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

Data Sources:
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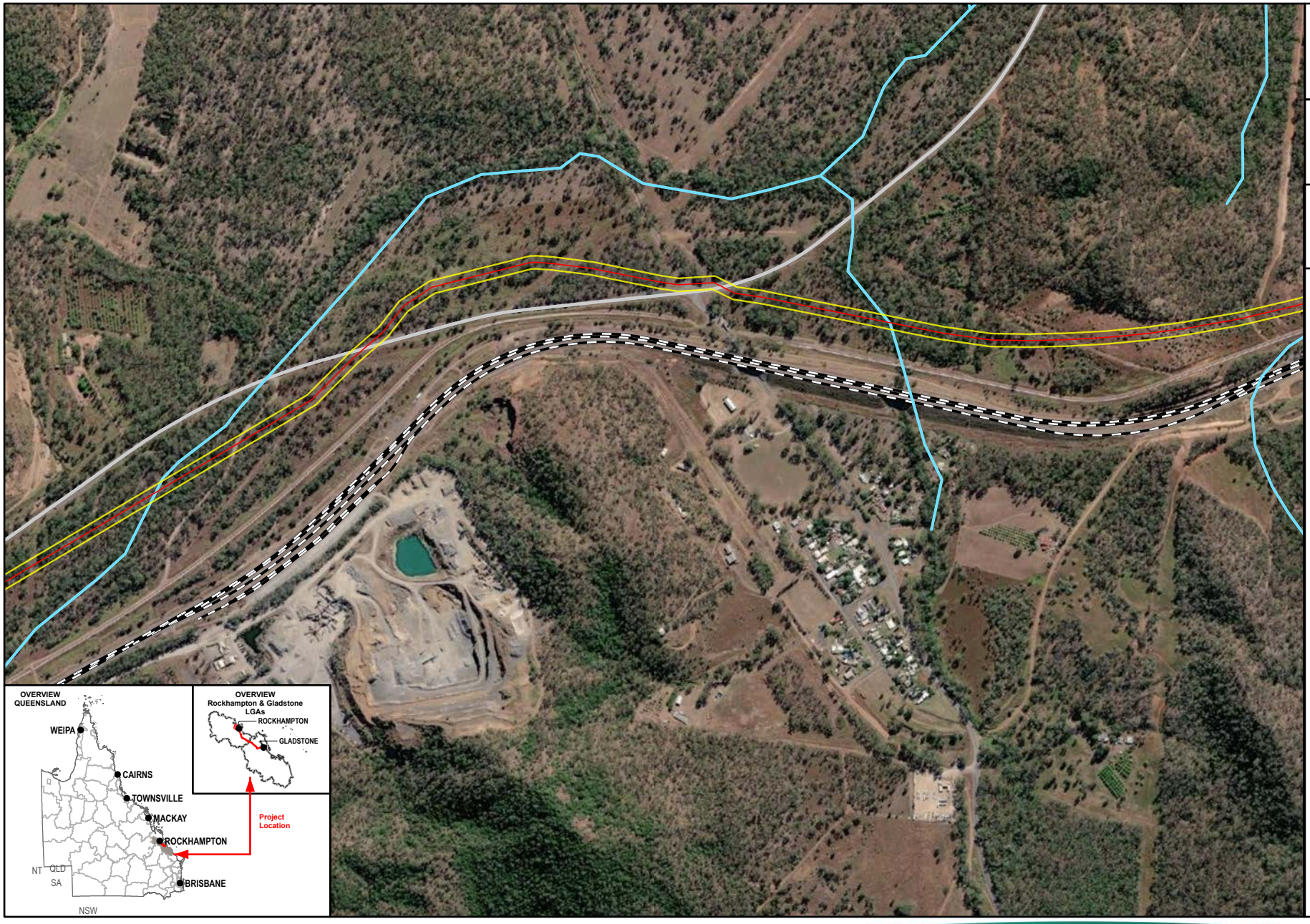
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-3a
Distribution of Powerful Owl Habitat Within the GSDA Study Area
000-G-MAP-2425 Version:3 Date:19/09/2022



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Fitzroy to Gladstone Pipeline
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Figure 7-3b
Distribution of Powerful Owl Habitat Within the GSDA Study Area
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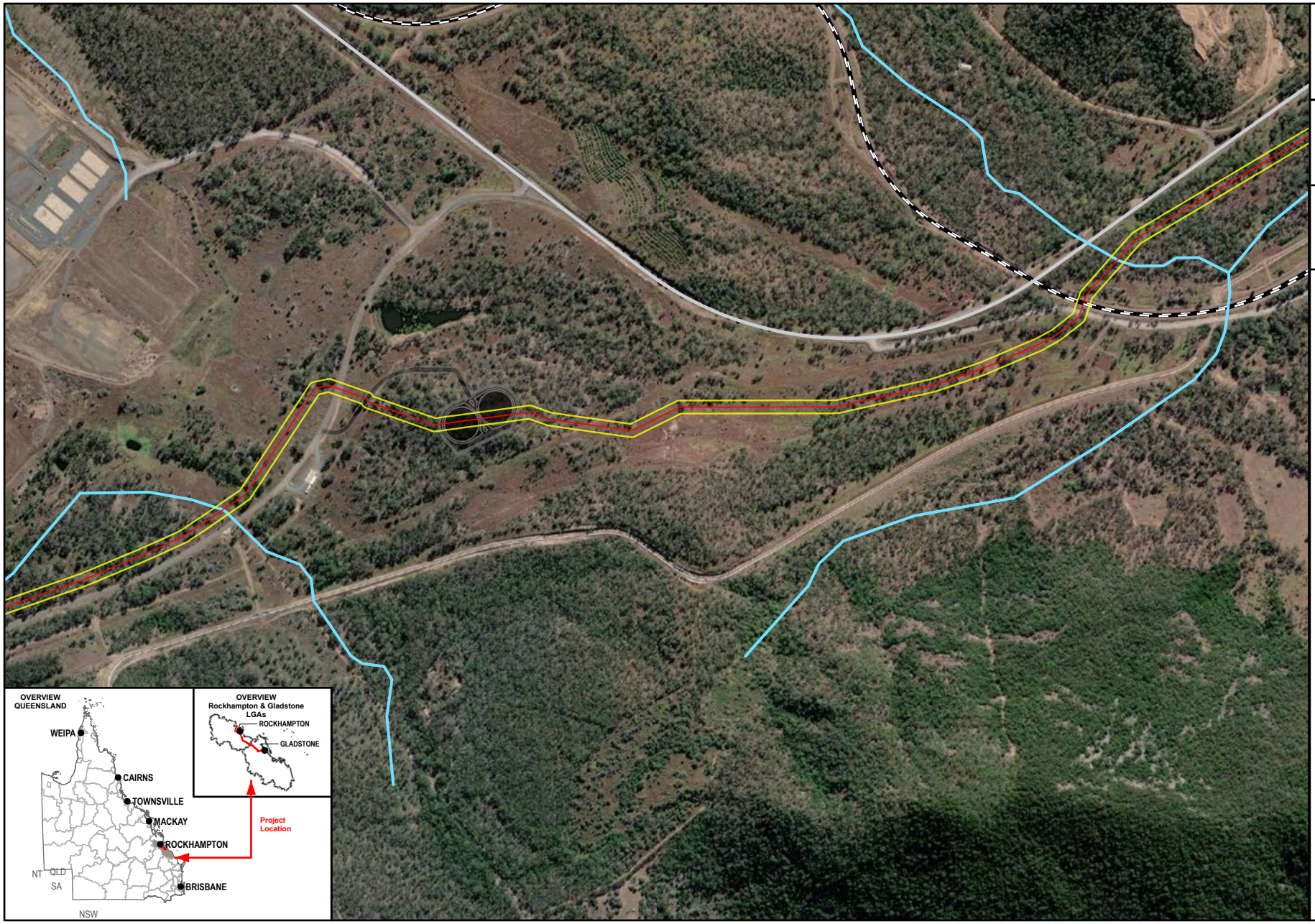

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Legend

- GSDA Pipeline Alignment
- Study Area
- Aldoga Reservoirs Layout
- Waterways
- Main Roads
- Railways

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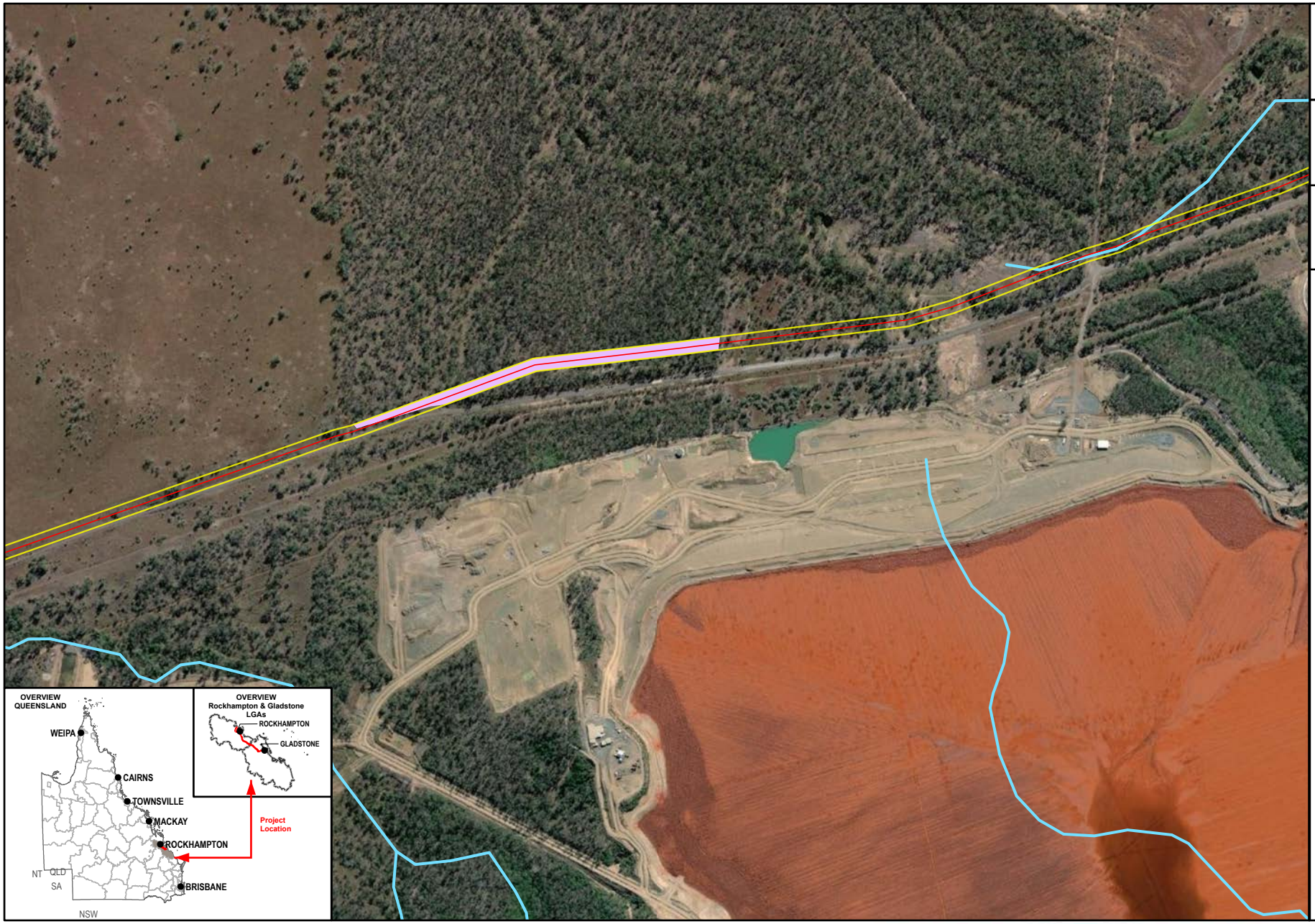
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-3c
Distribution of Powerful Owl Habitat Within the GSDA Study Area
000-G-MAP-2425 Version:3 Date:19/09/2022



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- GSDA Pipeline Alignment
- Study Area
- Predicted Powerful Owl Habitat
- Waterways

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Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-3d
Distribution of Powerful Owl Habitat Within the GSDA Study Area
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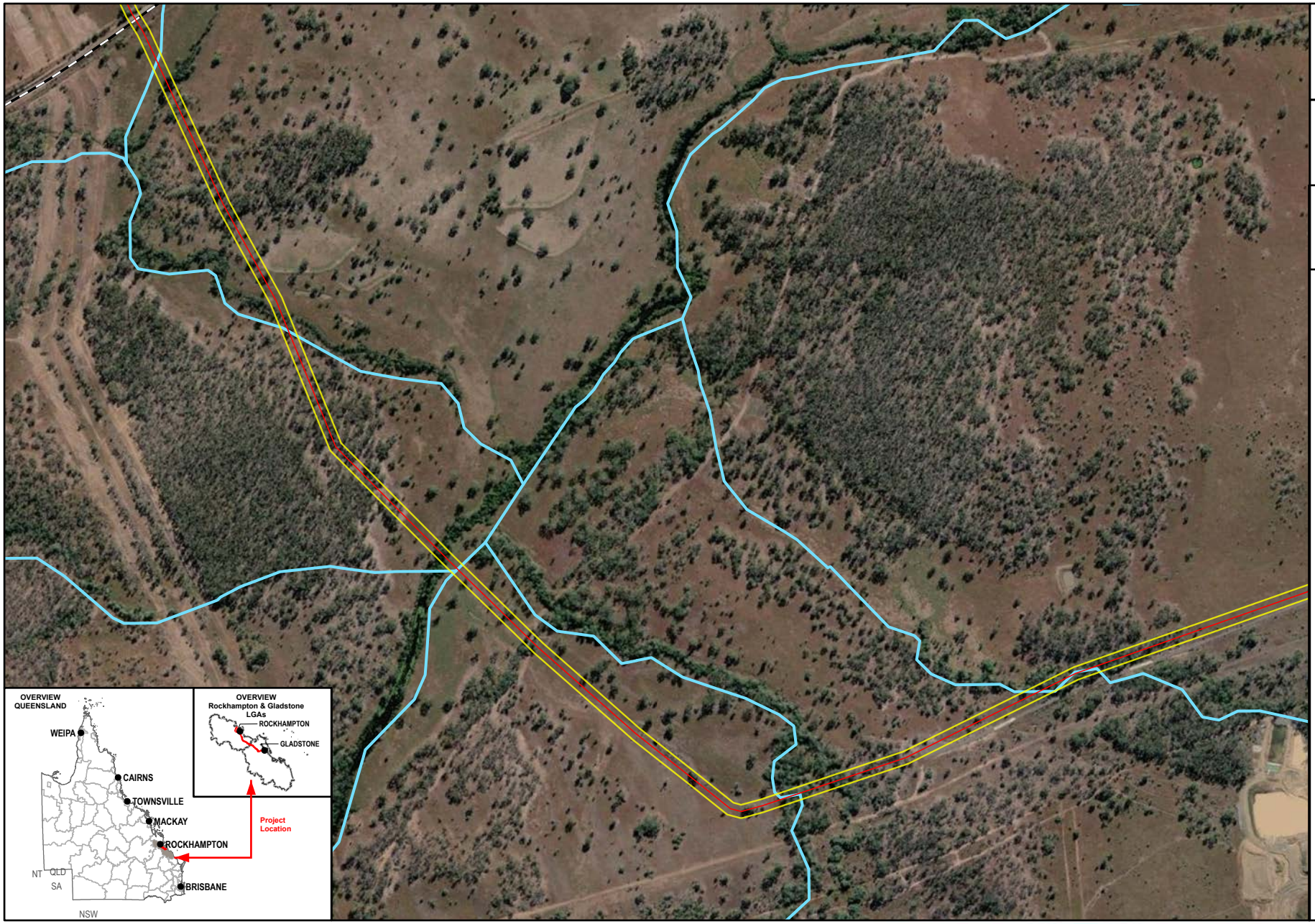

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- GSDA Pipeline Alignment
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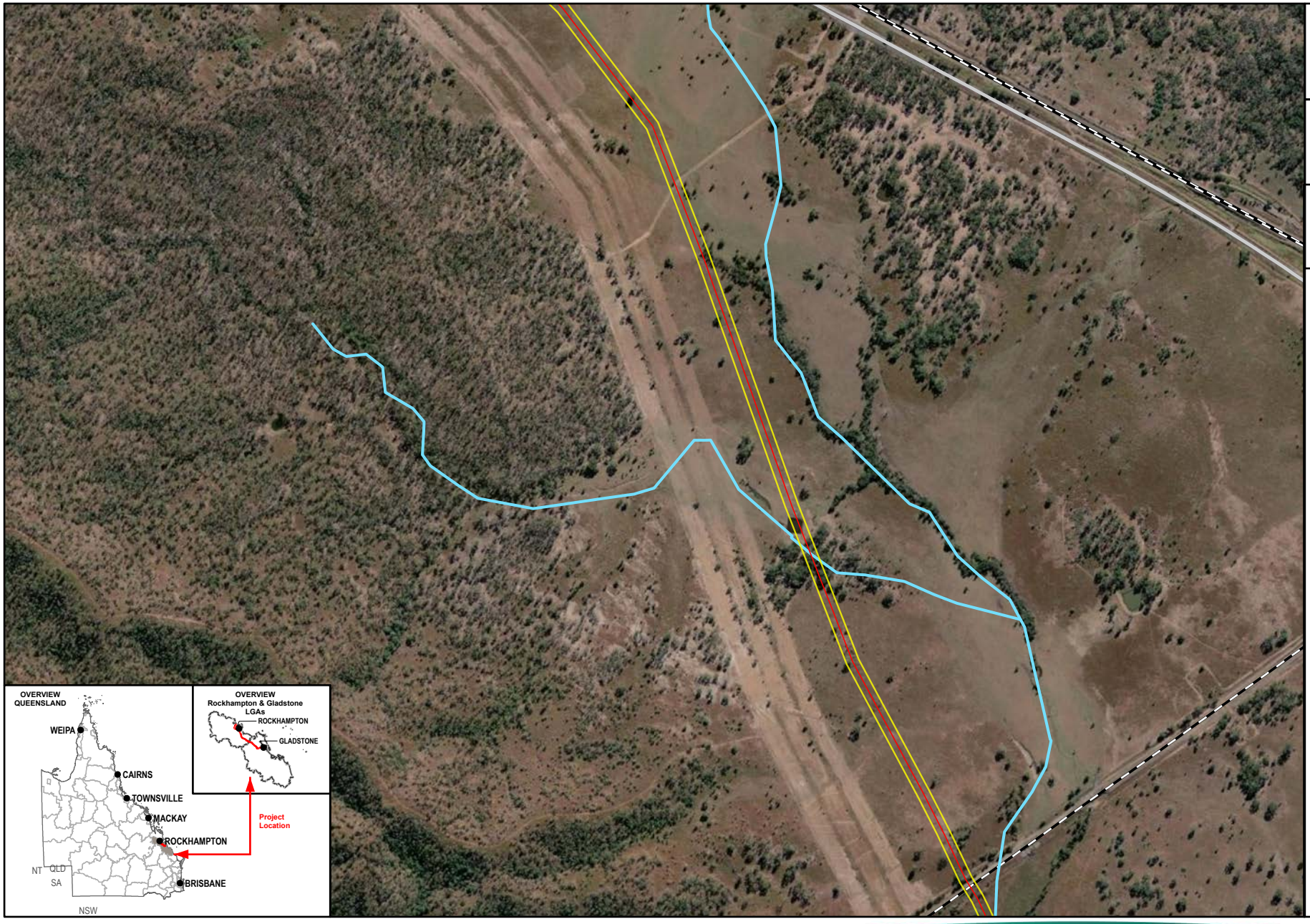
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-3e
Distribution of Powerful Owl Habitat Within the GSDA Study Area
000-G-MAP-2425 Version:3 Date:19/09/2022



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- Waterways
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Figure 7-3f
Distribution of Powerful Owl Habitat Within the GSDA Study Area
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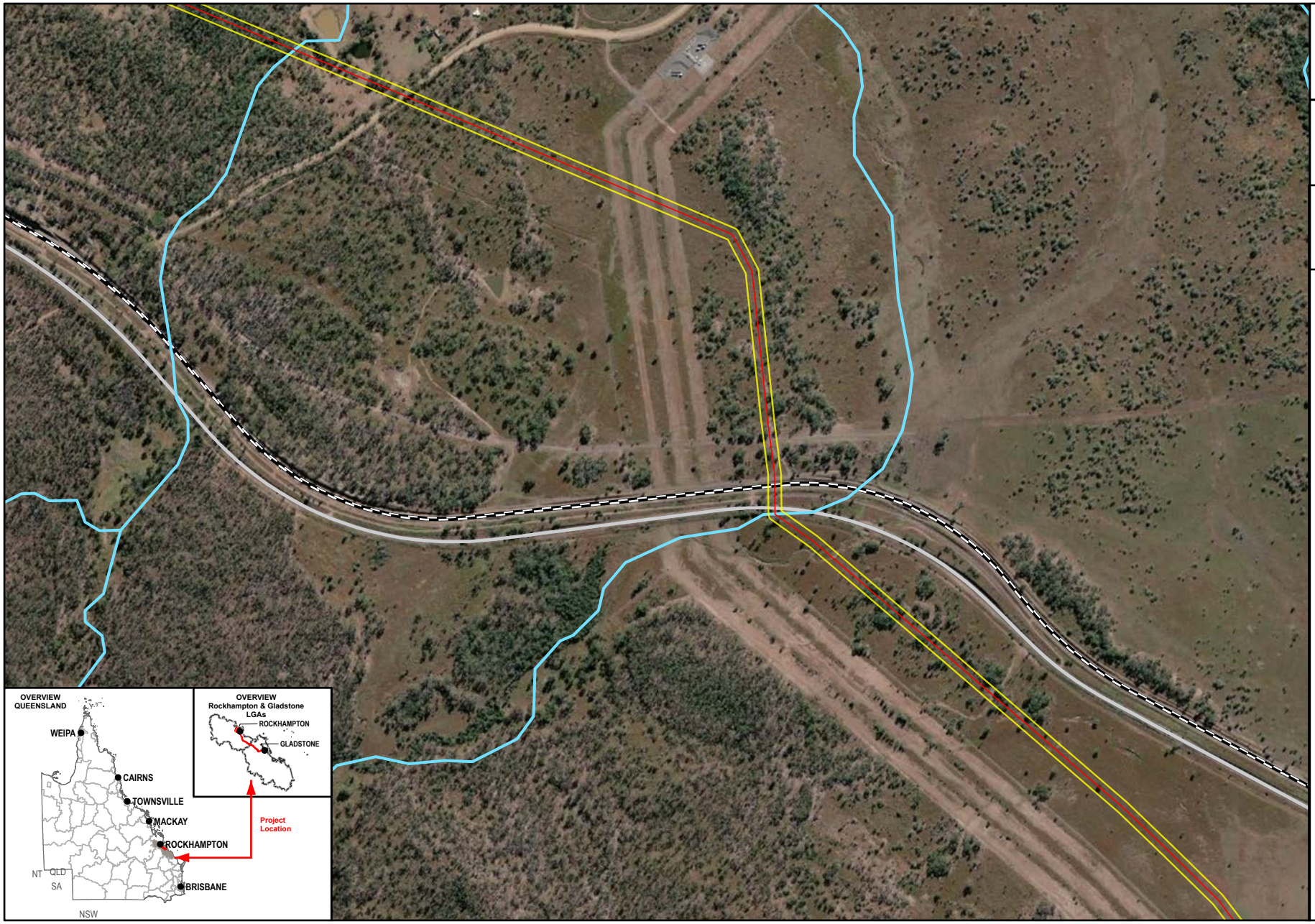

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Figure 7-3g
Distribution of Powerful Owl Habitat Within the GSDA Study Area
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7.1.1.7 Greater glider (southern and central)

Conservation status and species ecology

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

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

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

Field survey results and distribution of suitable habitat

The greater glider (southern and central) was not recorded during the field surveys within the GSDA study area. Survey effort for the greater glider (southern and central) included two nights of 2-3 hours of spotlighting and faecal pellet searches at 12 locations within potentially suitable habitat in the GSDA study area. Suitable habitat is widely distributed within the region and the species has been historically recorded at 30 locations within the desktop search extent (10 km buffer), the most recent recorded in 2014 approximately 100 m from the GSDA pipeline alignment. Many of these records have been historically recorded in riparian habitats, in close proximity to drainage lines and watercourses.

Suitable foraging habitat was recorded in eucalypt woodland areas retaining preferred tree species at numerous locations along the GSDA pipeline alignment, especially along waterways and drainage lines. Potentially suitable denning habitat was recorded within remnant and regrowth woodland habitats where hollow-bearing trees persisted in the GSDA study area A large proportion of these habitats were highly fragmented or disconnected from large remnant patches and hollow-bearing trees occurred in low numbers. Within remnant vegetation, immediately north of Aldoga Road, suitable foraging and denning habitat was recorded. This woodland retains large, mature eucalypt trees supporting high densities of suitable hollows (diameter > 10 cm) and is connected to large patches of remnant woodland. Within this woodland area, the GSDA pipeline alignment follows an existing fence line which has been largely cleared, and therefore retains low abundance of suitable hollow-bearing trees for the species.

The distribution of predicted greater glider (southern and central) habitat is mapped in Figure 7-4.

Significance of impact assessment

The project is likely to result in a significant residual impact on the greater glider (southern and central). A significance of impact assessment of the project on the greater glider (southern and central) (endangered under the EPBC Act and NC Act) is provided in Table 7-8.

Table 7-8 Significance of impact on the greater glider (southern and central)

Significant residual impact criteria	Potential to occur
A long-term decrease in the size of a local population	**Unlikely** The greater glider (southern and central) was not recorded within the GSDA study area during the field surveys. The greater glider (southern and central) has been historically recorded at 30 locations within the desktop search extent (10 km buffer), the closest record occurring approximately 100 m from the GSDA pipeline alignment near Yarwun. At a national level, all populations of the greater glider (southern and central) are considered important populations (DCCEEW 2022a). The project will result in the clearing of 20.09 ha of predicted foraging habitat and 5.28 ha of predicted denning habitat for the species, representing 0.22% of habitat available within a 5 km buffer. The GSDA pipeline alignment largely supports regrowth vegetation (retaining few hollow-bearing trees) and open landscapes that have been previously cleared for agricultural practices. The remaining areas support remnant vegetation, providing suitable foraging and denning habitat for the greater glider (southern and central). Clearing has the potential to cause direct mortality and injury of individuals. This risk will be mitigated by the employment of a fauna spotter-catcher during clearing to check hollows in large fallen trees and relocate any encountered individuals. Sequential clearing will also be adopted to allow species to self-disperse and tree felling will occur towards cleared areas, rather than towards standing vegetation. The project is not considered likely to lead to a long-term decrease in the size of the greater glider (southern and central) local population. Considering the greater glider (southern and central) has been recorded extensively within the surrounding landscape, the local population of the species is anticipated to remain largely unaffected due to the availability of habitat within the surrounding landscape. The loss of vegetation within the GSDA pipeline alignment is unlikely to (1) limit movement of resident or transient individuals; nor (2) affect the availability of resident or transient individuals to acquire key resources. The project is unlikely to lead to a long-term decrease in the size of a local population.
Reduce the extent of occurrence of the species	**Unlikely** The project will result in a loss of 20.09 ha of predicted foraging habitat and 5.28 ha of predicted denning habitat for the greater glider (southern and central). Suitable denning habitat within the GSDA pipeline alignment is located within a large area of remnant vegetation immediately north of Aldoga Road. Within this area, the GSDA pipeline alignment is expected to follow an existing fence line which has been previously cleared. Therefore, low densities of suitable denning habitat occur within the GSDA pipeline alignment, with high densities of suitable denning habitat located in woodland immediately adjacent to the GSDA pipeline alignment. The maximum width of clearing required for construction of the GSDA pipeline alignment is 30 m. Once the pipeline has been installed and buried, a maximum width of 10 m will be permanently cleared with the remaining 20 m to be rehabilitated. Clearing along the GSDA pipeline alignment is unlikely to impact the species' ability to move nor access resources in adjacent habitats, as the proposed clearing extent is narrow (30 m) and mostly linear, and unlikely to generate edge effects or impact ecosystem structure and functioning. Given the minimal loss of 25.37 ha of suitable (foraging and denning) habitat, negligible impact of local and landscape connectivity, and low levels of disturbance during the operation phase, it is unlikely to have any significant indirect impact on the species. While there will be a localised loss of habitat for the greater glider (southern and central) (including ecological significant locations), this will not have a bearing on the species' extent of occurrence. Accordingly, the project is unlikely to reduce the extent of occurrence of the species, especially noting the definition of extent of occurrence per the Queensland *Significant Residual Impact Guideline* (DEHP 2014b): *Extent of occurrence is defined as the area contained within the shortest continuous imaginary boundary which can be drawn to encompass all the known, inferred or projected sites of present occurrence of a taxon*.

Significant residual impact criteria	Potential to occur
Fragment an existing population	**Unlikely** Greater gliders have been recorded gliding up to 100 m (Menkhorst and Knight 2011), but it is more widely accepted that their typical maximum gliding distance is 60 m (Weston 2003), and an average glide length is typically 25 to 35 m (with a launch height of 20 to 25 m) (Australian Museum Business Service 2001). The ability to glide at these distances enables gliders to traverse relatively open habitat providing that the distance between trees does not exceed the species' gliding capability (references within Ball and Goldingay 2008). Even when the distance between trees exceeds the maximum gliding distance, some glider species will glide some of the distance and then move across the ground to the next tree for the remaining short distance (van der Ree *et al*. 2003). The maximum width of clearing required for construction of the GSDA pipeline alignment (i.e. 30 m) is not considered to exceed the volplane distance of the species. As such, habitat loss within the GSDA pipeline alignment is not expected to impact connectivity between greater glider (southern and central) habitat retained on either side of the corridor as the habitat losses will be localised and is unlikely to create large gaps that present new barriers to greater glider (southern and central) movement. Connectivity to extensive areas of suitable habitat will persist in the surrounding landscape allowing opportunities for movement. Furthermore, large areas of remnant habitat are located within Mount Stowe State Forest, Calliope Conservation Park and Mount Larcom. Therefore, the GSDA pipeline alignment is unlikely to fragment an existing greater glider (southern and central) population.
Result in genetically distinct populations forming as a result of habitat isolation	**Unlikely** As detailed above, the species' capacity to move locally and regionally is unlikely to be limited by any localised clearing necessary to construct the GSDA pipeline alignment. As a result, the project is unlikely to cause any form of genetic isolation at a population level.
Result in invasive species that are harmful to a endangered species becoming established in the endangered species' habitat	**Unlikely** The project is unlikely to result in the introduction or spread of invasive species beyond current levels. The implementation of a Weed and Pest Management Plan will further reduce potential impacts of invasive species. As such, the project is not expected to result in invasive species that are harmful to the greater glider (southern and central) becoming established in the species' habitat.
Introduce disease that may cause the population to decline	**Unlikely** Disease is not a known threat to the species; however, greater glider habitat is susceptible to *Phytophthora cinnamomi* due the soil fungus's ability to infect eucalypt species. Clearance of vegetation will engage standard hygiene protocols to limit the potential for introduction or spread of phytophthora throughout the GSDA pipeline alignment (i.e. beginning works with clean vehicles and undertaking clearing works during dry conditions). Considering the implementation of strict biosecurity protocols, the project is unlikely to introduce a disease that may cause the species to decline.
Interfere with the recovery of the species	**Unlikely** The project is unlikely to interfere with the recovery of the species. The greater glider (southern and central) has been widely recorded within region, with large, contiguous patches of suitable habitat located adjacent to the project. Although the project will remove 20.09 ha of predicted foraging habitat and 5.28 ha of predicted denning habitat, equating to 0.22 % of habitat available within a 5 km buffer, the remaining habitat is connected to an extensive network of suitable habitat to facilitate dispersal of the species and enable recolonization. The impacts of the GSDA pipeline alignment are expected to be relatively benign, as the maximum corridor width (30 m) is well below the species maximum volplane distance) and is unlikely to produce fragmentation or habitat isolation. The risk of individual mortality or injury during construction will be addressed via the mitigation measures in the CEMP and the use sequential clearing and an experienced fauna spotter-catcher during clearing. Noting the above points relating to very limited if any effects on local populations (e.g. declines), extent of occurrence, fragmentation, invasive species, and disease, the project is not considered likely to interfere with the recovery of the greater glider (southern and central).

Significant residual impact criteria	Potential to occur
Result in disruption to ecologically significant locations (breeding, feeding or nesting sites) of a species	**Likely** The project will require the clearing of 25.37 ha of potentially suitable foraging and denning habitat for the greater glider (southern and central). Although the GSDA pipeline alignment has largely been placed within or adjacent to areas that have been previously cleared, the project will result in a loss of this species' preferred feed and den tree species, including *Corymbia citriodora*, *Eucalyptus moluccana*, *E. tereticornis* and *E. crebra.* Four tree species have been identified as frequently used foraging trees (Eyre *et al.* 2022), two of which were recorded within the GSDA study area, including *C. citriodora* and *E. moluccana.* In some months, the species has also been identified to favour *E. tereticornis* and *E. crebra* (Eyre *et al.* 2022), which were both observed throughout the GSDA study area. A study undertaken by Smith *et al.* 2007, found that greater gliders within the Brigalow Belt bioregion preferred certain tree species, including *E. fibrosa, E. moluccana* and *C. citriodora*, for denning and foraging. While the project is not expected to cause a long-term decline in the local population, reduce its extent of occurrence, cause adverse habitat fragmentation effects nor interfere with the recovery of the species, the loss of suitable greater glider (southern and central) habitat within the GSDA pipeline alignment is likely to result in disruption to ecologically significant foraging and breeding locations.
Conclusion	A conservative assessment has identified that the project is likely to result in a significant residual impact on the greater glider (southern and central). Although the GSDA pipeline alignment has been located within areas that have been previously cleared for agricultural practices and linear infrastructure such as railways, roads, access tracks and pipelines, the project will require the clearing of 25.37 ha of woodland areas retaining preferred food trees and suitable denning habitat within the GSDA pipeline alignment.

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- GSDA Pipeline Alignment
- Study Area

Predicted Greater Glider Habitat

Habitant Type

- Potential Foraging Habitat
- Potential Denning Habitat
- Waterways
- Main Roads
- Railways

Data Sources:

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Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-4a
Distribution of Great Glider Habitat Within the GSDA Study Area

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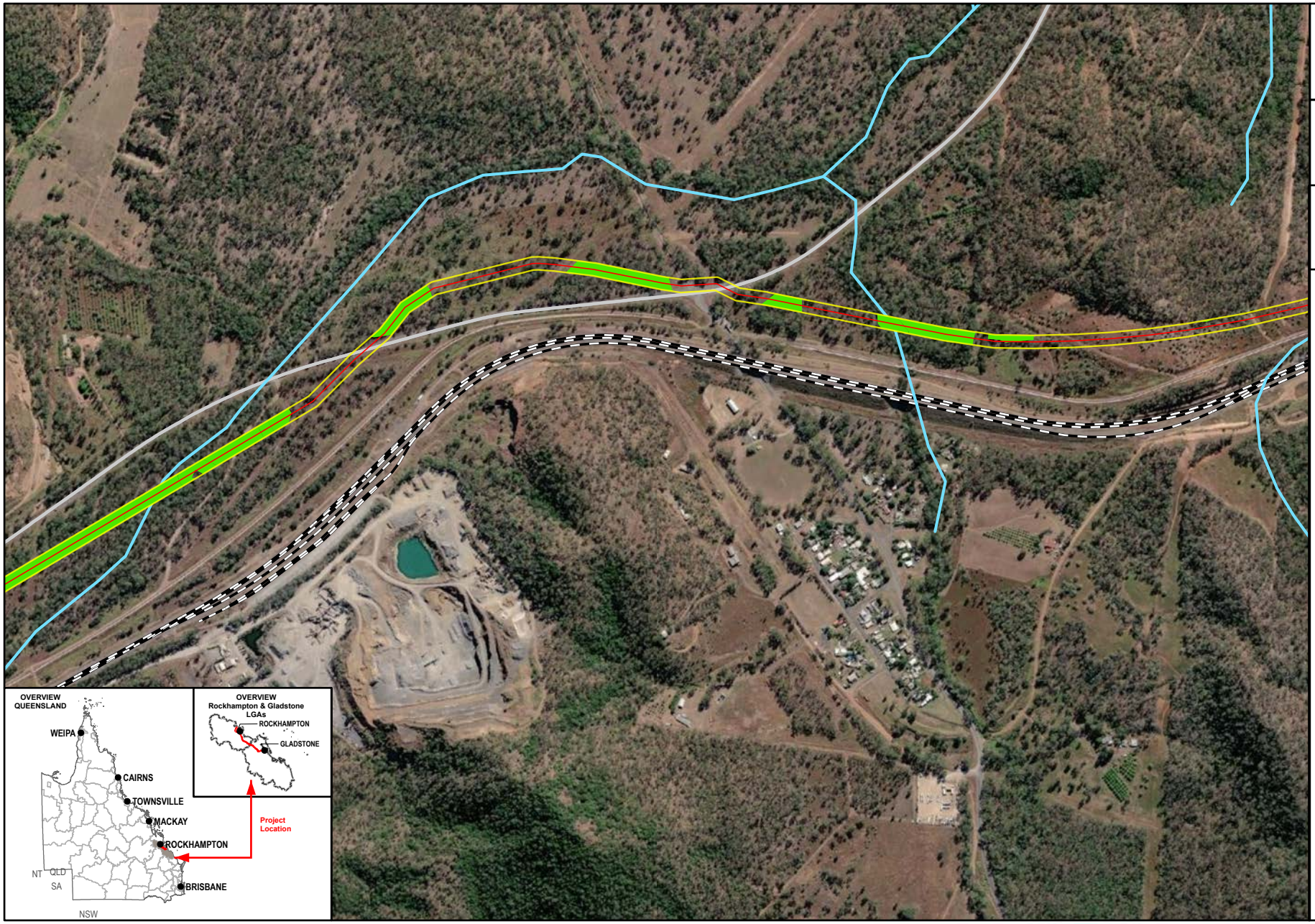

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Predicted Greater Glider Habitat

Habitant Type

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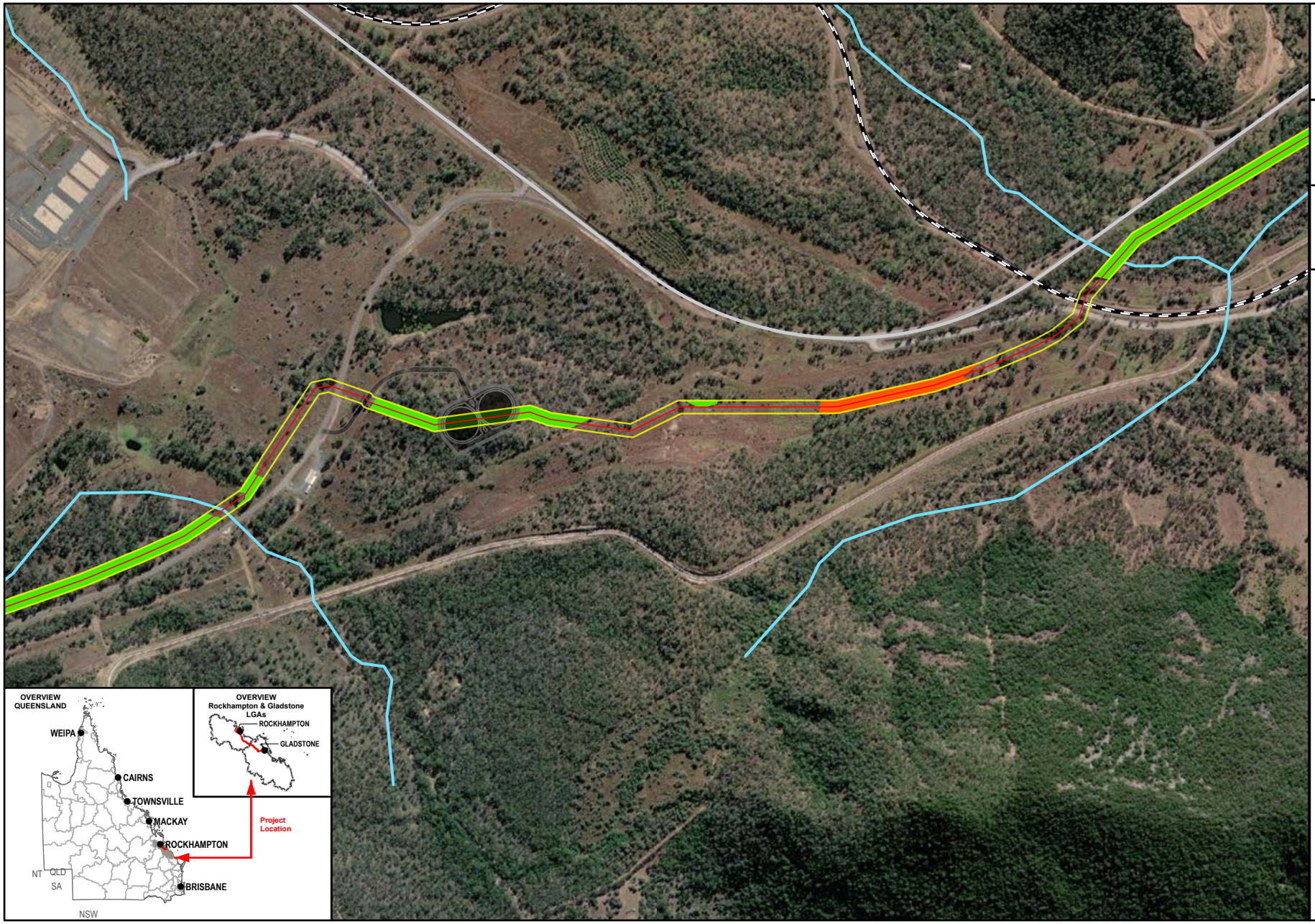

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Habitant Type

- Potential Foraging Habitat
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- Aldoga Reservoirs Layout
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PROJECTION UTM Zone 56
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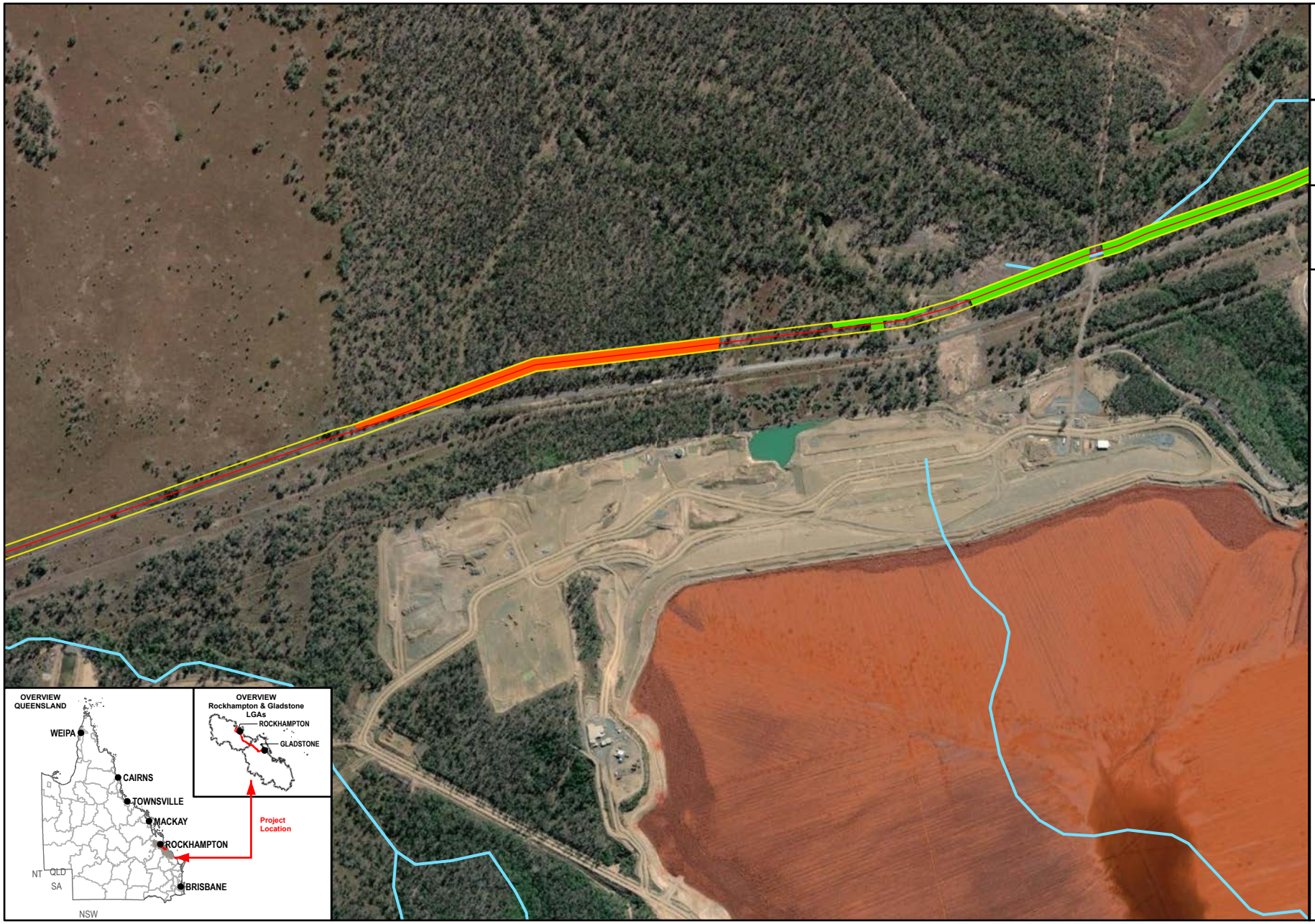
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-4c
Distribution of Great Glider Habitat Within the GSDA Study Area
000-G-MAP-2426 Version:4 Date:19/09/2022



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Legend

- GSDA Pipeline Alignment
- Study Area

Predicted Greater Glider Habitat

Habitant Type

- Potential Foraging Habitat
- Potential Denning Habitat
- Waterways

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

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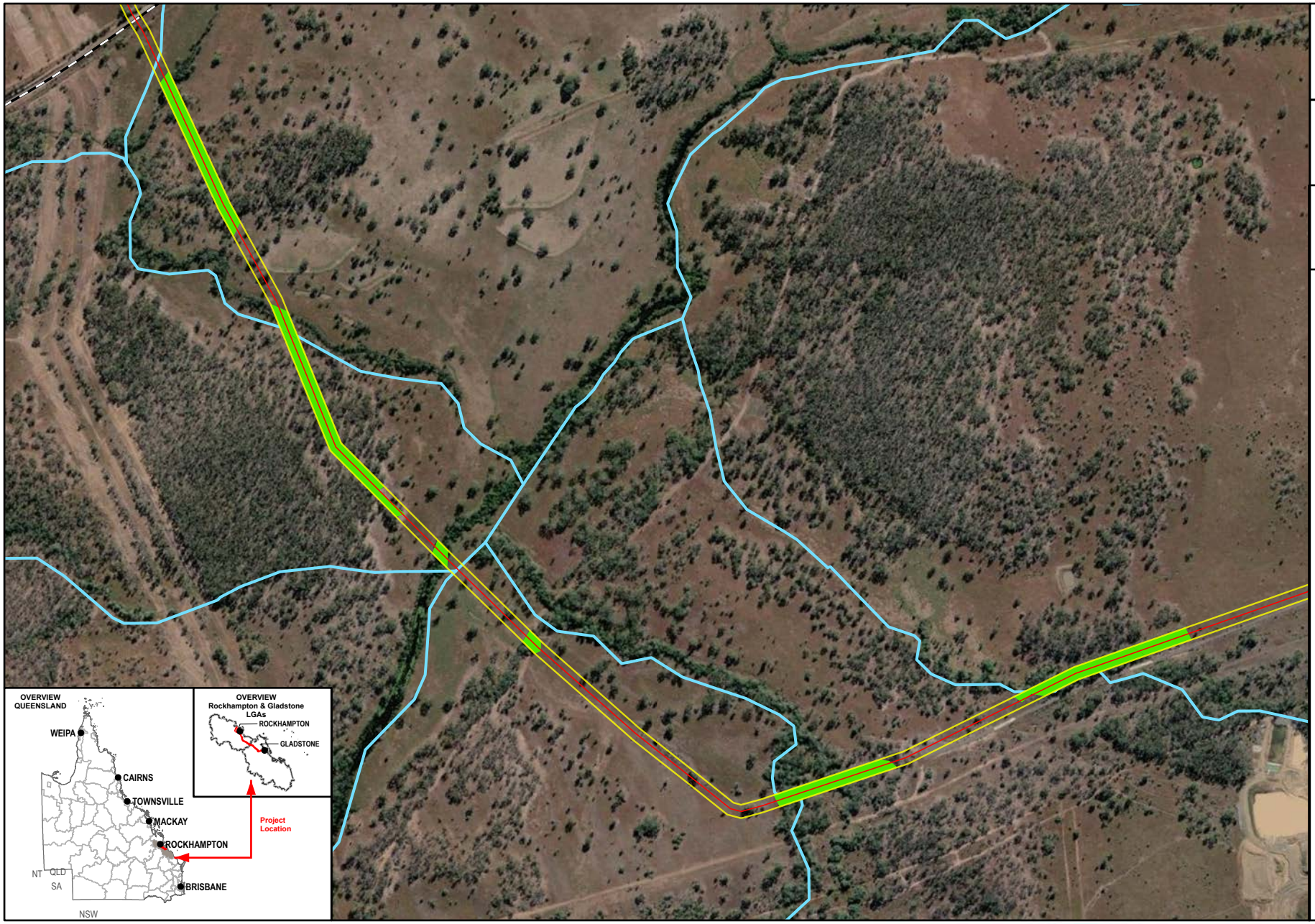
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-4d
Distribution of Great Glider Habitat Within the GSDA Study Area
000-G-MAP-2426 Version:4 Date:19/09/2022



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Legend

- GSDA Pipeline Alignment
- Study Area

Predicted Greater Glider Habitat

Habitant Type

- Potential Foraging Habitat
- Waterways
- Railways

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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Fitzroy to Gladstone Pipeline
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Figure 7-4e
Distribution of Great Glider Habitat Within the GSDA Study Area
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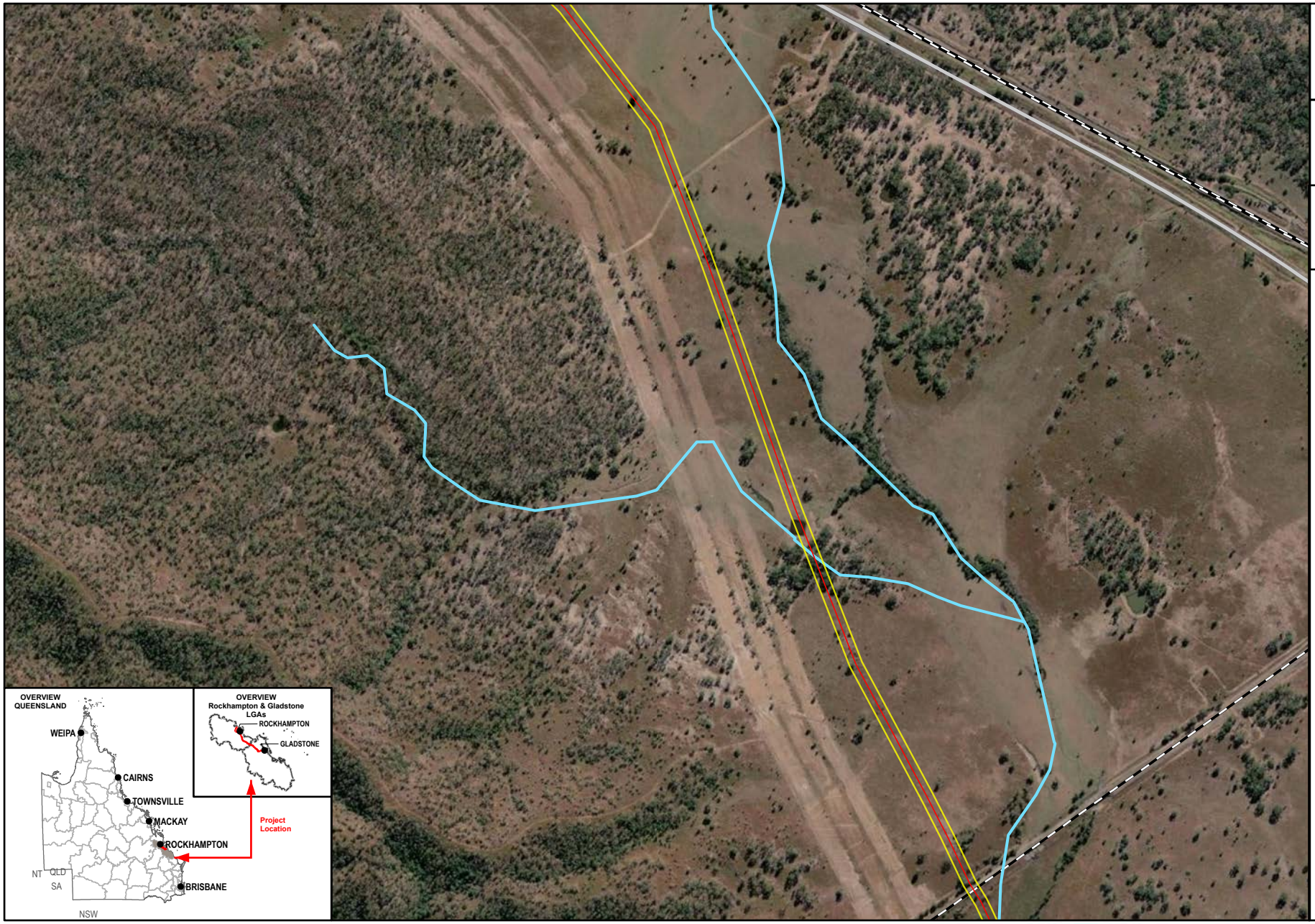

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Legend

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

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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Figure 7-4f
Distribution of Great Glider Habitat Within the GSDA Study Area
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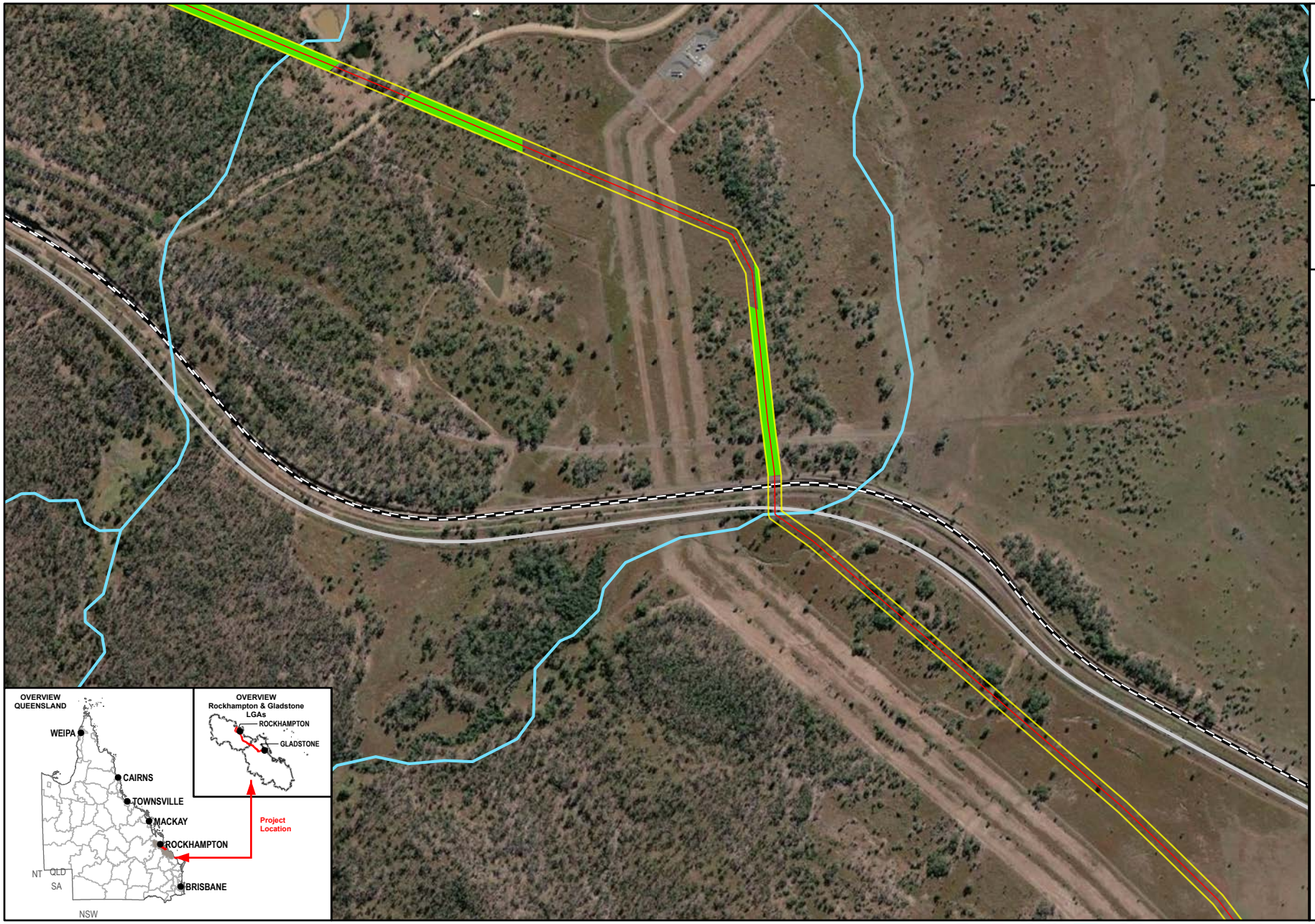

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Legend

- GSDA Pipeline Alignment
- Study Area

Predicted Greater Glider Habitat

Habitant Type

- Potential Foraging Habitat
- Waterways
- 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 7-4g
Distribution of Great Glider Habitat Within the GSDA Study Area

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7.1.1.8 Yellow-bellied glider (south-eastern)

Conservation status and species ecology

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

Field survey results and distribution of suitable habitat

No yellow-bellied glider (south-eastern) individuals or V-shaped incisions on smooth-barked eucalypts were recorded during the field surveys within the GSDA study area. Survey effort for the yellow-bellied glider (south-eastern) included two nights of 2-3 hours of spotlighting within potentially suitable habitat in the GSDA study area. Suitable habitat was recorded within the GSDA study area, and the species has been historically recorded at 15 locations within the desktop search extent (10 km buffer), the closest record located approximately 100 m from the GSDA pipeline alignment. Many of these records have been historically recorded in riparian habitats, in close proximity to drainage lines and watercourses.

Suitable foraging habitat was recorded in eucalypt woodland areas retaining preferred tree species at numerous locations along the GSDA pipeline alignment, especially along waterways and drainage lines. Potentially suitable denning habitat was recorded within remnant and regrowth woodland habitats where hollow-bearing tree persisted in the GSDA study area. A large proportion of these habitats were highly fragmented or disconnected from large remnant patches and hollow-bearing trees occurred in low numbers. Within remnant vegetation, immediately north of Aldoga Road, suitable foraging and denning habitat was recorded. This woodland retains large, mature eucalypt trees supporting high densities of suitable hollows, and is connected to large patches of remnant woodland (> 200 ha^2). Within this woodland area, the GSDA pipeline alignment follows an existing fence line which has been previously cleared, and therefore retains low densities of suitable hollow-bearing trees for the species. The distribution of predicted yellow-bellied glider (south-eastern) habitat is mapped in Figure 7-5.

Significance of impact assessment

The project is likely to result in a significant residual impact on the yellow-bellied glider (south-eastern). A significance of impact assessment of the project on the yellow-bellied glider (south-eastern) (vulnerable under the EPBC Act and NC Act) is provided in Table 7-9.

Table 7-9 Significance of impact on the yellow-bellied glider (south-eastern)

Significant residual impact criteria	Potential to occur
A long-term decrease in the size of a local population	**Unlikely** The yellow-bellied glider (south-eastern) has been historically recorded at 15 locations within the desktop search extent (10 km buffer), the closest record located approximately 100 m from the GSDA pipeline alignment near Yarwun. Due to a lack of population information, all local yellow-bellied glider (south-eastern) population are considered important populations (DAWE 2022a). The project will result in the clearing of 18.86 ha of predicted foraging habitat and 5.28 ha of predicted denning habitat for the species, representing 0.21% of habitat available within a 5 km buffer. The species is reliant on smooth-barked eucalypts for foraging given its tendency to acquire sap by incising directly into the bark. Mature smooth-barked eucalypt trees are moderately abundant within the GSDA pipeline alignment; however, low amounts of suitable denning habitat were recorded. The GSDA pipeline alignment largely supports regrowth vegetation (retaining few hollow-bearing trees) and open landscapes that have been previously cleared for agricultural practices. The remaining areas support remnant vegetation, providing suitable foraging and denning habitat for the yellow-bellied glider (south-eastern). Clearing has the potential to cause direct mortality and injury of individuals.

Significant residual impact criteria	Potential to occur
	This risk will be mitigated by the employment of a fauna spotter-catcher during clearing to check hollows in large fallen trees and relocate any encountered individuals. Sequential clearing will also be adopted to allow species to self-disperse and tree felling will occur towards cleared areas, rather than towards standing vegetation. The project is not considered likely to lead to a long-term decrease in the size of the yellow-bellied glider (south-eastern) local population. Considering the species has a large capacity for movement and can periodically move to access areas of foraging habitat, the species' local population is anticipated to remain largely unaffected due to the availability of habitat within the surrounding landscape. The loss of vegetation within the GSDA pipeline alignment is unlikely to (1) limit movement of resident or transient individuals; nor (2) affect the availability of resident or transient individuals to acquire key resources. The project is unlikely to lead to a long-term decrease in the size of a local population.
Reduce the extent of occurrence of the species	**Unlikely** The species is reliant on access to smooth-barked hollow-bearing trees (i.e. *Eucalyptus tereticornis* and *Corymbia citriodora*) for denning and foraging. As mentioned above, mature smooth-barked eucalypt trees are moderately abundant within the GSDA pipeline alignment, with low densities of suitable denning habitat. High densities of suitable denning sites were observed in mature woodland immediately adjacent to the GSDA pipeline alignment. The maximum width of clearing required for construction of the GSDA pipeline alignment is 30 m. Once the pipeline has been installed and buried, a maximum width of 10 m will be permanently cleared with the remaining 20 m to be rehabilitated. Clearing along the GSDA pipeline alignment is unlikely to impact the species as the proposed clearing extent is narrow (30 m) and mostly linear, and unlikely to generate edge effects or impact ecosystem structure and functioning. Given the minimal loss of 18.86 ha of suitable foraging habitat and 5.28 ha of suitable denning habitat, negligible impact of local and landscape connectivity, and low levels of disturbance during the operation phase, it is unlikely to have any significant indirect impact on the species. While there will be a localised loss of habitat for the yellow-bellied glider (south-eastern) (including ecological significant locations), this won't have a bearing on the species' extent of occurrence. Accordingly, the project is unlikely to reduce the extent of occurrence of the species, especially noting the definition of extent of occurrence per the Queensland *Significant Residual Impact Guideline* (DEHP 2014b): *Extent of occurrence is defined as the area contained within the shortest continuous imaginary boundary which can be drawn to encompass all the known, inferred or projected sites of present occurrence of a taxon*.
Fragment an existing population	**Unlikely** Linear impacts along the GSDA pipeline alignment is not considered to exceed the species' volplane distance and are unlikely to cause any fragmentation in the species habitat, as yellow-bellied gliders (southern) has been recorded to glide to a maximum distance of 140 m (DAWE 2022a). Connectivity to extensive areas of suitable habitat will persist in the surrounding landscape allowing opportunities for movement. Furthermore, large areas of remnant habitat are located within Mount Stowe State Forest, Calliope Conservation Park and Mount Larcom. Therefore, the GSDA pipeline alignment is unlikely to fragment an existing yellow-bellied glider (south-eastern) population.
Result in genetically distinct populations forming as a result of habitat isolation	**Unlikely** As detailed above, the species' capacity to move locally and regionally is unlikely to be limited by any localised land clearing necessary to construct the GSDA pipeline alignment. As a result, the project is unlikely to cause any form of genetic isolation at a population level.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat	**Unlikely** The predation by European red foxes (*Vulpes vulpes*) and feral cats (*Felis catus*) are listed as a threat to the yellow-bellied glider (south-eastern). It has been shown that European red foxes are able to climb trees where to can predate on living gliders, with feral cats likely eating the subspecies through scavenging (DAWE 2022a). The project is not considered likely to increase the incidence of any invasive species (particularly European red foxes and feral cats) that could threaten the yellow-bellied glider (south-eastern), especially noting mitigation measures in place to manage invasive species.

Significant residual impact criteria	Potential to occur
Introduce disease that may cause the population to decline	**Unlikely** The yellow-bellied glider (south-eastern) is potentially susceptible to adverse impact from *Phytophthora cinnamomi* due the soil fungus's ability to infect *Eucalyptus* species. Biosecurity requirements (e.g. weed and seed declarations) will be implemented throughout the project, and thus, this risk has been assessed as low.
Interfere with the recovery of the species	**Unlikely** The project is unlikely to interfere substantially with the recovery of the species. The yellow-bellied glider (south-eastern) has been widely recorded within region, with large, contiguous patches of suitable habitat located adjacent to the project. Although the project will remove 18.86 ha of predicted foraging habitat and 5.28 ha of denning habitat, equating to 0.21 % of habitat available within a 5 km buffer, the remaining habitat is connected to an extensive network of suitable habitat. The impacts of the GSDA pipeline alignment are expected to be relatively benign, as the maximum corridor width (30 m) is well below the species maximum volplane distance (> 100 m) and is unlikely to produce fragmentation or habitat isolation. The risk of individual mortality or injury during construction will be addressed via the mitigation measures in the CEMP and the use of sequential clearing and an experienced fauna spotter-catcher during clearing. Noting the above points relating to very limited if any effects on local populations (e.g. declines), extent of occurrence, fragmentation, invasive species, and disease, the project is not considered likely to interfere with the recovery of the yellow-bellied greater glider (south-eastern).
Cause disruptions to ecologically significant locations of a species	**Likely** The project will require the clearing of 24.14 ha of potentially suitable foraging and denning habitat for the yellow-bellied glider (south-eastern). Although the GSDA pipeline alignment has largely been placed within or adjacent to areas that have been previously cleared, the project will result in a loss of species preferred trees species, including *Corymbia citriodora, Eucalyptus moluccana* and *E. tereticornis*, for foraging and denning. While the project is not expected to cause a long-term decline in the local population, reduce its extent of occurrence, cause adverse habitat fragmentation effects nor interfere with the recovery of the species, the loss of suitable yellow-bellied glider (south-eastern) habitat within the GSDA pipeline alignment is likely to result in disruption to ecologically significant foraging and breeding locations.
Conclusion	A conservative assessment has identified that the project is likely to result in a significant residual impact on the yellow-bellied glider (south-eastern). Although the GSDA pipeline alignment has been located within areas that have been previously cleared for agricultural practices and linear infrastructure such as railways, roads, access tracks and pipelines, the project will require the clearing of 24.14 ha of woodland areas retaining preferred food trees and suitable denning habitat within the GSDA pipeline alignment.

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Legend

- GSDA Pipeline Alignment
- Study Area

Predicted Yellow-bellied Glider (South-eastern) Habitat

Habitat Type

- Potential Denning Habitat
- Potential Foraging Habitat
- Waterways
- Main Roads
- Railways

Data Sources:
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 7-5a
Distribution of Yellow-bellied Glider (South-eastern) Habitat Within the GSDA Study Area

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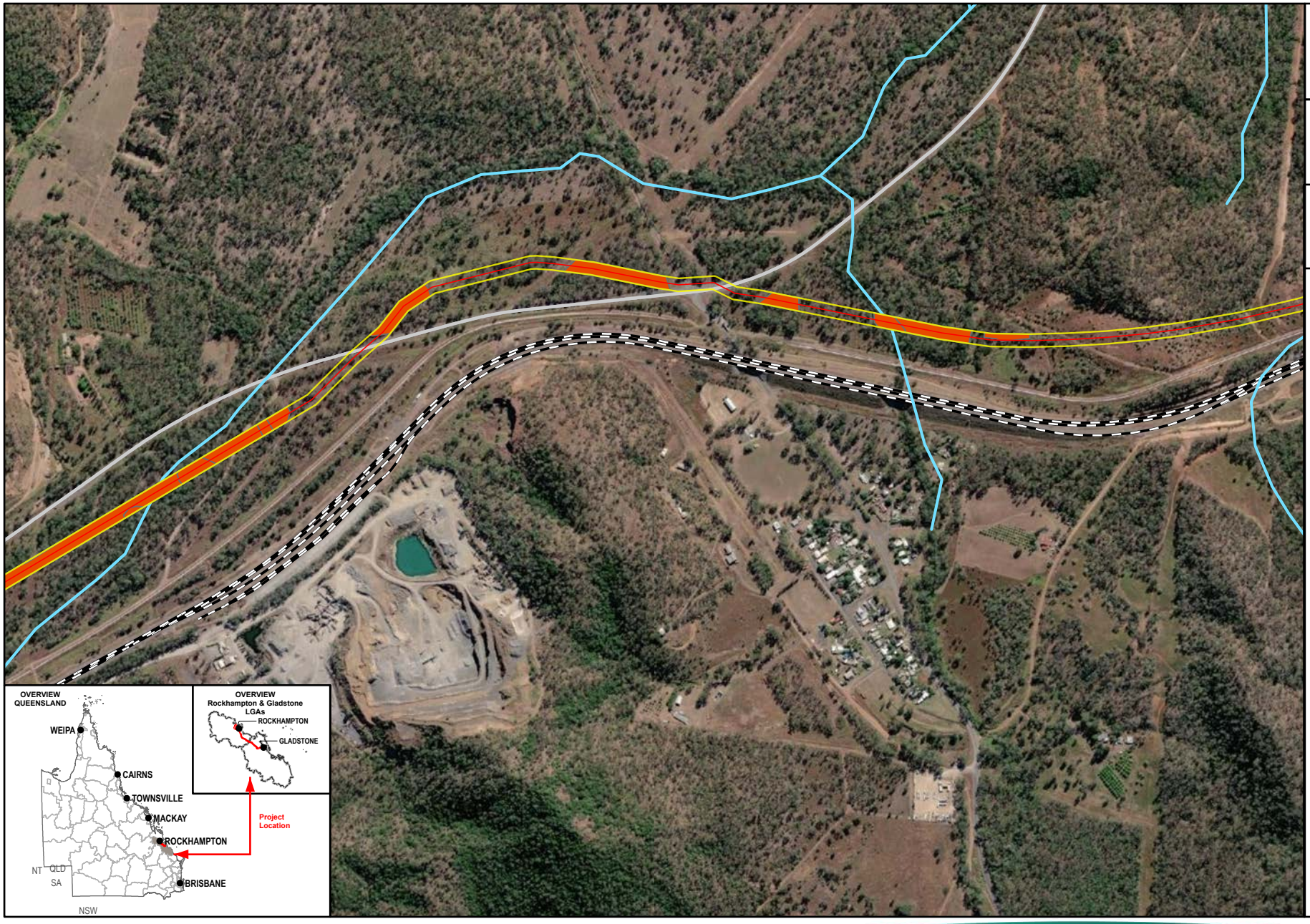

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Legend

- GSDA Pipeline Alignment
- Study Area

Predicted Yellow-bellied Glider (South-eastern) Habitat

Habitat Type

- Potential Foraging Habitat
- Waterways
- Main Roads
- Railways

Data Sources:
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(Datum GDA2020)

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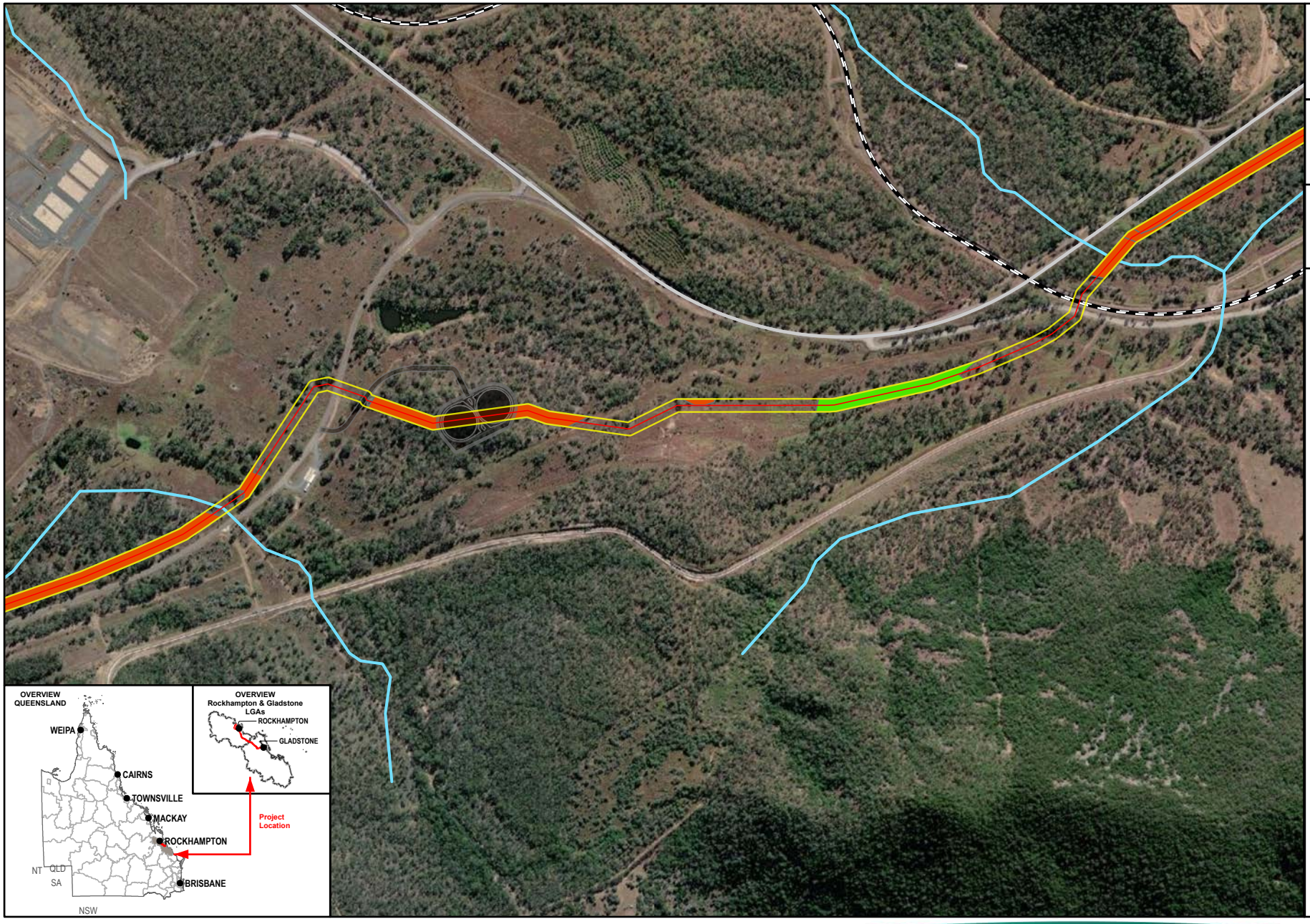
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-5b
Distribution of Yellow-bellied Glider (South-eastern) Habitat Within the GSDA Study Area

000-G-MAP-2427 Version:3 Date:19/09/2022



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Legend

- GSDA Pipeline Alignment
- Study Area

Predicted Yellow-bellied Glider (South-eastern) Habitat

Habitat Type

- Potential Denning Habitat
- Potential Foraging Habitat
- Aldoga Reservoirs Layout
- Waterways
- Main Roads
- Railways

Data Sources:
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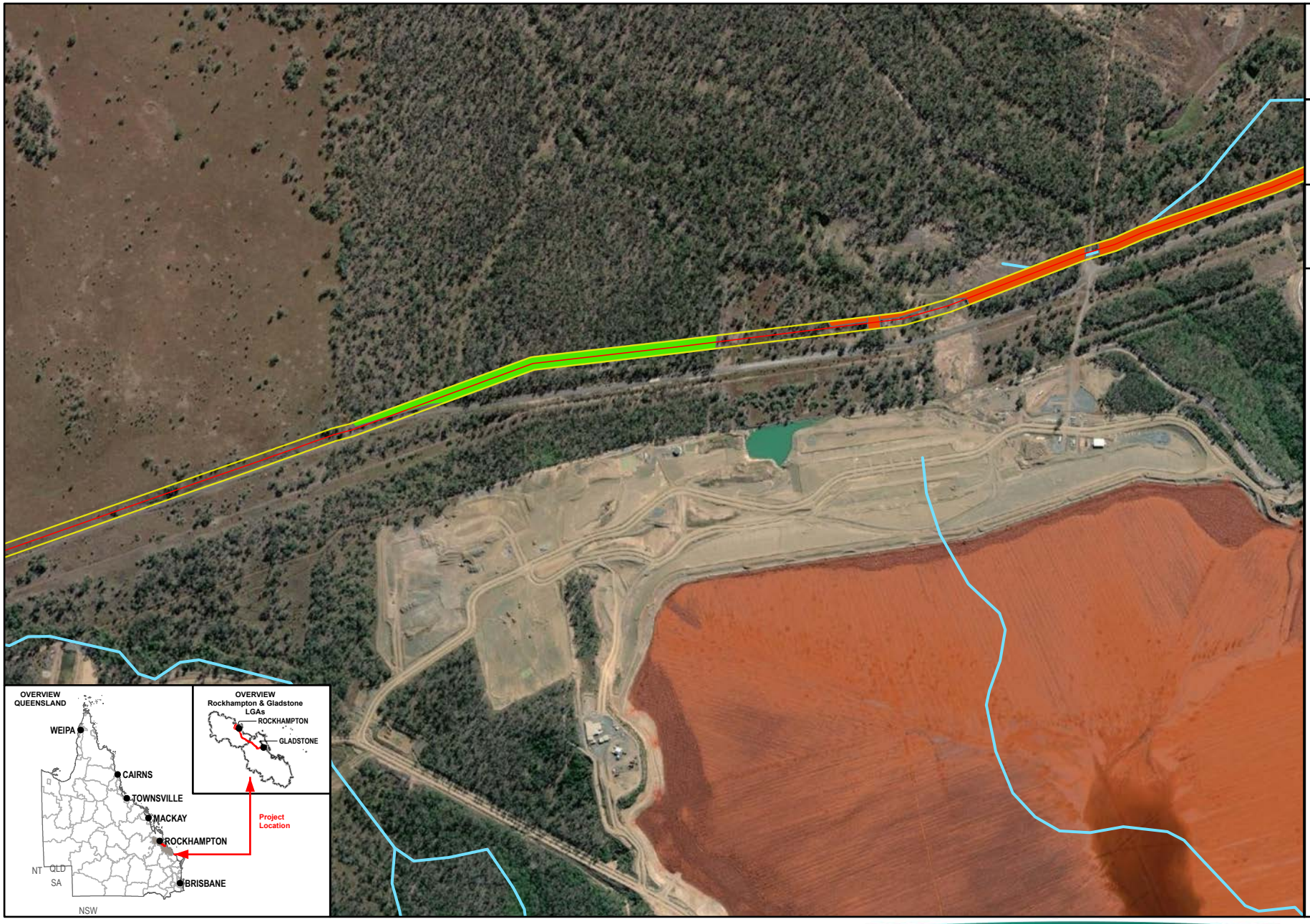
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-5c
Distribution of Yellow-bellied Glider (South-eastern) Habitat Within the GSDA Study Area

000-G-MAP-2427 Version:3 Date:19/09/2022



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Legend

- GSDA Pipeline Alignment
- Study Area

Predicted Yellow-bellied Glider (South-eastern) Habitat

Habitat Type

- Potential Denning Habitat
- Potential Foraging Habitat
- Waterways

Data Sources:
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Fitzroy to Gladstone Pipeline Baseline Terrestrial and Aquatic Ecology Technical Report

Figure 7-5d

Distribution of Yellow-bellied Glider (South-eastern) Habitat Within the GSDA Study Area

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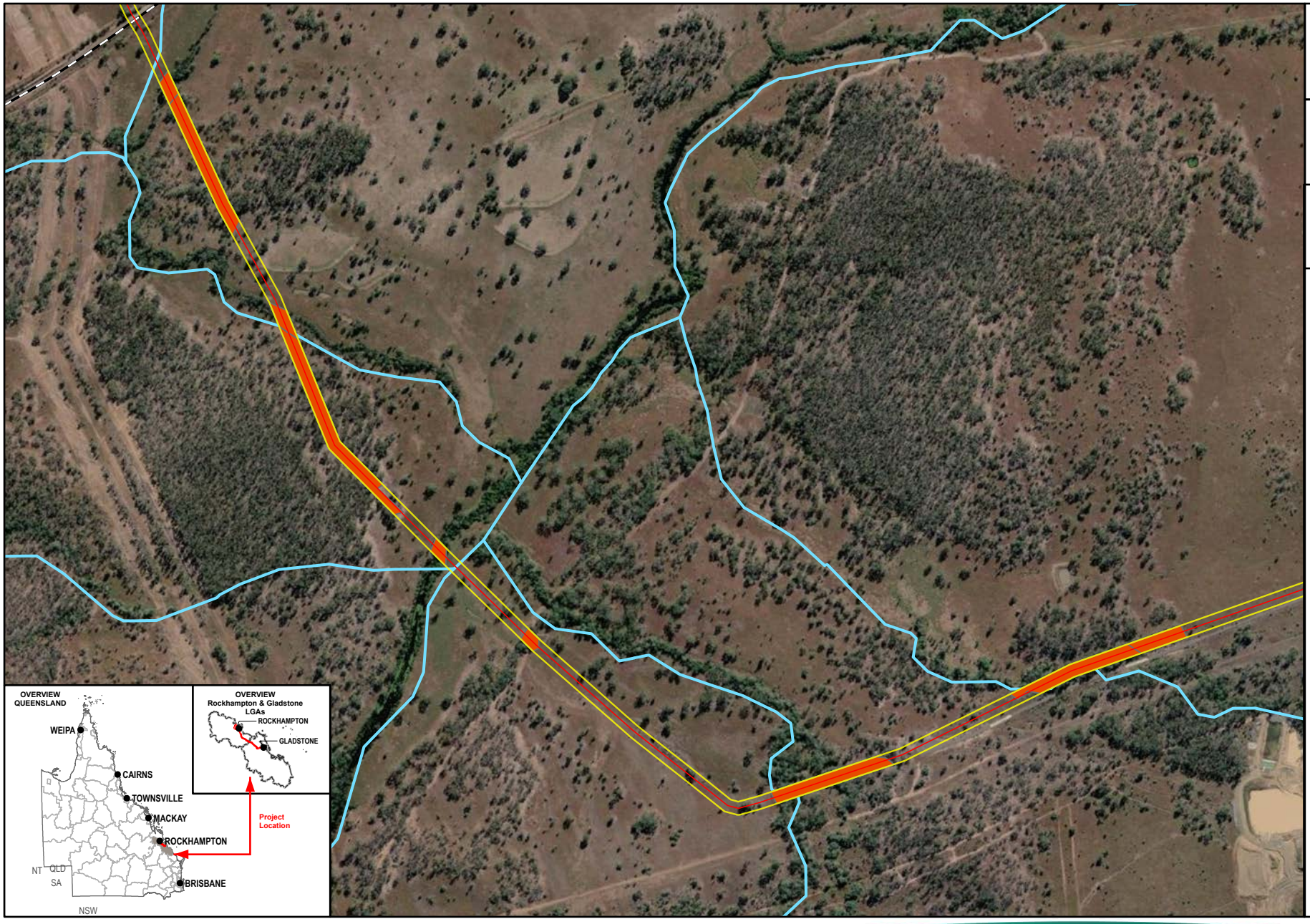

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- GSDA Pipeline Alignment
- Study Area

Predicted Yellow-bellied Glider (South-eastern) Habitat

Habitat Type

- Potential Foraging Habitat
- Waterways
- Railways

Data Sources:
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Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-5e
Distribution of Yellow-bellied Glider (South-eastern) Habitat Within the GSDA Study Area

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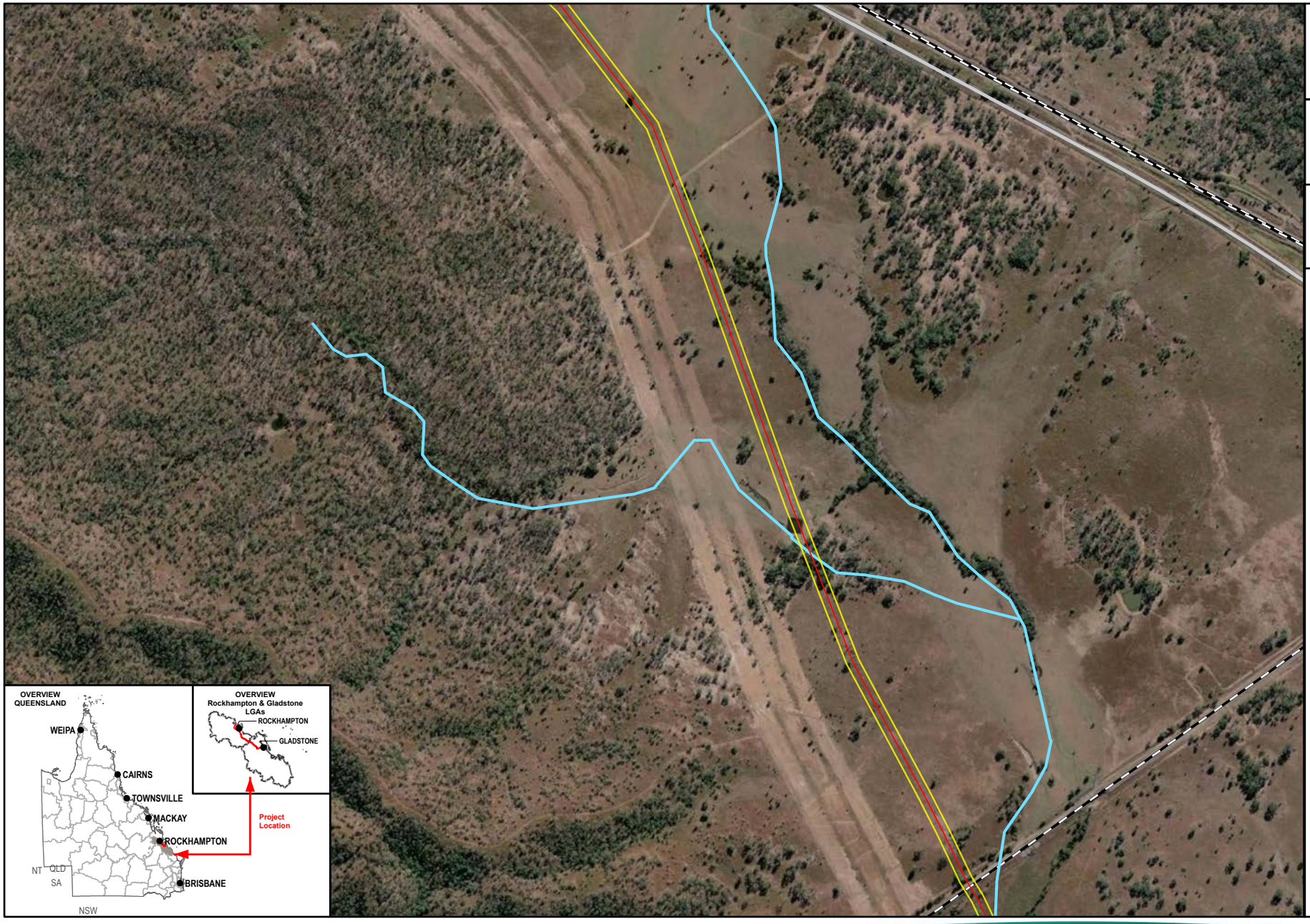

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PROJECTION UTM Zone 56
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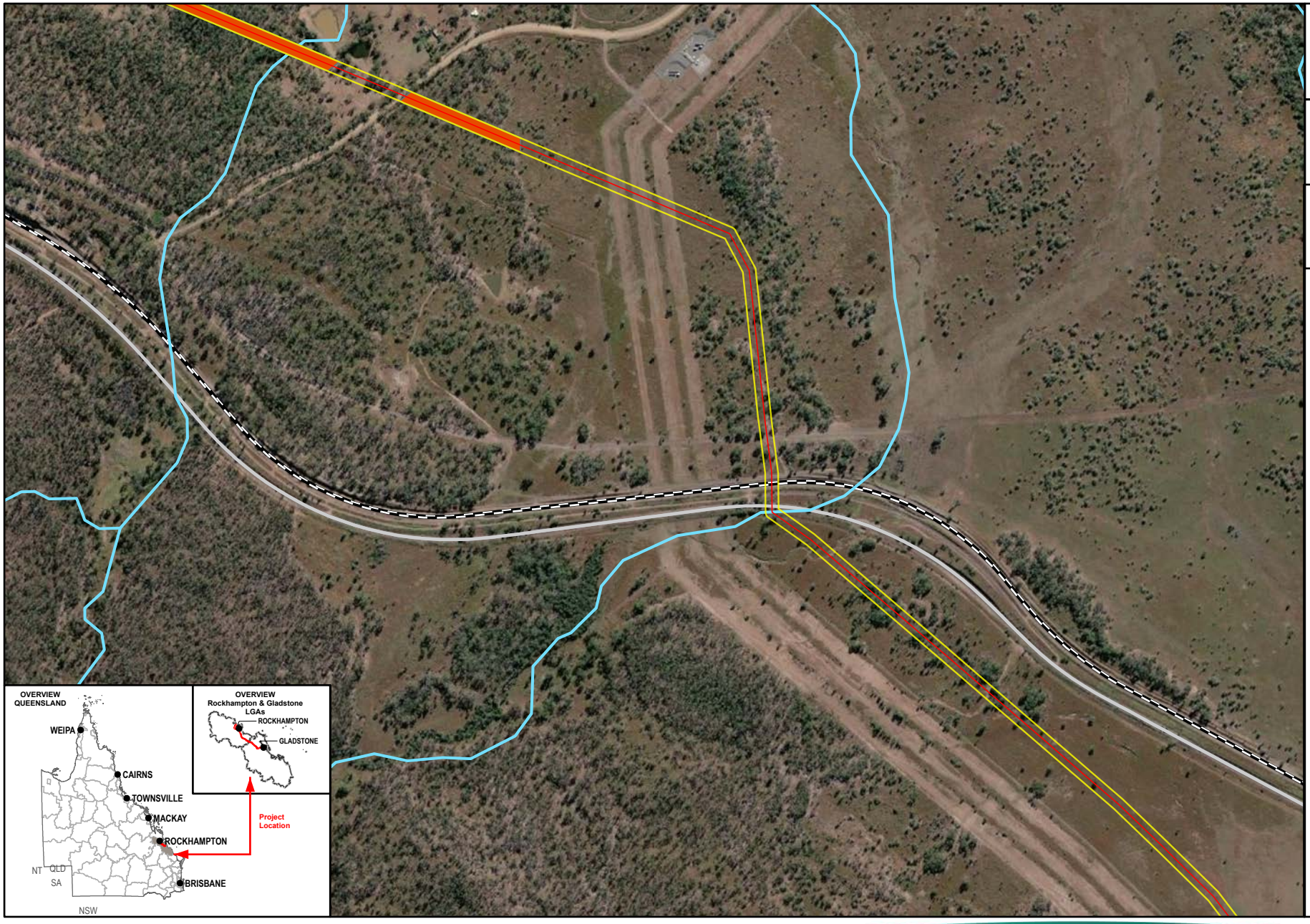
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-5f
Distribution of Yellow-bellied Glider (South-eastern) Habitat Within the GSDA Study Area

000-G-MAP-2427 Version:3 Date:19/09/2022



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Legend

- GSDA Pipeline Alignment
- Study Area

Predicted Yellow-bellied Glider (South-eastern) Habitat

Habitat Type

- Potential Foraging Habitat
- Waterways
- Main Roads
- Railways

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

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Fitzroy to Gladstone Pipeline Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-5g
Distribution of Yellow-bellied Glider (South-eastern) Habitat Within the GSDA Study Area

000-G-MAP-2427 Version:3 Date:19/09/2022

7.1.1.9 Koala

Conservation status and species ecology

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

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

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

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

Field survey results and distribution of suitable habitat

Koala scratches (on smooth-barked trees) and faecal pellets were recorded during the Arup (2008) field surveys within the GSDA study area. No individuals or traces were recorded during the 2022 field surveys. Survey effort for the koala included two nights of 2-3 hours of spotlighting and faecal pellet searches at 12 locations within potentially suitable habitat in the GSDA study area. Historical records for the species have been recorded at nine locations within the desktop search extent (10 km buffer), the closest record approximately 2 km from the GSDA pipeline alignment. Many of these records have been historically recorded along fringing riparian vegetation and woodland habitats, including tributaries adjoining Larcom Creek and within woodland adjacent to The Narrows Road.

Potential habitat for this species was widespread within all the GSDA study area, particularly within woodland habitats retaining koala food trees (i.e. *Melaleuca*, *Eucalyptus, Corymbia* and *Acacia* species) and fringing riparian vegetation. The distribution of predicted koala habitat was based on criteria detailed in Appendix F and is mapped

in Figure 7-6. Habitat assessments undertaken within the GSDA study area involved taking representative photos of the vegetation and general habitat. Nine habitat assessment sites within the GSDA study area were selected to illustrate suitable habitat for the koala, as well as presenting photos of areas that do not represent suitable habitat due to the lack of koala food and shelter trees. Each survey photo reference number refers to the photo that was taken at that habitat assessment site and is presented in Appendix G. Of those nine habitat assessment site photos, six photos (i.e. photo number 1, 2, 3, 5, 7 and 9) represent suitable koala habitat.

Significance of impact assessment

The project is likely to result in a significant residual impact on the koala. A significance of impact assessment of the project on the koala (endangered under the EPBC Act and NC Act) is provided in Table 7-10.

Table 7-10 Significance of impact on the koala

Significant residual impact criteria	Potential to occur
A long-term decrease in the size of a local population	**Unlikely** The koala population within the GSDA study area is considered an important population in the accordance with the Commonwealth approved conservation advice. The koala has been historically recorded at nine locations within the desktop search extent (10 km buffer), the closest record approximately 2 km from the GSDA pipeline alignment. Koala scratches and faecal pellets were recorded during the Arup (2008) field surveys within the GSDA study area; however, no individuals or evidence of presence was recorded during the 2022 field surveys. Based on the ecological field surveys and species ecology, koalas are predicted to occur at low densities within the GSDA pipeline alignment. The project is anticipated to result in the loss of 35.92 ha of suitable koala habitat. This represents 0.42 % of regional habitat (i.e. available within a 5 km buffer). The maximum width of clearing required for construction of the GSDA pipeline alignment is 30 m. Once the pipeline has been installed and buried, a maximum width of 10 m will be permanently cleared with the remaining 20 m to be rehabilitated. The GSDA pipeline alignment largely supports regrowth vegetation and open landscapes that have been previously cleared for agricultural practices and linear infrastructure such as railways, roads, access tracks and pipelines. The remaining areas support remnant vegetation retaining suitable koala food trees (i.e. *Melaleuca*, *Eucalyptus*, *Corymbia* and *Acacia* species) in woodland and fringing riparian habitats. Relatively large areas of suitable habitat will persist in the surrounding landscape allowing opportunities for movement, including woodland habitats, riparian corridors and large areas of remnant habitat located within Mount Stowe State Forest, Calliope Conservation Park and Mount Larcom. Construction and operation impacts associated with the project are unlikely to have permanent impacts on the persistence of local and regional koala populations. Based on the scarcity of historical records and lack of koala traces in field surveys, koalas are likely to occur in low local densities. While the loss of 35.92 ha of suitable habitat will reduce the local availability of koala food and shelter trees, this is unlikely to lead to excessive competition for resources, given the low koala densities. The local loss of resources is therefore likely to be absorbed within remaining habitat in areas adjacent to the GSDA pipeline alignment. Therefore, the local koala population is not expected to experience a significant reduction in foraging and breeding success due to any increase in competition for resources.
Reduce the extent of occurrence of the species	**Unlikely** The project is anticipated to result in the loss of 35.92 ha of suitable koala habitat. This represents 0.42 % of regional habitat (i.e. available within a 5 km buffer). A maximum width of 30 m will be cleared for construction of the GSDA pipeline alignment, with 20 m to be rehabilitated after the pipeline has been installed and buried. The GSDA pipeline alignment has been largely placed in landscapes that have been previously cleared (open grass paddocks and regrowth vegetation) and has largely avoided areas retaining intact and fragmented remnant vegetation. Much of the surrounding landscape is similar to the landscape present within the GSDA pipeline alignment, such as cleared open landscapes, riparian corridors, and regrowth and remnant vegetation. Extensive areas of remnant habitat occur within Mount Stowe State Forest, Calliope Conservation Park and Mount Larcom, which interconnect with suitable koala habitat present within and adjacent to the GSDA pipeline alignment. The project is unlikely to disrupt connectivity to the extent that movement between remnant patches will be disrupted. As such, the project is unlikely to reduce the extent of occurrence of the species, especially noting the definition of extent of occurrence per the Queensland *Significant Residual Impact Guideline* (DEHP 2014b): *Extent of occurrence is defined as the area contained within the shortest continuous imaginary boundary which can be drawn to encompass all the known, inferred or projected sites of present occurrence of a taxon*.

Significant residual impact criteria	Potential to occur
Fragment an existing population	**Unlikely** A maximum width of 30 m will be cleared for construction of the GSDA pipeline alignment, with 20 m to be rehabilitated after the pipeline has been installed and buried. The GSDA pipeline alignment has been largely placed in landscapes that have been previously cleared and in areas that retain regrowth vegetation. Much of the GSDA pipeline alignment has also been located adjacent to existing linear infrastructure including railways, roads, access tracks and pipelines, to reduce further fragmentation. Habitat loss within the GSDA pipeline alignment is not expected to impact connectivity with surrounding koala habitat as the habitat losses will be localised and is not considered to create large gaps to disrupt koala movement. Large areas of suitable koala habitat will persist within woodland and riparian corridor habitats immediately adjacent to the GSDA pipeline alignment, as well as extensive areas of remnant habitat located within Mount Stowe State Forest, Calliope Conservation Park and Mount Larcom. Therefore, the project is unlikely to fragment an existing koala population. It is noted that the local koala population in the landscape is likely to be very low, noting the low number of historic records and no contemporary records from 2022 field surveys.
Result in genetically distinct populations forming as a result of habitat isolation	**Unlikely** As detailed above, the species' capacity to move locally and regionally is unlikely to be limited by any localised land clearing necessary to construct the GSDA alignment. As a result, the project is not considered to cause any form of genetic isolation at a population level.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat	**Unlikely** Invasive species including wild dogs already occur throughout the area. Predatory species are attracted to prey opportunities presented by cleared corridors or prey moving away from disturbance areas. While new infrastructure has the potential to increase the risk of wild dog attack on koala by facilitating regional movement of dogs, these threats are already present within the receiving environment and are not likely to be exacerbated by the project. Feral animal control measures will be implemented throughout the duration of the project and have been designed to mitigate such risks. There is also potential for the spread of invasive weeds during the construction and operation phase. This potential will be addressed within the EMP and could provide the opportunity to enhance the quality of the environment utilised by the koala by providing mitigation measures to combat introduced species. The eradication of ground-covering weeds could enhance local koala movement. If mitigation measures are implemented correctly, the project is unlikely to result in the introduction of invasive species that are harmful to the koala.
Introduce disease that may cause the population to decline	**Unlikely** The project is not anticipated to introduce new diseases that may cause the species to decline. Stress may lead to an increase in the expression of chlamydia in koalas; however, the implementation of mitigation measure such as sequential clearing, site speed limits, use of experienced spotter-catchers during clearing and the requirement to allow koalas to self-disperse will reduce disturbance-related stress and risk of disease. Additionally, the species is susceptible to *Phytophthora cinnamomi* due the soil fungus's ability to infect *Eucalyptus* species. Biosecurity requirements (e.g. weed and seed declarations) will be implemented for the project, and thus, this risk has been assessed as low.
Interfere with the recovery of the species	**Unlikely** The project is expected to be relatively benign with no substantial long-term increase in mortality or any substantial barrier effects due to loss of habitat connectivity. All impacts are expected to be localised. Impacts along the GSDA pipeline alignment are expected to be consistent with existing levels of impact from habitat fragmentation and exposure to road noise and traffic. The risk of koala mortality of injury will be managed by the mitigation measures contained within the CEMP, and an experienced and suitably qualified fauna spotter-catcher will be employed during all clearing works. Accordingly, the project is unlikely to substantially interfere with the recovery of the species.

Significant residual impact criteria	Potential to occur
Result in disruption to ecologically significant locations (breeding, feeding or nesting sites) of a species	**Likely** The project will require the clearing of 35.92 ha of potentially suitable foraging and breeding habitat for the koala. Although the GSDA pipeline alignment has been largely placed within or adjacent to areas that have been previously cleared, the project will result in a loss of koala food and shelter trees (i.e. *Melaleuca*, *Eucalyptus, Corymbia* and *Acacia* species). While the project is not expected to cause a long-term decline in the local population, reduce its extent of occurrence, cause adverse habitat fragmentation effects nor interfere with the recovery of the species, the loss of suitable koala habitat within the GSDA pipeline alignment is likely to result in disruption to ecologically significant locations.
Conclusion	The project is likely to result in a significant residual impact on the koala. Although the GSDA pipeline alignment has been largely placed within or adjacent to areas that have been previously cleared, the project will require the clearing of 35.92 ha of suitable foraging habitat (i.e. *Melaleuca*, *Eucalyptus* and *Corymbia* species) and breeding habitat.

