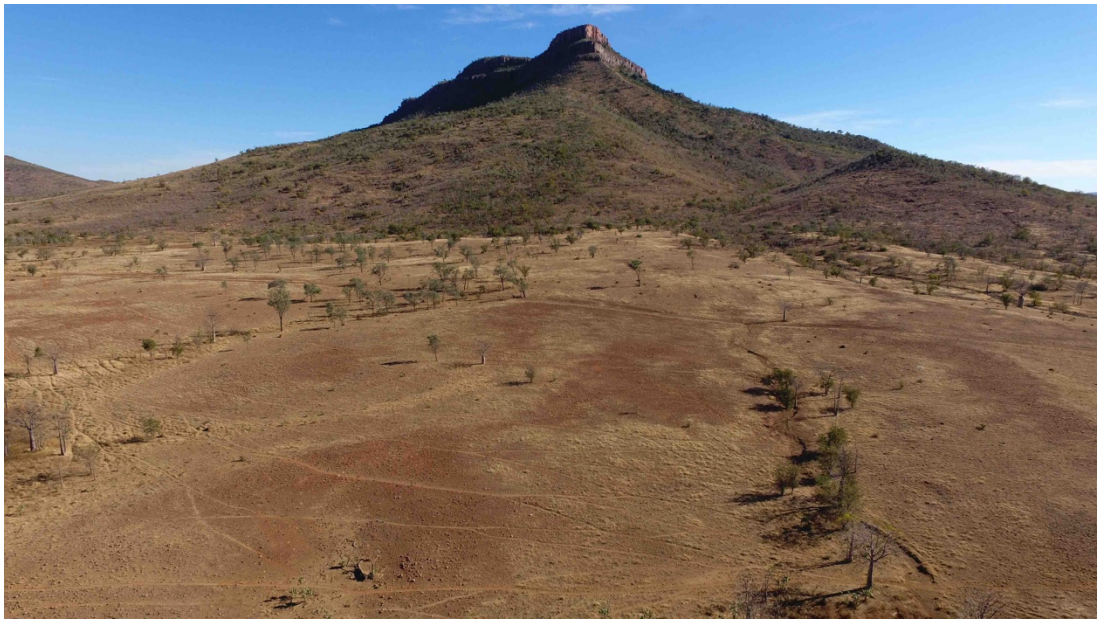


Plate 8 - House Roof Hill: view to hill across proposed infrastructure area

5.4 Potential impacts, predicted outcome and mitigation

The proposed Carlton Plain Stage 1 development is not expected to impact substantially on the landform that is House Roof Hill, or the nearby 'Shed Roof Hill'.

Drainage from House Roof Hill will be managed via hillside drains. Minimal clearing of foothill vegetation will be required, given the current state, as shown in Plate 8.

Other values, such as terrestrial fauna, are discussed later in this document. Aboriginal heritage assessment and clearance has been provided by Traditional Owners with the support of MG Corporation (June 2017).

No landform impacts on House Roof Hill are anticipated. The physical and ecological integrity of House Roof Hill will remain intact.

6.0 Key Environmental Factor 3 – Terrestrial Environmental Quality

6.1 EPA objective

To maintain the quality of land and soils so that environmental values are protected.

6.2 Policy and guidance

EPA considerations in relation to the environmental factor 'Terrestrial Environmental Quality' include

- Application of the mitigation hierarchy to avoid or minimise impacts to terrestrial environmental quality, where possible;
- The environmental values supported by soil quality which are potentially impacted, and their significance;
- The contaminants of concern and potential pathways through which soil quality may be impacted, and the associated risks to values supported by good soil quality;
- The significance of the potential impacts in the context of the location, regional cumulative impacts, and other relevant issues;
- That all risk modelling, analyses, mapping, testing and proposed management are undertaken to a standard consistent with recognised published guidance and appropriate accreditation;
- The current state of knowledge and the level of confidence in predicting the residual environmental impacts;
- The risk to environmental values should the predictions be incorrect; and
- Whether proposed mitigation is technically and practically feasible.

