Wanganella Swamp

2019/20 Watering Event

Inundation Extent & Vegetation Response

Report prepared for

Yanco Creek and Tributaries Advisory Council Inc.

Dan Hutton

August 2020

Report Title:	Wanganella Swamp 2019/20 Watering Event; Extent of Inundation and Vegetation Response (unpublished)
Author:	Dan Hutton, Environmental Consultant
	PO Box 1195, Deniliquin, NSW 2710
Report prepared for:	The Yanco Creek and Tributaries Advisory Council Inc.

Preference is this publication be attributed (and any material sourced from it) using the following:

Publication title: Hutton, D. 2020. Wanganella Swamp 2019/20 Watering Event; Extent of Inundation and Vegetation Response (Unpublished)

Contact us: Inquiries regarding the license and any use of the document are welcome at Yanco Creek and Tributaries Advisory Council Inc. https://landcare.nsw.gov.au/groups/yanco-creek-and-tributaries-advisory-council/

All photography by Dan Hutton ©

Front cover photograph: a pair of Brolga *Grus rubicunda* and a pair of Black Swan *Cygnus atratus* N.W Wanganella swamp 2020.

Document History			
Version	Author(s)	Date	Reviewed by
Draft 1.0	Dan Hutton	August 2020	Dr Dale McNeill
Final 1.1	Dan Hutton	August 2020	Dr Dale McNeill

Contents

Background and scope

This report provides data recorded at Wanganella Swamp during May and June 2020 following the completion of the 2019/2020 watering event. The scope of work covered was as follows;

Record extent of inundation;

- Combination of satellite imagery analysis and ground truthing to map and calculate the approximate extent inundation.

Identify areas of wetland vegetation type and response;

- Provide georeferenced vegetation photographic points.

Provide information to guide comparative wetland responses between different future watering regimes;

- Collected data to be suitable for future subjective comparison.

Provide a report presenting recorded data, methodologies and evaluation/interruption;

- Provide a written report including
    - Inundation extent maps
    - Vegetation response and species (where possible).

Provide collated data sets;

- Provide copies of collated GIS files
- Provide copies of photographs.

Introduction

Wanganella Swamp (the Swamp) is a 470 ha wetland complex located 3 km south of Wanganella village and includes hydrologically connected section of the Eight Mile and Clarke's Creeks (Figure 1). The Swamp consists of both freehold (55 per cent) and Crown land (45 per cent) and is a significant environmental asset of the Billabong Creek catchment with important ecological, cultural and social values (Hobbs, 1956. Roberts, Pasma, 1990. Glazebrook, 2000. Webster, Davidson, 2010.

Wanganella Swamp is a flow through wetland receiving water from the Billabong Creek and Murrumbidgee River catchments. Flows enter the Swamp from the South via Clarkes and Eight Mile Creeks; flows exit the swamp to the North West via Eight Mile Creek to join the Billabong or Forest Anabranch.

Figure 1: Map of the Wanganella swamp and associated creeks (Google Earth)

Following European settlement of the region flows into Forest Creek increased as a result of infrastructure works carried out at the Yanco Creek off-take from the Murrumbidgee River. The construction of the Forest Creek cutting in 1930 altered flows further to near continuous, resulting in the swamp remaining in a predominately wet state (Glazebrook 2000). This altered the swamp from its traditional ephemeral state to that of permanent wetland and produced changes to the vegetation, most notably allowing Cumbungi (*Typha spp.*) to invade and choke both the Eight Mile Creek delivery channel and the main distributary channels within the wetland complex (P. Maher pers. obs.). In November 2006, all flows over Warriston Weir were suspended due to critical water shortages resulting from the severe drought, drying both the Forest Creek and Wanganella swamp (Webster and Davidson 2010).

The Wanganella Swamp is widely acknowledged as a significant waterbird breeding habitat within the Billabong Creek catchment. Waterbird records include Hobbs (1956) who describes an Ibis rookery containing up to 30,000 breeding pairs. P Maher provided valuable records from 1988 to present day including a significant breeding event in 2010.

Delivery

Delivery via private irrigation channel commenced 21st October 2019 and was completed 17th April 2020 with a total of 2,250ML delivered. During the event there were three separate delivery periods; 21st October to 9th December, 12th to 28th January and 2nd to 17th April. Delivery was temporarily interrupted during the first delivery period to allow the McCrabb's spillway to be raised 0.2m. Table 1 below summarises the delivery periods and volumes.

Table 1: 2019/20 watering event delivery summary

Delivery stage	Date commenced	Date ceased	Volume delivered	Total delivered
1	21st October 2019	9th December 2019	950ML	950ML
2	12th January 2020	28th January 2020	550ML	1,500ML
3	2nd April 2020	17th April 2020	750ML	2,250ML