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Legend

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

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

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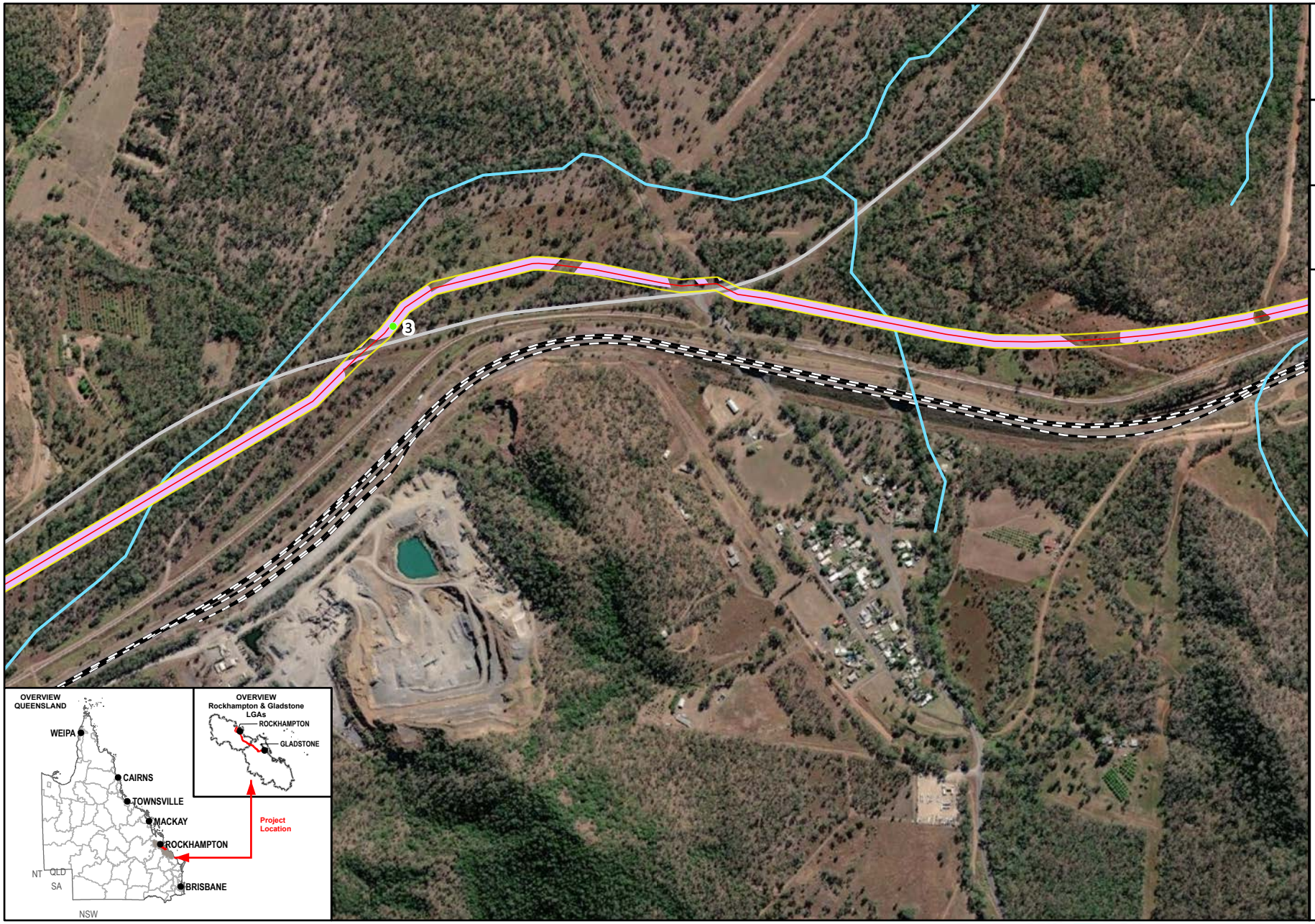
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-6a
Distribution of Koala Habitat Within the GSDA Study Area

000-G-MAP-2428 Version:4 Date:19/09/2022



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Legend

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

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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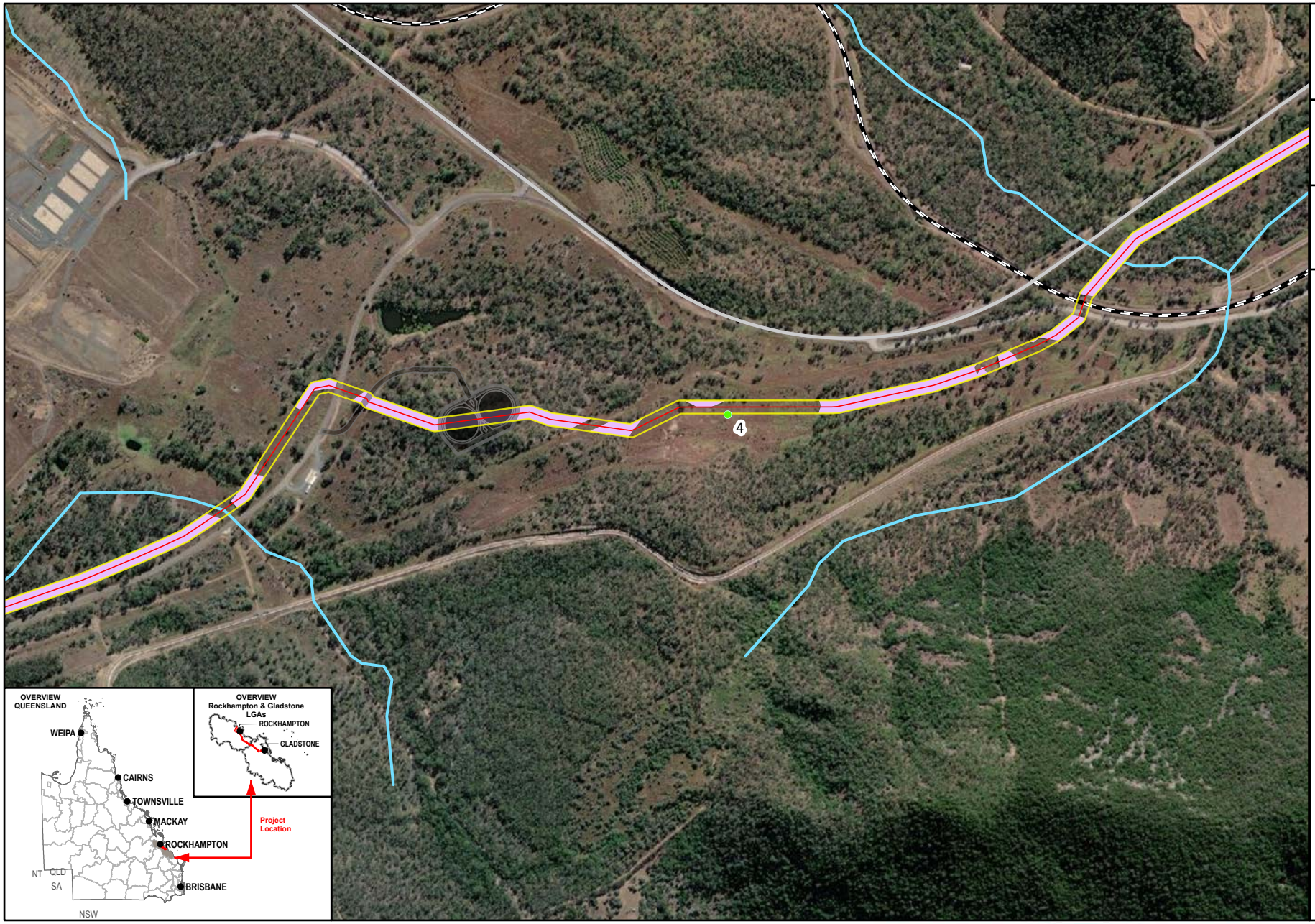
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-6b
Distribution of Koala Habitat Within the GSDA Study Area

000-G-MAP-2428 Version:4 Date:19/09/2022



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Legend

- GSDA Pipeline Alignment
- Study Area
- Survey Photo Reference Number
- Predicted Koala Habitat
- Aldoga Reservoirs Layout
- 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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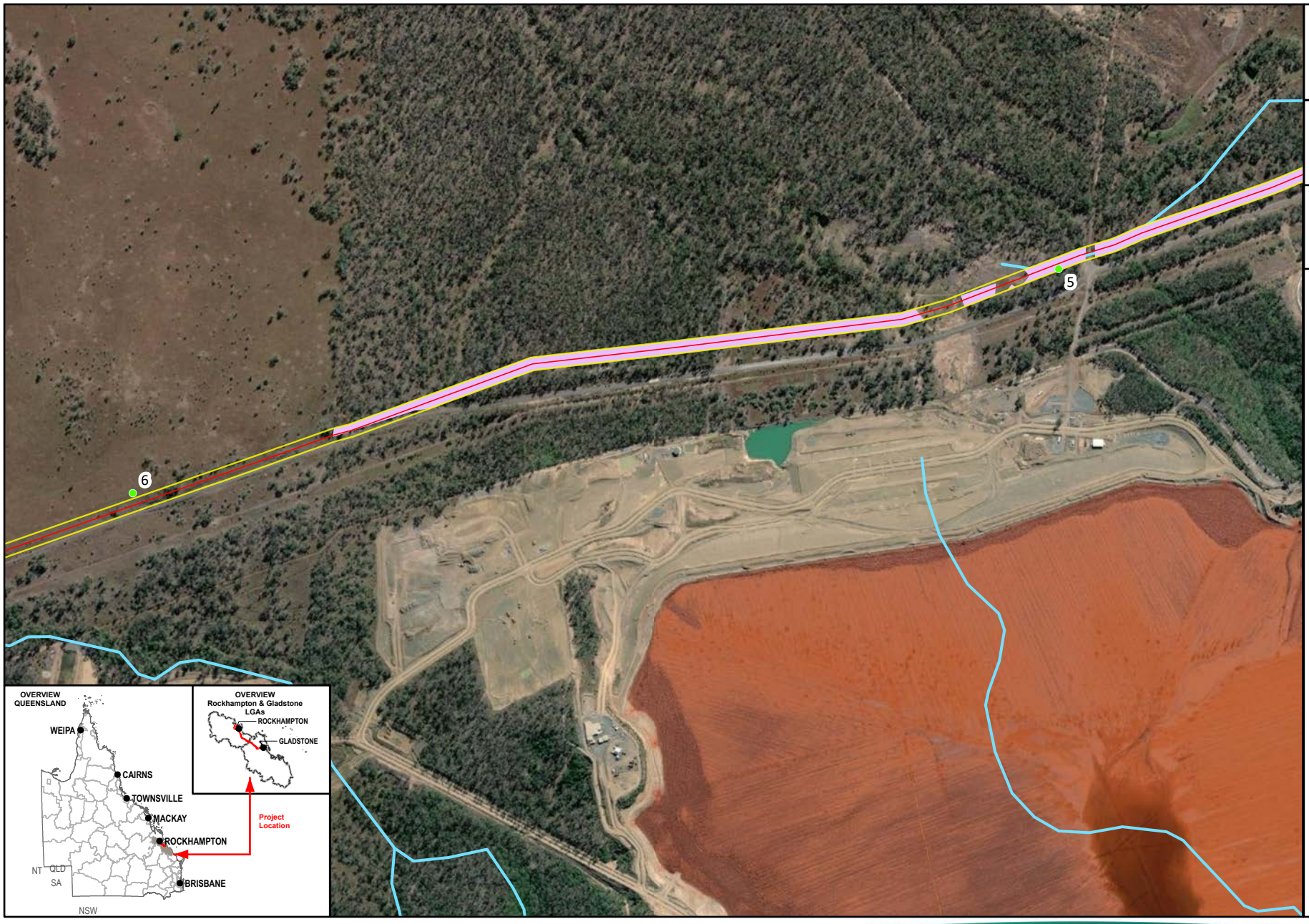
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-6c
Distribution of Koala Habitat Within the GSDA Study Area

000-G-MAP-2428 Version:4 Date:19/09/2022



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Legend

- GSDA Pipeline Alignment
- Study Area
- Survey Photo Reference Number
- Predicted Koala Habitat
- Waterways

Data Sources:
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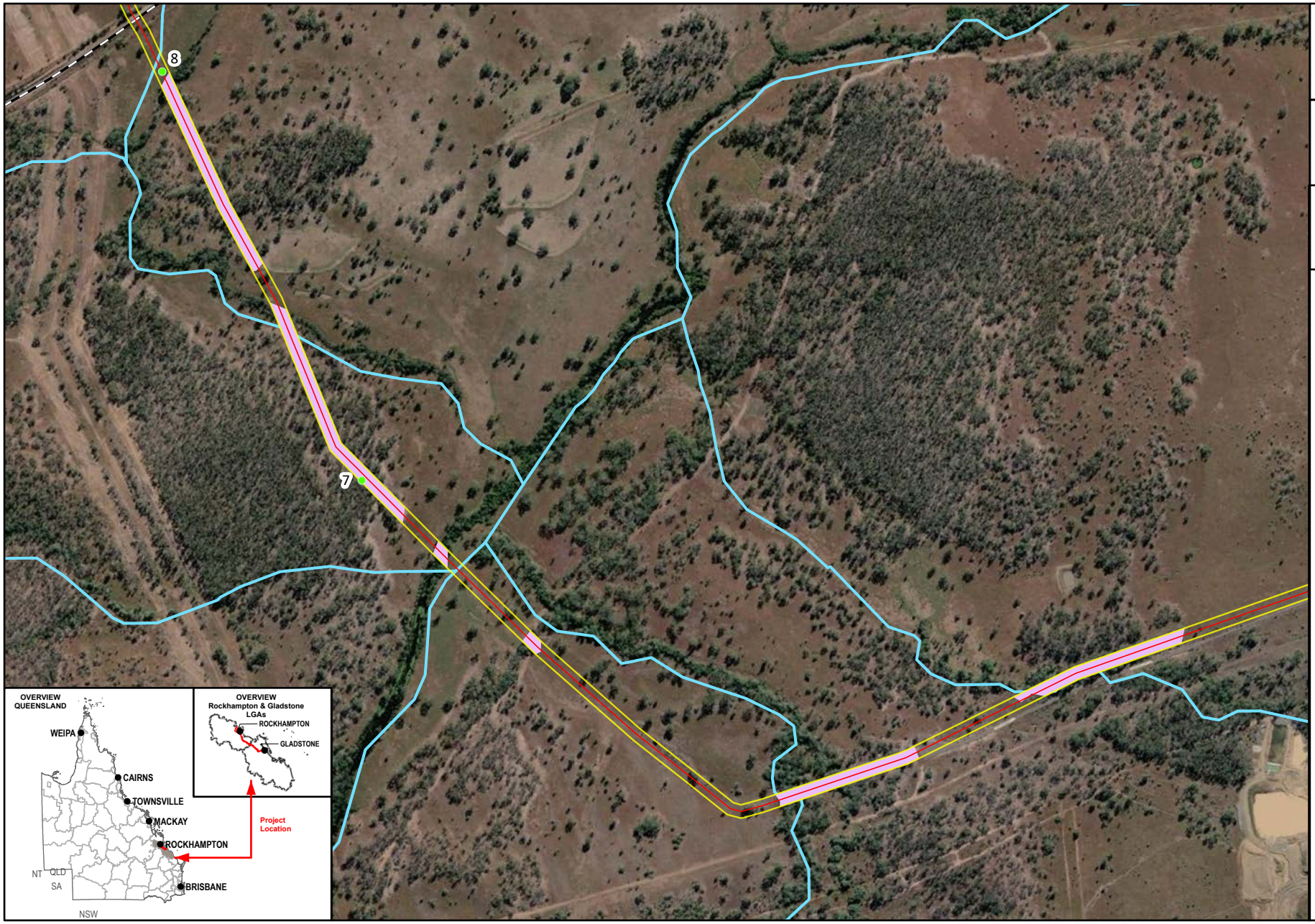
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-6d
Distribution of Koala Habitat Within the GSDA Study Area

000-G-MAP-2428 Version:4 Date:19/09/2022



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Legend

- GSDA Pipeline Alignment
- Study Area
- Survey Photo Reference Number
- Predicted Koala Habitat
- Waterways
- Railways

Data Sources:
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Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-6e
Distribution of Koala Habitat Within the GSDA Study Area

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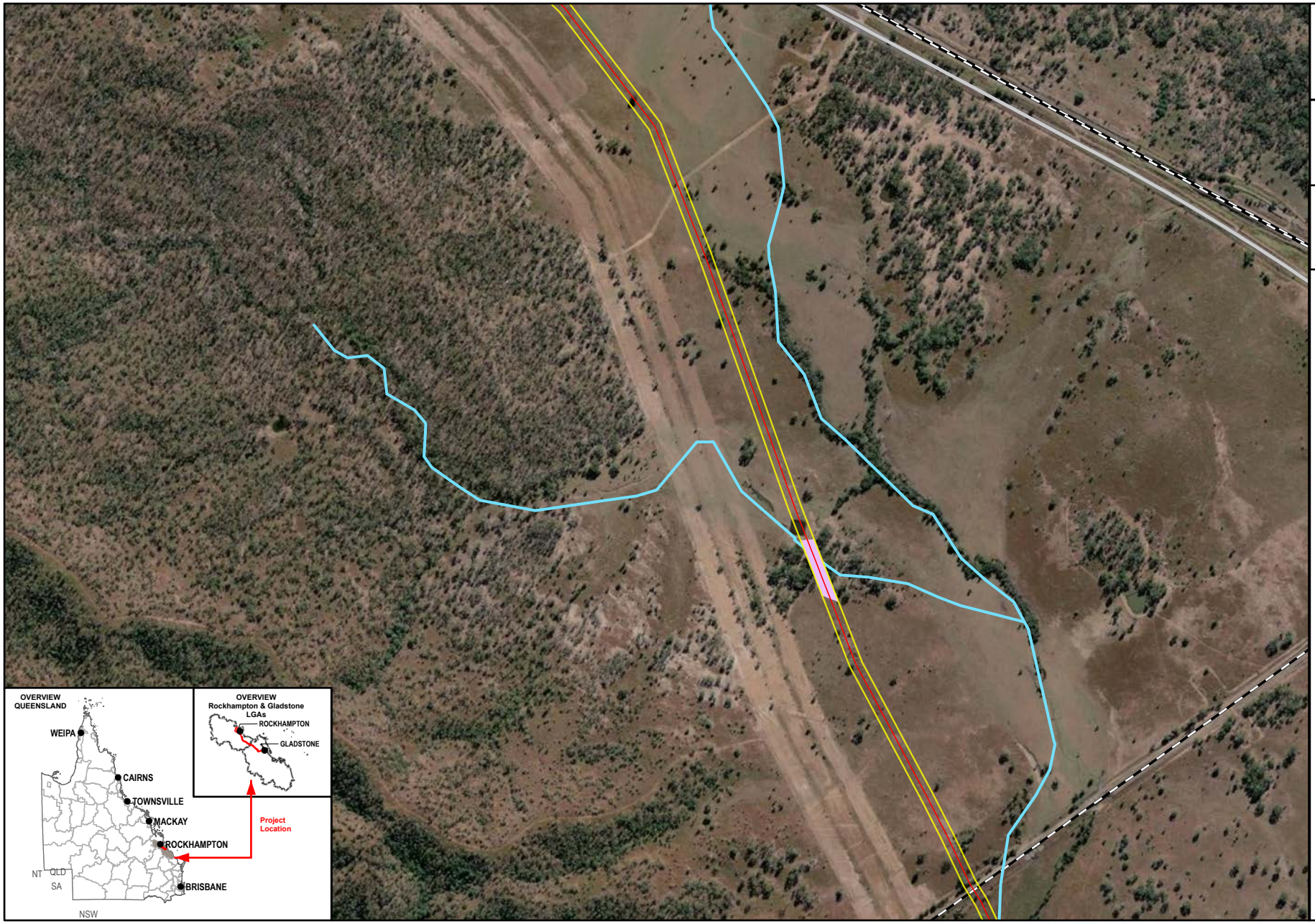

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Legend

- GSDA Pipeline Alignment
- Study Area
- Predicted Koala Habitat
- Waterways
- Main Roads
- Railways

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Distribution of Koala Habitat Within the GSDA Study Area

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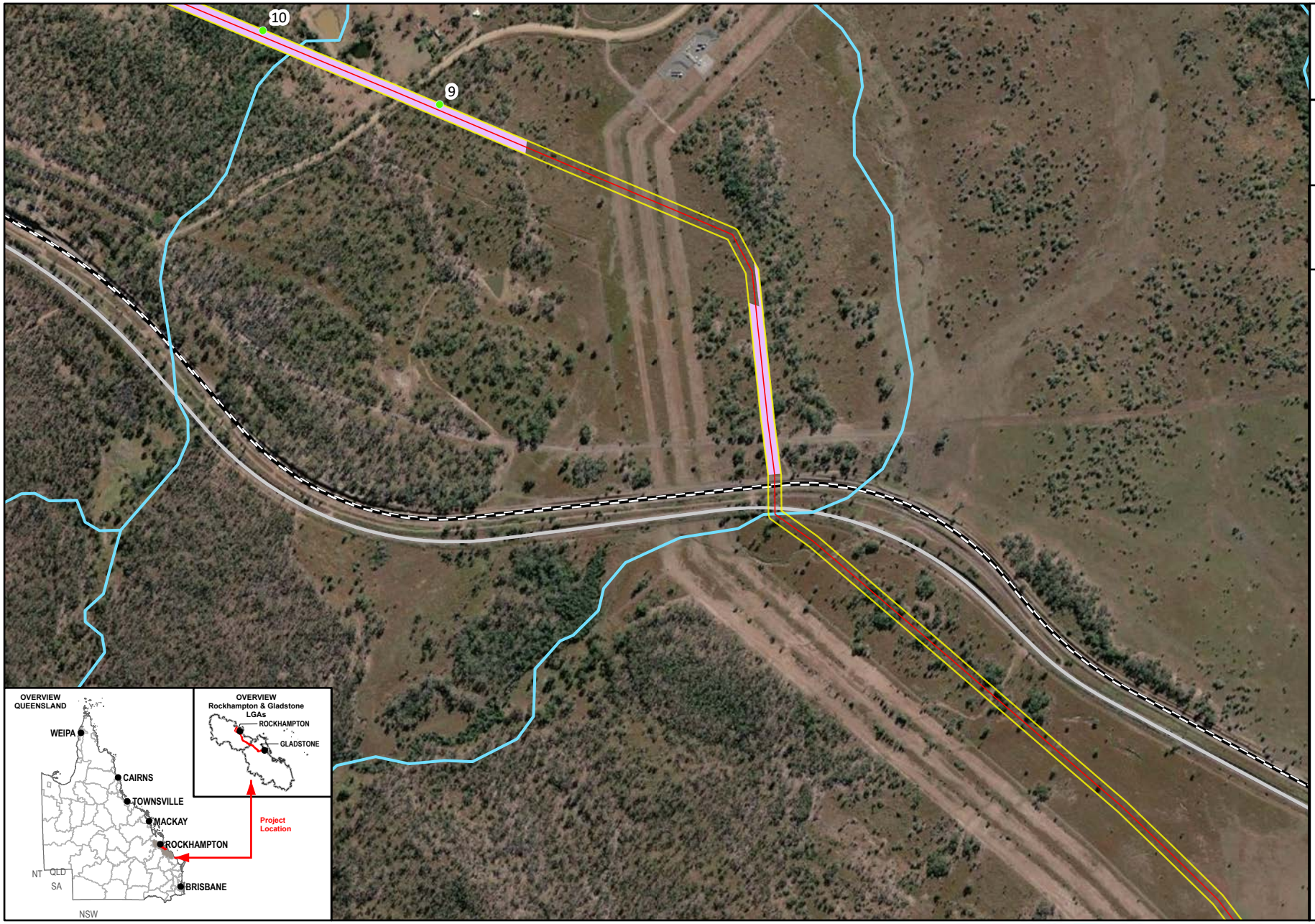

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Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-6g
Distribution of Koala Habitat Within the GSDA Study Area

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7.1.1.10 Grey-headed flying-fox

Conservation status and species ecology

The grey-headed flying-fox is listed as vulnerable under the EPBC Act and is not listed under the NC Act. The species was listed as an MNES at the time of the approval. The grey-headed flying-fox is one of the largest bats in the world (DAWE 2021) and Australia's only endemic flying-fox and occurs on the east coast of Australia from Ingham in Queensland to Adelainde in South Australia (DCCEEW 2022j). The species selectively forages for food where it is readily available, and hence, only utilises a small proportion of its range at any given time. A small number of local areas can support a continued presence of the species (DAWE 2021). Typically, patterns of occurrence and relative abundance for the species fluctuate between seasons and years in line with food availability (DCCEEW 2022j).

The species maintains one intermixing population throughout Australia. The grey-headed flying-fox requires foraging habitat and roosting sites, with it being a canopy-feeding frugivore and nectarivore, with the species diet supplemented with leaves DCCEEW 2022j; DAWE 2021). The species roosts in camps in areas ranging from continuous forests to patches of vegetation as small as 1 ha. Typically, camps are associated with water sources, in vegetation communities including rainforest, Melaleuca, mangroves and riparian vegetation (DCCEEW 2022j). The grey-headed flying-fox forages in canopy vegetation in a variety of habitats ranging from rainforests, open forest, open and closed woodlands and vegetation dominated by *Melaleuca* and *Banksia* species (DAWE 2021; DCCEEW 2022j). Major foraging sources for the species include blossoms from genus *Eucalyptus, Corymbia, Angophora, Melaleuca, Banksia* and *Syzygium* spp (DAWE 2021). Few of the grey-headed flying-fox foraging species flower in winter, or flower reliably in winter. As such, the species is subject to recurrent food shortages during winter and spring, with foraging resources typically restricted to coastal lowlands of south-east Queensland and northern New South Wales. As a result, the species continually migrates throughout its range to access food resources that are patchily distributed and seasonally available (DAWE 2021; DCCEEW 2022j).

Important winter and spring foraging habitat includes woodlands with *Eucalyptus tereticornis, E. albens, E. crebra, E. fibrosa, E. melliodora, E. paniculata, E. pilularis, E. robusta, E. seeana, E. sideroxylon, E. siderophloia, Banksia integrifolia, Castanospermum australe, Corymbia citriodora, C. eximia, C. maculata* (south from Nowra), *Grevillea robusta* and *Melaleuca quinquenervia or Syncarpia glomulifera* (DAWE 2021).

Grey-headed flying-foxes roost in groups of various sizes on exposed limbs of large trees (DCCEEW 2022j). The species typically utilise the same roosting site for longs periods of time (DCCEEW 2022j). The species commutes daily to foraging sites, which are usually within 15 km of the roosting site but can travel up to 40 km at night-time to different feeding areas as food resources change (DAWE 2021; DCCEEW 2022j).

Grey-headed flying-fox seasonally breed during a single event each year. Mating of grey-headed flying-foxes occurs in early autumn followed by the larger roosting camps tending to disperse in pursuit of available food resources (DAWE 2021; DCCEEW 2022j). Males and females segregate in October, when females give birth. Females give birth to their young following six months of gestation. As most adult grey-headed flying-foxes conceive one young annually, there is a low maximum rate of population growth. Females have a high tendency for aborting or abandoning their young in response to environmental stress such as a lack of food or high temperatures (DAWE 2021; DCCEEW 2022j).

Field survey results and distribution of suitable habitat

No grey-headed flying-fox nor any flying-fox camps were recorded during the field surveys within the GSDA study area. Survey effort for the grey-headed flying-fox included two nights of 2-3 hours of spotlighting within potentially suitable habitat in the GSDA study area. Suitable habitat was recorded within the GSDA study area, and the species has been historically recorded at eight locations within the desktop search extent, the most recent record recorded in 2014. The closest record is approximately 3 km east of the southern extent of the GSDA pipeline alignment, within coastal habitat. Suitable foraging habitat was recorded in eucalypt woodland areas retaining important winter and spring foraging tree species, including *Eucalyptus tereticornis, E. crebra, Corymbia citriodora* and *Melaleuca quinquenervia*. The distribution of predicted grey-headed flying-fox habitat is mapped in Figure 7-7.

Significance of impact assessment

The project is likely to result in a significant impact on the grey-headed flying-fox. As the species is not listed under the NC Act, a significance of impact assessment on the grey-headed flying-fox (vulnerable under the EPBC Act) was undertaken in accordance with the Commonwealth *Significant Impact Guidelines 1.1* (DoE 2013) and is provided in Table 7-11.

Table 7-11 Significance of impact on the grey-headed flying-fox

Significant impact criteria	Assessment
Lead to a long-term decrease in the size of an important population of the species	**Unlikely** The grey-headed flying-fox population is a single, interbreeding population and therefore not considered an important population under the definition outlined in the Commonwealth *Significant impact guidelines 1.1* (DoE 2013). The project will result in the loss of 35.92 ha of potential foraging habitat for the species, most of which would constitute habitat critical to the survival of the species due to the local abundance of key food tree species (i.e. *Eucalyptus tereticornis, E. crebra, Corymbia citriodora* and *Melaleuca quinquenervia*). This habitat is not within 20 km of the nearest nationally important flying-fox camp (i.e. the range in which the species typically forages), the nearest nationally important flying-fox camp is approximately 230 km south east of the GSDA pipeline alignment. Therefore, the project is unlikely to lead to a long-term population decrease.A
Reduce the area of occupancy of an important population	**Unlikely** As detailed above, the local population is unlikely to represent an important population as the nearest nationally important camp is >200 km distant. The project will result in the loss of 35.92 ha of habitat, most of which would constitute habitat critical to the survival of the species. However, the loss of habitat, noting its narrow and linear configuration, and recognising the mobility of the grey-headed flying-fox, is not considered likely to reduce the area of occupancy of the species.
Fragment an existing important population into two or more populations	**Unlikely** The grey-headed flying-fox has an extensive range with the capacity to move large distances between camps at a national level. The loss of habitat attributed to the project will have localised impact that unlikely pose any barrier to movement. As such, impacts attributed to the project is unlikely to fragment the population into two or more populations.
Adversely affect habitat critical to the survival of a species	**Likely** The *National Recovery Plan for the grey-headed flying-fox* (DAWE 2021) identifies habitat critical to the survival of the species as habitats associated with winter and spring flowering food tree species that are in limited supply across the species' range, due to historical land clearing, predominantly in coastal areas. The project will result in the loss of 35.92 ha of foraging habitat, likely to be habitat critical to the survival of the species due to the abundance of important winter and spring foraging tree species (i.e. *Eucalyptus tereticornis, E. crebra, Corymbia citriodora* and *Melaleuca quinquenervia*). Based on the extent of the impact, this is likely to represent a significant adverse impact on habitat critical to the survival of the species.
Disrupt the breeding cycle of an important population	**Unlikely** The project is unlikely to disrupt the breeding cycle of an important population or an important grey-headed flying-fox camp. The project will have no direct impact on roosting habitat. The nearest camp is located approximately 20 km to the south along Leixlip Creek in Calliope.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unlikely** The project will result in the loss of 35.92 ha of potential foraging habitat, representing habitat critical to the survival of the species. The nearest nationally important flying-fox camp is located approximately 228 km southeast of the GSDA pipeline alignment. As suitable foraging habitat is not within 20 km of a nationally important flying-fox camp, the habitat is unlikely to represent habitat utilised by the camp on a regular basis. However, it is within the species' foraging range (i.e. within 40 km of a camp) and may be important for supporting individuals at the camp, particularly during the winter and spring resource bottlenecks.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	**Unlikely** No invasive species are listed among the key threats to the grey-headed flying-fox in the Commonwealth approved conservation advice for the species. The project is unlikely to introduce or encourage the spread of any invasive species that could adversely affect the species.

Significant impact criteria	Assessment
Introduce disease that may cause the species to decline	**Unlikely** The grey-headed flying-fox is susceptible to Lyssavirus. While this is generally stable in the population, exposure to significant ecological stress can cause an increase in the incidence of Lyssavirus that can cause local declines in the species (DAWE 2021). The project will have no direct impact on camps or roosting sites, where there would typically be increased capacity for external impacts to cause adverse stress to an extent required to induce an increase in Lyssavirus.
Interfere substantially with the recovery of the species	**Unlikely** The project is unlikely to interfere substantially with the recovery of the species. Large, continuous patches of suitable foraging habitat for the grey-headed flying-fox is located adjacent to the GSDA pipeline alignment. Although, the project will result in the loss of 35.92 ha of potential foraging habitat, representing habitat critical to the survival of the species, the remaining habitat is connected to an extensive network of suitable habitat. The risk of individual mortality or injury during construction will be addressed via the mitigation measures in the EMP and the use sequential clearing and an experienced fauna spotter-catcher during clearing.
Conclusion	A conservative assessment has identified that the project is likely to result in a significant impact on the grey-headed flying-fox. Although the GSDA pipeline alignment has been largely placed within or adjacent to areas that have been previously cleared, the project will require the clearing of 35.92 ha of suitable foraging habitat, likely to be habitat critical to the survival of the species due to the abundance of important winter and spring foraging tree species (i.e. *Eucalyptus tereticornis, E. crebra, Corymbia citriodora* and *Melaleuca quinquenervia*).

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Legend

- GSDA Pipeline Alignment
- Study Area
- Predicted Grey-headed Flying-fox Habitat
- Waterways
- Main Roads
- Railways

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

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PROJECTION UTM Zone 56
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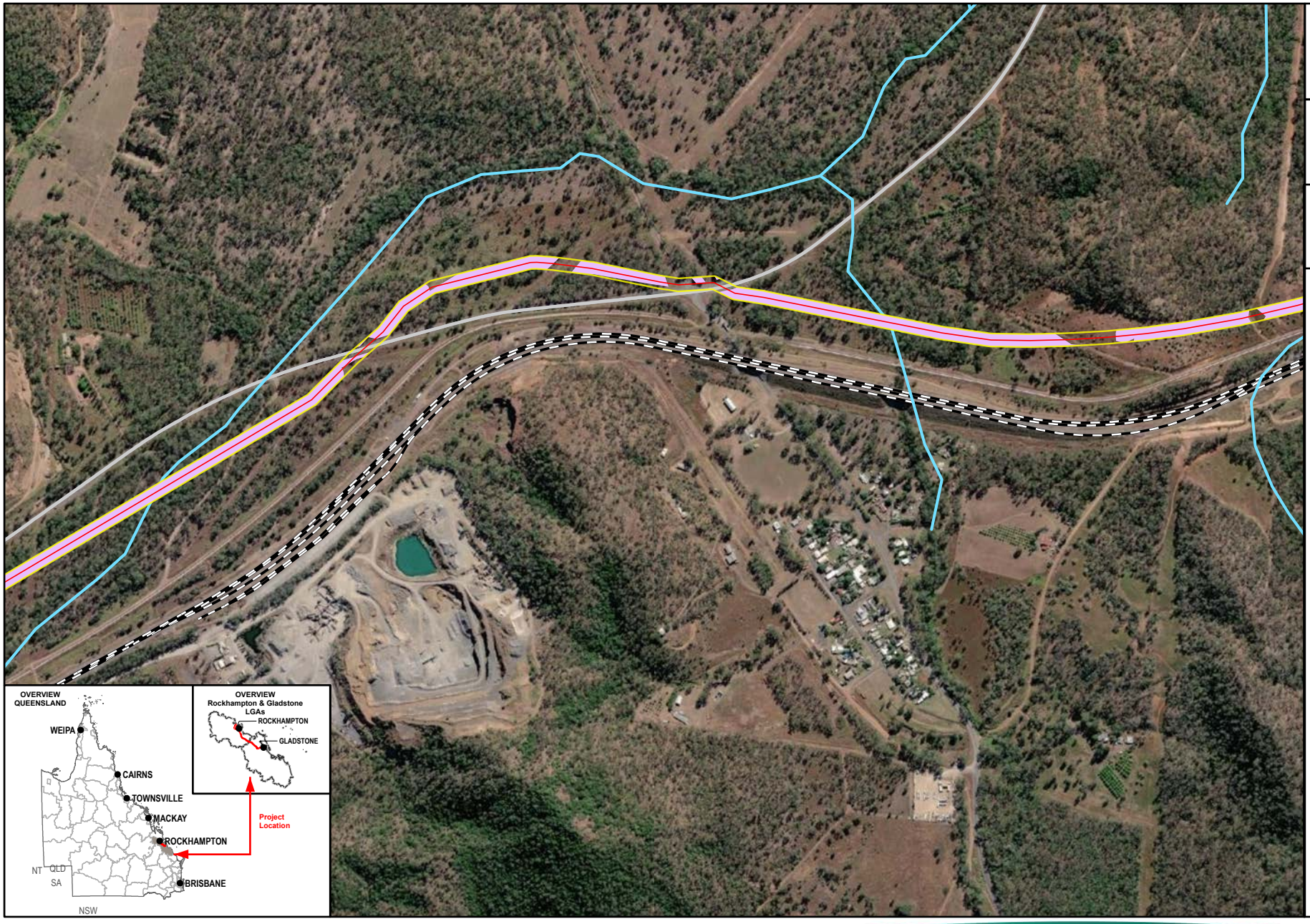
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-7a
Distribution of
Grey-headed Flying-fox Habitat
Within the GSDA Study Area

000-G-MAP-2430 Version:4 Date:19/09/2022



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Legend

- GSDA Pipeline Alignment
- Study Area
- Predicted Grey-headed Flying-fox Habitat
- Waterways
- Main Roads
- Railways

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Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-7b
Distribution of Grey-headed Flying-fox Habitat Within the GSDA Study Area

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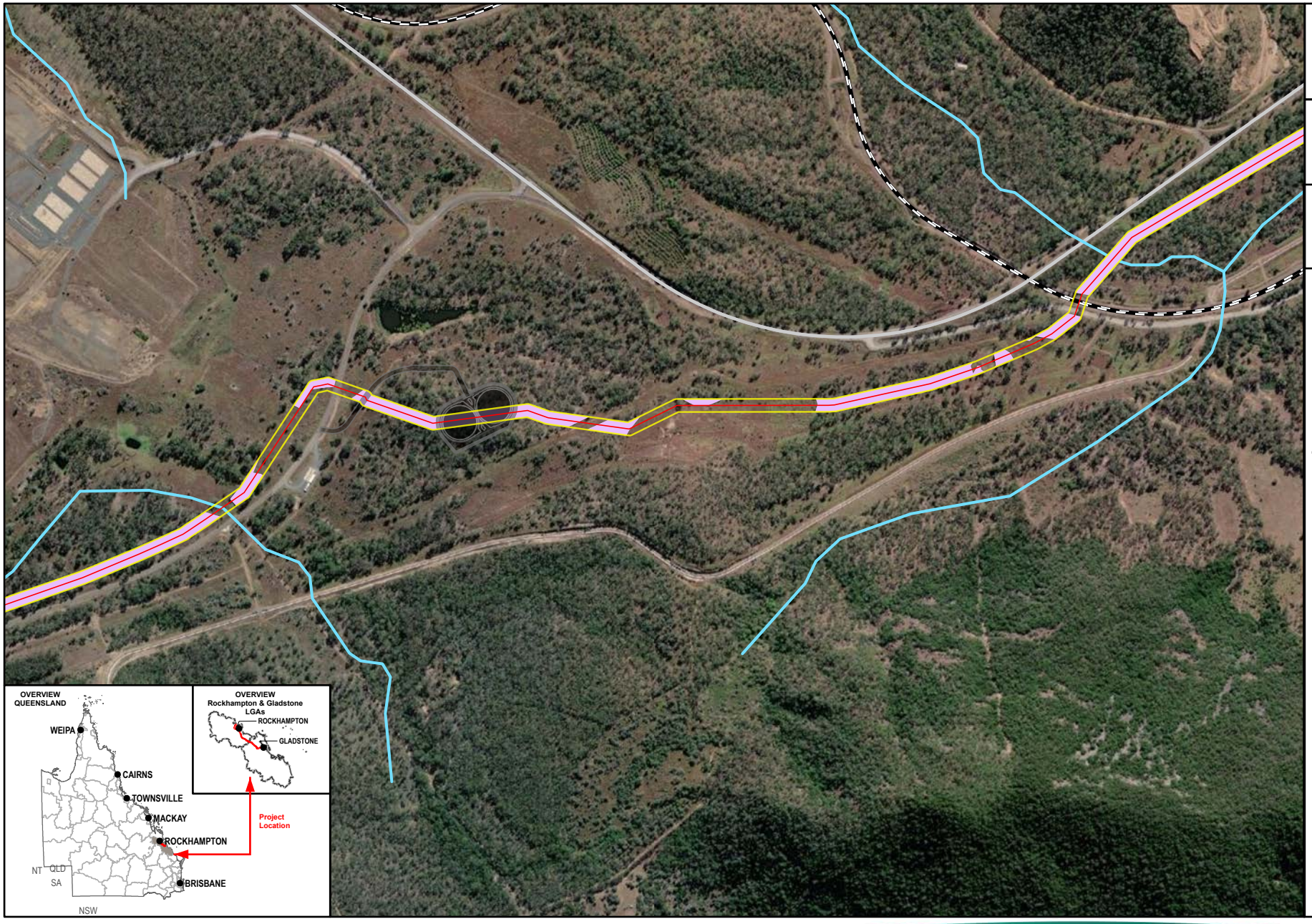

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Legend

- GSDA Pipeline Alignment
- Study Area
- Predicted Grey-headed Flying-fox Habitat
- Aldoga Reservoirs Layout
- Waterways
- Main Roads
- Railways

Data Sources:
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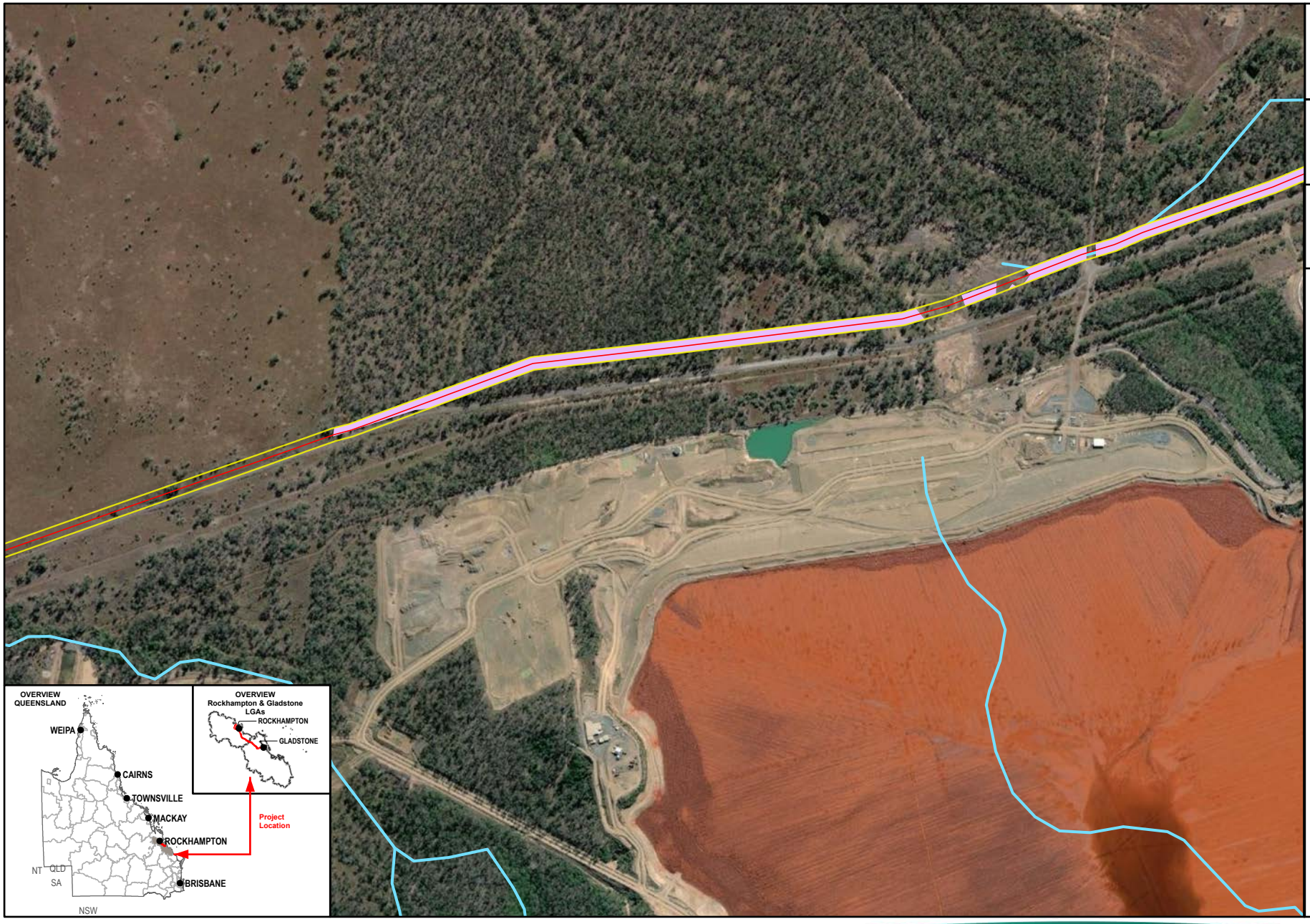
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-7c
Distribution of
Grey-headed Flying-fox Habitat
Within the GSDA Study Area

000-G-MAP-2430 Version:4 Date:19/09/2022



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Legend

- GSDA Pipeline Alignment
- Study Area
- Predicted Grey-headed Flying-fox Habitat
- Waterways

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 7-7d
Distribution of Grey-headed Flying-fox Habitat Within the GSDA Study Area

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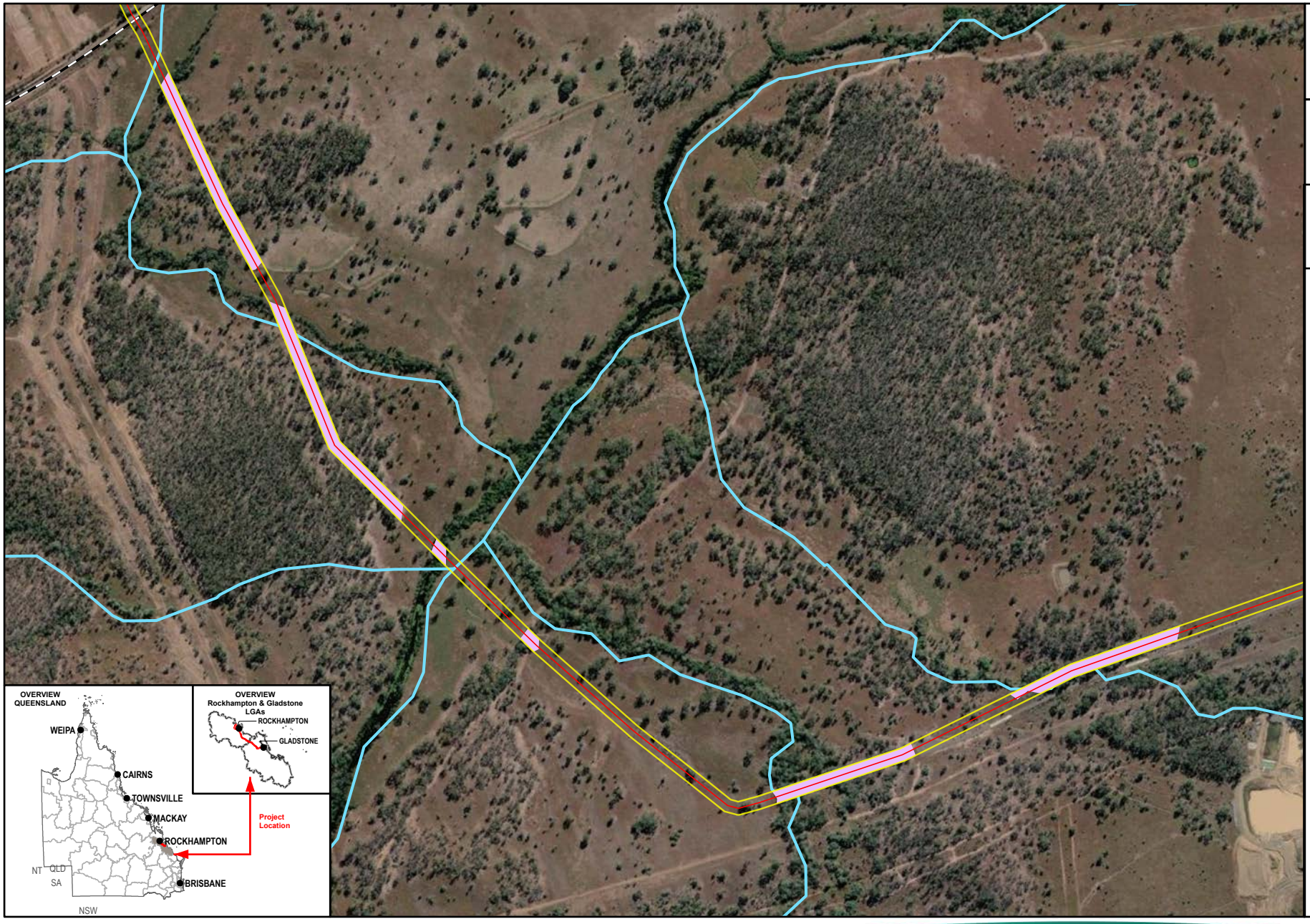

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Legend

- GSDA Pipeline Alignment
- Study Area
- Predicted Grey-headed Flying-fox Habitat
- Waterways
- Railways

Data Sources:
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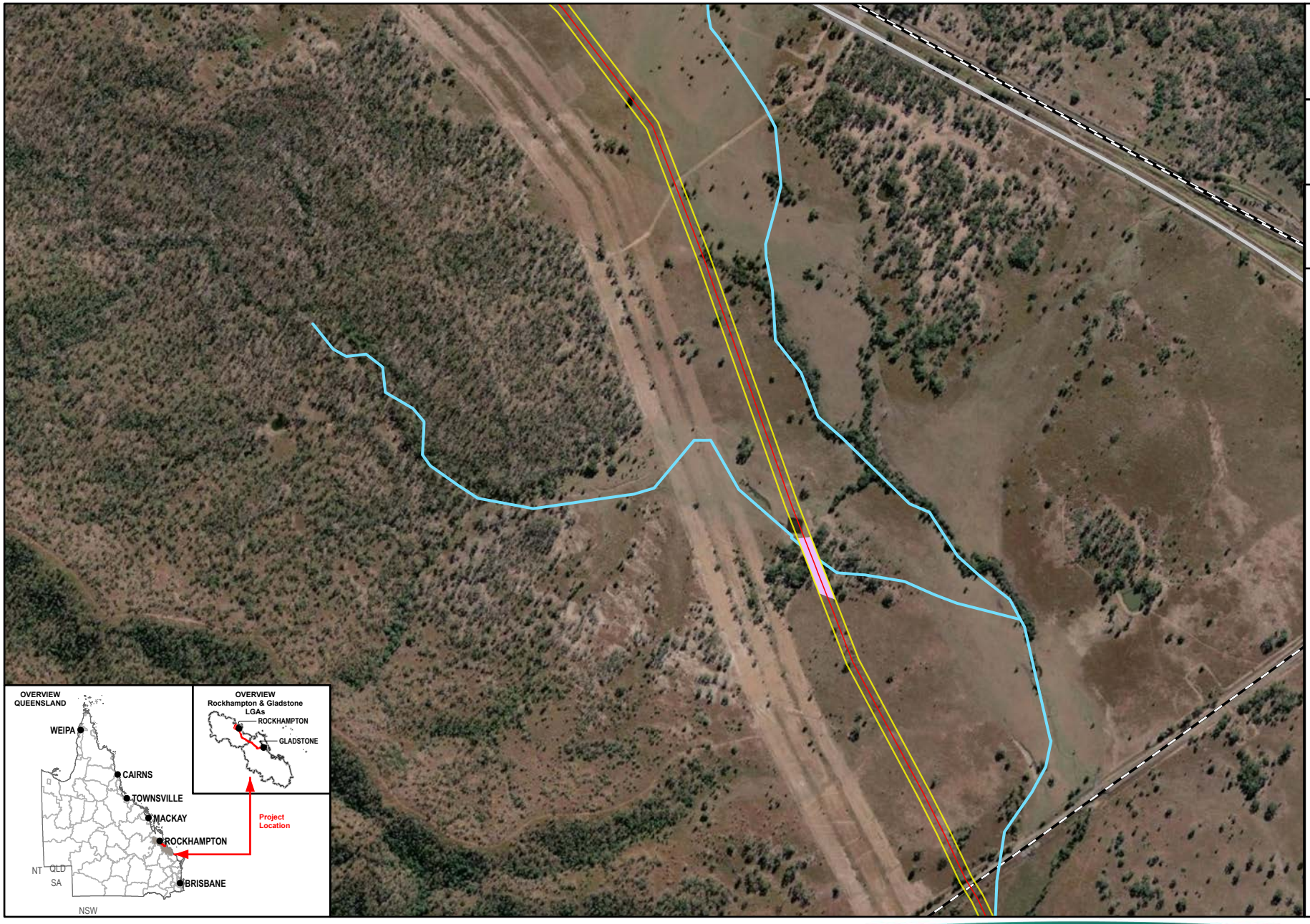
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-7e
Distribution of Grey-headed Flying-fox Habitat Within the GSDA Study Area

000-G-MAP-2430 Version:4 Date:19/09/2022



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Legend

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- Waterways
- Main Roads
- Railways

Data Sources:
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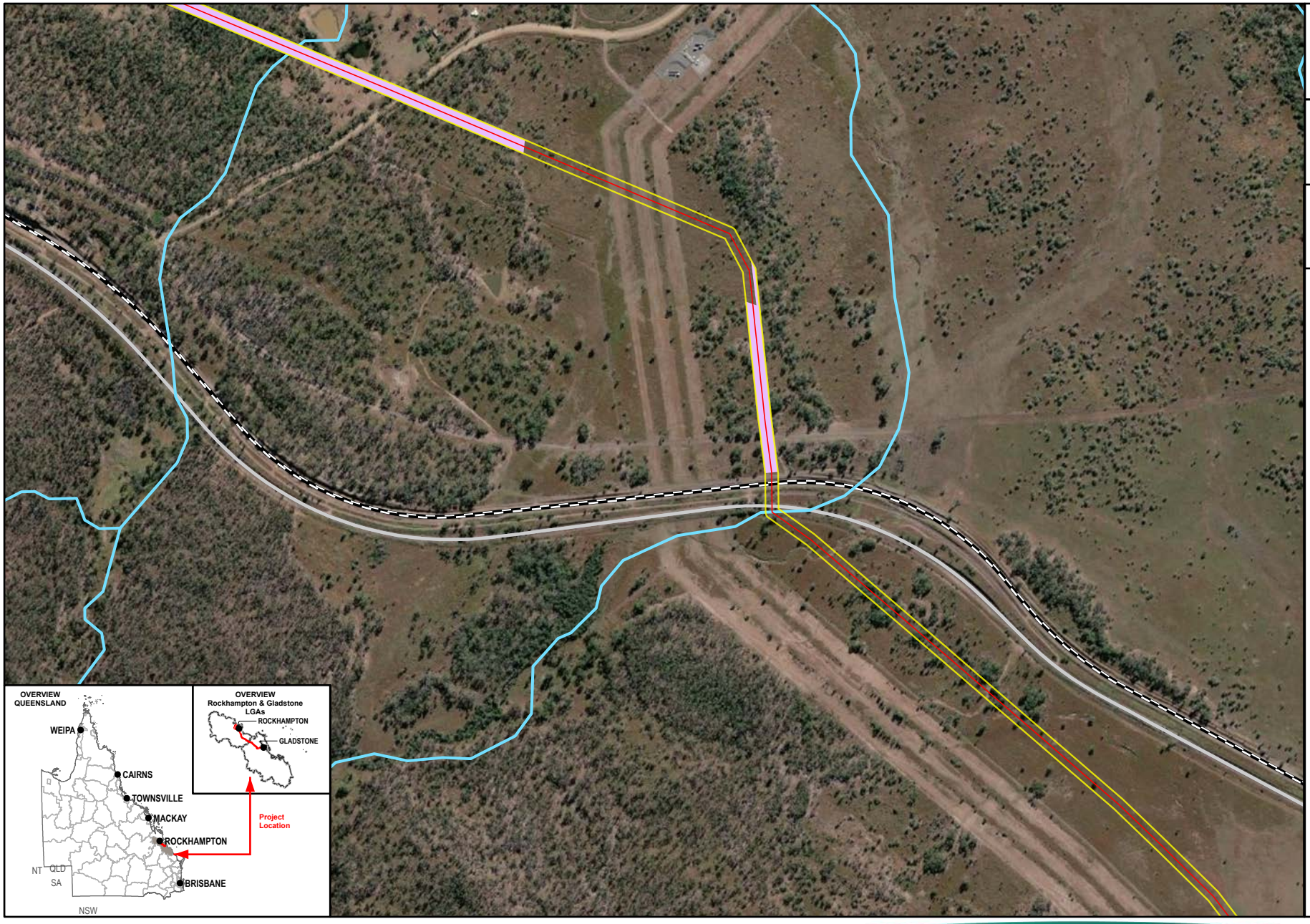
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-7f
Distribution of Grey-headed Flying-fox Habitat Within the GSDA Study Area

000-G-MAP-2430 Version:4 Date:19/09/2022



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- GSDA Pipeline Alignment
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Data Sources:
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Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-7g
Distribution of Grey-headed Flying-fox Habitat Within the GSDA Study Area

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7.1.2 Significant Residual Impact on MSES values

The following MSES values, listed in the *Significant Residual Impact Guideline 2014* (DEHP 2014b), have been identified as having the potential to be impacted by the project. Note that potential impacts on MSES conservation significant species and their habitat have been assessed above in Section 7.1.1. A summary of the significant residual impact assessments are provided in Table 7-12.

Table 7-12 Summary of the GSDA significant residual impact assessments

Value	Is the residual impact significant?
Regulated vegetation	Likely
Connectivity areas	Unlikely
Wetlands and watercourses	Unlikely
Waterway providing for fish passage	Unlikely

7.1.2.1 Regulated vegetation

The project is likely to have a significant impact on regulated vegetation within the GSDA pipeline alignment. A significant residual impact assessment is provided in Table 7-13.

Table 7-13 Significant residual impact assessment – regulated vegetation

Clearing in a regional ecosystem that is: endangered, or of concern	Clearing in the portion of a regional ecosystem that lies within a mapped wetland	Clearing in a regional ecosystem that is within the defined distance of a watercourse
Significant residual impact criteria		
For clearing for linear infrastructure: – Greater than 25 m wide in a grassland (structural category) regional ecosystem; or – Greater than 20 m wide in a sparse (structural category) regional ecosystem; or – Greater than 10 m wide in a dense to mid-dense (structural category) regional ecosystem.	For clearing for linear infrastructure: – Greater than 25 m wide in a grassland (structural category) regional ecosystem; or – Greater than 20 m wide in a sparse (structural category) regional ecosystem; or – Greater than 10 m wide in a dense to mid-dense (structural category) regional ecosystem.	For clearing for linear infrastructure: – Greater than 25 m wide in a grassland (structural category) regional ecosystem; or – Greater than 20 m wide in a sparse (structural category) regional ecosystem; or – Greater than 10 m wide in a dense to mid-dense (structural category) regional ecosystem.
	Clearing within 50 m of the defining bank.	Clearing within 5 m of the defining bank.
Assessment		
Significant – Clearing greater than 10 m wide in a dense (structural category) endangered regional ecosystem and greater than 20 m wide in a sparse (structural category) of concern regional ecosystem is proposed to occur. – Disturbance within 10 m to 30 m will be rehabilitated, leaving 10 m permanently cleared.	**Not significant** No wetlands are mapped as intersecting the GSDA pipeline alignment	**Significant** – Clearing greater than 10 m wide in a dense (structural category) regional ecosystem and greater than 20 m wide in a sparse (structural category) regional ecosystem that are within the defined distance of a watercourse is proposed to occur. Clearing within 5 m of the defining bank will also occur. – Disturbance within 10 m to 30 m will be rehabilitated, leaving 10 m permanently cleared. The disturbance within 5 m of a bank will be rehabilitated after construction as the pipeline is proposed to be buried under watercourses and associated bank vegetation.

7.1.2.2 Connectivity areas

To identify and quantify any significant impact on connectivity within the GSDA pipeline alignment, the Landscape Fragmentation Tool (LFC) was used. The LFC tool performs a desktop assessment of proposed impacts on connectivity areas containing remnant vegetation and determines whether the prescribed activity will be significant with respect to the Queensland Environmental Offset Framework.

The following significant residual impact criteria for the significant residual impact test for connectivity as listed in the *Significant Residual Impact Guideline 2014* (DEHP 2014b), have been assessed and the project is unlikely to have a significant impact on connectivity within the GSDA pipeline alignment. A significant residual impact assessment of connectivity is provided in Table 7-14.

Table 7-14 Significant residual impact assessment – connectivity

Significant residual impact criteria	Assessment
Change in core remnant ecosystem extent at the local scale	Unlikely
Loss or fragmentation of core remnant ecosystem at the site scale	Unlikely

7.1.2.3 Wetlands and watercourses

The following significant residual impact criteria for wetlands and watercourses as listed in the *Significant Residual Impact Guideline 2014* (DEHP 2014b), have been assessed and the project is unlikely to have a significant impact on wetlands and watercourses within the GSDA pipeline alignment. A significant residual impact assessment is provided in Table 7-15.

Table 7-15 Significant residual impact assessment – wetlands and watercourses

Significant residual impact criteria	Assessment
Areas of the wetland or watercourse being destroyed or artificially modified;	**Unlikely** There are no HES wetlands that intersect the GSDA pipeline alignment, therefore no MSES wetlands will be permanently destroyed or artificially modified as a result of the project. There are five moderate and nine low risk ephemeral waterways that intersect with the GSDA pipeline alignment a. Where works occur in ephemeral habitats, additional controls for the protection of habitat and flow will be implemented. These measures will include scheduling works during the dry season to avoid increased mobilisation or erosion and sedimentation and avoid key fish migration and spawning periods. Works in wetted waterways will be undertaken in accordance with the DAF's 'ADR for operational work that is constructing or raising waterway barrier works' (DAF 2018), and any approval conditions, to avoid impacts to flow and fauna movement within the wetland. Within ephemeral watercourses that are dry during construction, the pipelines will be constructed via trenching. There will be a temporary modification of the dry creek bed and banks during construction to clear vegetation within the pipeline trenching footprint which will cause a temporary disturbance. However, it is expected that after construction, the watercourse beds and banks within the footprint will be rehabilitated back to their natural state with no residual impact. Larcom Creek is the only high-risk waterway within the GSDA pipeline alignment. This site contains a permanent waterbody and therefore this pipeline crossing is expected to be constructed via thrust boring and have no impact upon the waterway.
A measurable change in water quality of the wetland or watercourse—for example a change in the level of the physical and/or chemical characteristics of the water, including salinity, pollutants, or nutrients in the wetland or watercourse, to a level that exceeds the water quality guidelines for the waters; or	**Unlikely** The GSDA pipeline alignment has been positioned to avoid impacts on MSES wetlands and water courses where possible. Within ephemeral watercourses and wetlands that are dry during construction, the pipelines will be constructed via trenching. There will be a temporary modification of the dry creek bed and banks during construction to clear vegetation within the pipeline trenching footprint which will cause a temporary disturbance. However, it is expected that after construction, the watercourse beds and banks within the footprint will be rehabilitated back to their natural state with no residual impact.

Significant residual impact criteria	Assessment
	For the high-risk waterway, Larcom Creek, the pipeline will be constructed via trenchless methods and is not expected to have any impact upon water quality. The water quality of watercourses that intersect the GSDA pipeline alignment are therefore unlikely to undergo a measurable change. A CEMP, including erosion and sediment control will be implemented to minimise impacts to water quality during construction.
The habitat or lifecycle of native species, including invertebrate fauna and fish species, dependent upon the wetland being seriously affected; or	**Unlikely** The habitats or lifecycles of native species that are dependent on the waterway are unlikely to be seriously affected by the project. The GSDA pipeline alignment has been positioned to avoid impacts to HES wetlands and high ecological waterways where possible. Within ephemeral watercourses and wetlands that are dry during construction, the pipelines will be constructed via trenching. There will be a temporary modification of the dry creek bed and banks during construction to clear vegetation within the pipeline trenching footprint which will cause a temporary disturbance. However, it is expected that after construction, the watercourse beds and banks within the footprint will be rehabilitated back to their natural state with no residual impact. For the high-risk waterway, Larcom Creek, the pipeline will be constructed via thrust boring. Where works occur in wetted habitats, additional controls for the protection of habitat and flow including short duration of works outside of key migration or breeding periods will occur, these works will be localised and unlikely to disrupt the lifecycles of native species.
A substantial and measurable change in the hydrological regime or recharge zones of the wetland, e.g. a substantial change to the volume, timing, duration and frequency of ground and surface water flows to and within the wetland; or	**Unlikely** No wetlands intersect the GSDA pipeline alignment. No downstream wetlands have the potential to be impacted by the project as the project is unlikely to interfere with hydrological regime or recharge zone of downstream wetlands.
An invasive species that is harmful to the environmental values of the wetland being established (or an existing invasive species being spread) in the wetland.	**Unlikely** No wetlands intersect the GSDA pipeline alignment. No downstream wetlands have the potential to be impacted by the project due to the nature of the proposed works. Site-specific Weed and Pest Management Plan in accordance with relevant legislation and plans will be implemented that outlines protocols to prevent the introduction of weed and pest species into the construction area and minimise the spread of declared weeds and pests within the project footprint.

7.1.2.4 Waterway providing for fish passage

The following significant residual impact criteria for waterways providing for fish passage as listed in the *Significant Residual Impact Guideline 2014* (DEHP 2014b), have been assessed and the project is unlikely to have a significant impact on waterway providing for fish passage within the GSDA pipeline alignment. A significant residual impact assessment is provided in Table 7-16.

Table 7-16 Significant residual impact assessment – waterway providing for fish passage

Significant residual impact criteria	Assessment
Result in the mortality or injury of fish; or	**Unlikely** It is considered unlikely that the proposed pipeline works will result in the mortality or injury of fish. Construction will occur during the dry season within ephemeral waterways thereby avoiding injury and mortality. For the high-risk waterway, Larcom Creek, the pipeline will be constructed via thrust boring, avoiding potential injury or morality impacts to the fish community. Construction will be conducted within 180 days (DAF's 'ADR for operational work that is constructing or raising waterway barrier works' (DAF 2018)), complying with approval conditions for the protection of waterways providing for fish passage. If construction is required within a waterway supporting aquatic fauna, then fauna salvage will occur in accordance with DAF Fish Salvage Guidelines. A CEMP will be implemented to protect habitat quality downstream of construction.

Significant residual impact criteria	Assessment
Result in conditions that substantially increase risks to the health, wellbeing and productivity of fish seeking passage such as through the depletion of fishes' energy reserves, stranding, increased predation risks, entrapment or confined schooling behaviour in fish; or	**Unlikely** It is considered unlikely that the proposed pipeline works will result in conditions that substantially increases the risks to the health, wellbeing and productivity of fish seeking passage. Key mitigation measures include construction during the dry season and the use of thrust boring at the high-risk waterway, Larcom Creek. Capture and relocation of fish in wetted waterways will also be undertaken in accordance with DAF Fish Salvage Guidelines where required. A CEMP will be implemented for the protection of habitat quality within and downstream of the construction footprints.
Reduce the extent, frequency or duration of fish passage previously found at a site; or	**Unlikely** It is considered unlikely that the proposed pipeline works will reduce the extent, frequency or duration of fish passage within the GSDA pipeline alignment. The location of the pipeline has been located to avoid and reduce impacts to permanent waterways. Construction will primarily occur within dry ephemeral waterways and no impacts to fish passage will occur. The only high-risk waterway within the GSDA pipeline alignment is Larcom Creek and thrust boring methods of construction will be used to further avoid direct impacts to fish, fish movement and habitat quality. Where works occur in wetted habitats, additional controls for the protection of habitat and flow including short duration of works outside of key migration or breeding periods will occur, these works will be localised and unlikely to disrupt the passage of fish. Works in wetted waterways will be undertaken in accordance with the DAF's 'ADR for operational work that is constructing or raising waterway barrier works' (DAF 2018), or any approval conditions and will allow for continued or facilitated movements.
Substantially modify, destroy or fragment areas of fish habitat (including, but not limited to in-stream vegetation, snags and woody debris, substrate, bank or riffle formations) necessary for the breeding and/or survival of fish; or	**Unlikely** It is considered unlikely that the proposed pipeline works will substantially modify, destroy or fragment areas of fish habitat within the GSDA pipeline alignment. The location of the pipeline has been located to avoid and reduce impacts to permanent waterways. Open trench construction methods will primarily occur within dry ephemeral waterways in which there will be a temporary modification of the dry creek bed and banks which will cause a temporary disturbance. However, it is expected that after construction, the watercourse beds and banks, along with other fish habitats within the footprint will be rehabilitated back to their natural state with no residual impact. For Larcom Creek, the high-risk mapped waterway under the WWBW spatial layer that will contain water at the time of construction, thrust boring will be used to further avoid direct impacts to fish habitat. Where works occur in wetted habitats, additional controls for the protection of habitat will include the implementation of a CEMP and fauna salvage in accordance with DAF guidelines. The works will be localised and unlikely to substantially modify, destroy or fragment area of fish habitat.
Result in a substantial and measurable change in the hydrological regime of the waterway, for example, a substantial change to the volume, depth, timing, duration and frequency of flows; or	**Unlikely** It is considered unlikely that the proposed pipeline works will substantially or measurably change the hydrological regime of the waterways within the GSDA pipeline alignment. Construction will primarily occur within dry ephemeral waterways and not impact upon the hydrological regime of these waterways. Waterways mapped as high and major risk under the WWBW spatial layer that contain water at the time of construction will utilise trenchless construction methods if possible and avoid impacts to the hydrological regime of the waterways. Where construction occurs in wetted habitats, works will be undertaken in accordance with the DAF's 'ADR for operational work that is constructing or raising waterway barrier works' (DAF 2018), or any approval conditions and will allow for continued flow through or around the construction footprint and is therefore unlikely to impact upon the hydrological regime of the waterway.

Significant residual impact criteria	Assessment
Lead to significant changes in water quality parameters such as temperature, dissolved oxygen, Ph and conductivity that provide cues for movement in local fish species.	**Unlikely** It is considered unlikely that the proposed pipeline works will lead to significant changes in water quality parameters within the GSDA pipeline alignment. The location of the pipeline has been located to avoid and reduce impacts to permanent waterways. Construction will primarily occur within dry ephemeral waterways and not impact upon the water quality within these waterways. For Larcom Creek, the high-risk mapped waterway under the WWBW spatial layer that will contain water at the time of construction, thrust boring will be used and will avoid impacts to water quality within the waterways. During any works that may occur in wetted waterways, a WQMP, as per the CEMP, will be developed to identify the potential for water quality degradation and allow for adaptive management if required. Therefore, works within the project are unlikely to impact upon water quality parameters and thereby not disrupt environmental cues for movement of local fish species.

7.2 SGIC SDA

7.2.1 Significance of impact on threatened communities

One TEC was confirmed present in the SGIC SDA pipeline alignment that was identified as a controlling provision and considered in deciding the EPBC Approval, namely the Brigalow (*Acacia harpophylla* dominant and co-dominant) (endangered under the EPBC Act). The potential for the project to significantly impact on this community was assessed against the criteria for endangered and critically endangered TECs in the EPBC Significant Impact Guidelines 1.1 (DoE 2013). The assessment found that the project is likely to have a significant impact on the community. Justification for this finding is included in the significance of impact assessment provided in Table 7-17. The Poplar Box Grassy Woodland on Alluvial Plains TEC was also confirmed present in the SGIC SDA pipeline alignment; however, it was not listed at the time of the approval and a significant impact assessment is not required for this community.

Table 7-17 EPBC Act significant impact assessment – Brigalow (Acacia harpophylla dominant and co-dominant) TEC

Significant impacts criteria	Assessment
Reduce the extent of an ecological community	**Unlikely** One patch of the TEC was confirmed present in the SGIC SDA pipeline alignment. This patch will be directly impacted, with a total of 1.52 ha of the TEC patch to be cleared for the project. Whilst the area of the impacted patch will be reduced by 12.7%, the majority of the patch will be retained and the extent of occurrence of the community in the local area is unlikely to change as a result of the project. Based on the definition of extent provided by the IUCN (TSSC 2017), no reduction in the extent of the TEC is expected.
Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines	**Likely** The SGIC SDA pipeline alignment crosses the TEC patch for a distance of approximately 507 m. The proposed clearing width of 30 m will represent a break in connectivity within this patch and also lead to greater vulnerability from edge effects. Furthermore, clearing for roads or transmission lines is cited in the Significant Impact Guidelines 1.1 (DoE, 2013) as an impact that would result in fragmentation and is likely to have a significant impact on a TEC. A pipeline corridor that is kept clear of vegetation is likely to have similar impact to a transmission line. Management measures will be implemented to reduce clearing for the pipeline and associated access track to the minimum extent practicable. Nevertheless, the project is likely to result in fragmentation of this community.
Adversely affect habitat critical to the survival of an ecological community	**Likely** Clearing 1.52 ha of the TEC patch will be required to accommodate the pipeline and associated maintenance track. This represents 12.7% of the patch. As per the listing advice, all confirmed TEC patches are considered areas critical to the survival of the ecological community. As such, clearing for the project is likely to adversely affect habitat critical to the survival of the TEC.
Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns.	**Unlikely** The landscape is not proposed to be altered in a way that will impact the abiotic features necessary to support the TEC. Surface water flows are not expected to be significantly impeded by the project.
Cause a substantial change in the species composition of an occurrence of an ecological community.	**Unlikely** No significant change in the species composition is expected. The introduction of a weed control program through the CEMP is likely to result in the overall reduction of invasive species across the project footprint. Equipment and personnel will be subject to weed hygiene requirements and are unlikely to contribute to the introduction of additional invasive species to the site.

Significant impacts criteria	Assessment
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community	**Unlikely** The introduction of a weed control program through the CEMP is likely to reduce existing weed levels within the project footprint. Equipment and personnel will be subject to weed hygiene conditions and are unlikely to contribute to the introduction of additional invasive species to the site.
Interfere with the recovery of an ecological community	**Unlikely** The nominated TEC patch occurs in a landscape that is subjected to ongoing cattle grazing. It is also unlikely that recovery actions would be initiated by landowners. Nevertheless, further fragmentation of the patch will be detrimental to any future recovery actions should they occur.
Conclusion	The project is likely to result in a significant impact on the Brigalow (Acacia harpophylla dominant and co-dominant) TEC. The project will result in clearing 1.52 ha of the TEC patch, which is likely to result in fragmentation of the community and adversely affect habitat critical to the survival of the TEC. Biosecurity and hygiene measures will be incorporated in the project's CEMP to limit the introduction of weeds and other organic matter from outside of the project footprint.

7.2.2 Significant Impact on MNES and MSES species

This section assesses the significance of the SGIC SDA impacts on MNES and MSES that have been confirmed present or are considered likely to occur within the SGIC SDA study area. The significance of impact assessment has been undertaken in accordance with the Queensland *Significant Residual Impact Guideline* (DEHP 2014b) and Commonwealth *Significant Impact Guidelines 1.1* (DoE 2013). A summary of outcomes of the MNES and MSES significant impact assessment are presented in Table 7-18.

Table 7-18 Summary of residual significant impact assessment on MSES

Species	Significant impact	EPBC Approval	Assessed as MSES	Assessed as MNES
Flora				
Samadera bidwillii	Unlikely	✓	✓	
Fauna				
Curlew sandpiper	Unlikely		✓	
Green turtle	Unlikely		✓	
Estuarine crocodile	Unlikely		✓	
Ornamental snake	Unlikely	✓	✓	
Yellow chat (Dawson)	Unlikely	✓	✓	
Squatter pigeon (southern)	Likely	✓	✓	
Grey snake	Unlikely		✓	
White-throated needletail	Unlikely		✓	
Powerful owl	Unlikely		✓	
Platypus	Unlikely		✓	
Greater glider (southern and central)	Likely		✓	
Yellow-bellied glider (south-eastern)	Likely		✓	
Koala	Likely		✓	
Grey-headed flying-fox	Likely	✓		✓
Australian painted snipe	Unlikely	✓	✓	

7.2.2.1 Samadera bidwillii

Conservation status and species ecology

Samadera bidwillii is listed as a vulnerable under both the NC Act and the EPBC Act and was listed as an MNES at the time of the approval. It is a small shrub or tree that grows up to 6 m in height. Its leaves are stiff and leathery and up to 9 cm in length and 6 to 12 mm wide. Flowering occurs from November to March. Inflorescences occur in axillary clusters of 1 to 4; sepals are 0.75 mm to 1 mm long and petals are up to 2.5 mm long. The fruit is a drupe (up to 1 cm long) with short hairs (DotE, 2015). Fruiting typically occurs from February to April but only a small proportion of plants produce viable seed in any one season. Plants often resprout from rootstock following disturbance.

S. bidwillii typically inhabits lowland rainforest or rainforest margins and can also be found in other forest types including open forest and woodland and habitats adjacent to temporary and permanent watercourses (DotE, 2015).

Significance of impact assessment

The project is unlikely to result in a significant residual impact on *Samadera bidwillii*. A significance of impact assessment of the project on *Samadera bidwillii* (vulnerable under the EPBC Act and NC Act) is provided in Table 7-19.

***Table 7-19 Significance of impact on* Samadera bidwillii**

Significant residual impact criteria	Assessment
A long-term decrease in the size of a local population	**Unlikely** Although this species is considered likely to occur based on the species distribution and habitat present, no individuals have been confirmed present in the SGIC SDA pipeline alignment during successive on-ground survey efforts by various consultants. As such the project is unlikely to result in a long-term decrease in the size of a local population.
Reduce the extent of occurrence of the species	**Unlikely** No population has been recorded historically or during recent survey efforts within the SGIC SDA pipeline alignment. Therefore, the project is unlikely to result in a reduction in the extent of occurrence of the species.
Fragment an existing population	**Unlikely** No population has been recorded historically or during recent survey efforts within the SGIC SDA pipeline alignment. Therefore, no fragmentation of an existing population is expected to occur.
Result in genetically distinct populations forming as a result of habitat isolation	**Unlikely** The project is unlikely to impact any local occurrences or their supporting habitats and opportunities for breeding and dispersal are not expected to be impeded by the project. As such, the project is unlikely to result in the isolation of habitats for the species or the formation of genetically distinct populations.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat	**Unlikely** The project is unlikely to result in an invasive species becoming established within the SGIC SDA pipeline alignment. Strict biosecurity measures will be incorporated in the Project CEMP to limit the introduction of weeds and other organic matter from outside of the project footprint.
Introduce disease that may cause the population to decline	**Unlikely** Disease is not considered to be a key threat to *S. bidwillii*; however, hygiene management measures will be utilised during the construction phase to limit the introduction of organic matter into the SGIC SDA pipeline alignment.
Interfere with the recovery of the species	**Unlikely** No population has been recorded historically or during recent survey efforts within the SGIC SDA pipeline alignment. Therefore, no interference with the recovery of the species has been identified.

Significant residual impact criteria	Assessment
Result in disruption to ecologically significant locations (breeding, feeding or nesting sites) of a species	**Unlikely** No population has been recorded historically or during recent survey efforts within the SGIC SDA pipeline alignment. Therefore, the project footprint is not considered to be ecologically significant for this species.
Conclusion	The project is unlikely to result in a significant residual impact on *Samadera bidwillii.* No individuals or population have been recorded historically or during recent surveys efforts within the GSDA pipeline alignment. Biosecurity and hygiene measures will be incorporated in the project's CEMP to limit the introduction of weeds and other organic matter from outside of the project footprint.

7.2.2.2 Curlew sandpiper

Conservation status and species ecology

The curlew sandpiper is listed as critically endangered and migratory under the EPBC Act and critically endangered under the NC Act. The species was not listed at the time of the approval. During the non-breeding period and breeding season for non-breeding birds, the species occurs within suitable habitats along the coast and inland Australia (DoE 2015a). In Australia, the species occurs on intertidal mudflats in sheltered coastal areas, including estuaries, and non-tidal swamps, including lakes and lagoons near the coast (DoE 2015a). The species forages mainly on invertebrates, including worms, molluscs, crustaceans, and insects in tidal and non-tidal habitats, such as mudflats, sandy shores, flooded paddocks and inundated saltflats (DoE 2015a). The curlew sandpiper roosts around coastal or near-coastal lagoons and other wetlands on open substrates. The species has been recorded roosting in mangroves (DoE 2015a). The breeding range of the curlew sandpiper is restricted to the Arctic of northern Siberia. The species departs breeding grounds in July and August, stops over in northern Australia and then continues the direct route to south-east Australia in late August and September. The species' return to breeding grounds begins in March (DoE 2015a).

Field survey results and distribution of suitable habitat

The curlew sandpiper was not recorded during the field surveys within the SGIC SDA study area. The species is considered likely to occur due to the presence of suitable habitat and the species has been historically recorded at 13 locations within the desktop search extent (10 km buffer). The closest record is approximately 1.7 km west from the SGIC SDA pipeline alignment, near Marmor. Suitable habitat for the species was observed in areas where the SGIC SDA pipeline alignment intersects tidal (i.e. mangroves, saltmarshes and mudflats) and non-tidal habitats (i.e. seasonal wetlands). The distribution of predicted curlew sandpiper habitat is mapped in Figure 7-8.

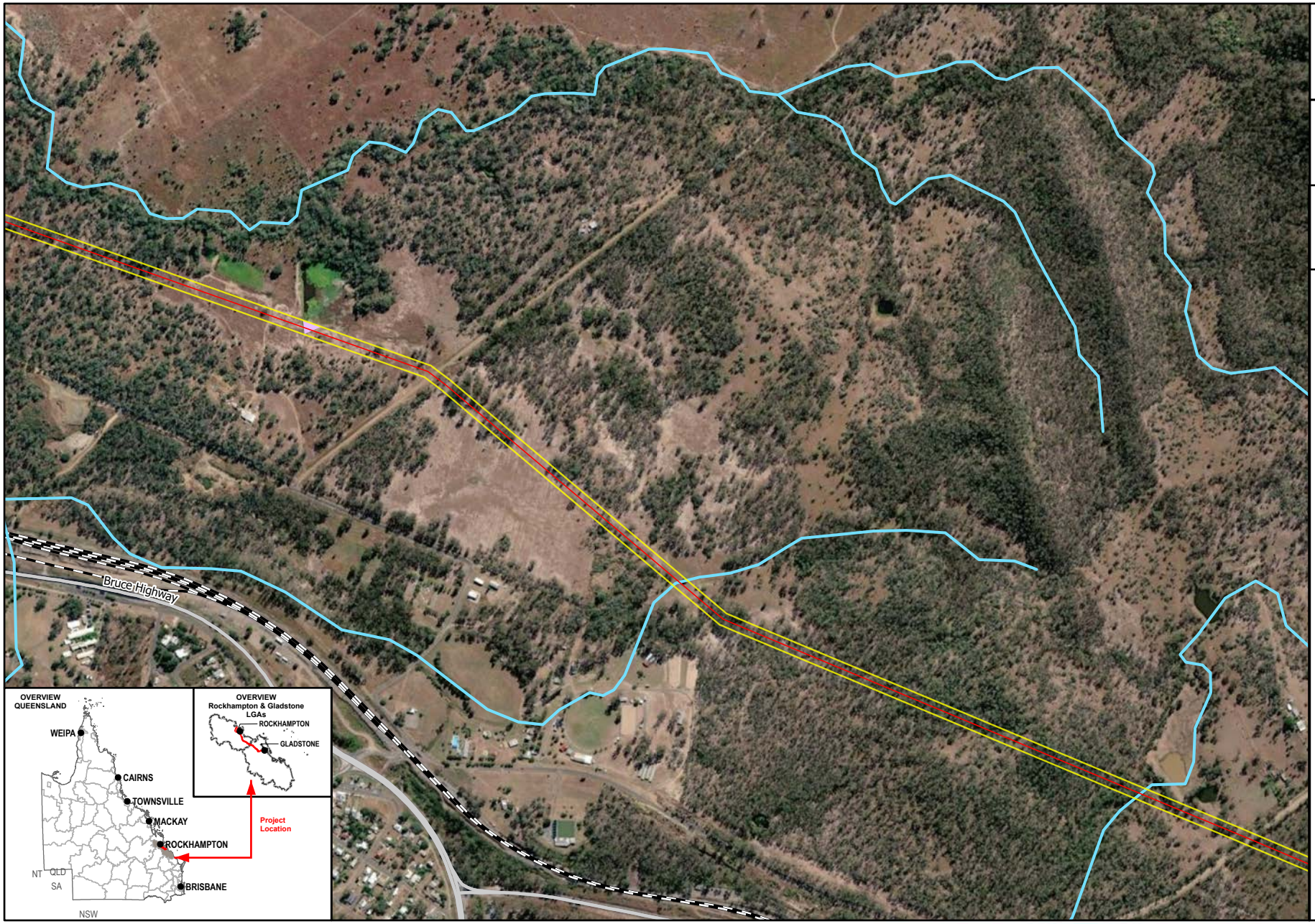
Significance of impact assessment

The project is unlikely to result in a significant residual impact on the curlew sandpiper. A significance of impact assessment of the project on the curlew sandpiper (critically endangered and migratory under the EPBC Act and critically endangered under the NC Act) is provided in Table 7-20.

Table 7-20 Significance of impact on the curlew sandpiper

Significant residual impact criteria	Assessment
A long-term decrease in the size of a local population	**Unlikely** The curlew sandpiper is not considered to have a limited geographic distribution as the species is known to move locally, regionally, and globally. The species has been historically recorded at 13 locations within the desktop search extent (10 km buffer). The project will result in the clearing of 1.64 ha of predicted habitat for the species, representing 0.29% of habitat available within a 5 km buffer. Given the scarcity of records within the local landscape and the species' is highly mobile, the loss of suitable habitat within the SGIC SDA pipeline alignment is unlikely to (1) limit movement of resident or transient individuals; nor (2) affect the availability of resident or transient individuals to acquire key resources (especially noting that the dearth of historical records indicates that adjacent habitats are unlikely to be at carrying capacity and the species does not breed within Australia). The project is unlikely to lead to a long-term decrease in the size of the local population.
Reduce the extent of occurrence of the species	**Unlikely** Occurrence of the species within the SGIC SDA pipeline alignment has not been recorded. The closest record is approximately 1.7 km west from the SGIC SDA pipeline alignment, near Marmor. The maximum width of clearing required for construction of the SGIC SDA pipeline alignment is 30 m. Once the pipeline has been installed and buried, a maximum width of 10 m will be permanently cleared with the remaining 20 m to be rehabilitated. Clearing along the SGIC SDA pipeline alignment is unlikely to impact the species as the proposed clearing extent is narrow and mostly linear, and unlikely to impact intertidal systems within and adjacent to the SGIC SDA pipeline alignment. The project will result in a loss of 1.64 ha of predicted habitat for the curlew sandpiper. Given the minimal loss of habitat, negligible impact of local and landscape connectivity, and low levels of disturbance during the operation phase, it is unlikely to have any significant indirect impact on the species. Accordingly, the project is unlikely to reduce the extent of occurrence of the species.
Fragment an existing population	**Unlikely** A maximum width of 30 m will be cleared for construction of the SGIC SDA pipeline alignment, with 20 m to be rehabilitated after the pipeline has been installed and buried. As the SGIC SDA pipeline alignment is narrow and linear and the curlew sandpiper is highly mobile, the project is unlikely to fragment the curlew sandpiper population.
Result in genetically distinct populations forming as a result of habitat isolation	**Unlikely** The species' breeding grounds do not occur within Australia. The species' capacity to move locally, regionally, and globally is unlikely to be limited by any localised land clearing necessary to construct the SGIC SDA pipeline alignment. As a result, the project is unlikely to cause any loss of gene transfer that would cause genetically distinct populations to form.
Result in invasive species that are harmful to a (critically) endangered species becoming established in the (critically) endangered species' habitat	**Unlikely** Numerous invasive weeds and pasture grasses are currently well established within the SGIC SDA pipeline alignment. Implementation of a site-specific Weed and Pest Management Plan will reduce the risk of further weed spread. Therefore, the project is unlikely to result in the establishment of novel invasive species affecting curlew sandpiper foraging habitat.
Introduce disease that may cause the population to decline	**Unlikely** Disease is not listed as a potential threat to the species (DoE 2015a). The project is unlikely to introduce a disease that may cause the species to decline.
Interfere with the recovery of the species	**Unlikely** No impacts on the lifecycle are predicted to occur and the species does not breed in Australia. No impacts on the long-term persistence of the species in the local landscape is anticipated, and no reduction in population size is expected such that no genetic diversity will be lost for the species. Noting the above points relating to very limited if any effects on local populations (e.g. declines), extent of occurrence, fragmentation, invasive species, and disease, the project is not considered likely to interfere with the recovery of the glossy black-cockatoo.

Significant residual impact criteria	Assessment
Result in disruption to ecologically significant locations (breeding, feeding or nesting sites) of a species	**Unlikely** The project will result in a loss of 1.64 ha of potentially suitable foraging habitat for the curlew sandpiper. While the species is known to mainly occur within intertidal mudflats (DCCEEW 2022), only a small proportion of habitat loss contains tidal wetlands (i.e. mudflats and saltmarshes) and fringing mangrove vegetation along tidal waterways. A large proportion of habitat loss contains large seasonal wetlands retaining pastural grasses, which is not considered as an ecological significant location of the species. While disturbance to species' may be experienced during construction, this disturbance will be short-term such that no impact on the lifecycle of this species is anticipated. Furthermore, any disturbance during construction will be highly localised and therefore unlikely to impact ecologically significant locations of a species. This conclusion is based on the small extent of the proposed impact. Similarly, owing to the narrow clearing extent, food resources in the local landscape for the species' is unlikely to be substantially reduced and movement patterns are not anticipated to be impacted as there will be no functional disruption in habitat connectivity. The project is unlikely to disrupt the species breeding cycle, as the species breeding range is restricted to the Arctic of northern Siberia (DoE 2015a).
Conclusion	The project is unlikely to result in a significant residual impact on the curlew sandpiper. The project will result in a loss (1.64 ha) of potentially suitable foraging habitat for the curlew sandpiper; however, due to the narrow clearing extent, food resources in the local landscape for the species' is unlikely to be substantially reduced and movement patterns are not anticipated to be impacted as there will be no functional disruption in habitat connectivity. Furthermore, the project is unlikely to impact the species' breeding cycle, as its breeding range is restricted to the Arctic of northern Siberia (DoE 2015a).



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Legend

- SGIC SDA Pipeline Alignment
- Study Area
- Predicted Curlew Sandpiper Habitat
- Waterways
- Main Roads
- Railways

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

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PROJECTION UTM Zone 56
(Datum GDA2020)

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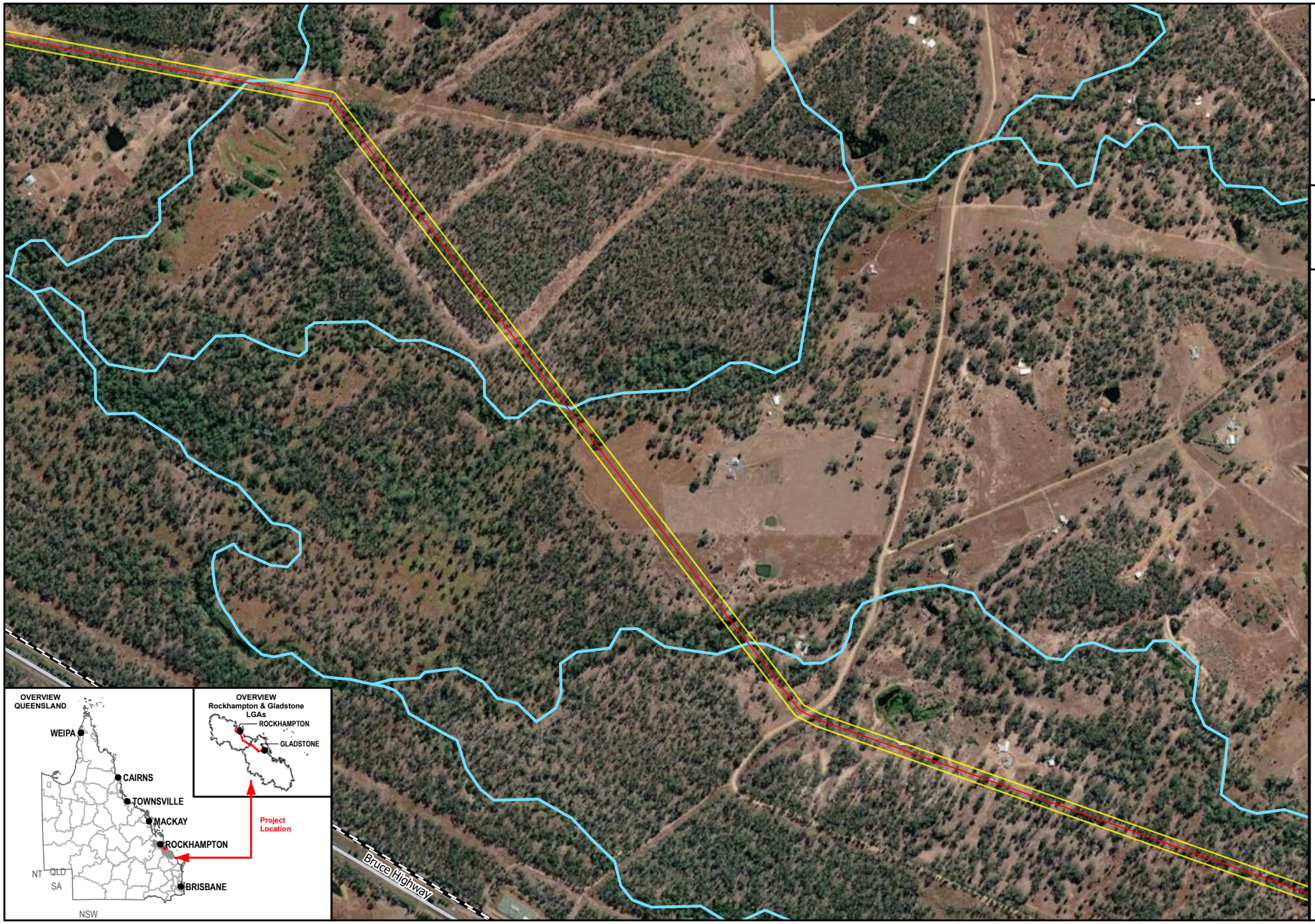
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-8a
Distribution of Curlew Sandpiper Habitat Within the SGIC SDA Study Area
000-G-MAP-2429 Version:3 Date:19/09/2022



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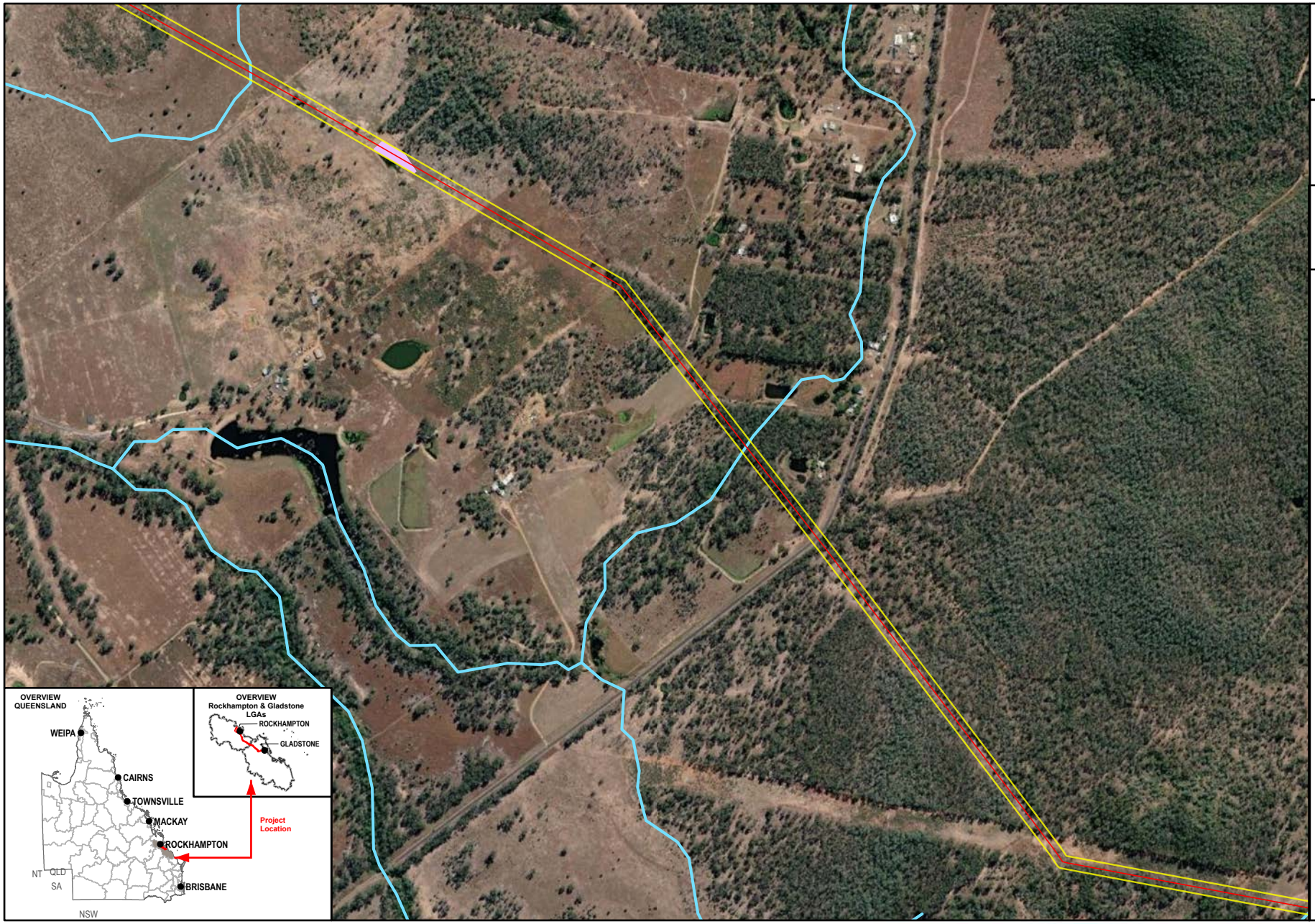
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-8b
Distribution of Curlew Sandpiper Habitat Within the SGIC SDA Study Area
000-G-MAP-2429 Version:3 Date:19/09/2022



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Legend

- SGIC SDA Pipeline Alignment
- Study Area
- Predicted Curlew Sandpiper Habitat
- Waterways

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

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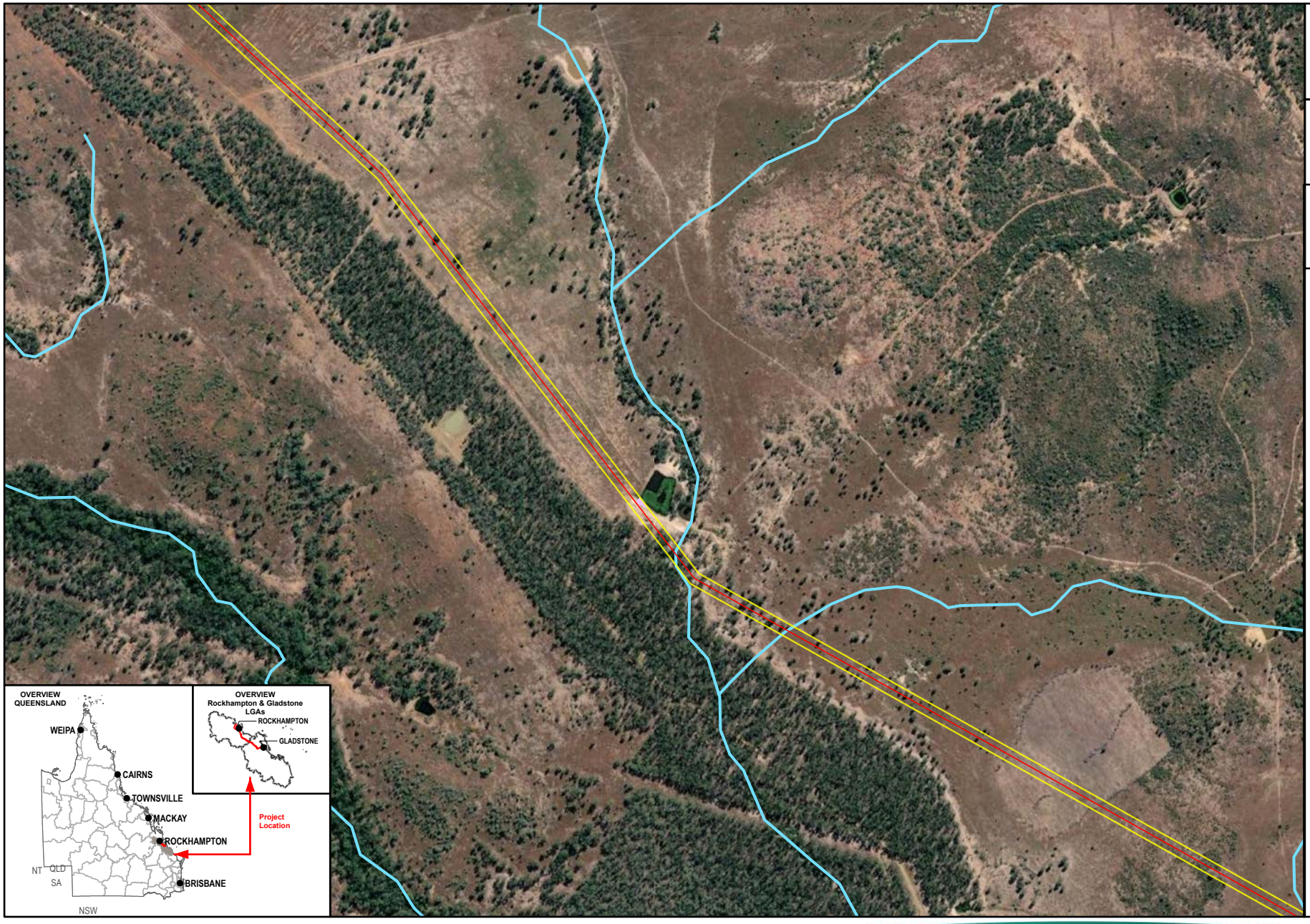
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-8c
Distribution of Curlew Sandpiper Habitat Within the SGIC SDA Study Area
000-G-MAP-2429 Version:3 Date:19/09/2022



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- Waterways

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

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PROJECTION UTM Zone 56
(Datum GDA2020)

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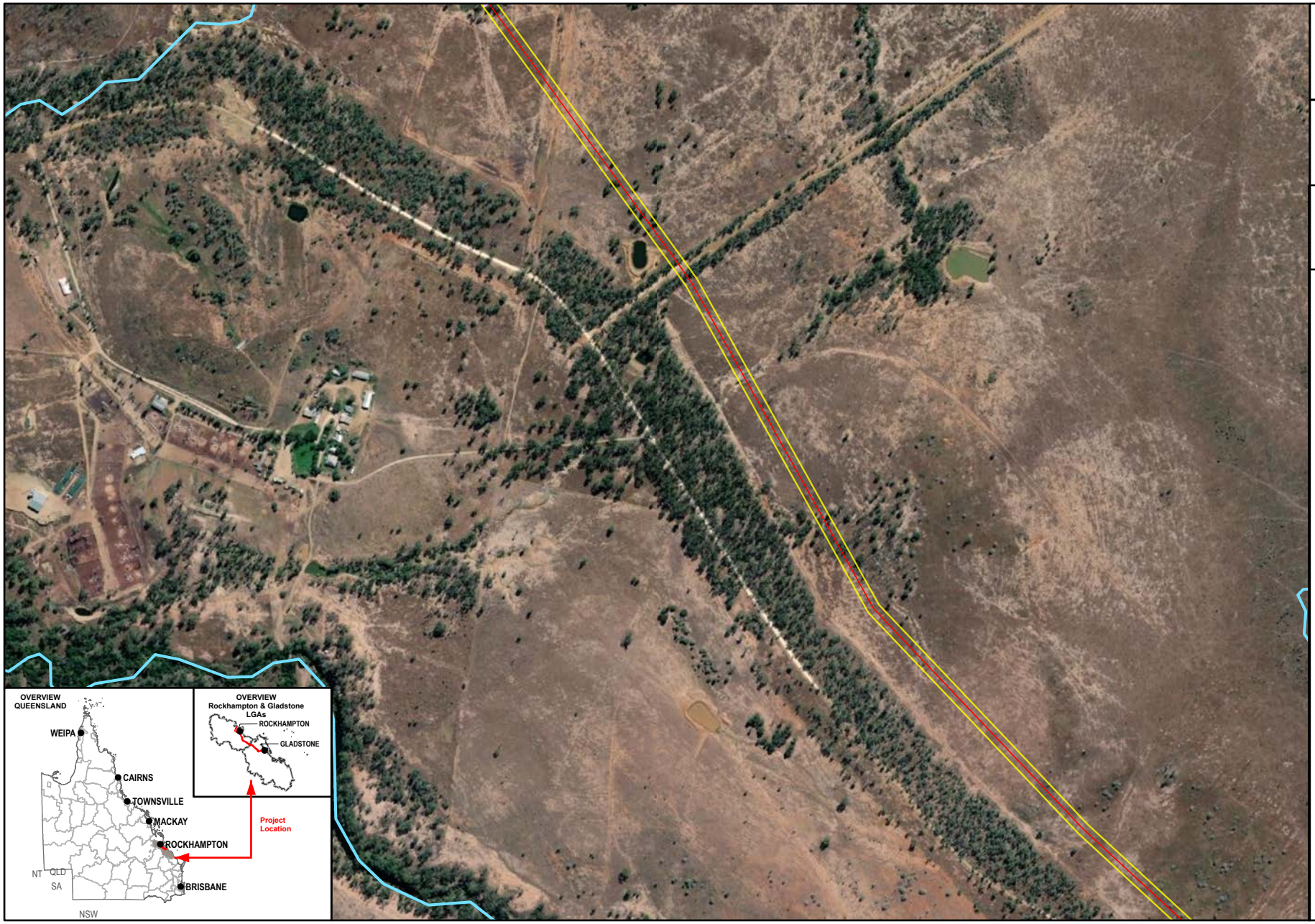
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-8d
Distribution of Curlew Sandpiper Habitat Within the SGIC SDA Study Area
000-G-MAP-2429 Version:3 Date:19/09/2022



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Legend

- SGIC SDA Pipeline Alignment
- Study Area
- Predicted Curlew Sandpiper Habitat
- Waterways

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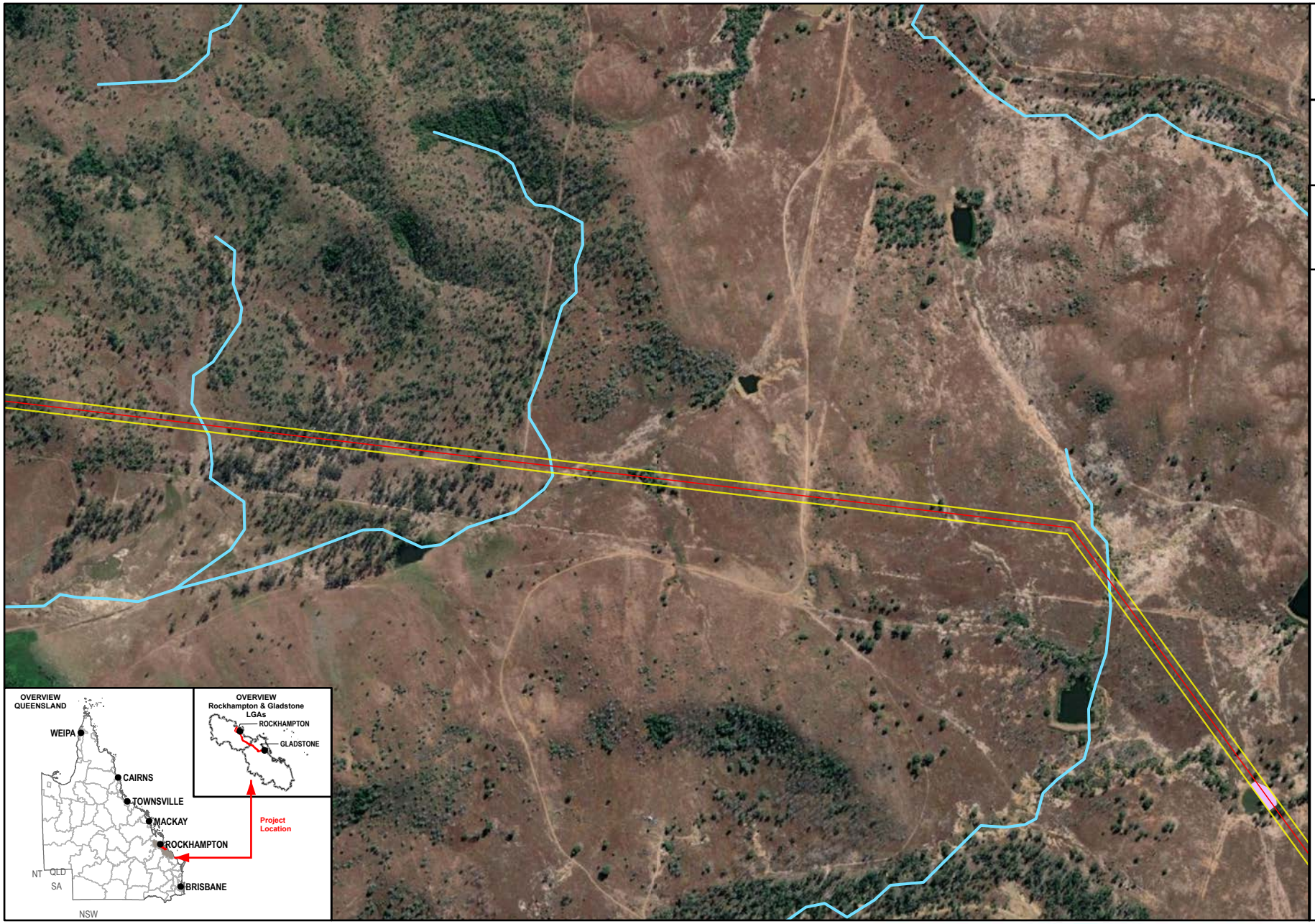
Fitzroy to Gladstone Pipeline Baseline Terrestrial and Aquatic Ecology Technical Report

Figure 7-8e

Distribution of Curlew Sandpiper Habitat Within the SGIC SDA Study Area

000-G-MAP-2429 Version:3 Date:19/09/2022



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Legend

- SGIC SDA Pipeline Alignment
- Study Area
- Predicted Curlew Sandpiper Habitat
- Waterways

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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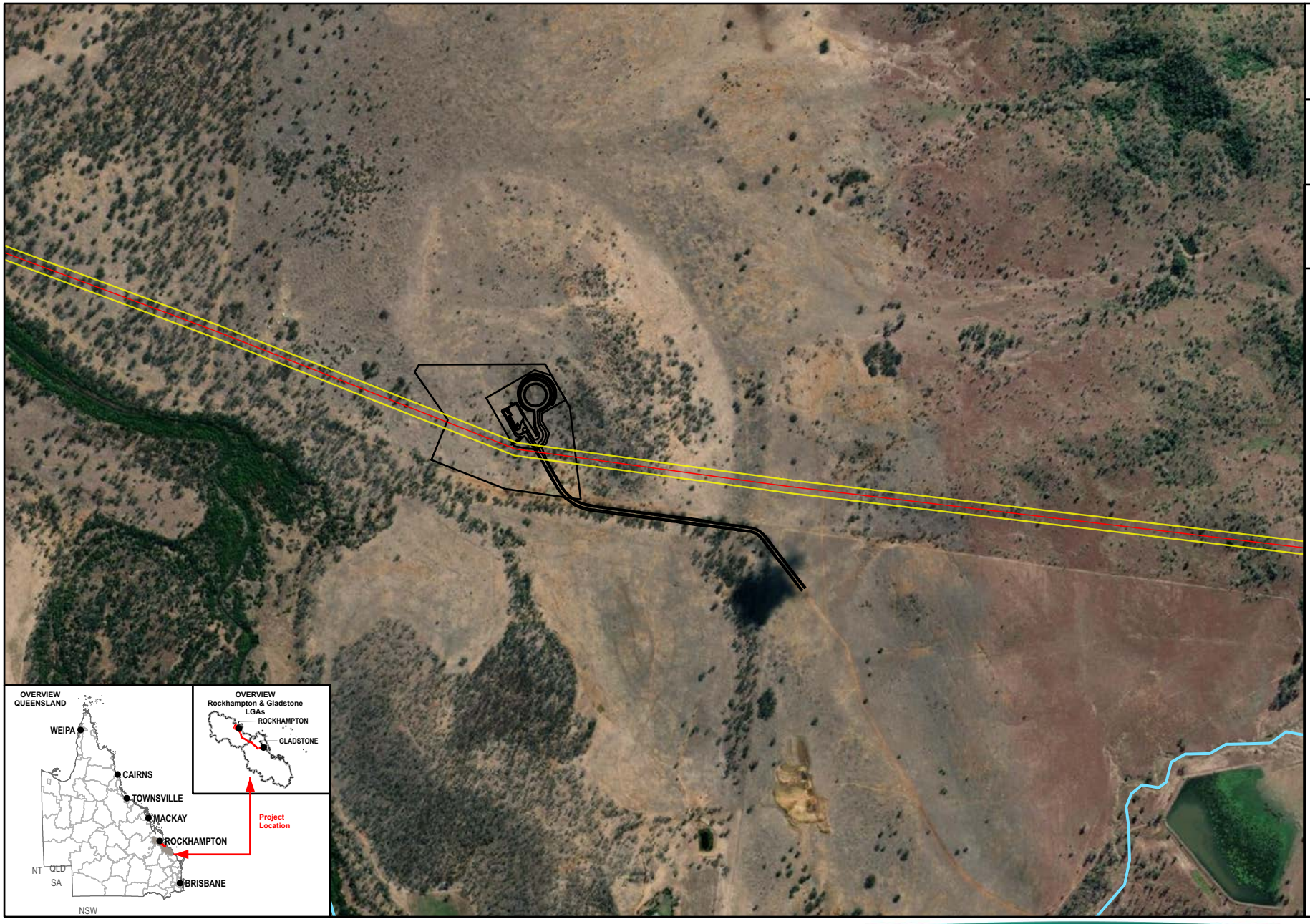
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-8f
Distribution of Curlew Sandpiper Habitat Within the SGIC SDA Study Area
000-G-MAP-2429 Version:3 Date:19/09/2022



