



Legend

-  Proposed Wind Turbine Location
-  Major Waterway 50 m Buffer
(Loodon River, Pyramid Creek and Calivil Creek)
-  Minor and Agricultural Waterway 30 m Buffer

DESIGNED:	K Prout
CHECKED:	J Baumann
DATE OF ISSUE:	7/4/2026
REVISION:	0



Macorna Wind Farm
Turbines and Waterway Buffers





Legend

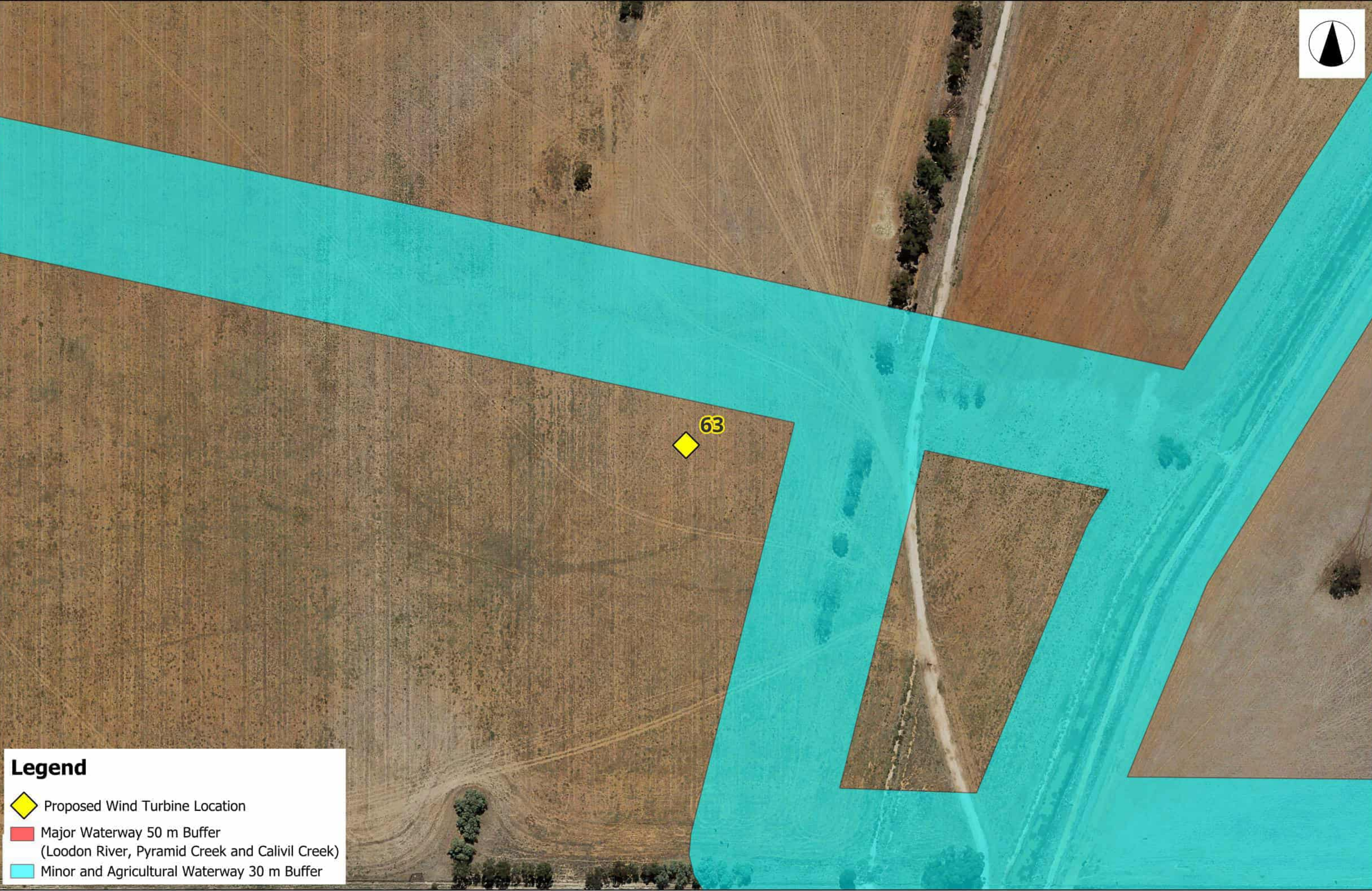
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Macorna Wind Farm
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65

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Macorna Wind Farm
Turbines and Waterway Buffers





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Macorna Wind Farm
Turbines and Waterway Buffers





67

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Macorna Wind Farm
Turbines and Waterway Buffers





68

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Macorna Wind Farm
Turbines and Waterway Buffers





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Macorna Wind Farm
Turbines and Waterway Buffers





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Macorna Wind Farm
Turbines and Waterway Buffers





71

Legend

 Proposed Wind Turbine Location

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(Loodon River, Pyramid Creek and Calivil Creek)

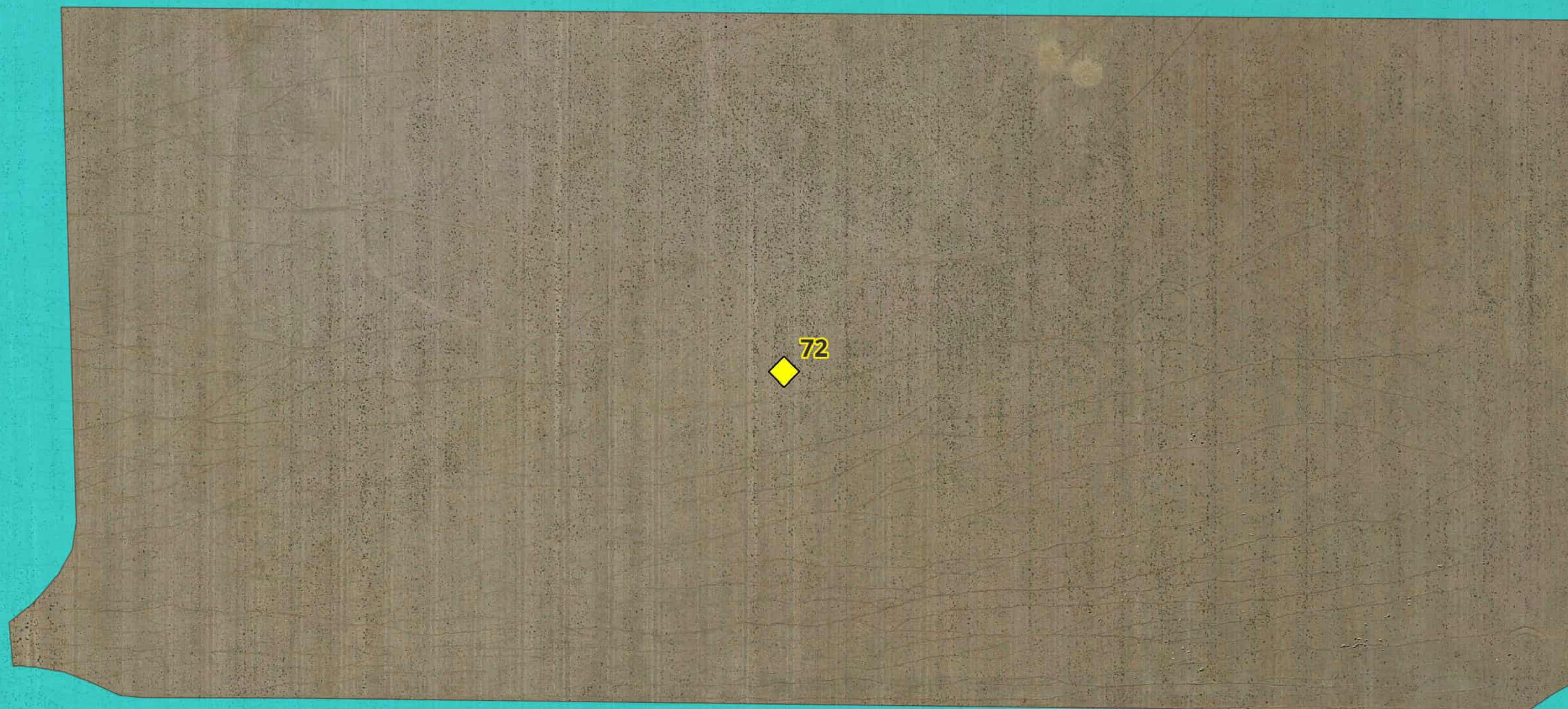
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Macorna Wind Farm
Turbines and Waterway Buffers





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Macorna Wind Farm
Turbines and Waterway Buffers





73

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Macorna Wind Farm
Turbines and Waterway Buffers





74

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0

25

50

75

100

125 m



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Turbines and Waterway Buffers





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Macorna Wind Farm
Turbines and Waterway Buffers





76

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DESIGNED:	K Prout
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0

25

50

75

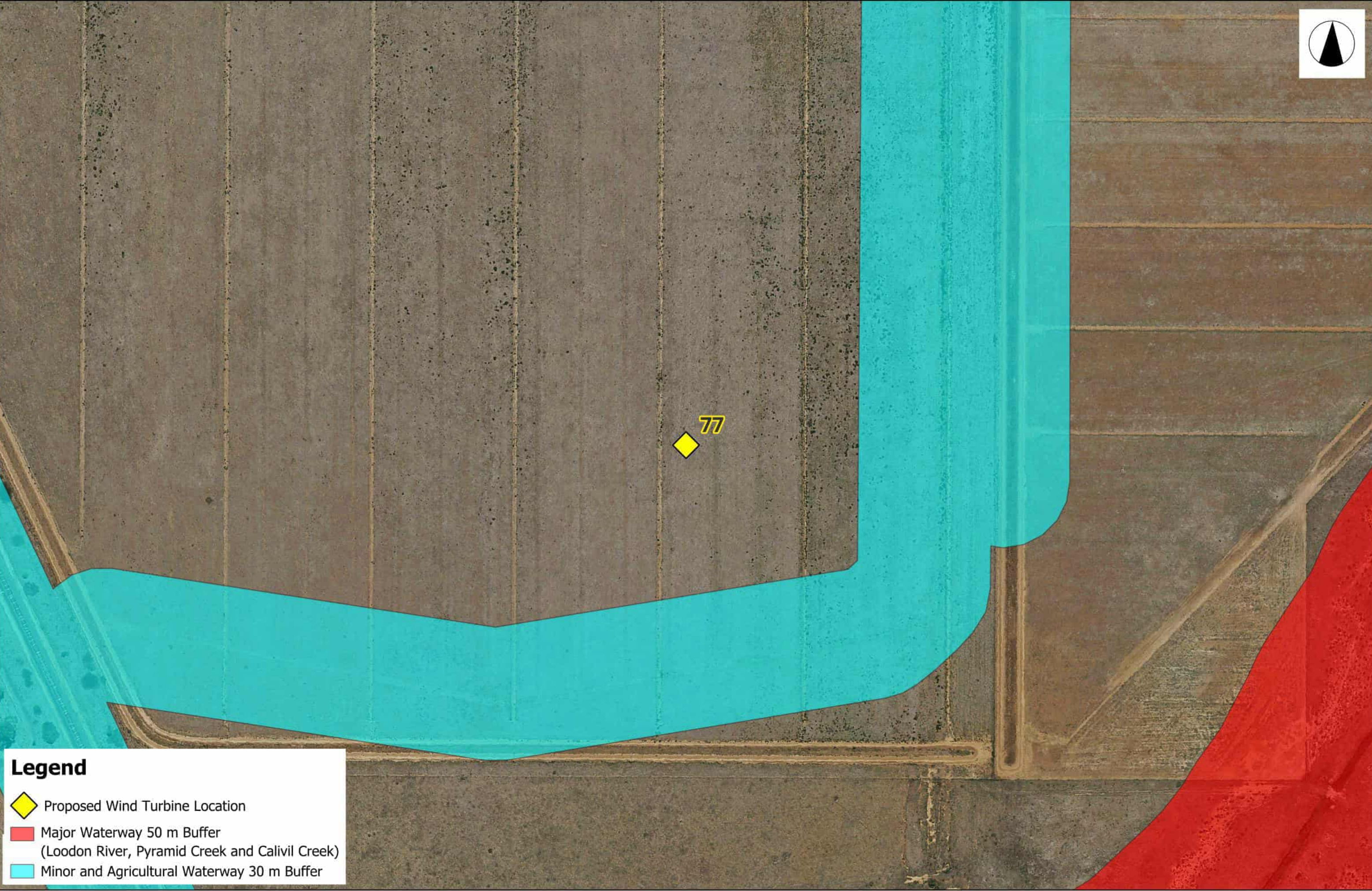
100

125 m



Macorna Wind Farm
Turbines and Waterway Buffers





Legend

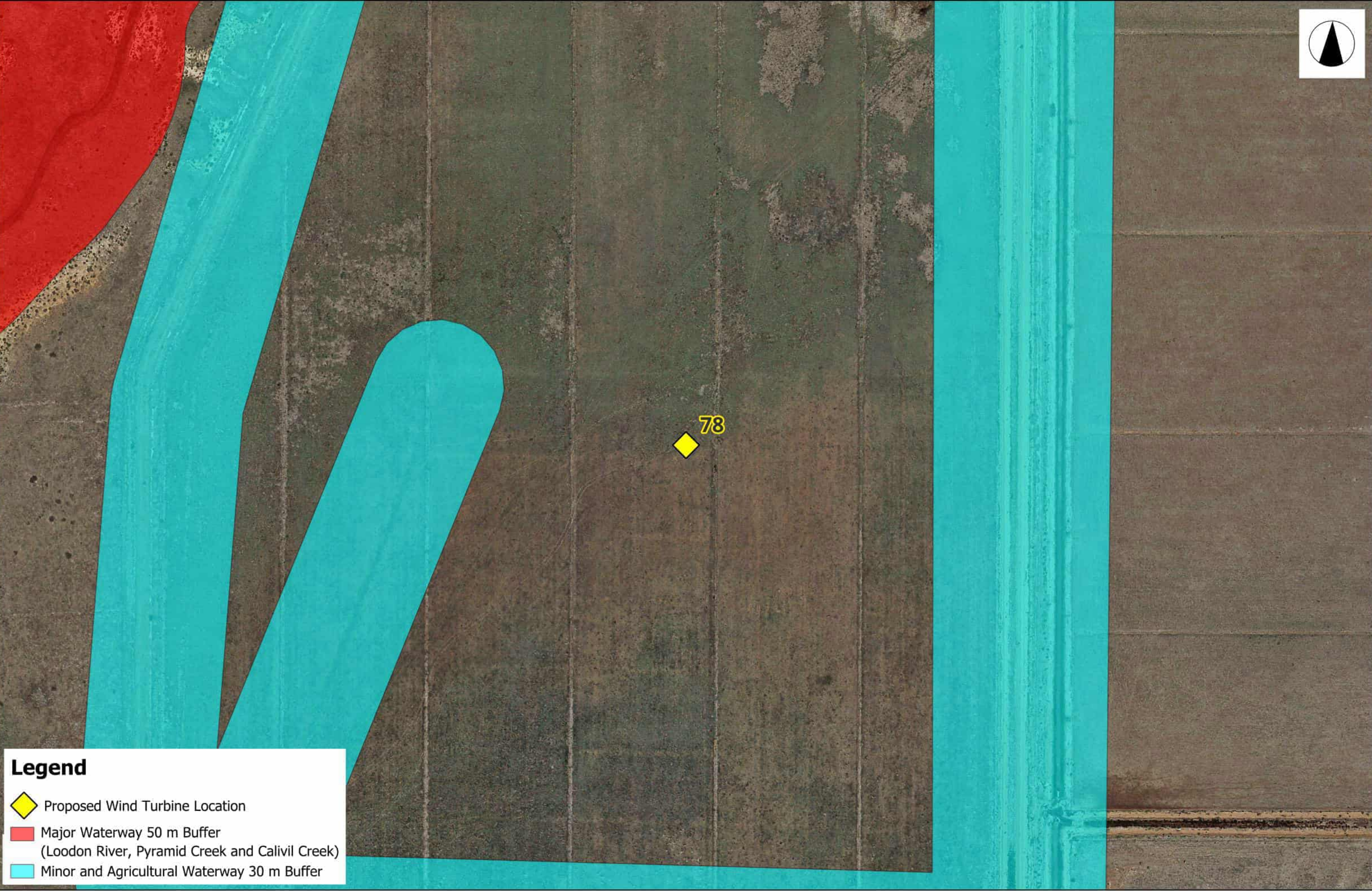
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Macorna Wind Farm
Turbines and Waterway Buffers





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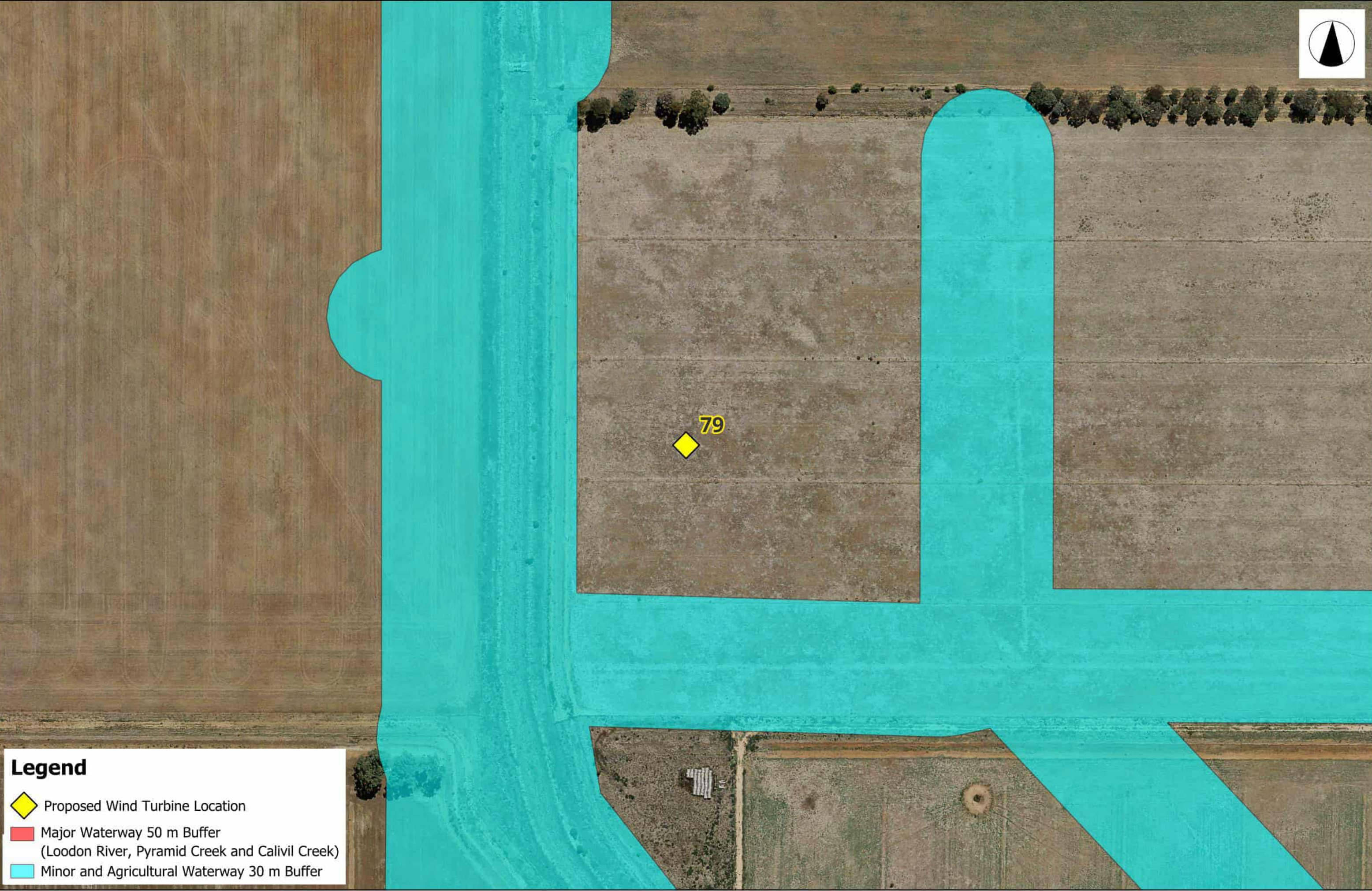
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Macorna Wind Farm
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0

