# Miralga Creek Iron Ore Project

# Desktop Review of Potential Groundwater Dependent Vegetation

ATLAS IRON PTY LTD

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**Miralga Creek Iron Ore Project – Desktop Review of Potential Groundwater Dependent Vegetation**

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**DISCLAIMER**

# TABLE OF CONTENTS

## FIGURES

# 1 INTRODUCTION

The Atlas Iron Pty Ltd (Atlas) Miralga Creek Iron Ore Project (The Project) is located 50 kilometres (km) west northwest of Marble Bar, approximately 100 km from Port Hedland (Figure 1).

Atlas is seeking environmental approval to commence mining of iron ore from multiple deposits at Miralga Creek. Atlas proposes to abstract groundwater for use in the operations from local aquifers and require definition of areas of vegetation at risk of impact from this groundwater abstraction.

Woodman Environmental Consulting Pty Ltd have undertaken surveys for flora and vegetation associated with the Project and have prepared vegetation maps over the Project study area (The Study Area) (Woodman Environmental 2019a), identifying those vegetation types that potentially represent groundwater dependent vegetation (GDV).

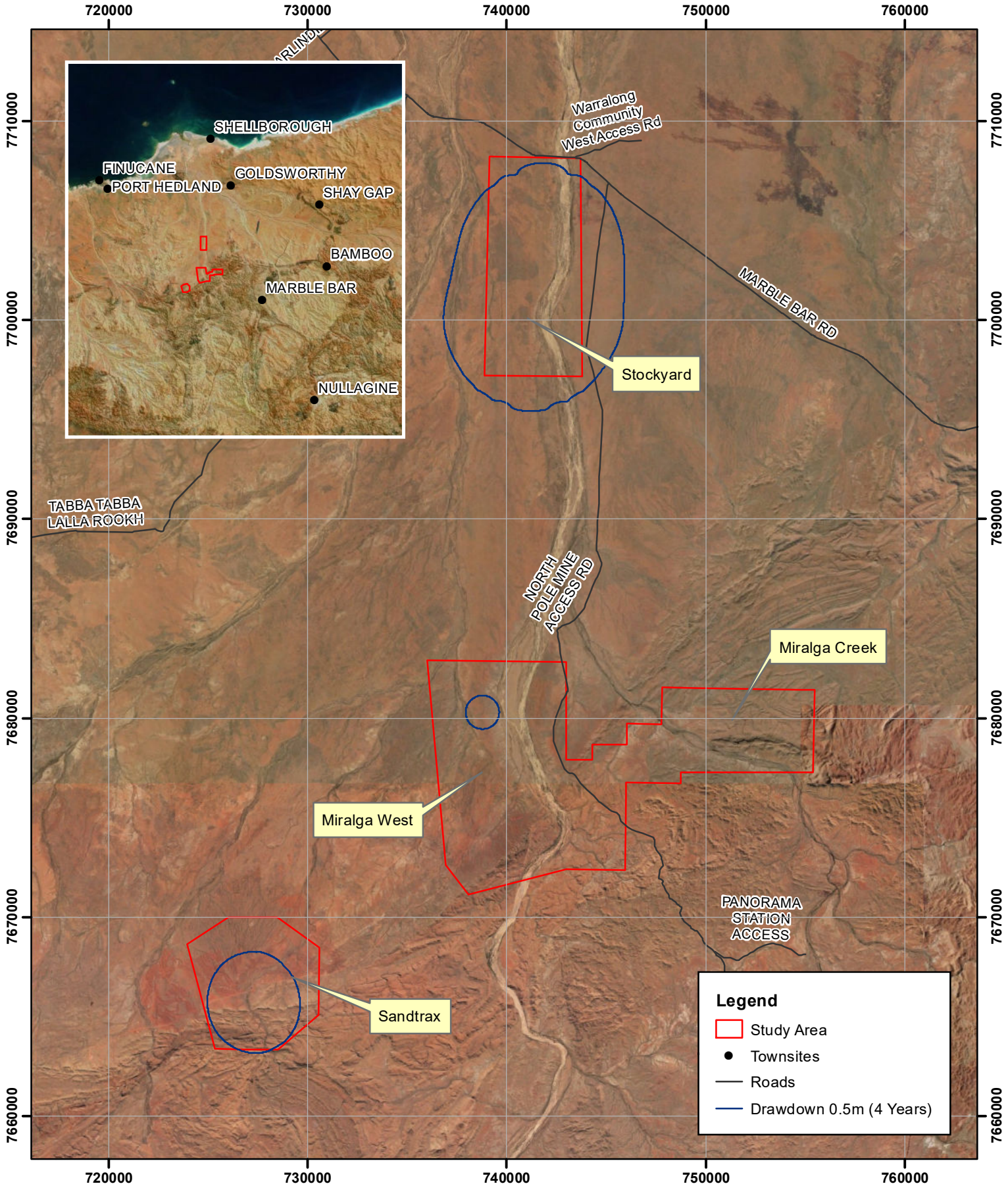
Atlas has modelled areas of potential groundwater drawdown as a result of their planned groundwater abstraction, portions of which extend beyond the limits of current vegetation mapping.