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Legend

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

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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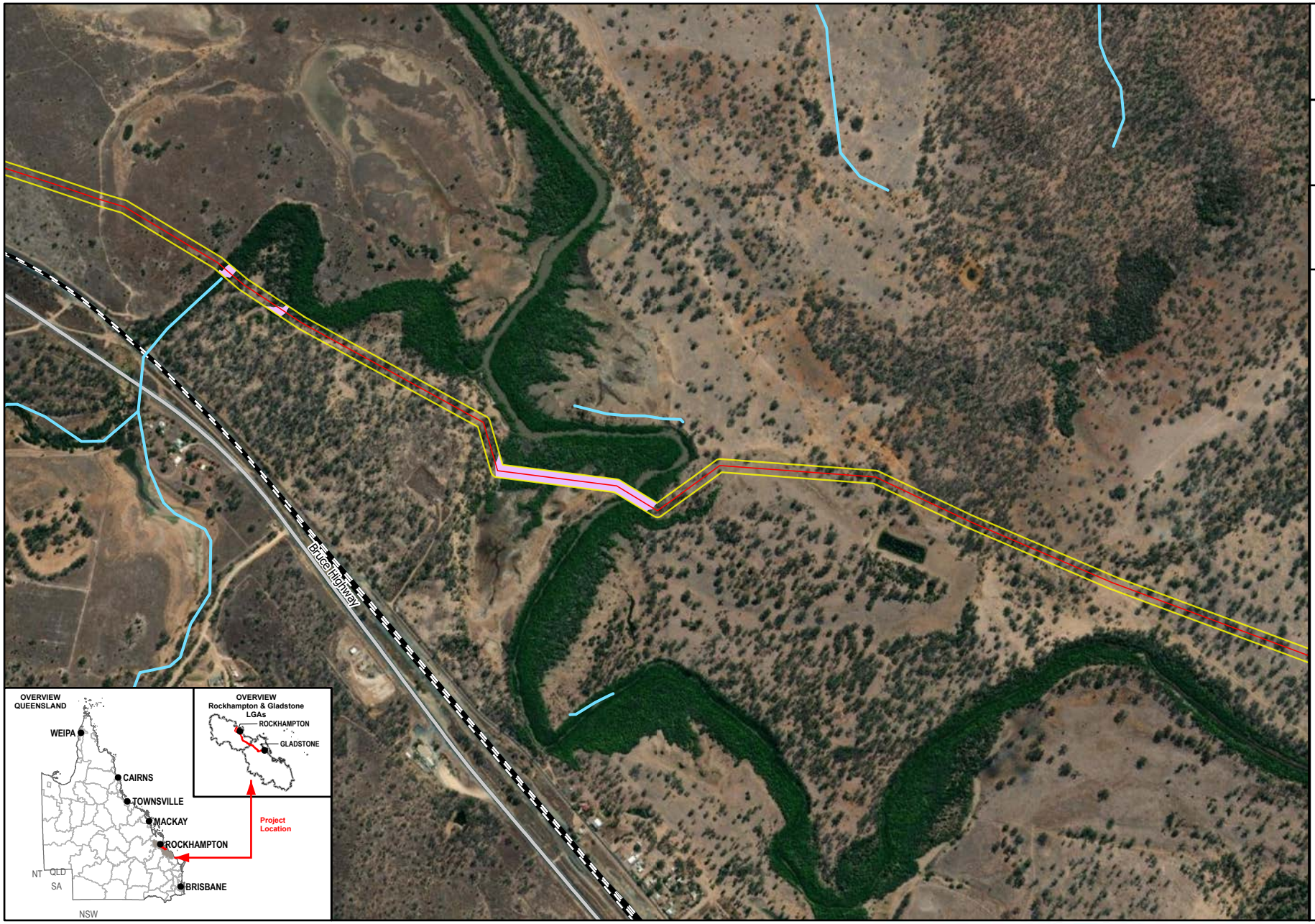
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-8g
Distribution of Curlew Sandpiper Habitat Within the SGIC SDA Study Area
000-G-MAP-2429 Version:3 Date:19/09/2022



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Legend

- SGIC SDA Pipeline Alignment
- Study Area
- Predicted Curlew Sandpiper Habitat
- Waterways
- Main Roads
- Railways

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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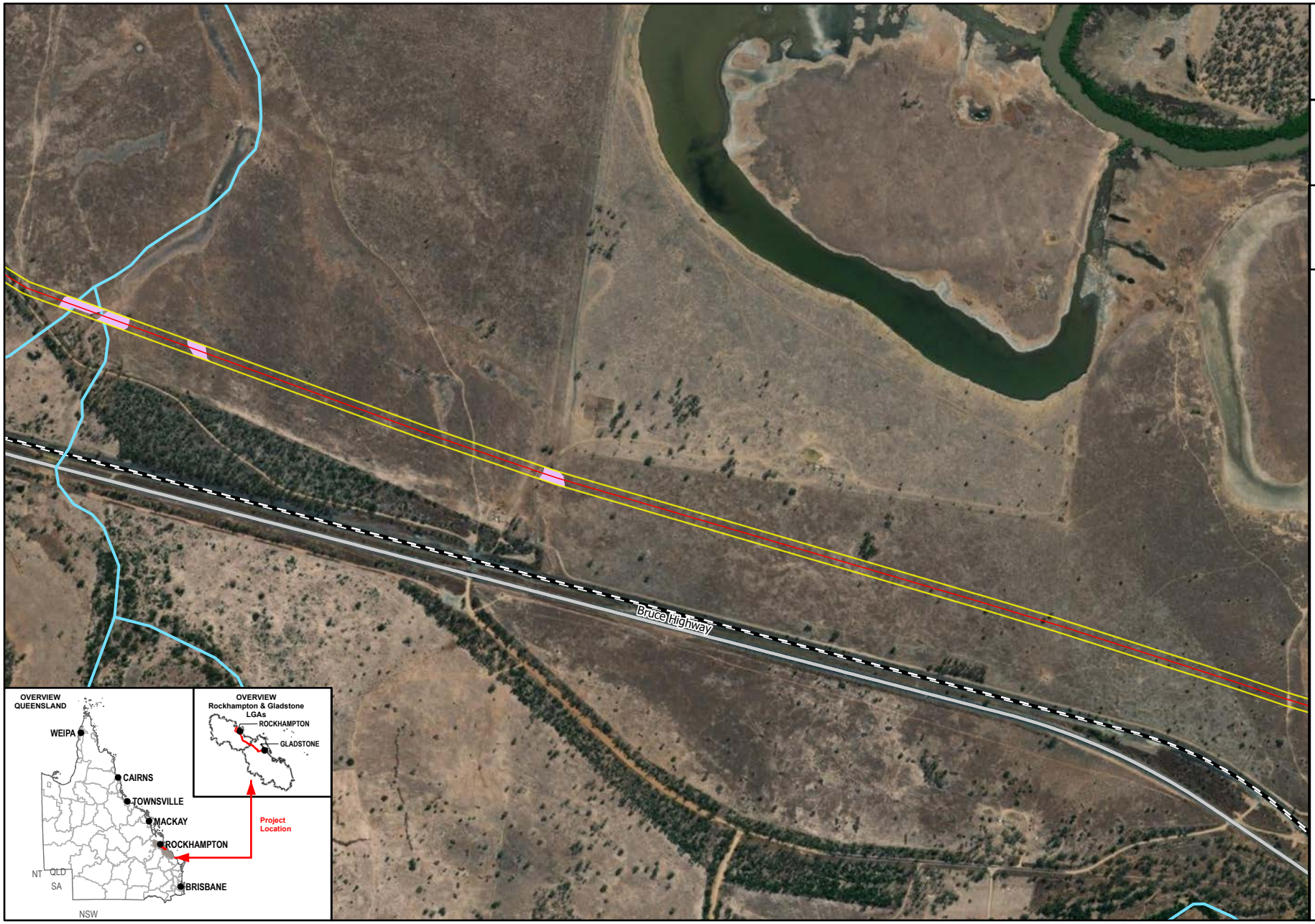
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-8h
Distribution of Curlew Sandpiper Habitat Within the SGIC SDA Study Area
000-G-MAP-2429 Version:3 Date:19/09/2022



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Legend

- SGIC SDA Pipeline Alignment
- Study Area
- Predicted Curlew Sandpiper Habitat
- Waterways
- Main Roads
- Railways

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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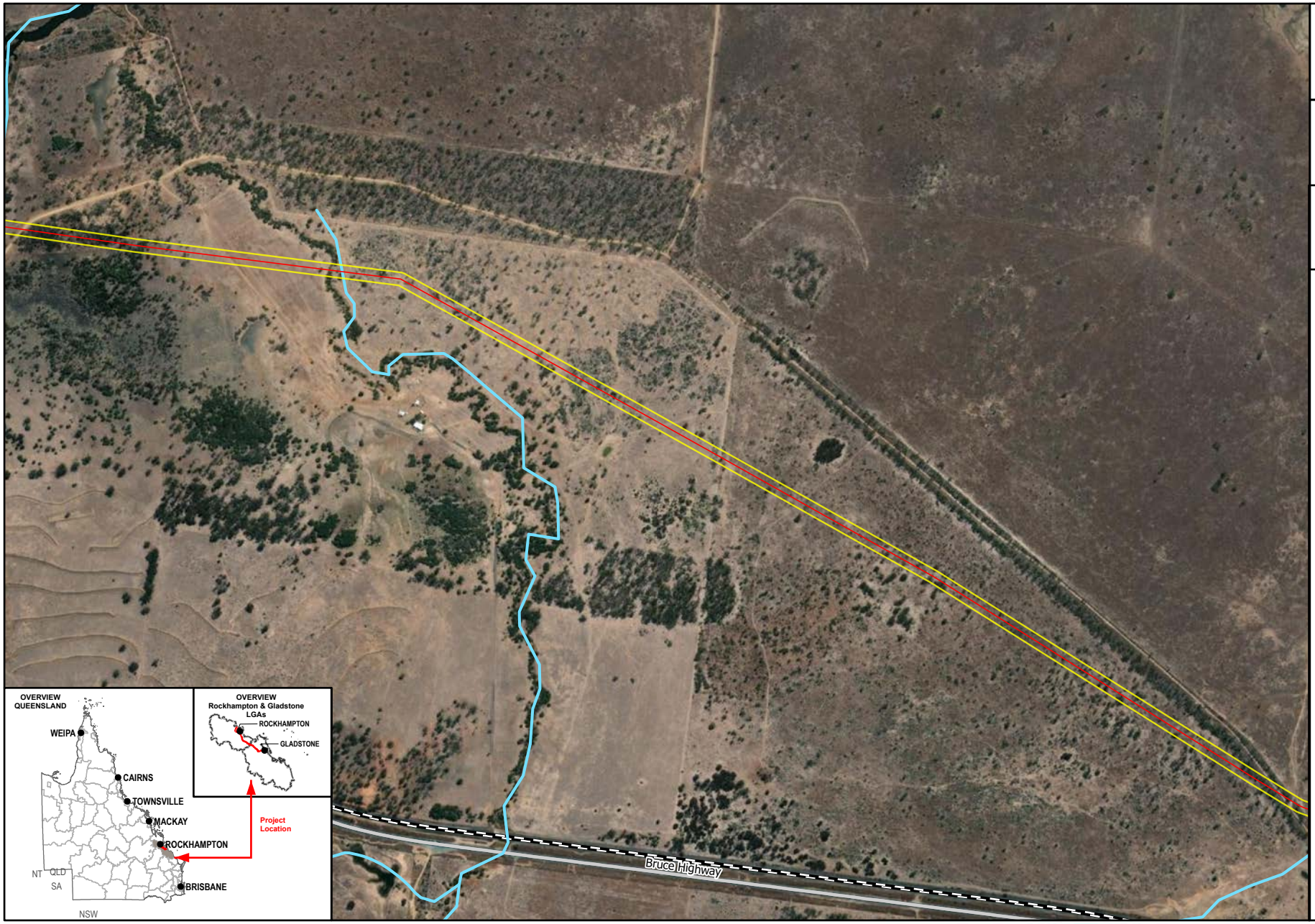
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-8i
Distribution of Curlew Sandpiper Habitat Within the SGIC SDA Study Area
000-G-MAP-2429 Version:3 Date:19/09/2022



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

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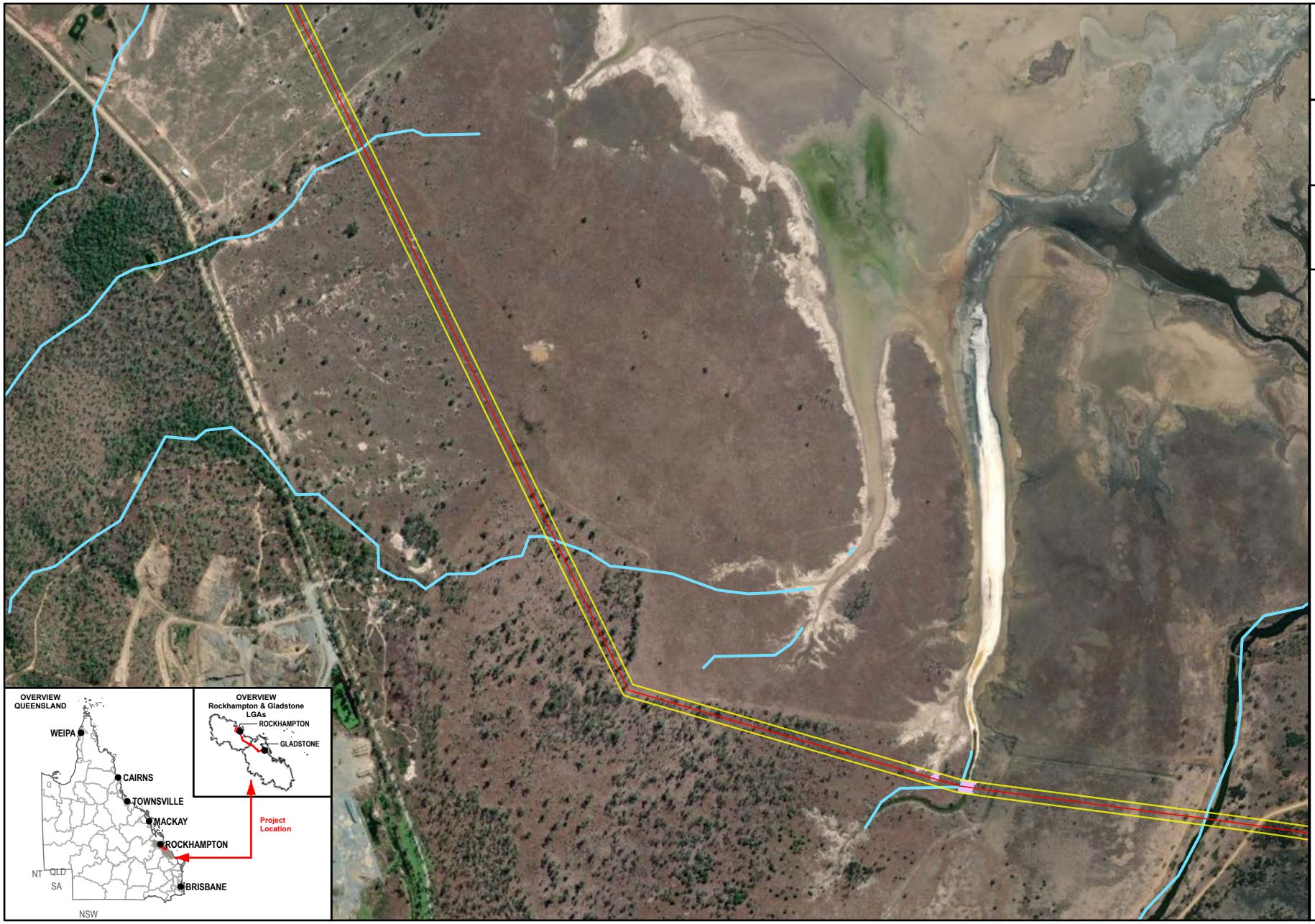
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-8j
Distribution of Curlew Sandpiper Habitat Within the SGIC SDA Study Area
000-G-MAP-2429 Version:3 Date:19/09/2022



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- SGIC SDA Pipeline Alignment
- Study Area
- Predicted Curlew Sandpiper Habitat
- Waterways

Data Sources:
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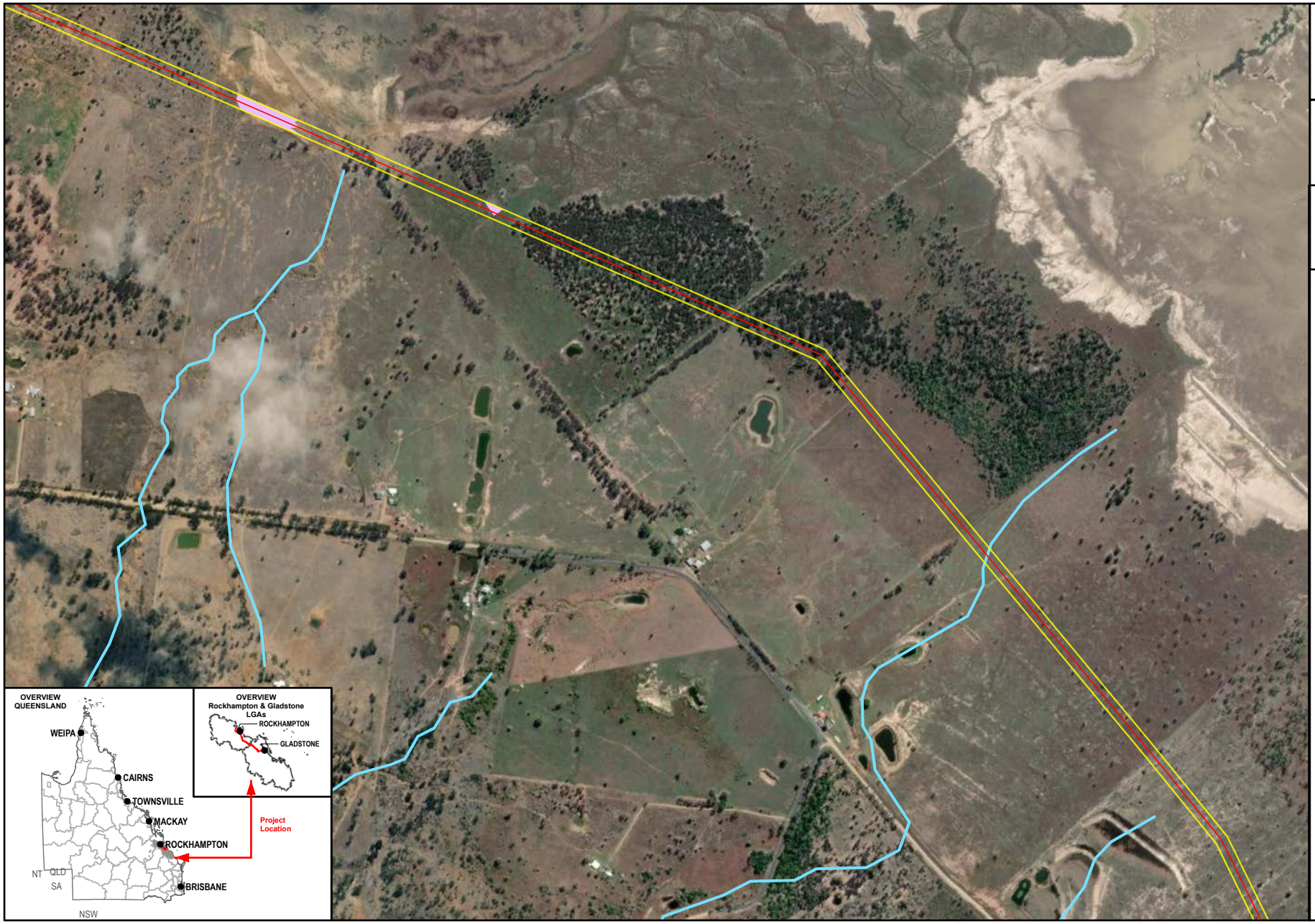
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-8k
Distribution of Curlew Sandpiper Habitat Within the SGIC SDA Study Area
000-G-MAP-2429 Version:3 Date:19/09/2022



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- SGIC SDA Pipeline Alignment
- Study Area
- Predicted Curlew Sandpiper Habitat
- Waterways

Data Sources:
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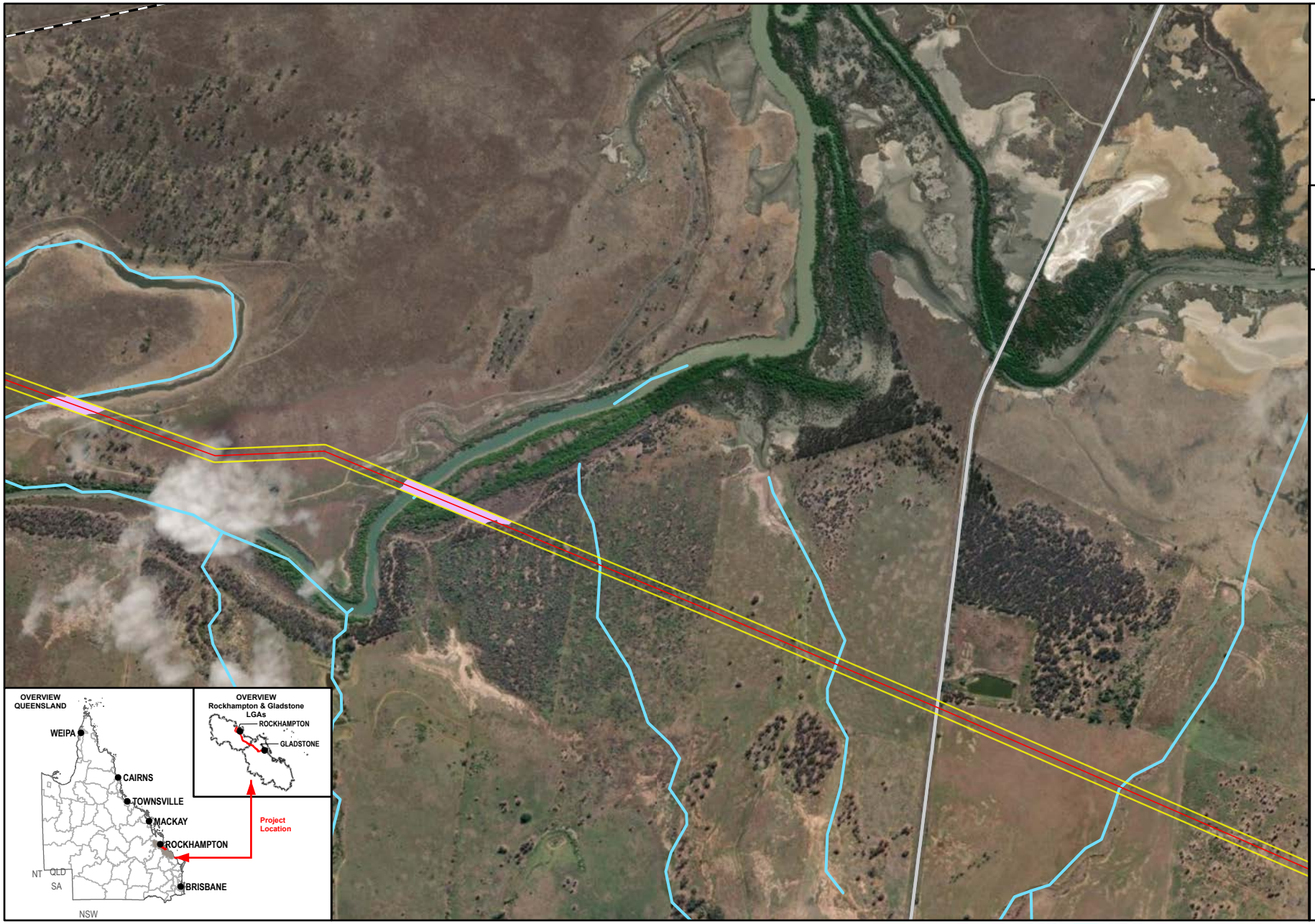
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-8l
Distribution of Curlew Sandpiper Habitat Within the SGIC SDA Study Area
000-G-MAP-2429 Version:3 Date:19/09/2022



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- SGIC SDA Pipeline Alignment
- Study Area
- Predicted Curlew Sandpiper Habitat
- Waterways
- Main Roads
- Railways

Data Sources:
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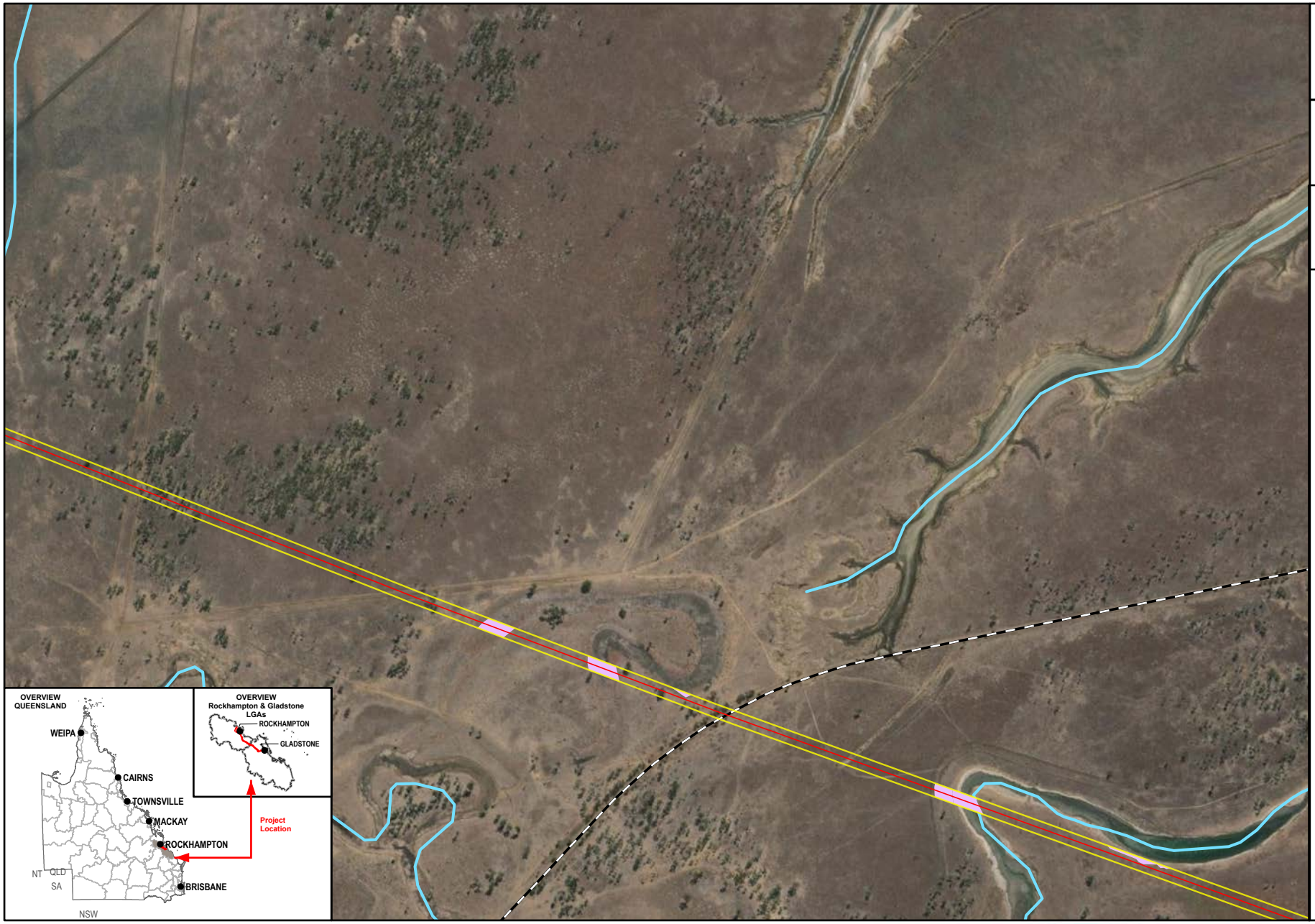
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-8m
Distribution of Curlew Sandpiper Habitat Within the SGIC SDA Study Area
000-G-MAP-2429 Version:3 Date:19/09/2022



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- SGIC SDA Pipeline Alignment
- Study Area
- Predicted Curlew Sandpiper Habitat
- Waterways
- Railways

Data Sources:
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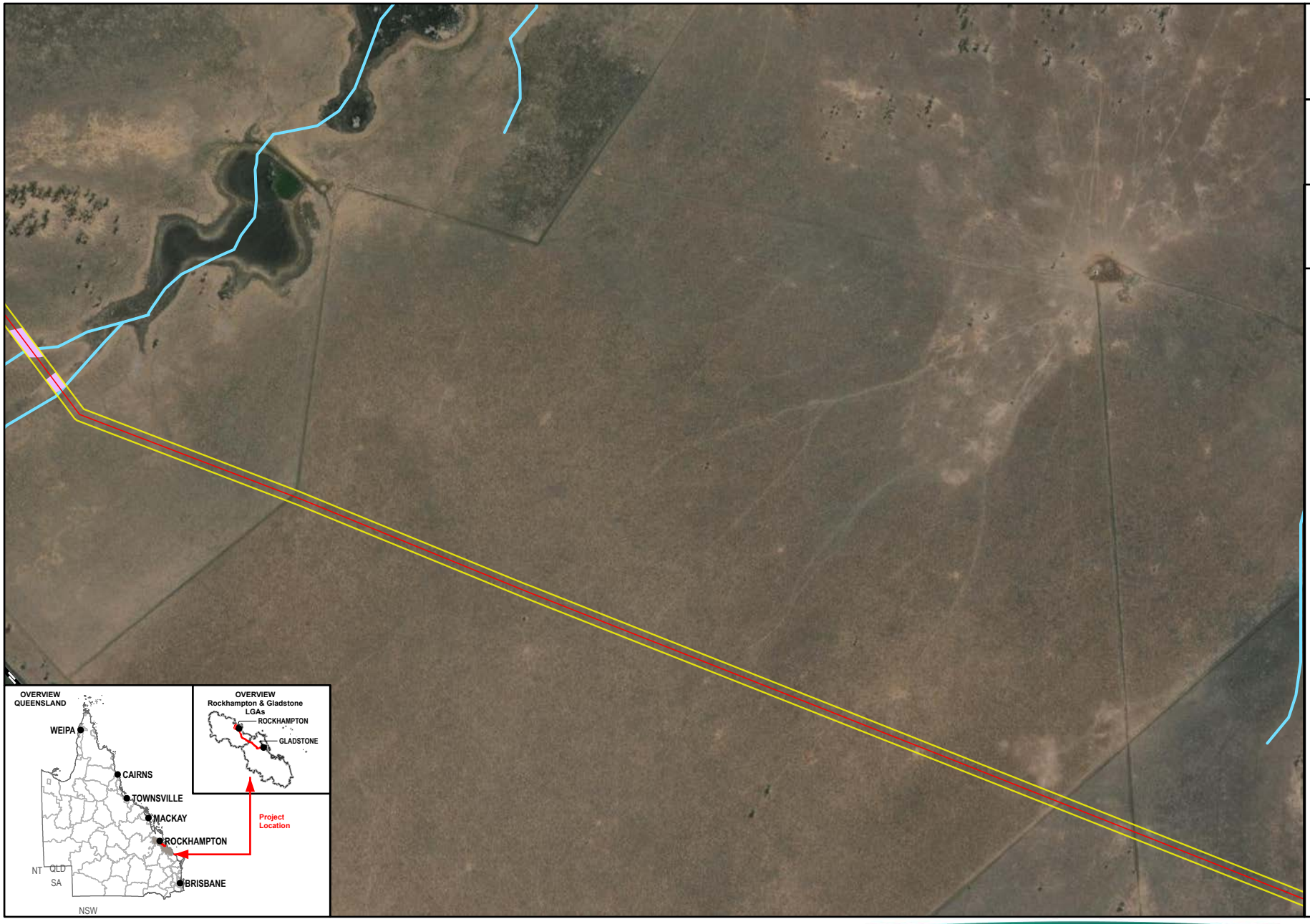
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-8n
Distribution of Curlew Sandpiper Habitat Within the SGIC SDA Study Area
000-G-MAP-2429 Version:3 Date:19/09/2022



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Legend

- SGIC SDA Pipeline Alignment
- Study Area
- Predicted Curlew Sandpiper Habitat
- Waterways
- Railways

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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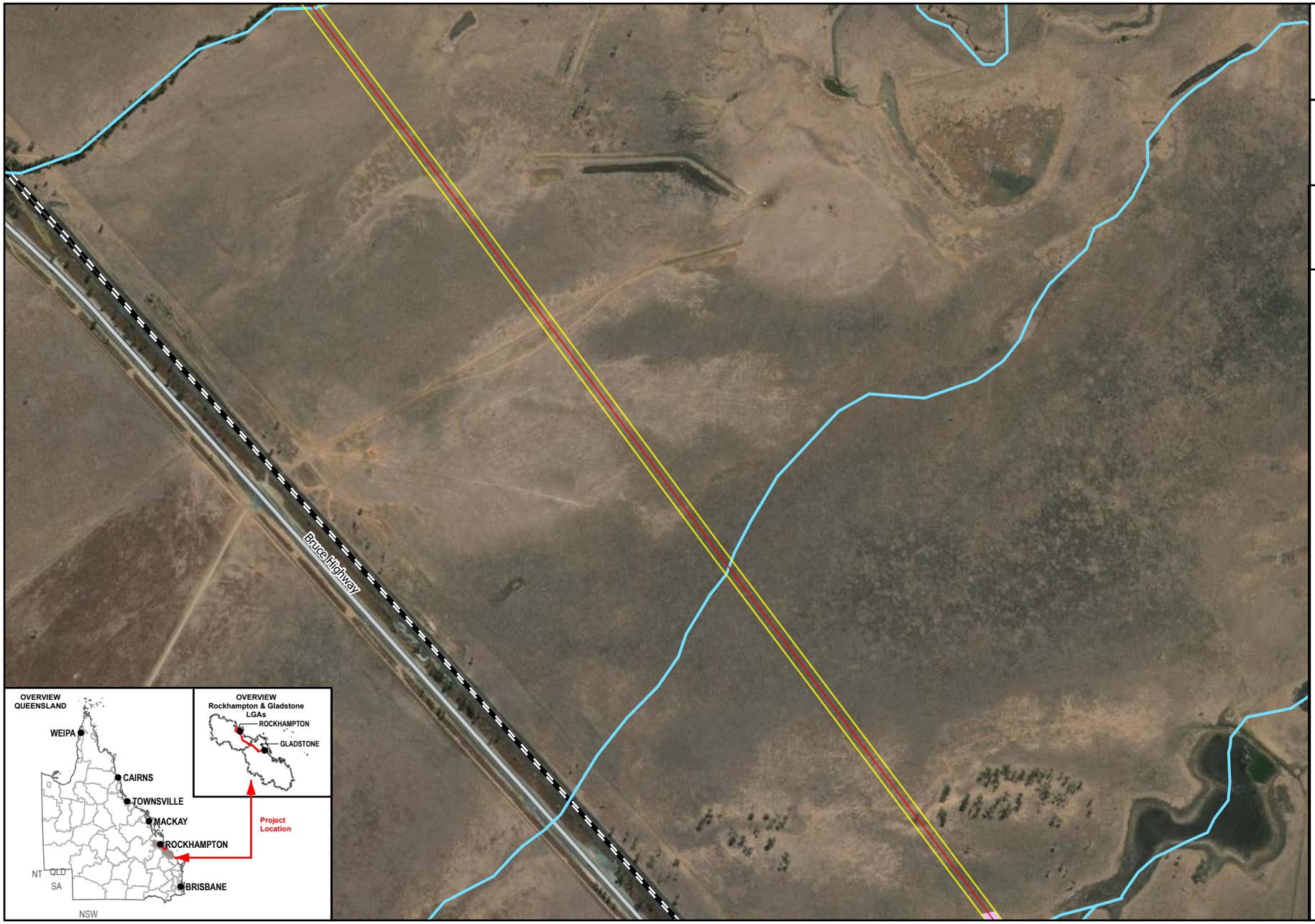
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-8o
Distribution of Curlew Sandpiper Habitat Within the SGIC SDA Study Area
000-G-MAP-2429 Version:3 Date:19/09/2022



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Legend

- SGIC SDA Pipeline Alignment
- Study Area
- Predicted Curlew Sandpiper Habitat
- Waterways
- Main Roads
- Railways

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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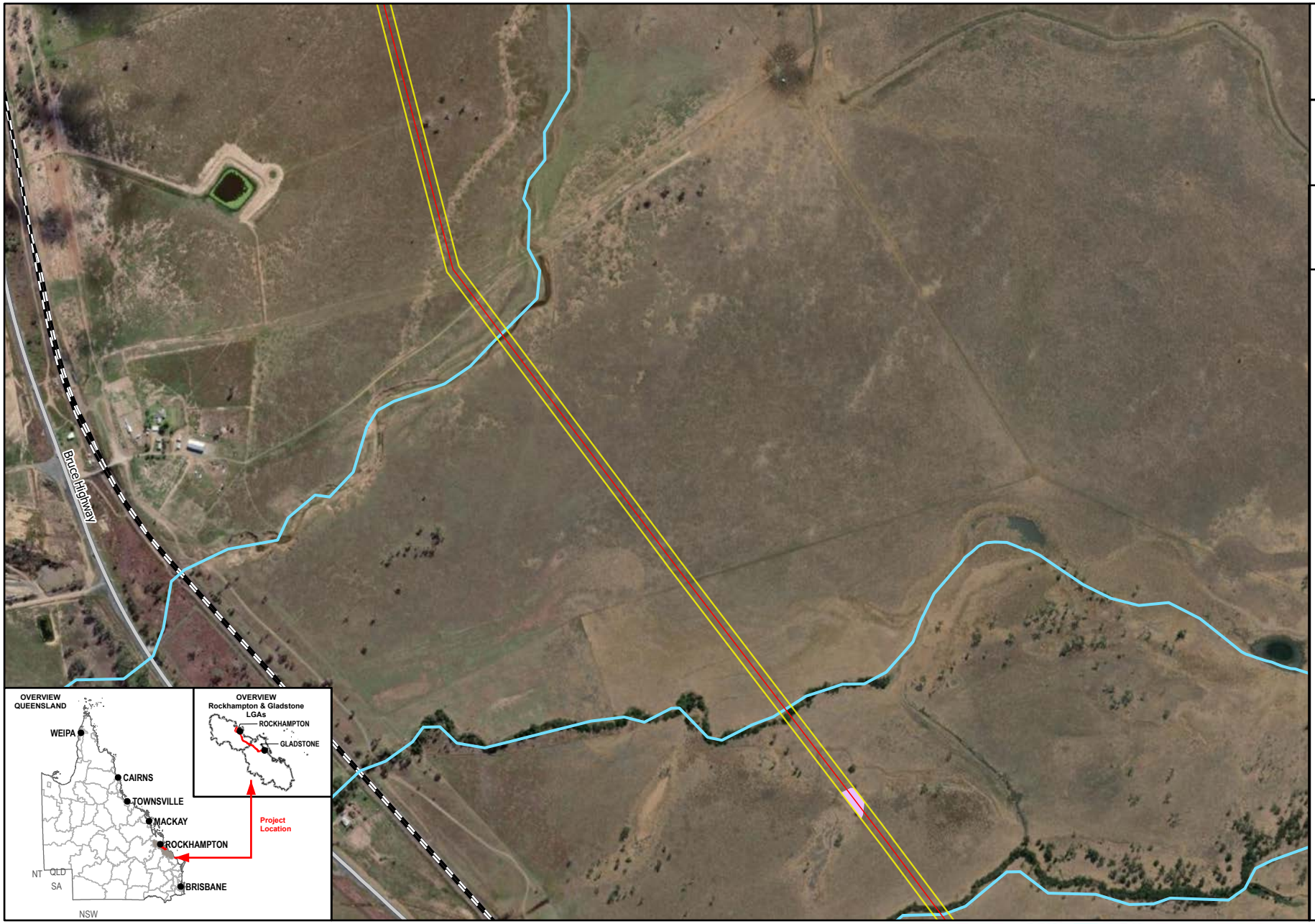
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-8p
Distribution of Curlew Sandpiper Habitat Within the SGIC SDA Study Area
000-G-MAP-2429 Version:3 Date:19/09/2022



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- SGIC SDA Pipeline Alignment
- Study Area
- Predicted Curlew Sandpiper Habitat
- Waterways
- Main Roads
- Railways

Data Sources:
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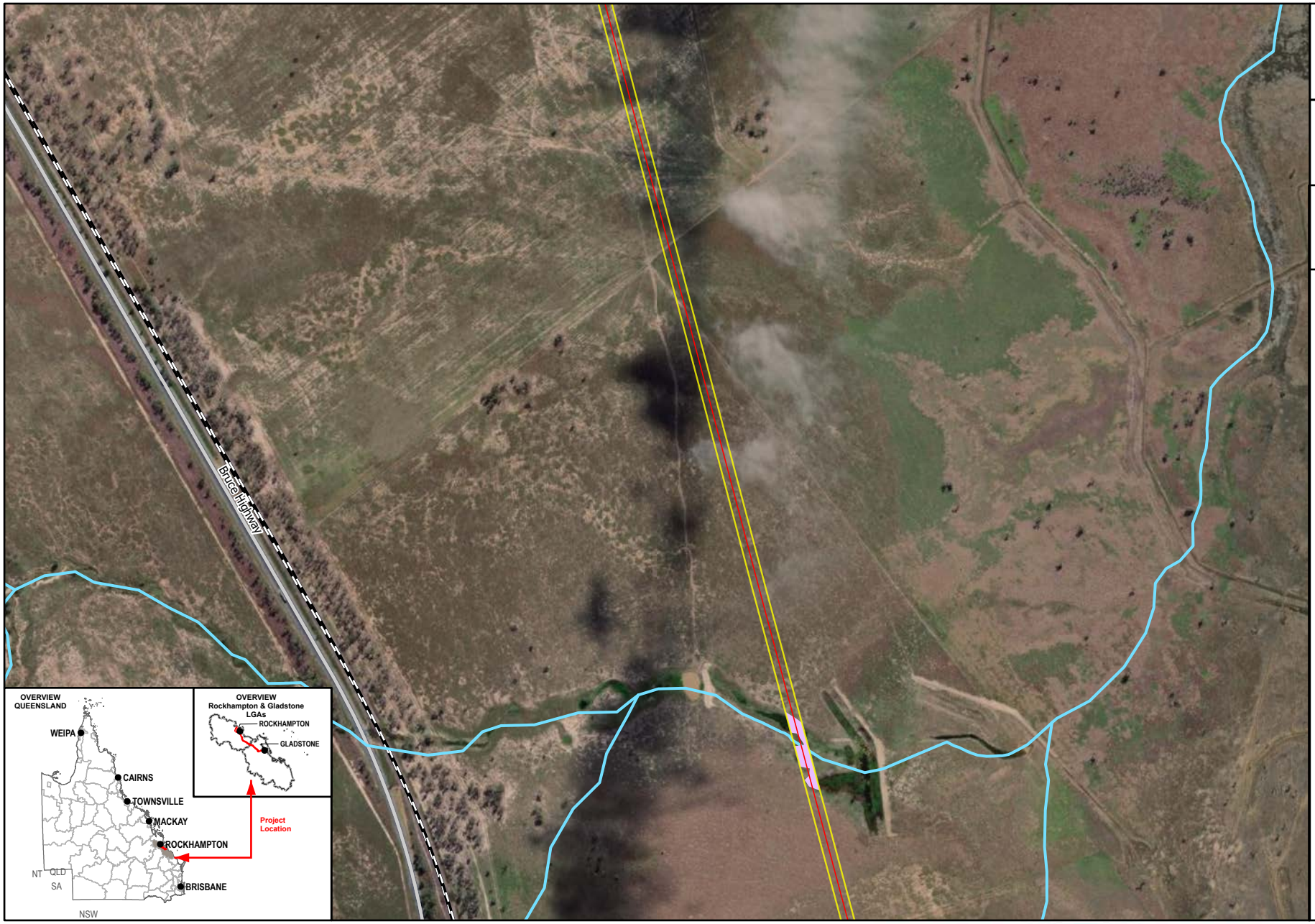
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-8q
Distribution of Curlew Sandpiper Habitat Within the SGIC SDA Study Area
000-G-MAP-2429 Version:3 Date:19/09/2022



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- SGIC SDA Pipeline Alignment
- Study Area
- Predicted Curlew Sandpiper Habitat
- Waterways
- Main Roads
- Railways

Data Sources:
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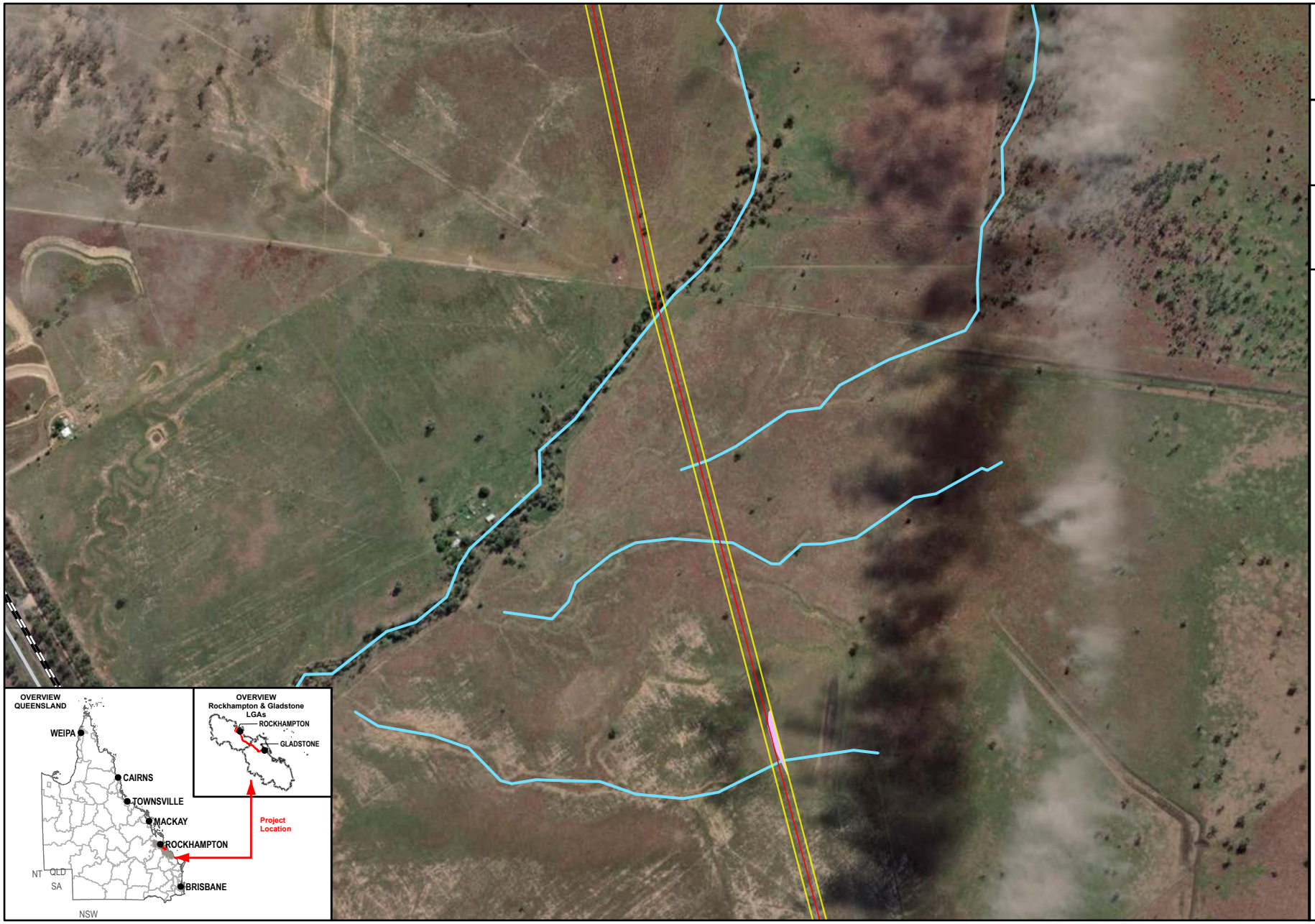
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-8r
Distribution of Curlew Sandpiper Habitat Within the SGIC SDA Study Area
000-G-MAP-2429 Version:3 Date:19/09/2022



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- SGIC SDA Pipeline Alignment
- Study Area
- Predicted Curlew Sandpiper Habitat
- Waterways
- Main Roads
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Data Sources:
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Figure 7-8s
Distribution of Curlew Sandpiper Habitat Within the SGIC SDA Study Area
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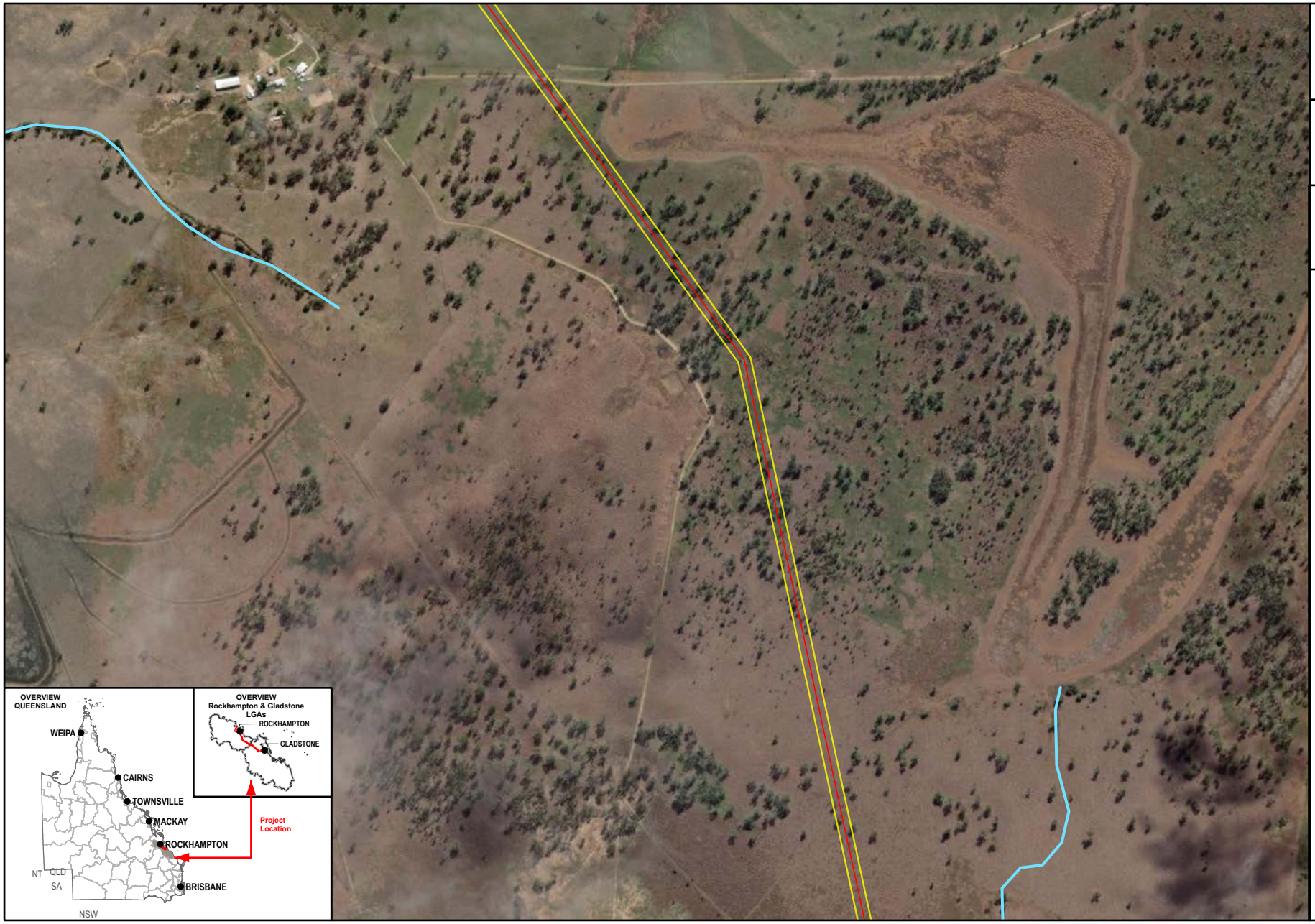

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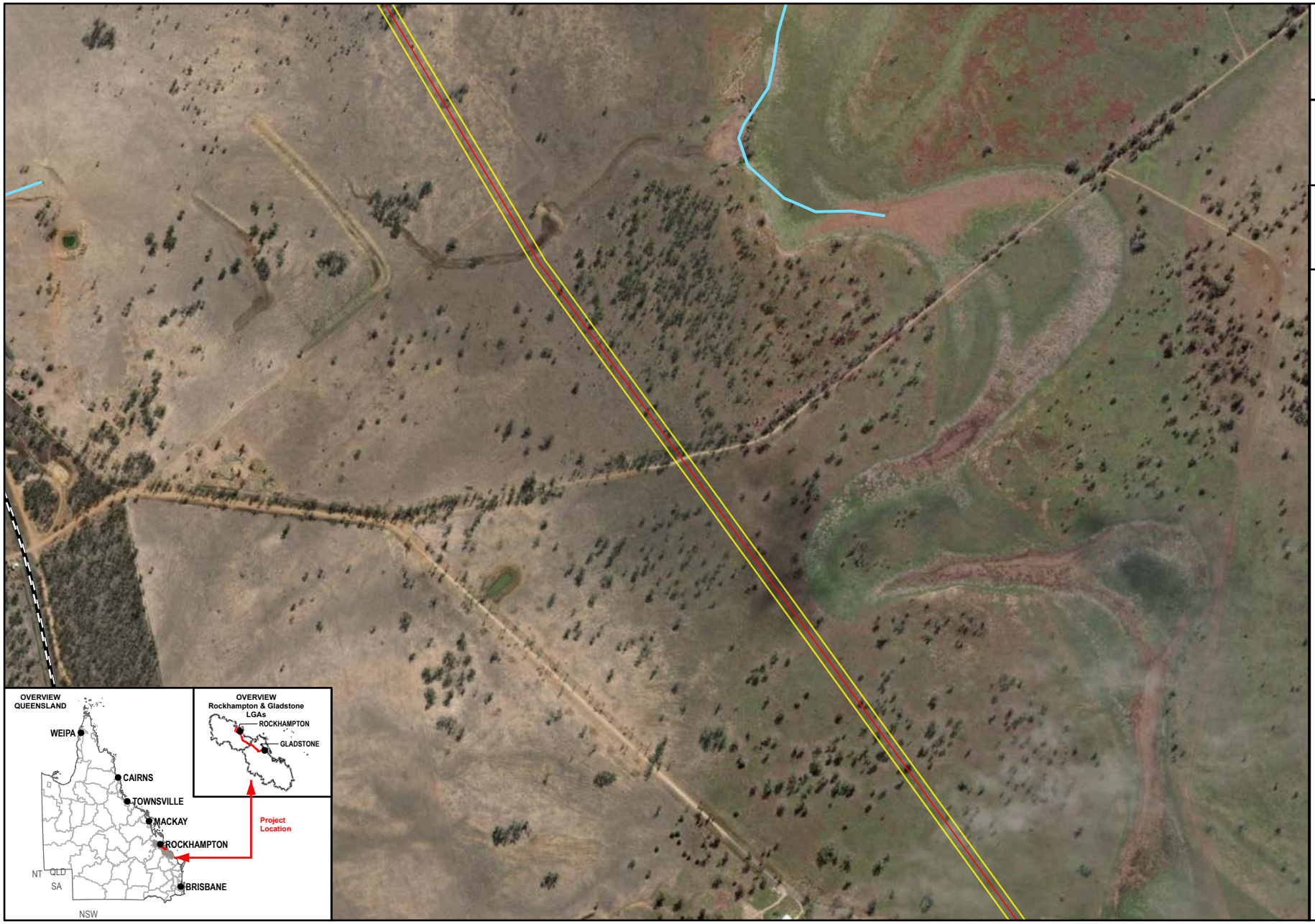

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Figure 7-8u

Distribution of Curlew Sandpiper Habitat Within the SGIC SDA Study Area

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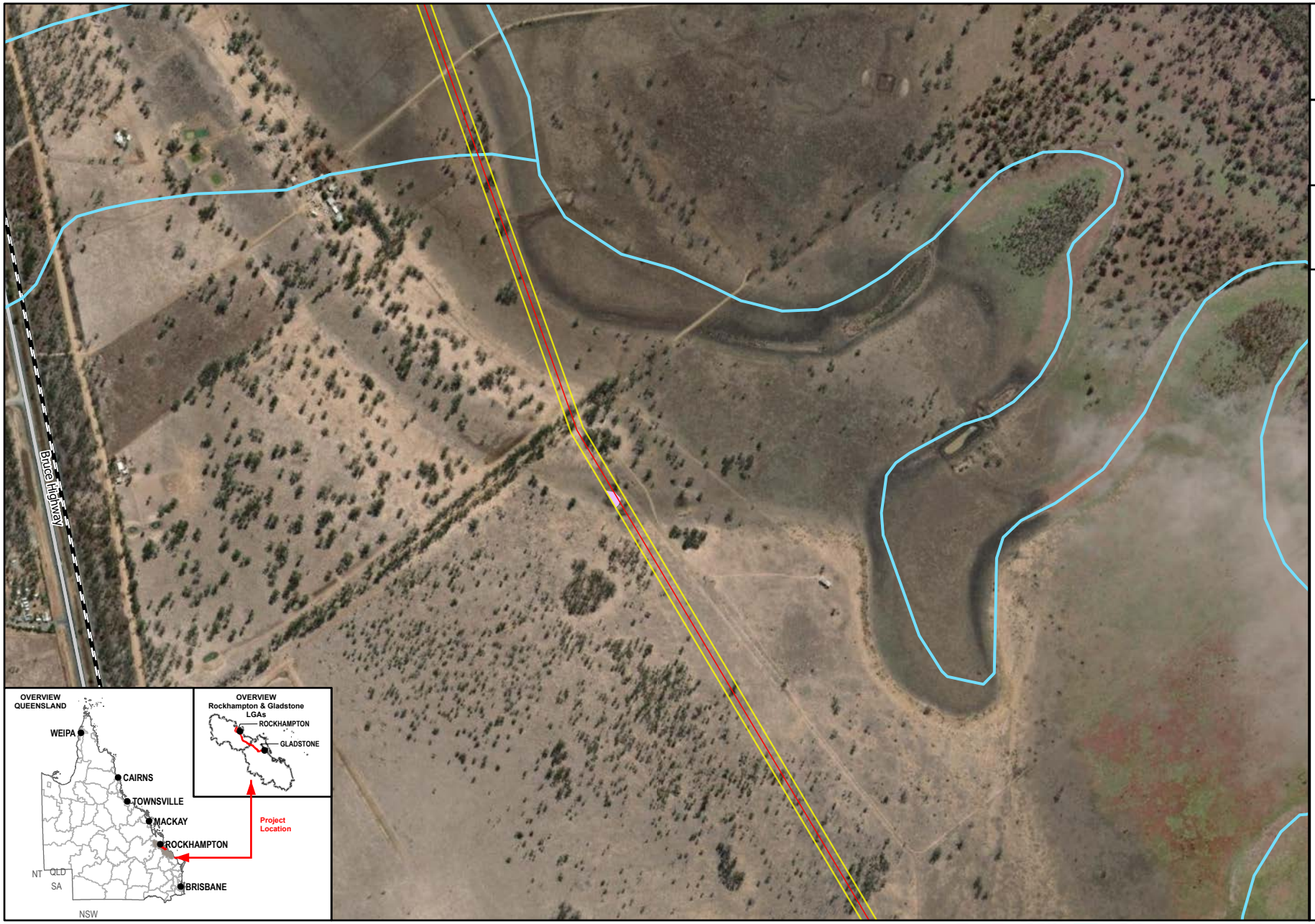

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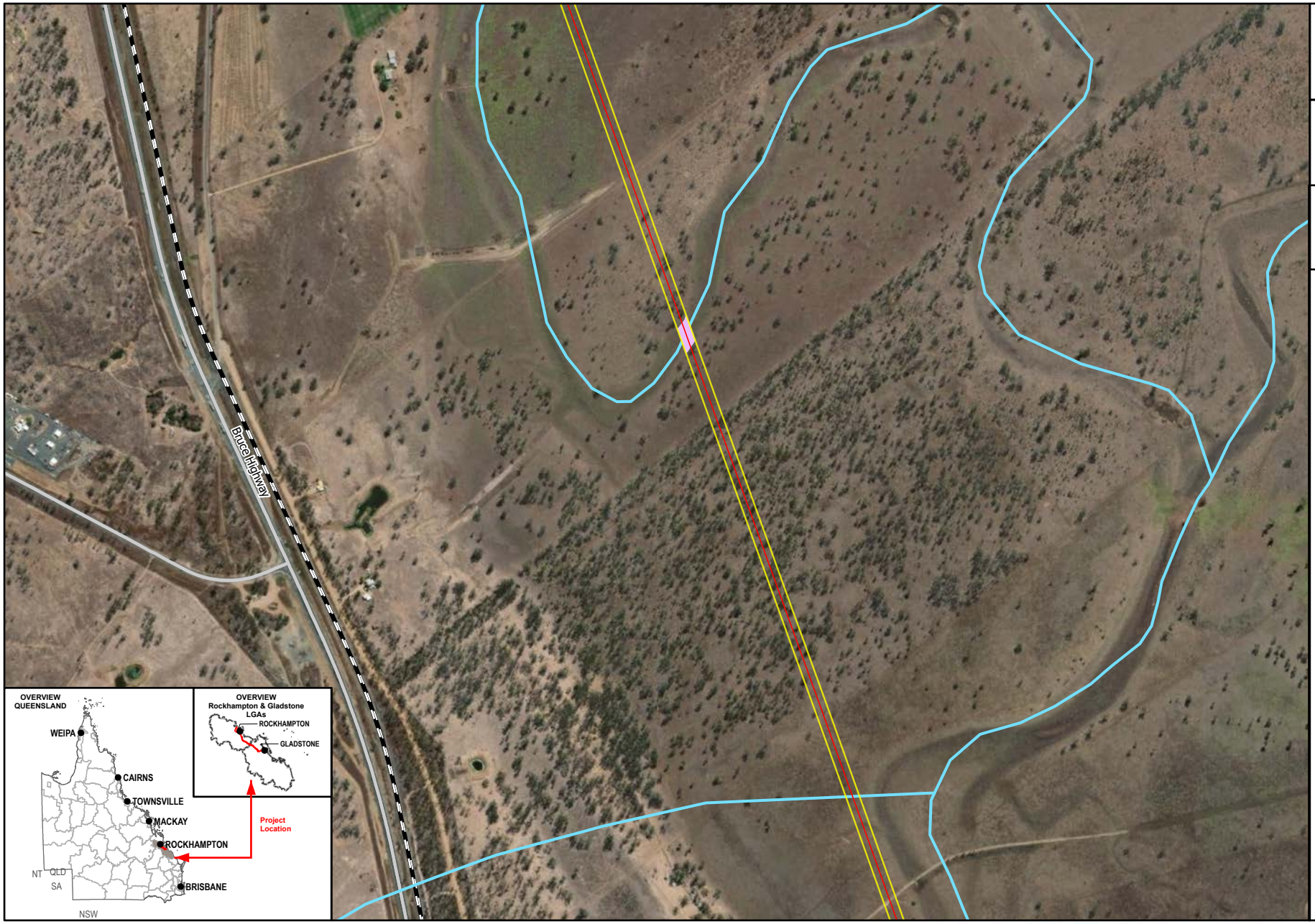

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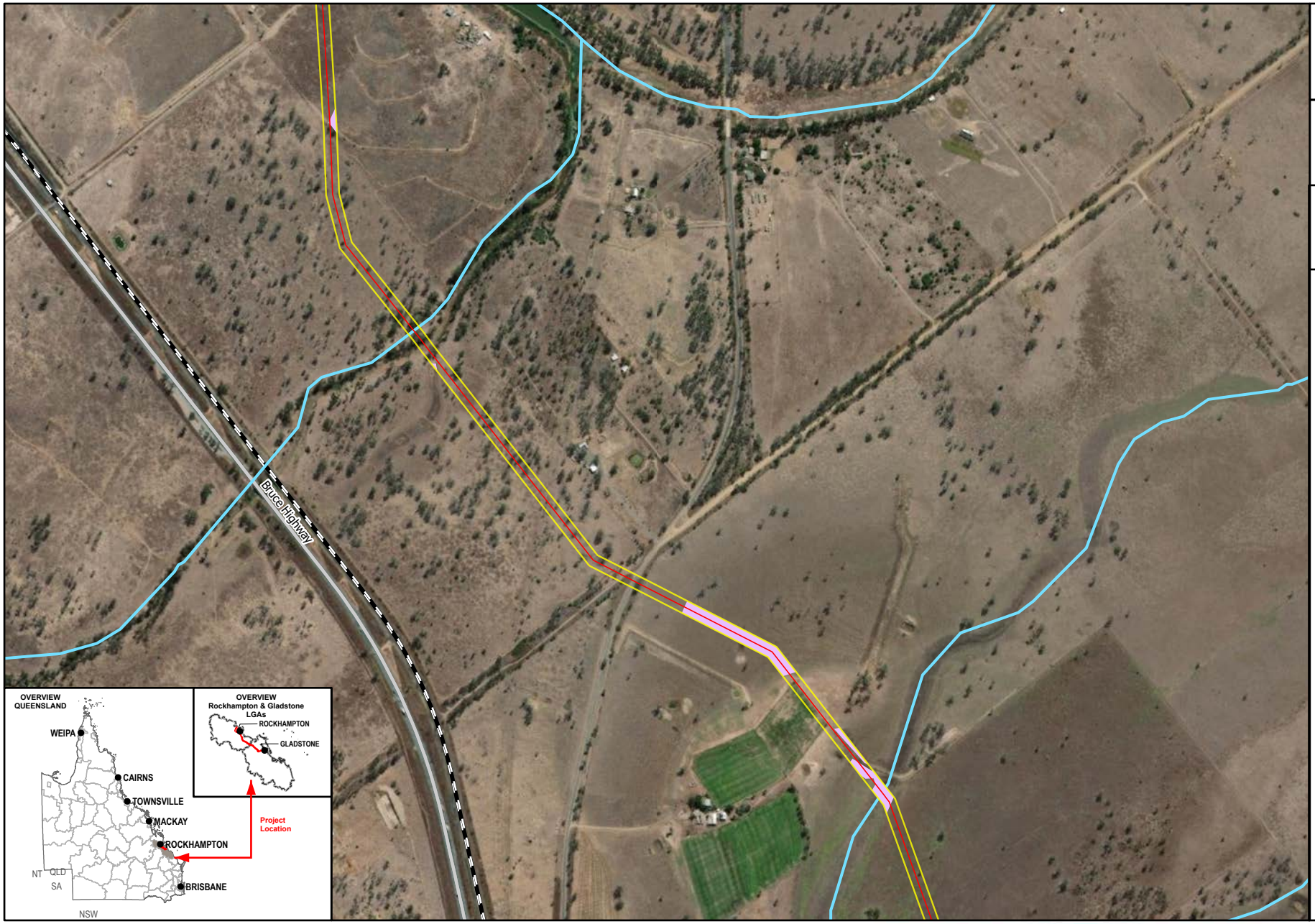

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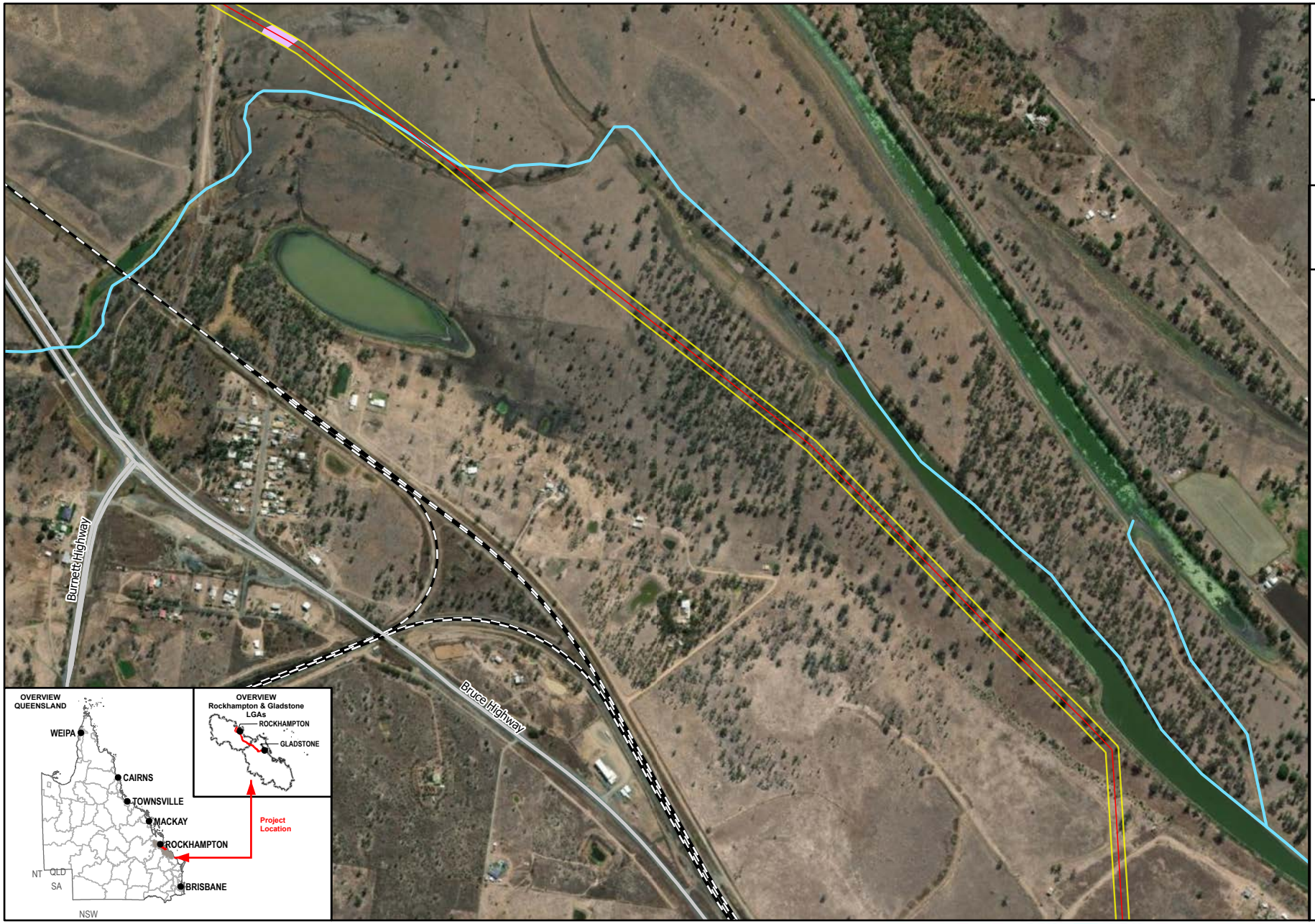

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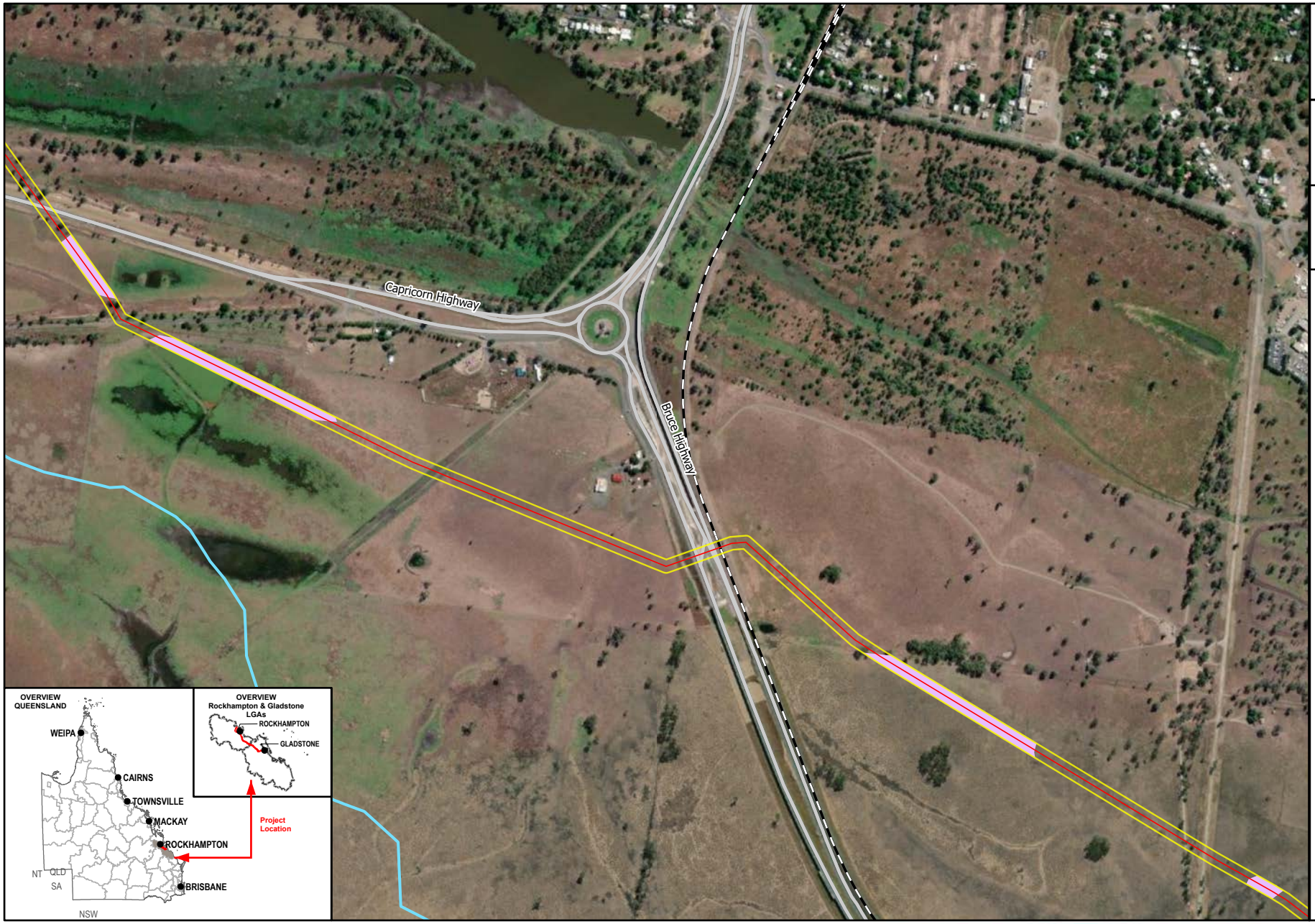

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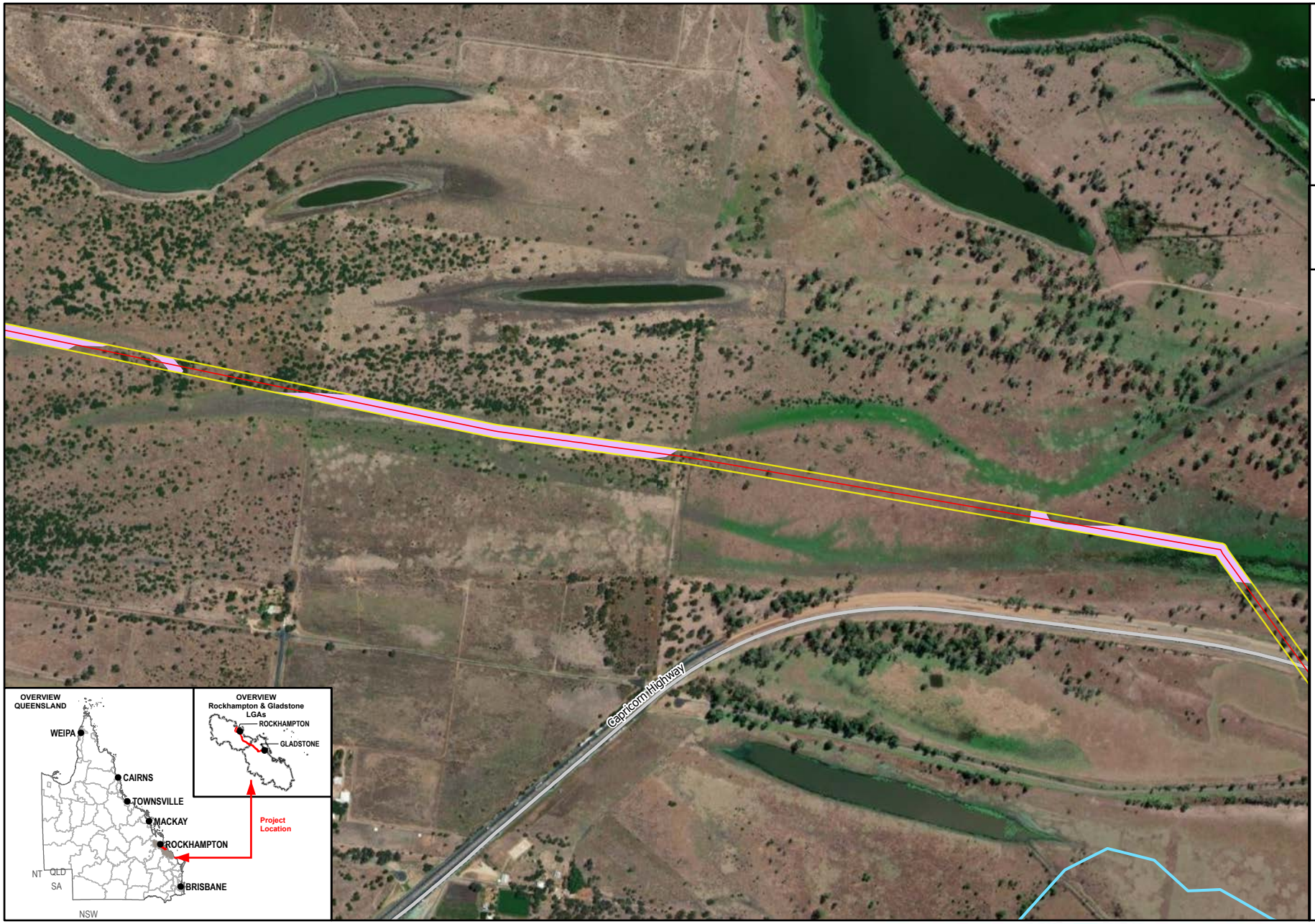

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Figure 7-8a1
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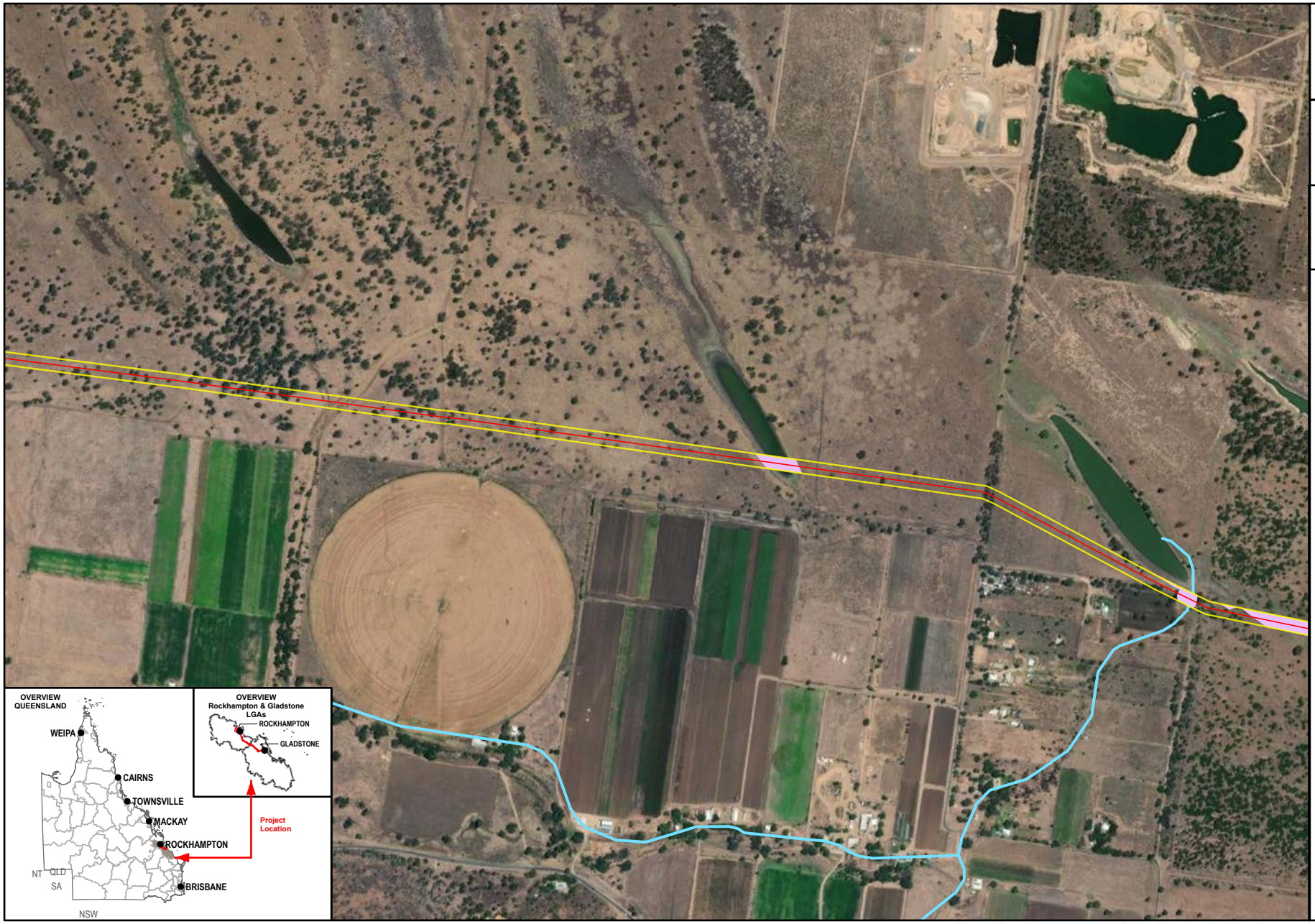

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7.2.2.3 Ornamental snake

Conservation status and species ecology

The ornamental snake is listed as vulnerable under the EPBC Act and NC Act and was listed as an MNES at the time of the approval. The ornamental snake is a cryptic nocturnal species that feeds almost exclusively on frogs (DCCEEW 2022g). The species is more active during the summer months but may be encountered throughout the year. Activity peaks generally correlate to heavy rains when frogs congregate to breed, and later when young frogs emerge (DCCEEW 2022g). Important populations occur in remnant vegetation near gilgai mounds and depressions (DSEWPaC 2011).

Across its distribution, the species occurs sparsely, and the population size is unknown. It occurs in woodlands and shrublands, preferably brigalow, in low lying areas where deep-cracking clays are abundant. The species is reliant on the cracking clay substrate and can persist in areas of regrowth and non-remnant vegetation provided cracking clay soils and gilgais persist (DoE 2014). Ornamental snakes utilise high specialised habitat and can transition from highly abundant to absent within a few hundred metres should topography or soil type change (DCCEEW 2022g).

Field survey results and distribution of suitable habitat

The ornamental snake was confirmed present during the Arup (2008) field surveys. Two individuals were recorded in a vegetated area adjoining a seasonal wetland near Casuarina Road, Midgee. Both individuals were located under large ground logs within an area retaining large hollow-bearing Eucalyptus coolabah trees and cracking clays. The species was not recorded during the 2022 field surveys. Survey effort for the ornamental snake included active searches at 11 locations and one night of spotlighting within the SGIC SDA study area. The species has been historically recorded at 24 locations within the desktop search extent, the most recent record recorded in 2003. Suitable habitat for the species was recorded within vegetated areas retaining E. coolabah (Plate 7-1) or Acacia harpophylla with large ground logs and cracking clays (Plate 7-1) on alluvial plains, associated with gilgais or adjoining wetlands. The distribution of predicted ornamental snake habitat is mapped in Figure 7-9.

Plate 7-1 Eucalyptus coolabah woodland with large ground logs and cracking clays (Casuarina Road, Midgee).

Significance of impact assessment

The project is unlikely to result in a significant residual impact on ornamental snake. A significance of impact assessment of the project on ornamental snake (vulnerable under the EPBC Act and NC Act) is provided in Table 7-21.

Table 7-21 Significance of impact on ornamental snake

Significant residual impact criteria	Assessment
A long-term decrease in the size of a local population	**Unlikely** The ornamental snake has been historically recorded at 11 locations within the desktop search extent (10 km buffer). The project will result in the clearing of 8.77 ha of predicted habitat for the species, representing 0.10% of habitat available within a 5 km buffer. The species inhabits woodland habitats retaining *E. coolabah* or *A. harpophylla* with logs and coarse ground litter on heavier, cracking clay soils, particularly in association with waterbodies or gilgais (DoE 2022a). The SGIC SDA pipeline alignment intersects vegetated areas with large *E. coolabah* trees, retaining large ground logs and cracking clays. Although these areas were recognised as suitable habitat for the species, the ground has been modified with pasture grasses and the areas are subject to cattle grazing and trampling. The SGIC SDA pipeline alignment also intersects brigalow woodland retaining seasonally inundated habitats (i.e. gilgais). These areas have been largely cleared for agricultural purposes, with remaining brigalow occurring as fragmented, isolated and modified remnants within the SGIC SDA study area and broader landscape. Suitable ground-level microhabitats such as cracking clays, ground logs, woody debris and rocks were recorded as low densities within remnant brigalow areas, and very sparse to absent within regrowth brigalow areas. Due to the lack of suitable ground-level microhabitats within areas retaining brigalow, these habitats are considered suboptimal habitat for the species. The projects impact is not anticipated to correspond to a regional level or a long-term decrease as the impacted area equates to only 0.10% of suitable habitat available within a 5 km buffer. The impact is considered unlikely to lead to a long-term decrease in the size of the local ornamental snake population.
Reduce the extent of occurrence of the species	**Unlikely** Two individuals were recorded approximately 500 m east of the SGIC SDA pipeline alignment near Casuarina Road, Midgee, during the Arup (2008) field surveys. The SGIC SDA pipeline alignment intersects 8.77 ha of predicted habitat for the ornamental snake, representing 0.10% of suitable habitat for the species at a local scale (5 km buffer). The surrounding landscape has been largely cleared and heavily altered by intensive agriculture, and cattle grazing and trampling, with a small proportion of potentially suitable habitat occurring within the SGIC SDA pipeline alignment. A maximum width of 30 m will be cleared for construction of the SGIC SDA pipeline alignment. Suitable ground-level microhabitats such as ground logs, woody debris and rocks are to be retained during the construction works and to be placed on the SGIC SDA pipeline alignment after the pipeline has been installed and buried. Accordingly, the project is unlikely to reduce the extent of occurrence of the species.
Fragment an existing population	**Unlikely** While the SGIC SDA pipeline alignment may support an existing ornamental snake population, the magnitude of impact is unlikely to present a permanent barrier to movement. The maximum width of clearing required for construction of the SGIC SDA pipeline alignment is 30 m. Once the pipeline has been installed and buried, a maximum width of 10 m will be permanently cleared with the remaining 20 m to be rehabilitated. Construction activities will be planned to minimise the period of time the trench is open and the length of open trench. Where the trench remains open overnight or for extended length, the ends of the trench left open will be ramped to a gentle include (< 50%) to allow fauna to escape and sawdust filled hessian bags (shelter sites) will be placed at regular intervals. If mitigation measures are implemented correctly, the project is unlikely to fragment the existing local population.
Result in genetically distinct populations forming as a result of habitat isolation	**Unlikely** As detailed above, the species' capacity to move locally post-construction is unlikely be limited by any localised land clearing necessary to construct the SGIC SDA pipeline alignment. As a result, the project is unlikely to cause any form of genetic isolation at a population level.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat	**Unlikely** As this species feeds almost exclusively on frogs, the ornamental snake is considered to be at risk from lethal ingestion of cane toads (DoE 2022a). Cane toads are already known to occur within the SGIC SDA study area, and the construction or operation of the project is unlikely to exacerbate the risks. The project is therefore expected to have negligible impact on the species due to the influence of cane toads or other pest species.
Introduce disease that may cause the population to decline	**Unlikely** There are no known diseases that could be introduced by the construction or operation of the project.

Significant residual impact criteria	Assessment
Interfere with the recovery of the species	**Unlikely** The project is unlikely to interfere substantially with the recovery of the species. The impacts of the SGIC SDA pipeline alignment are expected to be relatively benign, as the project is expected to remove 8.77 ha of suboptimal habitat due to the moderately low abundance of ground-level microhabitats within brigalow habitats occurring within the SGIC SDA study area. Suitable ground-level microhabitats such as ground logs, woody debris and rocks are to be retained during the construction works and to be placed on the SGIC SDA pipeline alignment after the pipeline has been installed and buried. The risk of individual mortality or injury during construction will be addressed via the mitigation measures in the CEMP and the use of an experienced fauna spotter-catcher during clearing and grading.
Result in disruption to ecologically significant locations (breeding, feeding or nesting sites) of a species	**Unlikely** Due to the operational and logistic constraints associated with undertaking construction during the wet season, works will take place in dry season months (where practicable) and therefore avoid the species' peak period of breeding and foraging activity (i.e. the wet season). The *Draft referral guidelines for the nationally listed brigalow belt reptiles* (DSEWPaC 2011) indicates that a loss of more than 2 ha of important habitat risks a significant impact. Important habitat is considered to be any gilgais or mounds within areas of known habitat and connecting habitat that links gilgais (DSEWPaC 2011). The SGIC SDA pipeline alignment is estimated to impact 8.77 ha of potential habitat. Potentially suitable habitat for the species is considered suboptimal due to the moderately low abundance of ground-level microhabitats and the overall condition of the habitat. Vegetated areas containing large *E. coolabah* trees retained suitable shelter habitat (i.e. ground logs and shallow cracking clays); however, the ground has been modified with pasture grasses and has been subject to cattle grazing and trampling. Vegetated areas containing *A. harpophylla* retained gilgais; however, the ground had been exposed to high levels of disturbance caused by cattle trampling and feral pig rooting. A large proportion of these areas had been previously cleared, retaining regrowth (2 – 3 m tall) vegetation. Therefore, the loss of suitable ornamental snake habitat within the SGIC SDA pipeline alignment is unlikely to result in disruption to ecologically significant locations.
Conclusion	The project is unlikely to result in a significant residual impact on the ornamental snake. The project will result in a loss (8.77 ha) of potentially suitable habitat for the ornamental snake; however, suitable habitat identified within the SGIC SDA pipeline alignment is considered suboptimal due to the low abundance of ground-level microhabitats and the low condition of the habitat caused by cattle grazing and trampling throughout the area. An experienced fauna spotter-catcher is to be present during clearing and grading, and to undertake open trench inspections along the SGIC SDA pipeline alignment and relocate any encountered individuals.

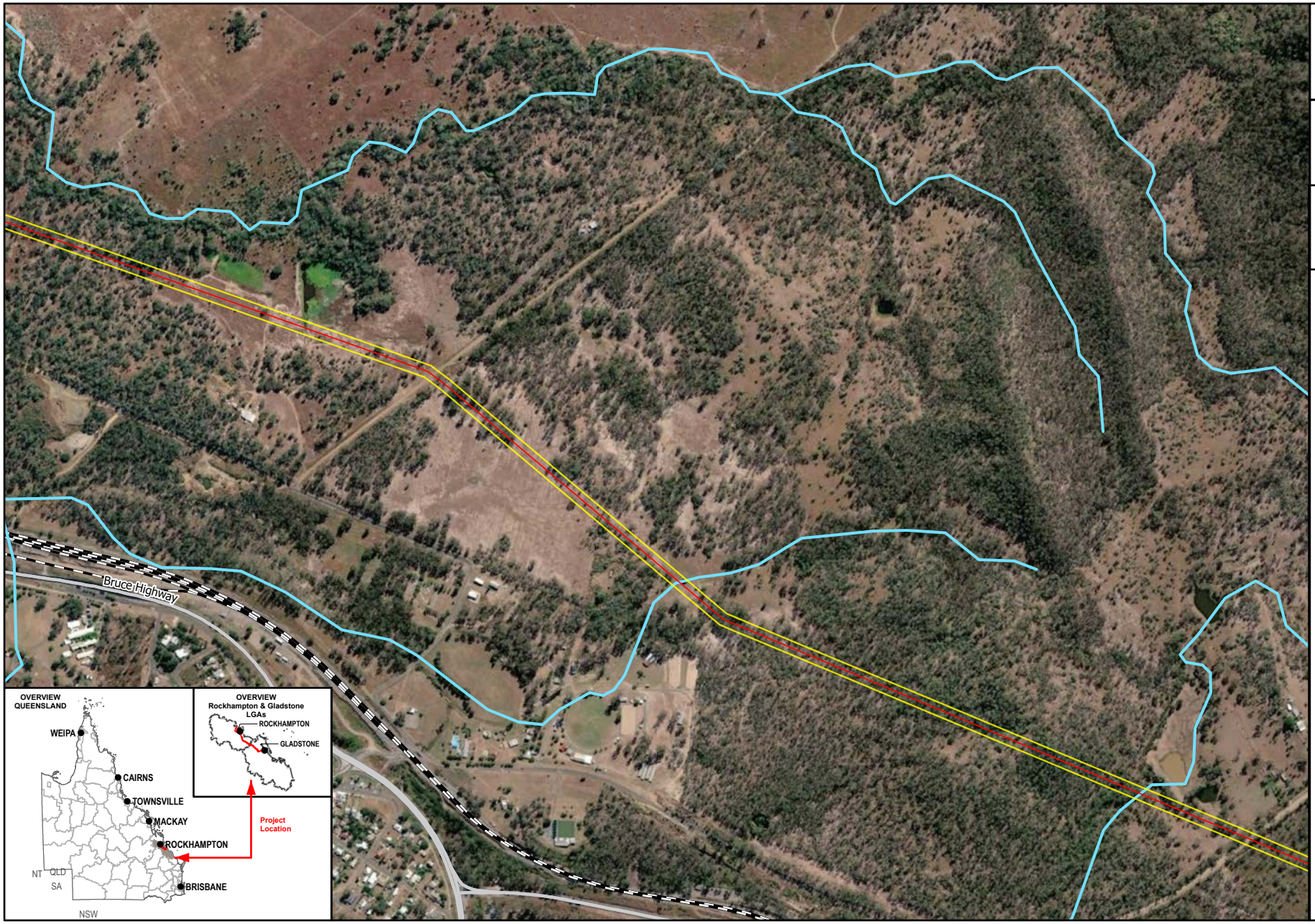

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Figure 7-9a
Distribution of Ornamental Snake Habitat Within the SGIC SDA Study Area
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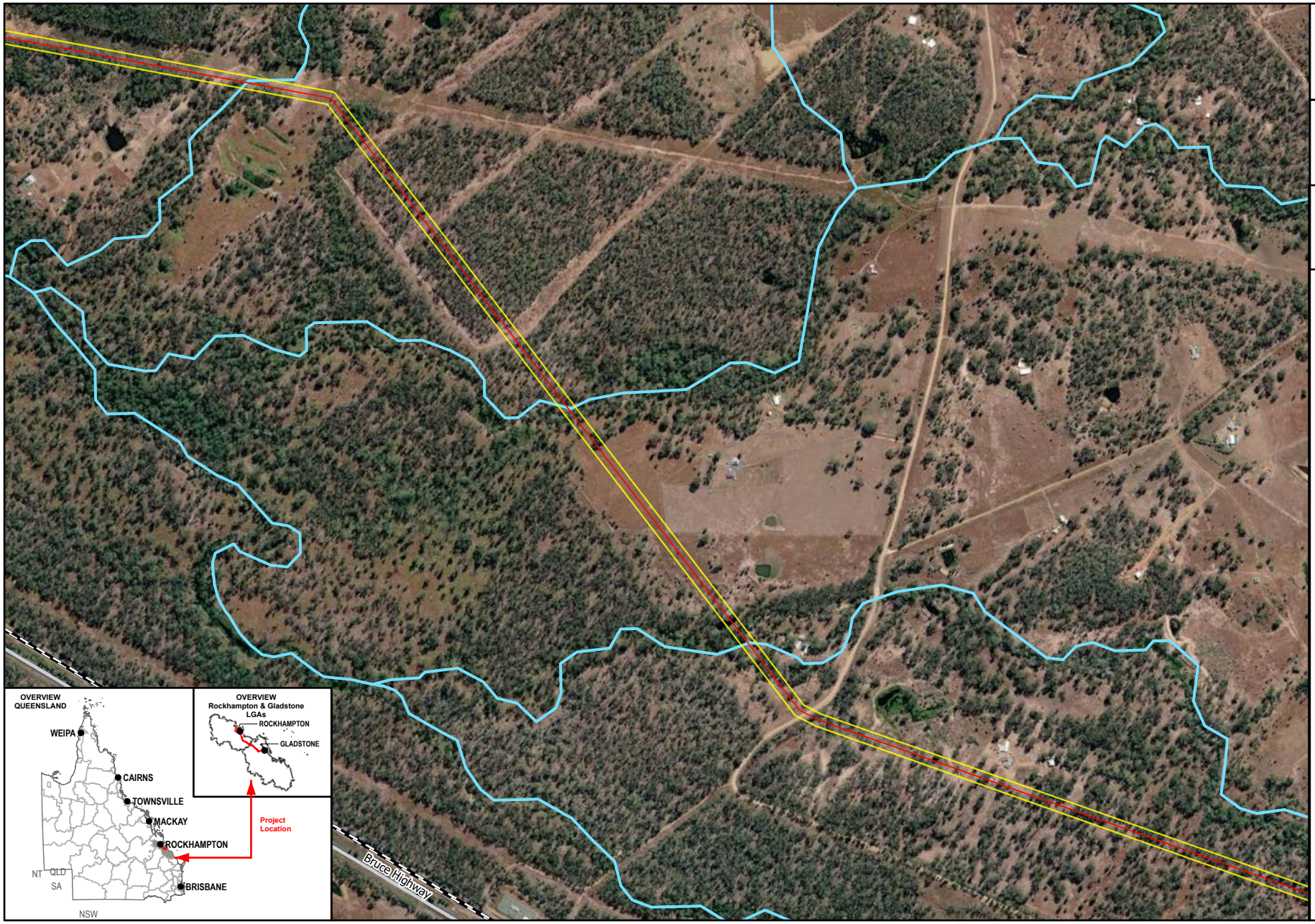

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PROJECTION UTM Zone 56
(Datum GDA2020)

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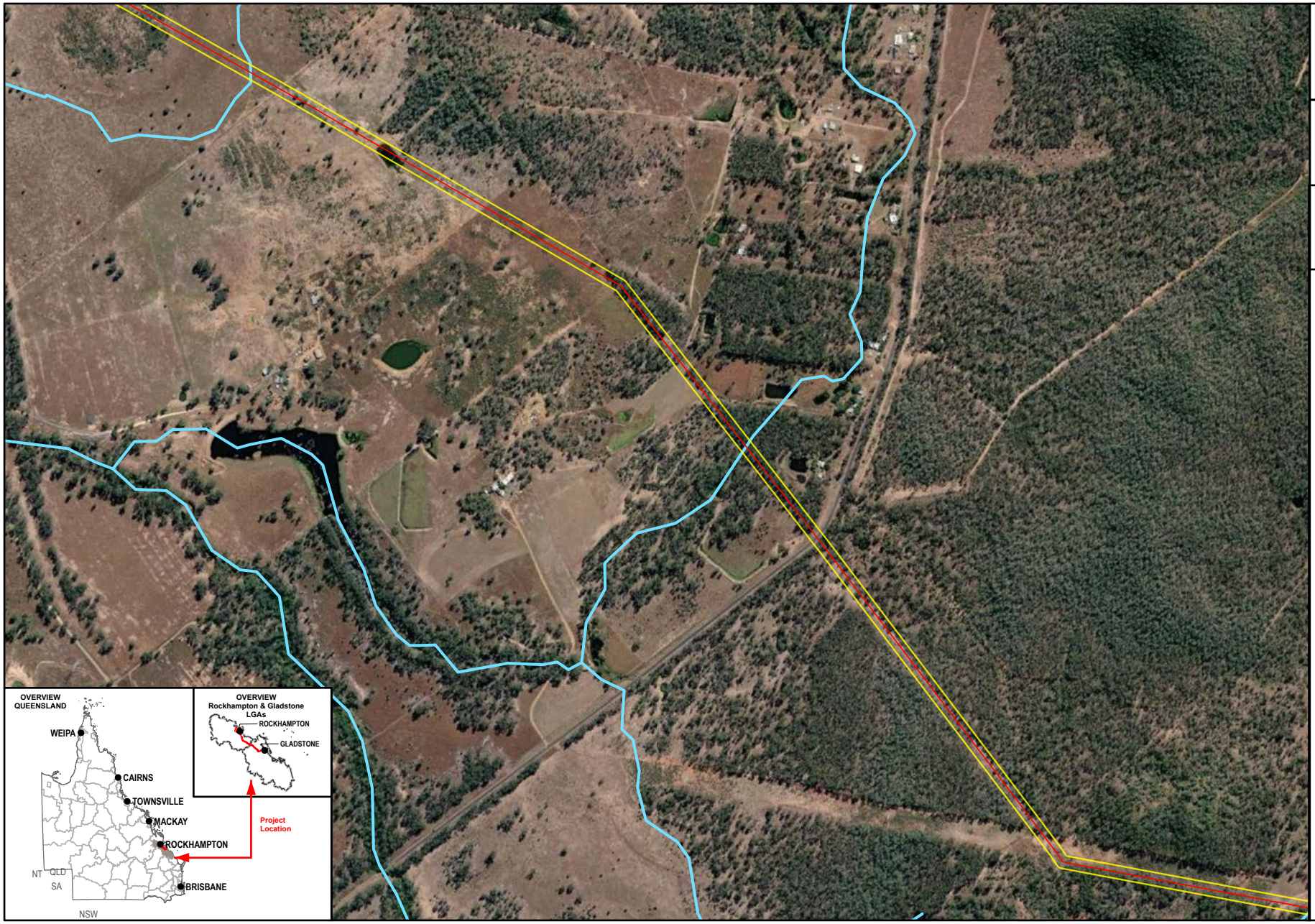
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-9b
Distribution of Ornamental Snake Habitat Within the SGIC SDA Study Area
000-G-MAP-2431 Version:4 Date:19/09/2022



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Legend

- SGIC SDA Pipeline Alignment
- Study Area
- Waterways

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

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PROJECTION UTM Zone 56
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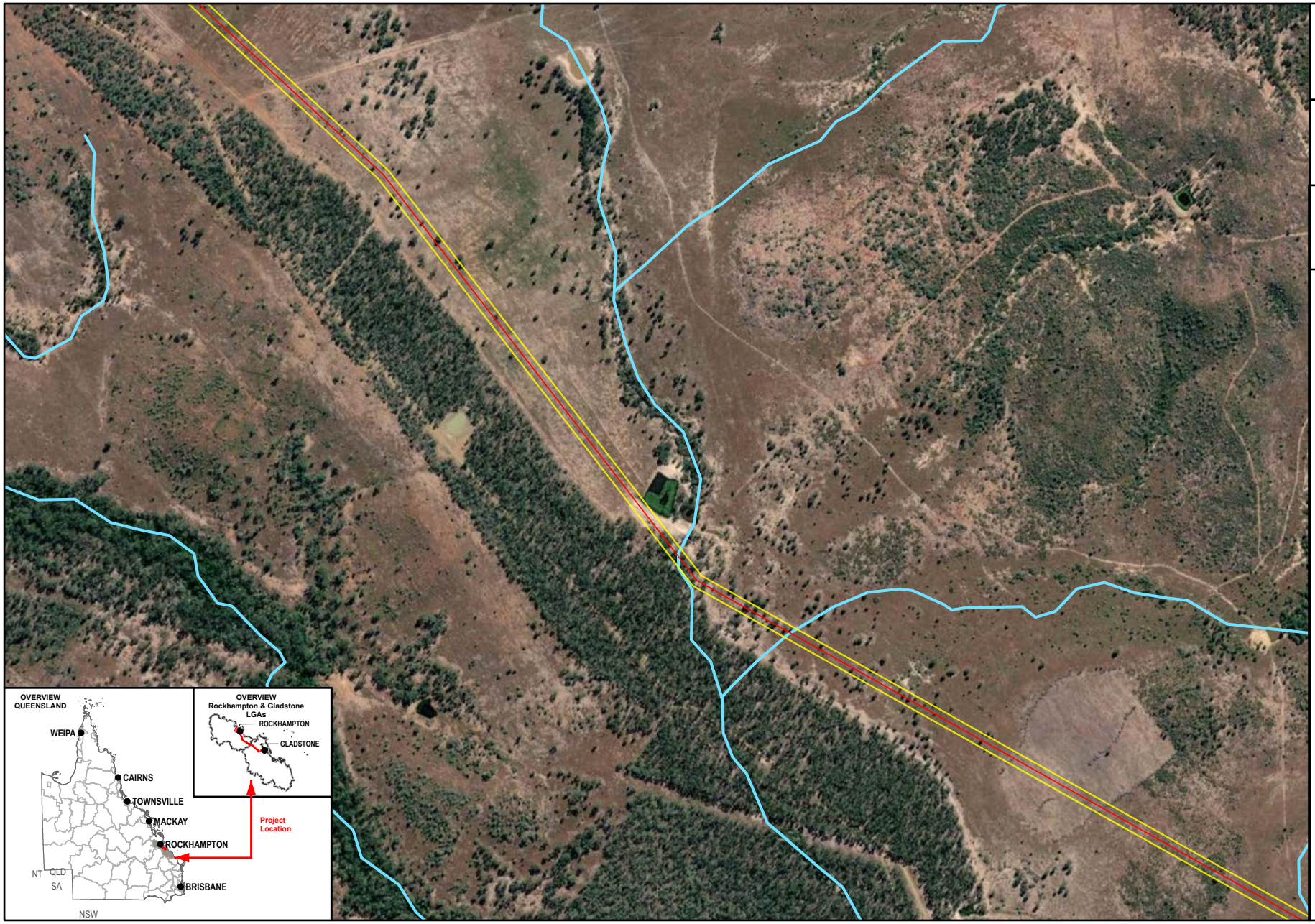
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-9c
Distribution of Ornamental Snake Habitat Within the SGIC SDA Study Area
000-G-MAP-2431 Version:4 Date:19/09/2022