25

50

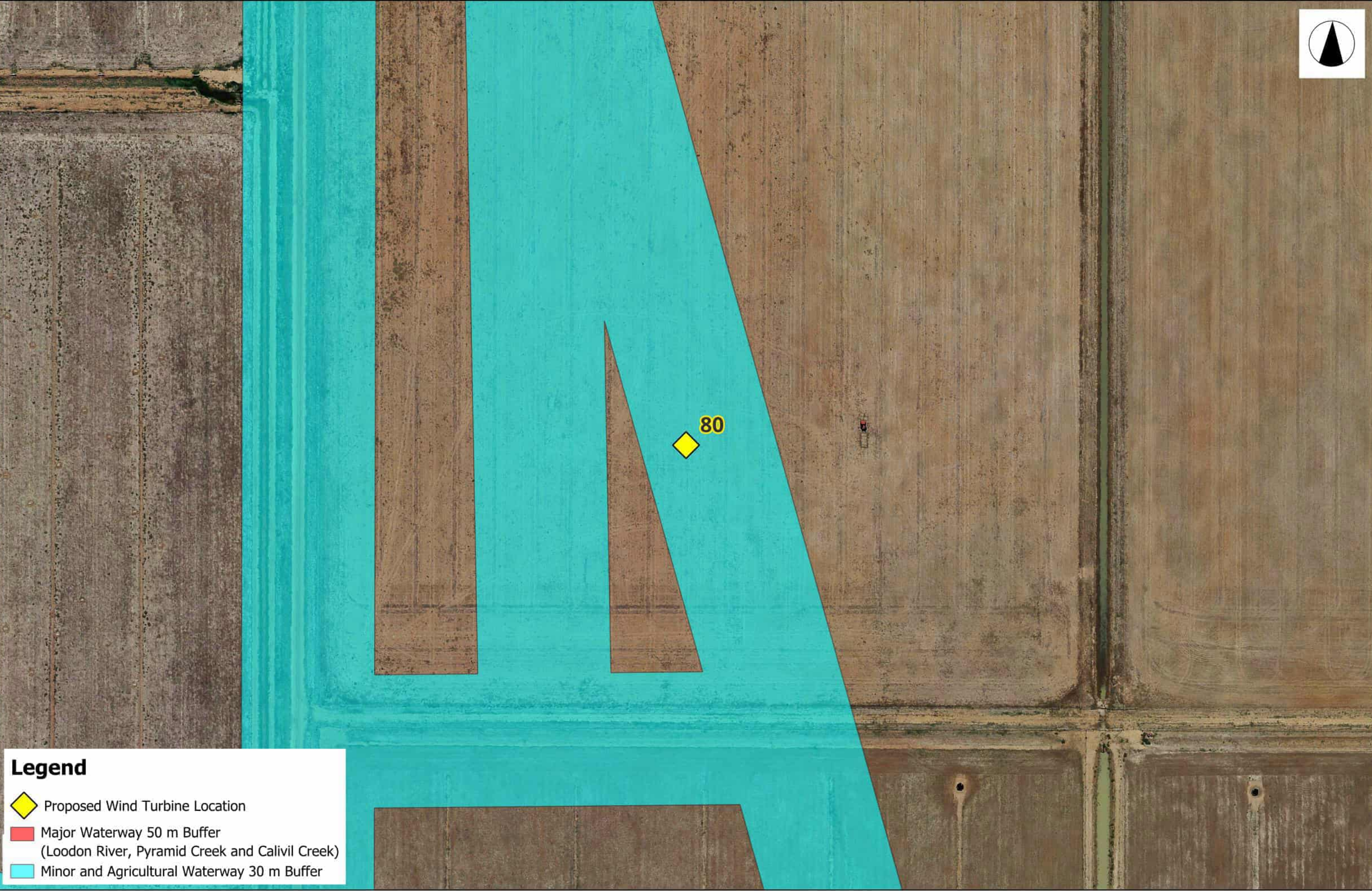
75

100

125 m

Macorna Wind Farm
Turbines and Waterway Buffers





Legend

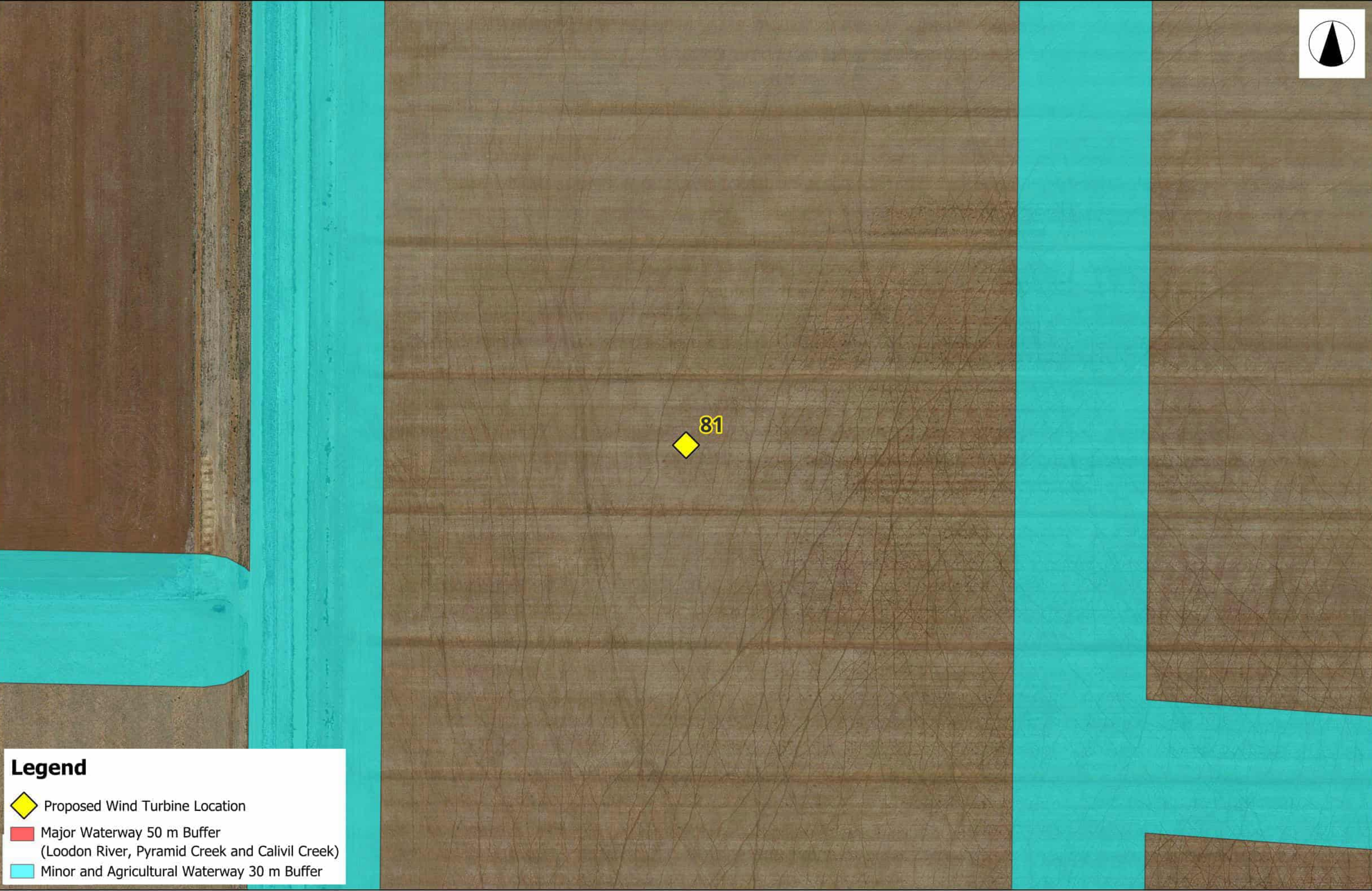
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Macorna Wind Farm
Turbines and Waterway Buffers





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0

25

50

75

100

125 m

Macorna Wind Farm
Turbines and Waterway Buffers





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Macorna Wind Farm
Turbines and Waterway Buffers





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Macorna Wind Farm
Turbines and Waterway Buffers





86

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DESIGNED: CHECKED: DATE OF ISSUE: REVISION:	K Prout J Baumann 7/4/2026 0
--	---------------------------------------

0 25 50 75 100 125 m



Macorna Wind Farm
Turbines and Waterway Buffers





Legend

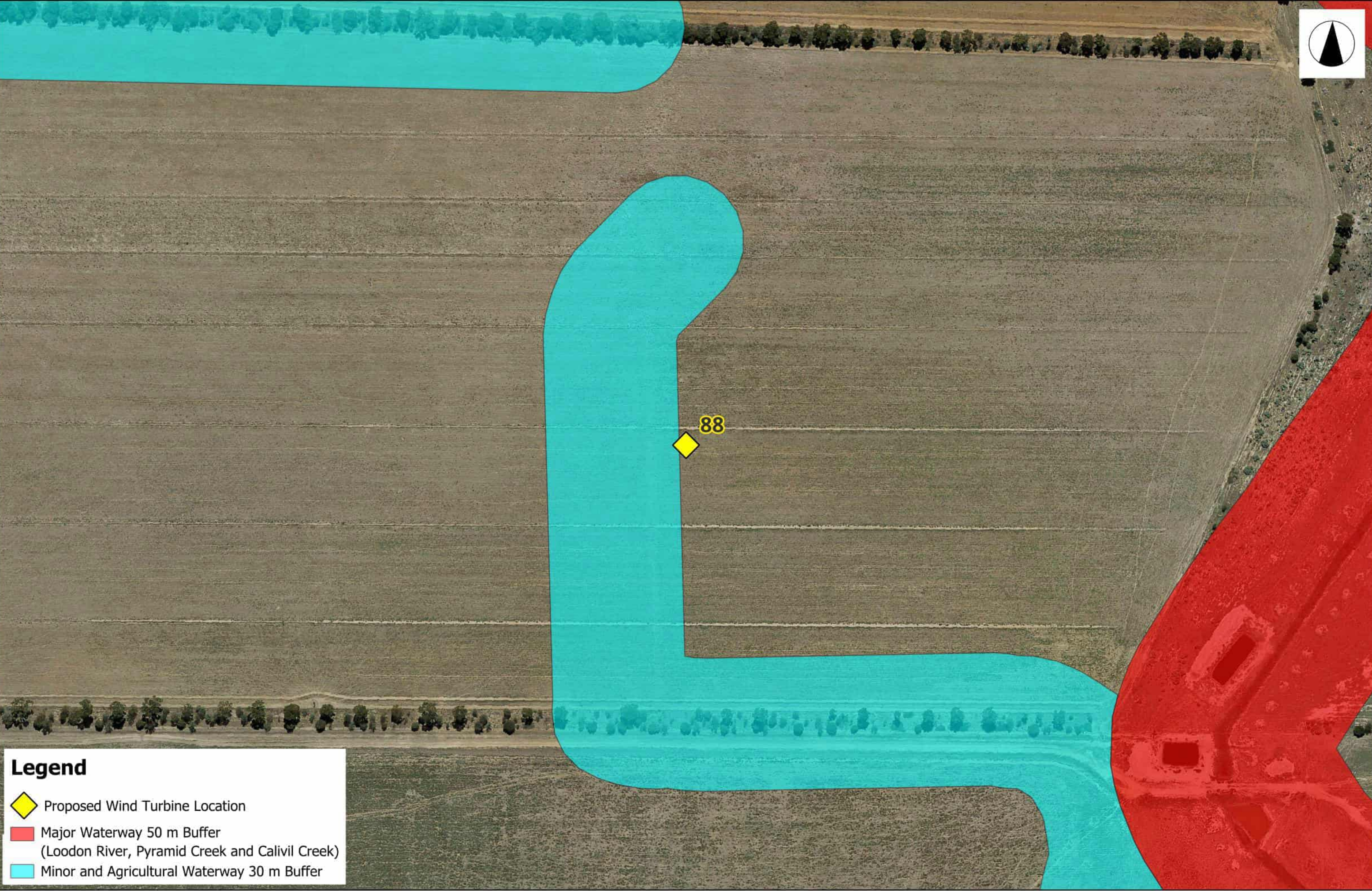
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Macorna Wind Farm
Turbines and Waterway Buffers





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Macorna Wind Farm
Turbines and Waterway Buffers





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Macorna Wind Farm
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Macorna Wind Farm
Turbines and Waterway Buffers





91

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Macorna Wind Farm
Turbines and Waterway Buffers





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Macorna Wind Farm
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Macorna Wind Farm
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Macorna Wind Farm
Turbines and Waterway Buffers





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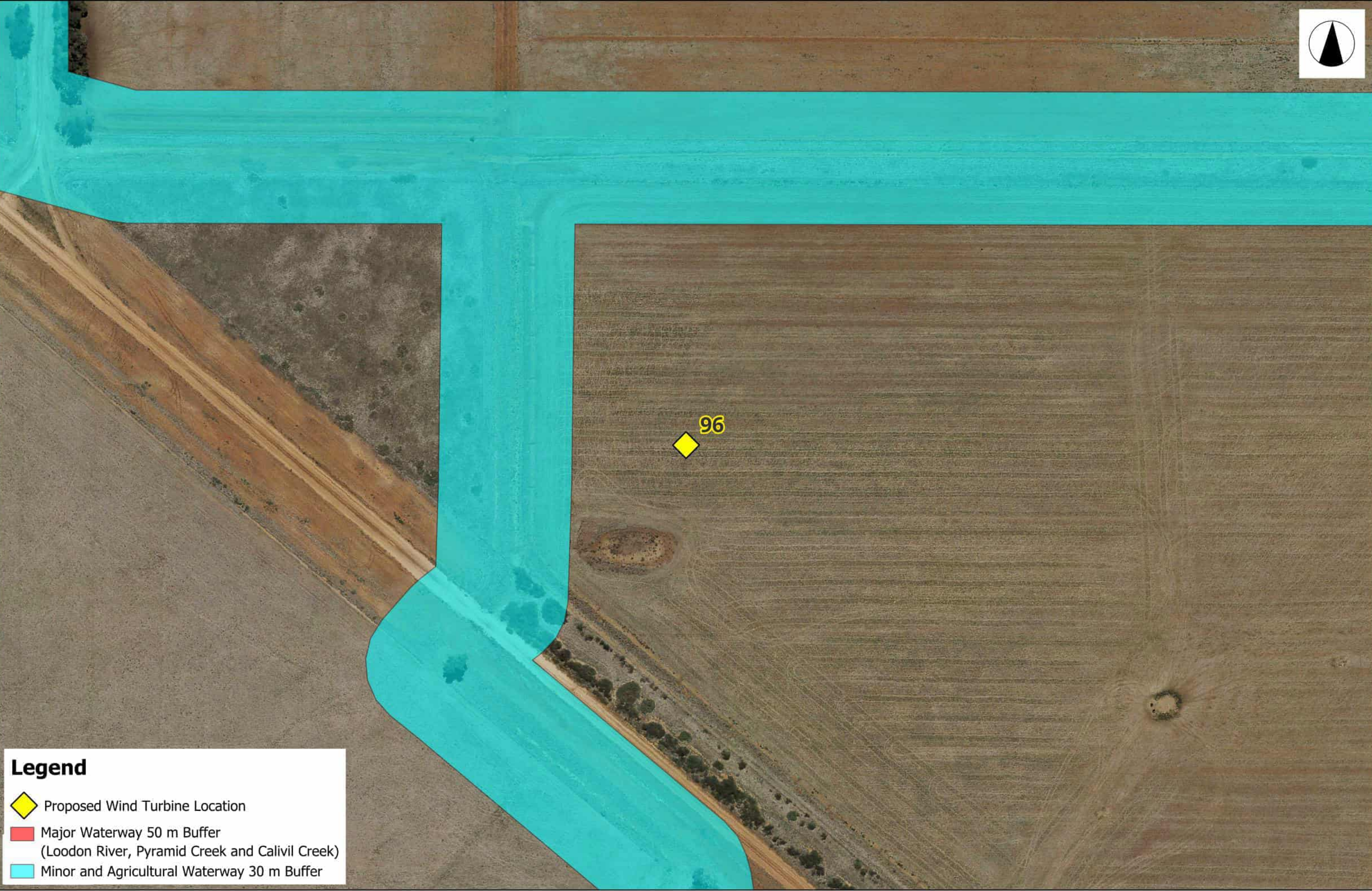
DESIGNED:	K Prout
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DATE OF ISSUE:	7/4/2026
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Macorna Wind Farm
Turbines and Waterway Buffers



**DALTON
CONSULTING
ENGINEERS**



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Macorna Wind Farm
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Macorna Wind Farm
Turbines and Waterway Buffers





98

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Macorna Wind Farm
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Macorna Wind Farm
Turbines and Waterway Buffers





102

Legend

 Proposed Wind Turbine Location

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Macorna Wind Farm
Turbines and Waterway Buffers





Legend

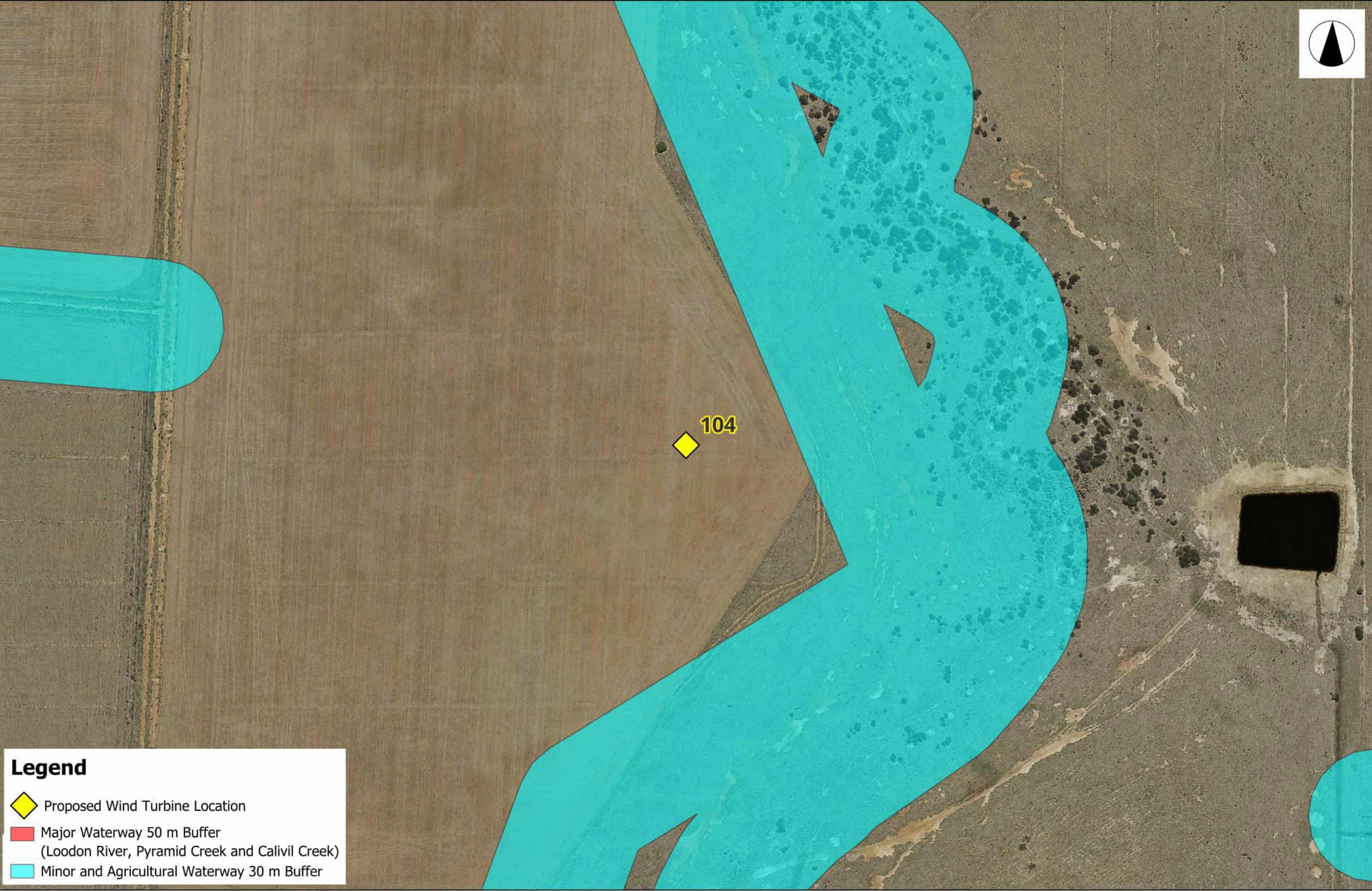
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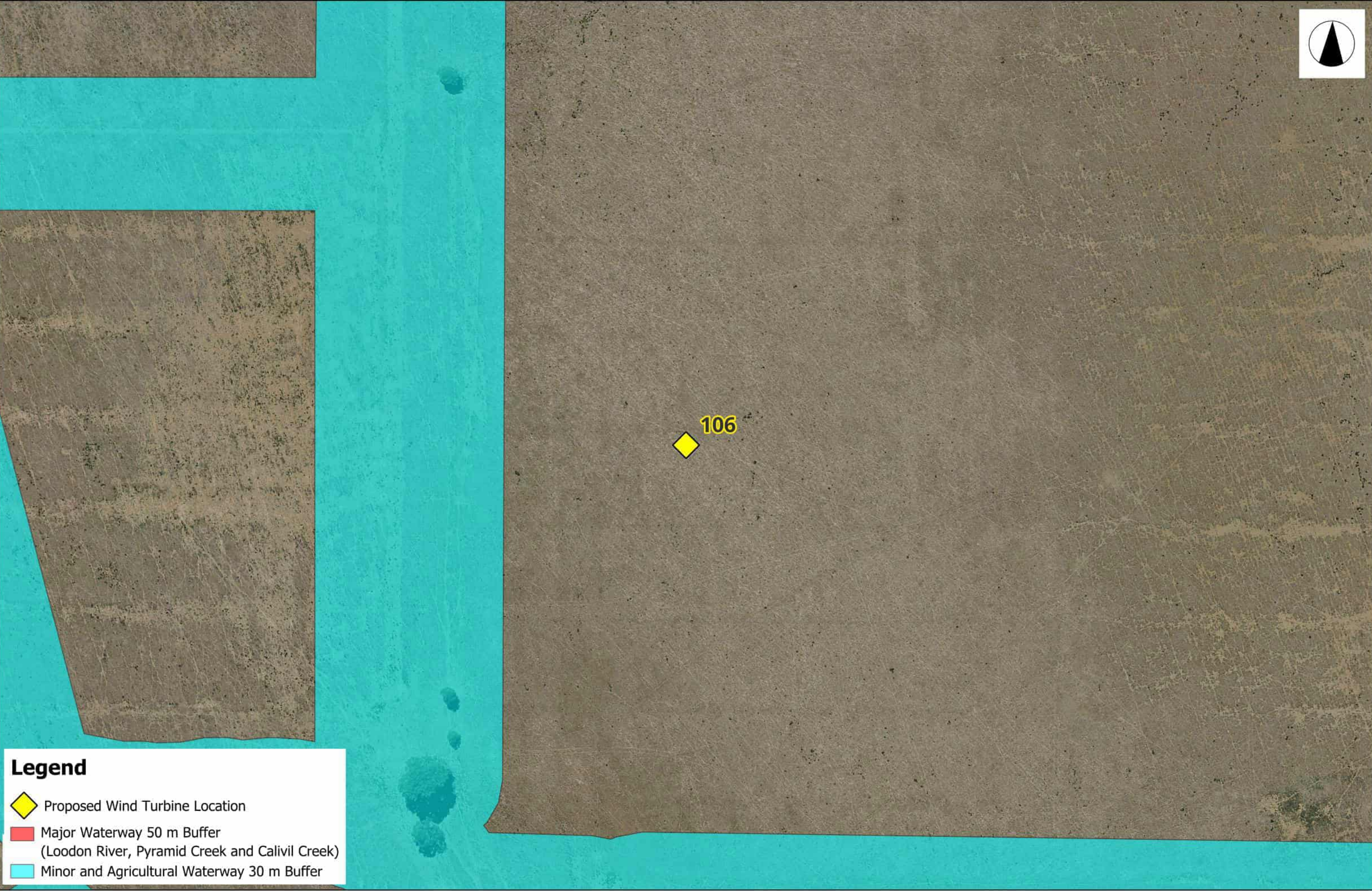
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Macorna Wind Farm
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Macorna Wind Farm
Turbines and Waterway Buffers





107

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Macorna Wind Farm
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Macorna Wind Farm
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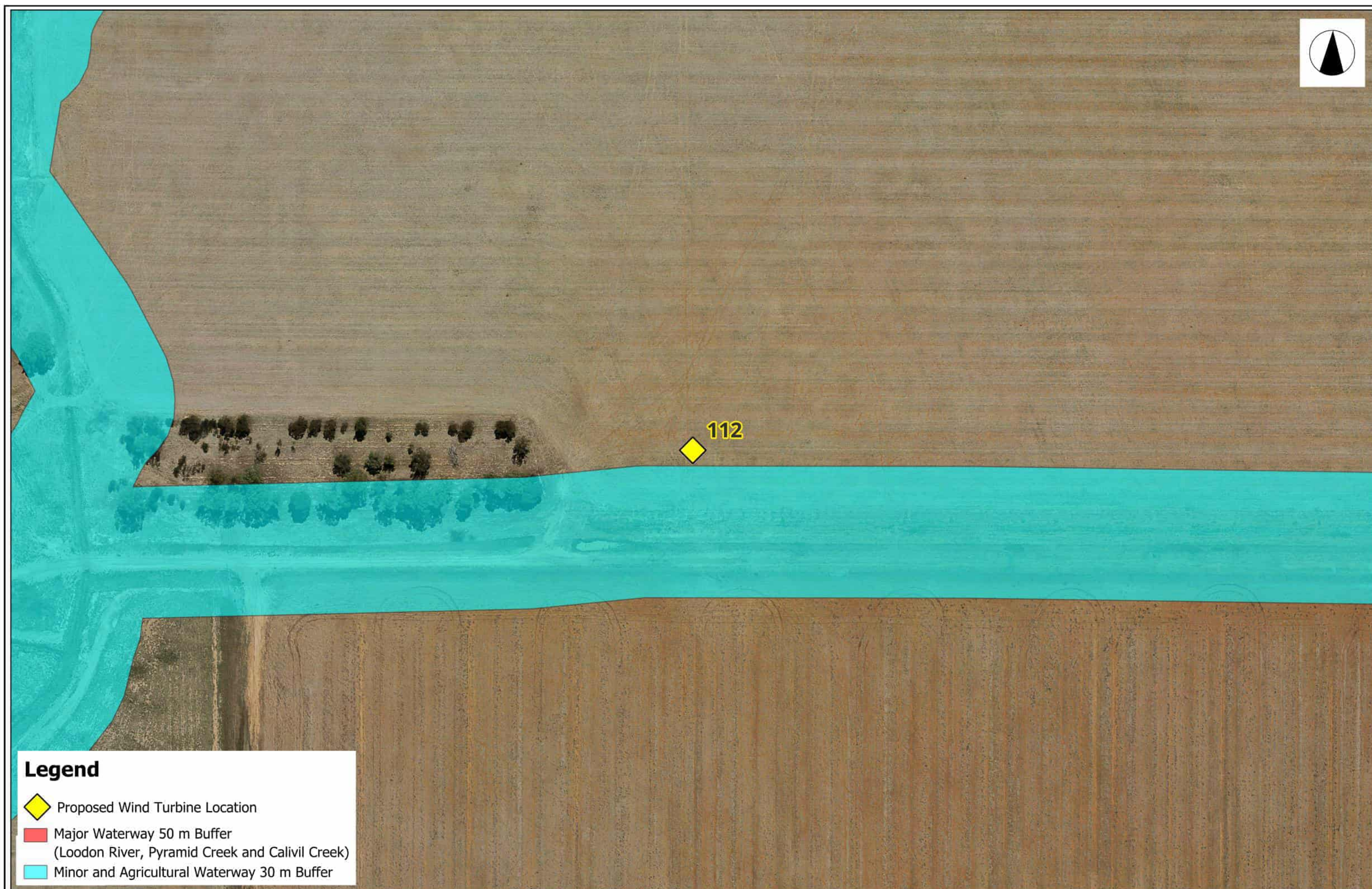
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Macorna Wind Farm
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Macorna Wind Farm
Turbines and Waterway Buffers





