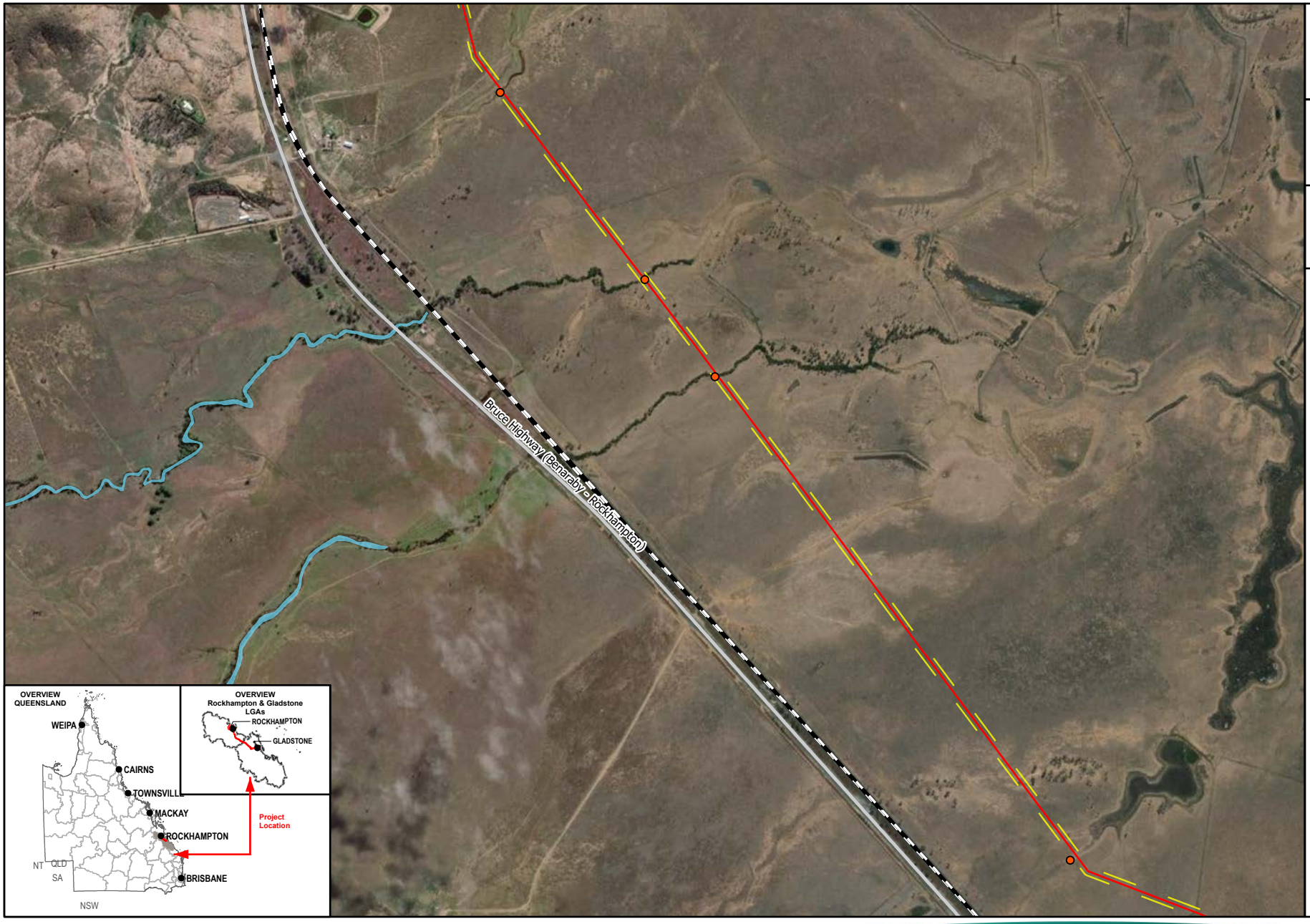

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Distribution of Aquatic Survey Sites Within the Study Area
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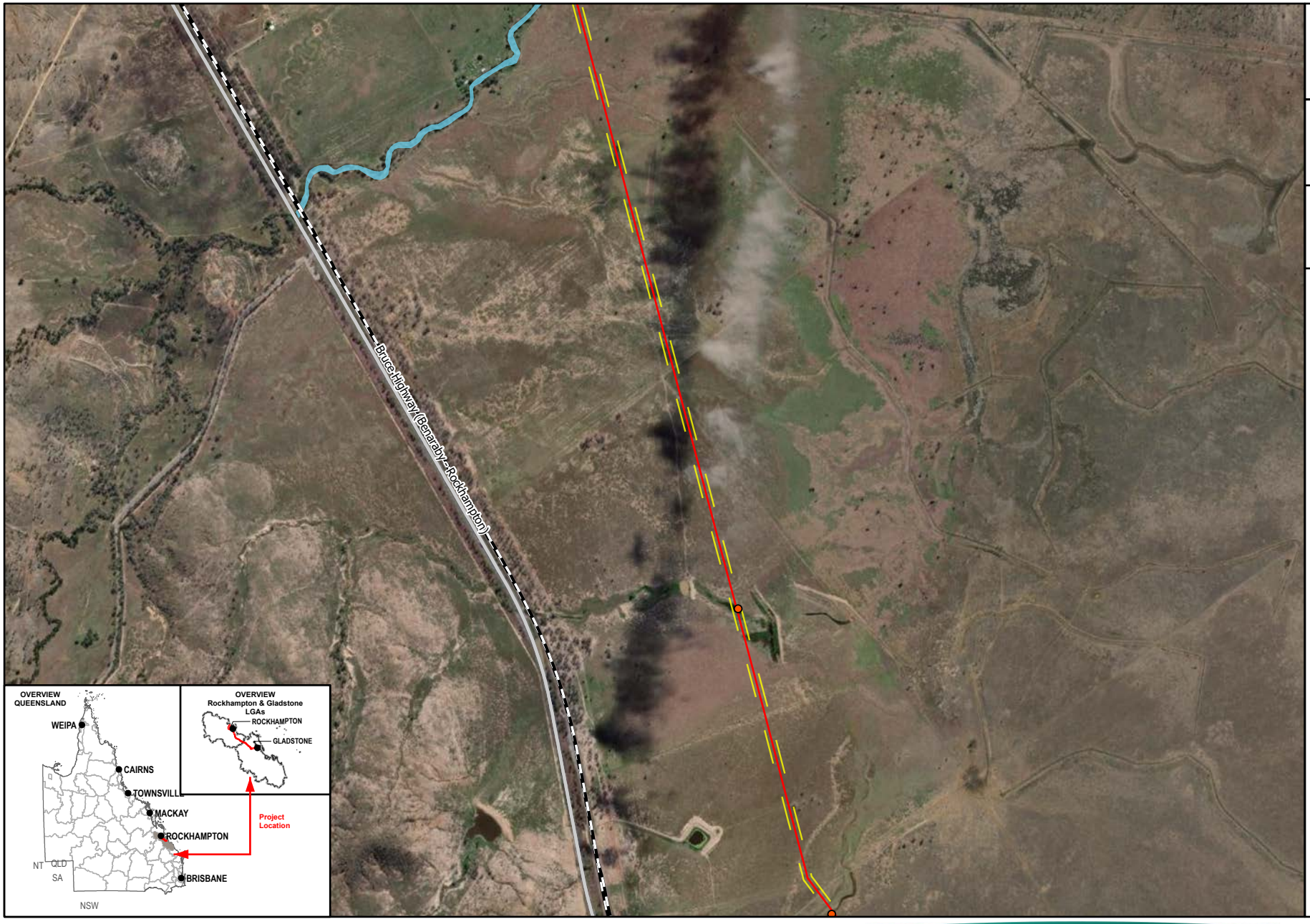

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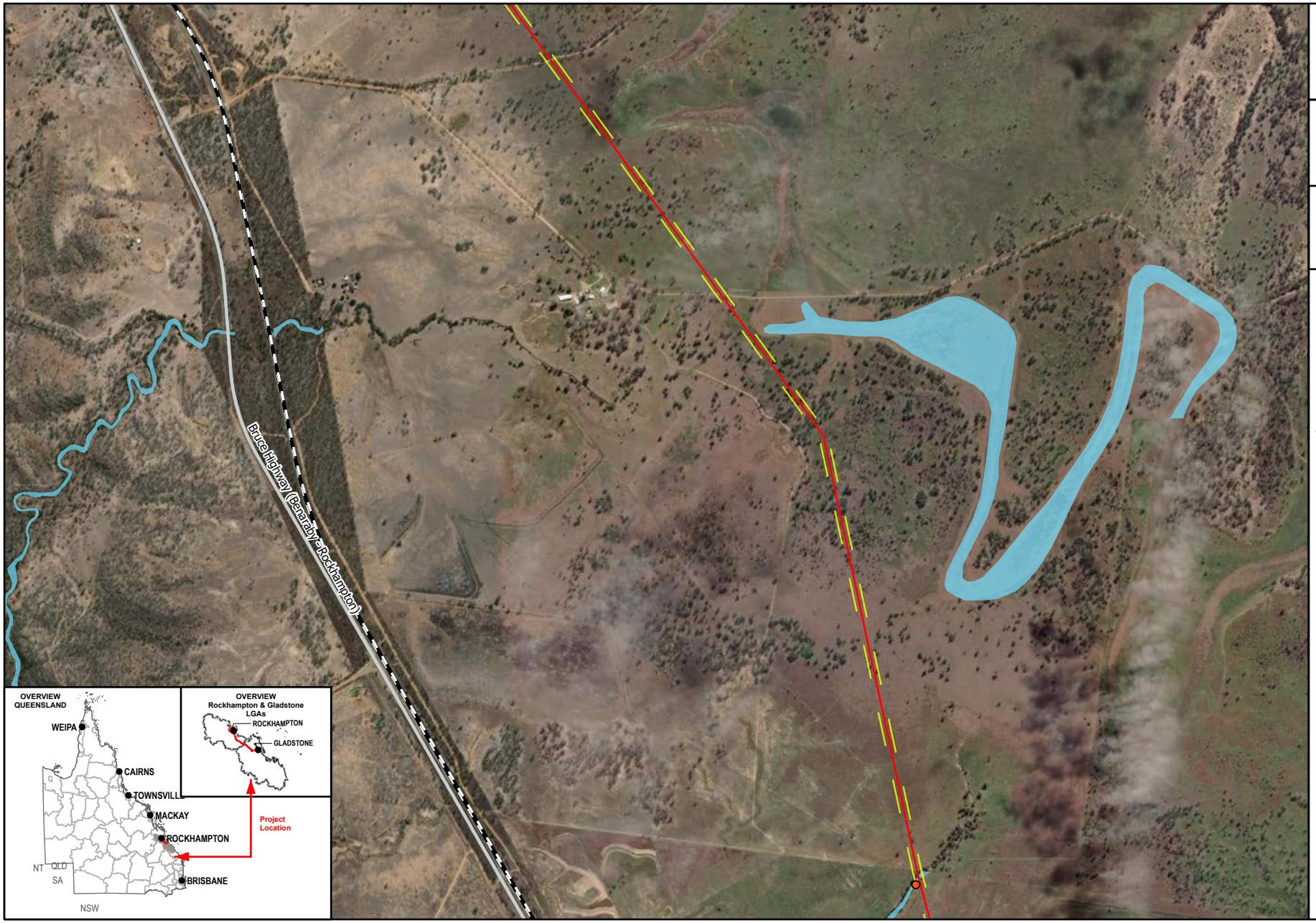

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Figure 2-3o
Distribution of Aquatic Survey Sites Within the Study Area
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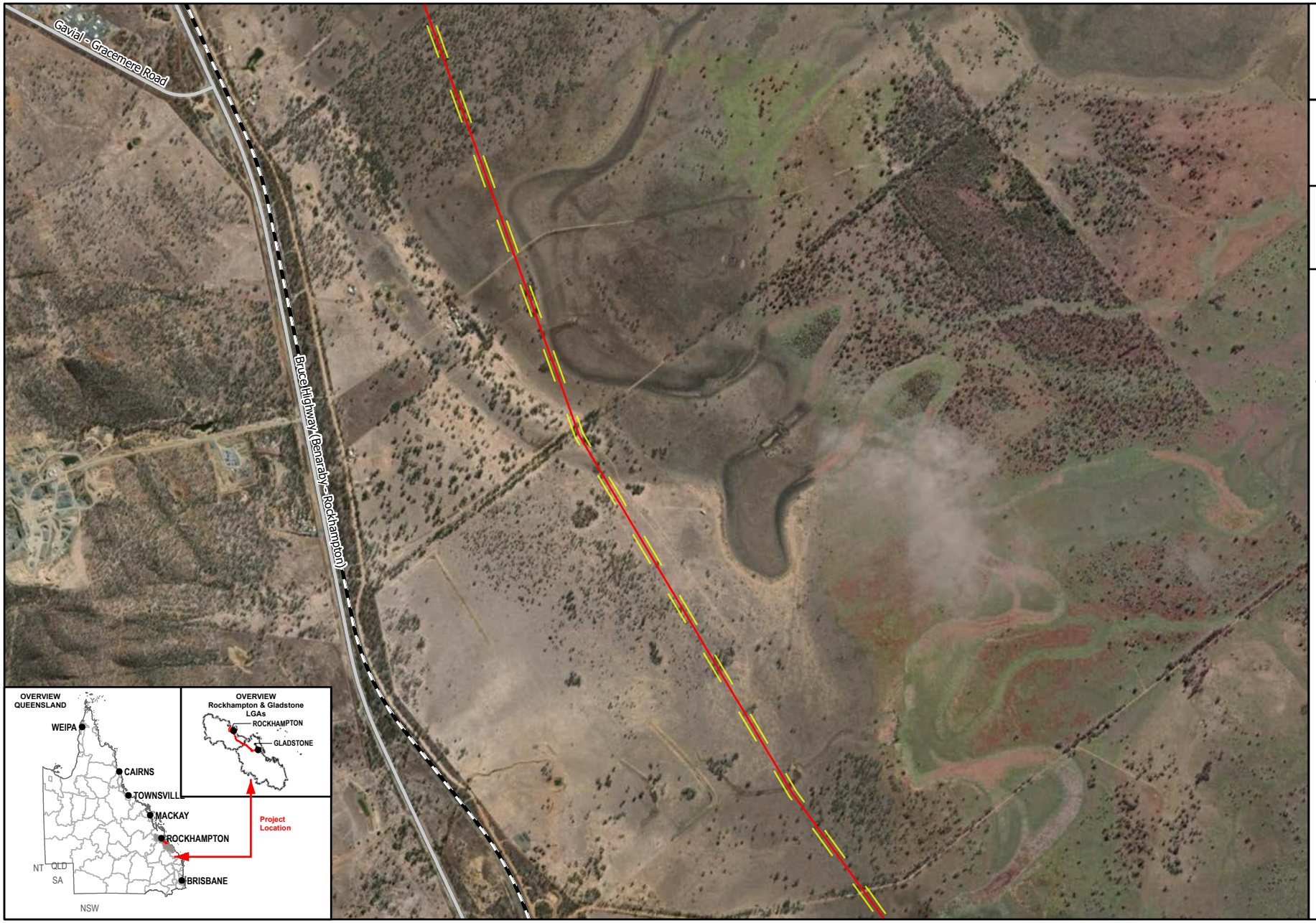

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Figure 2-3p
Distribution of Aquatic Survey Sites Within the Study Area
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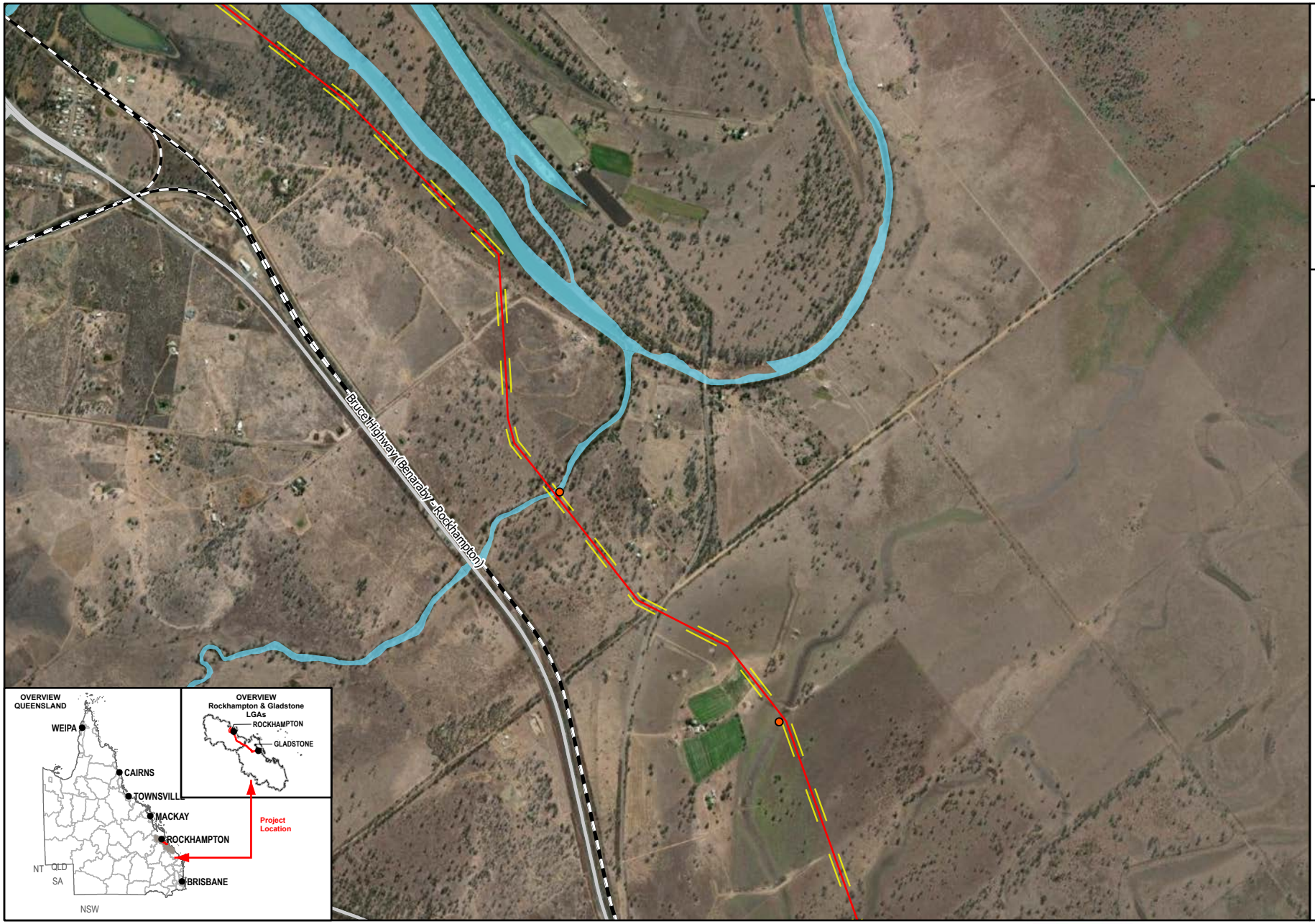

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Survey Corridor

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Figure 2-3q
Distribution of Aquatic Survey Sites Within the Study Area
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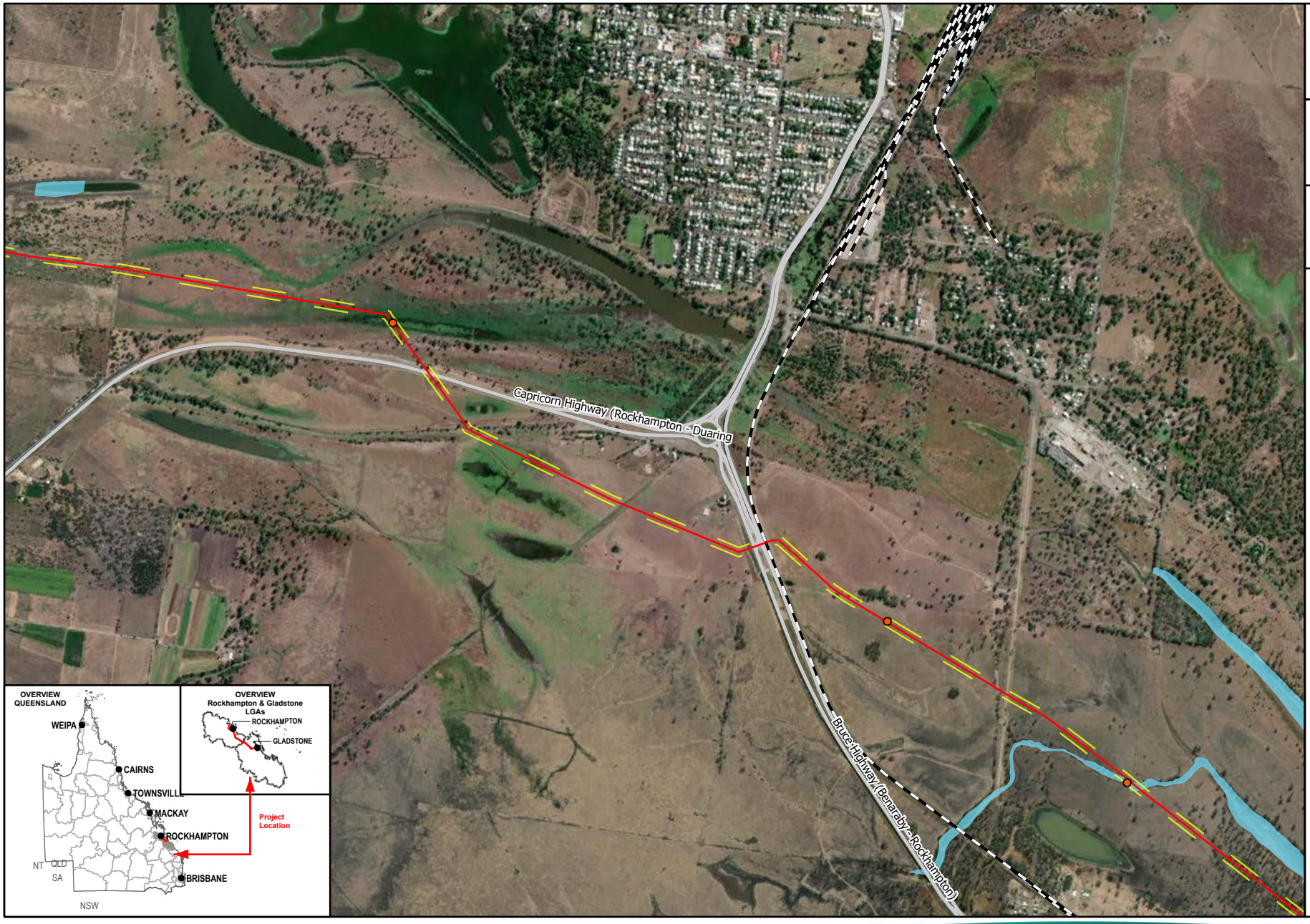

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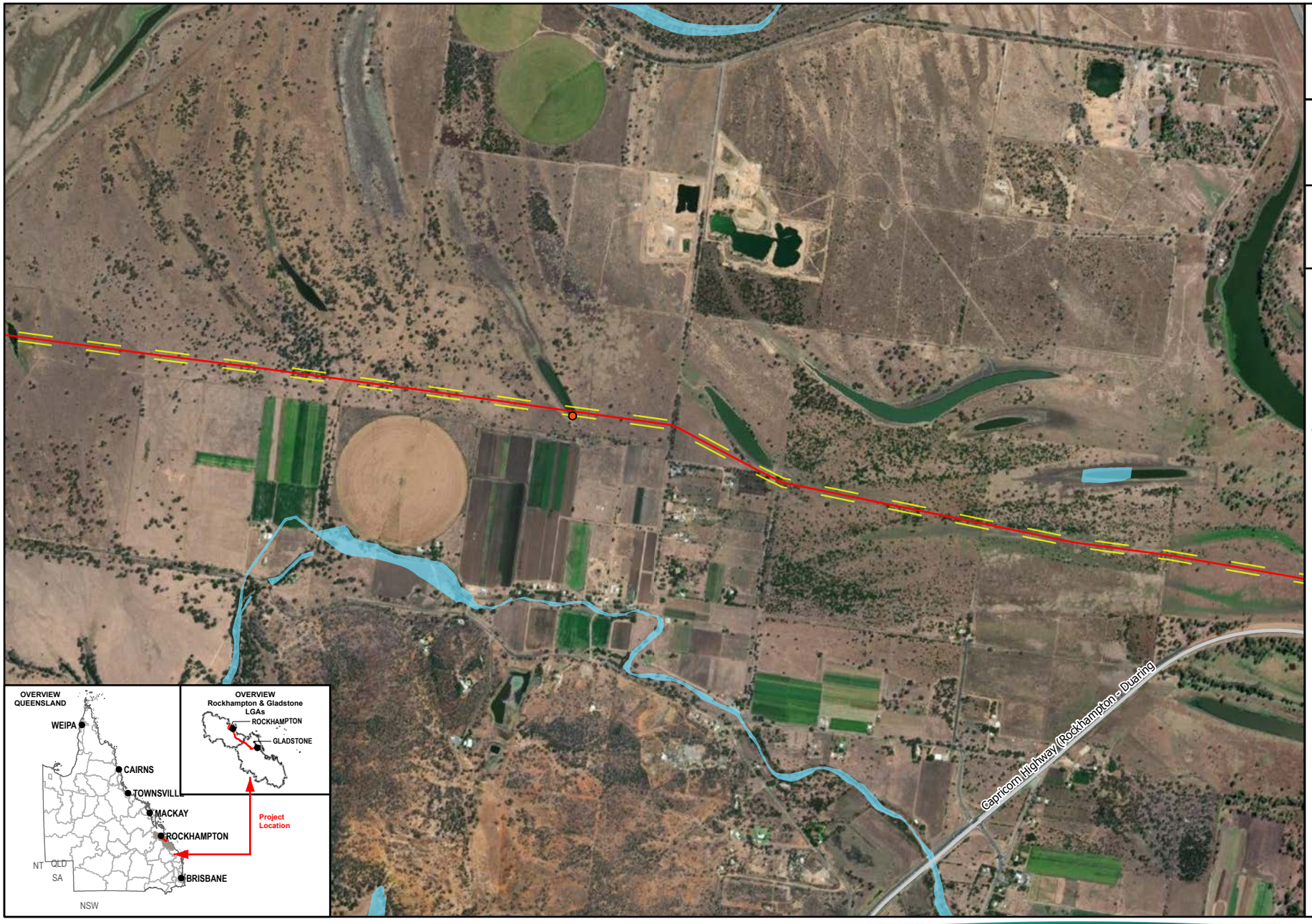

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Figure 2-3s
Distribution of Aquatic Survey Sites Within the Study Area
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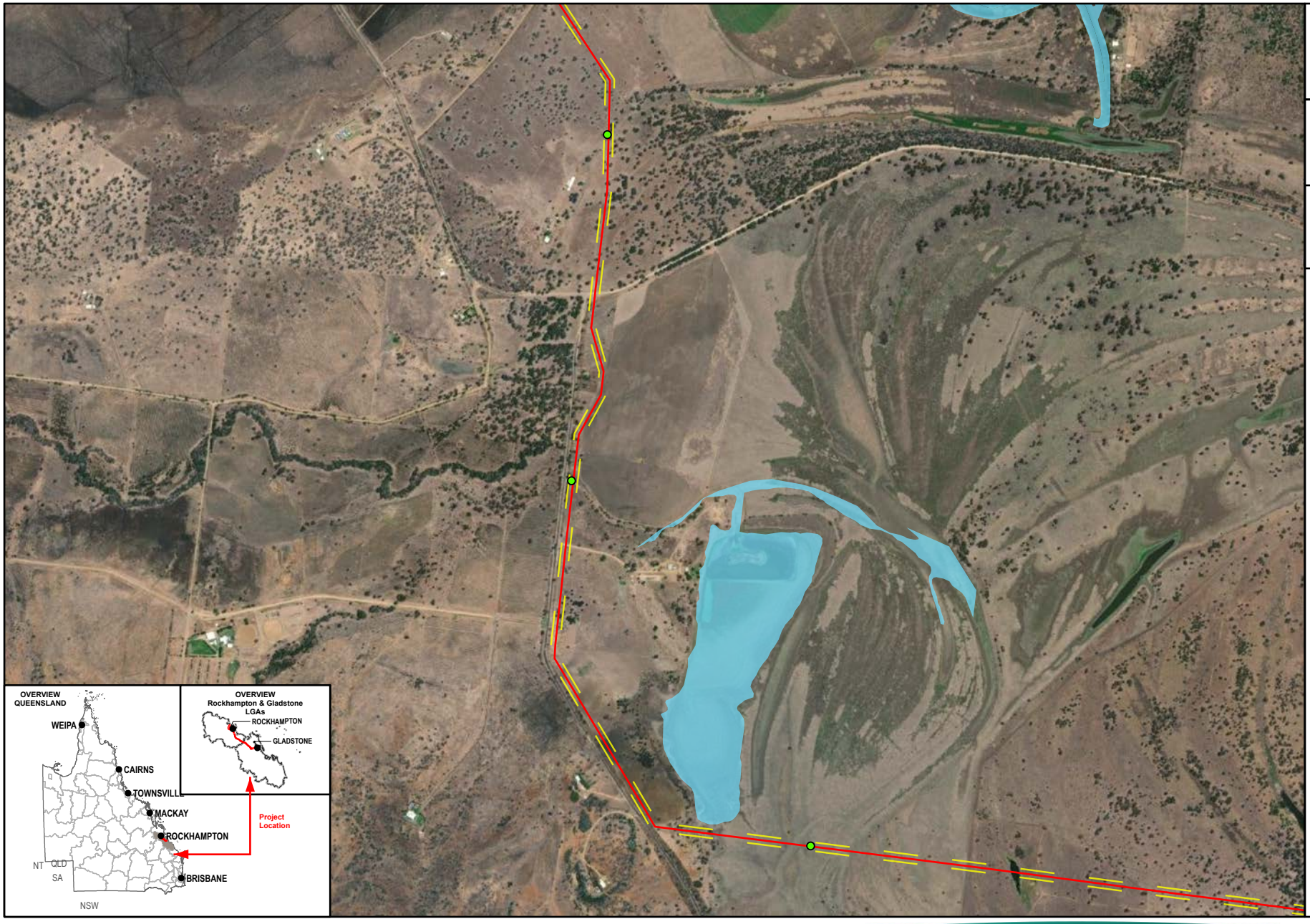

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Survey Corridor

- Northern Section
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Distribution of Aquatic Survey Sites Within the Study Area
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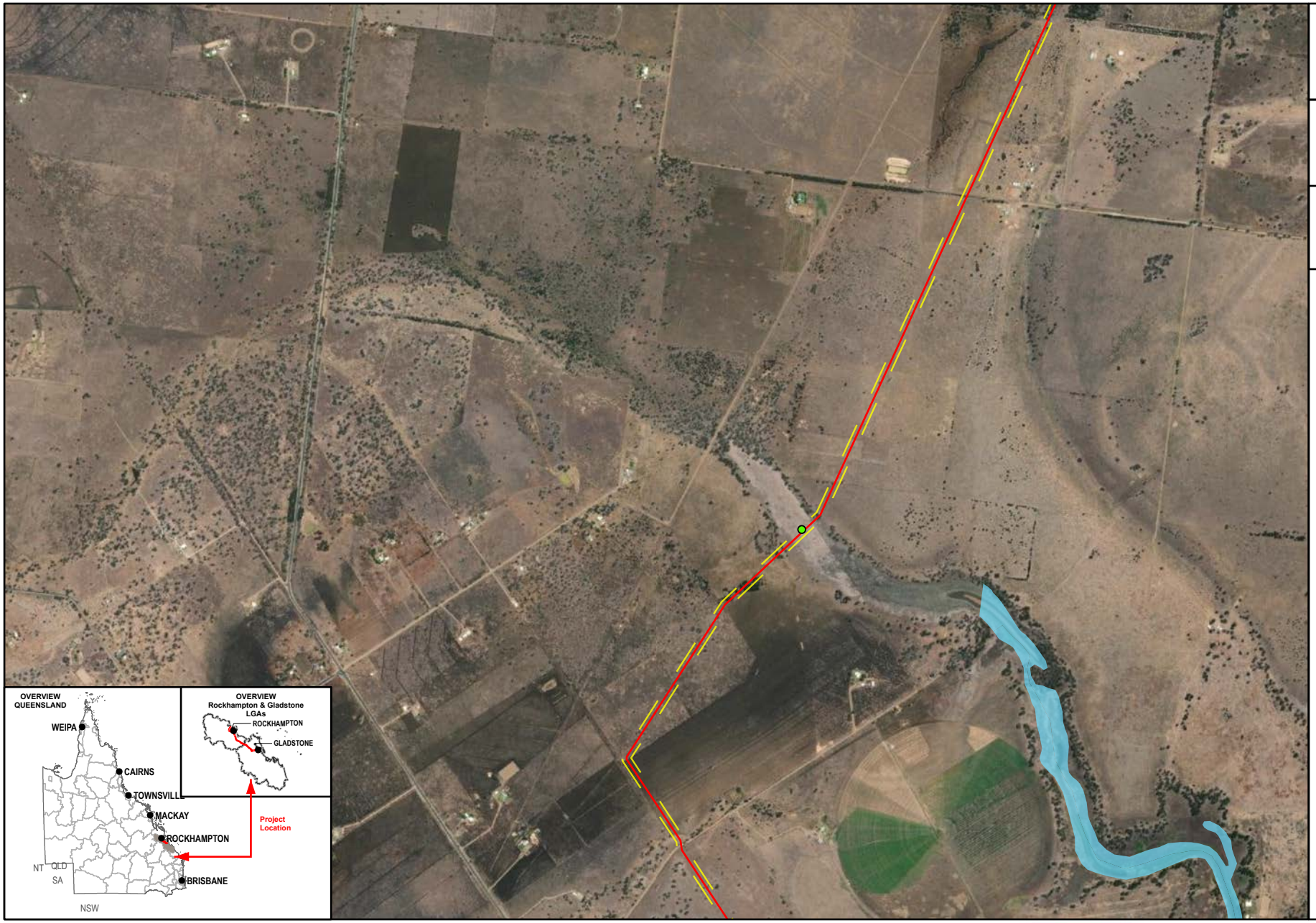

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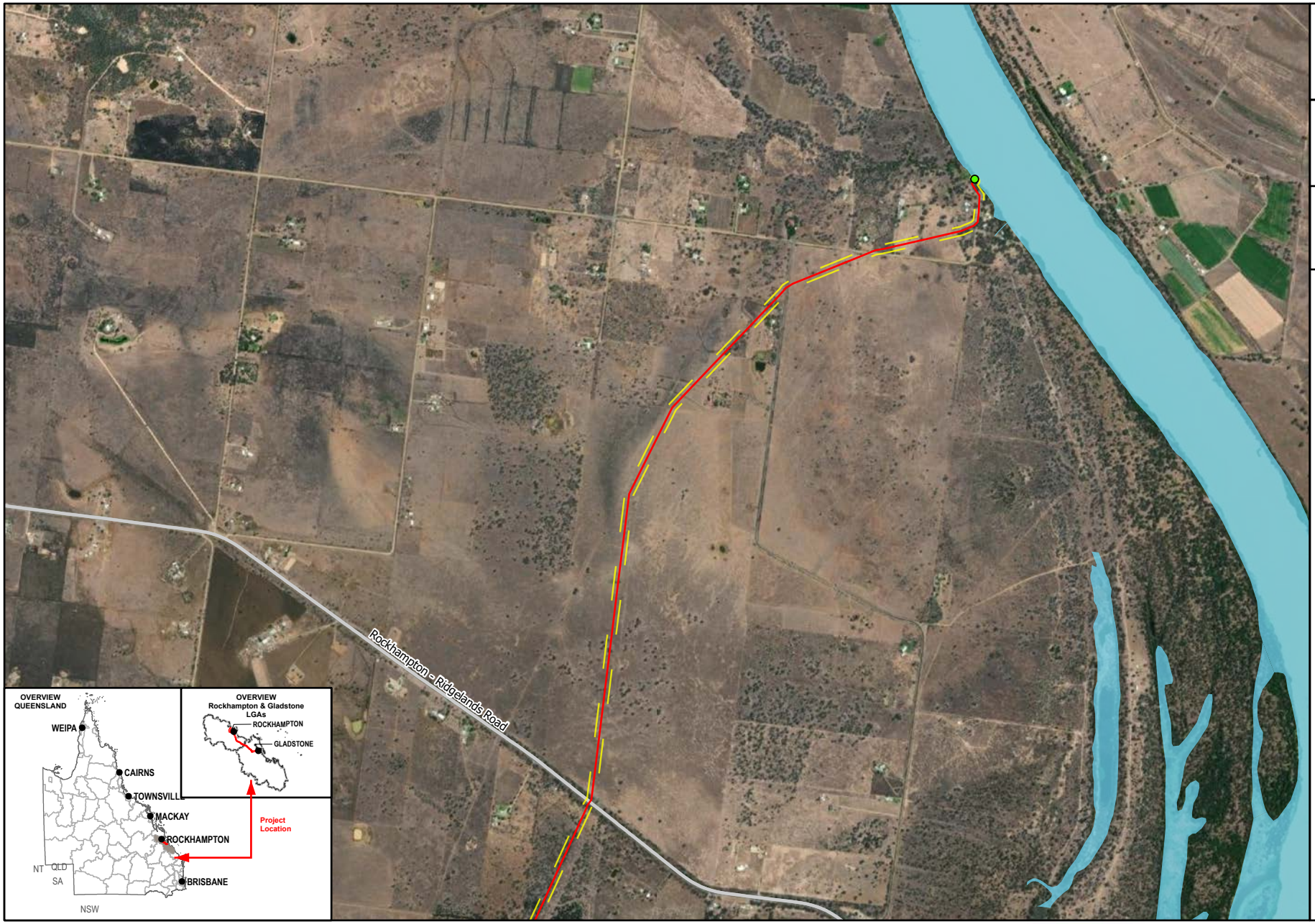

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Figure 2-3v
Distribution of Aquatic Survey Sites Within the Study Area
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2.4.4.1 Habitat assessments

Aquatic habitat assessments were undertaken at all five rapid sites and the one detailed assessment site to describe the presence and condition of key aquatic habitat features and overall condition of each site. The assessments were conducted in accordance with the Queensland AusRivAS Sampling and Processing Manual (DNRM 2001) and the Monitoring and Sampling Manual (DES 2018a).

Habitats were characterised in terms of key features outlined in Table 2-8.

Table 2-8 Habitat characteristics and features recorded during habitat assessments

Habitat characteristic	Key features
Channel type	Reach morphology: bank full bank height, bank full stream width, stream wetted width, normal wetted width, water depth.
Habitat diversity and extent	Variety of habitat: the presence of shallow, deep, pool, run, riffle, undercut bank, woody debris and macrophytes habitats.
Bed and bank composition	Substrate: per cent representation by bedrock, boulder (>256 mm), cobble (64-256 mm), pebble (4-64 mm), gravel (2-4 mm), sand (0.05-2 mm) and silt/clay (<0.05 mm) classifications. Sediment deposits: presence of instream deposits of either sand or silt (or none).
Surface water attributes	Water quality: substrate anoxia, water surface colour and condition, the presence of water or substrate odour was noted.
Instream habitat	Snags and woody debris: representation of detritus (leaves, twigs), sticks (<2 cm diameter), branches (<15 cm diameter) and logs (>15 cm diameter) classifications. These were estimated in terms of cover within the reach as either none, little (1-10 per cent), some (10-50 per cent), moderate (50-75 per cent) or extensive (>75 per cent). Habitat attributes: presence of periphyton, moss, filamentous algae, macrophytes, bank overhang vegetation, trailing bank vegetation, blanketing silt and substrate anoxia. The same 'none' to 'extensive' categories were used as for snags and woody debris. Macrophytes: general characterisations of visible macrophytes.
Riparian condition	Riparian zone: width of riparian zone, per cent canopy cover, per cent shading, cover (none' to 'extensive') of bare ground, grass, shrubs, tress < 10 m high; trees > 10 m high and presence of exotic species.
Existing disturbances/modifications or barriers	Disturbances: impacts from humans, pastoral animals, non-pastoral animals. Presence of erosion, artificial and/or natural barriers.
Breeding habitat	Location and suitability of potential breeding habitats.

The location and extent of habitats (including potential breeding habitats) within the site were mapped and a longitudinal profile sketch of the stream reach completed. Photographs of each site were taken as an additional record of habitat conditions at the time of the survey.

An overall condition score was calculated by scoring each habitat variable against condition criteria detailed in Table 2-9. These bioassessment scores are conducted to determine habitat quality which supports assessment of suitability for conservation significant species and susceptibility of sites to potential construction and operational phase impacts.

Table 2-9 River bioassessment program: habitat assessment score criteria

Habitat variable	Poor	Fair	Good	Excellent
Bottom substrate	0 – 5	6 – 10	11 – 15	16 – 20
Embeddedness	0 – 5	6 – 10	11 – 15	16 – 20
Velocity and depth category	0 – 5	6 – 10	11 – 15	16 – 20
Channel alteration	0 – 3	4 – 7	8 – 11	12 – 15
Bottom scouring and deposition	0 – 3	4 – 7	8 – 11	12 – 15
Pool/riffle, run/bend ratio	0 – 3	4 – 7	8 – 11	12 – 15

Habitat variable	Poor	Fair	Good	Excellent
Bank stability	0 – 2	3 – 5	6 – 8	9 – 10
Bank vegetation and stability	0 – 2	3 – 5	6 – 8	9 – 10
Streamside cover	0 – 2	3 – 5	6 – 8	9 – 10
Total	**0 – 38**	**39 – 74**	**75 – 110**	**111 – 135**

2.4.4.2 Physico-chemical water quality

In-situ physico-chemical water quality data was measured at each wetted site where sufficient water was available. Measurements were recorded at the surface (0.1 m depth) using a calibrated water quality meter. Parameters recorded included:

– Water temperature (°C)
– pH (pH units)
– Electrical conductivity (µS/cm)
– Dissolved oxygen (mg/L and % saturation)
– Turbidity (NTU).

In-situ physico-chemical water quality data was collected to inform the assessment of habitat condition at a site.

The water quality survey results from sites within the GSDA were compared to the moderately disturbed lowland freshwater objectives set out in the DEHP document for Calliope River basin (DEHP 2014a). The water quality survey results from sites within the SGIC SDA were compared to the aquatic ecosystem – moderately disturbed objectives in the Fitzroy River sub-basin fresh waters as set out in the DEHP document for the Fitzroy River sub-basin (DEHP 2013).

2.4.4.3 Aquatic survey method

Targeted aquatic surveys were conducted at throughout the survey at sites outline above, methods for each survey type are outlined in Table 2-10.

Table 2-10 Aquatic survey methods used within the study area

Assessment	Survey methods
Aquatic flora	An inventory of aquatic plants (macrophytes) species was compiled for each site sampled. A description of riparian vegetation composition was also recorded. Surveys were conducted in accordance with the Monitoring and Sampling Manual (DES2018a).
Freshwater fishes	Fish community assessments were conducted at one detailed assessment site. In support of collecting as representative a sample as possible, a variety of trapping methods were used during the survey. Methods selected supported ability to target a variety of habitats, fish sizes and site conditions in accordance with the survey guidelines for Australia's threatened fish: Guidelines for detecting fish listed as threatened under the EPBC Act (Commonwealth of Australia 2011b) and the Monitoring and Sampling Manual (DES 2018a). The fish community data was assessed to determine abundance and diversity of species collected at each site, as well as health and general population structure. After completion of processing, all native species were released at the point of capture. All noxious specimens declared under relevant Commonwealth and State legislation were euthanised and disposed of in accordance with GHD's animal ethics approval.
Freshwater turtles	Survey for freshwater turtles, including targeted surveys for the conservation significant white-throated snapping turtle (*Elseya albagula)* and Fitzroy River turtle (*Rheodytes leukops*) involved fyke netting and cathedral trapping in accordance with the standard methodology of the DES (Limpus *et al*. 2002; Hamann *et al*. 2007; Limpus *et al*. 2011) and the survey guidelines for Australian's threatened reptiles (Commonwealth of Australia 2011c). Snorkelling and muddling were not conducted as the risk of estuarine crocodiles in the vicinity was too high. Survey for potential nesting habitat involved searching accessible bank margins for habitat suitability for nesting, as surveys were conducted outside of breeding season. Potential suitability of habitat for turtle nesting were assessed based on results of the trapping and an assessment of habitat characteristics.

Assessment	Survey methods
	On capture, turtle specimens were photographed (carapace, plastron, forelimbs, and neck/head), identified, sexed, measured (carapace length, carapace width), and returned to the water at the point of capture.
Platypus	The presence of the platypus (*Ornithorhynchus anatinus*) within the study area was assessed through active searches for evidence of platypus occurrence and assessment of habitat suitability. Active searches were undertaken at all sites to identify the presence of platypus burrows in banks (typically indicated by a horizontally oval cross-section burrow under a tangle of tree roots). The suitability of habitat at each site was assessed based on bank substrate type and coherence, water permanence, habitat size and connectivity compared to species requirements detailed in published literature (Grant 2007; Grant and Temple-Smith 1998). Passive surveys for platypus were also conducted at comprehensive survey sites by deploying fyke nets and cathedral traps where possible.
Crocodiles	The presence of the freshwater crocodile (*Crocodylus johnstoni*) and estuarine crocodile (*Crocodylus porosus*) within the study area was assessed through active searches for evidence of crocodile occurrence and assessment of habitat suitability. Daytime active searches were undertaken at all sites for individuals, nesting sites and bank slides in accordance with the Queensland Crocodile Monitoring Plan (DES 2018b). The suitability of habitat at each site was assessed based on water depth, water permanence habitat size and connectivity.

2.5 Likelihood of occurrence assessment

An assessment was conducted to attribute a 'likelihood of occurrence' to EPBC Act and NC Act listed threatened species that have been previously recorded or were predicted to occur from the desktop search extent. The assessment criteria are provided in Table 2-11.

The likelihood of occurrence assessment was based on a review of species distributions and habitat requirements, historical records for the region, and the results of habitat assessments and ecological field surveys conducted within the study area. The likelihood of occurrence findings for this project are provided in Appendix E.

Table 2-11 Likelihood of occurrence assessment criteria

Category	Criteria
Confirmed present	Species recorded during the 2022 field surveys and previous field surveys undertaken by Arup (2008).
Likely to occur	Species has been historically recorded in the desktop search extent and suitable habitat is present in the study area. Comprehensive field surveys have not been undertaken or were undertaken in sub-optimal conditions or the species is highly cryptic and/or very short-lived.
May occur	Species distribution incorporates the study area, but only marginal habitat is present or the species has not been historically recorded in the desktop search extent.
Unlikely to occur	Species has not been historically recorded in the desktop search extent and current known distribution does not encompass the study area or suitable habitat is generally lacking from the study area.

2.6 Predicted habitat for conservation significant species

For all conservation significant flora and fauna species confirmed present or considered likely to occur, the distribution of predicted habitat was mapped based on criteria detailed in Appendix F. For most species, this was based on habitat criteria detailed in the Commonwealth or State listing/conservation advice and/or other related documents (e.g. recovery plans). Field verified REs and other mapped vegetation (e.g. regrowth) or waterways that are recognised as habitat factors were used as a foundation for this exercise, together with observations on habitat quality obtained during field surveys.

2.7 Assessment of potential impacts and mitigation measures

An assessment was undertaken to determine the potential construction and operational impacts of the project on the identified existing environmental values. This included conducting a review of publicly available scientific literature and Australian and Queensland government publications. Based on the identified potential direct and indirect impacts outlined in Section 6, management actions for the entire pipeline alignment were developed to avoid and minimise those impacts.

2.8 Significant impact assessment

A significance of impacts assessment was undertaken for each section (GSDA, SGIC SDA and Northern Section) of the pipeline alignment (Sections 7.1, 7.2 and 7.3) of the project's potential impacts on MSES and MNES that have been confirmed present or considered likely to occur within the study area.

As identified in Section 1.2, EPBC approval has been granted for the project, with the controlling provisions being threatened species and ecological communities listed at the time of the approval. A significant impact assessment (SIA) was undertaken in accordance with the EPBC Act Policy Statement 1.1 Significant Impact Guidelines – MNES (May 2006) as part of the EIS and SEIS and the approval conditions based on this assessment for these MNES controlling provisions. In this report, a significant residual impact (SRI) assessment was undertaken in accordance with the Queensland *Significant Residual Impact Guideline* (DEHP 2014b) for 20 flora and fauna species currently listed under both the EPBC Act and NC Act that have been confirmed present or likely to occur. In addition, the grey-headed flying-fox (*Pteropus poliocephalus*) is only listed under the EPBC Act, and therefore, an SIA was undertaken for this species.

The assessment was made against the Queensland *Significant Residual Impact Guideline* (DEHP 2014b) for the following listed values:

– Regulated vegetation
– Connectivity areas
– Wetlands and watercourses
– Waterway providing for fish passage
– Protected wildlife habitat for species (listed under the EPBC Act and NC Act) confirmed or likely to occur.

The assessment was made against the Commonwealth *Significant Impact Guidelines 1.1* (DoE 2013) for the following listed values listed at the time of the approval:

– Threatened ecological communities confirmed to occur
– Threatened species (only listed under the EPBC Act) confirmed or likely to occur.

3. GSDA ecological values

3.1 Threatened ecological communities

3.1.1 Desktop assessment results

The EPBC Act PMST search predicted that nine TECs have the potential to occur within the desktop search extent of the GSDA (Appendix A). Of those nine, only four have associated REs mapped within the GSDA study area (Table 3-1).

Although nine TECs were shown as predicted to occur within the search area, only two were listed at the time of the EPBC approval, and as such, subject to the EPBC approval including:

– Brigalow (*Acacia harpophylla* dominant and co-dominant) (listed as endangered)

– Semi-evergreen vine thickets of the brigalow belt (listed as endangered).

Neither of the abovementioned communities were confirmed present within the current GSDA study area during the previous field assessment (Arup 2008).

Table 3-1 TECs predicted to occur within the desktop search extent

TEC	EPBC Act status	Associated REs	RE(s) mapped within the GSDA study area
Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and Southeast Queensland ecological community	E	12.1.1, 12.3.20	No
Coastal Swamp Sclerophyll Forest of New South Wales and Southeast Queensland	E	12.1.1, 12.3.20	No
Coolibah – Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions	E	11.3.3, 11.3.16, 11.3.15, 11.3.37, 11.3.28	Yes
Littoral Rainforest and Coastal Vine Thickets of Eastern Australia	CE	11.2.2, 3.12.20, 3.2.1, 3.2.11, 3.2.12, 3.2.13, 3.2.28, 3.2.29, 3.2.31, 7.12.11d, 7.2.1, 7.2.2, 7.2.5a, 7.2.6b, 7.11.3b, 8.2.2, 7.2.2a – 7.2.2h, 7.2.1a – 7.2.1i, 3.2.1a, 3.2.1b	No
Lowland Rainforest of Subtropical Australia	CE	12.3.1a, 12.3.16, 12.3.17, 12.5.13, 12.8.3, 12.8.4, 12.8.13, 12.11.1, 12.11.10, 12.12.1, 12.12.16, 12.5.13b	No
Poplar Box Grassy Woodland on Alluvial Plains	E	11.3.2, 11.3.17, 11.4.7, 11.4.12, 12.3.10	Yes
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	E	11.11.18, 11.2.3, 11.3.11, 11.4.1, 11.5.15, 11.8.13, 11.8.3, 11.8.6, 11.9.4, 11.9.8	Yes
Subtropical and Temperate Coastal Saltmarsh	V	12.1.2	No
Weeping Myall Woodlands	E	11.3.2, 11.3.28	Yes
Key to table: CE – critically endangered; E – endangered; V – vulnerable			

3.1.2 Field survey results

No vegetation communities were observed in the GSDA study area that met the diagnostic or condition criteria of any EPBC Act listed TEC. In most instances, vegetation communities lacked the floristic composition to constitute a listed TEC.

3.2 Regional Ecosystems and regulated vegetation

3.2.1 Desktop assessment results

The GSDA study area is located within the Burnett - Curtis Hills and Ranges subregion of the Southeast Queensland bioregion and the Mount Morgan Ranges subregion of the Brigalow Belt bioregion. The study area is mapped by DoR as comprising a mixture of Category B (remnant vegetation), Category R (Great Barrier Reef riverine regrowth vegetation), Category C (high-value regrowth vegetation) and Category X vegetation (not generally regulated under the *Vegetation Management Act 1999* (VMA)). Descriptions of REs comprising the polygons of mapped remnant and regrowth vegetation within the study area, together with their status under the VMA are provided in Table 3-2. Property maps of assessable vegetation (PMAVs) are also in place across substantial portions of the study area. The vast majority of the mapped polygons in the PMAVs are Category X. Essential habitat and defined watercourses also intersect the GSDA pipeline alignment.

DoR vegetation mapping relative to the study area is provided in Appendix C.

Table 3-2 REs mapped within the GSDA study area, either as components of heterogenous polygons or as homogenous polygons

Mapped REs	VMA status	Short description	Broad vegetation group
11.3.4	OC	*Eucalyptus tereticornis* and/or *Eucalyptus* spp. woodland on alluvial plains	16c
11.3.25	LC	*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines	16a
11.3.26	LC	*Eucalyptus moluccana* or *E. microcarpa* woodland to open forest on margins of alluvial plains	13d
11.3.29	LC	*Eucalyptus crebra*, *E. exserta*, *Melaleuca* spp. woodland on alluvial plains	18b
11.11.4	LC	*Eucalyptus crebra* woodland on old sedimentary rocks with varying degrees of metamorphism and folding. Coastal ranges	13c
11.11.4c	LC	*Eucalyptus moluccana* dominated woodland.	13c
11.11.5	LC	Microphyll vine forest +/- *Araucaria cunninghamii* on old sedimentary rocks with varying degrees of metamorphism and folding	7a
11.11.15	LC	*Eucalyptus crebra* woodland to open woodland on deformed and metamorphosed sediments and interbedded volcanics	13c
11.11.18	E	Semi-evergreen vine thicket on old sedimentary rocks with varying degrees of metamorphism and folding	7a
12.3.3	E	*Eucalyptus tereticornis* woodland on Quaternary alluvium	16c
12.11.6	LC	*Corymbia citriodora* subsp. *variegata*, *Eucalyptus crebra* woodland on metamorphics +/- interbedded volcanics	10b
12.11.14	OC	*Eucalyptus crebra*, *E. tereticornis*, *Corymbia intermedia* woodland on metamorphics +/- interbedded volcanics	13c
Key to table: E – endangered; OC – of concern; LC – least concern			

3.2.2 Field survey results

A number of discrepancies were identified between the mapped DoR REs and the field verified REs within the GSDA pipeline alignment. Most commonly, mapped heterogenous polygons comprising multiple REs were comprised of single RE within the extent of the alignment. In most cases, the VMA status (least concern, of concern, or endangered) and/or the remnant status (remnant, regrowth, non-remnant) of the field verified polygons remained the same, despite the change in RE composition. Where changes occurred, all resulted in a lower VMA status (i.e. less threatened). Notably, the one patch of remnant endangered vegetation mapped within the GSDA pipeline alignment (i.e. RE 11.11.4/ 11.11.15/ 11.11.4c/ 11.11.5/ 11.11.18) was field verified as comprising remnant least concern vegetation (RE11.11.15) and non-remnant vegetation.

Several areas containing PMAVs were mapped as Category X, despite vegetation appearing to have reached remnant status. These polygons were historically secured as Category X vegetation through the PMAV process and their assigned designation within the study area was retained.

Field verified RE mapping is provided in Table 3-4 and Figure 3-1. It is noted that DoR vegetation mapping was accepted for those polygons not ground-truthed during surveys (refer hatched polygons in Figure 3-1). Impact areas for respective REs within the GSDA, based on field verified mapping and a nominal 30 m wide corridor, are provided in Table 3-3.

A description of REs where field verification has resulted in a change to the VMA status or remnant status of the mapped polygon (version 12.1) is provided in Table 3-4.

