

**AERIAL ASSESSMENT OF ACID SULFATE SOILS HAZARDS
ALONG THE DARLING RIVER CORRIDOR, WESTERN
NEW SOUTH WALES**

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AERIAL ASSESSMENT OF ACID SULFATE SOILS HAZARDS ALONG THE DARLING RIVER CORRIDOR, WESTERN NEW SOUTH WALES

Summary report of aerial assessment conducted 19th – 21st September 2008

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1. INTRODUCTION

The Murray-Darling Basin Authority's (MDBA) acid sulfate soils (ASS) risk rapid assessment program was supplemented by aerial assessment along the Darling River corridor in western New South Wales. This aerial survey formed part of the NSW Department of Environment, Climate Change and Water's (DECCW) acid sulfate soils rapid assessment project (ASSAP) that is overseen and funded by the MDBA.

Numerous wetlands of the Darling Riverine Plain region were identified through the MDBA ASS risk desktop assessment phase for inclusion in the rapid assessment phase of NSW ASSAP. However staff from the MDBA Wetlands Unit, DECCW Rivers and Wetlands Unit and Murray-Darling Freshwater Research Centre (MDFRC) agreed that an aerial assessment of the Darling River corridor should be undertaken in order to help set priorities for potential additional on-ground rapid assessment.

Parts of the Darling River corridor, including the main Darling River channel and its adjoining channels and floodplain wetlands (typically abandoned channels and other floodplain depressions), were considered to have some likelihood of ASS hazard due to:

- the history of pooling behind weirs in the Darling River and its branches;
- the infrequent drying regime in some reaches and likelihood of recharge from agricultural land and groundwater, leading to potential increased salinity; and,
- the high likelihood of rewetting and longitudinal flow connection in the event of a flood following the recent severe drought.

Therefore the aim of the aerial assessment was to rapidly inspect the Darling River corridor from Bourke to Wentworth to ascertain the likelihood of ASS hazards using key visual indicators, and to help determine the need for additional on-ground assessment as part of NSW ASSAP.

An aerial survey of this type does not negate the need for further rapid or detailed on-ground assessment, nor can it unequivocally show that ASS materials are not present, but it was anticipated that the survey would enable clear examples of disturbed ASS

or potential severe problems to be identified and may highlight the need to fill spatial gaps in the current distribution of on-ground rapid assessment sites in NSW.

2. AERIAL ASSESSMENT ZONE AND FLIGHT PATHS

The zone of the ASS hazard aerial assessment began on the Darling River at the town of Bourke in northern NSW and continued ~750 km downstream to the junction of the Darling River and the Murray River at the town of Wentworth in southwestern NSW (Figure 1). Broken Hill Airport was used as the operation base due to the reliable source of aviation fuel and presence of technical support in the event of unforeseen problems with the aircraft. Due to the great distances involved, the limitations on permissible pilot hours and the need for regular refuelling at depots, the aerial assessment was undertaken over three days (average ~7 hours per day):

- Bourke to ~75 km downstream of Tilpa (19th September 2008);
- ~75 km downstream of Tilpa to Menindee (20th September 2008); and,
- Menindee to Wentworth (21st September 2008) (Figure 1).

3. METHODS

A small helicopter was determined to be the best means of transport for the ASS hazard aerial assessment as this type of aircraft can cover vast distances fairly quickly and can also maintain a flight path along a river at a speed and altitude most suitable for an accurate visual assessment of rivers and wetlands. Baldwin *et al.* (in prep.) used a similar aircraft when conducting an aerial assessment of ASS hazards along the reaches of the Murray River and found the approach both highly effective and flexible enough to assess wetlands that occurred in an intricate arrangement on the floodplain.

Key visual indicators were used to help determine the likelihood of severe ASS hazards in the areas surveyed by helicopter, including:

- marked discolouration of the channel bed, banks or wetlands (i.e. the presence of yellow/red tinges and/or seepage zones, and/or white scalds or salt efflorescences, and/or black pugging in grey or light coloured sediments); and,
- the presence of dead and/or dying riparian or wetland vegetation.