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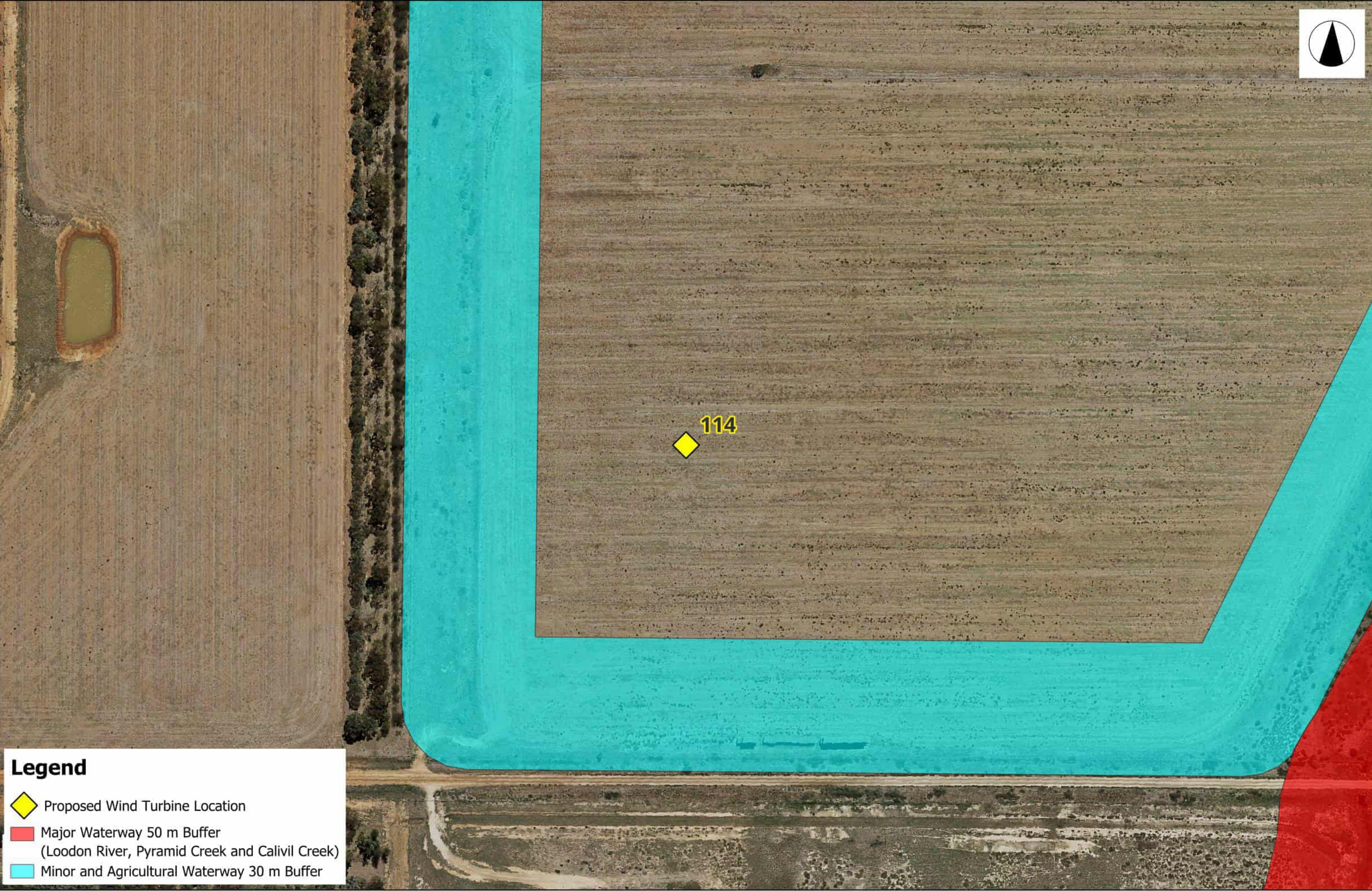
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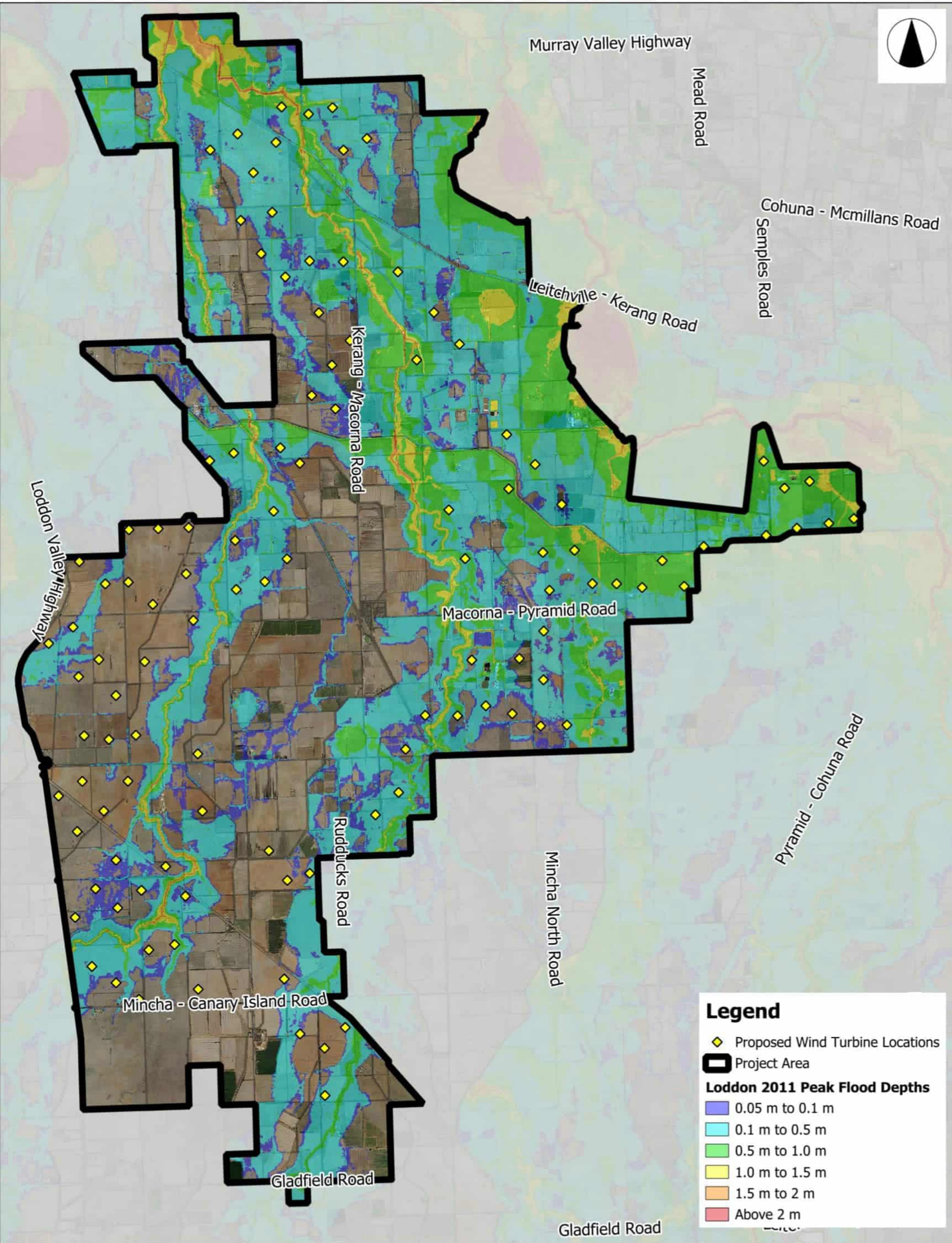
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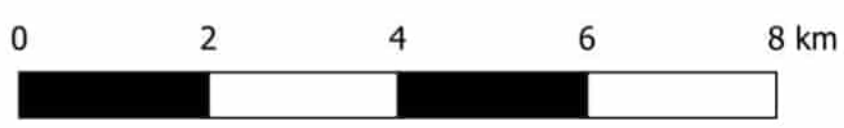
Appendix G NCCMA Flood Depth and Flood Velocity Maps



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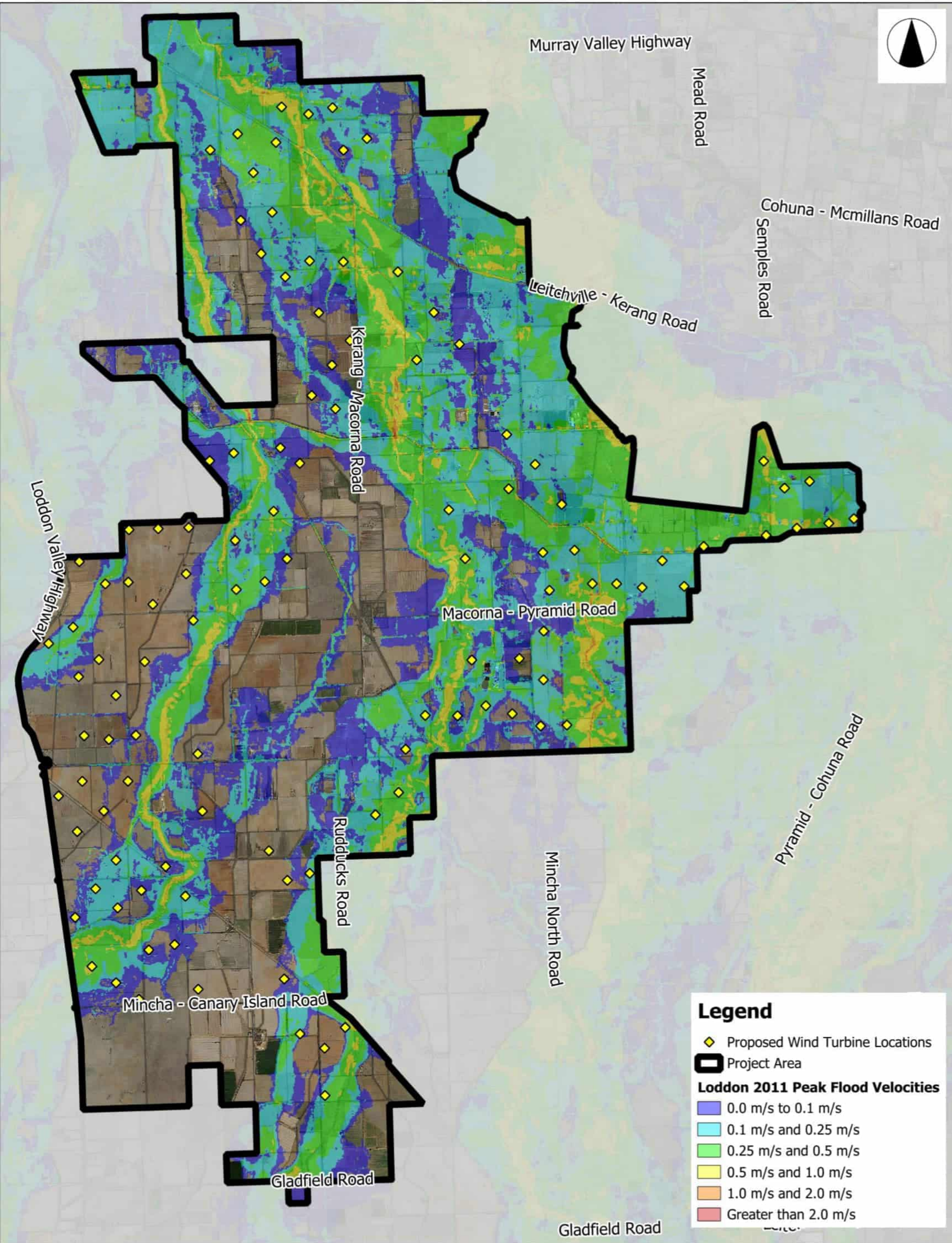
- ◆ Proposed Wind Turbine Locations
- ▭ Project Area
- Loddon 2011 Peak Flood Depths**
 - 0.05 m to 0.1 m
 - 0.1 m to 0.5 m
 - 0.5 m to 1.0 m
 - 1.0 m to 1.5 m
 - 1.5 m to 2 m
 - Above 2 m

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Macorna Wind Farm
Loddon River 2011 Peak Flood Depths





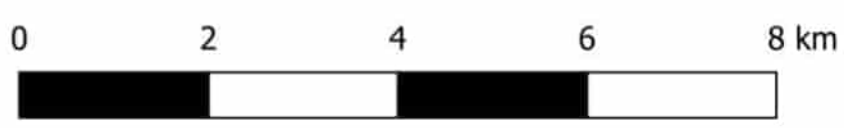
Legend

- ◆ Proposed Wind Turbine Locations
- ▭ Project Area

Loddon 2011 Peak Flood Velocities

- 0.0 m/s to 0.1 m/s
- 0.1 m/s and 0.25 m/s
- 0.25 m/s and 0.5 m/s
- 0.5 m/s and 1.0 m/s
- 1.0 m/s and 2.0 m/s
- Greater than 2.0 m/s

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Macorna Wind Farm
Loddon River 2011 Peak Flood Velocities



Appendix H Potential Brolga Breeding Habitat Wetland Investigation

4. Brolga Breeding Wetlands

The proposed wind farm falls within the Brolga area of interest as defined by DEECA. The study area includes five (5) locations in the DEECA Brolga Breeding Habitat Suitability Model data set (DEECA, May 2025). This means that there are Brolga Breeding Wetlands and likely Potential Breeding Wetlands within the project boundary and study area.

4.1 Wetlands in the DEECA Brolga Breeding Habitat Suitability Model

The areas identified as Brolga Breeding Wetlands or Potential Breeding Wetlands by the DEECA Brolga Breeding Habitat Suitability Model (DEECA, May 2025) within the study area are shown in Figure 4. Wetlands 8 (Johnson Swamp) and 13 (Hird Swamp) are Ramsar-listed wetlands, as discussed in Section 3.1. Wetlands 8330 and 8331 are both located along Calivil Creek. Wetland 12 includes storages and online sections of Bannagher Creek, part of the Serpentine Creek waterway system, and ultimately a tributary of the Loddon River.

The wetlands identified by the DEECA Brolga Breeding Habitat Suitability Model (DEECA, May 2025) were checked to ensure they meet the requirements for brolga breeding habitat related to existing at present and generally having the correct boundaries defined. Aerial survey and LIDAR terrain data indicates that the footprints included in the DEECA Brolga Breeding Habitat Suitability Model (DEECA, May 2025) reflect actual depressions in the terrain. Furthermore, the boundaries of the wetlands generally match those from the DEECA wetlands database for Victoria (DEECA, 2025). Based on the terrain and spatial data, the wetlands from the DEECA Brolga Breeding Habitat Suitability Model (DEECA, May 2025) appear correct.

DCE was unable to assess conclusively if the wetlands in the DEECA Brolga Breeding Habitat Suitability Model (DEECA, May 2025) had been permanently drained through desktop assessment. However, historic aerial imagery shows vegetation within the wetland areas that could not be supported without occasional inundation. This appears to indicate that the wetlands are not permanently drained.

4.2 Study Area for Identification of Potential Brolga Breeding Wetlands

A study area for assessing potential brolga breeding wetlands was created by buffering 5 km from the proposed project boundary.

4.3 Potential Brolga Breeding Wetlands

DCE's scope of works, as summarised in Figure 5, was to use spatial data and hydrological analysis to determine if there are Potential Brolga Breeding Wetlands within the study area. DCE's investigation included:

- DEECA Brolga Breeding Habitat Model (as discussed in Section 4.1) (DEECA, 2025).
- LIDAR spatial analysis to identify unmapped depressions within the landscape.
- DEECA mapped wetland data - DEECA Victorian Wetland Inventory (Current) spatial data set (DEECA, 2025)

Then, the identified wetlands were refined based on the criteria set in Table 11 within Appendix 2 of the Handbook for the development of renewable energy in Victoria (DEECA, 2025). The following wetlands were omitted from consideration:

- Wetlands where the inundation requirement for 120 days of inundation July-December for the past 10 years were not met.
- Wetlands less than 0.1 ha in size
- Permanent and temporary saline swamps, marshes, and meadows.
- Farm dams without a known breeding record*
- Wetlands that no longer exist through being paved or being permanently drained.

* For the purposes of this investigation, it has been assumed that all potential breeding wetlands with a known brolga breeding record have been included in the DEECA Brolga Breeding Habitat Suitability Model (DEECA, May 2025). Therefore, all other farm dams can be excluded from the potential brolga breeding habitat wetland investigation.

A discussion of the investigation is included in this report. Spatial data can be obtained from DCE upon request. Maps and plans related to the brolga breeding habitat investigation are included in Appendix B.

4.3.1 Wetland Identification - Terrain

Aerial imagery from 2022 and LIDAR data from the 2009-10 Victorian State Wide (sic) Floodplains LIDAR Project (flown 2009-2011) was used to identify depressions that may serve as wetlands for Brolga Breeding Habitat. The LIDAR data used generally has an accuracy of 0.1 m vertical accuracy. LIDAR for the entire study area was filled, and then the original LIDAR was subtracted from the filled LIDAR to produce a map of depressions across the study area. The depressions were further refined based on the following:

- All depressions where the depth was less than 0.1 m were removed from the data set.
- Depressions where depths included areas of 0.3 m, an ideal depth for Brolga breeding habitat, were identified.
- All depressions with areas less than 0.1 ha were removed from the data set.

The methodology identified seven (7) potential wetlands across the study area that have not been included in either the DEECA Brolga Breeding Habitat Model or the DEECA Victorian Wetland Inventory (Current) (DEECA, 2025) data sets. The seven potential wetlands are shown in Figure 12.

Further refinement of the identified potential wetlands was undertaken. Three (3) potential wetlands are clearly human-constructed dams and features. As farm dams are to be omitted from Brolga breeding habitat, this discounts the three features. The remaining four (4) potential wetlands were confirmed through latest near map imagery to be located within unnamed drainage swales/irrigation channels. Drains and swales are not designed to hold water as they serve to direct water away from roads to overland flow paths. **For these reasons, none of the potential wetlands identified by DCE are considered potential Brolga Breeding Habitat.**

The DCE-identified potential wetlands are included within the summary wetland table in Appendix C. A spatial data set of the identified wetlands is available upon request from DCE.

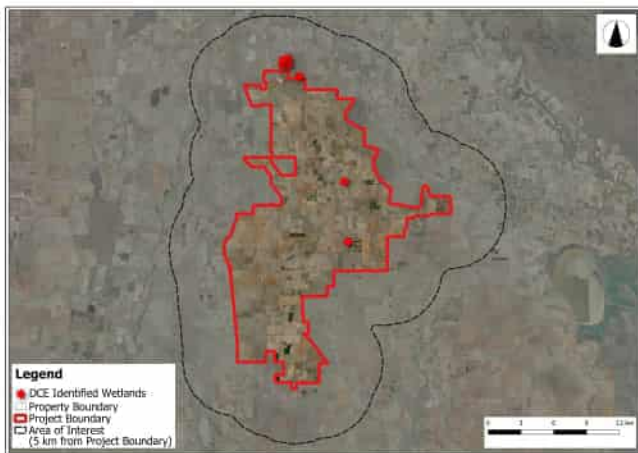


Figure 12: Potential Brolga Breeding Wetlands Identified by DCE

4.3.2 Wetland Identification – DEECA Victorian Wetland Inventory (Current)

The DEECA Victorian Wetland Inventory (Current) spatial data set (DEECA, 2025) was used to identify larger potential brolga breeding wetlands within the study area. A spatial query resulted in 1030 wetlands within the DEECA data set falling within or partially within the study area. A complete table of the assessed wetlands is included as Appendix C. A spatial data set of the wetlands is available upon request from DCE.

Area Less Than 0.1 Ha

Not all of the identified wetlands from the DEECA Victorian Wetland Inventory (Current) spatial data set (DEECA, 2025) within the area of interest are appropriate to assess for Brolga breeding habitat. Wetlands smaller than 0.1 ha are not suitable brolga breeding habitat. Therefore, the wetlands were filtered to remove all wetlands smaller than 0.1 ha in area. There were 445 wetlands within the data set that are smaller than 0.1 ha. Once these wetlands are removed, 585 wetlands remained to be assessed for potential brolga breeding habitat.

Salinity

DEECA wetlands with 'Saline' salinity regime were removed. There were two (2) saline wetlands—a saltpan/flat (43238) and a temporary saline lake (43253). Tragowel Swamp, a hyposaline environment that allows for the survival of pockets of freshwater species within it, has been retained within the wetlands to be assessed.

Once the two (2) saline wetlands are removed, 583 wetlands remained to be assessed for potential brolga breeding habitat.

Farm Dams

DCE assumed that all farm dams that appear in the DEECA Victorian Wetland Inventory (Current) data set do not have recorded brolga breeding use. If breeding use was recorded, the dams would appear in the DEECA Brolga Breeding Habitat Suitability Model data set. For this reason, all farm dams were removed from the data set.

A total of 469 wetlands are identified in the DEECA Victorian Wetland Inventory (Current) data set as being dams and storages. These wetlands have been removed from consideration. Upon review a further 24 wetlands within the DEECA Victorian Wetland Inventory (Current) data set have been identified as farm dams, or constructed dam through assessment of the LIDAR and catchment delineation process. These wetlands have no contributing catchment beyond the berms that form them. They are used as water storages. The agricultural use of the land within the study area depends on irrigation, and water storage is a critical component of the local irrigation system. Generally, the farm dams are for storage of irrigation flows, not harvest of runoff. As a result, aerial imagery corroborates the notes in the DEECA data set that minimal vegetation exists within the dams.

Once the all farm dams are removed from the reduced data set, 90 wetlands remain to be assessed for potential brolga breeding habitat.

Wetlands That No Longer Exist

During catchment assessment, DCE noted that some wetlands included in the DEECA data set did not correspond with depressions in the aerial imagery or LIDAR terrain data. The DEECA data set was issued in 2025. However, the metadata for the DEECA wetland data set does not mention that any checks of the wetland data were made against terrain data, only that additional wetlands were added from existing state data sources.

The aerial imagery (2022 and Nearmap 2025), and the LIDAR used to supplement terrain data in areas where aerial survey does not exist was flown in 2009-2010. Whilst the wetland data set was issued in the same year as the aerial survey, it's unclear if the wetland data set is based on newer terrain information. The difference between the wetland data set and wetlands in the LIDAR is a result of the difference that existed when the LIDAR was vs when the wetland was recorded.