Table 3-3 Impact areas for REs mapped within the GSDA

RE	VMA Class	VMA Status	Total area (m^2)
11.3.4	High value regrowth	OC	81,803
11.3.4	Remnant	OC	11,171
11.3.4/11.3.26/11.3.25	High value regrowth	OC	6
11.3.25	High value regrowth	LC	1,260
11.3.25	Remnant	LC	3,734
11.3.25/11.3.4	High value regrowth	OC	1,415
11.3.26	High value regrowth	LC	18,872
11.3.26	Remnant	LC	6,655
11.3.26/11.3.4	High value regrowth	OC	37,282
11.3.26/11.3.4/11.11.4c	High value regrowth	OC	26,808
11.3.26/11.3.4/11.3.25	High value regrowth	OC	5,637
11.3.29	High value regrowth	LC	22,378
11.3.29	Remnant	LC	1,635
11.11.4	High value regrowth	LC	94,265
11.11.4	Remnant	LC	23,729
11.11.15	Remnant	LC	1,562
12.3.3	High value regrowth	E	2,158
12.11.6	High value regrowth	LC	5,180
12.11.6	Remnant	LC	15,600
12.11.6/12.11.14	High value regrowth	OC	7,340
12.11.6/12.11.14	Remnant	OC	9,893
12.11.14	High value regrowth	OC	1,637
Non-remnant	Non-remnant	NA	341,596

Table 3-4 Field verified REs resulting in change to VMA status and/or remnant status in the GSDA study area

Location	Mapped RE	Field verified RE	Field description	Representative photograph
-23.813, 151.002	Category C 11.3.26/ 11.3.4/ 11.11.4c	Category C 11.11.4	T1 – *Eucalyptus crebra*, *Corymbia erythrophloia* (10-13 m tall, 25 % cover). T2 – T1 juveniles, *Acacia disparrim*a subsp. *disparrima*, *Corymbia tessellaris* (4-6 m, 4 % cover). S1 – *A. disparrima* subsp. *disparrima*, *E. crebra* (1.1 m tall, 2 % cover) G – *Hyparrhenia rufa**, *Themeda triandra*, *Pterocaulon redolens* (0.1-0.7 m, 85 % cover) Landform: Low hill on metamorphics (Land Zone 11)	
-23.857, 151.032	Category C 11.3.26/ 11.3.4/ 11.11.4	Category C 11.3.26	T1 – *Eucalyptus moluccana* (14 – 20 m tall, 64 % cover) T2 – *E. moluccana* (3 m tall, 2 % cover) S1 – *Lantana camara**, *Alphitonia excelsa*, *Cryptostegia grandiflora**, *Stylosanthes scabra**, *Carissa ovata* (1.1 m tall, 4 % cover) G – *Sporobolus pyramidalis**, *Eremophila debilis*, *Phyllanthus virgatus**, *Fimbristylis* sp., *Cyanthillium cinereum* (0.3 m tall, 20 % cover) Landform: alluvial plain (Land Zone 3) Note: RE 11.3.4 observed immediately east of study area and RE 11.11.4 absent	

Location	Mapped RE	Field verified RE	Field description	Representative photograph
-23.856, 151.068	Category C 11.3.26/ 11.3.4/ 11.11.4c	Category C 11.3.26	Canopy dominated by *Eucalyptus moluccana* with associated *C. citriodora* to 18 m over a sub-canopy of T1 spp. and *Acacia disparrima* subsp. *deticisparrima*. Landform: alluvial plain (Land Zone 3)	
-23.856, 151.071	Category C 11.3.26/ 11.3.4/ 11.11.4c	Category C 11.3.26	Dominated by *Eucalyptus moluccana* with associated *E. tereticornis* and *Corymbia tessellaris* in drainage line. No *E. crebra* present. Landform: alluvial plain (Land Zone 3)	

Location	Mapped RE	Field verified RE	Field description	Representative photograph
-23.855, 151.075	Category B 11.3.26/ 11.11.4c/ 11.3.4	Category B 11.3.26	T1 – *Eucalyptus moluccana* (22 – 29 m tall, 35 % cover) T2 – *E. moluccana* (6 – 13 m tall, 5 % cover) T3 – *E. moluccana*, *Acacia decora*, *Alphitonia excelsa* (2 – 4 m tall) S1 – *Cryptostegia grandiflora**, *Acacia decora*, *Alphitonia excelsa*, *Acacia disparrima*, *Acacia leiocalyx*, *Breynia oblongifolia*, *Stylosanthes scabra**, *Dodonaea viscosa*, *Coelospermum reticulatum*, *Denhamia cunninghamii* (1 – 1.5 m tall) G – *Megathyrsus maximus**, *Bothriochloa decipiens*, *Sida* sp., *Biden pilosa**, *Eremophila debilis*, *Praxelis clematidea** Landform: alluvial plain (Land Zone 3)	
-23.851, 151.088		Category C 11.11.4	T1 – *Eucalyptus tereticornis*, *E. crebra*, *C. tessellaris*, *E. moluccana* (15 m tall, 25 % cover). T2 – T1 juveniles, *A. Disparrima* subsp. *Disparrima*, *Petalostigma pubescens*, *Corymbia intermedia* (2-8 m tall, 10 % cover), S1 – *Lantana camara**, T1 juveniles (1 m tall, 3 % cover) G – *Cymbopogon refractus*, *Melinis repens**, *Aristida* sp. *Cyanthillium cinereum*, *Hyparrhenia rufa**, *Megathyrsus maximus** (0.1 – 0.7 m tall, 60%) Landform: lower slopes of low hill and adjacent plain	

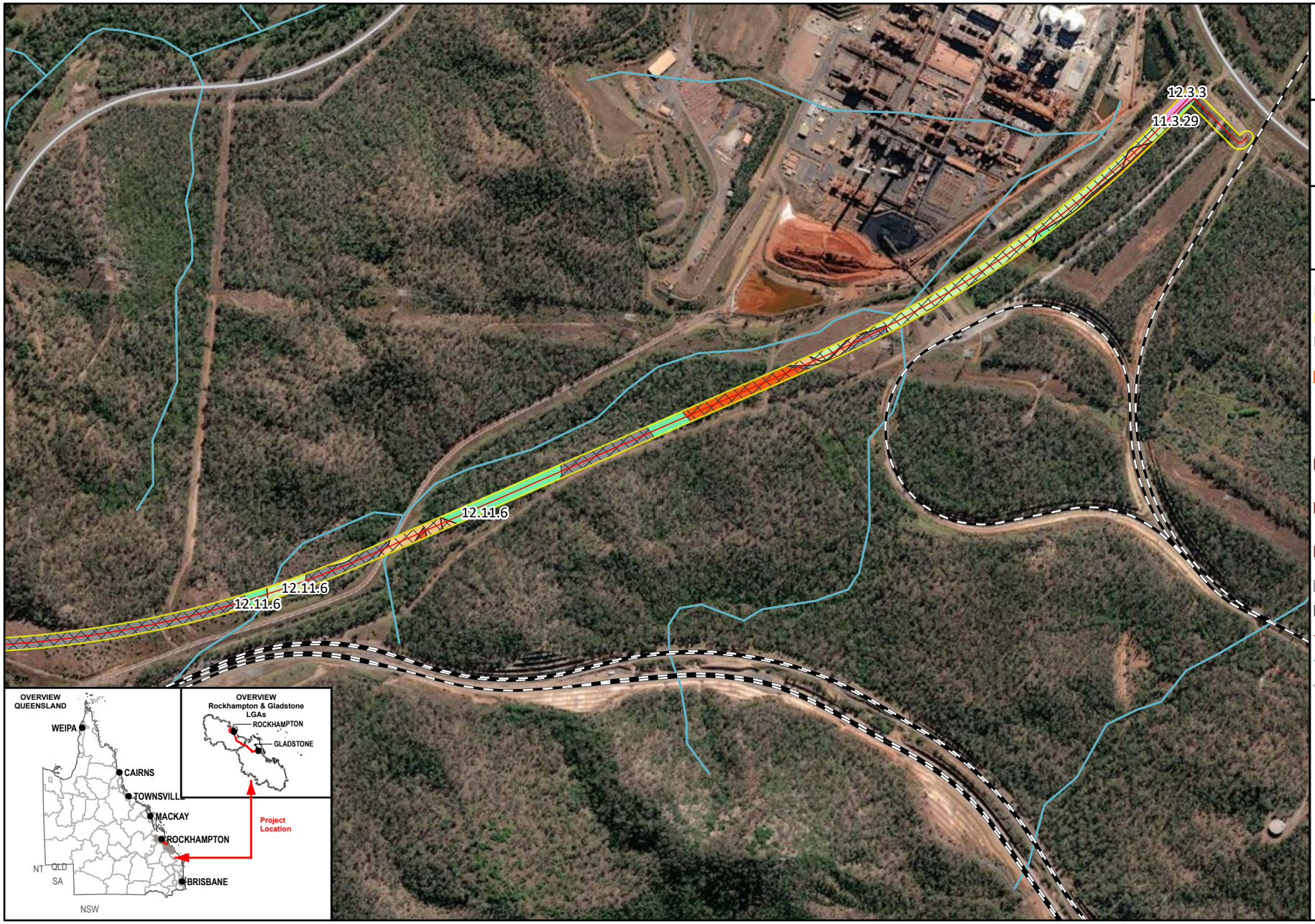
Location	Mapped RE	Field verified RE	Field description	Representative photograph
-23.850, 151.090	Category C 11.3.26/ 11.3.4/ 11.11.4c	Category C 11.11.4	T1 – *Eucalyptus crebra*, *Corymbia citriodora*, *E. Moluccana*, *E. exserta* (12-18 m tall, 25% cover) T2 – *E. crebra*, *C. erythrophloia*, (6-10 m, 8% cover) T3 – *E. Crebra*, *C. Erythrophloia*, *Petalostigma pubescens*, *Alphitonia excelsa* (2-4 m, 5 % cover) S1 – *A. Excelsa*, *E. Crebra*, *Denhamia cunninghamii* (1.6 m tall, 5 % cover) G – Mid-dense *Themeda triandra*, *Sida hackettiana*, *Bothriochloa pertusa**, *Stylosanthes scabra** Landform: low hill on metamorphics (Land Zone 11)	
-23.850, 151.094	Category B 11.11.4/ 11.11.15/ 11.11.4c/ 11.11.5/ 11.11.18	Category B 11.11.15	T1 – *Eucalyptus crebra*, *Corymbia erythrophloia*, *C. tessellaris*, *E. tereticornis* (15 -18 m tall, 40 % cover) T2 – T1 juveniles, *Acacia fasciculifera*, *Lophostemon suaveolens*, *A. Disparrima* subsp. *Disparrima* (2-8 m tall, 5 % cover) S1 – *A. Disparrima* subsp. *Disparrima*, *Vachellia bidwillii*, *A. Fasciculifera* (1.3 m tall, 3 % cover) G – *Themeda triandra*, *Hyparrhenia rufa**, *Megathyrsus maximus**, *Bothriochloa pertusa** (0.1 – 1 m tall, 85 % cover) Landform: mid-slope of low hill on metamorphics (Land Zone 11)	

Location	Mapped RE	Field verified RE	Field description	Representative photograph
-23.850, 151.0946		Category X	Very sparse regrowth of *Eucalyptus crebra*, *E. tereticornis* and *Acacia* spp. over dense *Hyparrhenia rufa**, *Megathyrsus maximus**, Bothriochloa pertusa*. Landform: mid-slope of low hill on metamorphics (Land Zone 11) Note: Vegetation does not meet the minimum crown cover requirements for Category C vegetation specified in the Guideline for determining category C areas Vegetation management (DoR 2019) (i.e. 10% crown cover for sparse vegetation).	
-23.850, 151.096	Category B 11.3.25	Category X 11.3.25	Very sparse regrowth of *Eucalyptus tereticornis* and *Acacia* spp. to 6m tall over dense *Hyparrhenia rufa**, *Megathyrsus maximus**, *Bothriochloa pertusa**. Landform: footslope of low hill (Land Zone 3) Note: Vegetation does not meet the minimum crown cover requirements for Category C vegetation specified in the Guideline for determining category C areas Vegetation management (DoR 2019) (i.e. 10% crown cover for sparse vegetation).	

Location	Mapped RE	Field verified RE	Field description	Representative photograph
-23.8405, 151.1298	Category B 12.11.6/ 12.11.14	Category B 12.11.6	T1 – *Corymbia citriodora*, *C. intermedia* (18 m tall, 60% cover) T2 – *C. citriodora*, *C. intermedia*, *Eucalyptus crebra*, *Lophostemon suaveolens*, *Acacia disparrima* subsp. *Disparrima* (10 m tall, 15% cover) T3 – *Planchonella careya*, *A. disparrima* subsp. *Disparrima* S1 – *A. disparrima* subsp. *Disparrima*, *C. intermedia*, *C. citriodora*, *Grewia latifolia* G – *Hyparrhenia rufa**, *Melinis repens**, *Crotolaria lanceolata**, *Dianella brevipedunculata*, *Praxelis clematidea** Landform: lower slope of low hill (Land Zone 11)	
-23.8396, 151.1371	Category B 12.11.6/ 12.11.14	Category B 12.11.6	T1 – *Corymbia citriodora*, *Eucalyptus crebra*, *C. intermedia*, *Lophostemon suaveolens*, *E. tereticornis* (14-16 m tall, 40 % cover) T2 – *C. intermedia*, *L. suaveolens*, *Planchonella careya*, *E. crebra*, *Acacia disparrima* subsp. *Disparrima* (4-8 m tall, 20 % cover) S1 – *L. suaveolens*, *Ficus opposita*, *E. crebra*, *Macrozamia miquelii*, *Coelospermum reticulatum*, *Xanthorrhoea latifolia* (0.4-2 m tall, 3% cover) G – *Themeda triandra*, *Melinis repens**, *Praxelis clematidea**, *Dianella brevipedunculata*, *Eustrephus latifolius*, *Sida hackettiana*, *Alloteropsis semialata* (0.3 – 0.7 m tall, 40 % cover) Landform: lower hill slope (Land Zone 11)	

Location	Mapped RE	Field verified RE	Field description	Representative photograph
-23.840, 151.138	Category C 12.11.6/ 12.11.14	Category C 12.11.6	Regrowth dominated by *Acacia disparrima* subsp. *Disparrima* with associated *Eucalyptus tereticornis* to 6 m tall. Dense exotic grasses dominant in the ground layer. Landform: lower hill slope (Land Zone 11)	
-23.8375, 151.1430	Category B 12.11.14	Category B 12.11.6	Sparse canopy of *Corymbia citriodora*, *Eucalyptus tereticornis*, *C. tessellaris* and *C. intermedia* to 20 m tall over mid-dense lower tree layer of *Acacia disparrima* subsp. *Disparrima* and *Planchonella careya* over very sparse shrub layer of *Xanthorrhoea johnsonii* over a mid-dense ground layer dominated by *Hyparrhenia rufa**, *Themeda triandra* and *Sida hackettiana*. Landform: adjacent to drainage line at footslope of hill (Land Zone 11)	

Key to table: Pink shading: Remnant regulated vegetation containing endangered REs; Pale orange shading: High value regrowth regulated vegetation containing of concern REs; Orange shading: Remnant regulated vegetation containing of concern REs; Pale green shading: High value regrowth regulated vegetation containing least concern REs; Green shading: Remnant regulated vegetation containing least concern REs; (*) – introduced flora species.



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Legend

- Study Area

Filed verified REs

- Category A or B area containing of concern
- Category A or B area that is least concern
- Category C or R area containing endangered
- Category C or R area containing of concern
- Category C or R area that is least concern
- Non-remnant
- Unverified Fields
- GSDA Pipeline Alignment
- 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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PROJECTION UTM Zone 56
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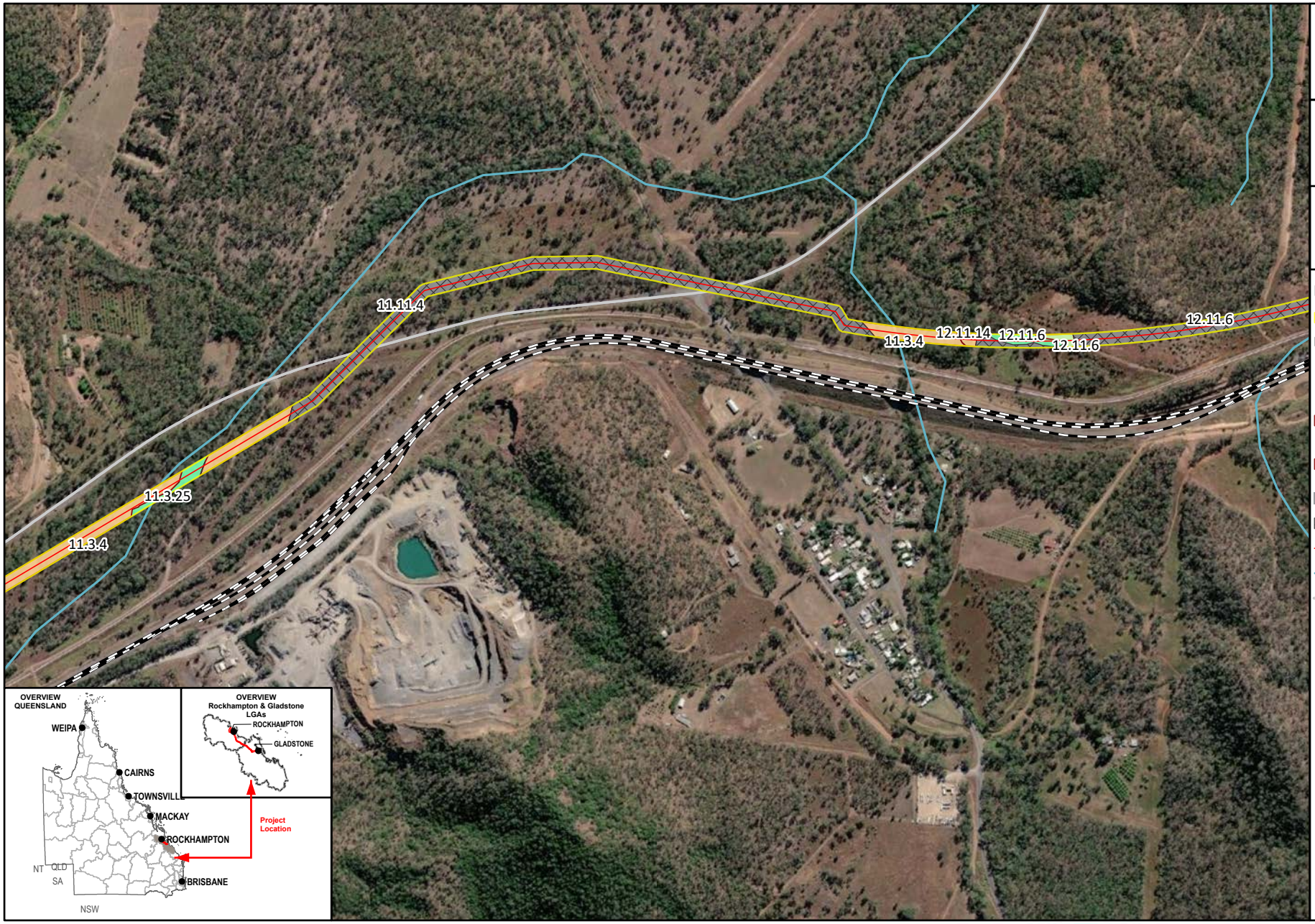
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 3-1a
Field Verified REs Within the GSDA Study Area

000-G-MAP-2404 Version:3 Date:19/09/2022



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Legend

- Study Area

Filed verified REs

- Category A or B area that is least concern
- Category C or R area containing of concern
- Category C or R area that is least concern
- Non-remnant
- Unverified Fields
- GSDA Pipeline Alignment
- Waterways
- Main Roads
- Railways

Data Sources:
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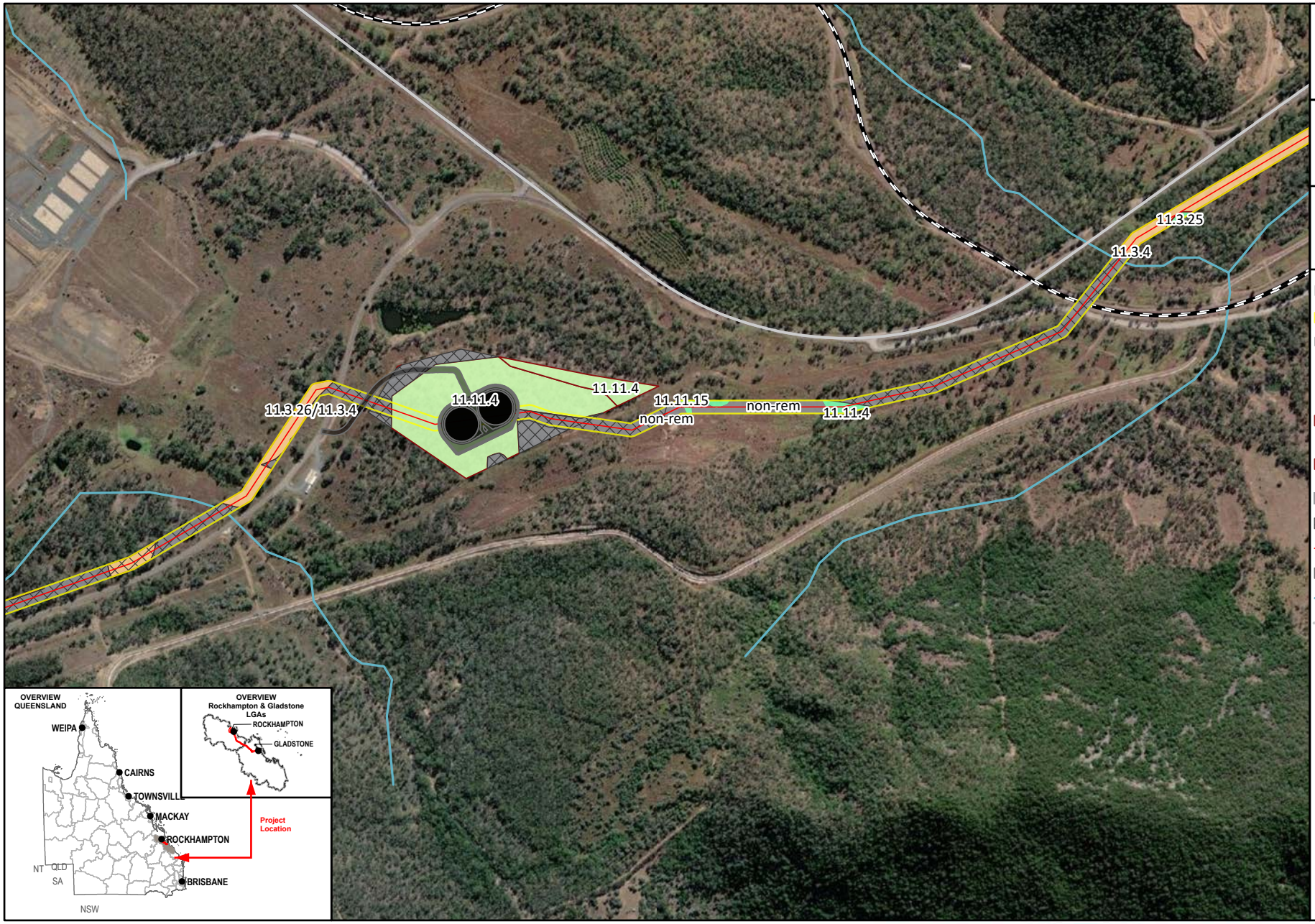
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 3-1b
Field Verified REs Within the GSDA Study Area

000-G-MAP-2404 Version:3 Date:19/09/2022



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Legend

- Study Area

Filed verified REs

- Category A or B area that is least concern
- Category C or R area containing of concern
- Category C or R area that is least concern
- Non-remnant
- Unverified Fields
- GSDA Pipeline Alignment
- Aldoga Reservoirs Layout
- Waterways
- Main Roads
- Railways

Data Sources:
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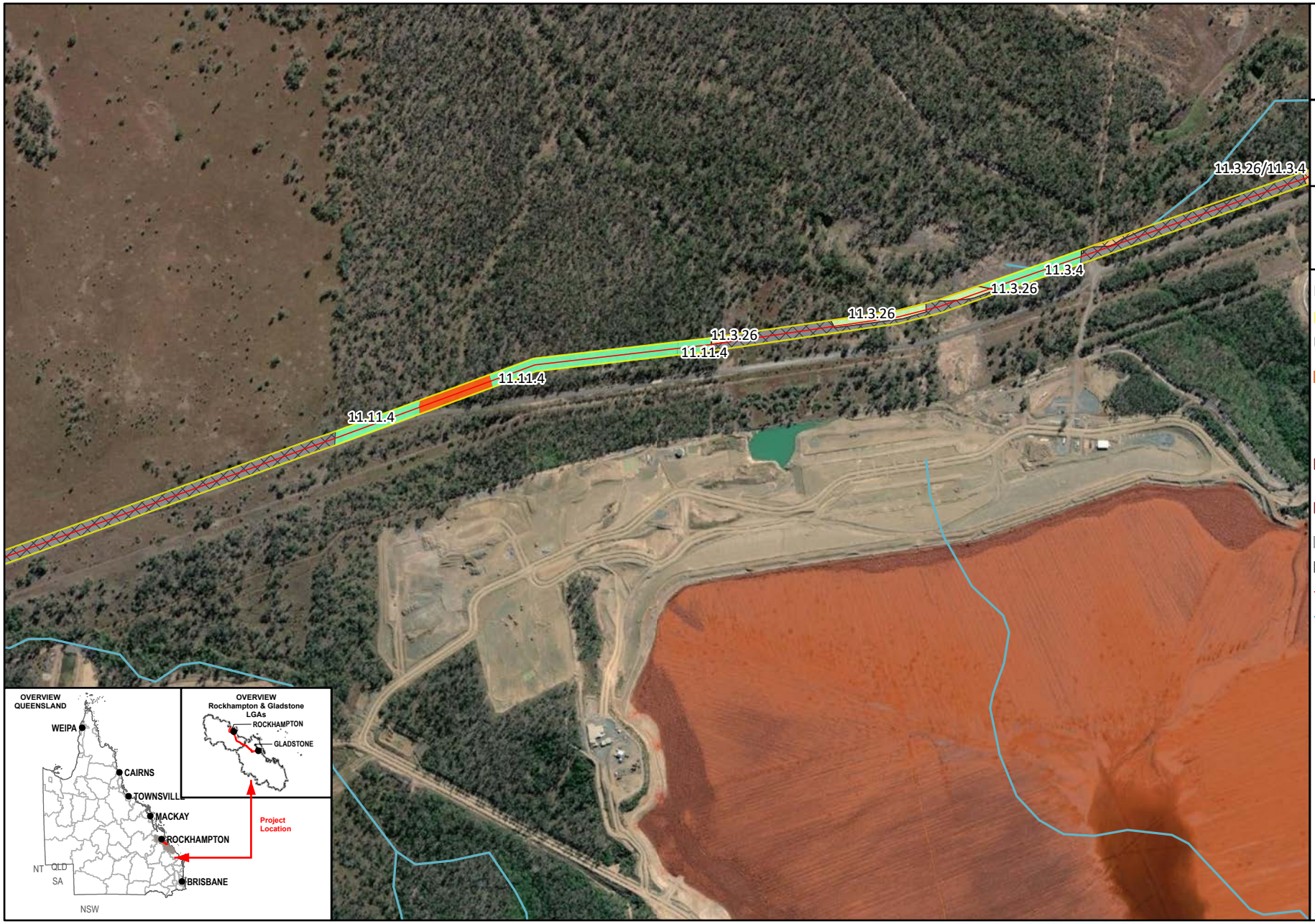
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 3-1c
Field Verified REs Within the GSDA Study Area

000-G-MAP-2404 Version:3 Date:19/09/2022



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Legend

- Study Area

Filed verified REs

- Category A or B area containing of concern
- Category A or B area that is least concern
- Category C or R area containing of concern
- Category C or R area that is least concern
- Non-remnant
- Unverified Fields
- GSDA Pipeline Alignment
- Waterways

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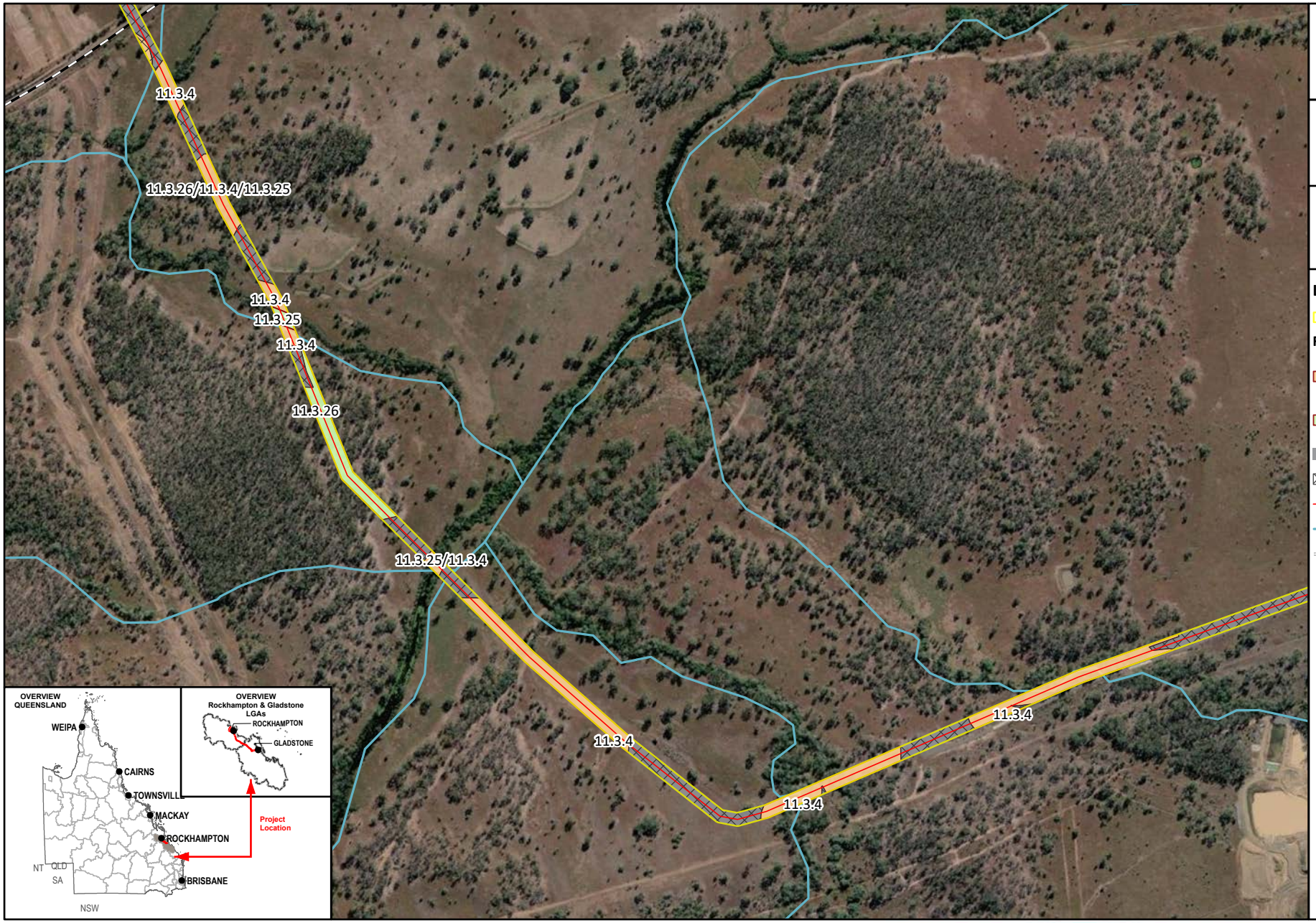
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 3-1d
Field Verified REs Within the GSDA Study Area

000-G-MAP-2404 Version:3 Date:19/09/2022



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- Study Area

Filed verified REs

- Category C or R area containing of concern
- Category C or R area that is least concern
- Non-remnant
- Unverified Fields
- GSDA Pipeline Alignment
- Waterways
- Railways

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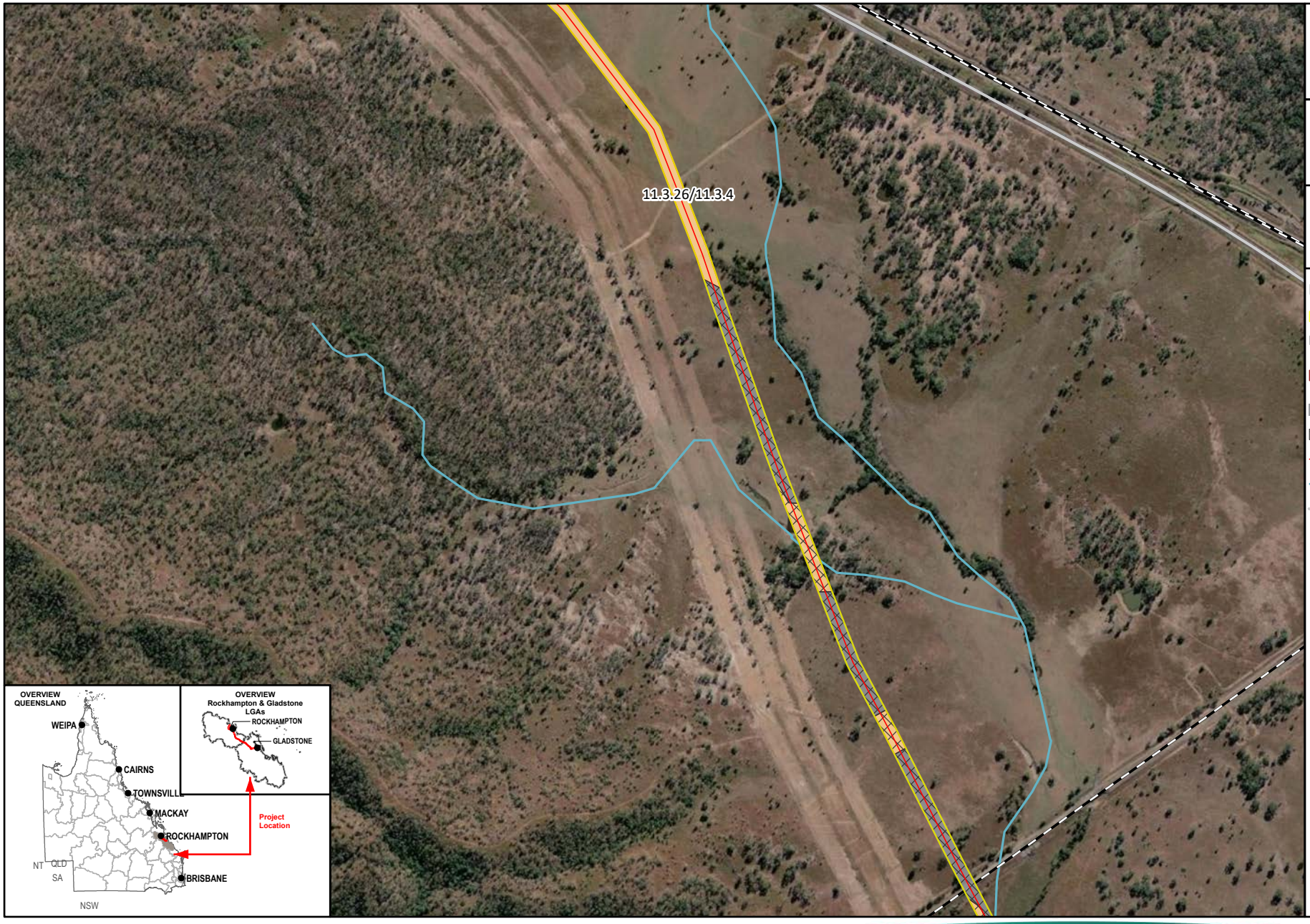
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 3-1e
Field Verified REs Within the GSDA Study Area

000-G-MAP-2404 Version:3 Date:19/09/2022



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- Study Area

Filed verified REs

- Category C or R area containing of concern
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- Unverified Fields
- GSDA Pipeline Alignment
- Waterways
- Main Roads
- Railways

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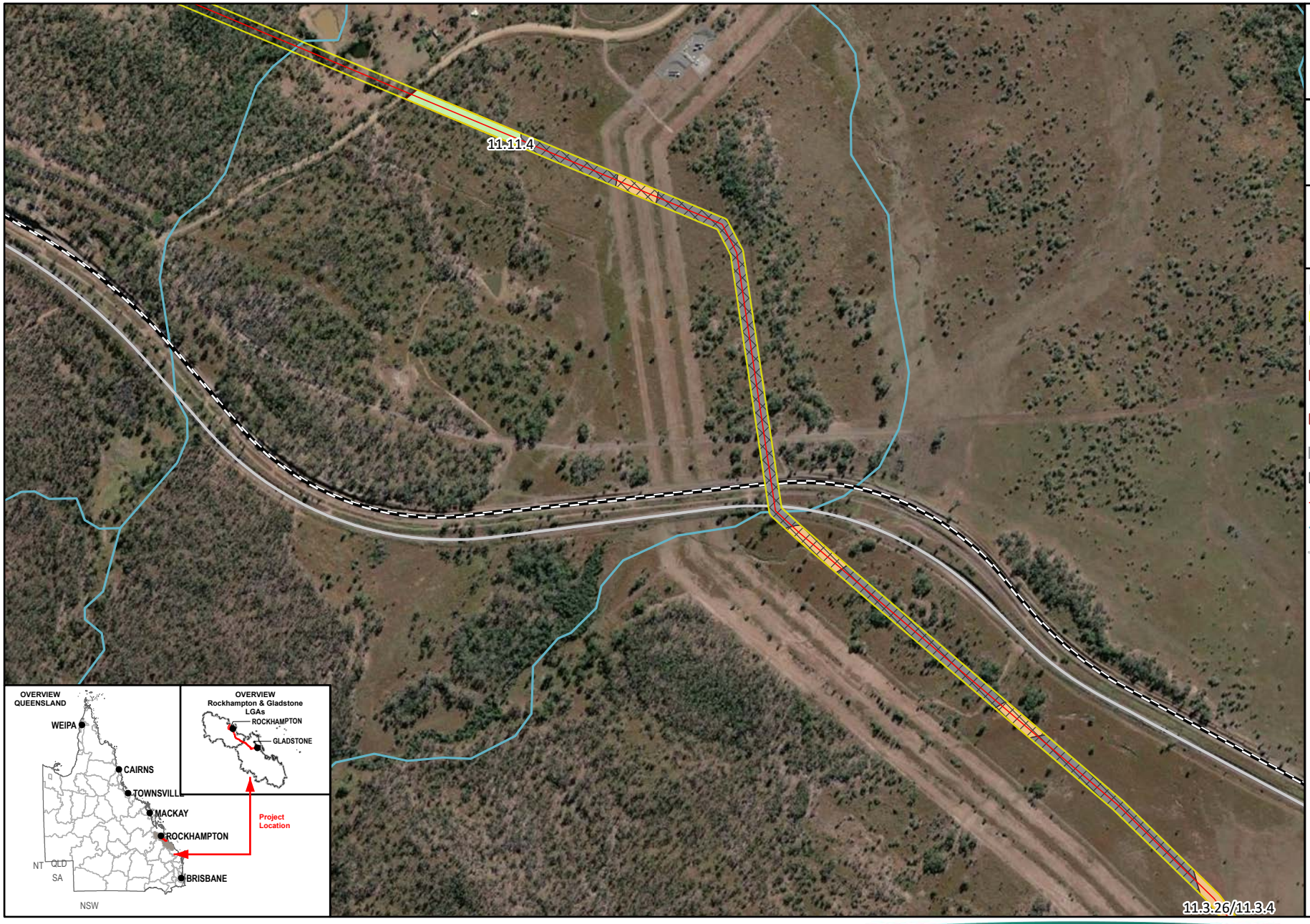
Figure 3-1f
Field Verified REs Within the GSDA Study Area

000-G-MAP-2404 Version:3 Date:19/09/2022



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Legend

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- Category C or R area that is least concern
- Non-remnant
- Unverified Fields
- GSDA Pipeline Alignment
- Waterways
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Fitzroy to Gladstone Pipeline Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 3-1g
Field Verified REs Within the GSDA Study Area

000-G-MAP-2404 Version:3 Date:19/09/2022

3.3 Conservation significant flora

3.3.1 Desktop assessment results

3.3.1.1 Protected plants flora survey trigger areas

Three high-risk flora trigger areas on the NC Act Flora Survey Trigger Map are intersected by the GSDA pipeline alignment, between Yarwun and the proposed Aldoga Reservoir (Figure 3-2). Additional high-risk flora trigger areas are mapped throughout the broader desktop search extent, predominantly within remnant vegetation (Appendix A).

3.3.1.2 Conservation significant flora species

The EPBC Act PMST database identified 14 conservation significant flora species that have the potential to occur within the GSDA desktop search extent (Table 3-5). The WildNet search identified 11 conservation significant flora species that have been historically recorded within the GSDA desktop search extent, five of which were not listed in the PMST results (Table 3-5 and Figure 3-2). Table 3-5 also identifies threatened flora species that were identified as controlling provisions at the time of the EPBC approval.

The species identified in the PMST search that were either not a listed species or not identified as potentially occurring within the PMST as part of the EIS (Arup 2008) include:

– *Dichanthium setosum*
– *Macadamia integrifolia*
– *Phaius australis.*

No conservation significant flora species were recorded within the GSDA study area during the previous field survey (Arup 2008).

Table 3-5 ***Conservation significant flora species identified as present or having suitable habitat present in the desktop search extent***

Scientific name	Status		Source	WN Records (post 1980)	Nearest Record to ROW	EPBC Approval
	EPBC Act	NC Act				
Atalaya collina	E	E	WN; PMST	12	2.6 km	✓
Bosistoa transversa	V	LC	WN; PMST	12	1.22 km	✓
Bulbophyllum globuliforme	V	NT	PMST	-	>60 km	✓
Cossinia australiana	E	E	PMST	-	>50 km	✓
Cupaniopsis shirleyana	V	V	WN; PMST	3	1.6 km	✓
Cycas megacarpa	E	E	WN; PMST	6	~5.8 km	✓
Cycas ophiolitica	E	E	PMST	-	>45 km	✓
Dansiea elliptica	NL	NT	WN	6	3.15 km	
Dichanthium setosum	V	LC	PMST	-	>220 km	
Eucalyptus raveretiana	V	LC	PMST	-	>70 km	✓
Graptophyllum excelsum	NL	NT	WN	9	8.12 km	
Hernandia bivalvis	NL	NT	WN	9	2.9 km	
Macadamia integrifolia	V	V	PMST	-	>70 km	
Macropteranthes leiocaulis	NL	NT	WN	12	7.10 km	
Marsdenia brevifolia	V	V	PMST	-	>70 km	✓
Parsonsia larcomensis	V	V	WN; PMST	7	3.8 km	✓
Phaius australis	E	E	PMST	-	>270 km	

Scientific name	Status		Source	WN Records (post 1980)	Nearest Record to ROW	EPBC Approval
	EPBC Act	NC Act				
Samadera bidwillii	V	V	WN; PMST	4	4.25 km	✓
Zieria actites	NL	CE	WN	6	3.94 km	
Key to table: CE – critically endangered; E – endangered; V – vulnerable; NT – near threatened; Mig – migratory; SL – special least concern; LC – least concern; NL – not listed; WN – WildNet; PMST – Protected Matters Search Tool.						

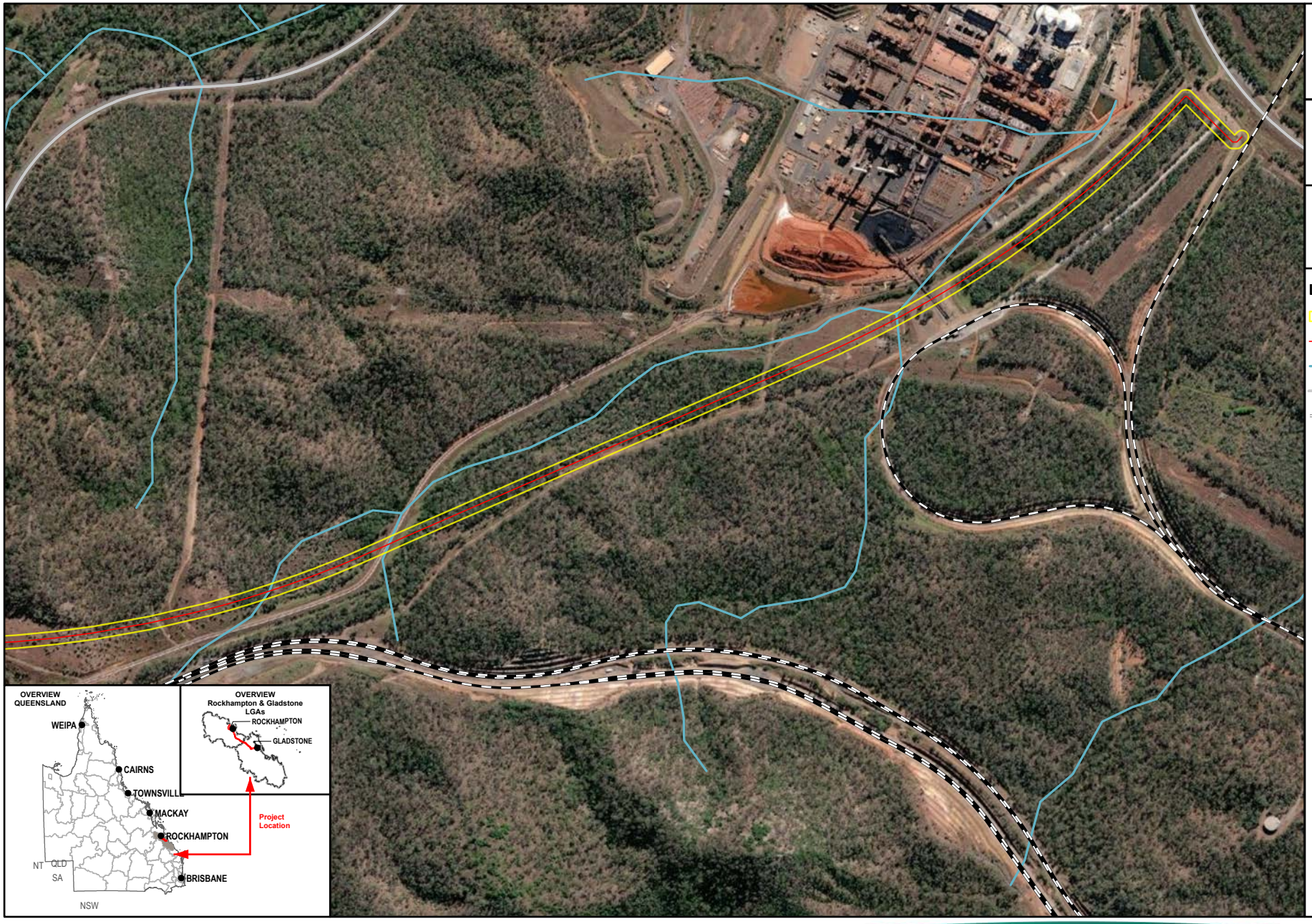
3.3.2 Field survey results

3.3.2.1 Conservation significant flora species

Comprehensive surveys for conservation significant flora species were undertaken within sections of the pipeline alignment intersected by high-risk flora trigger areas. Results of the protected plant surveys are presented in a standalone flora survey report, included as Appendix D. A protected plants Exemption Notification was submitted to DES via email on 3 August 2022. Opportunistic searches were also undertaken beyond the high-risk flora trigger areas. No conservation significant flora species were recorded during field surveys; however, suitable habitat was recorded for the following species, and their presence in the GSDA study area cannot be entirely discounted.

– *Cycas ophiolitica*
– *Cycas megacarpa*
– *Samadera bidwillii.*

Results of the protected plant surveys completed in high-risk flora trigger areas are presented in a standalone flora survey report, included as Appendix D. A protected plants Exemption Notification was submitted to DES via email on 3 August 2022.



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Legend

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

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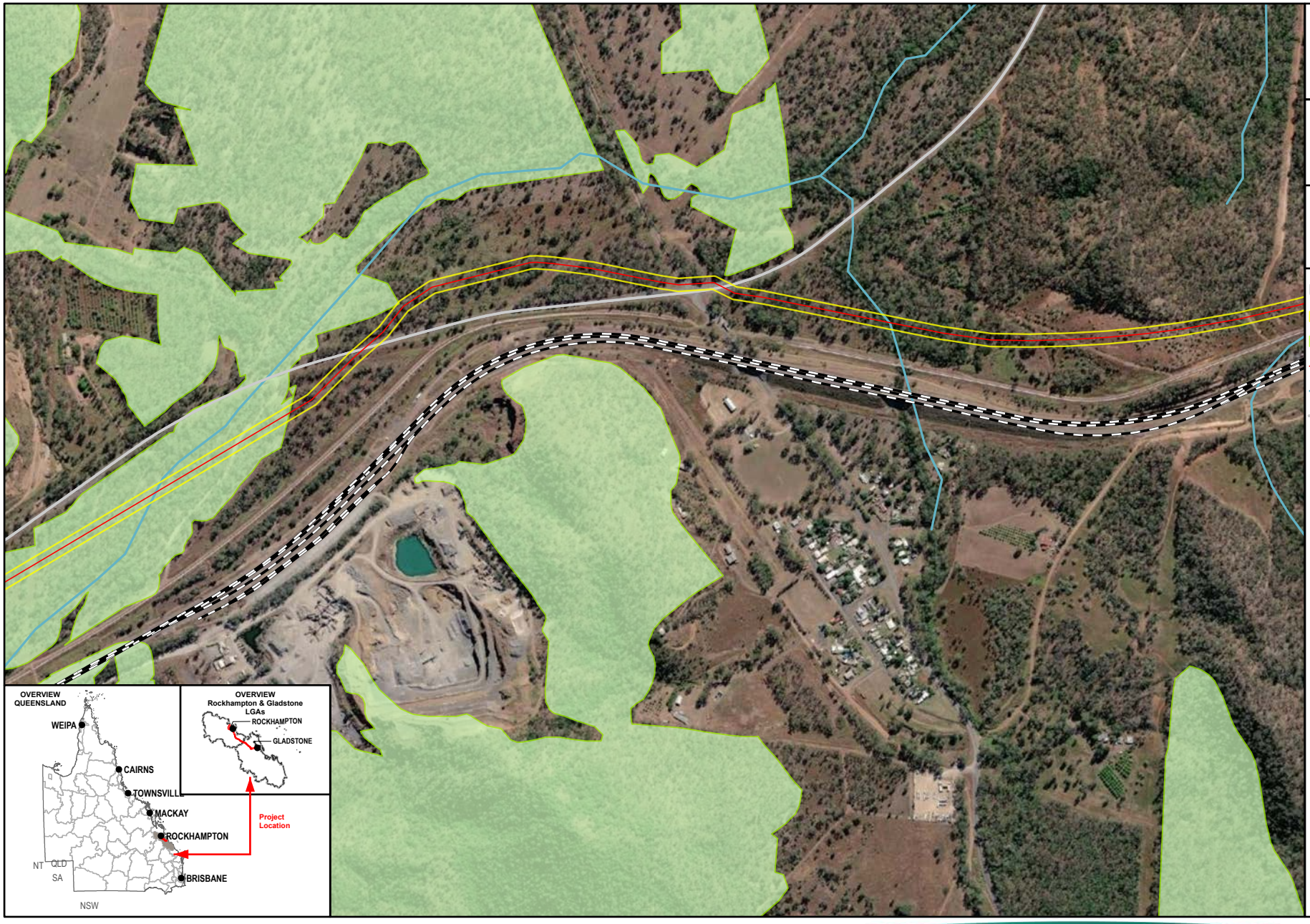
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 3-2a
High-risk Flora Survey Trigger Mapping Within the GSDA Desktop Search Extent

000-G-MAP-2405 Version:3 Date:13/09/2022



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- Study Area
- High-risk Flora Trigger Areas
- GSDA Pipeline Alignment
- Waterways
- Main Roads
- Railways

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Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 3-2b
High-risk Flora Survey Trigger Mapping Within the GSDA Desktop Search Extent

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Legend

- Study Area
- High-risk Flora Trigger Areas
- GSDA Pipeline Alignment
- Aldoga Reservoirs Layout
- Waterways
- Main Roads
- Railways

Data Sources:
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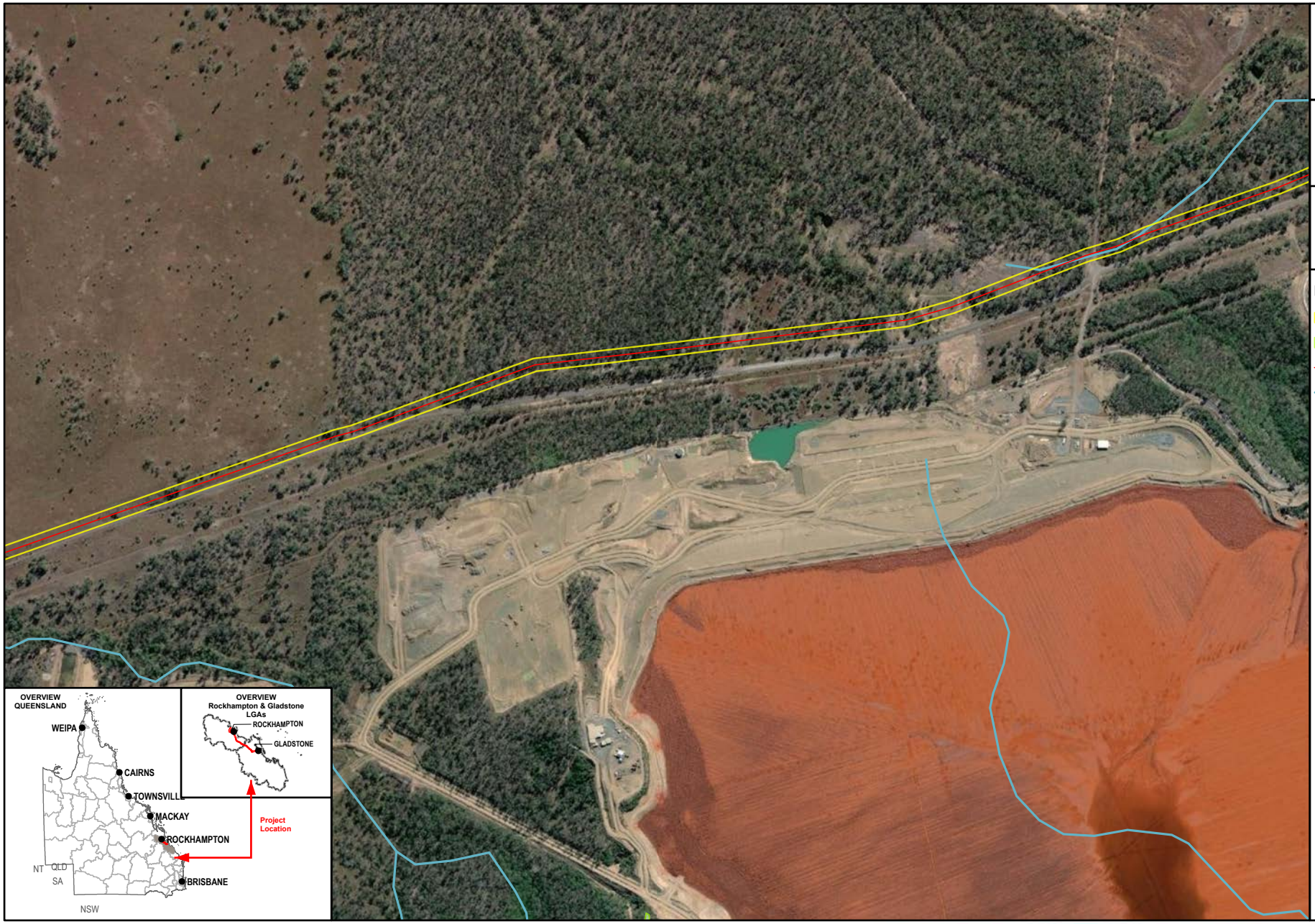
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 3-2c
High-risk Flora Survey Trigger Mapping Within the GSDA Desktop Search Extent

000-G-MAP-2405 Version:3 Date:13/09/2022



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Legend

- Study Area
- High-risk Flora Trigger Areas
- GSDA Pipeline Alignment
- Waterways

Data Sources:
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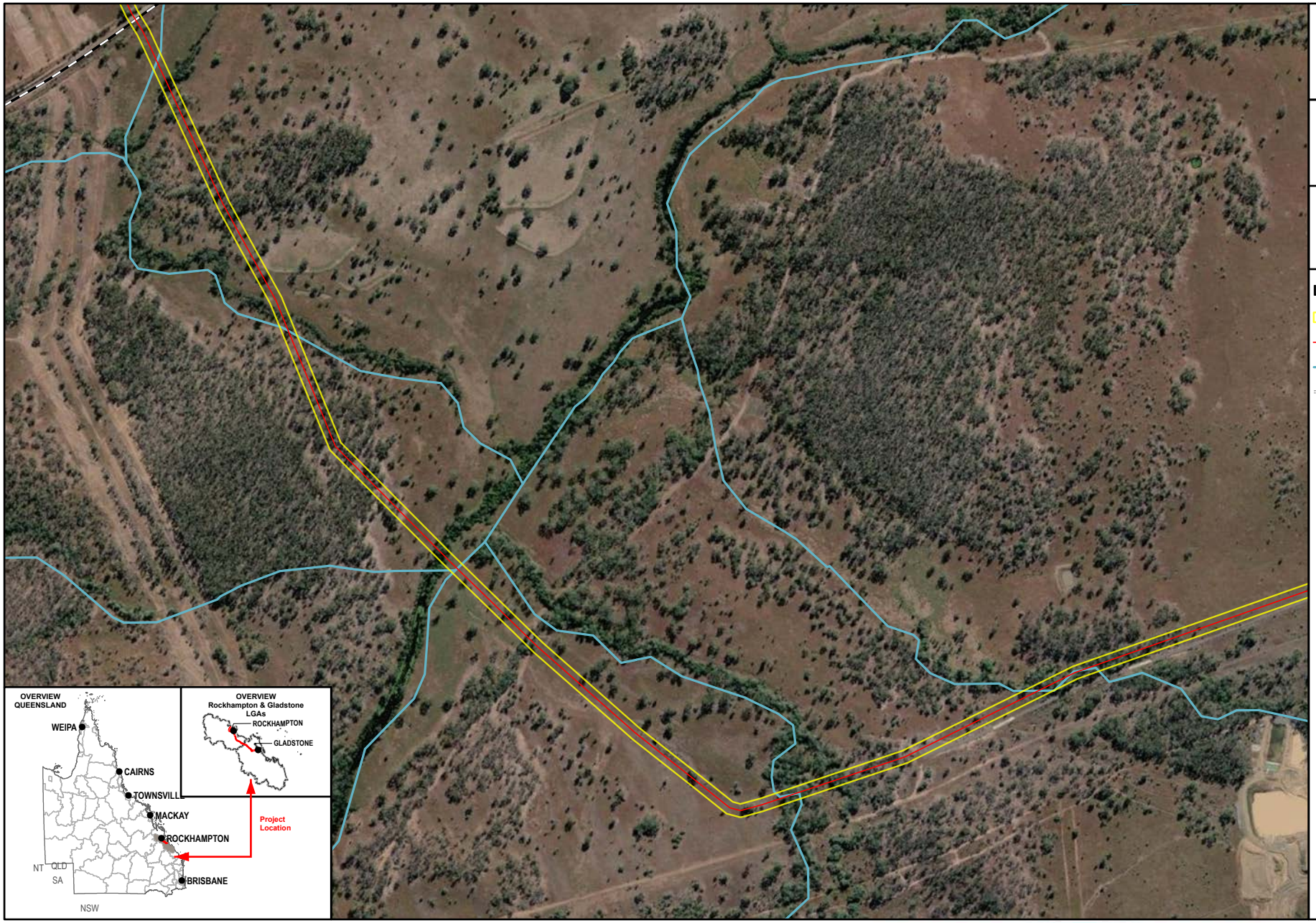
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 3-2d
High-risk Flora Survey Trigger Mapping Within the GSDA Desktop Search Extent

000-G-MAP-2405 Version:3 Date:13/09/2022



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Legend

- Study Area
- GSDA Pipeline Alignment
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- Railways

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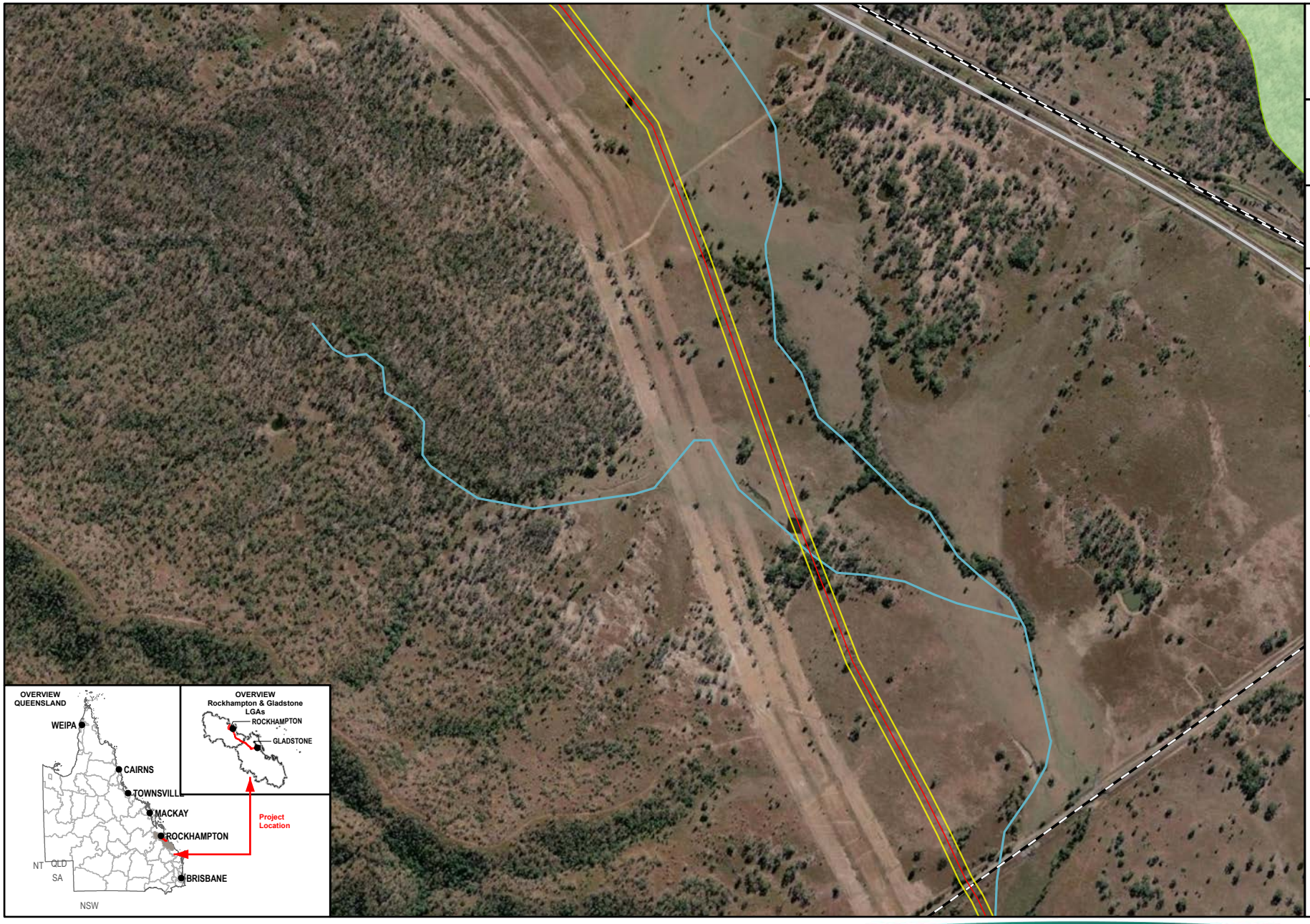
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 3-2e
High-risk Flora Survey Trigger Mapping Within the GSDA Desktop Search Extent

000-G-MAP-2405 Version:3 Date:13/09/2022



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- GSDA Pipeline Alignment
- Waterways
- Main Roads
- Railways

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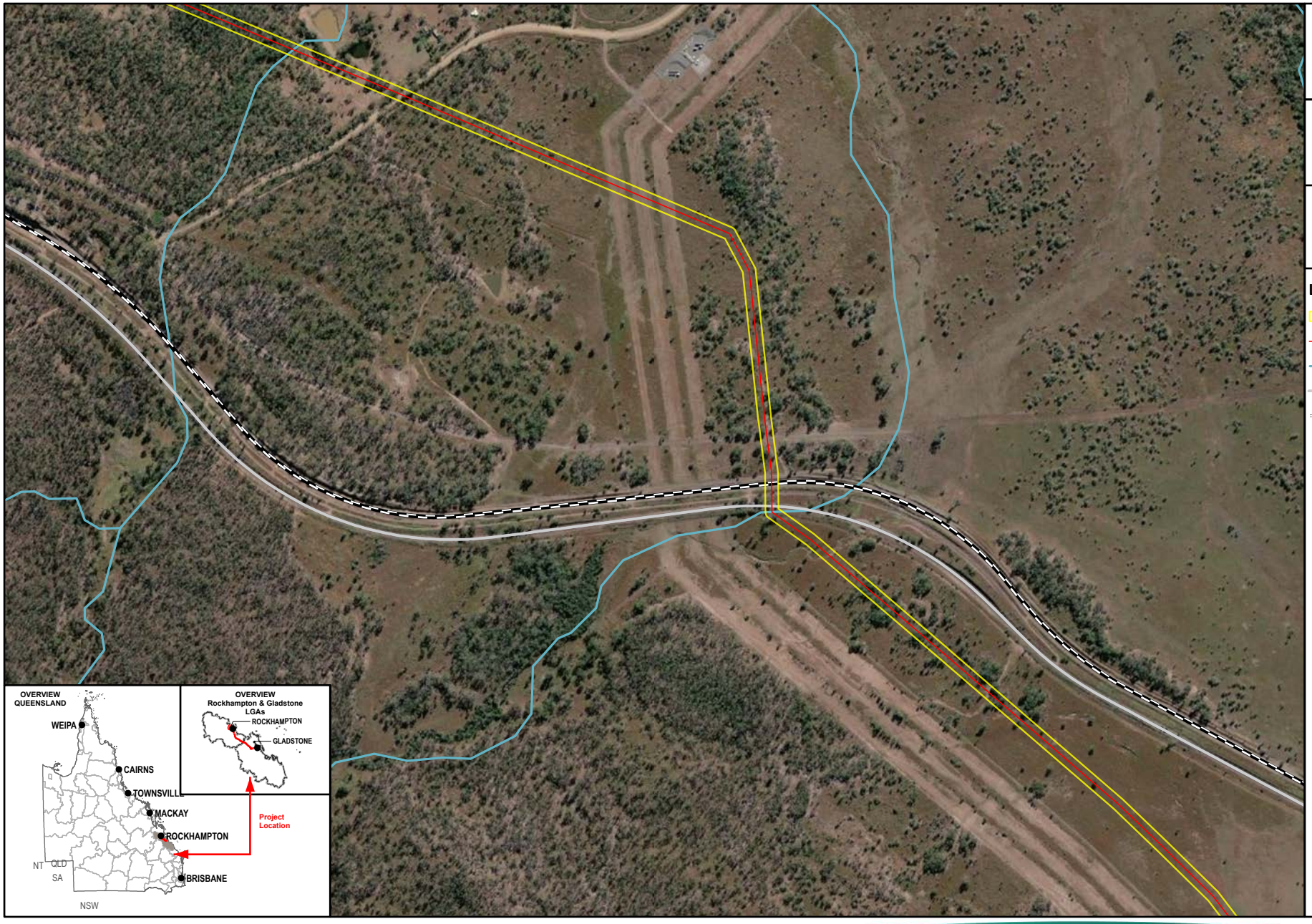
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 3-2f
High-risk Flora Survey Trigger Mapping Within the GSDA Desktop Search Extent

000-G-MAP-2405 Version:3 Date:13/09/2022



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Legend

- Study Area
- GSDA Pipeline Alignment
- 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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Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 3-2g
High-risk Flora Survey Trigger Mapping Within the GSDA Desktop Search Extent

000-G-MAP-2405 Version:3 Date:13/09/2022

3.4 Terrestrial fauna

3.4.1 Desktop assessment results

3.4.1.1 Threatened fauna species

The EPBC Act PMST database identified 33 threatened fauna species that have the potential to occur within the desktop search extent. State based searches (i.e. WildNet, Species Profile Search and Biomaps) identified 20 threatened fauna species that have been historically recorded within the desktop search extent. Note that marine species have been addressed in Section 3.6.