The main channel of the river was kept on the passenger side (left side) of the helicopter at nearly all times, with the two assessors also on that side of the aircraft and a note recording person in the rear right side seat. The GPS coordinates of sites of interest were recorded while above the relevant locations using the on-board GPS navigation system and oblique aerial photographs were taken at suitable times. Unfortunately, due to a GPS malfunction, the saved coordinates were only available for download in August 2009. The helicopter was also landed at one wetland.

Although parts of the Paroo Overflow and the Darling Anabranch were overpassed during the aerial assessment, these broad areas of floodplain with numerous lakes were not considered in any detail due to the fact that several were designated for on-ground rapid assessment and due to the imposition of time constraints while in the air; the highest priority of the aerial survey being the Darling River corridor. The Menindee Lakes complex was also included in the aerial assessment zone, but due to the relatively high water levels in this part of the system at the time of the survey, a visual assessment of ASS hazard was not possible for this area.

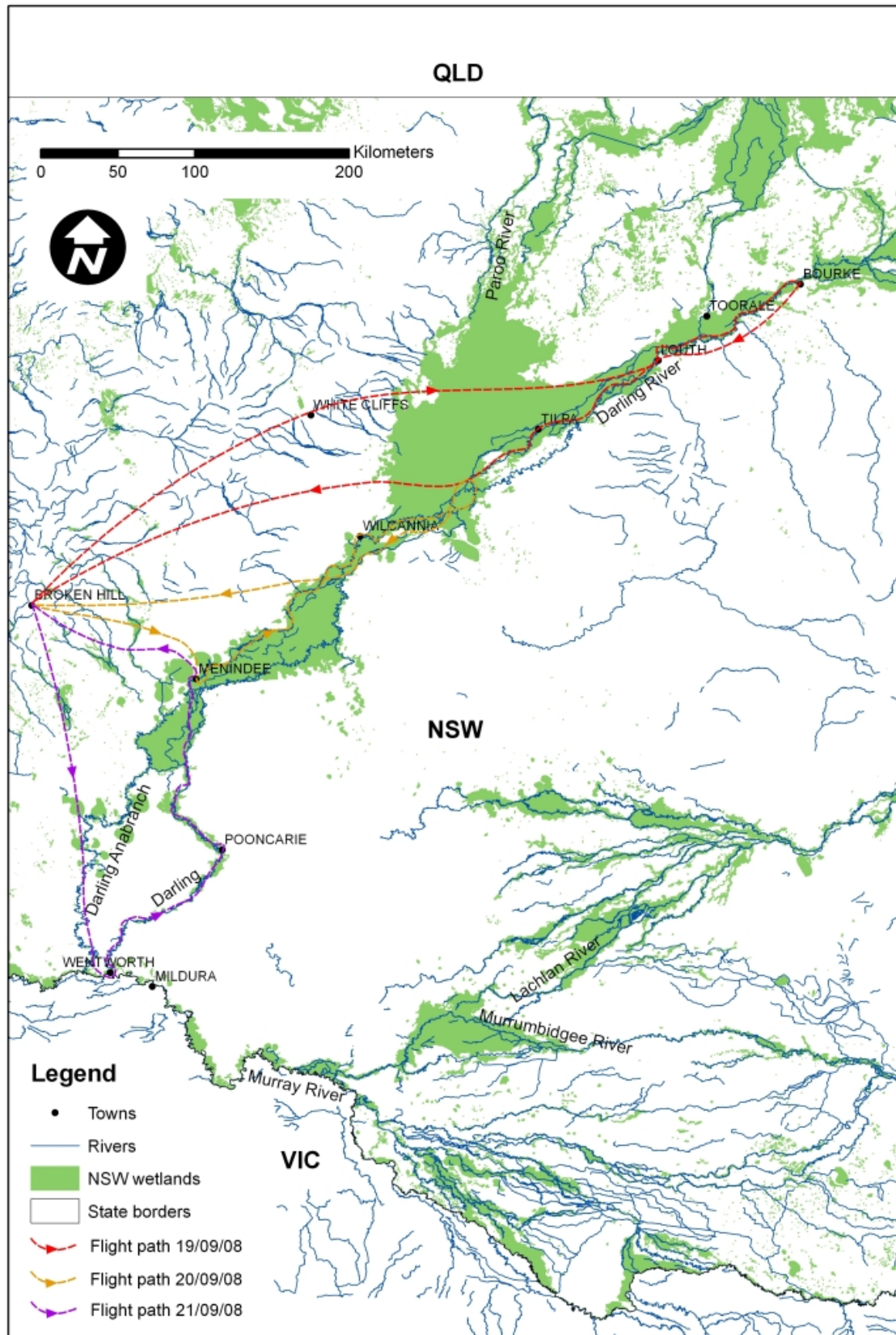


Figure 1: The ASS hazard aerial assessment zone between Bourke and Wentworth and the daily flight paths along the Darling River corridor, western New South Wales.