The remaining wetlands from the DEECA Victorian Wetland Inventory (Current) spatial data set (DEECA, 2025) were checked against the aerial survey and LIDAR terrain data. The check against terrain data allowed for 6 wetlands to be removed. Generally, wetlands that were removed were smaller farm dams that have been filled in based on changing agricultural needs. Once non-existent wetlands are removed from the reduced data set, 84 wetlands remain to be assessed for potential brolga breeding habitat.

4.3.3 Wetland Identification – 120 Days of Inundation

The 84 remaining wetlands from the DEECA Victorian Wetland Inventory (Current) spatial data set (DEECA, 2025) needed to be assessed against the final criteria of 120 days of inundation during Brolga breeding season over the previous 10 years to determine if any of them are Potential Brolga Breeding Wetlands. DCE's scope of work included continuous simulation hydrological modelling of

the wetlands using actual rainfall and evaporation in MUSIC software to determine if the wetlands satisfy the 120-day requirement for potential brolga breeding habitat.

4.3.3.1 Waterways

A portion of the wetlands within the DEECA Victorian Wetland Inventory (Current) spatial data set (DEECA, 2025), including the wetlands that also are included within the DEECA Brolga Breeding Habitat Suitability Model data set are online to waterways. MUSIC modelling is not an appropriate way to model water levels within these wetlands. Furthermore, some of the wetlands are adjacent to waterways, and the wetlands will fill when water levels within the watercourse reached a certain level.

A total of 52 wetlands have been assessed as having a filling regime that is linked to water levels of watercourses within the study area (refer to Figure 14 and Appendix B). A summary of the major watercourses, their management (as many have human-managed flow regimes), and (where available) historical level data for the period of interest is provided in this section of the report. Most waterways within the study area are managed for irrigation water supply and receive inflows that are separate to those from their natural catchment.

For some wetlands, there is no gauge on the Victorian Water Measurement Information System (WMIS) online portal that can provide level information to definitively confirm filling of the wetland. Additionally due to the low-lying elevations within the project boundary there are lots of interconnected watercourse which make it hard to determine what systems are in isolation and which are connected (some may become interconnected during a significant flow event or through human-controlled flow regimes) (refer to Figure 13). Wetlands online or adjacent to waterways are noted in the summary wetland table in Appendix C.

The following waterways (and their tributaries) contain DEECA wetlands within the area of interest.

- Calivil Creek
- Loddon River
- Nine Mile Creek
- Pyramid Creek
- Serpentine Creek

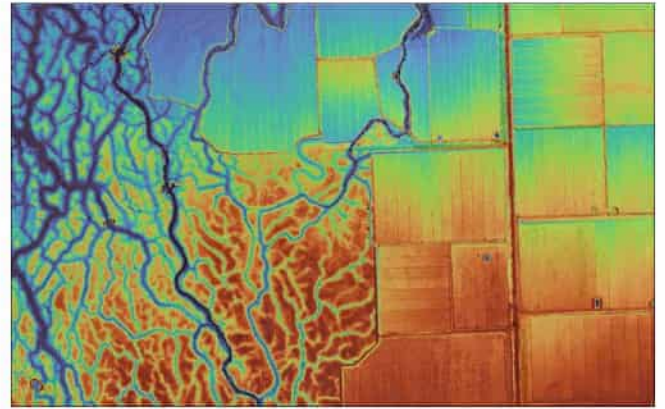


Figure 13: Example Braided Waterway systems within the Area of Interest

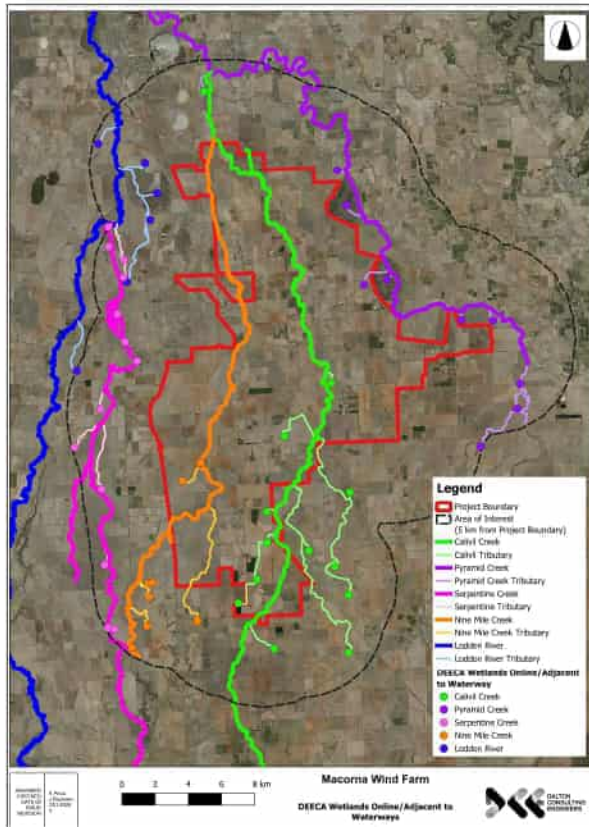


Figure 14: DEECA Wetlands Online/Adjacent to Waterways

Pyramid Creek

Pyramid Creek is a major waterway that generally forms the north-eastern boundary of the project area. Bullock Creek and Welches Creek are tributaries of Pyramid Creek and are discussed in this section of the report.

Water is provided to Pyramid Creek through releases from Kow (Ghow) Swamp. The source for Kow Swamp is the Murray River at Torrumbarry Weir. Publicly available data indicates that flows into Pyramid Creek are controlled by the North Central CMA to manage habitat for aquatic species and to connect the many ponds that exist along the creek. The hydrology modelling methodology for assessing days full of water based on catchment area is not appropriate for modelling features that have a consistent outlet (like creeks, irrigation channels, or roadside swales). Furthermore, a hydrology assessment cannot capture the human-controlled inflows through the managed creek system. Historical data has been used to provide an assessment of wetland online and adjacent to Pyramid Creek and its tributaries.

Following a spatial analysis, 10 wetlands from the DEECA Victorian Wetland Inventory (Current) spatial data set (DEECA, 2025) have been identified as having water levels that depend on levels and flows within Pyramid Creek. A discussion of wetlands connected to Pyramid Creek is made in this section of the report. Figure 15 shows locations of water level data recording stations along Pyramid Creek. Table 5 summarises the assessment that can be made of wetlands associated with Pyramid Creek.

- **RAMSAR wetlands** – The two (2) Ramsar wetlands Johnson Swamp (45222) and Hird Swamp (45231) are located on Pyramid Creek. These wetlands also are included in the Brolga Model Wetlands Data set (ID's 8 and 13, respectively). The data set indicates that these are temporary wetlands. Notes about flow releases from Gow Swamp indicate that maintaining water levels in these wetlands is a control for the human-managed flows in Pyramid Creek.
- **Wetland 45406** is located adjacent to Hird Swamp and is connected to it via minor agricultural drainage lines. This wetland has a minimal natural catchment, likely with additional inflows provided through minor agricultural waterways.
- **Other online wetlands** – Wetland 45407 is an online wetland to Pyramid Creek. Publicly available information from the North Central CMA and GMW indicate that flows within Pyramid Creek, and therefore flows and water levels within these wetlands, are managed to provide habitat. The DEECA Victorian Wetland Inventory (Current) spatial data set (DEECA, 2025) identifies these wetlands as temporary.
- **Dependent wetlands** – There are a number of wetlands whose water level appears to be controlled by the Pyramid Creek system even though they are not online to Pyramid Creek or its major tributaries. These wetlands have small/minimal natural catchments. The DEECA Victorian Wetland Inventory (Current) spatial data set (DEECA, 2025) identifies them as temporary. Wetlands 45217, 45381, and 45408 are wetlands where the water level is dependent on flows in Pyramid Creek, its tributaries, or on human intervention.
- **Bullock Creek (tributary of Pyramid Creek)** – Within wetland 45265, Bullock Creek, a tributary of Pyramid Creek, joins the main waterbody. The junction of the waterbodies is generally within the Flannery Nature Conservation Reserve, an area where hunting is prohibited. Bullock Creek is a highly modified waterway where irrigation use changes the natural flow regime. Assessing the amount of time that water is present within the wetland adjacent to Bullock Creek cannot be done using the hydrology modelling methodology. Wetland 45377 is also online with Bullock Creek and the same applies as 45265.

- Welches Creek (tributary of Pyramid Creek) – Wetland 45200 is located immediately upstream of wetland 45265 along Welches Creek, a tributary of Bullock Creek. Welches Creek is a highly modified waterway where irrigation use changes the natural flow regime. Assessing the amount of time that water is present within the wetland adjacent to Welches Creek cannot be done using the hydrology modelling methodology.



Figure 15: Pyramid Creek - Historic Data Locations

Table 5: Wetlands Hydraulically Connected to Pyramid Creek

Wetland ID	Waterway	Method to Assess Wetland Filling Regime	Relevant Gauge	Result
45200	Pyramid Creek - Welches Creek	Historical water levels	No Local Gauge	Other gauges on Pyramid Creek indicate 1-3 periods of inundation during 10-year period of interest.
45217	Pyramid Creek	Historical water levels	407294*	Wetland likely inundated when water level > 80.7 m AHD. Water Level in 2022 indicates at least 1x inundation during 10-year period.
45222 or 8** (Johnson Swamp)	Pyramid Creek	Historical water levels	407294*	Wetland naturally inundated when water level > 80.7 m AHD at gauge (occurred in 2022). Note human-controlled water releases to fill this wetland also occur.
45231 or 13** (Hird Swamp)	Pyramid Creek	Historical water levels	407294*	Wetland naturally inundated when water level > 80.7 m AHD at gauge (occurred in 2022). Note human-controlled water releases to fill this wetland also occur.
45265	Pyramid Creek - Bullock Creek	Historical water levels	407287***	Wetland likely inundated when water level > 80.5 m AHD. Recorded over 80.5 m AHD occurred in 2016, 2022, and 2023. At least 3 periods of inundation during 10-year period.
45377	Pyramid Creek - Bullock Creek	Historical water levels	No Local Gauge	Other gauges on Pyramid Creek indicate 1-3 periods of inundation during 10-year period of interest.
45381	Pyramid Creek	Historical water levels	No Local Gauge	This wetland is located downstream of the Ramsar wetlands. Other gauges on Pyramid Creek indicate 1-3 periods of inundation during the 10-year period of interest.
45406	Pyramid Creek	Historical water levels	407294*	Wetland likely inundated when water level > 80.7 m AHD. Water Level in 2022 indicates at least 1x inundation during 10-year period.
45407	Pyramid Creek	Historical water levels	407294*	Wetland likely inundated when water level > 80.7 m AHD. Water Level in 2022 indicates at least 1x inundation during 10-year period.
45408	Pyramid Creek	Historical water levels	407294*	Wetland likely inundated when water level > 80.7 m AHD. Water Level in 2022 indicates at least 1x inundation during 10-year period.

*Gauge Data is from station 407294 – Pyramid Creek @ Flannery's Bridge, on the Victorian Water Measurement Information System (WMIS) online portal, accessed January 2026.

**DEECA Brolga Breeding Habitat Wetlands Model data set has different IDs than the DEECA Wetlands Current Data set. For wetlands within both sets, the Wetlands Current IDs are listed first, then the Brolga Breeding Habitat Model IDs.

*** Gauge Data is from station 407287 – (Bullock Creek @ U/S Box Creek) on the Victorian Water Measurement Information System (WMIS) online portal, accessed January 2026.

Nine Mile Creek

Nine Mile Creek is a highly modified waterway that ultimately flows into Pyramid Creek. Nine Mile Creek is generally the western project boundary. The study area extends west of Nine Mile Creek. The confluence of Nine Mile Creek and Pyramid Creek is outside and north of the project boundary.

Publicly available information indicates that Nine Mile Creek does not receive consistent (managed) inflows, at least in its upper reaches. Therefore, flow in the creek is ephemeral and related to either natural rainfall or rainfall refusal, an irrigation term for when landowners don't accept their scheduled irrigation allotment as a result of previous or forecast rainfall. Instead, the unaccepted irrigation water (rainfall refusal) is directed to Nine Mile Creek.

The catchment draining to Nine Mile Creek has been highly modified because of changes to the natural landscape resulting from agricultural land use. Engineering judgement has been used to refine the catchment draining to wetlands along Nine Mile Creek. Ten (10) remaining wetlands within the DEECA Victorian Wetland Inventory (Current) spatial data set (DEECA, 2025) exist along Nine Mile Creek within the area of interest.

- Wetlands 314620, 314621, 315144, 315145, are small wetlands with areas under 1 ha that are online to or immediately adjacent to Nine Mile Creek. These wetlands will fill when Nine Mile Creek overtops during a flood event.
- Wetlands 42671 and 42672 are located adjacent to, and Wetland 314919 is located online to a tributary of Nine Mile Creek, generally east of Wetland 43348 and Wetland 12 (on the Serpentine Creek waterway). Flow in these wetlands depends on overtopping of their waterway, a tributary of Nine Mile Creek.
- Wetland 314884 is located immediately adjacent to an irrigation channel connected to a tributary of Nine Mile Creek. Based on the catchment draining to this area, its flow regime depends on creek flows overtopping the bank.
- Wetlands 42670 and 42779 are located online to a tributary of Nine Mile Creek.

The Victorian Measurement Information System (WMIS) contains historic data from two gauges located on Nine Mile Creek:

407285 Nine Mile Creek at Coads Road – This gauge is located north of Coad (Coads) Road. This gauge records depth, not water level to Australian Height Datum (AHD). Terrain data indicates that Nine Mile Creek is approximately 1.6 m deep at the gauge. When water levels exceed 1.6 m, flows break out. Historical data indicates that levels equal to or greater than 1.6 m have occurred in September 2016 and October 2022, indicating that the wetlands dependent on Nine Mile Creek flows downstream of this gauge likely have filled at least twice within the period of interest.

407289 Nine Mile Creek at Serpentine Creek Offtake – This gauge is located on Nine Mile Creek downstream of the irrigation connection to Serpentine Creek. This gauge is located outside of the study area. Gauge 407289 records depth, not water level to AHD. Terrain data indicates that Nine Mile Creek is approximately 1.4 m deep at the gauge. When water levels exceed 1.4 m, flows break out. Historical data indicates that levels equal to or greater than 1.4 m have occurred in October 2016, October 2018, and October and November of 2022, indicating that the wetlands dependent

on Nine Mile Creek flows downstream of this gauge likely have filled at least twice within the period of interest.

There is no historical data to definitively corroborate the *duration* of inundation of the wetlands along Nine Mile Creek.

Calivil Creek

Calivil Creek is a highly modified waterway that is a tributary of Pyramid Creek. As the confluence of Calivil Creek and Pyramid Creek occurs outside (north) of the area of interest, Calivil Creek is discussed separately in this report. Calivil Creek generally is within the centre of the project area. Calivil Creek has a natural catchment, and it also receives flow from the human-controlled irrigation network.

Thirteen (13) remaining wetlands within the DEECA Victorian Wetland Inventory (Current) spatial data set (DEECA, 2025) are located within the study area online or adjacent to Calivil Creek. Two (2) wetlands from the DEECA Brolga Breeding Habitat Model data set are located within the study area directly online to Calivil Creek.

- Brolga breeding wetlands – two (2) brolga breeding habitat wetlands, 8330 and 8331, have been identified along Calivil Creek, as discussed in Section 4.1. DEECA wetland (315269), classified as a farm dam, so not included in this discussion of Calivil Creek wetlands, is within the footprint of Brolga Breeding Wetland 8330.
- Other On-Line Wetlands – The DEECA Victorian Wetland Inventory (Current) spatial data set (DEECA, 2025) identifies 44705 and 43254 as online to Calivil Creek, and essentially part of the Calivil Creek waterway.
- Wetland 45395 is located immediately adjacent to the Calivil Creek waterway.
- Wetlands 44870, 44871, 44877, 45209, 314771, 314809, and 315345 are online to tributaries of Calivil Creek. Water levels in these wetlands depends on flows in the tributaries.
- Wetland 44700 (Hunts Swamp) is also located along a tributary of Calivil Creek
- Wetlands 44869 and 315192 are adjacent to tributaries of Calivil Creek. It is likely that these wetlands fill when flows in the tributaries break out of the banks.

The Victorian Measurement Information System (WMIS) contains historic data from a single gauge located on Calivil Creek within the study area. The gauge is located north of Wishart Road, and the gauge is number 407284. This gauge records depth, not water level to AHD. Terrain data indicates that the Calivil Creek is approximately 1.2 m deep at the gauge. When water levels exceed 1.2 m, flows break out. Historical data indicates that levels equal to or greater than 1.2 m have occurred in October 2022 and January 2024, indicating that the wetlands dependent on Calivil Creek flows likely have filled at least twice within the period of interest.

There is no historical data to definitively corroborate the *duration* of inundation of the wetlands along Calivil Creek.

Serpentine Creek (Including Loddon River, Bannagher Creek, Pennyroyal Creek, and Twelve Mile Creek)

Serpentine Creek is a major, managed waterway that is located at the far west of the study area. Serpentine Creek, and its downstream system that connects to the Loddon River, Bannagher Creek, Pennyroyal Creek, and Twelve Mile Creek is managed by the North Central CMA. For example, information on the North Central CMA website indicates that during dry months, low flows of 10

ML/day are sourced from the Loddon River and directed to Serpentine Creek and downstream systems to provide aquatic habitat during dry months of the year.

The hydrology modelling methodology for assessing days full of water based on catchment area is not appropriate for modelling features that have a consistent outlet (like creeks, irrigation channels, or roadside swales). Furthermore, a hydrology assessment cannot capture the human-controlled inflows through the managed creek system. A spatial analysis was made of the wetlands connected to Serpentine Creek and its downstream system. A discussion of wetlands connected to Serpentine Creek is made in this section of the report. Nineteen (19) wetlands within the study area have been defined as having flow regimes dependent on flows within Serpentine Creek/Loddon River system.

The system of online and adjacent wetlands at the Serpentine Creek waterways are complex and interconnected. The wetlands are managed through water resources releases and flow transfers by the North Central CMA.

- Brolga Breeding Model Wetlands – Wetland 12 – Wetland 12 in the Brolga Model Wetlands is a system of wetlands on Bannagher and Pennyroyal Creeks, near the confluence with the Loddon River. There are currently no turbines proposed within 1.5 km of Wetland 12. The DEECA data set includes the same area broken into several unique ID's 43231, 43232, 43343, 43346, and 43348. All portions of this wetland are identified as 'temporary'. However, it is noted that there is a consistent water release during summer months into the Serpentine Creek system, and it is likely that these wetlands have some amount of consistent water during the year.
- Wetland 42775 is included in the DEECA Victorian Wetland Inventory (Current) spatial data set (DEECA, 2025). It is located along Pennyroyal Creek, downstream of Serpentine Creek. Whilst not included in the Brolga model, it appears to be similar in terms of size and location. **DCE suggest including this wetland as a potential Brolga Breeding wetland given its proximity and the similarity of its flow regime to Wetland 12 within the Brolga Model.**
- Wetlands 43342 and 321247 are located adjacent to Bannagher Creek.
- Wetlands 43341 is located online to Bannagher Creek.
- Wetlands 42776, and 42778 are located online to Pennyroyal Creek.
- Wetland 43347 is located online to a tributary of Serpentine Creek.
- Wetland 43236 (Tragowel Swamp) is located along a tributary of the Loddon River.
- Wetland 43345 is located along a tributary of the Loddon River, adjacent to Tragowel Swamp.
- Wetland 321268 is located along a tributary of the Loddon River, just upstream of Tragowel Swamp.
- Wetlands 43340, 315032, 43223 and 321268 are located online to tributaries of the Loddon River.
- Wetland 43344 is located at the confluence of Serpentine Creek and the Loddon River.

The Victorian Water Measurement Information System (WMIS) does not have any flow gauges on Serpentine Creek. There is a gauge at Nine Mile Creek at Serpentine Creek Offtake. However, this gauge appears to record water levels within Nine Mile Creek, and only a flow depth is recorded. For this reason, there is no conclusive historical data regarding water levels within the Serpentine Creek wetlands.

After review of the 52 wetlands online/adjacent to waterways there are a remaining 42 DEECA wetlands left for hydrological investigation.

4.3.3.2 Hydrological Investigation

After removing wetlands from the DEECA Victorian Wetland Inventory (Current) spatial data set (DEECA, 2025) that do not fit the other requirements of Brolga breeding habitat, the remaining criteria was to determine if the remaining potential wetlands experienced 120 days of inundation from July-December for the previous 10 years.

Local rainfall and evaporation data was sourced from the Bureau of Meteorology. The Canary Island Bureau of Meteorology data station (station number 080004) is the closest weather station to the study area with consistent daily rainfall data for the period of interest. Where rainfall was aggregated across multiple days, DCE split the total rainfall evenly across the aggregation period.

Kerang Airport (station number 080132) is the closest weather station to the study area with evapotranspiration data available. However, Kerang Airport only has evapotranspiration data for July 2025 to December 2025. The weather station at Charlton (station number 080128) has consistent daily evapotranspiration data for the period of interest. Charlton data for evapotranspiration was adopted for the period of interest prior to July 2025, and the Kerang data was used for July to December 2025. Where evapotranspiration daily values were missing, was missing, DCE took the average of the days before and after the missing data to estimate daily evapotranspiration. There were only about five (5) instances of missing data in the 12-year data set.

The impact of the major flooding in 2022 was immediately obvious in the rainfall data. Between July and December 2022, 345 mm of rainfall was recorded at the Canary Island gauge. The 2022 rainfall total is more than triple the rainfall recorded in 2019, and the 2022 July-December total is approximately 20% higher than the 2016 July-December total, the next highest during the period of interest. The 2022 rainfall data includes a storm event estimated to be approximately the 2% AEP at Kerang. It also coincided with major riverine flooding.

DCE undertook preliminary hydrological modelling using a spreadsheet to assess daily rainfall inflows to wetlands vs evaporative losses from wetlands. Based on the preliminary work, when nearly all rainfall became inflow (i.e. there were no soil/infiltration losses), inundated for 120 days in 2022 was likely. In addition, riverine flooding and high levels within waterways in 2022 inundated most potential wetlands within the study area.

More detailed hydrological modelling was undertaken to account for the losses through soil infiltration and plant interception that occur, especially for wetlands with natural catchments. 35 Wetlands were assessed in MUSICX (version 1.50.1). For all the modelled wetlands, the upstream catchment areas were modelled as 100% pervious and having agricultural land use. Soil parameters were based on the standard soil parameters for Melbourne. Rainfall and evaporation data, as detailed above, were applied to the catchments.

Catchment areas, wetland areas, and wetland average depths were based on GIS data. The wetland areas were adopted from the DEECA Victorian Wetland Inventory (Current) spatial data set (DEECA, 2025), after confirmation that they reflect terrain data. The wetland average depth data was based on current terrain data. Catchment areas were delineated based on terrain data. Catchment delineation cannot account for human-influenced flow controls and assumes natural catchments only. The modelling input parameters for each wetland are listed in Table 6. Refer to Figure 16 for the MUSIC model setup.

The MUSIC modelling results indicate that in 2016, 2019, 2020, 2021, and 2025 there was insufficient rainfall over July-December period for any of the wetlands to maintain 120 days of inundation that achieves the brolga breeding habitat requirements. For 2017, 2018, 2022, 2023, and 2024, 32 of the modelled wetlands achieve the 120 days full requirement through a natural flow regime. Refer to Table 7 for a summary of the MUSIC modelling results. These wetlands should be considered by the ecological consultant for inclusion as potential brolga breeding habitat.

The five wetlands that do not achieve the flow regime are briefly discussed here, as their failure to achieve 120 days of inundation in the modelling may not mean that they should not be considered as potential brolga breeding habitat.