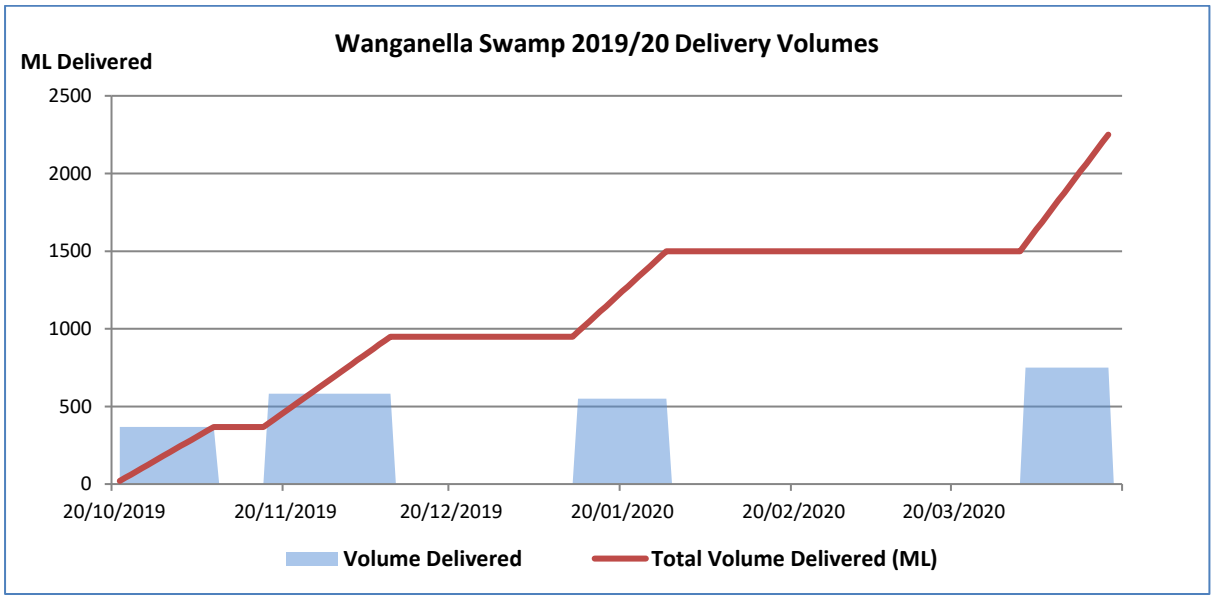


Figure 2: Graph showing the three delivery periods and volumes delivered (ML)

Rainfall

Heavy rain fell on March 5th with 82mm recorded at Deniliquin, falls exceeding 100mm were recorded on properties north of Deniliquin. A further 93mm of rain was recorded at Deniliquin during April producing local run-off and significant vegetation response across the region.

Table 2: Deniliquin monthly rainfall during the 2019/20 watering event (BOM)

Month	Rainfall Recorded Deniliquin 2019/20 (mm)	Average Rainfall Deniliquin 1997-2018 (mm)
October 2019	5.6	33.6
November 2019	18.4	47.0
December 2019	8.6	29.0
January 2020	38.0	23.8
February 2020	7.6	32.5
March 2020	89.6	24.8
April 2020	93.4	25.8
May 2020	24.8	27.4
June 2020	19.0	32.0
Period Totals	**305.0**	**275.9**

Inundation extent

Satellite imagery

Recording the extent of inundation occurred after delivery had ceased. Historical satellite imagery was sourced from the Sentinel Hub website which offers full-resolution Sentinel-1, Sentinel-2, Landsat 8, DEM and MODIS imagery. Sentinel 2 imagery was selected which offers seven rendering spectral view options;

- Natural colour - based on bands 4, 3 & 2
- Color Infrared - (vegetation) based on bands 8, 4 & 3
- False color – (urban) based on bands 12, 11 & 4
- Agriculture – based on bands 11, 8 & 2
- Vegetation Index – based on combination of bands (B8 – B4)/(B8 + B4)
- Moisture Index – based on combination of bands (B8A – B11)/(B8A + B11)
- Geology – based on bands 12, 4 & 2

A total of 31 images were downloaded cover the period between October 23rd 2019 and June 29th 2020 using the agriculture rendering spectral view option. Not all the images available were suitable mainly due to cloud cover. The full set of images is provided in the accompanying PowerPoint presentation and document titled Wanganella Swamp – 2019/20 Watering Event Inundation Sequence.

The image recorded October 23rd 2019 (Figure 3) shows the site immediately prior to delivery commencing. The image recorded May 5th 2020 (Figure 4) showed the maximum extent of inundation.