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Legend

- SGIC SDA Pipeline Alignment
- Study Area
- Waterways

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

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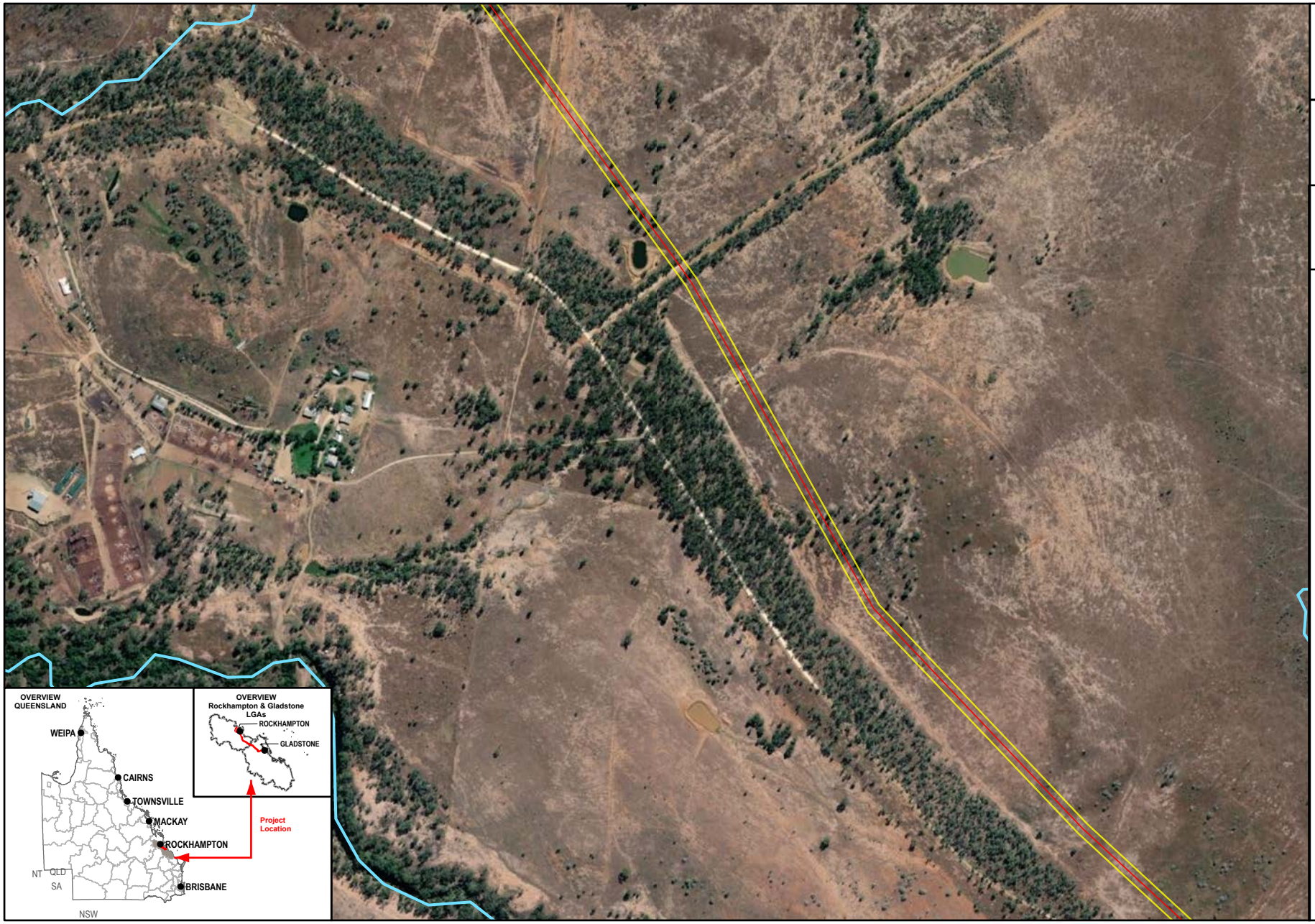
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-9d
Distribution of Ornamental Snake Habitat Within the SGIC SDA Study Area
000-G-MAP-2431 Version:4 Date:19/09/2022



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Legend

- SGIC SDA Pipeline Alignment
- Study Area
- Waterways

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

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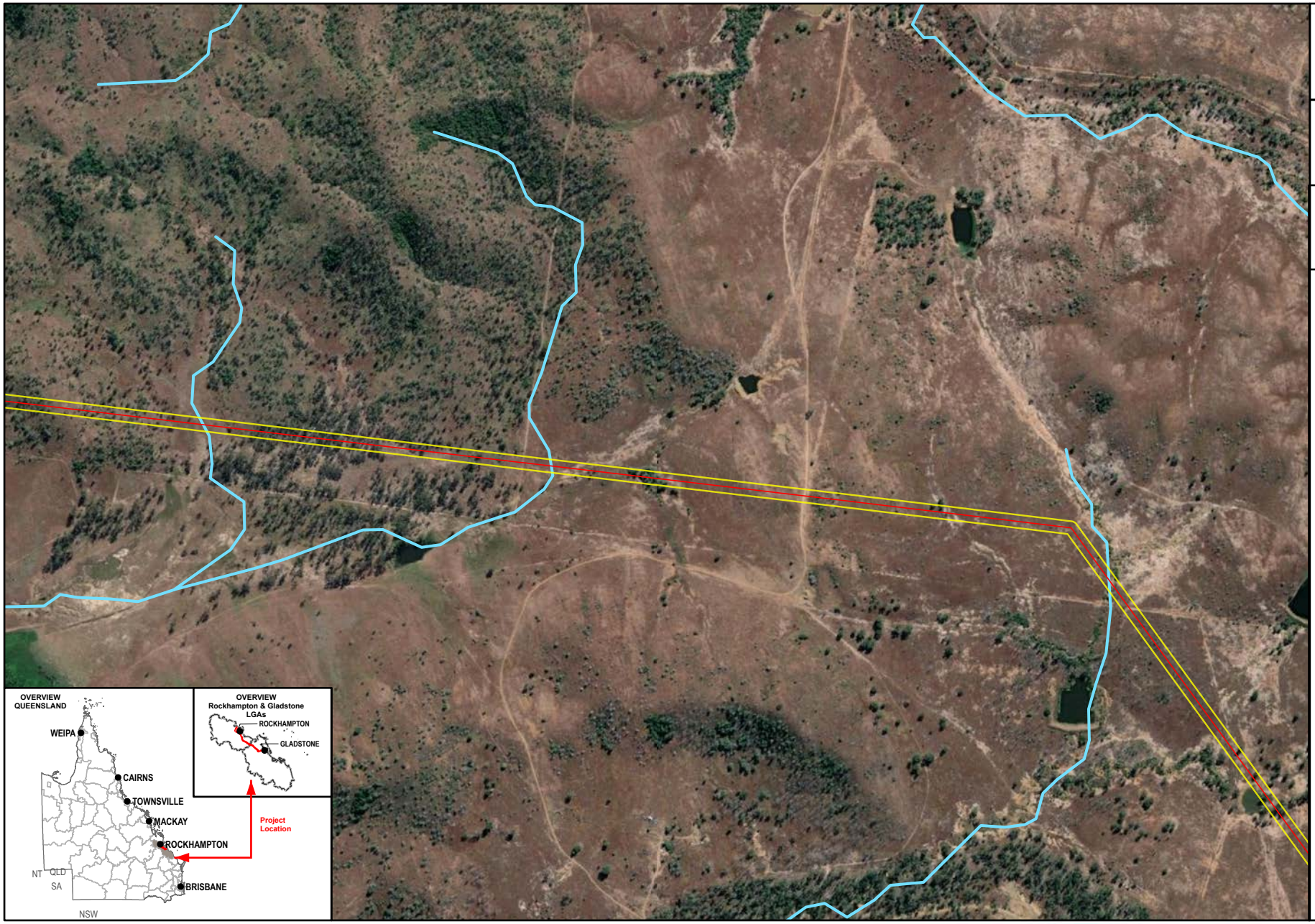
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-9e
Distribution of Ornamental Snake Habitat Within the SGIC SDA Study Area
000-G-MAP-2431 Version:4 Date:19/09/2022



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Legend

- SGIC SDA Pipeline Alignment
- Study Area
- Waterways

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

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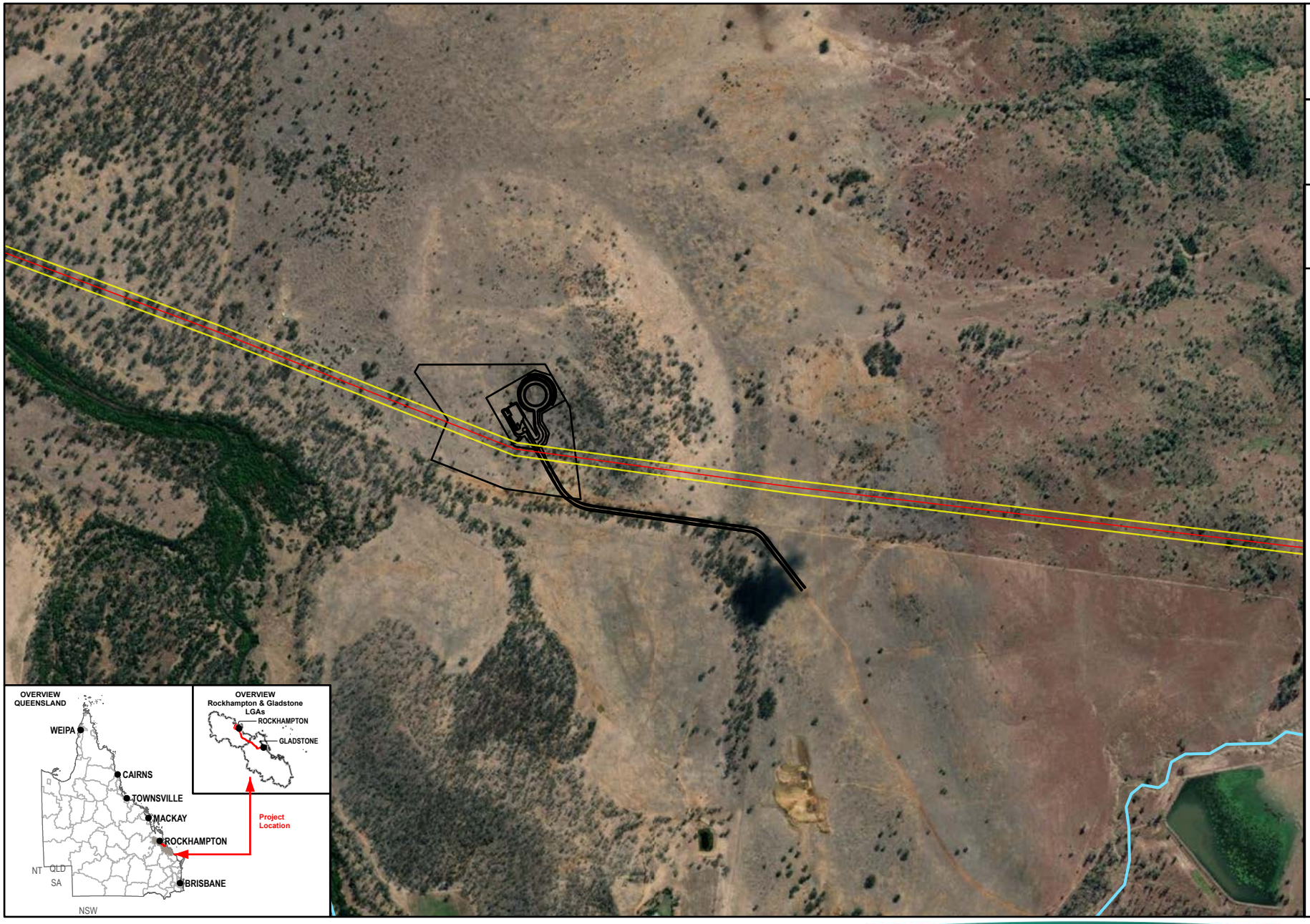
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-9f
Distribution of Ornamental Snake Habitat Within the SGIC SDA Study Area
000-G-MAP-2431 Version:4 Date:19/09/2022



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

Data Sources:
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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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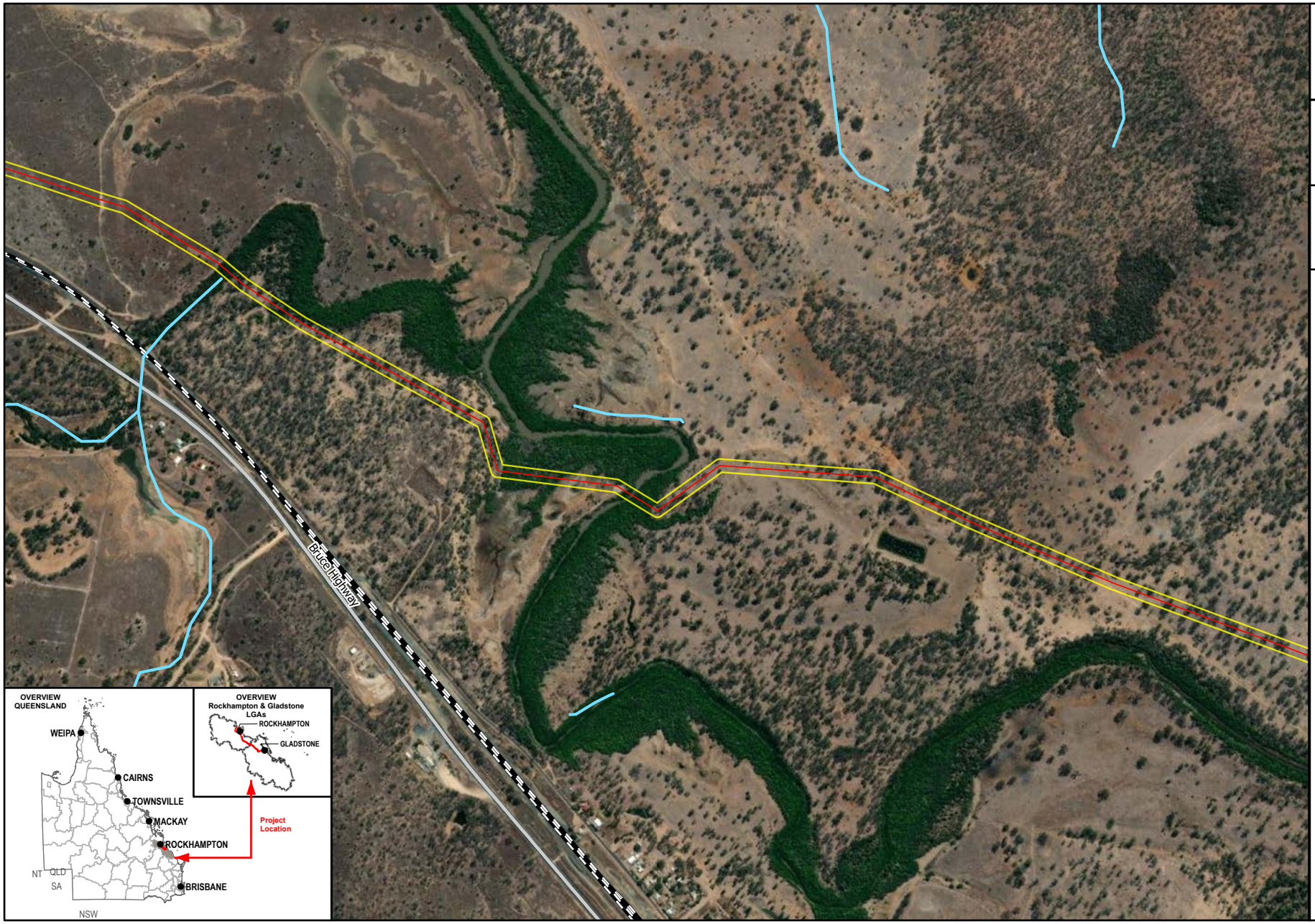
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-9g
Distribution of Ornamental Snake Habitat Within the SGIC SDA Study Area
000-G-MAP-2431 Version:4 Date:19/09/2022



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Legend

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

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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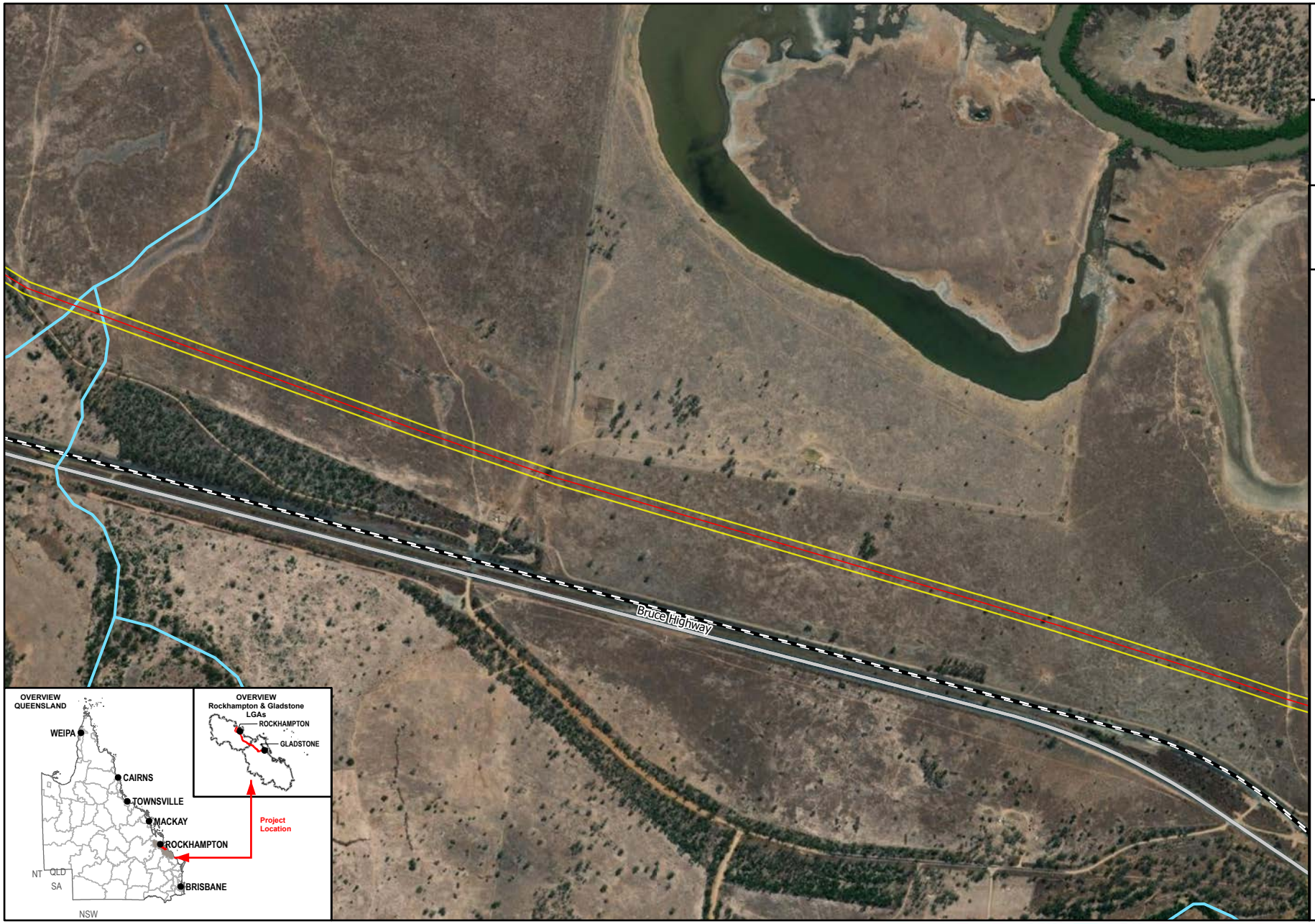
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-9h
Distribution of Ornamental Snake Habitat Within the SGIC SDA Study Area
000-G-MAP-2431 Version:4 Date:19/09/2022



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

Data Sources:
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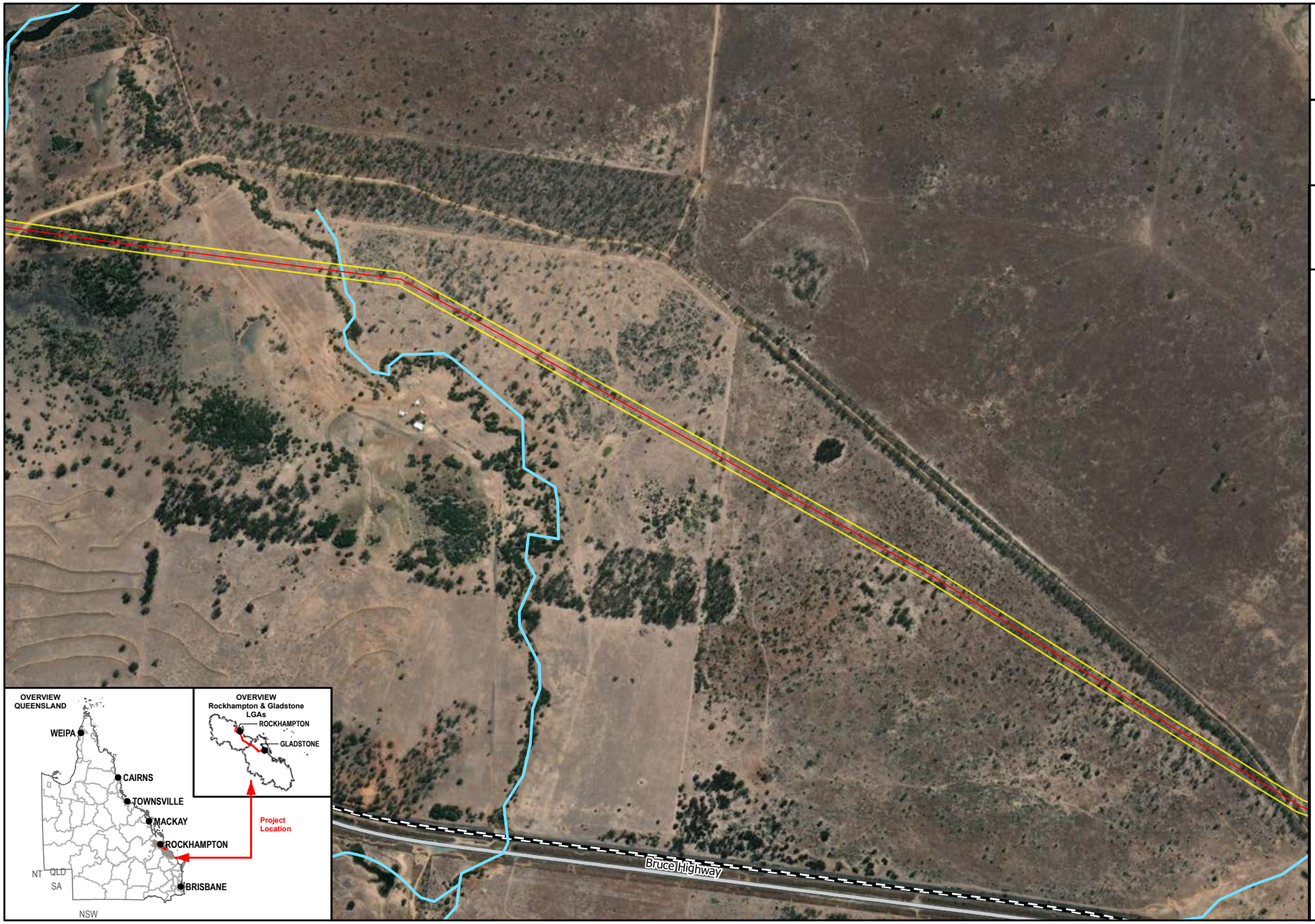
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-9i
Distribution of Ornamental Snake Habitat Within the SGIC SDA Study Area
000-G-MAP-2431 Version:4 Date:19/09/2022



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

Data Sources:
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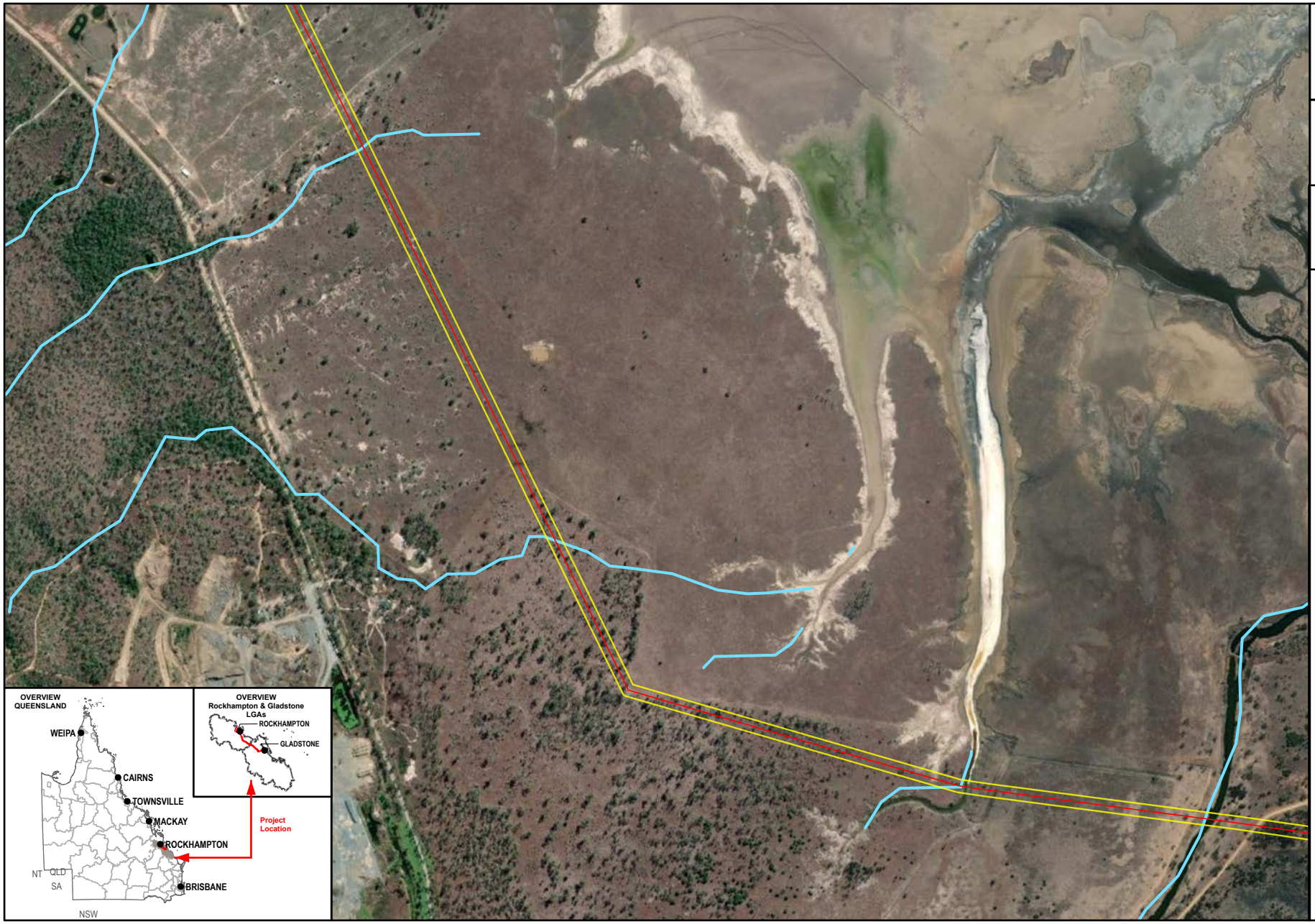
Figure 7-9j
Distribution of Ornamental Snake Habitat Within the SGIC SDA Study Area
000-G-MAP-2431 Version:4 Date:19/09/2022



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- SGIC SDA Pipeline Alignment
- Study Area
- Waterways

Data Sources:
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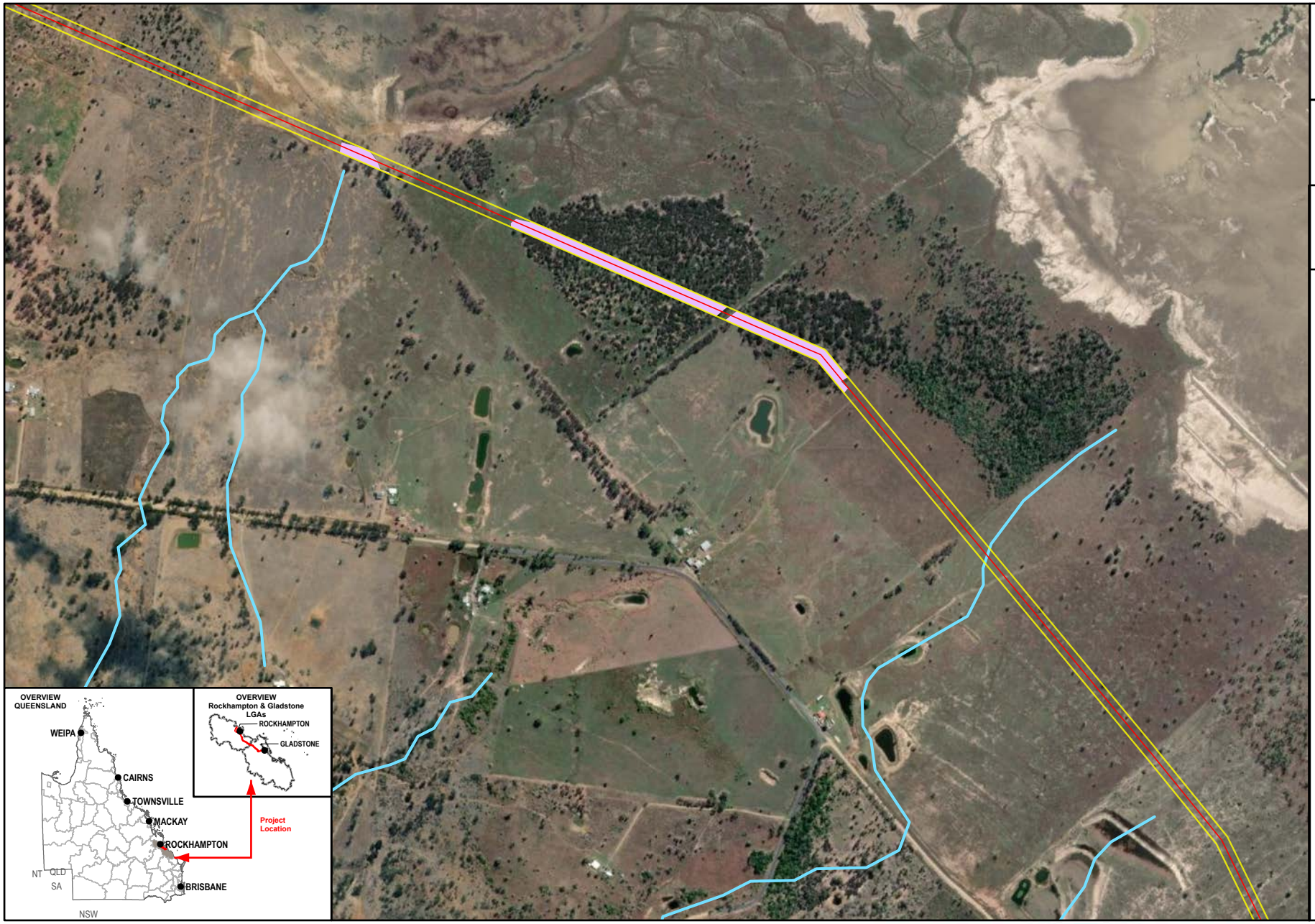
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-9k
Distribution of Ornamental Snake Habitat Within the SGIC SDA Study Area
000-G-MAP-2431 Version:4 Date:19/09/2022



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- SGIC SDA Pipeline Alignment
- Study Area
- Predicted Ornamental Snake Habitat
- Waterways

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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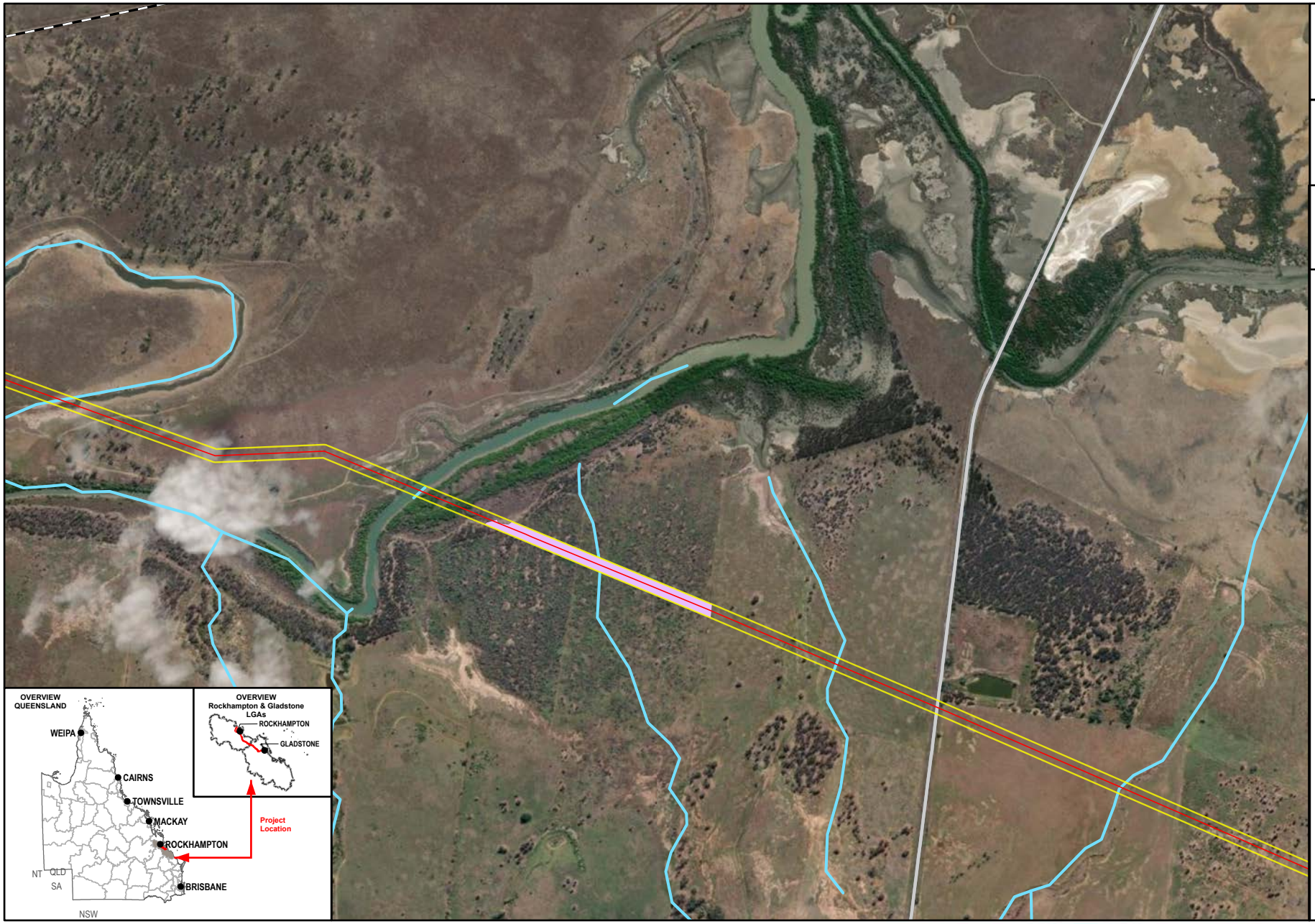
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-9l
Distribution of Ornamental Snake Habitat Within the SGIC SDA Study Area
000-G-MAP-2431 Version:4 Date:19/09/2022



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- SGIC SDA Pipeline Alignment
- Study Area
- Predicted Ornamental Snake Habitat
- Waterways
- Main Roads
- Railways

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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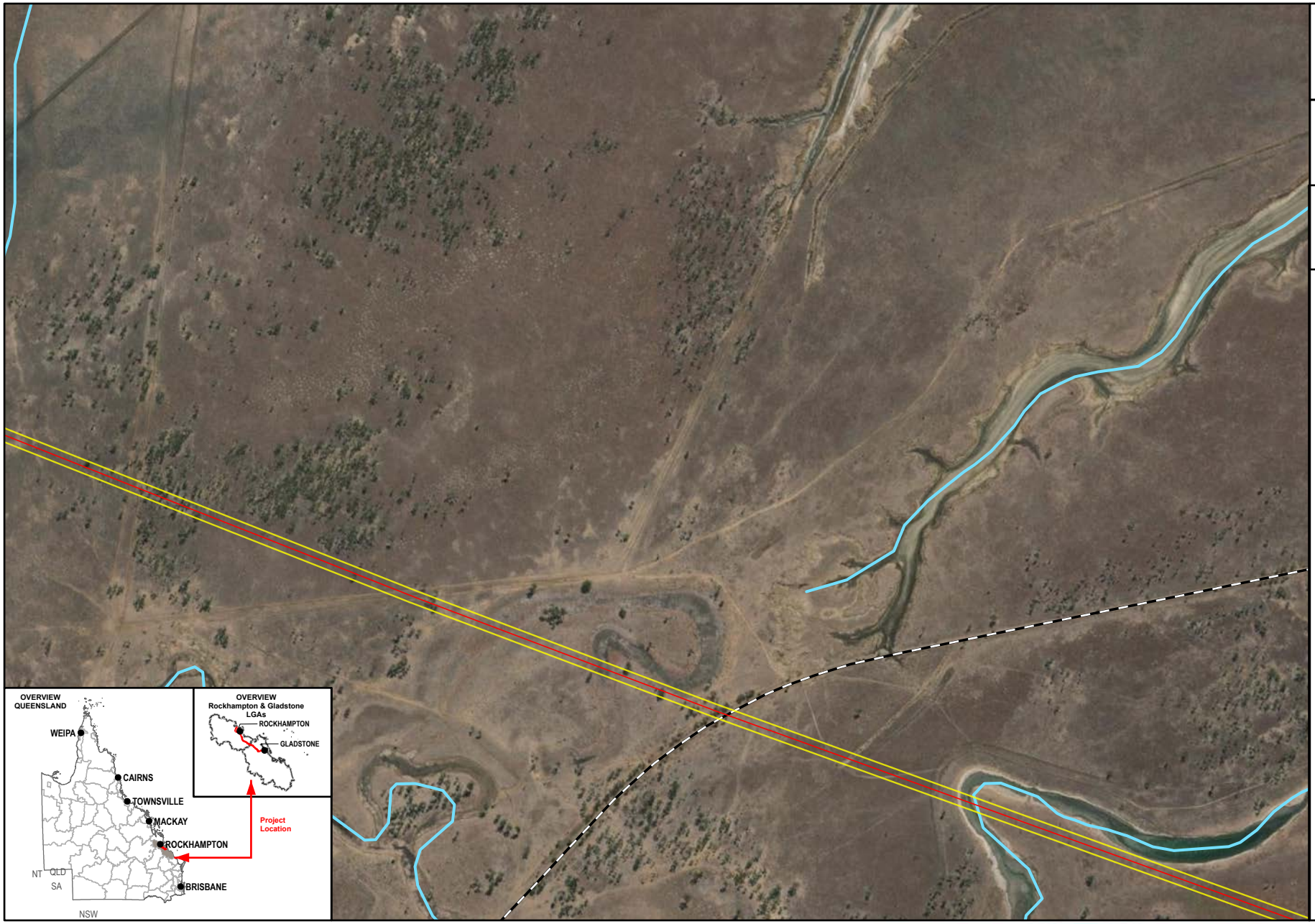
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-9m
Distribution of Ornamental Snake Habitat Within the SGIC SDA Study Area
000-G-MAP-2431 Version:4 Date:19/09/2022



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

Data Sources:
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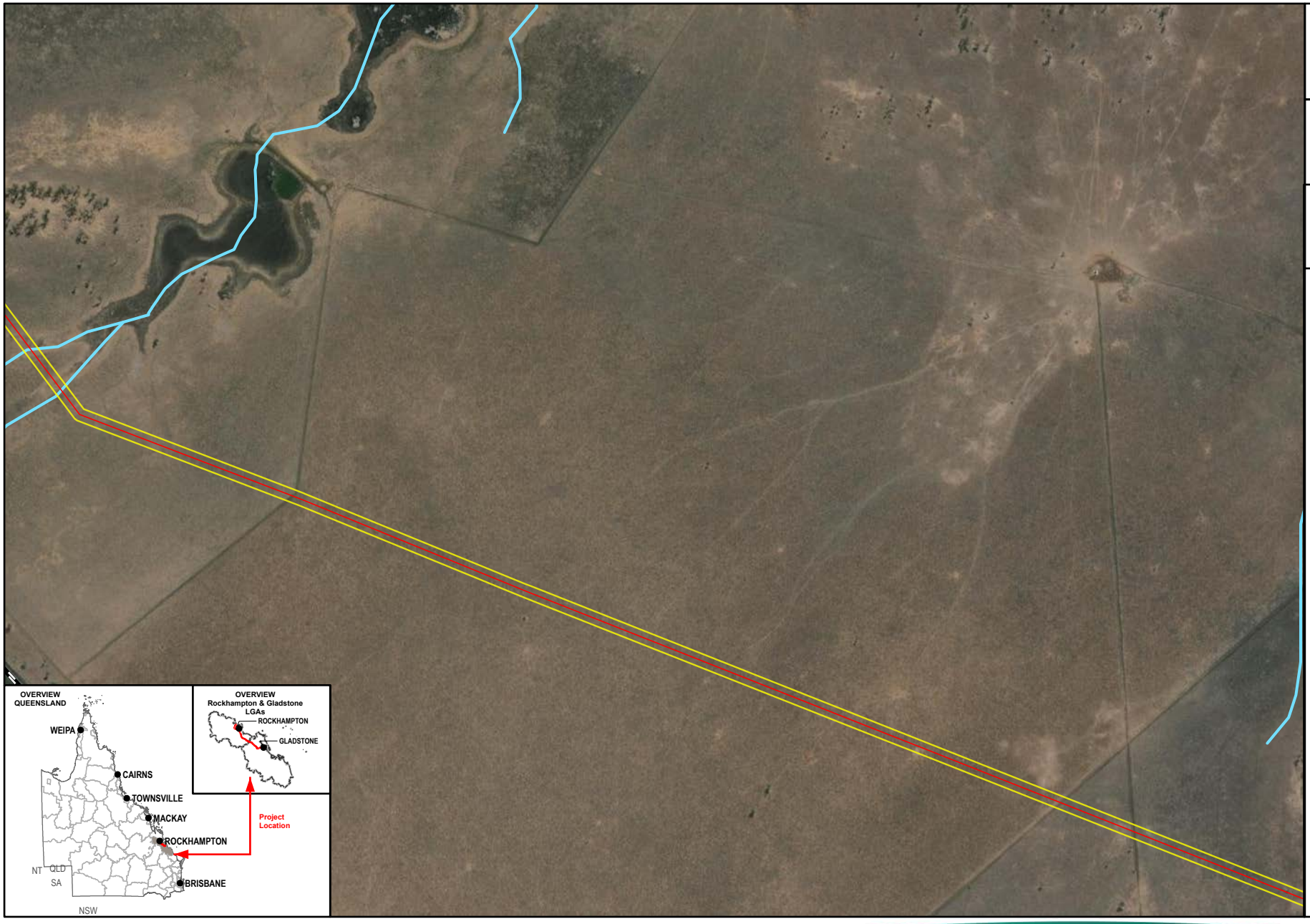
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-9n
Distribution of Ornamental Snake Habitat Within the SGIC SDA Study Area
000-G-MAP-2431 Version:4 Date:19/09/2022



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

Data Sources:
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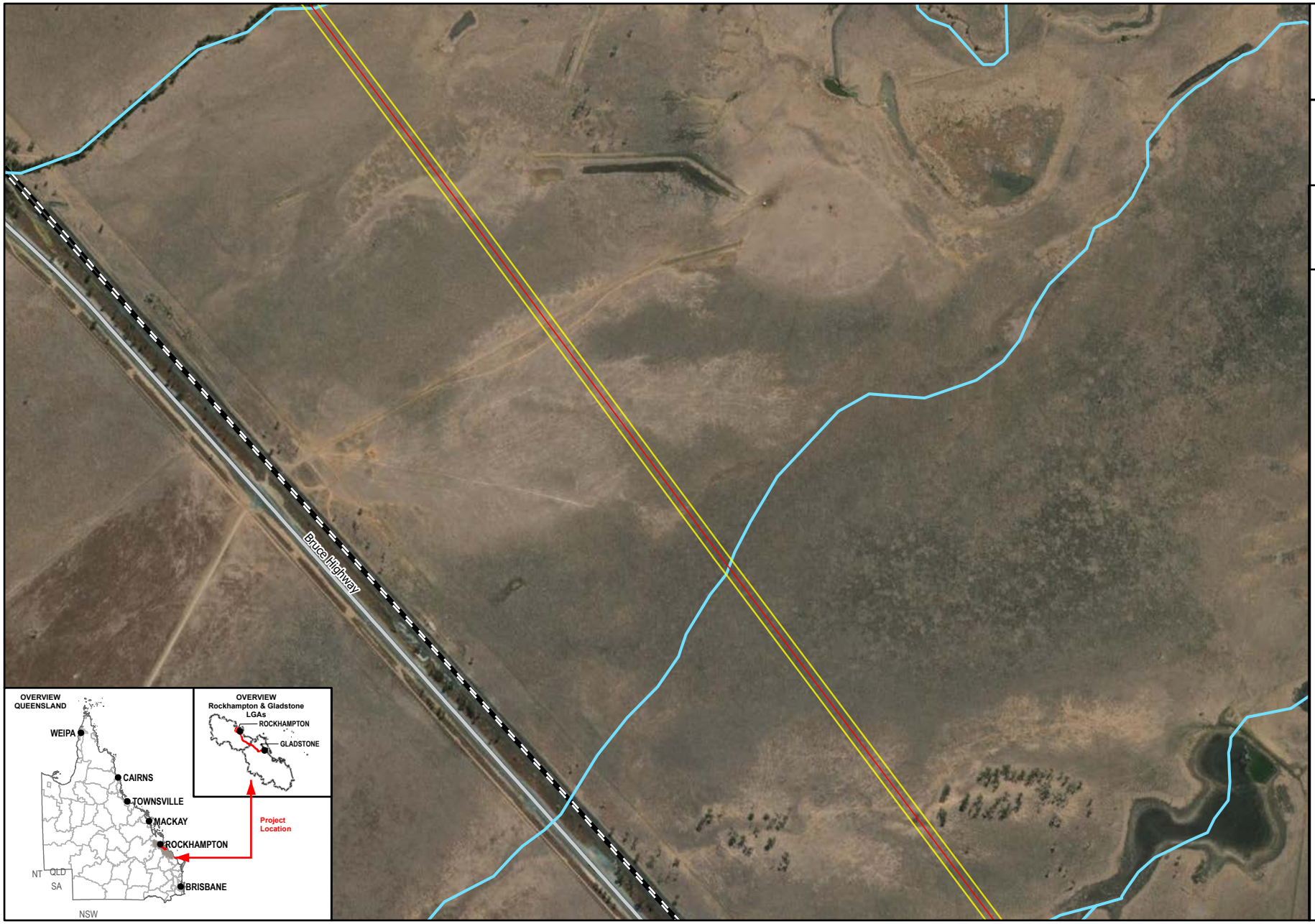
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-9o
Distribution of Ornamental Snake Habitat Within the SGIC SDA Study Area
000-G-MAP-2431 Version:4 Date:19/09/2022



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Legend

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

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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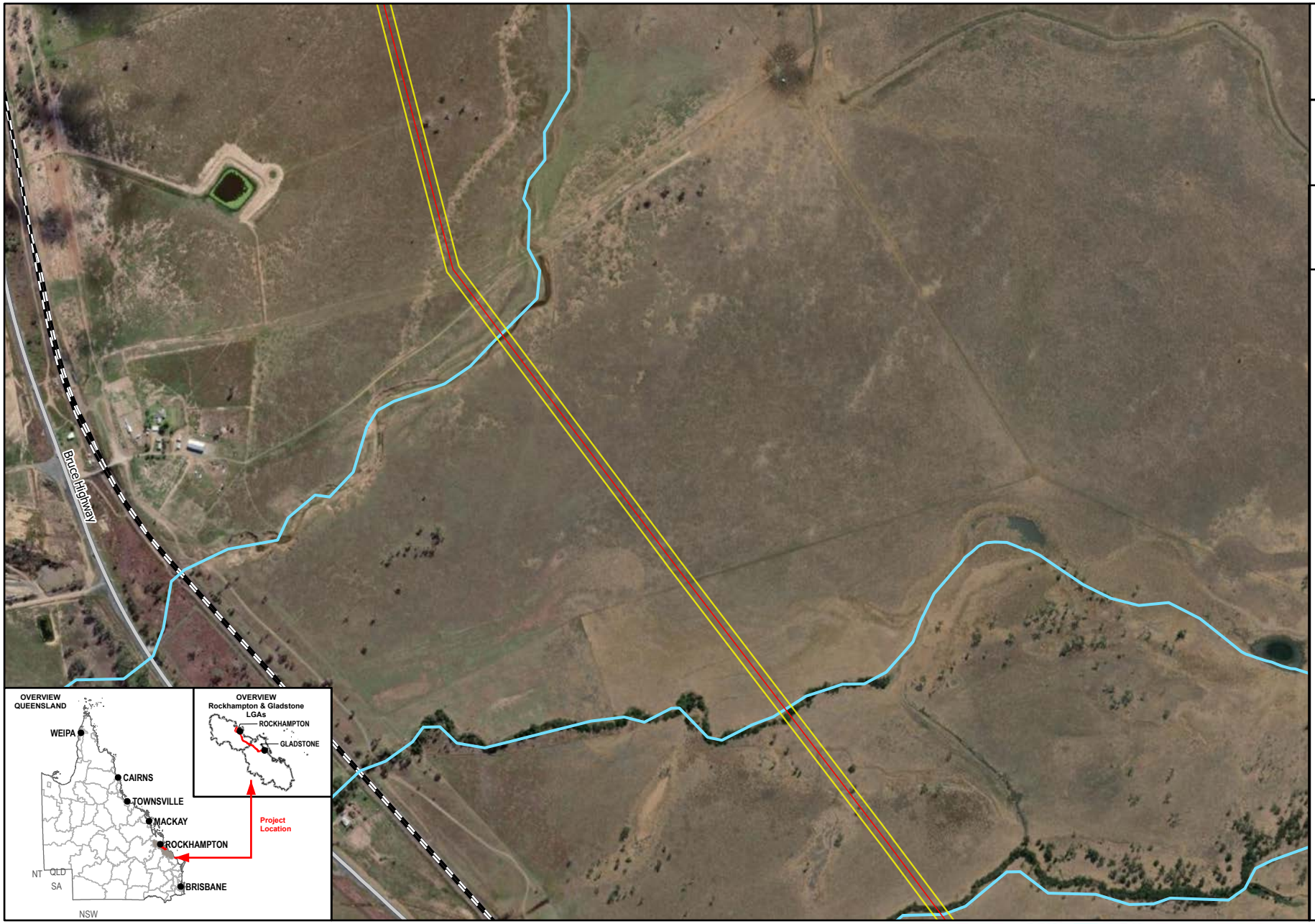
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-9p
Distribution of Ornamental Snake Habitat Within the SGIC SDA Study Area
000-G-MAP-2431 Version:4 Date:19/09/2022



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

Data Sources:
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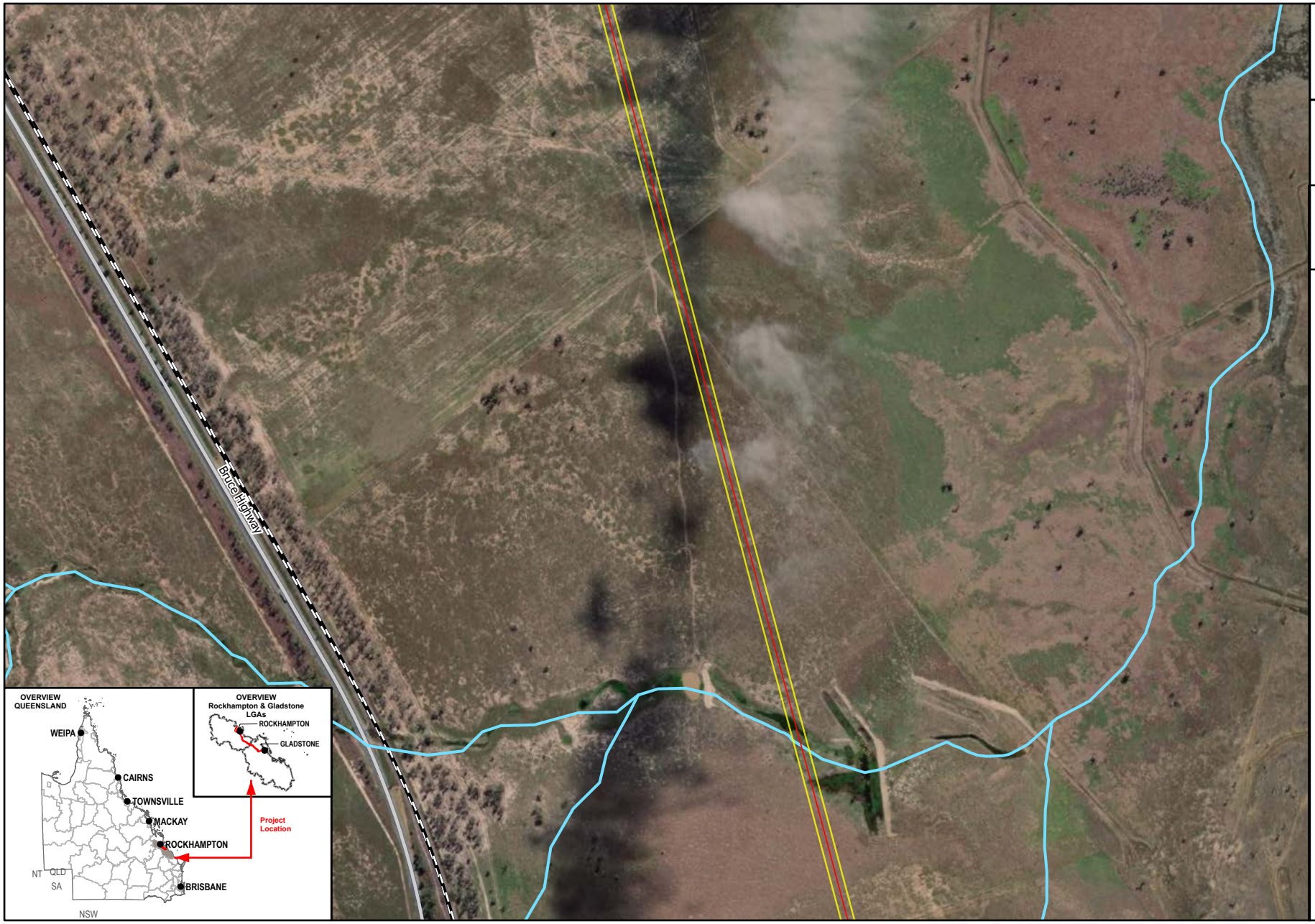
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-9q
Distribution of Ornamental Snake Habitat Within the SGIC SDA Study Area
000-G-MAP-2431 Version:4 Date:19/09/2022



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- Main Roads
- Railways

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Figure 7-9r
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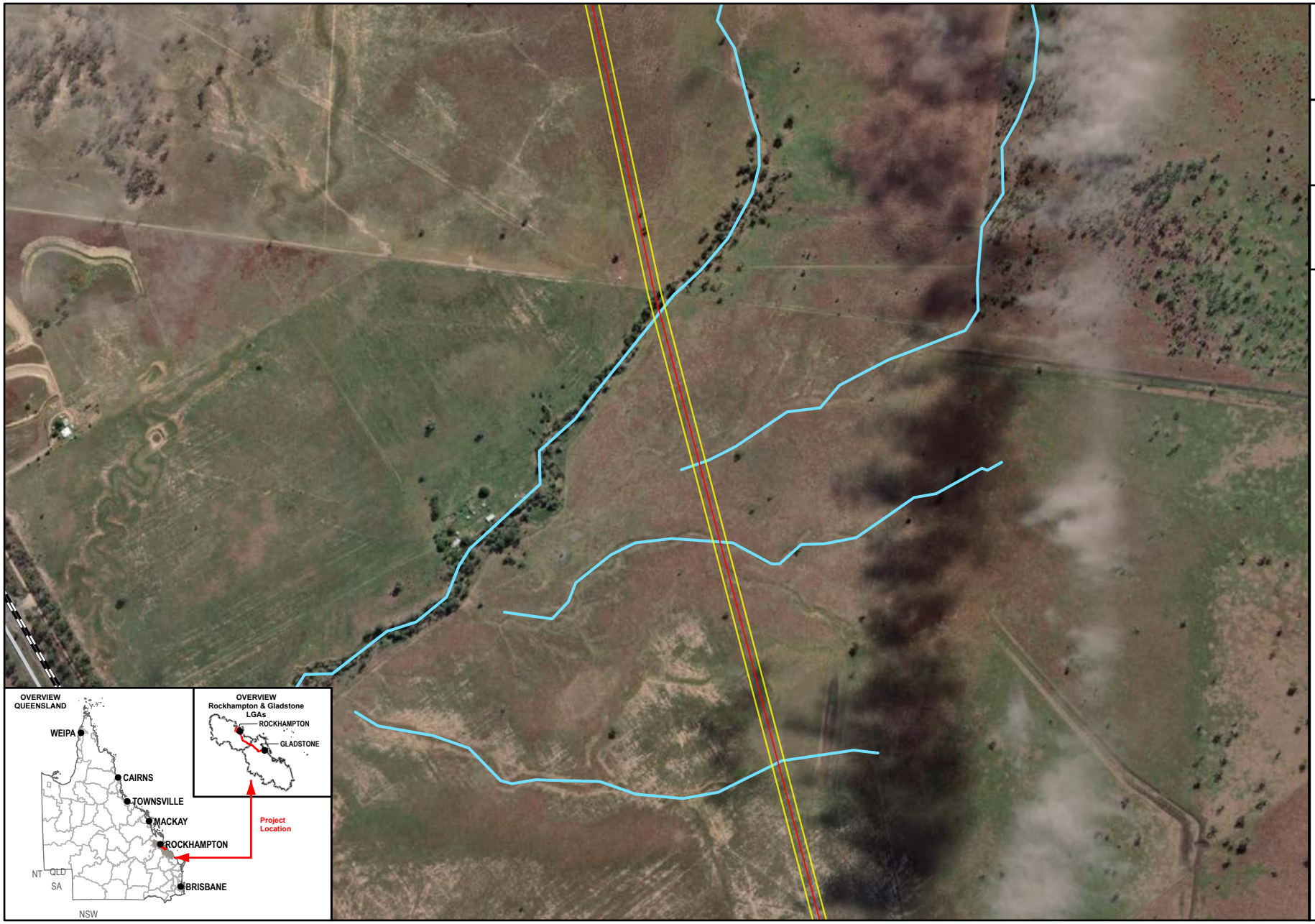

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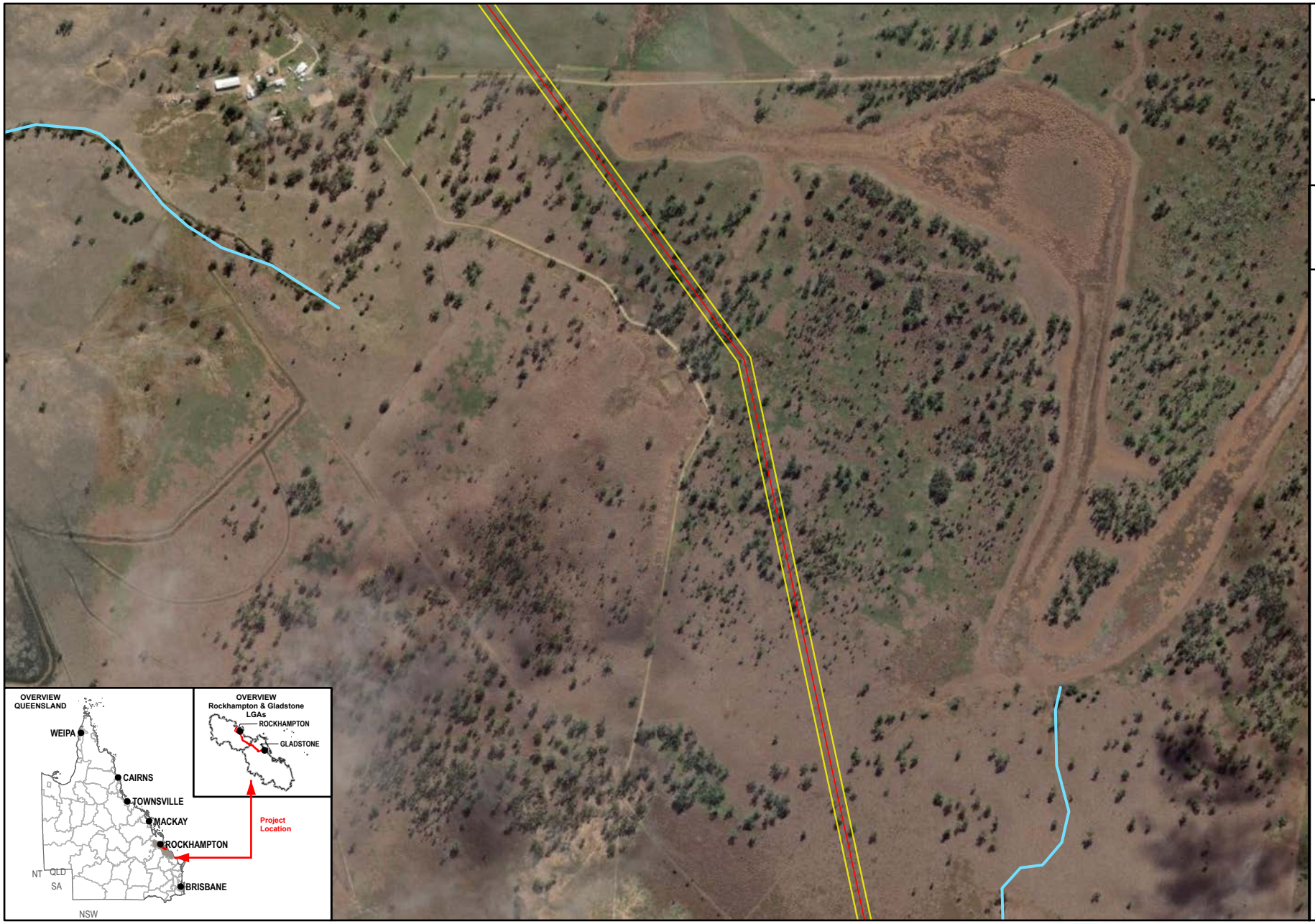

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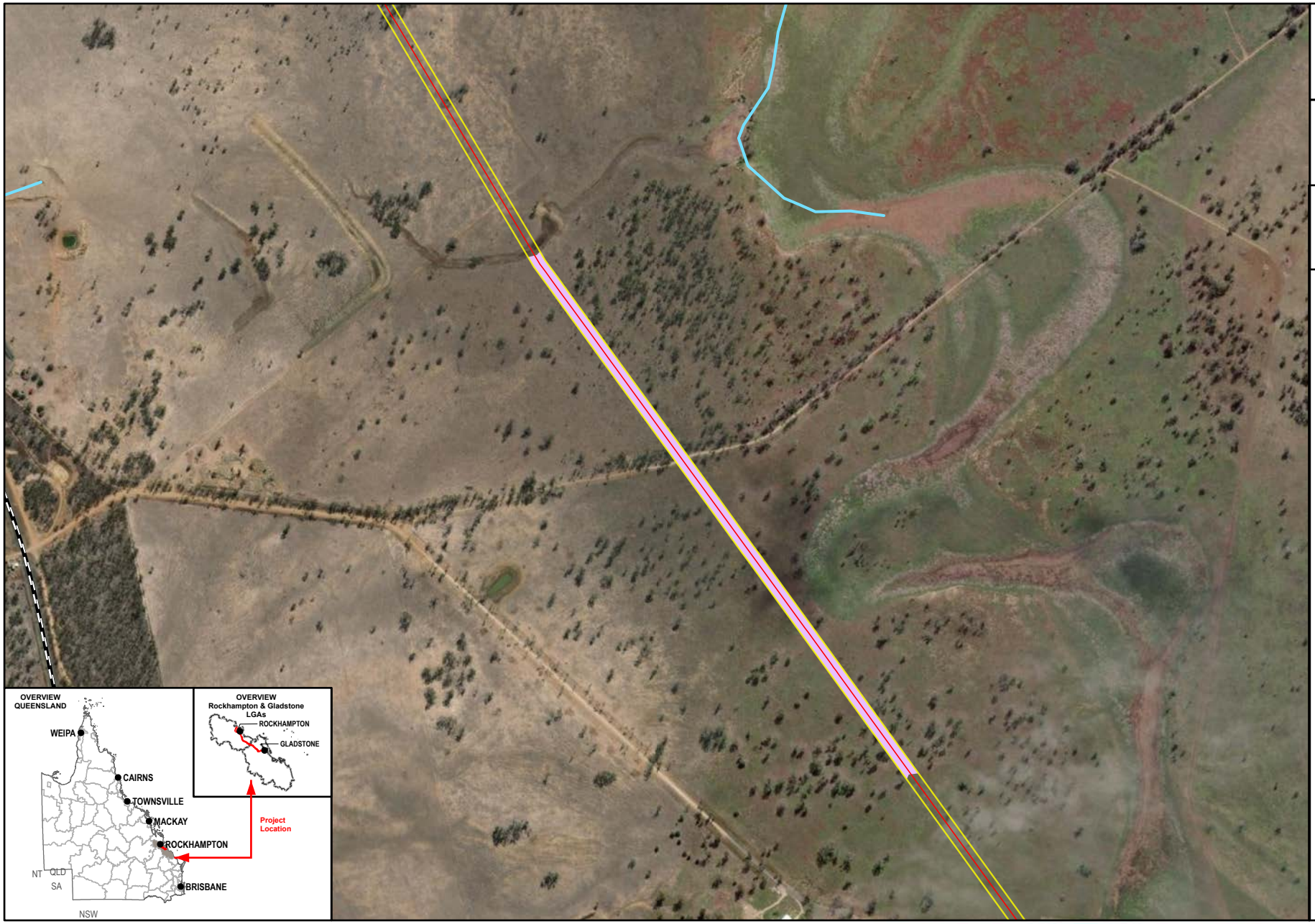

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Figure 7-9u
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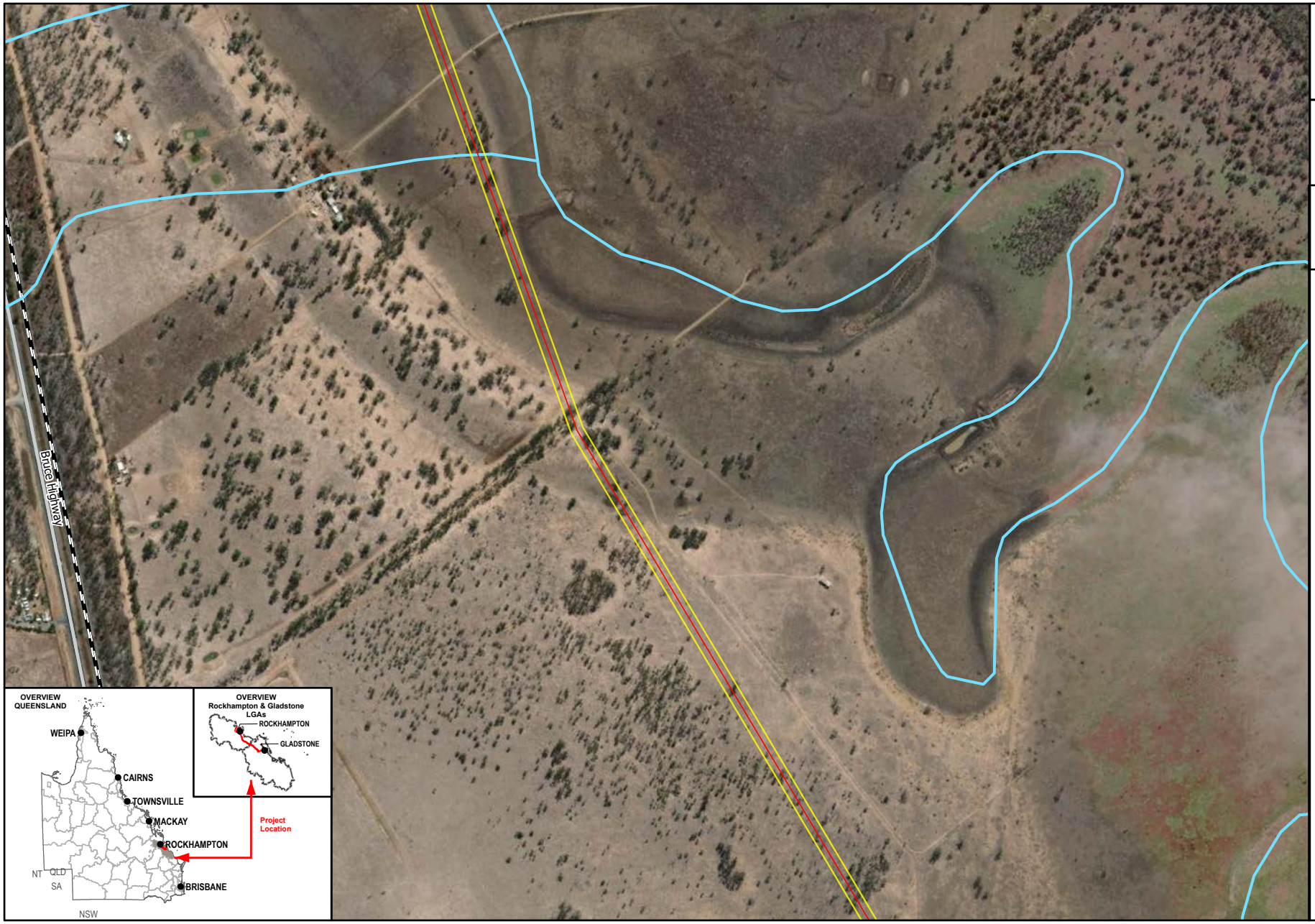

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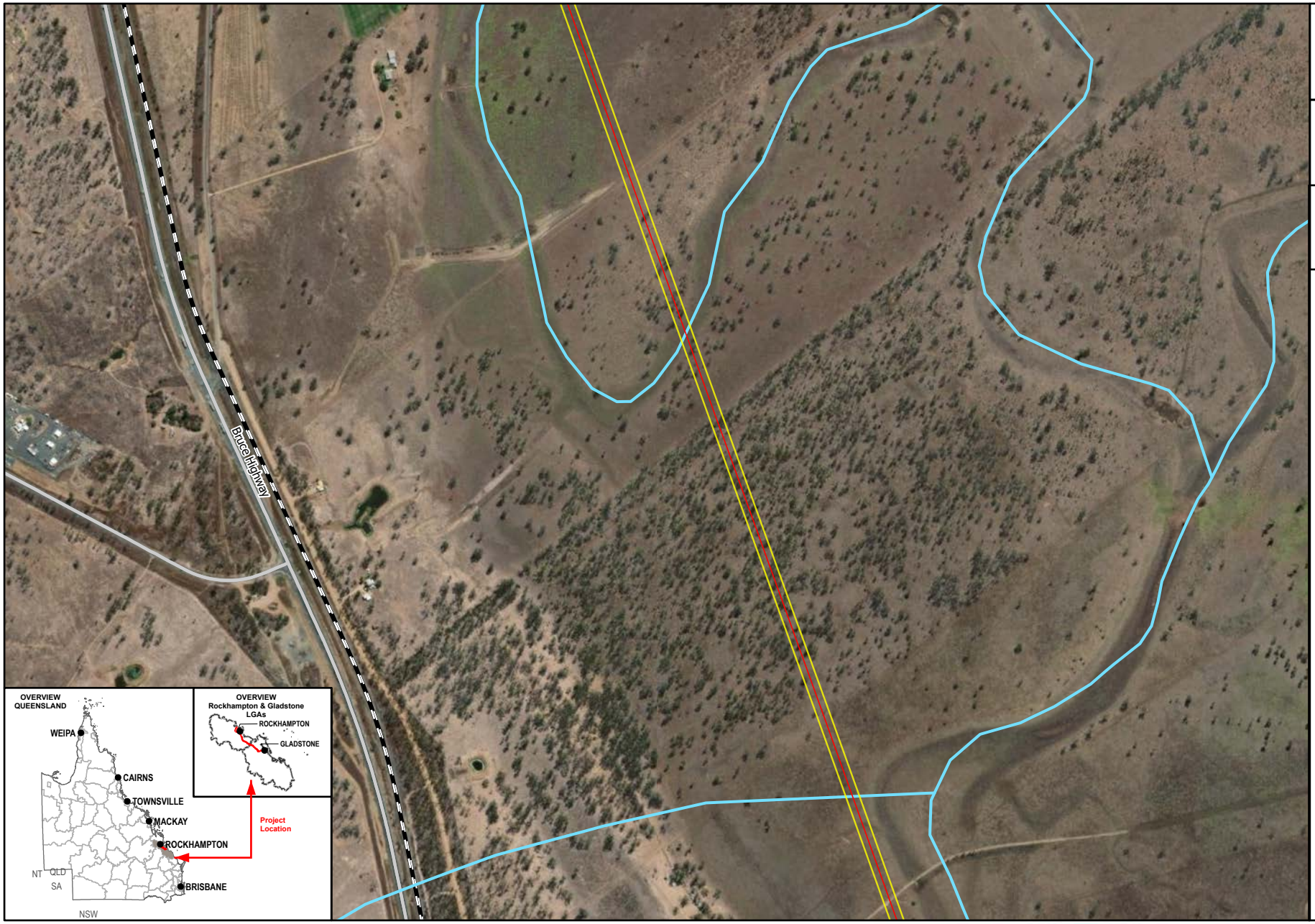

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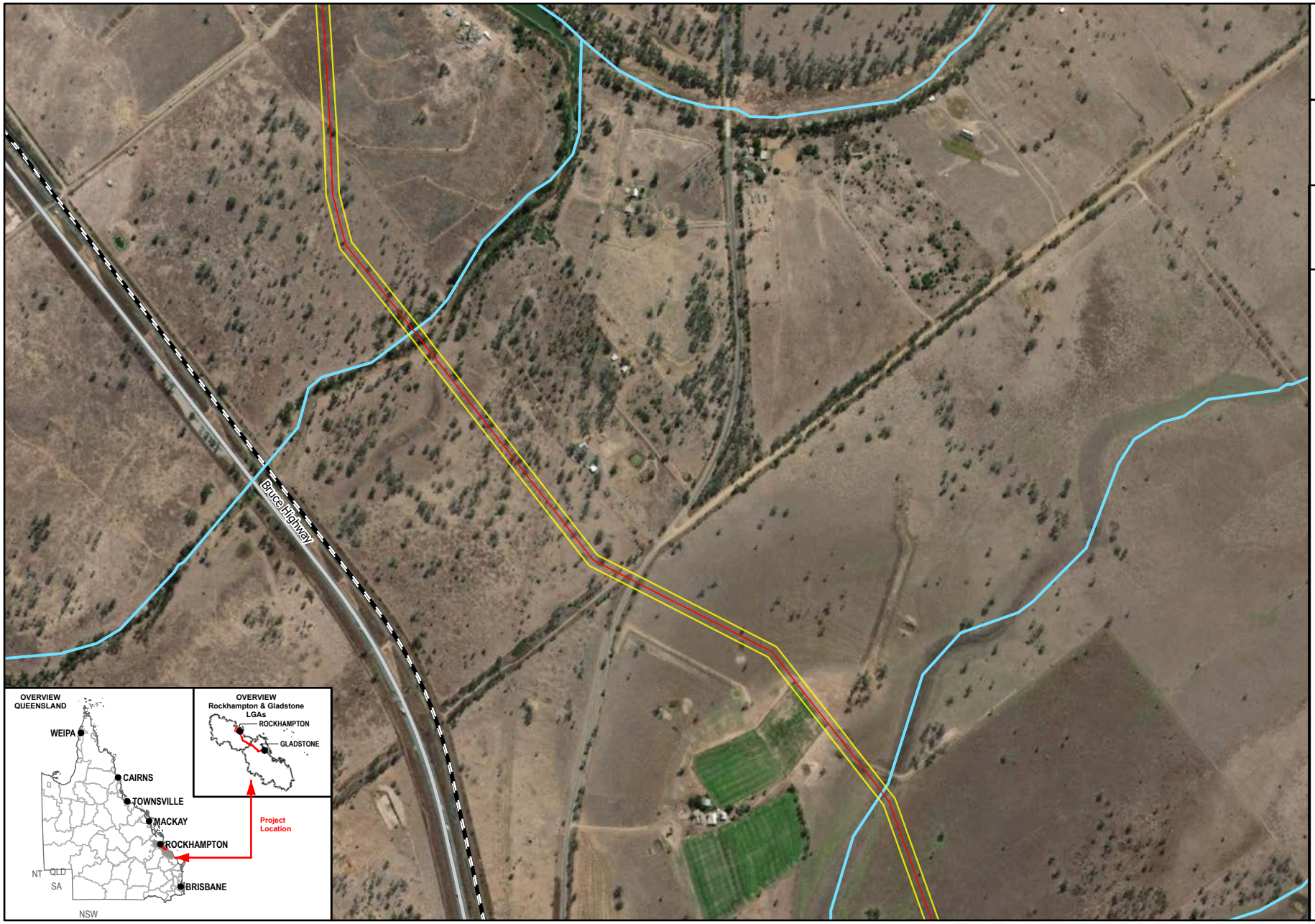

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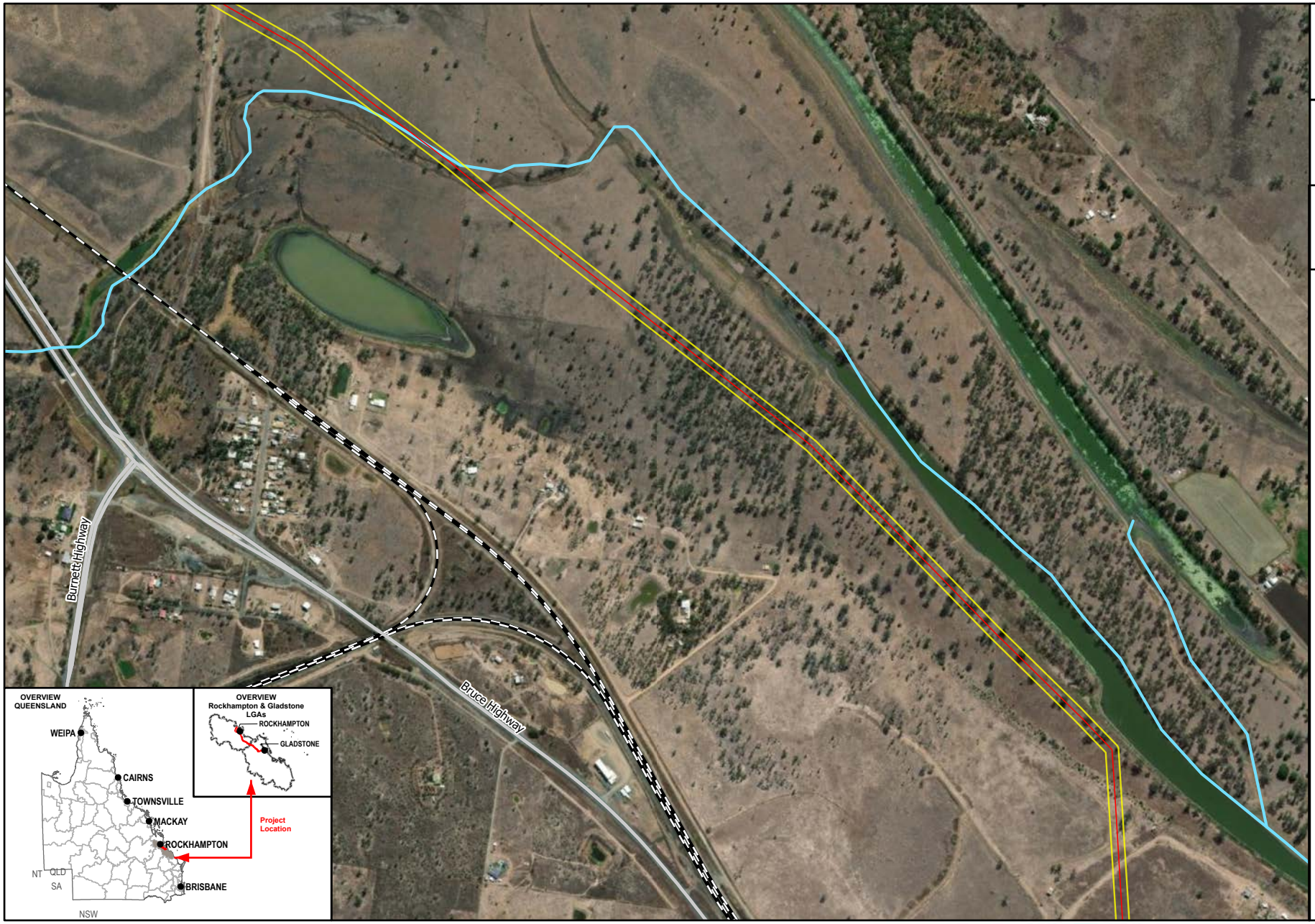

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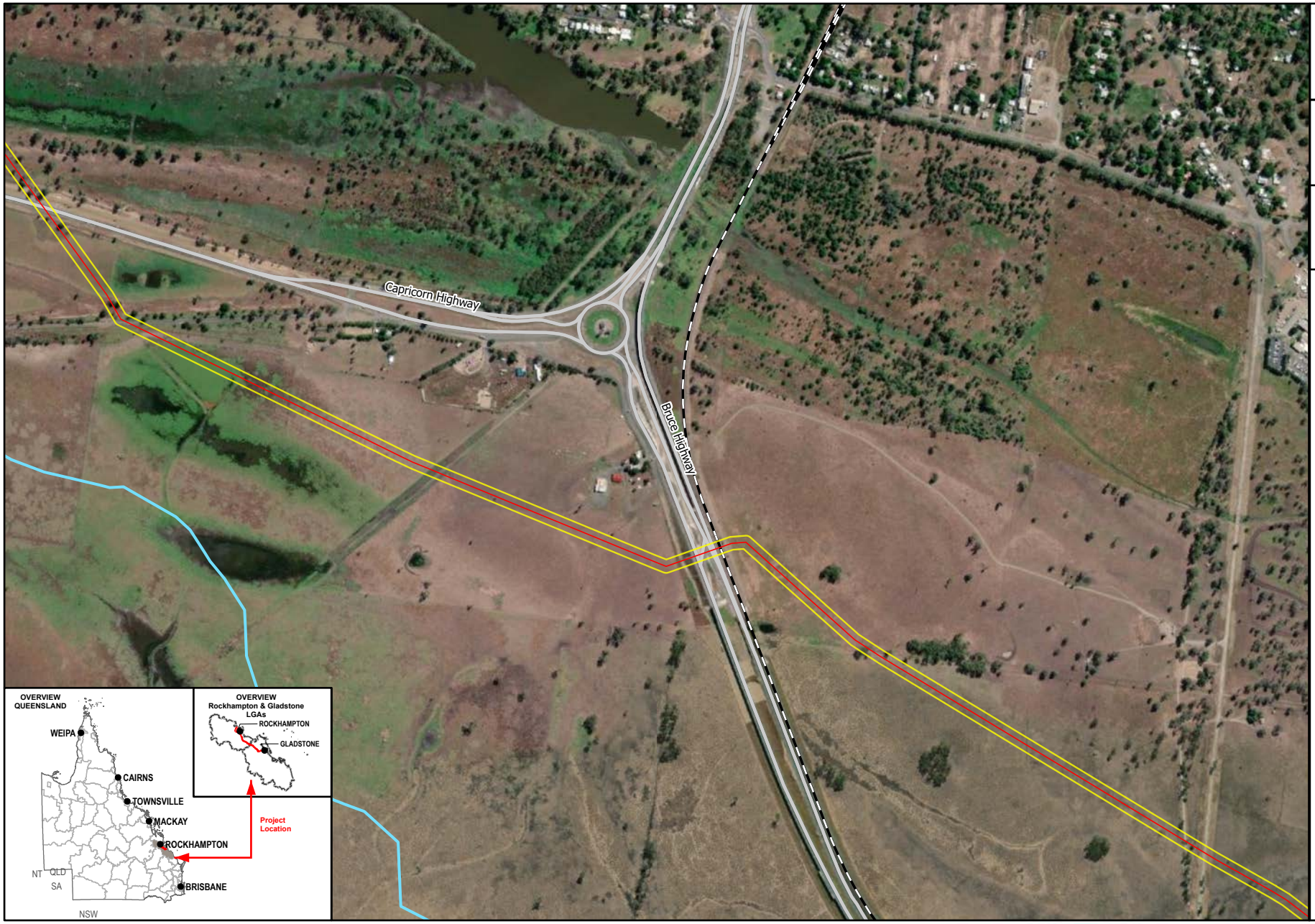

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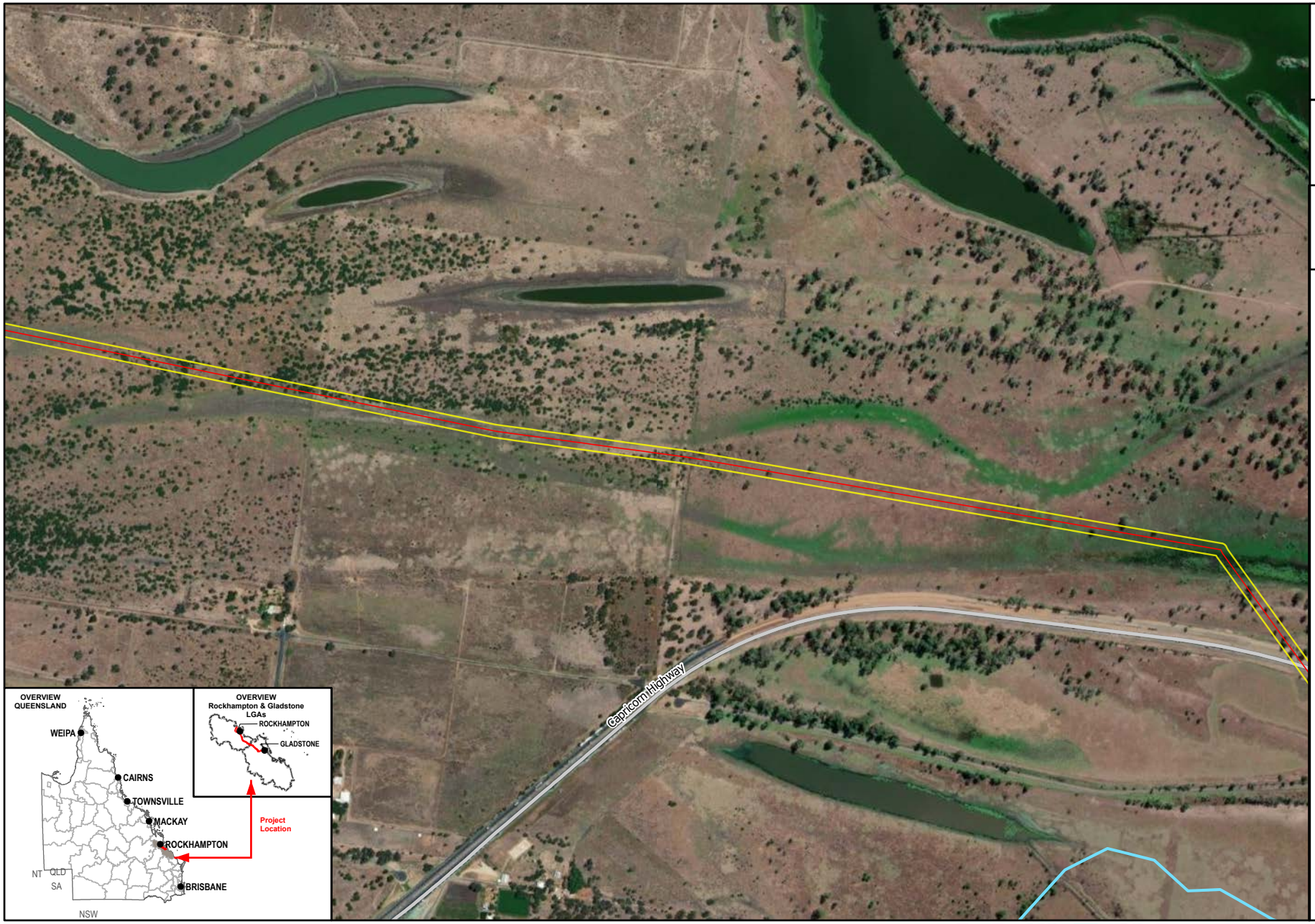

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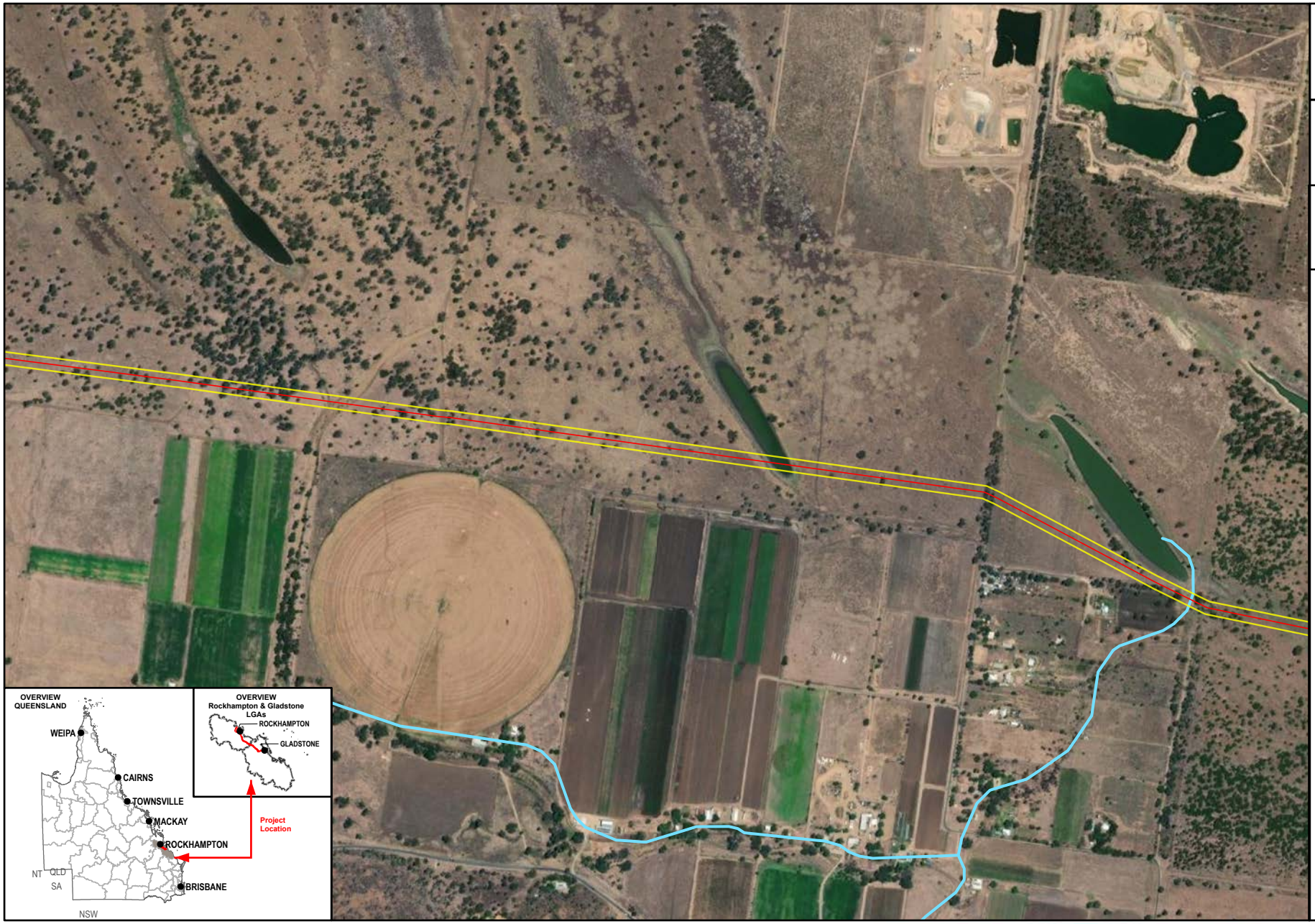

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7.2.2.4 Yellow chat (Dawson)

Conservation status and species ecology

The yellow chat (Dawson) is listed as critically endangered under the EPBC Act and endangered under the NC Act and was listed as an MNES at the time of the approval. It is distributed in coastal areas of central Queensland, with two separate breeding populations being located on the Torrila Plain and the Fitzroy River Delta (DCCEEW 2022). The yellow chat (Dawson) inhabits marine wetlands that are subjected to extensive seasonal inundation. They often occupy marine plains that have a network of shallow drainage channels with a large variety of vegetation (DCCEEW 2022). Nests are often found close to the ground in grasses and/or rushes while supporting a small cup shape. These often consist of 2 or 3 eggs (DCCEEW 2022). The diet consists of insects, including moths, damselflies, caterpillars, mosquito larvae as well as other invertebrates such as spiders. These will often be targeted from surface of shallow water, stems of rushes, grasses, and occasionally low shrubs (DCCEEW 2022).

Field survey results and distribution of suitable habitat

The yellow chat (Dawson) was confirmed present during the yellow chat (Dawson) field survey program that was initiated in April 2007 by Lindsay Agnew and Dr. Ed Meyer (Arup 2008). Four individuals from two locations were recorded from saline wetlands on marine plains along Twelve Mile Creek. The 2007 field survey program comprised of the following survey events:

– A preliminary biodiversity investigation
– A series of monthly surveys to monitor known and potential habitat areas for the yellow chat (Dawson)
– A spring-season avifauna survey
– A comprehensive target species and biodiversity survey.

The yellow chat (Dawson) was identified as controlling provisions at the time of the EPBC approval. Conditions within the EPBC Approval, condition 2, and Coordinator-General evaluation report, condition 10, related to provision of funding for research. GAWB has been able to complete this condition and outcomes of the research have been published.

The species was not recorded during the 2022 field surveys within the SGIC SDA study area. The species has been historically recorded at 157 locations within the desktop search extent (10 km buffer). The closest record is approximately 40 m from the SGIC SDA pipeline alignment. Suitable habitat for the species was recorded at vegetated marine plains (field verified REs 11.1.2b and 11.1.1) near Inkerman Creek and Twelve Mile Creek. Distribution of predicted yellow chat (Dawson) habitat is mapped in Figure 7-10.

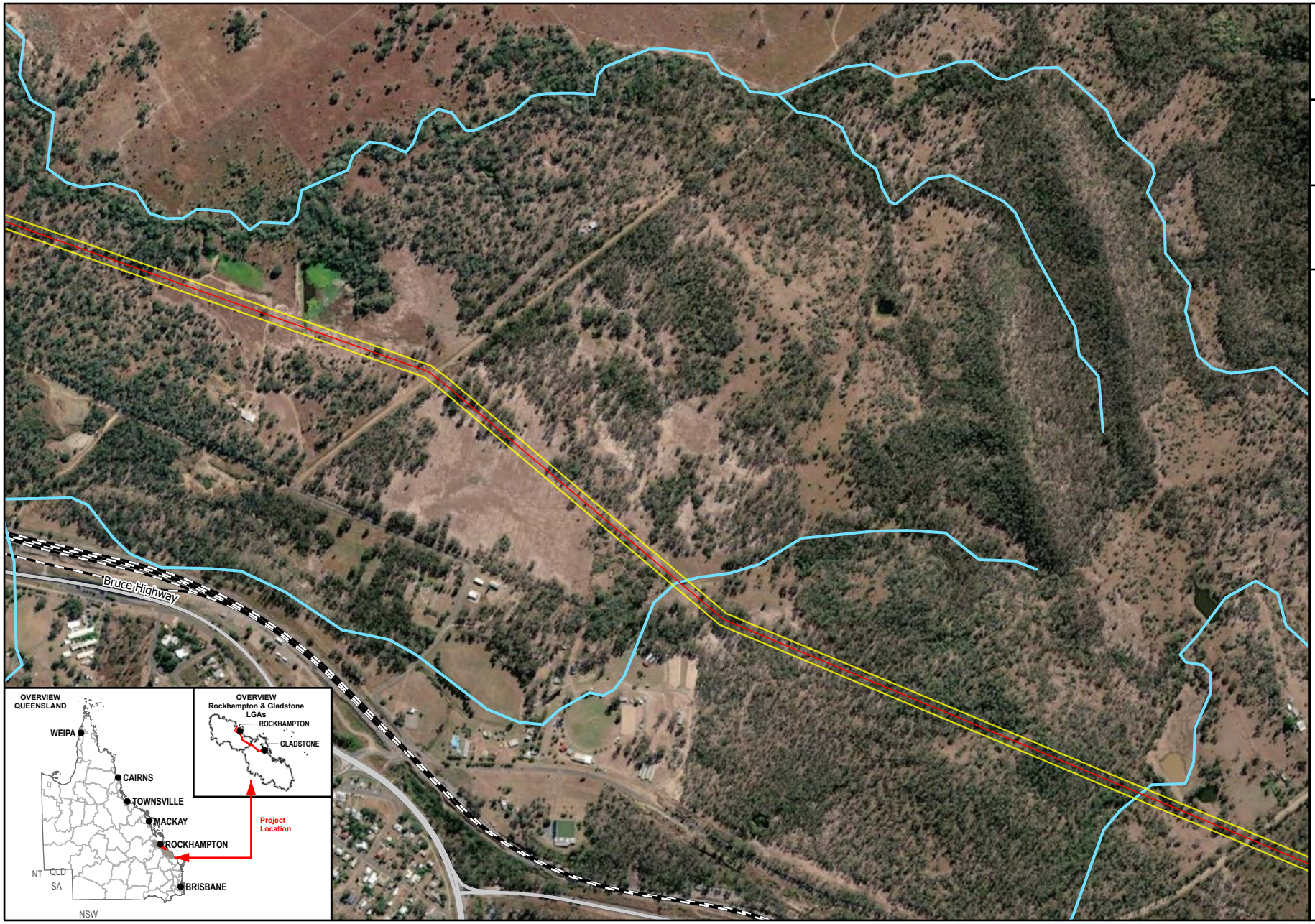
Significance of impact assessment

The project is unlikely to result in a significant residual impact on the yellow chat (Dawson). A significance of impact assessment of the project on the yellow chat (Dawson) (critically endangered under the EPBC Act and endangered under the NC Act) is provided in Table 7-22.

Table 7-22 Significance of impact on the yellow chat (Dawson)

Significant residual impact criteria	Assessment
A long-term decrease in the size of a local population	**Unlikely** The project will result in the clearing of 0.51 ha of predicted habitat for the species, representing 0.01% of habitat available within a 5 km buffer. The population on Fitzroy River Delta is located on grazing and special lease land (used for salt mining). The yellow chat (Dawson) population is estimated to comprise of about 40 birds, and previous monitoring programs have indicated that the population is relatively stable (DCCEEW 2022k). The species has also been historically recorded at 157 locations within the desktop search extent (10 km buffer), the closest record approximately 40 m from the SGIC SDA pipeline alignment. The SGIC SDA pipeline alignment is proposed to intersect suitable habitat near Inkerman Creek and Twelve Mile Creek, where four individuals were recorded on vegetated marine plains just north of the SGIC SDA pipeline alignment. Given the availability of habitat within the local landscape, the loss of vegetated marine plains within the SGIC SDA pipeline alignment are unlikely to (1) limit movement of resident or transient individuals; nor (2) affect the availability of resident or transient individuals to acquire key resources. The project is unlikely to lead to a long-term decrease in the size of a local population.
Reduce the extent of occurrence of the species	**Unlikely** The extent of occurrence of the yellow chat (Dawson) is estimated to be approximately 60 km^2 (DCCEEW 2022k). The project will result in a loss of 0.51 ha of potential habitat for yellow chat (Dawson). This represents only a small percentage of the predicted habitat available within a 5 km buffer (0.01 %). Four individuals were recorded on vegetated marine plains near Inkerman Creek and Twelve Mile Creek during the yellow chat (Dawson) field survey program undertaken in 2007 (Arup 2008). The SGIC SDA pipeline alignment is proposed to intersect Inkerman Creek and Twelve Mile Creek, just south of where the species was historically recorded. Given the small loss of suitable habitat for the yellow chat (Dawson) and 20 m of the pipeline alignment will be rehabilitated once the pipeline has been installed and buried, the project is unlikely to reduce the extent of occurrence of the species, especially noting the definition of extent of occurrence per the Queensland *Significant Residual Impact Guideline* (DEHP 2014b): *Extent of occurrence is defined as the area contained within the shortest continuous imaginary boundary which can be drawn to encompass all the known, inferred or projected sites of present occurrence of a taxon*.
Fragment an existing population	**Unlikely** The SGIC SDA pipeline alignment will intersect two areas (i.e. Inkerman Creek and Twelve Mile Creek) that provide suitable habitat for the species. The maximum width of clearing required for the construction of the SGIC SDA pipeline alignment is 30 m and the SGIC SDA pipeline alignment is proposed to intersect the outer extent of these two areas that have been identified as suitable habitat for the species. As the SGIC SDA pipeline alignment is narrow and linear and the yellow chat (Dawson) is capable of moving to other connected tidal wetland habitats, the project is unlikely to fragment the yellow chat (Dawson) population.
Result in genetically distinct populations forming as a result of habitat isolation	**Unlikely** The species' capacity to move locally is unlikely to be limited by any localised land clearing necessary to construct the SGIC SDA pipeline alignment. As a result, the project is unlikely to cause any form of genetic isolation at a population level.
Result in invasive species that are harmful to a endangered species becoming established in the endangered species habitat	**Unlikely** Numerous invasive weeds and pasture grasses are currently well established within the SGIC SDA pipeline alignment. Introduced pasture grasses have the potential to alter habitat structure of marine plain wetlands, and therefore, impacts the species habitat values (Houston and Melzer 2008). Implementation of a site-specific Weed Management Plan will reduce the risk of further weed spread. Invasive species including feral pigs already occur throughout the area. Feral pigs cause extensive uprooting of sedges and associated grasslands upon which the species depends on for shelter and foraging (Houston and Melzer 2008). Feral animal control measures will be implemented throughout the duration of the project and have been designed to mitigate risks using a Pest Management Plan. If mitigation measures are implemented correctly, the project is unlikely to result in the introduction of invasive species that are harmful to the yellow chat (Dawson).

Significant residual impact criteria	Assessment
Introduce disease that may cause the population to decline	**Unlikely** Disease is not listed as a potential threat to the species. The project is unlikely to introduce a disease that may cause the species to decline.
Interfere with the recovery of the species	**Unlikely** The project is not anticipated to interfere with the recovery of the yellow chat (Dawson). No impact on the long-term persistence of the species in the local landscape is anticipated, and no reduction in population size is expected such that no genetic diversity will be lost for the species. Noting the above points relating to very limited if any effects on local populations (e.g. declines), extent of occurrence, fragmentation, invasive species, and disease, the project is not considered likely to interfere with the recovery of the yellow chat (Dawson).
Result in disruption to ecologically significant locations (breeding, feeding or nesting sites) of a species	**Unlikely** While disturbance to individuals may be experienced during construction, this disturbance will be short-term such that no impact on the lifecycle of this species is anticipated. Furthermore, any disturbance during construction will be highly localised and therefore unlikely to impact ecologically significant locations of a species. This conclusion is based on the small extent of the proposed impact. Similarly, owing to the narrow clearing extent, food resources in the local landscape for the species' is unlikely to be substantially reduced and movement patterns are not anticipated to be impacted as there will be no functional disruption in habitat connectivity.
Conclusion	The project is unlikely to result in a significant residual impact on the yellow chat (Dawson). The project will result in a loss (0.51 ha) of potentially suitable foraging and breeding habitat for the yellow chat (Dawson); however, due to the narrow clearing extent, food resources in the local landscape for the species are unlikely to be substantially reduced and movement patterns are not anticipated to be impacted as there will be no functional disruption in habitat connectivity.