- Wetland 45234 – This wetland has a large area (8,200 m²) and a small natural catchment of 11 ha. Natural inflows alone cannot consistently fill this wetland. Therefore, this wetland likely receives human-managed inflows. It is recommended to liaise with GMW regarding its flow regime to see if human-managed flows result in 120 consecutive days of water in the wetland.
- Wetland 45391 – This wetland has a large area (28,260 m²) and a small natural catchment of 44 ha. Natural inflows alone cannot consistently fill this wetland. Therefore, this wetland likely receives human-managed inflows. It is recommended to liaise with GMW regarding its flow regime to see if human-managed flows result in 120 consecutive days of water in the wetland.
- Wetland 318768 – This wetland has a small area (160 m²) and a small natural catchment of 0.6 ha. Soil losses mean that this wetland does not have 120 consecutive days of water between July and December over the period of interest without human-managed inflows.
- Wetland 321641 – This wetland has a small area (150 m²) and a small natural catchment of 0.2 ha. Soil losses mean that this wetland does not have 120 consecutive days of water between July and December over the period of interest without human-managed inflows.
- Wetland 321644 – This wetland has a small area (110 m²) and a small natural catchment of 3 ha. Soil losses mean that this wetland does not have 120 consecutive days of water between July and December over the period of interest without human-managed inflows.

Table 6 MUSIC Modelled Wetlands Input Parameters

Wetland MUSIC ID	Wetland ID	Wetland Area (m ²)	Catchment Area Revised (ha)	Typical EDD (m)
Wetland 43320	43320	54726.6	151.0	0.6
Wetland 44856	44856	13901.9	191.0	0.2
Wetland 43240	43240	139330.8	563.0	0.3
Wetland 43239	43239	120779.3	217.0	1.3
Wetland 43315	43315	6642.8	14.0	0.3
Wetland 321641	321641	152.6	0.2	0.1
Wetland 45214	45214	9920.6	67.9	0.7
Wetland 45207	45207	16267.3	62.7	0.5
Wetland 45390	45390	45523.2	74.2	0.9
Wetland 318768	318768	160.7	0.6	0.2
Wetland 315395	315395	721.3	3.6	0.4
Wetland 45225	45225	2138.0	12.6	0.3
Wetland 45220	45220	49283.9	146.4	0.5
Wetland 45393	45393	23030.6	252.5	0.4
Wetland 45227	45227	3102.2	54.8	0.7
Wetland 45229	45229	10485.4	130.0	1
Wetland 45234	45234	8197.7	11.1	0.6
Wetland 45235	45235	5506.3	17.6	0.2
Wetland 45238	45238	8597.4	44.3	0.2
Wetland 321644	321644	111.4	2.8	0.4
Wetland 315444	315444	2950.2	15.1	0.3
Wetland 45237	45237	6694.1	28.0	0.3
Wetland 45236	45236	22660.1	55.5	0.3
Wetland 45391	45391	28259.4	43.8	0.2
Wetland 45392	45392	13915.8	20.3	0.9
Wetland 43316	43316	8800.8	145.7	0.1
Wetland 45412	45412	27408.6	80.0	0.4
Wetland 42677	42677	26095.4	207.5	0.7
Wetland 42767	42767	12012.4	32.1	1
Wetland 43243	43243	47093.5	162.3	0.4
Wetland 44879	44879	19870.6	155.0	0.2
Wetland 44885	44885	17230.9	117.1	0.3
Wetland 44919	44919	17467.5	34.4	0.4
Wetland 45383	45383	14013.5	69.4	0.8
Wetland 314603	314603	146.7	21.7	0.6

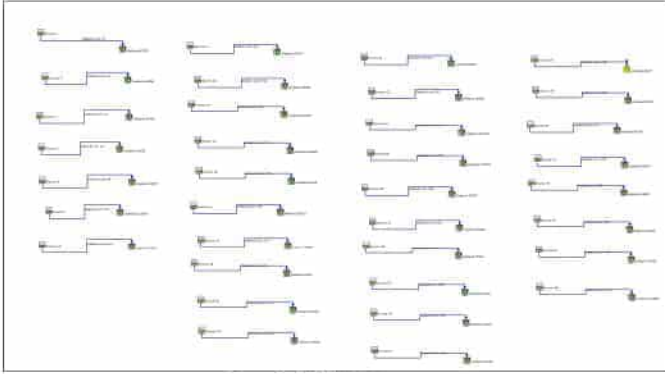


Figure 16: MUSIC Model setup

Table 7 MUSIC Modelled Wetlands Results

Number of Days Inundated in July-December						
Wetland ID	2017	2018	2022	2023	2024	Inundated for >120 Days
Wetland 43320	214	0	88	0	0	Yes
Wetland 44856	176	17	184	86	9	Yes
Wetland 43240	186	0	106	4	0	Yes
Wetland 43239	214	0	86	0	0	Yes
Wetland 43315	178	0	86	0	0	Yes
Wetland 321641	16	0	44	0	0	No
Wetland 45214	214	4	156	5	135	Yes
Wetland 45207	214	0	97	4	0	Yes
Wetland 45390	180	0	85	0	0	Yes
Wetland 318768	90	0	70	0	0	No
Wetland 315395	163	0	93	5	0	Yes
Wetland 45225	176	0	120	5	0	Yes
Wetland 45220	214	0	89	0	0	Yes
Wetland 45393	208	16	184	70	95	Yes
Wetland 45227	214	32	184	100	136	Yes
Wetland 45229	214	117	184	137	189	Yes
Wetland 45234	147	0	85	0	0	Yes
Wetland 45235	162	0	90	0	0	Yes
Wetland 45238	167	0	126	5	0	Yes
Wetland 321644	118	17	95	7	0	No
Wetland 315444	179	0	113	5	0	Yes
Wetland 45237	183	0	102	4	0	Yes
Wetland 45236	182	0	87	0	0	Yes
Wetland 45391	130	0	82	0	0	Yes
Wetland 45392	159	0	85	0	0	Yes
Wetland 43316	158	17	151	73	0	Yes
Wetland 45412	199	0	88	0	0	Yes
Wetland 42677	214	11	177	41	146	Yes
Wetland 42767	214	0	87	0	0	Yes
Wetland 43243	202	0	91	2	0	Yes
Wetland 44679	171	10	174	27	0	Yes
Wetland 44885	188	4	158	5	6	Yes
Wetland 44919	195	0	86	0	0	Yes
Wetland 45383	214	0	125	5	96	Yes
Wetland 314603	163	18	132	61	0	Yes

4.3.4 Potential Additional Brolga Breeding Wetlands

The findings from the historic waterway assessments and MUSIC model are partially inconclusive, therefore DCE recommends that the 52 DEECA wetlands online/adjacent to waterways alongside the 35 MUSIC modelled wetlands be assessed as potential brolga wetlands by a specialist

environmental consultant. A map showing the locations of these 87 wetlands is shown in Figure 17 and Appendix B.

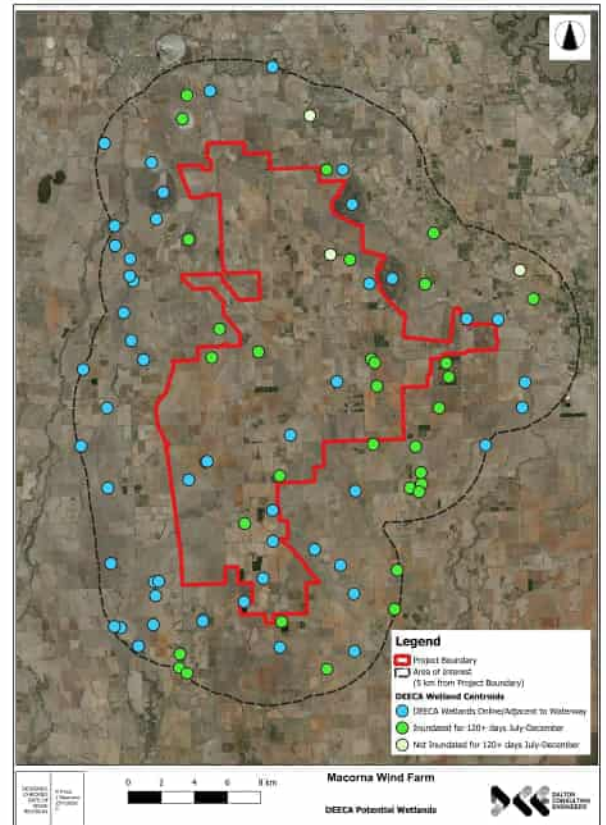
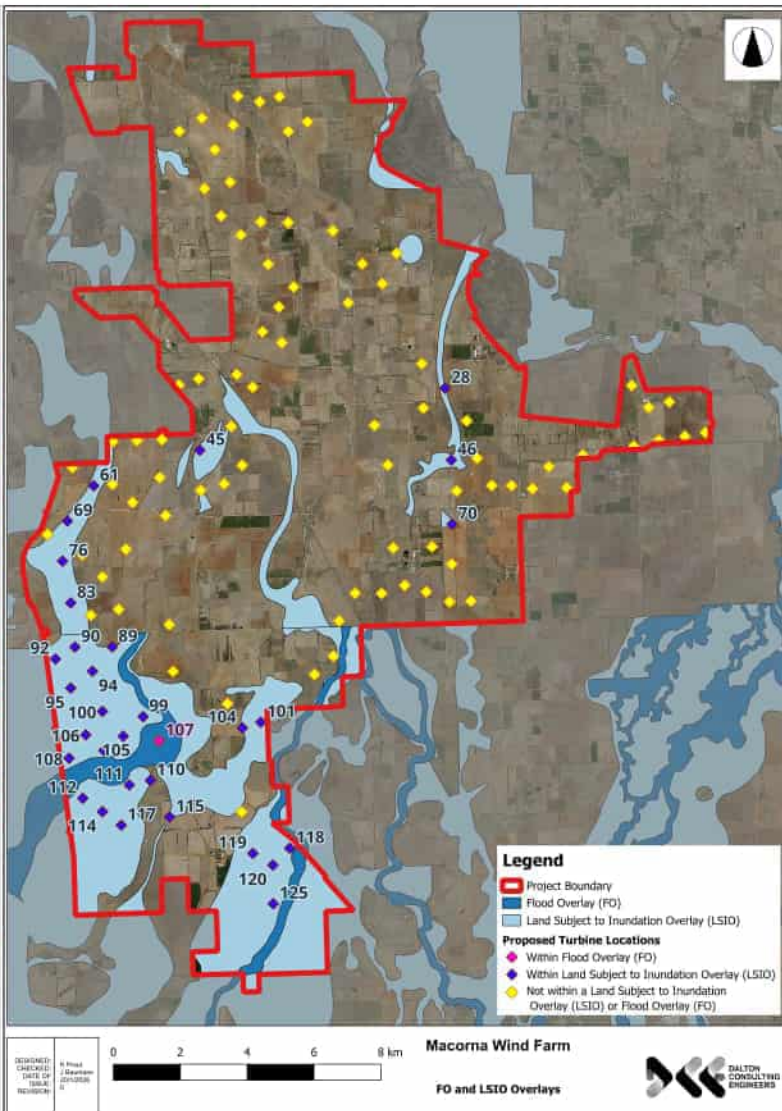
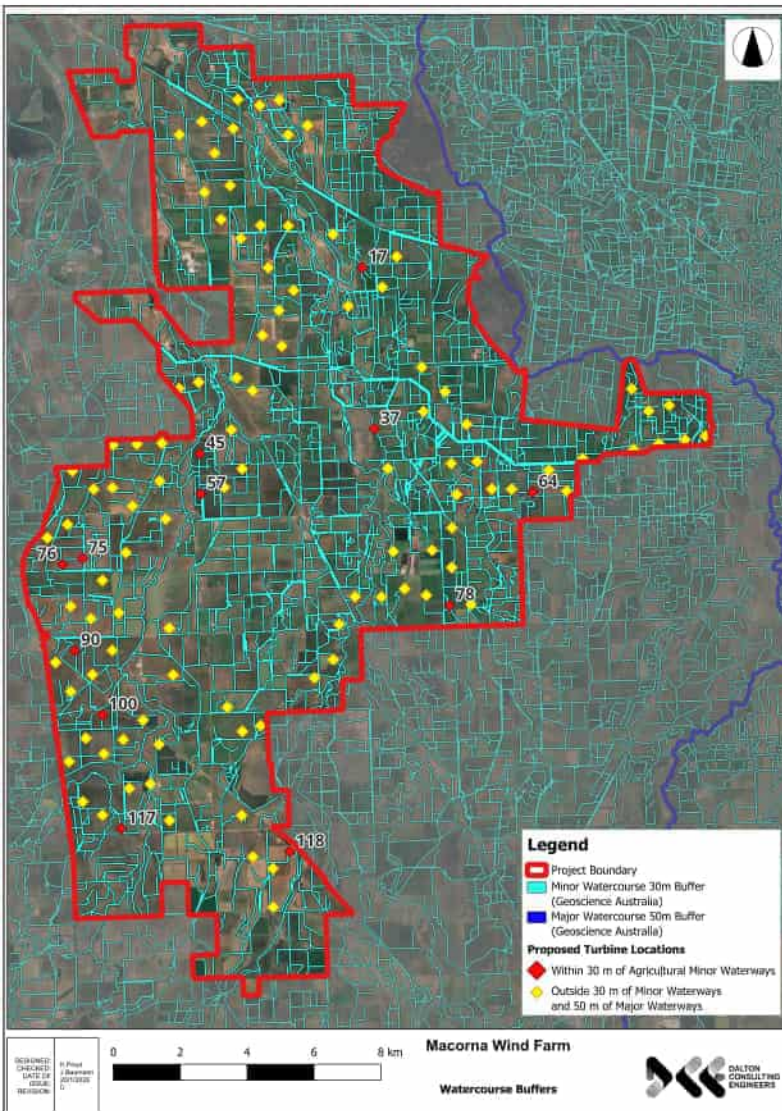
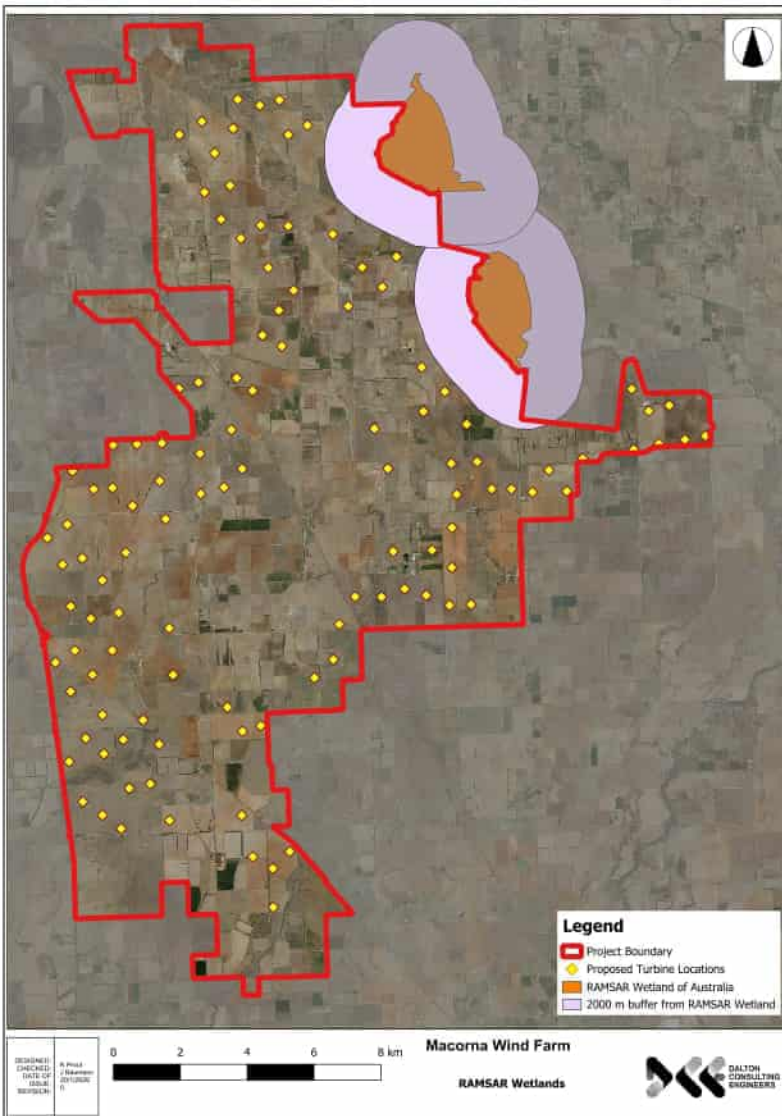
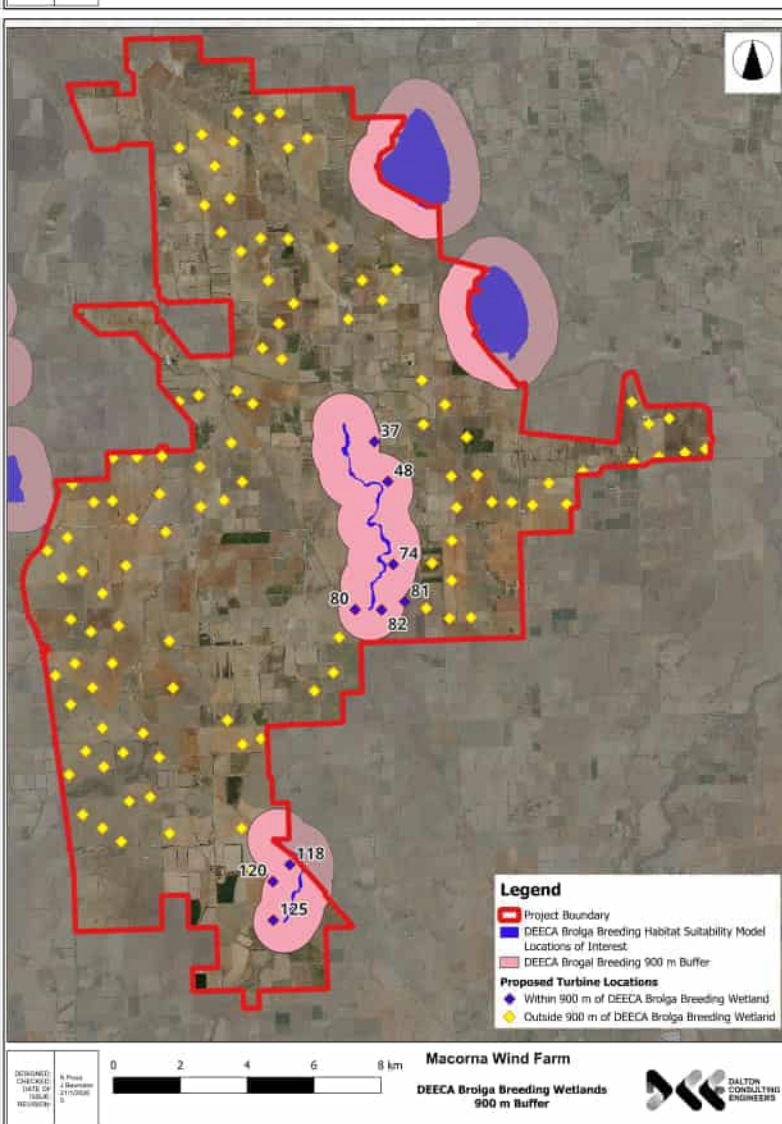
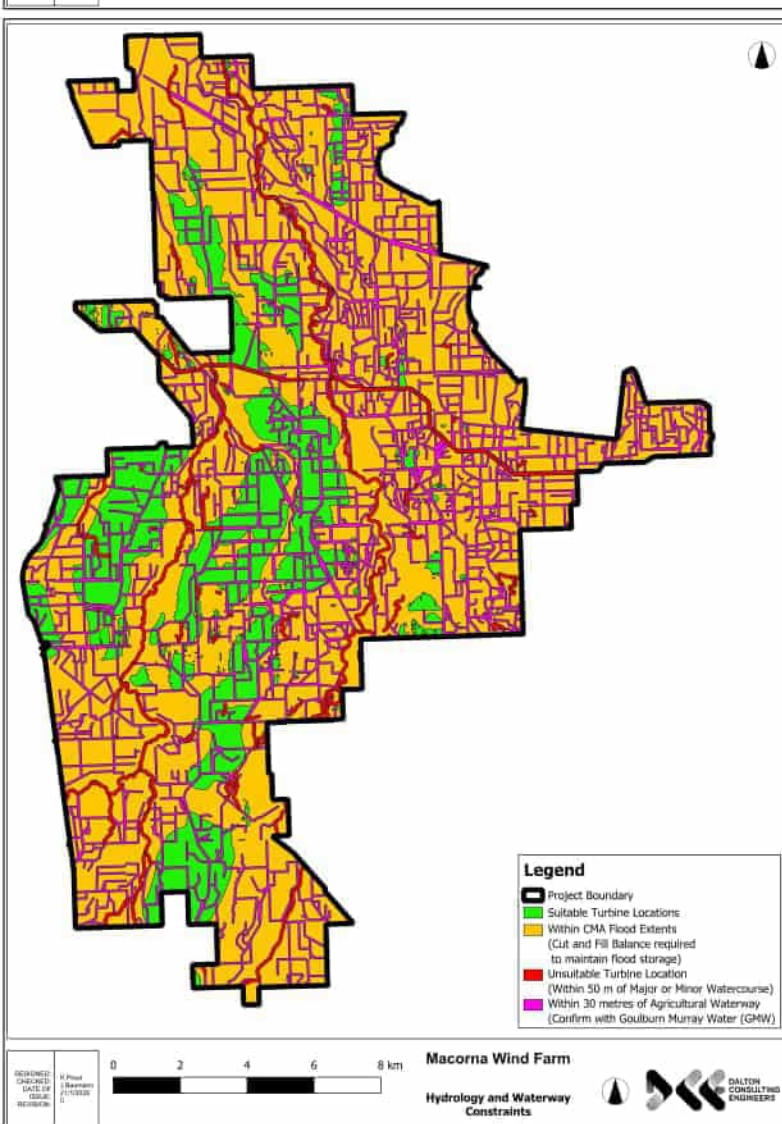
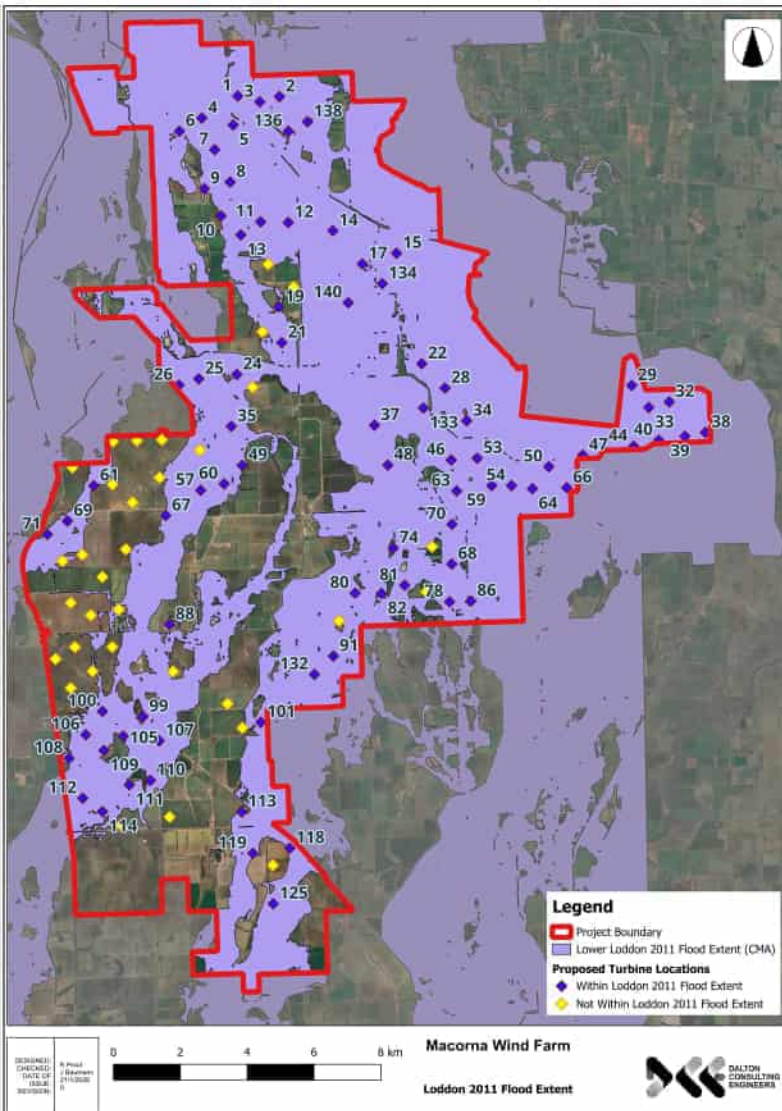
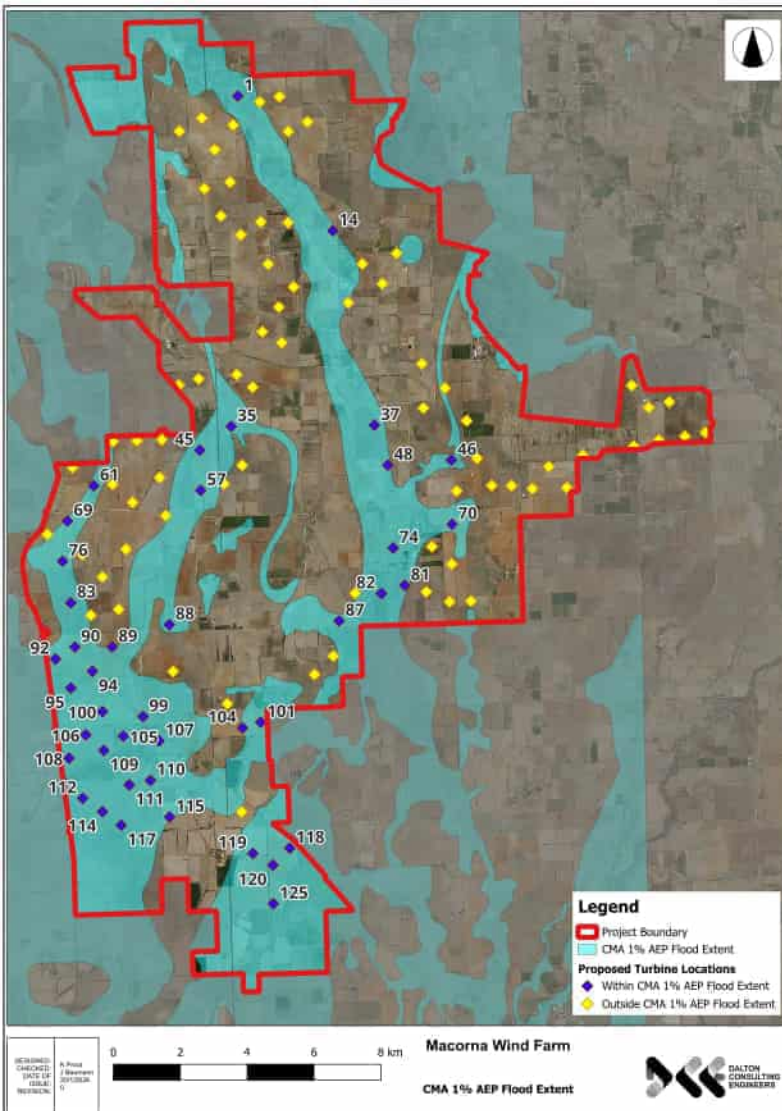
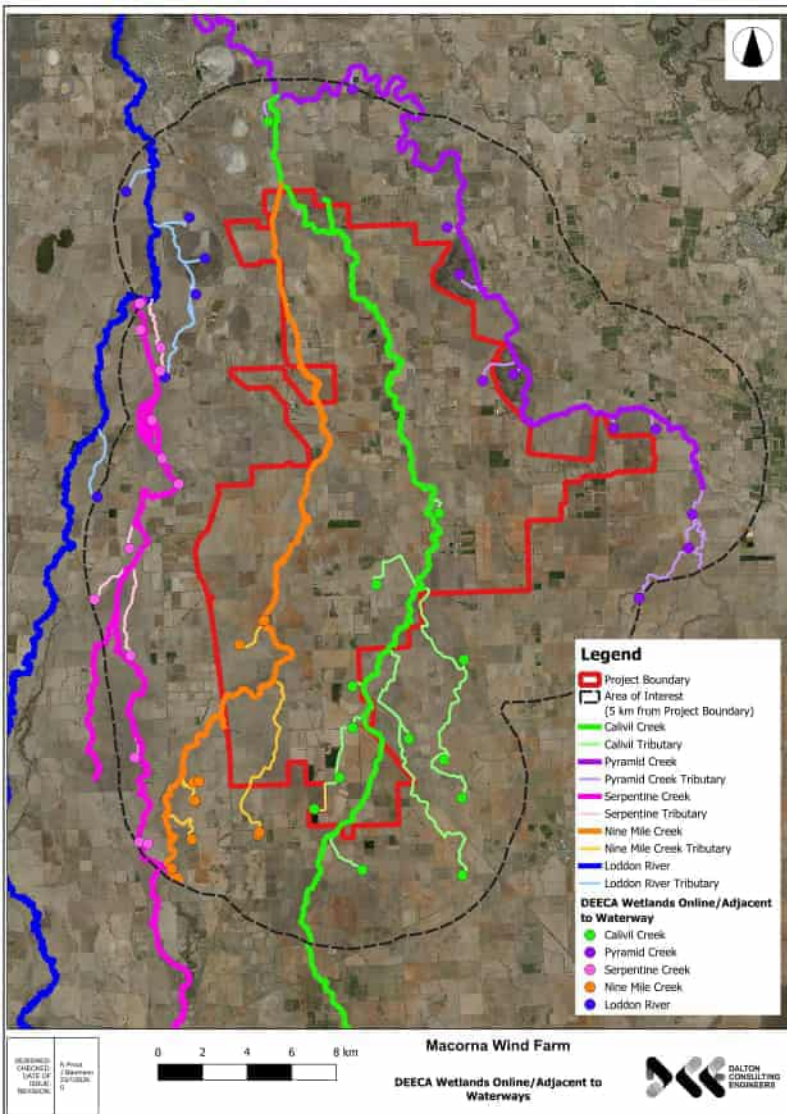