This memo presents an assessment of the local extent of vegetation units within the modelled extent of groundwater drawdown that potentially represent GDV.

## 1.1 Aim and Objectives

The aim of this memo is to provide mapping of the potential distribution of potential GDV within the area of modelled groundwater drawdown to support Atlas' environmental impact assessment process. The specific objectives of this memo are to:

- Present the rationale utilised to define potential GDV at Miralga Creek;
- Present a map of potential GDV at Miralga Creek that may be at risk of impacts from groundwater drawdown associated with the proposed mining operation.

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| **Location of Study Area** | Author: Greg Woodman | N |
| | WEC Ref: Atlas19-07-02 | |
| WOODMAN ENVIRONMENTAL | Filename: Atlas19-07-02-f01.mxd | **Figure** |
| | Scale: 1:250,000 (A4) | 1 |
| | Projection: GDA 1994 MGA Zone 50 | |
| This map should only be used in conjunction with WEC report Atlas19-07-02. | Revision: 0 - 04 November 2019 | |

## 1.2 Groundwater Dependent Vegetation

The phreatophytes recorded in the Study Area are predominantly facultative (either known based on the literature or presumed based on gross morphology and habitat preference). However, *Melaleuca argentea* is known to be an obligate phreatophyte (Graham 2001; cited in Department of Water 2010), and *Eucalyptus camaldulensis* can be obligate or facultative depending on the specific hydrological characteristics of a site (Department of Water 2010). *Sesbania canabina* is also considered likely to be an obligate phreatophyte, as it is restricted to alluvial soils in rivers or major creeks, potentially indicating high groundwater use (Department of Water 2010). No published data was available that describes this taxon's reliance on groundwater or sensitivity to drawdown. *S. cannabina* has been recorded within the Shaw River at Miralga Creek, and was also recorded at Pardoo by Woodman Environmental during a long-term project to monitor recovery of riverine vegetation impacted by groundwater drawdown (Woodman Environmental 2011-2019b). Monitoring data indicated that impacts of drawdown were confined to the two tree species *M. argentea* and *E. camaldulensis* subsp. *refulgens* with changes in mid and lower storey vegetation not recorded. Given that *S. cannabina* was not present in all quadrats monitored it is possible that it may be sensitive to reductions in groundwater, however no data currently exists to support this.

*Melaleuca glomerata*, *Atalaya hemiglauca*, *Acacia ampliceps* and *Melaleuca linophylla* appear to generally be considered at least partially facultative phreatophytes, primarily based on their presence in major river channels where groundwater is known to be close to the surface (Loomes 2010a, 2010b; Loomes and Braimbridge 2010). However, this appears to not have been substantiated by any specific investigation; only Loomes (2010a) has investigated depth to water ranges for some of these species, however this investigation considered a limited number of sample sites, all of which were in significant drainage channels. Recent assessment of small pockets of stressed vegetation at Atlas Iron's Mt Webber DSO Project (Woodman Environmental 2019c) found groundwater drawdown impacts to the obligate phreatophytes *Melaleuca argentea* and *Eucalyptus camaldulensis*, with localised impact to *Melaleuca glomerata* individuals located on a shallow sandbar that had been supported by a shallow groundwater table. All other taxa including *Atalaya hemiglauca* appeared to not suffer observable stress indicating a low likelihood that other presumed facultative taxa are phreatophytic in nature.