4. RESULTS AND DISCUSSION

A summary of the findings from the ASS hazard aerial assessment is presented below (Table 1). Overall, most of the Darling River corridor was very dry and appeared to be drought-stressed, with evidence of tree and understorey vegetation death and poor health in areas away from the riparian zone; areas without a reliable supply of water. Most trees in the riparian zone appeared to be living, indicating a fairly good source of water from the river and minor adverse impacts from factors such as high salinity, exposed sulfidic sediments, or ASS. Actually, a reverse trend of healthy vegetation away from the river and wetlands, and unhealthy vegetation closer to the river and wetlands would be expected if ASS was a significant problem in parts of this system.

Sites overpassed that were of little note were too numerous to record, but examples of these and key sites of 'low' and 'low to moderate' ASS hazards (qualitative ranking from visual assessment) are given in Table 1. Sites including Bourke Weir and Balaka Lake were deemed to have 'low to moderate' likelihood of ASS hazard due to their probable regular or prolonged inundation. Some abandoned meanders and floodplain depressions near Louth, Tilpa, Wilcannia, Menindee and Pooncarie showed signs of orange/red/green colouration. However, once one site was checked on the ground (site M), this type of colouration was noted to be caused by wet and/or dry aquatic vegetation (e.g. azolla) at the sites. All the recorded sites had living trees (river red gums) around their margins, indicating reasonable ecosystem health. One meander near Wilcannia (site J) showed signs of orange seepage on one bank and was situated next to an old irrigation block.

Based on the presence/absence of the key visual indicators of ASS, none of the river reaches or wetlands in the assessment zone appeared to require urgent on-ground rapid assessment, although some sites may need consideration for further assessment following a review of the rapid assessment fieldwork data gathered for NSW ASSAP. If further assessment is to be undertaken, then reaches of the Darling River that pond water, either behind block banks, weirs or other features, should be considered first, along with those abandoned meander bends and depressions that are easily inundated.

5. CONCLUSIONS

The aerial assessment of the Darling River corridor conducted in September 2008 provided a rapid visual means of determining the likelihood of ASS hazards in the main Darling River channel and its branches and wetlands. As expected, the majority of the system appeared to be drought-stressed and no obvious signs of ASS were documented. It is likely that some sites may require further on-ground assessment, although these sites should not be prioritised above others already listed for on-ground rapid assessment until the results from similar or nearby sites are available for review.

Following this review, additional sites may be included in the prioritisation process for wetlands that require further assessment once all the rapid assessments in NSW are complete. This prioritisation process will allow DECCW and other jurisdictional authorities to consider those wetlands or sites that have the greatest need for further assessment and thus ensure the most effective and efficient use of project resources for the detailed assessment phase of the MDBA acid sulfate soils assessment project.

6. REFERENCE

Baldwin, D. *et al.* (in prep.). Aerial assessment of Murray River wetlands. MDFRC.





Site name	Site location	Visual ASS risk	CNES/SPOT image	Oblique aerial photograph
A. Bourke Weir	Darling River Zone 55, 393446 E, 6671081 S	Low to moderate – nearly permanent inundation? Predominantly living trees on banks.	27 th February 2007, Digital Globe 	19 th September 2008, Tim Ralph 
B. Weir near Orange Tree Lagoon	Darling River Zone 55, 376020 E, 6654628 S	Low to moderate – colour difference between water upstream (turbid) and downstream (clear); possible indication of salinity? Predominantly living trees on banks.	Unknown image acquisition date, Digital Globe 	19 th September 2008, Tim Ralph 

Table 1: Summary of sites recorded during the ASS hazard aerial assessment of the Darling River corridor. The directions of oblique aerial photos are indicated by arrows.