Figure 17: DEECA Brolga Potential Wetlands





Appendix C Wetland Summary of Brolga Assessment



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25018a232b_HandSW_Macorna_RenV

DCE ID	Data Source	Wetland Identification Number	Wetland Area (ha)	Description
DCE001	DCE	8920	0.11	Irrigation Channel not a wetland
DCE002	DCE	15534	0.12	Irrigation Channel not a wetland
DCE003	DCE	15867	0.12	Irrigation Channel not a wetland
DCE004	DCE	16589	0.32	Irrigation Channel not a wetland
DCE005	DEECA Wetlands Current	315133	0.10	Wetland is smaller than 0.1 ha
DCE006	DEECA Wetlands Current	315129	0.08	Wetland is smaller than 0.1 ha
DCE007	DEECA Wetlands Current	314787	0.07	Wetland is smaller than 0.1 ha
DCE008	DEECA Wetlands Current	314766	0.07	Wetland is smaller than 0.1 ha
DCE009	DEECA Wetlands Current	315177	0.07	Wetland is smaller than 0.1 ha
DCE010	DEECA Wetlands Current	315174	0.09	Wetland is smaller than 0.1 ha
DCE011	DEECA Wetlands Current	314768	0.09	Wetland is smaller than 0.1 ha
DCE012	DEECA Wetlands Current	315175	0.10	Wetland is smaller than 0.1 ha
DCE013	DEECA Wetlands Current	314807	0.09	Wetland is smaller than 0.1 ha
DCE014	DEECA Wetlands Current	314816	0.07	Wetland is smaller than 0.1 ha
DCE015	DEECA Wetlands Current	314808	0.08	Wetland is smaller than 0.1 ha
DCE016	DEECA Wetlands Current	315136	0.09	Wetland is smaller than 0.1 ha
DCE017	DEECA Wetlands Current	321602	0.08	Wetland is smaller than 0.1 ha
DCE018	DEECA Wetlands Current	321743	0.07	Wetland is smaller than 0.1 ha
DCE019	DEECA Wetlands Current	321578	0.07	Wetland is smaller than 0.1 ha
DCE020	DEECA Wetlands Current	321421	0.08	Wetland is smaller than 0.1 ha
DCE021	DEECA Wetlands Current	321617	0.10	Wetland is smaller than 0.1 ha
DCE022	DEECA Wetlands Current	321549	0.07	Wetland is smaller than 0.1 ha
DCE023	DEECA Wetlands Current	321309	0.07	Wetland is smaller than 0.1 ha
DCE024	DEECA Wetlands Current	321422	0.07	Wetland is smaller than 0.1 ha
DCE025	DEECA Wetlands Current	321765	0.07	Wetland is smaller than 0.1 ha
DCE026	DEECA Wetlands Current	321764	0.06	Wetland is smaller than 0.1 ha
DCE027	DEECA Wetlands Current	321733	0.07	Wetland is smaller than 0.1 ha
DCE028	DEECA Wetlands Current	321615	0.09	Wetland is smaller than 0.1 ha
DCE029	DEECA Wetlands Current	321598	0.06	Wetland is smaller than 0.1 ha
DCE030	DEECA Wetlands Current	321735	0.07	Wetland is smaller than 0.1 ha
DCE031	DEECA Wetlands Current	321302	0.09	Wetland is smaller than 0.1 ha
DCE032	DEECA Wetlands Current	321633	0.07	Wetland is smaller than 0.1 ha
DCE033	DEECA Wetlands Current	321756	0.10	Wetland is smaller than 0.1 ha
DCE034	DEECA Wetlands Current	321547	0.09	Wetland is smaller than 0.1 ha
DCE035	DEECA Wetlands Current	321551	0.09	Wetland is smaller than 0.1 ha
DCE036	DEECA Wetlands Current	321271	0.08	Wetland is smaller than 0.1 ha
DCE037	DEECA Wetlands Current	321443	0.09	Wetland is smaller than 0.1 ha
DCE038	DEECA Wetlands Current	321304	0.07	Wetland is smaller than 0.1 ha
DCE039	DEECA Wetlands Current	321609	0.07	Wetland is smaller than 0.1 ha
DCE040	DEECA Wetlands Current	321634	0.06	Wetland is smaller than 0.1 ha
DCE041	DEECA Wetlands Current	321440	0.09	Wetland is smaller than 0.1 ha
DCE042	DEECA Wetlands Current	321296	0.08	Wetland is smaller than 0.1 ha
DCE043	DEECA Wetlands Current	321297	0.06	Wetland is smaller than 0.1 ha
DCE044	DEECA Wetlands Current	321770	0.09	Wetland is smaller than 0.1 ha
DCE045	DEECA Wetlands Current	321574	0.07	Wetland is smaller than 0.1 ha
DCE046	DEECA Wetlands Current	321594	0.07	Wetland is smaller than 0.1 ha
DCE047	DEECA Wetlands Current	321305	0.07	Wetland is smaller than 0.1 ha
DCE048	DEECA Wetlands Current	321631	0.09	Wetland is smaller than 0.1 ha
DCE049	DEECA Wetlands Current	321427	0.10	Wetland is smaller than 0.1 ha
DCE050	DEECA Wetlands Current	321616	0.08	Wetland is smaller than 0.1 ha
DCE051	DEECA Wetlands Current	321298	0.08	Wetland is smaller than 0.1 ha
DCE052	DEECA Wetlands Current	321597	0.08	Wetland is smaller than 0.1 ha

DCE053	DEECA Wetlands Current	321299	0.09	Wetland is smaller than 0.1 ha
DCE054	DEECA Wetlands Current	321760	0.09	Wetland is smaller than 0.1 ha
DCE055	DEECA Wetlands Current	321550	0.07	Wetland is smaller than 0.1 ha
DCE056	DEECA Wetlands Current	321300	0.09	Wetland is smaller than 0.1 ha
DCE057	DEECA Wetlands Current	321577	0.09	Wetland is smaller than 0.1 ha
DCE058	DEECA Wetlands Current	321301	0.08	Wetland is smaller than 0.1 ha
DCE059	DEECA Wetlands Current	321308	0.09	Wetland is smaller than 0.1 ha
DCE060	DEECA Wetlands Current	321741	0.08	Wetland is smaller than 0.1 ha
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DCE063	DEECA Wetlands Current	321506	0.07	Wetland is smaller than 0.1 ha
DCE064	DEECA Wetlands Current	321595	0.08	Wetland is smaller than 0.1 ha
DCE065	DEECA Wetlands Current	321587	0.07	Wetland is smaller than 0.1 ha
DCE066	DEECA Wetlands Current	321469	0.07	Wetland is smaller than 0.1 ha
DCE067	DEECA Wetlands Current	321590	0.08	Wetland is smaller than 0.1 ha
DCE068	DEECA Wetlands Current	321619	0.08	Wetland is smaller than 0.1 ha
DCE069	DEECA Wetlands Current	321599	0.09	Wetland is smaller than 0.1 ha
DCE070	DEECA Wetlands Current	321740	0.09	Wetland is smaller than 0.1 ha
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DCE072	DEECA Wetlands Current	315112	0.07	Wetland is smaller than 0.1 ha
DCE073	DEECA Wetlands Current	321261	0.07	Wetland is smaller than 0.1 ha
DCE074	DEECA Wetlands Current	315319	0.09	Wetland is smaller than 0.1 ha
DCE075	DEECA Wetlands Current	321546	0.08	Wetland is smaller than 0.1 ha
DCE076	DEECA Wetlands Current	321528	0.08	Wetland is smaller than 0.1 ha
DCE077	DEECA Wetlands Current	315117	0.09	Wetland is smaller than 0.1 ha
DCE078	DEECA Wetlands Current	321572	0.10	Wetland is smaller than 0.1 ha
DCE079	DEECA Wetlands Current	321537	0.09	Wetland is smaller than 0.1 ha
DCE080	DEECA Wetlands Current	321252	0.10	Wetland is smaller than 0.1 ha
DCE081	DEECA Wetlands Current	315291	0.08	Wetland is smaller than 0.1 ha
DCE082	DEECA Wetlands Current	315292	0.09	Wetland is smaller than 0.1 ha
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DCE085	DEECA Wetlands Current	321573	0.07	Wetland is smaller than 0.1 ha
DCE086	DEECA Wetlands Current	315295	0.07	Wetland is smaller than 0.1 ha
DCE087	DEECA Wetlands Current	321534	0.07	Wetland is smaller than 0.1 ha
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DCE090	DEECA Wetlands Current	321559	0.10	Wetland is smaller than 0.1 ha
DCE091	DEECA Wetlands Current	321553	0.06	Wetland is smaller than 0.1 ha
DCE092	DEECA Wetlands Current	321280	0.09	Wetland is smaller than 0.1 ha
DCE093	DEECA Wetlands Current	321541	0.07	Wetland is smaller than 0.1 ha
DCE094	DEECA Wetlands Current	321570	0.07	Wetland is smaller than 0.1 ha
DCE095	DEECA Wetlands Current	321542	0.07	Wetland is smaller than 0.1 ha
DCE096	DEECA Wetlands Current	321548	0.08	Wetland is smaller than 0.1 ha
DCE097	DEECA Wetlands Current	321567	0.07	Wetland is smaller than 0.1 ha
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DCE099	DEECA Wetlands Current	315109	0.07	Wetland is smaller than 0.1 ha
DCE100	DEECA Wetlands Current	321257	0.06	Wetland is smaller than 0.1 ha
DCE101	DEECA Wetlands Current	321255	0.06	Wetland is smaller than 0.1 ha
DCE102	DEECA Wetlands Current	315282	0.10	Wetland is smaller than 0.1 ha
DCE103	DEECA Wetlands Current	315313	0.08	Wetland is smaller than 0.1 ha
DCE104	DEECA Wetlands Current	321259	0.06	Wetland is smaller than 0.1 ha
DCE105	DEECA Wetlands Current	321253	0.07	Wetland is smaller than 0.1 ha
DCE106	DEECA Wetlands Current	315288	0.07	Wetland is smaller than 0.1 ha
DCE107	DEECA Wetlands Current	321258	0.08	Wetland is smaller than 0.1 ha

DCE768	DEECA Wetlands	Current	321643	0.12	Feature is a Farm Dam
DCE769	DEECA Wetlands	Current	315269	0.11	Feature is a Farm Dam
DCE770	DEECA Wetlands	Current	315382	0.27	Feature is a Farm Dam
DCE771	DEECA Wetlands	Current	321649	0.45	Feature is a Farm Dam
DCE772	DEECA Wetlands	Current	315442	0.12	Feature is a Farm Dam
DCE773	DEECA Wetlands	Current	315327	0.52	Feature is a Farm Dam
DCE774	DEECA Wetlands	Current	321568	0.21	Feature is a Farm Dam
DCE775	DEECA Wetlands	Current	315414	0.89	Feature is a Farm Dam
DCE776	DEECA Wetlands	Current	315194	0.12	Feature is a Farm Dam
DCE777	DEECA Wetlands	Current	315311	0.13	Feature is a Farm Dam
DCE778	DEECA Wetlands	Current	315425	0.16	Feature is a Farm Dam
DCE779	DEECA Wetlands	Current	315349	0.13	Feature is a Farm Dam
DCE780	DEECA Wetlands	Current	315197	0.10	Feature is a Farm Dam
DCE781	DEECA Wetlands	Current	315421	0.16	Feature is a Farm Dam
DCE782	DEECA Wetlands	Current	315381	0.12	Feature is a Farm Dam
DCE783	DEECA Wetlands	Current	315258	0.10	Feature is a Farm Dam
DCE784	DEECA Wetlands	Current	315400	0.11	Feature is a Farm Dam
DCE785	DEECA Wetlands	Current	321655	0.14	Feature is a Farm Dam
DCE786	DEECA Wetlands	Current	315352	0.15	Feature is a Farm Dam
DCE787	DEECA Wetlands	Current	315324	0.13	Feature is a Farm Dam
DCE788	DEECA Wetlands	Current	315415	0.00	Feature is a Farm Dam
DCE789	DEECA Wetlands	Current	315191	0.13	Feature is a Farm Dam
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DCE797	DEECA Wetlands	Current	315329	1.55	Feature is a Farm Dam
DCE798	DEECA Wetlands	Current	321653	0.12	Feature is a Farm Dam
DCE799	DEECA Wetlands	Current	321863	0.14	Feature is a Farm Dam
DCE800	DEECA Wetlands	Current	315332	0.16	Feature is a Farm Dam
DCE801	DEECA Wetlands	Current	315337	0.14	Feature is a Farm Dam
DCE802	DEECA Wetlands	Current	315347	0.13	Feature is a Farm Dam
DCE803	DEECA Wetlands	Current	315403	0.13	Feature is a Farm Dam
DCE804	DEECA Wetlands	Current	315205	0.12	Feature is a Farm Dam
DCE805	DEECA Wetlands	Current	321569	0.12	Feature is a Farm Dam
DCE806	DEECA Wetlands	Current	315330	0.13	Feature is a Farm Dam
DCE807	DEECA Wetlands	Current	321856	0.30	Feature is a Farm Dam
DCE808	DEECA Wetlands	Current	315413	3.71	Feature is a Farm Dam
DCE809	DEECA Wetlands	Current	315331	0.13	Feature is a Farm Dam
DCE810	DEECA Wetlands	Current	315250	0.15	Feature is a Farm Dam
DCE811	DEECA Wetlands	Current	321654	0.18	Feature is a Farm Dam
DCE812	DEECA Wetlands	Current	315384	0.13	Feature is a Farm Dam
DCE813	DEECA Wetlands	Current	315190	0.13	Feature is a Farm Dam
DCE814	DEECA Wetlands	Current	315325	2.72	Feature is a Farm Dam
DCE815	DEECA Wetlands	Current	315386	0.12	Feature is a Farm Dam
DCE816	DEECA Wetlands	Current	315432	0.16	Feature is a Farm Dam
DCE817	DEECA Wetlands	Current	315310	0.11	Feature is a Farm Dam
DCE818	DEECA Wetlands	Current	315333	0.13	Feature is a Farm Dam
DCE819	DEECA Wetlands	Current	315334	0.1478193	Feature is a Farm Dam
DCE820	DEECA Wetlands	Current	315328	0.9592351	Feature is a Farm Dam
DCE821	DEECA Wetlands	Current	315270	0.111655	Feature is a Farm Dam
DCE822	DEECA Wetlands	Current	315350	0.1685423	Feature is a Farm Dam

DCE823	DEECA Wetlands	Current	315441	0.200187	Feature is a Farm Dam
DCE824	DEECA Wetlands	Current	315341	0.1448934	Feature is a Farm Dam
DCE825	DEECA Wetlands	Current	315251	0.1096209	Feature is a Farm Dam
DCE826	DEECA Wetlands	Current	315321	0.1419773	Feature is a Farm Dam
DCE827	DEECA Wetlands	Current	314606	0.1125263	Feature is a Farm Dam
DCE828	DEECA Wetlands	Current	314890	0.1121891	Feature is a Farm Dam
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DCE937	DEECA Wetlands	Current	315216	0.1011979	Feature is a Farm Dam
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DCE950	DEECA Wetlands	Current	45409	6.12	Doesn't Exist
DCE951	DEECA Wetlands	Current	42670	19.10	Inundation determined based on historical data
DCE952	DEECA Wetlands	Current	44700	69.58	Inundation determined based on historical data
DCE953	DEECA Wetlands	Current	42776	129.95	Inundation determined based on historical data
DCE954	DEECA Wetlands	Current	42778	37.25	Inundation determined based on historical data
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DCE970	DEECA Wetlands_Current	43254	138.80	Inundation determined based on historical data
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DCE996	DEECA Wetlands_Current	315032	36.92	Inundation determined based on historical data
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DCE1002	DEECA Wetlands_Current	43232	178.15	Inundation determined based on historical data
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DCE1004	DEECA Wetlands_Current	42767	12.01	Modelled in MUSIC
DCE1005	DEECA Wetlands_Current	43243	47.09	Modelled in MUSIC
DCE1006	DEECA Wetlands_Current	44879	19.87	Modelled in MUSIC
DCE1007	DEECA Wetlands_Current	44885	17.23	Modelled in MUSIC
DCE1008	DEECA Wetlands_Current	44919	17.47	Modelled in MUSIC
DCE1009	DEECA Wetlands_Current	45383	14.01	Modelled in MUSIC
DCE1010	DEECA Wetlands_Current	314603	0.15	Modelled in MUSIC
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DCE1012	DEECA Wetlands_Current	44856	13.90	Modelled in MUSIC
DCE1013	DEECA Wetlands_Current	43315	6.64	Modelled in MUSIC
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DCE1017	DEECA Wetlands_Current	45235	5.51	Modelled in MUSIC
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DCE1020	DEECA Wetlands_Current	45392	13.92	Modelled in MUSIC
DCE1021	DEECA Wetlands_Current	43316	8.80	Modelled in MUSIC
DCE1022	DEECA Wetlands_Current	43239	120.78	Modelled in MUSIC
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DCE1026	DEECA Wetlands_Current	45220	49.28	Modelled in MUSIC
DCE1027	DEECA Wetlands_Current	45227	3.10	Modelled in MUSIC
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DCE1031	DEECA Wetlands_Current	315444	2.95	Modelled in MUSIC
DCE1032	DEECA Wetlands_Current	45237	6.69	Modelled in MUSIC
DCE1033	DEECA Wetlands_Current	45236	22.66	Modelled in MUSIC
DCE1034	DEECA Wetlands_Current	321641	0.15	Modelled in MUSIC
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DCE1036	DEECA Wetlands_Current	45390	45.52	Modelled in MUSIC
DCE1037	DEECA Wetlands_Current	45412	27.41	Modelled in MUSIC
DCE1038	DEECA Brolga Habitat Model	8	410.78	Brolga Habitat
DCE1039	DEECA Brolga Habitat Model	12	1570.43	Brolga Habitat
DCE1040	DEECA Brolga Habitat Model	13	344.69	Brolga Habitat
DCE1041	DEECA Brolga Habitat Model	8330	57.62	Brolga Habitat
DCE1042	DEECA Brolga Habitat Model	8331	23.06	Brolga Habitat

Excerpt from Revision B Macorna Wind Farm Hydrology and Stormwater Constraints Investigation (DCE, January 2026)



Additional Wetlands Investigation

To: Macorna Wind Farm Project Team
From: Julia Baumann of DCE
Subject: Additional Wetlands Investigation
DCE Ref: 25018
Date: 19 February 2026
Prepared: J Baumann AN 401451

At the request of Nature Advisory and the wider Macorna Wind Farm project team, DCE has undertaken additional investigations. The additional investigations relate to wetlands identified in the Nature Advisory document 24129.04_Wetlands of Interest_MH_260205.docx received by email 5 February 2026. The Nature Advisory document is included as **Attachment 1** to this report.