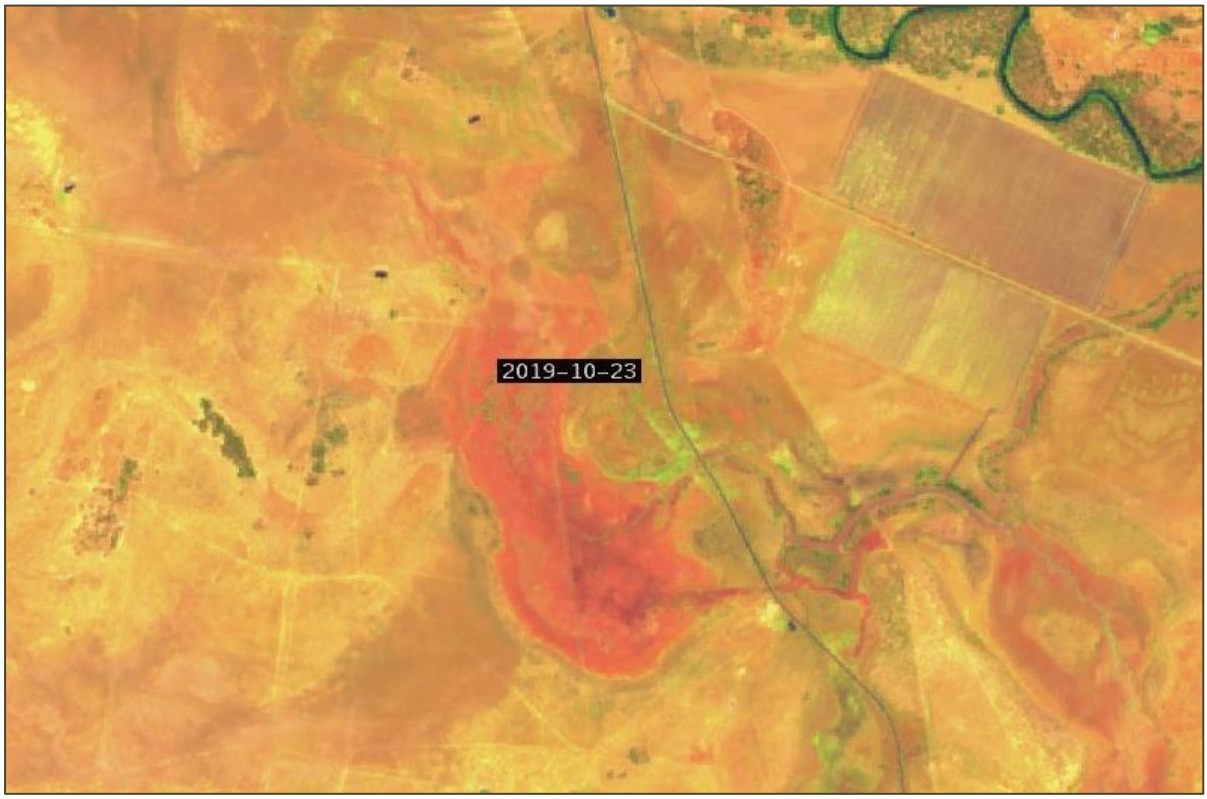


Figure 3: Sentinel 2 satellite image 23/10/2019 showing a dry site prior to delivery commencing (Sentinel Hub)

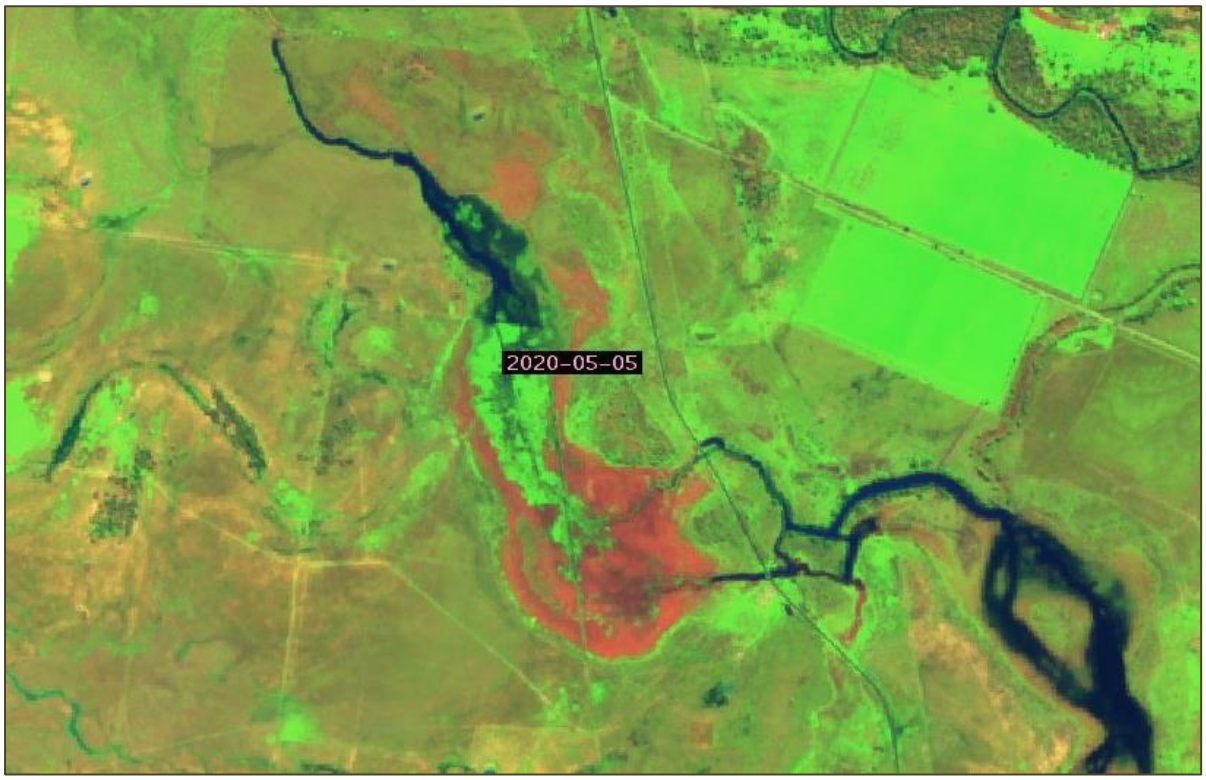
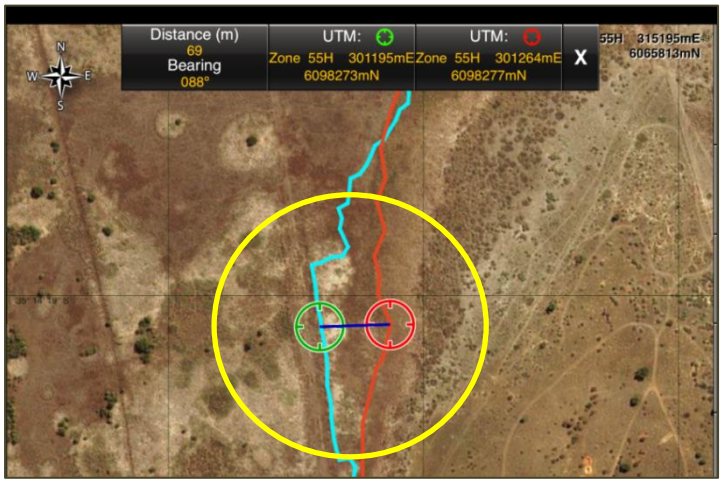


Figure 4: Sentinel 2 satellite image 5/05/2020 showing the site at maximum inundation extent and vegetation response to rain fall events in April and May (Sentinel Hub)

Ground truthing

Vegetation response to rainfall in March and April produced difficulties in evaluating the satellite imagery to accurately determine the extent of inundation. The image recorded on May 5th showing the probable maximum extent of inundation, was used to produce a GIS track file of the approximate extent. The file was then loaded onto an iPad mapping App for ground truthing in the field. The maximum extent of inundation was identifiable in the field by residual soil moisture levels and the response of wetland specific vegetation species.