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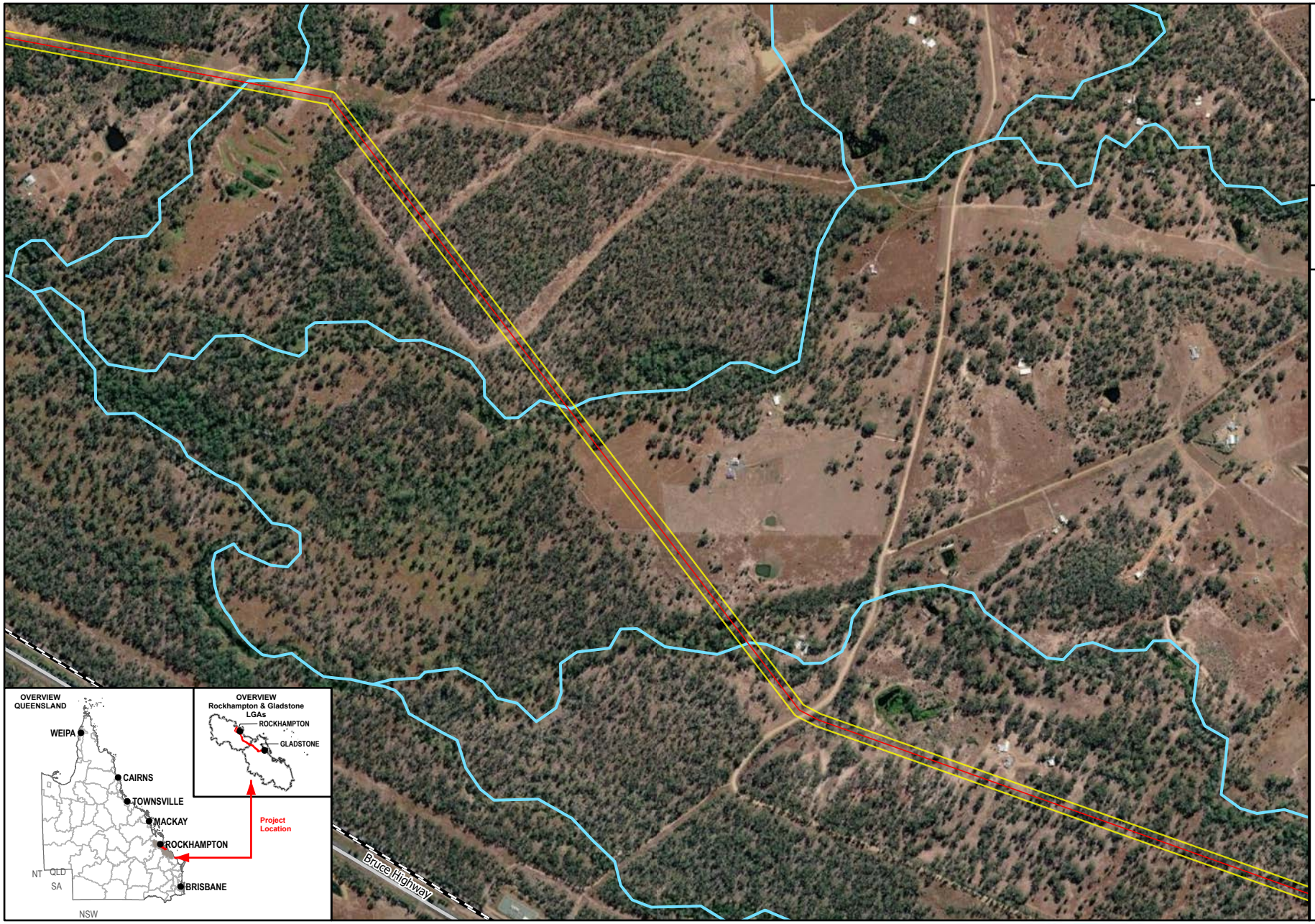
PROJECTION UTM Zone 56
(Datum GDA2020)

Compiled by:YS16239

Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-10a
Distribution of Yellow Chat (Dawson) Habitat Within the SGIC SDA Study Area
000-G-MAP-2432 Version:3 Date:19/09/2022



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Legend

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

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

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PROJECTION UTM Zone 56
(Datum GDA2020)

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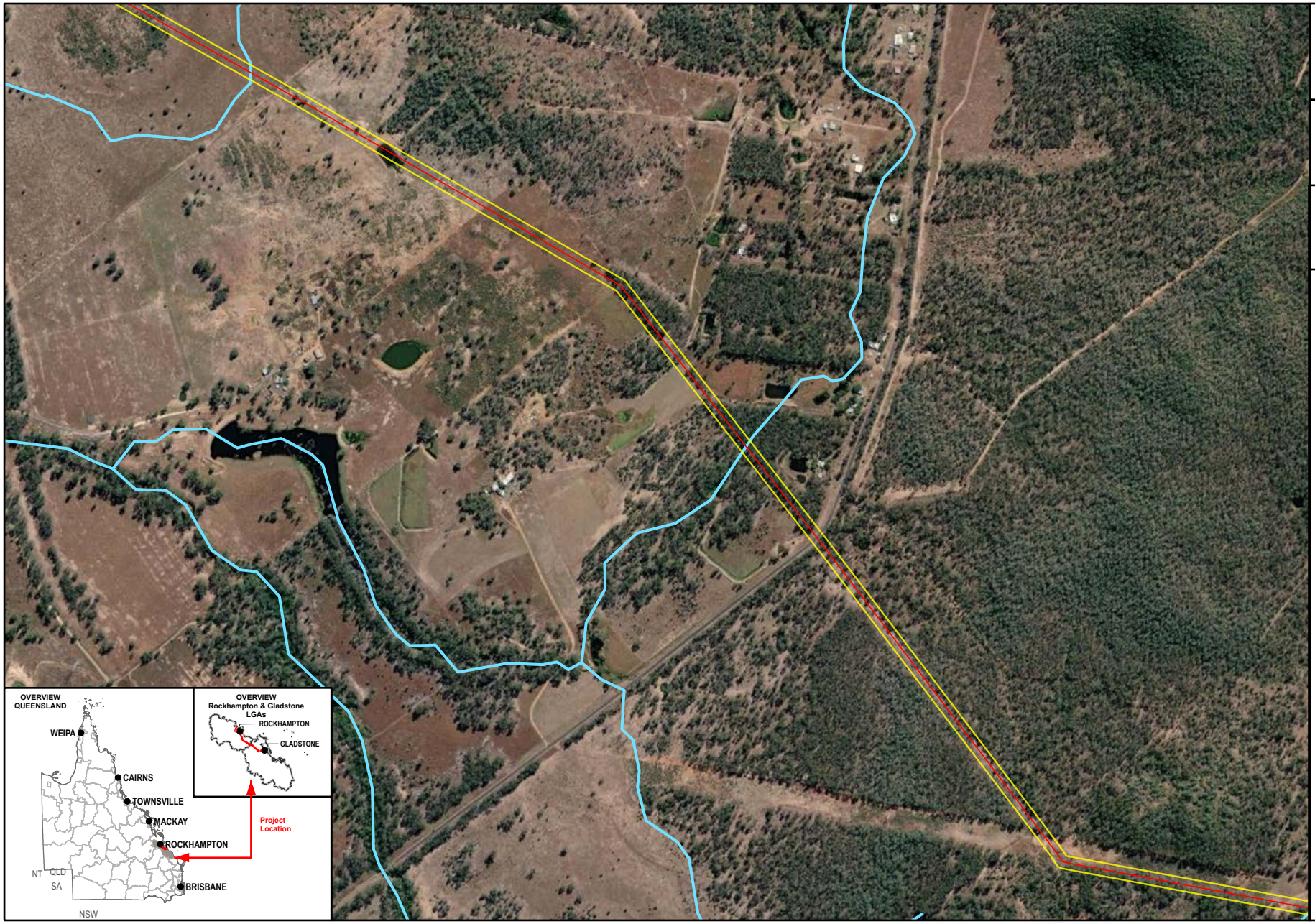
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-10b
Distribution of Yellow Chat (Dawson) Habitat Within the SGIC SDA Study Area
000-G-MAP-2432 Version:3 Date:19/09/2022



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Legend

- SGIC SDA Pipeline Alignment
- Study Area
- Waterways

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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PROJECTION UTM Zone 56
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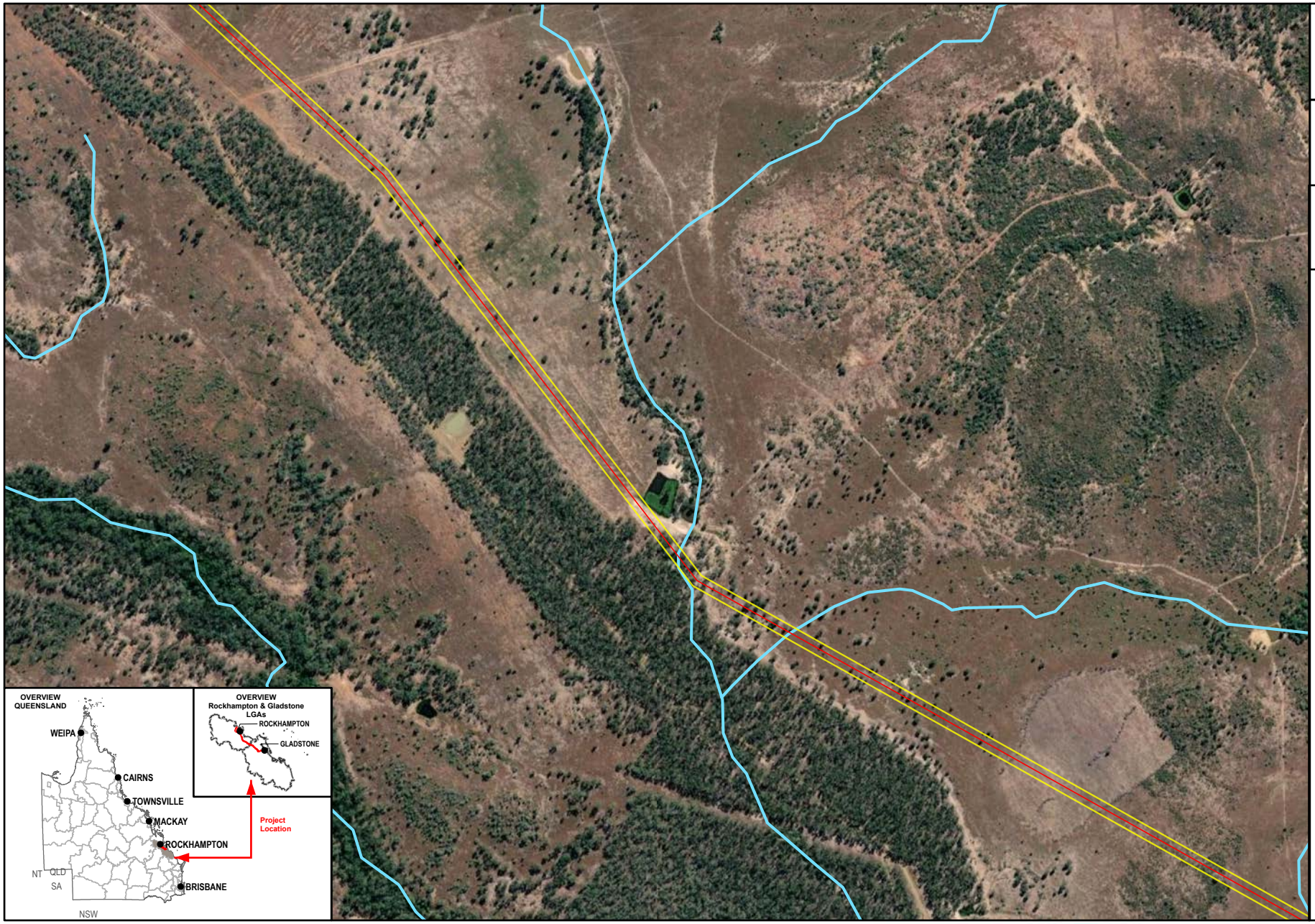
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-10c
Distribution of Yellow Chat (Dawson) Habitat Within the SGIC SDA Study Area
000-G-MAP-2432 Version:3 Date:19/09/2022



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Legend

- SGIC SDA Pipeline Alignment
- Study Area
- Waterways

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

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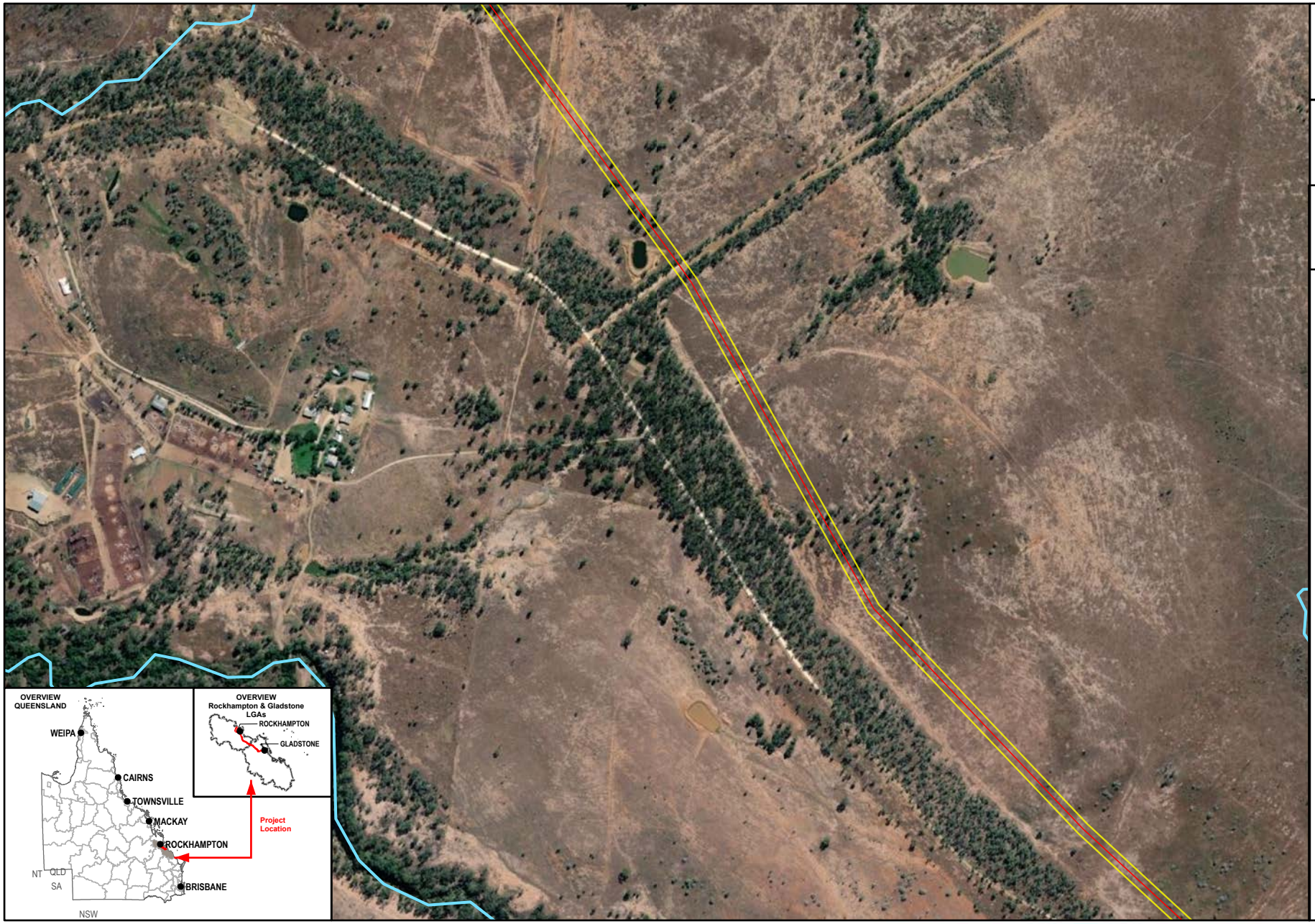
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-10d
Distribution of Yellow Chat (Dawson) Habitat Within the SGIC SDA Study Area
000-G-MAP-2432 Version:3 Date:19/09/2022



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Legend

- SGIC SDA Pipeline Alignment
- Study Area
- Waterways

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

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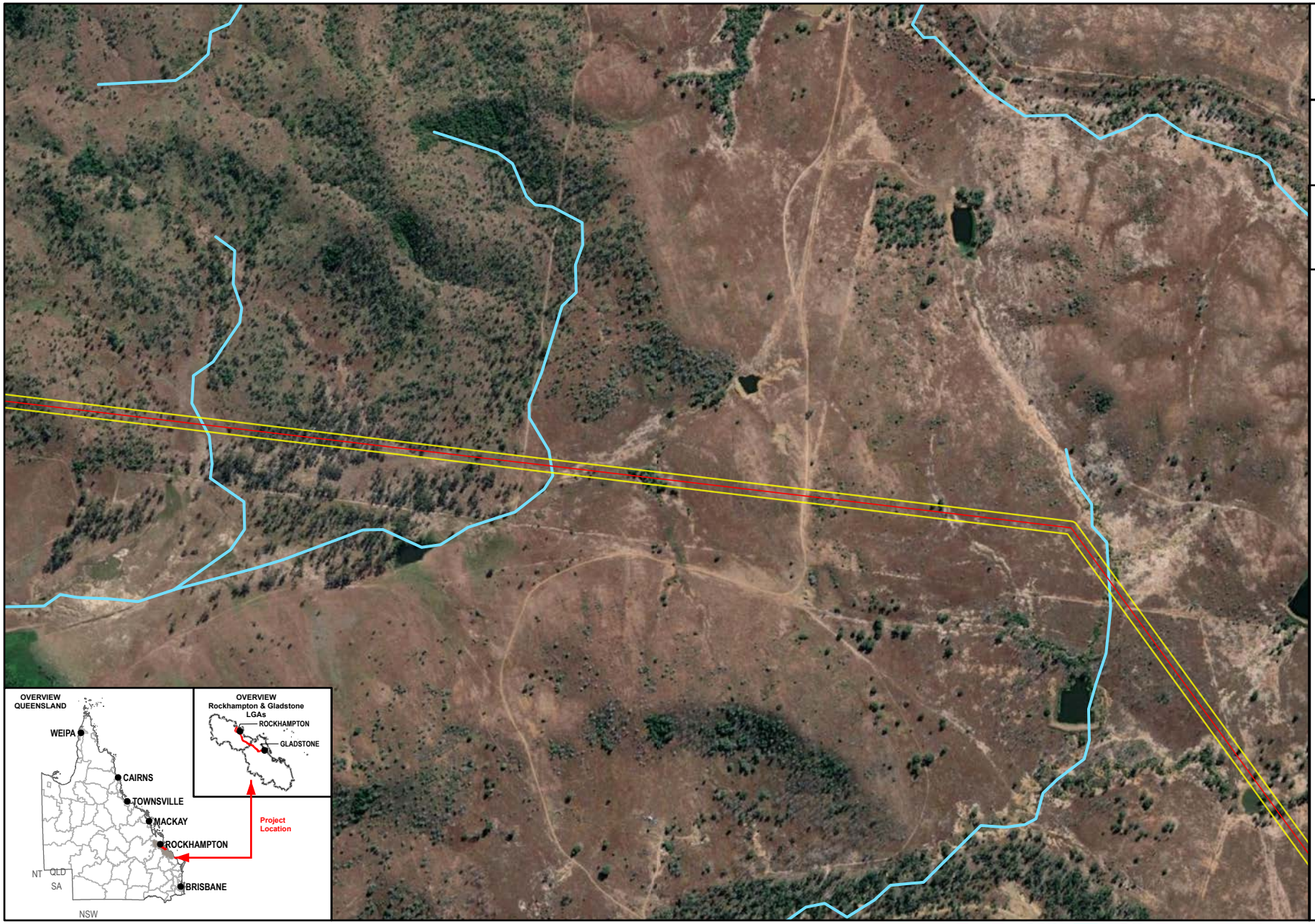
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-10e
Distribution of Yellow Chat (Dawson) Habitat Within the SGIC SDA Study Area
000-G-MAP-2432 Version:3 Date:19/09/2022



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Legend

- SGIC SDA Pipeline Alignment
- Study Area
- Waterways

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

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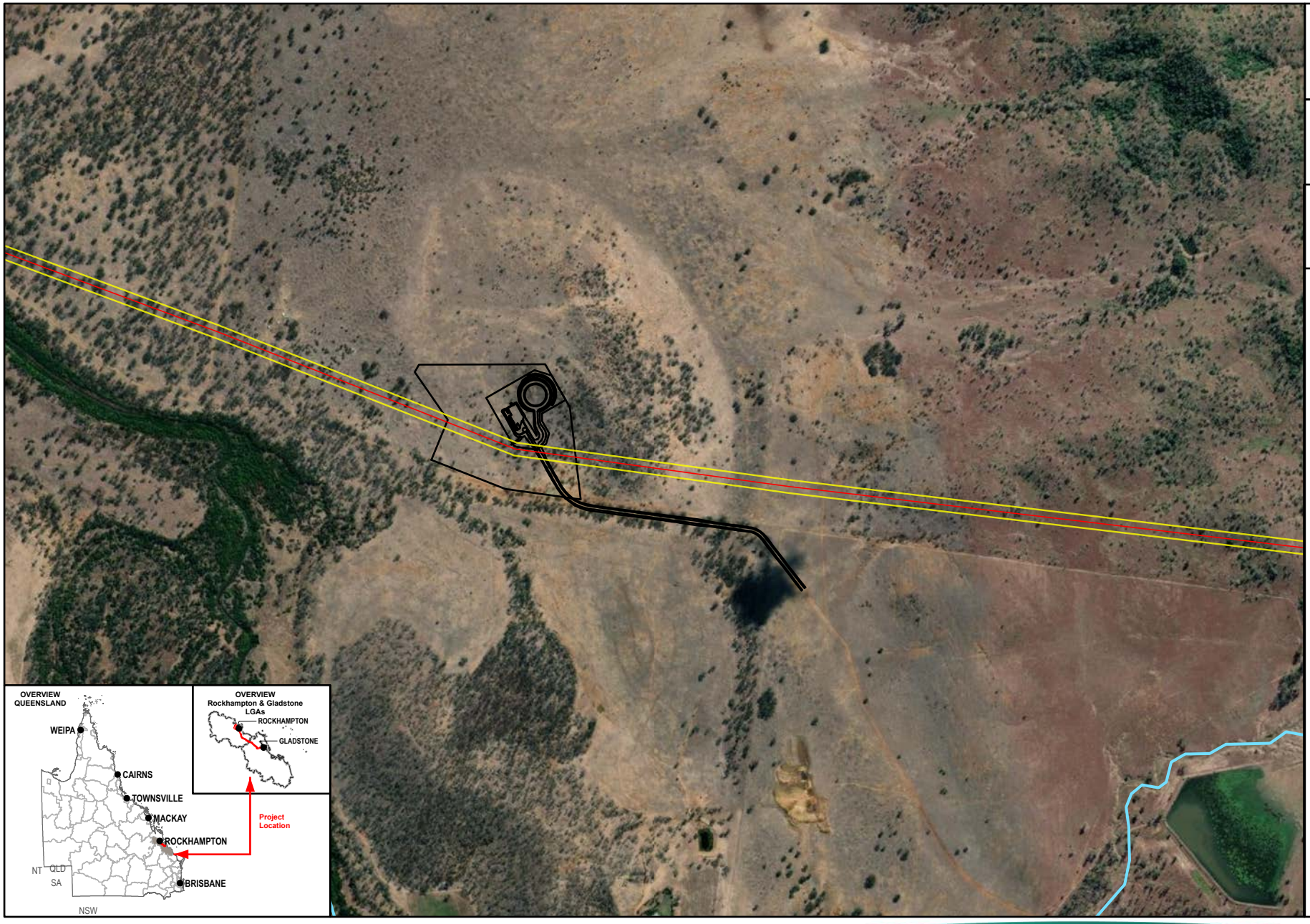
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-10f
Distribution of Yellow Chat (Dawson) Habitat Within the SGIC SDA Study Area
000-G-MAP-2432 Version:3 Date:19/09/2022



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Legend

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

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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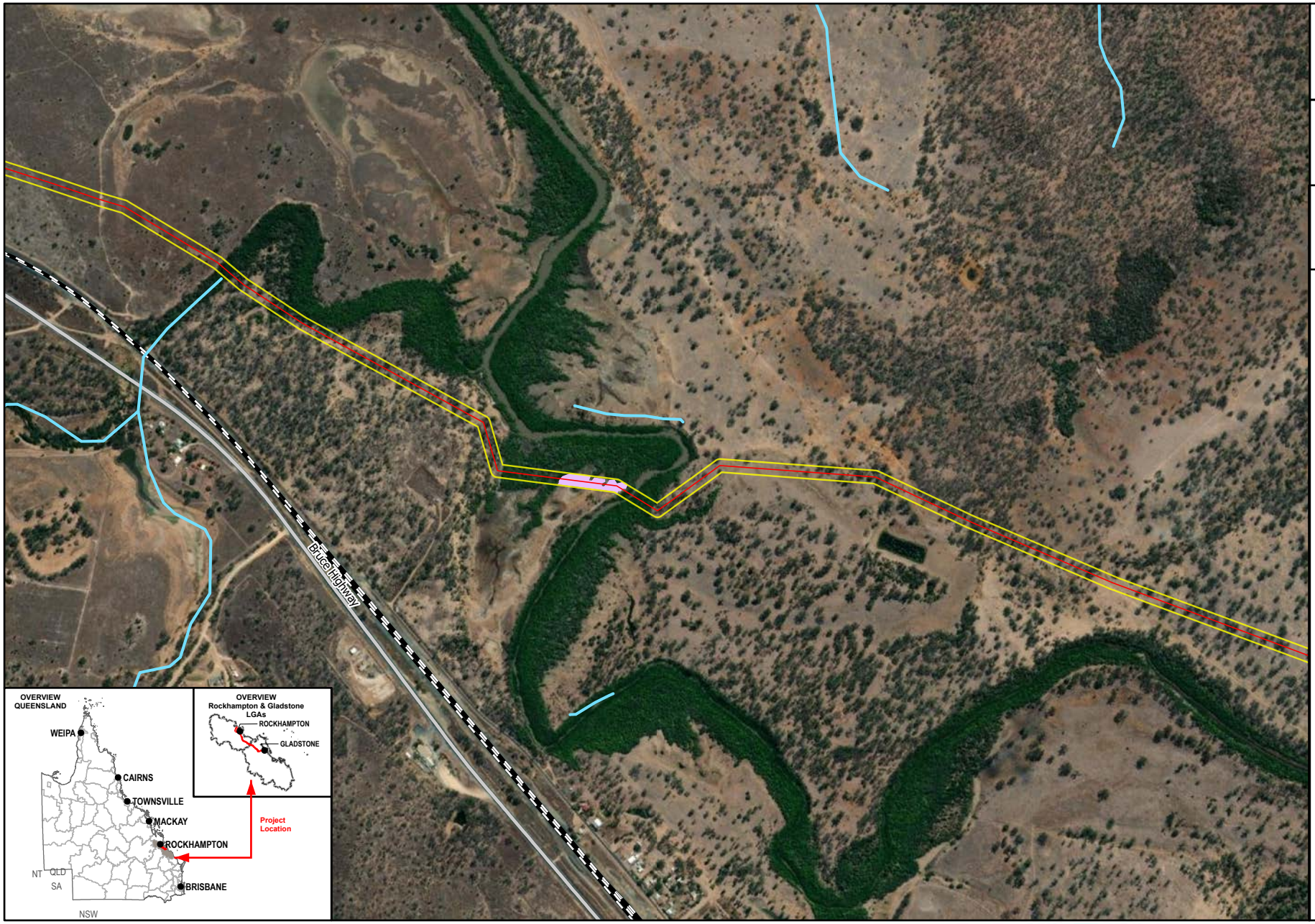
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-10g
Distribution of Yellow Chat (Dawson) Habitat Within the SGIC SDA Study Area
000-G-MAP-2432 Version:3 Date:19/09/2022



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Legend

- SGIC SDA Pipeline Alignment
- Study Area
- Predicted Yellow Chat (Dawson) Habitat
- Waterways
- Main Roads
- Railways

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

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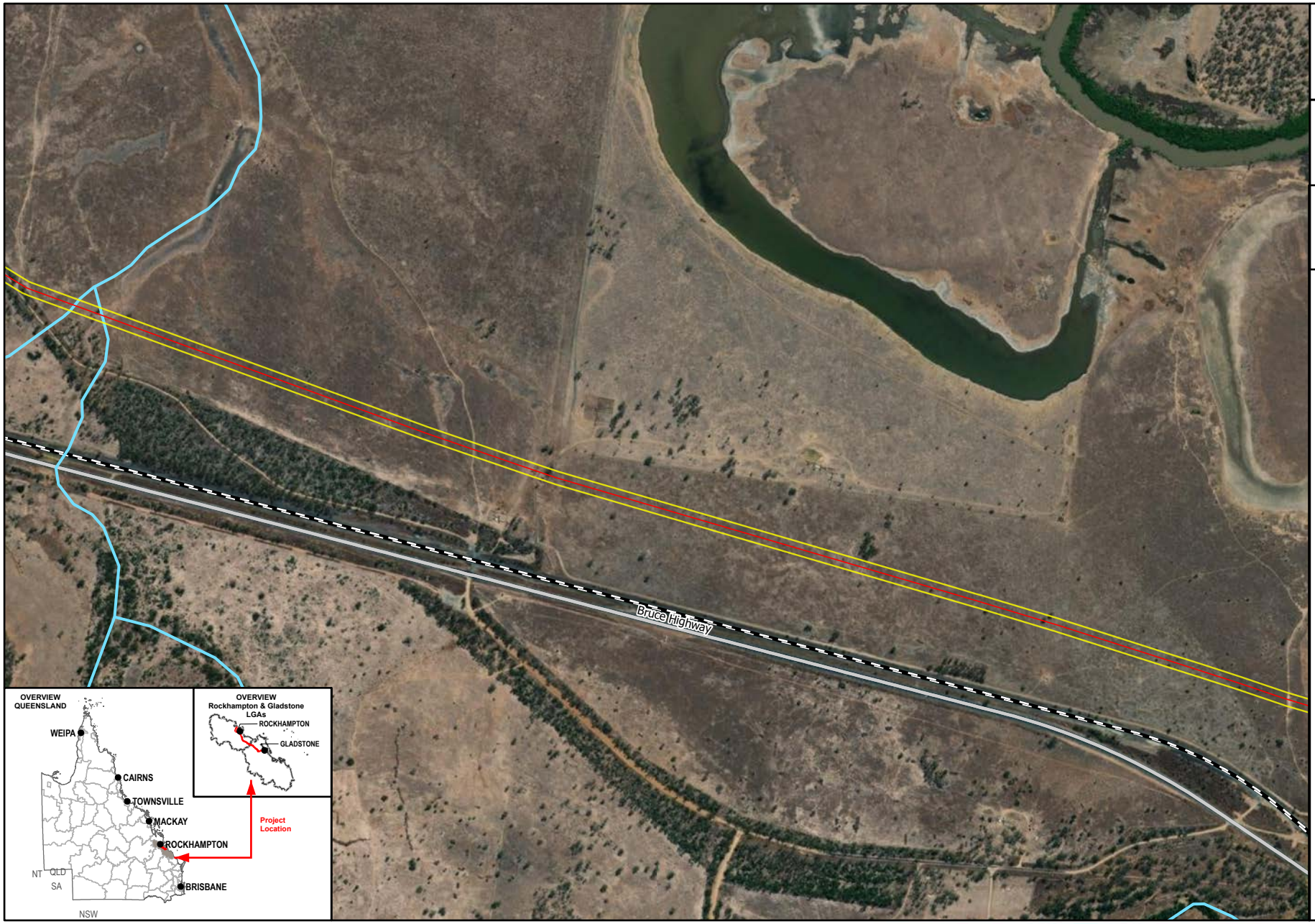
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-10h
Distribution of Yellow Chat (Dawson) Habitat Within the SGIC SDA Study Area
000-G-MAP-2432 Version:3 Date:19/09/2022



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

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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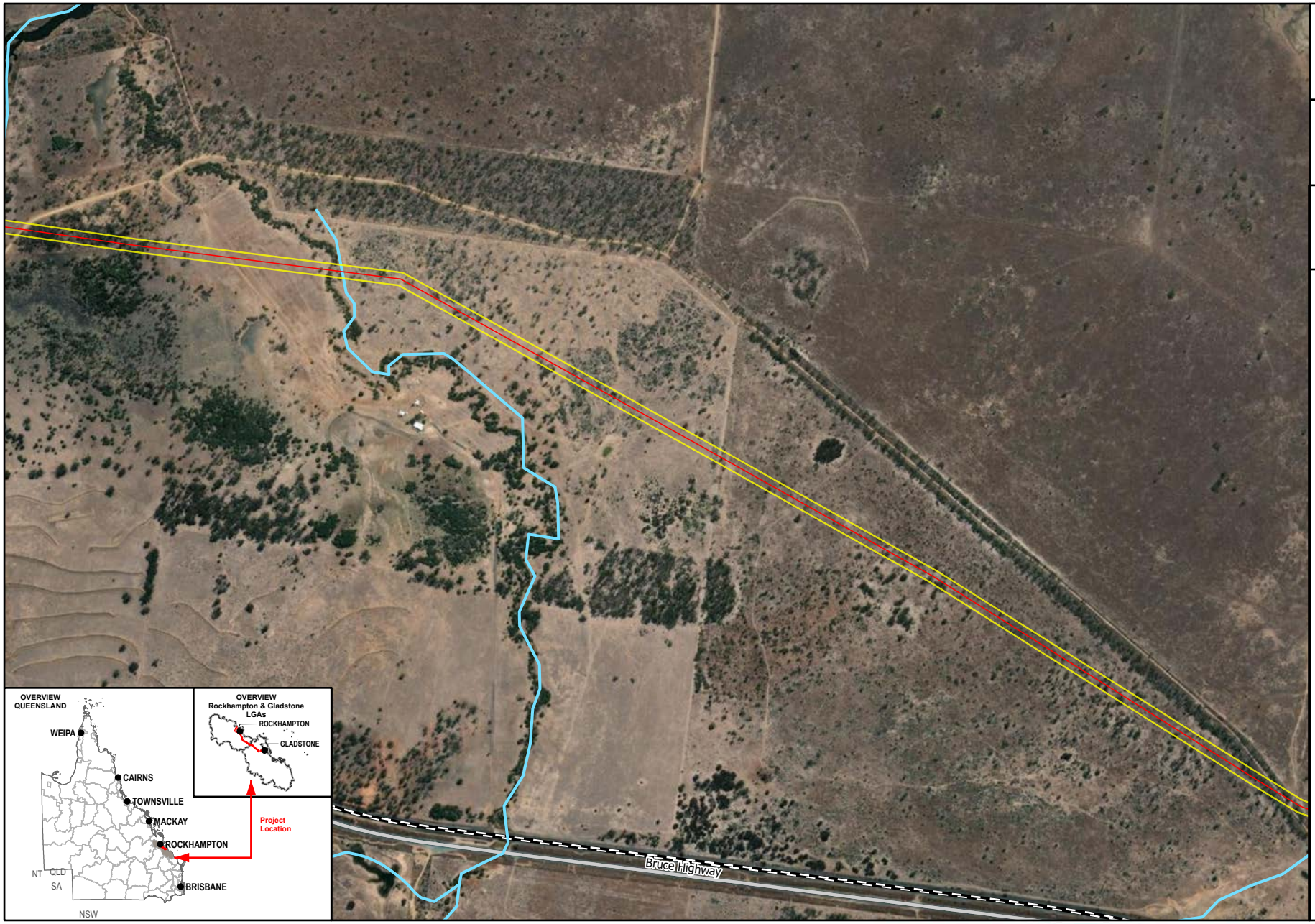
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-10i
Distribution of Yellow Chat (Dawson) Habitat Within the SGIC SDA Study Area
000-G-MAP-2432 Version:3 Date:19/09/2022



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

Data Sources:
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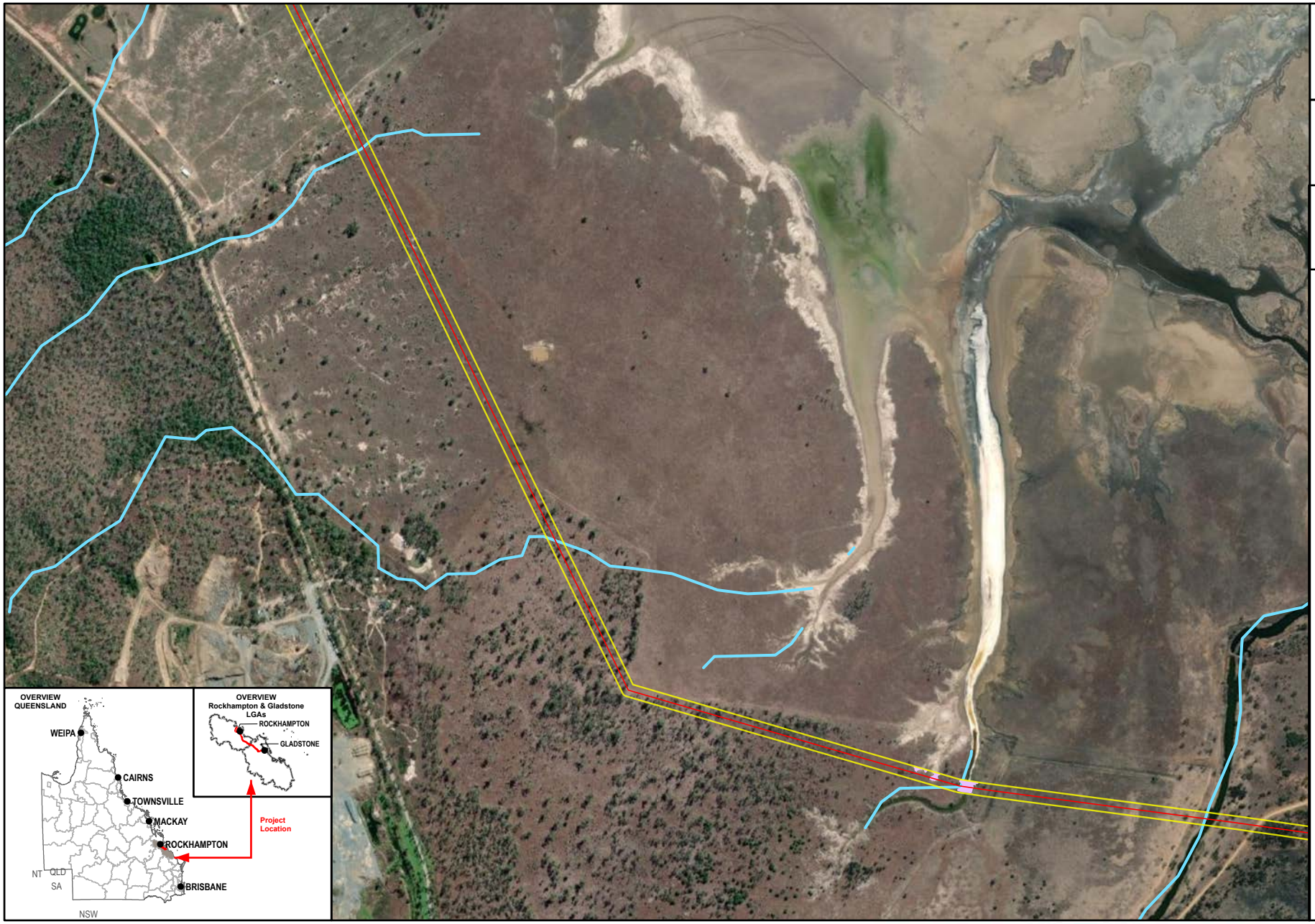
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-10j
Distribution of Yellow Chat (Dawson) Habitat Within the SGIC SDA Study Area
000-G-MAP-2432 Version:3 Date:19/09/2022



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- SGIC SDA Pipeline Alignment
- Study Area
- Predicted Yellow Chat (Dawson) Habitat
- Waterways

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

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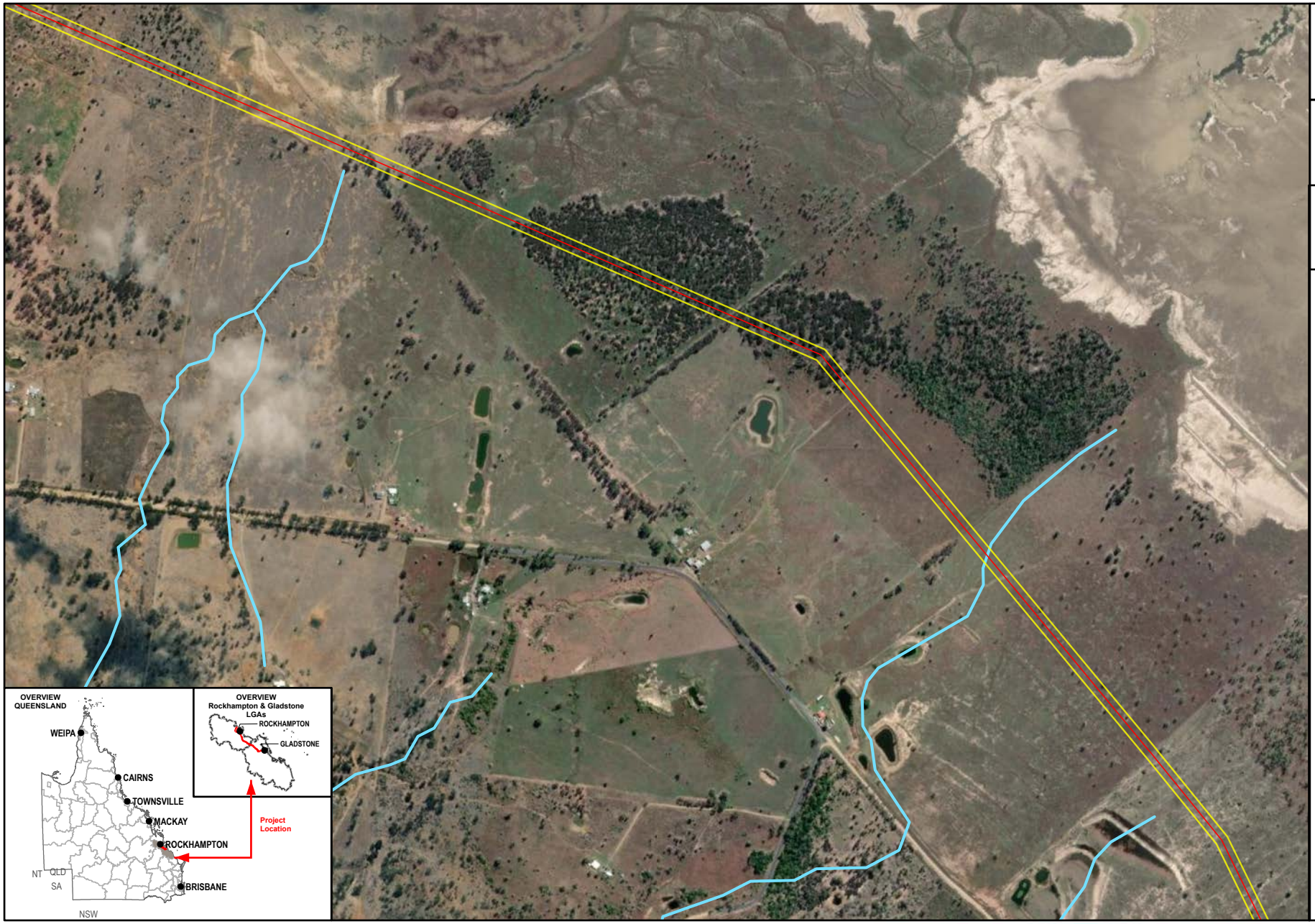
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-10k
Distribution of Yellow Chat (Dawson) Habitat Within the SGIC SDA Study Area
000-G-MAP-2432 Version:3 Date:19/09/2022



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- SGIC SDA Pipeline Alignment
- Study Area
- Waterways

Data Sources:
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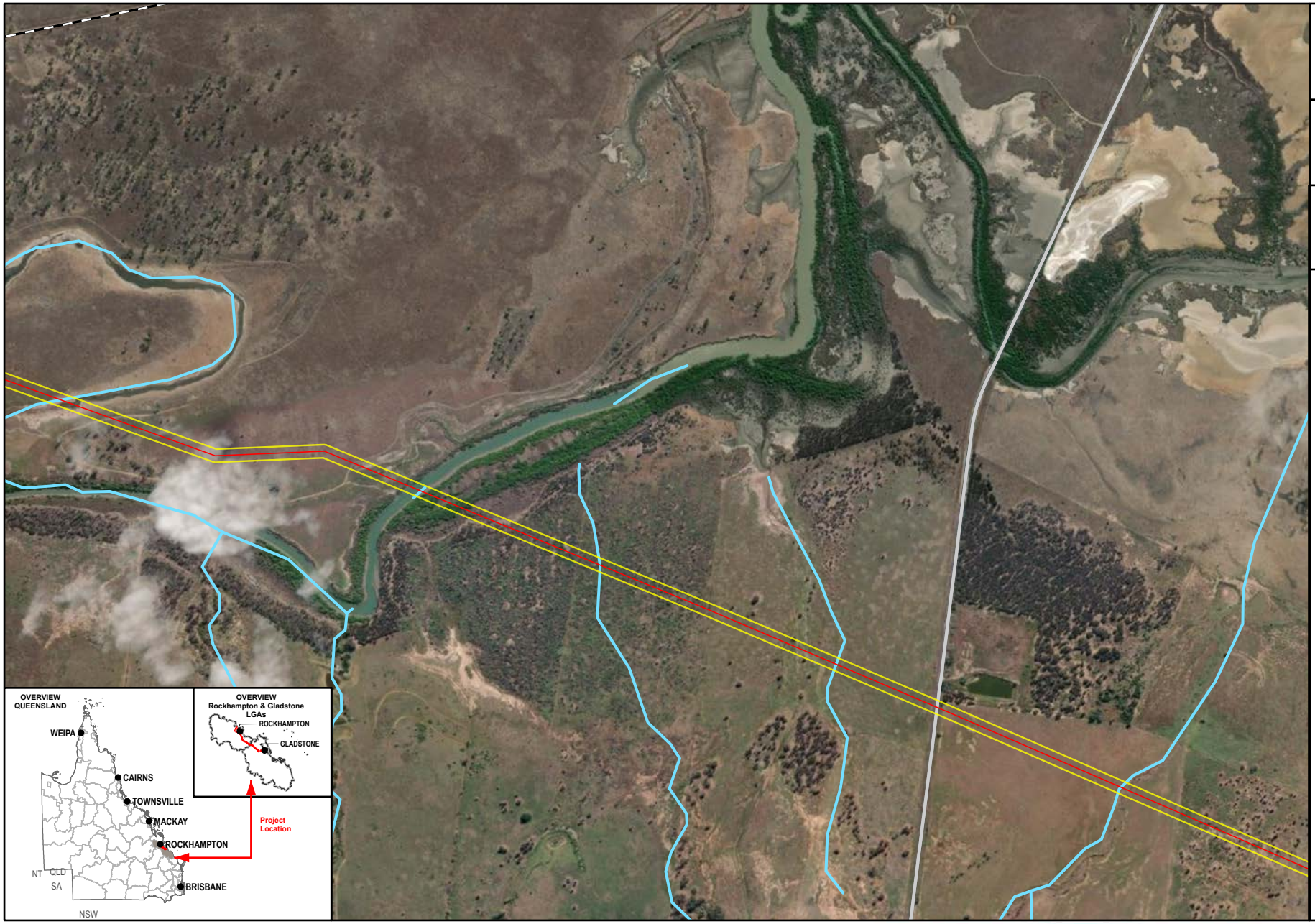
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-10l
Distribution of Yellow Chat (Dawson) Habitat Within the SGIC SDA Study Area
000-G-MAP-2432 Version:3 Date:19/09/2022



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

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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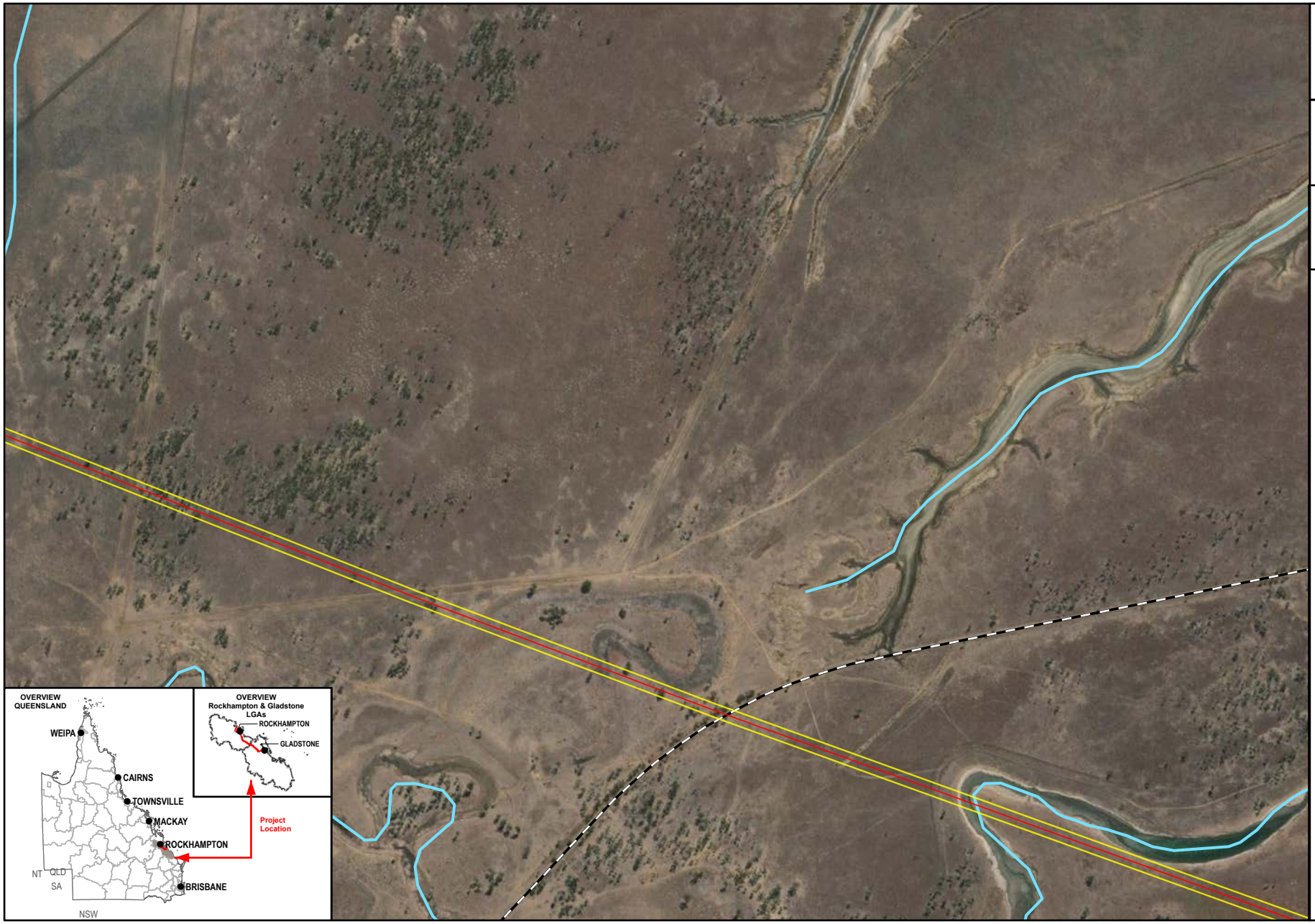
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-10m
Distribution of Yellow Chat (Dawson) Habitat Within the SGIC SDA Study Area
000-G-MAP-2432 Version:3 Date:19/09/2022



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

Data Sources:
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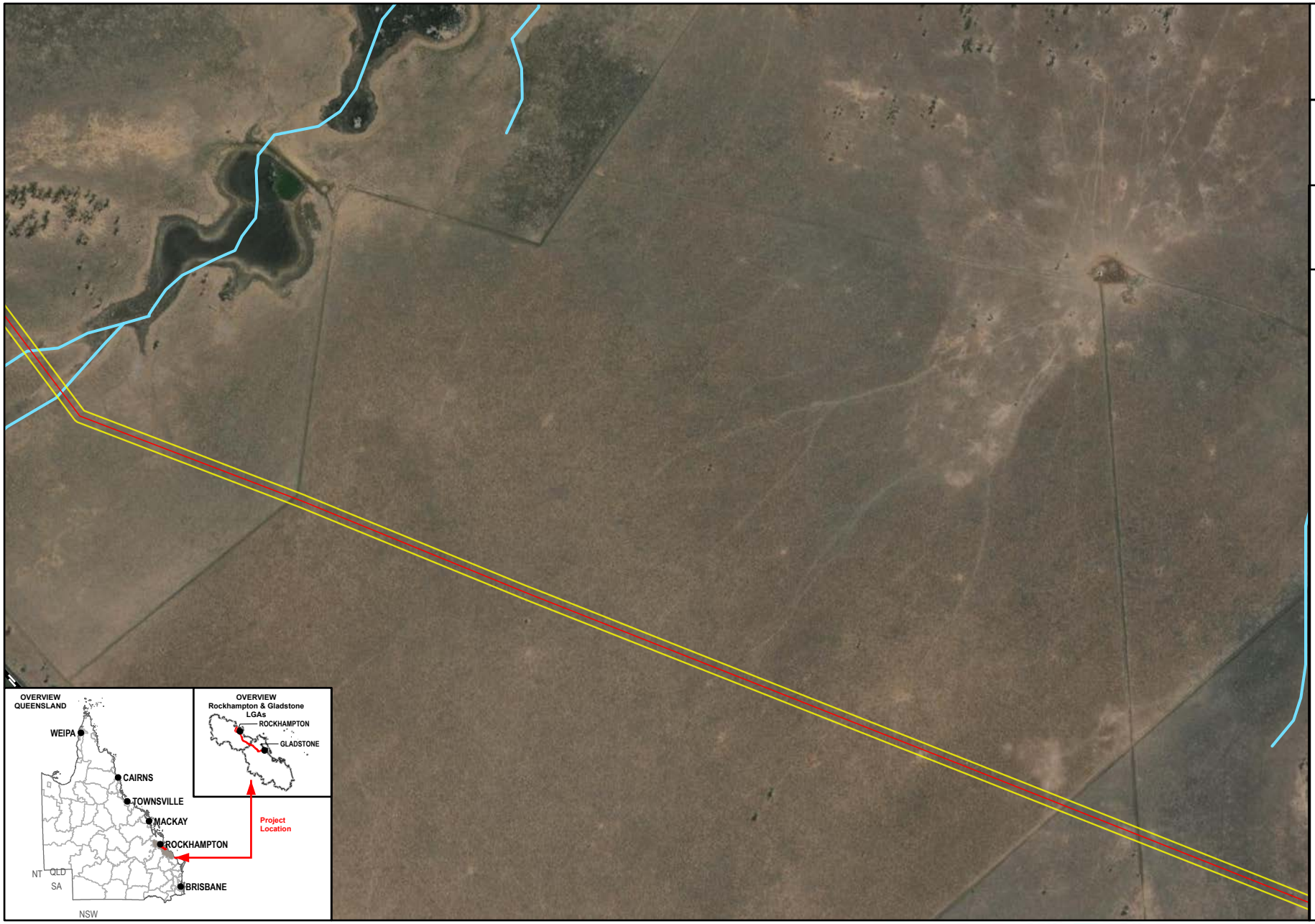
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-10n
Distribution of Yellow Chat (Dawson) Habitat Within the SGIC SDA Study Area
000-G-MAP-2432 Version:3 Date:19/09/2022



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

Data Sources:
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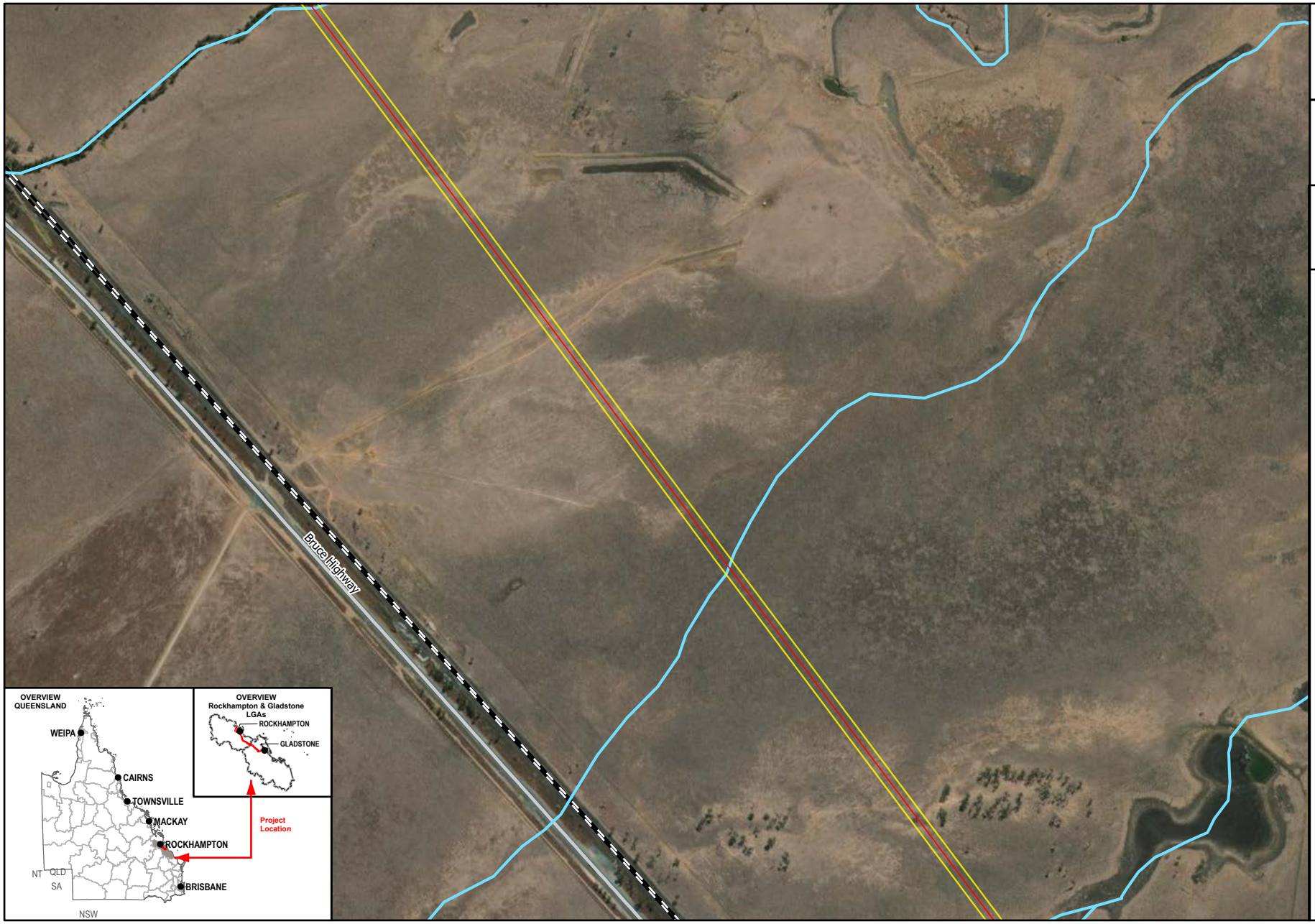
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-10o
Distribution of Yellow Chat (Dawson) Habitat Within the SGIC SDA Study Area
000-G-MAP-2432 Version:3 Date:19/09/2022



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

Data Sources:
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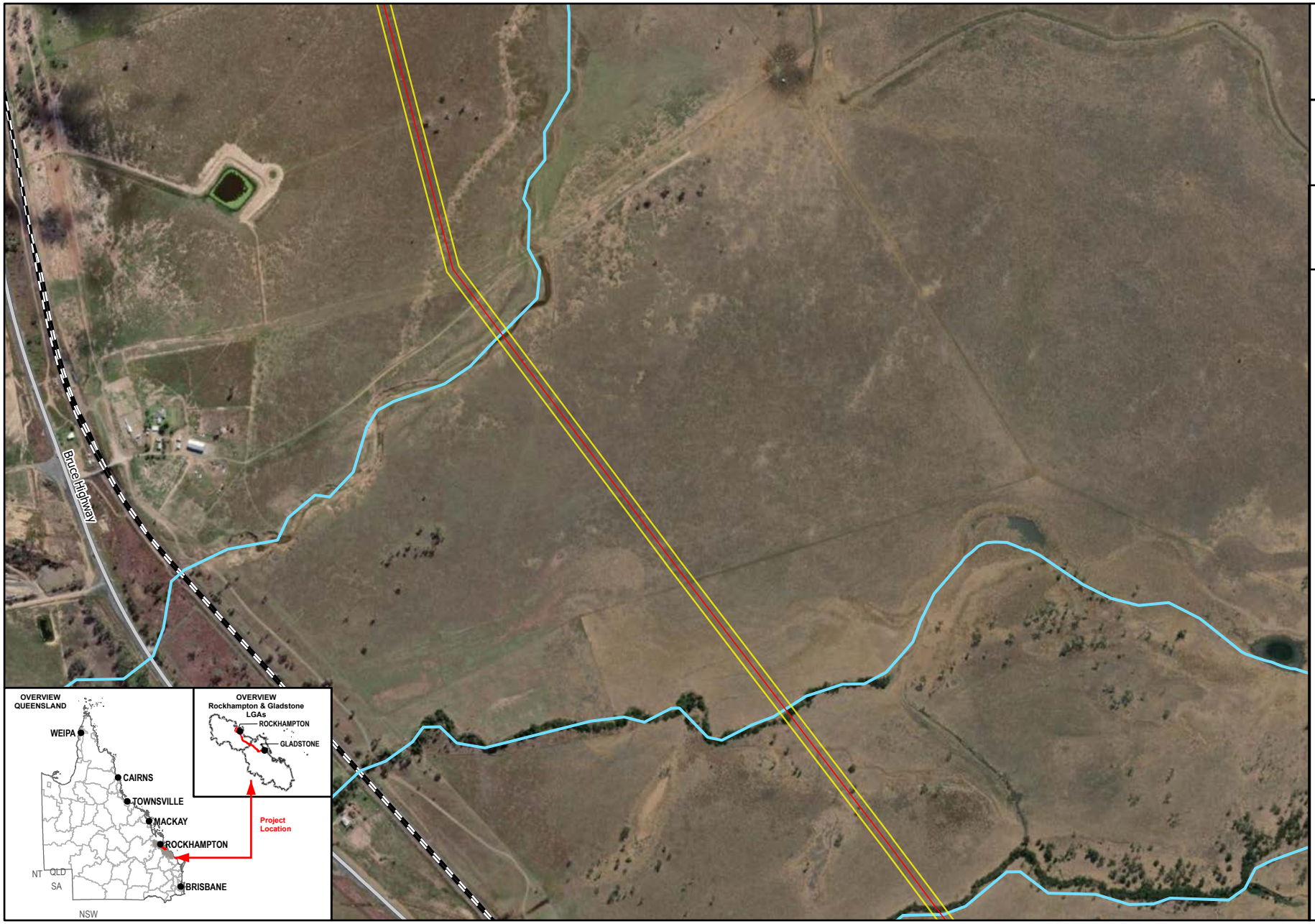
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-10p
Distribution of Yellow Chat (Dawson) Habitat Within the SGIC SDA Study Area
000-G-MAP-2432 Version:3 Date:19/09/2022



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- Main Roads
- Railways

Data Sources:
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Figure 7-10q
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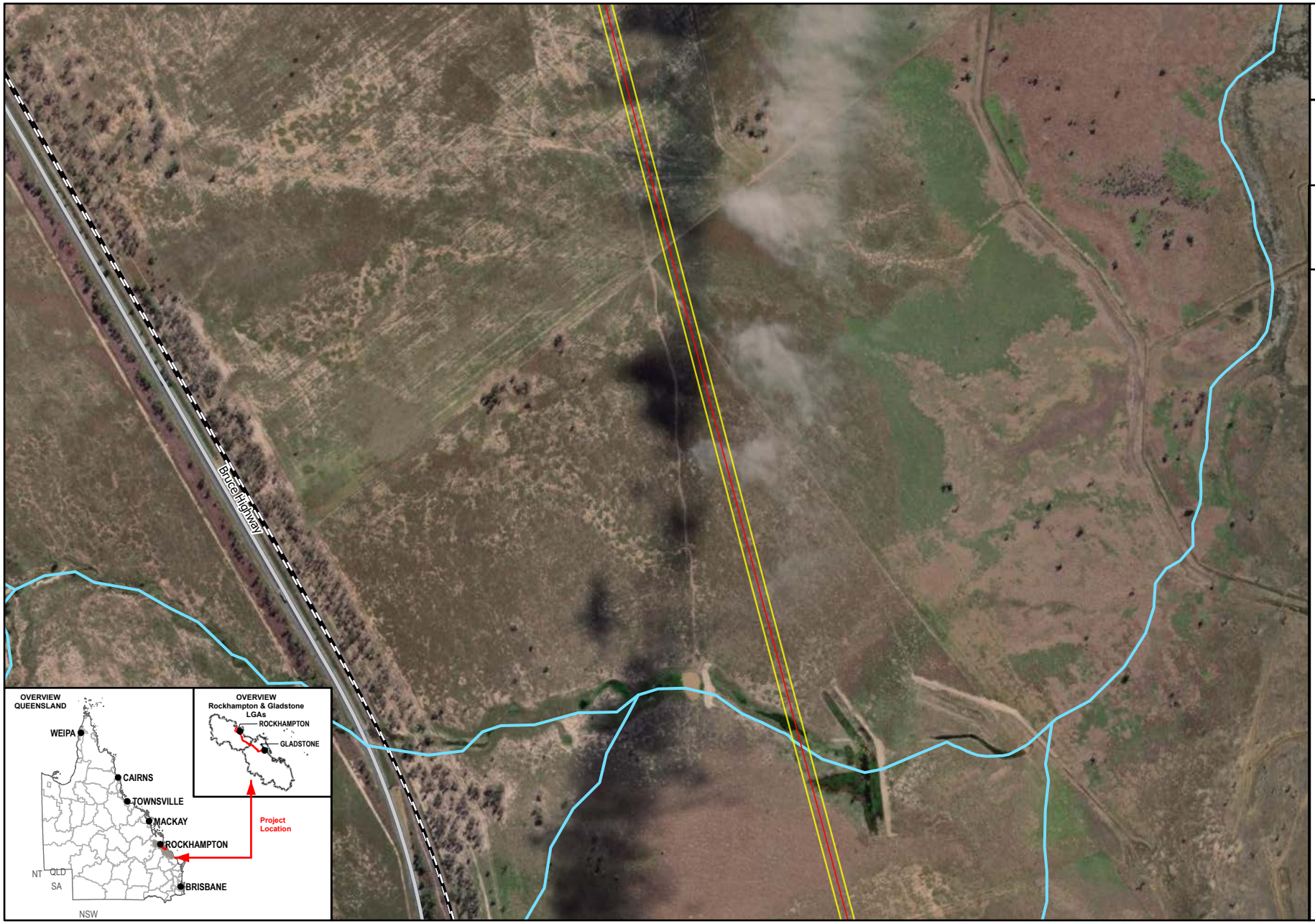

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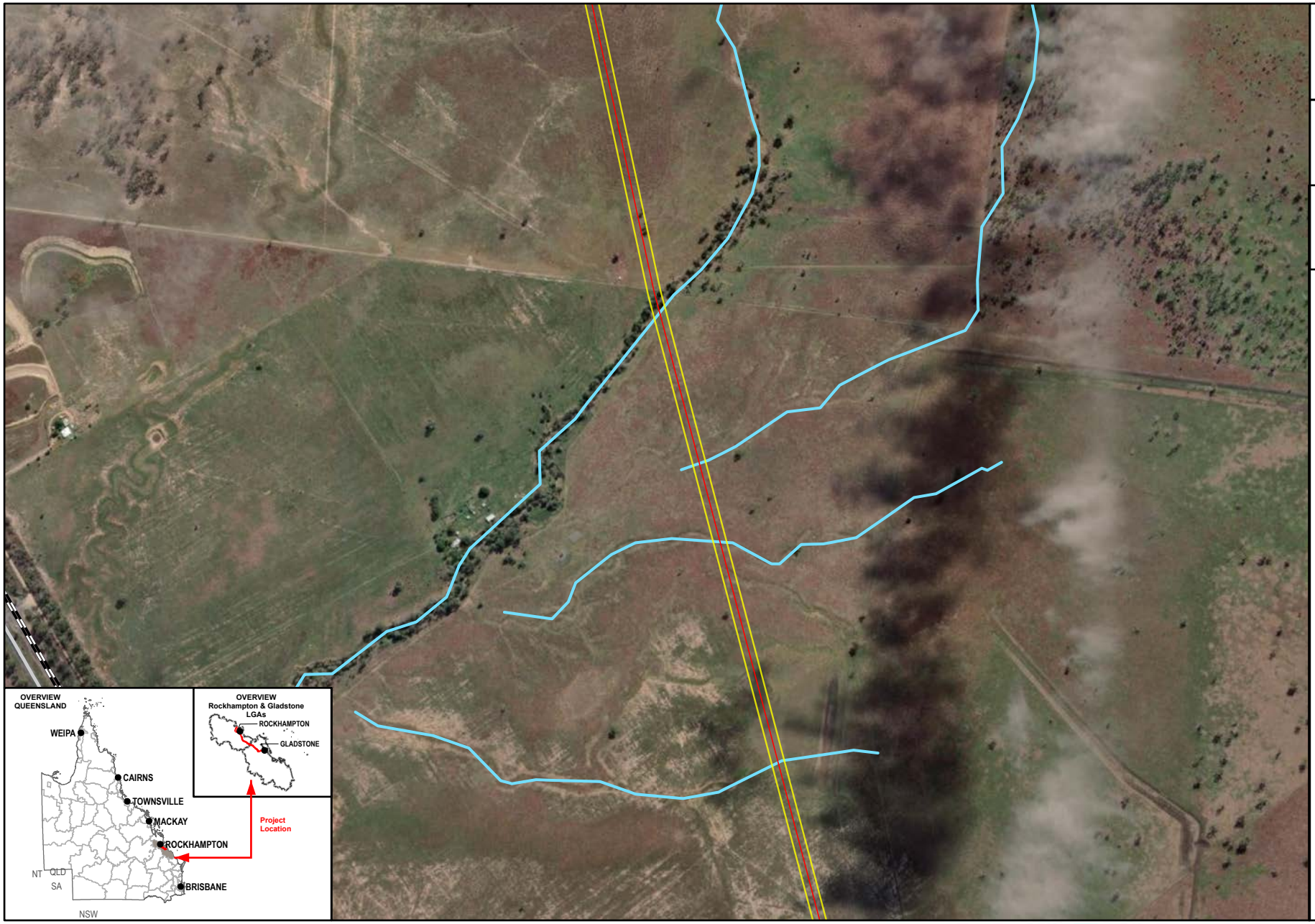

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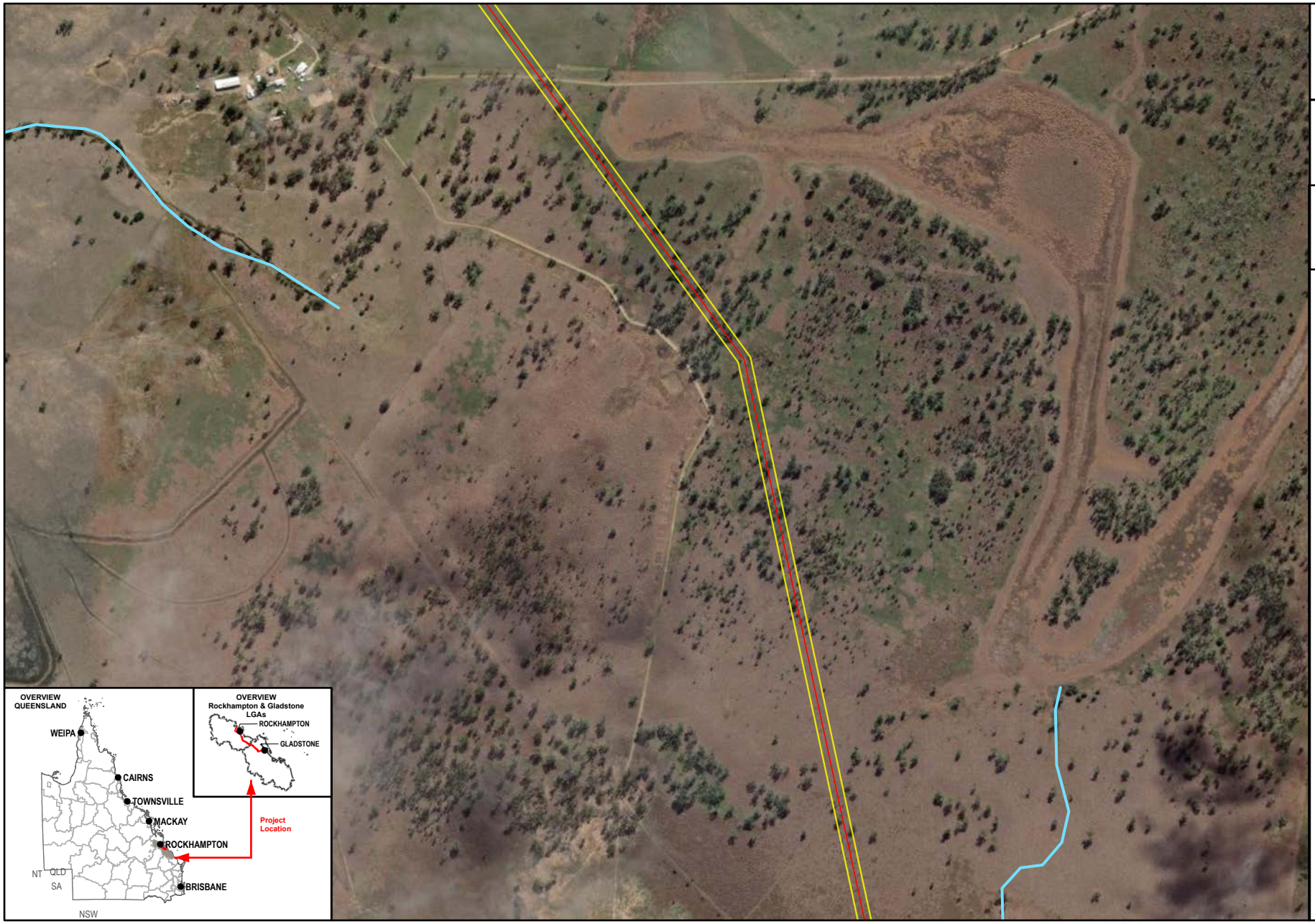

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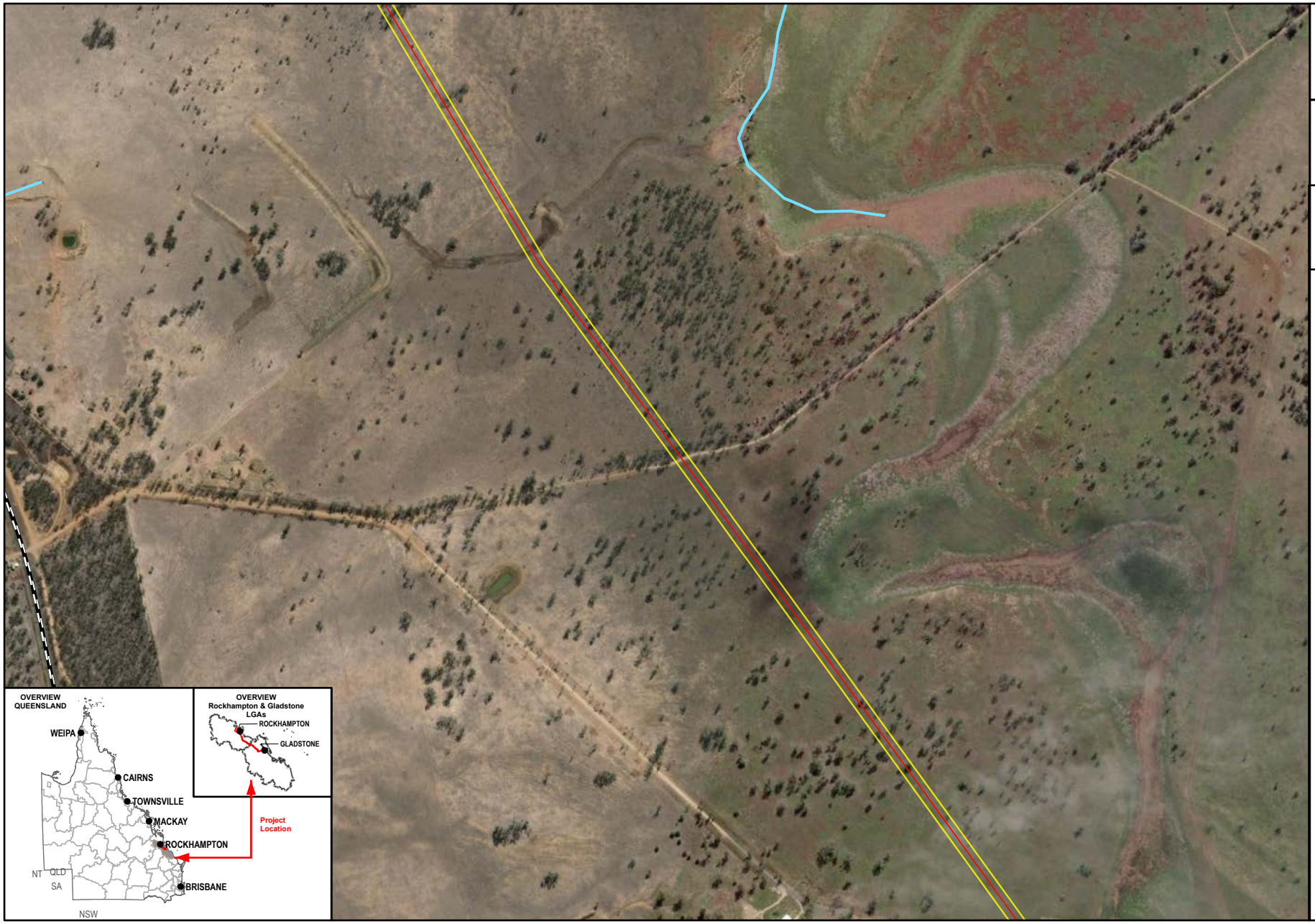

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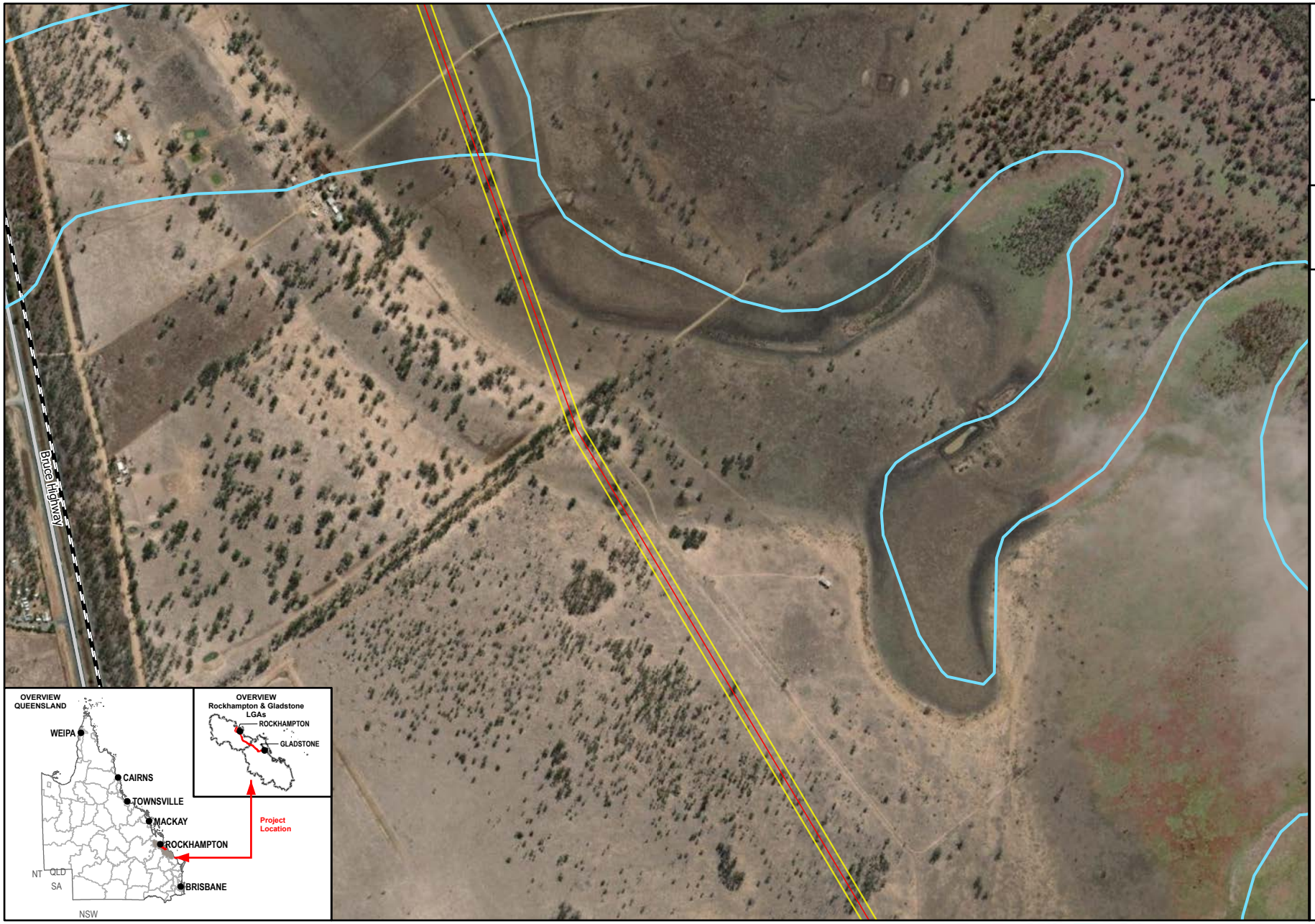

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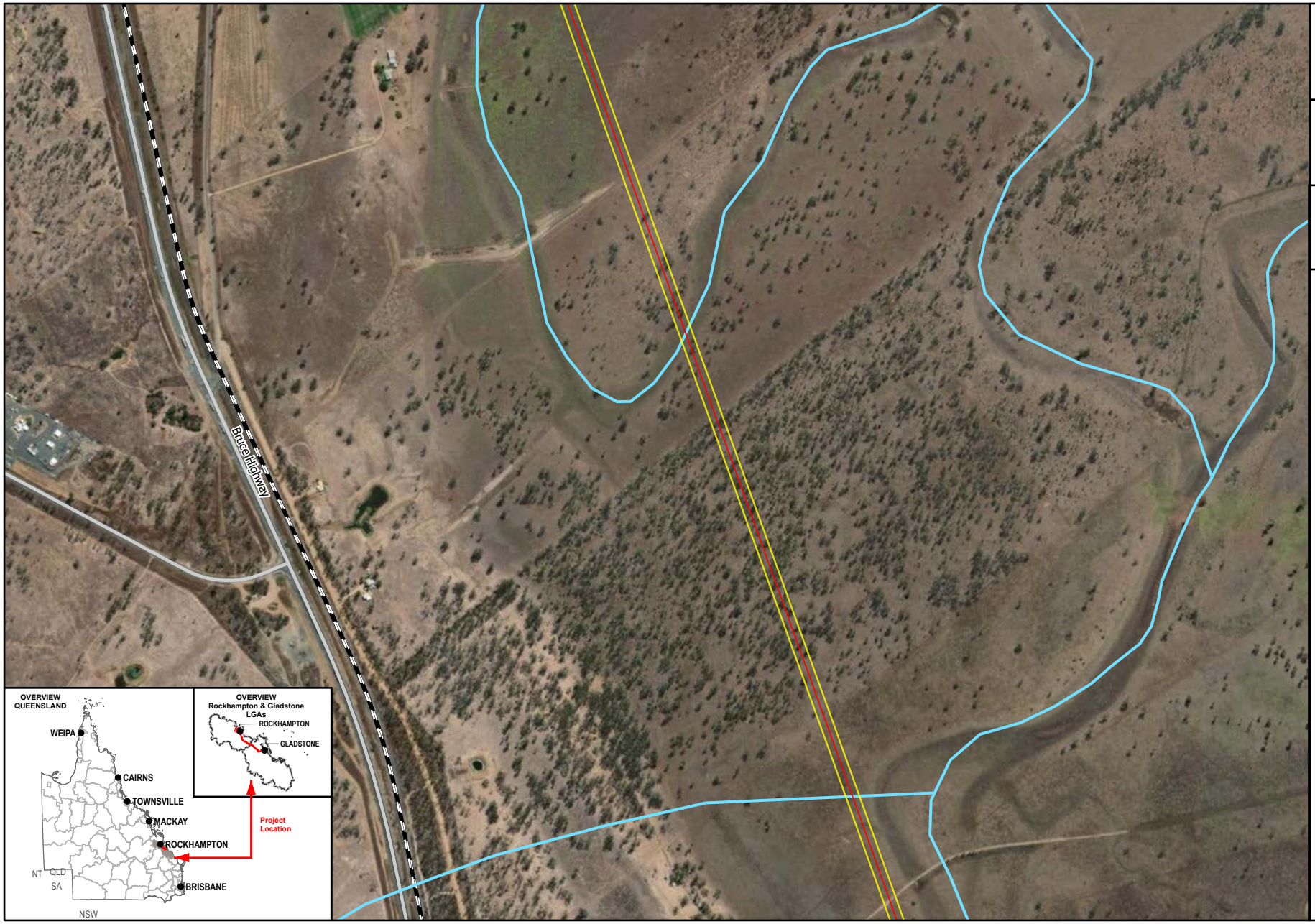

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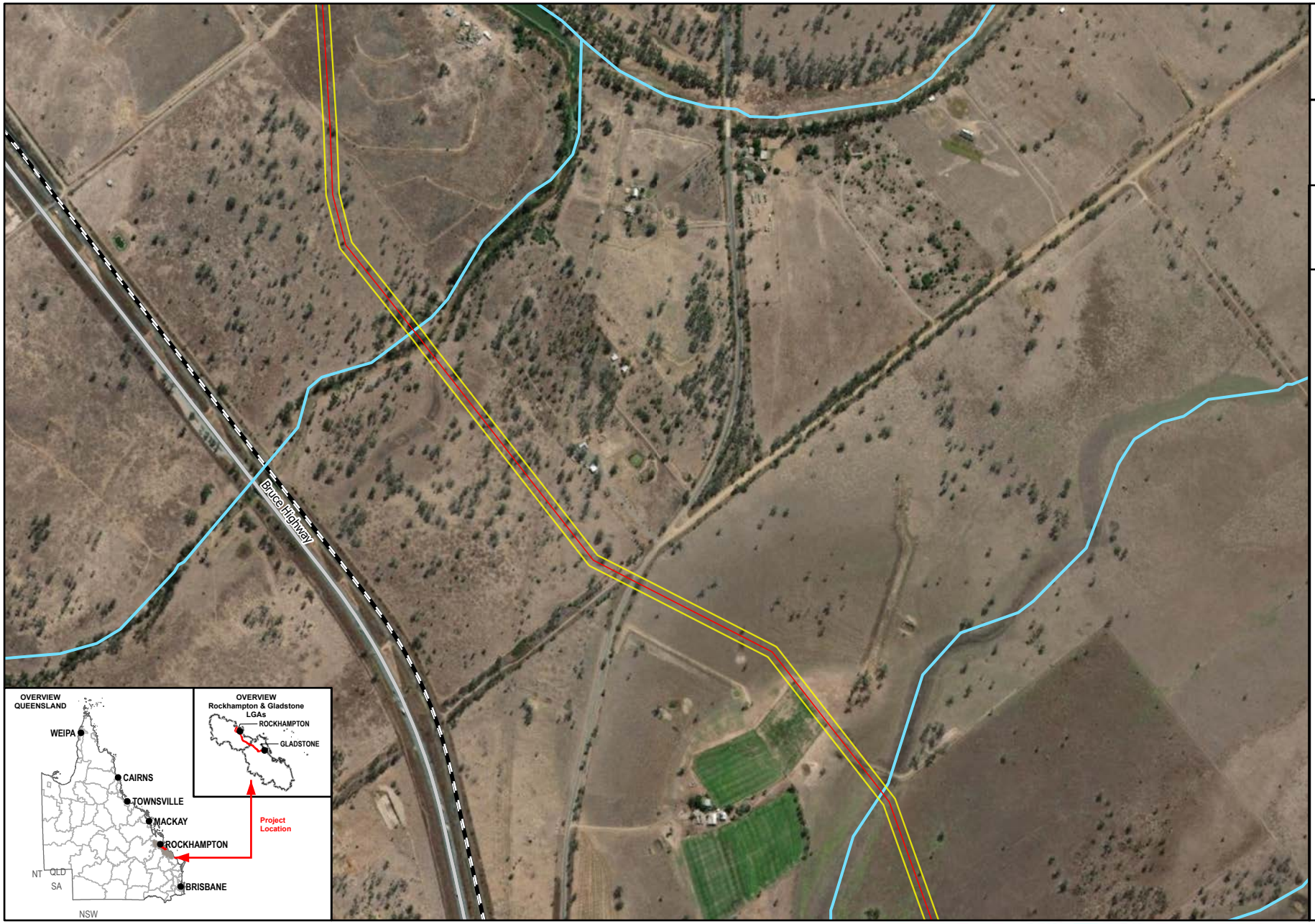

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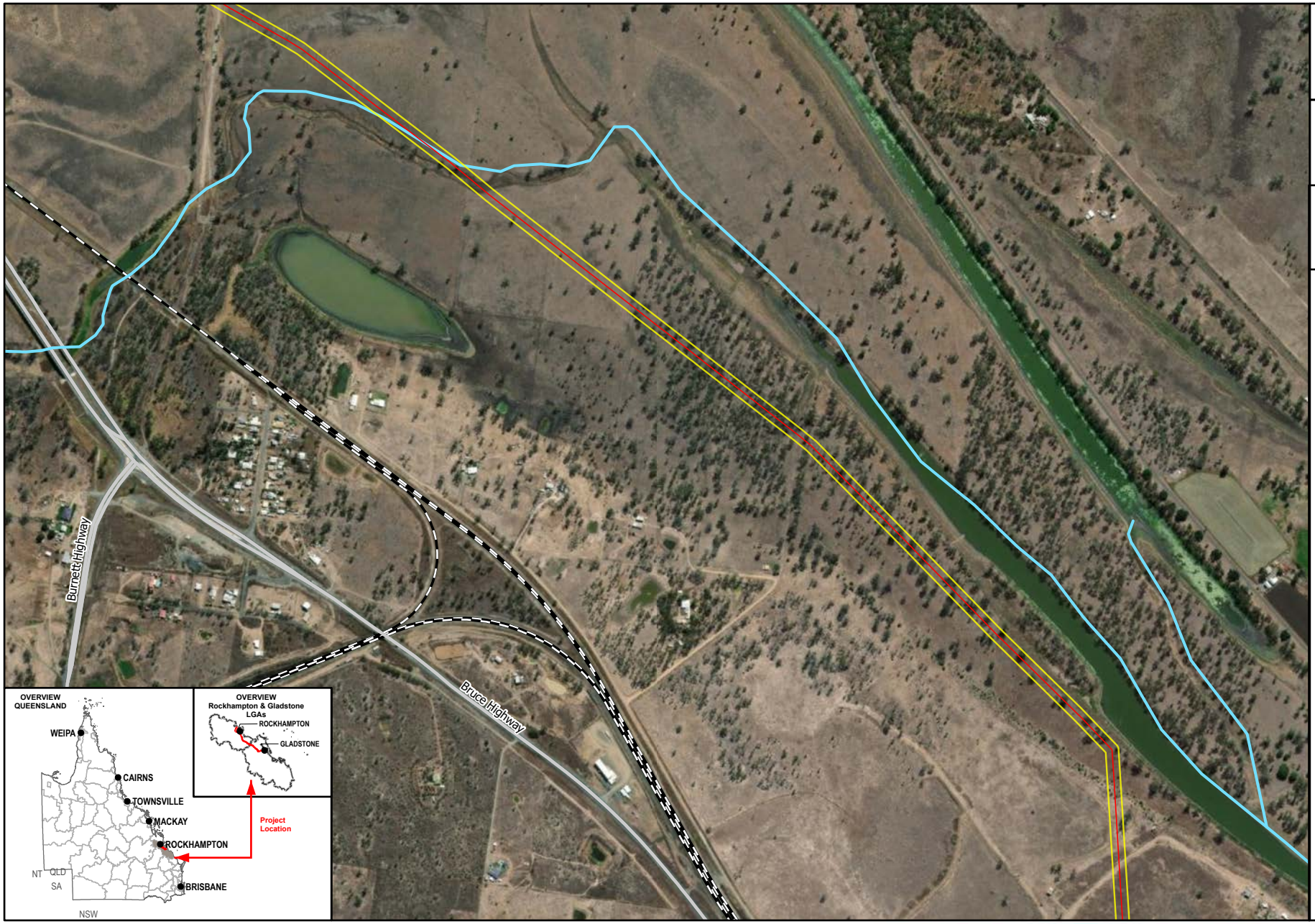

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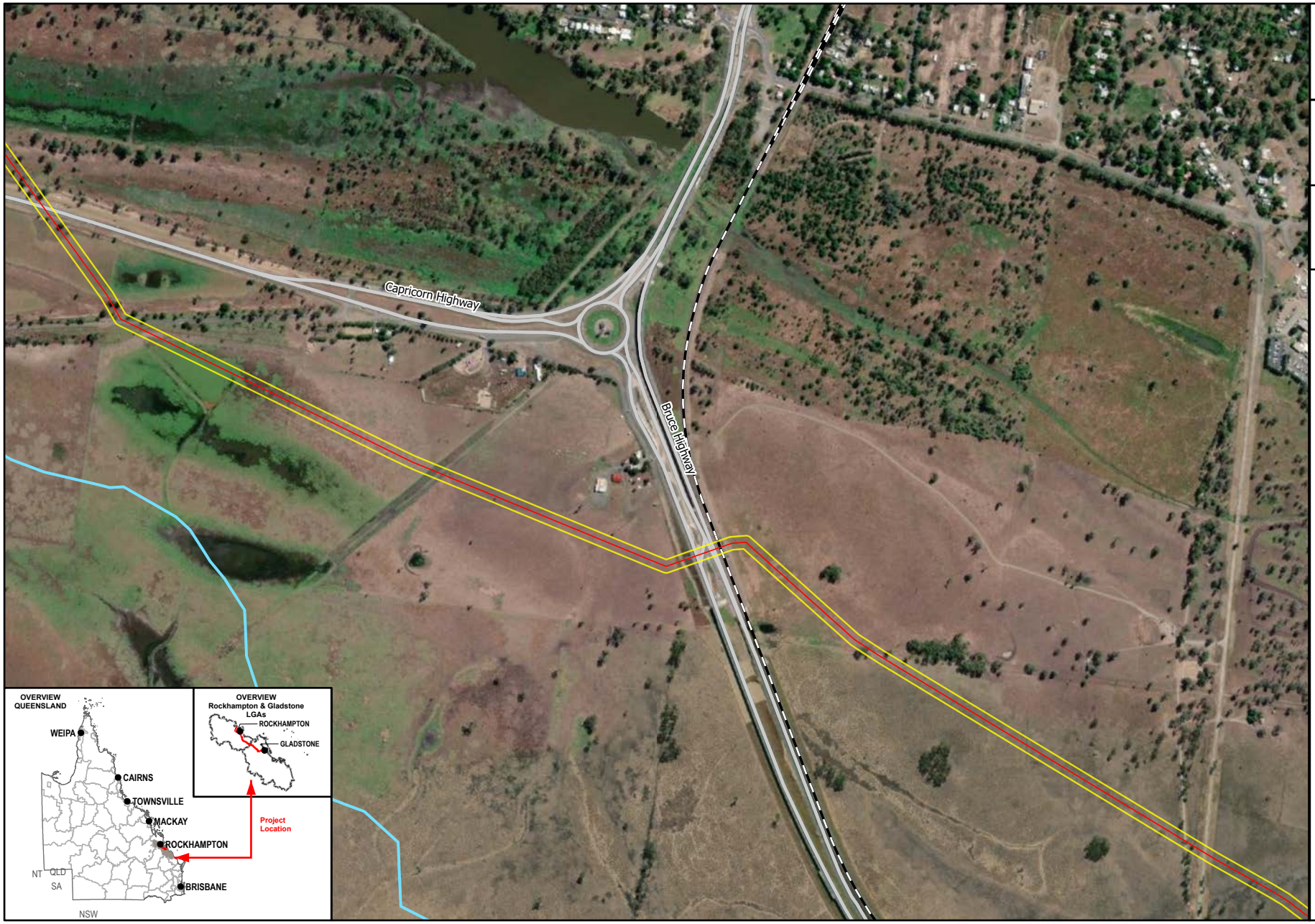

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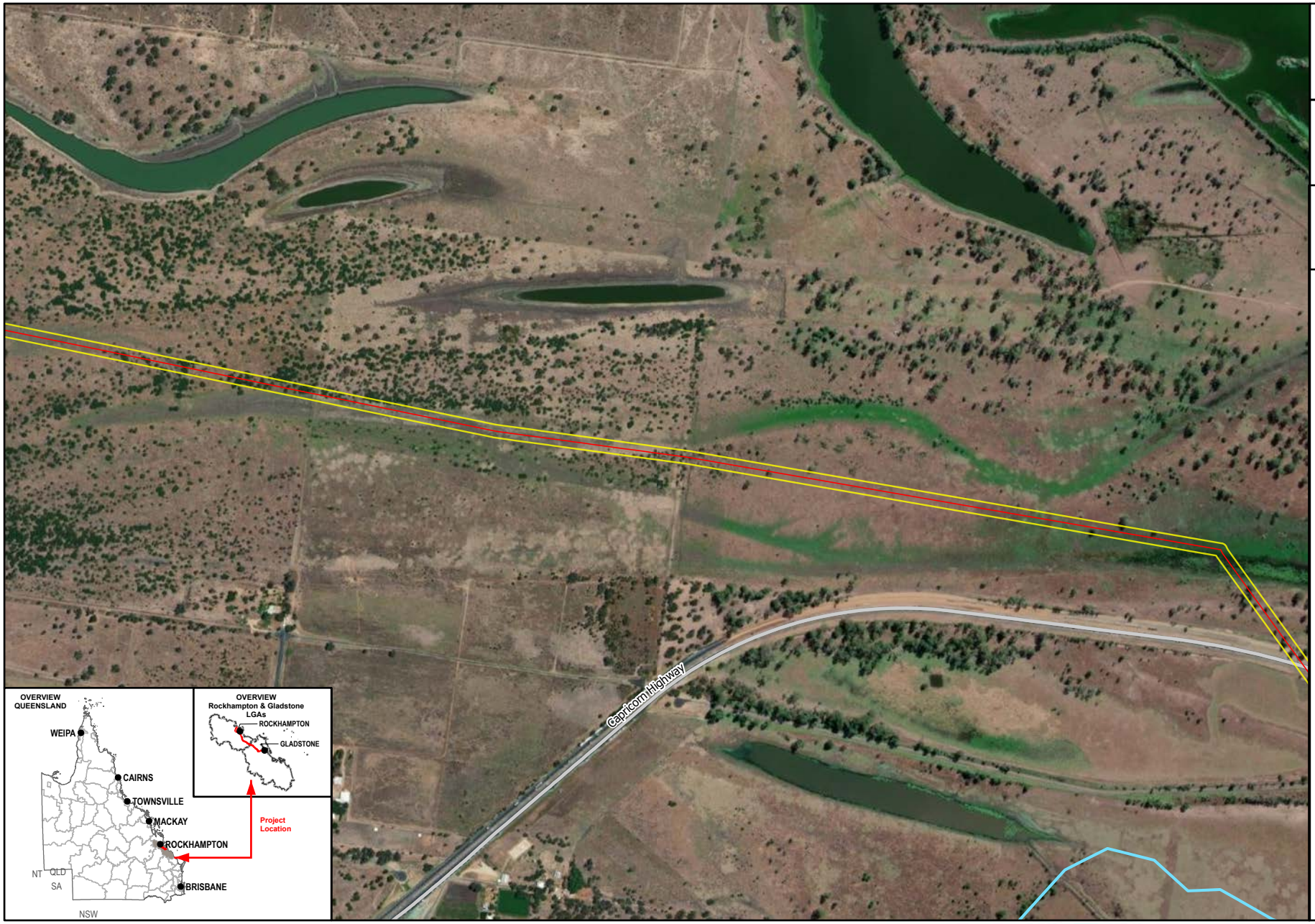

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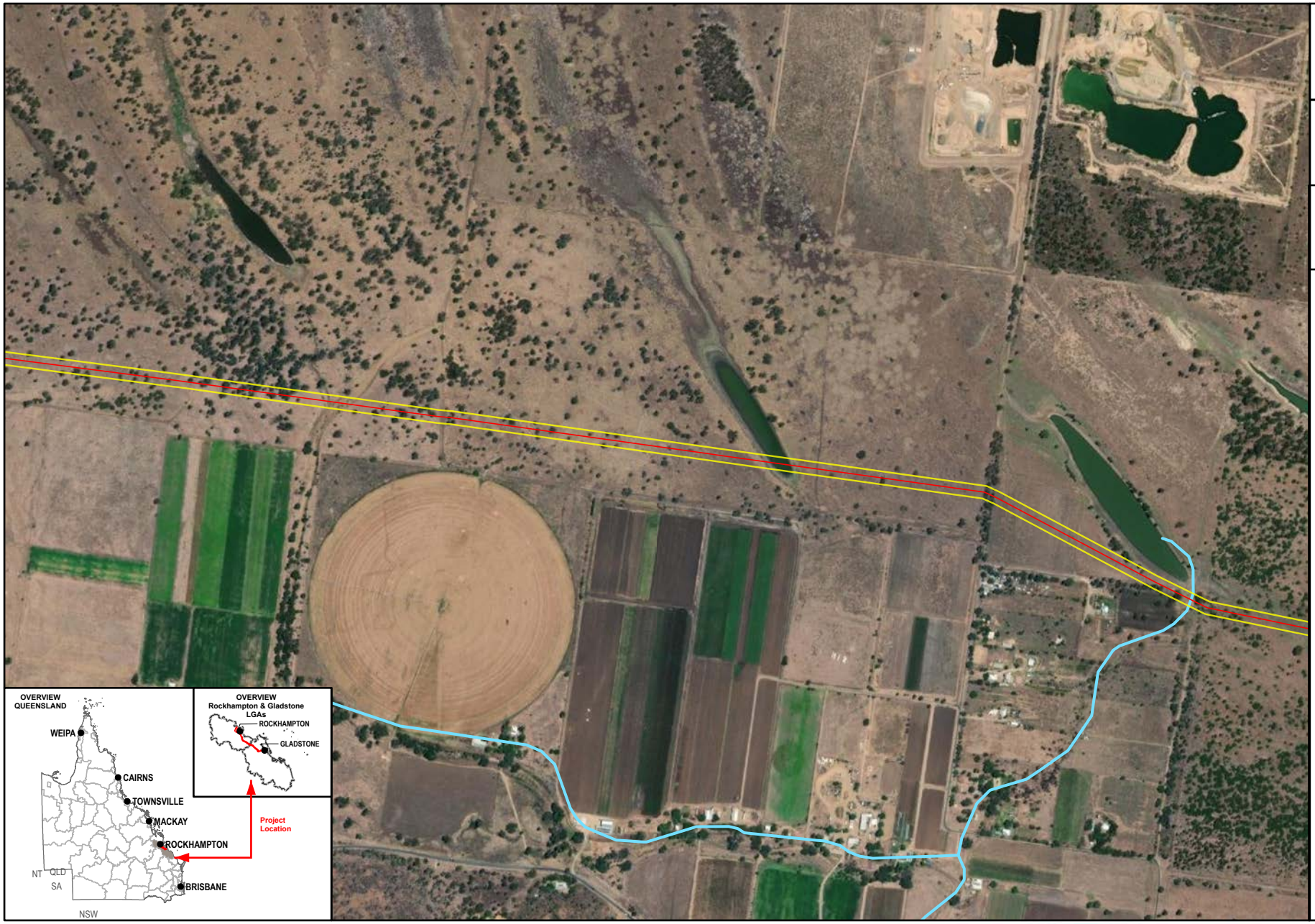

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7.2.2.5 Squatter pigeon (southern)

Conservation status and species ecology

The squatter pigeon (southern) is listed as vulnerable under the EPBC Act and NC Act and was listed as an MNES at the time of the approval. Its current distribution extends from central Queensland, west to Longreach and Charleville, and south to New South Wales (DCCEEW 2022h). The species occurs in remnant and regrowth open forest and woodland dominated by *Eucalyptus*, *Corymbia*, *Acacia* and *Callitris* species with tussock grassy understorey with 3 km of water sources (DCCEEW 2022h). Soils are generally a good predictor of their foraging and breeding habitat, which is generally restricted to well-draining, gravelly, sandy or loamy soils. These typically have a patchy ground layer composed of native perennial tussock grasses or a mix of native perennial tussock grasses and low shrubs or forbs (Squatter Pigeon Workshop 2011). Breeding habitats are typically on stony rises within 1 km of permanent water (Squatter Pigeon Workshop 2011). The subspecies is unlikely to move far from woodland trees which provide protection from predatory birds (Squatter Pigeon Workshop 2011). Where scattered trees still occur, and the distance of cleared land between remnant trees or patches of habitat does not exceed 100 m, individuals may be found foraging in, or moving across modified or degraded environments (Squatter Pigeon Workshop 2011).

Field survey results and distribution of suitable habitat

The squatter pigeon (southern) was confirmed present during the 2022 field surveys. Ten individuals were recorded along a waterway (Larcom Gully) within the southern extent of the SGIC SDA study area, near Raglan. An additional four individuals were recorded from two locations outside of the SGIC SDA study area, along Raglan Station Road and an access track in Raglan. The species has been historically recorded at 59 locations within the desktop search extent, the most recent record recorded in 2019. A series of low hills and rises with stony soils, woody debris and tussocky native grasses were recorded within the GSDA study area as potentially suitable breeding habitat for the subspecies. Areas of potentially suitable foraging habitat was recorded in open eucalypt woodland with grassy understorey. The distribution of predicted squatter pigeon (southern) habitat is mapped in Figure 7-11.

Significance of impact assessment

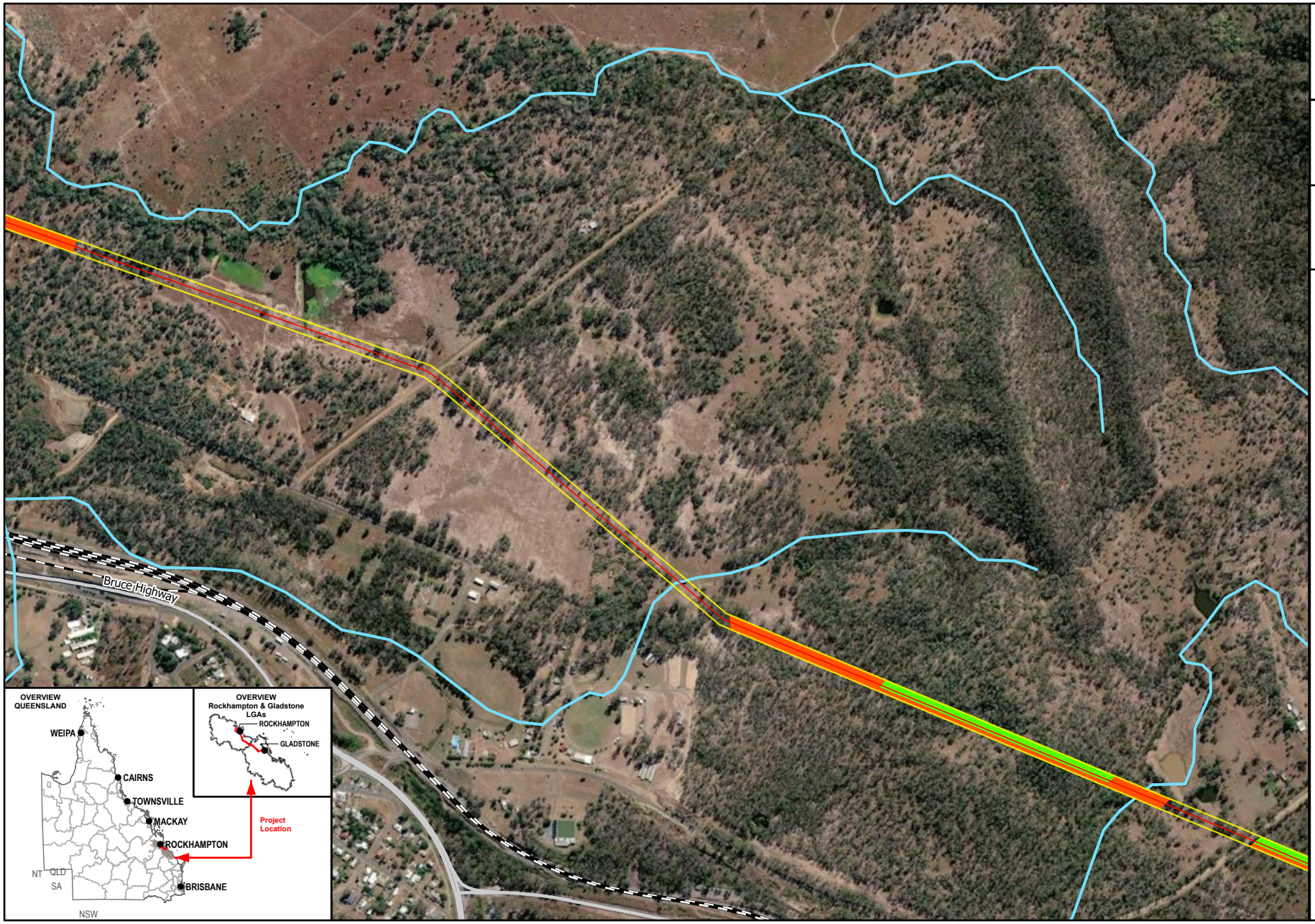
The project is likely to result in a significant residual impact on squatter pigeon (southern). A significance of impact assessment of the project on squatter pigeon (southern) (vulnerable under the EPBC Act and NC Act) is provided in Table 7-23.