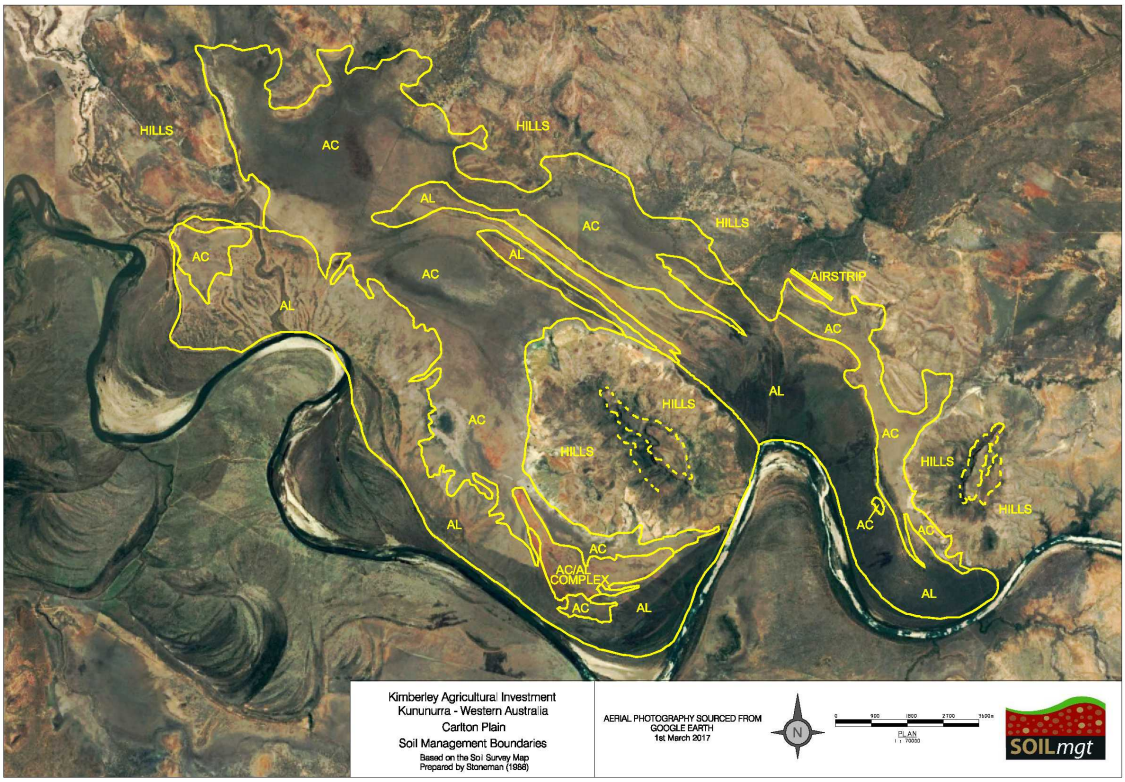
(EPA 2016d)

6.3 Receiving environment

Soils mapping of Carlton Plain has been undertaken by Stoneman (2001) and others during multiple soils, groundwater risk and general agricultural assessments over recent decades. The proposed development area forms part of the Ivanhoe land system, of which there is 123,900ha mapped extent (Schocknect and Payne 2010, cited in Woodman 2016a). This system comprises 'small to medium areas of gently sloping alluvial black soil plains with some timbered 'red' soil in the central and northern parts of the Ord-Victoria survey area'.

Figure 16 illustrates the broad soil groupings across Carlton Plain, with alluvial loams and clays dominant As described in Section 4.3, the Stage 1 soils exhibit sand and loam properties (as opposed to the heavier 'black soil clays' found elsewhere in the Ivanhoe system). Soil surveys of Carlton Plain undertaken by Stoneman (2001) identified two geomorphic units including the clay plains which belong to the Cununurra family of cracking clays, and the levee areas which are generally more variable and of medium texture. A total of 5 soil units within the broader Carlton Plain area (that is, Stage 1 plus other proposed development areas) were mapped by Stoneman, including Mantinea clay (6,465 ha), Group A Soils consisting of variable light textured brown soils (3,760 ha), Winbidji Fine Sandy Loam (1,040 ha), Group B Soils which have a gradual increase in texture down the profile (180 ha), and Soil Complex which is mixture of Mantinea clay and Winbidji fine sandy loam (310 ha) (Stoneman 2001).