The wetlands identified for additional investigation within the document can generally be divided into the following classifications:

- Calivil Creek Investigations – Completed and documented in *Calivil Creek Wetlands Investigation* (DCE, 13 February 2026)
- Wetland Boundary Update (see Page 3)
- Potentially Unmapped Wetlands Inundation Confirmation (see Page 19)

DCE has completed additional terrain analysis using GIS software. LIDAR can identify low-lying areas. GIS data processing of the LIDAR can identify depressions that are likely to hold water. Additional assessment based on the Loddon 2011 flood extents, aerial imagery, and mapped waterways has also been undertaken.

Item	Page
1. Wetland Boundary Considerations (Typical vs Flood Conditions)	2
2. Wetland Boundary Update and Extents Confirmation	3
3. Potentially Unmapped Wetlands and Inundation Confirmation	19
4. Recommendations	29

Attachments:

1. 24129.04_Wetlands of Interest_MH_260205.docx (Nature Advisory, February 2026)
2. Lower Loddon Flood Extents 2022 (North Central CMA, provided 2025) overlaid on wetlands of interest map set
3. 25018fe1926_AdditionalWetlandsData.xlsx
4. DCE-identified Wetlands (Shapefile)



2. Wetland Boundary Update and Extents Confirmation

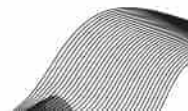
Nature Advisory provided a list of wetlands for an assessment of extents. Generally, Nature Advisory is interested in understanding if the footprint of the nominated wetlands can be decreased. A common concern is that aerial imagery shows a portion of the 'wetland' as being cropped. As detailed in Section 1, irrigation practices within this study area can result in agricultural land being intentionally inundated. Furthermore, in flood conditions, agricultural land can be inundated for extended periods of time. For the purposes of this investigation, DCE has considered that agricultural land is unlikely to be inundated in typical conditions. This assumption should be validated by a specialist agricultural consultant.

DCE utilised a variety of information in the assessment:

- **Aerial (NoirMap) imagery** from February 2022 was used to identify areas where water appears to pond, where agriculture is and is not undertaken, or where drainage channels visually provide an outlet.
- **Aerial survey** terrain data from August 2025 provided by the Macorna Wind Farm project team was assessed to determine if the DEECA-mapped wetland extents correspond with a low-lying area. Where aerial survey does not exist (notably for wetland 314817), LIDAR data from 2011 was the best available information for assessing terrain.
- **Lower Loddon 2011 flood extents** provided by the North Central CMA to the project team.
- **Geoscience Australia waterway data set** utilised the hydrology constraints investigation. DCE note that not every alignment shown in this data set is correct, so where this data set has resulted in a finding, the waterway alignment has been checked with terrain and aerial imagery data.
- **DEECA's Wetland CURRENT spatial data set** (referred to as VWI in the Nature Advisory document)

DCE undertook a variety of investigations using GIS processes to assess the terrain data. Detailed 'fill' of the aerial survey digital terrain model at the areas of interest was undertaken using Global Mapper software. The 'fill' results allow for a more exact understanding of which areas hold water to a depth greater than 0.2 m. The fill results allowed for wetlands identified in the depression analysis to be removed from additional consideration based on if they hold water, and if so, is the area of held water is generally greater than 0.1 ha in area.

A brief discussion of the wetlands assessed (with screen prints, where relevant) is included in this section of the report. If additional mapping information is required, please contact DCE. The wetlands assessed are listed in Table 1. A complete table of investigated wetlands, including a summary of the advice related to potential change of extents is included as **Attachment 3**.



1. Wetland Boundary Considerations

The investigation area is within the Loddon River Floodplain. The land and waterways have been heavily modified from their original state, and under typical conditions, flows and inundation are controlled by humans undertaking water resource management through water releases and/or controlled water direction through the wider drainage system.

Typically, irrigation of agricultural land within the study area occurs through 'flood irrigation'. Water is released into fields that are bounded by earthen bunds. Earth bunds within the fields distribute water evenly across the land, and the water is left to soak into the soil. In some ways, within this particular study area, land can be both agricultural and inundated for an extensive period of time.

Under flood conditions, large areas of the investigation area are inundated. **Attachment 2** to this report shows the 2011 Lower Loddon flood extent (as provided by the North Central CMA) overlaid on the additional wetlands in this investigation. All but two (2) wetlands (43316 and 43320) identified for further investigation are within the Lower Loddon Flood extent.

Low-lying areas within the Lower Loddon Flood extent will be inundated when the lower portion of the Loddon River floods. The floods correspond with high water levels downstream of the study area that limit natural drainage and maintain flooding conditions, even in areas that have an outlet under typical conditions. Some areas within the flood extents will naturally drain (as they do in typical conditions) once downstream conditions allow. Other areas do not drain naturally and will pond/retain water even after downstream conditions change.

It is important for the project team to understand that wetlands within the study area have different areas of inundation in different conditions. In typical conditions, only areas where water can pond without draining away will retain water. Some agricultural land will experience ponded water as irrigation water is applied to soak into the land. In flood conditions, the downstream drainage connection becomes irrelevant. High downstream water levels lead to the ponding/retention of water in low-lying areas.

DCE will discuss the potential changes to wetland inundation areas based on typical conditions and flood conditions. Understanding the difference between the two flow regimes is important when deciding if wetland boundaries should be changed.

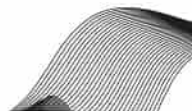


Table 1: Wetlands Boundary and Extents Investigation

Category	Wetland ID (DEECA Wetlands_Current)	MS Word Document Number	New ID
Wetland Boundary Update	44869	1	44869_A
Wetland Boundary Update	44869	1	44869_B
Wetland Boundary Update	44869	1	44869_C
Wetland Boundary Update	44869	1	44869_D
Wetland Boundary Update	44870	2	n/a
Wetland Boundary Update	43320	3	n/a
Wetland Boundary Update	45395	4	45395_A
Wetland Boundary Update	45395	4	45395_B
Wetland Boundary Update	45395	4	45395_C
Wetland Boundary Update	45407	6	45407_A
Wetland Boundary Update	45407	6	45407_B
Wetland Boundary Update	45407	6	45407_C
Wetland Boundary Update	45407	6	45407_D
Wetland Boundary Update	45407	6	45407_E
Wetland Boundary Update	45407	6	45407_F
Wetland Boundary Update	45407	6	45407_G
Wetland Boundary Update	45407	6	45407_H
Wetland Boundary Update	45407	6	45407_I
Wetland Boundary Update	45407	6	45407_J
Wetland Boundary Update	45408	6	45408_A
Wetland Boundary Update	45408	6	45408_B
Wetland Boundary Update	45408	6	45408_C
Wetland Boundary Update	45408	6	45408_D
Wetland Boundary Update	45406	7	45406_A
Wetland Boundary Update	45406	7	45406_B
Wetland Boundary Update	45406	7	45406_C
Wetland Boundary Update	45220	8	45220_A
Wetland Boundary Update	45220	8	45220_B
Wetland Boundary Update	321647	n/a	321647_A
Wetland Boundary Update	45209	9	45209_A
Wetland Boundary Update	45209	9	45209_B
Confirm Wetland Exists	45412	2	45412_A
Confirm Wetland Exists	43316	3	43316_A
Confirm Wetland Exists	45229	4	45229_A



Wetland 44869

- Typical conditions
 - Obvious areas of cropping (delineated by fields modified to have berms constructed to direct water for flood irrigation) have been removed from wetland extents.
 - Areas unable to pond water have been removed from wetland extents.
 - The wetland has been split into four (4) parts: 44869_A, 44869_B, 44869_C, and 44869_D where the surface indicates that water is retained to a depth of more than 0.2 m. All new wetlands > 0.1 ha in area.
 - The Geoscience Australia database shows irrigation connections between the ponding areas. Depending on water resource management, the areas may pond under typical conditions, or water may be released downstream.
- Flood conditions
 - The majority of the DEECA Wetlands_Current extents for the original wetland are within the Lower Loddon 2011 flood extents. All areas where ponding is likely are included in the flood extents.
 - The DEECA extents for the original wetland correspond with low-lying areas in the LIDAR, indicating that the original wetland extents include areas that retain water in flood conditions.
- Inundation Frequency
 - Mapped irrigation connections traverse the wetland, linking ponding areas and potentially providing drainage outlets, under certain water resources management conditions.
 - Mapped irrigation connections traverse the 'natural' catchment that terrain data indicates drains to the wetland, altering flow regimes both with their physical presence and with the water resource management conditions that can be applied through them.
 - Owing to the location of this wetland online to water resources drainage channels, inundation frequency cannot be conclusively determined.
 - Flood conditions are likely approximately once every 10 years (based on conversations with the CMA).



Figure 1: Wetland 44869 Showing Drainage Channels

Wetland 44870

- Typical conditions
 - Obvious areas of cropping (delineated by fields modified to have berms constructed to direct water for flooded irrigation) have been removed from wetland extents.
 - Areas unable to pond water have been removed from wetland extents.
 - The wetland has been reduced in size. The wetland is > 0.1 ha in area.
- Flood conditions
 - The majority of the DEECA Wetlands_Current extents for the original wetland are within the Lower Loddon 2011 flood extents. All areas where ponding is likely are included in the flood extents.
 - The DEECA extents for the original wetland correspond with low-lying areas in the LIDAR, indicating that the original wetland extents include areas that retain water in flood conditions.
 - The wetland is adjacent to Calivil Creek (immediately upstream of BHM wetland 8331) and is connected to the Calivil Creek main channel. When high flows occur in Calivil Creek, it is likely that they inundate the wetland.
- Inundation Frequency
 - A mapped irrigation waterway traverses the original wetland extents and connects (without obvious control) to Calivil Creek. While it cannot be proven from a desktop study, it is likely from terrain data and aerial imagery that this wetland drains naturally and does not hold water during typical conditions.
 - Mapped irrigation connections traverse the 'natural' catchment that terrain data indicates drains to the wetland, altering flow regimes both with their physical presence and with the water resource management conditions that can be applied through them.
 - In flood conditions, this wetland's filling regime likely depends on high flows in Calivil Creek and subsequent downstream water levels that may force the area to retain water.
 - Flood conditions are likely approximately once every 10 years (based on conversations with the CMA).

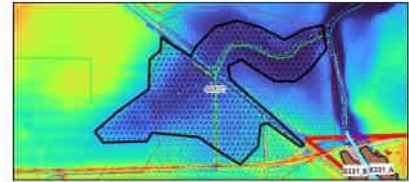


Figure 2: Terrain Data Shows Wetland 870 Directly Connected to Calivil Creek

Wetland 43320

- Typical conditions
 - Obvious areas of cropping (delineated by fields modified to have berms constructed to direct water for flooded irrigation) have been removed from wetland extents.
 - Areas unable to pond water have been removed from wetland extents.
 - The wetland has been reduced in size. The wetland is > 0.1 ha in area.
- Flood conditions
 - This wetland is outside the 2011 Lower Loddon flood extents. Based on this data, the wetland does not experience flood conditions. However, the North Central CMA has advised that flood mapping is being updated.
 - Drainage connections exist that may fill the original wetland extents, including the southern, vegetated area, even though the wetland is not mapped within the 2011 flood extents.
- Inundation Frequency
 - Mapped irrigation connections surround the wetland. Note that the irrigation connections show ponded water in the aerial image even though the wetland is dry.
 - Aerial imagery doesn't show an obvious outlet, indicating that this wetland may have a more natural drying regime.
 - Mapped irrigation connections traverse the 'natural' catchment that terrain data indicates drains to the wetland, altering flow regimes both with their physical presence and with the water resource management conditions that can be applied through them.
 - Inundation regimes at this wetland likely are dependent on a combination of water resource management (irrigation) and rainfall. DCE recommends assessing the local soil to determine if it is high-infiltration (sandy) or if it is generally low-infiltration and capable of retaining water.



Figure 3: Wetland 43320 Dry whilst Water Ponds in Irrigation Channel at West

Wetland 45395

- Typical conditions
 - Obvious areas of cropping (delineated by fields modified to have berms constructed to direct water for flooded irrigation) have been removed from wetland extents.
 - Minimal areas of ponding exist within this wetland, and ponding depth maximum is about 0.2 m.
 - Areas unable to pond water have been removed from wetland extents.
 - The wetland has been split into three (3) parts: 45395_A, 45395_B, and 45395_C where water is retained. All new wetlands > 0.1 ha in area.
- Flood conditions
 - The entire DEECA Wetlands_Current extents for the original wetland are within the Lower Loddon 2011 flood extents.
 - The DEECA extents for the original wetland correspond with low-lying areas in the LIDAR, indicating that the original wetland extents include areas that retain water in flood conditions.
 - The wetland is adjacent to Calivil Creek (upstream of BHM wetland 8331) and is connected to the Calivil Creek main channel. When high flows occur in Calivil Creek, it is likely that they inundate the wetland.
 - Human-constructed levee banks along Calivil Creek direct Calivil Creek flows through the centre of the wetland.
- Inundation Frequency
 - Unmapped irrigation drainage connects to the original wetland extents to Calivil Creek and the wider irrigation drainage networks. The connections potentially provide drainage outlets under certain water resources management conditions.
 - Flood conditions are likely approximately once every 10 years (based on conversations with the CMA).
 - Owing to the location of this wetland online to water resources drainage channels, inundation frequency in typical conditions cannot be conclusively determined.
 - In flood conditions, this wetland's filling regime likely depends on high flows in Calivil Creek and subsequent downstream water levels that force the area to retain water.

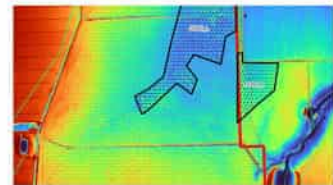


Figure 4: Wetland 45395 and Terrain Data Showing Unmapped Irrigation Connection to Calivil Creek

Wetland 45407

- Typical conditions
 - Obvious areas of cropping (delineated by fields modified to have berms constructed to direct water for flooded irrigation) have been removed from wetland extents.
 - Areas unable to pond water have been removed from wetland extents.
 - The wetland has been split into 11 parts: 45407_A, 45407_B, 45407_C, 45407_D, 45407_E, 45407_F, 45407_G, 45407_H, 45407_I, 45407_J, and 45407_K where water is retained. All new wetlands > 0.1 ha in area.
 - The identified areas are generally shallow, and maximum depths (outside of farm dam storages constructed within them) are maximum 0.2 m.
- Flood conditions
 - The entire DEECA Wetlands_Current extents for the original wetland are within the Lower Loddon 2011 flood extents. Note that the CMA have cropped the flood extents roughly along Pyramid Creek. The flood extent continues north.
 - The DEECA extents for the original wetland correspond with low-lying areas in the LIDAR, indicating that the original wetland extents include areas that retain water in flood conditions.
- Inundation Frequency
 - A Mapped irrigation waterway traverses 45407_B, 45407_C, 45407_D, and 45407_E, linking ponding areas and potentially providing a drainage outlet under certain water resources management conditions. A separate minor waterways traverses 45407_H, but it has berms that appear to isolate the waterway from the wetland in typical conditions. The waterways make determining inundation frequency for these wetlands uncertain as flows likely are controlled through water resources management.
 - Wetlands 45407_A, 45407_F, 45407_G, 45407_I, 45407_J, and 45407_K are oxbow lakes (billabongs) south of Pyramid Creek. Their inundation frequency is tied to major flows within the waterway overtopping and filling wetlands.
 - Flood conditions are likely approximately once every 10 years (based on conversations with the CMA).

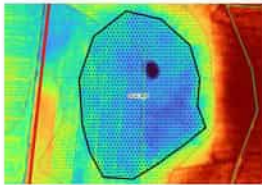


Figure 5: Constructed Water Storage Dam within Wetland 45407_B

Wetland 45408

- This feature is as much a wetland as the other features investigated in this report. It appears to be a low area corresponding to a previous alignment of Pyramid Creek (i.e. an Oxbow Lake or Billabong)
- Typical conditions
 - Obvious areas of cropping (delineated by fields modified to have berms constructed to direct water for flooded irrigation) have been removed from wetland extents.
 - Areas unable to pond water have been removed from wetland extents.
 - The wetland has been split into four (4) parts: 45408_A, 45408_B, 45408_C, and 45408_D where water is retained. All new wetlands > 0.1 ha in area.
- Flood conditions
 - The entire DEECA Wetlands_Current extents for the original wetland are within the Lower Loddon 2011 flood extents. Note that the CMA have cropped the flood extents roughly along Pyramid Creek. The flood extent continues north.
 - The DEECA extents for the original wetland correspond with low-lying areas in the LIDAR, indicating that the original wetland extents include areas that retain water in flood conditions.
- Inundation Frequency
 - Mapped irrigation waterways traverse 45408_A and 45408_C, linking ponding areas. DEECA wetland 318747 essentially serves as the outlet from the larger area. However, water resources management may divert stored water prior to it reaching the outlet, making inundation frequency determination under typical conditions uncertain.
 - Wetlands 45408_A and 45408_D are oxbow lakes (billabongs) south of Pyramid Creek. Their inundation frequency is tied to major flows within the waterway.
 - Flood conditions are likely approximately once every 10 years (based on conversations with the CMA).

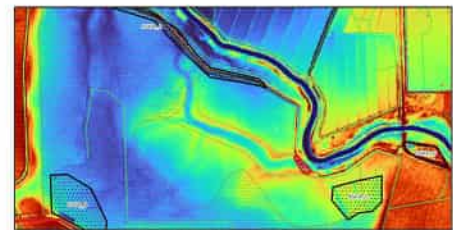


Figure 6: DEECA Wetland 318747 Connects Wetland 45408 to Pyramid Creek

Wetland 45406

- Typical conditions
 - Obvious areas of cropping (delineated by fields modified to have berms constructed to direct water for flooded irrigation) have been removed from wetland extents.
 - Areas unable to pond water have been removed from wetland extents.
 - The wetland has been split into three (3) parts: 45406_A, 45406_B, and 45406_C where water is retained. All new wetlands > 0.1 ha in area. 45406_A and 45406_C barely have ponding areas deeper than 0.2 m.
- Flood conditions
 - The entire DEECA Wetlands_Current extents for the original wetland are within the Lower Loddon 2011 flood extents.
 - The DEECA extents for the original wetland correspond with low-lying areas in the LIDAR, indicating that the original wetland extents include areas that retain water in flood conditions.
- Inundation Frequency
 - A Mapped irrigation waterway links ponding areas within this wetland to Hird Swamp (DEECA ID 45231 and BBHSM ID 13). It is likely that this wetland fills when flows in Hird Swamp reach a certain level under certain water resources management conditions. The waterway and connection to Hird Swamp, a known managed wetland with environmental flows provided by the CMA, make determining inundation frequency for these wetlands uncertain.
 - Wetland 45406_B is a constructed farm dam. Its inundation frequency is tied to agricultural use and supports the assumption that typical flow regimes are managed for water resources outcomes.
 - Flood conditions are likely approximately once every 10 years (based on conversations with the CMA).



Figure 7: Wetland 45406 and Irrigation Waterways

Wetland 45220

- The shape of this feature indicates that it may have been an ephemeral lake (similar to Lake Boga, north of the study area) prior to water resource management.
- Typical conditions
 - Obvious areas of cropping (delineated by fields modified to have berms constructed to direct water for flooded irrigation) have been removed from wetland extents.
 - Areas unable to pond water have been removed from wetland extents.
 - The wetland has been split into two (2) parts: 45220_A and 45220_B. All new wetlands > 0.1 ha in area.
- Flood conditions
 - The entire DEECA Wetlands_Current extents for the original wetland are within the Lower Loddon 2011 flood extents.
 - The DEECA extents for the original wetland correspond with low-lying areas in the LIDAR, indicating that the original wetland extents include areas that retain water in flood conditions.
- Inundation Frequency
 - Mapped minor waterways traverse the ponding areas and dam storage within this wetland. The waterway and connections make determining inundation frequency for these wetlands uncertain. The previous 120-day assessment assumed natural catchment and natural flow conditions. Based on available information, it is likely that flows in and out of the wetland are managed for water resources outcomes.
 - Mapped irrigation connections traverse the 'natural' catchment that terrain data indicates drains to the wetland, altering flow regimes both with their physical presence and with the water resource management conditions that can be applied through them.
 - Wetland 45220_B is a constructed farm dam. Its inundation frequency is tied to agricultural use.
 - Flood conditions are likely approximately once every 10 years (based on conversations with the CMA).

Wetland 321647_A

- Typical conditions
 - This is a water storage.
 - During the assessment of 45220, this storage was identified as being substantially larger in area than the associated area in the DEECA Wetlands_Current data set.
 - The additional wetland area has been provided as 321647_A. The new wetland > 0.1 ha in area.
- Flood conditions
 - The entire DEECA Wetlands_Current extents for the original wetland and 321647_A are within the Lower Loddon 2011 flood extents.
 - The DEECA extents for the original wetland correspond with low-lying areas in the LIDAR, indicating that the original wetland extents include areas that retain water in flood conditions.
- Inundation Frequency
 - A mapped irrigation waterway connects the storage at 321647_A to the wider irrigation network. The waterway connection makes determining inundation frequency for this wetland uncertain.
 - Wetland 321647_A is a constructed farm dam. Its inundation frequency is tied to agricultural use.
 - Flood conditions are likely approximately once every 10 years (based on conversations with the CMA).



Figure 8: Wetland 45220, Irrigation Waterways, and Constructed Water Storages 321647_A and 45220_B

Wetland 45209

- The shape of this feature indicates that it may have been an ephemeral lake (similar to Lake Boga, north of the study area) prior to water resource management.
- Typical conditions
 - Obvious areas of cropping (delineated by fields modified to have berms constructed to direct water for flooded irrigation) have been removed from wetland extents.
 - Areas unable to pond water have been removed from wetland extents.
 - The wetland has been split into two (2) parts: 45209_A, and 45209_B. All new wetlands > 0.1 ha in area.
- Flood conditions
 - The entire DEECA Wetlands_Current extents for the original wetland are within the Lower Loddon 2011 flood extents.
 - The DEECA extents for the original wetland correspond with low-lying areas in the LIDAR, indicating that the original wetland extents include areas that retain water in flood conditions.
- Inundation Frequency
 - Mapped minor and irrigation waterways traverse the ponding areas within this wetland. The waterways and connections make determining inundation frequency for the wetlands uncertain. The irrigation waterways show pooling of water in the aerial while the wetland area is conspicuously dry.
 - Wetland 45209_B is a constructed farm dam. Its inundation frequency is tied to agricultural use.
 - Flood conditions are likely approximately once every 10 years (based on conversations with the CMA).