Although the satellite based extent was relatively accurate in some areas it proved to be inaccurate by up to 70m in the flatter areas of the western swamp. Figure 5 below shows an iPad screenshot with both the satellite derived and the field recorded extents. Due to the inaccuracy of the satellite derived extent the entire extent was recorded in the field. Field recorded files were uploaded to a GIS program to map and calculate the maximum extent of inundation.



The map appearing in Figure 6 show the maximum extent of 160ha. GIS files of the recorded maximum extent of inundation have been provided separately.

Figure 5: iPad screenshot showing a discrepancy circled in yellow of 70m between the satellite based extent in red and the on-ground recorded extent in blue (GPS MotionX).

Figure 6: Maximum extent of inundation recorded at Wanganella Swamp (Google Earth).

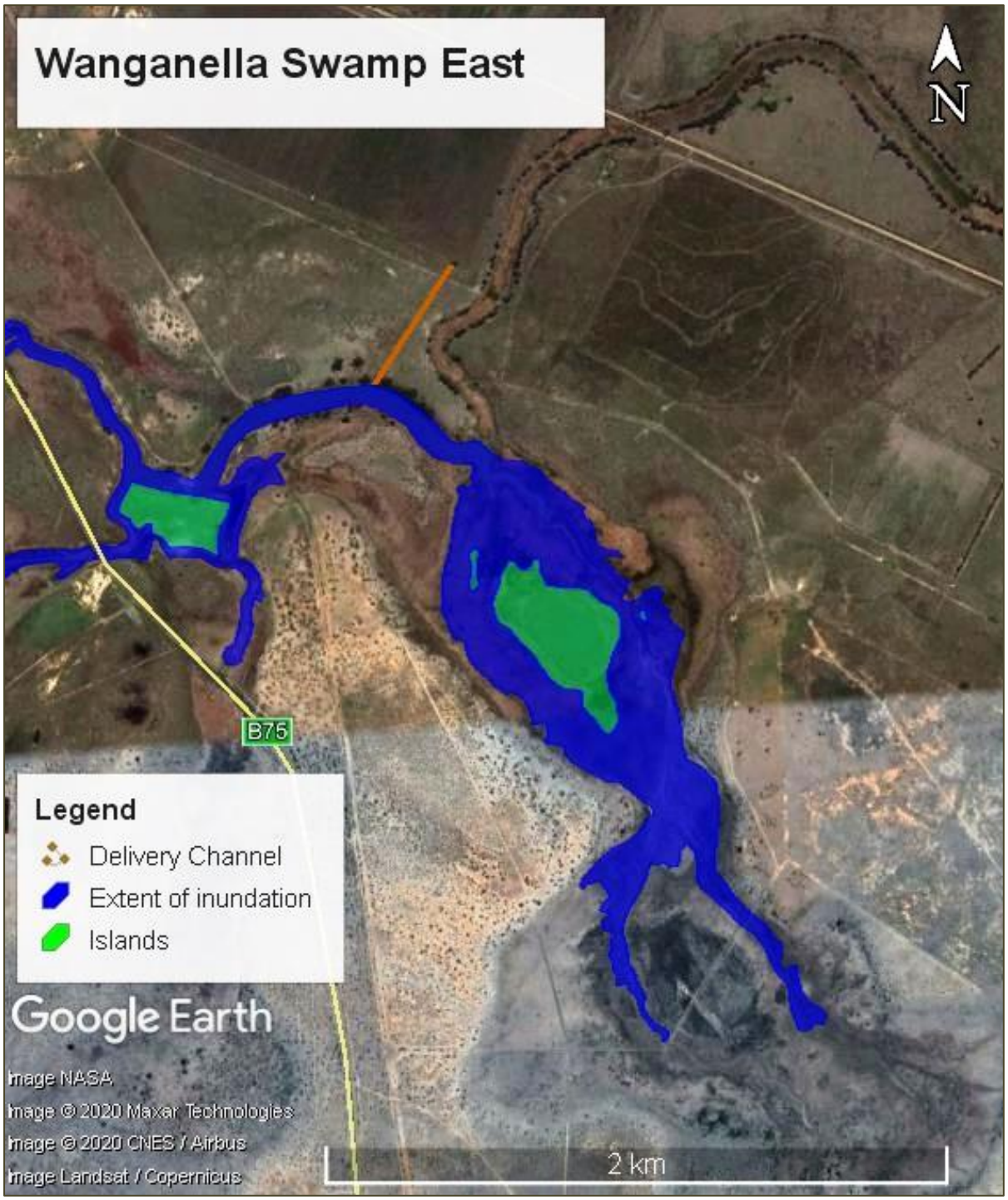


Figure 7: Maximum extent recorded at Wanganella Swamp East of 74ha (Google Earth).