Figure 16 - Soil groupings



A simplified version of the Stoneman (2001) soil map (see Appendix B) showing the main texture-based management groupings at Carlton Plain: AL = alluvial loams (includes loams overlying deeply buried clay, and deep loams), AC = alluvial clays. [Source: McKenzie 2017]

Upon review of available soils data, McKenzie (2017) determined that:

> *The ~4,000 ha of deep loam soil upstream of about the mid-point of House Roof Hill has excellent potential for a broad range of irrigated crops. It has a low salinity hazard.* (McKenzie 2017, page 2).

The landforms, flood areas and natural drainage on the Carlton Plain and Mantinea sites have directly informed the concept plans contained in Figure 4 and Figure 5 respectively.

6.4 Potential impacts, predicted outcome and mitigation

The Ord Stage II irrigated farm area has environmental conditions related to soils, drainage and salinity which have been developed in line with Environmental Management Plans (EMPs) approved by State and Commonwealth regulators under the EP Act 1986 and EPBC Act 1999 respectively. The EMPs have been developed to meet the requirements of conditions set by regulators, with the intent of managing risks identified for soils and other factors impacted by irrigated agriculture in the region. KAI proposes duplicating management practices applied to similar soils and landforms, in line with plans approved for its other land developments. This will be done on the basis that regulators have identified that the management actions applied elsewhere are considered adequate to minimise environmental risk through the development and operational phases of irrigated agriculture. Preliminary EMP actions derived directly from the Knox Creek Plain EMP approved by the EPA is contained in Appendix A – DRAFT Environmental Management Actions.

By applying management practices that have recently been endorsed by the EPA as suitable for sound environmental protection, KAI is confident it can minimise impacts to terrestrial environmental quality within the Carlton Plain Stage 1 area. It is in KAI's best and direct interest, as the land user with the most immediate and direct impact of the terrestrial quality, to ensure that monitoring and management requirements are implemented to the highest standard.

7.0 Key Environmental Factor 4 – Terrestrial Fauna

7.1 EPA objective

To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.

7.2 Policy and guidance

EPA considerations in relation to the environmental factor Terrestrial Fauna include:

- Application of the mitigation hierarchy to avoid or minimise impacts to terrestrial fauna, where possible;
- The terrestrial fauna affected by the proposal;
- The potential impacts and the activities that will cause them, including direct and indirect impacts;
- The implications of cumulative impacts;
- Whether surveys or analyses have been undertaken to a standard consistent with EPA technical guidance;
- The scale at which impacts to terrestrial fauna are considered;
- The significance of the terrestrial fauna and the risk to those fauna;
- The current state of knowledge of the affected species/assemblages and the level of confidence underpinning the predicted residual impacts; and
- Whether proposed management approaches are technically and practically feasible.