Site name	Site location	Visual ASS risk	CNES/SPOT image	Oblique aerial photograph
C. Abandoned meander ~7.5 km southwest of Louth	Darling River floodplain Zone 55, 315274 E, 6613925 S	Low – some discolouration at margins due to aquatic vegetation; predominantly living trees on banks.	22 nd June 2002, Digital Globe 	19 th September 2008, Tim Ralph 
D. Abandoned meander ~27 km southwest of Louth	Darling River floodplain Zone 55, 299174 E, 6605870 S	Low – some discolouration; predominantly living trees on banks.	Unknown image acquisition date, Digital Globe 	19 th September 2008, Tim Ralph 

Table 1 continued: Summary of sites recorded during the ASS hazard aerial assessment of the Darling River corridor.





Site name	Site location	Visual ASS risk	CNES/SPOT image	Oblique aerial photograph
E. Abandoned meander ~35 km southwest of Louth	Darling River floodplain Zone 55, 293605 E, 6603145 S	Low – some discolouration at margins due to aquatic vegetation; predominantly living trees on banks.	Unknown image acquisition date, Digital Globe 	19 th September 2008, Tim Ralph 
F. Meander ~36 km southwest of Louth	Darling River Zone 55, 294426 E, 6601488 S	Low – no discolouration; predominantly living trees on banks.	Unknown image acquisition date, Digital Globe 	19 th September 2008, Tim Ralph 

Table 1 continued: Summary of sites recorded during the ASS hazard aerial assessment of the Darling River corridor.





Site name	Site location	Visual ASS risk	CNES/SPOT image	Oblique aerial photograph
G. Abandoned meander ~22 km southwest of Tilpa	Darling River floodplain Zone 55, 241407 E, 6559426 S	Low – no discolouration (red sand dunes at northern margin); predominantly living trees on banks.	Unknown image acquisition date, Digital Globe 	19 th September 2008, Tim Ralph 
H. Meander ~87 km southwest of Tilpa	Darling River Zone 54, 773511 E, 6518563 S	Low – no discolouration in channel, some scalding on floodplain; predominantly living trees on banks.	Unknown image acquisition date, Digital Globe 	20 th September 2008, Tim Ralph 

Table 1 continued: Summary of sites recorded during the ASS hazard aerial assessment of the Darling River corridor.





Site name	Site location	Visual ASS risk	CNES/SPOT image	Oblique aerial photograph
I. Abandoned meander ~16 km northeast of Wilcannia	Darling River floodplain Zone 54, 738770 E, 6505959 S	Low – some discolouration at margins due to aquatic vegetation; predominantly living trees on banks.	20 th August 2008, Digital Globe 	20 th September 2008, Tim Ralph 
J. Meander ~3 km south of Wilcannia	Darling River Zone 54, 725765 E, 6502928 S	Low to moderate – some discolouration at margin due to saline seepage from adjoining irrigation block? Predominantly living trees on banks.	21 st October 2006, Digital Globe 	20 th September 2008, Tim Ralph 

Table 1 continued: Summary of sites recorded during the ASS hazard aerial assessment of the Darling River corridor.





Site name	Site location	Visual ASS risk	CNES/SPOT image	Oblique aerial photograph
K. Lake Woytchugga	Darling River floodplain (playa lake) Zone 54, 719085 E, 6505519 S	Low – living vegetation on dry lake bed.	21 st October 2006, Digital Globe 	20 th September 2008, Tim Ralph 
L. Abandoned meander ~9.5 km south of Wilcannia	Darling River floodplain Zone 54, 723918 E, 6497443 S	Low – some discolouration at margins due to aquatic vegetation; predominantly living trees on banks.	Unknown image acquisition date, Digital Globe 	20 th September 2008, Tim Ralph 

Table 1 continued: Summary of sites recorded during the ASS hazard aerial assessment of the Darling River corridor.




Site name	Site location	Visual ASS risk	CNES/SPOT image	Oblique aerial photograph
M. Abandoned meander ~26 km southwest of Wilcannia	Darling River floodplain Zone 54, 713938 E, 6486160 S	Low – some discolouration at margins due to aquatic vegetation; predominantly living trees on banks.	Unknown image acquisition date, Digital Globe 	20 th September 2008, Tim Ralph 
As above.	As above.	As above.	Site photograph – 20 th September 2008, Tim Ralph 	

Table 1 continued: Summary of sites recorded during the ASS hazard aerial assessment of the Darling River corridor.