The searches collectively identified 39 State and/or Federal threatened fauna species that are either predicted to occur or have been confirmed as occurring, within the desktop search extent. This comprised 24 birds, 10 mammals, four reptiles and one insect. Some historical records identified within the desktop search extent are classified and therefore, the exact location of these records within the search extent are unknown. The PMST and WildNet desktop search results are provided in Appendix A and summarised in Table 3-6.

Table 3-6 also identifies seven threatened fauna species that were identified as controlling provisions at the time of the EPBC approval.

Table 3-6 Threatened fauna species identified within the GSDA desktop search extent

Scientific name	Common name	Status		Source	WN Records	Nearest record to ROW	EPBC Approval
		EPBC Act	NC Act				
Birds							
Calidris canutus	Red knot	E, Mig	E	WN; PMST	7	3.1 km	
Calidris ferruginea	Curlew sandpiper	CE, Mig	CE	WN; PMST	34	3.2 km	
Calidris tenuirostris	Great knot	CE, Mig	CE	WN; PMST	9	4.8 k	
Charadrius leschenaultii	Greater sand plover	V, Mig	V	WN	4	3.2 km	
Charadrius mongolus	Lesser sand plover	E, Mig	E	WN; PMST	40	*	
Cyclopsitta diophthalma coxeni	Coxen's fig-parrot	E	E	PMST	-	-	
Epthianura crocea macgregori	Yellow chat (Dawson)	CE	E	PMST	-	-	✓
Erythrotriorchis radiatus	Red goshawk	V	E	PMST	-	-	✓
Esacus magnirostris	Beach stone-curlew	NL	V	WN	31	3.1 km	
Falco hypoleucos	Grey falcon	V	V	PMST	-	-	
Fregetta grallaria grallaria	White-bellied storm-petrel	V	LC	PMST	-	-	
Geophaps scripta scripta	Squatter pigeon (southern)	V	V	WN; PMST	35	100 m	✓
Hirundapus caudacutus	White-throated needletail	V, Mig	V	WN; PMST	4	100 m	
Limosa lapponica baueri	Western Alaskan bar-tailed godwit	V	V	WN; PMST	108	2 km	
Macronectes giganteus	Southern giant petrel	E, Mig	E	PMST	-	-	
Neochmia ruficauda ruficauda	Star finch (eastern, southern)	E	E	PMST	-	-	

Scientific name	Common name	Status		Source	WN Records	Nearest record to ROW	EPBC Approval
		EPBC Act	NC Act				
Ninox strenua	Powerful owl	NL	V	WN	15	930 m	
Numenius madagascariensis	Eastern curlew	CE	E	WN; PMST	163	2.1 km	
Pachyptila turtur subantarctica	Fairy prion (southern)	V	LC	PMST	-	-	
Poephila cincta cincta	Black-throated finch (southern)	E	E	PMST	-	-	
Pterodroma neglecta neglecta	Kermadec petrel (western)	V	LC	PMST	-	-	
Rostratula australis	Australian painted snipe	E	E	PMST	-	-	
Thalassarche impavida	Campbell albatross	V, Mig	SL	PMST	-	-	
Turnix melanogaster	Black-breasted button-quail	V	V	WN; PMST	2	3.5 km	
Mammals							
Chalinolobus dwyeri	Large-eared pied bat	V	V	PMST	-	-	
Dasyurus hallucatus	Northern quoll	E	LC	PMST	-	-	
Macroderma gigas	Ghost bat	V	E	WN; PMST	1	*	
Nyctophilus corbeni	Corben's long-eared bat	V	V	PMST	-	-	
Petauroides volans	Greater glider (southern and central)	V	E	WN; PMST	30	70 m	
Petaurus australis australis	Yellow-bellied glider (south-eastern)	V	V	WN	15	104 m	
Phascolarctos cinereus	Koala	E	E	WN; PMST	9	2 km	
Pteropus poliocephalus	Grey-headed flying-fox	V	LC	WN; PMST	8	2.9 km	✓
Taphozous australis	Coastal sheathtail bat	NL	NT	WN	3	*	
Xeromys myoides	Water mouse	V	V	WN; PMST	15	3 km	
Reptiles							
Delma torquata	Collared delma	V	V	PMST	-	-	✓
Denisonia maculata	Ornamental snake	V	V	PMST	-	-	✓
Egernia rugosa	Yakka skink	V	V	PMST	-	-	✓
Furina dunmalli	Dunmall's snake	V	V	PMST	-	-	
Insects							
Jalmenus eubulus	Pale imperial hairstreak	NL	V	WN	1	*	

Key to table: CE – critically endangered; E – endangered; V – vulnerable; NT – near threatened; Mig – migratory; SL – special least concern; LC – least concern; NL – not listed.

WN – WildNet; PMST – Protected Matters Search Tool.

* – location of historical record classified.

3.4.1.2 Migratory species

The desktop searches (i.e. PMST, WildNet, Species Profile Search and Biomaps) identified 45 migratory species that have the potential to occur within the desktop search extent (Table 3-7). The PMST and WildNet desktop search results of migratory species listed under the EPBC Act are provided in Appendix A and summarised in Table 3-7. Migratory species listed as threatened under the EPBC Act and NC Act have also been included in Table 3-7.

At the time of the EPBC Referral and EPBC approval, migratory species were not identified as controlling provisions.

Table 3-7 Migratory species identified within the desktop search extent

Scientific name	Common name	Status		Source	Records
		EPBC Act	NC Act		
Birds					
Actitis hypoleucos	Common sandpiper	Mig	SL	WN; PMST	20
Apus pacificus	Fork-tailed swift	Mig	SL	WN	1
Arenaria interpres	Ruddy turnstone	Mig	SL	WN; PMST	3
Calidris acuminata	Sharp-tailed sandpiper	Mig	SL	WN; PMST	27
Calidris alba	Sanderling	Mig	SL	WN	2
Calidris canutus	Red knot	E, Mig	E	WN; PMST	7
Calidris falcinellus	Broad-billed sandpiper	Mig	SL	WN	3
Calidris ferruginea	Curlew sandpiper	CE, Mig	CE	WN; PMST	34
Calidris melanotos	Pectoral sandpiper	Mig	SL	PMST	-
Calidris ruficollis	Red-necked stint	Mig	SL	WN; PMST	62
Calidris tenuirostris	Great knot	CE, Mig	CE	WN; PMST	9
Charadrius mongolus	Lesser sand plover	E, Mig	E	WN; PMST	40
Chlidonias leucopterus	White-winged black tern	Mig	SL	WN	1
Cuculus optatus	Oriental cuckoo	Mig	SL	WN; PMST	1
Gallinago hardwickii	Latham's snipe	Mig	SL	WN; PMST	2
Gallinago megala	Swinhoe's snipe	Mig	SL	PMST	-
Gallinago stenura	Pin-tailed snipe	Mig	SL	PMST	-
Gelochelidon nilotica	Gull-billed tern	Mig	SL	WN	95
Hirundapus caudacutus	White-throated needletail	V, Mig	V	WN; PMST	4
Hydroprogne caspia	Caspian tern	Mig	SL	WN	92
Limnodromus semipalmatus	Asian dowitcher	Mig	SL	PMST	-
Limosa lapponica	Bar-tailed godwit	Mig	SL	PMST	-
Limosa limosa	Black-tailed godwit	Mig	SL	WN; PMST	4
Macronectes giganteus	Southern giant petrel	E, Mig	E	PMST	-
Monarcha melanopsis	Black-faced monarch	Mig	SL	WN; PMST	6
Monarcha trivirgatus	Spectacled monarch	Mig	SL	WN; PMST	10
Myiagra cyanoleuca	Satin flycatcher	Mig	SL	WN; PMST	9
Numenius madagascariensis	Eastern curlew	CE	E	WN; PMST	163
Numenius minutus	Little curlew	Mig	SL	WN; PMST	1

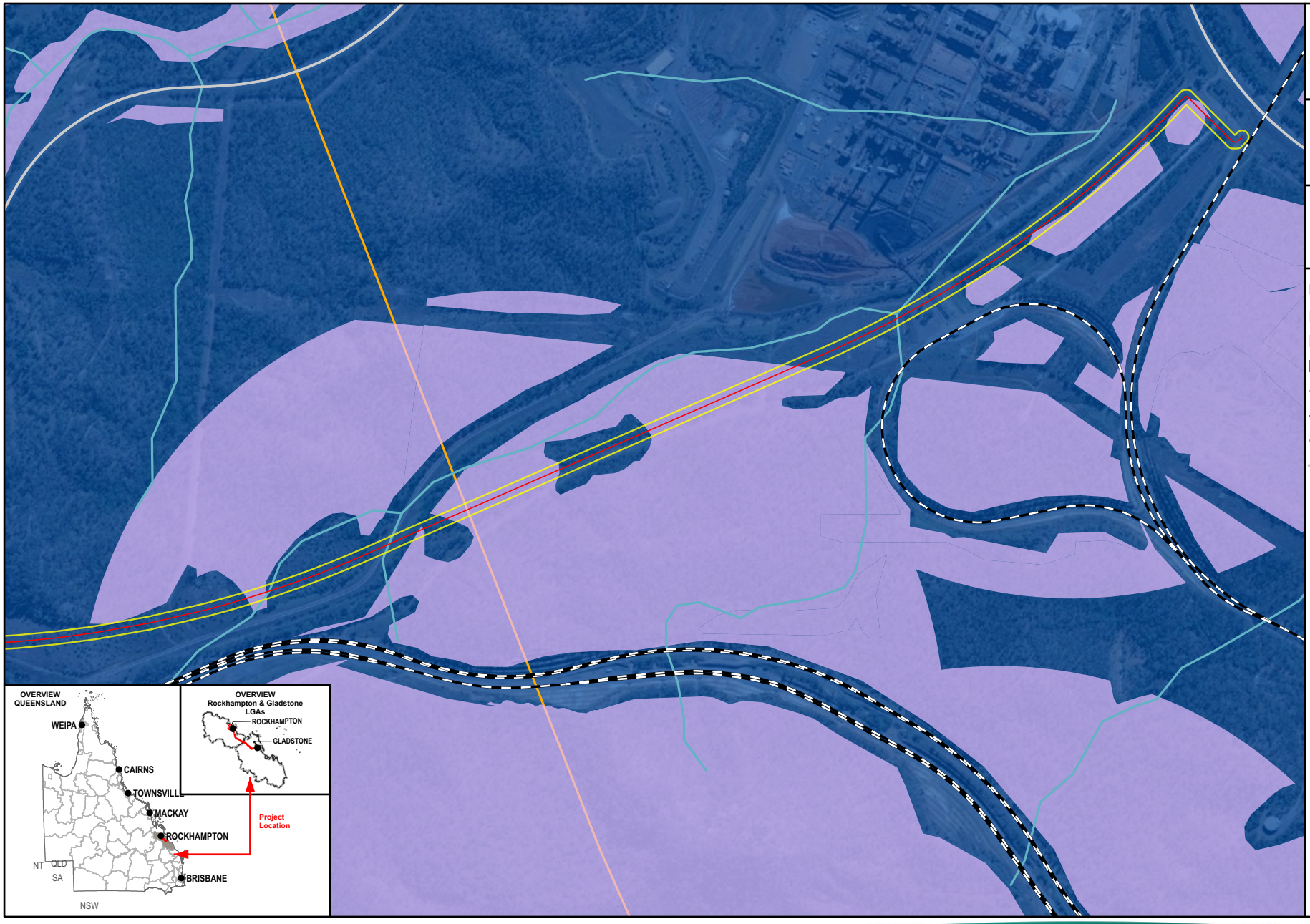
Scientific name	Common name	Status		Source	Records
		EPBC Act	NC Act		
Numenius phaeopus	Whimbrel	Mig	SL	WN; PMST	184
Pandion haliaetus	Osprey	Mig	SL	WN; PMST	32
Plegadis falcinellus	Glossy ibis	Mig	SL	WN	2
Pluvialis fulva	Pacific golden plover	Mig	SL	WN; PMST	24
Pluvialis squatarola	Grey plover	Mig	SL	WN; PMST	3
Rhipidura rufifrons	Rufous fantail	Mig	SL	WN; PMST	18
Sterna hirundo	Common tern	Mig	SL	WN	2
Sternula albifrons	Little tern	Mig	SL	WN	3
Sula leucogaster	Brown booby	Mig	SL	WN	1
Thalasseus bergii	Crested tern	Mig	SL	WN	43
Thalassarche impavida	Campbell albatross	V, Mig	LC	PMST	-
Tringa brevipes	Grey-tailed tattler	Mig	SL	WN; PMST	41
Tringa incana	Wandering tattler	Mig	SL	WN	1
Tringa nebularia	Common greenshank	Mig	SL	WN; PMST	59
Tringa stagnatilis	Marsh sandpiper	Mig	SL	WN; PMST	37
Xenus cinereus	Terek sandpiper	Mig	SL	WN; PMST	47
Key to table: CE – critically endangered; E – endangered; V – vulnerable; NT – near threatened; Mig – migratory; SL – special least concern; LC – least concern; NL – not listed. WN – WildNet; PMST – Protected Matters Search Tool.					

3.4.1.3 Essential habitat

The GSDA pipeline alignment intersects multiple areas of mapped essential habitat for conservation significant species listed under the NC Act as shown in Figure 3-3. These areas include essential habitat for the lesser sand plover (*Charadrius mongolus*), squatter pigeon (southern) (*Geophaps scripta scripta*), powerful owl (*Ninox strenua*), greater glider (southern and central) (*Petauroides volans*) and koala (*Phascolarctos cinereus*).

3.4.1.4 State and regional wildlife corridors

The GSDA pipeline alignment crosses one regional riparian corridor which follows Larcom Creek (Figure 3-3) in a south-west direction. The pipeline alignment also crosses one state terrestrial corridor, which crosses approximately 4.8 km of the end of the GSDA pipeline alignment in a north/south direction (Figure 3-3).



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Legend

- Study Area
- Essential Habitat
- State Wildlife Corriors
- Terrestrial Corridor Centrelines
- GSDA Pipeline Alignment
- 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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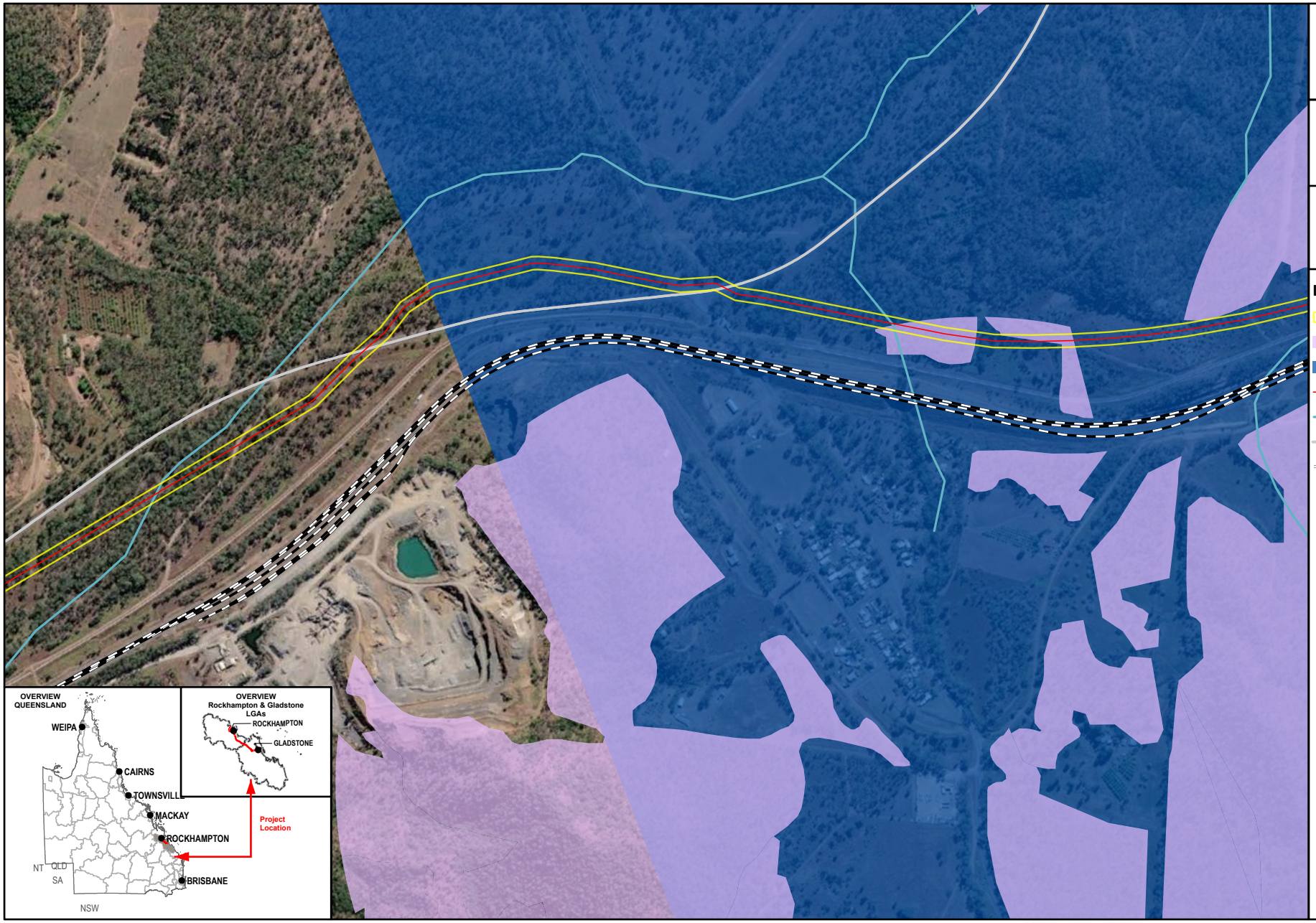
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 3-3a
Essential Habitat and Wildlife Corridors Within the GSDA Desktop Search Extent
000-G-MAP-2406 Version:3 Date:7/09/2022



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- Essential Habitat
- State Wildlife Corriors
- GSDA Pipeline Alignment
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Figure 3-3b
Essential Habitat and Wildlife Corridors Within the GSDA Desktop Search Extent
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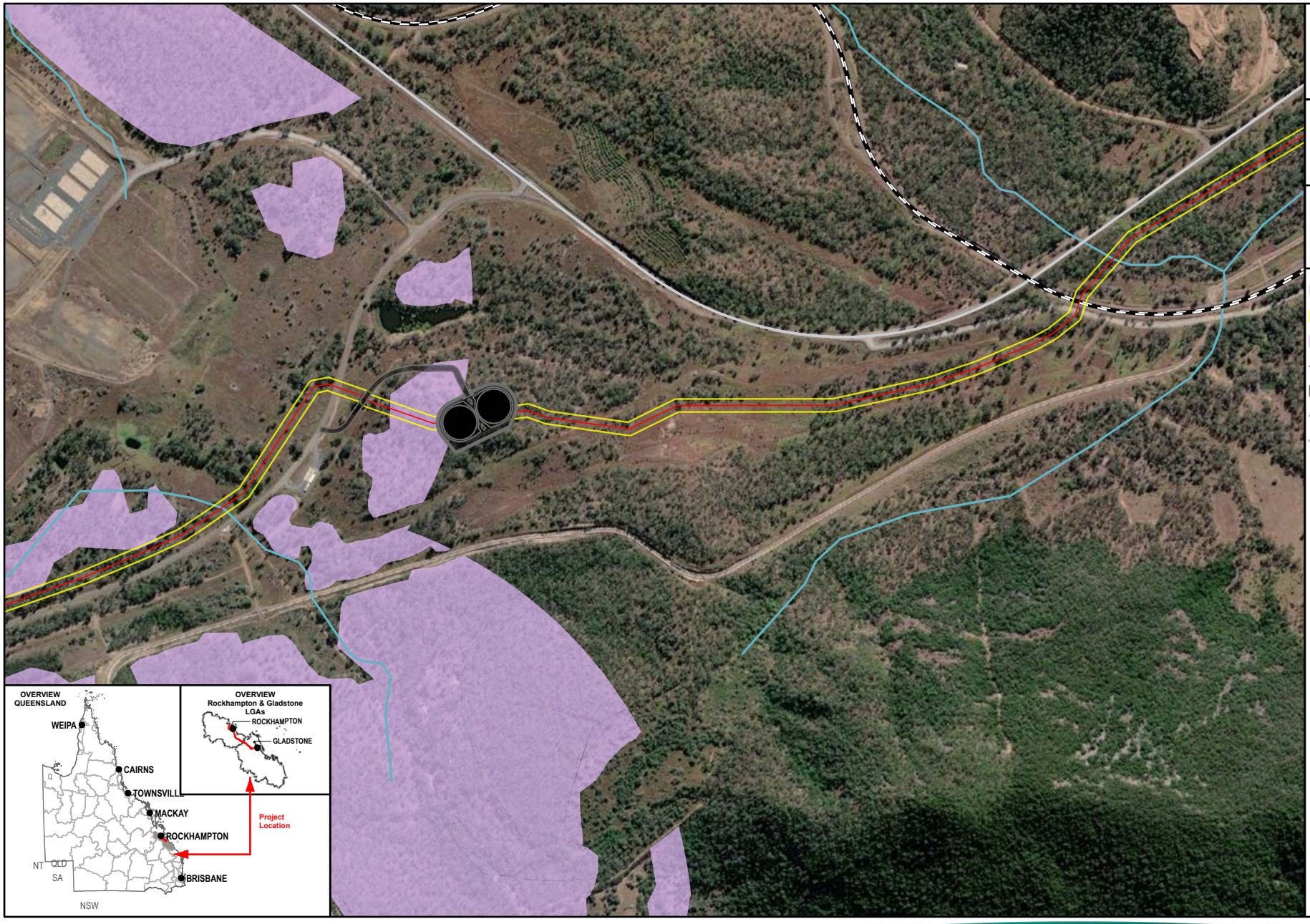

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- Essential Habitat
- GSDA Pipeline Alignment
- Aldoga Reservoirs Layout
- Waterways
- Main Roads
- Railways

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Figure 3-3c
Essential Habitat and Wildlife Corridors Within the GSDA Desktop Search Extent

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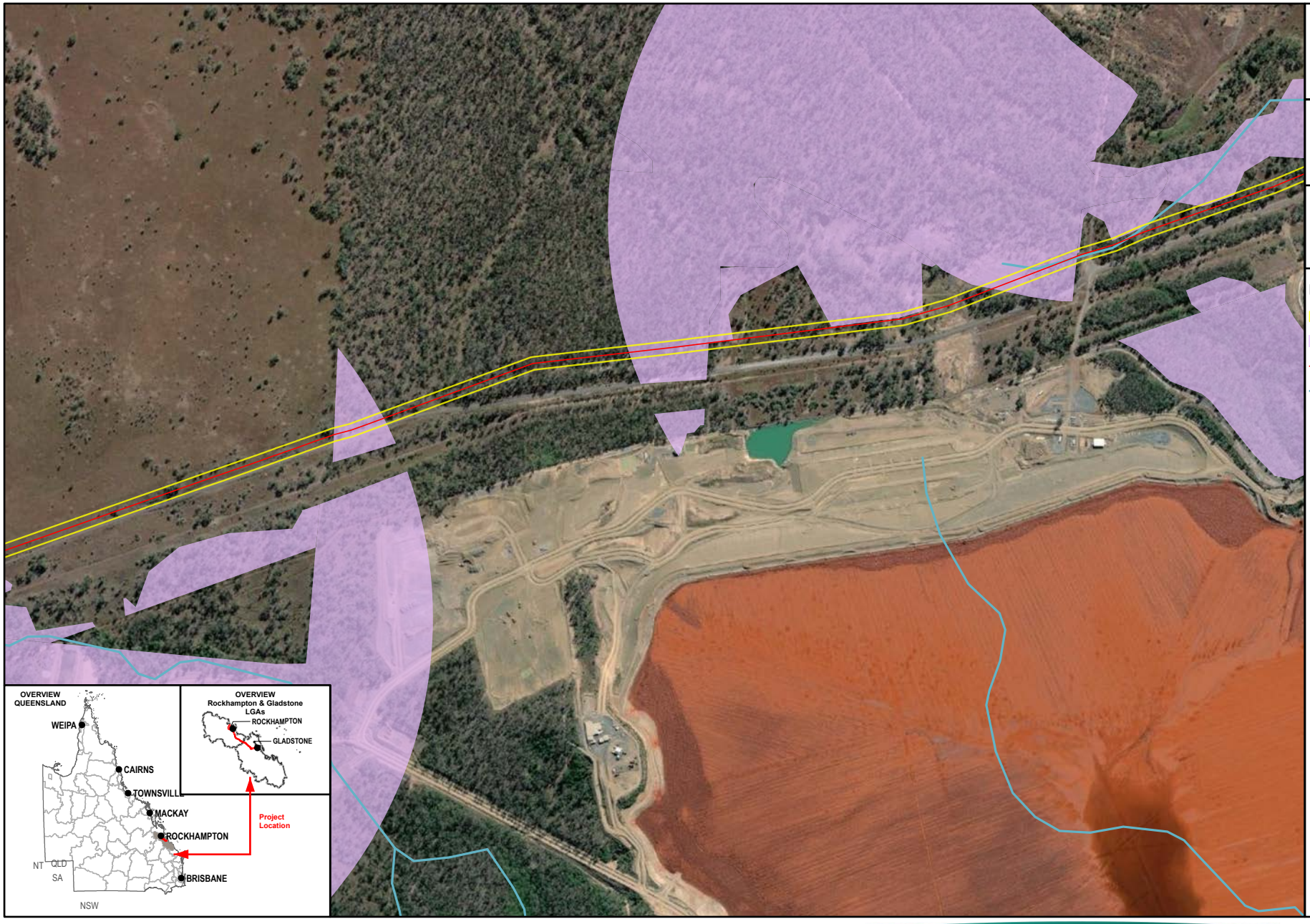

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Legend

- Study Area
- Essential Habitat
- GSDA Pipeline Alignment
- Waterways

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Fitzroy to Gladstone Pipeline Baseline Terrestrial and Aquatic Ecology Technical Report

Figure 3-3d
Essential Habitat and Wildlife Corridors Within the GSDA Desktop Search Extent

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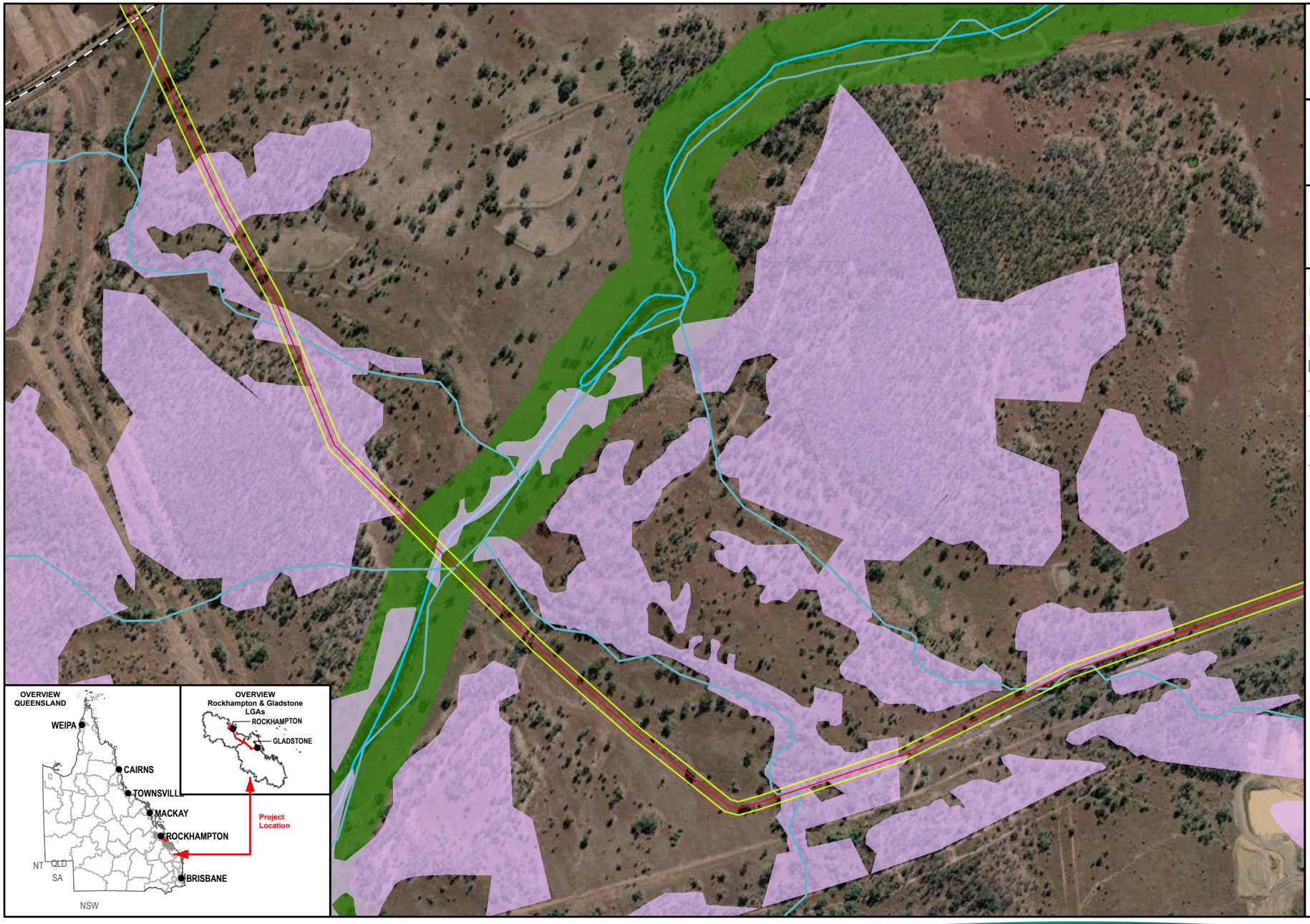

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Legend

- Study Area
- Essential Habitat
- Regional Wildlife Corriors
- GSDA Pipeline Alignment
- Waterways
- Railways
- Riparian Corridor Centrelines

Data Sources:
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Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 3-3e
Essential Habitat and Wildlife Corridors Within the GSDA Desktop Search Extent
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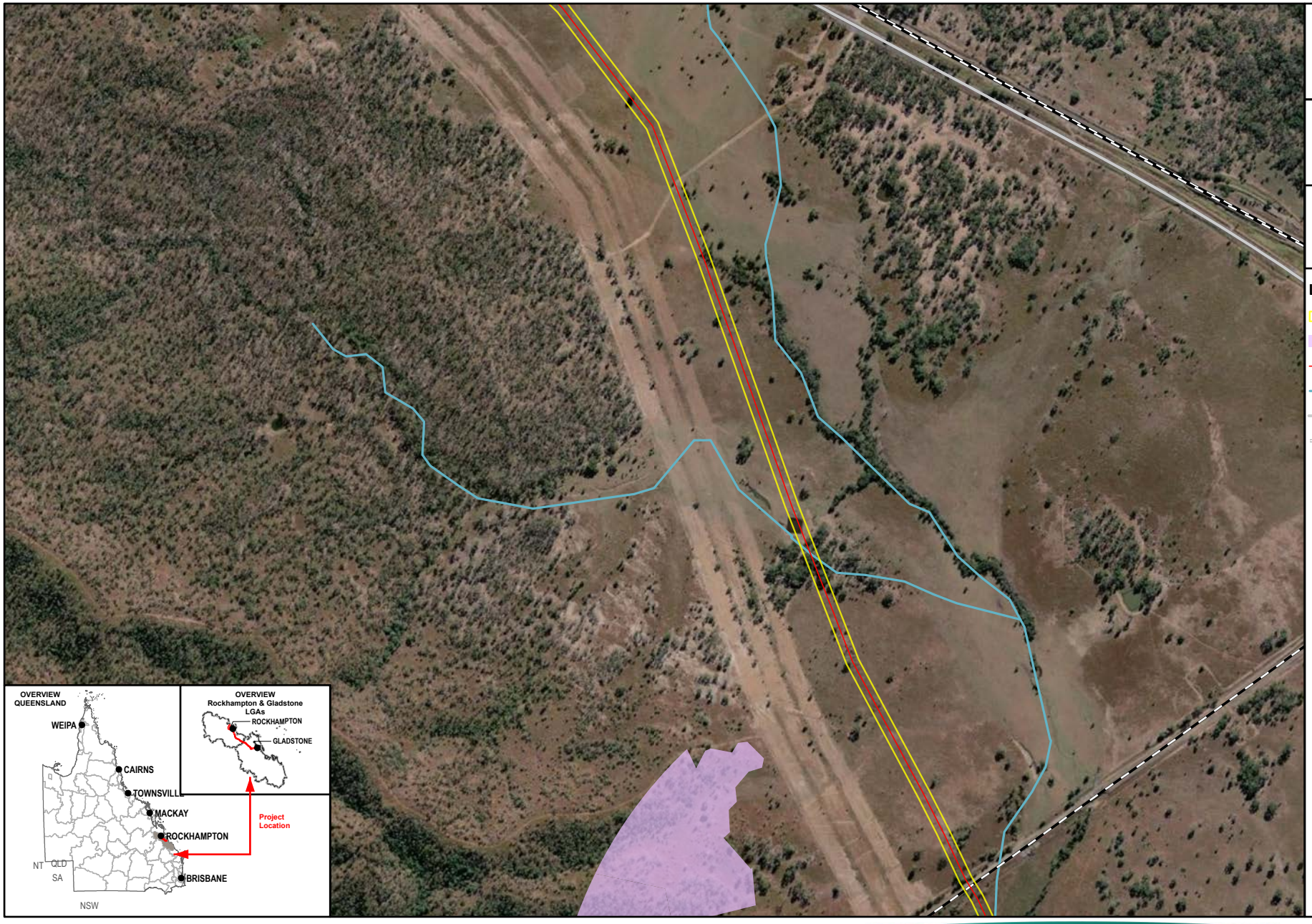

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- Study Area
- Essential Habitat
- GSDA Pipeline Alignment
- Waterways
- Main Roads
- Railways

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Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 3-3f
Essential Habitat and Wildlife Corridors Within the GSDA Desktop Search Extent
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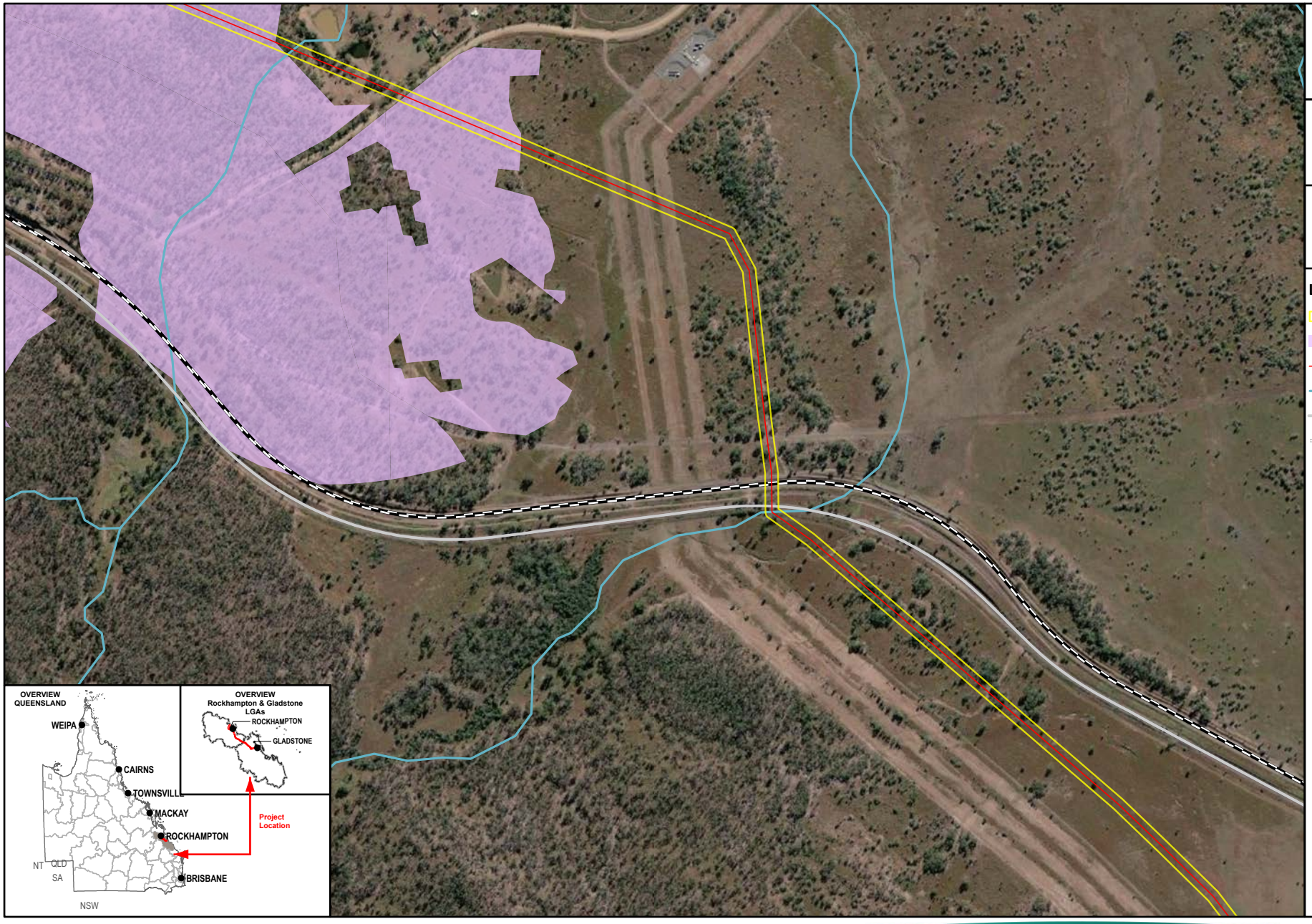

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Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 3-3g
Essential Habitat and Wildlife Corridors Within the GSDA Desktop Search Extent
000-G-MAP-2406 Version:3 Date:7/09/2022

3.4.2 Field survey results

3.4.2.1 Terrestrial fauna survey methods

Survey methods undertaken within the GSDA study area are listed below:

– Habitat assessments
– Bird surveys
– Active searches
– Anabat detectors
– Remote cameras
– Hollow-bearing tree counts
– Nocturnal searches and spotlighting
– Opportunistic searches.

Details of each survey method are provided in Table 2-5.

3.4.2.2 Terrestrial fauna communities

A total of 68 terrestrial fauna species were recorded during the ecological surveys within the GSDA study area. This comprised of 47 species of birds, 15 species of mammals, three species of reptiles and three species of amphibians. A description of each of the fauna groups is provided below. A list of fauna species encountered in the field survey is provided in Appendix G.

Birds

One conservation significant bird species, namely the squatter pigeon (southern), was confirmed present within the GSDA study area during the 2022 field surveys. More information on this species is provided in Section 7.1.1.4. The glossy black-cockatoo was confirmed present during the Arup (2008) field surveys and potentially suitable foraging and nesting habitat was recorded within the GSDA study area during the 2022 field surveys. More information on this species is provided in Section 7.1.1.3. The white-throated needletail (Section 7.1.1.5) and powerful owl (Section 7.1.1.6) are considered likely to occur.

A total of 47 bird species were recorded during the field surveys within the GSDA study area. Bird species that were most abundant and widespread were species naturally adapted to open landscapes such as the Australian Magpie (*Cracticus tibicen*), magpie-lark (*Grallina cyanoleuca*), noisy minor (*Manorina melanocephala*), pied butcherbird (*Cracticus nigrogularis*), torresian crow (*Corvus orru*) and willie wagtail (*Rhipidura leucophrys*).

Grassland bird specialists including the Australasian pipit (*Anthus novaeseelandiae*), brown quail (*Coturnix ypsilophora*), and masked lapwing (*Vanellus miles*) were observed within the cleared landscapes. Open areas provided foraging habitat for raptors including the nankeen kestrel (*Falco cenchroides*), black kite (*Milvus migrans*) and whistling kite (*Haliastur sphenurus*).

Open woodland areas supported a range of birds including red-winged parrot (*Aprosmictus erythropterus*), red-tailed cockatoo (*Calyptorhynchus banksii*), black-faced cuckoo-shrike (*Coracina novaehollandiae*) and blue-winged kookaburra (*Dacelo novaeguineae*). Riparian woodland areas supported a mix of honeyeaters, kingfishers, lorikeets, rosellas, fantails, gerygones and fairy-wrens.

Mammals

No conservation significant mammal species were recorded within the GSDA study area during the 2022 field surveys. The koala was confirmed present during the Arup (2008) field surveys and potentially suitable habitat was recorded within the GSDA study area during the 2022 field surveys. More information on this species is provide in Section 7.1.1.9.The greater glider (southern and central) (Section 7.1.1.7), yellow-bellied glider (south-eastern) (Section 7.1.1.8) and grey-headed flying-fox (Section 7.1.1.10) are considered likely to occur.

A total of 15 mammal species were recorded within GSDA study area during the field surveys. Of these species, three introduced mammal species were recorded including the European red fox (*Vulpes vulpes*), feral pig (*Sus scrofa*) and European rabbit (*Oryctolagus cuniculus*). Eight species of bats were identified via microbat call recordings (Appendix I). The most frequent bat species were the northern broad-nosed bat (*Scotorepens sanborni*), yellow bellied sheath tailed bat (*Saccolaimus flaviventris*) and northern freetail bat (*Chaerephon jobensis*). Other mammals that were commonly recorded during the field surveys included the eastern grey kangaroo (*Macropus giganteus*), swamp wallaby (*Wallabia bicolor*) and little red flying-fox (*Pteropus scapulatus*).

Reptiles

No conservation significant reptile species were recorded within the GSDA study area during the 2022 field surveys. No conservation significant terrestrial reptiles are considered likely to occur. More information is detailed in the likelihood of occurrence assessment in Appendix E.

A total of three reptile species were recorded within the GSDA study area during field surveys. Identified reptile species included the dubious dtella (*Gehyra dubia*), Bynoe's gecko (*Heteronotia binoei*) and eastern bearded dragon (*Pogona barbata*). Within the GSDA study area, reptiles were generally observed within woodland areas (mature eucalypt woodland and mixed Eucalyptus/Corymbia woodland), where relatively complex ground-level microhabitats, with a high density of ground logs, woody debris and leaf litter were present.

Amphibians

No conservation significant frog species were recorded within the GSDA study area during the 2022 field surveys. No conservation significant frogs are considered likely to occur.

A total of three amphibian species were recorded within the GSDA study area. Amphibian species included the green tree frog (*Litoria caerulea*), desert tree frog (*Litoria rubella)* and cane toad (*Rhinella marina*). Within the GSDA study area, amphibians were generally observed within fringing riparian and woodland vegetation. These habitat types presented a high density of ground logs, woody debris and leaf litter.

3.4.2.3 Conservation significant fauna species

One conservation significant fauna species, namely the squatter pigeon (southern), was confirmed present during the 2022 field surveys, and two conservation significant fauna species, namely the glossy black-cockatoo and koala were confirmed present during the Arup (2008) field surveys (Table 3-8). Survey effort undertaken for threatened fauna species within the study area is outlined in Table 2-6.

Table 3-8 Conservation significant fauna species recorded within the GSDA study area

Scientific name	Common name	Status		Details
		EPBC Act	NC Act	
Calyptorhynchus lathami	Glossy black-cockatoo	NL	V	One individual was confirmed present during the Arup (2008) field surveys within remnant vegetation near the existing slurry pipeline easement. During the 2022 field surveys, a habitat assessment was undertaken approximately 300 m south-east of the species record. No individuals or traces were recorded. However, suitable foraging habitat was identified approximately 800 m west of the species record.
Geophaps scripta scripta	Squatter pigeon (southern)	V	V	Two individuals were confirmed present within the GSDA study area during the 2022 field surveys. The species was also recorded during the Arup (2008) field surveys.

Scientific name	Common name	Status		Details
		EPBC Act	NC Act	
Phascolarctos cinereus	Koala	E	E	Tree trunk scratches and scats were identified at three locations within riparian vegetation during the Arup (2008) field surveys. During the 2022 field surveys, two habitat assessments and one SAT survey were undertaken approximately 250 m southwest and northwest of the two confirmed koala traces' locations. No individuals or traces were recorded. However, suitable habitat was identified throughout vegetated areas retaining koala food and shelter trees within the GSDA study area.
Key to table: E – endangered; V – vulnerable; NL – not listed.				

3.4.2.4 Essential habitat

Based on the field verified REs within the GSDA study area, the mapped essential habitat for conservation significant species, identified in Section 3.4.1.3, did not change.

3.4.2.5 Habitat types

Historically, the landscape has been impacted by decades of disturbance from cattle grazing, vegetation clearing and intrusion by invasive weeds. These processes have altered local ecosystem composition and processes, reducing in places the density of native vegetation including eucalypts, and habitat for threatened species. Despite this, sizeable remnants of natural habitat have been retained.

Six broad habitat types were identified within the GSDA during the field survey, including:

– Mature eucalypt woodland
– Mixed *Eucalyptus/Corymbia* woodland
– Regrowth and/or scattered *Eucalyptus/Corymbia/Acacia* trees
– Freshwater waterbodies and seasonal wetlands
– Fringing riparian vegetation
– Cleared and highly modified landscapes.

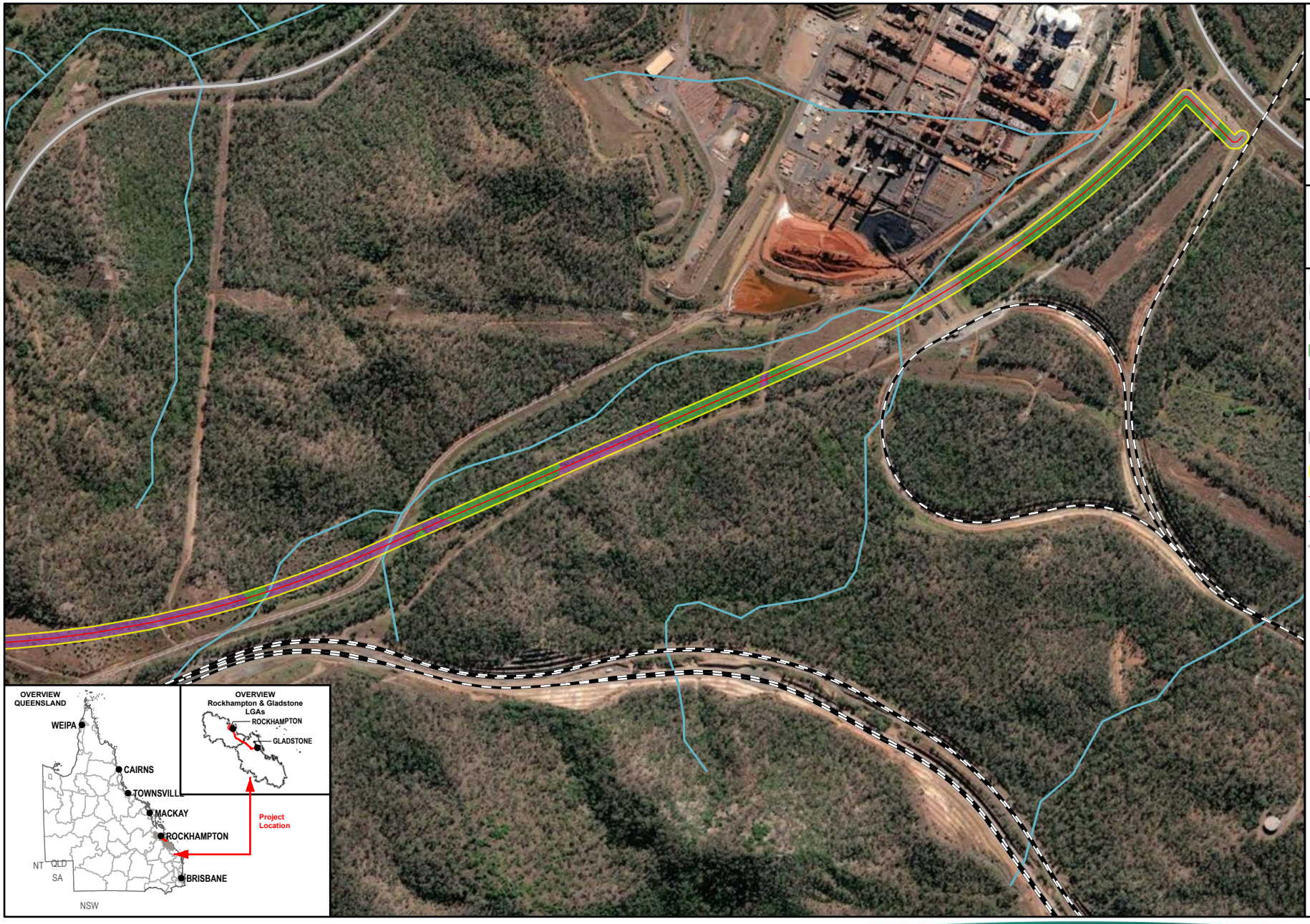
Broad habitat types were defined and broadly mapped throughout the study area based on habitat assessments, DoR and field verified RE mapping, and aerial imagery. These habitat types were validated, and mapping refined, through the ecological field surveys. A representative photograph and description of each of these habitat types is provided in Table 3-9, together with identification of which habitat types provide potential habitat for fauna that are MNES and MSES. Habitat types identified within the study area are mapped in Figure 3-4.

Table 3-9 Habitat types recorded within the GSDA study area

Habitat type	General characteristics and ecological values
Mature eucalypt woodland 	– Mature canopy vegetation provides blossom and nesting opportunities for honeyeaters, flower peckers and parrots, and foraging habitat for flying-foxes. – Variety of koala food trees present, including *Eucalyptus moluccana*, *E. tereticornis* and *E. crebra*. – Hollow-bearing trees were moderately dense, retaining small to medium sized hollows with some large hollows (> 30 cm). – Relatively complex ground-level microhabitats, with a high density of ground logs, woody debris and leaf litter. These microhabitats provide shelter and foraging microhabitat for ground-dwelling mammals, reptiles and amphibians. – Decorticating bark from dead ironbark trees provide refuge for microbats, reptiles and amphibians. – Ground cover was moderately dense with a mixture of native and introduced grasses. Grasses provided food resources for some granivorous birds and herbivorous mammals.
	MNES and MSES species: – Potential foraging and breeding habitat for the squatter pigeon (southern) within 1 km (for breeding) and 3 km (for foraging) of a suitable, permanent or seasonal waterbody. – Potential foraging and denning habitat for the greater glider (southern and central) and yellow-bellied glider (south-eastern). – Potential foraging habitat for the powerful owl, koala and grey-headed flying-fox.
Mixed *Eucalyptus/Corymbia* woodland 	– Eucalypts provide blossoms and nesting opportunities for honeyeaters, and foraging habitat for flying-foxes. – Variety of koala food trees present, including *Eucalyptus tereticornis*, *E. crebra*, *E. moluccana*, *Corymbia tessellaris*, *C. citriodora C. erythrophloia*, *C. intermedia* and *Lophostemon suaveolens.* – Moderate density of hollow-bearing trees. Hollow sizes and densities vary throughout vegetated areas. Hollows provide nesting sites for hollow-nesting birds and denning sites for arboreal mammals, microbats, reptiles and amphibians. – Arboreal termite mounds with an excavated hole provide suitable nesting sites for bird species, including the laughing kookaburra (*Dacelo novaeguineae*), blue-winged kookaburra (*Dacelo leachii*) and forest kingfisher (*Todiramphus macleayii*). – Ground-level microhabitats varied throughout vegetated areas. Moderately dense to dense ground logs, woody debris, rocks and leaf litter were present, providing shelter and foraging habitat for small to medium sized mammals, reptiles and amphibians. – Decorticating bark provide refuge for microbats, reptiles and amphibians. – Groundcover densities varied throughout vegetated areas. A mixture of native and introduced grasses were present.
	MNES and MSES species: – Potential foraging and breeding habitat for the squatter pigeon (southern) within 1 km (for breeding) and 3 km (for foraging) of a suitable, permanent or seasonal waterbody. – Potential foraging and denning habitat for the greater glider (southern and central) and yellow-bellied glider (south-eastern). – Potential foraging habitat for the koala and grey-headed flying-fox.

Habitat type	General characteristics and ecological values
Regrowth and/or scattered *Eucalyptus/Corymbia/Acacia* trees 	– Characterised by the low density of mature and regrowth vegetation and is dominated by introduced pasture grasses. – Scattered koala food trees present, including *Eucalyptus tereticornis*, *E. crebra* and *Corymbia* species. – Low density of hollow-bearing tree resulting in limited roosting sites for microbat species, nesting sites for hollow-nesting bird species, and denning sites for arboreal mammals. Mature *Eucalyptus tereticornis* trees retain large (>30 cm) hollows on alluvial plains adjacent to waterways. – Introduced grass species provide food resources for some grassland birds, and herbivorous mammals such as macropods. – The open landscape provides foraging habitat for raptors and snakes. – In most areas, the ground-layer has been heavily altered by cattle grazing and trampling, and intensive cultivation. These alterations have reduced the presence of suitable microhabitats for a range of fauna species.
	MNES and MSES species: – Potential foraging habitat for the squatter pigeon (southern) within 1 km (for breeding) and 3 km (for foraging) of a suitable, permanent or seasonal waterbody. – Potential foraging habitat for the koala (where paddock trees retained).
Freshwater waterbodies and seasonal wetlands 	– Levees have been built on open floodplains to retain flood water from Larcom Creek. – When these areas are inundated with water, these waterbodies may provide suitable foraging habitat for waterbirds. – Canopy and/or shrub layer was either very sparse or absent. – Contains dense grasses.
	MNES and MSES species: – Potential foraging habitat for the sharp-tailed sandpiper, Latham's snipe, satin flycatcher, glossy ibis, common greenshank and marsh sandpiper.

Habitat type	General characteristics and ecological values
Fringing riparian vegetation 	– Fringing riparian vegetation along ephemeral waterways were dominated by *Melaleuca* spp. and *Casuarina* spp., with the upper banks retaining *Eucalyptus* spp. and *Corymbia* spp. – *Melaleuca* species provide foraging opportunities for honeyeaters and flying-foxes. – Fringing *Melaleuca* and *Casuarina* trees are moderately dense providing shelter and nesting habitat for finches, fairy-wrens and other shrub-dwelling birds. – Ground-level microhabitats, including coarse woody debris and dense ground cover, provide shelter and foraging habitat for a variety of reptile and frog species. – Creek banks allow bird species, such as the rainbow bee-eater (*Merops ornatus*) to excavate long horizontal nesting tunnels. – Instream complexity with undercut banks, root balls, trailing vegetation and shallow water edges. – An important movement corridor for native mammals, birds, reptiles and amphibians, and are important foraging routes and flyways for microbats.
	MNES and MSES species: – Potential foraging habitat for the squatter pigeon (southern) (confirmed present). – Potential foraging habitat for the greater glider (southern and central) and yellow-bellied glider (south-eastern). – Potential foraging habitat for the glossy black-cockatoo. – Potential foraging habitat for the koala and grey-headed flying-fox.
Cleared and highly modified landscapes 	– Characterised by the absence or very low density of mature and regrowth vegetation and is dominated by introduced pasture grasses. – Very low density of koala food trees present (< 1 tree per ha), including *Eucalyptus, Corymbia* and *Acacia* species. – Introduced grass species provide food resources for some grassland birds, and herbivorous mammals such as macropods. – The open landscape provides foraging habitat for raptors and snakes. – Ground-level microhabitats have been historically cleared and lack structural complexity. – In most areas, the ground-layer has been heavily altered by cattle grazing and trampling, and intensive cultivation. These alterations have reduced the presence of suitable microhabitats for a range of fauna species.
	MNES and MSES species: No suitable habitat for conservation significant fauna species.