Table 7-23 Significance of impact on squatter pigeon (southern)

Significant residual impact criteria	Assessment
A long-term decrease in the size of a local population	**Unlikely** The squatter pigeon (southern) is abundant within the region. The species has been historically recorded at 59 locations within the desktop search extent (10 km buffer) and was confirmed present within the SGIC SDA study area, with four individuals recorded along Raglan Station Road and an access track in Raglan. The local population is not an important population at a national level. Important populations of the squatter pigeon (southern) have been identified in the Commonwealth approved conservation advice as all of the relatively small, isolated and sparsely distributed sub-populations occurring south of the Carnarvon Ranges in Central Queensland (Squatter Pigeon Workshop 2011). Populations in the southern parts of the subspecies range have experienced dramatic declines due to land clearing and grazing by sheep, which tends to have more significant adverse impacts on the subspecies than cattle grazing (TSSC 2015). The subspecies is still locally abundant within cattle grazing areas at the northern parts of its range (TSSC 2015). The loss of 14.35 ha of potential foraging habitat and 3.88 ha of potential breeding habitat (representing 0.15 % of habitat within a 5 km buffer) is unlikely to is not expected to lead to a decline in the local squatter pigeon (southern) population and the subspecies will likely continue to persist in large numbers within the local area and surrounding region. Due to their localised and relatively temporary nature, construction and operation impacts associated with the SGIC SDA pipeline alignment are unlikely to have any permanent impacts on the persistence of local and regional squatter pigeon (southern) populations. Increased vehicular movements during construction will increase the risk of mortality and injury of squatter pigeons; however, this will be managed through implementing speed limits and signage in areas that may support the subspecies. The project is expected to be relatively benign in terms of operational impacts with negligible noise, vibration, land

Significant residual impact criteria	Assessment
	disturbance and vehicular movements. Permanent speed limits and signage on internal roads and education of staff during inductions will minimise the risk of direct mortality by operational vehicles. As such, the project is unlikely to lead to a long-term decrease in the size of a local population of the species.
Reduce the extent of occurrence of the species	**Unlikely** As detailed above, the squatter pigeon (southern) is abundant within the region. The maximum width of clearing required for construction of the SGIC SDA pipeline alignment is 30 m. Once the pipeline has been installed and buried, a maximum width of 10 m will be permanently cleared with the remaining 20 m to be rehabilitated. The project will result in a loss of 14.35 ha of potential foraging habitat and 3.88 ha of potential breeding habitat for the squatter pigeon (southern). This represents only a small percentage of the predicted habitat available within a 5 km buffer (0.15 %). Suitable foraging habitat and resources will persist in the area immediately adjacent to the SGIC SDA pipeline alignment, and the extent and magnitude of mortality during construction is such that the subspecies will continue to persist locally. Given the relatively benign nature of the project in its operation phase, and the continued presence of suitable habitat within the local area, the project is unlikely to result in a localised reduction in the extent of occurrence per the Queensland *Significant Residual Impact Guideline* (DEHP 2014b): *Extent of occurrence is defined as the area contained within the shortest continuous imaginary boundary which can be drawn to encompass all the known, inferred or projected sites of present occurrence of a taxon.*
Fragment an existing population	**Unlikely** Fragmentation of the existing squatter pigeon (southern) population is not expected, as the maximum width of clearing required for construction of the SGIC SDA pipeline alignment (30 m) is narrow and linear. This is unlikely to present a permanent barrier to the squatter pigeon (southern) movement. Once the pipeline has been installed and buried, a maximum width of 10 m will be permanently cleared with the remaining 20 m to be rehabilitated. Habitat connectivity will be maintained among areas of habitat within and adjacent to the SGIC SDA pipeline alignment, by maintaining ground-level substrates and vegetation, and by retaining existing unsealed tracks that provide important pathways for local squatter pigeon (southern) movement. The implementation of the Weed Management Plan is expected to maintain suitable ground-level habitat and continue to facilitate ground-level movement of the squatter pigeon (southern). Based on these considerations, the project is unlikely to fragment the existing squatter pigeon (southern) population.
Result in genetically distinct populations forming as a result of habitat isolation	**Unlikely** As detailed above, the subspecies' capacity to move locally and regionally is not considered to be limited by any localised land clearing necessary to construct the SGIC SDA pipeline alignment. As a result, the project is unlikely to is unlikely to cause any loss of gene transfer that would cause genetically distinct populations to form.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat	**Unlikely** The project footprint is currently impacted by weed and pest species that could be harmful to the squatter pigeon (southern). The presence of these invasive species is unlikely to be exacerbated by the project, and any risks of their establishment will be managed via a site specific CEMP and operational EMP.
Introduce disease that may cause the population to decline	**Unlikely** Recognised threats to the squatter pigeon (southern) do not include diseases. It is however, not expected that the project would result in the introduction of disease.
Interfere with the recovery of the species	**Unlikely** The project is unlikely to interfere substantially with the recovery of the species. The loss of habitat is unlikely to be significant, representing only 14.35 ha of potential foraging habitat and 3.88 ha of potential breeding habitat present within the SGIC SDA pipeline alignment and 0.15% within a 5 km buffer. Implementation of a CEMP for the project has the potential to increase the value of local habitats through the control of weed and pest species. Local noise disturbance and mortality threats associated with the project are also expected to be low.
Result in disruption to ecologically significant locations (breeding, feeding or nesting sites) of a species	**Likely** The project will require the clearing of 14.35 ha of potentially suitable foraging habitat and 3.88 ha of potentially suitable breeding habitat for the squatter pigeon (southern). Although the SGIC SDA pipeline alignment has largely been placed within or adjacent to areas that have been previously cleared, the project will result in a loss of suitable foraging and breeding

Significant residual impact criteria	Assessment
	habitat. While the project is not expected to cause a long-term decline in the local population, reduce its extent of occurrence, cause adverse habitat fragmentation effects nor interfere with the recovery of the species, the loss of suitable squatter pigeon (southern) habitat within the SGIC SDA pipeline alignment is likely to result in disruption to ecologically significant foraging and breeding locations.
Conclusion	A conservative assessment has identified that the project is likely to result in a significant residual impact on the squatter pigeon (southern). Although the SGIC SDA pipeline alignment has been located within areas that have been previously cleared for agricultural practices and linear infrastructure such as railways, roads, access tracks and pipelines, the project will require the clearing of 18.23 ha of suitable foraging and breeding habitat within the SGIC SDA pipeline alignment.



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Legend

- GSDA Pipeline Alignment
- Study Area

Predicted Squatter Pigeon (Southern) Habitat

Habitat Type

- Potential Breeding Habitat
- Potential Foraging Habitat
- Waterways
- Main Roads
- Railways

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

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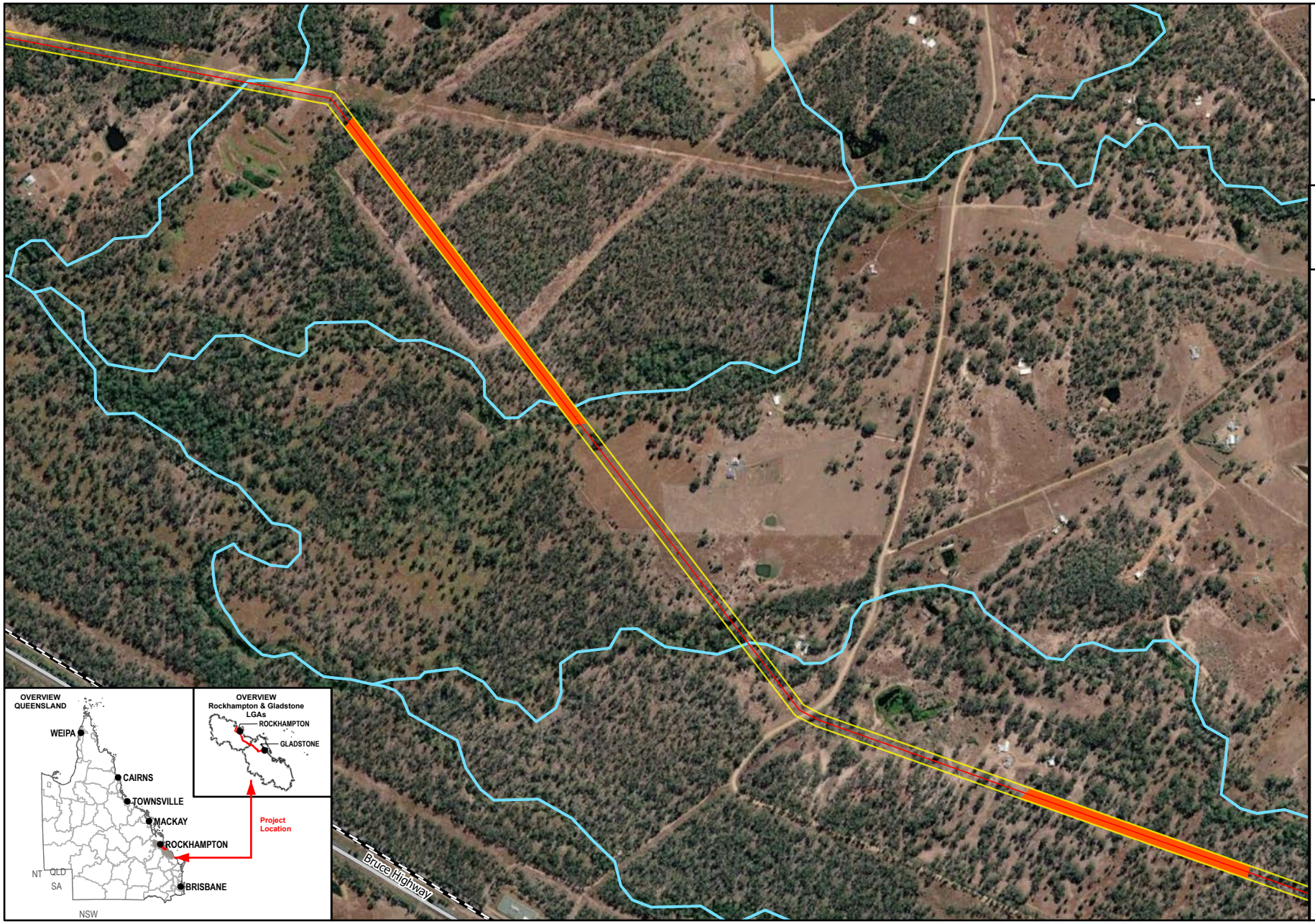
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-11a
Distribution of Squatter Pigeon (Southern) Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:4 Date:21/09/2022



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Legend

- GSDA Pipeline Alignment
- Study Area

Predicted Squatter Pigeon (Southern) Habitat

Habitat Type

- Potential Foraging Habitat
- Waterways
- Main Roads
- Railways

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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Fitzroy to Gladstone Pipeline
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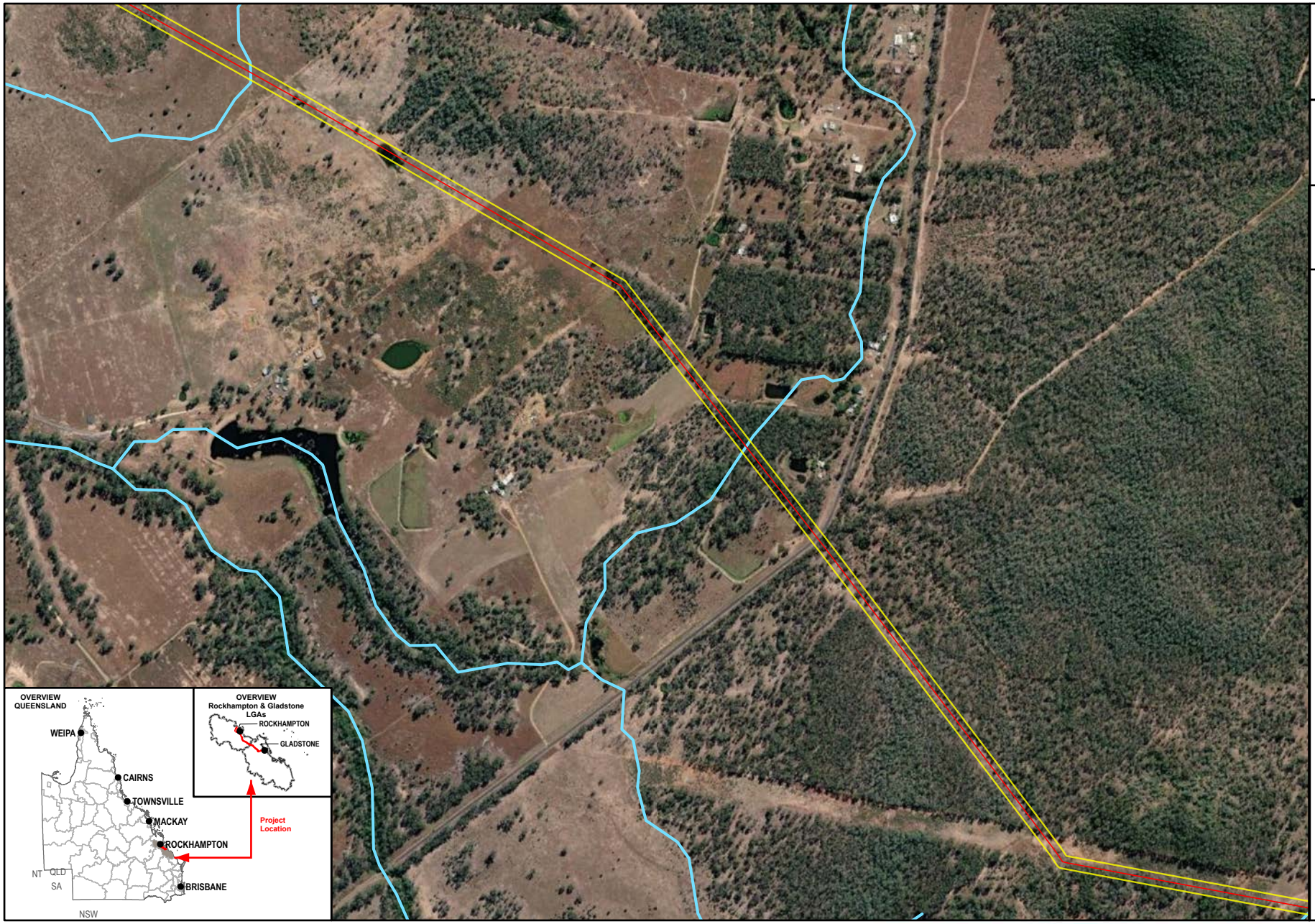
Figure 7-11b
Distribution of Squatter Pigeon (Southern) Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:4 Date:21/09/2022



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Legend

- GSDA Pipeline Alignment
- Study Area
- Waterways

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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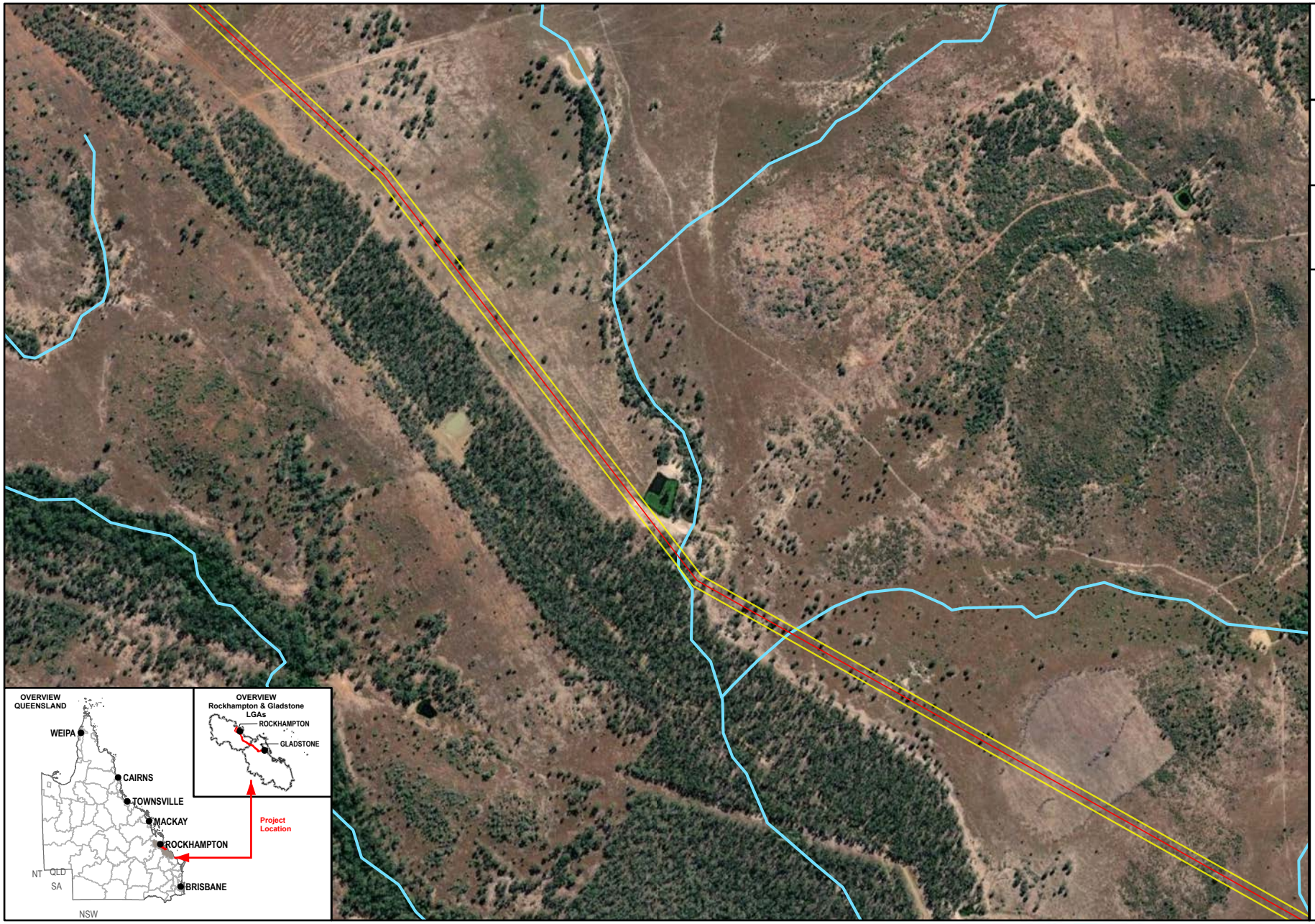
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-11c
Distribution of Squatter Pigeon (Southern) Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:4 Date:21/09/2022



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Legend

- GSDA Pipeline Alignment
- Study Area
- Waterways

Data Sources:
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2.Imagery @ Esri, Maxar, GeoEye, Earthstar Geographics, CNES-Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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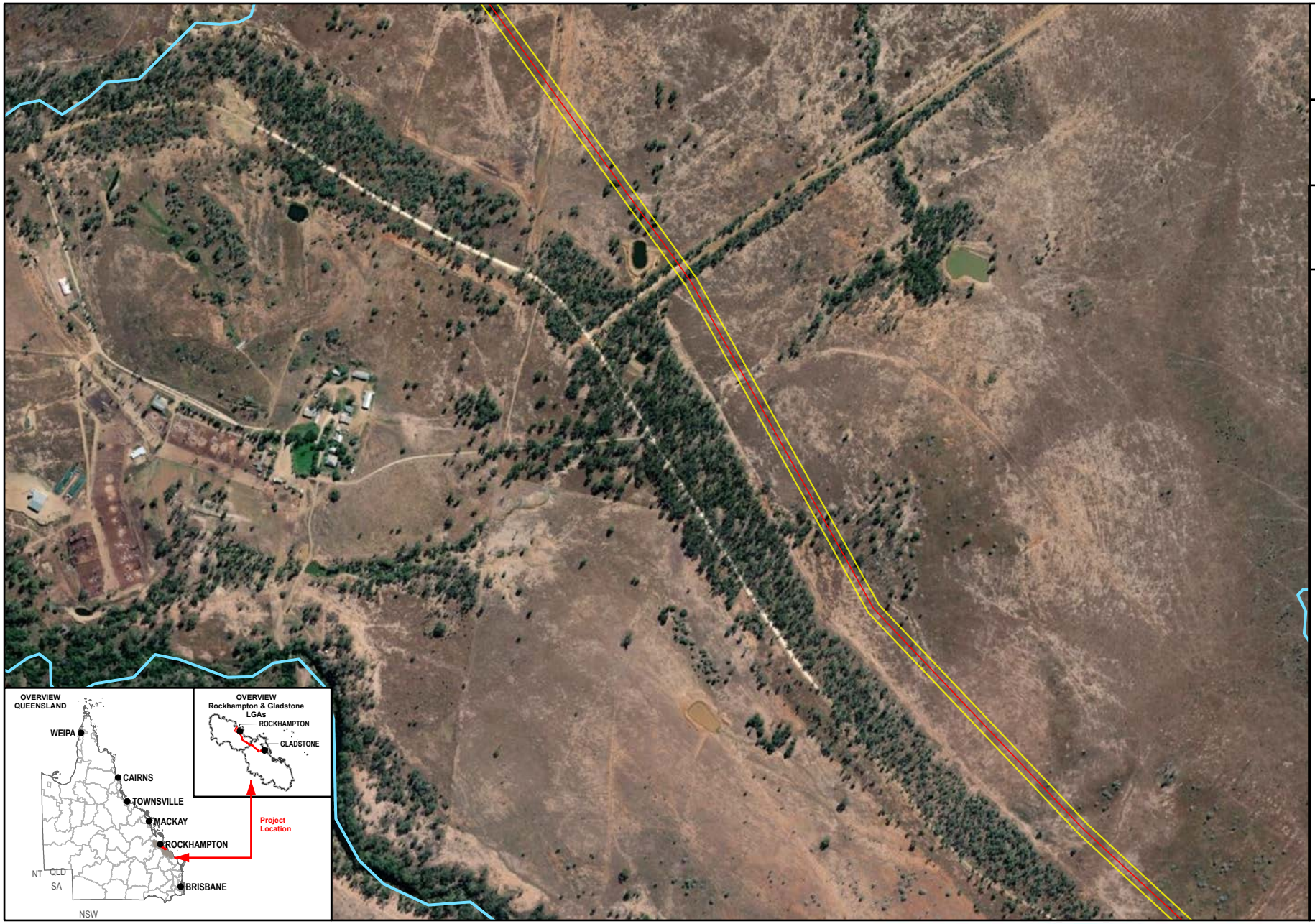
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-11d
Distribution of Squatter Pigeon (Southern) Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:4 Date:21/09/2022



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Legend

- GSDA Pipeline Alignment
- Study Area
- Waterways

Data Sources:
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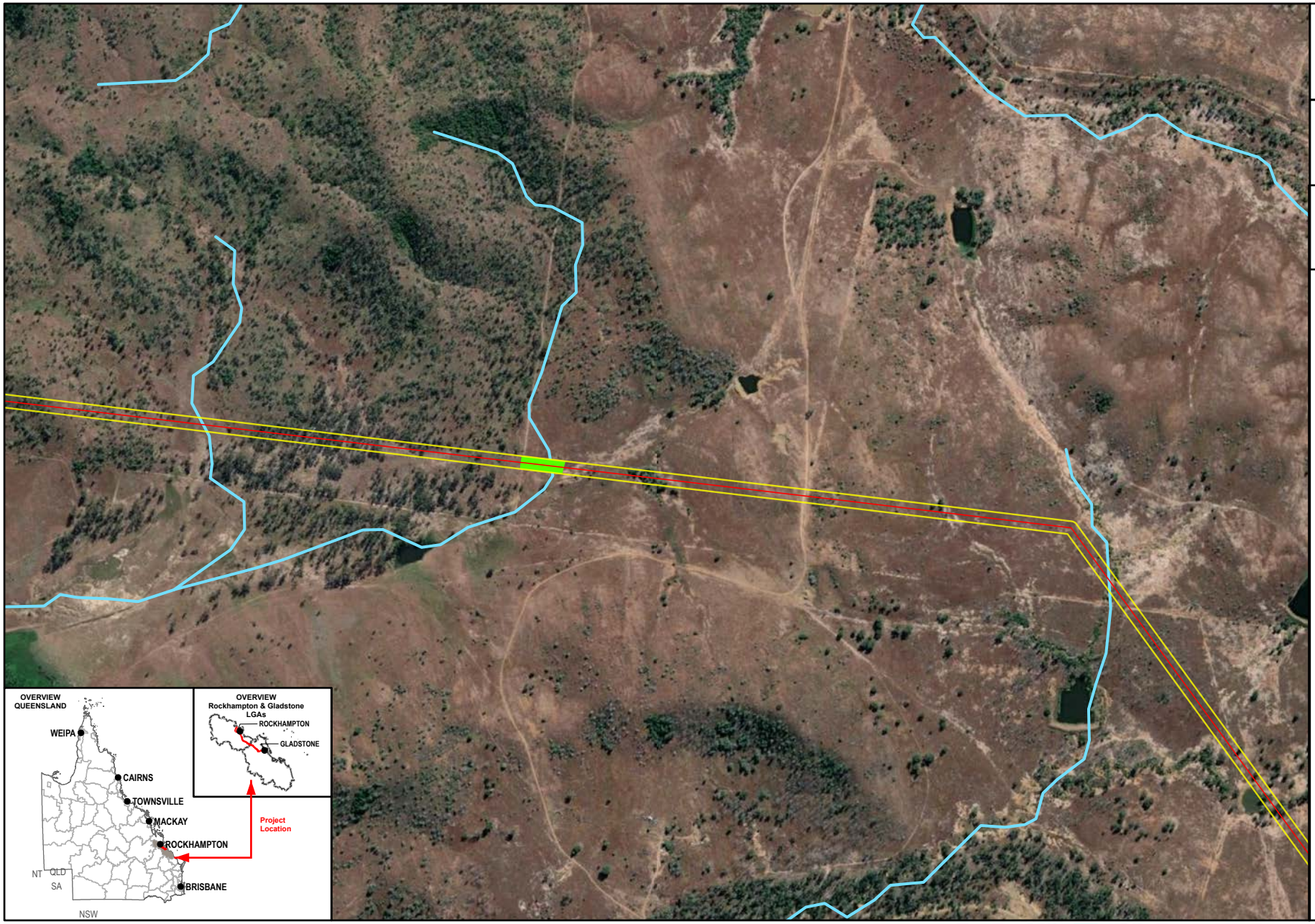
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-11e
Distribution of Squatter Pigeon (Southern) Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:4 Date:21/09/2022



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Legend

- GSDA Pipeline Alignment
- Study Area

Predicted Squatter Pigeon (Southern) Habitat

Habitat Type

- Potential Breeding Habitat
- Waterways

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

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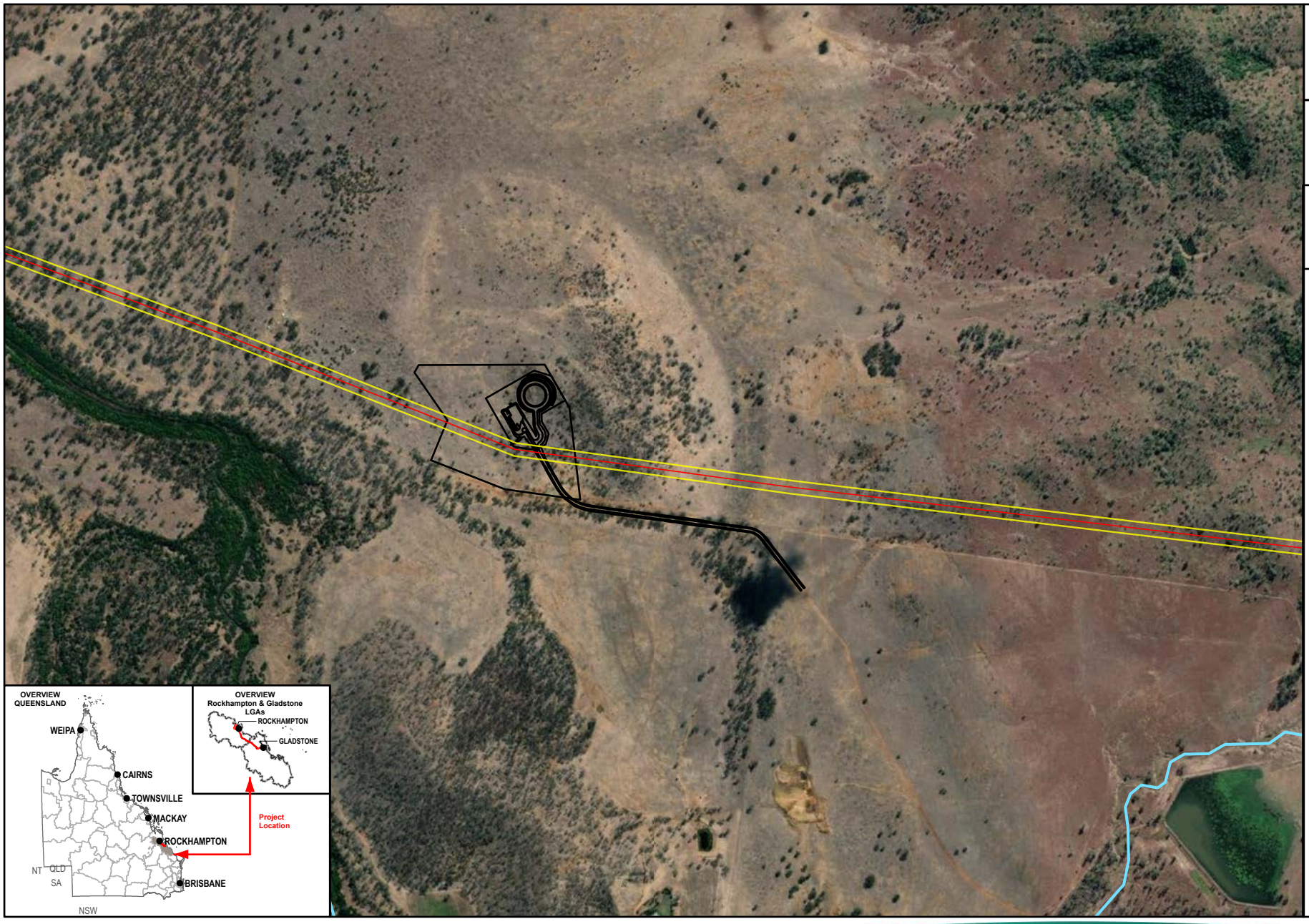
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-11f
Distribution of Squatter Pigeon (Southern) Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:4 Date:21/09/2022



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Legend

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

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

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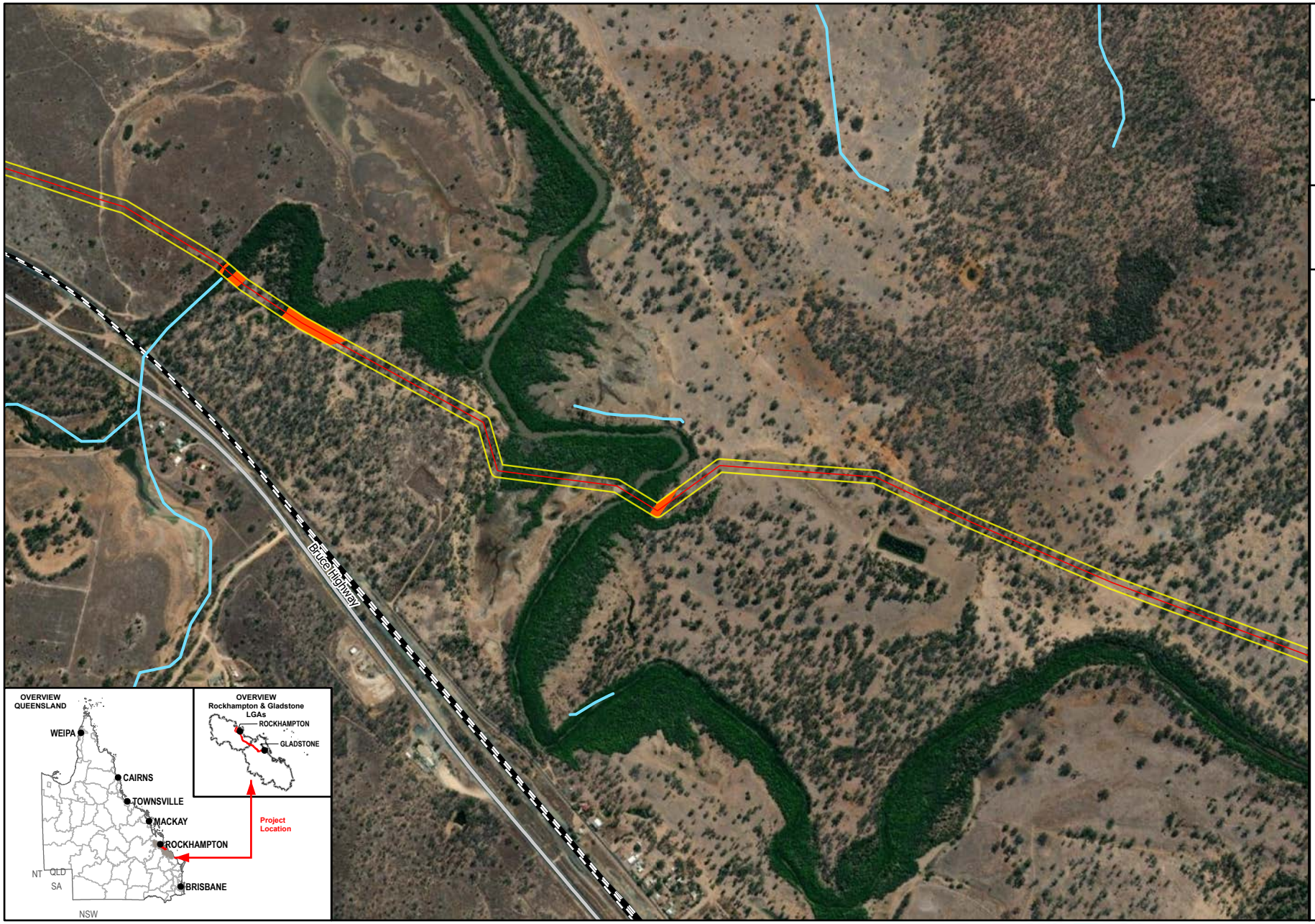
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-11g
Distribution of Squatter Pigeon (Southern) Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:4 Date:21/09/2022



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Legend

- GSDA Pipeline Alignment
- Study Area

Predicted Squatter Pigeon (Southern) Habitat

Habitat Type

- Potential Foraging Habitat
- Waterways
- Main Roads
- Railways

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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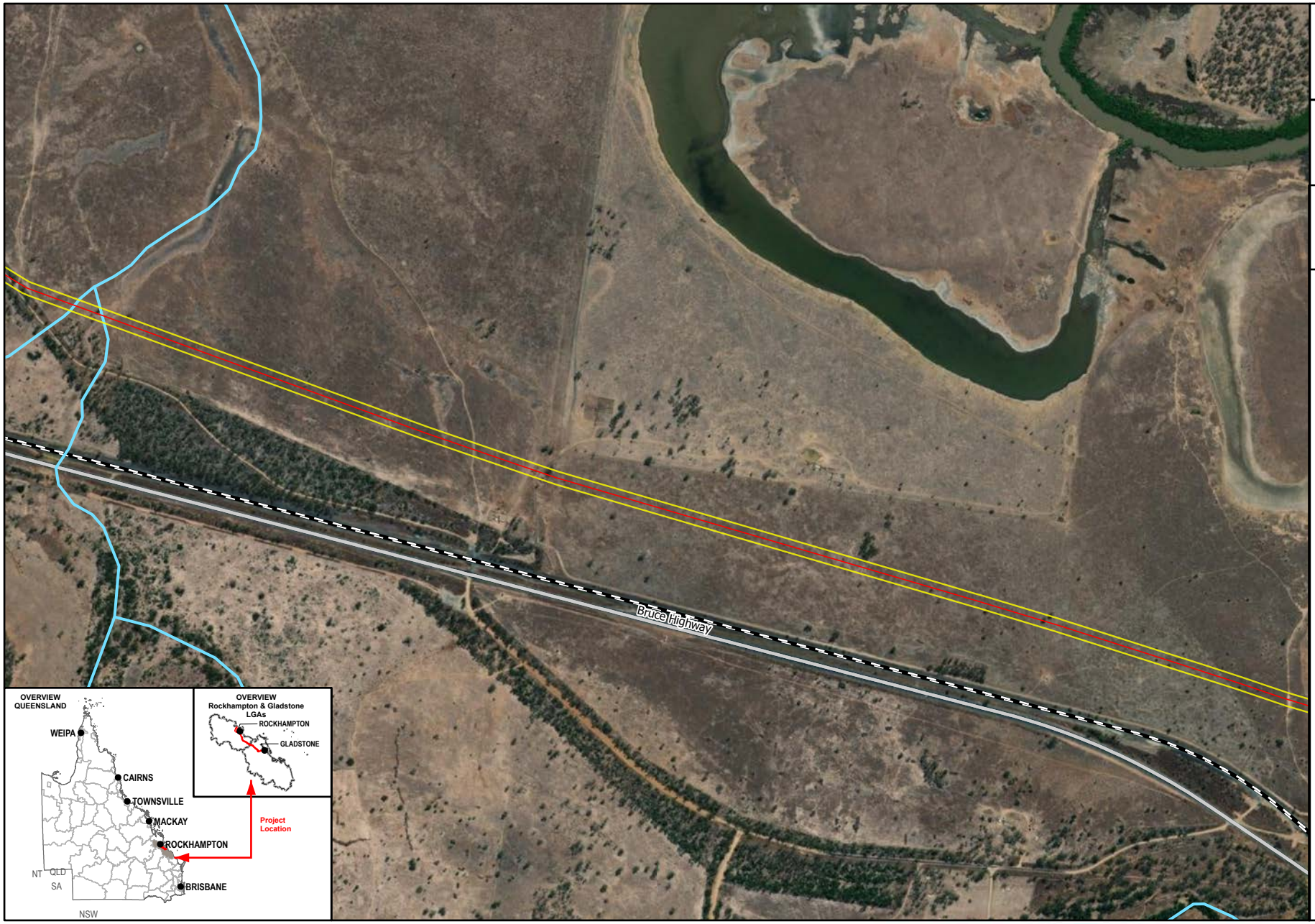
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-11h
Distribution of Squatter Pigeon (Southern) Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:4 Date:21/09/2022



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Legend

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

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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(Datum GDA2020)

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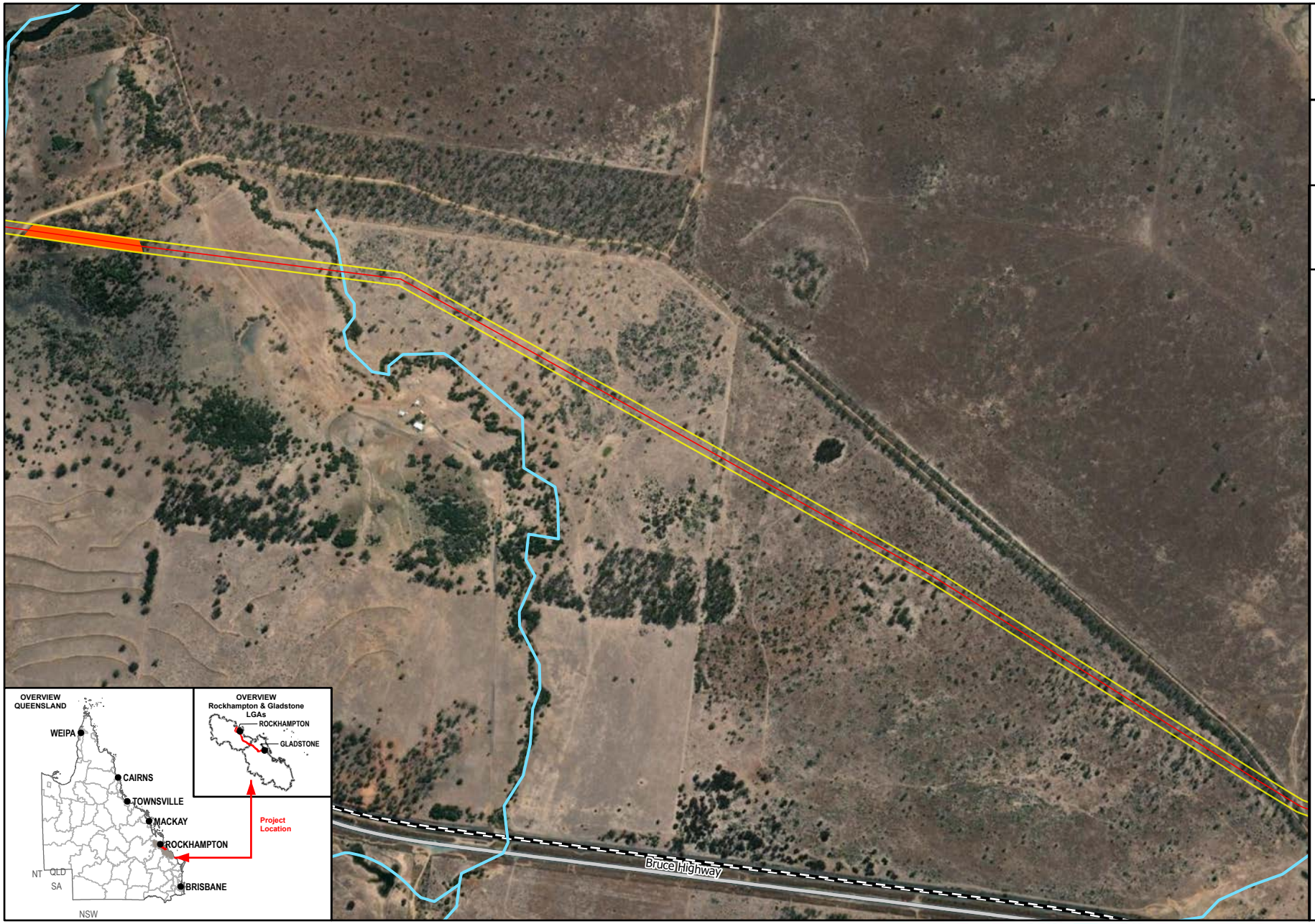
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-11i
Distribution of Squatter Pigeon (Southern) Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:4 Date:21/09/2022



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Legend

- GSDA Pipeline Alignment
- Study Area

Predicted Squatter Pigeon (Southern) Habitat

Habitat Type

- Potential Foraging Habitat
- Waterways
- Main Roads
- Railways

Data Sources:
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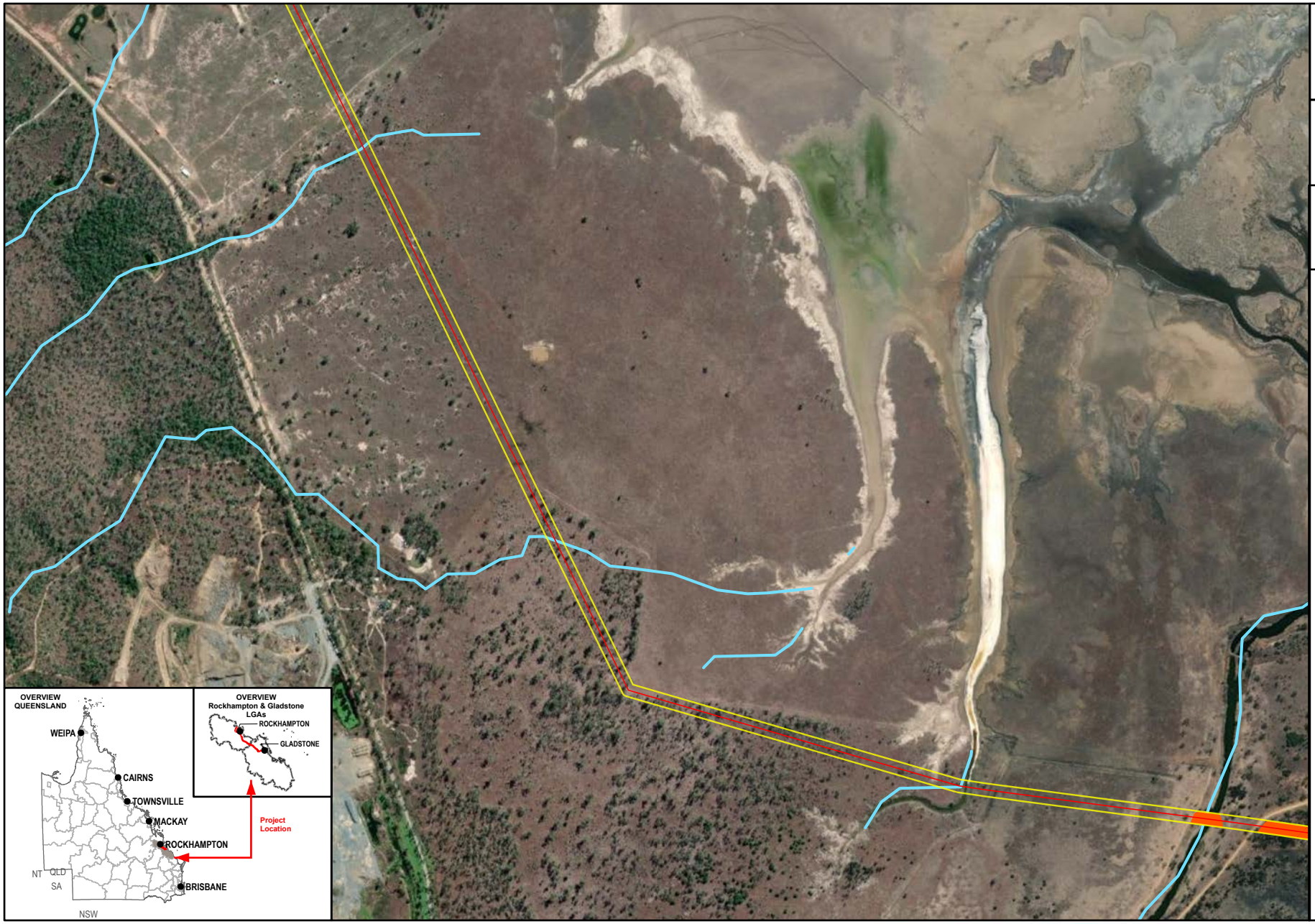
Figure 7-11j
Distribution of Squatter Pigeon (Southern) Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:4 Date:21/09/2022



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Legend

- GSDA Pipeline Alignment
- Study Area

Predicted Squatter Pigeon (Southern) Habitat

Habitat Type

- Potential Foraging Habitat
- Waterways

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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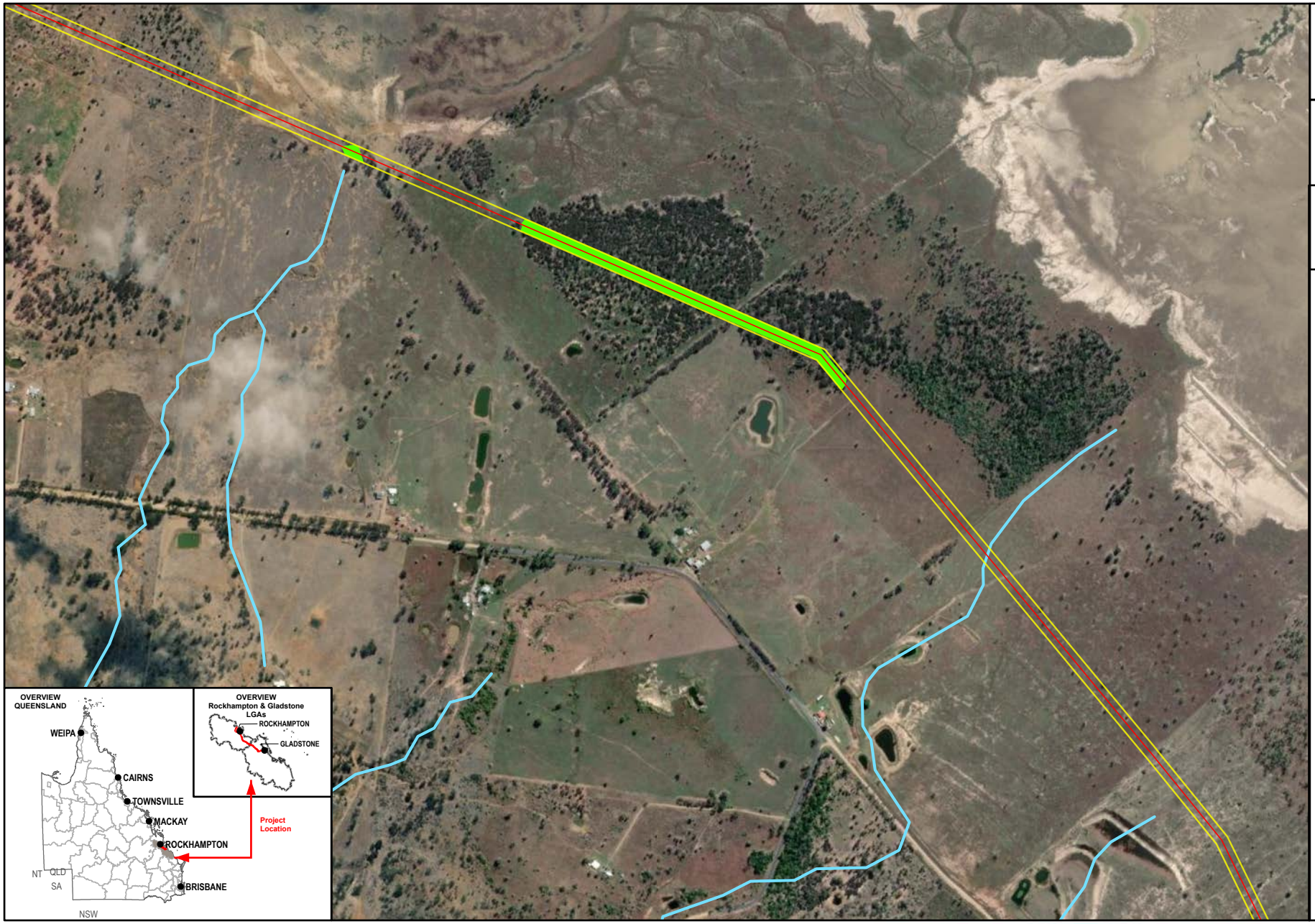
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-11k
Distribution of Squatter Pigeon (Southern) Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:4 Date:21/09/2022



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Legend

- GSDA Pipeline Alignment
- Study Area

Predicted Squatter Pigeon (Southern) Habitat

Habitat Type

- Potential Breeding Habitat
- Waterways

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

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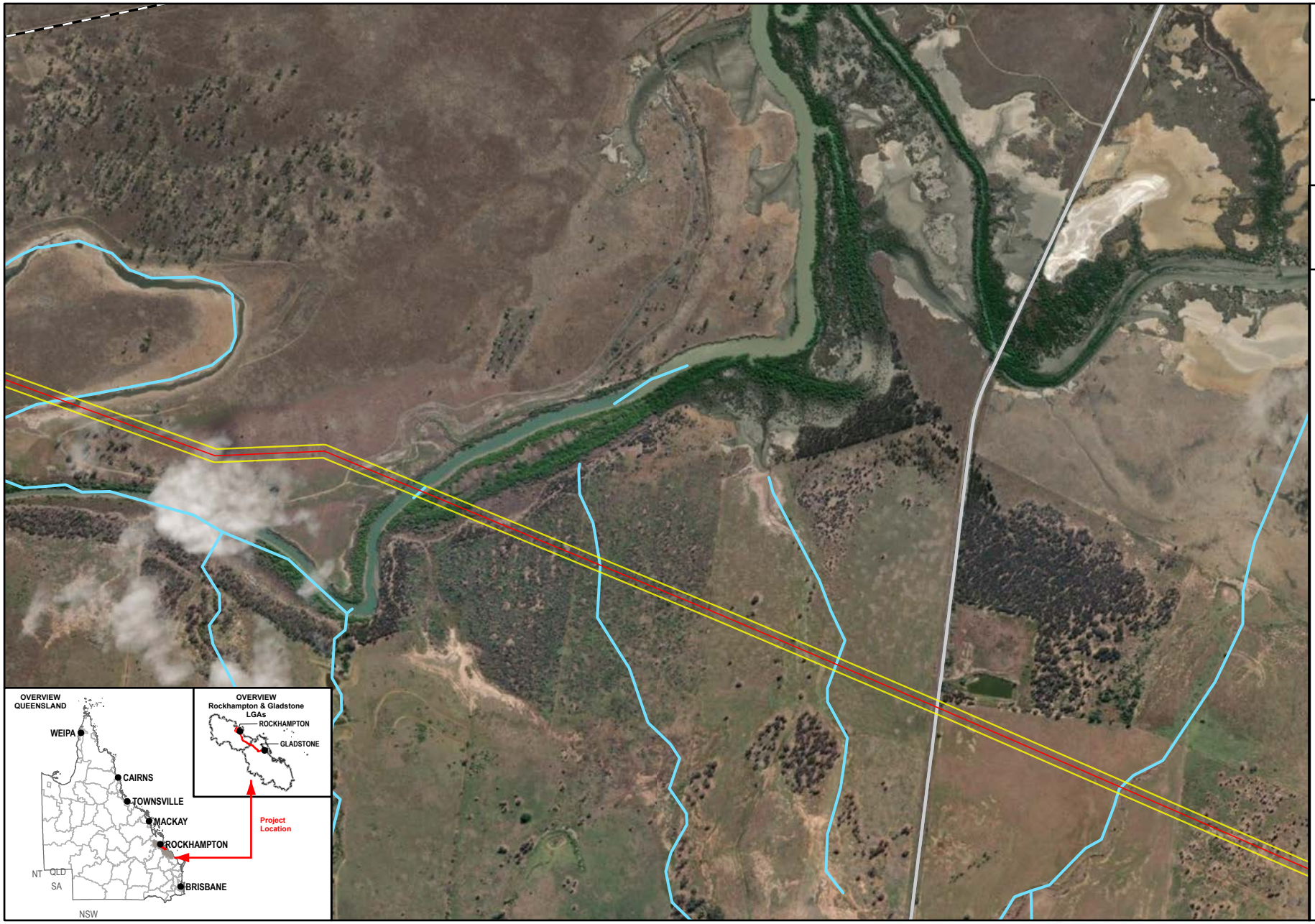
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-11l
Distribution of Squatter Pigeon (Southern) Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:4 Date:21/09/2022



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Legend

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

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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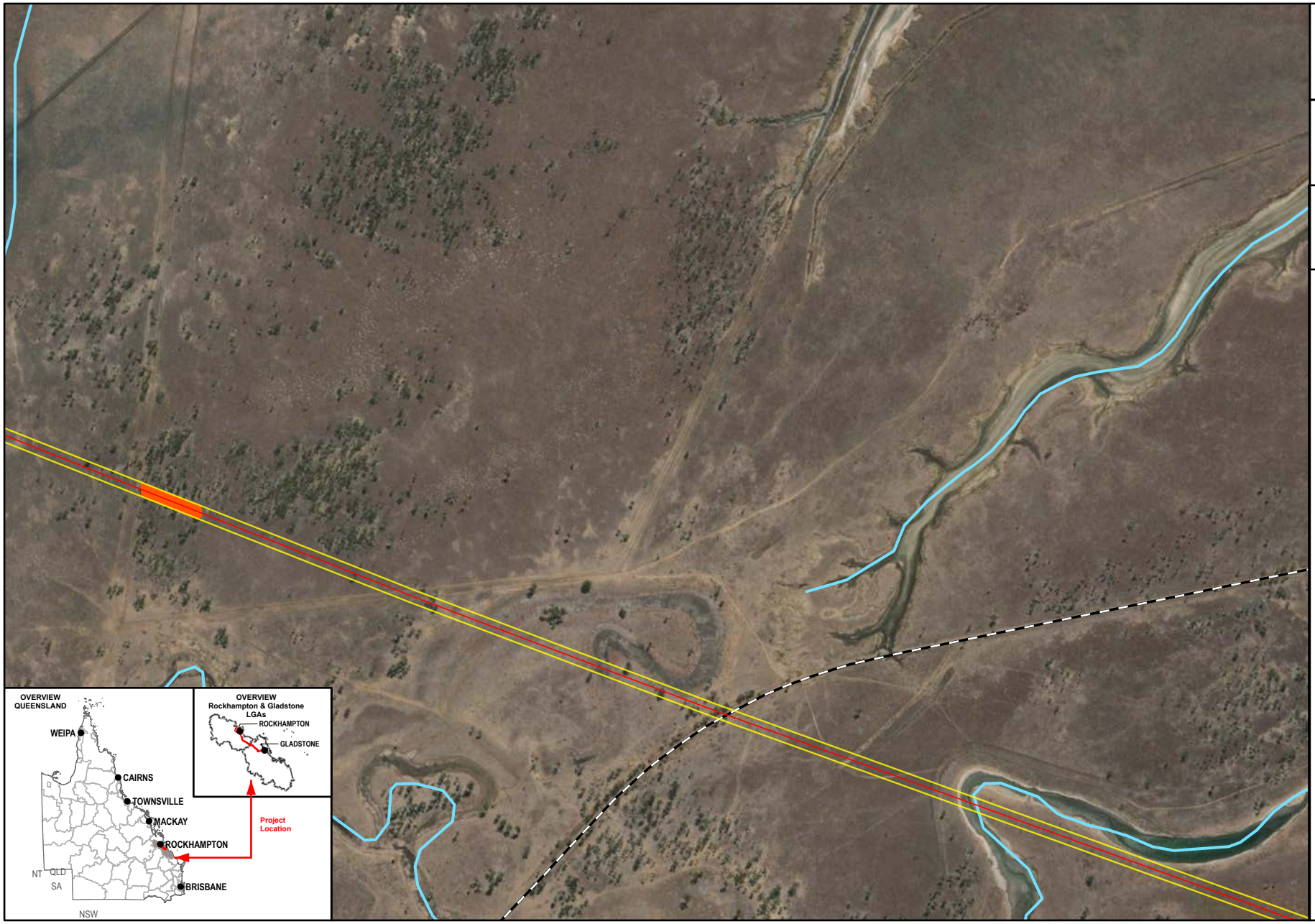
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-11m
Distribution of Squatter Pigeon (Southern) Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:4 Date:21/09/2022



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Legend

- GSDA Pipeline Alignment
- Study Area

Predicted Squatter Pigeon (Southern) Habitat

Habitat Type

- Potential Foraging Habitat
- Waterways
- Railways

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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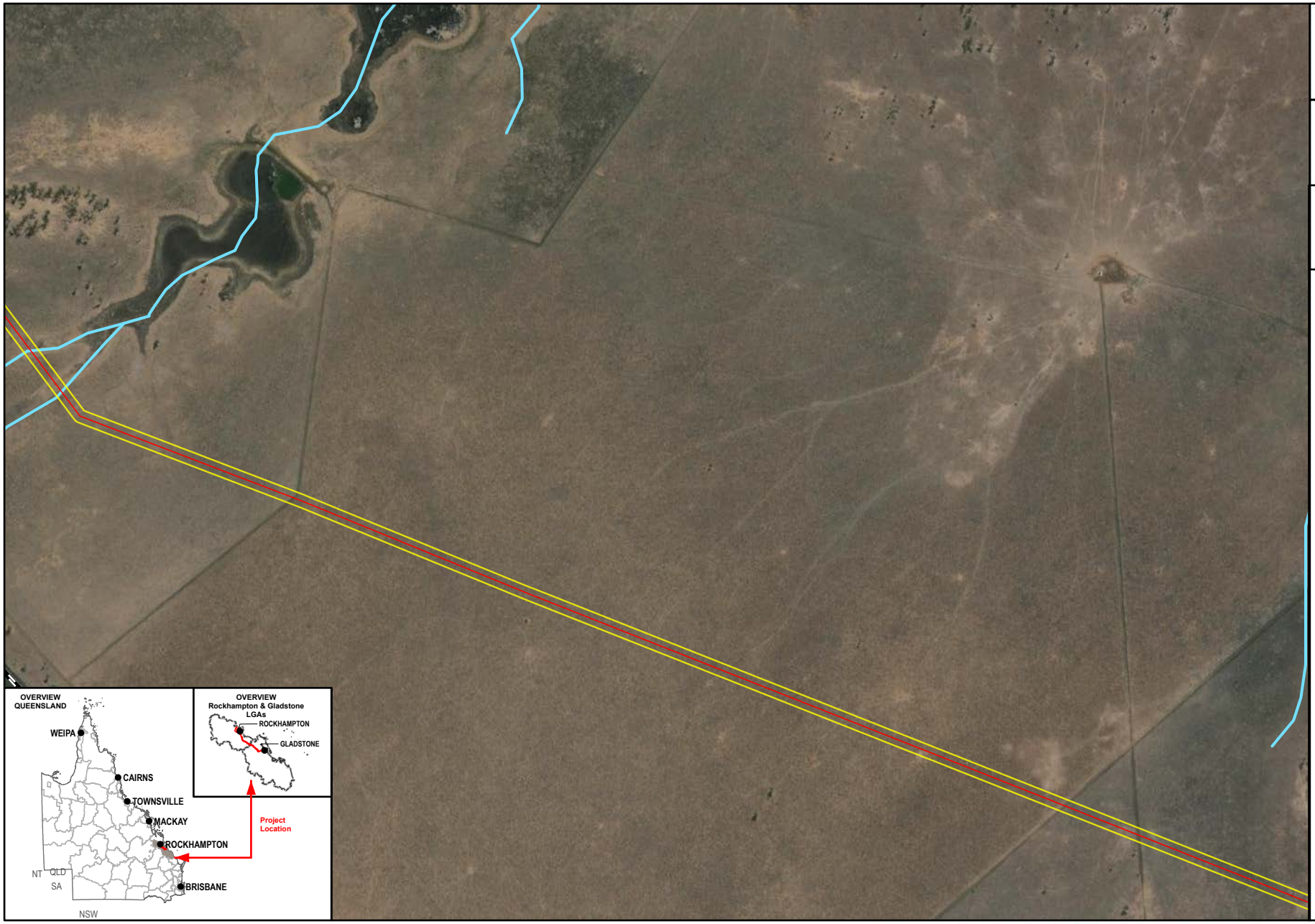
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-11n
Distribution of Squatter Pigeon (Southern) Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:4 Date:21/09/2022



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Legend

- GSDA Pipeline Alignment
- Study Area
- Waterways
- Railways

Data Sources:
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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 7-11o
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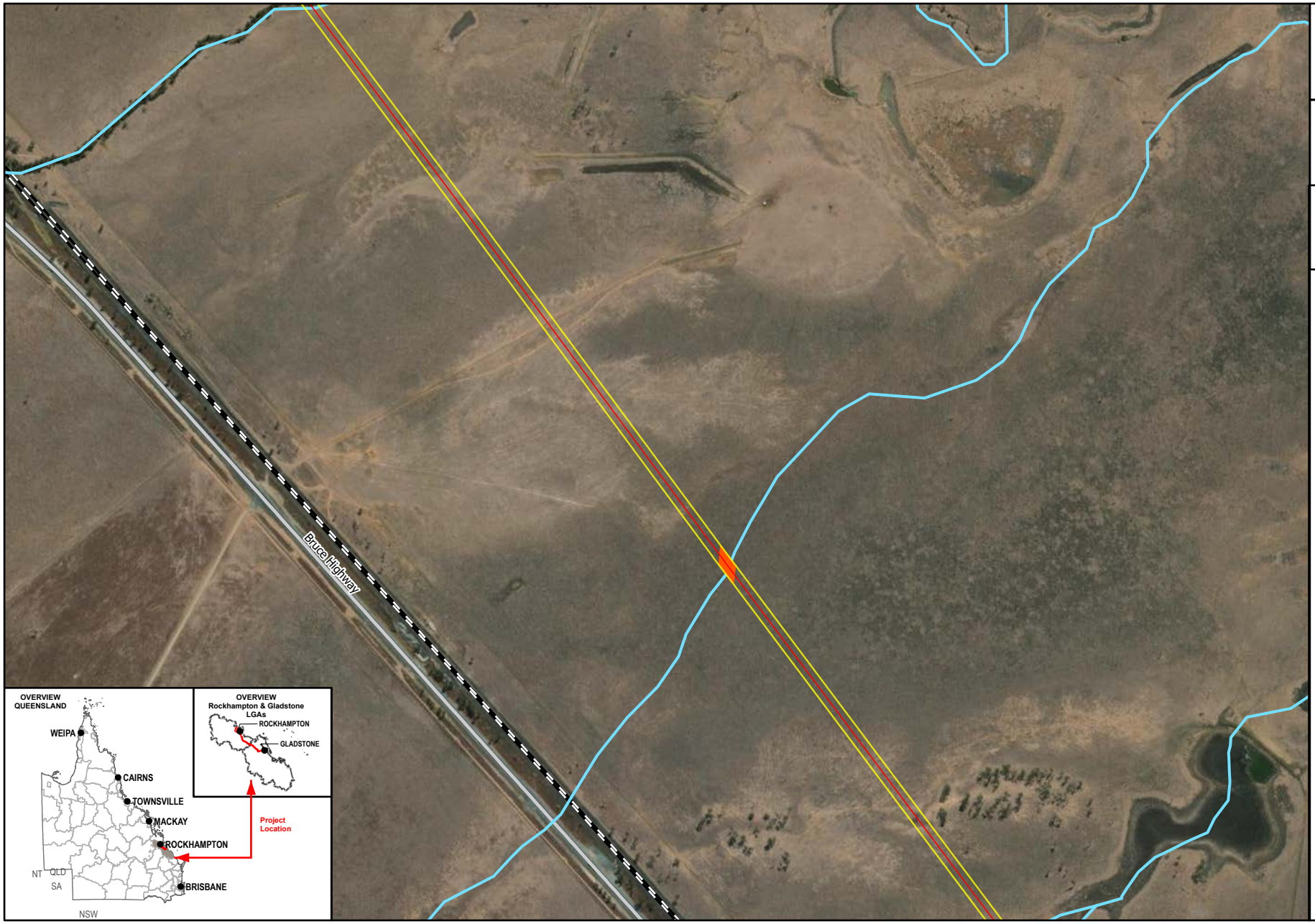
000-G-MAP-2433 Version:4 Date:21/09/2022



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- GSDA Pipeline Alignment
- Study Area

Predicted Squatter Pigeon (Southern) Habitat

Habitat Type

- Potential Foraging Habitat
- Waterways
- Main Roads
- Railways

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Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-11p
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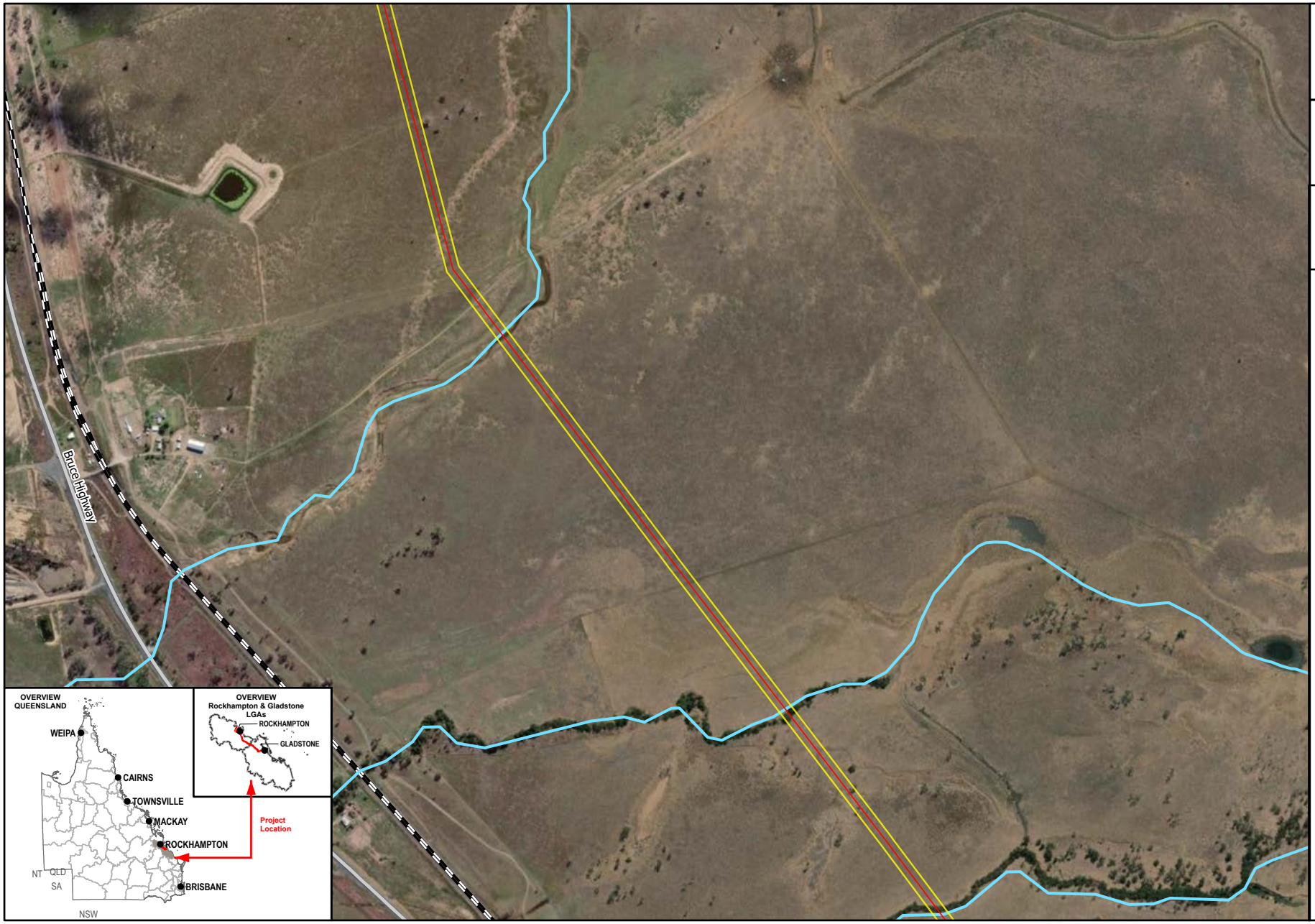
000-G-MAP-2433 Version:4 Date:21/09/2022



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- GSDA Pipeline Alignment
- Study Area
- Waterways
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- Railways

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Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-11q
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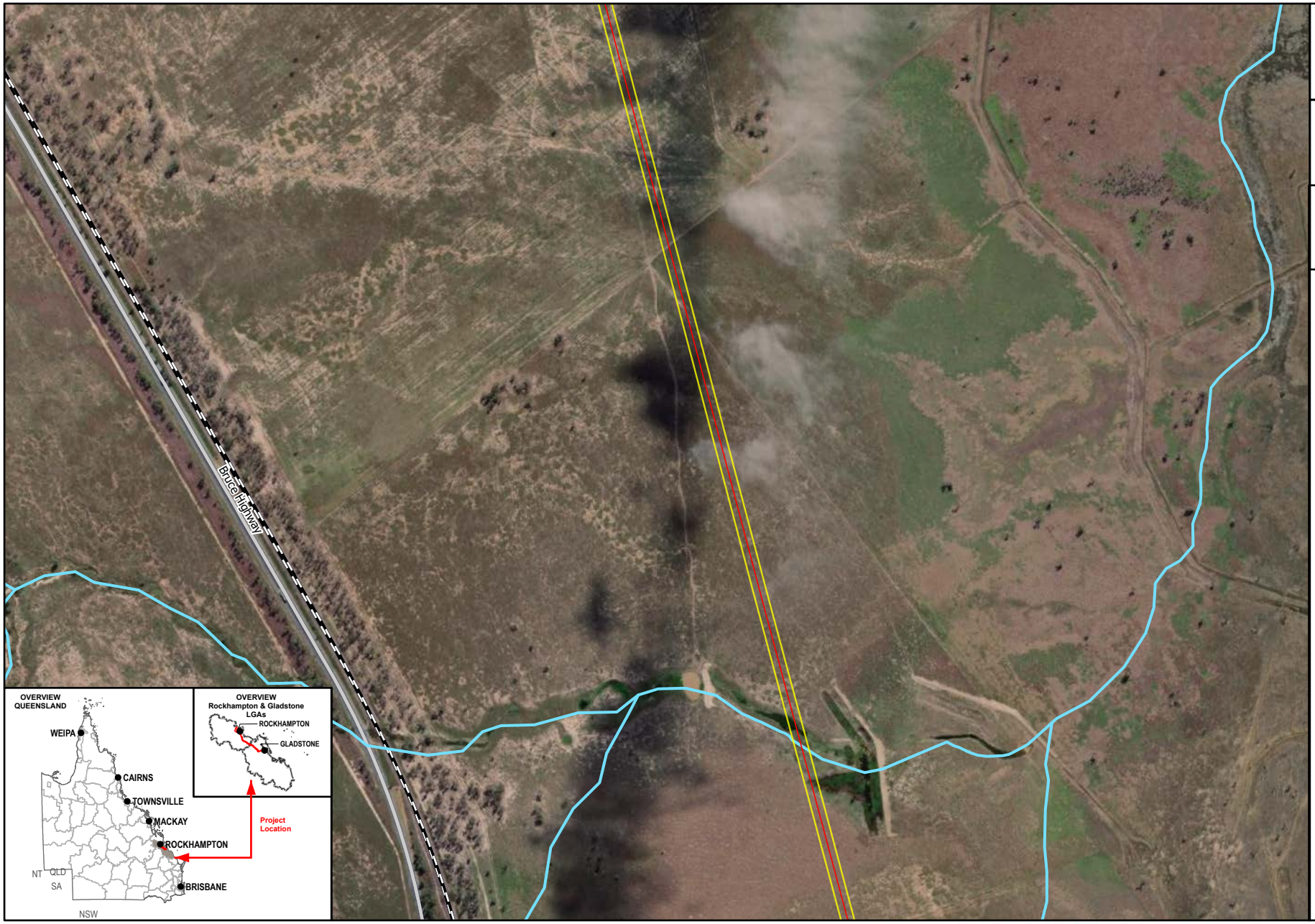
000-G-MAP-2433 Version:4 Date:21/09/2022



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- Study Area
- Waterways
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- Railways

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Figure 7-11r
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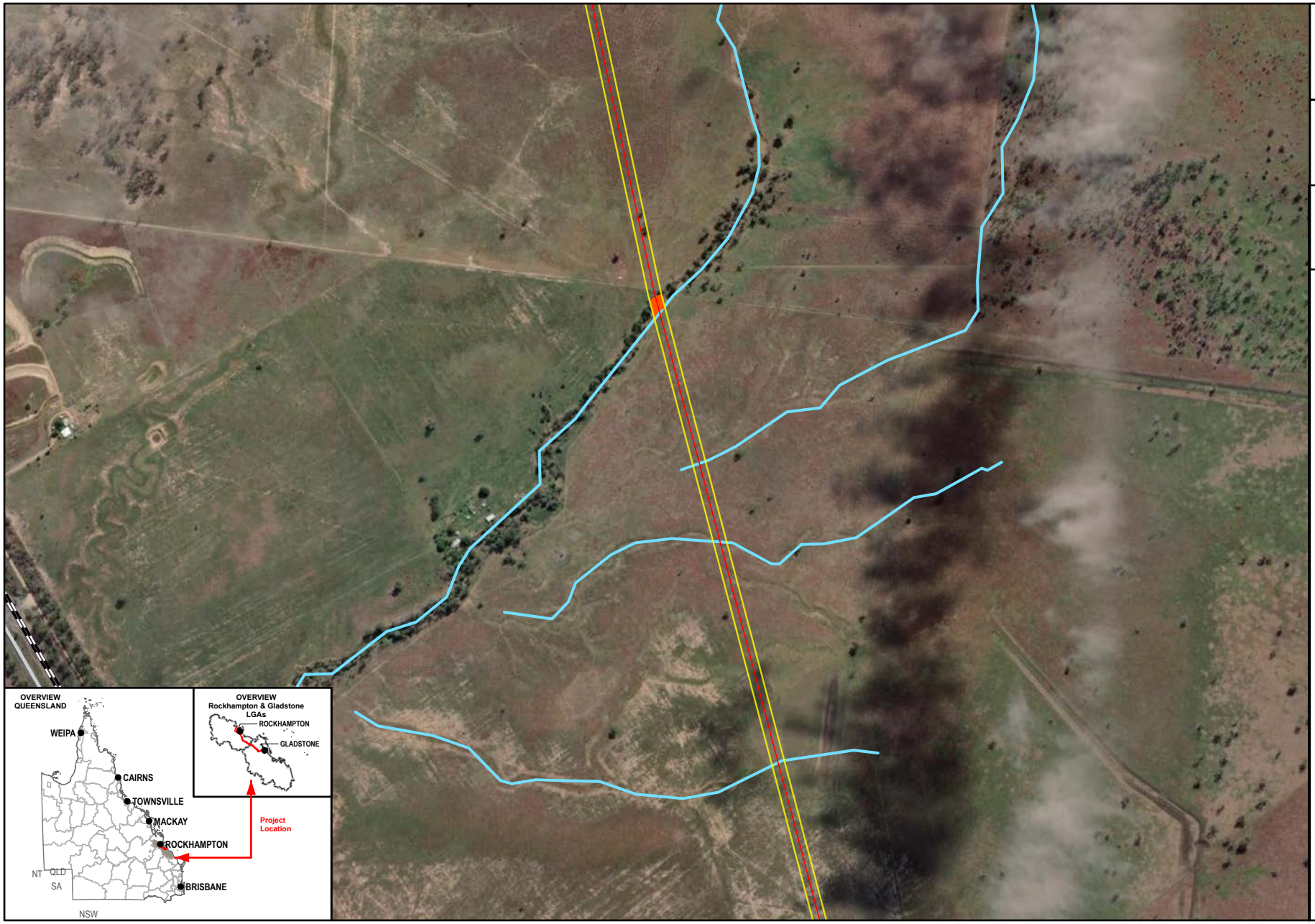
000-G-MAP-2433 Version:4 Date:21/09/2022



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- GSDA Pipeline Alignment
- Study Area

Predicted Squatter Pigeon (Southern) Habitat

Habitat Type

- Potential Foraging Habitat
- Waterways
- Main Roads
- Railways

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Figure 7-11s
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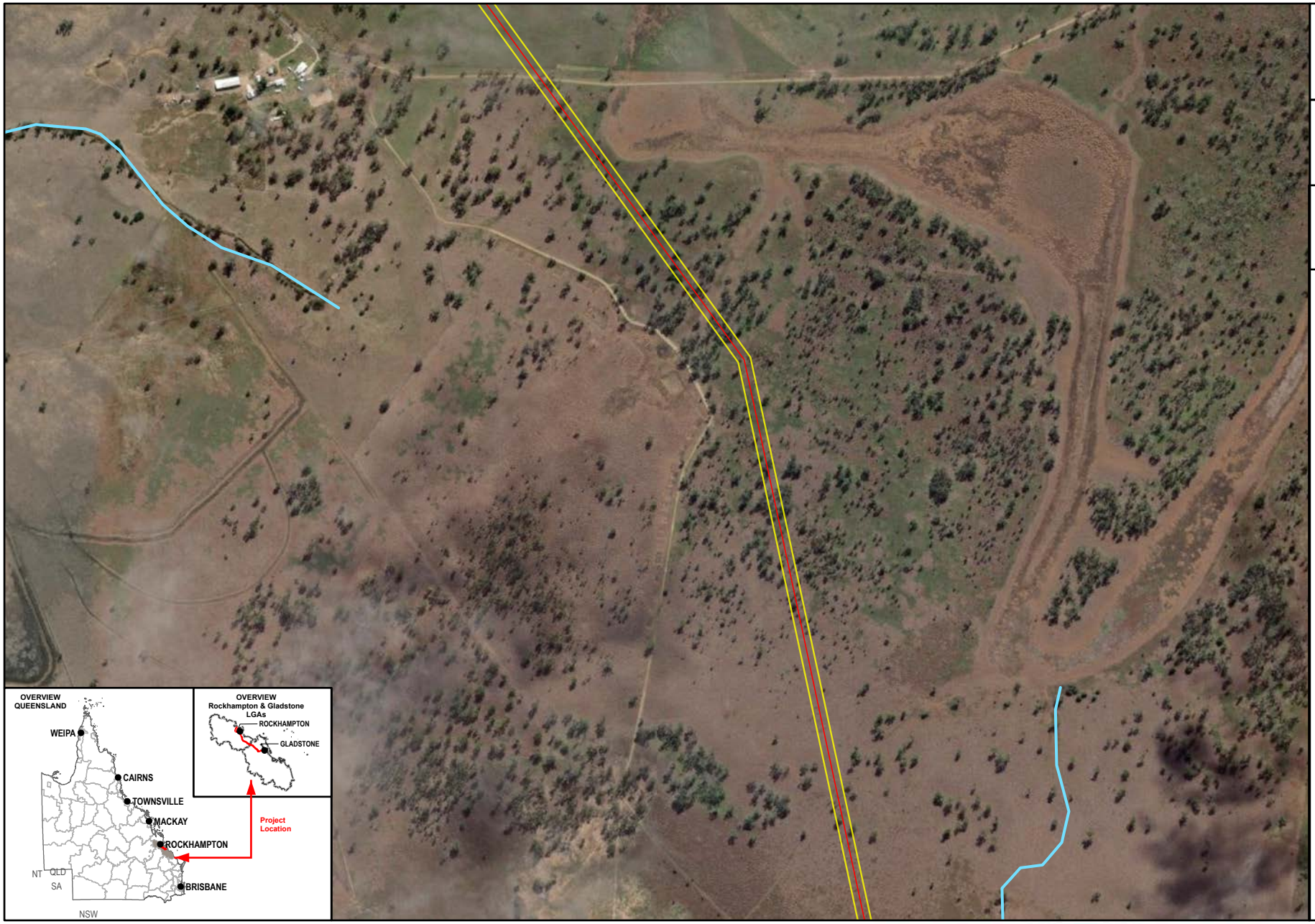

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Figure 7-11t
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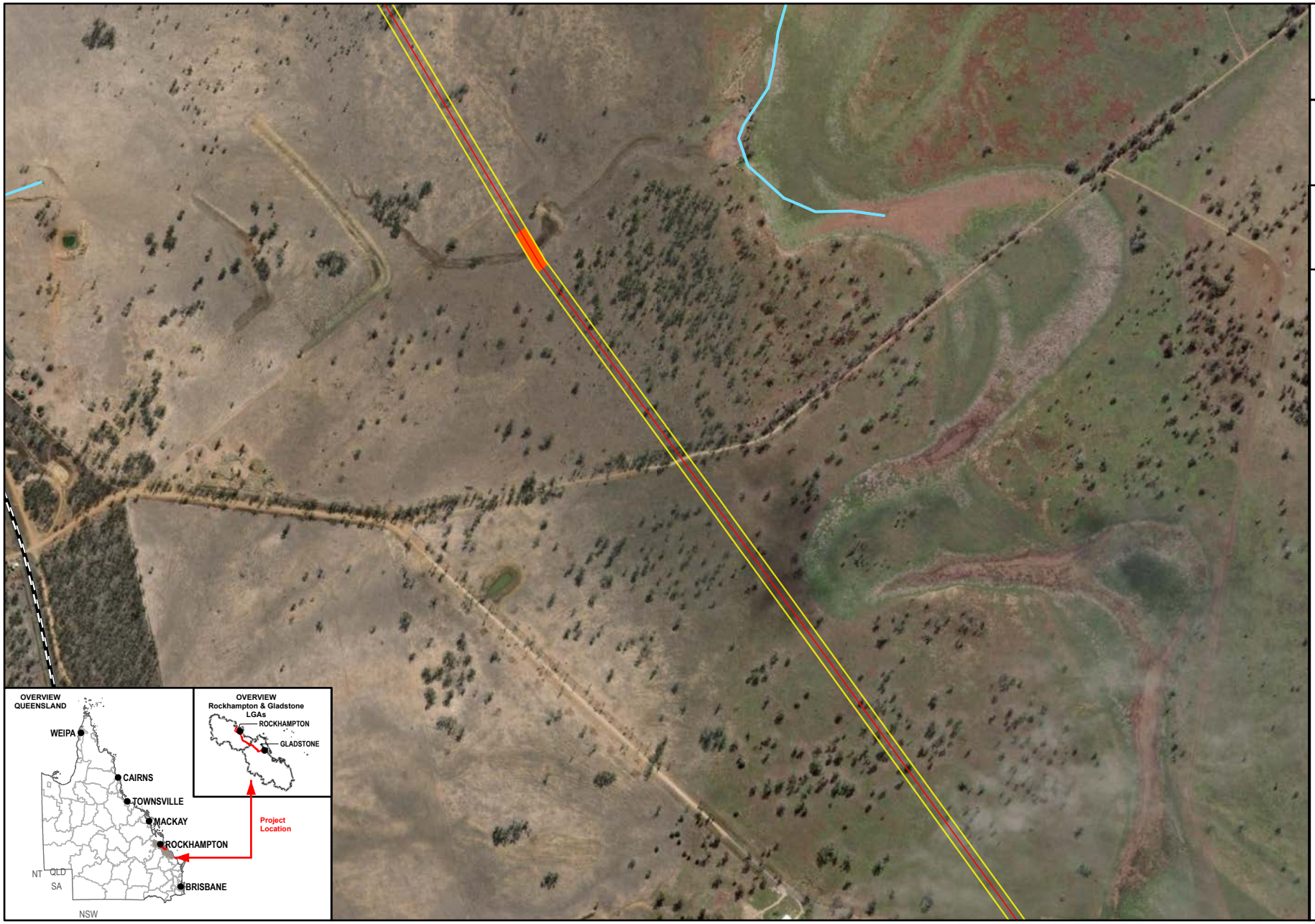

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- GSDA Pipeline Alignment
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Predicted Squatter Pigeon (Southern) Habitat

Habitat Type

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- Railways

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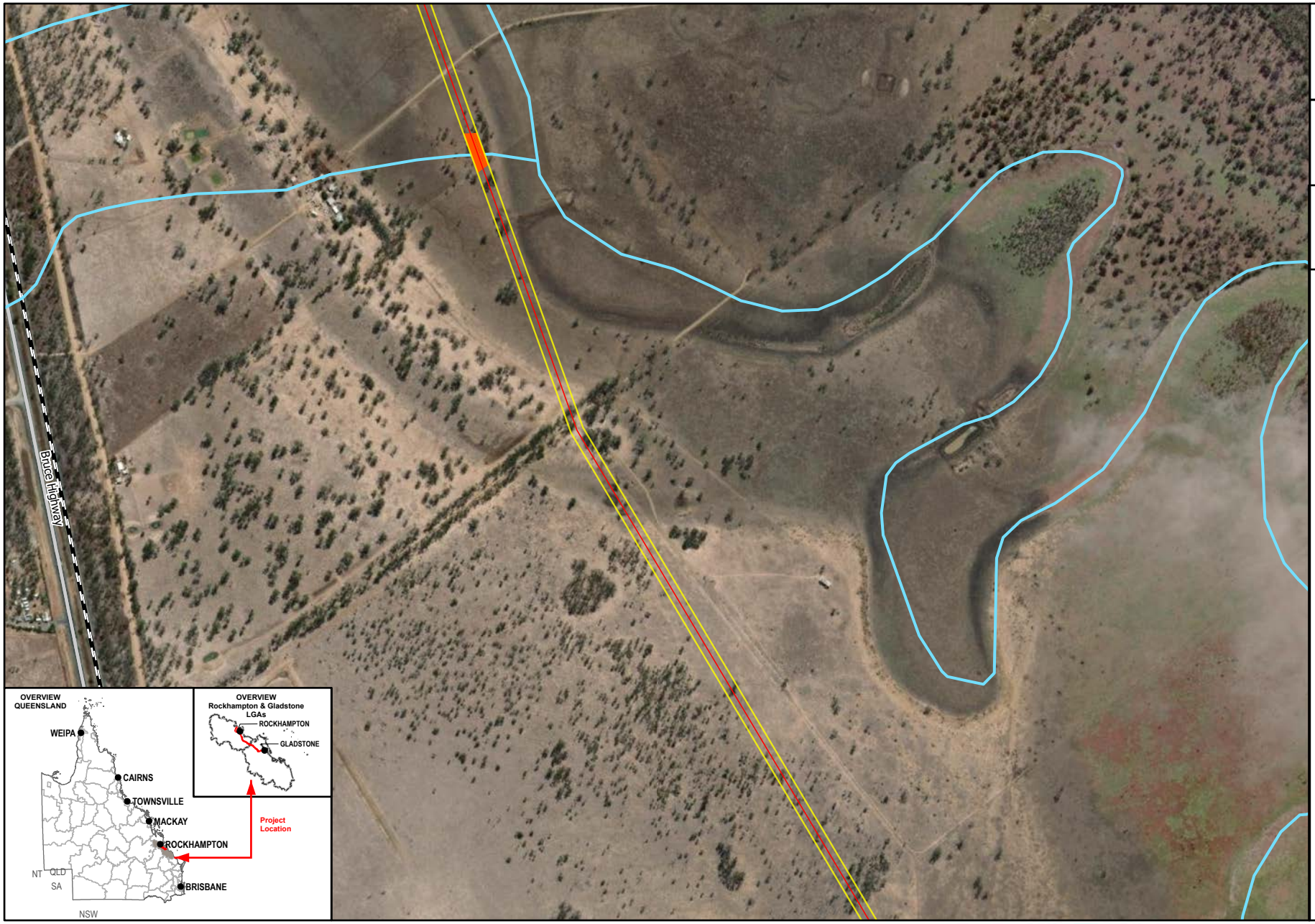
Figure 7-11u
Distribution of Squatter Pigeon (Southern) Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:4 Date:21/09/2022



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- GSDA Pipeline Alignment
- Study Area

Predicted Squatter Pigeon (Southern) Habitat

Habitat Type

- Potential Foraging Habitat
- Waterways
- Main Roads
- Railways

Data Sources:
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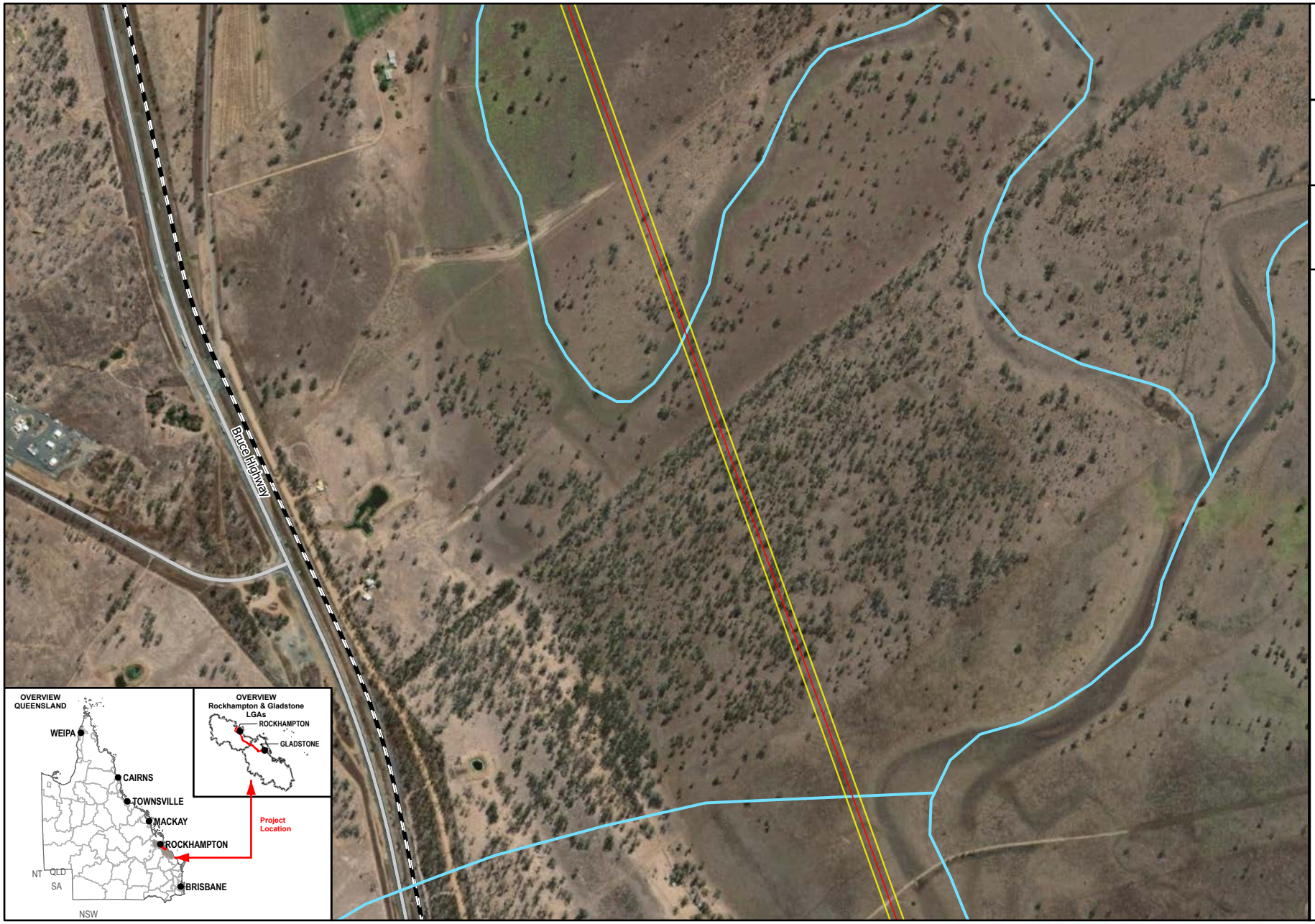
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-11v
Distribution of Squatter Pigeon (Southern) Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:4 Date:21/09/2022



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- GSDA Pipeline Alignment
- Study Area
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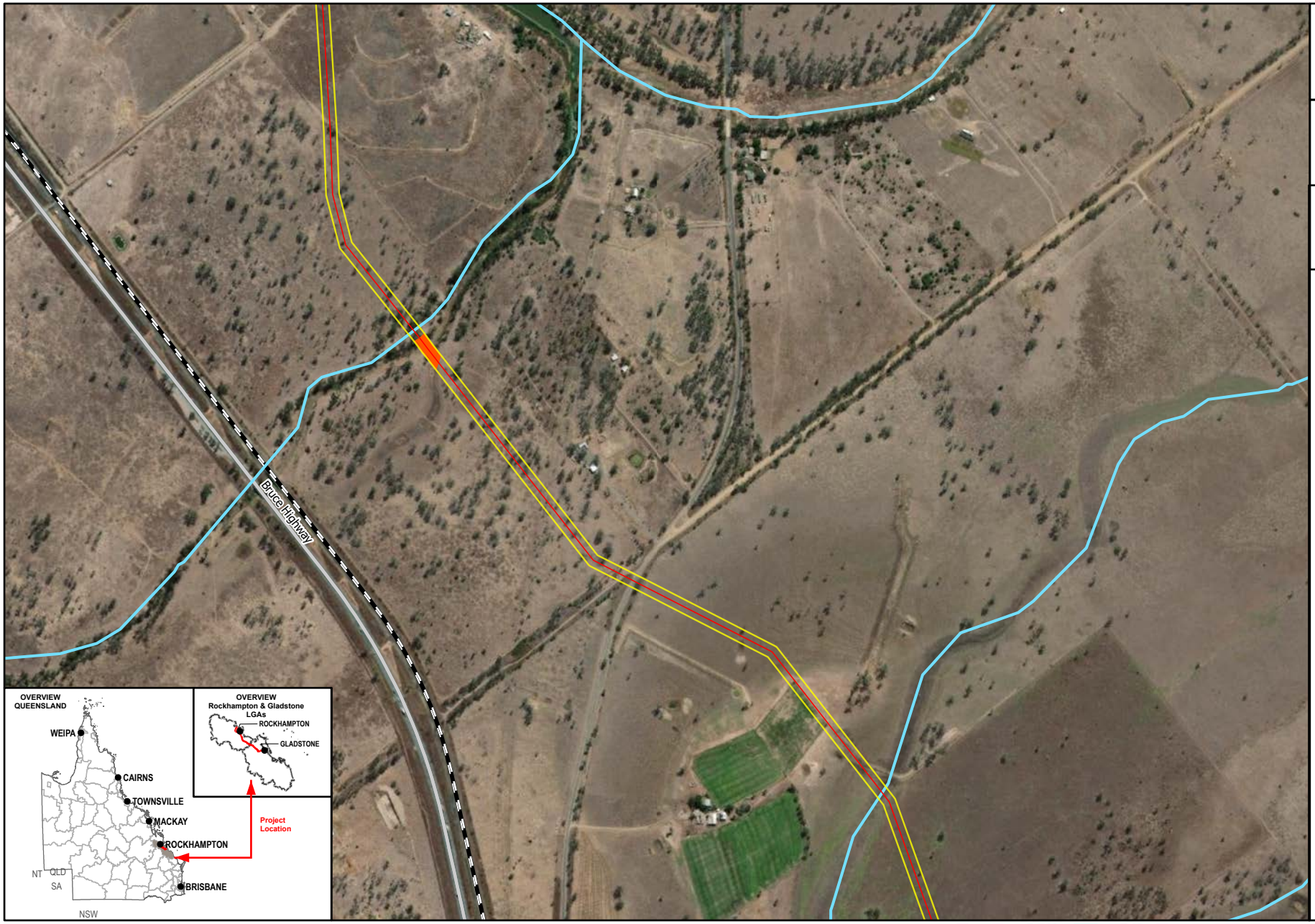
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-11w
Distribution of Squatter Pigeon (Southern) Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:4 Date:21/09/2022



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- GSDA Pipeline Alignment
- Study Area

Predicted Squatter Pigeon (Southern) Habitat

Habitat Type

- Potential Foraging Habitat
- Waterways
- Main Roads
- Railways

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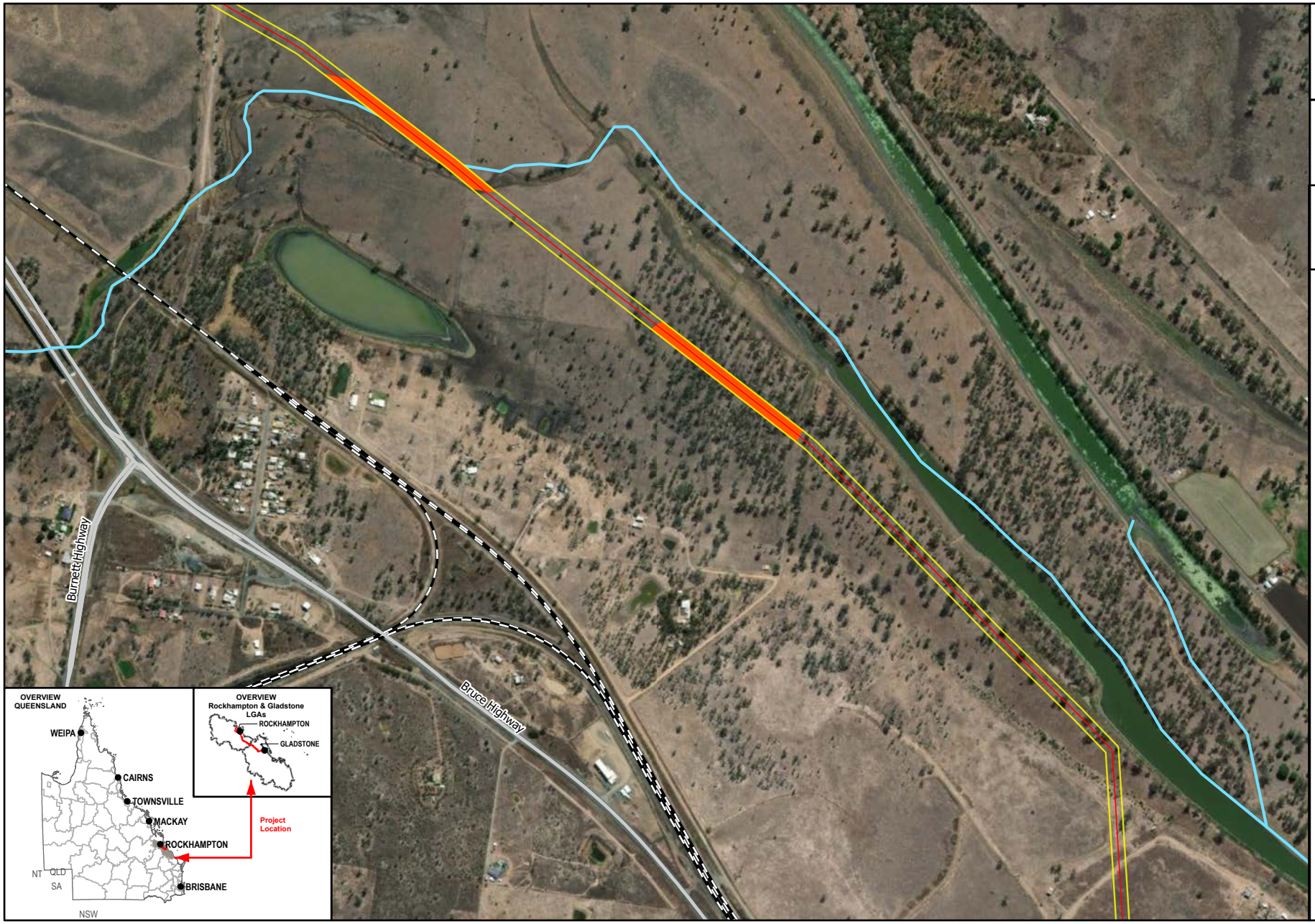
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-11x
Distribution of Squatter Pigeon (Southern) Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:4 Date:21/09/2022



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- GSDA Pipeline Alignment
- Study Area

Predicted Squatter Pigeon (Southern) Habitat

Habitat Type

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Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-11y
Distribution of Squatter Pigeon (Southern) Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:4 Date:21/09/2022

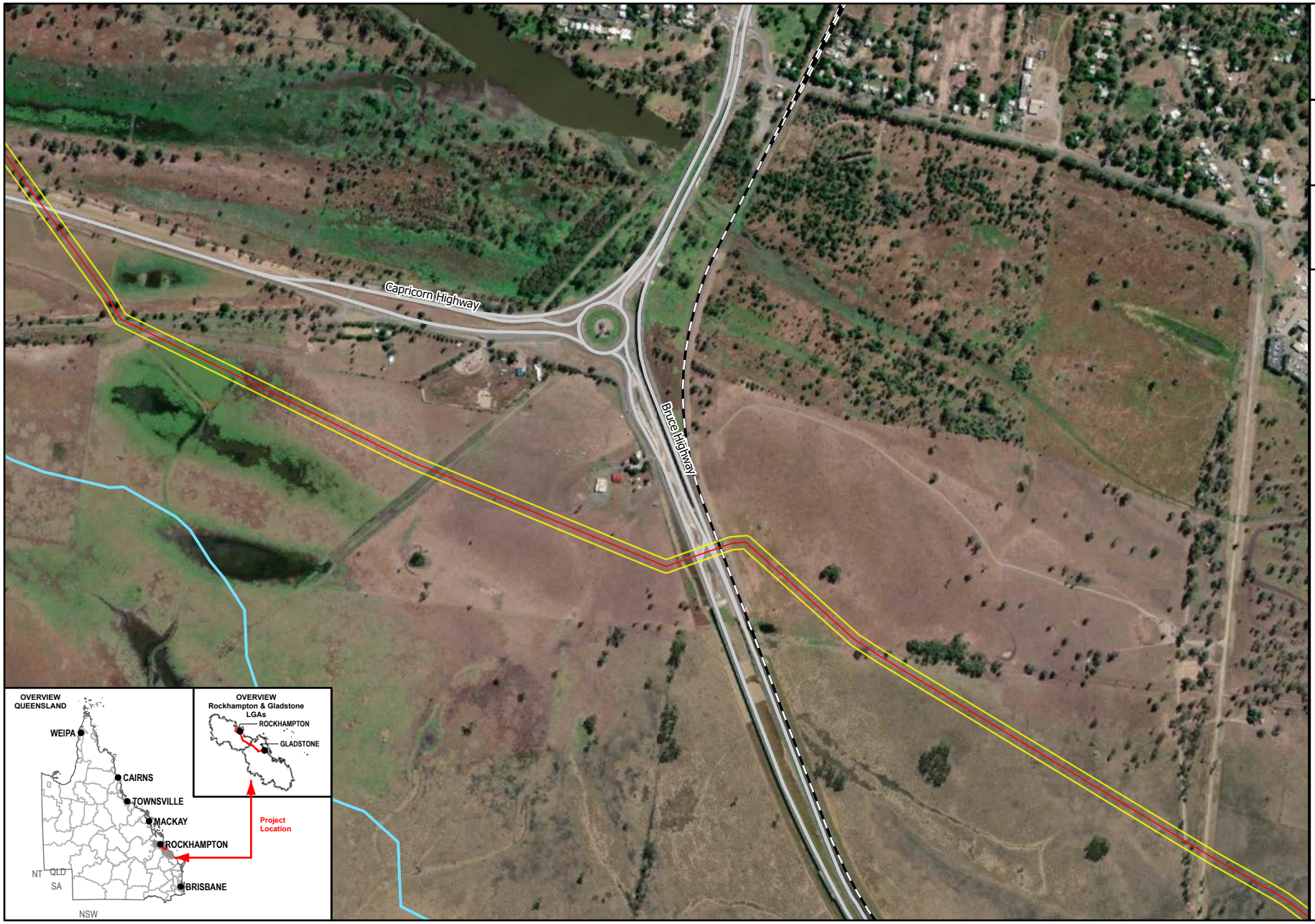

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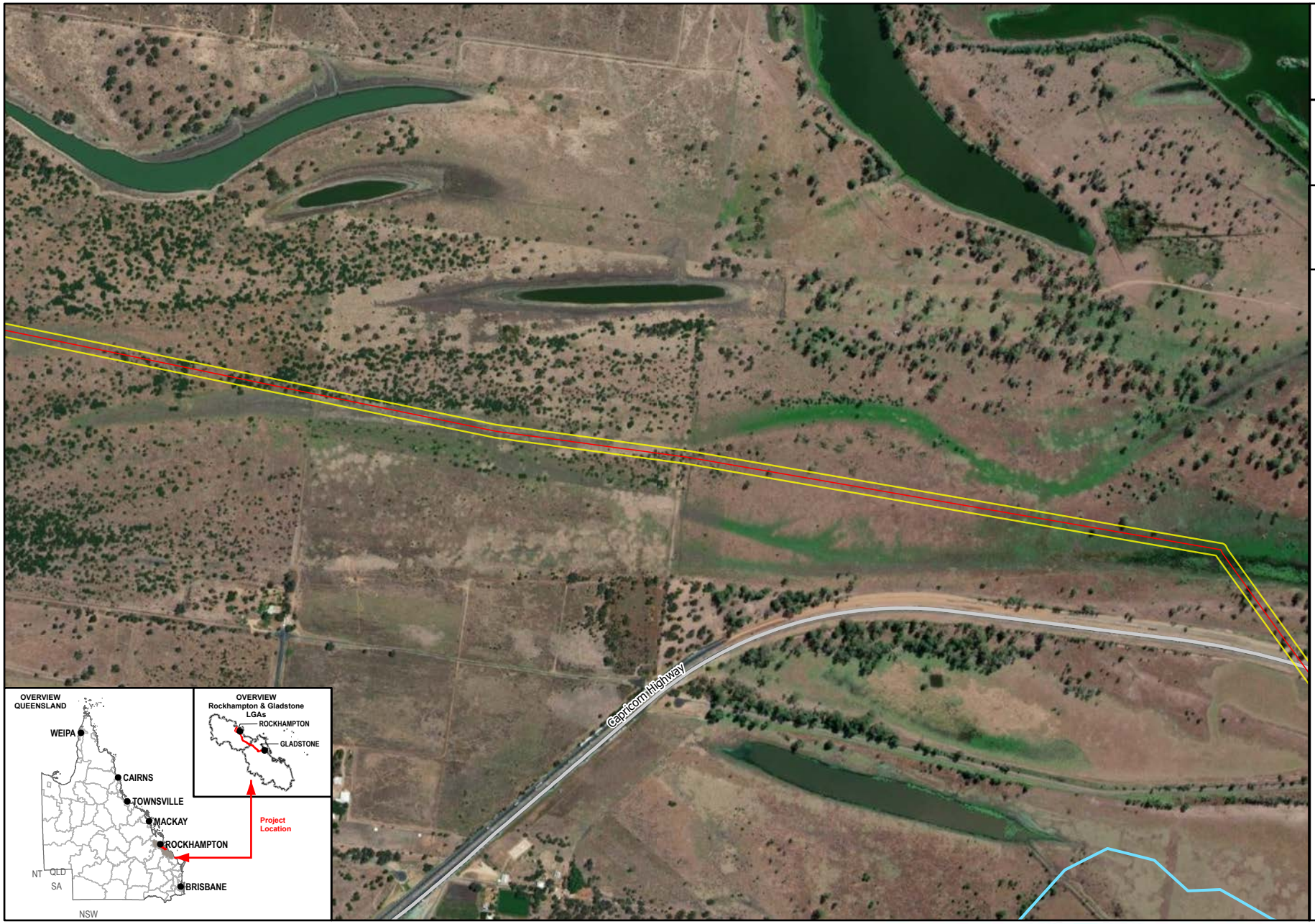
Figure 7-11z
Distribution of Squatter Pigeon (Southern) Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:4 Date:21/09/2022



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- GSDA Pipeline Alignment
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- Main Roads