7.3 Receiving environment

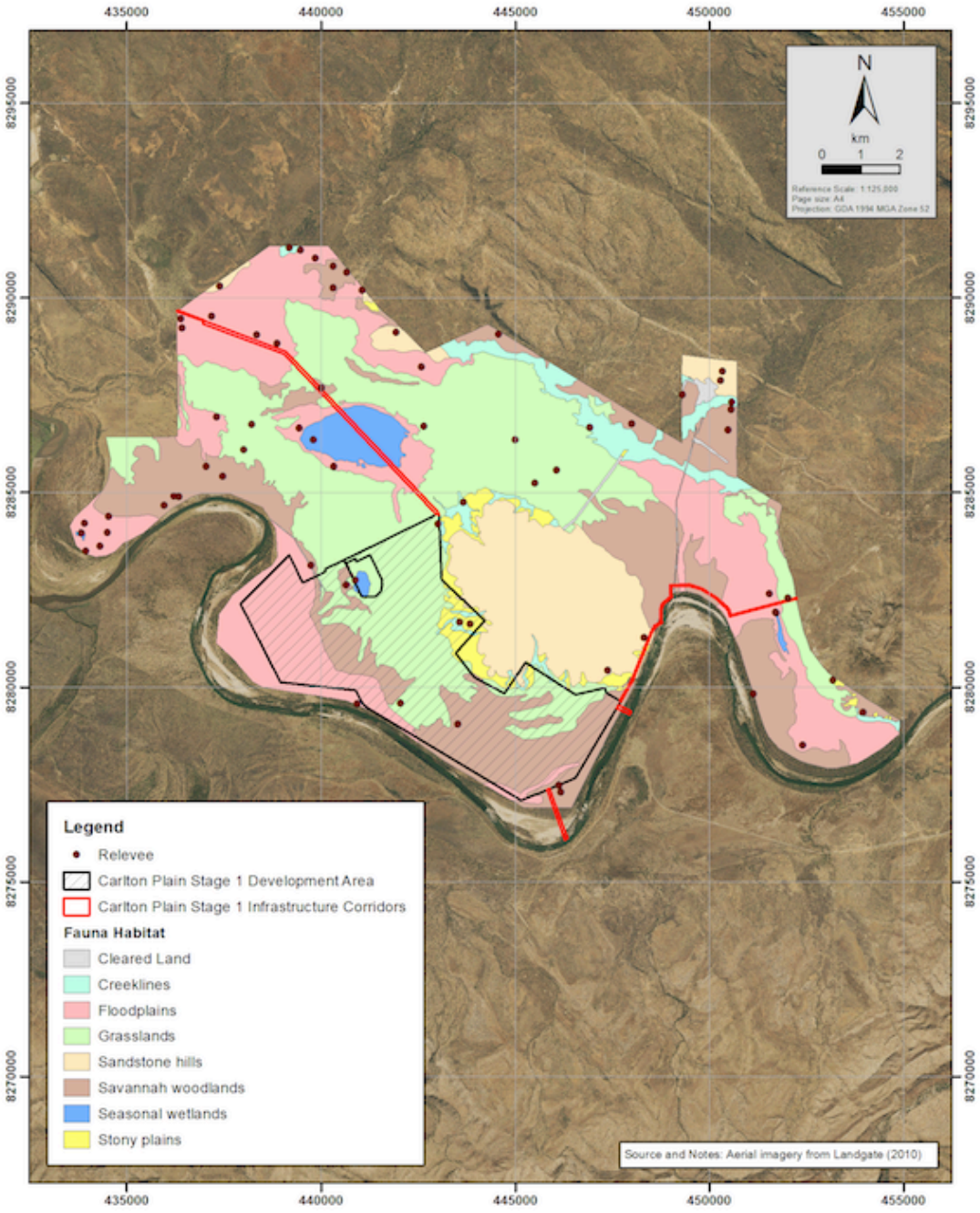
Fauna habitats across Carlton Plain Stage 1 have been mapped by Woodman Environmental Consulting, following their 2016 dry season survey and after review of existing published and online documentation.

Figure 17 illustrates the identified fauna habitats, with Table 14 summarising areas of each habitat type.

Table 14 - Fauna habitat distribution: Carlton Plain Stage 1 Development Envelope

Fauna Habitat	Area (ha)	% of Carlton Plain Stage 1
Cleared Land	1.6	0.1%
Creeklines	27.6	0.9%
Floodplains	637.9	20.7%
Grasslands	1,230.2	39.9%
Sandstone hills	15.6	0.5%
Savannah woodlands	1,044.1	33.8%
Seasonal wetlands	19	0.6%
Stony plains	98.8	3.2%
Outside of mapped area	11.2	0.4%
TOTAL	**3,086**	**100.0%**

Figure 17 - Fauna Habitats of Carlton Plain



The databases as listed below in Table 15 were searched by Woodman (2016a) for fauna records in and around the Carlton Plain. In all cases the extent of the database search was larger than the extent of the development area, in order to capture records of species in the wider area that may also occur on the Plain.