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Habitat Type

- Mixed Eucalyptus/Corymbia Woodland
- Regrowth and/or scattered Eucalyptus/Corymbia/Acacia Trees
- Cleared and Highly Modified Landscapes
- Study Area
- GSDA Pipeline Alignment
- 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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Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 3-4a
Habitat Types Identified Within the GSDA Study Area

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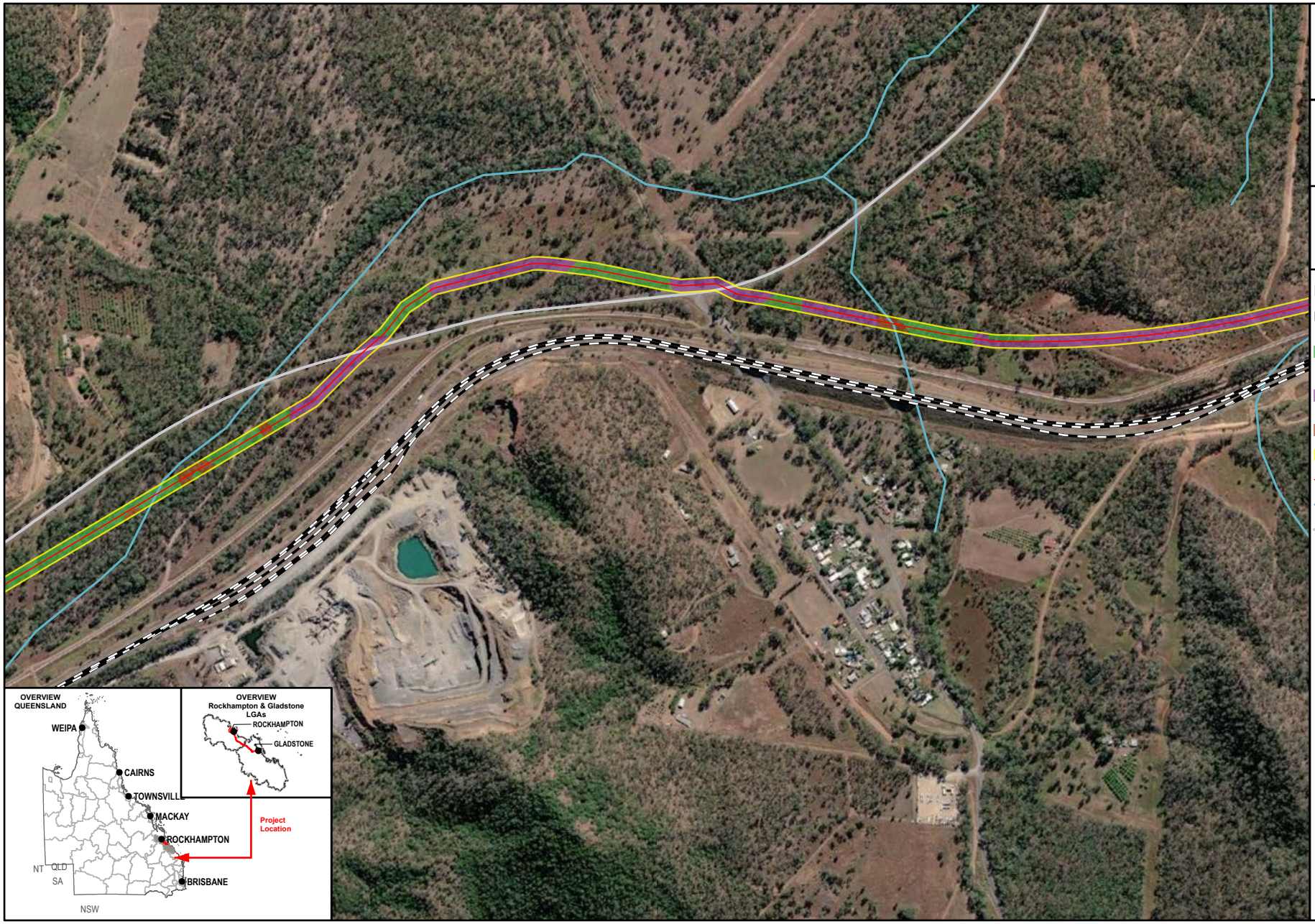

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Habitat Type

- Mixed Eucalyptus/Corymbia Woodland
- Regrowth and/or scattered Eucalyptus/Corymbia/Acacia Trees
- Fringing Riparian Vegetation
- Study Area
- GSDA Pipeline Alignment
- Waterways
- Main Roads
- Railways

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Figure 3-4b
Habitat Types Identified Within the GSDA Study Area

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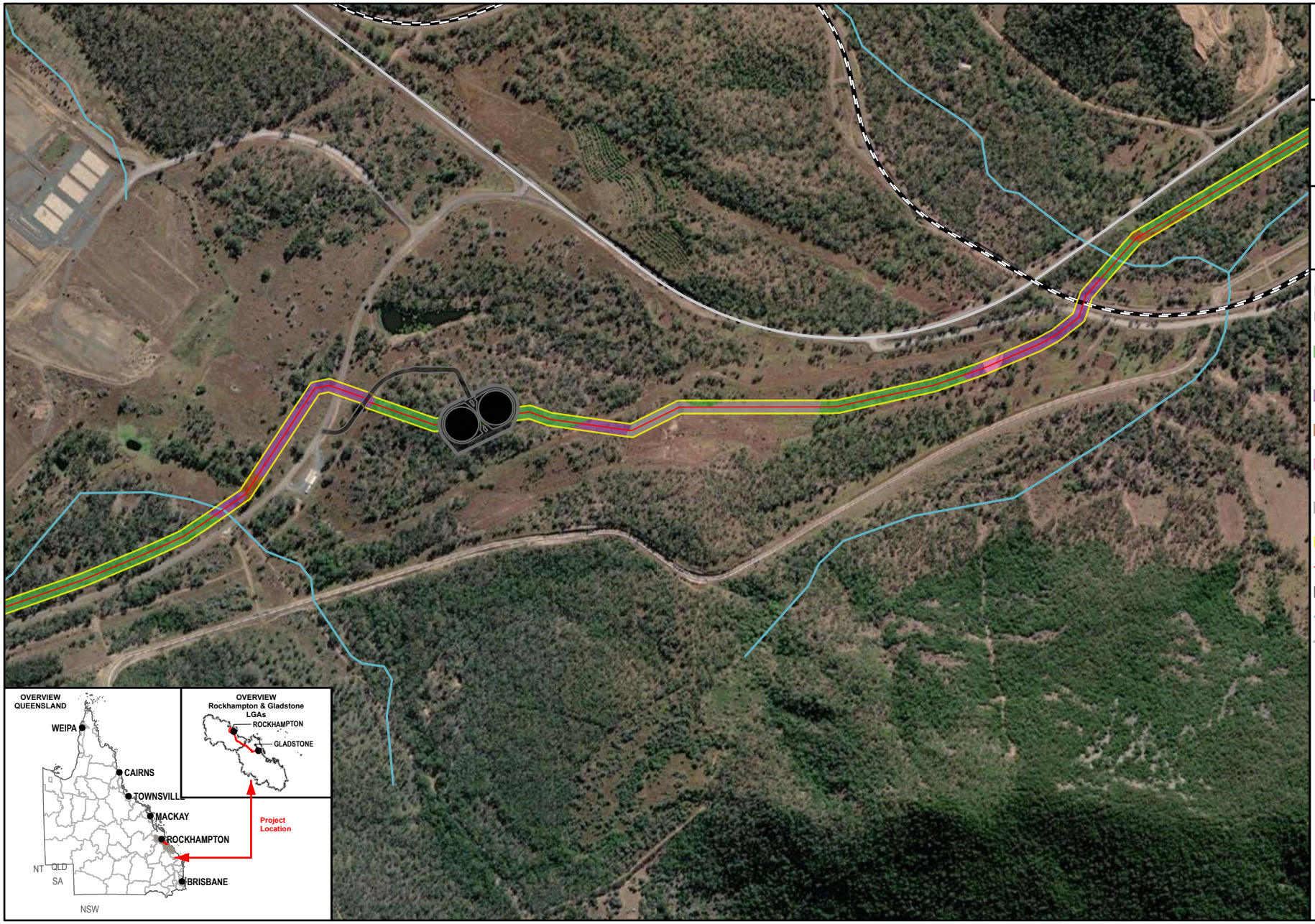

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Habitat Type

- Mixed Eucalyptus/Corymbia Woodland
- Regrowth and/or scattered Eucalyptus/Corymbia/Acacia Trees
- Fringing Riparian Vegetation
- Freshwater Waterbodies and Seasonal Wetlands
- Cleared and Highly Modified Landscapes
- Study Area
- GSDA Pipeline Alignment
- Aldoga Reservoirs Layout
- Waterways
- Main Roads
- Railways

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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Figure 3-4c
Habitat Types Identified Within the GSDA Study Area

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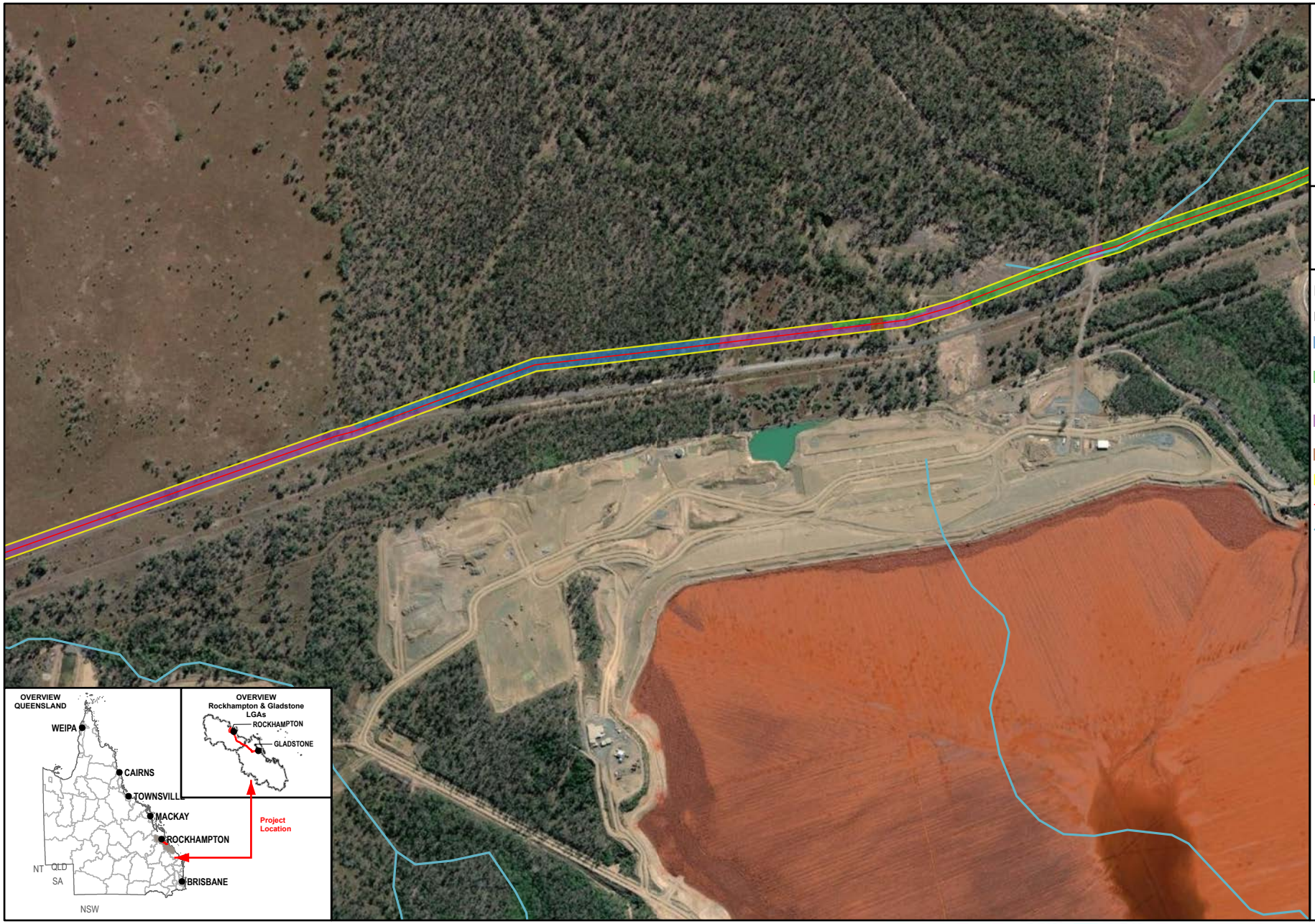

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Habitat Type

- Mature Eucalypt Woodland
- Mixed Eucalyptus/Corymbia Woodland
- Regrowth and/or scattered Eucalyptus/Corymbia/Acacia Trees
- Fringing Riparian Vegetation
- Study Area
- GSDA Pipeline Alignment
- Waterways

Data Sources:
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Figure 3-4d
Habitat Types Identified Within the GSDA Study Area

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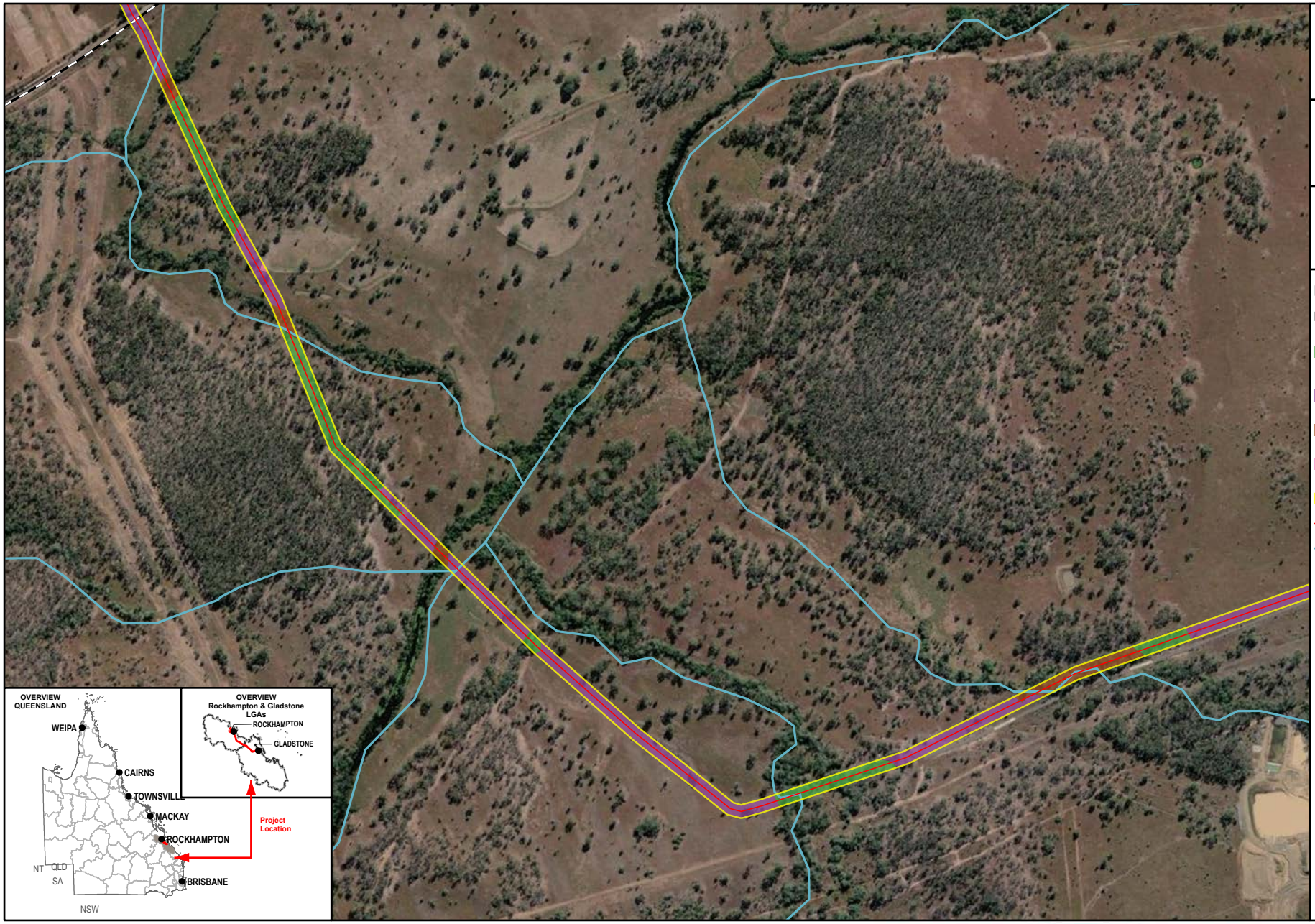

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Habitat Type

- Mixed Eucalyptus/Corymbia Woodland
- Regrowth and/or scattered Eucalyptus/Corymbia/Acacia Trees
- Fringing Riparian Vegetation
- Freshwater Waterbodies and Seasonal Wetlands
- Study Area
- GSDA Pipeline Alignment
- Waterways
- Railways

Data Sources:
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Figure 3-4e
Habitat Types Identified Within the GSDA Study Area

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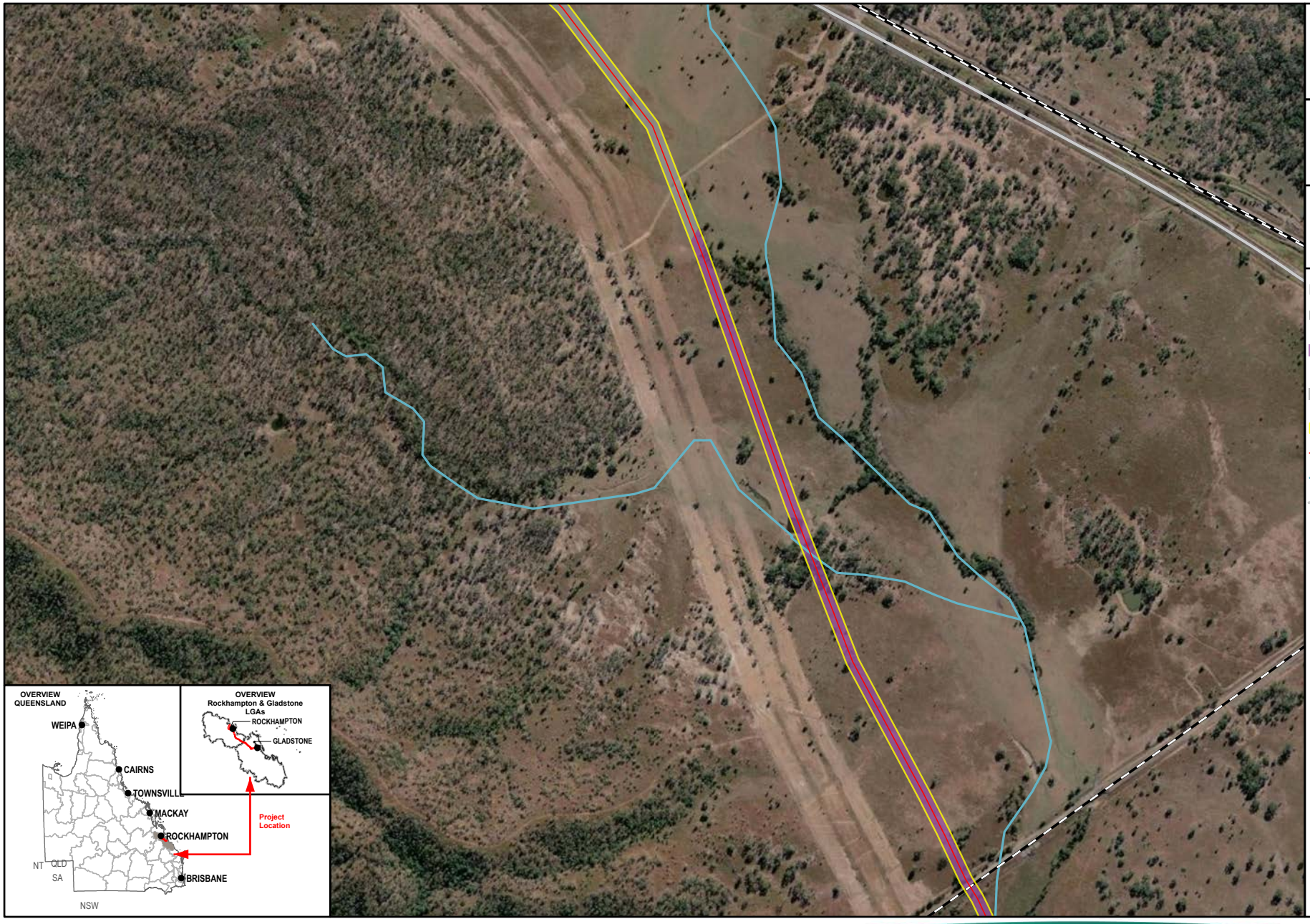

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Habitat Type

- Regrowth and/or scattered Eucalyptus/Corymbia/Acacia Trees
- Cleared and Highly Modified Landscapes
- Study Area
- GSDA Pipeline Alignment
- Waterways
- Main Roads
- Railways

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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Figure 3-4f
Habitat Types Identified Within the GSDA Study Area

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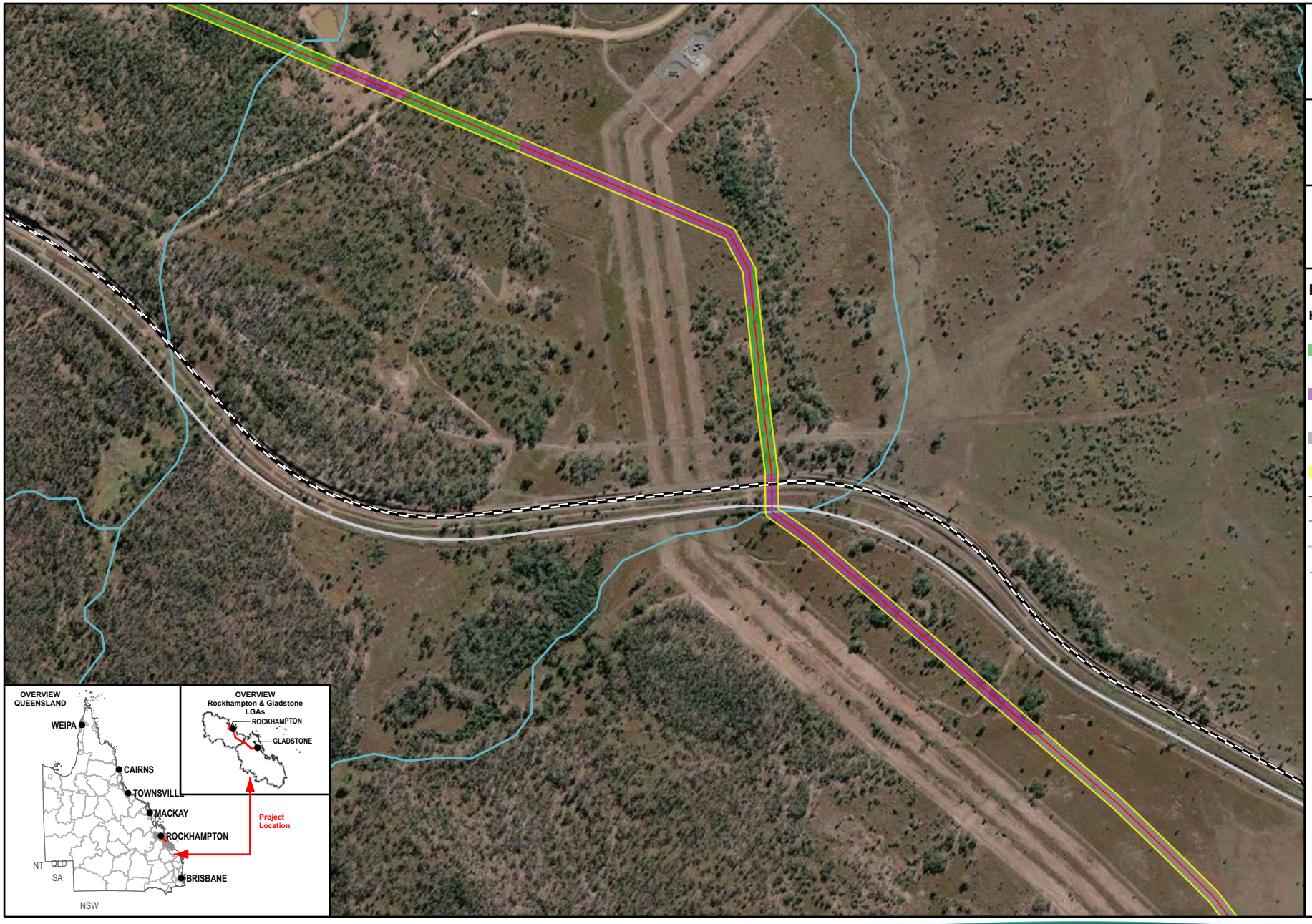

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Habitat Type

- Mixed Eucalyptus/Corymbia Woodland
- Regrowth and/or scattered Eucalyptus/Corymbia/Acacia Trees
- Cleared and Highly Modified Landscapes
- Study Area
- GSDA Pipeline Alignment
- Waterways
- Main Roads
- Railways

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Figure 3-4g
Habitat Types Identified Within the GSDA Study Area

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3.5 Biosecurity matters

3.5.1 Field survey results

3.5.1.1 Introduced flora species

Weed species were commonly observed throughout the GSDA study area. Weeds of National Significance (WoNS) and restricted invasive weeds (listed under the Queensland *Biosecurity Act 2014* (Biosecurity Act)) recorded within the GSDA study area are listed in Table 3-10. All restricted invasive plants recorded are Category 3 restricted matters.

Table 3-10 Introduced flora species recorded within the GSDA study area

Species name	Common name	WoNS	State declaration Biosecurity Act
Parthenium hysterophorus	Parthenium	X	Category 3
Lantana camara	Lantana	X	Category 3
Opuntia stricta	Common pest pear	X	Category 3
Opuntia tomentosa	Velvet tree pear	X	Category 3
Sporobolus pyramidalis	Giant rat's tail grass		Category 3
Cryptostegia grandiflora	Rubber vine	X	Category 3
Cascabela thevetia syn. Thevetia peruviana	Yellow oleander		Category 3
Harrisia martinii	Harrisia cactus		Category 3
Parkinsonia aculeata	Parkinsonia	X	Category 3
Lantana montevidensis	Creeping lantana		Category 3

3.5.1.2 Introduced fauna species

Four introduced fauna species were identified within the GSDA study area (Table 3-11), including three mammal species declared as restricted invasive animals under the Queensland's *Biosecurity Act 2014* (DAF 2017). Baited remote cameras detected the presence of the feral pig and European red fox during the field surveys within the GSDA study area and are shown below in Plate 3-1.

Table 3-11 Introduced fauna species recorded within the GSDA study area

Species name	Common name	State declaration Biosecurity Act
Oryctolagus cuniculus	European rabbit	Category 3, 4 and 6
Rhinella marina	Cane toad	-
Sus scrofa	Feral pig	Category 3, 4 and 6
Vulpes vulpes	European red fox	Category 3, 4 and 6

Plate 3-1 Feral pig (left) and European red fox (right)

3.6 Aquatic environment

3.6.1 Desktop assessment results

3.6.1.1 Threatened aquatic species

The EPBC Act PMST database identified nine threatened aquatic species that have the potential to occur within the desktop search extent. State based searches (i.e. WildNet, Species Profile Search and Biomaps) identified four threatened aquatic species that have been historically recorded within the desktop search extent.

Combined, all searches identified 10 threatened aquatic species within the desktop search extent. These species comprise one freshwater turtle, six marine turtles, one shark, one marine mammal and one crocodile species. The PMST and WildNet desktop search results are provided in Appendix A and summarised in Table 3-12. This table also identifies threatened aquatic species that were identified as controlling provisions under the EPBC approval.

None of the marine species identified within the database searches are expected to be located within study area. The loggerhead turtle (*Caretta caretta*), green turtle (*Chelonia mydas*), leatherback turtle (*Dermochelys coriacea*), hawksbill turtle (*Eretmochelys imbricata*), olive ridley turtle (*Lepidochelys olivacea*), flatback turtle (*Natator depressus*), green sawfish (*Pristis zijsron*), and the dugong (*Dugong dugon*) are all marine species that can also be found in estuarine waters. The crossing of the waterway at Larcom Creek is approximately 40 km upstream of the upper limits of the tidal reach, all other waterway crossings are either ephemeral waterways or small creeks unlikely to support these marine species. As such, these species are unlikely to occur within the study area and are therefore excluded from any further assessment within the GSDA.

The Fitzroy River turtle (*Rheodytes leukops*) is known only from the Fitzroy River and its tributaries (DAWE 2008). Larcom River and all sub-catchments of the Calliope River are outside of any known distribution for the species and therefore, this species has also been excluded from any further assessment within the GSDA.

The estuarine crocodile or species habitat was predicted likely to occur within the study area by the DCCEEW Protected Matter Search Tool (DCCEEW 2022c). Site 1 is located outside the current known distribution of the estuarine crocodile and no individuals have been previously recorded within Larcom Creek (ALA 2022; DES 2022b), and therefore the species is unlikely to occur within the GSDA.

Table 3-12 Threatened aquatic species identified within the GSDA desktop search extent

Scientific name	Common name	Status		Source	WN Records	Nearest Record to ROW	EPBC Approval
		EPBC Act	NC Act				
Reptiles							
Caretta caretta	Loggerhead turtle	E, Mig	E	WN, PMST	1	6.0 km	
Chelonia mydas	Green turtle	V, Mig	V	WN, PMST	14	5.60 km	
Dermochelys coriacea	Leatherback turtle	E, Mig	E	PMST	-	> 50 km	
Eretmochelys imbricata	Hawksbill turtle	V, Mig	E	PMST	-	22.55 km	
Lepidochelys olivacea	Olive Ridley turtle	E, Mig	E	PMST	-	> 160 km	
Natator depressus	Flatback turtle	V, Mig	V	PMST	-	14.39 km	
Rheodytes leukops	Fitzroy River turtle	V	V	PMST	-	~10.58 km	✓
Crocodylus porosus	Estuarine crocodile	Mig	V	WN, PMST	1	~ 8.67 km	
Sharks							
Pristis zijsron	Green sawfish	V, Mig	NL	PMST		>1,000 km	

Scientific name	Common name	Status		Source	WN Records	Nearest Record to ROW	EPBC Approval
		EPBC Act	NC Act				
Mammals							
Dugong dugon	Dugong	Mig	V	WN	2	~5.20 km	
Key to table: CE – critically endangered; E – endangered; V – vulnerable; NT – near threatened; Mig – migratory; SL – special least concern; LC – least concern; NL – not listed; WN – WildNet; PMST – Protected Matters Search Tool.							

3.6.1.2 Great Barrier Reef Marine Park

The Great Barrier Reef (GBR) is listed as a World Heritage Area, National Heritage Property, Marine Park and nationally important wetland. It contains approximately 10% of the coral reef ecosystems in the world and supports an enormous amount of biodiversity. The GBR supports a large number of conservation significant species including marine megafauna, shorebirds, and marine fish species.

The pipeline alignment does not intersect with the GBR. The Calliope River sub-catchment discharges into the GBR approximately 62 km downstream of where Larcom River intersects the GSDA pipeline alignment (Figure 3-5).

3.6.1.3 Wetlands

No MSES or MNES listed wetlands intersect the GSDA pipeline alignment. A number of Nationally Important Wetlands listed under the Directory of Important Wetlands in Australia are downstream of the GSDA pipeline alignment along the coastline. These wetlands, along with a relative location and distance from the nearest section of the GSDA pipeline alignment, are outlined in Table 3-13 and are shown in Figure 3-5.

Table 3-13 Nationally Important Wetlands downstream of the GSDA pipeline alignment

Wetland ID	Wetland name	Location
QLD019	Port Curtis	1 km northeast of the GSDA pipeline alignment
QLD100	Great Barrier Reef Marine Park	18 km northeast of the GSDA pipeline alignment
QLD021	The Narrows	8 km north of the GSDA pipeline alignment

One wetland protection area (Wilmot lagoon) is located approximately 4 km west of the GSDA pipeline alignment near Mount Larcom township (Figure 3-5). The coastline has numerous polygons of MSES high ecological significance wetlands mapped, between the coastline and Curtis and Facing Islands (Figure 3-5).

3.6.1.4 Waterways and fish habitat

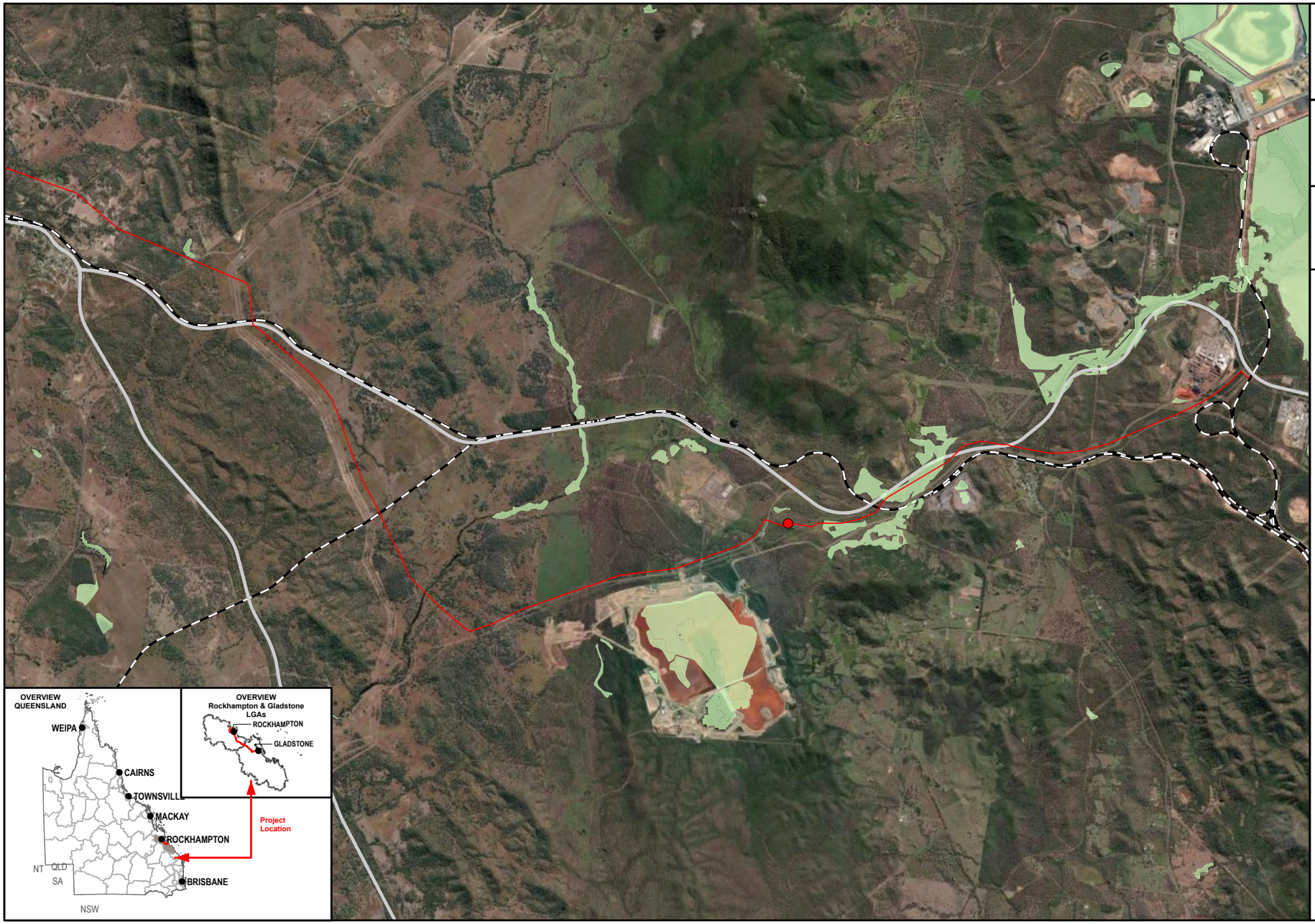
The waterways within the desktop search extent are generally mapped as low and moderate risk (green and amber) waterways for fish passage under the Queensland waterways for waterway barrier works (WWBW) spatial layer (Figure 3-6). The risk ratings assist with the determination of DAF's 'Accepted Development Requirements (ADR) for operational work that is constructing or raising waterway barrier works' (DAF 2018). The ratings are based on the shape and location of the waterway in the catchment, as well as the characteristics of species that reside within them. Waterways with a rating of major or high-risk to fish passage generally contain larger biomasses of fish populations and contain species that are more likely to have weaker swimming abilities (DAF 2021). Low or moderate risk waterways for fish passage are often in the upper reaches of a catchment and have steeper slopes and generally have a lower biomass of fish populations than downstream reaches (DAF 2021).

One waterway, Larcom Creek intersects the GSDA pipeline alignment and is categorised as a high-risk waterway for fish passage (red). Numerous moderate risk (amber) and low risk (green) waterways also occur. Larcom Creek flows into the Calliope River, 21 km downstream of the GSDA pipeline alignment The Calliope River is mapped as a major risk for fish passage (purple) waterway. A summary of all waterway crossings is outlined in Table 3-14 and shown in Figure 3-6.

Table 3-14 Summary of all waterway crossings in the GSDA pipeline alignment

Waterway barrier works risk rating	Number of waterways intersected
Red (high)	1
Amber (moderate)	5
Green (low)	9

The inner coastline between the mainland coast and Curtis and Facing islands, as well as the lower reaches of Calliope River are mapped as a tidal waterway for fish passage. Thirty-nine kilometres downstream of the GSDA pipeline alignment is the Calliope River fish habitat area (management area B).



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Legend

- Facility Locations
- Pipeline Alignment
- Main Roads
- Railways
- Nationally Important Wetlands

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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(Datum GDA2020)

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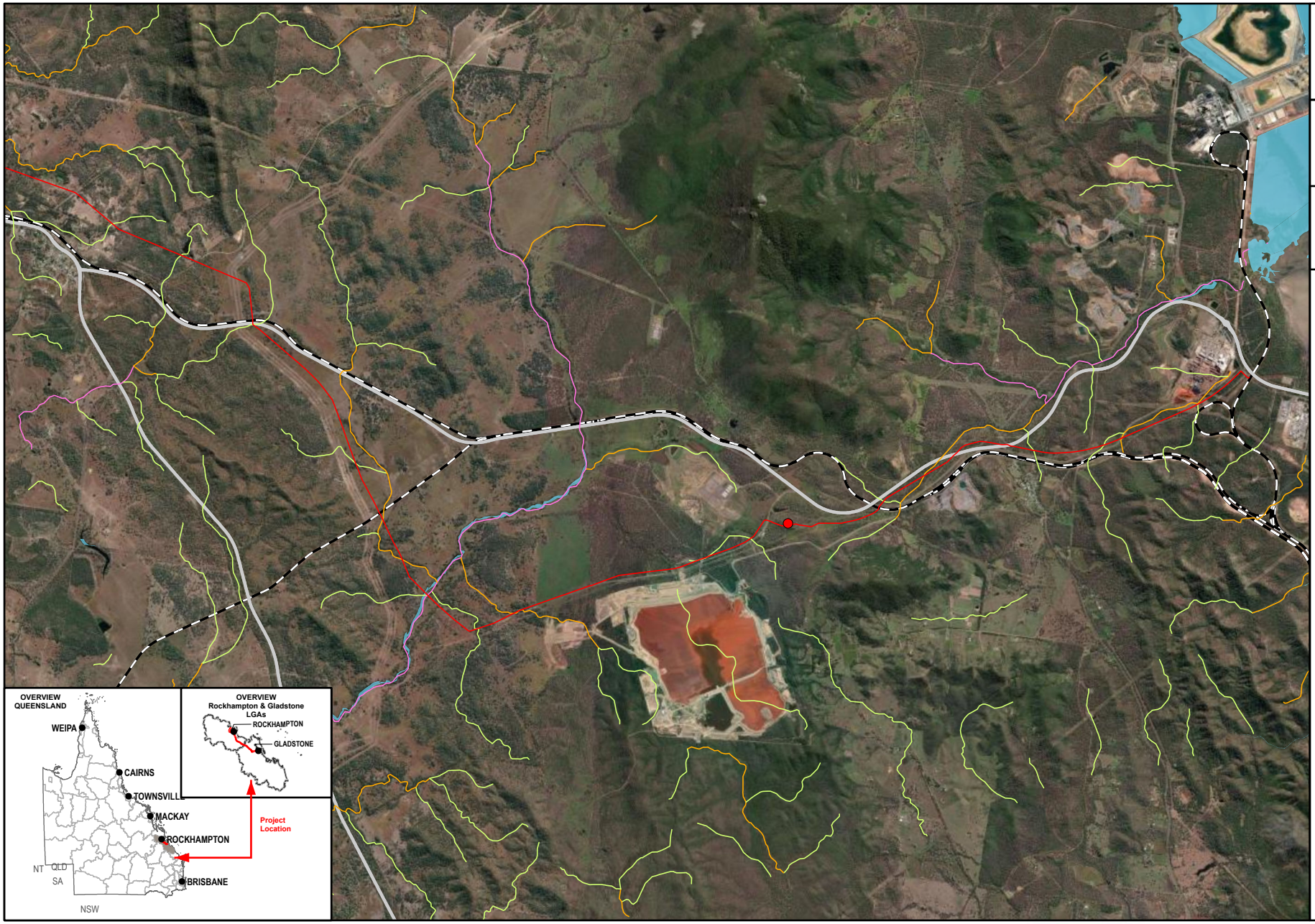
Gladstone to Fitzroy Pipeline Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 3-5 Mapped Wetlands Within the GSDA Desktop Search Area
000-G-MAP-2222 Version:0 Date:15/06/2022



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Legend

- Facility Locations
- Pipeline Alignment
- Main Roads
- Railways

Queensland Waterways for Waterway Barrier Works

- 1 - Low
- 2 - Moderate
- 3 - High
- Waterbody

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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Gladstone to Fitzroy Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 3-6 Mapped Waterways for Waterway Barrier Works and Fish Habitat Areas Within the GSDA Desktop Search Extent

000-G-MAP-2223 Version:0 Date:15/06/2022

3.6.2 Field survey results

3.6.2.1 Aquatic habitat

Larcom Creek is the only high-risk waterway and was the only site surveyed within the GSDA. The overall condition of Larcom Creek (site 1) was assessed as 'fair' with a bioassessment score of 62 (out of 135) (Table 3-15). This site performed poorly in the bottom substrate and embeddedness categories as the site is an open water channel, with no flow and a large deposition of silt upon the substrate creating a lack of habitat complexity. The channel alteration category was assessed as being in excellent condition, with established vegetation alongside the backs and no evidence of erosion or any other factors that would cause channel alteration.

Site characteristics and ecological values from the habitat assessment for this site is detailed below in Table 3-17.

Table 3-15 ***Bioassessment scores for sites within the GSDA***

	Scale	Site 1
Bottom substrate	0-20	3
Embeddedness	0-20	2
Velocity and depth category	0-20	7
Channel alteration	0-15	13
Habitat variable	0-15	10
Pool/riffle, run/bend ratio	0-15	4
Bank stability	0-10	8
Bank vegetation and stability	0-10	7
Streamside cover	0-10	8
Totals	**0-135**	**62**
Habitat score category		**Fair**

3.6.2.2 Physico-chemical water quality

The *in-situ* water quality data obtained from Larcom Creek (site 1) indicated that the water quality was within guidelines for the region for dissolved oxygen and turbidity. However, the Ph was higher than the water quality objective (Table 3-16). Conductivity was slightly elevated with a value of 496 µS/cm, while the temperature within the pool was 30.9^{o}C.

Table 3-16 ***Water Quality Data at sites within the GSDA***

Parameter	Water quality objective*	Site 1
Date	-	22/02/2022
Time	-	12:00 pm
Depth of location (m)	-	0.3
Temperature (^{o}C)	-	30.99
Ph	6.5-8.0	8.11
Electrical conductivity (µS/cm)	-	496
Dissolved oxygen (mg/L)	-	8.05
Dissolved oxygen (% saturation)	85-110	108.9
Turbidity (NTU)	<50	27.6
Key to table: (*) – As per the moderately disturbed lowland freshwater objectives set out in DEHP for Calliope River basin (2014).		

Table 3-17 Site characteristics and ecological values of sites within the GSDA

Site 1 – Larcom Creek	Characteristics	Ecological values
Upstream  Downstream 	– Red – high-risk waterway mapped under the WWBW spatial layer. – Water was isolated in a large pool within a mildly sinuous main channel with no flow. – Wetted width was approximately 17 m, and a depth greater than 1.5 m. – Substrate within the waterbody was comprised entirely of silt/clay, with a stable bed and low compaction of sediment. – Banks on both sides were moderately sloped with concave and convex shaped slopes and were 1.5 m in height. – Both banks were moderately stable with only some local catchment erosion present. – Land use adjacent to the survey area was subject to cattle grazing. – Adjacent riparian zone had moderate amounts of grasses, shrubs and trees <10 m tall, there was only presence of exotic species in the understory of the riparian zone. The canopy consisted of Callistemon. – Water within pool was turbid.	– Overall habitat condition rating was fair (62). – Instream habitat consisted of both shallow and deep pool areas, large woody debris and macrophytes. – The macrophyte species present within the bed were *Ludwigia peploides*, *Nymphoides indica*, *Azolla pinnata*, *Ceratophyllum demersum*, *Ottelia alismoides*, and *Nymphaea* sp. – The macrophytes species within the bank were *Cyperus* spp., and *Persicaria hydropiper*. – The pool supports both small and larger bodied fish species as well as turtles.

3.6.2.3 Aquatic flora

There were no threatened aquatic flora species confirmed present or predicted to occur within the study area. Details of the aquatic species present during the survey is in Table 3-17.

3.6.2.4 Freshwater fishes

A total of 25 native freshwater fish species are known to occur within the Calliope catchment (Pusey *et al.* 2004). A total of six fish species were captured throughout the survey and all species observed were common and native species. Agassiz's glassfish (*Ambassis agassizii*) was the most abundant species recorded with more than six individuals recorded. No conservation significant species were recorded during the field survey and no conservation significant species were predicted to occur in the desktop search outlined in Section 3.6.1.1. No pest species were recorded during the field survey or previously known within the Calliope catchment (Pusey *et al.* 2004). Biosecurity matters are further discussed in Sections 6.2.8 and 6.3.4.

The other species recorded were the fly-specked hardyhead (*Craterocephalus stercusmuscarum*), mouth almighty (*Glossamia aprion*), firetail gudgeon (*Hypseleotris galii*), western carp gudgeon (*Hypseleotris klunzingeri*), and Hyrtl's tandan (*Neosilurus hyrtlii*). Further details on the fish survey results are located in Appendix J.

3.6.2.5 Other aquatic fauna

Three species of freshwater turtles are known to occur within the desktop search extent area, none of which are conservation significant species.

One juvenile Krefft's river turtle (*Emydura macquarii krefftii*) was captured within Larcom Creek (site 1; Plate 3-2). There were no sandy banks present within the study area, however clay/silt banks that are suitable for common turtle species were present.

Plate 3-2 Krefft's river turtle (Emydura macquarii krefftii) observed at Larcom Creek

No freshwater crocodiles or estuarine crocodiles were detected during the field survey, nor any evidence of any individuals present.

3.7 Likelihood of occurrence

Based on the desktop searches and field survey results undertaken during 2008 (Arup) and GHD (2022), the following conservation significant species have the potential to occur within the GSDA study area (Table 3-18). The *Cycas megacarpa*, *Samadera bidwillii,* squatter pigeon and grey-headed flying-fox were identified as controlling provisions at the time of EPBC approval. With exception to the grey-headed flying-fox, these species also listed under the NC Act were assessed against the Queensland Government's *Significant Residual Impact Guideline* (DEHP 2014b) for MSES (Section 7.1). The grey-headed flying-fox was assessed against the Commonwealth *Significant Impact Guidelines (1.1)* (DoE 2013). A detailed likelihood of occurrence assessment is provided in Appendix E.

Table 3-18 Likelihood of occurrence summary

Scientific name	Common name	Status		Likelihood of occurrence	EPBC approval
		EPBC Act	NC Act		
Threatened species					
*Calyptorhynchus lathami**	Glossy black-cockatoo	NL	V	**Confirmed present**	
Cycas megacarpa	-	E	E	**Likely to occur**	✓
*Geophaps scripta scripta**	Squatter pigeon (southern)	V	V	**Confirmed present**	✓
Hirundapus caudacutus	White-throated needletail	V, Mig	V	**Likely to occur**	
Ninox strenua	Powerful owl	NL	V	**Likely to occur**	
Petauroides volans	Greater glider (southern and central)	E	E	**Likely to occur**	
Petaurus australis australis	Yellow-bellied glider (south-eastern)	V	V	**Likely to occur**	
*Phascolarctos cinereus**	Koala	E	E	**Confirmed present**	
Pteropus poliocephalus	Grey-headed flying-fox	V	LC	**Likely to occur**	✓
Samadera bidwillii	-	V	V	**Likely to occur**	✓
Migratory species					
Apus pacificus	Fork-tailed swift	Mig	SL	**Likely to occur**	
Calidris acuminata	Sharp-tailed sandpiper	Mig	SL	**Likely to occur**	
Cuculus optatus	Oriental cuckoo	Mig	SL	**Likely to occur**	
Gallinago hardwickii	Latham's snipe	Mig	SL	**Likely to occur**	
Myiagra cyanoleuca	Satin flycatcher	Mig	SL	**Likely to occur**	
Plegadis falcinellus	Glossy ibis	Mig	SL	**Likely to occur**	
Tringa nebularia	Common greenshank	Mig	SL	**Likely to occur**	
Tringa stagnatilis	Marsh sandpiper	Mig	SL	**Likely to occur**	

Key to table: CE – critically endangered; E – endangered; V – vulnerable; NT – near threatened; Mig – migratory; SL – special least concern; NL – not listed; (*) – confirmed present during the Arup (2008) field surveys.

4. SGIC SDA ecological values

4.1 Threatened ecological communities

4.1.1 Desktop assessment results

The EPBC Act PMST search predicted seven TECs have the potential to occur within the desktop search extent of the SGIC SDA (Appendix A). The predicted TECs and their associated REs are summarised in Table 4-1.

Although seven TECs were shown as predicted to occur within the search area, only two were listed at the time of the EPBC approval, and as such, subject to the EPBC approval including:

– Brigalow (*Acacia harpophylla* dominant and co-dominant) (listed as endangered)
– Semi-evergreen vine thickets of the brigalow belt (listed as endangered).

Table 4-1 TECs predicted to occur within the desktop search extent

TEC	EPBC Act status	Associated REs	RE(s) mapped in study area
Brigalow (*Acacia harpophylla* dominant and co-dominant)	E	11.3.1, 11.4.3, 11.4.7, 11.4.8, 11.4.9, 11.4.10, 11.5.16, 11.9.1, 11.9.5, 11.9.6, 11.11.14 and 11.12.21	Yes
Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and Southeast Queensland	E	12.1.1, 12.3.20	No
Coolibah – Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions	E	11.3.3, 11.3.16, 11.3.15, 11.3.37, 11.3.28	Yes
Lowland Rainforest of Subtropical Australia	CE	12.3.1a, 12.3.16, 12.3.17, 12.5.13, 12.8.3, 12.8.4, 12.8.13, 12.11.1, 12.11.10, 12.12.1, 12.12.16, 12.5.13b	No
Poplar Box Grassy Woodland on Alluvial Plains	E	11.3.2, 11.3.17, 11.4.7, 11.4.12, 12.3.10	Yes
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	E	11.11.18, 11.2.3, 11.3.11, 11.4.1, 11.5.15, 11.8.13, 11.8.3, 11.8.6, 11.9.4, 11.9.8	No
Weeping Myall Woodlands	E	11.3.2, 11.3.28	Yes
Key to table: CE – critically endangered; E – endangered			

4.1.2 Field survey results

EPBC Act listed TECs confirmed present within the SGIC SDA study area, together with anticipated areas of impact are listed below:

– Brigalow (*Acacia harpophylla* dominant and co-dominant) – recorded as a single patch within Lot 98 on DS186 (Plate 4-1). Up to 1.5 ha of the TEC will be impacted by the project.
– Poplar Box Grassy Woodland on Alluvial Plains – recorded as a single patch within Lot A on SP226047 (Plate 4-2). Up to 0.45 ha of the TEC will be impacted by the project. Although this TEC was confirmed as present, it was not listed at the time of the approval and therefore, is not an MNES and is not considered further with respect to legislative or offset obligations.

Assessments against the TEC criteria provided in the respective listing advice are presented in Table 4-2 and Table 4-3. Representative site photos are provided in Plate 4-1 and Plate 4-2. Locations of confirmed TECs are provided in Figure 4.1.

Table 4-2 Brigalow (Acacia harpophylla dominant and co-dominant) – TEC site assessment

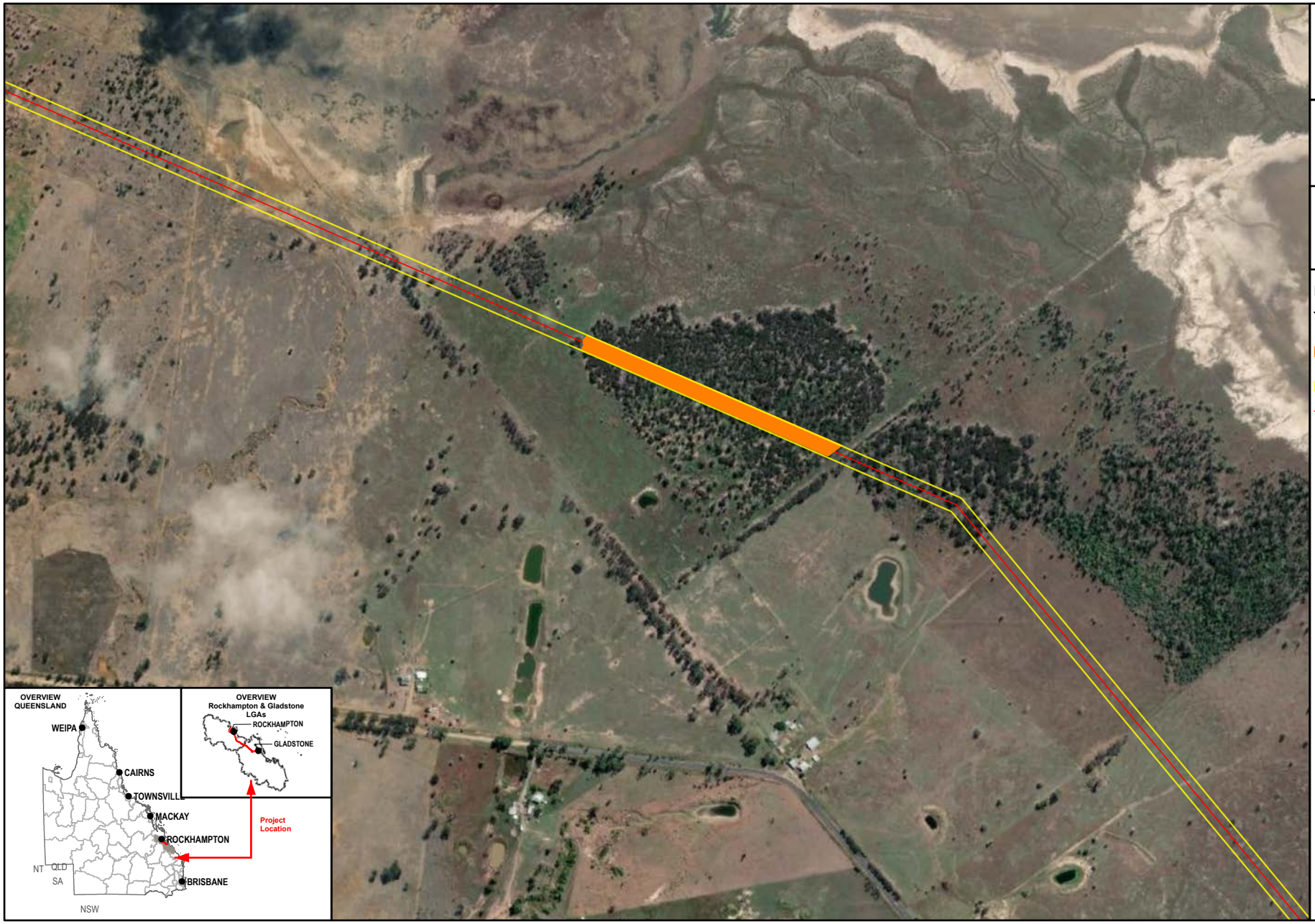
<table>
<tr><th>Criterion</th><th>Assessment outcome</th></tr>
<tr><td colspan="2">Diagnostic criteria</td></tr>
<tr><td>Acacia harpophylla dominant</td><td>Yes – recorded.</td></tr>
<tr><td>Meets description of an equivalent RE.</td><td>Yes – Vegetation in the patch was brigalow regrowth with a species composition and structural elements typical of RE 11.3.1 which is an equivalent RE cited in the listing advice.</td></tr>
<tr><td>At least 15 years old</td><td>Aerial imagery confirms that the patch has not been cleared in the last 15 years.</td></tr>
<tr><td colspan="2">Condition thresholds</td></tr>
<tr><td>Patch > 0.5 ha</td><td>Yes – patch is approximately 10 ha in area</td></tr>
<tr><td>Exotic perennial plants comprise less than 50% of the total vegetation cover of the patch.</td><td>Yes – proportion of native cover across combined strata relative to benchmark data exceeds exotic cover.
<table>
<tr><td></td><td>Canopy</td><td>Shrub</td><td>ground</td><td>Total</td></tr>
<tr><td>Exotic</td><td>0%</td><td>0.88%</td><td>7.88%</td><td>8.76%</td></tr>
<tr><td>Native</td><td>9%</td><td>7.12%</td><td>0.12%</td><td>16.24%</td></tr>
</table>
</td></tr>
<tr><td>Not an excluded RE</td><td>Yes – species composition and landform more closely resembling RE 11.3.1 than RE 11.11.16 which is a similar but excluded RE.</td></tr>
</table>

*Plate 4-1 Brigalow (**Acacia harpophylla** dominant and co-dominant) TEC in study area*

Table 4-3 Poplar Box Grassy Woodland on Alluvial Plains – TEC site assessment

Criterion	Assessment outcome
Location and landform	
Located in listed bioregion	Yes – Brigalow Belt North Bioregion.
Associated with alluvial plain	Yes – Mapped as 11.3.4/11.3.2 in pre-clear mapping. Mapped as fine textured alluvial plains in soil mapping at 1:500,000 (CSIRO, 1968).
Vegetation structure	
Grassy open woodland (20-50 % cover) to open woodland (<20 percent); can occasionally occur as open forest.	Yes – recorded as a woodland along 100 m transect (T1 – 44 % cover).
Crown cover 10 % or more	Yes – 44% cover.
Canopy species capable of exceeding 10 m in height	Yes – height range of 14 – 19 m recorded at the assessment site.
Eucalyptus populnea dominant	Yes – *E. populnea* dominant in the T1 canopy layer.
Shrubs and small trees 30 % or less cover, excluding seedlings and juveniles of *E. populnea.*	Yes – shrubs and small trees recorded along the transect was <5% cover.
Ground layer (< 1 m) dominated by native grasses, herbs and chenopods, ranging from sparse to thick.	Yes. 70% over perennial ground layer vegetation was native. Common ground layer species included *Themeda triandra, Eriochloa pseudoacrotricha, Panicum effusum, Bothriochloa decipiens, Dichanthium sericeum, Chloris inflata*, Dichanthium aristatum*.*
Vegetation condition	
Class A, B or C – refer Conservation Advice for the Poplar Box Grassy Woodland on Alluvial Plains (DoEE, 2019)	Assessed as Category B (good quality) with the following condition measures recorded at the assessment site: – Crown cover of canopy trees > 10 % – At least 50% of perennial native vegetation cover in the ground layer was native. 28 mature trees/ha with a DBH of 30 cm or greater.

Plate 4-2 Poplar Box Grassy Woodland on Alluvial Plains TEC in study area



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Legend

TEC Verified Area

- Brigalow (Acacia harpophylla dominant and co-dominan
- Study Area
- SGIC SDA Pipeline Alignment

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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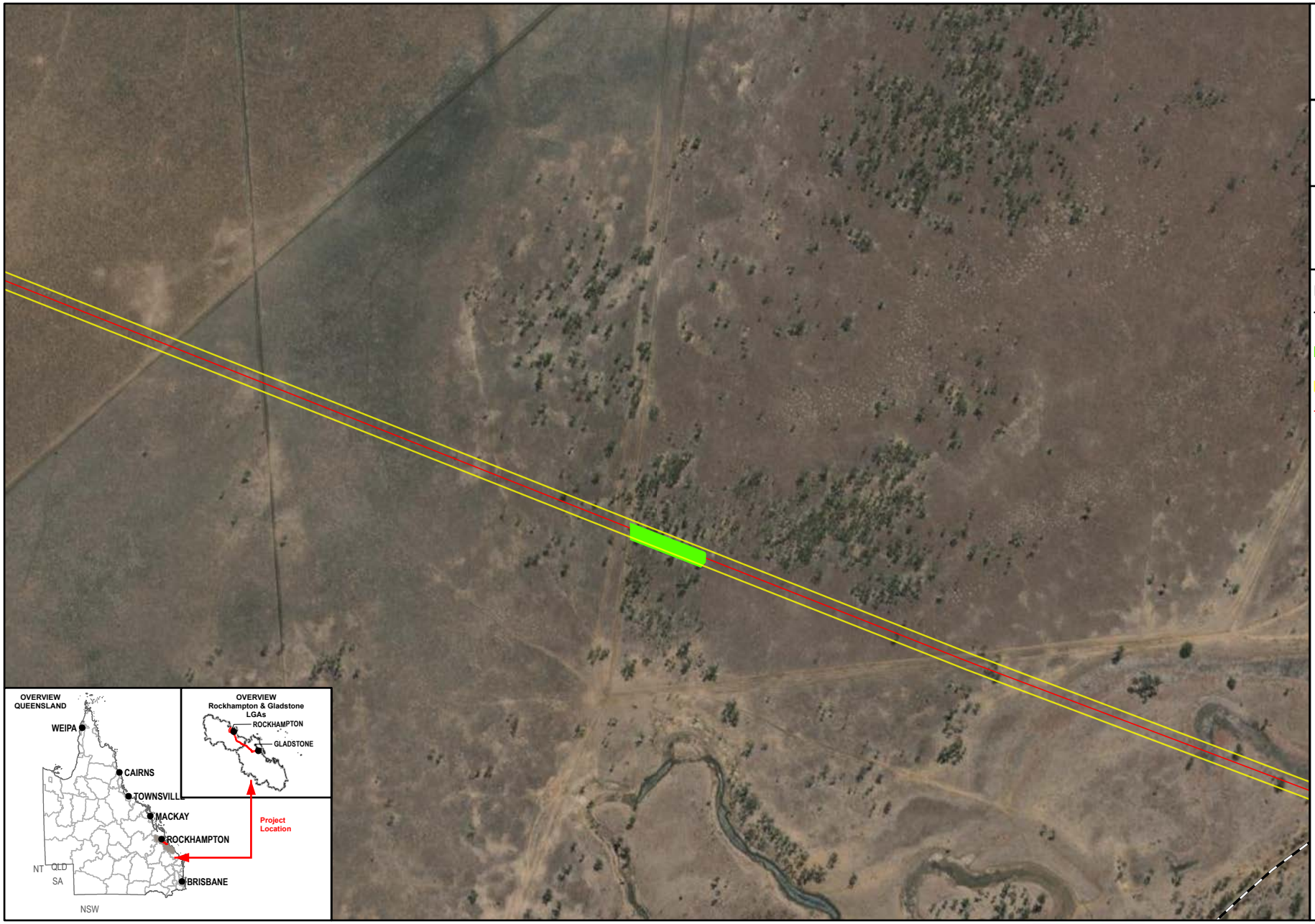
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 4-1a
Mapped TECs Intersected by the SGIC SDA Alignment
000-G-MAP-2410 Version:2 Date:23/08/2022



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Legend

TEC Verified Area

- Poplar Box Grassy Woodland on Alluvial Plains
- Study Area
- SGIC SDA Pipeline Alignment
- Railways

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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Gladstone Area Water Board
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PROJECTION UTM Zone 56
(Datum GDA2020)

Compiled by:YS16239

Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 4-1b
Mapped TECs Intersected by the SGIC SDA Alignment
000-G-MAP-2410 Version:2 Date:23/08/2022

4.2 Regional Ecosystems and regulated vegetation

4.2.1 Desktop assessment results

The SGIC study area is located within the Mount Morgan Ranges and Marlborough subregions of the Brigalow Belt bioregion. The SGIC SDA study area is mapped by DoR as comprising a mixture of Category B (remnant vegetation), Category R (Great Barrier Reef riverine regrowth vegetation), Category C (high-value regrowth vegetation) and Category X vegetation (not generally regulated under the *Vegetation Management Act 1999* (VMA)). Descriptions of REs comprising the polygons of mapped remnant and regrowth vegetation within the SGIC SDA study area, together with their status under the VMA are provided in Table 4-4. Property maps of assessable vegetation (PMAVs) are also in place across substantial portions of the SGIC SDA study area. Essential habitat and defined watercourses also intersect the SGIC SDA pipeline alignment.

DoR vegetation mapping is provided at Appendix C.

Table 4-4 ***REs mapped within the SGIC SDA study area, either as components of heterogenous polygons or as homogenous polygons***

Mapped RE	VM Act status	Short description	Broad Vegetation Group
11.1.2a	LC	Bare mud flats on Quaternary estuarine deposits, with very isolated individual stunted mangroves	35b
11.1.4	LC	Mangrove low open forest and/or woodland on marine clay plains	35a
11.1.4d	LC	Dominated by a range of species from genera such as from *Avicennia* sp., *Ceriops* sp., *Rhizophora* sp. and *Bruguiera* sp. which form a low closed forest.	35a
11.3.1	E	*Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains	25a
11.3.2	OC	*Eucalyptus populnea* woodland on alluvial plains	17a
11.3.3	OC	*Eucalyptus coolabah* woodland on alluvial plains	16c
11.3.3c	OC	*Eucalyptus coolabah* woodland to open woodland (to scattered trees) with a sedge or grass understorey in back swamps and old channels.	16c
11.3.4	OC	*Eucalyptus tereticornis* and/or *Eucalyptus* spp. woodland on alluvial plains	16c
11.3.25	LC	*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines	16a
11.3.26	LC	*Eucalyptus moluccana* or *E. microcarpa* woodland to open forest on margins of alluvial plains	13d
11.3.27x1b	LC	Sedgelands to grasslands on Quaternary deposits.	34d
11.11.4c	LC	*Eucalyptus moluccana* dominated woodland. Other tree species listed above may occur as sub or co-dominant species.	13c
11.11.5	LC	Microphyll vine forest +/- *Araucaria cunninghamii* on old sedimentary rocks with varying degrees of metamorphism and folding	7a
11.11.15	LC	*Eucalyptus crebra* woodland to open woodland on deformed and metamorphosed sediments and interbedded volcanics	13c
11.11.16	OC	*Eucalyptus cambageana*, *Acacia harpophylla* open forest to woodland on old sedimentary rocks with varying degrees of metamorphism and folding. Lowlands	25a
Key to table: E – endangered; OC – of concern; LC – least concern			

4.2.2 Field survey results

A number of discrepancies were identified between the mapped DoR RE layer and the field verified REs within the SGIC SDA pipeline alignment. Most commonly, mapped heterogenous polygons comprising multiple REs were comprised of single RE within the extent of the alignment. Often, the VMA status (endangered, of concern, least concern) and/or remnant status (remnant, regrowth, non-remnant) of verified polygons remained the same, despite the change in RE designation. Where a change was recorded, the VMA status was typically a lower conservation status (i.e. less threatened).