*Eucalyptus victrix* is another species that has been suggested to be a facultative phreatophyte in some situations (AQ2, 2015; Eastham, 2015; Loomes and Braimbridge 2010; Loomes 2010a), however it is generally considered to be a vadophyte (AQ2, 2015). This is supported by Woodman Environmental's multi-year monitoring of vegetation considered at risk of impact from dewatering at Atlas's Pardoo minesite, east of Port Hedland. In an area east of the Bobby deposit, where the pre-dewatering depth to water was known to be between 5 and 10 m (Woodman Environmental, 2012), drawdown of nearly 10 m from pre-dewatering levels was observed at a bore adjacent to a monitoring site in a stand of *E. victrix* over a 3-year period (Woodman Environmental, 2013). No impacts to the health of *E. victrix* that could be related to drawdown were observed over this drawdown period (Woodman Environmental, 2011, 2012b, 2012c, 2013, 2014).

Comparatively, both *M. argentea* and *E. camaldulensis* subsp. *refulgens*, which occur in wetter sites relative to *E. victrix* (river beds and major creeks – presumably where the water table is closer to the surface) in the same area at Pardoo described above, appeared to be affected by drawdown of almost identical magnitude to that described above (Woodman Environmental 2013). Numerous individuals either declined observably in health or were killed in this area; such individuals were more numerous for *M. argentea* than for *E. camaldulensis* subsp. *refulgens*. This reflects the knowledge on the water use strategies of these taxa, and their response to drawdown. Both are known to be obligately phreatophytic; in the case of *M. argentea* this is seemingly true for all situations that it occurs in, however for *E. camaldulensis* subsp. *refulgens*, it appears to be the case only at sites when groundwater is near the surface (i.e., within 10 m). Both species are also known to be sensitive to drawdown, particularly if it is of a relatively large magnitude over a short period of time (e.g., 8 to 10 m over 1 to 2 years), such as occurred at Pardoo.

*M. argentea* appears to be the most sensitive to changes in groundwater regimes according to literature. Studies by Graham (2001) indicate that this species has a shallow planiform root system adapted to areas of very shallow groundwater (2-3 m below ground level) and has difficulties adjusting to short periods of dry conditions (Department of Water 2010). Studies undertaken by BHP (1997) indicate that a decline in groundwater level of 0.5 m may result in decreased vigour of plants and that a decline of 1 m or more may result in death. In comparison, *E. camaldulensis* subsp. *refulgens* has a bimorphic root system (surface lateral roots and a tap root) capable of utilising both groundwater and soil water from the unsaturated soil profile. This species is capable of sinking new tap roots in response to groundwater decline however drawdown of greater than 10 m over a prolonged period may cause irreversible stress (Department of Water 2010). Data collected by BHP (1997) suggests that an overall fall of groundwater of 8 m or greater may adversely affect this species, but that it is likely to tolerate reductions up to 8 m if the rate of groundwater decline is equal to or less than 5 m per annum. This data was supported by observed deaths of this species at Pardoo in an area that experienced declines in groundwater level from 4 m to 13 m below ground level over the period April 2009 to February 2011 (Woodman Environmental 2011).