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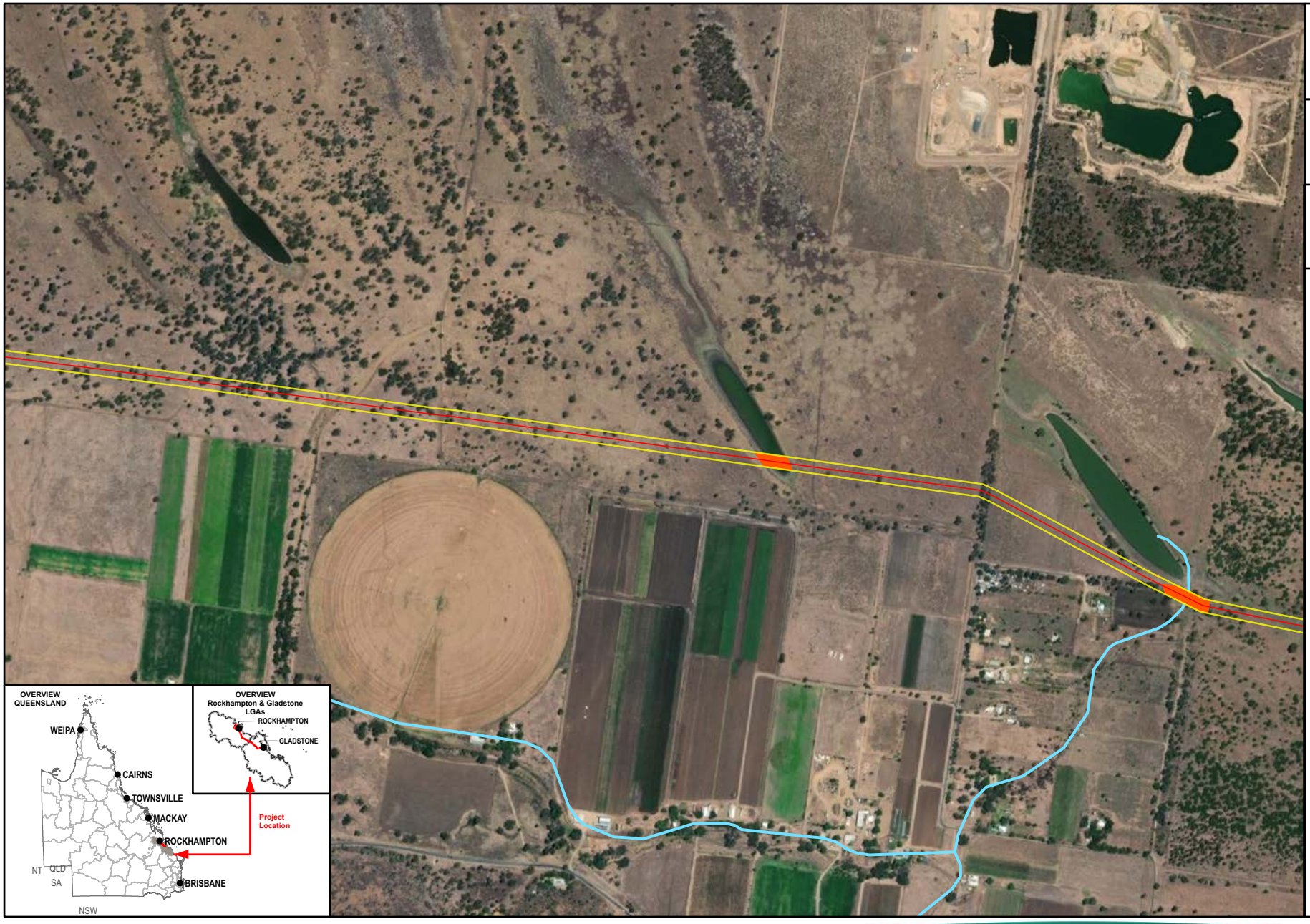
Figure 7-11a1
Distribution of Squatter Pigeon (Southern) Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:4 Date:21/09/2022



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- GSDA Pipeline Alignment
- Study Area

Predicted Squatter Pigeon (Southern) Habitat

Habitat Type

- Potential Foraging Habitat
- Waterways

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Figure 7-11b1
Distribution of Squatter Pigeon (Southern) Habitat Within the SGIC SDA Study Area
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7.2.2.6 Grey snake

Conservation status and species ecology

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

Field survey results and distribution of suitable habitat

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

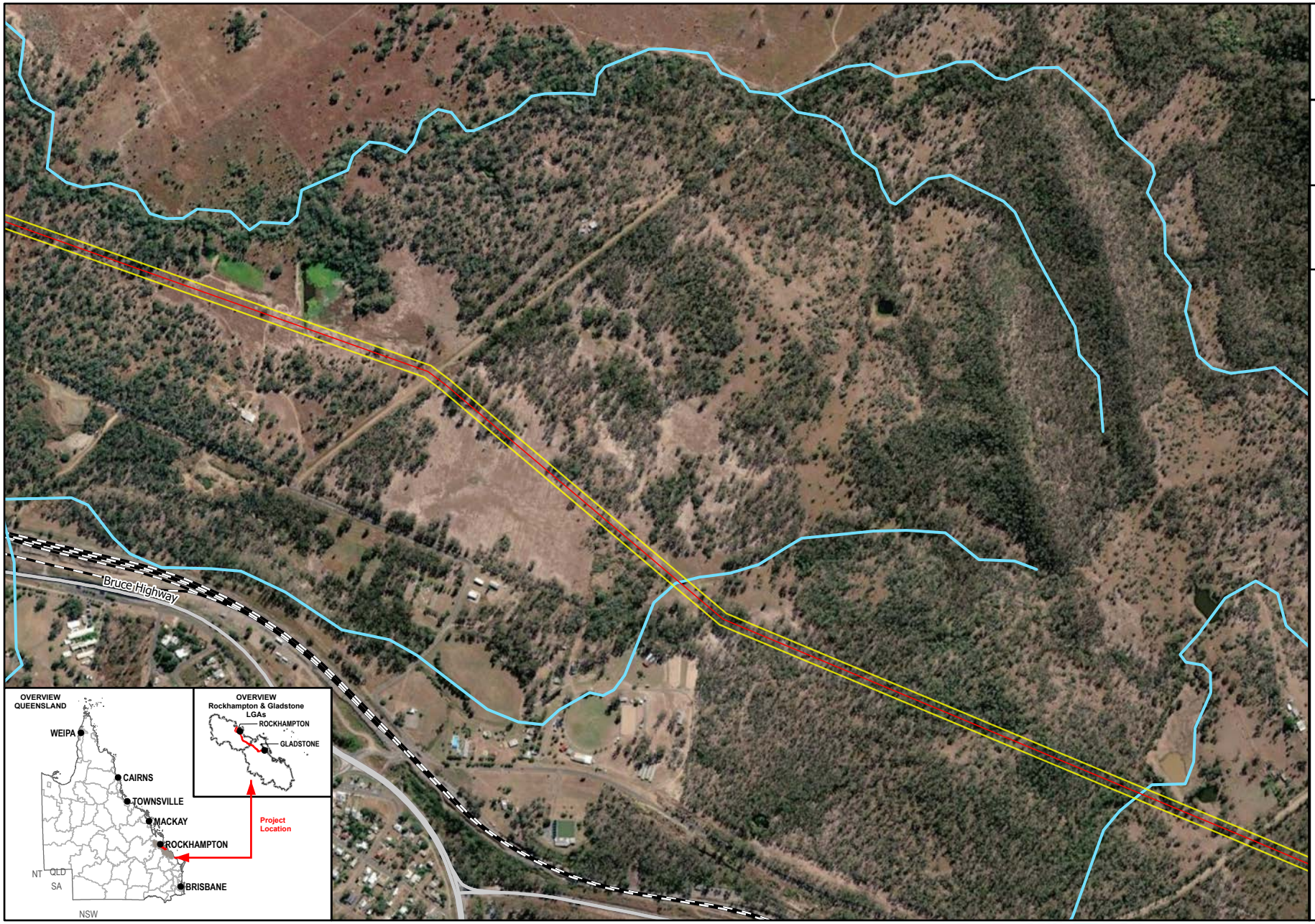
Significance of impact assessment

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

Table 7-24 Significance of impact on the grey snake

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

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



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Legend

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

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

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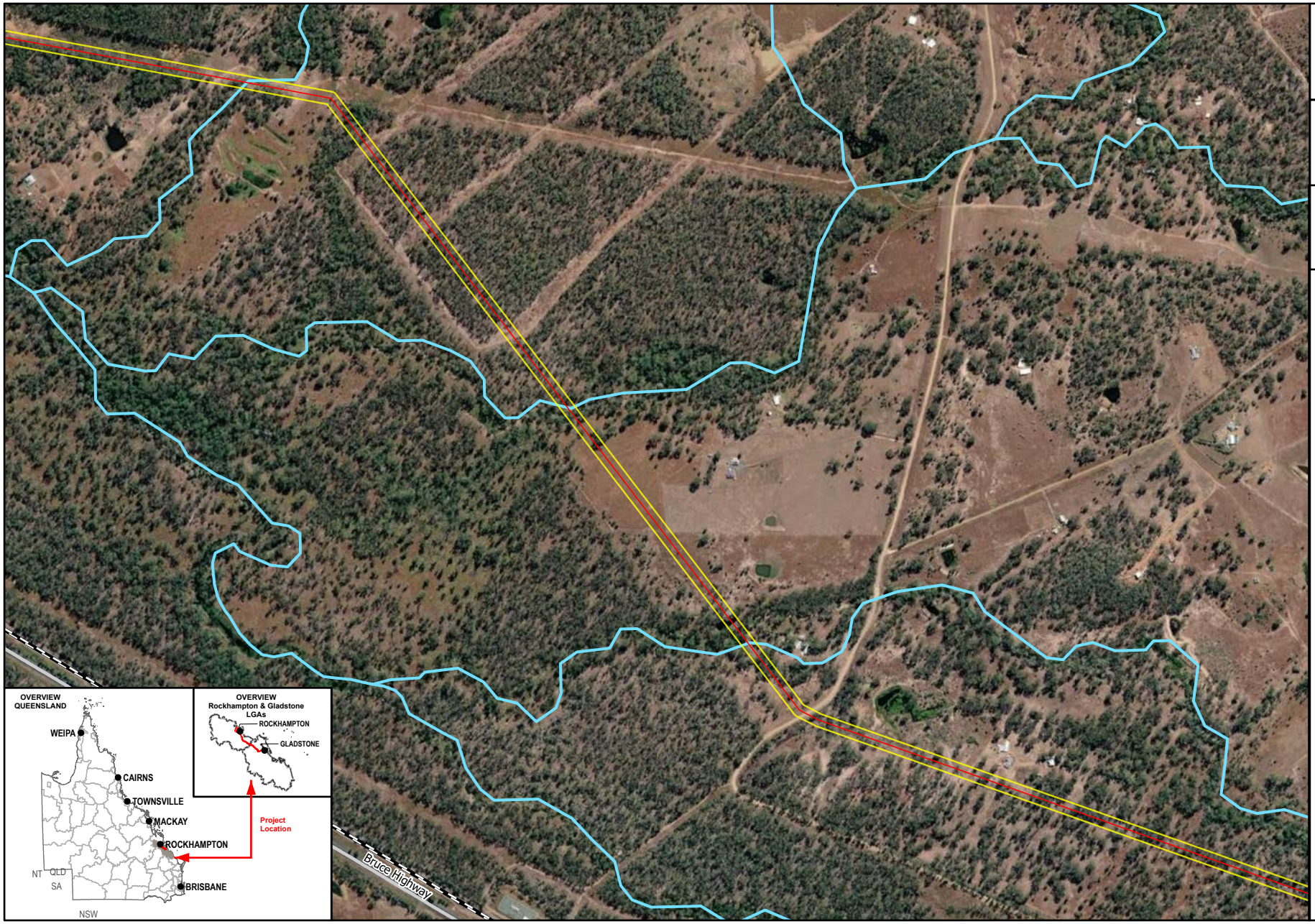
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-12a
Distribution of Grey Snake Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:3 Date:19/09/2022



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Legend

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

Data Sources:
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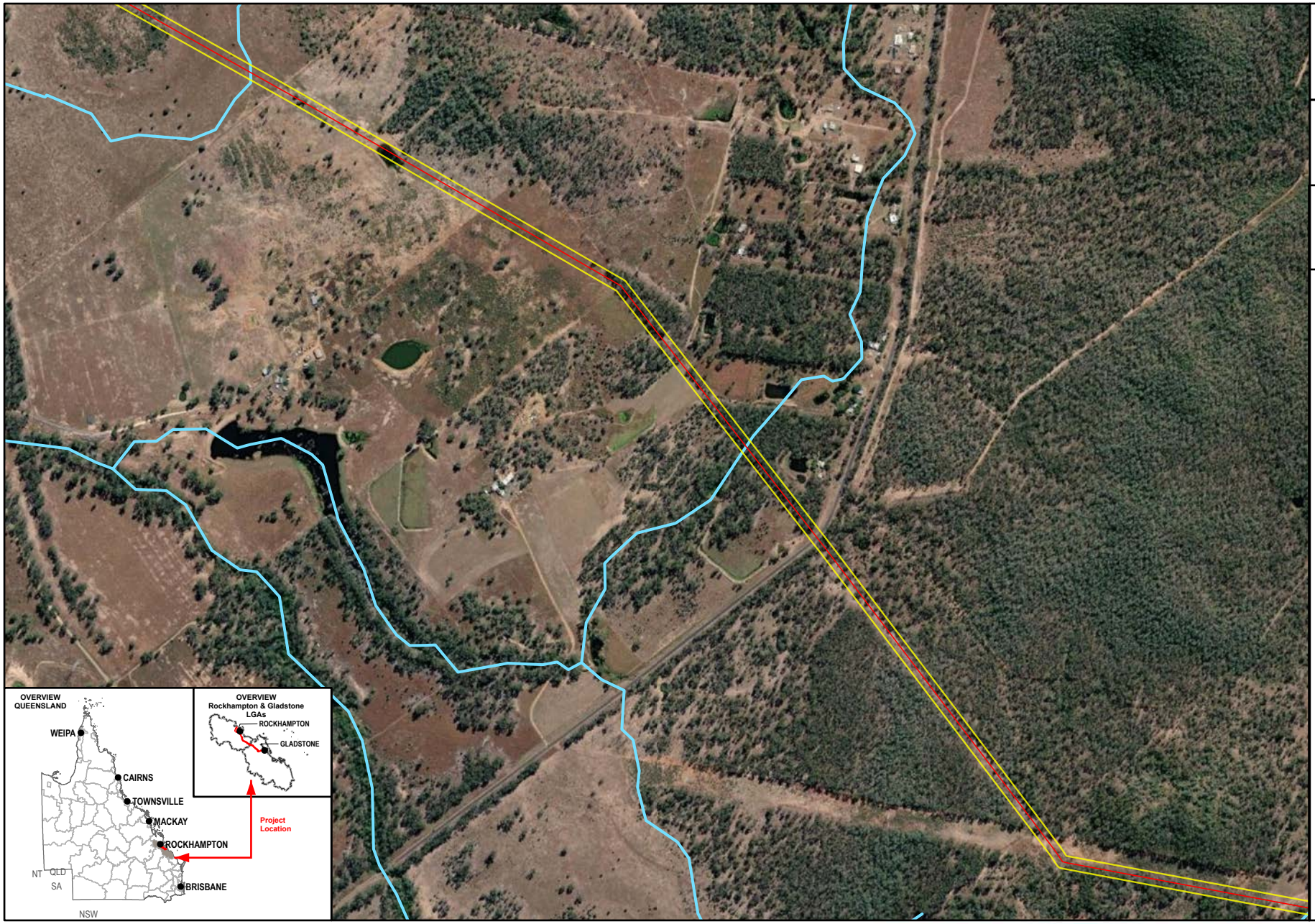
Figure 7-12b
Distribution of Grey Snake Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:3 Date:19/09/2022



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- SGIC SDA Pipeline Alignment
- Study Area
- Waterways

Data Sources:
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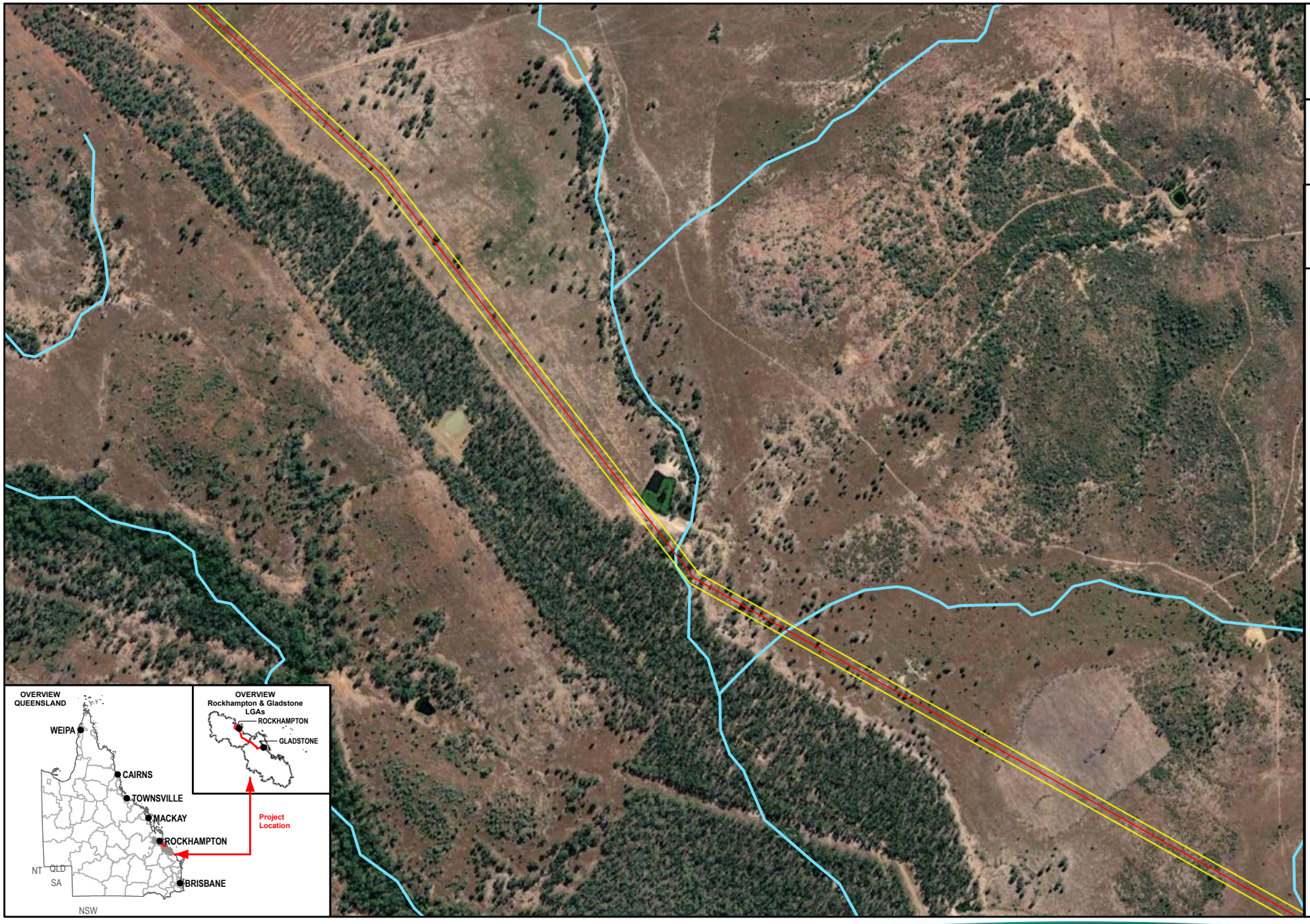
Figure 7-12c
Distribution of Grey Snake Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:3 Date:19/09/2022



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- SGIC SDA Pipeline Alignment
- Study Area
- Waterways

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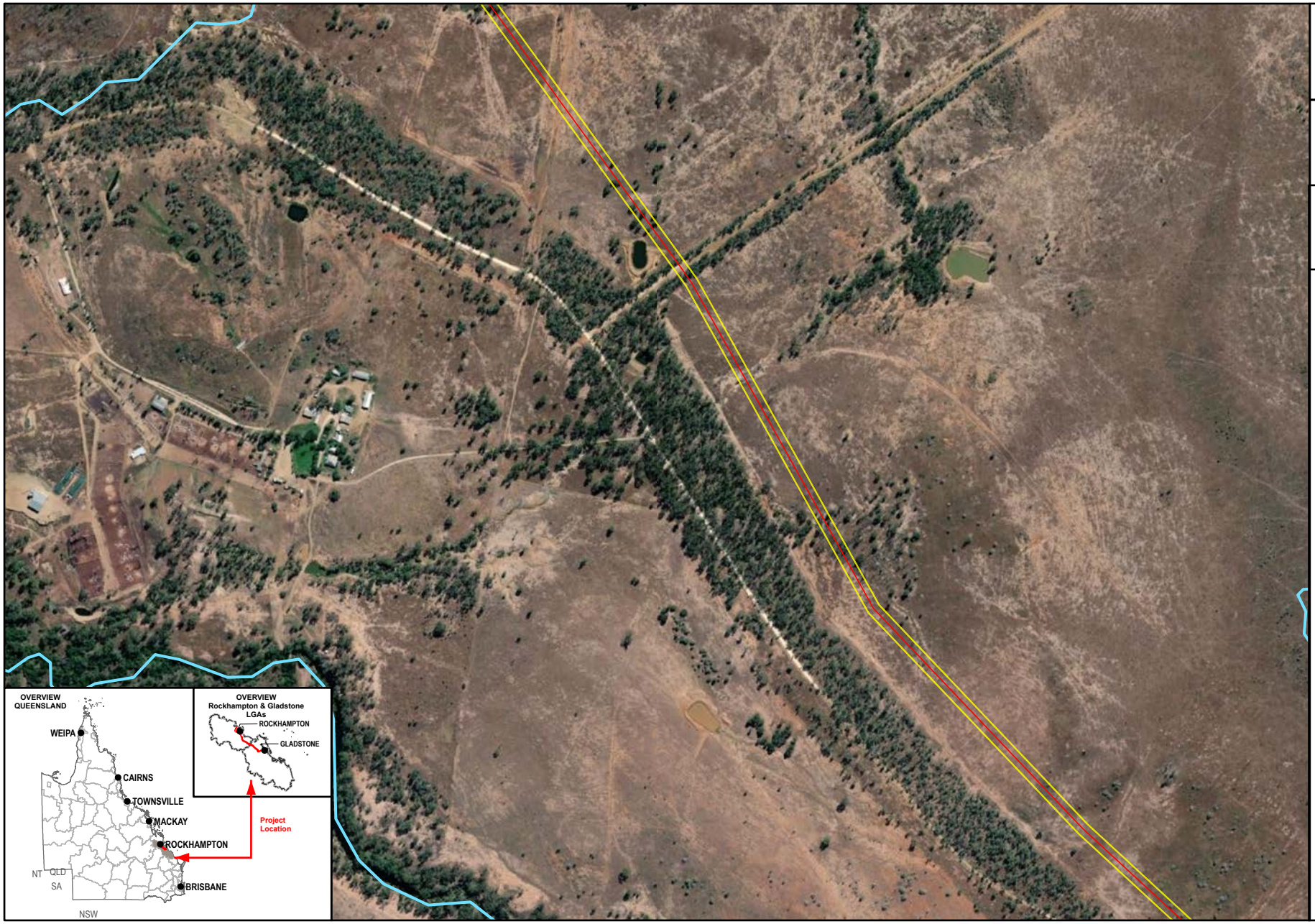
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-12d
Distribution of Grey Snake Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:3 Date:19/09/2022



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- SGIC SDA Pipeline Alignment
- Study Area
- Waterways

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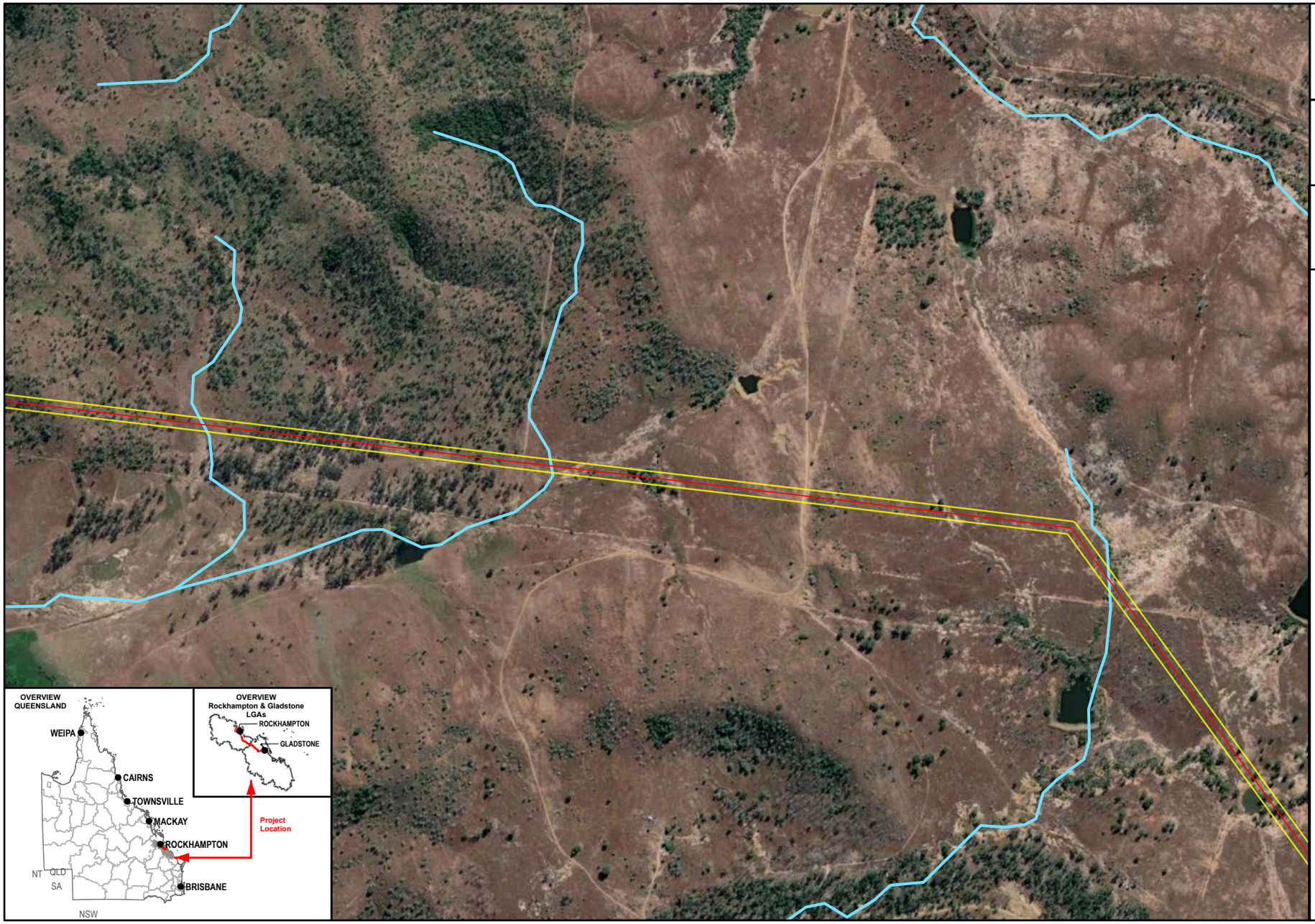
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-12e
Distribution of Grey Snake Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:3 Date:19/09/2022



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- SGIC SDA Pipeline Alignment
- Study Area
- Waterways

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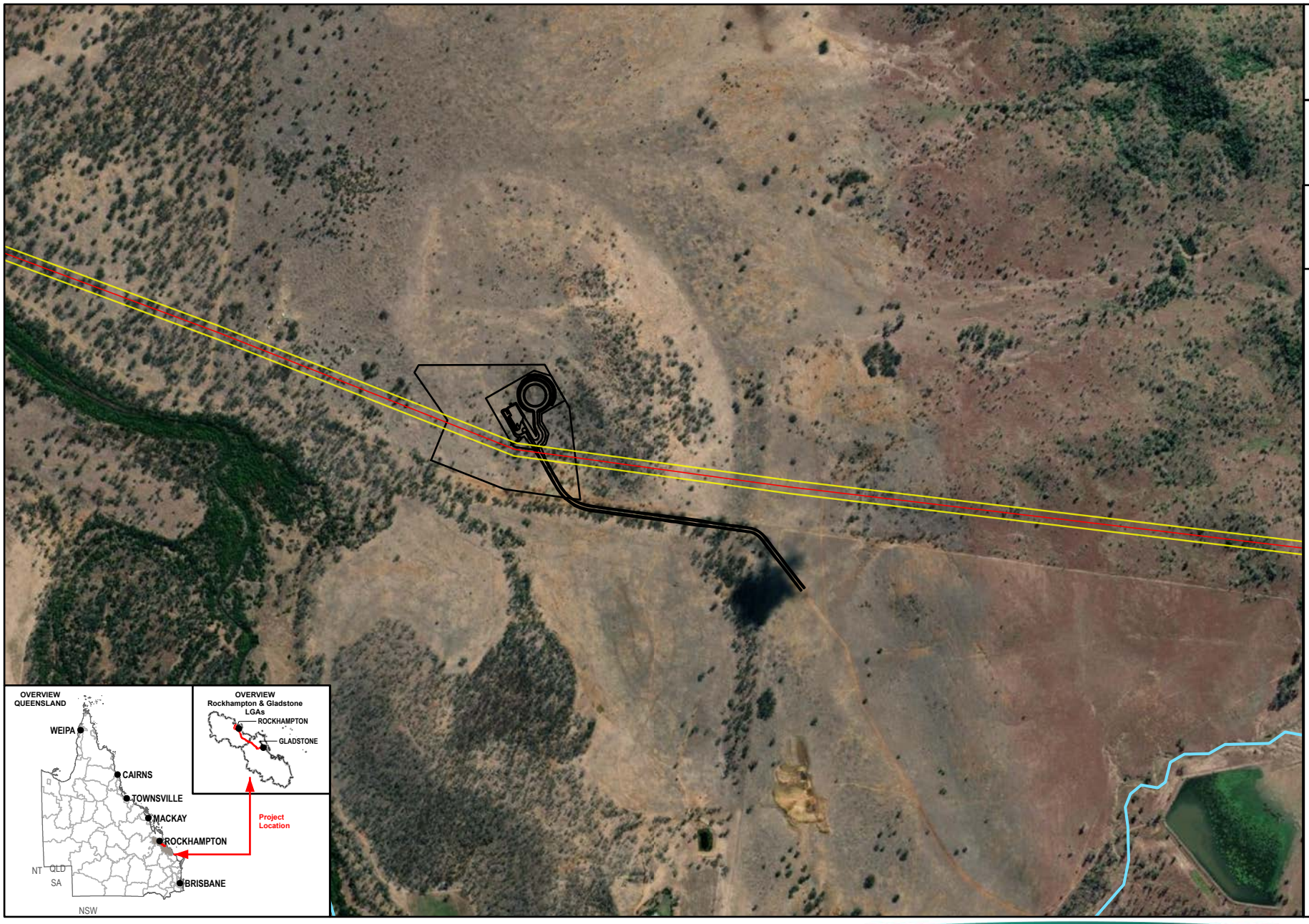
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-12f
Distribution of Grey Snake Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:3 Date:19/09/2022



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Legend

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

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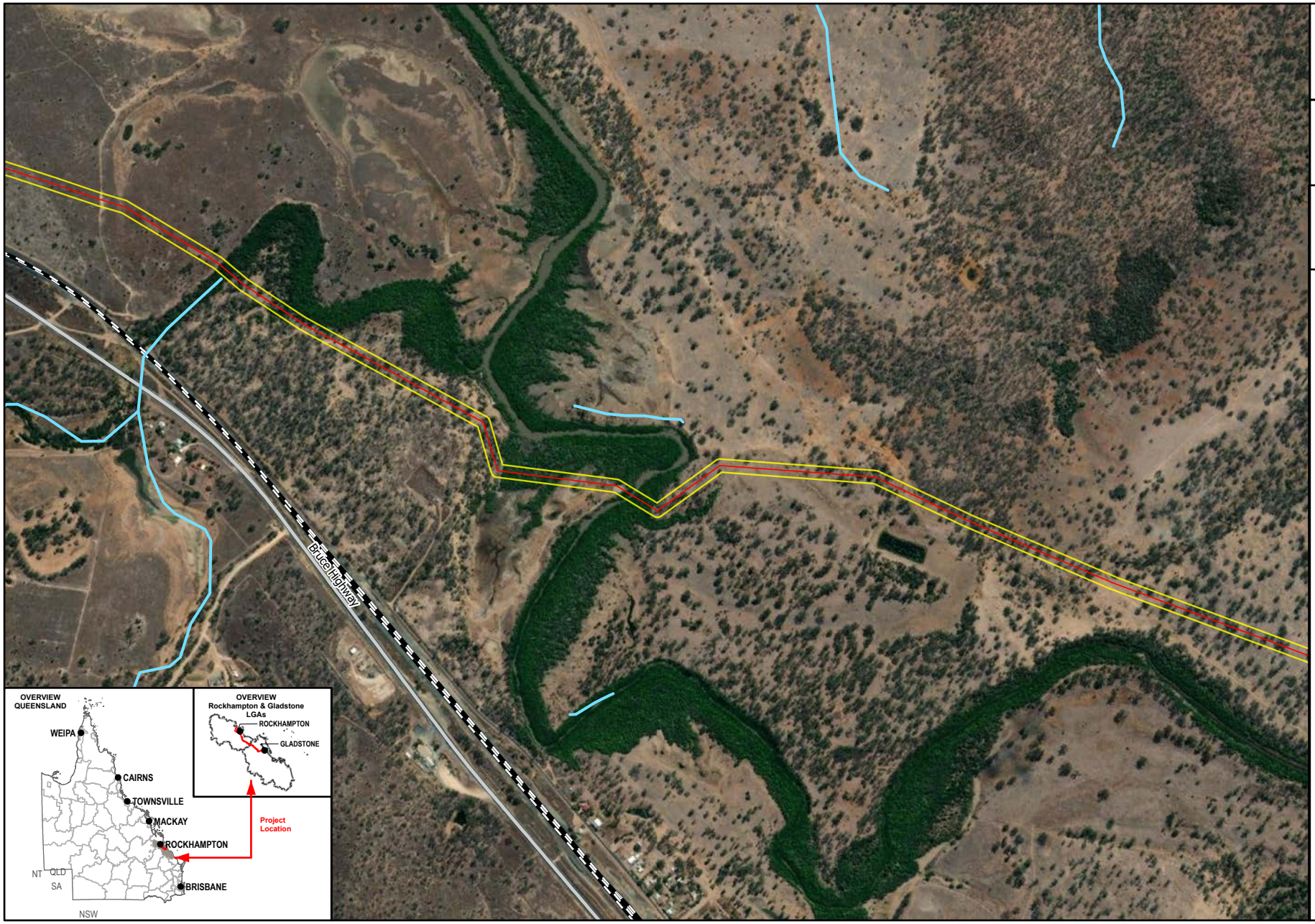
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-12g
Distribution of Grey Snake Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:3 Date:19/09/2022



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

Data Sources:
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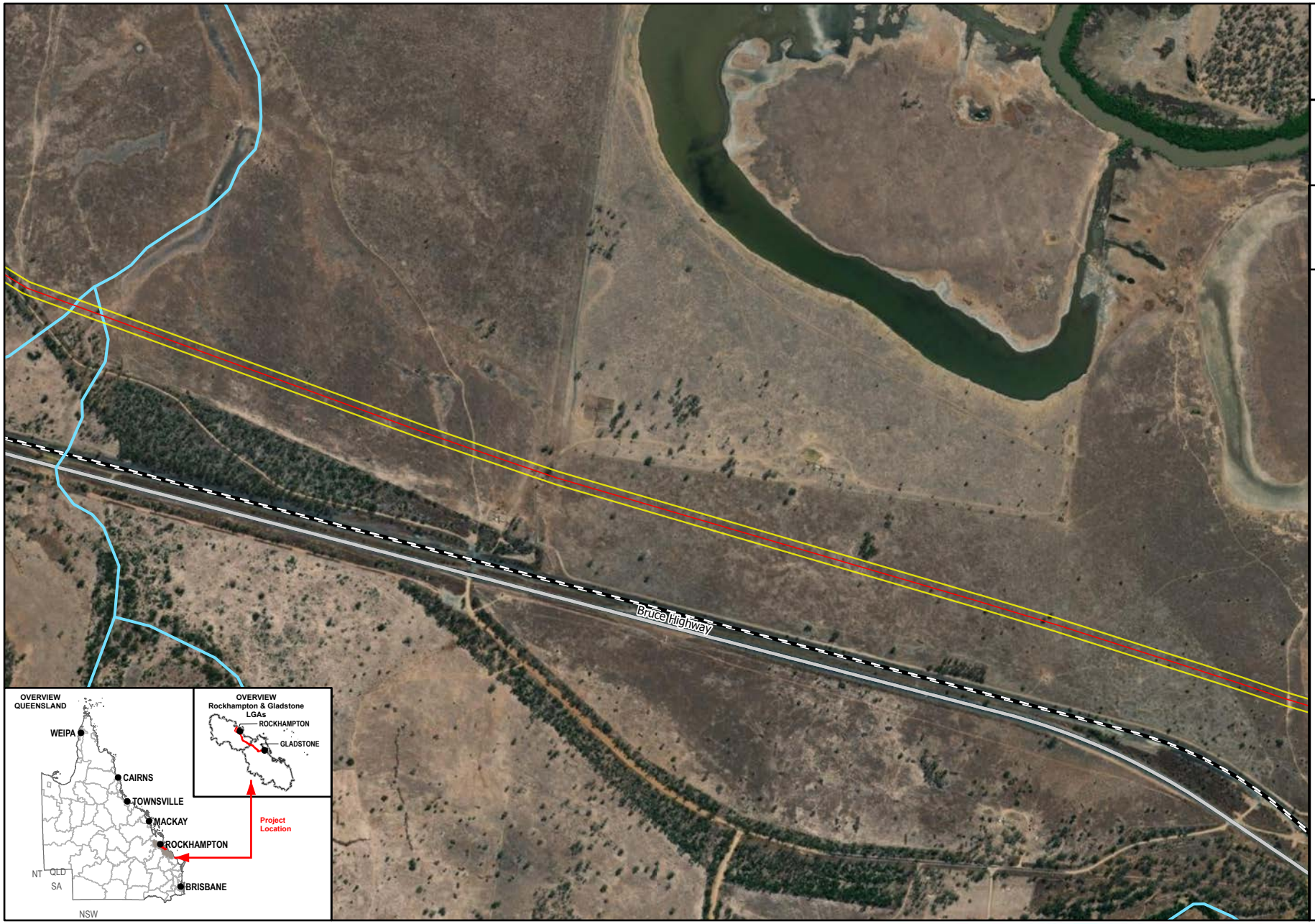
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-12h
Distribution of Grey Snake Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:3 Date:19/09/2022



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

Data Sources:
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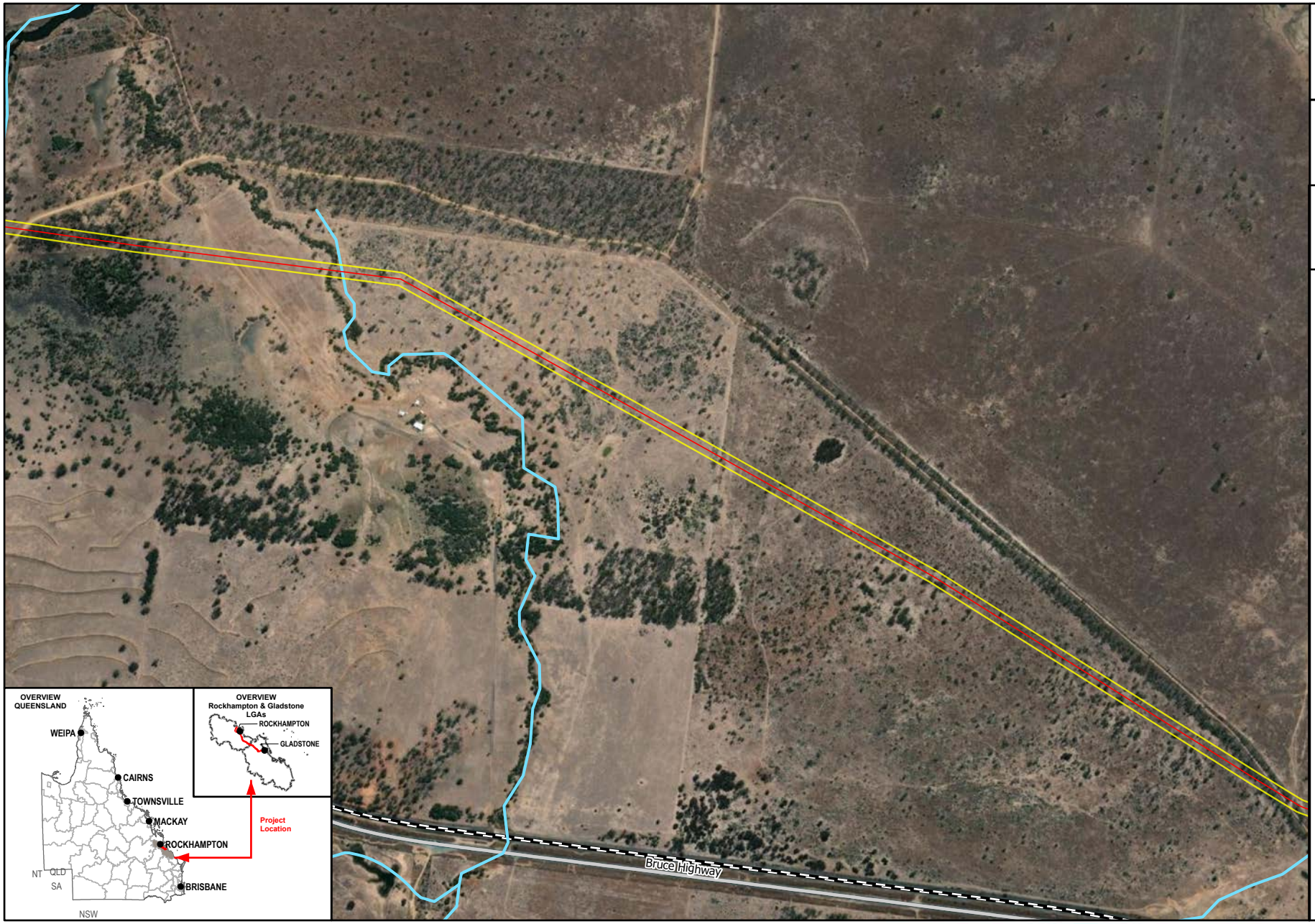
Figure 7-12i
Distribution of Grey Snake Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:3 Date:19/09/2022



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

Data Sources:
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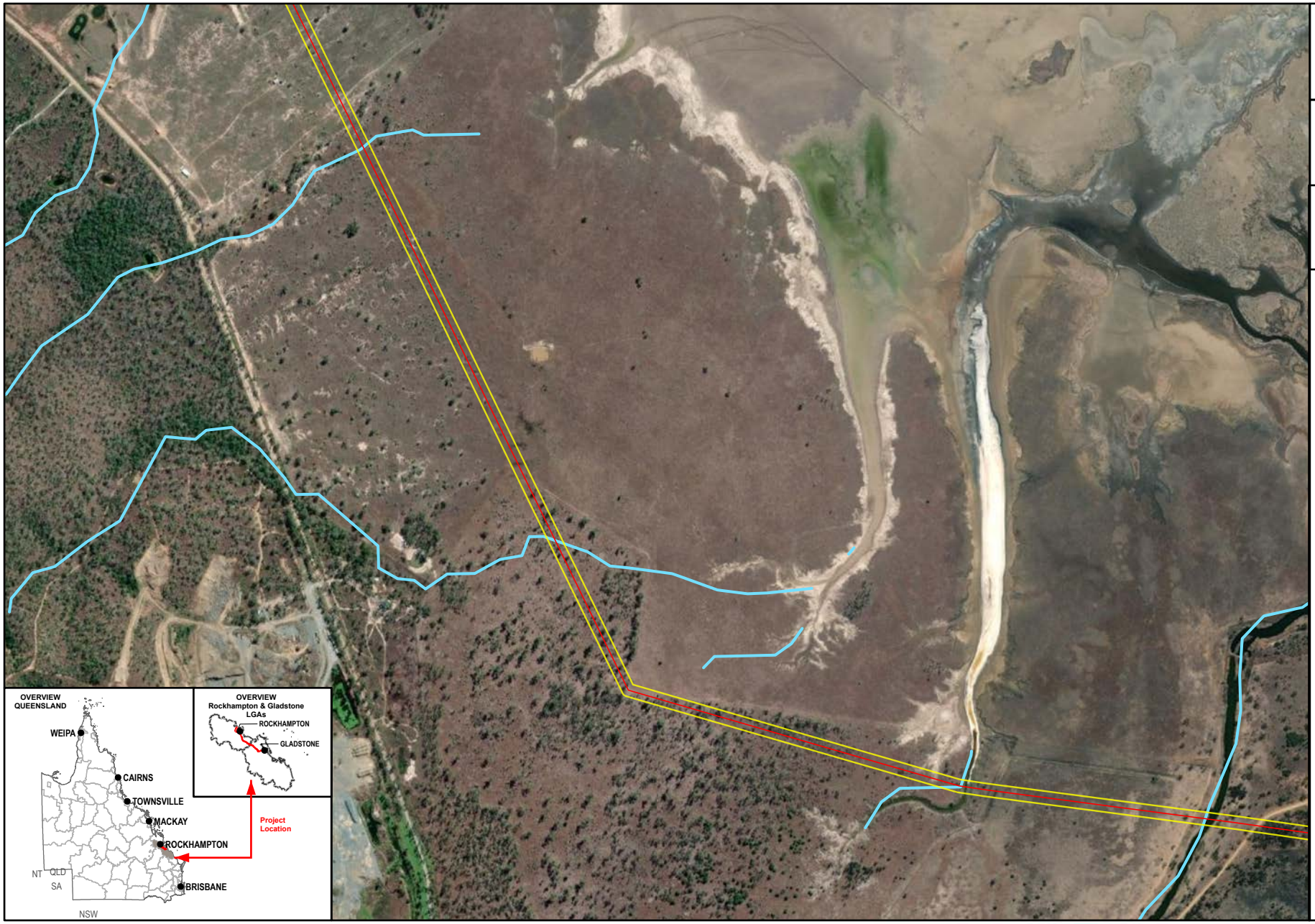
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-12j
Distribution of Grey Snake Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:3 Date:19/09/2022



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- SGIC SDA Pipeline Alignment
- Study Area
- Waterways

Data Sources:
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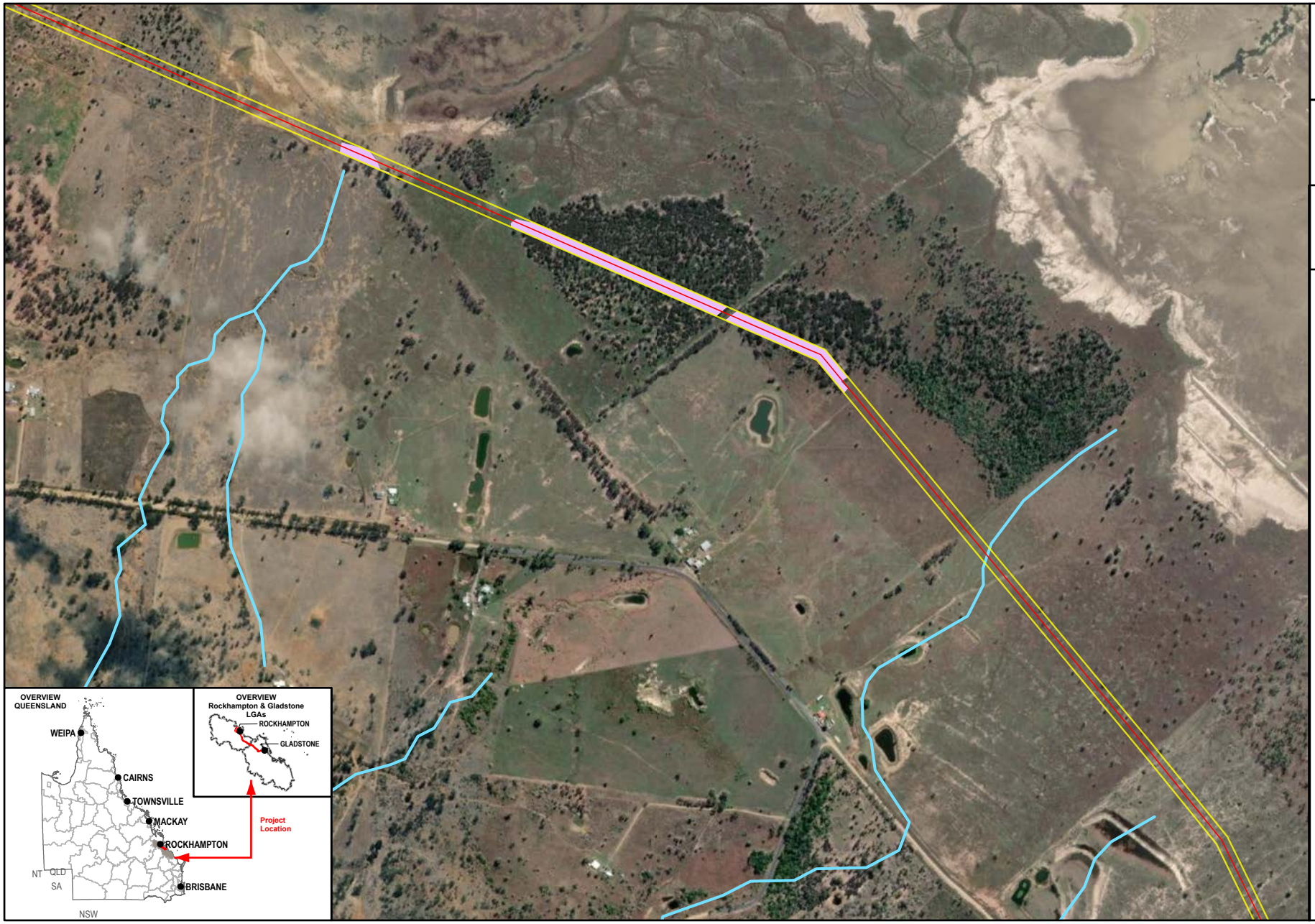
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-12k
Distribution of Grey Snake Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:3 Date:19/09/2022



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Legend

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

Data Sources:
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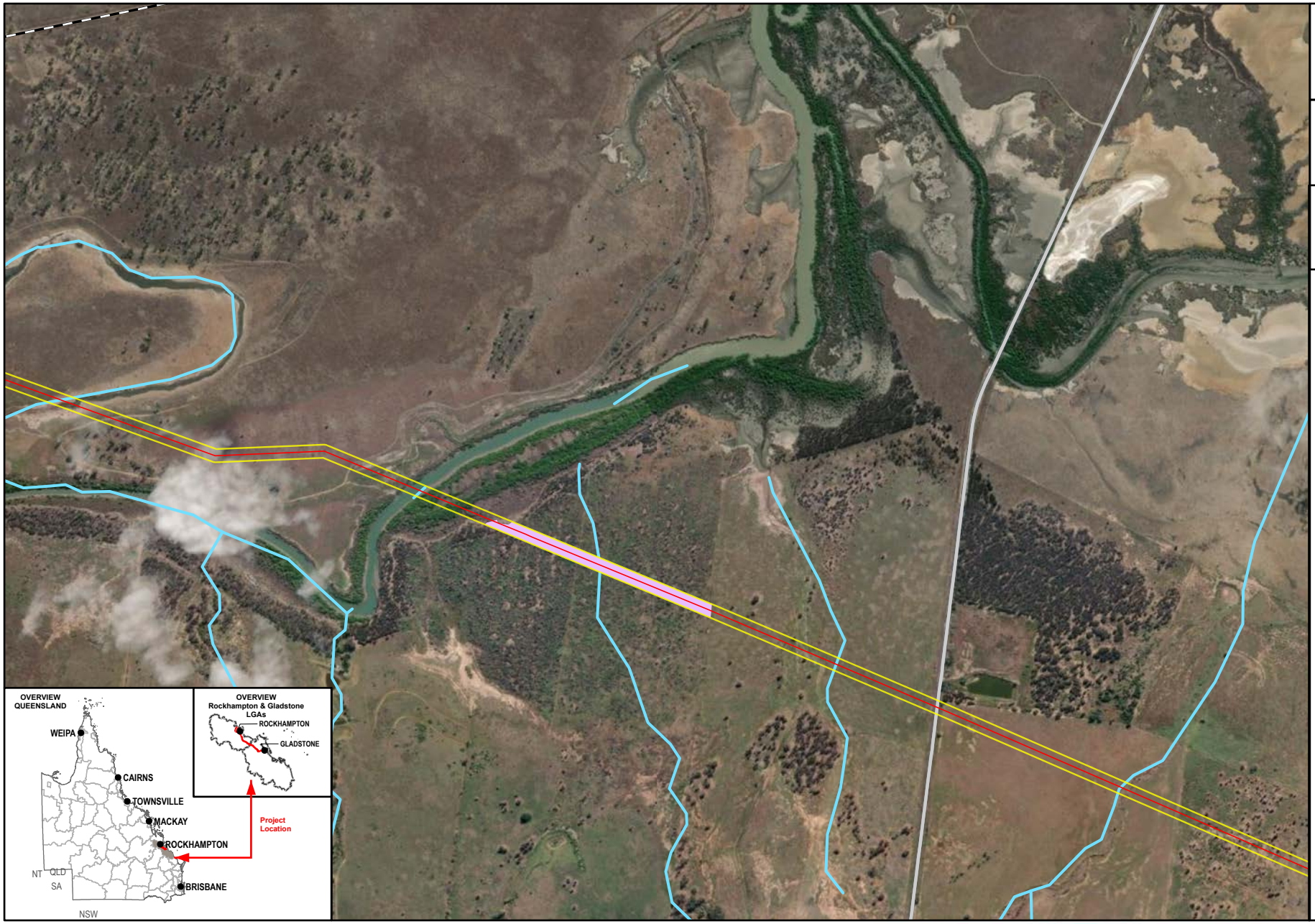
Figure 7-12l
Distribution of Grey Snake Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:3 Date:19/09/2022



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

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PROJECTION UTM Zone 56
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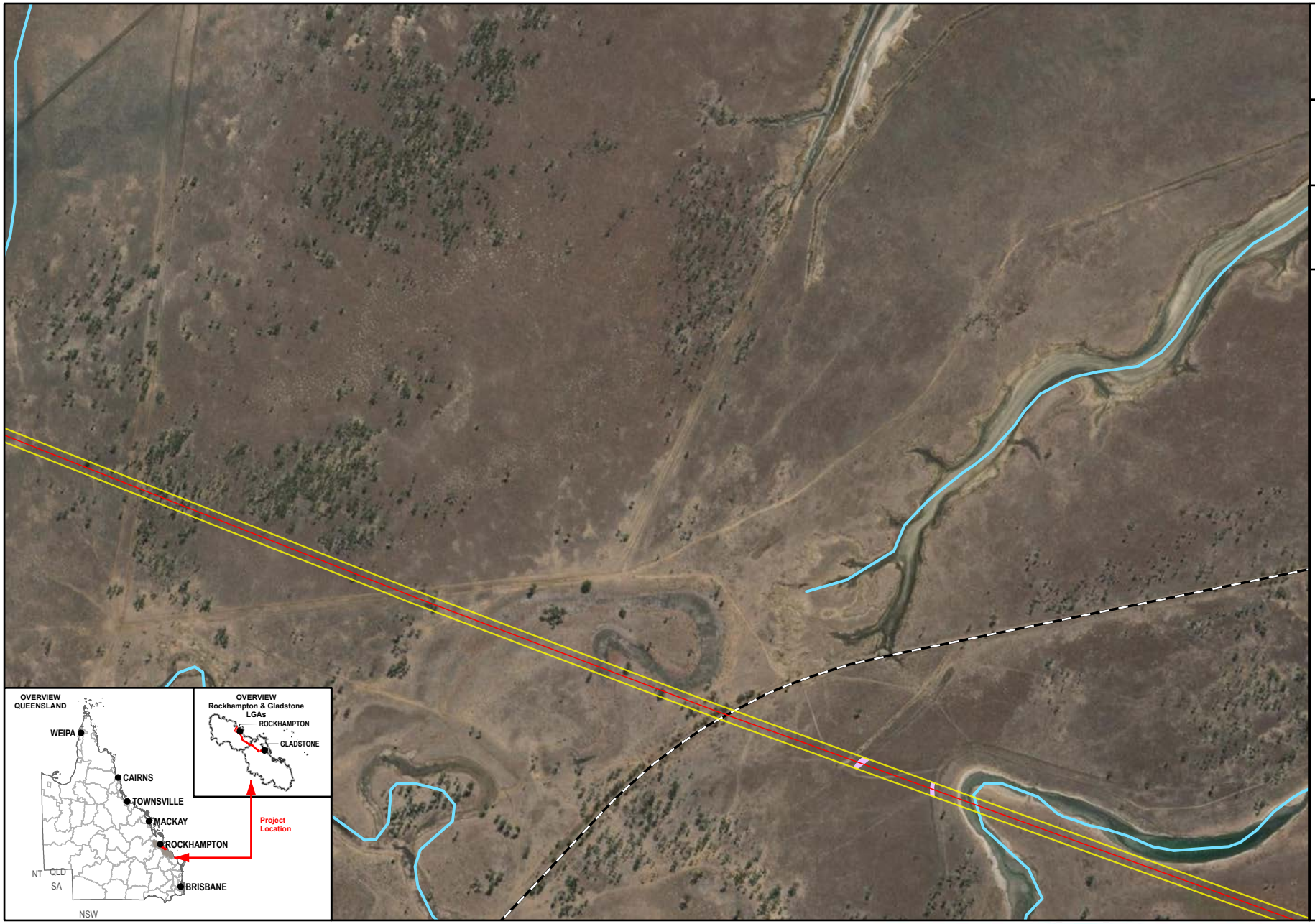
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-12m
Distribution of Grey Snake Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:3 Date:19/09/2022



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Legend

- SGIC SDA Pipeline Alignment
- Study Area
- Predicted Grey Snake Habitat
- Waterways
- 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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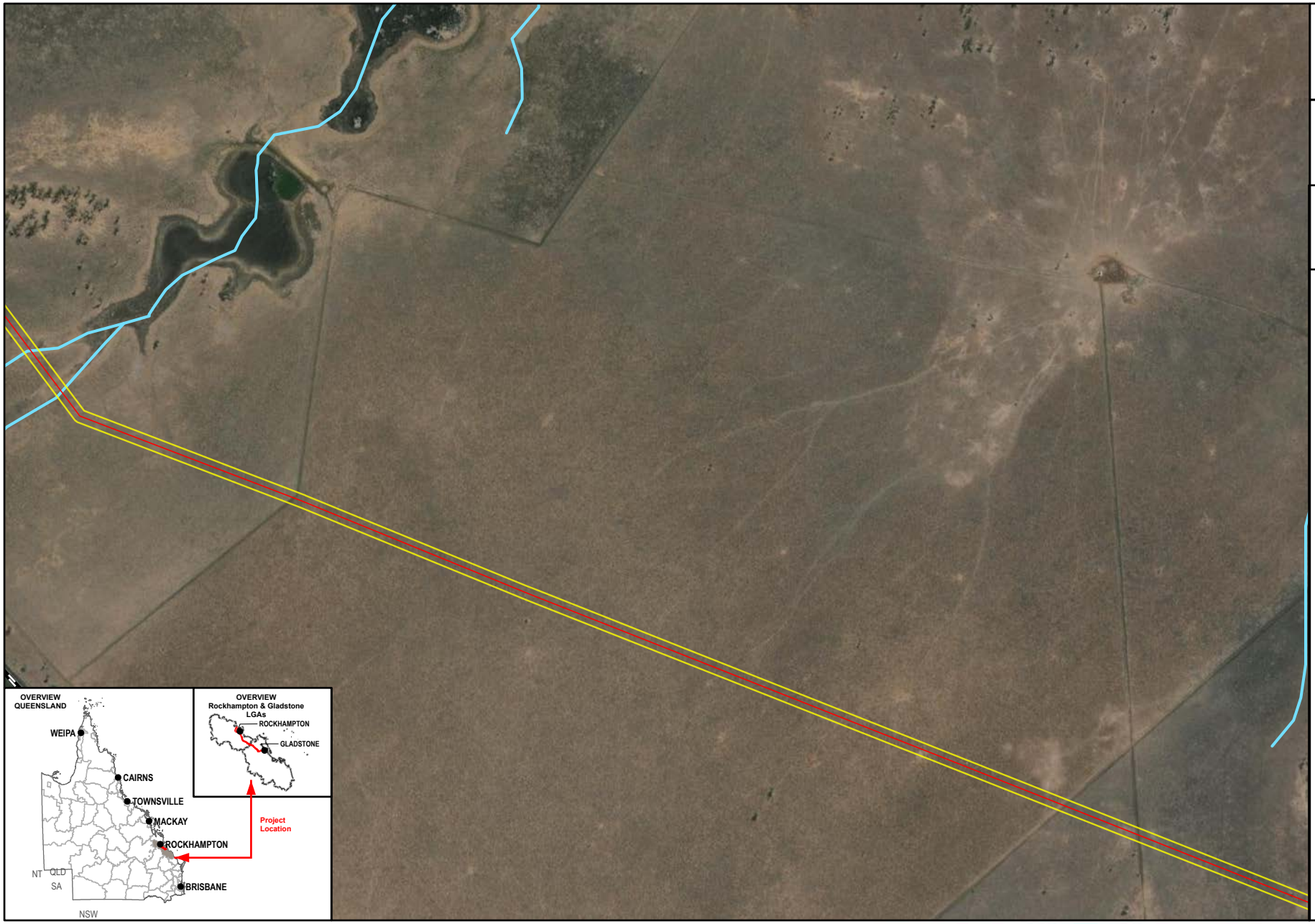
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-12n
Distribution of Grey Snake Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:3 Date:19/09/2022



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Legend

- SGIC SDA Pipeline Alignment
- Study Area
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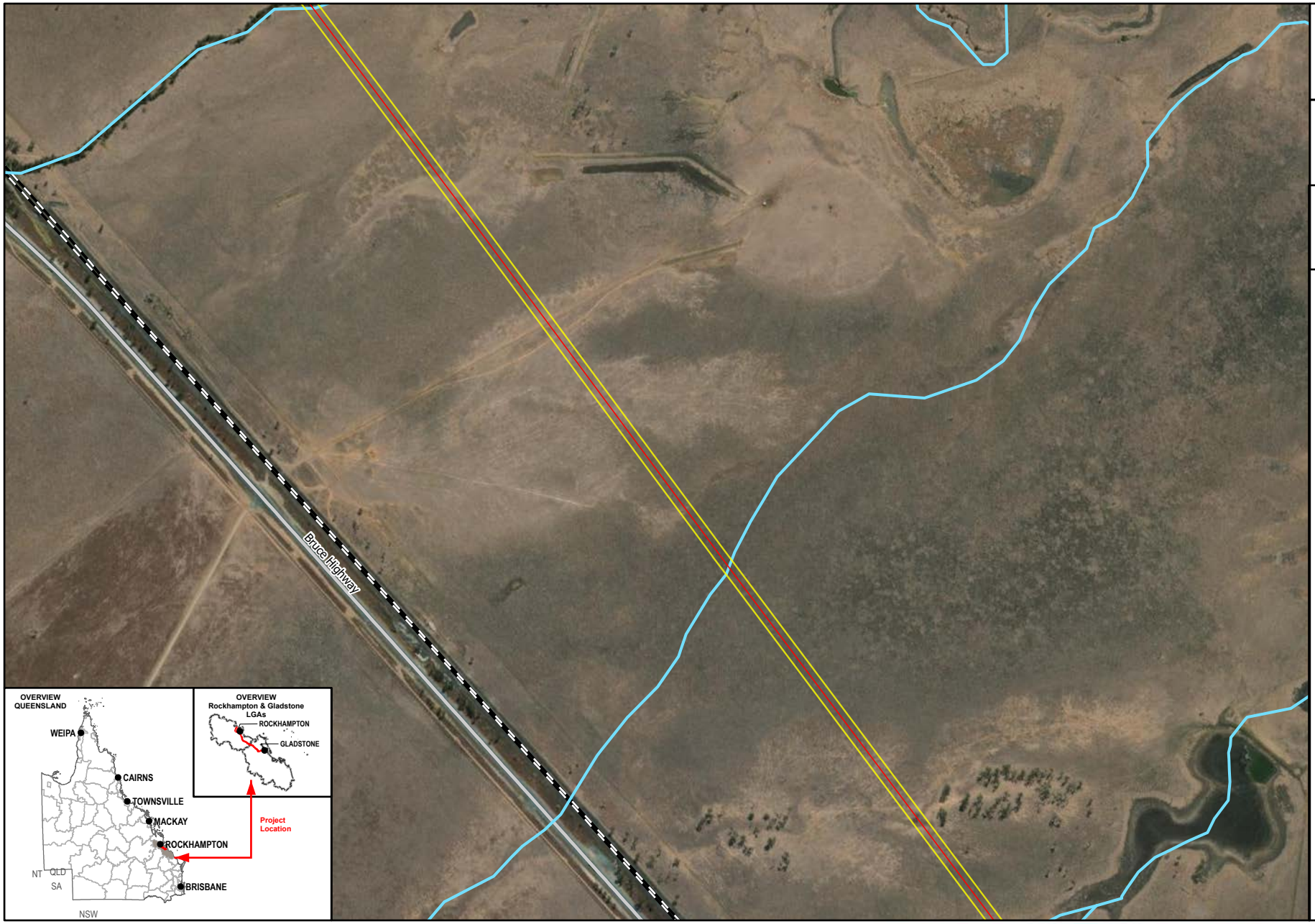
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-12o
Distribution of Grey Snake Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:3 Date:19/09/2022



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Legend

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

Data Sources:
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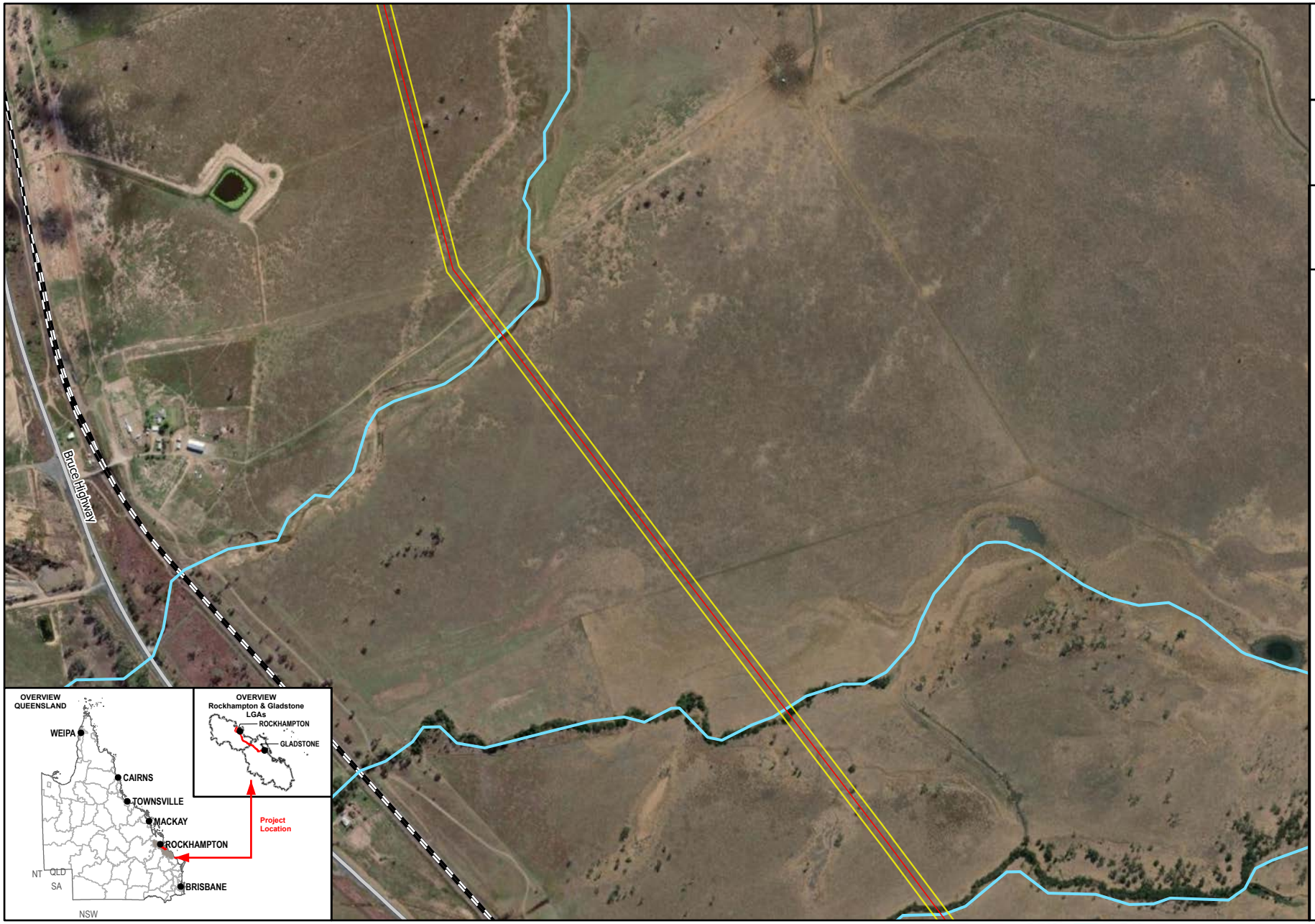
Figure 7-12p
Distribution of Grey Snake Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:3 Date:19/09/2022



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Legend

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

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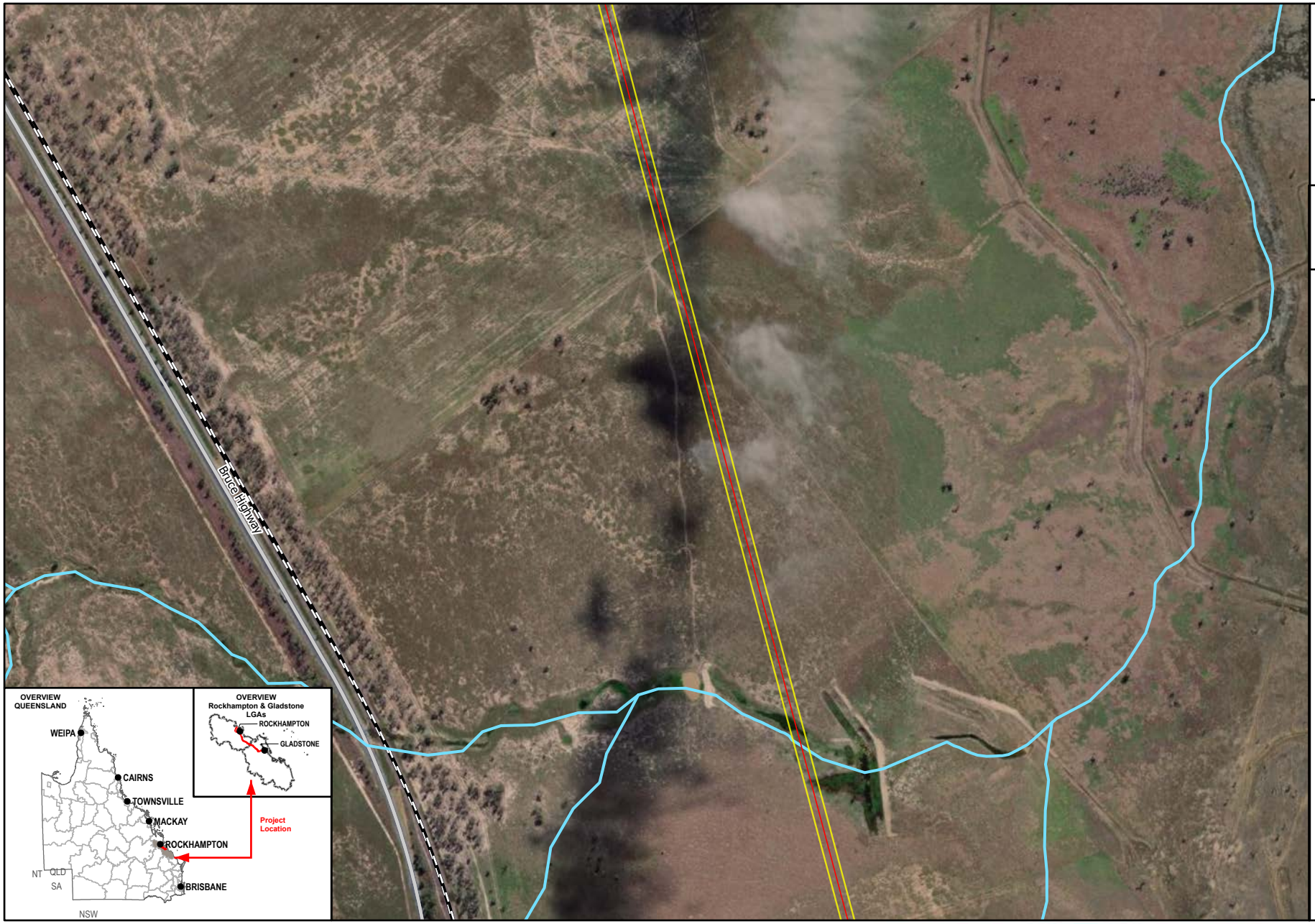
Figure 7-12q
Distribution of Grey Snake Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:3 Date:19/09/2022



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

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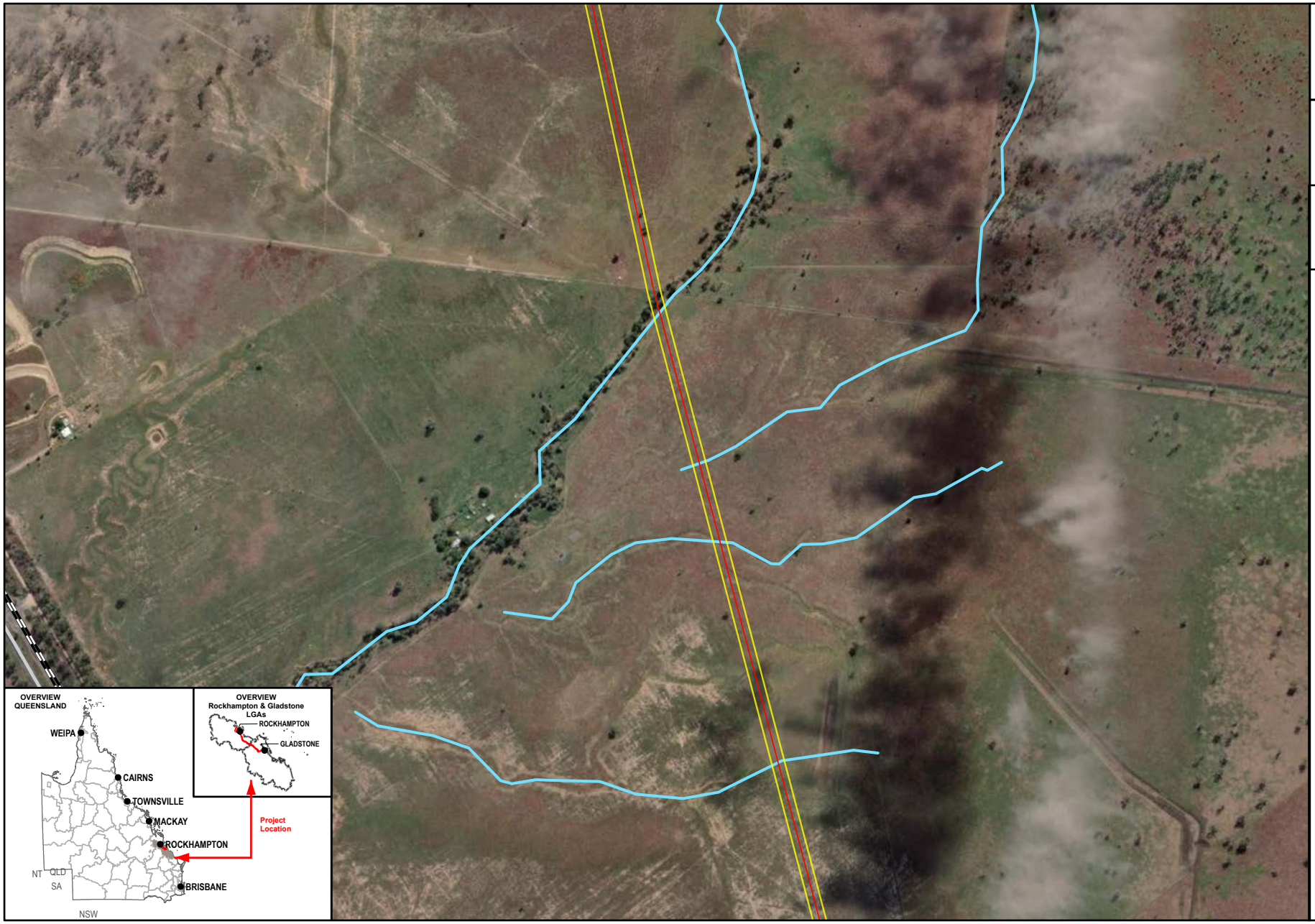
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-12r
Distribution of Grey Snake Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:3 Date:19/09/2022



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- SGIC SDA Pipeline Alignment
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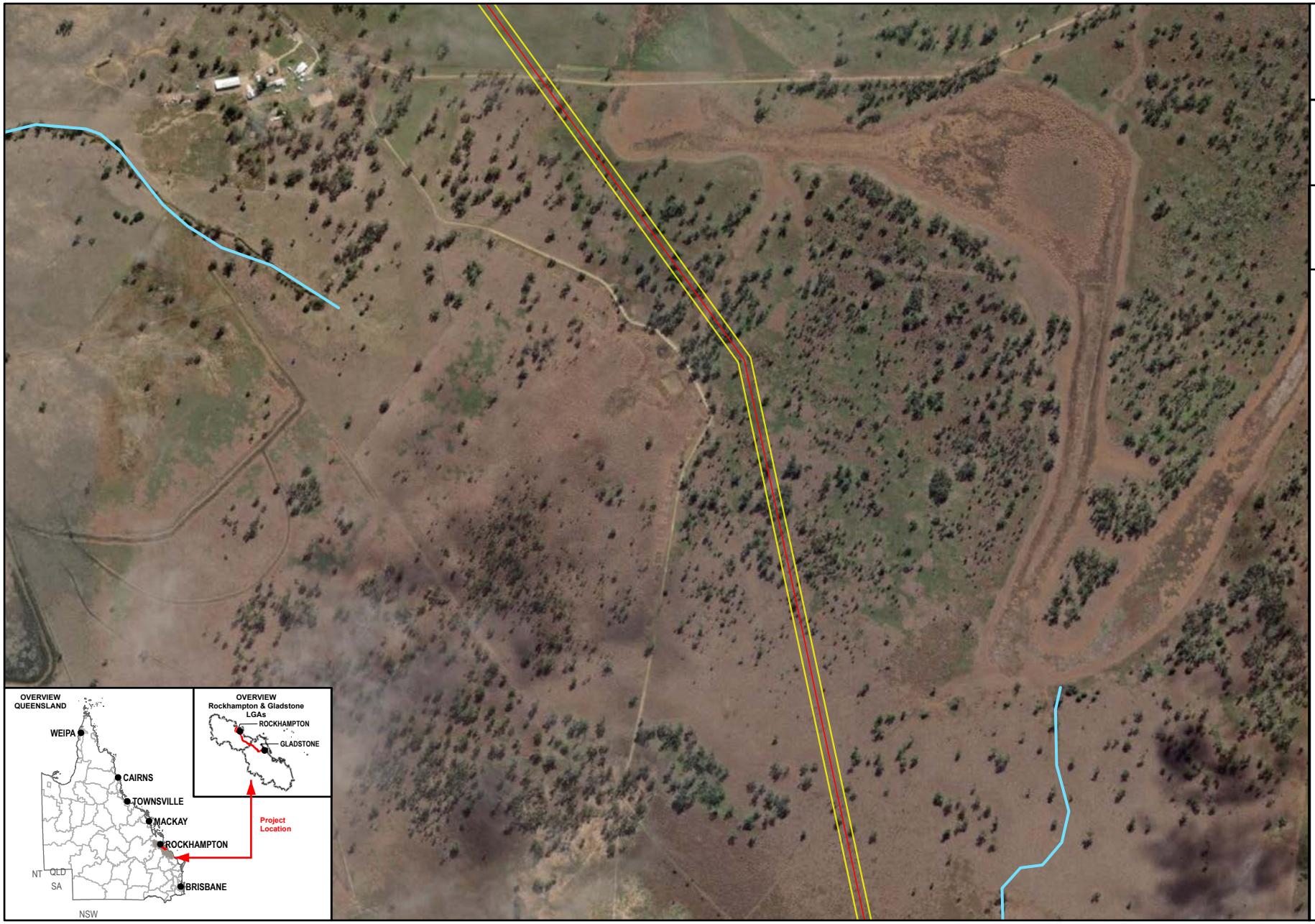

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Figure 7-12t
Distribution of Grey Snake Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:3 Date:19/09/2022

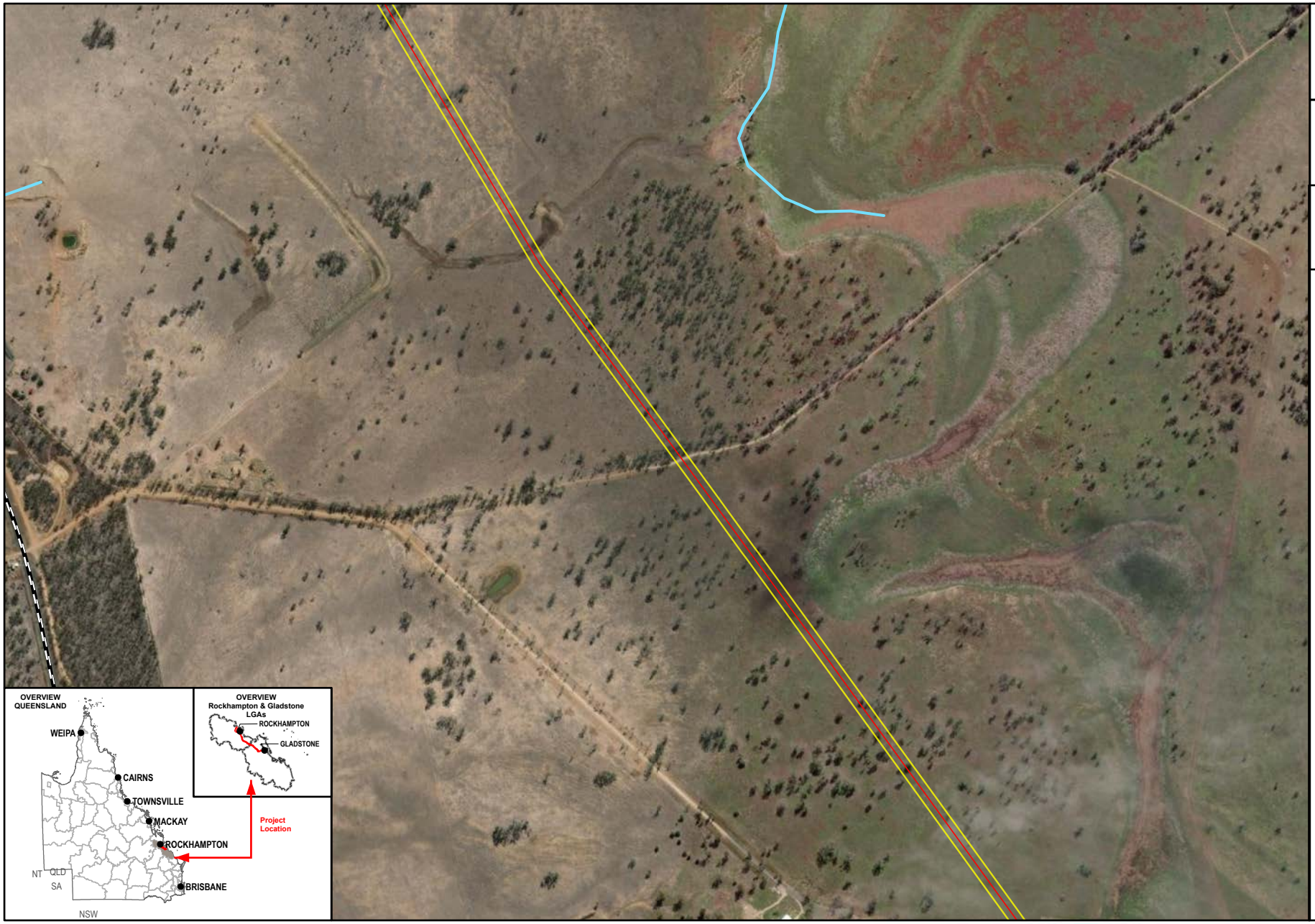

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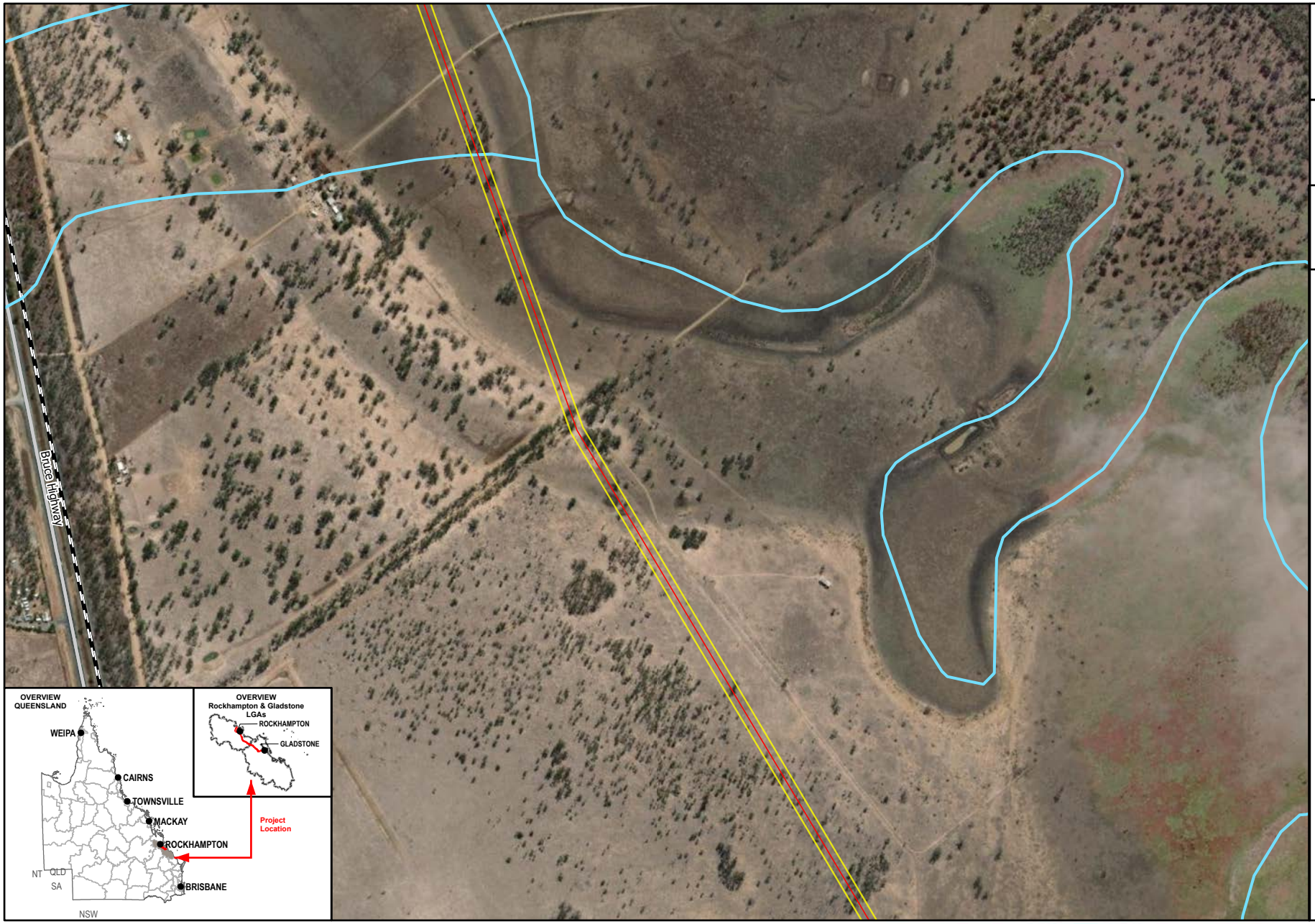
Figure 7-12u
Distribution of Grey Snake Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:3 Date:19/09/2022



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- SGIC SDA Pipeline Alignment
- Study Area
- Waterways
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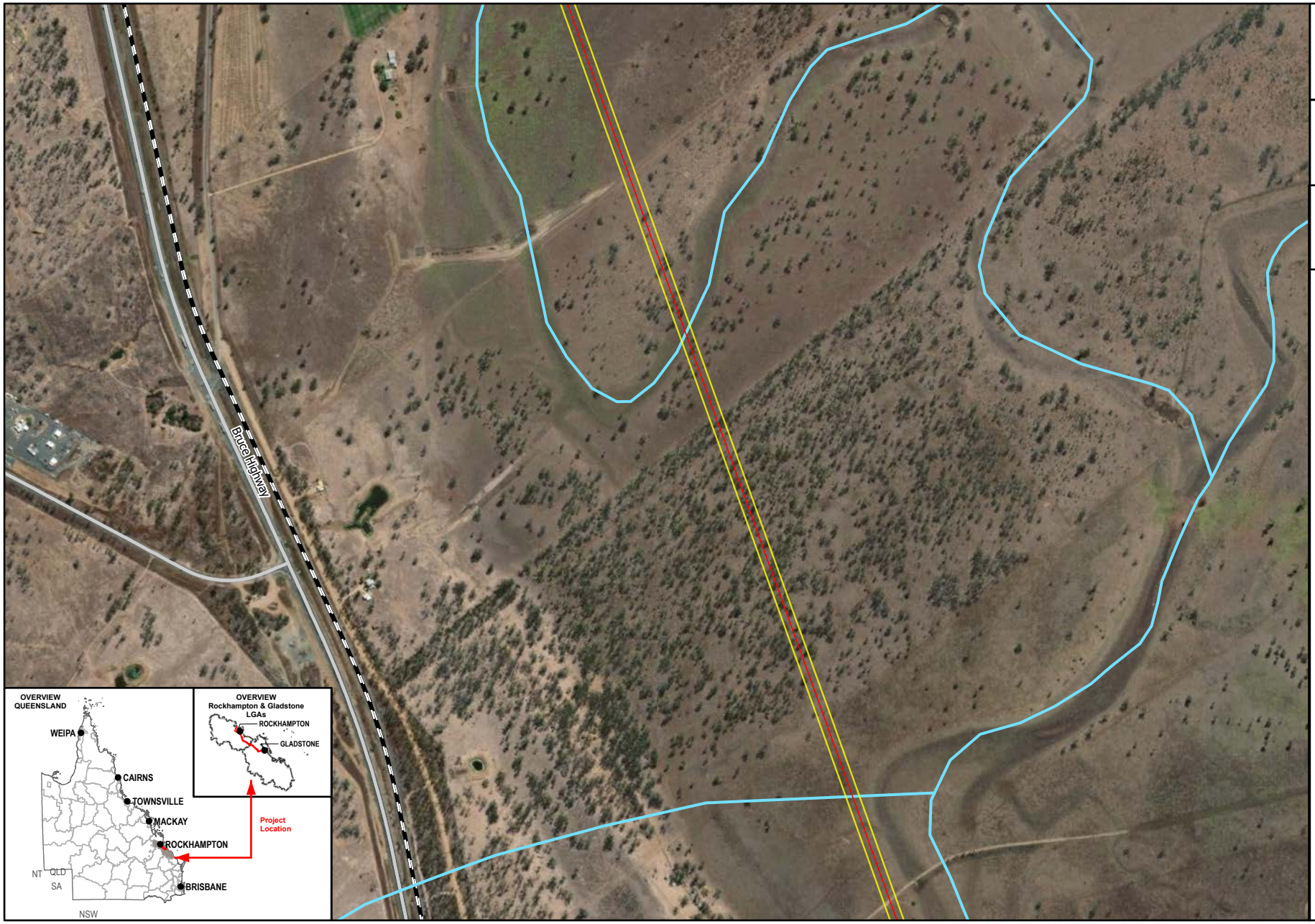
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-12v
Distribution of Grey Snake Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:3 Date:19/09/2022



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- SGIC SDA Pipeline Alignment
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Figure 7-12w
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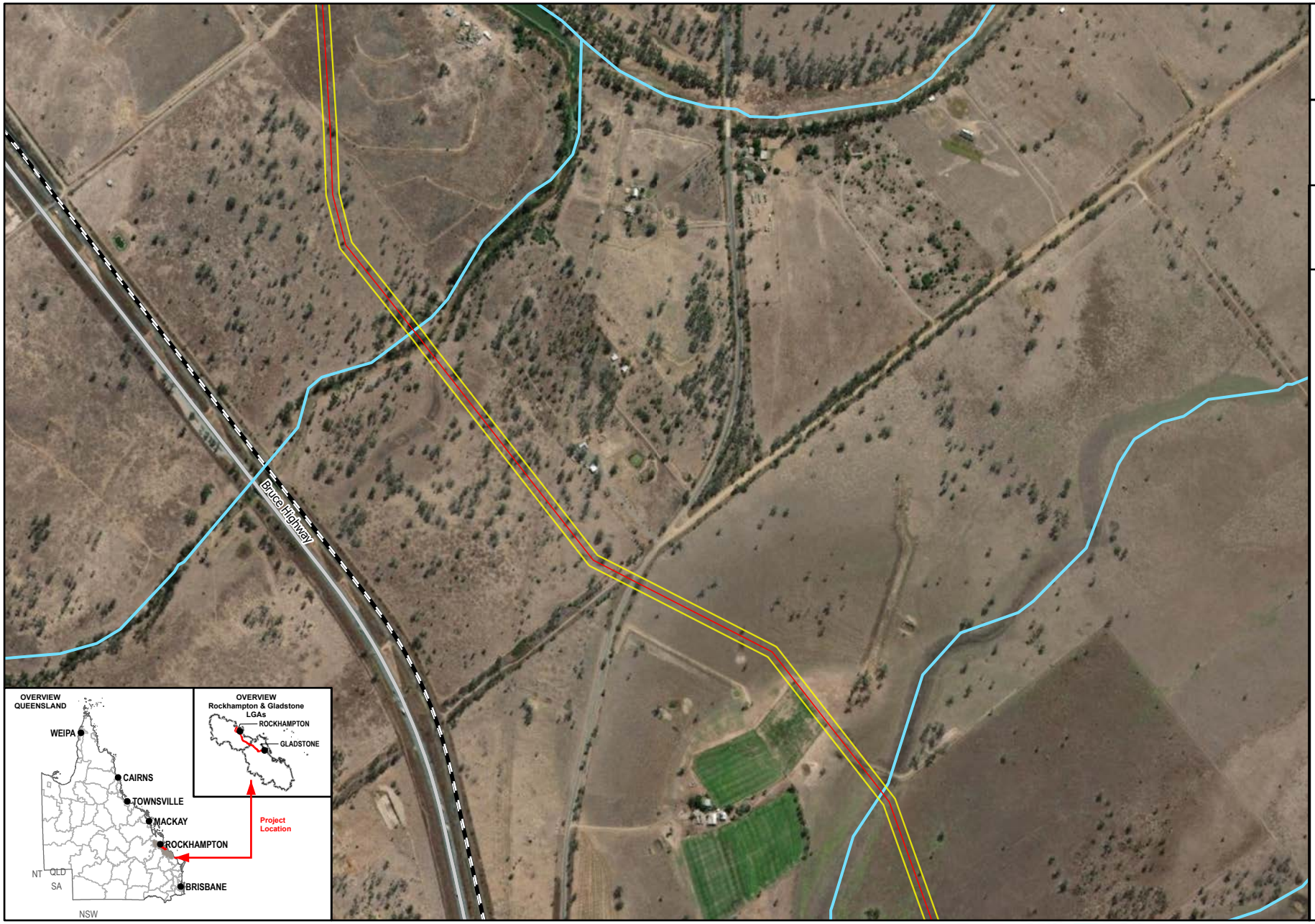

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Figure 7-12x
Distribution of Grey Snake Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:3 Date:19/09/2022

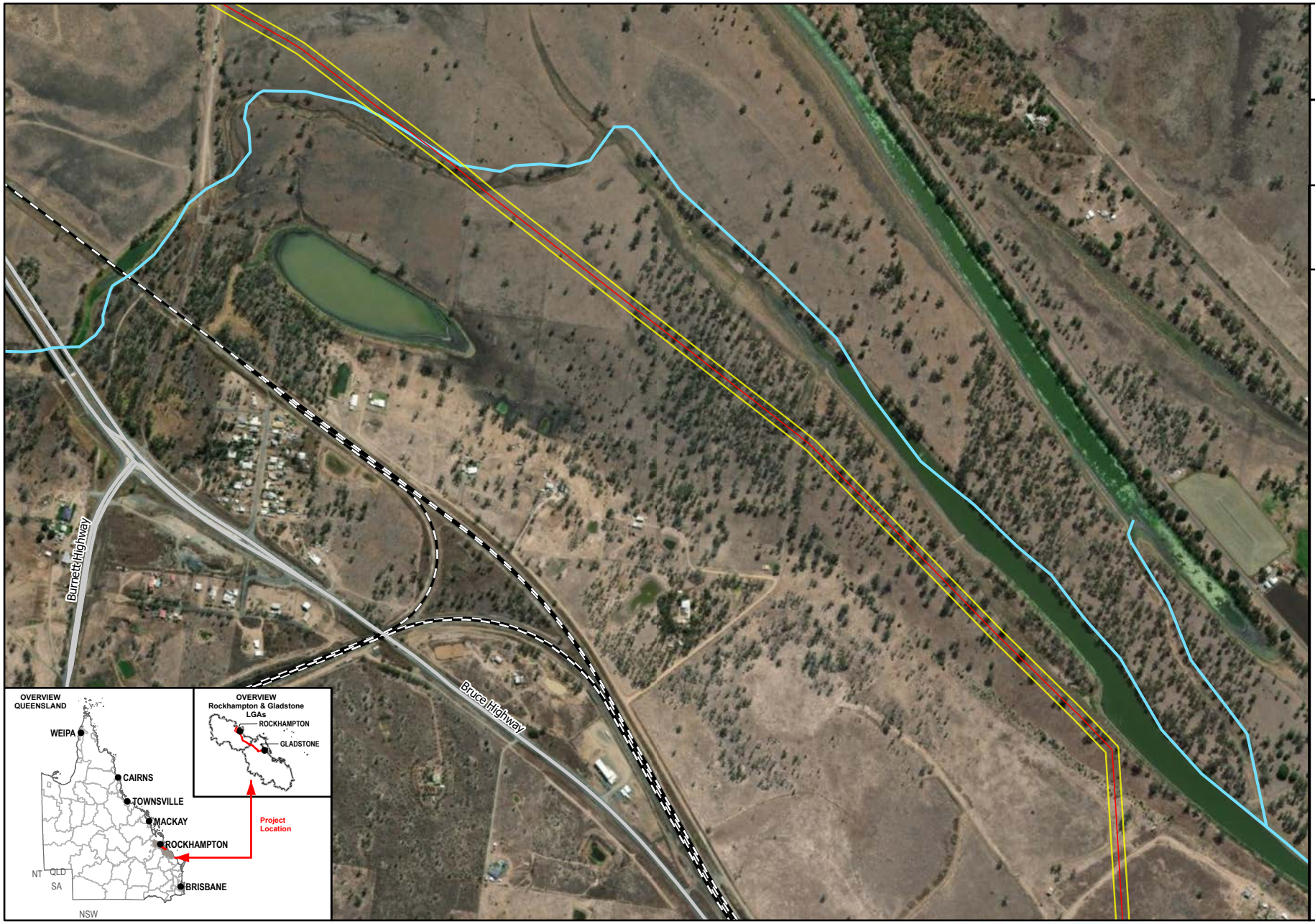

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Figure 7-12y
Distribution of Grey Snake Habitat Within the SGIC SDA Study Area
000-G-MAP-2433 Version:3 Date:19/09/2022

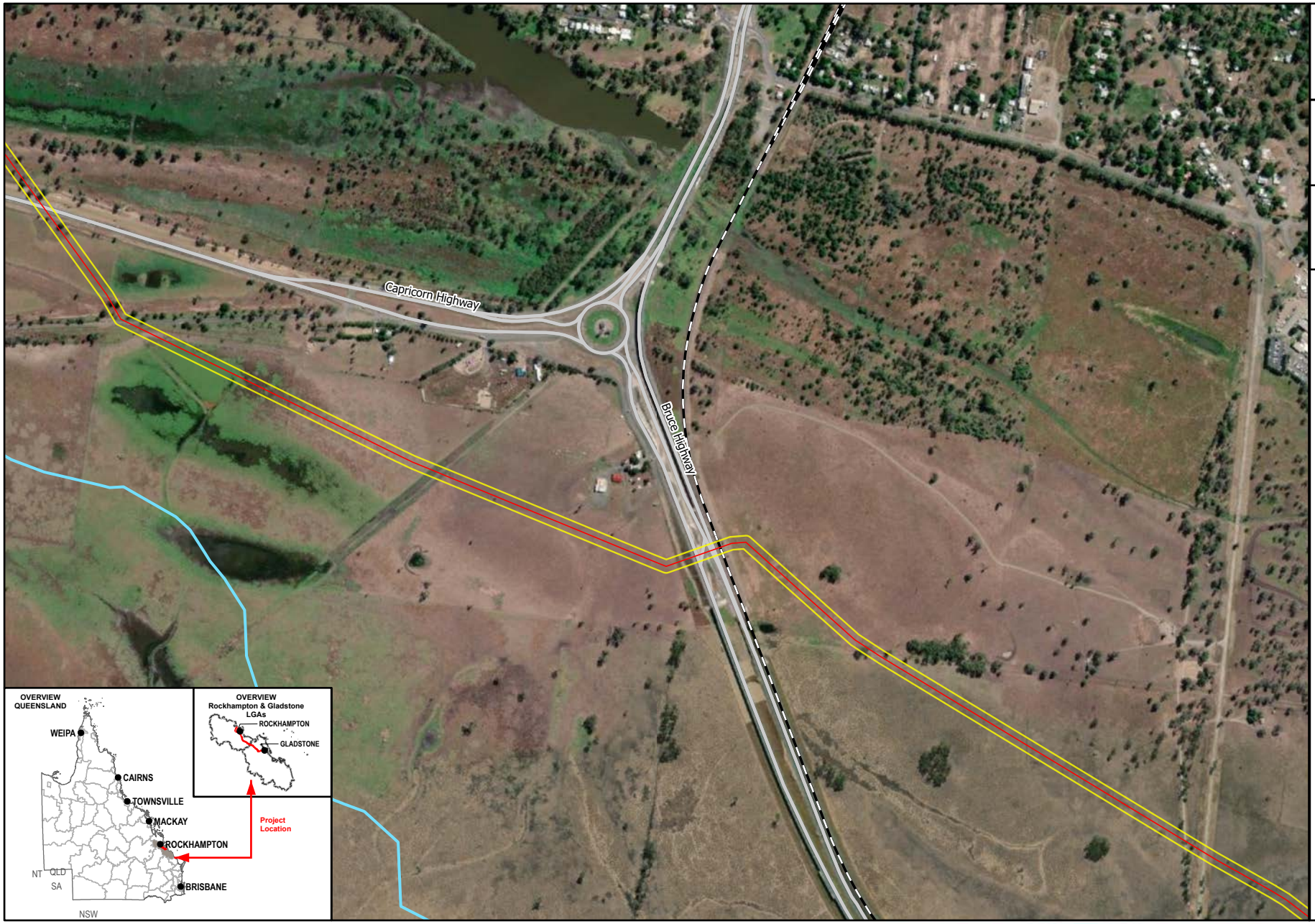

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Figure 7-12z
Distribution of Grey Snake Habitat Within the SGIC SDA Study Area
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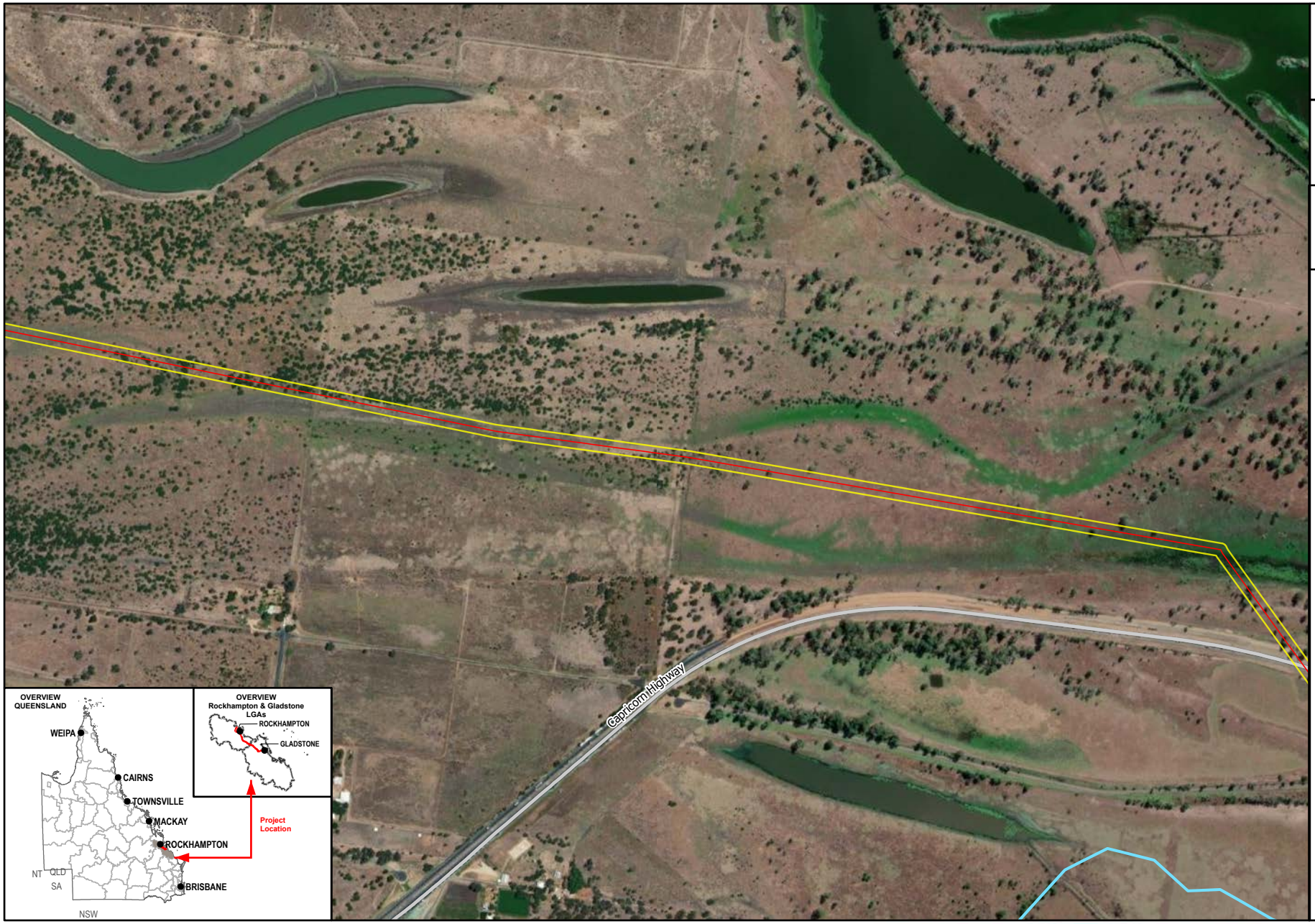

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Figure 7-12a1
Distribution of Grey Snake Habitat Within the SGIC SDA Study Area
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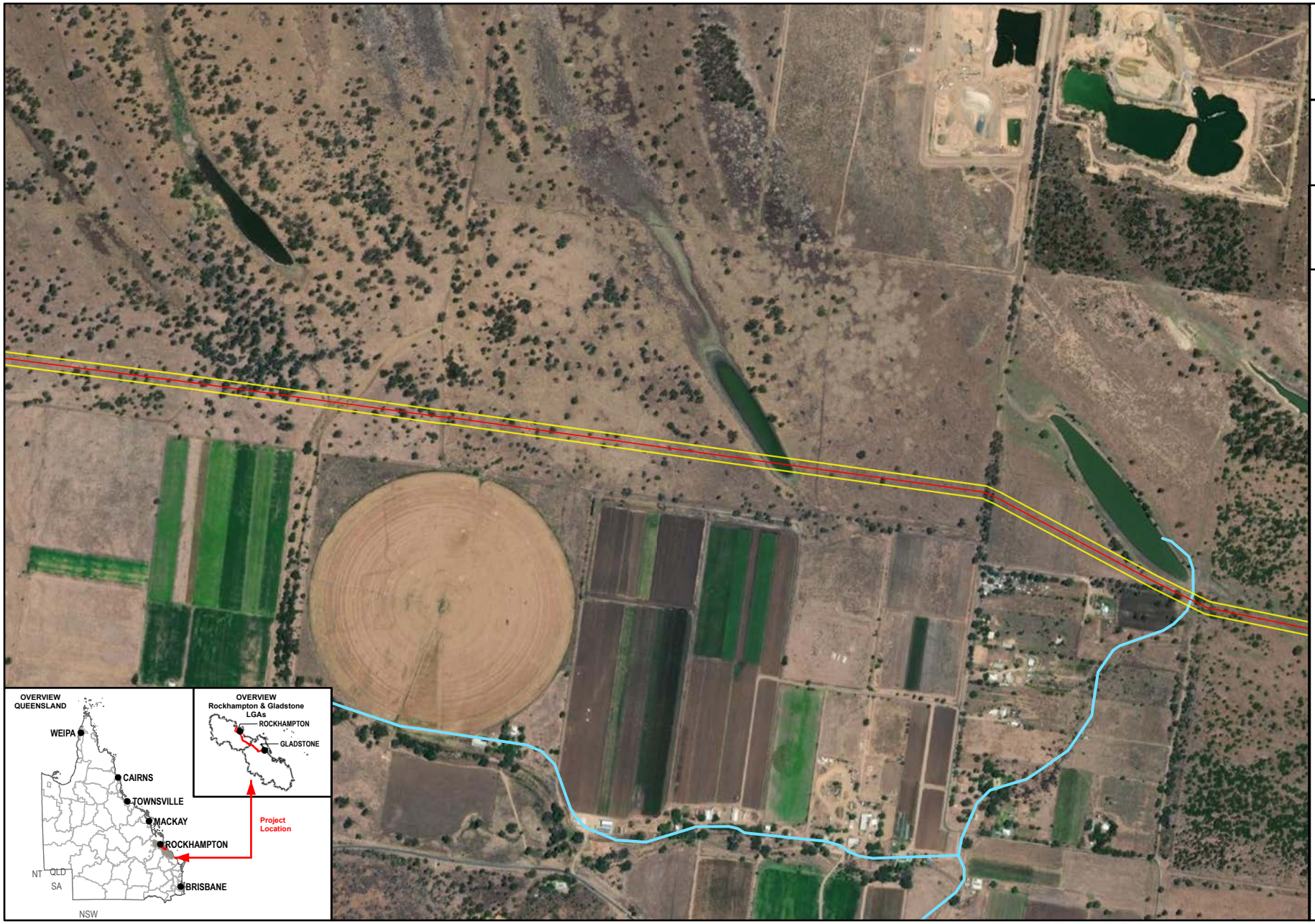

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Figure 7-12b1
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7.2.2.7 White-throated needletail

Conservation status and species ecology

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

Field survey results and distribution of suitable habitat

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

Significance of impact assessment

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

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

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

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

7.2.2.8 Powerful owl

Conservation status and species ecology

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

Field survey results and distribution of suitable habitat

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

Significance of impact assessment

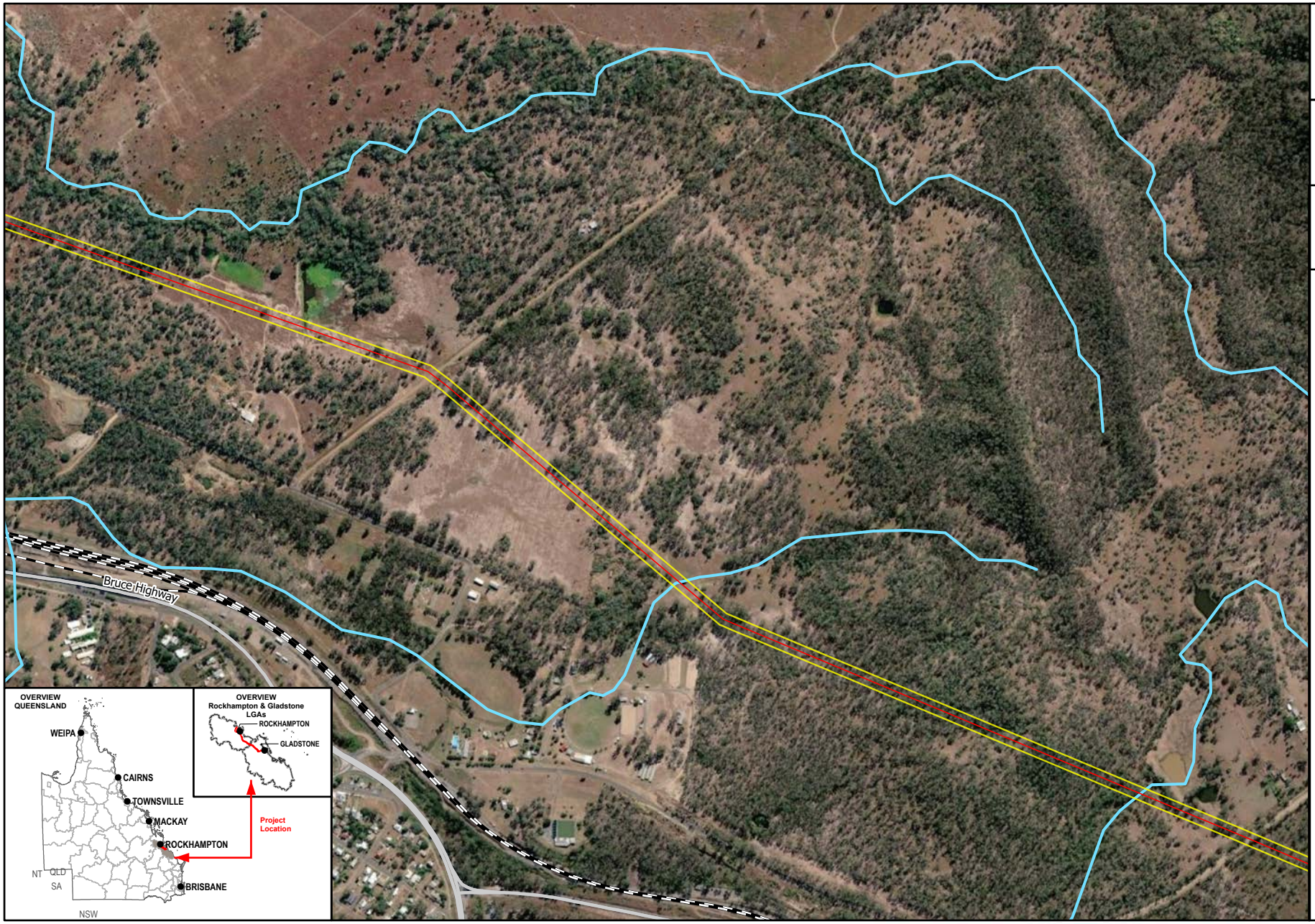
The project is unlikely to result in a significant residual impact on the powerful owl. A significance of impact assessment of the project on the powerful owl (vulnerable under the NC Act) is provided in Table 7-26.