Several areas containing PMAVs were mapped as Category X, despite vegetation appearing to have reached remnant status. These polygons were historically secured as Category X vegetation through the PMAV process and their assigned designation within the study area was retained.

Field verified RE mapping is provided in Figure 4-2. It is noted that DoR vegetation mapping was accepted for those polygons not ground-truthed during surveys (refer hatched polygons in Figure 4-2). Impact areas for respective REs within the SGIC SDA pipeline alignment, based on field verified mapping and a nominal 30 m wide corridor, are provided in Table 4-5.

A description of REs where field verification has resulted in a change to the VMA status and/or remnant status of the mapped polygon (version 12.1) is provided in Table 4-6.

Table 4-5 Impact areas for REs mapped within the SGIC SDA pipeline alignment

RE	VMA Class	VMA Status	Total area (m^2)
11.1.1	Remnant	LC	4,327
11.1.2b	High value regrowth	LC	1,008
11.1.2b	Remnant	LC	3,681
11.1.4	Remnant	LC	9,174
11.1.4/11.3.4	Remnant	OC	639
11.1.4d	High value regrowth	LC	312
11.1.4d	Remnant	LC	5,239
11.3.1	High value regrowth	E	30,173
11.3.2	High value regrowth	OC	2,014
11.3.2	Remnant	OC	4,437
11.3.2/11.3.4	High value regrowth	OC	12
11.3.3	High value regrowth	OC	3,029
11.3.3/11.3.4	High value regrowth	OC	2,768
11.3.3/11.3.4	Remnant	OC	12,632
11.3.3/11.3.4/11.3.2/11.3.3c/11.3.27x1b	High value regrowth	OC	4,018
11.3.3c	High value regrowth	OC	22
11.3.4	High value regrowth	OC	15,105
11.3.4	Remnant	OC	4,456
11.3.4/11.3.2	High value regrowth	OC	4,832
11.3.4/11.3.3/11.3.25	High value regrowth	OC	12,824
11.3.25	High value regrowth	LC	1,183
11.3.25	Remnant	LC	1,719
11.3.26	Remnant	LC	22,733
11.3.26/11.3.4	Remnant	OC	18,612
11.3.26/11.3.4/11.11.4c	High value regrowth	OC	167

RE	VMA Class	VMA Status	Total area (m^2)
11.3.26/11.3.4/11.11.5	High value regrowth	OC	45,611
11.3.27c	High value regrowth	LC	347
11.3.27c	Remnant	LC	2,091
11.11.15	High value regrowth	LC	17,151
11.11.16	High value regrowth	E	1,188
Non-remnant	non-remnant	NA	2,191,245
water	water	NA	943
Key to table: E – endangered; OC – of concern; LC – least concern; NA – not applicable.			

Table 4-6 Field verified REs resulting in change to VMA status and/or remnant status in the SGIC SDA study area

Location	Mapped RE	Field verified RE	Field description	Representative photograph
-23.8104, 150.9958	Category C 11.3.26/ 11.3.4/ 11.11.15	Category C 11.11.15	T1 – *Eucalyptus crebra* (9-12 m tall, 55% cover) T2 – *Acacia disparrima, Corymbia erythrophloia, Lophostemon suaveolens Acacia fasciculifera* (2-6m tall, 18% cover) S1 – *Lantana camara*, A. Disparrima, Alstonia constricta, Grewia latifolia* (0.5-2m tall, 40% cover) G – *Aristida sp., Pterocaulon redolens, Sida hackettiana, Heteropogon contortus, Praxelis clematidea** Landform: mid-sloe on metamorphic low hill	
-23.7987, 150.9718	Category C 11.3.26/ 11.3.4/ 11.11.5	Category B 11.3.26/ 11.3.4	T1 – *Eucalyptus moluccana and Eucalyptus tereticornis with associated E. crebra and Corymbia tessellaris* (21 m tall, 33% cover) T2 – *C. tessellaris and C. intermedia* (8-13 m tall, 5% cover) T3 – *Acacia disparrima, Psydrax oleifolia, C. tessellaris* (2-4 m tall, 2% cover)S1 – *A. disparrima, Lantana camara* C. tessellaris* (1.2 m tall, 5% cover) G – *Bothriochloa pertusa*, Sida hackettiana, Pterocaulon redolens* (0.3 m tall, 65% cover) Landform: Undulating plain with rises	

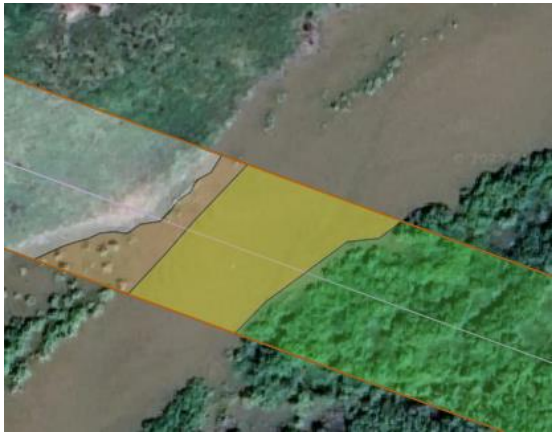
Location	Mapped RE	Field verified RE	Field description	Representative photograph
-23.7901, 150.959	Category C 11.3.26/ 11.3.4/ 11.11.5	Category B 11.3.4	T1 – *Eucalyptus tereticornis* (23 m tall, 30% cover) S1 – *E. tereticornis*, *Cryptostegia grandiflora** (1 m tall, 1 % cover) G – *Chloris gayana*, *Heteropogon contortus*, *Arundelliana nepalensis*, *Cynodon dactylon**, *Dichanthium aristatum** (1m tall, 95% cover) Landform: Alluvial plain	
-23.7864, 150.956	Category B 11.3.26/ 11.3.4	Category B 11.3.26	T1 – *Eucalyptus moluccana* (20 m tall, 40% cover) T2 – *E. moluccana* (10m tall, 15% cover) S1 – *E. moluccana*, *Acacia decora* and associated *A. leiocalyx*, *Capparis canescens* (1 m tall, 3% cover) G – *Aristida* sp., *Chrysopogon fallax*, *Fimbristylis dichotoma*, *Eragrostis* sp., *Dianella brevipedunculata*, *Eriochloa pseudoacrotricha*, *Pterocaulon redolens*, *Panicum* sp. (0.1-0.2 m tall, 60% cover) Landform: Undulating plain with lateritic surface gravels	

Location	Mapped RE	Field verified RE	Field description	Representative photograph
-23.7194, 150.8716	Category R 11.11.15	Category R 11.3.4	T1 – *Eucalyptus tereticornis* (10-15m tall, 5% cover) Landform: alluvial plain Note: Canopy cover <10% but meets Category R criteria.	
-23.7090, 150.8195	Category B 11.1.4/ 11.3.4	Category B 11.1.4	T1 – *Excoecaria agallocha*, *Avicennia marina* (6-8 m tall, 80% cover) S1 – *Clerodendrum inerme*, *A. marina, Aegiceras corniculatum*, *E. agallocha* (0.1-2m, 15% cover) G – *Sporobolus virginicus*, *Einadia nutans* subsp. *linifolia* (0.1 m tall, 10% cover) Landform: Marine plain	

Location	Mapped RE	Field verified RE	Field description	Representative photograph
-23.7086, 150.8183	non-remnant	Category B 11.1.1	E – *Excoecaria agallocha* 1-1.5 m tall, 2 % cover) G – *Sporobolus virginicus, Fimbristylis sp., Sesuvium portulacastrum, Enchylaena tomentosa, Atriplex muelleri* (0.1-0.3 m tall, 75% cover) Landform: Marine plain	
-23.7085, 150.8171	Category B 11.1.4/ 11.3.4	Category B 11.1.4	T1 – *Excoecaria agallocha, Avicennia marina and associated Xylocarpus granatum, Cupaniopsis anacardioides* (7-10 m tall, 75% cover) S1 – *Clerodendrum inerme, A. marina, Aegiceras corniculatum, E. agallocha, Acanthus ilicifolia* (0.1-2m, 17% cover) G – *Sporobolus virginicus, Enchylaena tomentosa* (0.1 m tall, 7% cover) Landform: Marine plain	

Location	Mapped RE	Field verified RE	Field description	Representative photograph
-23.7050, 150.8117	Category B 11.1.4/ 11.3.4	Category B 11.1.4	T1 – *Excoecaria agallocha, Trophis scandens, Avicennia marina, Cupaniopsis anacardioides, Melaleuca bracteata* (8-10m tall, 90% cover) T2 – *Excoecaria agallocha, Clerodendrum inerme, Avicennia marina* (6 m tall, 10% cover) S1 – *Acanthus ilicifolia, Solanum seaforthianum*, Senna pendula*, Ricinus communis** (0.3 m tall, 4% cover) G – *Sporobolus virginicus, Enchylaena tomentosa, Fimbristylis ferruginea, Solanum seaforthianum*, Ludwigia octovalvis*, Passiflora foetida*, Eclipta prostrata*, Rivina humilis*, Atriplex muelleri, Ruellia simplex** (0.1 m tall, 5% cover) Landform: Marine plain	
-23.7042, 150.8104	Category C 11.3.4/ 11.3.25	Category B 11.1.4	T1 – *Excoecaria agallocha, Trophis scandens, Avicennia marina, Cupaniopsis anacardioides, Melaleuca bracteata* (8-10m tall, 90% cover) T2 – *Excoecaria agallocha, Clerodendrum inerme, Avicennia marina* (6 m tall, 10% cover) S1 – *Acanthus ilicifolia, Solanum seaforthianum*, Senna pendula*, Ricinus communis** (0.3 m tall, 4% cover) G – *Sporobolus virginicus, Enchylaena tomentosa, Fimbristylis ferruginea, Solanum seaforthianum*, Ludwigia octovalvis*, Passiflora foetida*, Eclipta prostrata*, Rivina humilis*, Atriplex muelleri, Ruellia simplex** (0.1 m tall, 5% cover) Landform: Marine plain	

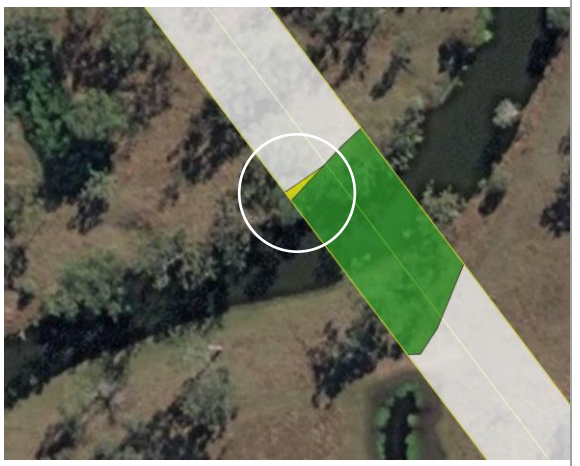
Location	Mapped RE	Field verified RE	Field description	Representative photograph
-23.6816, 150.7524	Category C 11.3.26/ 11.11.16	Category C 11.3.1	T1 – *Casuarina cristata, Melaleuca bracteata and associated Eucalyptus populnea* (10-16 m tall, 70% cover) T2 – *C. cristata, M. bracteata and associated diospyros geminata, Alectryon diversifolius, Denhamia oleaster* (2-5 m tall, 8% cover) S1 – *A. diversifolius, Breynia oblongifolia, C. cristata, M. bracteata* (0.5-2 m tall, 5% cover) G – *Eriochloa pseudoacrotricha, Chloris gayana*, Cyperus spp., Malvastrum americanum*, Fimbristylis sp.* (0.5 m tall, 65% cover) Landform: Alluvial plain	
-23.6804, 150.7442	Category R 11.3.2/ 11.3.4	Category R 11.1.2b	G – *Sporobolus virginicus, Tecticornia pergranulata subsp. Queenslandica, Tecticornia indica, Sclerolaena muricata Sesbania cannabina, Eriochloa* sp.*, Dichanthium* sp.*, Chloris* sp. (0.1-0.3 m tall, 40% cover) Landform: Banks of estuary	

Location	Mapped RE	Field verified RE	Field description	Representative photograph
-23.6519, 150.7171	Category B 11.11.16/ 11.3.26	Category C 11.3.1	T1 – *Acacia harpophylla, Casuarina cristata* (6 m tall, 57% cover) S1 – *Acacia harpophylla, Alectryon diversifolius, Carissa ovata, Jasminum didymum, Capparis lasiantha, Citrus glauca, Melaleuca bracteata, Cryptostegia grandiflora*, Opuntia tomentosa*, Harissa martini** (1.2 m tall, 27% cover) G – *Megathyrsus maximus*, Cenchrus ciliaris*, Ludwigia octovalvis, Bothriochloa pertusa*, Ocimum polystachyos*, Sporobolus caroli, Cyperus sp*. (0.2 m tall, 70% cover) Landform: Alluvial plain	
-23.6384, 150.6841	Category C 11.3.4/ 11.3.2/ 11.3.25	Water	Water, devoid of vegetation. Landform: estuary Note: Determined via site observations and supported by interrogation of historical aerial imagery.	

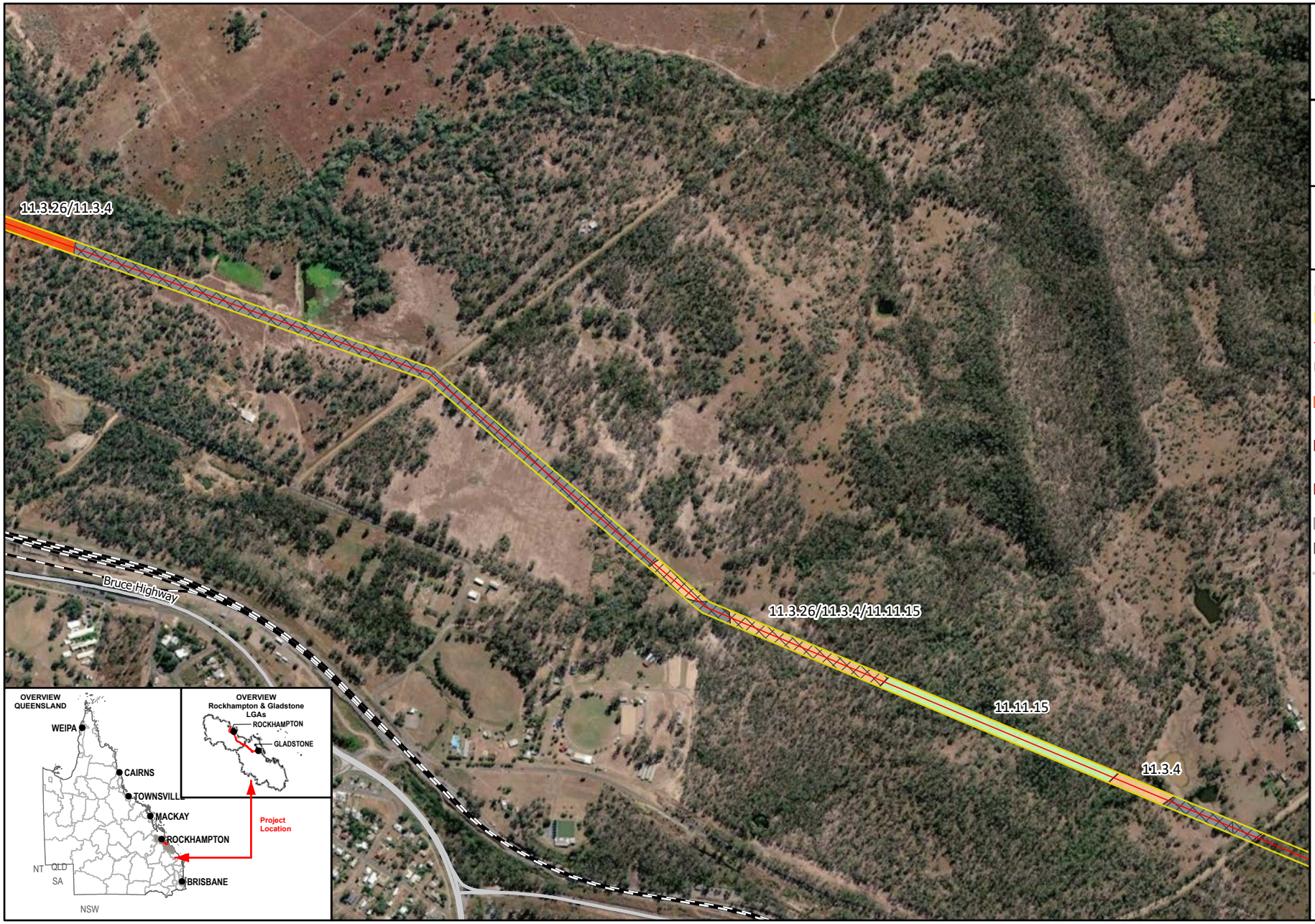
Location	Mapped RE	Field verified RE	Field description	Representative photograph
-23.6384, 150.6839 PM site 193	Category R 11.3.4/ 11.3.2/ 11.3.25	Category R 11.1.4d	T1 – *Avicennia marina and associated Aegialitis annulata, Ceriops australis* (0.2-3 m tall, 45% cover) G – *Sporobolus virginicus, Enchylaena tomentosa, Suaeda arbusculoides* (0.2 m tall, 30% cover) Landform: Banks of estuary	
-23.6367, 150.6766 marine plants; PM site 161. Note – mapped in PMAV as Cat X. Refer tech desc with ave cover of S.vir of 60%. Site has 70%.	non-rem	Category B 11.1.1	G – *Sporobolus virginicus with associated Chloris inflata*, Sclerolaena calcarata, Sporobolus caroli, Alternanthera sp., Dinebra sp.* (0.1 m tall, 75% cover) Landform: Banks of minor tidal estuary on alluvial plain	

Location	Mapped RE	Field verified RE	Field description	Representative photograph
-23.6366, 150.6762	non-rem	Category B 11.1.2b	E – *Avicennia marina* (0.3 m tall, 2% cover) G – *Sporobolus virginicus, Tecticornia pergranulata subsp. Queenslandica, Tecticornia indica, Enchylaena tomentosa, Suaeda arbusculoides, Sesuvium portulacastrum* (0.2 m tall, 40% cover) Landform: Banks of minor tidal estuary on alluvial plain	
-23.6269, 150.6501	non-rem	Category B 11.3.2	T1 – *Eucalyptus populnea with associated E. tereticornis* (18 m tall, 44 % cover) T2 – *E. populnea, E. tereticornis* (2-6 m tall, 4% cover) S1 – *E. populnea, Acacia salicina* (0.5 – 1.2 m tall, 2% cover) G – *Themeda triandra, Chloris inflata*, Dichanthium aristatum*, Eriochloa pseudoacrotricha, Panicum effusum, Bothriochloa decipiens, Dichanthium sericeum* (0.6 m tall, 90% cover) Landform: Alluvial plain	

Location	Mapped RE	Field verified RE	Field description	Representative photograph
-23.5425, 150.5818	Category R 11.3.4/ 11.3.2	Category R 11.3.25	T1 – *Melaleuca fluviatilis, Eucalyptus tereticornis* (10 m tall) S1 – *M. viminalis, Cryptostegia grandiflorus*, Senna pendula** (1-4 m tall) G – *Dichanthium aristatum*, Sesbania cannabina, Urochloa mutica*, Chloris gayana, Sida rhombifolia*, Cyperus exaltatus* (0.3-1m tall) Landform: Banks of waterway on alluvial plain	
-23.5076, 150.5656	Category C 11.3.4/11.3.2	Category X	Determined from aerial imagery. Vegetation does not meet the minimum crown cover requirements for Category C vegetation specified in the *Guideline for determining category C areas Vegetation management* (DoR 2019) (i.e. 10% crown cover for sparse vegetation).	

Location	Mapped RE	Field verified RE	Field description	Representative photograph
-23.4511, 150.5327	Category R 11.3.4/11.3.2/11.3.25/11.3.27x1b	Category R 11.3.25	Total area of RE polygon approximately 40 m^2. Its position on the bank rather than the adjacent plain indicates that it is more closely aligned to Category R 11.3.25. Distal observations of landform and vegetation present support this determination. Landform: Upper bank of watercourse (Land Zone 3)	
-23.4333, 150.5217	Category C 11.3.3/ 11.3.27c	Category B 11.3.3/ 11.3.4	T1 – *Eucalyptus coolabah, E. tereticornis* (16 m tall, 30% cover) T2 – E*. coolabah, E. tereticornis* (8-11 m tall, 5 % cover) S1 – *E. coolabah* (0.2 m tall, 0.5 % cover) G – *Salsola australis, Panicum sp., Cyperus sp. Abutilon sp., Dichanthium aristatum** (0.3 m tall, 30% cover) Landform: Alluvial plain	

Location	Mapped RE	Field verified RE	Field description	Representative photograph
-23.4035, 150.4533	Category R 11.3.3/ 11.3.27c	Category R 11.3.27c	Landform: closed depression (wetland). Note: Boundary of the existing polygon (RE11.3.27c) refined to reflect extent of regular inundation and lack of woody vegetation. Inundation area determined through interrogation of historical aerial imagery and site observations.	
Key to table: Pink shading: Remnant regulated vegetation containing endangered REs; Pale orange shading: High value regrowth regulated vegetation containing of concern REs; Orange shading: Remnant regulated vegetation containing of concern REs; Pale green shading: High value regrowth regulated vegetation containing least concern REs; Green shading: Remnant regulated vegetation containing least concern REs; (*) – introduced flora species.				



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Legend

- Study Area
- SGIC Pipeline Alignment

Field verified REs

- Category A or B area containing of concern
- Category C or R area containing of concern
- Category C or R area that is least concern
- Non-remnant
- Unverified Fields
- 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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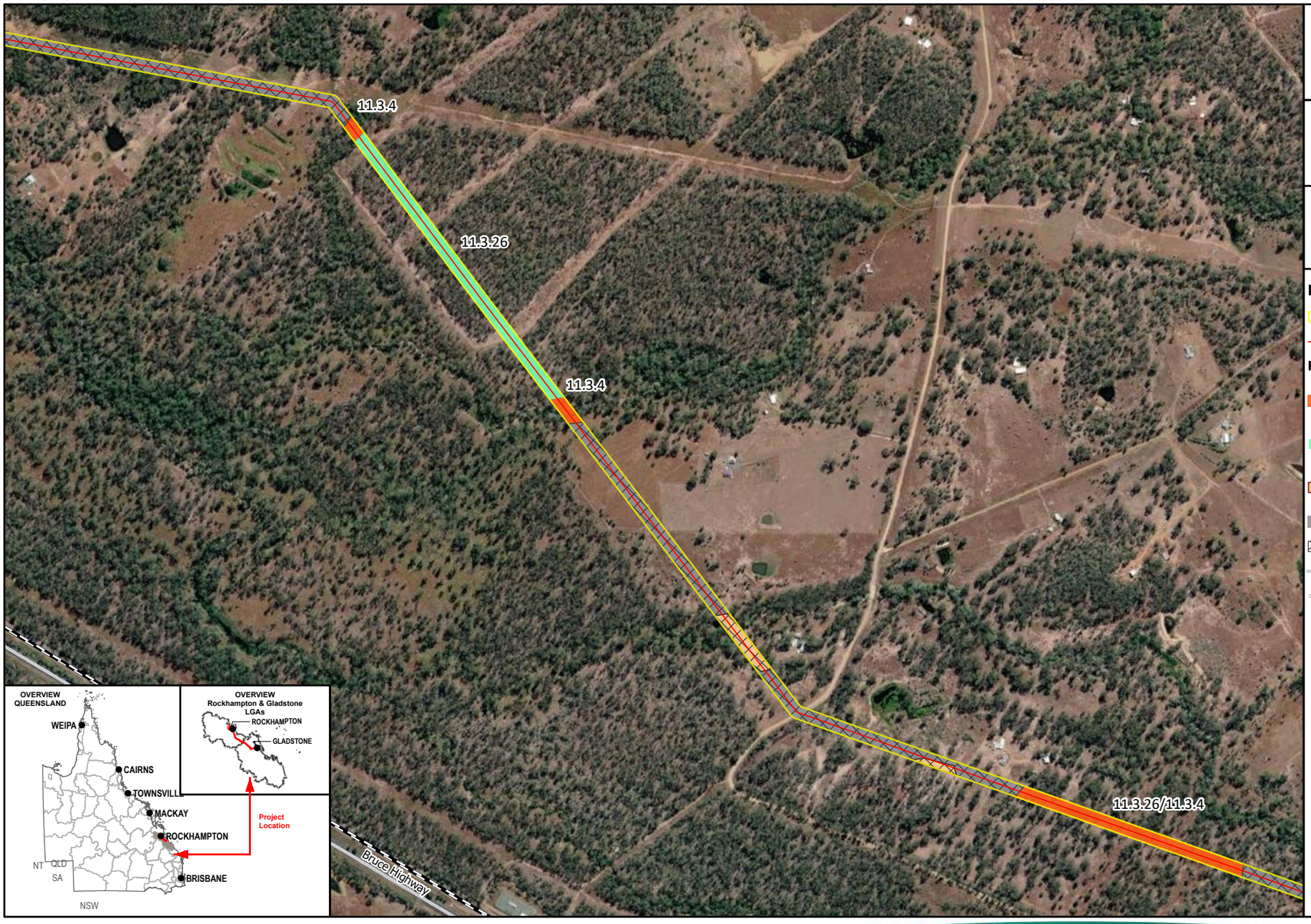
Fitzroy to Gladstone Pipeline Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 4-2a
Field Verified REs Within the SGIC SDA Study Area

000-G-MAP-2411 Version:3 Date:19/09/2022



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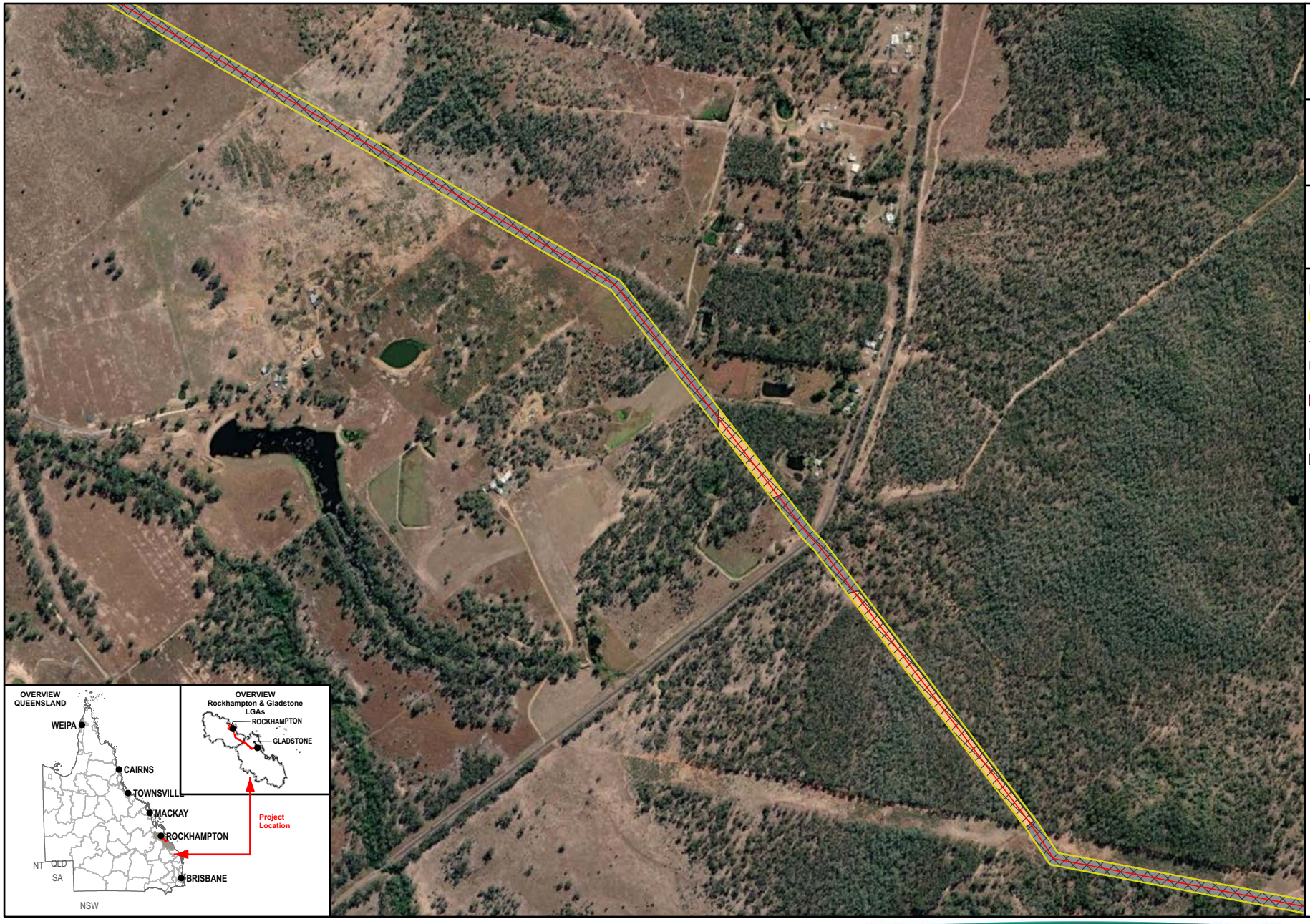

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Legend

- Study Area
- SGIC Pipeline Alignment

Field verified REs

- Category C or R area containing of concern
- Non-remnant
- Unverified Fields

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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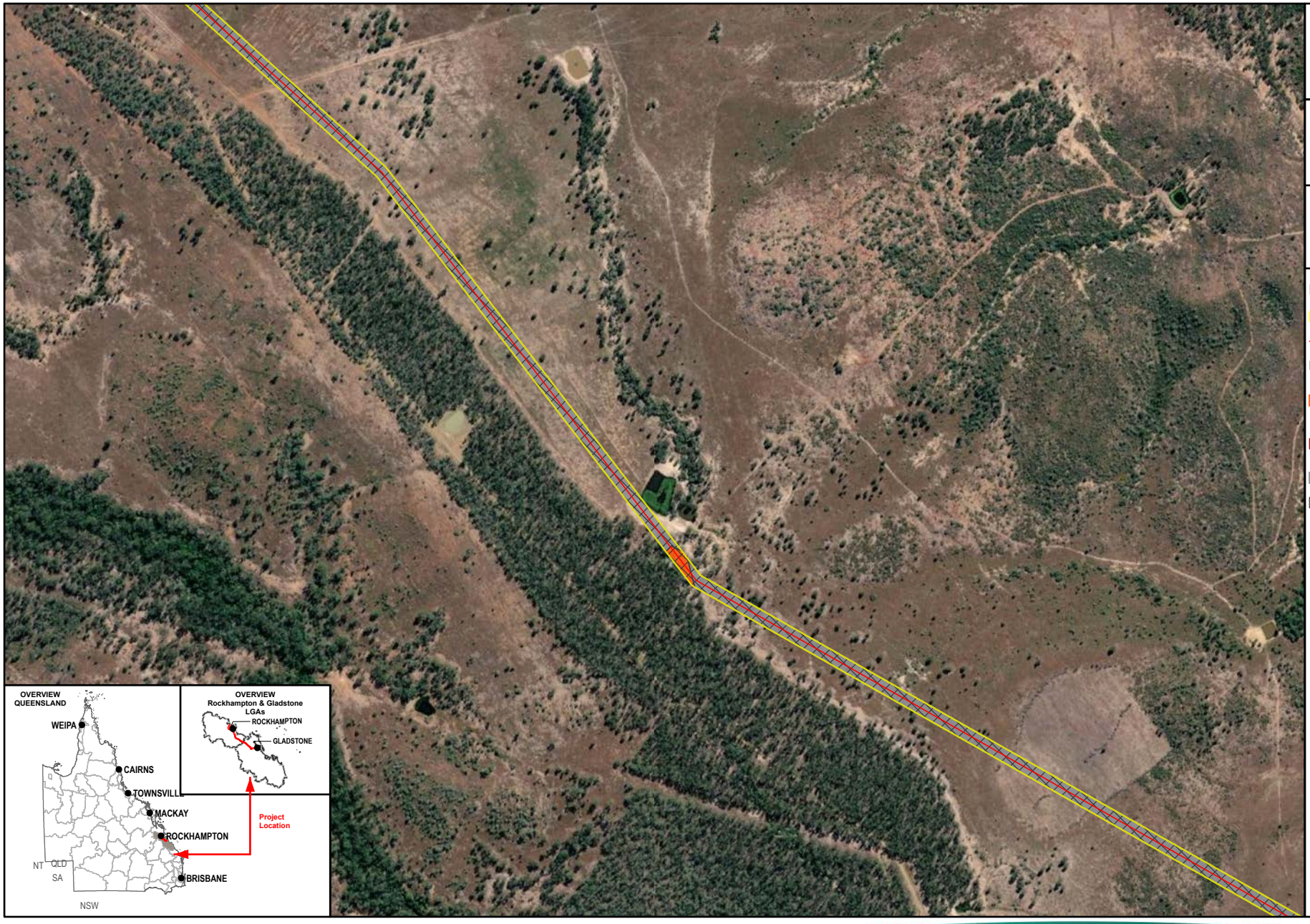
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 4-2c
Field Verified REs Within the SGIC SDA Study Area

000-G-MAP-2411 Version:3 Date:19/09/2022



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Legend

- Study Area
- SGIC Pipeline Alignment

Field verified REs

- Category A or B area containing of concern
- Category C or R area containing of concern
- Non-remnant
- Unverified Fields

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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PROJECTION UTM Zone 56
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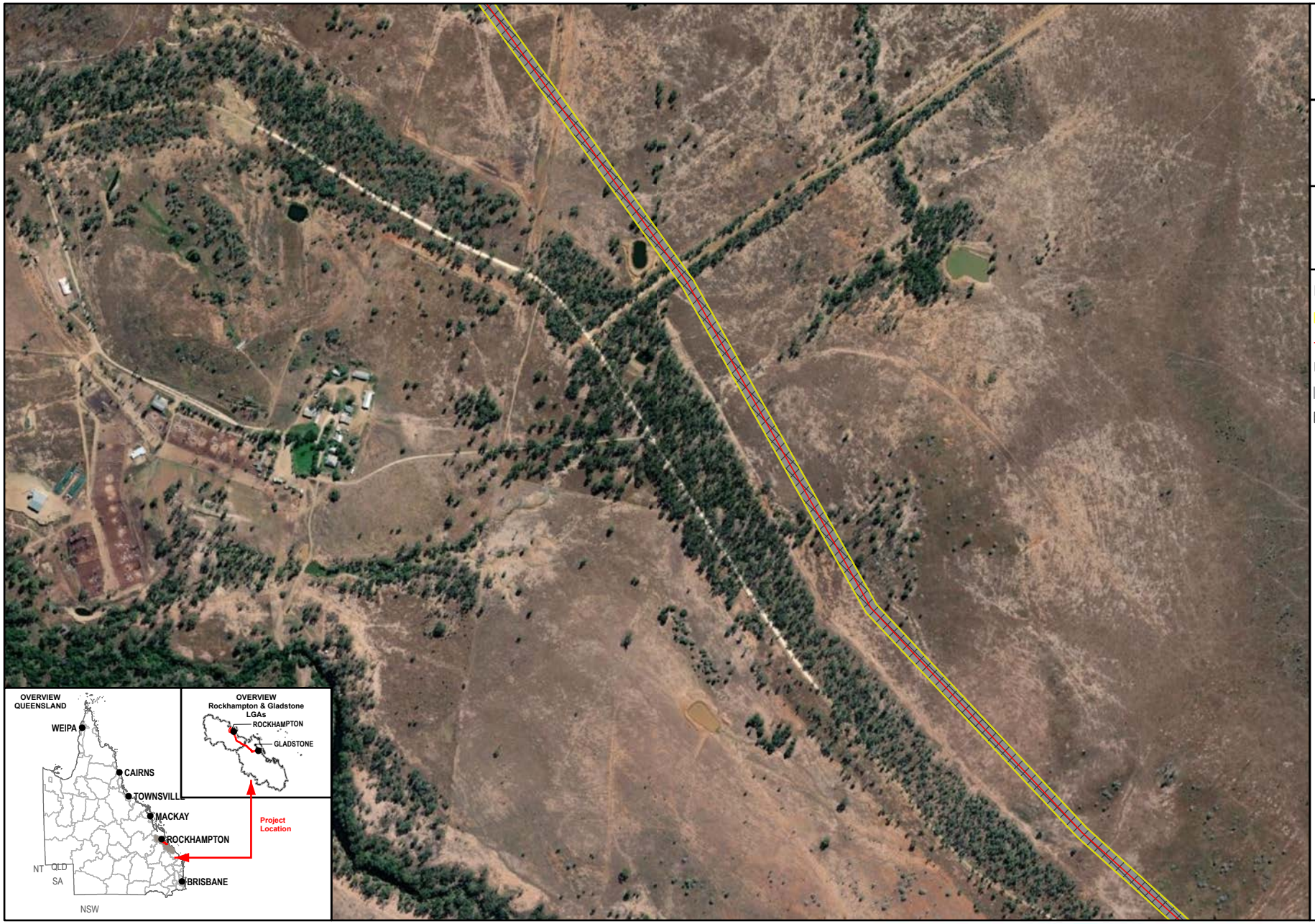
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 4-2d
Field Verified REs Within the SGIC SDA Study Area

000-G-MAP-2411 Version:3 Date:19/09/2022



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Legend

- Study Area
- SGIC Pipeline Alignment

Field verified REs

- Non-remnant
- Unverified Fields

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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PROJECTION UTM Zone 56
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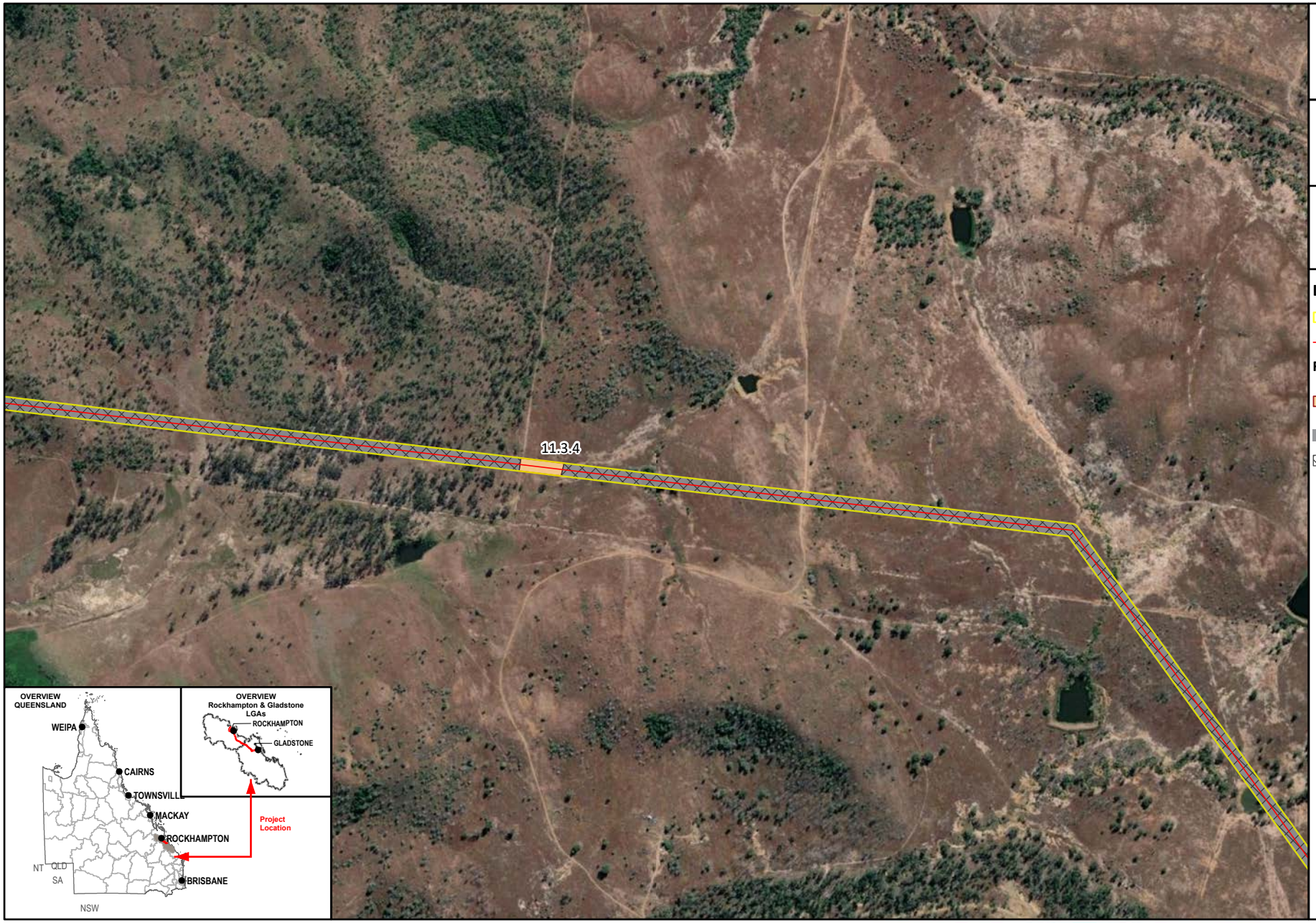
Fitzroy to Gladstone Pipeline Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 4-2e
Field Verified REs Within the SGIC SDA Study Area

000-G-MAP-2411 Version:3 Date:19/09/2022



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Legend

- Study Area
- SGIC Pipeline Alignment

Field verified REs

- Category C or R area containing of concern
- Non-remnant
- Unverified Fields

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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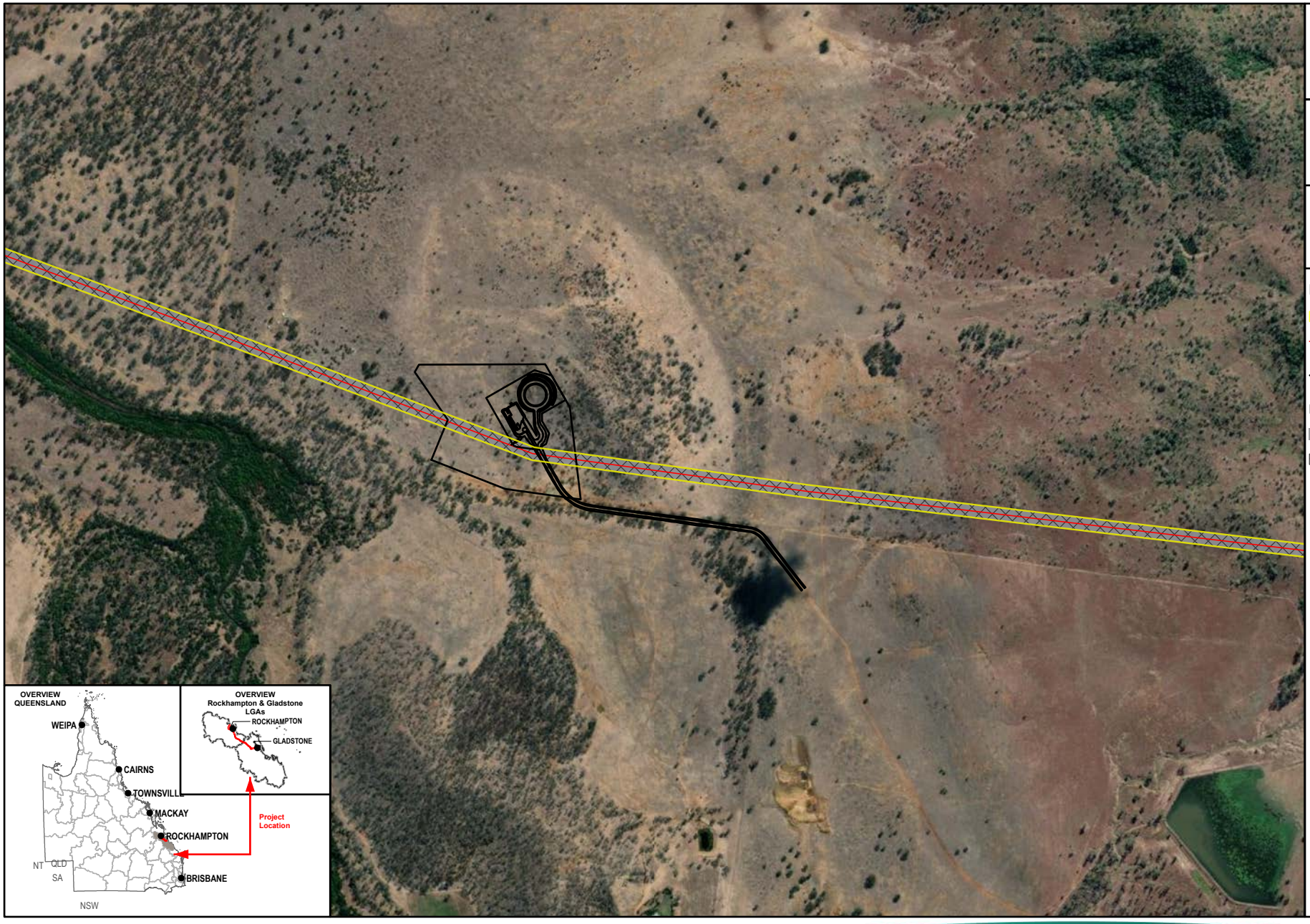
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 4-2f
Field Verified REs Within the SGIC SDA Study Area

000-G-MAP-2411 Version:3 Date:19/09/2022



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Legend

- Study Area
- SGIC Pipeline Alignment
- Raglan Pump Station and Reservoir Layout

Field verified REs

- Non-remnant
- Unverified Fields

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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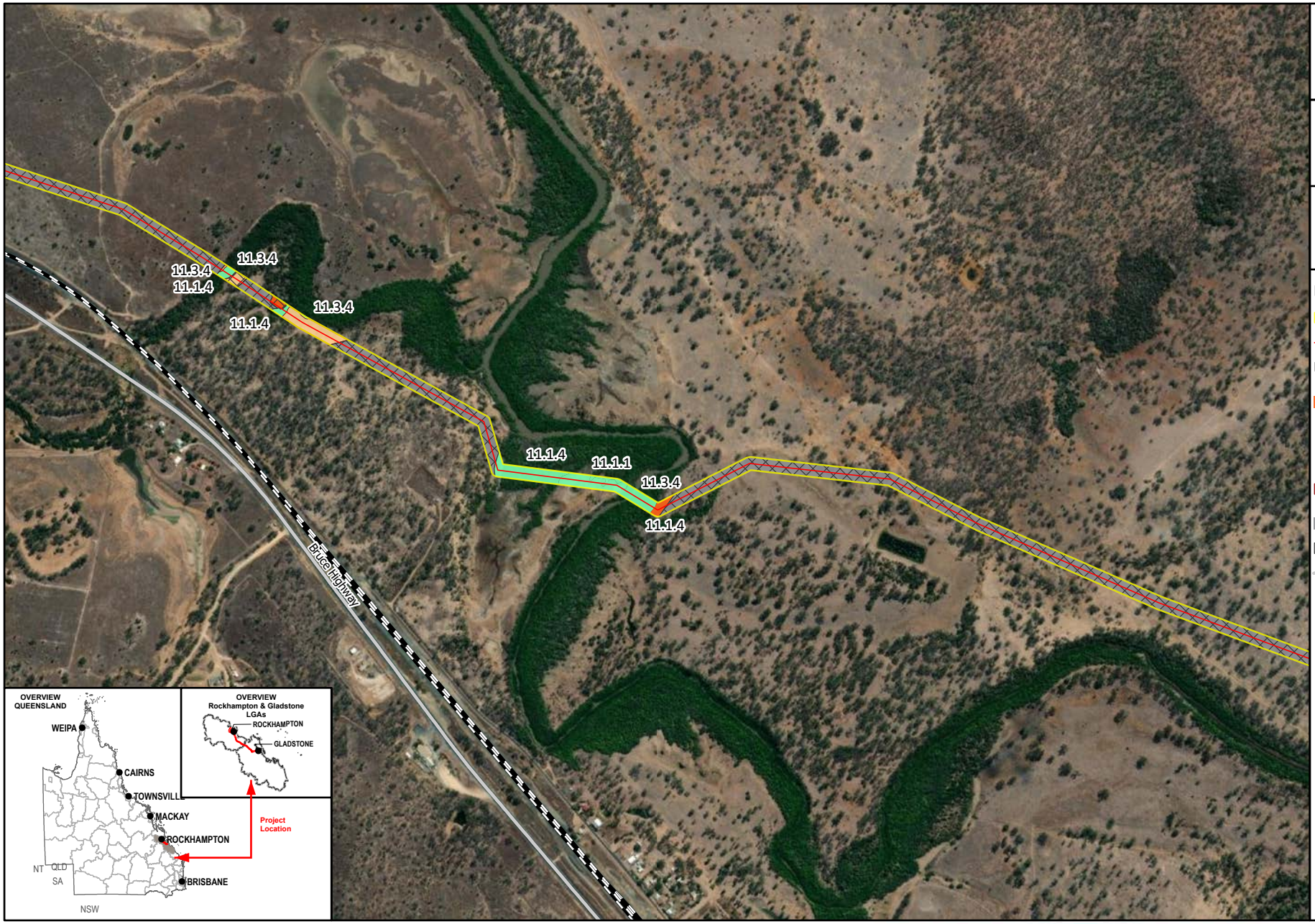
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 4-2g
Field Verified REs Within the SGIC SDA Study Area

000-G-MAP-2411 Version:3 Date:19/09/2022



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Legend

- Study Area
- SGIC Pipeline Alignment

Field verified REs

- Category A or B area containing of concern
- Category A or B area that is least concern
- Category C or R area containing of concern
- Non-remnant
- Unverified Fields
- 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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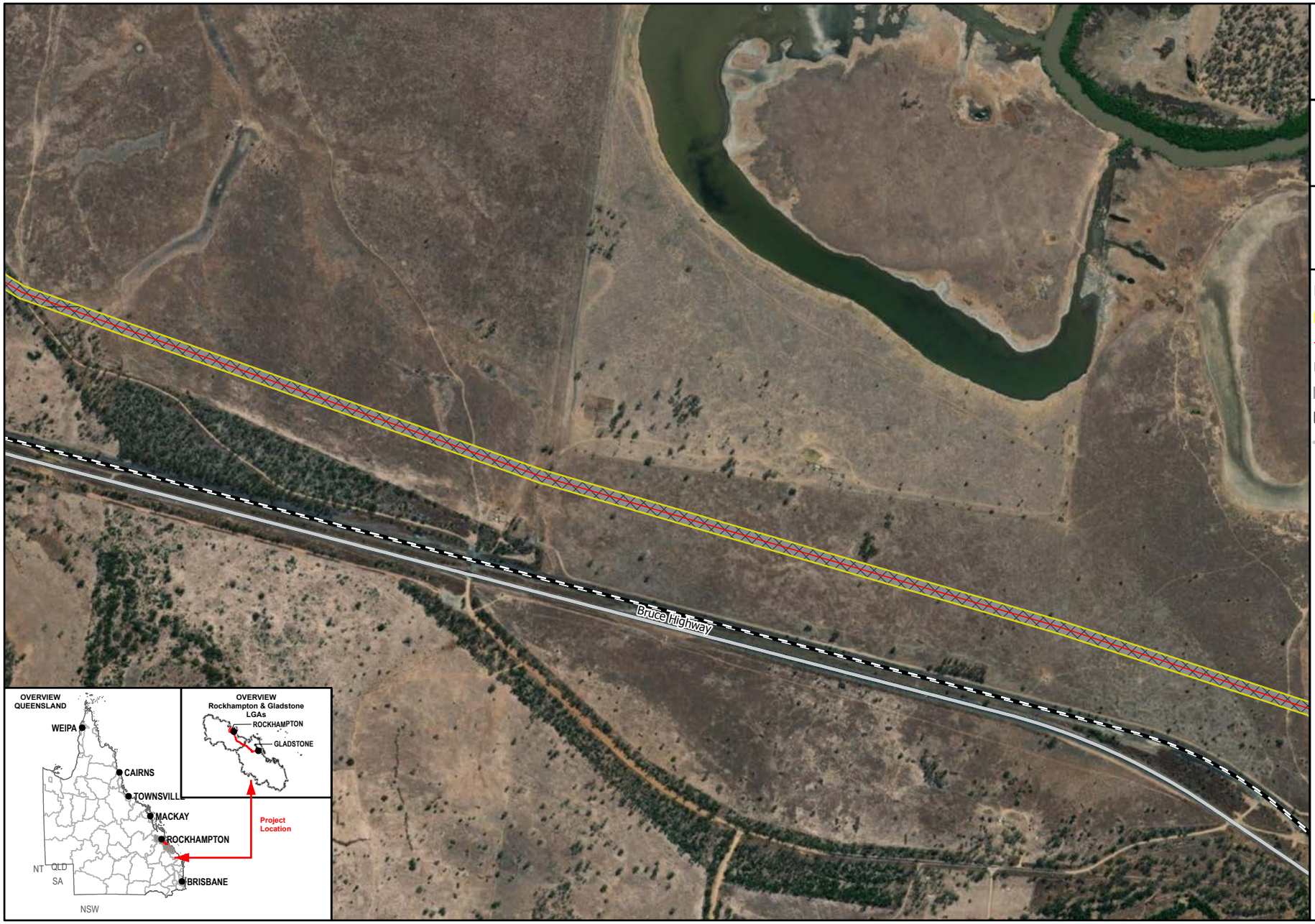
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 4-2h
Field Verified REs Within the SGIC SDA Study Area

000-G-MAP-2411 Version:3 Date:19/09/2022



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Legend

- Study Area
- SGIC Pipeline Alignment

Field verified REs

- Non-remnant
- Unverified Fields
- 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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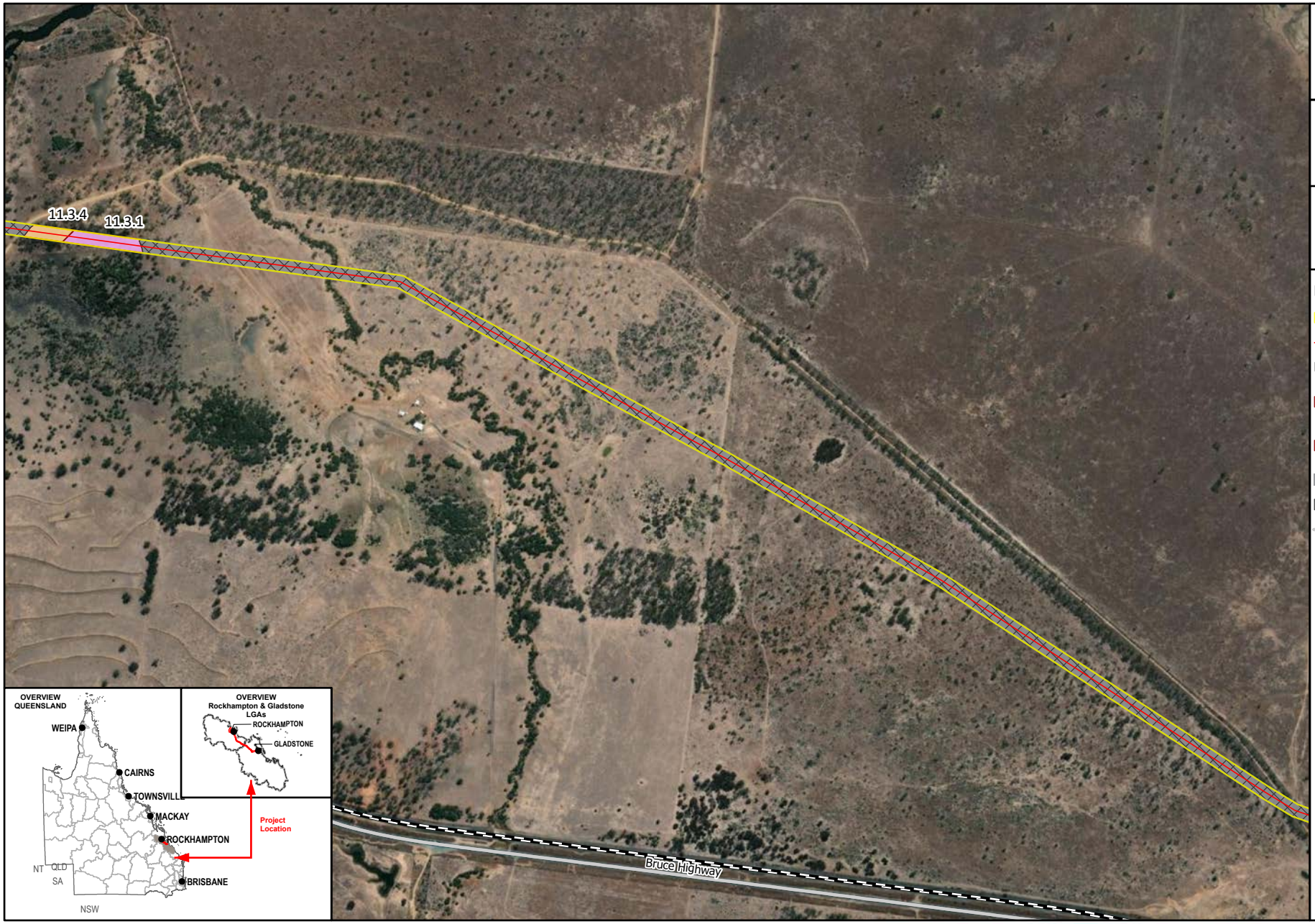
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 4-2i
Field Verified REs Within the SGIC SDA Study Area

000-G-MAP-2411 Version:3 Date:19/09/2022



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Legend

- Study Area
- SGIC Pipeline Alignment

Field verified REs

- Category C or R area containing endangered
- Category C or R area containing of concern
- Non-remnant
- Unverified Fields
- Main Roads
- Railways

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 4-2j
Field Verified REs Within the SGIC SDA Study Area

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Legend

- Study Area
- SGIC Pipeline Alignment

Field verified REs

- Category A or B area that is least concern
- Category C or R area containing endangered
- Category C or R area containing of concern
- Category C or R area that is least concern
- Non-remnant
- Unverified Fields

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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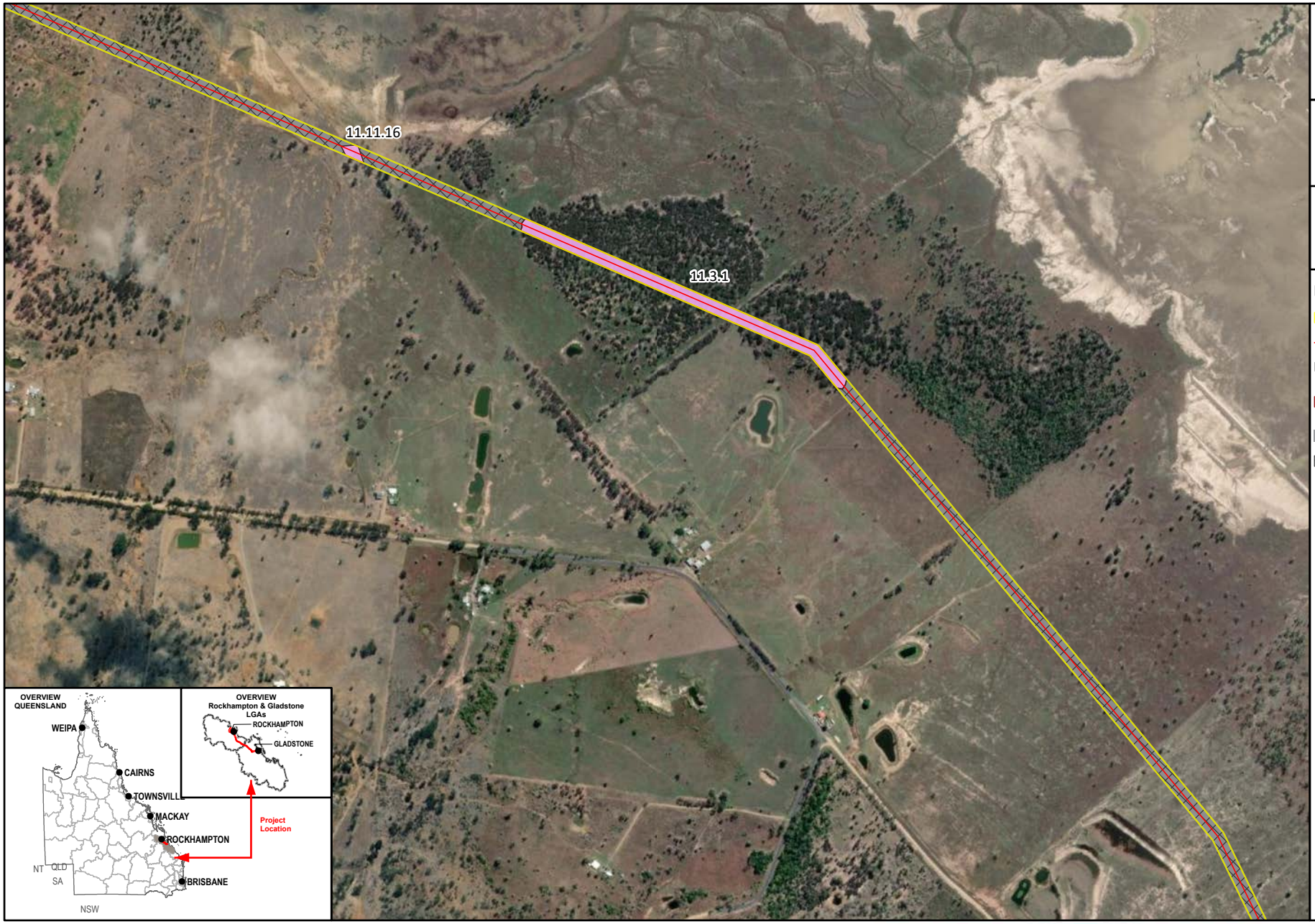
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 4-2k
Field Verified REs Within the SGIC SDA Study Area