Table 15 - Fauna database search register

Database	Type of records held on Database	Area Searched
WA Museum Specimen Database (DPAW 2007-)	Includes records from specimens held in the WA Museum specimen database, including historical data.	30km buffer around 128°28'25"E, 15°32'12"S
Fauna Survey Returns Database (DPAW 2007-)	Records from fauna surveys carried out in Western Australia, including data from trapping and observations.	30km buffer around 128°28'25"E, 15°32'12"S
DPAW's Threatened and Priority Fauna Database	Information and records on Threatened and Priority species in Western Australia.	40km buffer around 52L 443377E, 8282053N.
Birds Australia Atlas Database	Records of bird observations in Australia, 1998-current.	30km buffer around 128°28'25"E, 15°32'12"S
EPBC Act Protected Matters Search Tool	Records on matters protected under the EPBC Act, including threatened species and ecological communities, migratory species and marine species.	30km buffer around 128°28'25"E, 15°32'12"S

(Source: Woodman 2016a)

Following analysis of existing reports and databases, terrestrial fauna presence at Mantinea has been surveyed and assessed by Pilbara Flora (2010) and Woodman Environmental Consulting (2016a and 2016b). The fauna assessment was undertaken by Western Wildlife, at a Level 1 standard as defined by the Environmental Protection Authority's (EPA) Guidance Statement No. 56 (EPA 2004b), and Position Statement No. 3 (EPA 2002).

The survey was conducted according to the guidelines presented in the following documents:

- EPA Position Statement No.3 - Terrestrial Biological Surveys as an element of biodiversity protection. (EPA 2002).
- Environmental Protection Authority (EPA) Guidance Statement 56 for Terrestrial Fauna Surveys (EPA 2004b).
- Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA and Department of Environment and Conservation (DEC) 2010).
- Survey Guidelines for Australia's Threatened Birds (Department of the Environment, Water, Heritage and the Arts (DEWHA) 2010).
- Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) referral guideline for the endangered northern quoll *Dasyurus hallucatus* (Commonwealth of Australia 2011).

The pre-survey review of existing documentation identified

- 7 conservation significant reptile species potentially occurring within the vicinity of Carlton Plain;
- 39 conservation significant bird species potentially occurring within the vicinity of Carlton Plain; and
- 6 conservation significant mammal species potentially occurring within the vicinity of Carlton Plain.

(Woodman, 2016a).

Field studies were subsequently conducted, with 44 locations across Carlton Plain and the adjacent Mantinea lands targeted for fauna observations. The sites were chosen by Western Wildlife personnel in order to sample the variety of habitats present, and to target areas which were considered likely to support a diversity of fauna during the dry season (e.g. dams, seasonal wetlands containing water or dense vegetation along creeklines). At each location all birds seen or heard were recorded, and hand-searching for reptiles was carried out. Hand-searching involved raking through leaf litter or loose soil, turning over rocks or logs, stripping bark and using a torch to inspect hollows or rock crevices. The presence of any other species, e.g. diurnal mammals, were also recorded if encountered. Night surveys and the use of motion sensors were also implemented.

Western Wildlife, through Woodman (2016b), identified that, for the entire Carlton Plain and Mantinea area,

> *There are 32 migratory species (as listed under the EPBC Act or under Schedule 5 of the WC Act) which are likely to occur in the Proposal Area, including 1 reptile species [saltwater crocodile] and 31 bird species. However, the Proposal Area is unlikely to support significant populations for the majority of these species. The seasonal wetlands in the Proposal Area have the potential to support significant numbers of a migratory shorebird species (although unlikely).*
>
> (Woodman 2016b, p9).

Amphibians

The Woodman (2016) study found that while 28 species of frog have the potential to occur in the study area, four were recorded. Further, Woodman (2016a) surmised that no frogs of conservation significance are likely to be present on Carlton Plain or Mantinea.