## 1.3 Vegetation Units identified as Groundwater Dependent

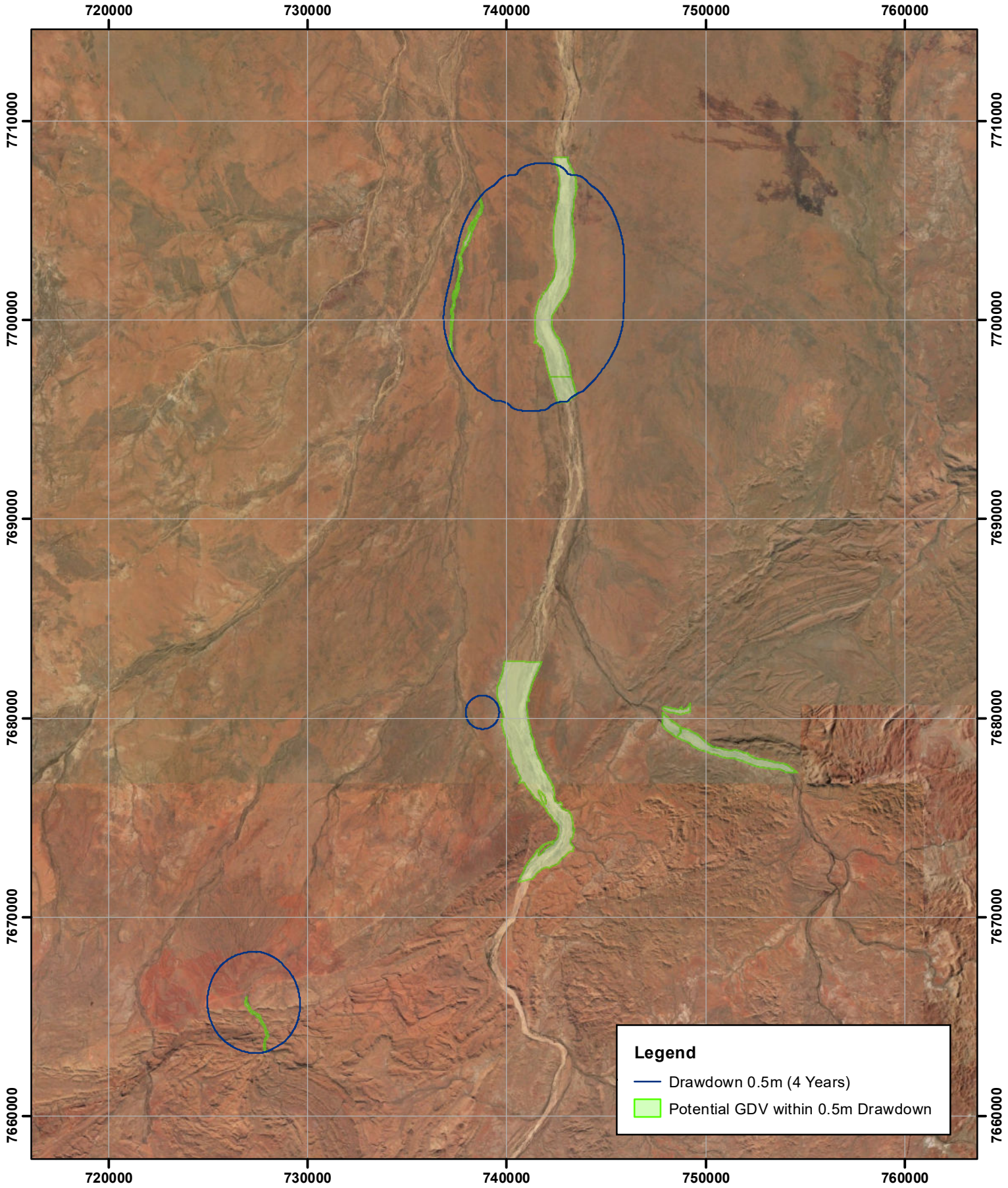
The vegetation type analysis and mapping (Woodman Environmental 2019) was undertaken using classification analysis to determine similarities of floral composition between sampling sites; the groundwater dependency of the resulting groupings (VTs) is not considered consistent throughout any of the particular VTs, however VT 5 which is restricted to major creek and river channels on deeper alluvium has been identified as containing obligate phreatophytes (*Melaleuca argentea* and *Eucalyptus camaldulensis*) and as such determined to represent GDV.

# 2 DESKTOP REVIEW METHODS

This review builds on the vegetation mapping work conducted over the Project Area (Woodman Environmental 2019).

Boundaries of VT 5 within river channels (as mapped by Woodman Environmental 2019a) and vegetation associated with major flowlines that potentially contain phreatophytic species have been interpreted from aerial photography at a scale of 1:10 000, and are presented on Figure 2. Atlas' area of modelled groundwater drawdown (where drawdown will equal or exceed 0.5m) is also presented on Figure 2. The 0.5m groundwater drawdown outer limit has been selected as this coincides with the level where some impacts to *M. argentea* may occur (Section 1.2).

This data represents areas that may contain phreatophytic species and experience impacts from groundwater drawdown. The severity of impacts will depend on the rate and extent of drawdown and also on the distribution of the two main phreatophytes known from the Project Areas. Additional survey will be required to confirm the interpreted areas of potential GDV and to delineate the distributions of phreatophytes. This information may support a more detailed assessment of the likely impacts of groundwater drawdown on vegetation at Miralga Creek.

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| **Potential Groundwater Dependent Vegetation at risk of impacts from drawdown** | Author: Greg Woodman<br>WEC Ref: Atlas19-07-02 | N |
| WOODMAN ENVIRONMENTAL<br>This map should only be used in conjunction with WEC report Atlas19-07-02. | Filename: Atlas19-07-02-f02.mxd<br>Scale: 1:250,000 (A4)<br>Projection: GDA 1994 MGA Zone 50<br>Revision: 0 - 04 November 2019 | **Figure** 2 |

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