Site name	Site location	Visual ASS risk	CNES/SPOT image	Oblique aerial photograph
N. Abandoned meander ~63 km southwest of Wilcannia	Darling River floodplain Zone 54, 687680 E, 6465995 S	Low – some discolouration at margins due to aquatic vegetation; predominantly living trees on banks.	8 th January 2005, Digital Globe 	20 th September 2008, Tim Ralph 
O. Floodplain depression ~36 km northeast of Menindee	Darling River floodplain Zone 54, 659003 E, 6436472 S	Low to moderate – red aquatic vegetation, nearly permanently inundated? Predominantly living trees at margins.	Unknown image acquisition date, Digital Globe 	20 th September 2008, Tim Ralph 

Table 1 continued: Summary of sites recorded during the ASS hazard aerial assessment of the Darling River corridor.

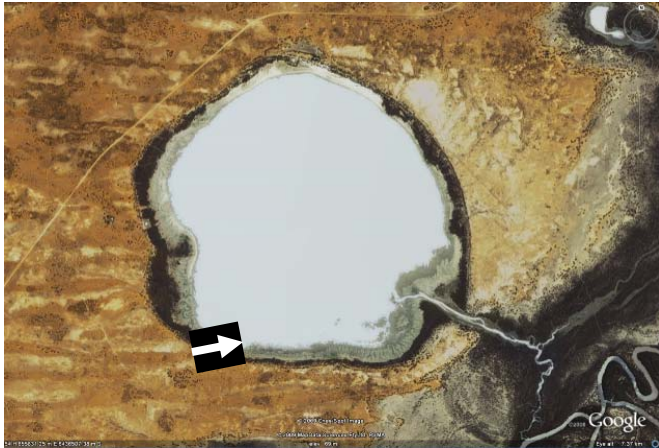

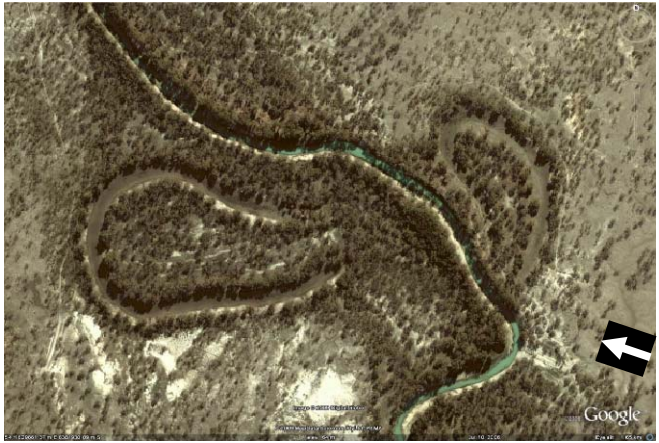

Site name	Site location	Visual ASS risk	CNES/SPOT image	Oblique aerial photograph
P. Balaka Lake	Darling River floodplain (playa lake) Zone 54, 655831 E, 6436507 S	Low to moderate – regularly inundated? Predominantly living vegetation at margins.	Unknown image acquisition date, Digital Globe 	20 th September 2008, Tim Ralph 
Q. Abandoned meanders ~38 km south of Menindee	Darling River floodplain Zone 54, 629661 E, 6381930 S	Low – no discolouration; predominantly living trees on banks.	10 th July 2006, Digital Globe 	21 st September 2008, Tim Ralph 

Table 1 continued: Summary of sites recorded during the ASS hazard aerial assessment of the Darling River corridor.





Site name	Site location	Visual ASS risk	CNES/SPOT image	Oblique aerial photograph
R. Floodplain depression ~26 km northwest of Pooncarie	Darling River floodplain Zone 54, 627321 E, 6323751 S	Low – some discolouration; predominantly living trees at margins.	10 th July 2006, Digital Globe 	21 st September 2008, Tim Ralph 
S. Andruco Lagoon	Darling River floodplain Zone 54, 589926 E, 6243053 S	Low – no discolouration; predominantly living trees on banks.	6 th March 2006, Digital Globe 	21 st September 2008, Tim Ralph 

Table 1 continued: Summary of sites recorded during the ASS hazard aerial assessment of the Darling River corridor.