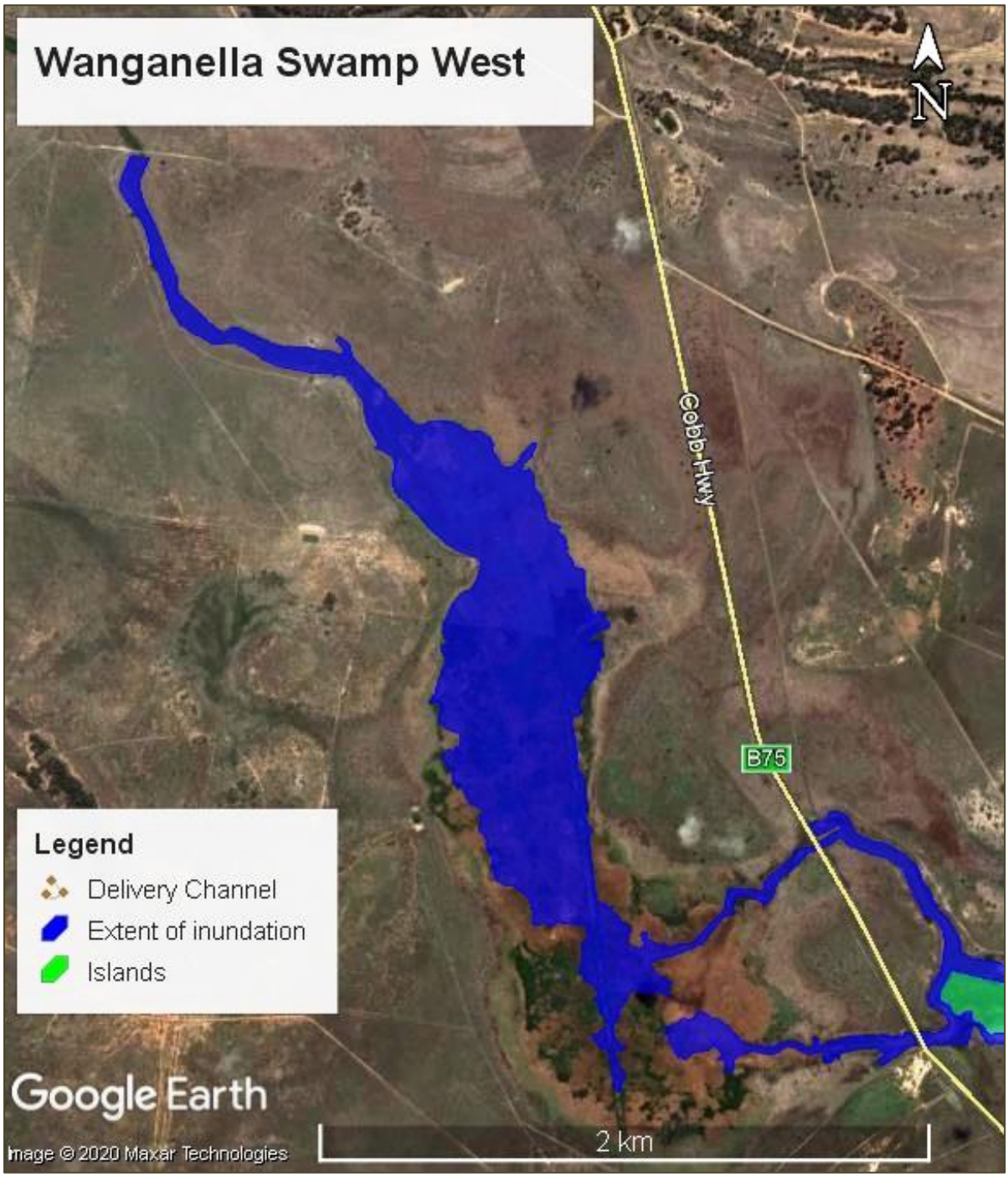


Figure 8: Maximum extent of inundation recorded at Wanganella Swamp West of 86ha (Google Earth).

Wetland vegetation response

Background

The vegetation at Wanganella Swamp was described by Roberts and Pasma (1993) as 'fairly rich', with a total of 45 species recorded. They identified seven vegetation types within the swamp, these are described below;

1. Open water – patches of submerged herbs and localised stands of free-floating species;
2. Tall grassland – dense, tall stands of cumbungi (*Typha orientalis*) with small patches of reed (*Phragmites australis*) and giant rush (*Juncus ingens*);
3. Herbland – dense stands of milfoil, (*Myriophyllum papillosum*);
4. Sedge-herbland – mixed community of milfoils and sedges;
5. Sedgeland – dominated by sedges but with patches of mixed aquatic herbs e.g. buttercups (*Ranunculus spp.)* and nardoo (*Marsilea drummondii*);
6. Grassland – dominated by dense grasses; and
7. Shrub-sedgeland – scattered shrubs of nitre goosefoot (*Chenopodium nitrariaceum*) and lignum with understorey of sedges and rushes (*Juncus spp*).

Response by vegetation type

To provide continuity vegetation types identified by Roberts and Pasma are used for this report. The wetland vegetation response to the 2019/20 watering event was varied, dependant largely upon the duration of inundation.

1. Open water

Water primrose (*peploides ssp.*) and *Ferny* Azola (*Azola pinnata*) were both recorded in abundance within the Eight Mile Creek channel of the western swamp. Species were less abundance within the eastern swamp channels, this may have been due to waterbird numbers being considerably higher east of the Highway.

Figure 9: Water primrose (*peploides ssp*.) and Ferny Azola (*Azola pinnata*).

2. Tall grassland

Cumbungi (*Typha orientalis*) response was strong within all the main creek channels particularly those east of the highway. Despite the inundation covering large areas with old stands of Cumbungi across the western swamp the response beyond the channels was negligible.