000-G-MAP-2411 Version:3 Date:19/09/2022



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Legend

- Study Area
- SGIC Pipeline Alignment

Field verified REs

- Category C or R area containing endangered
- Non-remnant
- Unverified Fields

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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Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 4-2l
Field Verified REs Within the SGIC SDA Study Area

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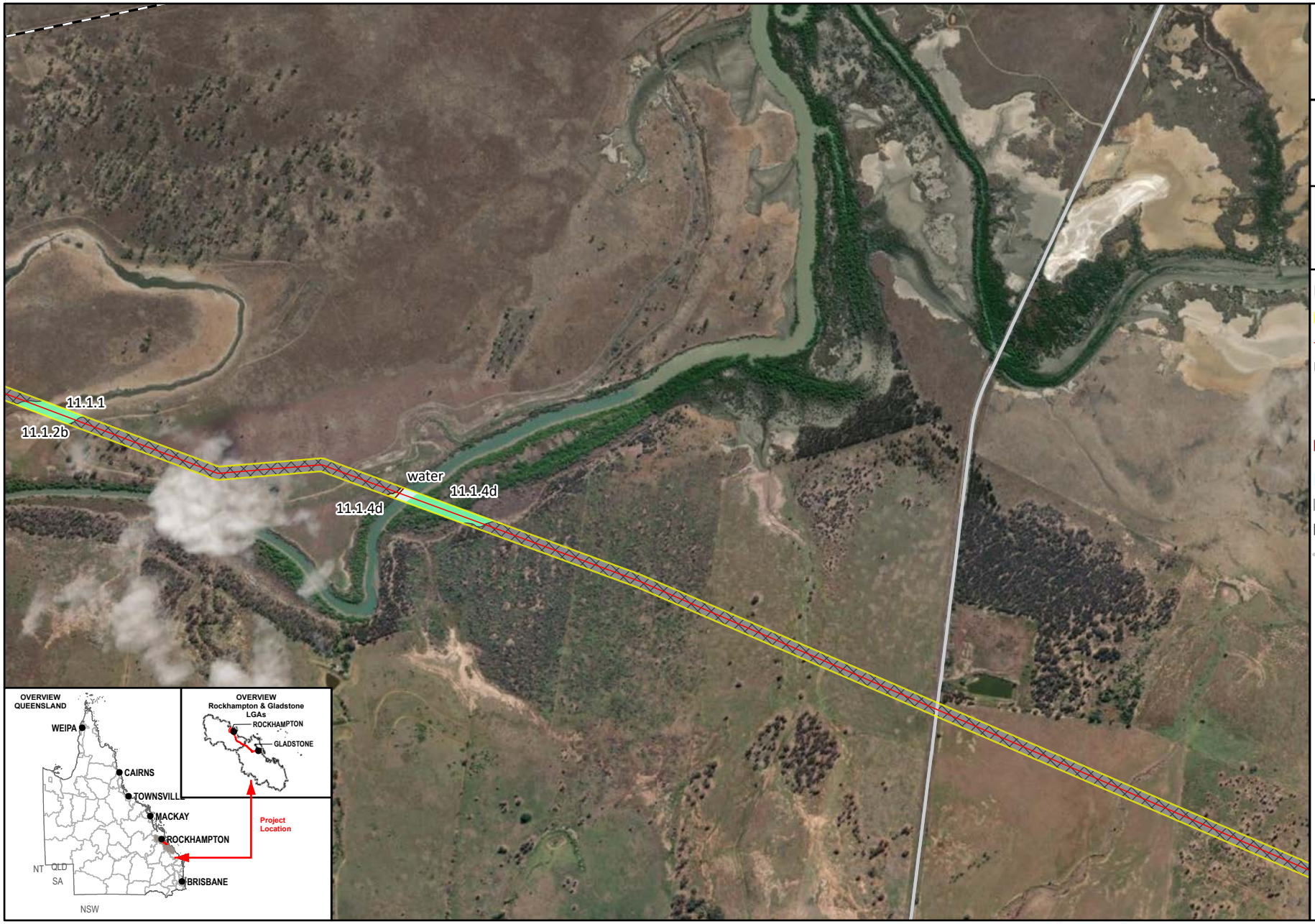

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- Study Area
- SGIC Pipeline Alignment

Field verified REs

- Category A or B area that is least concern
- Category C or R area that is least concern
- Water
- Non-remnant
- Unverified Fields
- 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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Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 4-2m
Field Verified REs Within the SGIC SDA Study Area

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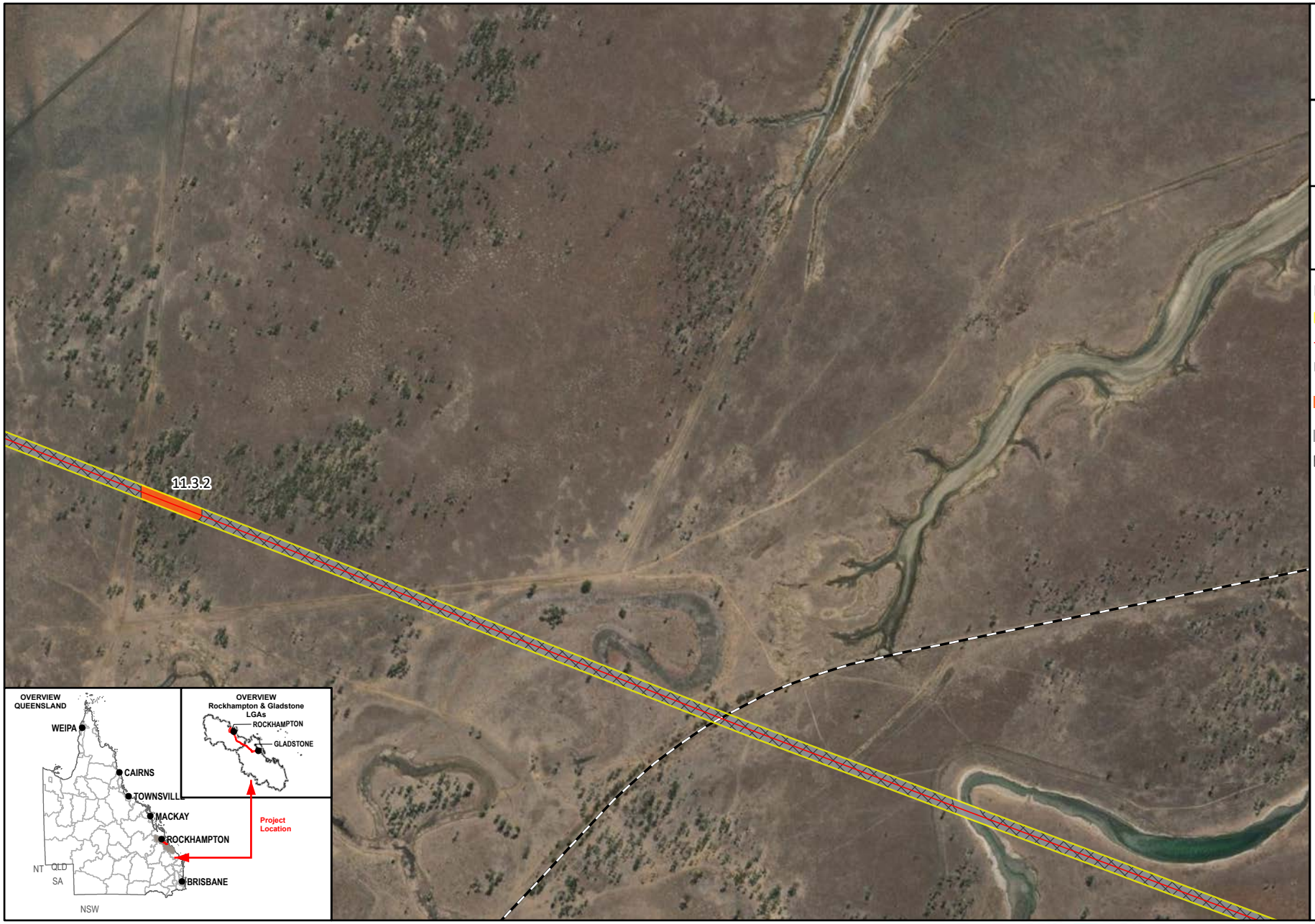

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- Study Area
- SGIC Pipeline Alignment

Field verified REs

- Category A or B area containing of concern
- Non-remnant
- Unverified Fields
- Railways

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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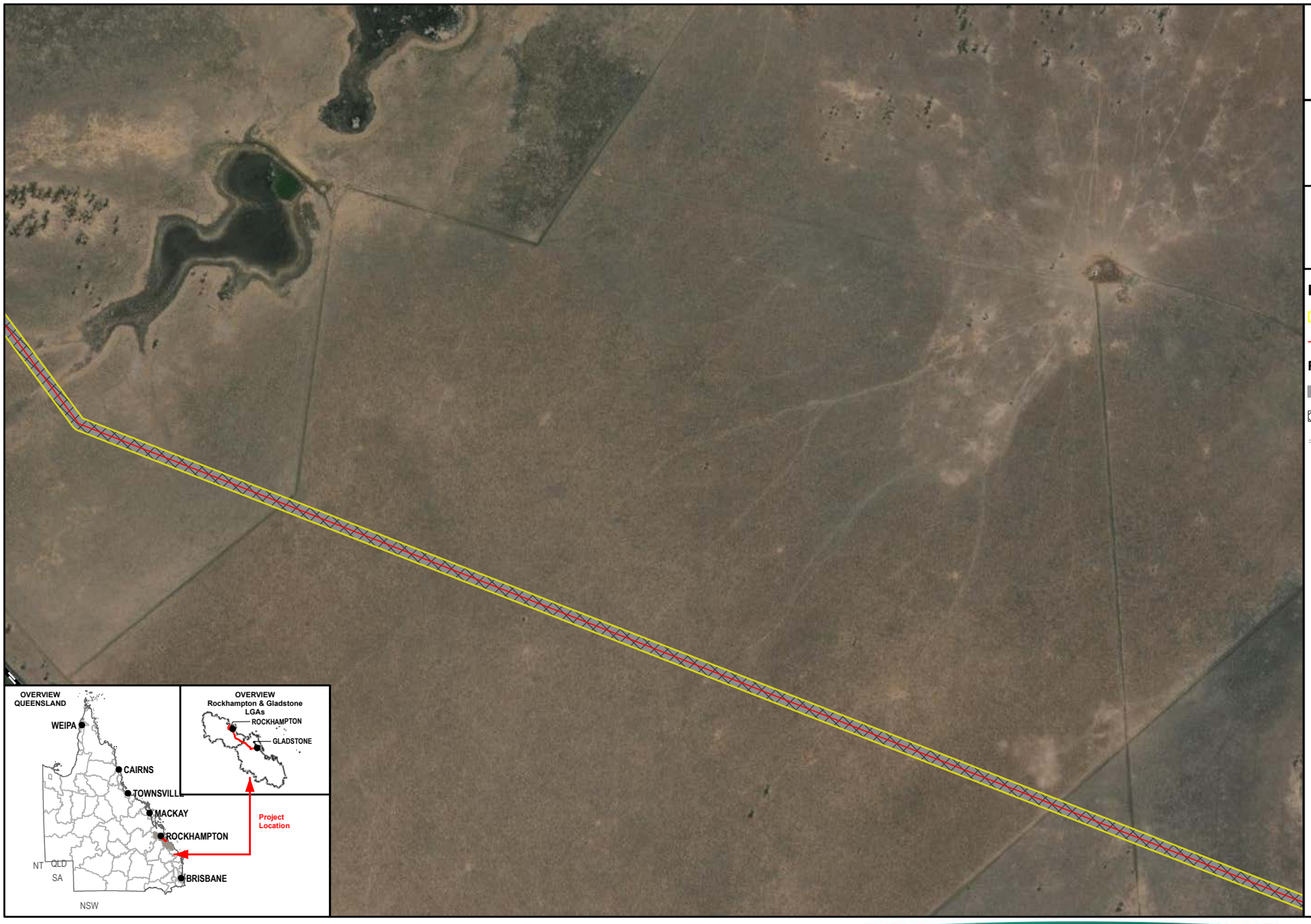
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 4-2n
Field Verified REs Within the SGIC SDA Study Area

000-G-MAP-2411 Version:3 Date:19/09/2022



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Legend

- Study Area
- SGIC Pipeline Alignment

Field verified REs

- Non-remnant
- Unverified Fields
- Railways

Data Sources:
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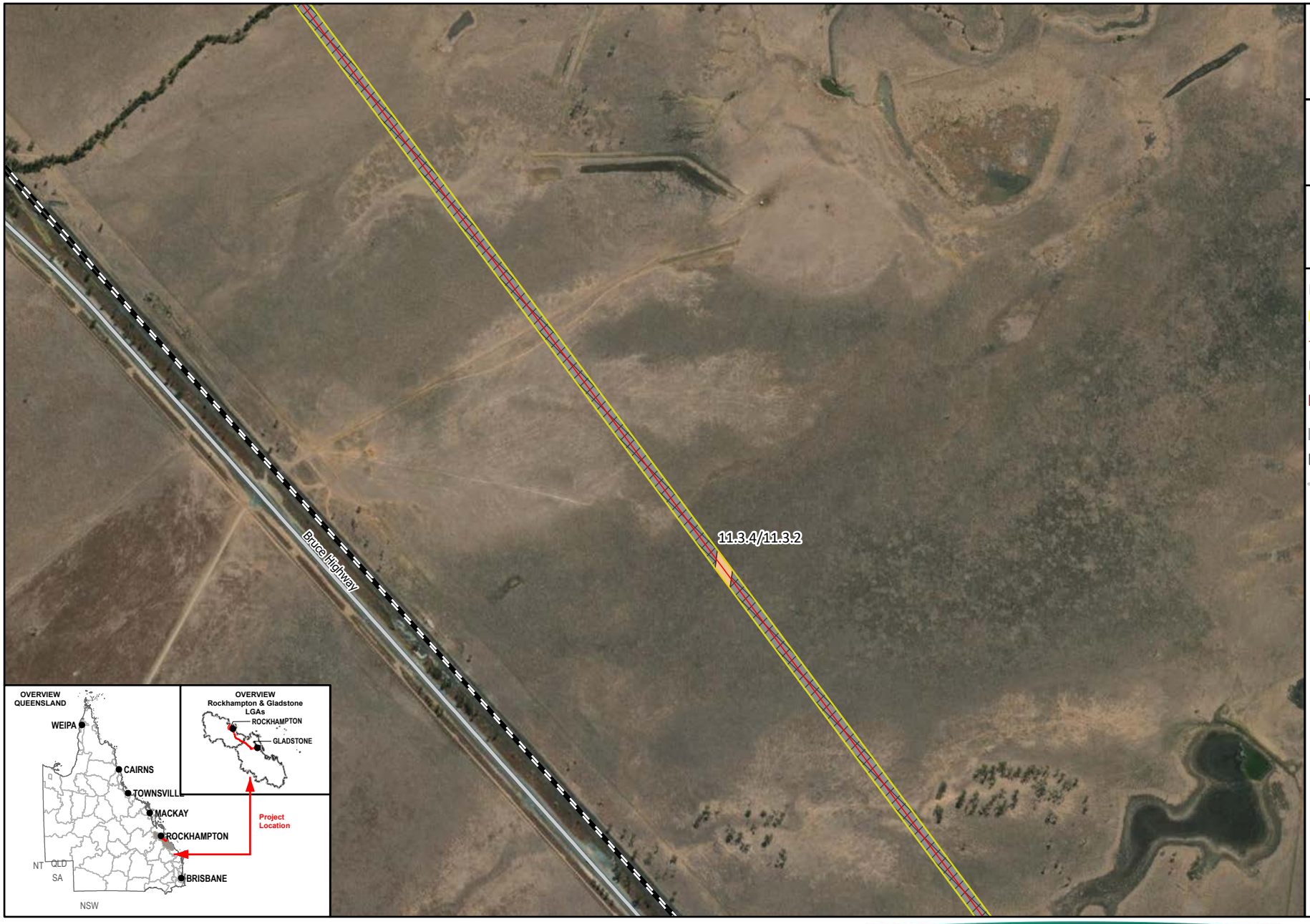
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 4-2o
Field Verified REs Within the SGIC SDA Study Area

000-G-MAP-2411 Version:3 Date:19/09/2022



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Legend

- Study Area
- SGIC Pipeline Alignment

Field verified REs

- Category C or R area containing of concern
- Non-remnant
- Unverified Fields
- 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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Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 4-2p
Field Verified REs Within the SGIC SDA Study Area

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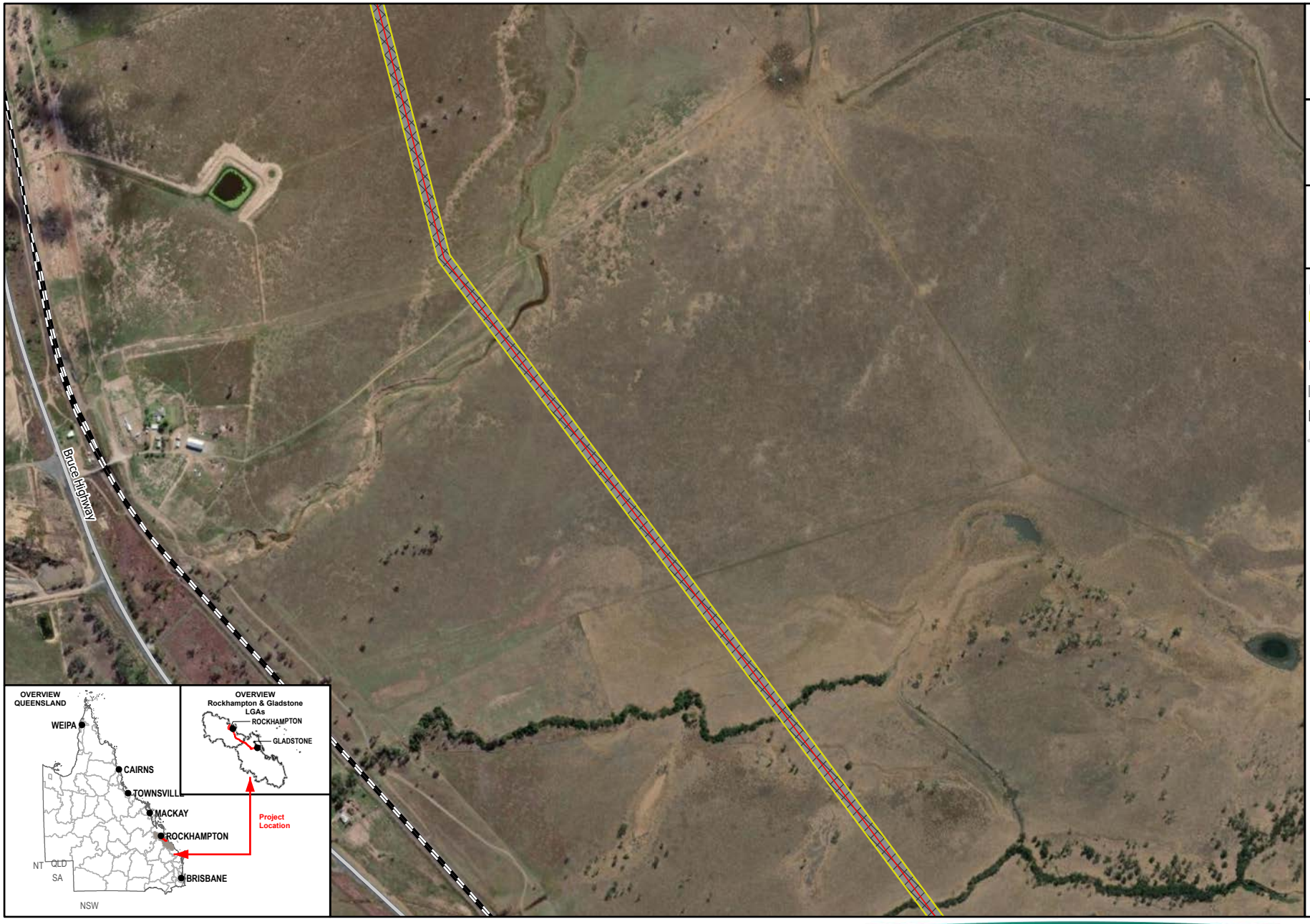

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Legend

- Study Area
- SGIC Pipeline Alignment

Field verified REs

- Non-remnant
- Unverified Fields
- Main Roads
- Railways

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 4-2q
Field Verified REs Within the SGIC SDA Study Area

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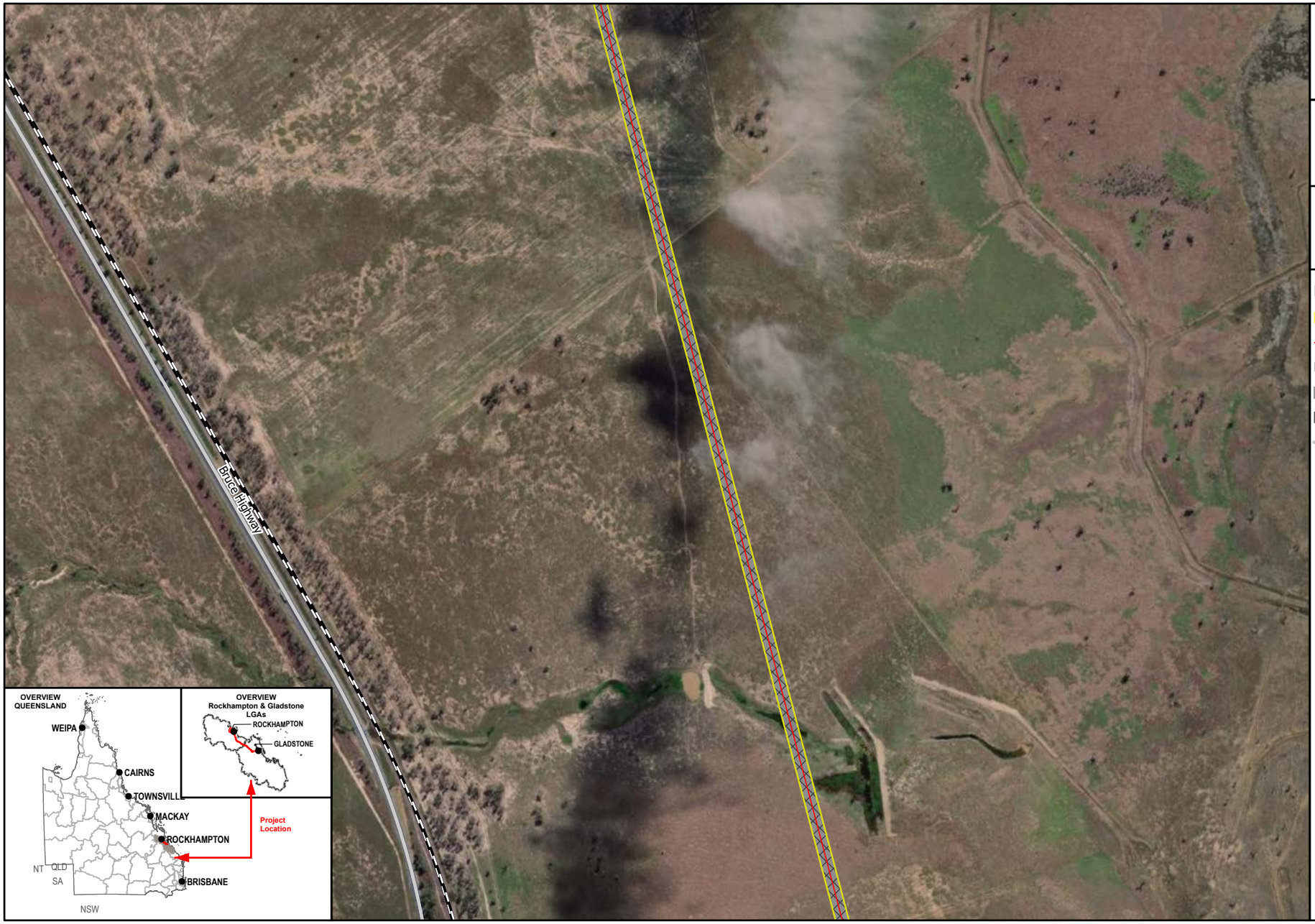

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- Study Area
- SGIC Pipeline Alignment

Field verified REs

- Non-remnant
- Unverified Fields
- Main Roads
- Railways

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 4-2r
Field Verified REs Within the SGIC SDA Study Area

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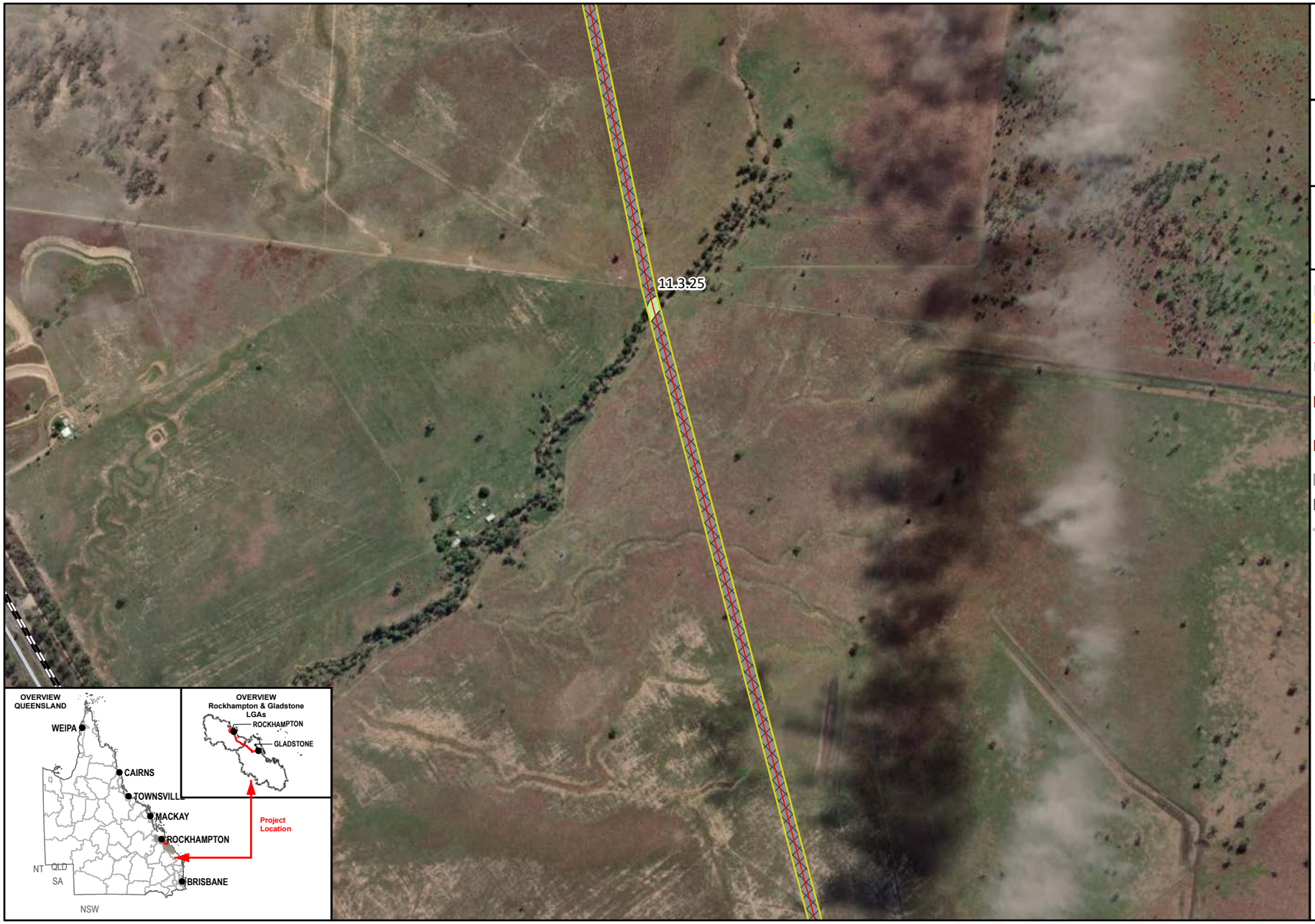

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Legend

- Study Area
- SGIC Pipeline Alignment

Field verified REs

- Category C or R area containing of concern
- Category C or R area that is least concern
- Non-remnant
- Unverified Fields
- Main Roads
- Railways

Data Sources:
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Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 4-2s
Field Verified REs Within the SGIC SDA Study Area

000-G-MAP-2411 Version:3 Date:19/09/2022

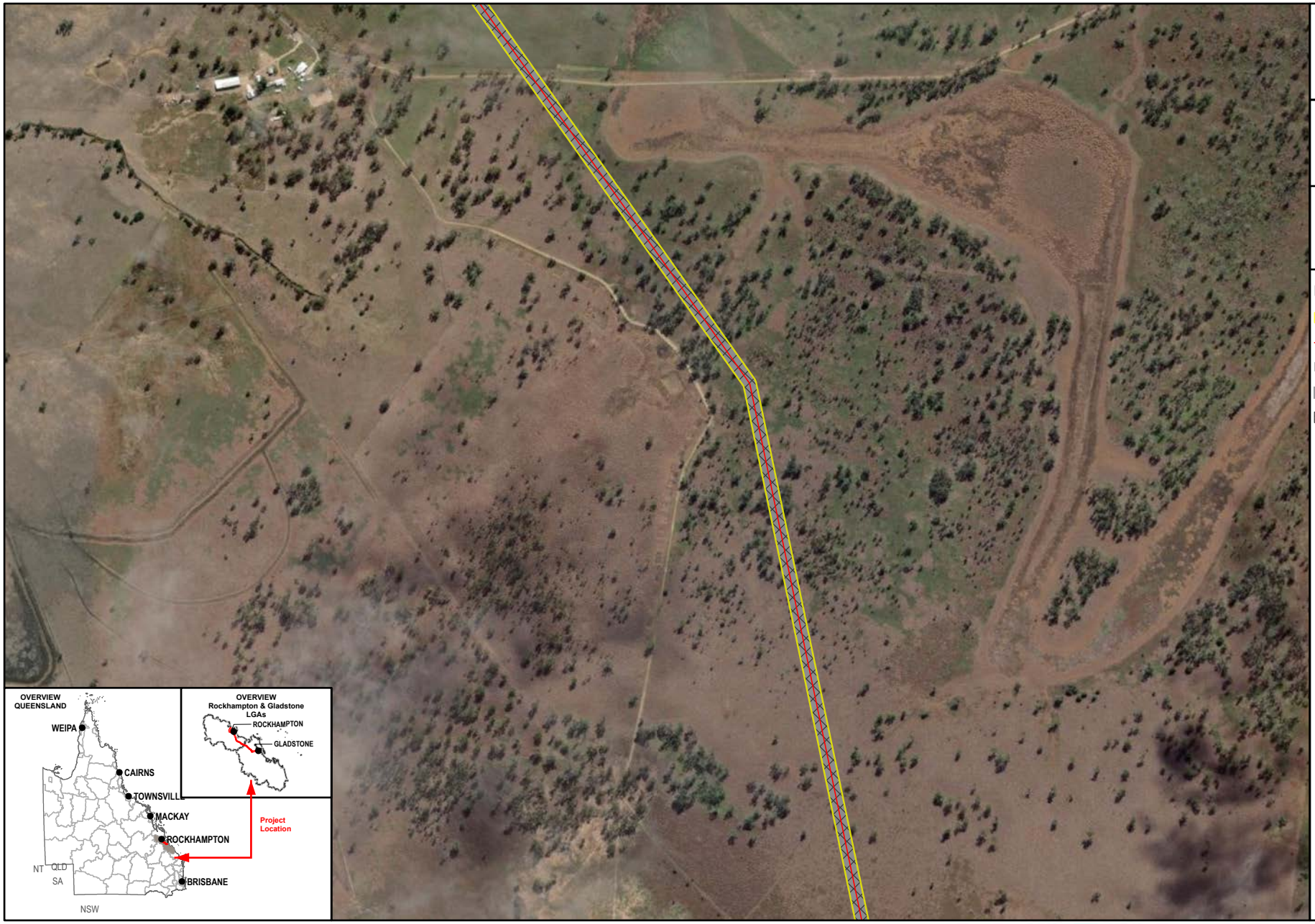

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Figure 4-2t
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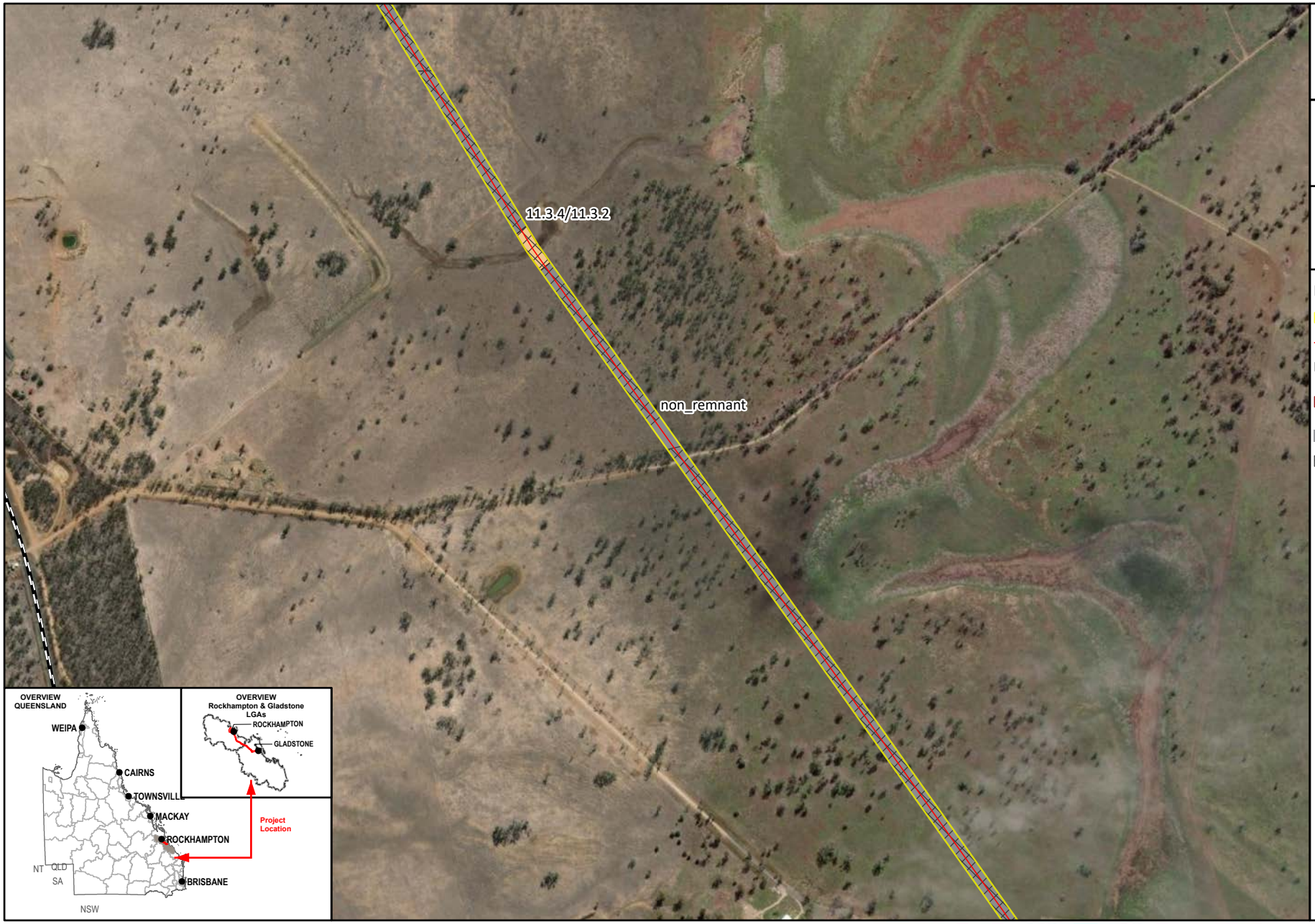

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Field verified REs

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- Railways

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Figure 4-2u
Field Verified REs Within the SGIC SDA Study Area

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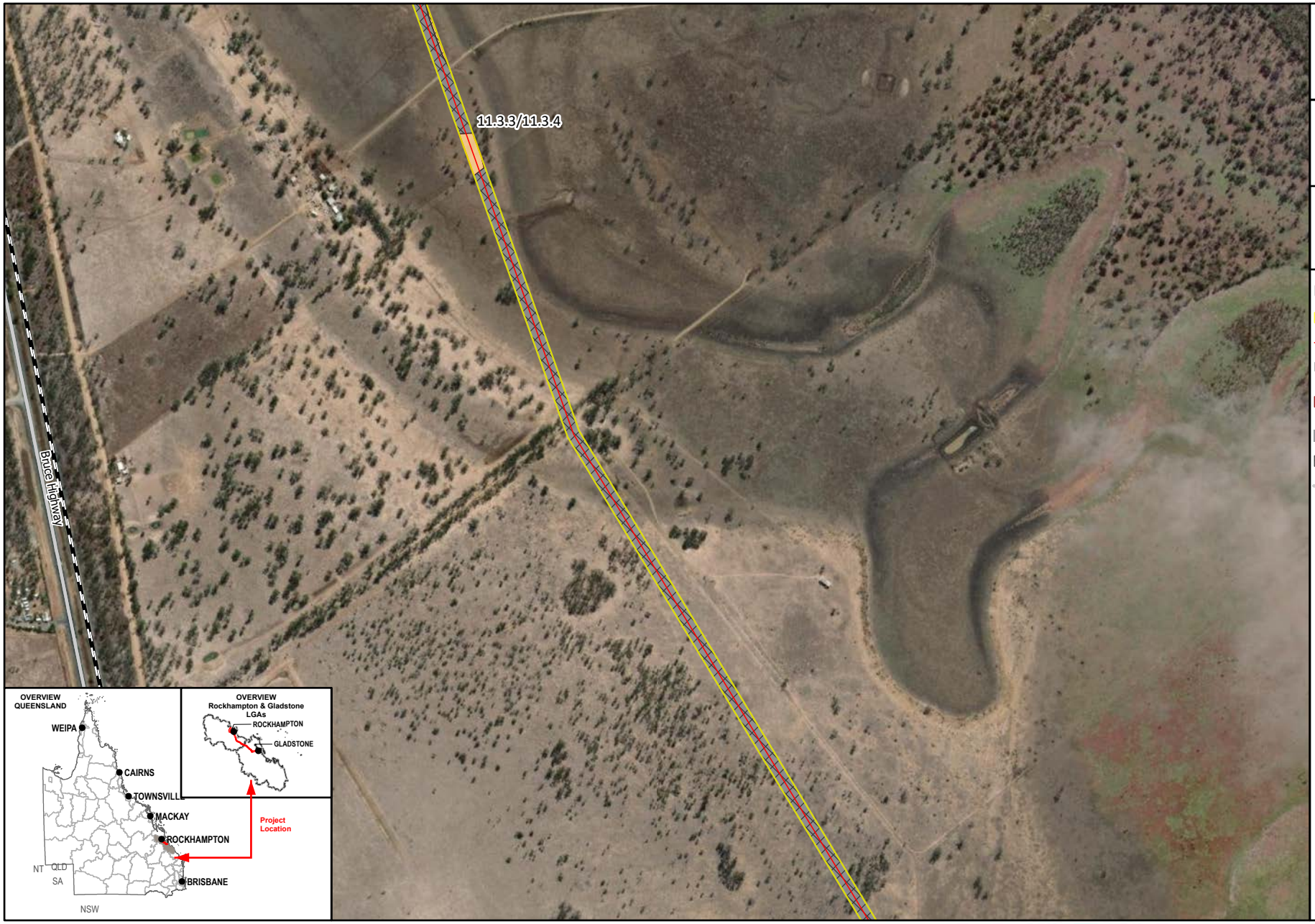

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- Study Area
- SGIC Pipeline Alignment

Field verified REs

- Category C or R area containing of concern
- Non-remnant
- Unverified Fields
- Main Roads
- Railways

Data Sources:
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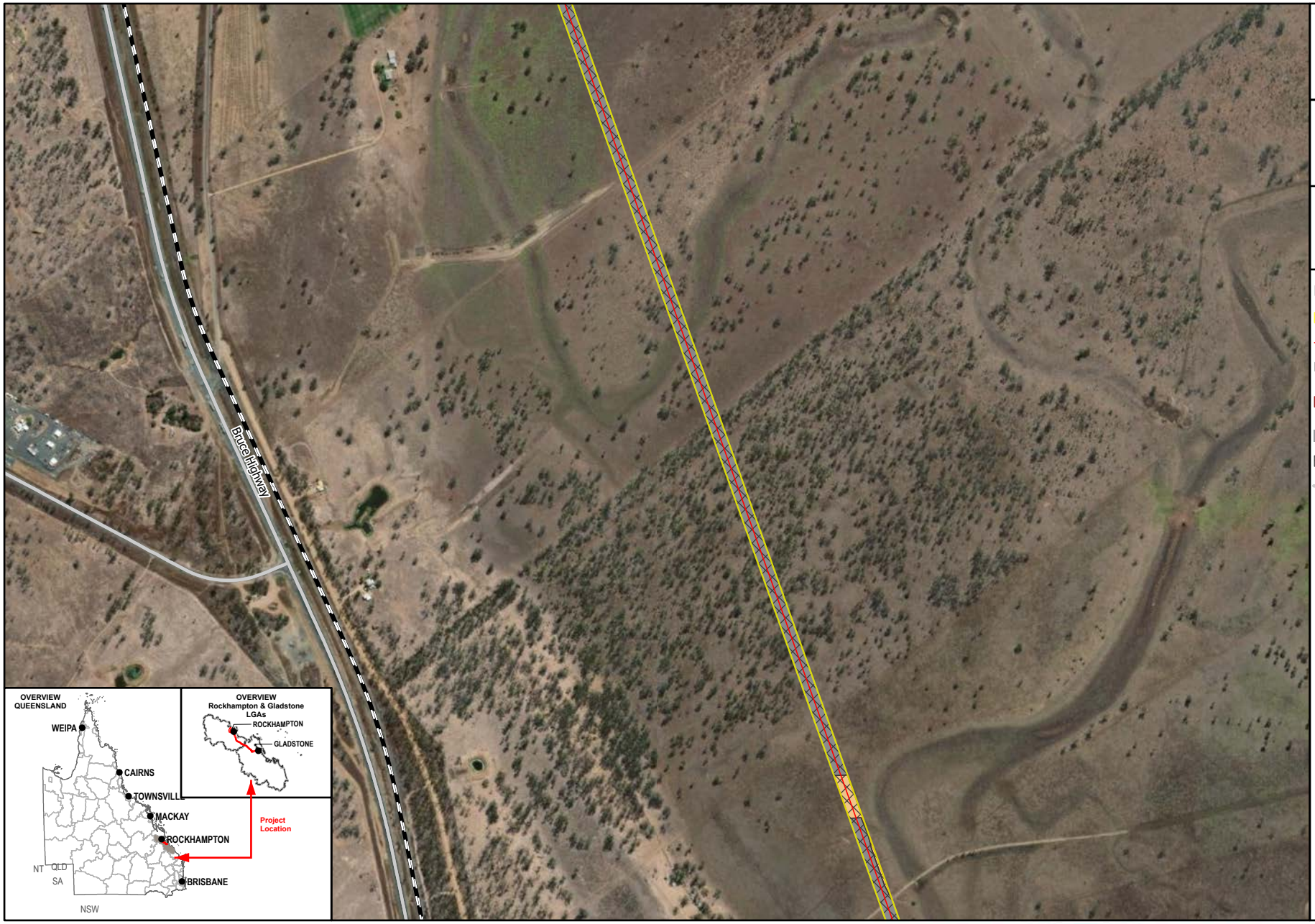
Fitzroy to Gladstone Pipeline Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 4-2v
Field Verified REs Within the SGIC SDA Study Area

000-G-MAP-2411 Version:3 Date:19/09/2022



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Legend

- Study Area
- SGIC Pipeline Alignment

Field verified REs

- Category C or R area containing of concern
- Non-remnant
- Unverified Fields
- Main Roads
- Railways

Data Sources:
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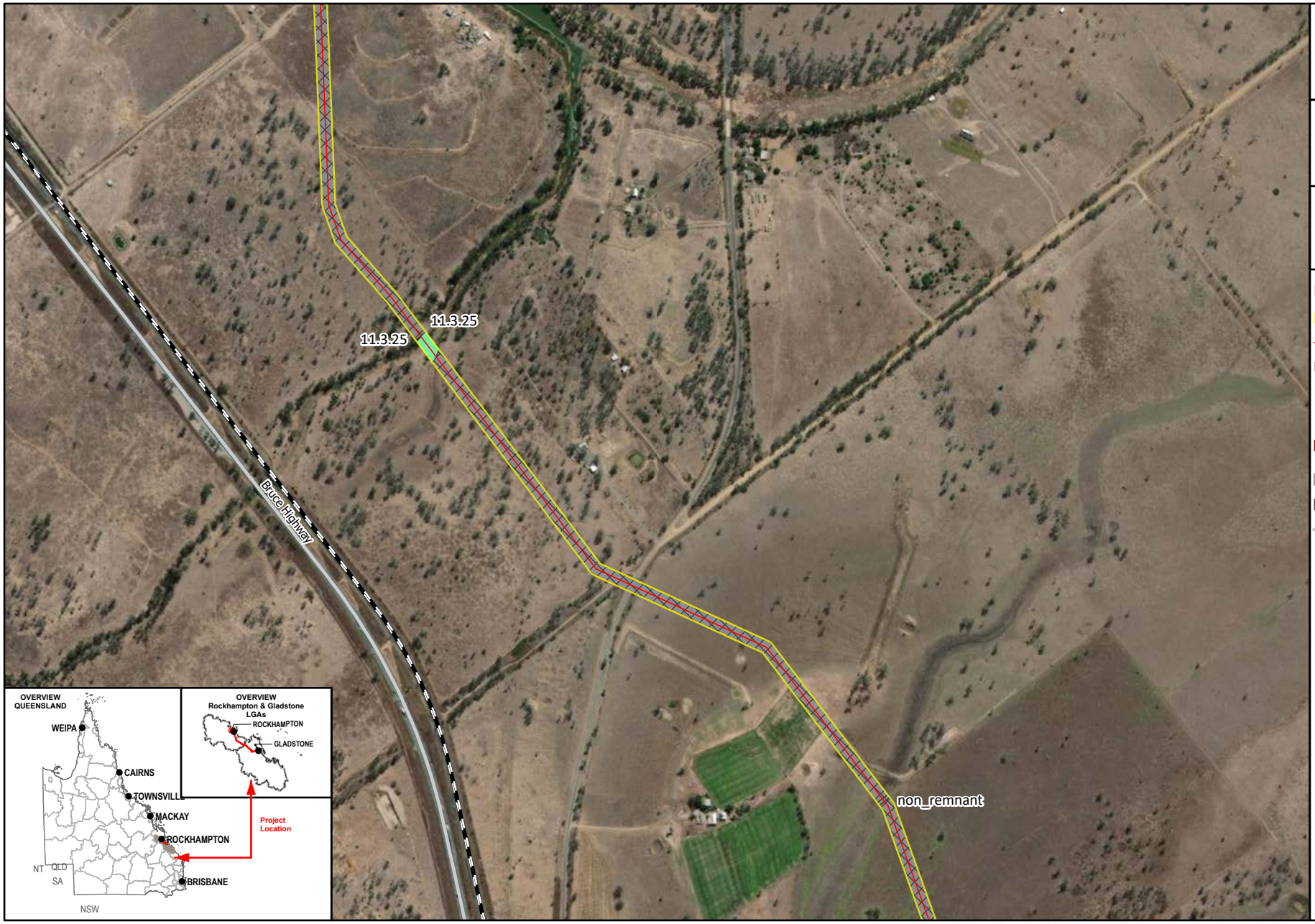
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 4-2w
Field Verified REs Within the SGIC SDA Study Area

000-G-MAP-2411 Version:3 Date:19/09/2022



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Legend

- Study Area
- SGIC Pipeline Alignment

Field verified REs

- Category A or B area that is least concern
- Category C or R area that is least concern
- Non-remnant
- Unverified Fields
- Main Roads
- Railways

Data Sources:
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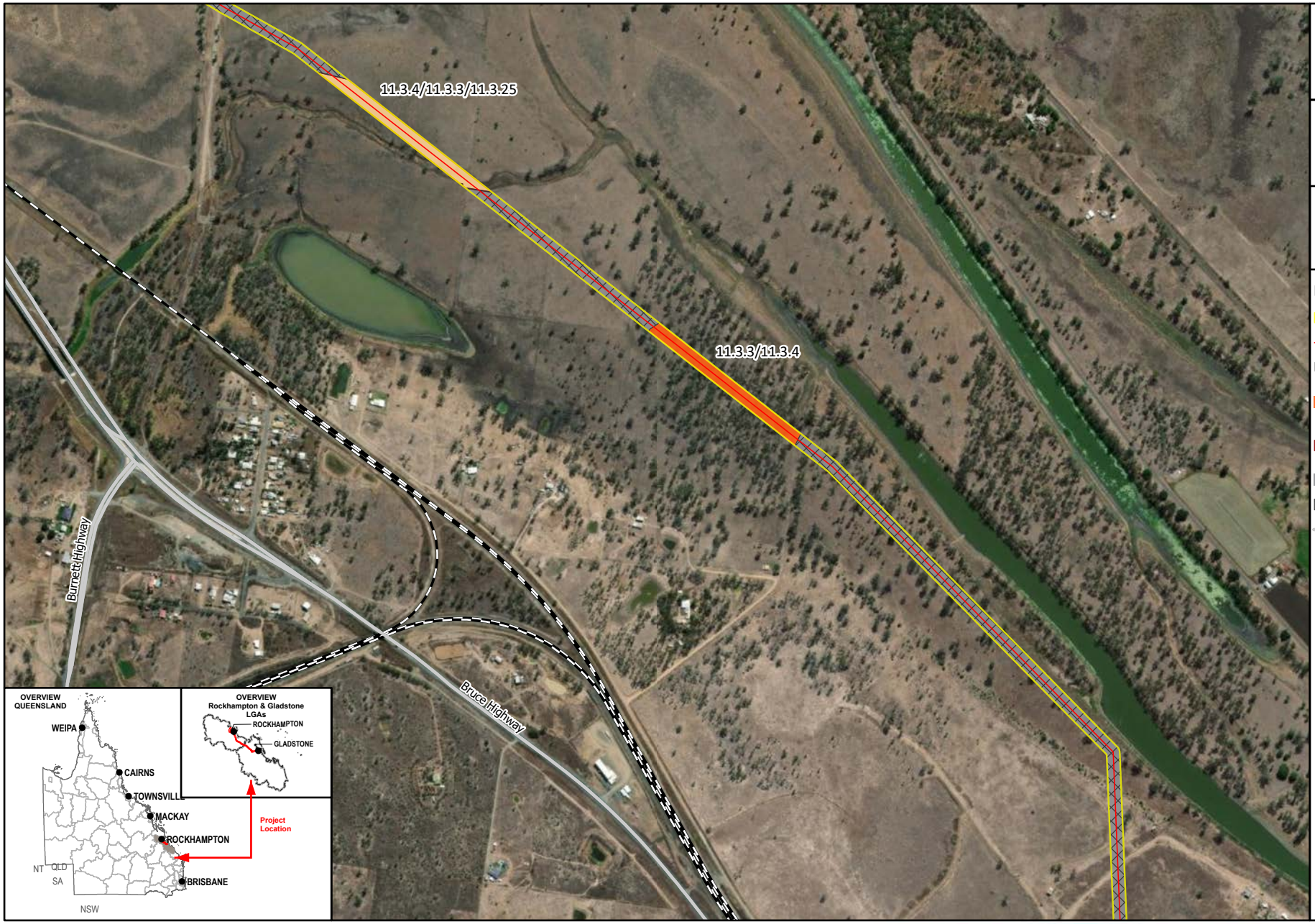
Fitzroy to Gladstone Pipeline Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 4-2x
Field Verified REs Within the SGIC SDA Study Area

000-G-MAP-2411 Version:3 Date:19/09/2022



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- Study Area
- SGIC Pipeline Alignment

Field verified REs

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- Category C or R area containing of concern
- Non-remnant
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- Main Roads
- Railways

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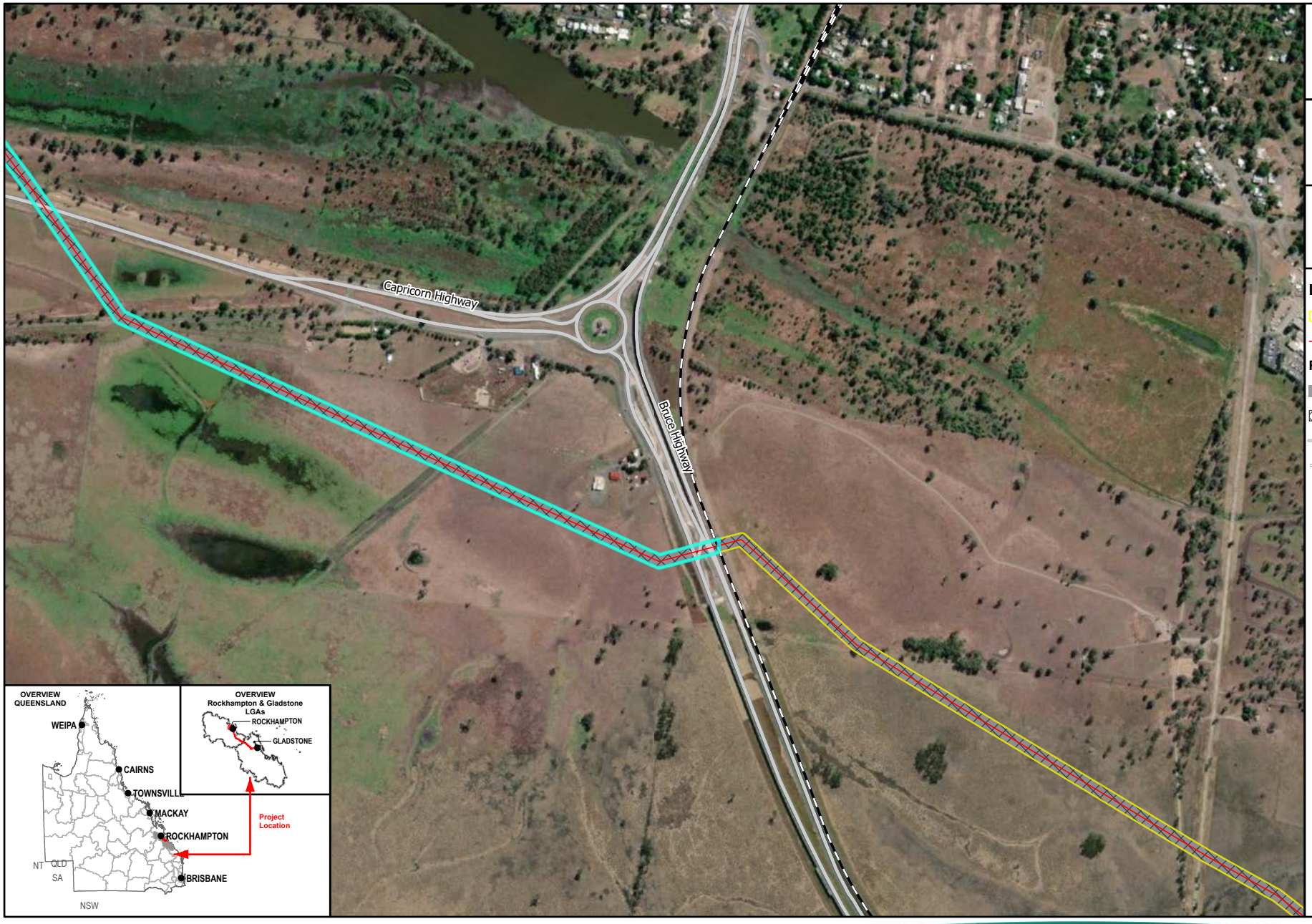
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 4-2y
Field Verified REs Within the SGIC SDA Study Area

000-G-MAP-2411 Version:3 Date:19/09/2022



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- Study Area
- SGIC Pipeline Alignment

Field verified REs

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- Railways

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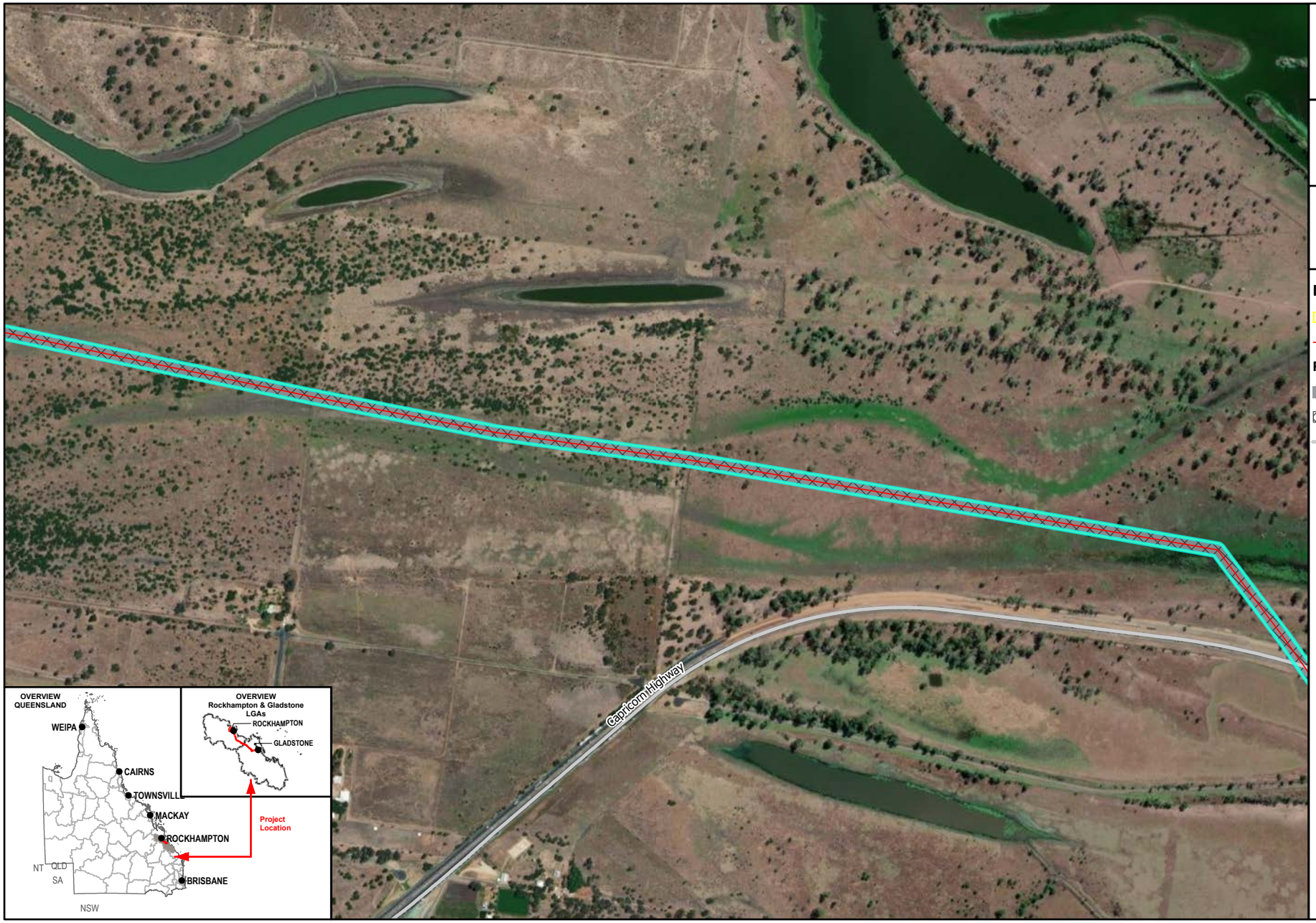
Figure 4-2z
Field Verified REs Within the SGIC SDA Study Area

000-G-MAP-2411 Version:3 Date:19/09/2022



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Field verified REs

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- Unverified Fields
- Main Roads

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Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 4-2a1
Field Verified REs Within the SGIC SDA Study Area

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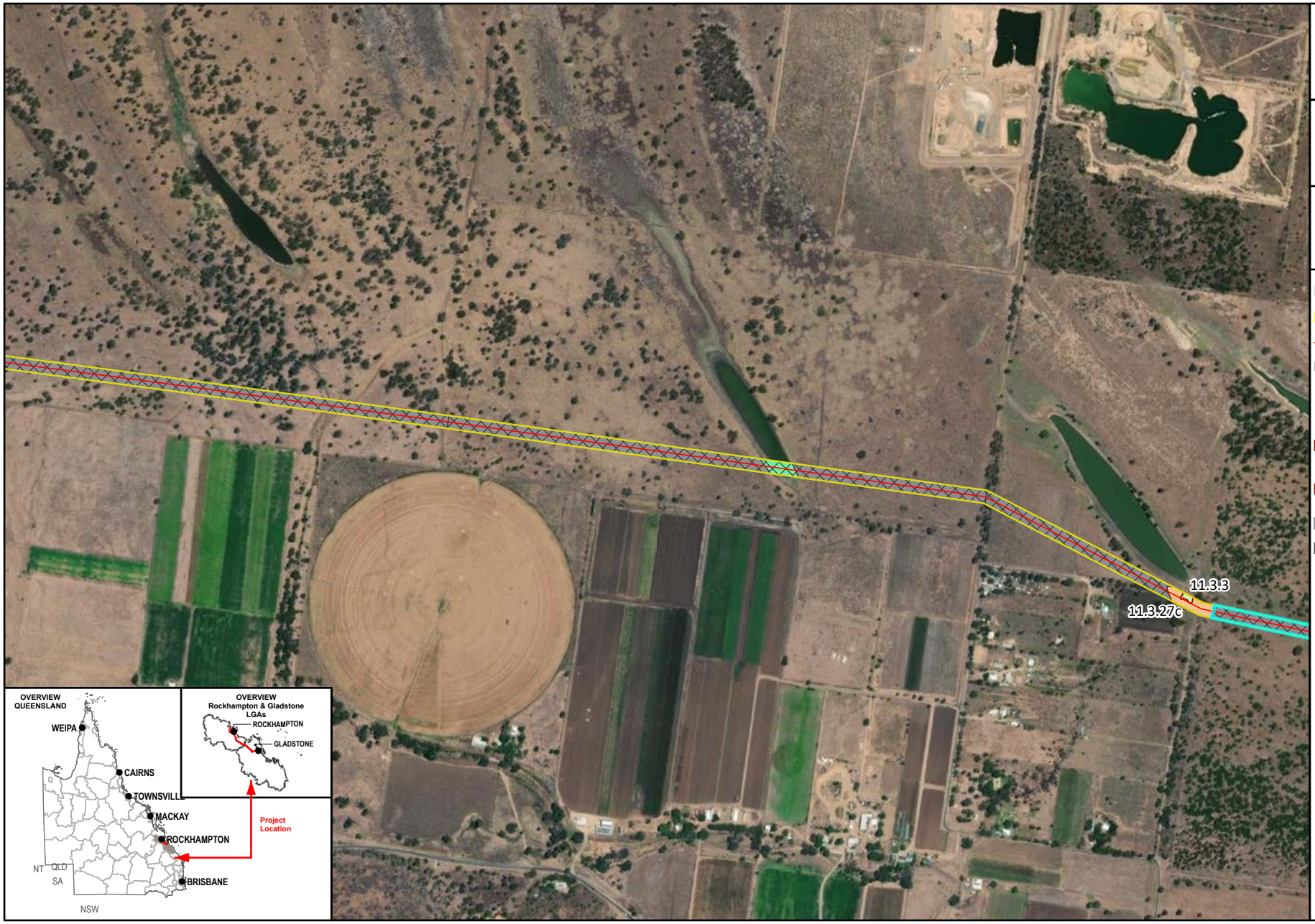

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Field verified REs

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Figure 4-2b1
Field Verified REs Within the SGIC SDA Study Area

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4.3 Conservation significant flora

4.3.1 Desktop assessment results

4.3.1.1 Protected plants flora survey trigger areas

Two high-risk flora trigger areas are intersected by the SGIC SDA pipeline alignment, both within the vicinity of Twelve Mile Road (Figure 4-3). Additional high-risk flora trigger areas are mapped within the broader desktop search extent, predominantly between Raglan and Bajool (Appendix A).