Reptiles

Woodman (2016) identified that there are 101 species of reptile that have the potential to occur across Carlton Plain and Mantinea of which 17 species were recorded in the study area during the fauna surveys. Many species are widespread, occurring on a range of substrates (sands, clays and rock) in a range of vegetation types (grasslands, shrublands, woodlands or wetland margins). However, there are suites of reptiles that show more specific habitat requirements, and these are likely to be restricted to parts of the Study Area.

There are seven reptiles of conservation significance that may occur in the Study Area, two of CS1 and five of CS2. Freshwater crocodile (*Crocodylus johnstoni*) and saltwater crocodile (*Crocodylus porosus*) are listed as Specially Protected Fauna under the Wildlife Conservation Act 1950. The saltwater crocodile is also listed as migratory under the EPBC Act 1999. Five other reptiles (snakes) were identified as potentially occurring in the Carlton Plain area, of which three - the Black-soil Skink, Ord Snake and Curl Snake are known to favour cracking clays and are likely to be restricted to floodplains and grasslands with cracking clays. Carlton Plain Stage 1 does not include cracking clays. The remaining two 'potential' reptiles – the wide-banded and narrow-banded northern bandy bandy are known from few records. Woodman (2016) identified that it is difficult to ascertain their status in the proposed development area.

Birds

There are 234 species of bird that have the potential to occur in the Study Area, of which 103 were recorded during the fauna survey (Woodman 2016a). Many of these are waterbirds and wetland-dependent species such as ducks, herons, ibis, cormorants and shorebirds. These species are likely to occur along the adjacent Ord River, as well as in seasonal wetlands, dams and in pools along creeklines (Woodman 2016a). Vegetated wetland areas are potential breeding sites for waterbirds, including those that breeding trees (e.g. herons and ibis) and those that breed on the ground amongst

vegetation. A full description of bird species potentially present on or around Carlton Plain is contained in Woodman (2016).

Bird fauna of the Lower Ord are not unique to that location. They occupy similar habitat along the Ord River in Parry Lagoons and other Conservation Reserves, and in the 140,000 hectares of floodplain and estuarine wetlands on around Carlton Hill Station. Furthermore, it is now evident that in the new Ord Stage II irrigated farm area that bird numbers and diversity have increased in around the irrigated versus the un-development black soil plains. There are clear reasons for this - food sources increase associated with grass seeds and insects where water is present.

As described below in Section 0, the impact of the proposed development upon migratory bird species is not expected to be significant.

Mammals

Western Wildlife, through Woodman (2016), identified 49 species of mammal that have the potential to occur around the Carlton Plain and Mantinea development areas. Of these, 43 are native and six introduced. Eighteen species (15 native and three introduced) were recorded opportunistically during the fauna survey. Woodman (2016 p66) identified that "the mammal assemblage is likely to have changed in the 100+ years since the area was established as pastoral property".)

Eight species of bat were positively identified in the Carlton study area, on the basis of their calls recorded during the Woodman survey. Depending on the species, bats generally roost in hollows or crevices in trees, or in caves and crevices in rocky habitats. The Study Area lacks caves, but tree hollows are present in the savannah woodlands and rock crevices are present on the sandstone hills. As described in Section 5.0, sandstone hills will not be substantially impacted upon by the proposed development.

Woodman (2016) identified six mammals of conservation significance potentially occurring in the Carlton Plain and Mantinea area. The Northern Quoll (*Dasyurus hallucatus*) is listed as endangered under the EPBC Act 1999, and Schedule 2 (endangered) under the WC Act 1950. The Ghost Bat (*Macroderma gigas*) is listed as vulnerable under the EPBC Act 1999 and Schedule 3 (Vulnerable) under the WC Act 1950.

The Northern Quoll is a medium-sized carnivore that was listed under the EPBC Act in 2005 partly due to concern about the impact of the Cane Toad on the species. Except for House Roof Hill, Carlton Plain lacks the rocky habitats that are considered to be the core habitat for the Northern Quoll. The Northern Quoll was not recorded on camera traps set on House Roof Hill.