Figure 10: Cumbungi (*Typha orientalis*) stands outside the channels predominately failed to respond to inundations.

Common reed (*Phragmites australis*) and Giant Rush (*Juncus ingens*) response was similar to that of Cumbungi in being predominately limited to within channels of both the east and west swamps.

Figure 11: Cumbungi (*Typha orientalis*) with Common reed (*Phragmites australis*) and Pale Knotweed (*Polygonum lapathifolium)* behind.

3. Herbland

Water Milfoil, (*Myriophyllum papillosum*) was recorded in small isolated communities within the creek channels of both the east and western swamps. All plants had been subject to heavy grazing.

4. Sedge herbland

Pale Knotweed (*Polygonum lapathifolium*) response was one of the most prolific with large area of dense stand covering many hectares, particularly across the western swamp.

Figure 12: Pale Knotweed (*Polygonum lapathifolium*).

5. Sedgeland

Smooth Nardoo (*Marsilea drummondii*) responded well following the recession, particularly at the downstream portion of the western swamps.

Figure 13: Smooth Nardoo (*Marsilea drummondii*).

6. Grassland

Grassland response was not surveyed.

7. *Shrub-sedgeland*

Flowering Lignum (*Eremophila polyclada)* response was recorded at one location only as the inundation failed to reach other locations surveyed with stands of similar species.

Figure 14: Flowering Lignum (*Eremophila polyclada).*

Table 3: Location of vegetation type photographs

Vegetation Type	Easting (GDA 94 55H)	Northing (GDA 94 55H)
1. Open water	300990	6098228
2. Tall grasses	301029	6098050
3. Herbland	301855	6097788
4. Sedge herbland	301360	6097682
5. Sedgeland	301009	6098657
6. Grassland	Not recorded	Not recorded
7. Scrub-sedgeland	300771	6098187

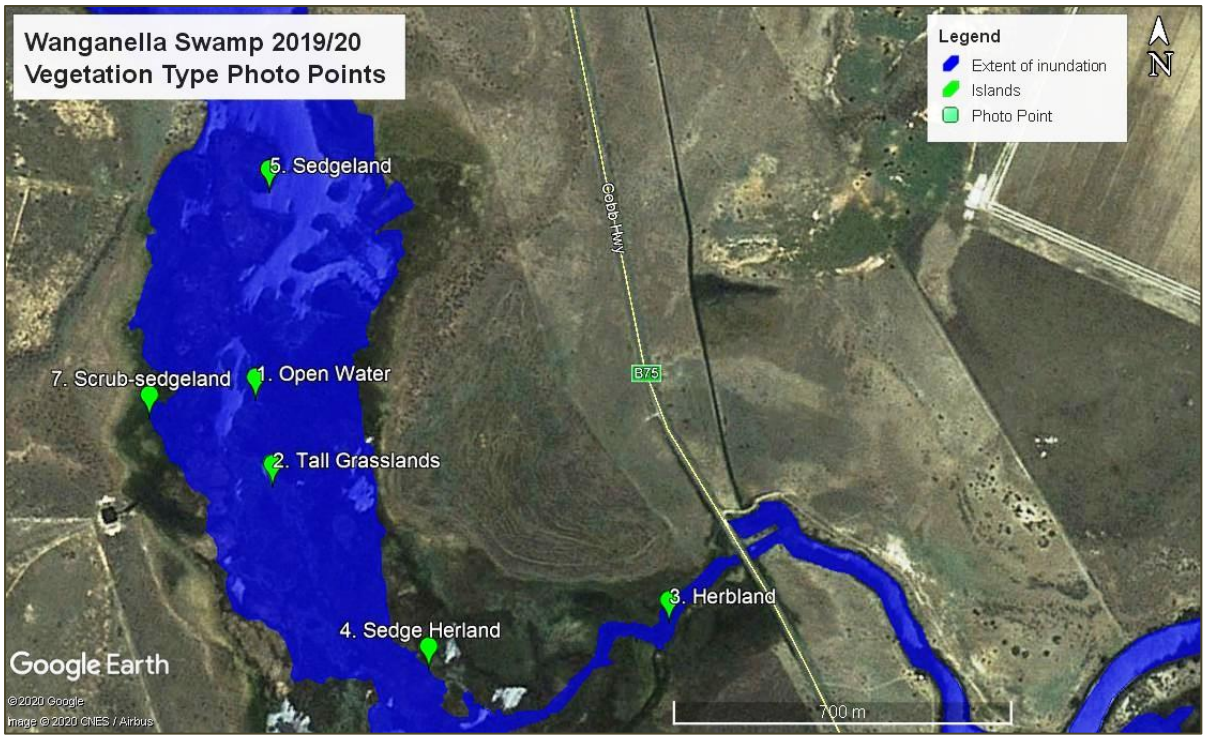


Figure 15: Map indicating the location of the vegetation type photo points

Incidental observations

Eight Mile Creek - southern channel flow impediment

Flows to the western swamp via Eight Mile Creek were predominantly via the northern channel. An old earth bank 300m west of the highway appeared to have significantly impeded flows within the southern channel. The inundation map in Figure 16 below shows the limited flooding that occurred downstream of the old block bank.