Figure 9: Wetland 45209 with Irrigation and Minor Waterways

Wetland 45412

- Typical conditions
 - Obvious areas of cropping (delineated by fields modified to have berms constructed to direct water for flooded irrigation) have been removed from wetland extents.
 - Areas unable to pond water have been removed from wetland extents. In typical conditions, the wetland can be considered permanently drained. Two (2) irrigation waterways drain the wetland.
 - The wetland has been split into a new, smaller shape: 45412_A. The new wetlands > 0.1 ha in area. The smaller shapes contain the internal channels and water storages.
- Flood conditions
 - The entire DEECA Wetlands_Current extents for the original wetland are within the Lower Loddon 2011 flood extents.
 - The DEECA extents for the original wetland correspond with low-lying areas in the LIDAR, indicating that the original wetland extents include areas that retain water in flood conditions.
 - The wetland is generally near the downstream reaches of Nine Mile Creek and likely experiences flooding when that waterway floods.
- Inundation Frequency
 - The previous inundation assessment assumed a natural catchment and a natural flow regime for this wetland. Aerial imagery does not show a managed outlet, which would support a natural outflow/evaporation regime. However, based on the detailed investigation, this wetland connects to the irrigation drainage network and contains water storages within it. In typical conditions, irrigation frequency will depend on water resource management goals, not a natural flow regime.
 - The wetland would connect to a tributary of Nine Mile Creek, but it has primary connections to irrigation waterways.
 - Flood conditions are likely approximately once every 10 years (based on conversations with the CMA).



Figure 10: 'Natural' Wetland 45412 Outlet (Blue) and Primary Irrigation Outlet (Green)

Wetland 43316

- This feature is as much a wetland as the other features investigated in this report. The shape of this feature indicates that it may have been an ephemeral lake (similar to Lake Boga, north of the study area) prior to water resource management.
- Typical conditions
 - This wetland is not located within an obvious area of cropping (delineated by fields modified to have berms constructed to direct water for flooded irrigation).
 - The outside of the DEECA-delineated wetland extent ponds water.
 - The wetland shape has been adjusted slightly into a new, smaller shape: 43316_A. The new wetlands > 0.1 ha in area.
 - This wetland does not have connections to irrigation waterways and has a natural drying regime. However, irrigation waterways and water resource management influence the amount of water that reaches the wetland.
- Flood conditions
 - This wetland is outside the 2011 Lower Loddon flood extents. Based on this data, the wetland does not experience flood conditions. However, the North Central CMA has advised that flood mapping is being updated.
- Inundation Frequency
 - Based on LIDAR data, this wetland could have a large, natural catchment. The catchment is traversed by mapped minor waterways controlled for water resource management, so accurately determining the catchment to the wetland is uncertain.
 - The MUSIC modelling indicates that the wetland maintains 120 days of inundation between July and December during the period of interest. The inundation regime depends on the assumptions related to the catchment of the wetland.

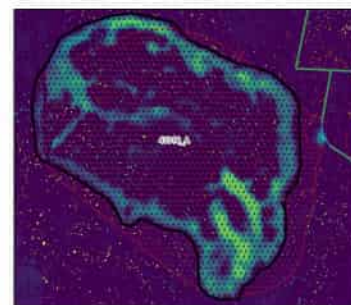


Figure 11: Filled Terrain Showing Areas of Depths > 0.2 m in Green

Wetland 45229

- Typical conditions
 - Obvious areas of cropping (delineated by fields modified to have berms constructed to direct water for flooded irrigation) have been removed from wetland extents.
 - Areas unable to pond water have been removed from wetland extents.
 - The wetland has been split into a new, larger shape: 45229_A. The new wetlands > 0.1 ha in area. The existing irrigation waterway and elevated road embankment will not allow the wetland to pond to the north in typical conditions.
 - No outlet connection appears to exist under typical conditions, indicating that outflow from the wetland may follow natural patterns.
- Flood conditions
 - The entire DEECA Wetlands_Current extents for the original wetland are within the Lower Loddon 2011 flood extents.
 - The DEECA extents for the original wetland correspond with low-lying areas in the LIDAR, indicating that the original wetland extents include areas that retain water in flood conditions.
- Inundation Frequency
 - Mapped minor waterways connect this wetland with the agricultural drainage network. The waterways and connections make determining inundation frequency for the wetlands uncertain. Previous inundation estimates assumed natural upstream catchments and natural outflows. The upstream catchment is not natural.
 - At least two (2) constructed dams exist within the wetland's extents. The inundation frequencies of the dams are likely managed for agricultural purposes.
 - Flood conditions are likely approximately once every 10 years (based on conversations with the CMA).
 - MUSIC modelling confirms days of inundation, not extents of inundation. Based on the terrain analysis, the portions of the wetland that retain water the longest are likely the constructed dams at the south and west of the extents.



Figure 12: Wetland 45229 and Upstream Irrigation Waterways

Wetlands Adjacent to 314817

- Typical conditions
 - Areas where water can pond have been identified based on filling the terrain data and identifying where water can pool.
 - The circled locations in the Nature Advisory Document *do not* relate to areas that will hold water under typical conditions. They are low-lying areas, but they drain naturally to the waterway.
 - Three (3) additional wetlands have been identified: 314817_A, 314817_B, and 314817_C, where water is retained. All new wetlands > 0.1 ha in area.
 - Wetland 314817_A is adjacent to the waterway and has no contributing catchment outside of waterway flows. Other than the storage dam within it, this wetland can be considered to be permanently drained by the waterway.
 - Wetland 314817_B has a small natural catchment but is connected to a drainage channel by an irrigation waterway. Water levels within this area are controlled by water resources management.
 - A culvert under the local road north of Wetland 314817_C likely provides an outlet for any water that would normally pond here, outside of the water storage. It can be considered permanently drained.
- Flood conditions
 - The newly identified wetlands are within the Lower Loddon 2011 flood extents.
 - The DEECA extents for the original wetland correspond with low-lying areas in the LIDAR, indicating that the original wetland extents include areas that retain water in flood conditions.
- Inundation Frequency
 - Owing to the drainage that appears to exist for all identified wetlands, it is unlikely these wetlands are inundated under typical conditions.
 - Flood conditions are likely approximately once every 10 years (based on conversations with the CMA and water level records available within the study area).

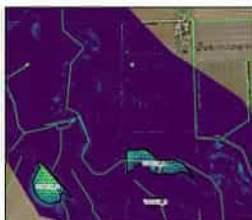


Figure 13: Detailed Filled Surface Showing Areas with Ponding > 0.2 m in Green

3. Potentially Unmapped Wetlands and Inundation Confirmation

DCE investigated the potentially unmapped wetlands in the document provided by Nature Advisory and summarised in Table 2. A summary of the investigations follows. The DCE-identified wetlands from the initial investigation are included in shapefile format as electronic **Attachment 4**.

Category	Wetland ID (DEECA Wetlands_Current)	MS Word Document Number	New ID
Unmapped Wetlands	314817 (adjacent)	2	314817_A
Unmapped Wetlands	314817 (adjacent)	2	314817_B
Unmapped Wetlands	314817 (adjacent)	2	314817_C
Unmapped Wetlands	44871 (adjacent)	3	n/a
Unmapped Wetlands	43320 (adjacent)	4	n/a
Unmapped Wetlands	315138 (adjacent)	5	n/a
Unmapped Wetlands	315172 (generally adjacent)	6	n/a
Unmapped Wetlands	45231	7	45231_A
Unmapped Wetlands	315145 (generally adjacent)	8	n/a
Inundation Period Confirmation	315144	1	n/a
Inundation Period Confirmation	315145	1	n/a
Inundation Period Confirmation	315269	2	n/a
Inundation Period Confirmation	315345	3	n/a
Inundation Period Confirmation	314819	4	n/a

Wetland Adjacent to 44871

- Nature Advisory asked DCE to determine if it was possible to identify the wetland an old breeding record is associated with. DCE has been asked to determine if the terrain data showed an area where water can pool, what the depth of the area may be, and if it was likely to be inundated for more than 120 days from June-December.
- Typical conditions
 - Areas where water can pond have been identified based on filling the terrain data and identifying where water can pool.
 - The circled locations in the Nature Advisory Document *do not* relate to areas that will hold water under typical conditions. They are low-lying areas generally achieve ponding depths of 0.2, but the area of ponding is much less than 0.1 ha.
 - Under typical conditions, no wetlands exist.
- Flood conditions
 - The area adjacent to 44871 is included in the 2011 Lower Loddon Flood extents.
 - It is likely that flood conditions control when water is contained within the landscape and how long it persists.
- Inundation Frequency
 - Flood conditions are likely approximately once every 10 years (based on conversations with the CMA and water level records available within the study area).



Figure 14: Area of Ponding Near Wetland 44871 < 0.1 ha

Wetland Adjacent to 43320

- Nature Advisory asked DCE to determine if the terrain data showed an area where water can pool, what the depth of the area may be, and if it was likely to be inundated for more than 120 days from June-December.
- Typical conditions
 - The area highlighted by Nature Advisory corresponds with low-lying areas in the LIDAR, indicating that water will be directed to this area.
 - Areas where water can pond have been identified based on filling the terrain data and identifying where water can pool.
 - Within the ponding area, only small areas, under 0.1 ha, have depths of ponding greater than 0.2 m.
 - The area of interest is adjacent to irrigation waterways and water storage dams, indicating that agricultural users would generally direct water away from the area of interest and to nearby storages.
- Flood conditions
 - The area of interest is *outside* the 2011 Lower Loddon flood extents. Based on this data, the wetland does not experience flood conditions. However, the North Central CMA has advised that flood mapping is being updated.
- Inundation Frequency
 - Owing to the minimal contributing natural catchment and the managed nature of water resources immediately adjacent to the area of interest, it is unlikely that the area is inundated in typical conditions.
 - Whilst not within the 2011 Loddon River flood extents, the area may pond in wet conditions when the nearby storages and irrigation waterways are full. However, with the current information available, it is unknown how often this may occur.

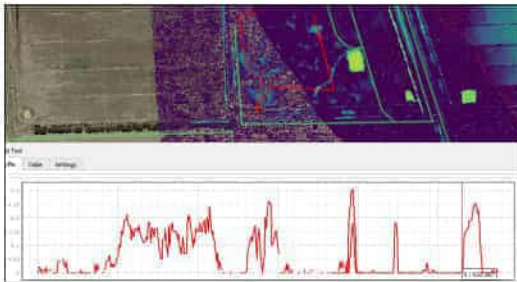


Figure 15: Section through Areas of Ponding Showing Maximum Depths

Wetland Adjacent to 315138

- Nature Advisory asked DCE to investigate a green area within the Nine Mile Creek waterway as a potential wetland.
- The aerial imagery shows a bridge structure to allow flow to pass under the road without constraint. Nine Mile Creek has an outlet, and any online wetland can be considered to be permanently drained.
- Typical conditions
 - Areas where water can pond have been identified based on filling the terrain data and identifying where water can pool.
 - The area of interest is the main channel of the waterway.
 - No areas with more than 200 m² of area have been identified outside of the main waterway channel.
- Flood conditions
 - The area of interest is within the Lower Loddon 2011 flood extents.
 - The area of interest corresponds with low-lying areas in the LIDAR, indicating that the original wetland extents include areas that retain water in flood conditions.
- Inundation Frequency
 - Owing to the minimal contributing catchment separate to the waterway, inundation of the area of interest depends on flows in the waterway.
 - Flood conditions are likely approximately once every 10 years (based on conversations with the CMA and water level records available within the study area).

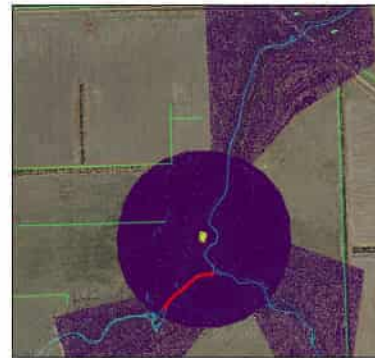


Figure 16: Nine Mile Creek Showing No Areas of Ponding > 0.2 m Outside Waterway Main Channel

Wetland Adjacent to 315172

- Nature Advisory asked DCE to investigate a green area within a tributary of Calivil Creek as a potential wetland. The area appears green in the aerial imagery.
- Typical conditions
 - Areas where water can pond have been identified based on filling the terrain data and identifying where water can pool.
 - The area of interest is the main channel of the waterway. Some ponding to depths less than 0.2 m is possible in adjacent oxbow lakes (billabongs).
 - The area of interest is online to a waterway and has minimal contributing catchment separate to the waterway. The wetland appears to be an area of silt deposit blocking a former channel.
- Flood conditions
 - New wetland is within the 2011 Lower Loddon Flood extents.
 - The potential new wetland area corresponds with low-lying areas in the LIDAR. The 'white' area in the aerial is raised above the stream level in the LIDAR.
- Inundation Frequency
 - Owing to the minimal contributing catchment separate to the waterway, inundation of the identified wetlands likely depends on flows in the waterway that break the banks.
 - Flood conditions are likely approximately once every 10 years (based on conversations with the CMA and water level records available within the study area).

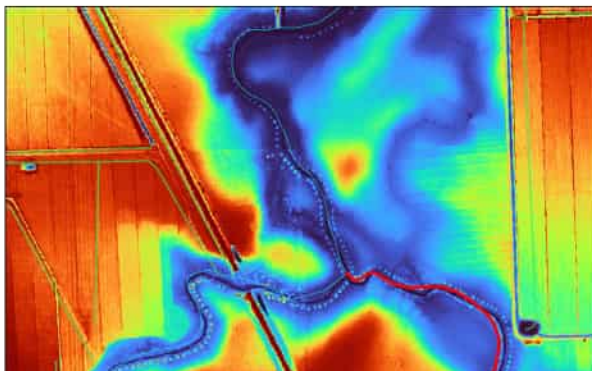


Figure 17: LIDAR Showing 'White' Region in Aerial Elevated

Wetland Adjacent to 45231

- Nature Advisory asked DCE to investigate a green area that visually pools water adjacent to Pyramid Creek as a potential wetland. The area appears green in the aerial imagery.
- Typical conditions
 - Areas where water can pond have been identified based on filling the terrain data and identifying where water can pool. An area of approximately 2 ha ponds water to a depth of approximately 0.5-0.8 m.
 - The area of interest appears to be a former alignment of Pyramid Creek, or a constructed dam that takes advantage of the previous channel. There are no obvious indications that the new wetland 45231_A is a constructed feature.
 - The terrain data and aerial do not show a connection from this wetland to irrigation waterways.
- Flood conditions
 - New wetland is within the 2011 Lower Loddon Flood extents.
 - The potential new wetland area corresponds with low-lying areas in the LIDAR.
- Inundation Frequency
 - Owing to the minimal contributing catchment separate to the waterway, inundation of the identified wetland likely depends on flows in Pyramid Creek that break the banks and fill the depression.
 - Flood conditions are likely approximately once every 10 years (based on conversations with the CMA and water level records available within the study area).

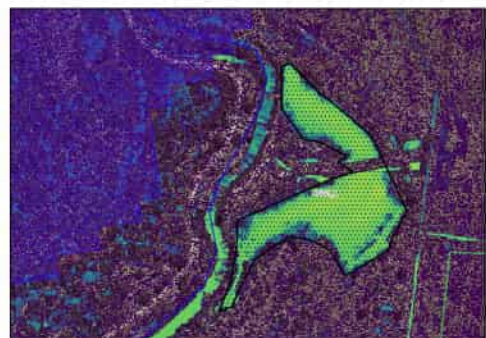


Figure 18: New Investigation Wetland 45231_A

Wetland Adjacent to 315145

- Nature Advisory asked DCE to investigate a pool within the Nine Mile Creek main waterway. This pool is online to the main channel and appears to generally drain downstream based on terrain data. The pool is connected to an irrigation waterway.
- Typical conditions
 - Areas where water can pond have been identified based on filling the terrain data and identifying where water can pool.
 - The area of interest is the main channel of the waterway.
 - The potential new wetland area is online to a minor waterway and has minimal contributing catchment separate to the waterway. The wetland appears to be a deeper section of the waterway where water pools before the ephemeral waterway disappears. An irrigation waterway connection may supply or divert water from the pool.
 - Depths in the pool are generally lower than 0.2 m. Based on this low depth, it is unlikely that ponding depths greater than 0.3 m could occur under typical conditions.
- Flood conditions
 - The area of interest is within the 2011 Lower Loddon Flood extents.
 - The area of interest corresponds with low-lying areas in the LiDAR.
- Inundation Frequency
 - Owing to the contributing catchment separate to the waterway, inundation of the identified wetlands likely depends on flows in Nine Mile Creek or the connecting irrigation waterway.
 - Flood conditions are likely approximately once every 10 years (based on conversations with the CMA and water level records available within the study area).

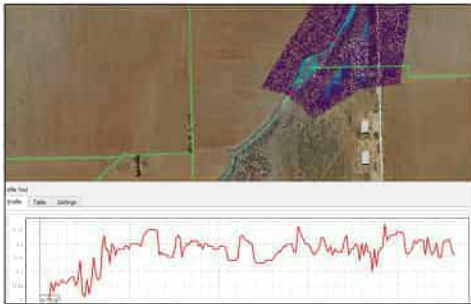


Figure 19: Pool within Nine Mile Creek and Max Ponding

Wetland 315144 and 315145

- Nature Advisory asked DCE to investigate the inundation period of the two DEECA wetlands 315144 and 315145. The wetlands appear to be residual oxbow lakes (billabongs) adjacent to Nine Mile Creek.
- Typical conditions
 - In typical conditions, the wetlands have minimal (less than 1 ha) catchments. Drains connect the upstream area directly to Nine Mile Creek, bypassing these wetlands.
 - In typical conditions, the lakes are generally dry. Aerial imagery from February 2022 shows the lakes dry. DCE recommends assessing the soil at the lakes to determine if sandy soil causes the lakes to drain more rapidly through infiltration.
- Flood conditions
 - The wetland/lake areas are within the 2011 Lower Loddon Flood extents.
 - When Nine Mile Creek breaks its banks, the wetland/lake areas will be filled.
- Inundation Frequency
 - Owing to the minimal contributing catchment separate to the waterway, inundation of the identified wetlands is unlikely during typical conditions.
 - Flood conditions are likely approximately once every 10 years (based on conversations with the CMA and water level records available within the study area).

Wetland 315345

- Nature Advisory asked DCE for additional information regarding inundation frequency for wetland 315345. Further clarification as to if the feature was a dam was also requested.
- Typical conditions
 - This wetland is not online to any mapped irrigation waterways. However, aerial and terrain data indicates that the mapping of irrigation waterways in the vicinity of this wetland is somewhat inaccurate.
 - The feature appears to be a dam, perhaps opportunistically located within a lower area that once was an alignment of Calivil Creek.
 - The feature has a minimal natural catchment. It is adjacent to an irrigation waterway shown in LiDAR.
 - Owing to the managed nature of the waterway (including this dam and dam 315347 along the same waterway), it is unlikely to have a natural flow regime. The aerial image shows this dam dry whilst 315347 is full, presumably with irrigation water. Inundation frequency cannot be exactly determined as inflows to the wetland depend on flood conditions or water resources management regimes.
- Flood conditions
 - The wetland is within the 2011 Lower Loddon Flood extents.
 - The potential new wetland area corresponds with low-lying areas in the LiDAR.
 - The wetland is close enough to Calivil Creek that it likely fills when Calivil Creek breaks its banks in high flow events.
- Inundation Frequency
 - Flood conditions are likely approximately once every 10 years (based on conversations with the CMA and water level records available within the study area).

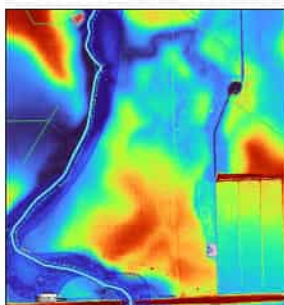


Figure 20: Wetland Location with Terrain and Calivil Creek Waterway

Wetland 314919

- Nature Advisory asked DCE to investigate DEECA Wetland 314919 to confirm that it is connected to a waterway and acts as a dam.
- Typical Conditions
 - This wetland is online to an irrigation waterway mapped with the Geoscience Australia database of Australian waterways. Aerial imagery confirms that the wetland is online to the drain and that the drain alignment in the data set is slightly off.
 - The wetland is a water storage (dam). A stock tank and excavation extents are visible in the aerial image.
 - Detailed terrain analysis did show an area of ponding with a depth of approximately 0.3 m upstream of the wetland. This area is just under 0.1 ha, and so is unlikely to be appropriate habitat under typical conditions.
- Flood Conditions
 - The area of interest is within the Lower Loddon 2011 flood extents.
 - The area of interest corresponds with low-lying areas in the LiDAR, indicating that the original wetland extents include areas that retain water in flood conditions.
- Inundation Frequency
 - Owing to the managed nature of the waterway (including this dam), it is unlikely to have a natural flow regime. Inundation frequency cannot be exactly determined as flows in the waterway depend on water resources management regimes.
 - Flood conditions are likely approximately once every 10 years (based on conversations with the CMA and water level records available within the study area).

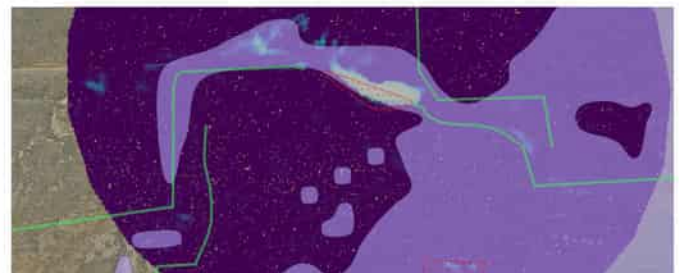


Figure 21: Wetland 314919 Detailed Terrain Analysis and 2011 Loddon River Flood Extents

Recommendations

DCE has completed the detailed analysis of the wetlands of interest flagged by Nature Advisory. DCE have used GIS terrain analysis to define low areas, areas without an outlet, and likely extents of ponding.

DCE recommends that project team consider the two conditions experienced by the study area when choosing to adjust wetland boundaries. In typical conditions, many of the DEECA-defined wetland footprints should be reassessed as ponding extents are likely less than the footprint defined in the data set. Water levels in typical conditions may be too low to support brolga breeding habitat. The entire footprint may not be inundated.

However, in flood conditions, the entire DEECA-defined wetland footprints are, in all but two instances, completely inundated. Downstream conditions are likely to retain water in these locations for extended periods of time. The duration of flooding depends on downstream water conditions, some influenced by major riverine flooding and other conditions dependent on the water resources management regime adopted by landowners.

Discussions with the CMA indicate that flood conditions in local waterways can be expected to occur approximately once in ten (10) years, and this is supported by water level gauge data throughout the study area. Discounting the flood conditions extent of wetlands may not be appropriate in this unique environment.

DCE's investigation has two key limitations:

- Soil conditions. In sandy, free-draining soil, water will seep into the ground and will not be retained to support brolga breeding. In clay soil, water will be retained until it evaporates. It's understood that both types of soil exist within the area of interest. Where a wetland's inundation period must be fully understood, detailed soil information is required. A specialist geotechnical consultant should be engaged to obtain the soil information.
- Wetland depth. Brolga breeding habitat wetlands need to be approximately 300 m depth to protect the nest from predators. Whilst the wetlands identified have at least this depth and the model shows the wetlands retaining water, this investigation did not quantify the depth of water within the wetlands at all times.

If soil conditions prevent infiltration, and if stored water isn't repurposed by landowners for irrigation or other agricultural use, all identified wetlands are likely to have retained water at some depth for 120 days between July and December through a combination of typical (but wet) and flood conditions. It is recommended that further assessment be made to determine if the additional identified areas of are potential brolga breeding habitat.