4.3.1.2 Essential habitat

According to the Vegetation Management Report, the SGIC SDA pipeline alignment intersects a polygon of regulated vegetation within the vicinity of Twelve Mile Creek which is mapped as containing essential habitat for the EVNT flora species *Macropteranthes leiocaulis.*

4.3.1.3 Previous field surveys

One suspected conservation significant flora species was identified during the Arup (2008) field survey, namely, *Cadellia pentastylis* (ooline). An extract from Chapter 6 of the EIS (Arup 2008) follows:

'*…one non-target species was observed, although it was a sterile specimen and absolute confirmation of identification was not possible. This was a Vulnerable species (listed under the EPBC Act), and was one individual of (probably) ooline (Cadellia pentastylis) found at Detailed Site 14 (Marble Creek)'*.

4.3.1.4 Database search results

The EPBC Act PMST database identified 14 conservation significant flora species that have the potential to occur within the SGIC SDA desktop search extent (Table 4-7). State based searches (i.e. WildNet and ALA) identified 15 conservation significant flora species that have been historically recorded within the SGIC SDA desktop search extent, seven of which were not listed in the PMST results (Table 4-7 and Figure 4-3).

The species identified in the current PMST search that were either not a listed species or not identified as potentially occurring within the PMST as part of the EIS (Arup 2008) include:

– *Decaspermum struckoilicum*
– *Dichanthium setosum*
– *Macadamia integrifolia.*

Table 4-7 Conservation significant flora species identified as present or having suitable habitat present in the desktop search extent

Scientific name	Status		Source	WN Records (post 1980)	Nearest Record to ROW	EPBC approval
	EPBC Act	NC Act				
Atalaya collina	E	E	PMST	-	11.47 km	✓
Bosistoa transversa	V	LC	WN; PMST	10	10.49 km	✓
Bulbophyllum globuliforme	V	NT	PMST	-	>60 km	✓
Callicarpa thozetii	NL	E	WN	3	8.82 km	
Capparis humistrata	E	E	WN	1	11.0 km	
Cossinia australiana	E	E	WN; PMST	1	11.7 km	✓
Cupaniopsis shirleyana	V	V	WN; PMST	2	7.19 km	✓
Cycas megacarpa	E	E	WN; PMST	13	2.1 km	✓
Cycas ophiolitica	E	E	WN; PMST	12	2.1 km	✓
Dansiea elliptica	NL	NT	WN	1	7.79 km	

Scientific name	Status		Source	WN Records (post 1980)	Nearest Record to ROW	EPBC approval
	EPBC Act	NC Act				
Decaspermum struckoilicum	E	CE	PMST	-	12.6 km	
Dichanthium setosum	V	LC	PMST	-	>200 km	
Eucalyptus raveretiana	V	LC	WN; PMST	4	5.59 km	✓
Graptophyllum excelsum	NL	NT	WN	14	4.7 km	
Hernandia bivalvis	NL	NT	WN	9	8.08 km	
Macadamia integrifolia	V	V	PMST	-	79 km	
Macropteranthes leiocaulis	NL	NT	WN	26	100 m	
Marsdenia brevifolia	V	V	PMST	-	4.5 km	✓
Parsonsia larcomensis	V	V	WN; PMST	7	7.71 km	✓
Samadera bidwillii	V	V	WN; PMST	4	8.63 km	✓
Zieria actites	NL	CE	WN	6	8.7 km	

Key to table: CE – critically endangered; E – endangered; V – vulnerable; NT – near threatened; Mig – migratory; SL – special least concern; LC – least concern; NL – not listed;

WN – WildNet; PMST – Protected Matters Search Tool.

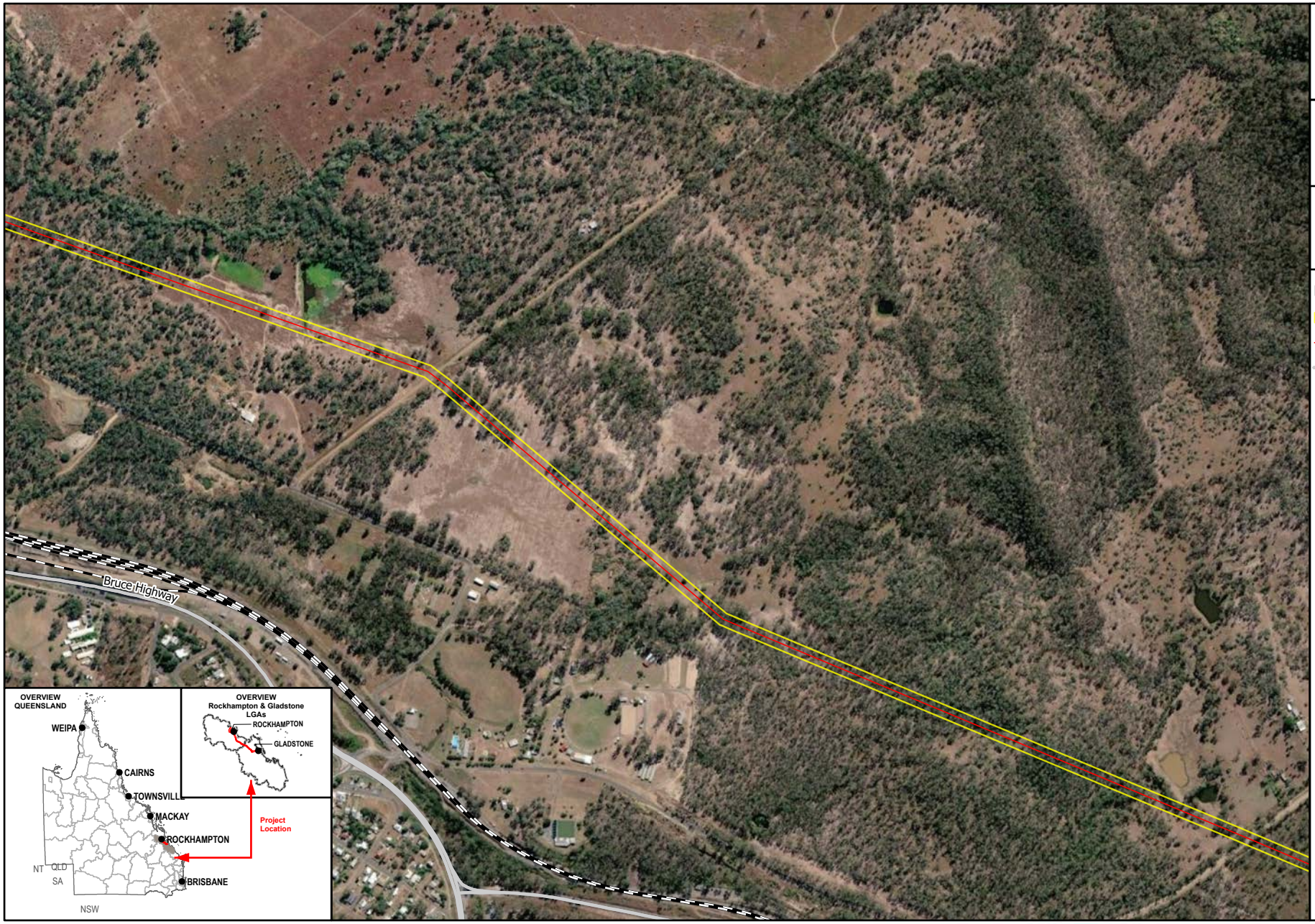

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Figure 4-3a
High-risk Flora Survey Trigger Mapping and Historical Records Within the SGIC SDA Desktop Search Extent

000-G-MAP-2412 Version:2 Date:2022/09/12

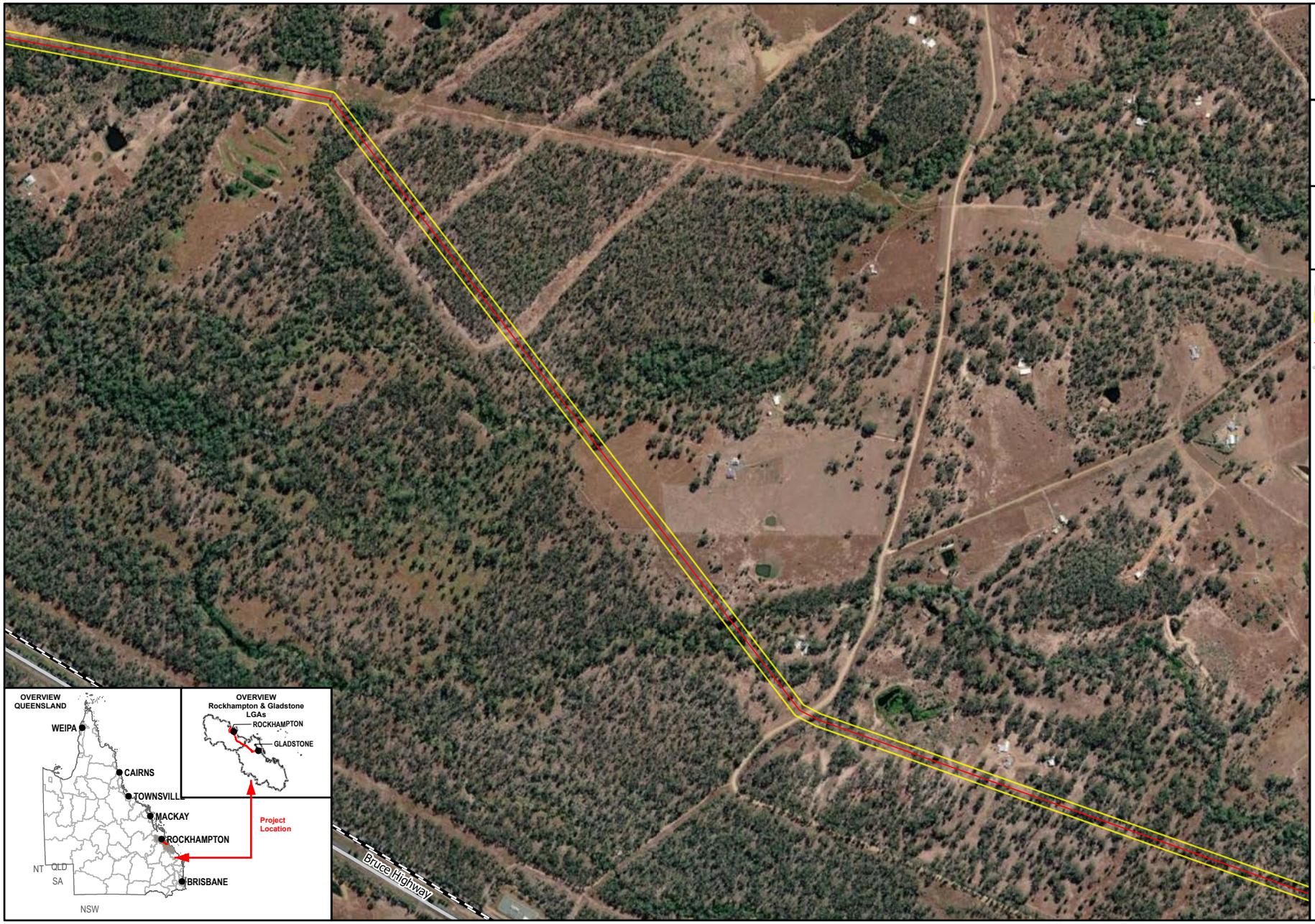

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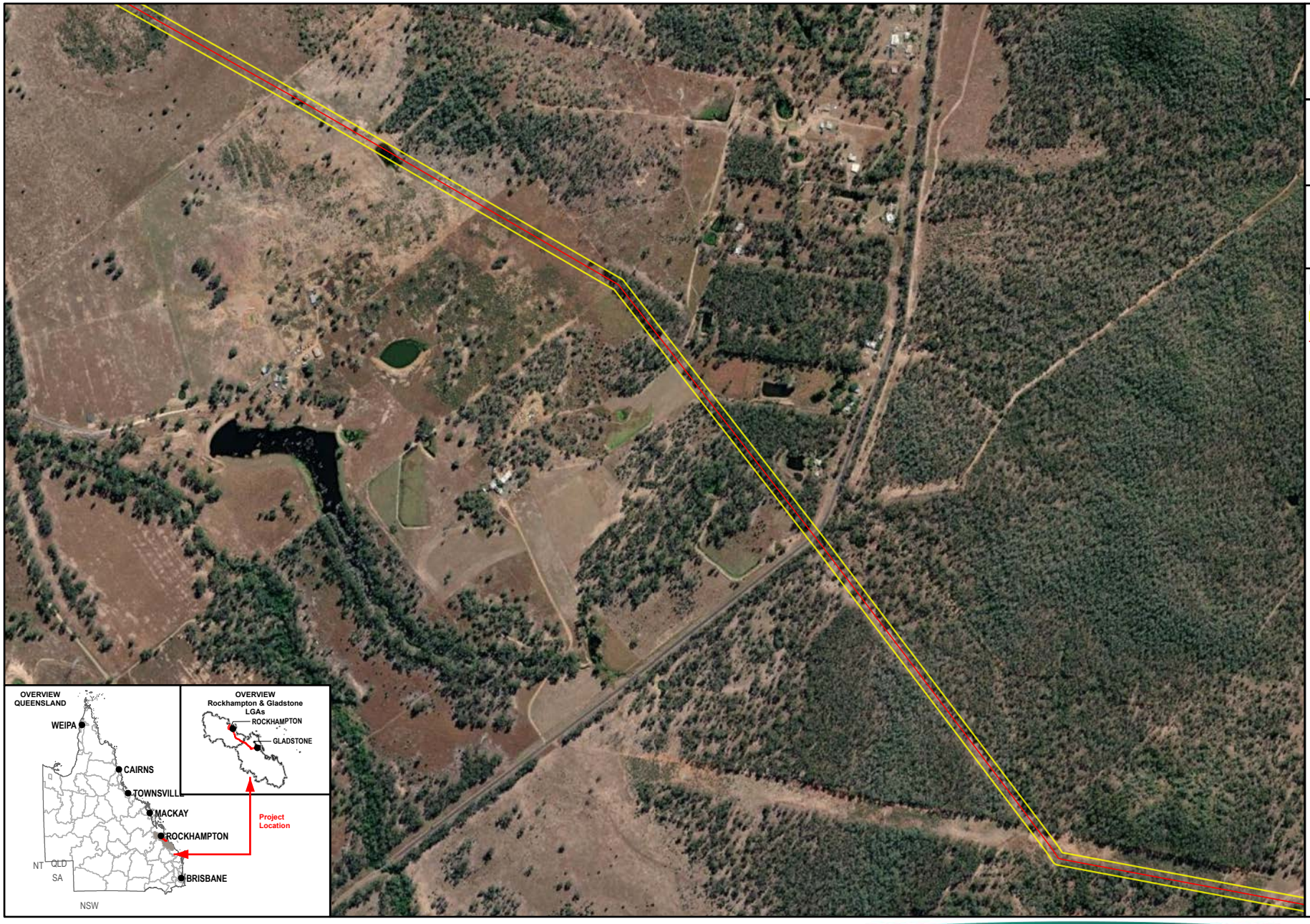
Figure 4-3b
High-risk Flora Survey Trigger Mapping and Historical Records Within the SGIC SDA Desktop Search Extent

000-G-MAP-2412 Version:2 Date:2022/09/12



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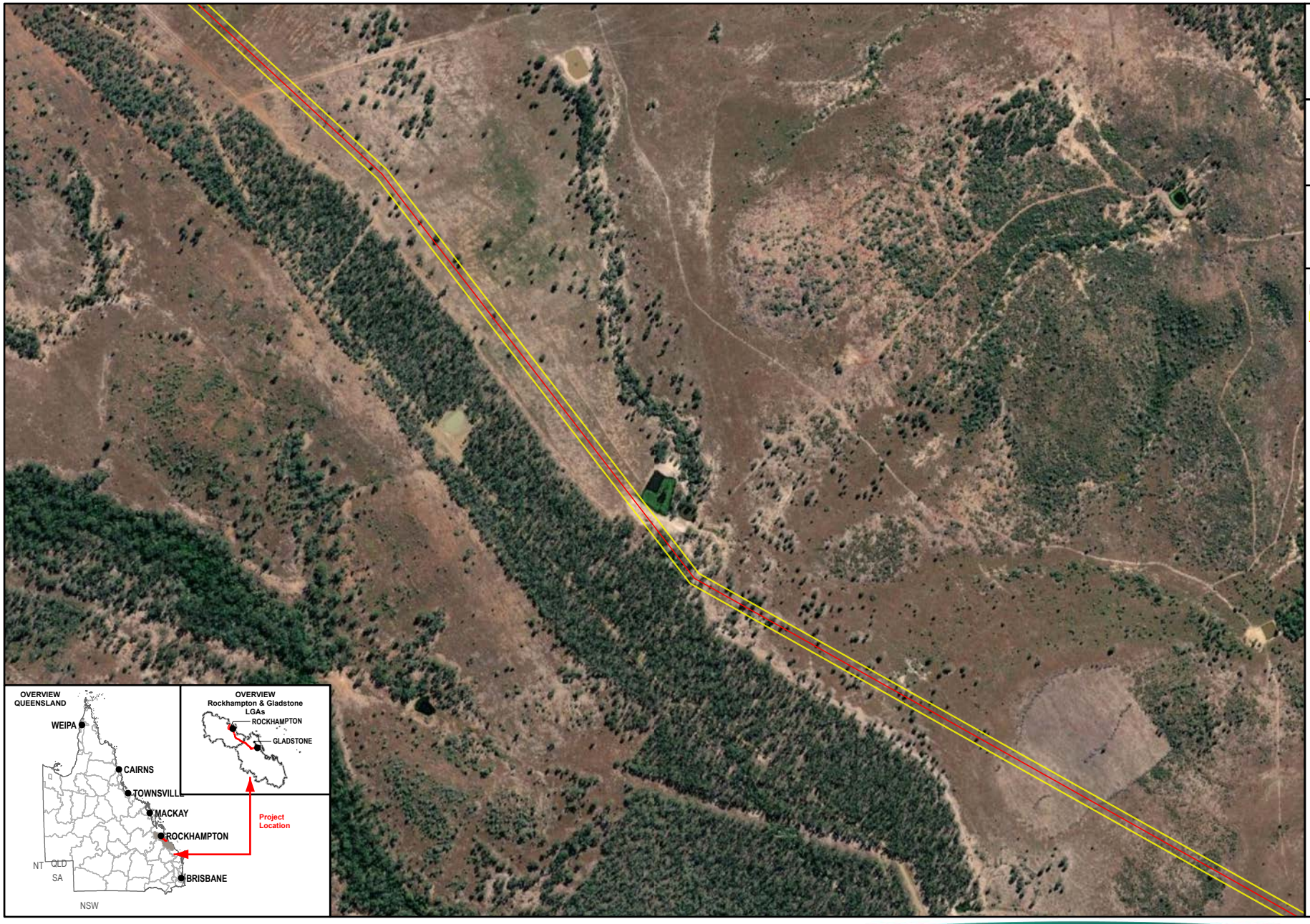
Fitzroy to Gladstone Pipeline Baseline Terrestrial and Aquatic Ecology Technical Report

Figure 4-3c

High-risk Flora Survey Trigger Mapping and Historical Records Within the SGIC SDA Desktop Search Extent

000-G-MAP-2412 Version:2 Date:2022/09/12



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Legend

- Study Area
- SGIC SDA Pipeline Alignment

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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PROJECTION UTM Zone 56
(Datum GDA2020)

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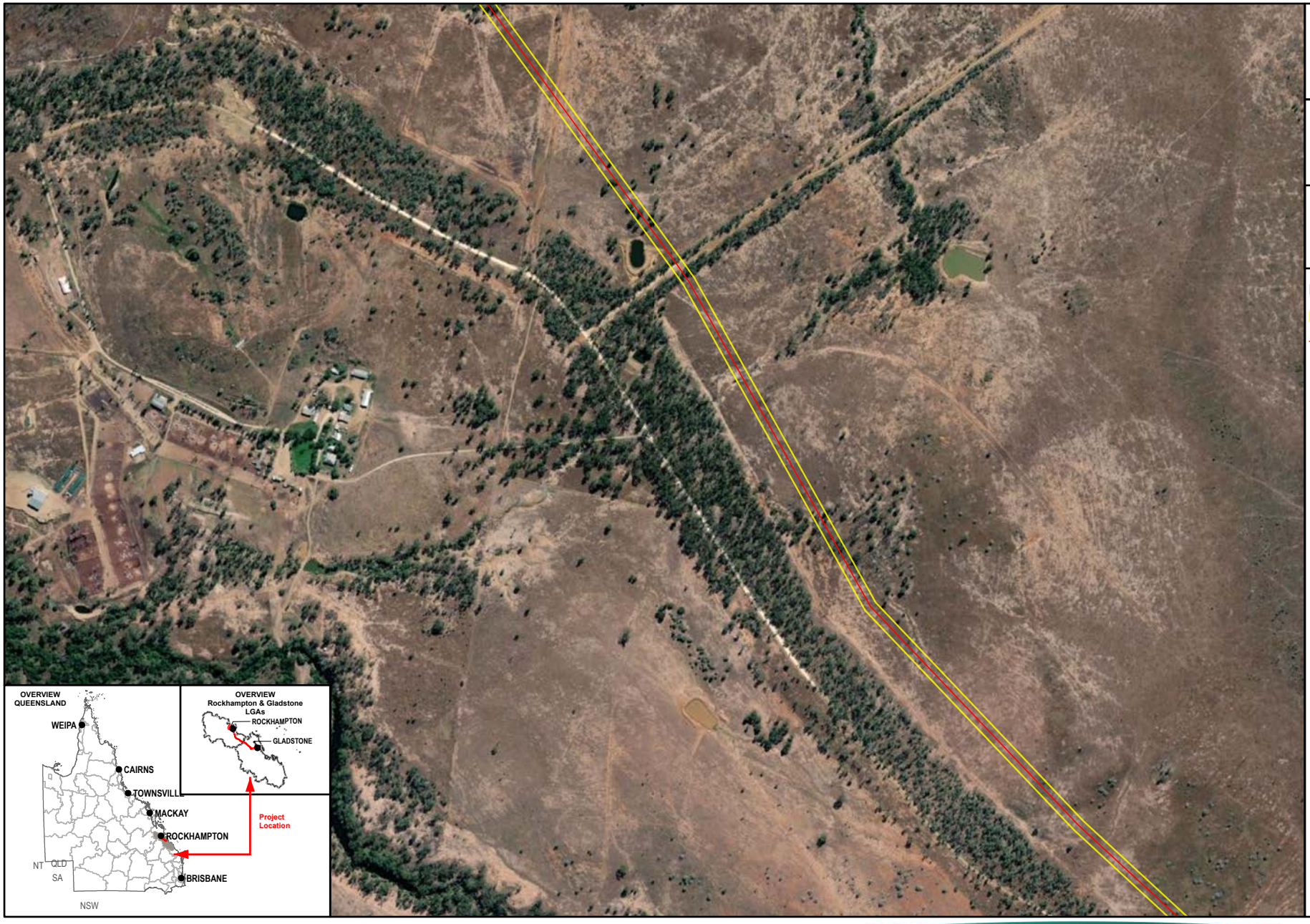
Fitzroy to Gladstone Pipeline Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 4-3d
High-risk Flora Survey Trigger Mapping and Historical Records Within the SGIC SDA Desktop Search Extent

000-G-MAP-2412 Version:2 Date:2022/09/12



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- Study Area
- SGIC SDA Pipeline Alignment

Data Sources:
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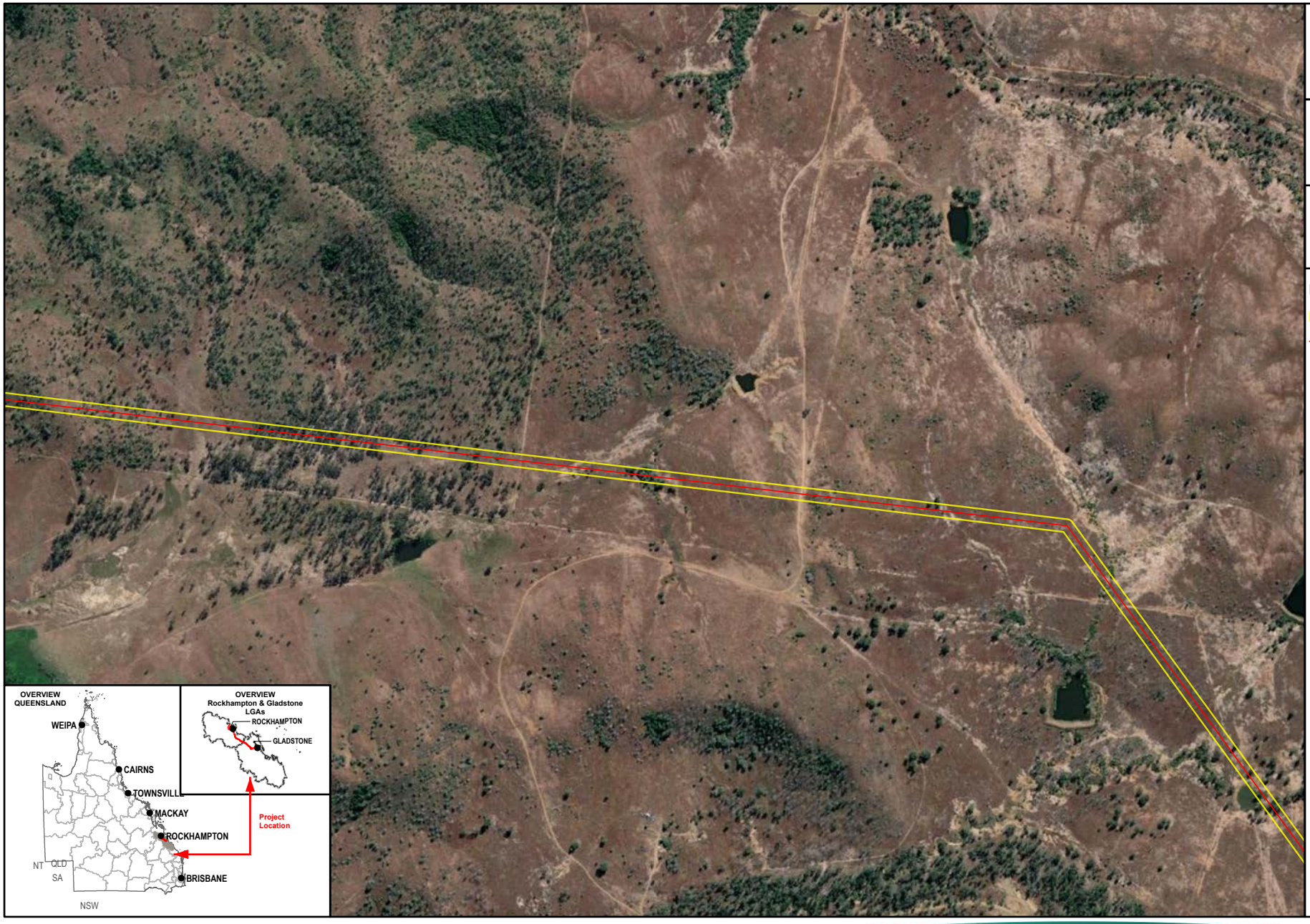
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 4-3e
High-risk Flora Survey Trigger Mapping and Historical Records Within the SGIC SDA Desktop Search Extent

000-G-MAP-2412 Version:2 Date:2022/09/12



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- Study Area
- SGIC SDA Pipeline Alignment

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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Figure 4-3f

High-risk Flora Survey Trigger Mapping and Historical Records Within the SGIC SDA Desktop Search Extent

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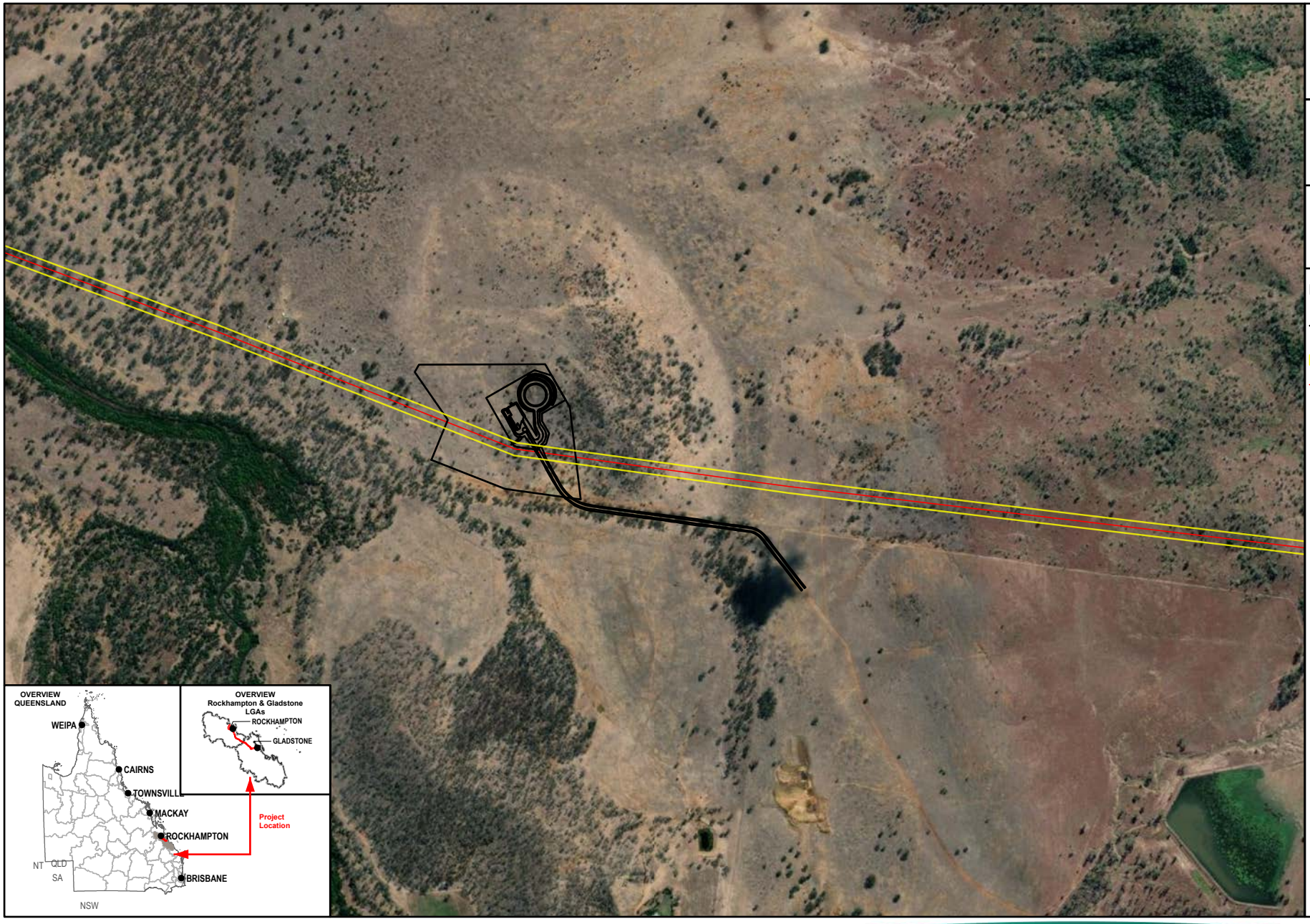

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Legend

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

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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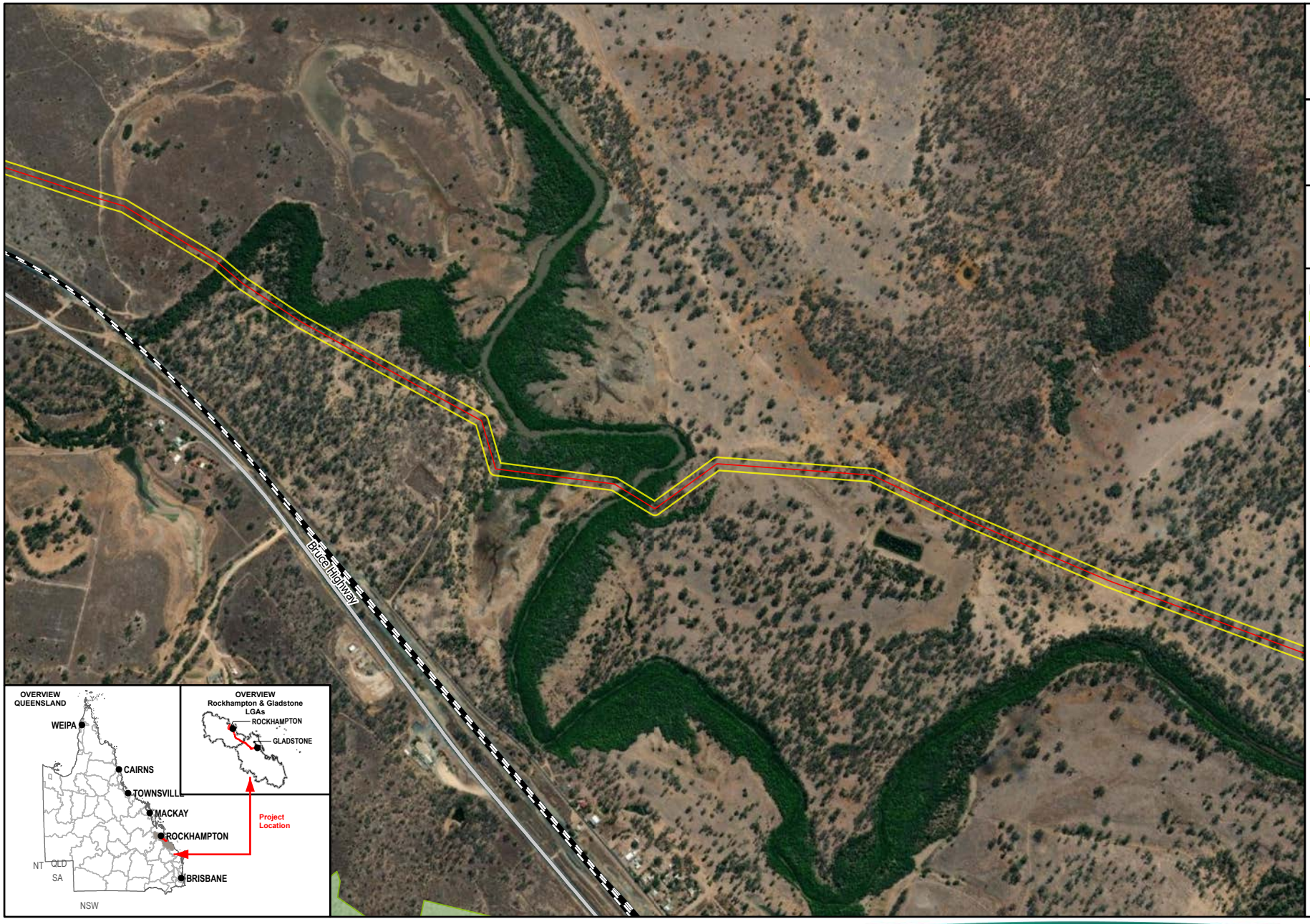
Fitzroy to Gladstone Pipeline Baseline Terrestrial and Aquatic Ecology Technical Report

Figure 4-3g

High-risk Flora Survey Trigger Mapping and Historical Records Within the SGIC SDA Desktop Search Extent

000-G-MAP-2412 Version:2 Date:2022/09/12



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- High-risk Flora Trigger Areas
- Study Area
- SGIC SDA Pipeline Alignment
- 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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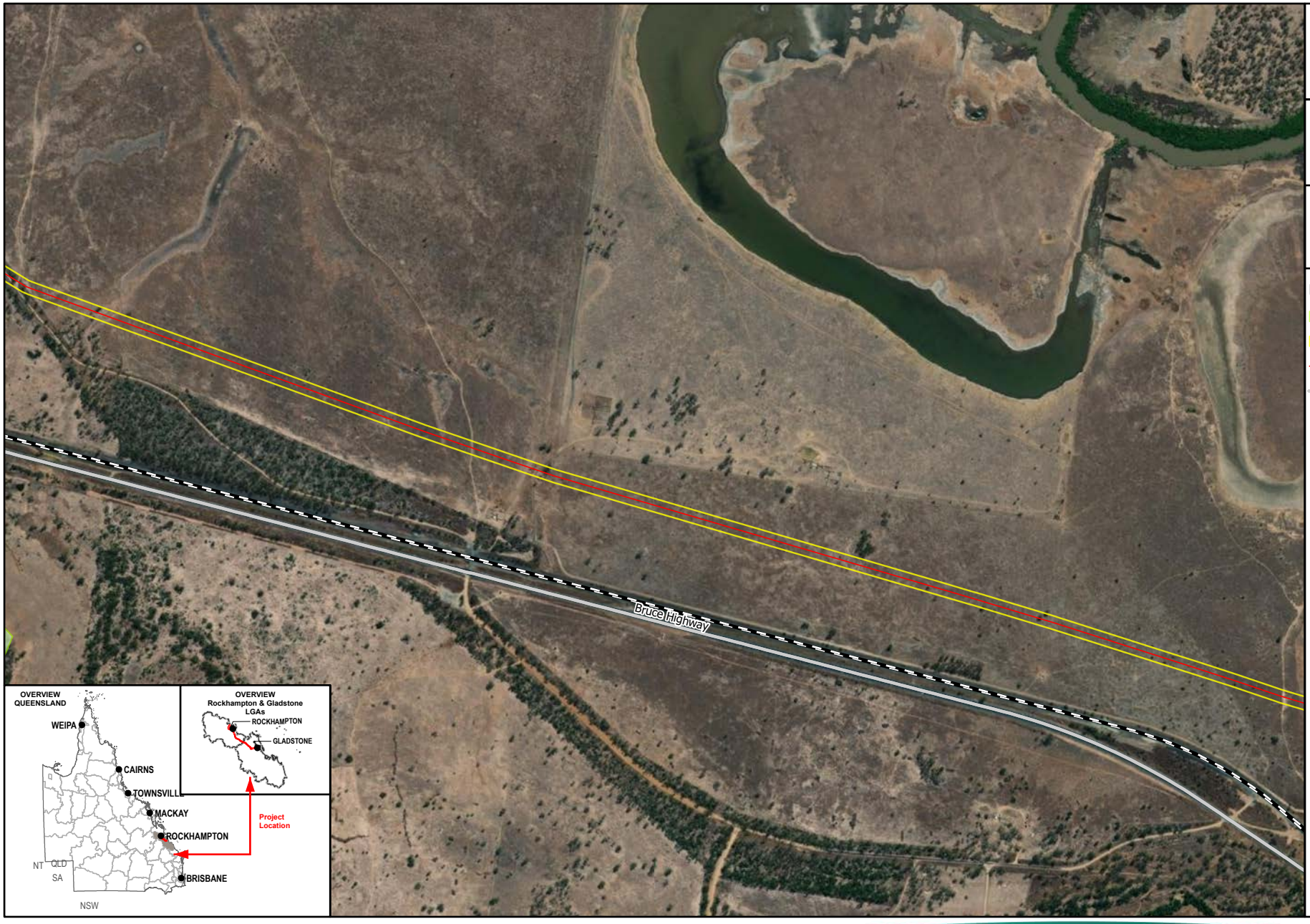
Figure 4-3h

High-risk Flora Survey Trigger Mapping and Historical Records Within the SGIC SDA Desktop Search Extent

000-G-MAP-2412 Version:2 Date:2022/09/12



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- High-risk Flora Trigger Areas
- Study Area
- SGIC SDA Pipeline Alignment
- 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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Figure 4-3i

High-risk Flora Survey Trigger Mapping and Historical Records Within the SGIC SDA Desktop Search Extent

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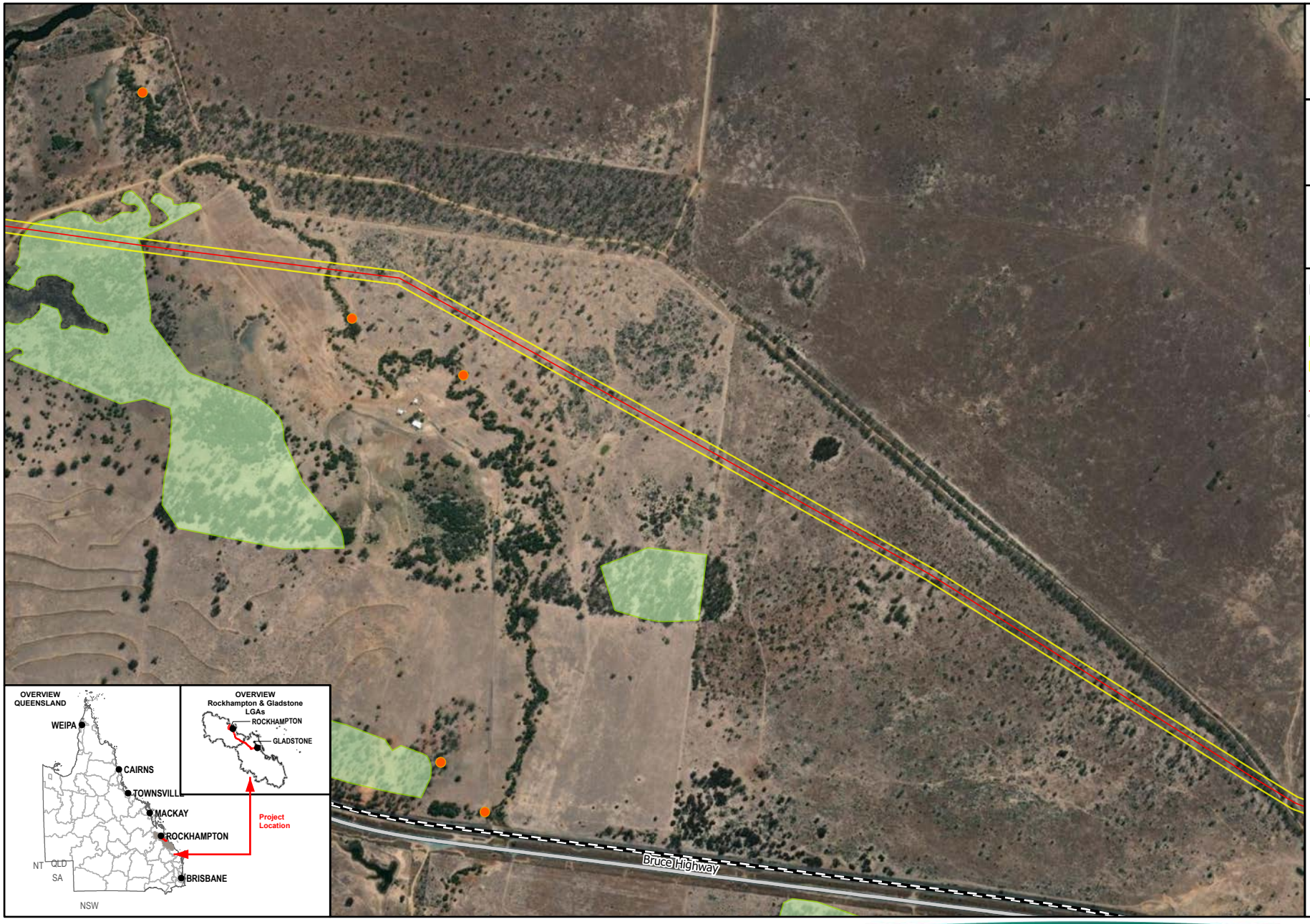

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Legend

- Threatened Flora Record
- High-risk Flora Trigger Areas
- Study Area
- SGIC SDA Pipeline Alignment
- Main Roads
- Railways

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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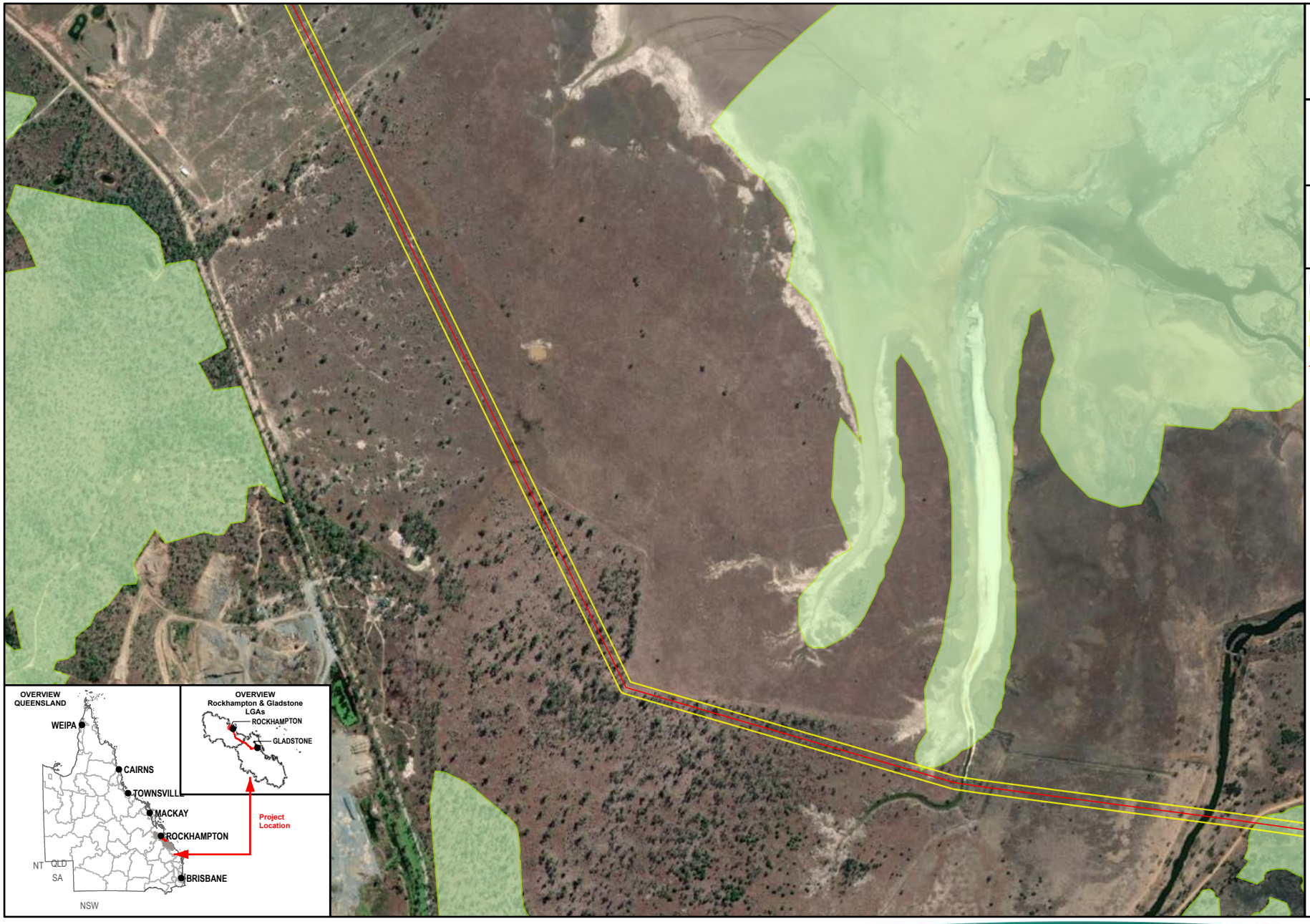
Figure 4-3j

High-risk Flora Survey Trigger Mapping and Historical Records Within the SGIC SDA Desktop Search Extent

000-G-MAP-2412 Version:2 Date:2022/09/12



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- High-risk Flora Trigger Areas
- Study Area
- SGIC SDA Pipeline Alignment

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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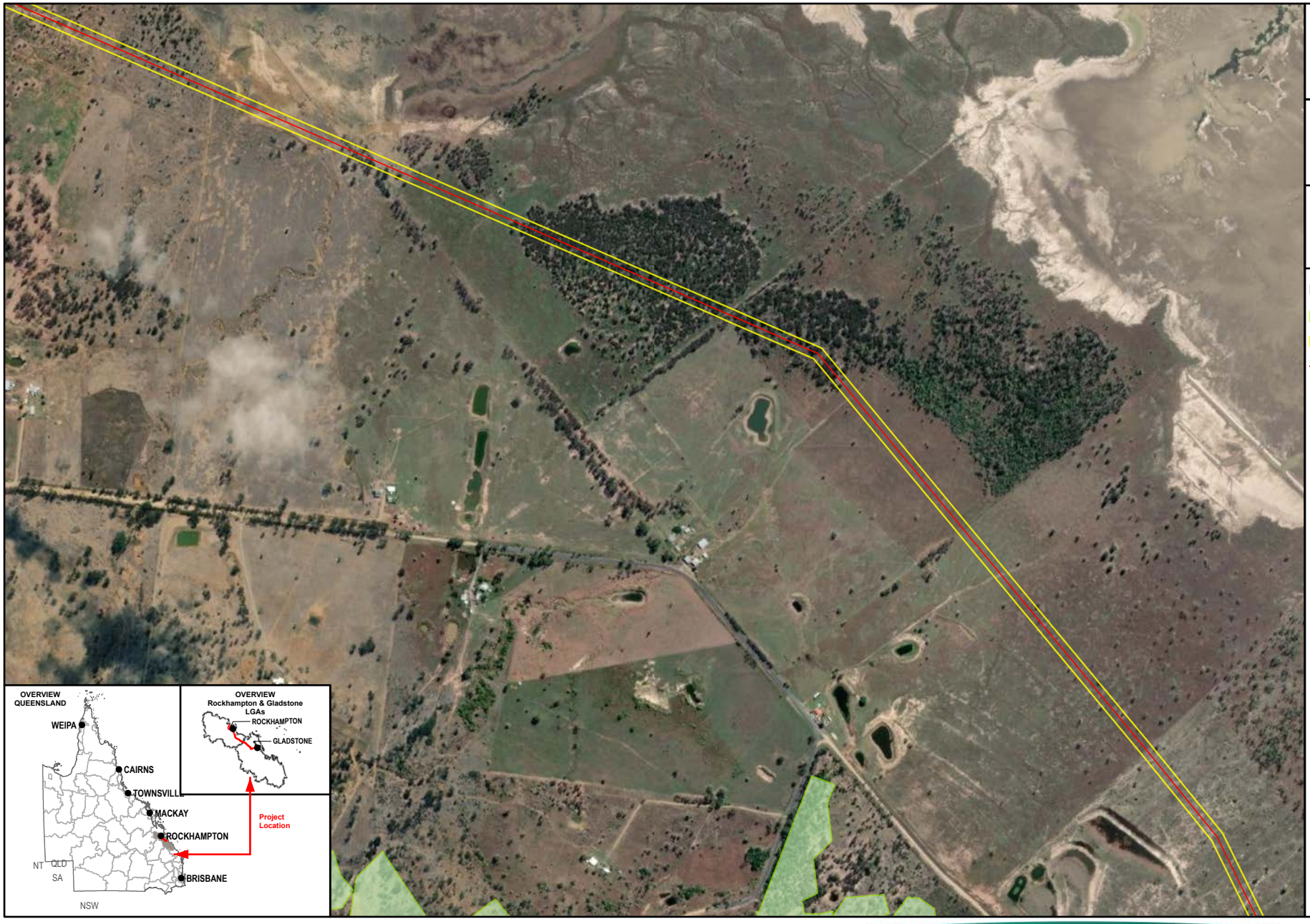
Figure 4-3k
High-risk Flora Survey Trigger Mapping and Historical Records Within the SGIC SDA Desktop Search Extent

000-G-MAP-2412 Version:2 Date:2022/09/12



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- High-risk Flora Trigger Areas
- Study Area
- SGIC SDA Pipeline Alignment

Data Sources:
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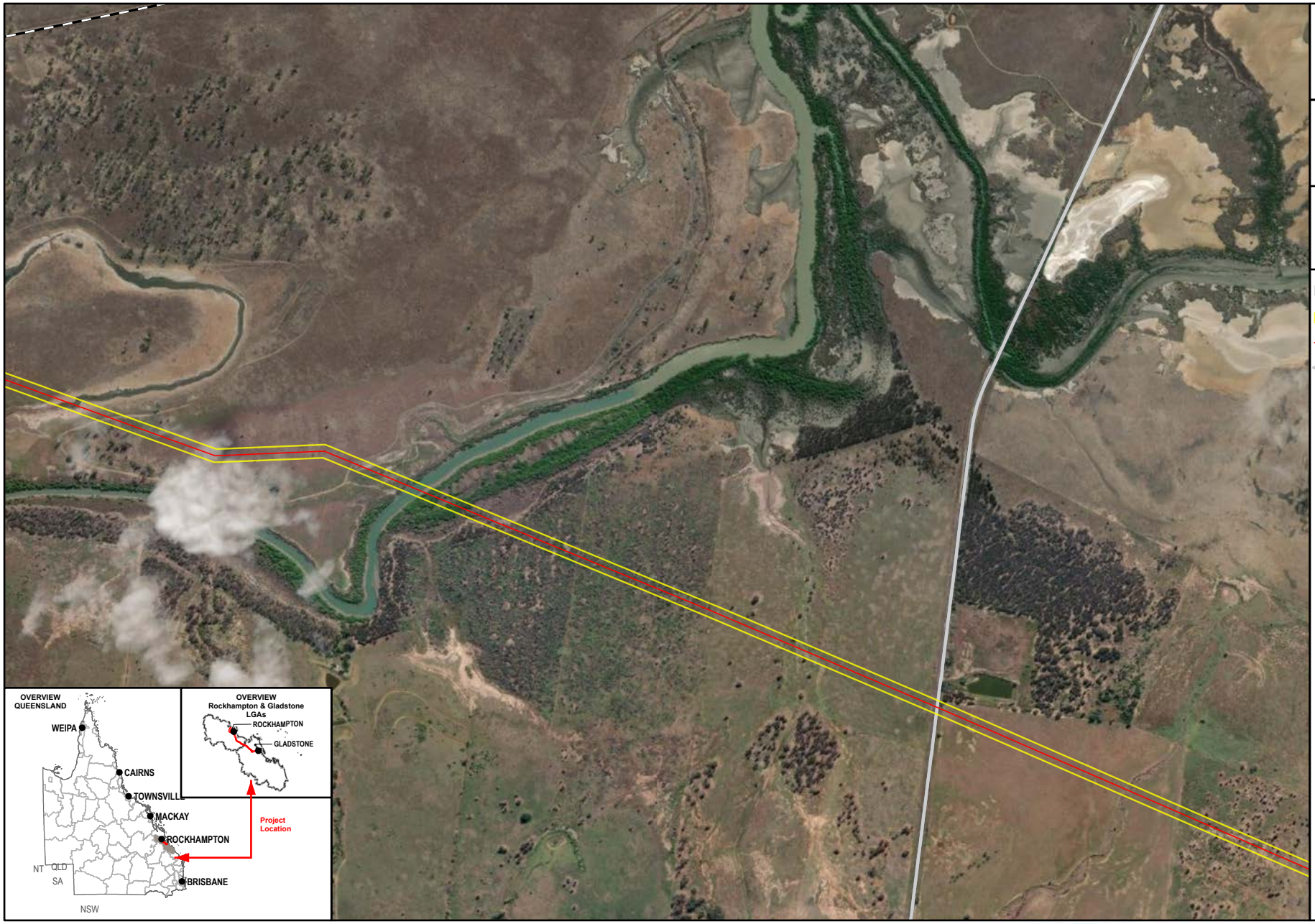
Figure 4-3l
High-risk Flora Survey Trigger Mapping and Historical Records Within the SGIC SDA Desktop Search Extent

000-G-MAP-2412 Version:2 Date:2022/09/12



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- Study Area
- SGIC SDA Pipeline Alignment
- 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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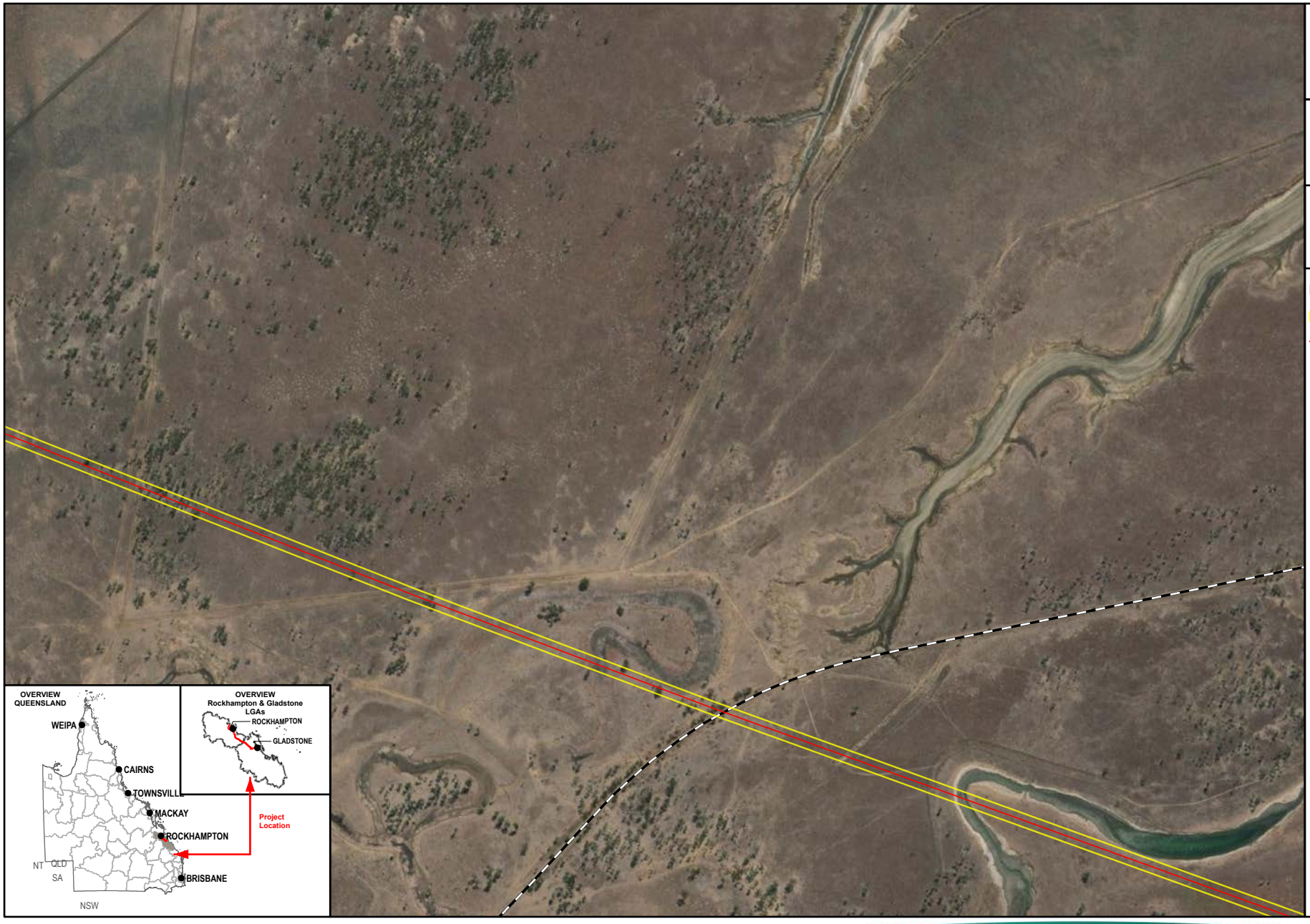
Figure 4-3m