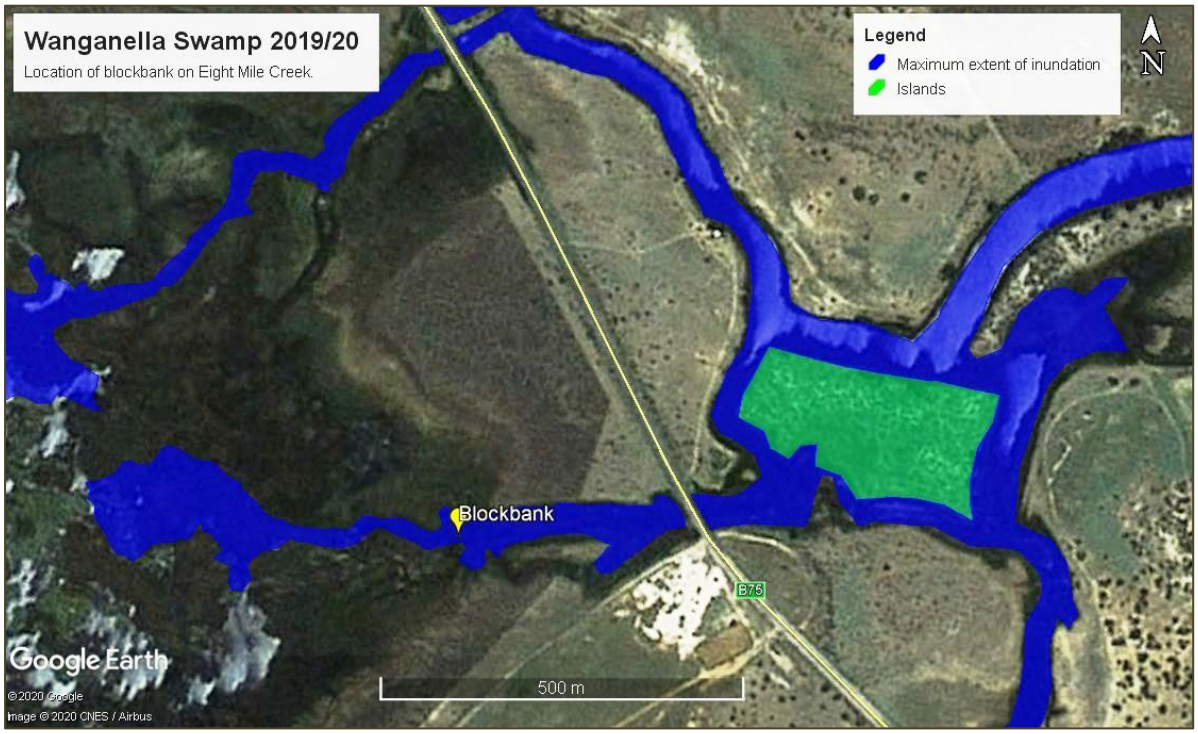


Figure 16: Location of the old block bank impeding flow via the southern Eight Mile Creek channel (Google Earth).

Figure 17: View east/upstream of the southern Eight Mile Ck channel, showing the old block bank.

Western Swamp - influence of excavated channel

The excavated channel which runs south to north within the western swamp heavily influenced the extent and duration of inundation. Satellite imagery indicated flows via the northern Eight Mile Creek channel predominantly remained within channel with the extent largely resulting from backfilling from the downstream regulator. The excavated channel and associated spoil bank prevent the flood waters extending further east (see Figures 18 & 19).

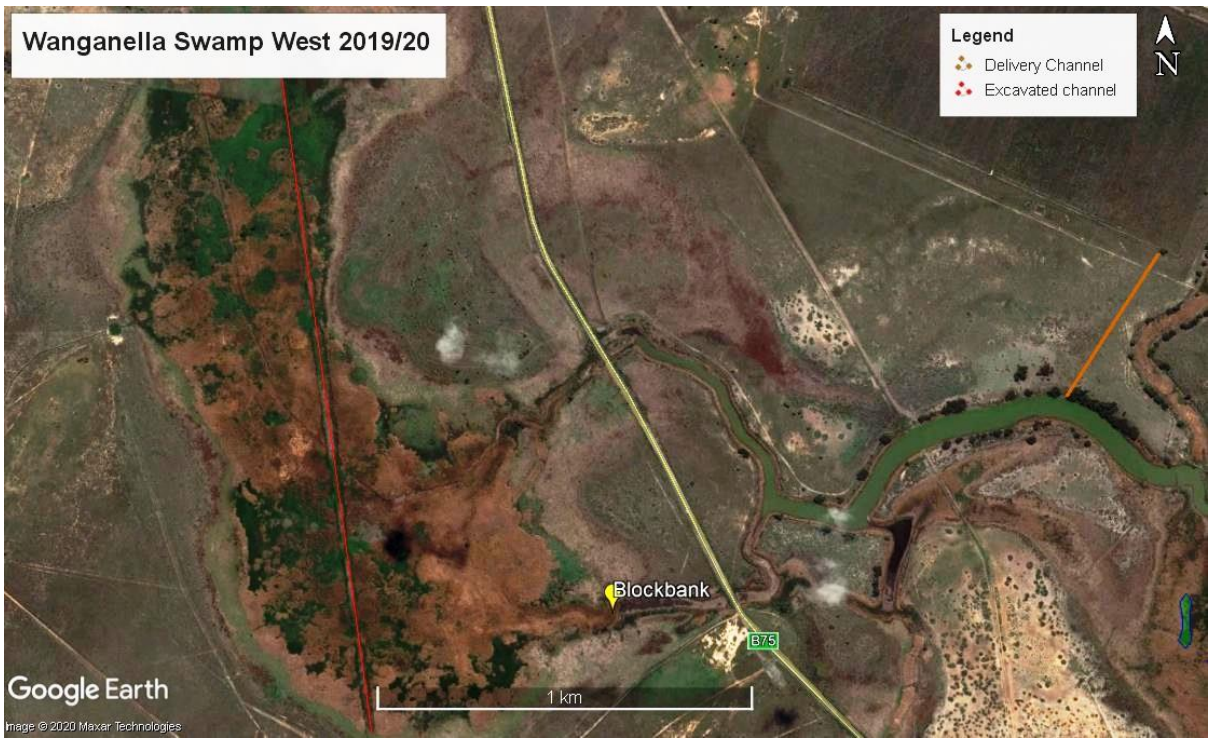


Figure 18: Map indicating the location of the excavated channel within the western swamp (Google Earth).