Table 7-26 Significance of impact on the powerful owl

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

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

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



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Legend

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

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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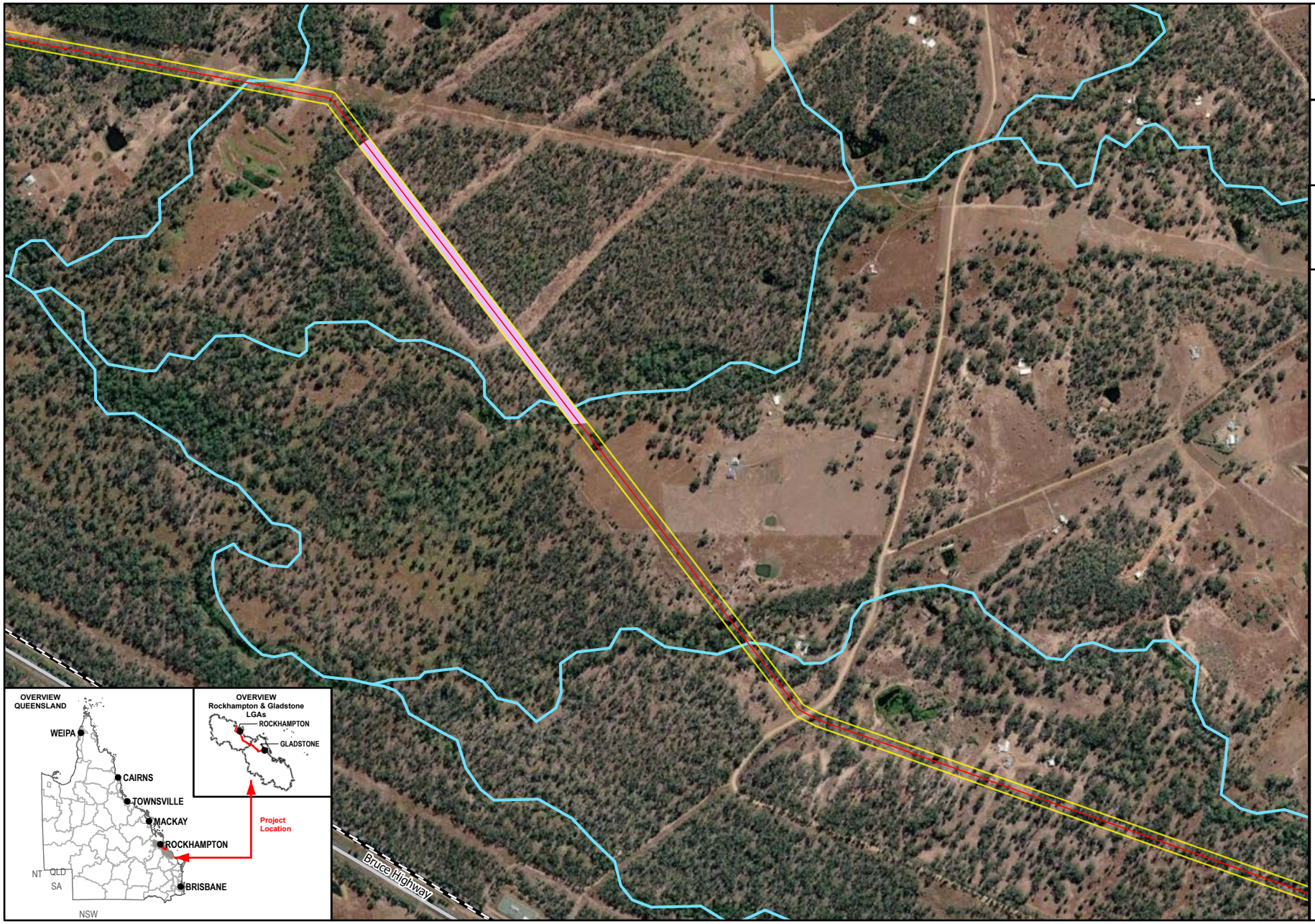
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-13a
Distribution of Powerful Owl Habitat Within the SGIC SDA Study Area
000-G-MAP-2435 Version:3 Date:19/09/2022



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- SGIC SDA Pipeline Alignment
- Study Area
- Predicted Powerful Owl Habitat
- Waterways
- Main Roads
- Railways

Data Sources:
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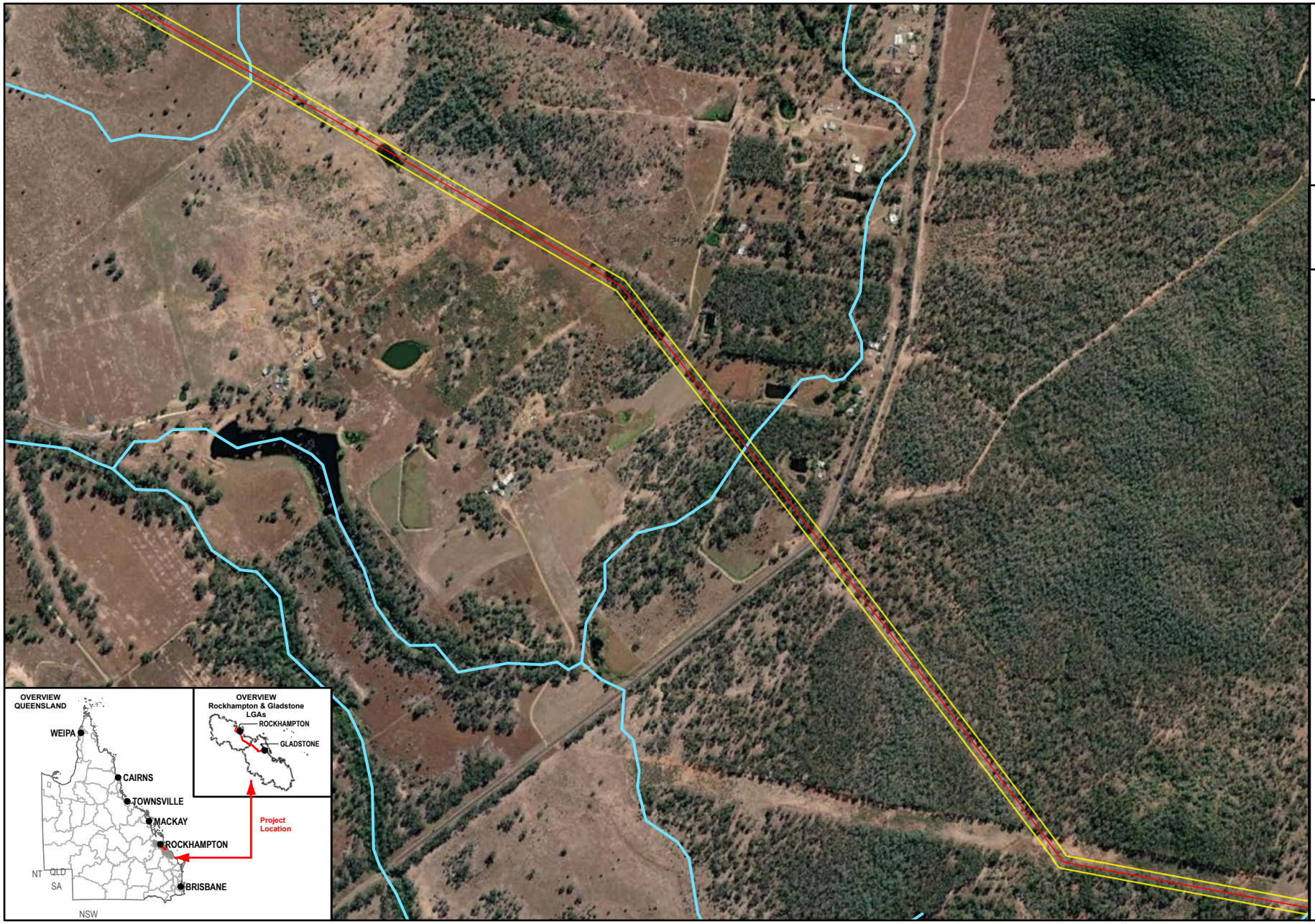
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-13b
Distribution of Powerful Owl Habitat Within the SGIC SDA Study Area
000-G-MAP-2435 Version:3 Date:19/09/2022



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- SGIC SDA Pipeline Alignment
- Study Area
- Waterways

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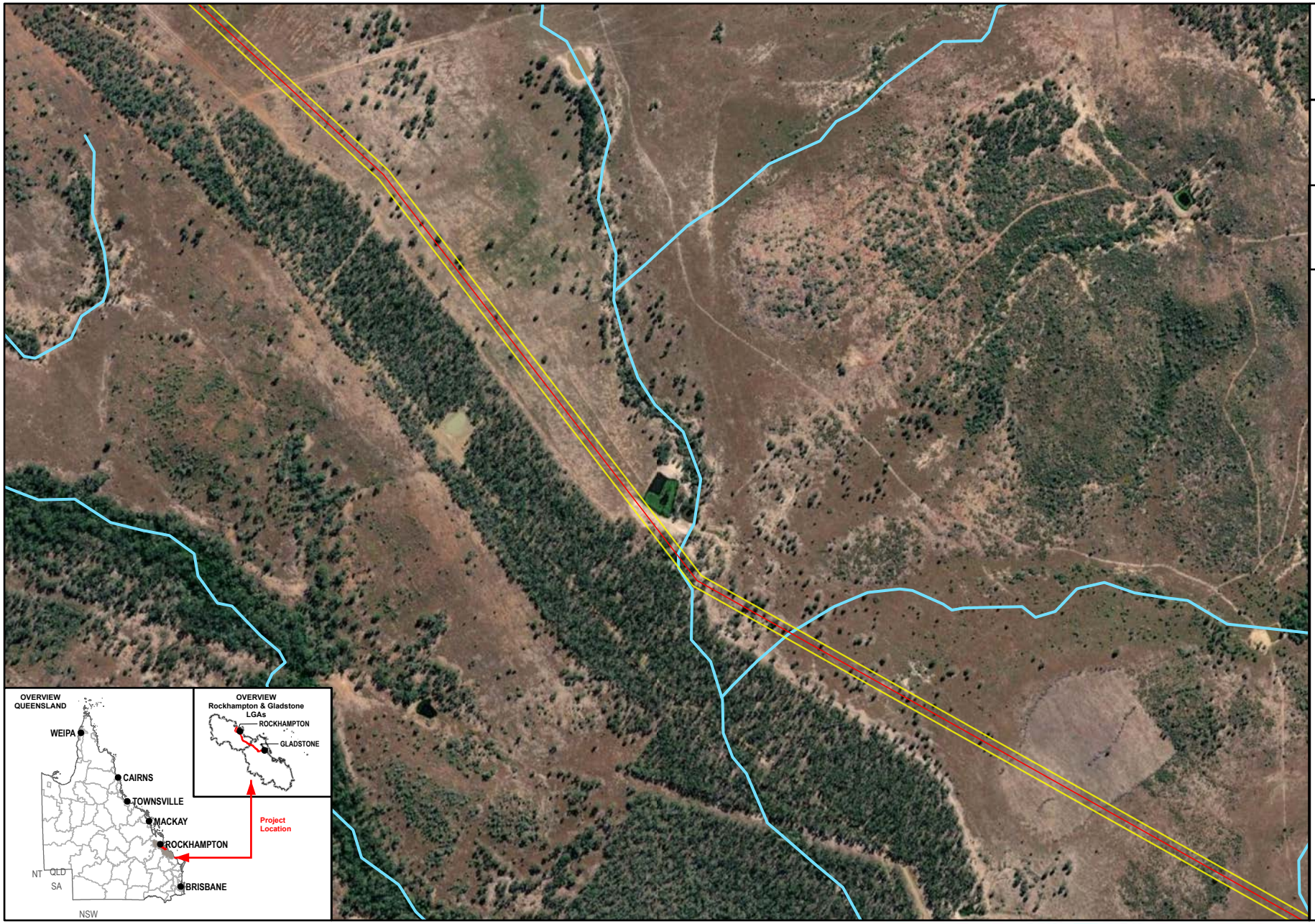
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-13c
Distribution of Powerful Owl Habitat Within the SGIC SDA Study Area
000-G-MAP-2435 Version:3 Date:19/09/2022



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- SGIC SDA Pipeline Alignment
- Study Area
- Waterways

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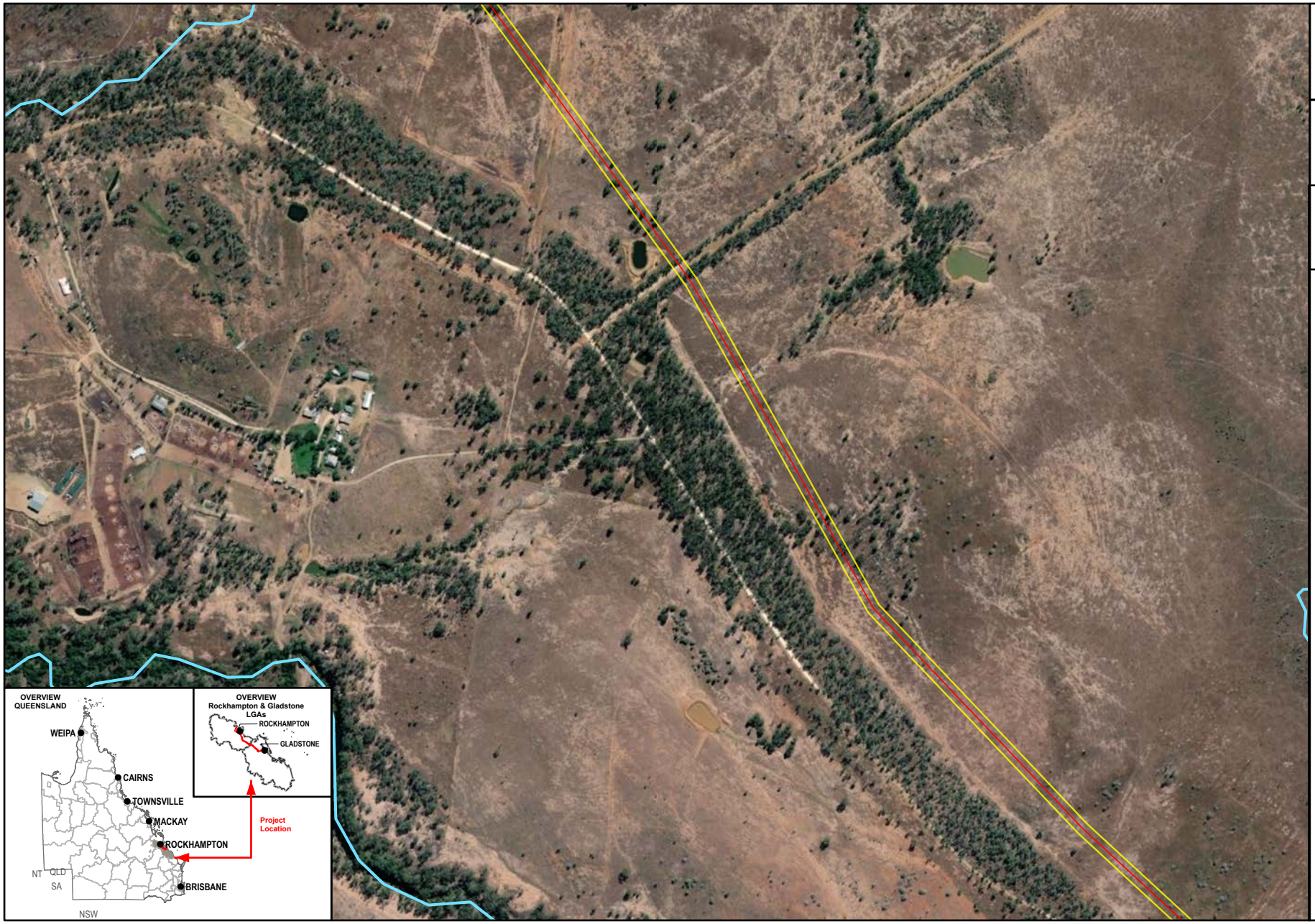
Figure 7-13d
Distribution of Powerful Owl Habitat Within the SGIC SDA Study Area
000-G-MAP-2435 Version:3 Date:19/09/2022



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- SGIC SDA Pipeline Alignment
- Study Area
- Waterways

Data Sources:
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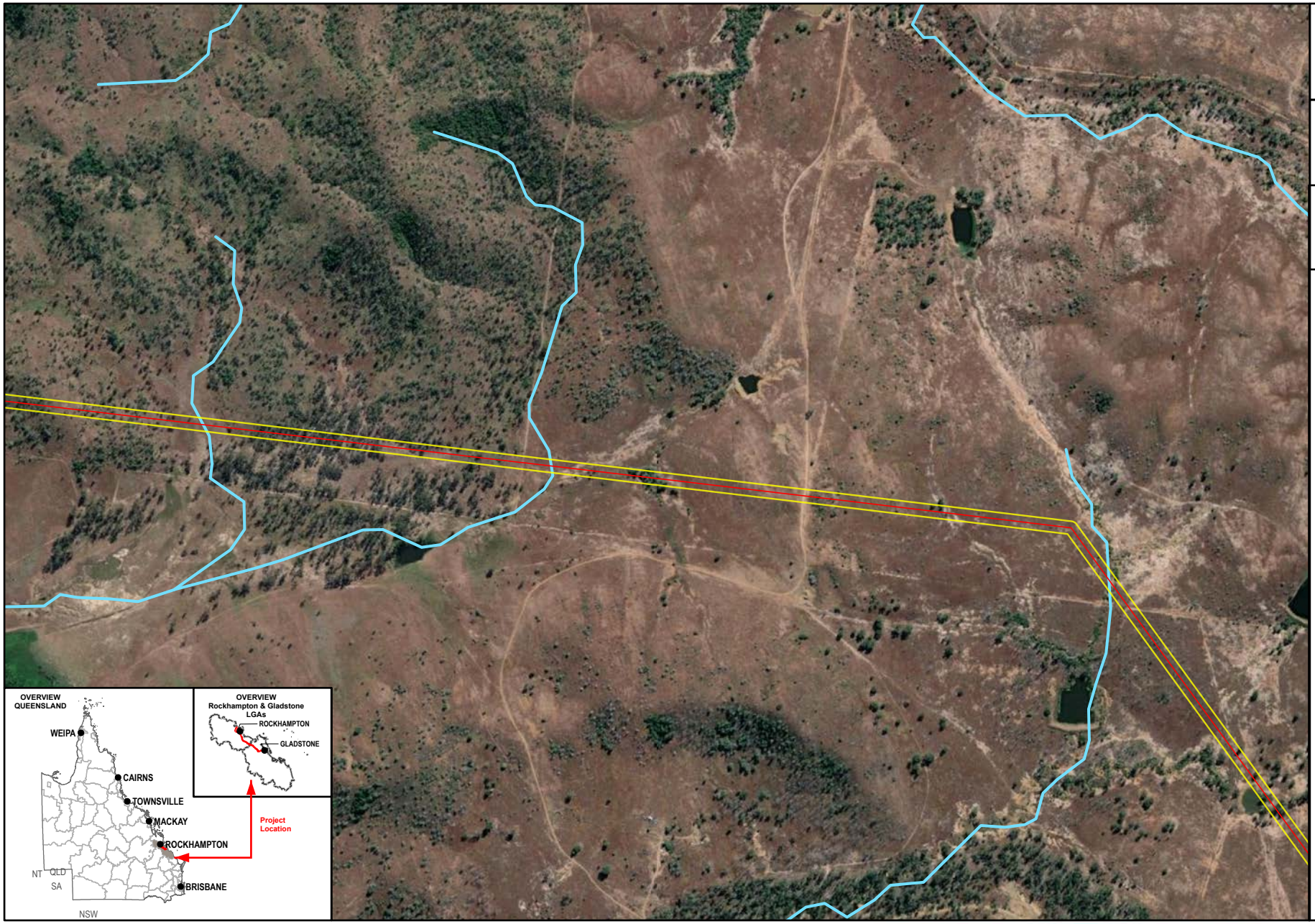
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-13e
Distribution of Powerful Owl Habitat Within the SGIC SDA Study Area
000-G-MAP-2435 Version:3 Date:19/09/2022



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- SGIC SDA Pipeline Alignment
- Study Area
- Waterways

Data Sources:
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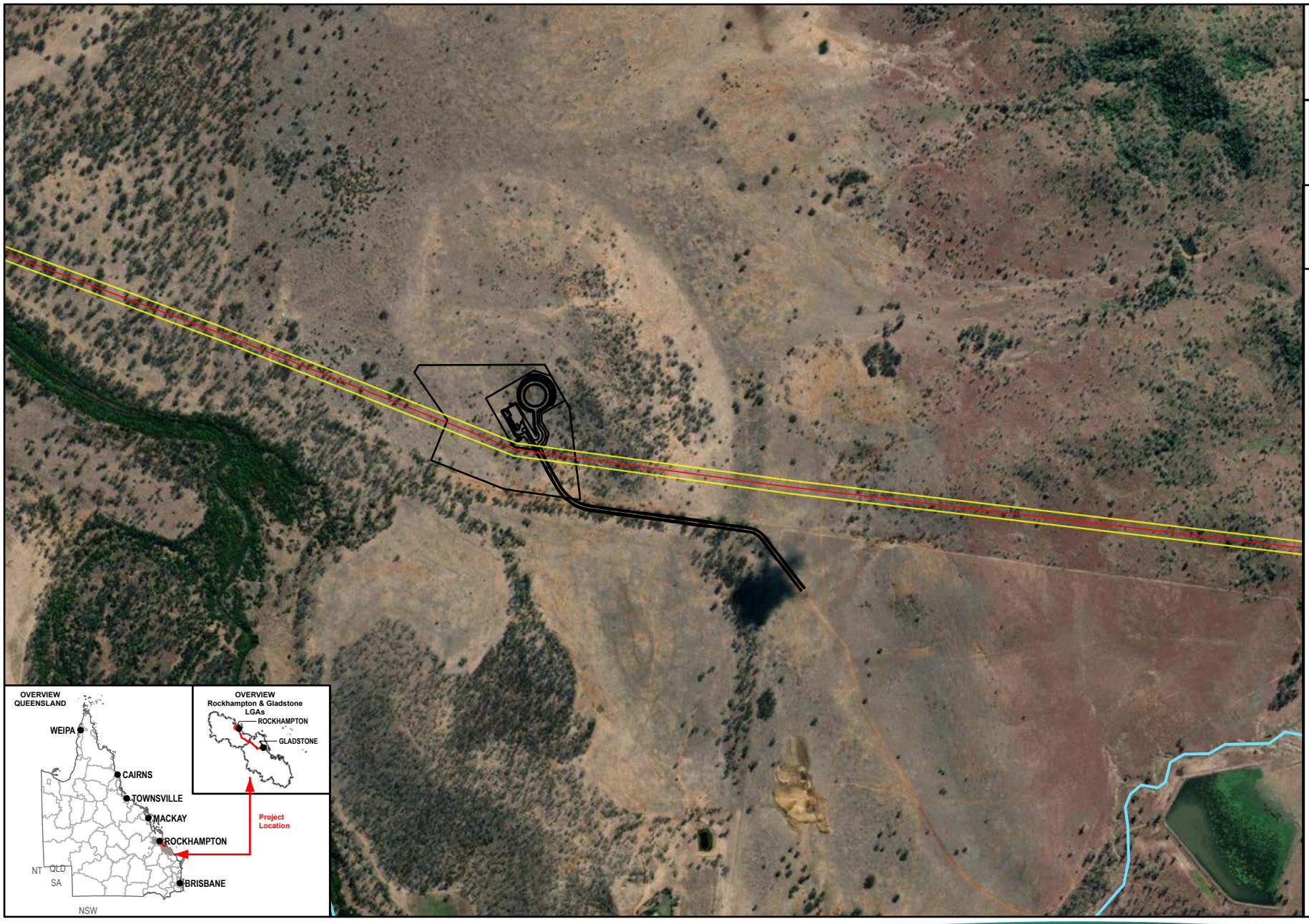
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-13f
Distribution of Powerful Owl Habitat Within the SGIC SDA Study Area
000-G-MAP-2435 Version:3 Date:19/09/2022



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Legend

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

Data Sources:
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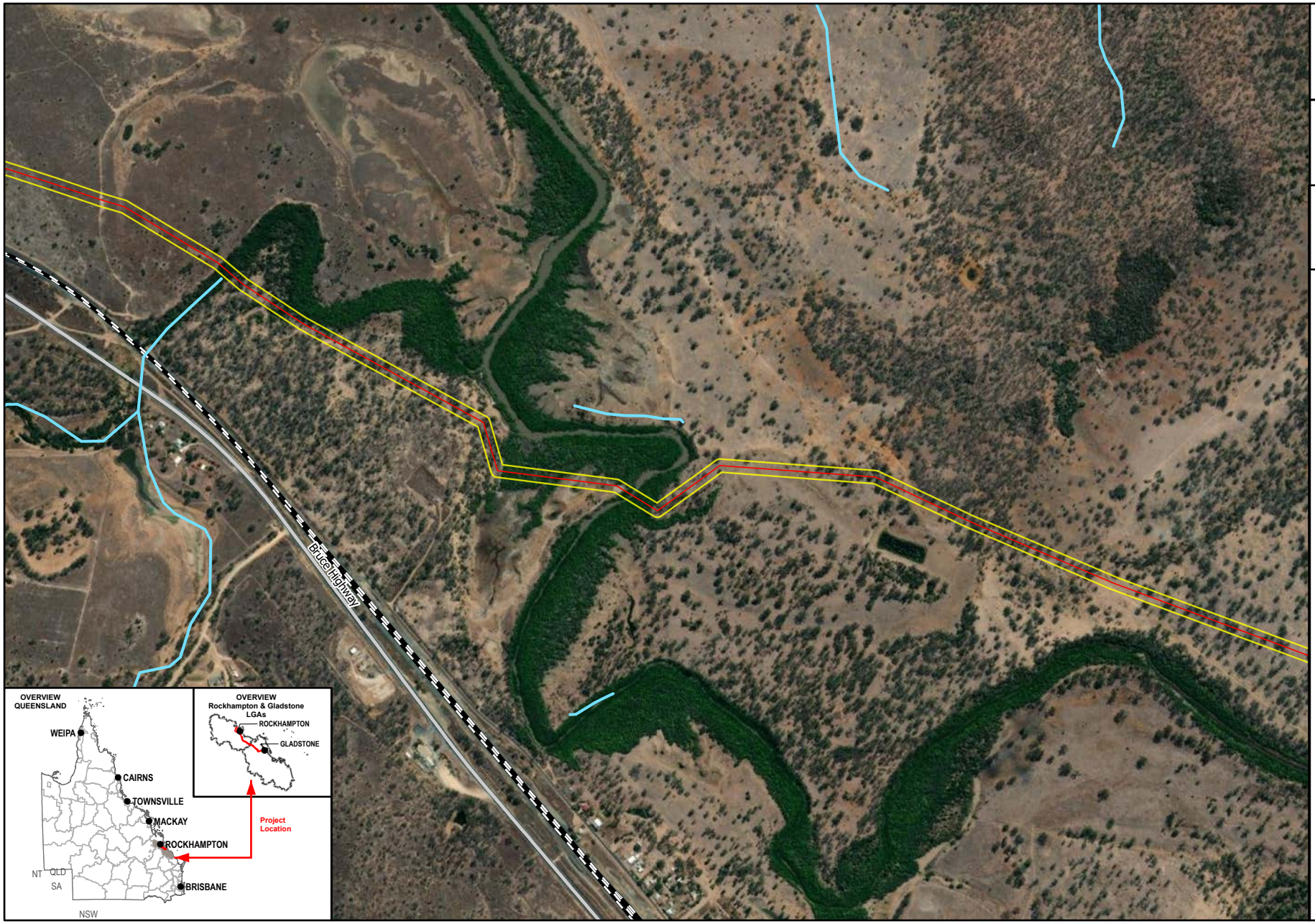
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-13g
Distribution of Powerful Owl Habitat Within the SGIC SDA Study Area
000-G-MAP-2435 Version:3 Date:19/09/2022



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Legend

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

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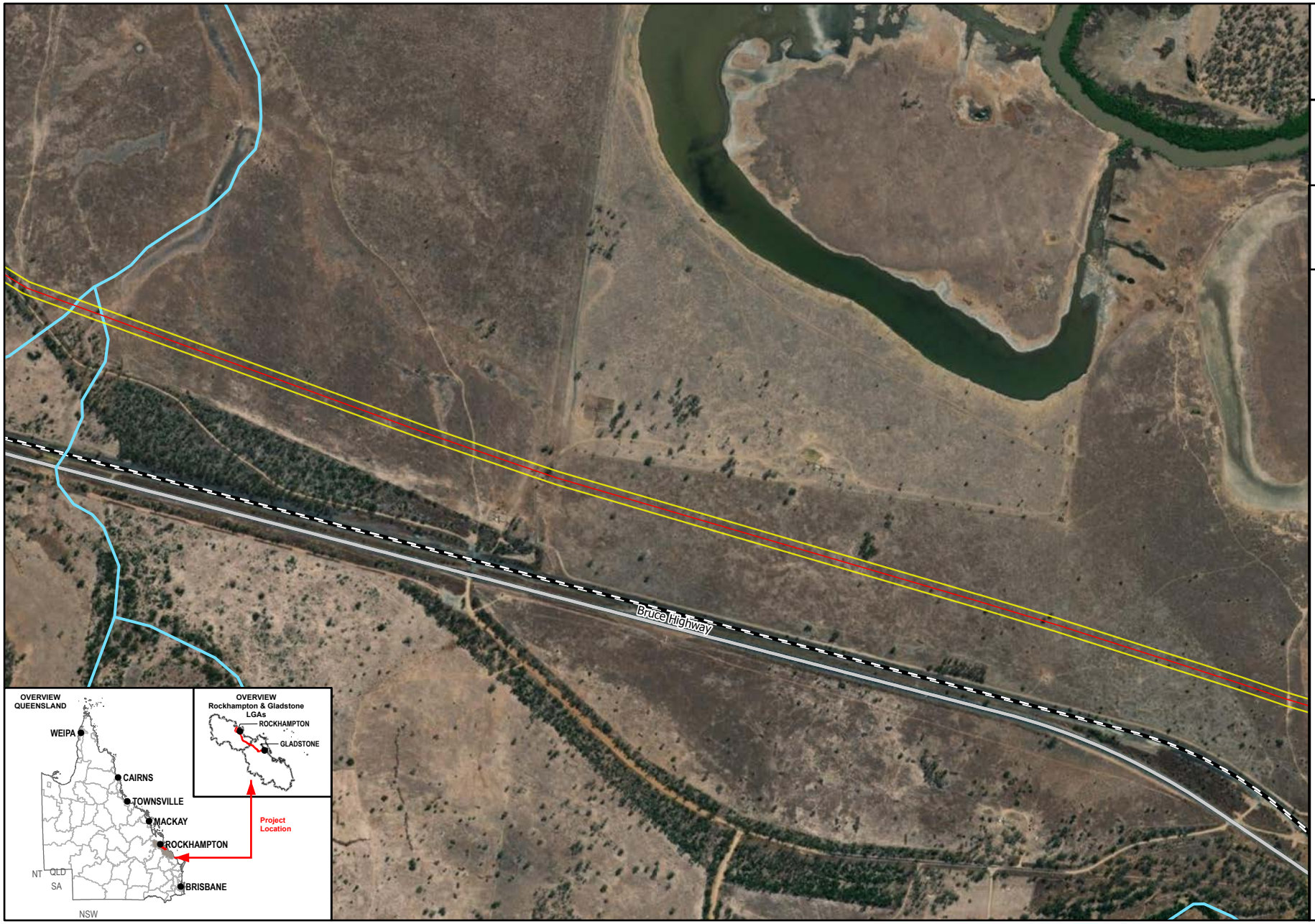
Figure 7-13h
Distribution of Powerful Owl Habitat Within the SGIC SDA Study Area
000-G-MAP-2435 Version:3 Date:19/09/2022



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Legend

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

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

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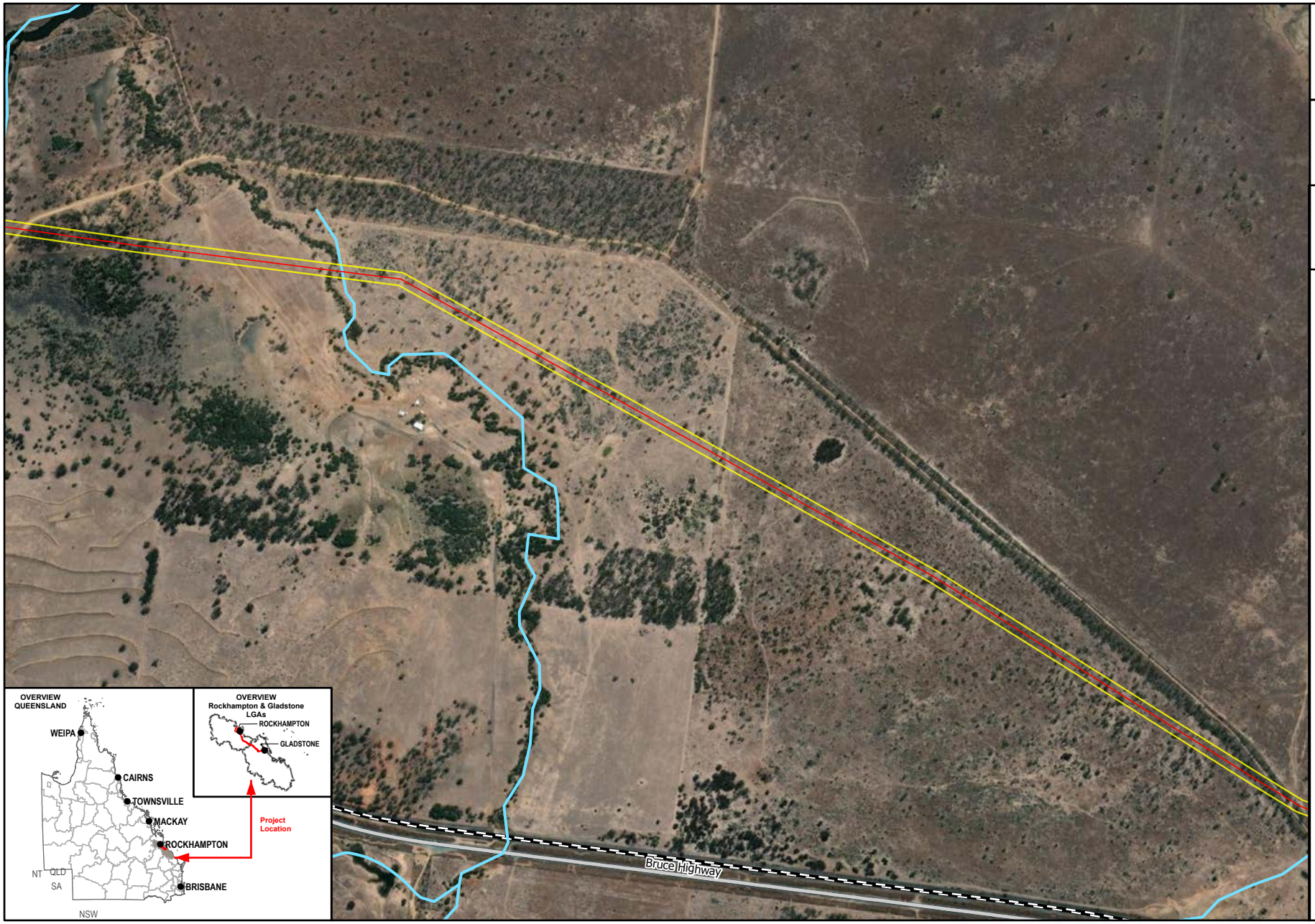
Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-13i
Distribution of Powerful Owl Habitat Within the SGIC SDA Study Area
000-G-MAP-2435 Version:3 Date:19/09/2022



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Legend

- SGIC SDA Pipeline Alignment
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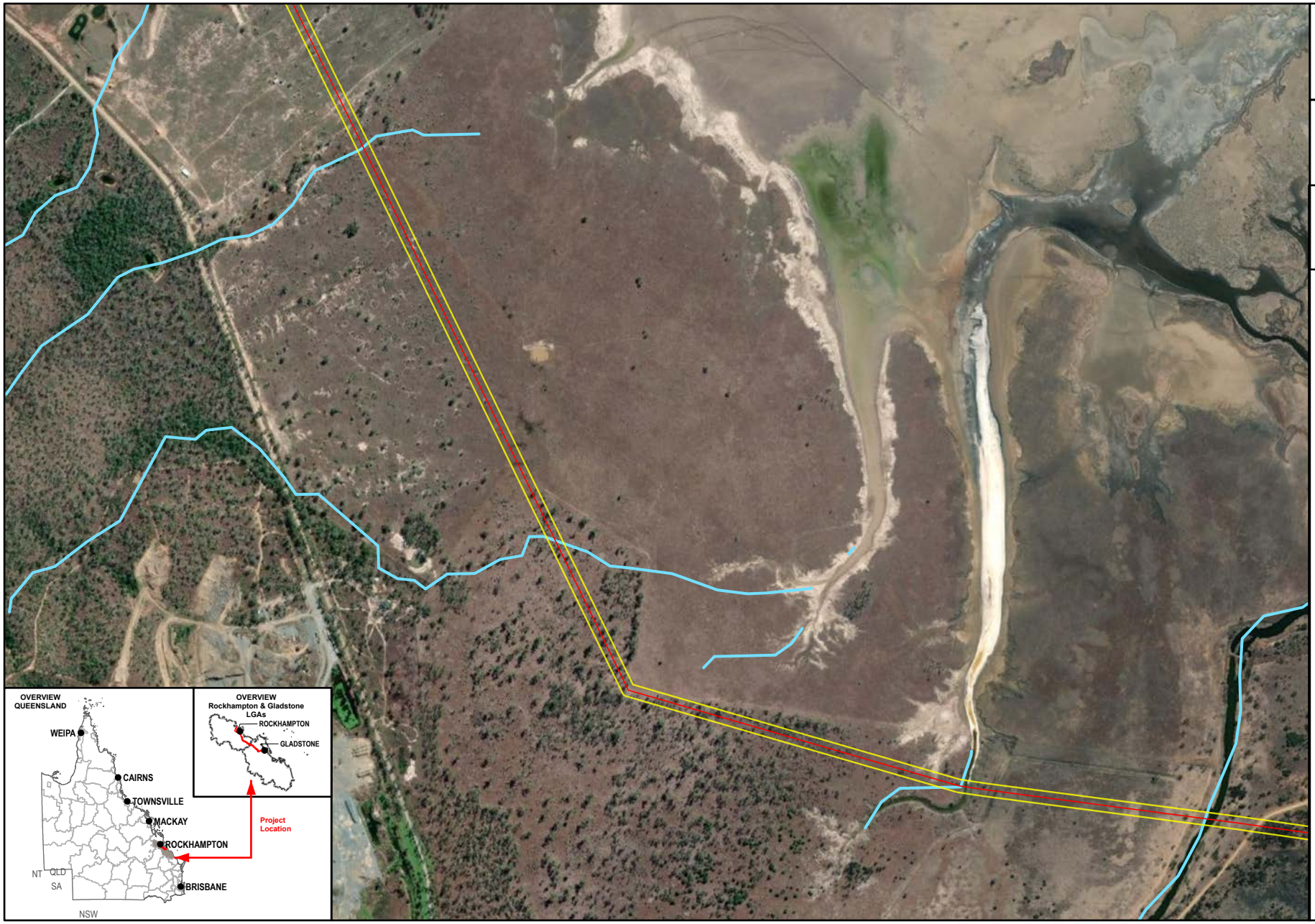
Figure 7-13j
Distribution of Powerful Owl Habitat Within the SGIC SDA Study Area
000-G-MAP-2435 Version:3 Date:19/09/2022



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Legend

- SGIC SDA Pipeline Alignment
- Study Area
- Waterways

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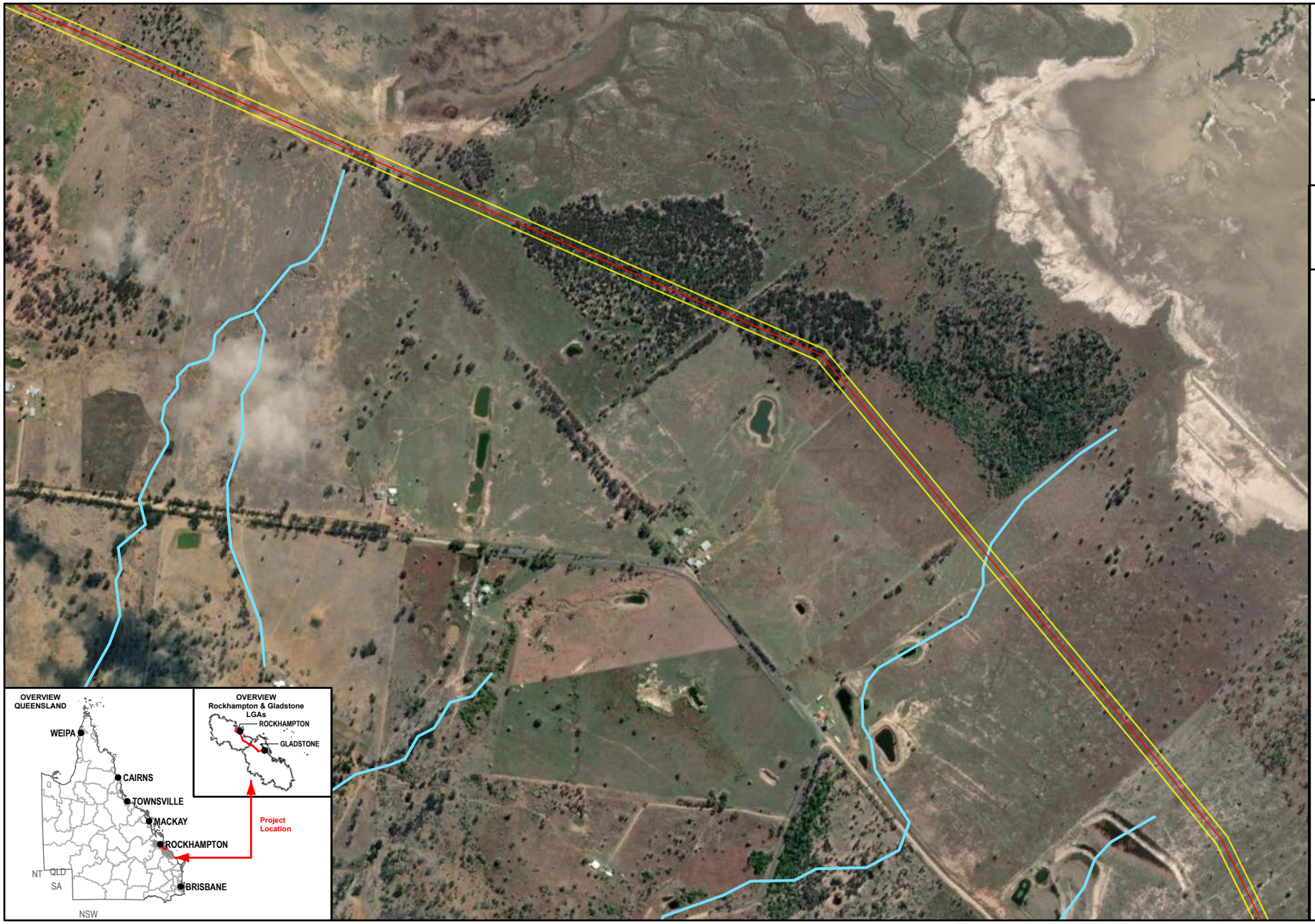
Figure 7-13k
Distribution of Powerful Owl Habitat Within the SGIC SDA Study Area
000-G-MAP-2435 Version:3 Date:19/09/2022



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- SGIC SDA Pipeline Alignment
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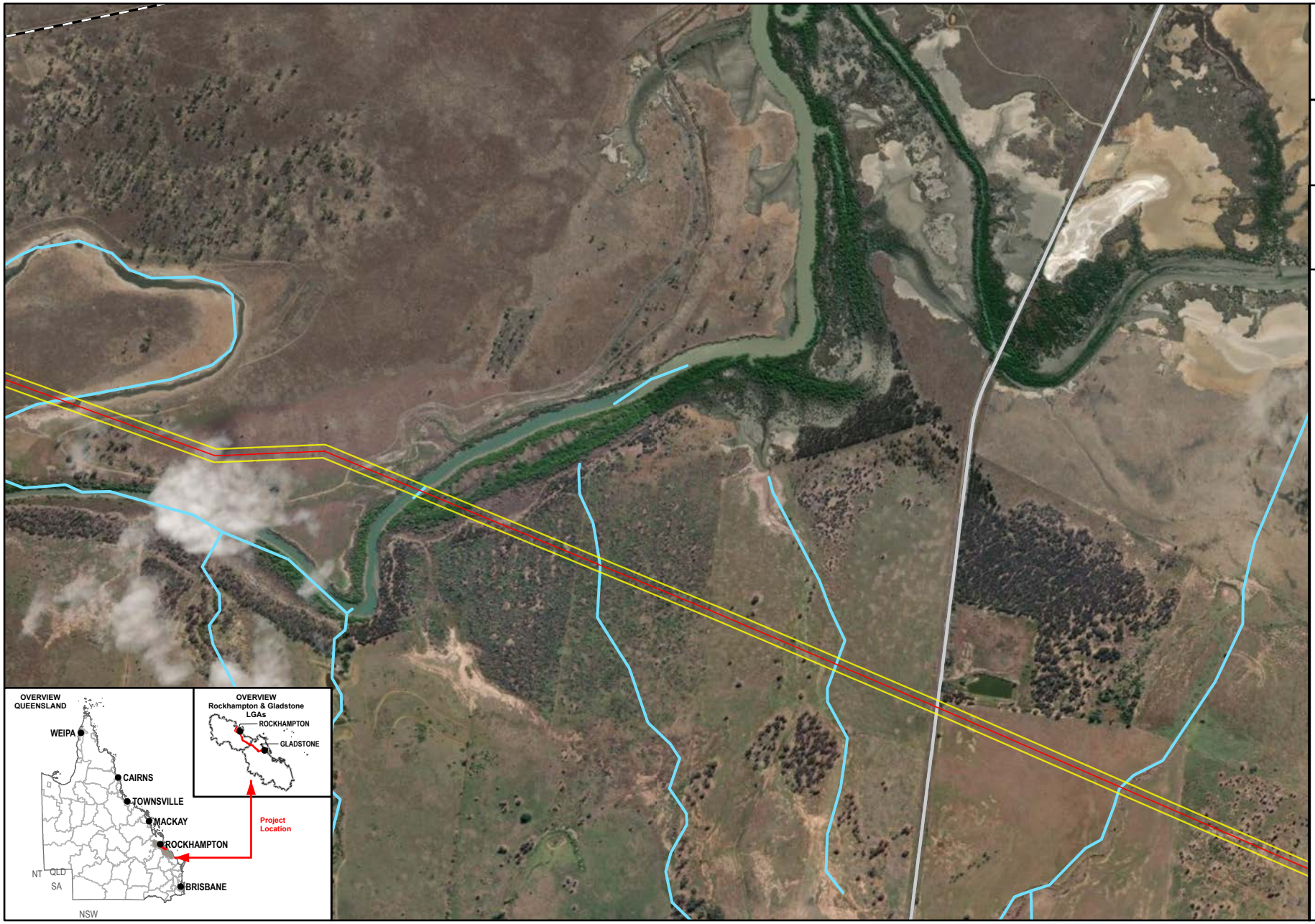
Figure 7-13l
Distribution of Powerful Owl Habitat Within the SGIC SDA Study Area
000-G-MAP-2435 Version:3 Date:19/09/2022



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

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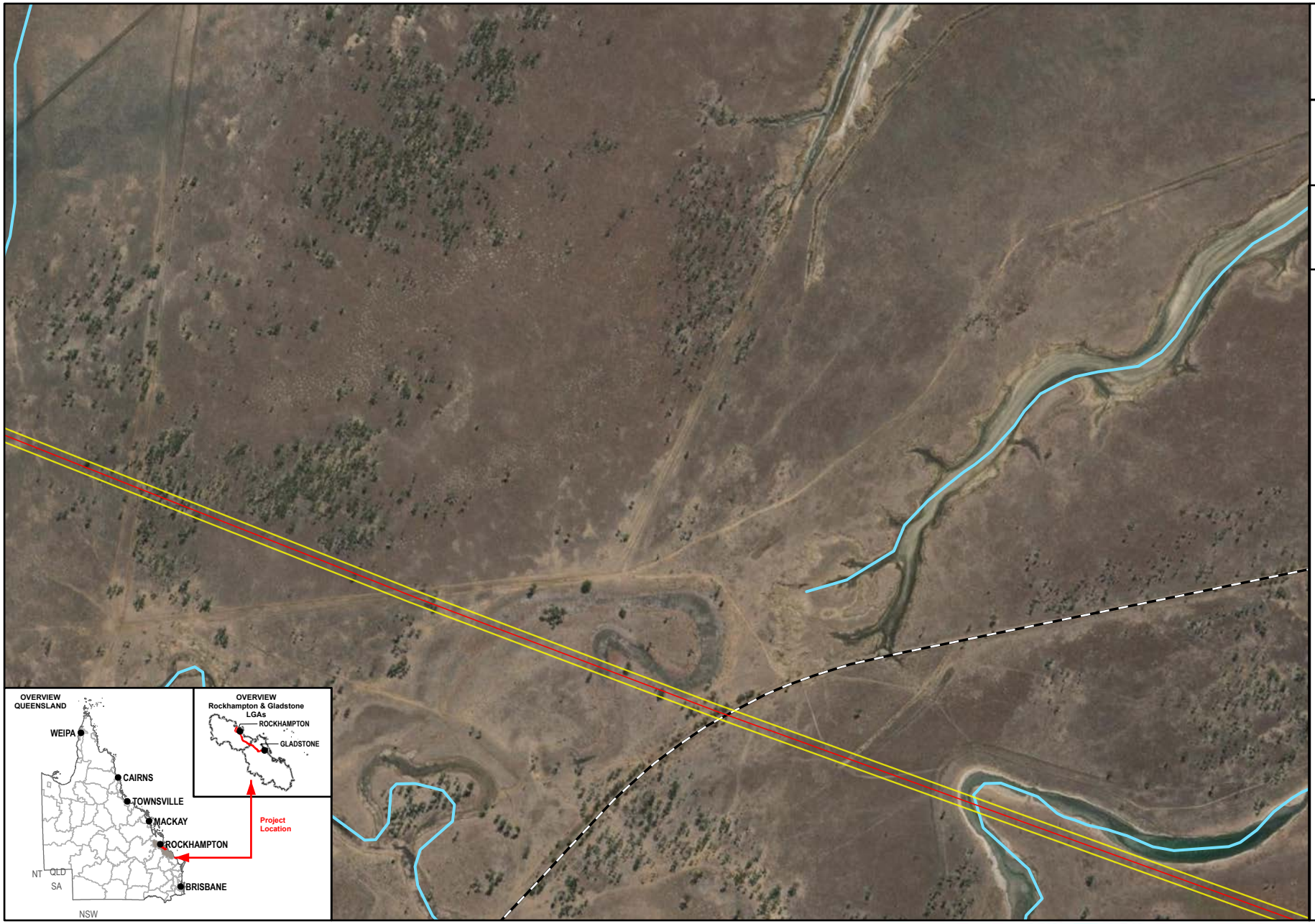
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-13m
Distribution of Powerful Owl Habitat Within the SGIC SDA Study Area
000-G-MAP-2435 Version:3 Date:19/09/2022



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- SGIC SDA Pipeline Alignment
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Figure 7-13n
Distribution of Powerful Owl Habitat Within the SGIC SDA Study Area
000-G-MAP-2435 Version:3 Date:19/09/2022

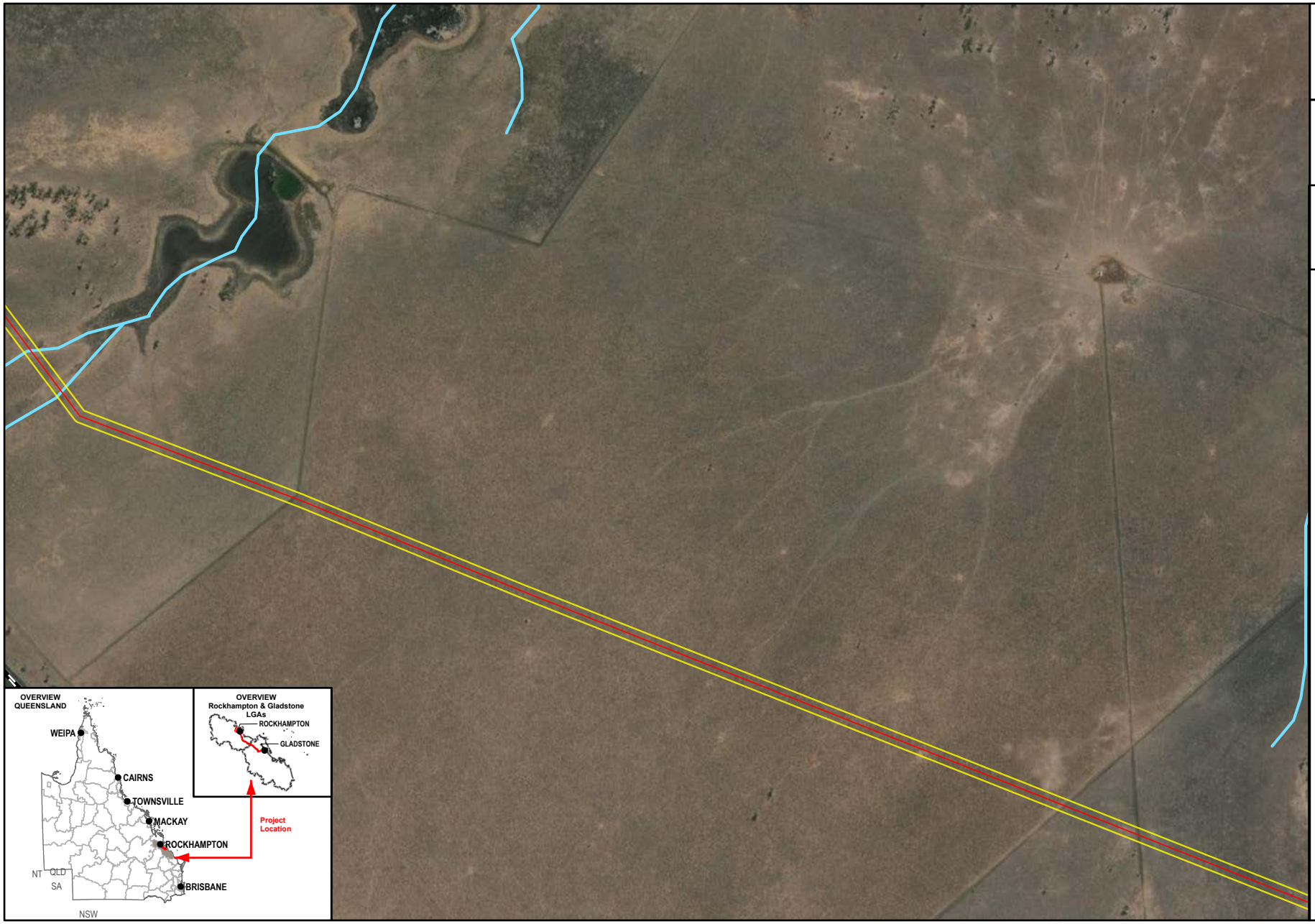

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Figure 7-13o
Distribution of Powerful Owl Habitat Within the SGIC SDA Study Area
000-G-MAP-2435 Version:3 Date:19/09/2022

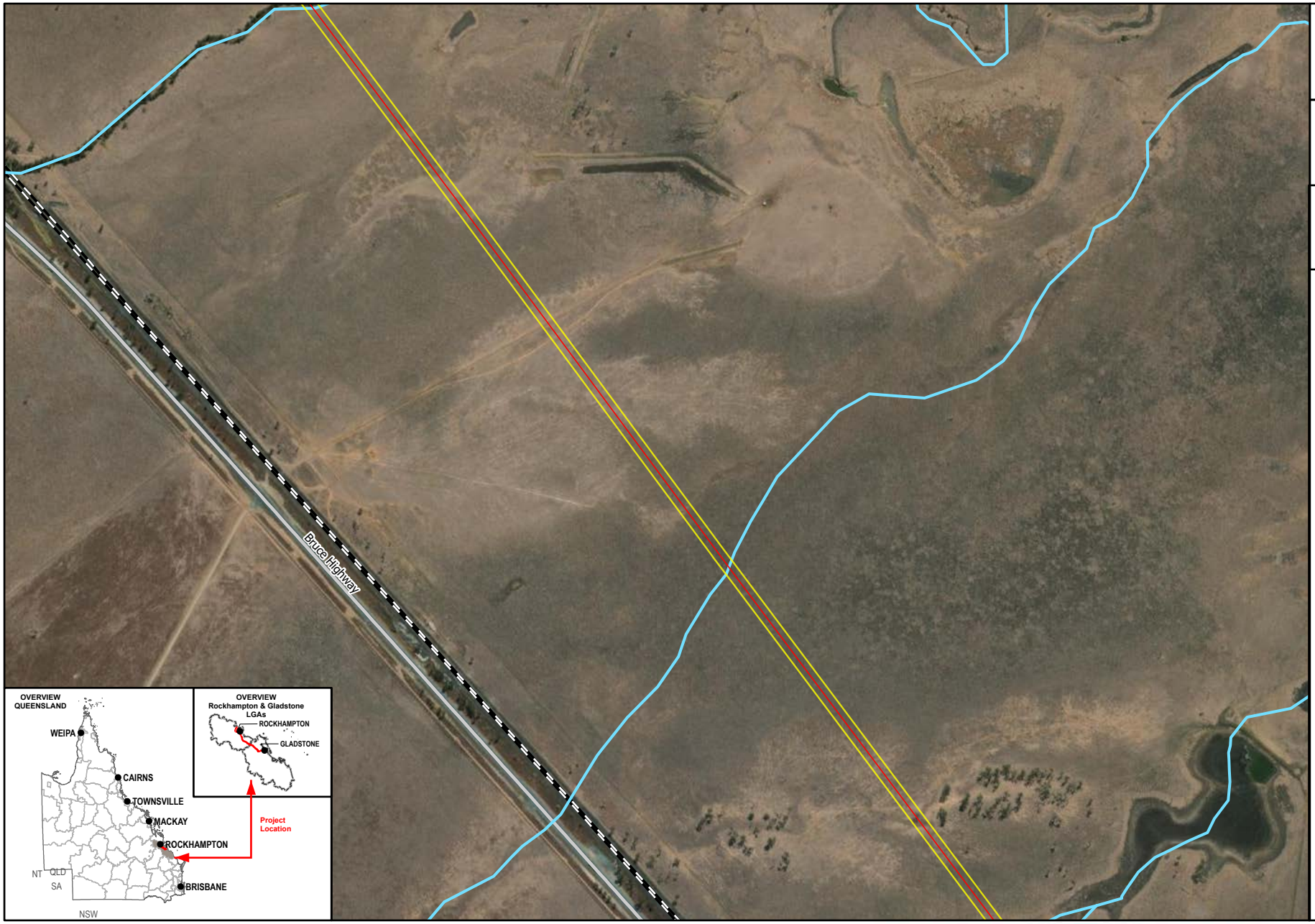

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Figure 7-13p
Distribution of Powerful Owl Habitat Within the SGIC SDA Study Area
000-G-MAP-2435 Version:3 Date:19/09/2022

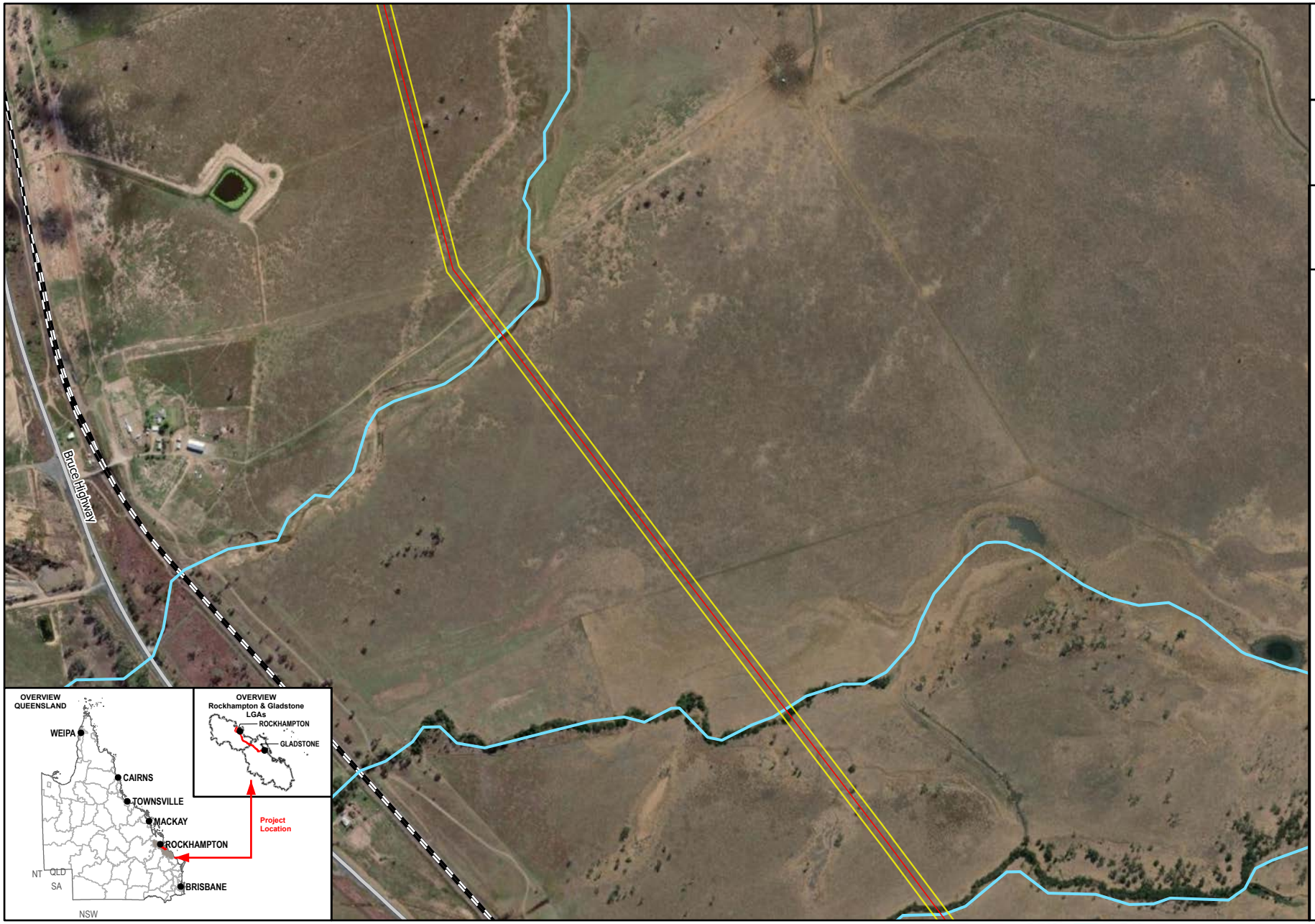

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Figure 7-13q
Distribution of Powerful Owl Habitat Within the SGIC SDA Study Area
000-G-MAP-2435 Version:3 Date:19/09/2022

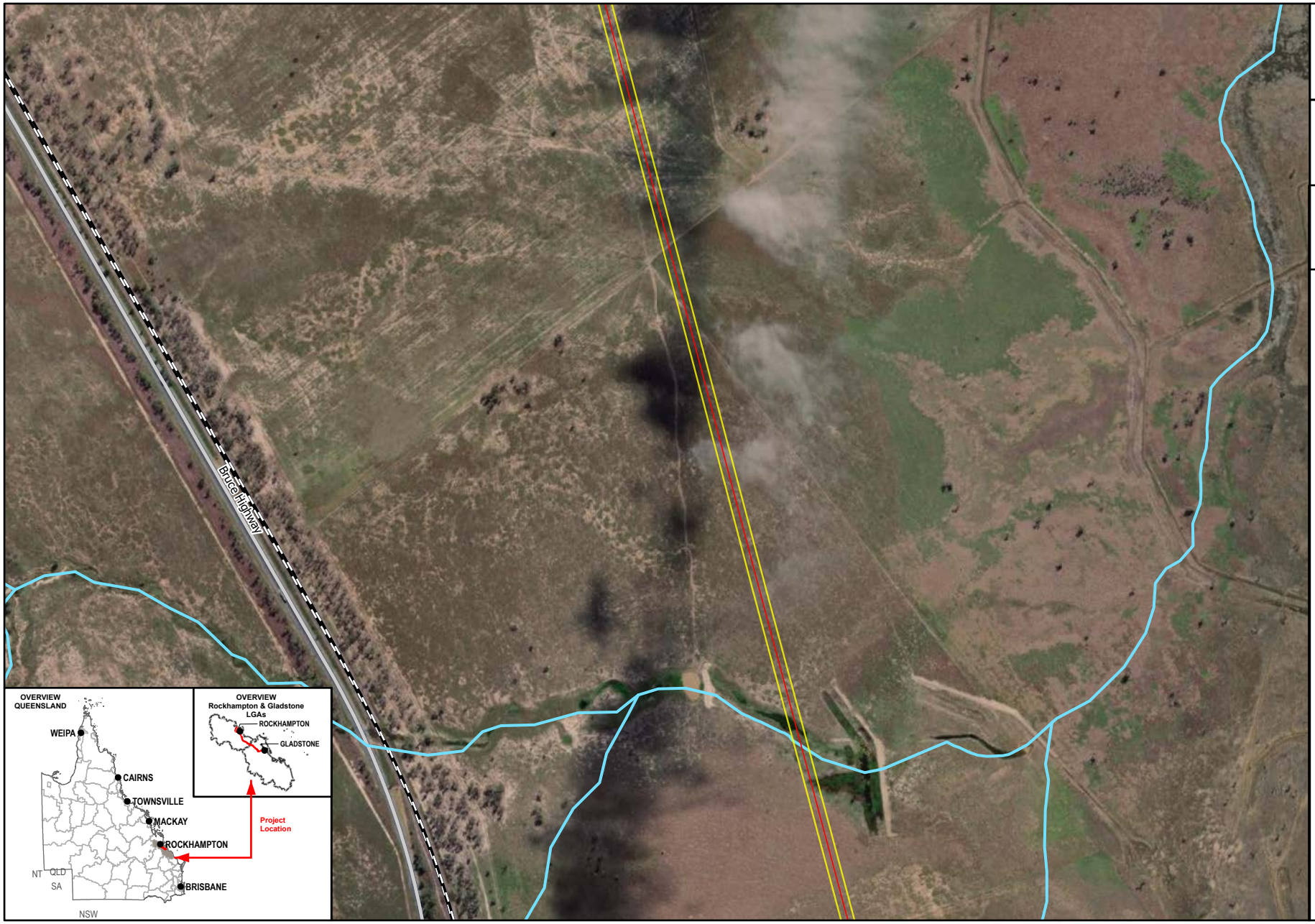

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Figure 7-13r
Distribution of Powerful Owl Habitat Within the SGIC SDA Study Area
000-G-MAP-2435 Version:3 Date:19/09/2022

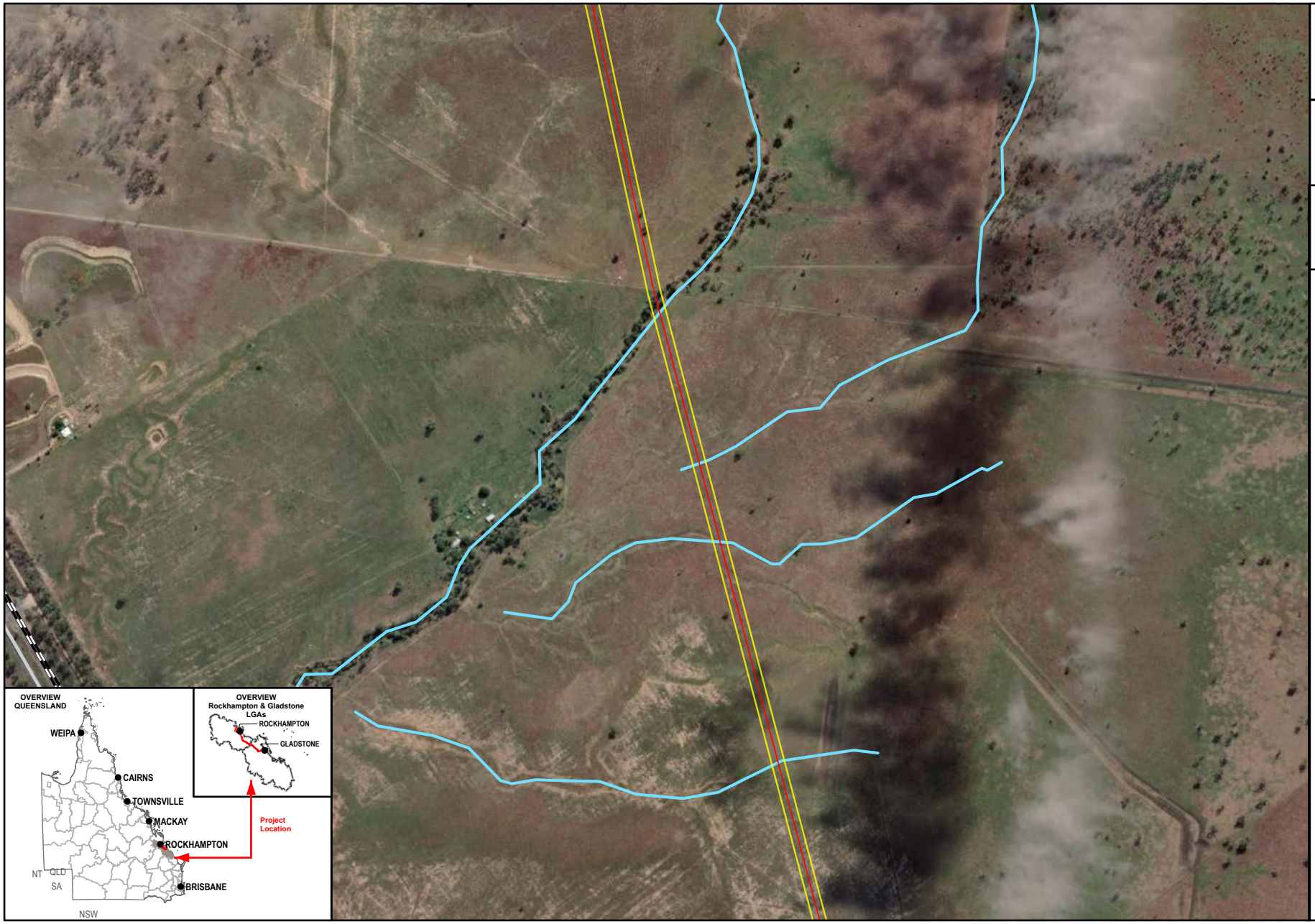

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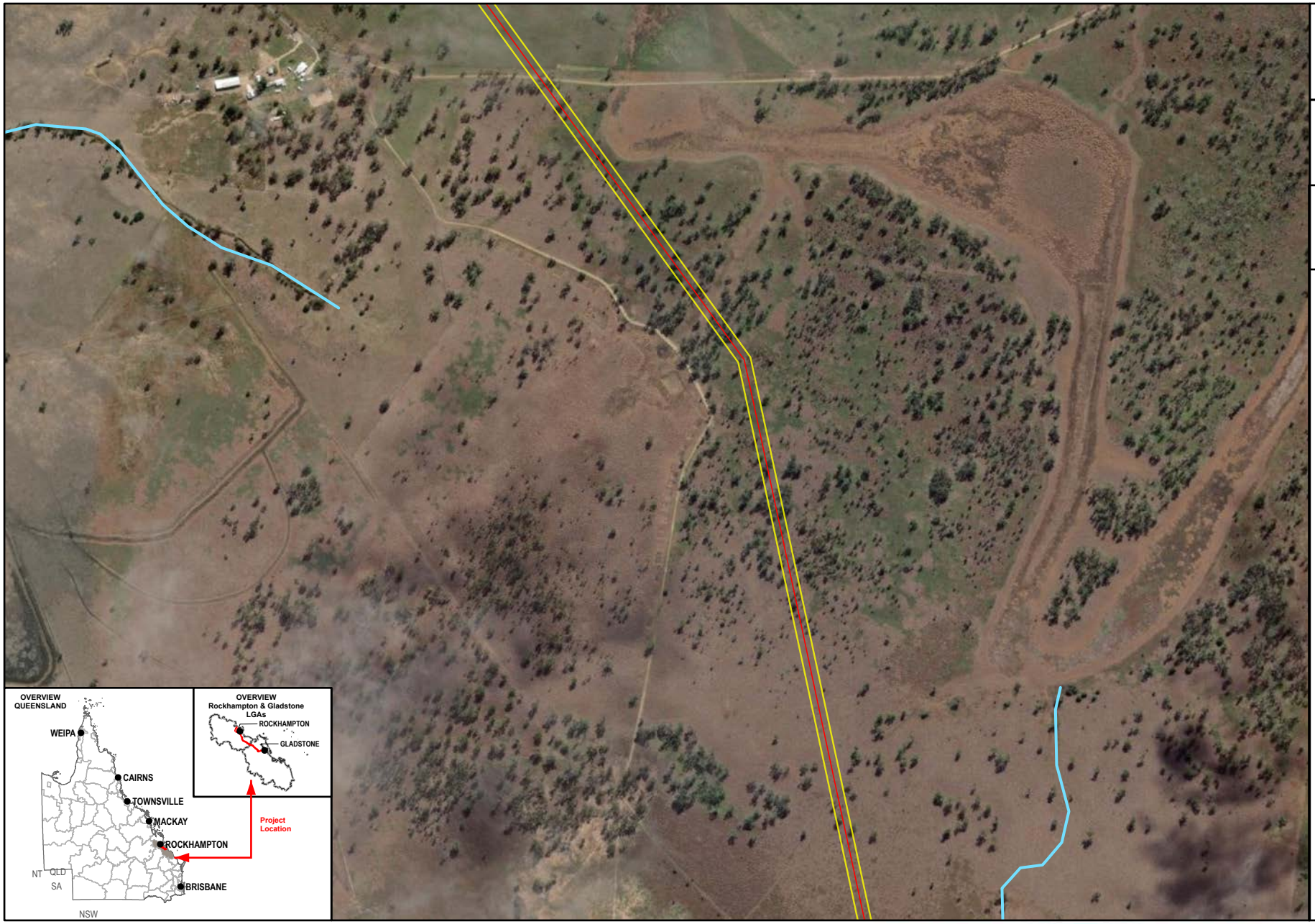
Figure 7-13s
Distribution of Powerful Owl Habitat Within the SGIC SDA Study Area
000-G-MAP-2435 Version:3 Date:19/09/2022



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Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-13t
Distribution of Powerful Owl Habitat Within the SGIC SDA Study Area
000-G-MAP-2435 Version:3 Date:19/09/2022

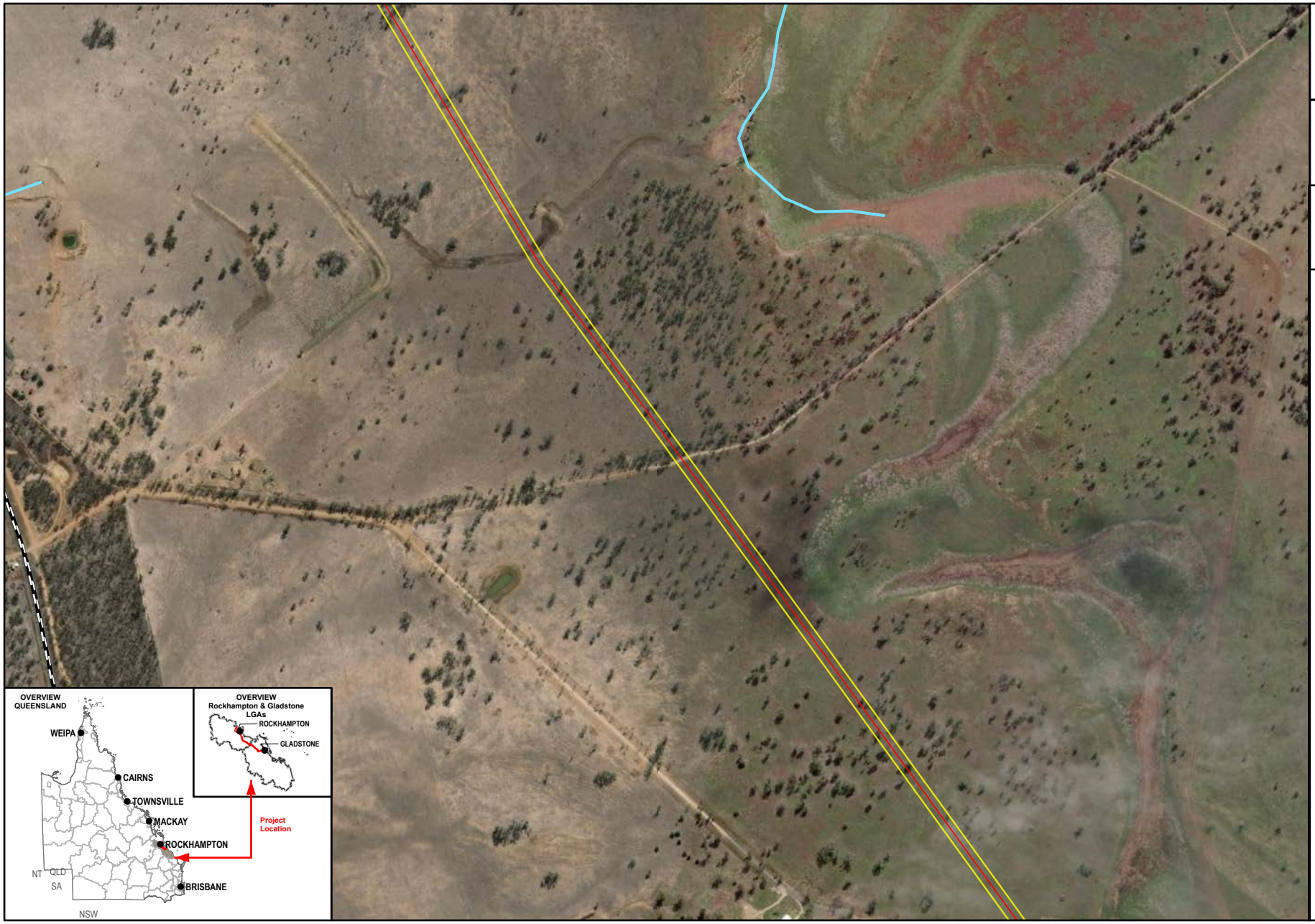

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Figure 7-13u
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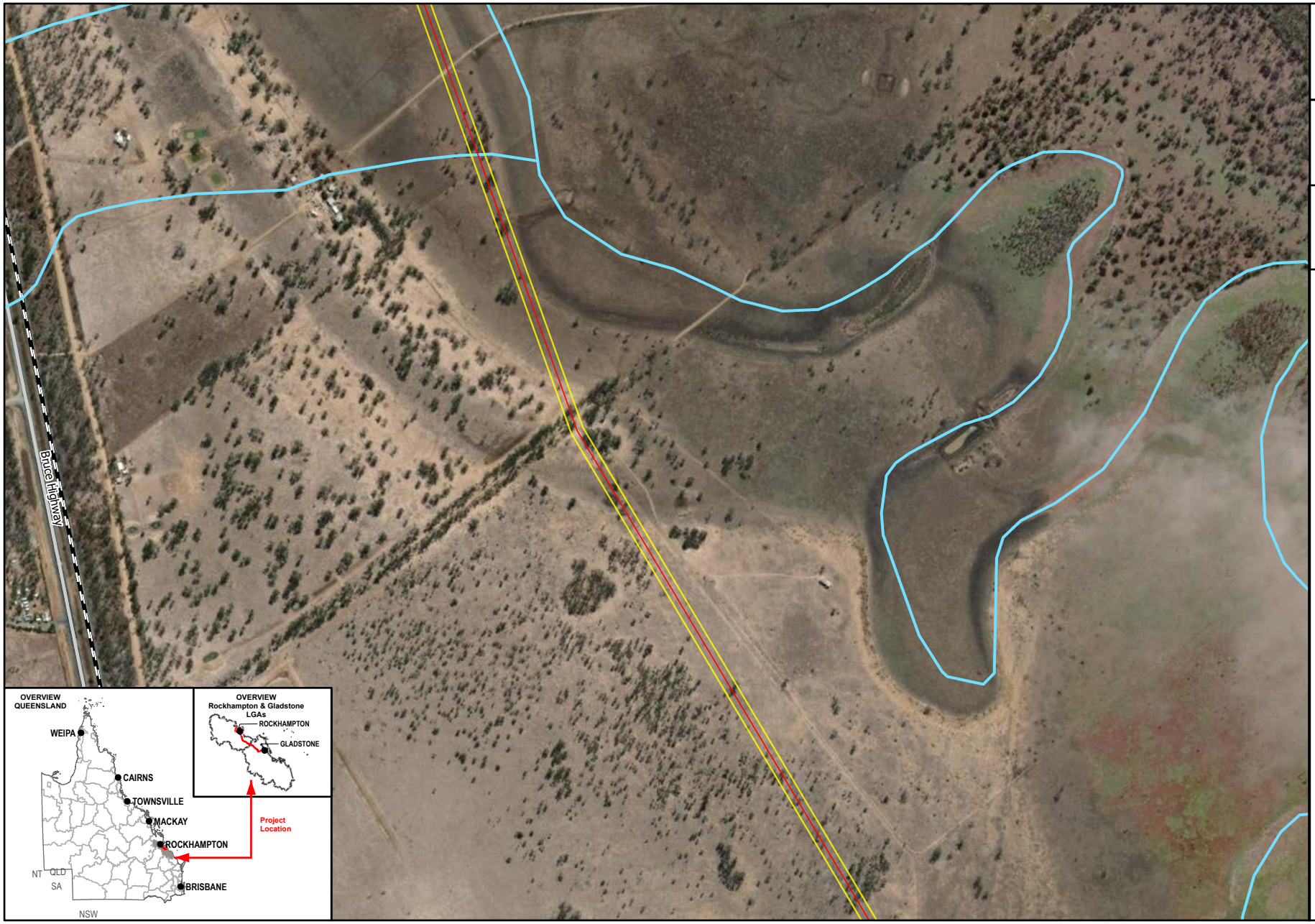

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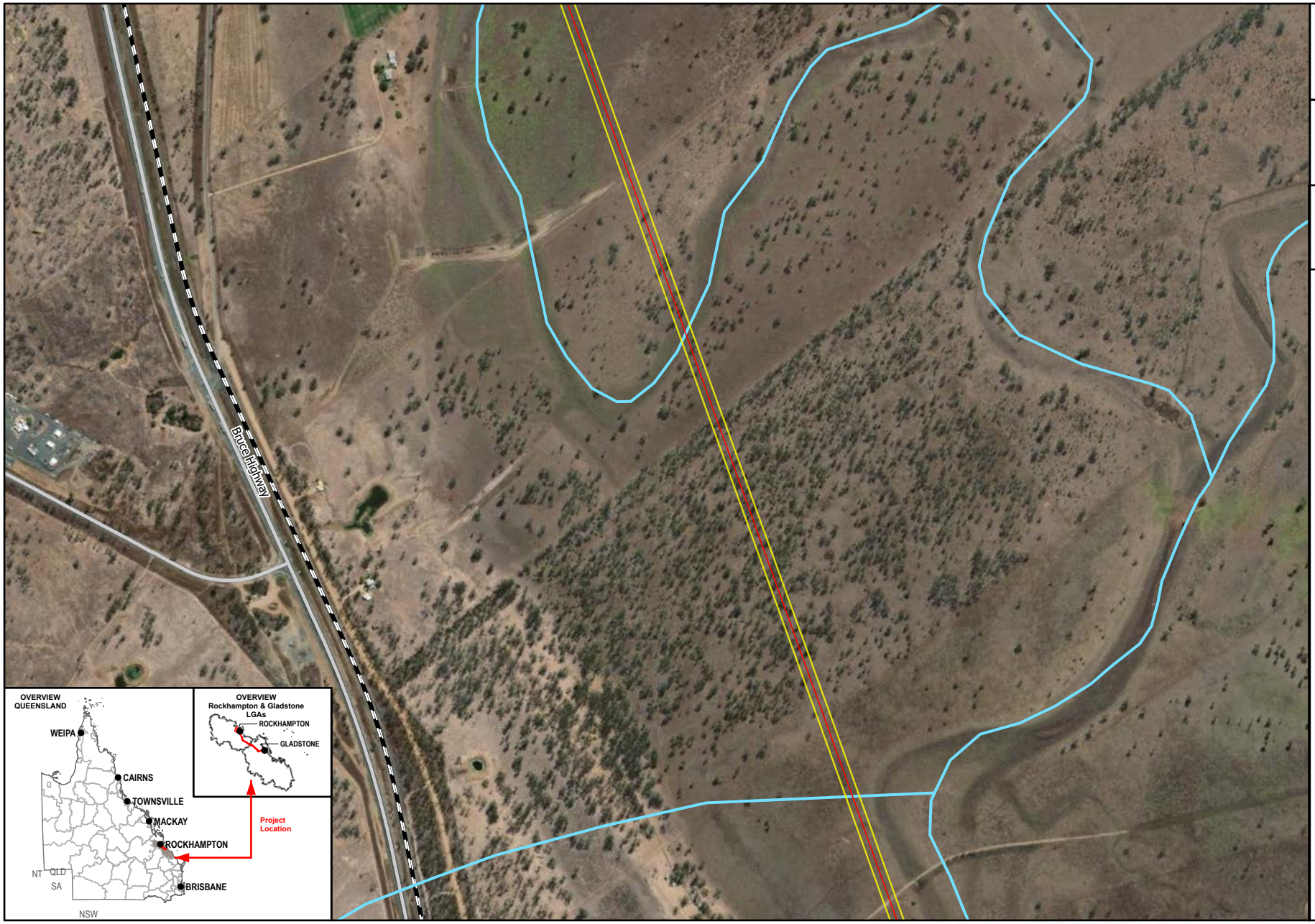
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-13v
Distribution of Powerful Owl Habitat Within the SGIC SDA Study Area
000-G-MAP-2435 Version:3 Date:19/09/2022



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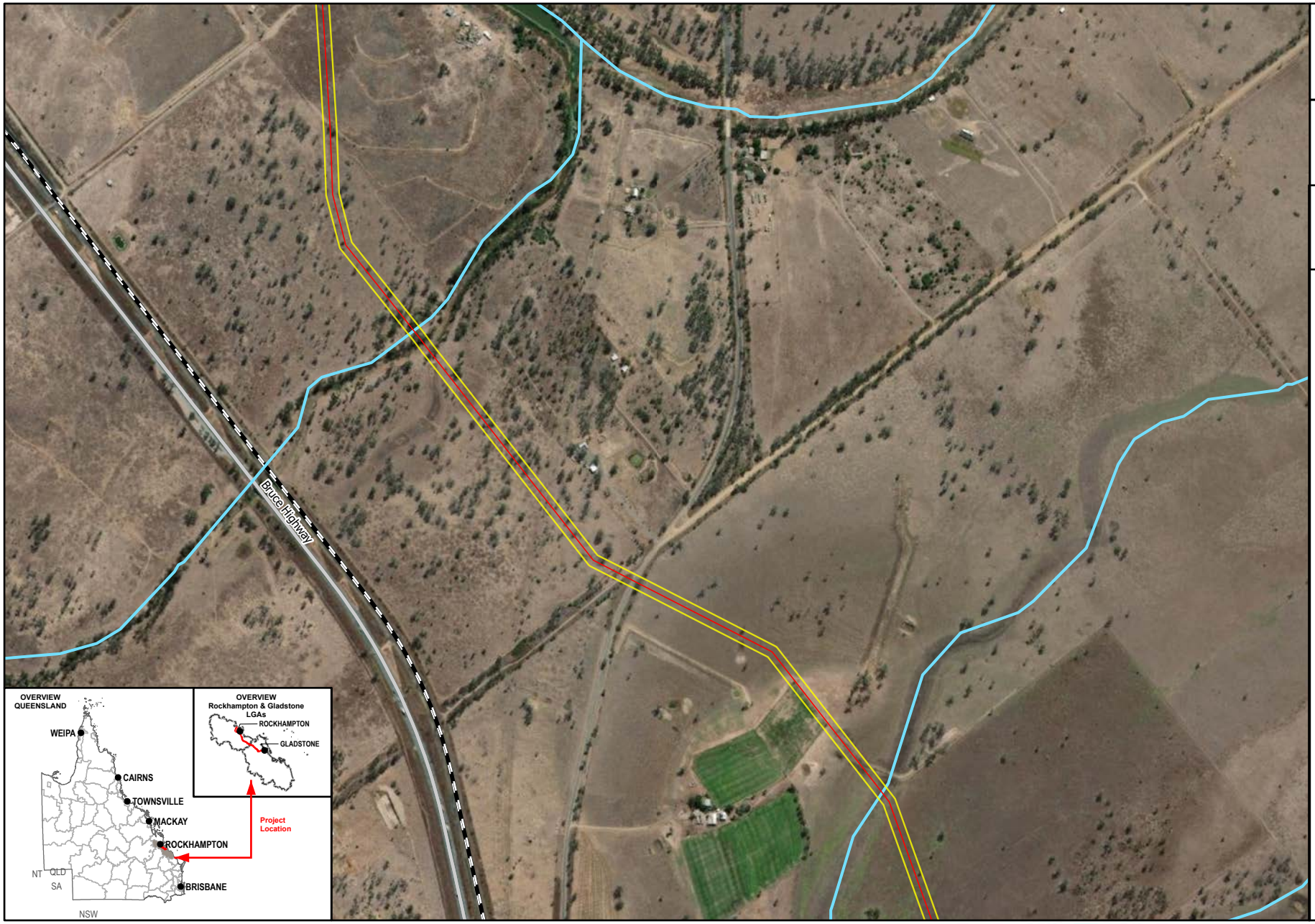
000-G-MAP-2435 Version:3 Date:19/09/2022



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2.Imagery @ Esri, Maxar, GeoEye, Earthstar Geographics, CNES-Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Gladstone Area Water Board
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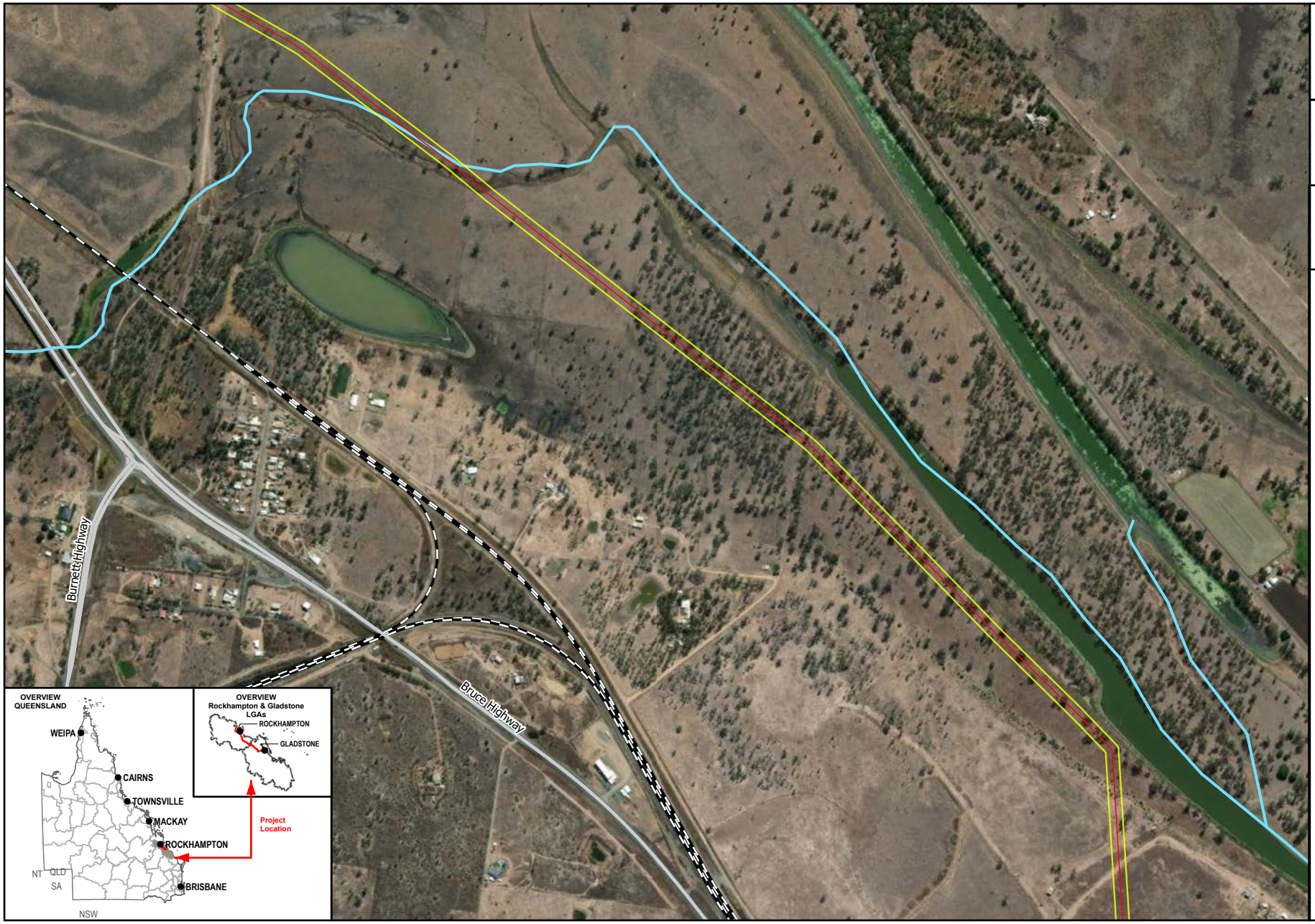
Ph: 07 4976 3000 www.gawb.qld.gov.au

PROJECTION UTM Zone 56
(Datum GDA2020)

Compiled by:YS16239

Fitzroy to Gladstone Pipeline
Baseline Terrestrial and Aquatic Ecology Technical Report
Figure 7-13x
Distribution of Powerful Owl Habitat Within the SGIC SDA Study Area
000-G-MAP-2435 Version:3 Date:19/09/2022



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Legend

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

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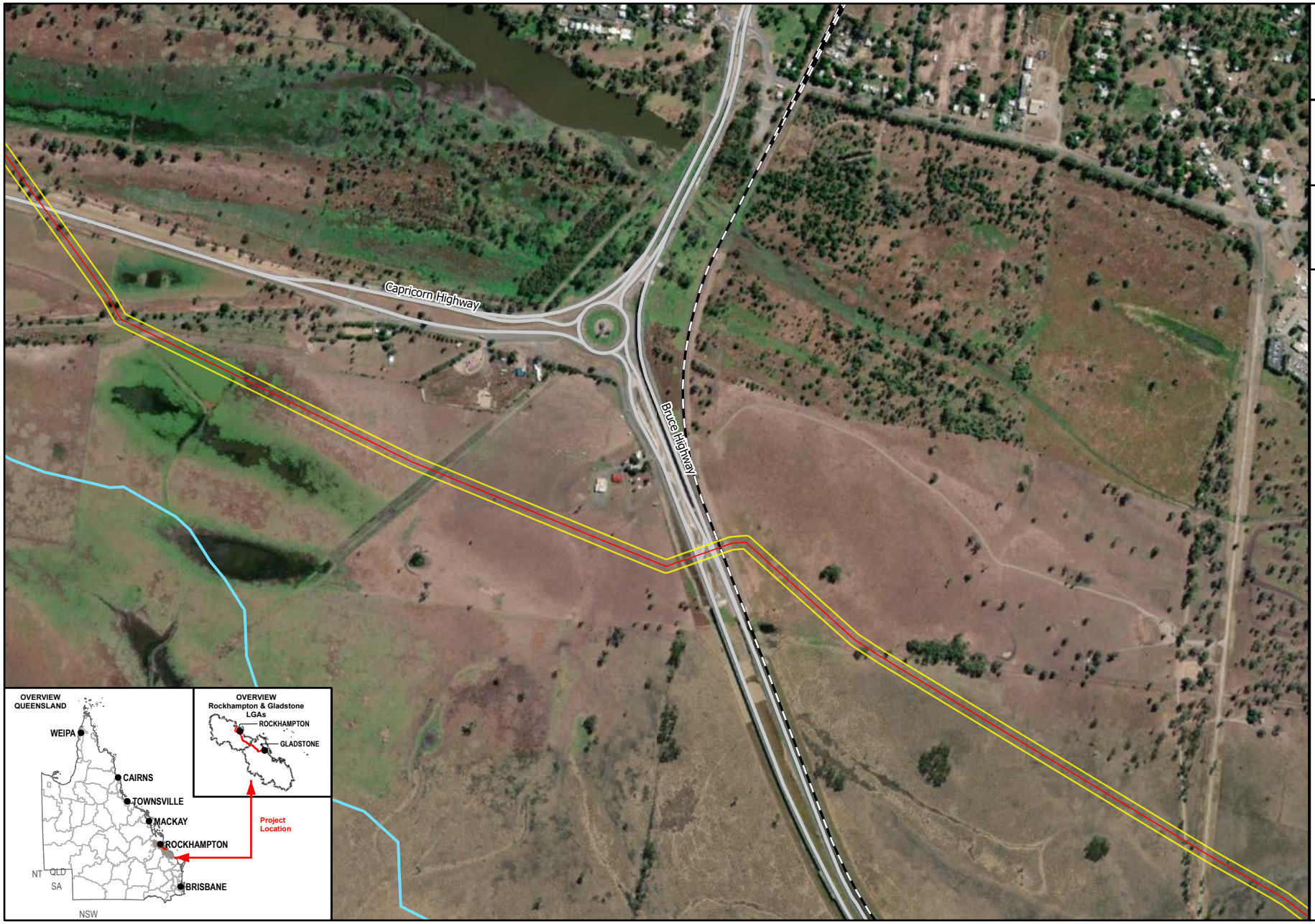

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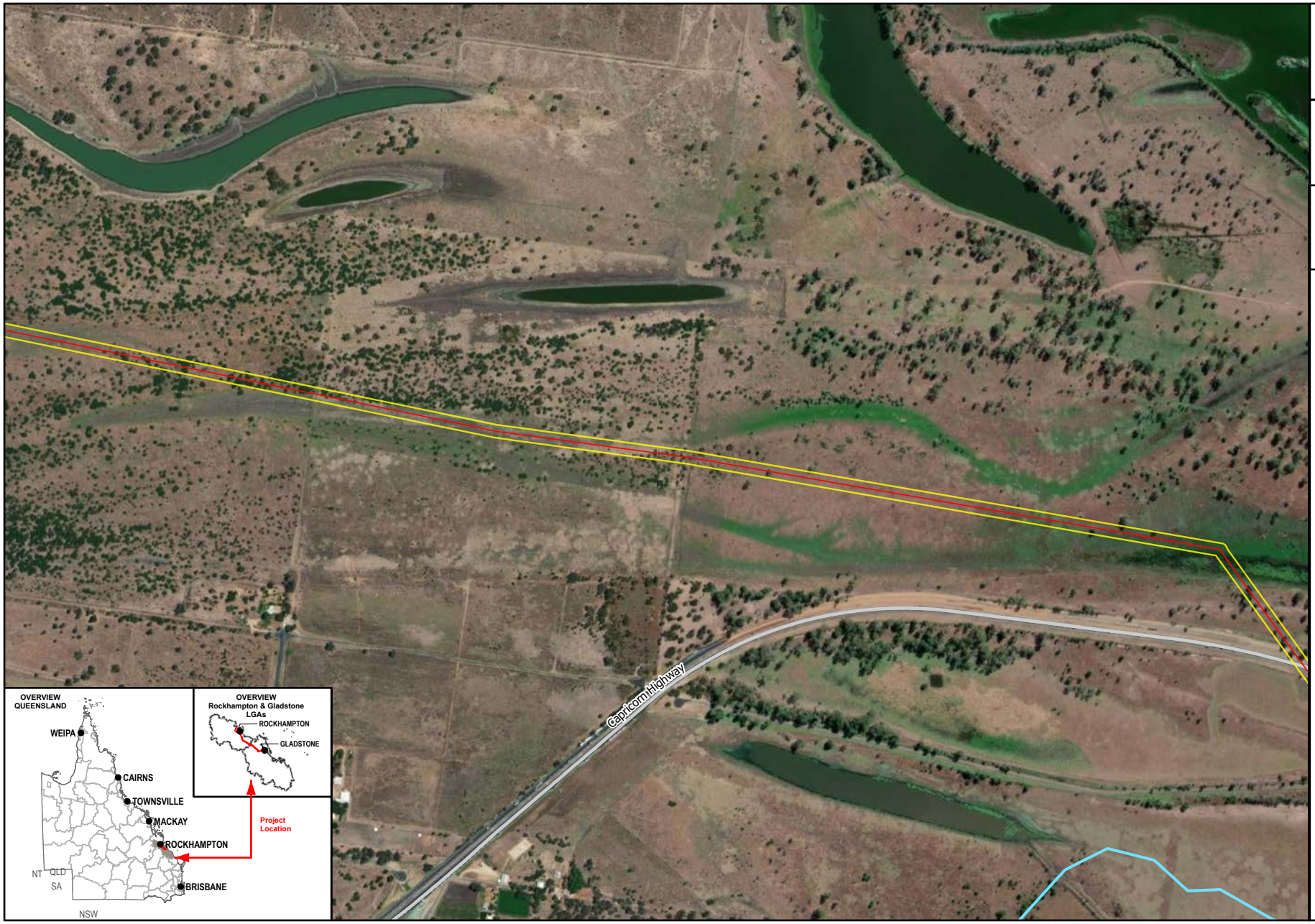

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