High-risk Flora Survey Trigger Mapping and Historical Records Within the SGIC SDA Desktop Search Extent

000-G-MAP-2412 Version:2 Date:2022/09/12



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- Study Area
- SGIC SDA Pipeline Alignment
- Railways

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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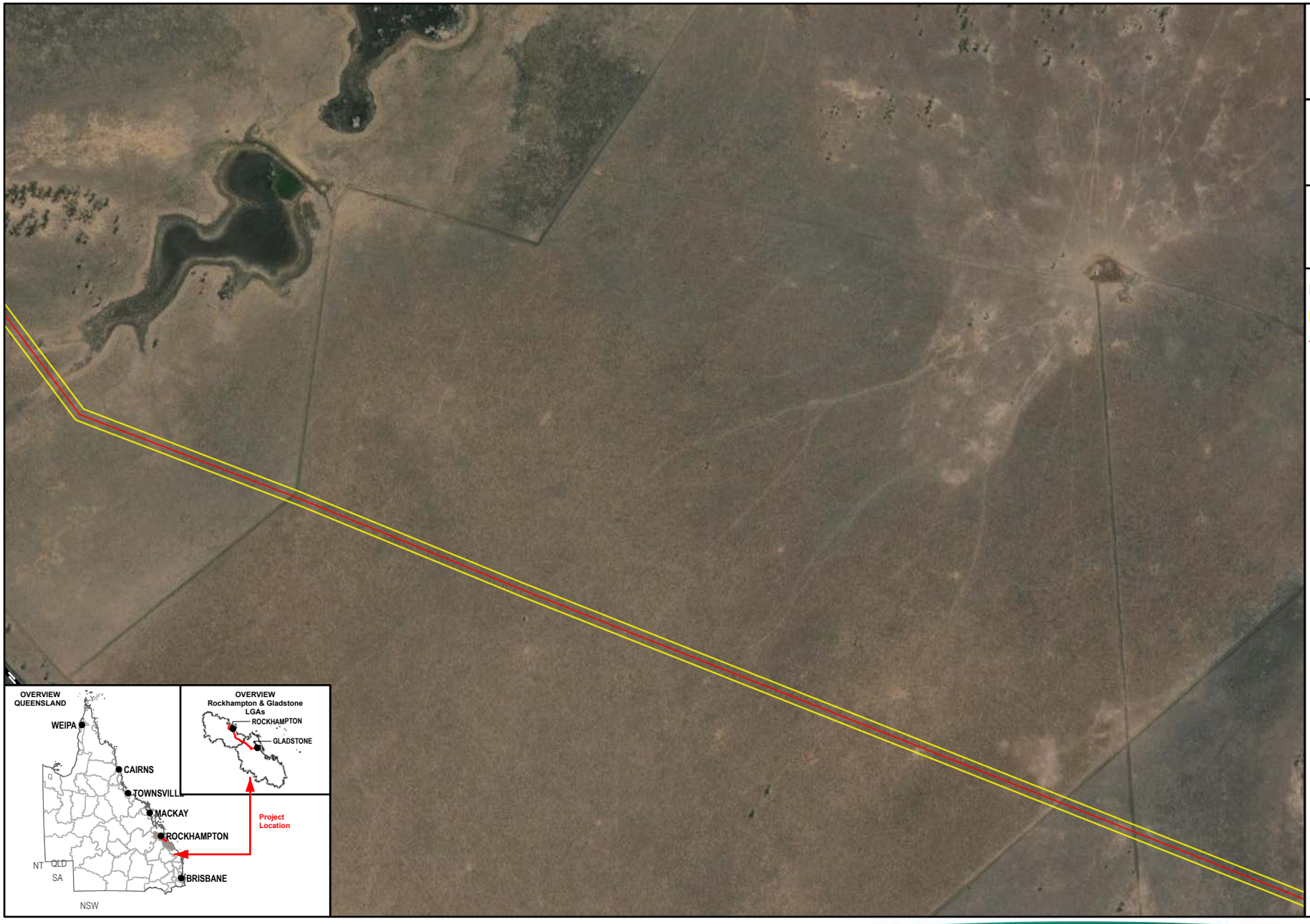
Figure 4-3n

High-risk Flora Survey Trigger Mapping and Historical Records Within the SGIC SDA Desktop Search Extent

000-G-MAP-2412 Version:2 Date:2022/09/12



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- Study Area
- SGIC SDA Pipeline Alignment
- Railways

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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Figure 4-3o
High-risk Flora Survey Trigger Mapping and Historical Records Within the SGIC SDA Desktop Search Extent

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

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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Figure 4-3p

High-risk Flora Survey Trigger Mapping and Historical Records Within the SGIC SDA Desktop Search Extent

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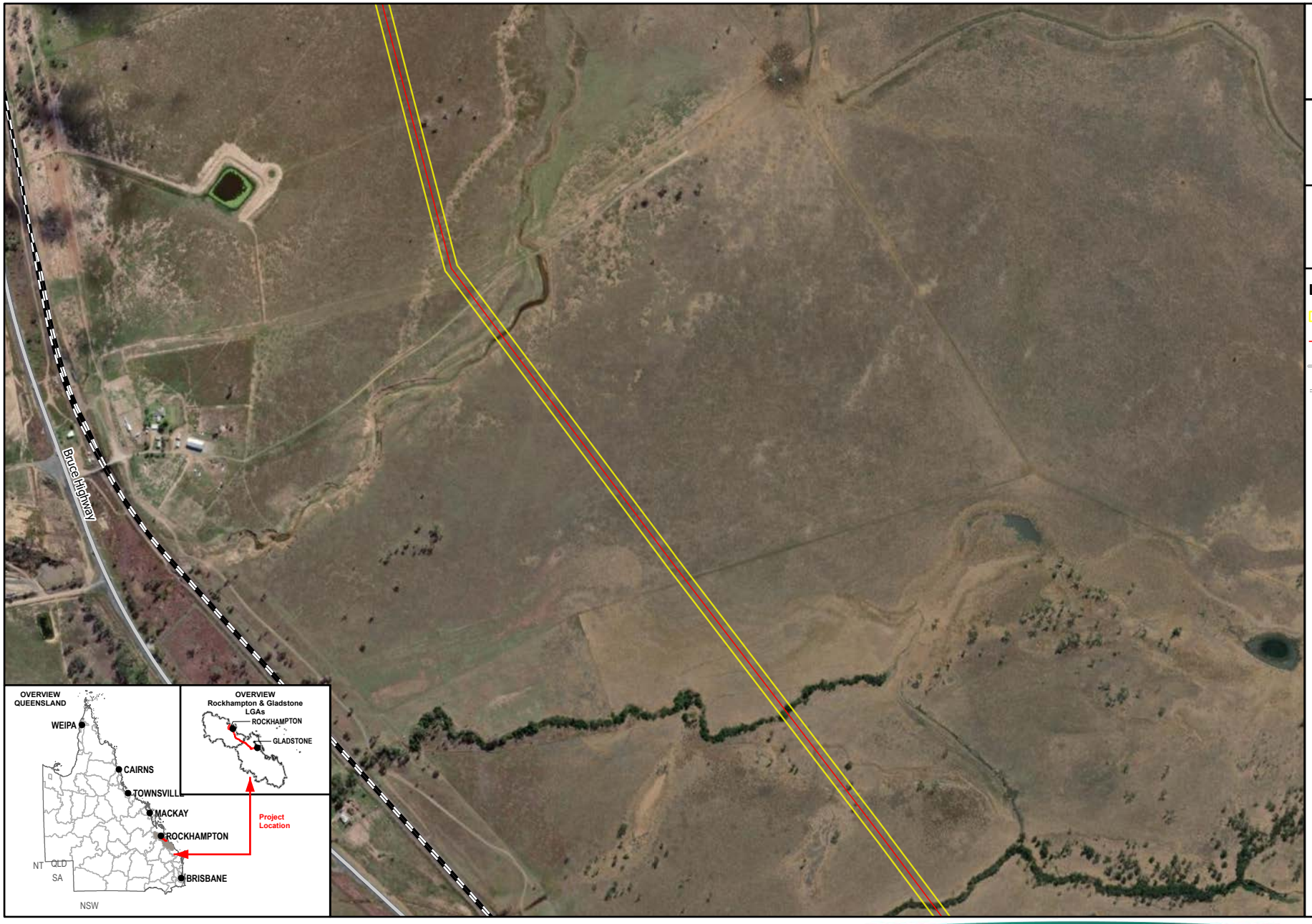

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- Study Area
- SGIC SDA Pipeline Alignment
- Main Roads
- Railways

Data Sources:
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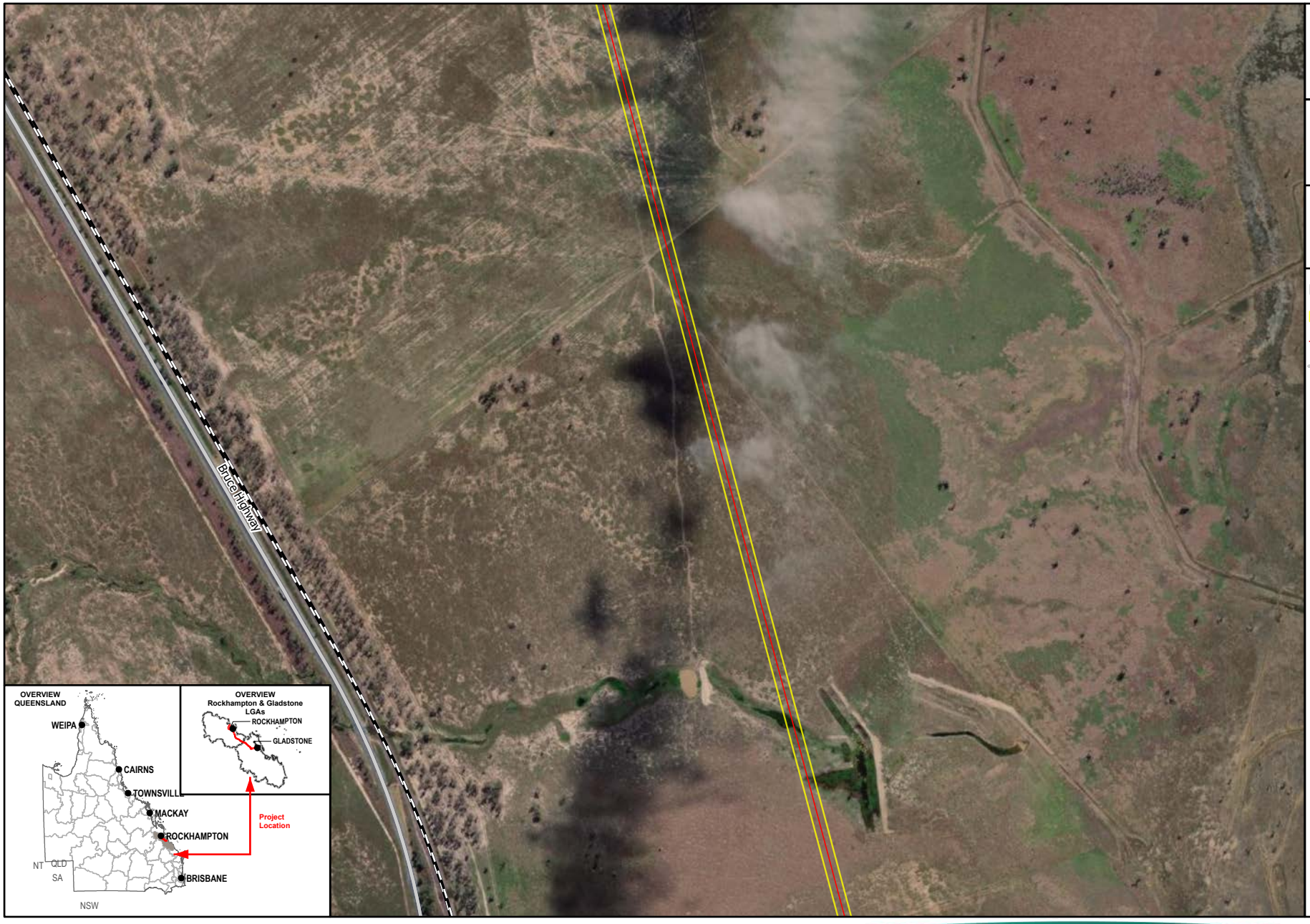
Figure 4-3q

High-risk Flora Survey Trigger Mapping and Historical Records Within the SGIC SDA Desktop Search Extent

000-G-MAP-2412 Version:2 Date:2022/09/12



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

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 4-3r
High-risk Flora Survey Trigger Mapping and Historical Records Within the SGIC SDA Desktop Search Extent

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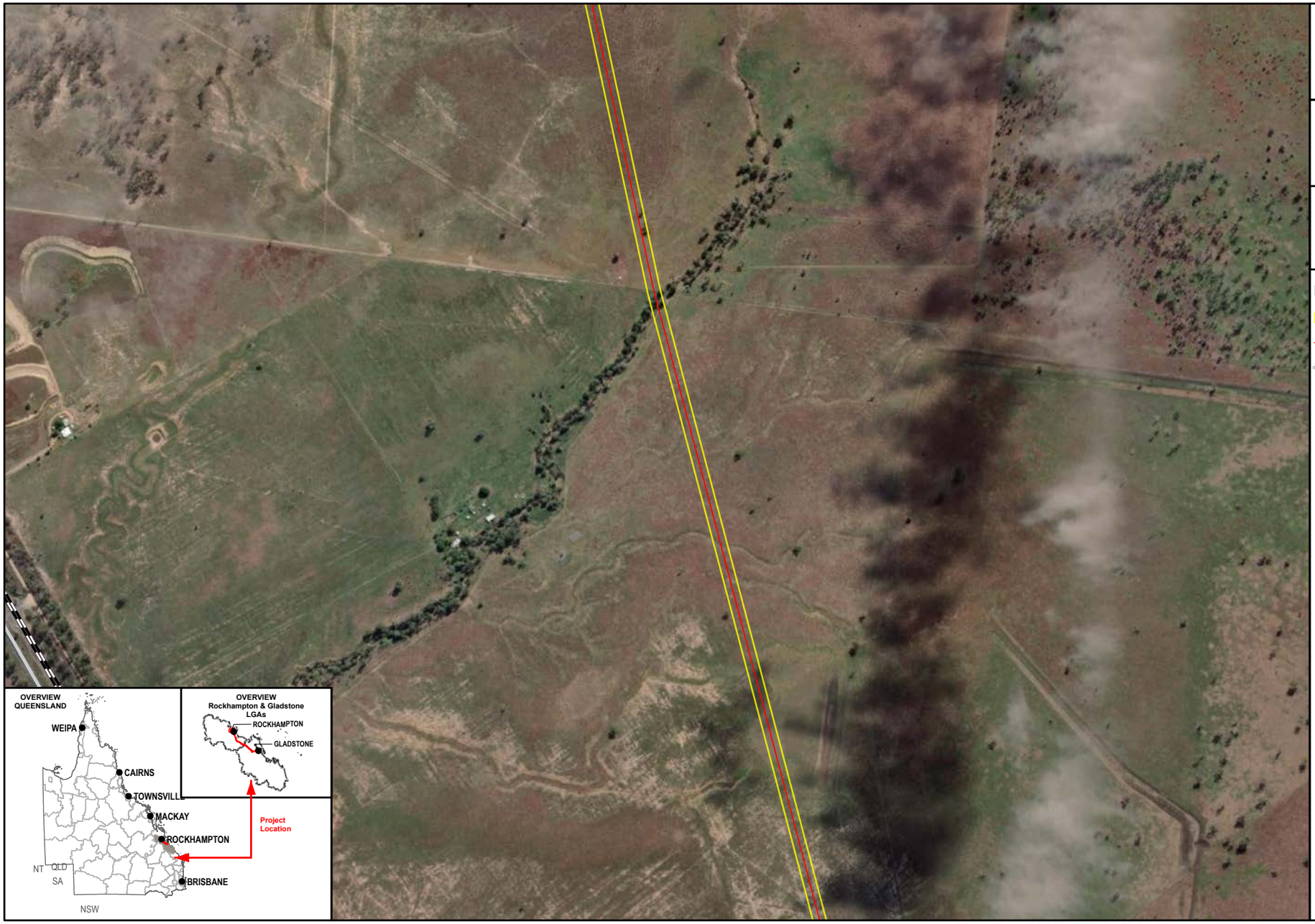

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- Study Area
- SGIC SDA Pipeline Alignment
- Main Roads
- Railways

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 4-3s
High-risk Flora Survey Trigger Mapping and Historical Records Within the SGIC SDA Desktop Search Extent

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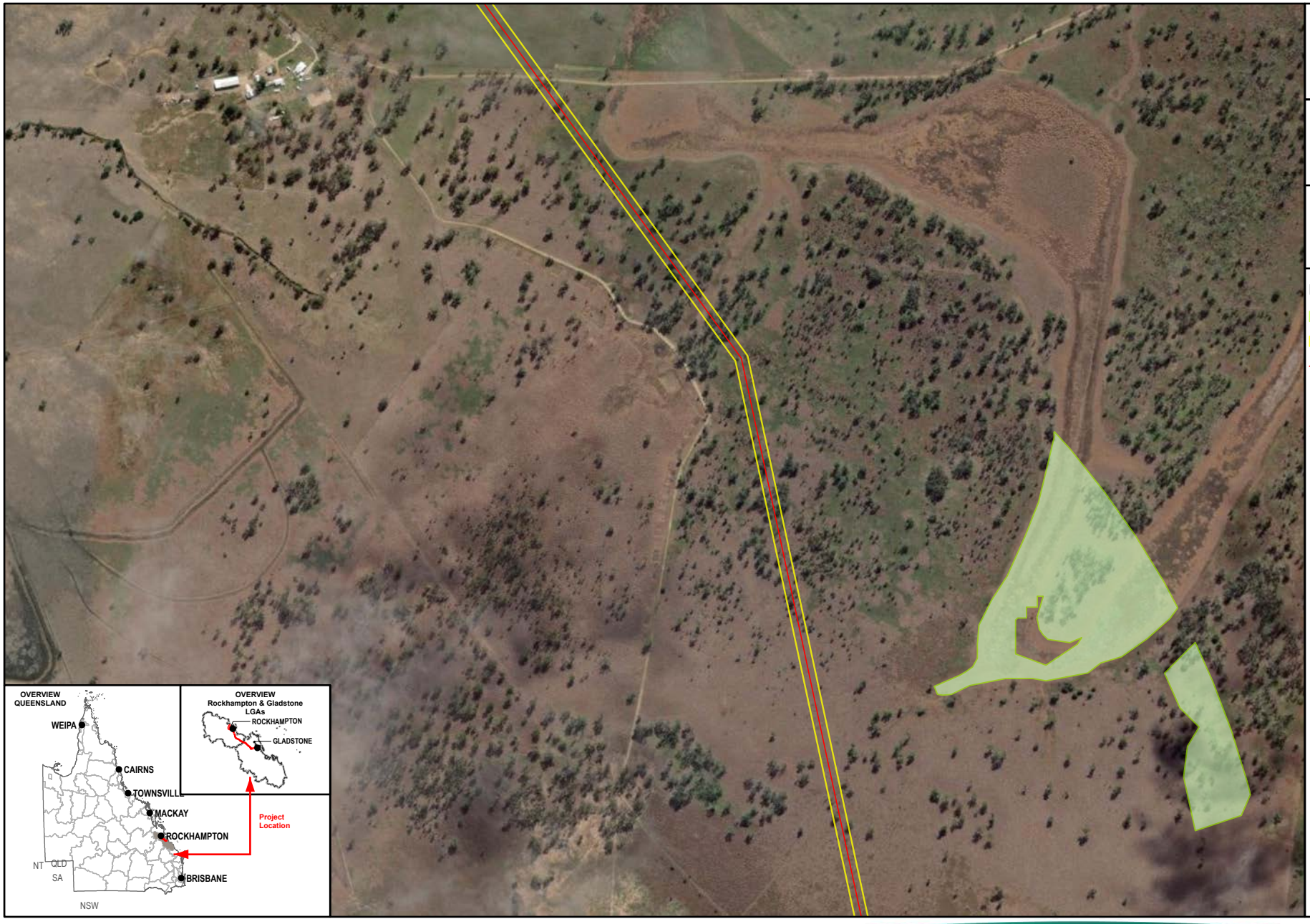

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Legend

- High-risk Flora Trigger Areas
- Study Area
- SGIC SDA Pipeline Alignment

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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Figure 4-3t
High-risk Flora Survey Trigger Mapping and Historical Records Within the SGIC SDA Desktop Search Extent

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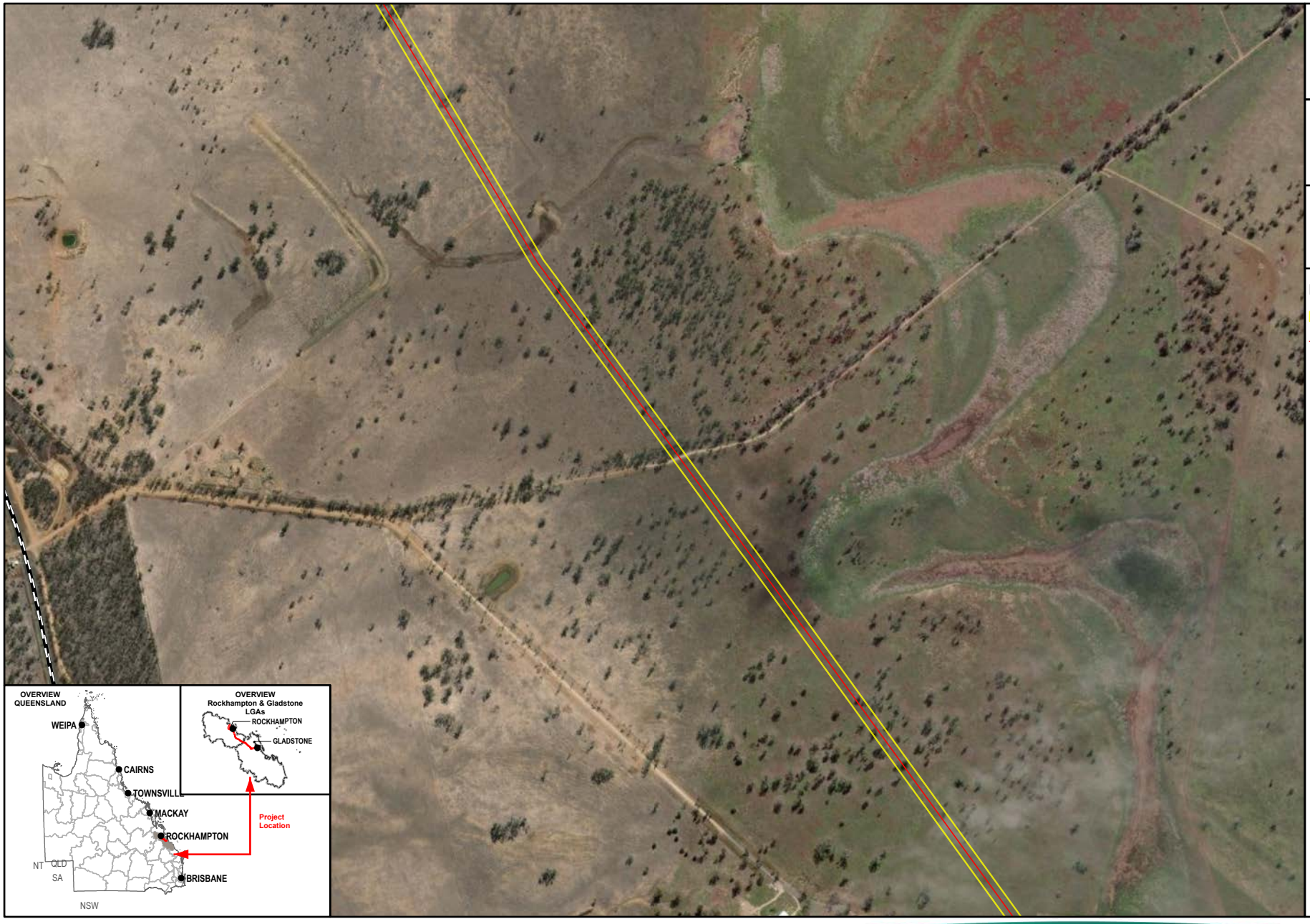

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- Study Area
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- Railways

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Figure 4-3u

High-risk Flora Survey Trigger Mapping and Historical Records Within the SGIC SDA Desktop Search Extent

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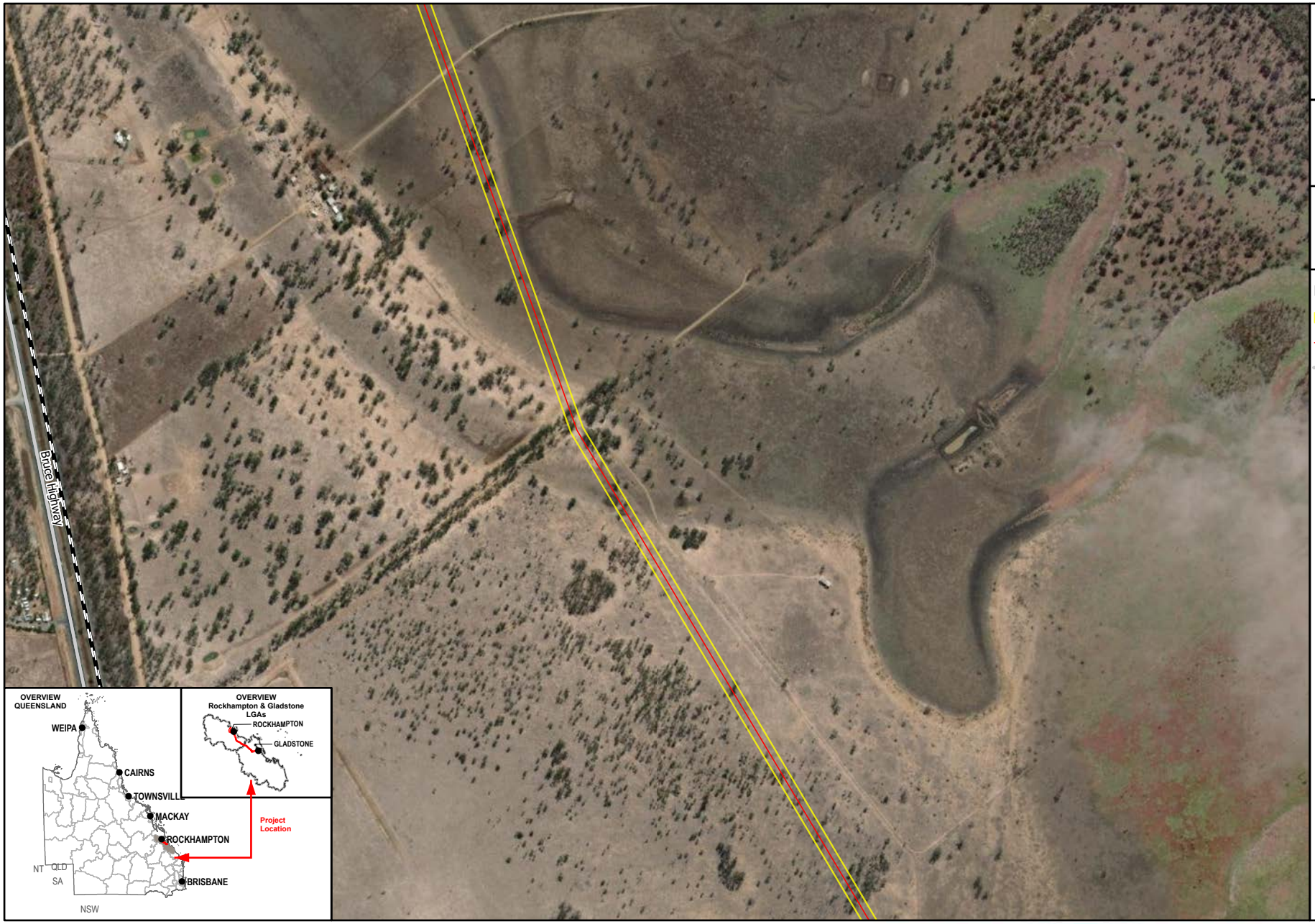

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- Study Area
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Figure 4-3v
High-risk Flora Survey Trigger Mapping and Historical Records Within the SGIC SDA Desktop Search Extent

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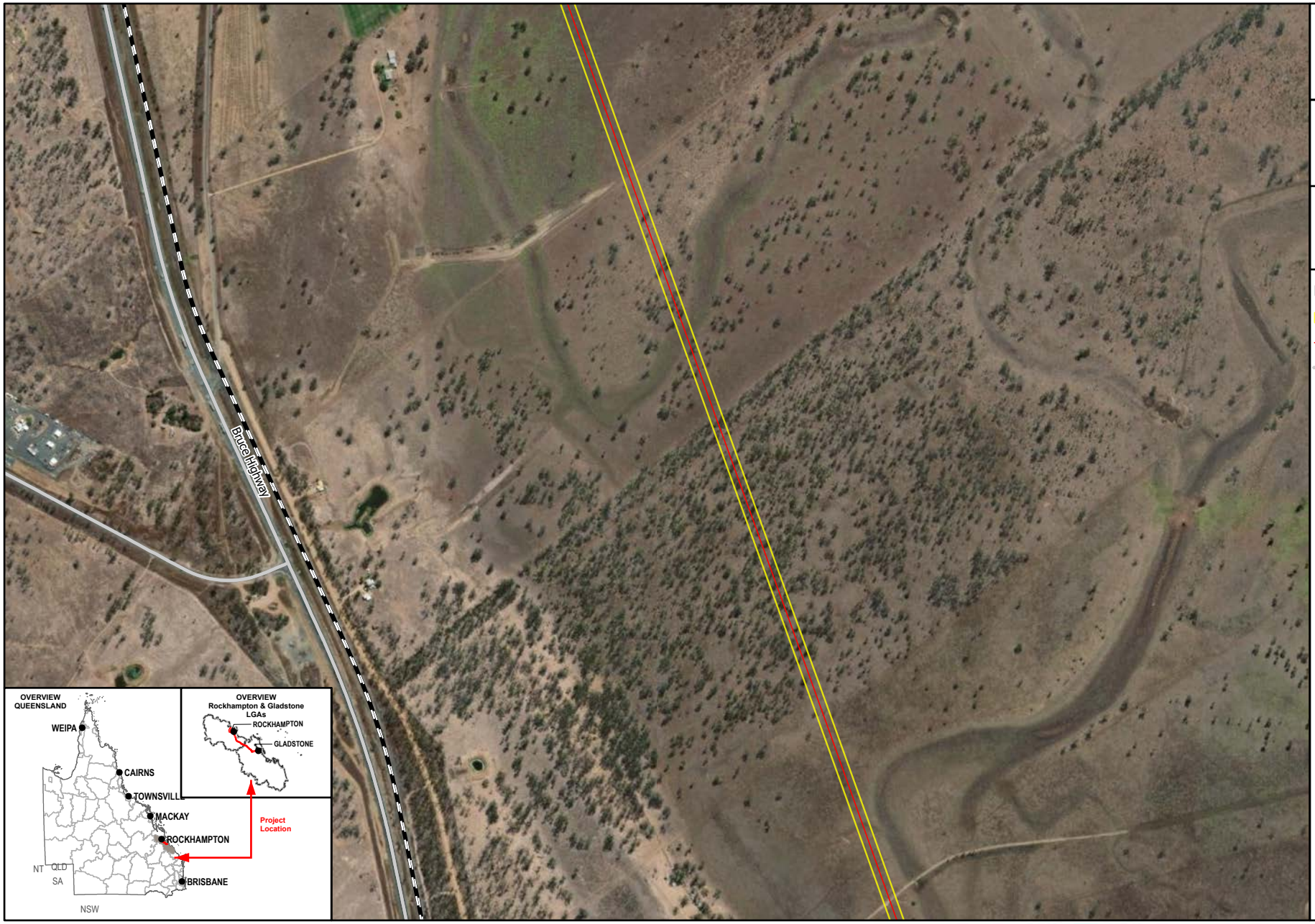

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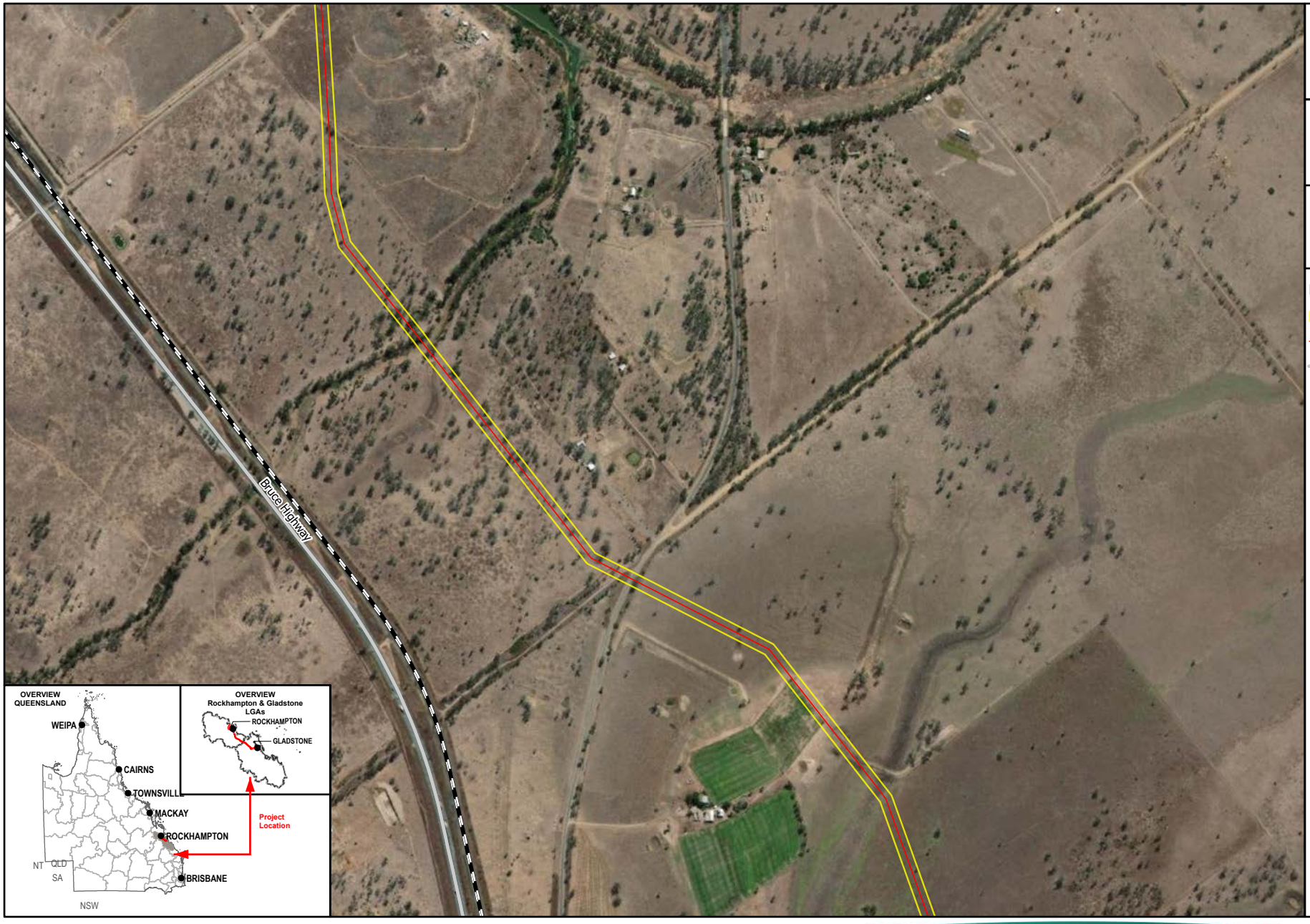

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Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 4-3x
High-risk Flora Survey Trigger Mapping and Historical Records Within the SGIC SDA Desktop Search Extent

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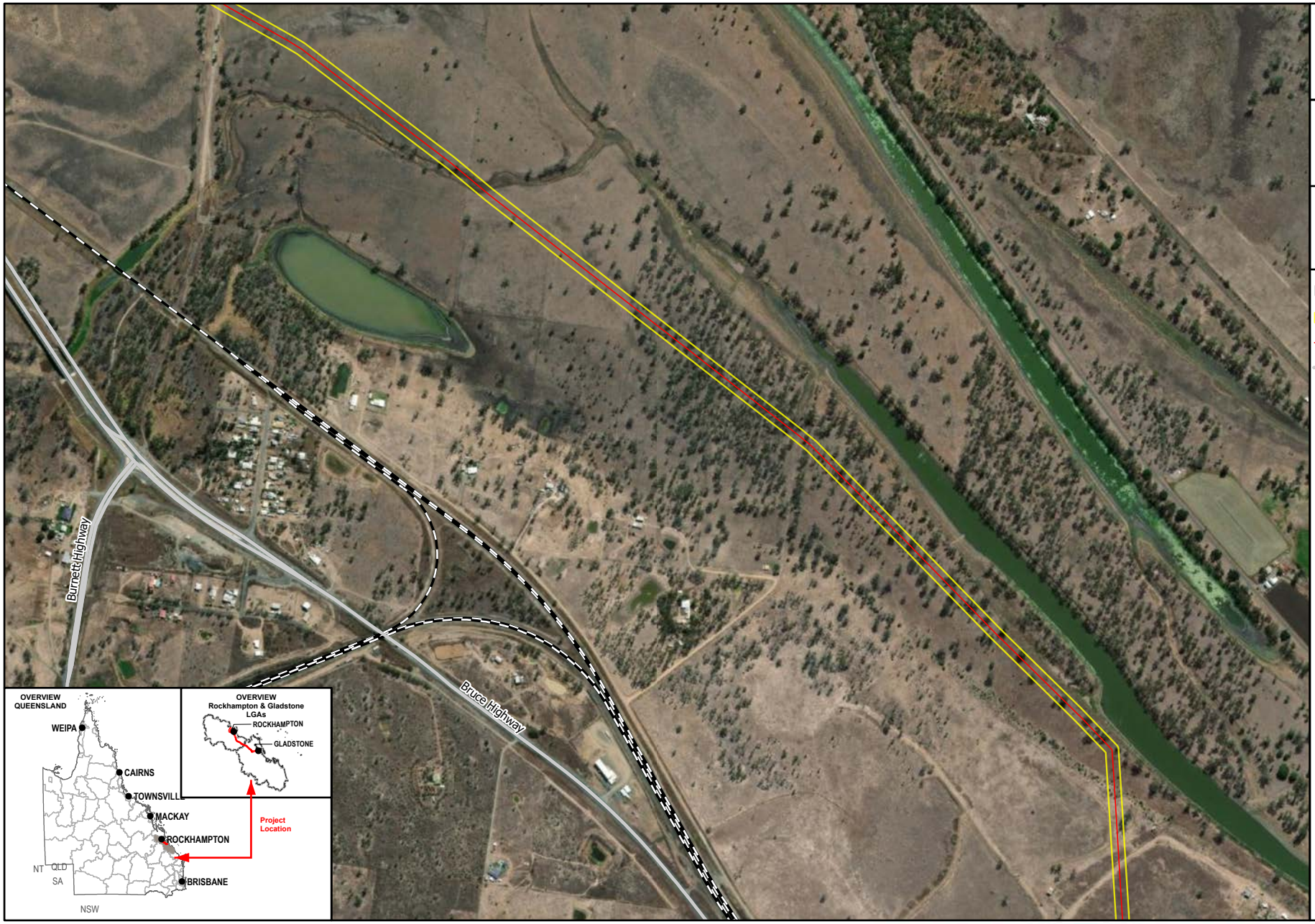

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- Main Roads
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Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 4-3y
High-risk Flora Survey Trigger Mapping and Historical Records Within the SGIC SDA Desktop Search Extent

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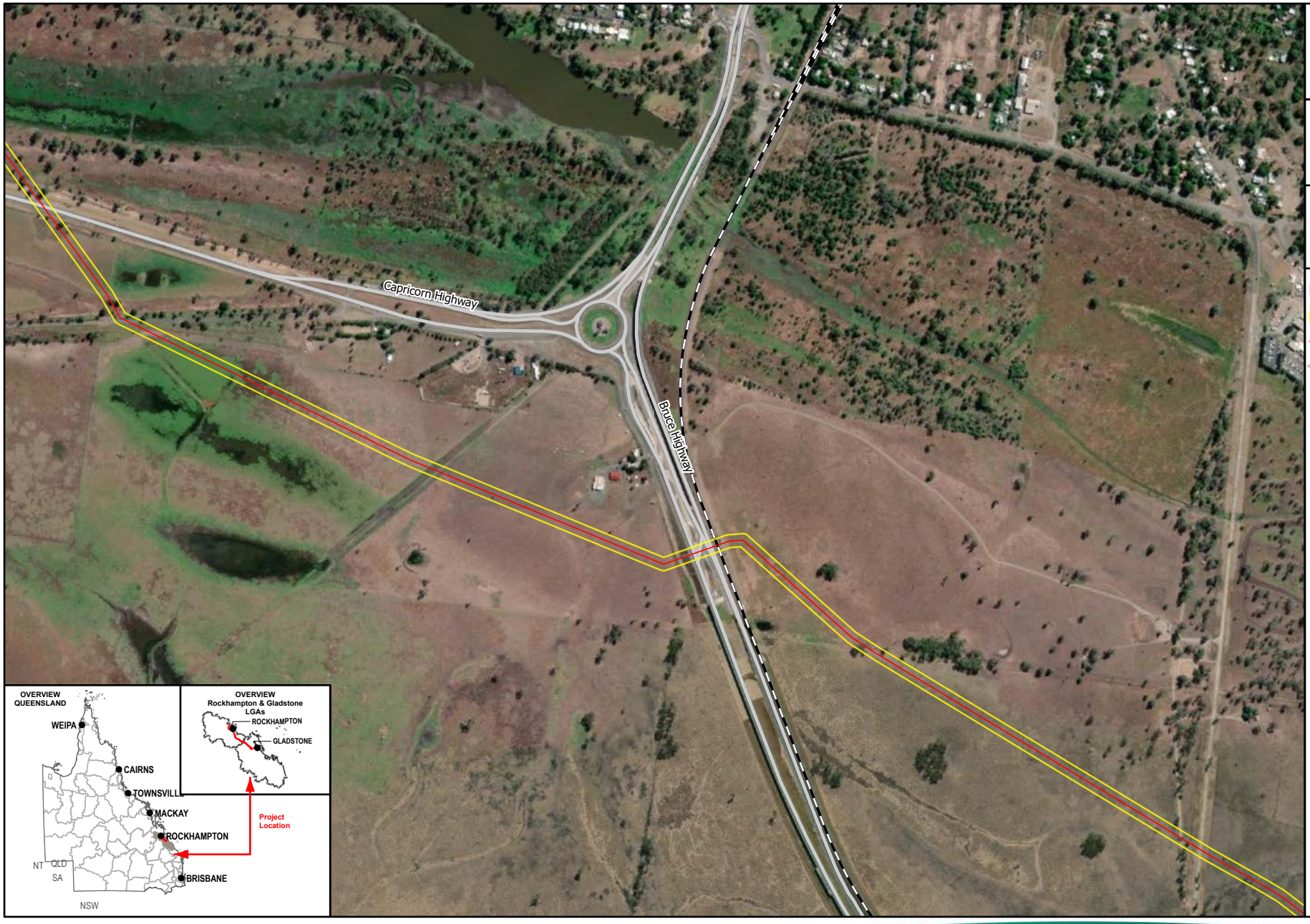

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Figure 4-3z
High-risk Flora Survey Trigger Mapping and Historical Records Within the SGIC SDA Desktop Search Extent

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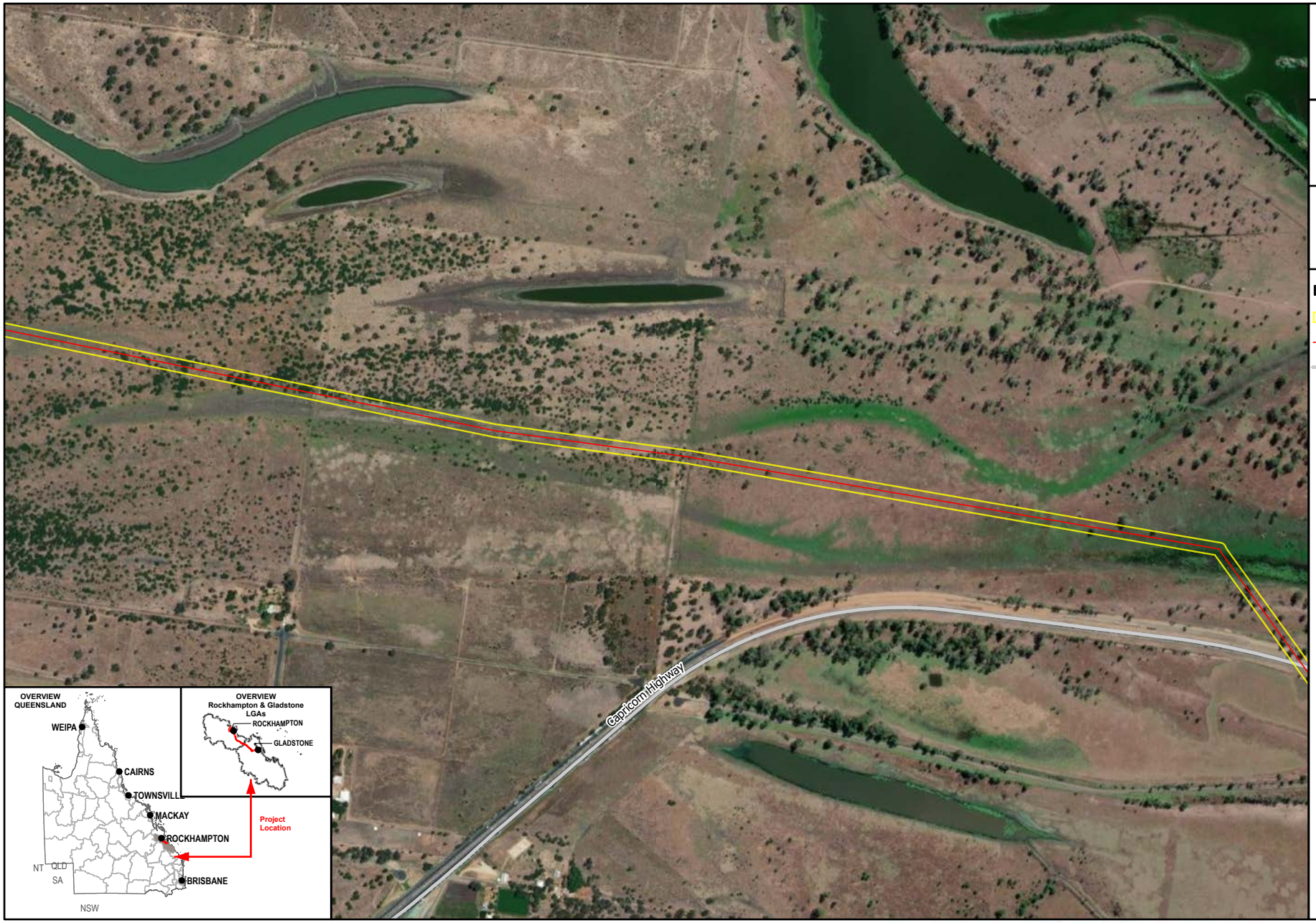

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Figure 4-3a1

High-risk Flora Survey Trigger Mapping and Historical Records Within the SGIC SDA Desktop Search Extent

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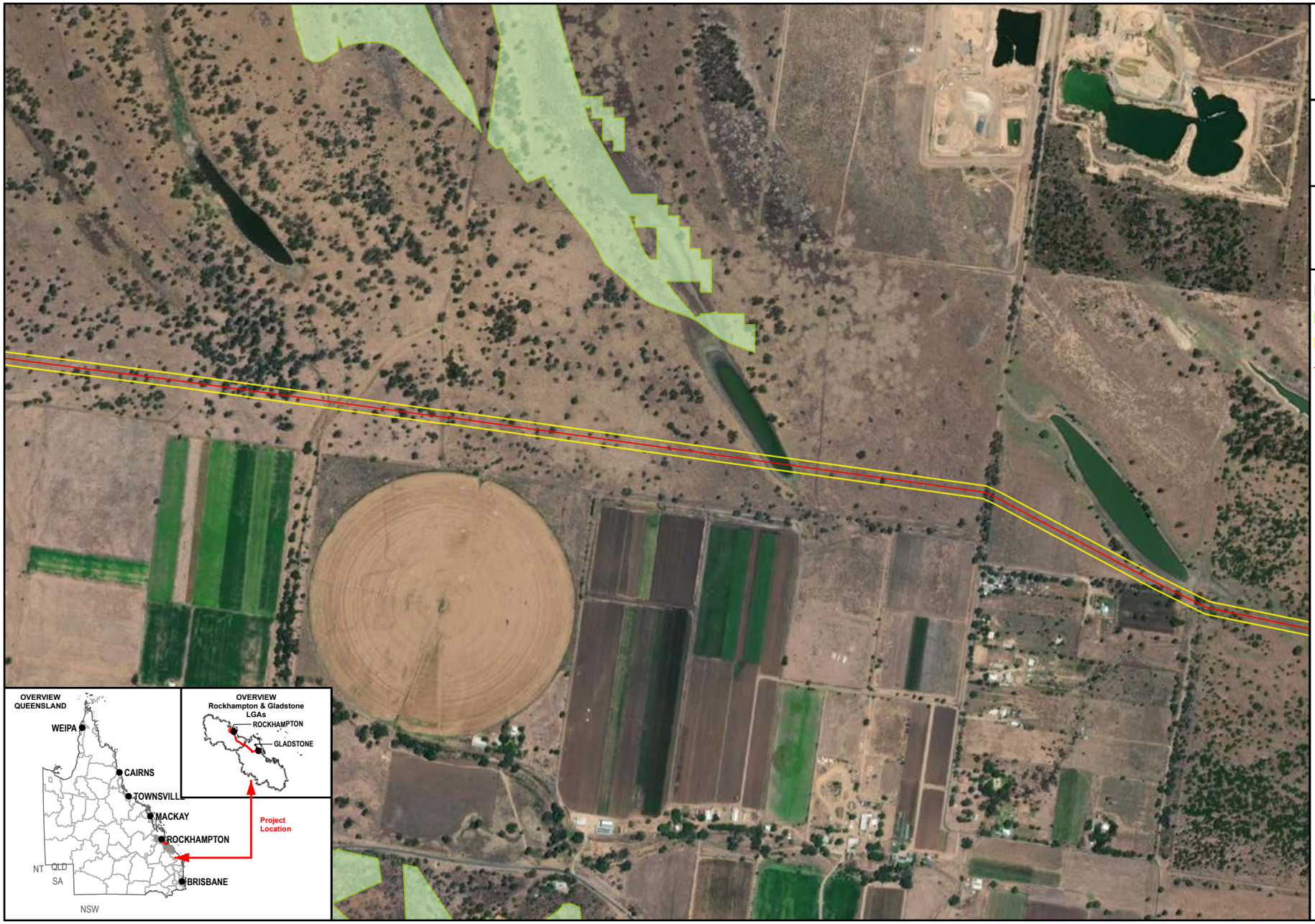

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Figure 4-3b1

High-risk Flora Survey Trigger Mapping and Historical Records Within the SGIC SDA Desktop Search Extent

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4.3.2 Field survey results

4.3.2.1 Conservation significant flora species

Comprehensive surveys for conservation significant flora species were undertaken within sections of the pipeline alignment intersected by high-risk flora trigger areas. Results of the protected plant surveys are presented in a standalone flora survey report, included as Appendix D. A protected plants Exemption Notification was submitted to DES via email on 3 August 2022. Opportunistic searches were also undertaken beyond the high-risk flora trigger areas. No EVNT flora species were recorded within the study area during the field assessment.

A voucher specimen of the plant previously identified as *Macropteranthes leiocaulis* at Marble Creek (-23.6833, 150.7581) was lodged with the Queensland Herbarium on 11 May 2022 as its morphological features and supporting habitat appeared more closely aligned to *Macropteranthes fitzalanii*. The Queensland Herbarium has since confirmed the specimen's identity as *M. fitzalanii* (least concern under the NC Act) (Herbarium reference: ME:PT 263/22). A high confidence is assigned to this identification as a fruiting specimen was supplied for identification purposes. Of note, the conservation status of *M. fitzalanii* under the NC Act was reclassified from near threatened to least concern in 2014.

Based on the location of the confirmed *M. fitzalanii* individual and some superficially similar appearances between it and *Cadellia pentastylis*, it is likely that the *'(probably)* ooline *(Cadellia pentastylis)*' identified by Arup in 2008 is actually *M. fitzalanii.*

Results of the protected plant surveys completed in high-risk flora trigger areas are presented in a standalone flora survey report, included as Appendix D. A protected plants Exemption Notification was submitted to DES via email on 3 August 2022.

4.3.2.2 Marine plants

Marine plant surveys were undertaken at six locations within the SGIC study area. Marine plant communities present at each location and their extents are listed in Table 4-8 and represented spatially in Figure 4-4.

The project is expected to result in a total of 17,175 m^2 of temporary marine plant impacts and a total of 9,499 m^2 (0.95 ha) of permanent marine plant impacts. The aforementioned areas are based on a construction corridor width of 30 m. It is expected that the areas cited in Table 4-8 would be substantially reduced if a narrower construction footprint was adopted in areas occupied by marine plants or alternative construction methodologies are employed in such areas (e.g. underground boring). The temporary impact definition adopted is that cited in the *State Development Assessment Provisions Guideline State code 11: Removal, destruction or damage of marine plants* (February 2022), whereby an impact is considered to be of a temporary nature if the site is expected to return to its pre-disturbance condition within five years of clearing.

Table 4-8 Marine plant communities present

Site	Latitude	Longitude	Community type	Inherent marine plants present	Other marine plants present (located on or adjacent to tidal lands)	Area of temporary impacts (m^2)	Area of permanent impacts (m^2)
A1	-23.7086	150.81805	Mangrove	*Excoecaria agallocha* *Avicennia marina* *Aegiceras corniculatum* *Clerodendrum inerme* *Xylocarpus granatum* *Acanthus ilicifolius* *Enchylaena tomentosa* *Sporobolus virginicus*	*Cupaniopsis anacardioides* *Einadia nutans* subsp. *linifolia* Seawrack	2,142	5,869
			Saltmarsh – grassland	*Sporobolus virginicus* *Excoecaria agallocha* *Fimbristylis sp.* *Sesuvium portulacastrum* *Enchylaena tomentosa*	*Atriplex muelleri*	3,769	13
A2	-23.7043	150.8104	Mangrove	*Excoecaria agallocha* *Avicennia marina* *Acanthus ilicifolius* *Clerodendrum inerme* *Sporobolus virginicus* *Fimbristylis ferruginea* *Atriplex semibaccata*	*Trophis scandens* *Ludwigia octovalvis* *Dysphania* sp. *Cyperus difformis* *Passiflora foetida** *Ricinus communis** *Cupaniopsis anacardioides* *Ruellia simplex** *Melaleuca bracteata* *Senna pendula** *Solanum seaforthianum** *Eclipta prostrata** *Rivina humilis** *Sonchus oleraceus** *Atriplex muelleri* *Conyza* sp.* Seawrack	108	1,163

Site	Latitude	Longitude	Community type	Inherent marine plants present	Other marine plants present (located on or adjacent to tidal lands)	Area of temporary impacts (m^2)	Area of permanent impacts (m^2)
B	-23.6804	150.7442	Saltmarsh – samphire forbland	*Sporobolus virginicus* *Tecticornia pergranulata subsp. Queenslandica* *Tecticornia indica*	*Sclerolaena muricata* *Eriochloa* sp. *Sesbania cannabina* *Dichanthium sp.* *Chloris sp.* *Atriplex muelleri* *Acacia salicina* Seawrack	1,631	0
C1	-23.6388	150.6848	Mangrove	*Avicennia marina* *Ceriops australis* *Aegiceras corniculatum* *Aegialitis annulata* *Tecticornia indica* *Suaeda arbusculoides* *Tecticornia pergranulata subsp. Queenslandica* *Enchylaena tomentosa* *Sporobolus virginicus*	*Chloris inflata** *Mariana microphylla* *Sclerolaena muricata* *Bothriochloa decipiens* *Sporobolus caroli* *Alternanthera* sp.	3,318	2,454
C2	-23.6366	150.6761	Saltmarsh – grassland	*Sporobolus virginicus*	*Chloris inflata** *Sclerolaena calcarata* *Sporobolus caroli* *Alternanthera sp.* *Dinebra sp.*	602	0
C2			Saltmarsh – samphire forbland	*Tecticornia pergranulata subsp. Queenslandica* *Tecticornia indica* *Enchylaena tomentosa* *Suaeda arbusculoides* *Avicennia marina* *Sesuvium portulacastrum*	*Sclerolaena muricata*	3,058	0

Site	Latitude	Longitude	Community type	Inherent marine plants present	Other marine plants present (located on or adjacent to tidal lands)	Area of temporary impacts (m^2)	Area of permanent impacts (m^2)
C3	-23.6336	150.6680	Saltmarsh – samphire forbland	*Sporobolus virginicus* *Tecticornia pergranulata* subsp. *Queenslandica* *Enchylaena tomentosa* *Suaeda arbusculoides* *Atriplex semibaccata*	*Sclerolaena calcarata* *Atriplex muelleri* *Alternanthera* sp. Seawrack	2,547	0
Total						17,175	9,499
Key to table: (*) – introduced flora species							

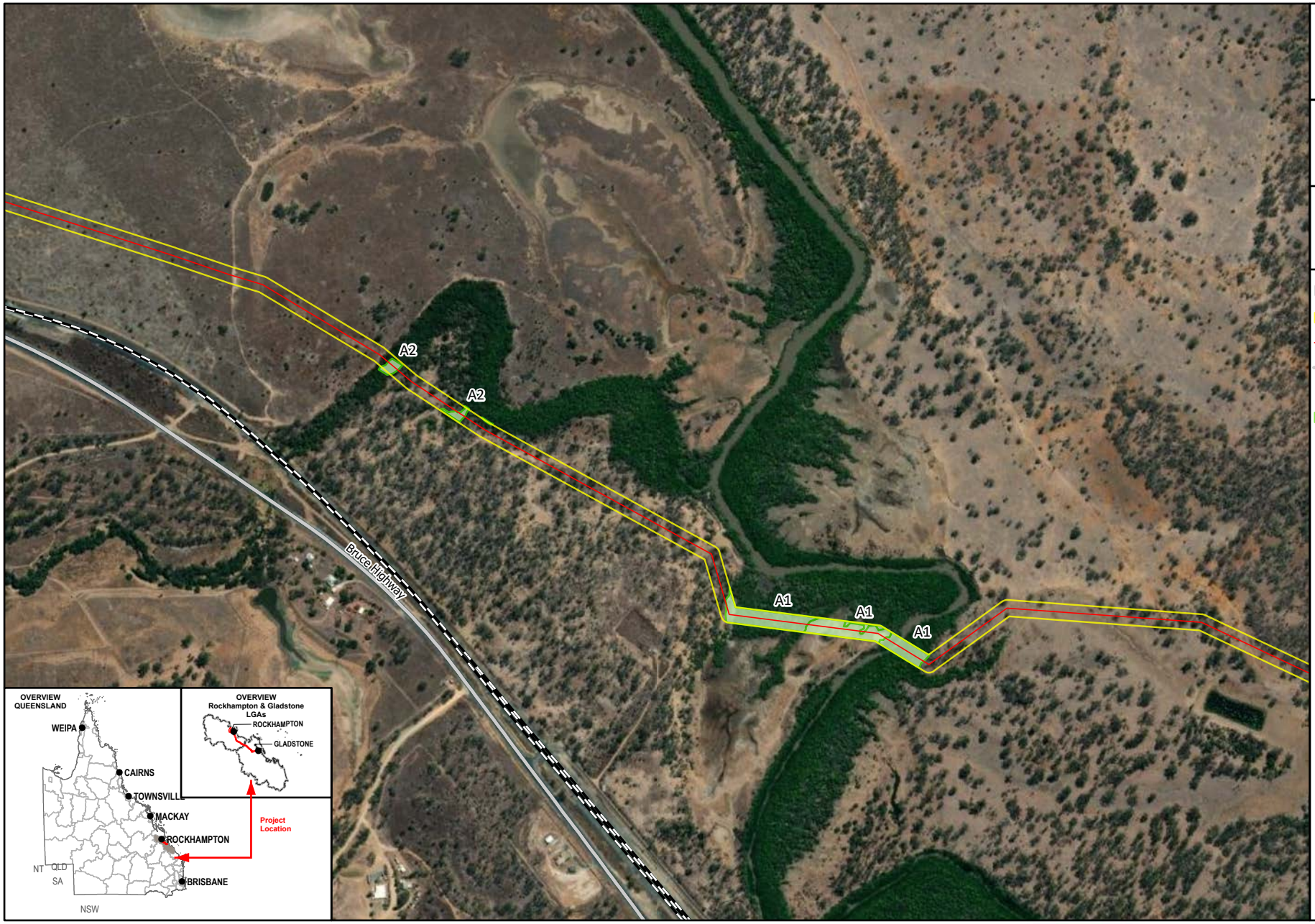

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Figure 4-4c Marine Plant Extents Within the SGIC SDA Study Area

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