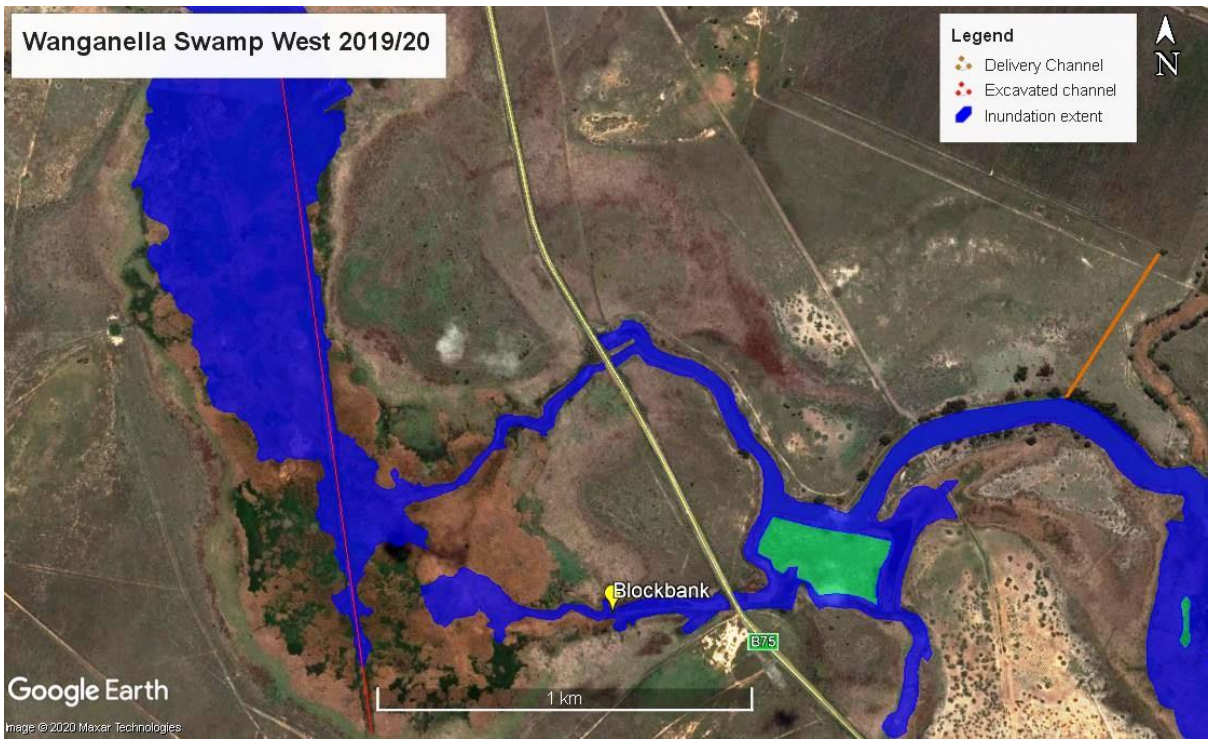


Figure 19: Map indicating the limited flooding east of the excavated channel marked with a red line (Google Earth).

Figure 20 below shows the spoil bank associated with the excavated channel with wetland vegetation response to flood inundation west of the excavated channel and the dry soil to the east with no inundation or wetland vegetation response.

Figure 20: Excavated channel spoil prevent inundation to the east.

Black swan

Up to 50 Black swans were observed at the northern/downstream end of the western swamp and 10 within the eastern swamp. There were 3 pairs recorded incubating in the western swamp in June of which one pair was later recorded with 4 signets. The recession at that time was well advanced resulting in the nests loosing flood water protection. With foxes regularly observed across the site during field visits, immediate foxes control was recommended.

Figure 21: Black swans taking four signets to the protection of the Cumbungi beds

Brolgas

Brolga (*Grus rubicunda*) have historically been recorded both visiting and breeding at the Wanganella swamps and Billabong Creek catchment although numbers have been dwindling over recent years (P. Maher per comms). One pair was regularly observed both east and west of the highway during site visits.

Figure 22: Pair of Brolgas at the northern end of the western swamp

References

Glazebrook, H. 2000. Draft Management Plan for the Forest Creek System including Forest Creek, Eight Mile Creek and the Forest Anabranch. Department of Land and Water Conservation, Deniliquin

Google Earth Pro: https://www.google.com/earth/versions/#earth-pro

Hobbs, J.N. 1956. A Flood Year in the Riverina. Emu 56: 349-352.

Roberts, J. and Pasma, S. 1993. Wanganella Swamp in A. Wilson (ed.) River, Plain and Sandhill. Proceedings of the Southern Riverina Field Naturalists Club Inc. Vol 1. 1993. Southern Riverina Field Naturalists Club Inc., Deniliquin.

Sentinel Hub: Sentinel 2 L1C https://apps.sentinel-hub.com/sentinel-playground/

Webster, R. and Davidson, I. 2010. Management Plan for Wanganella Swamp. Unpublished report to Water for Rivers. Ecosurveys Pty Ltd, Deniliquin.