The Ghost Bat is a large carnivorous bat that occurs across northern Australia. The population is thought to be less than 10,000 individuals, with two thirds of those in the Kimberley region (Woinarski et al. 2014, TSSC 2016, cited in Woodman 2016a). Ghost Bats were not recorded during the 2016 dry season survey. Woodman (2016) identified that no permanent (maternity) roosts are likely to be present.

Other conservation significant mammal species potentially present on Carlton Plain include:

- Northern Leaf-nosed Bat (*Hipposideros stenotis*) – Priority 2 DPaW listing. The calls of this species were recorded on House Roof Hill during the 2016 dry season study. The Northern Leaf-nosed Bat may roost in deep crevices on Houseroof Hill and in the ranges outside the Study Area. It is likely to forage across Carlton Plain.
- Orange Leaf-nosed Bat (*Rhinonicteris aurantia*) – Priority 4 DPaW listing. The calls of this species were recorded on Houseroof Hill and the woodland site on the Carlton study area.

The Orange Leaf-nosed Bat roosts in ranges outside the Carlton and Mantinea plains, and is likely to forage over Carlton Plain habitats.

- Water Rat (*Hydromys chrysogaster*) – Priority 4 DPaW listing. Woodman (2016a) note that there are several recordings of this species around Kununurra on DPAW's Threatened and Priority Fauna Database, including a record from 2008. This species may occur along the Ord River. Woodman indicate that its use of Carlton Plain may be sporadic, as individuals may opportunistically move into inundated seasonal wetlands.
- Lakeland Downs Mouse (*Leggadina lakedownensis*) – Priorty 4 DPaW listing. This species was recorded in the Mantinea Plains study area in 2009 (Strategen 2010) and may be widespread across the Carlton and Mantinea plains. This species potentially occurs in most habitats, but particularly grasslands.

7.4 Potential impacts, predicted outcome and mitigation

Woodman (2016), in their assessment of fauna habitats and associated risk to listed species, determined that those areas with cracking clays, and seasonal wetlands, were deemed significant amongst Carlton Plain (and Mantinea) habitat areas. Carlton Plain Stage 1 does not exhibit cracking clay habitat areas, and, furthermore, the seasonal wetland present to the west of the proposed development area will be retained and protected by a tailwater drainage network during the dry season. Wet season stormwater flow will be retained through carefully engineered stormwater drainage design.

The implementation of management actions which have been deemed by the EPA and DoEE to be suitable for the nearby Goomig and Knox development areas will ensure a high standard of environmental monitoring and management to avoid or mitigate unacceptable risks. The main potential impact on the seasonal wetland relates to the potential in-flow of tailwater should drainage not be carefully managed. KAI will ensure that tailwater is recycled as required, and will not be stored in or diverted to the wetland area.

The impact on migratory birds is not considered to be significant, given (a) the adjacent, year-round flow of the Ord River and associated wetlands, and (b) the creation of additional migratory bird habitat through the practice of irrigation.

The retention of over 6,000ha (or 38%) of the Carlton Plain freehold area, and approximately 95% of the adjacent Carlton Hill and Ivanhoe pastoral leases, even under a full development (Carlton plus Mantinea plus Tarrara) scenario, will ensure adequate additional habitat is retained.

8.0 Key Environmental Factor 5 – Hydrological Processes

8.1 EPA objective

To maintain the hydrological regimes of groundwater and surface water so that environmental values are protected.

8.2 Policy and guidance

Environmental impact assessment considerations for the factor Hydrological Processes include -

- Application of the mitigation hierarchy to avoid and minimise impacts to hydrological processes, where possible;
- The environmental values which are potentially impacted, and their significance;
- The significance of potential impacts in the context of the location, regional cumulative impacts, climate and other relevant issues;
- The all analyses are undertaken to a recognised standard;
- The current state of knowledge and the level of confidence in predicting the residual environmental impacts;
- The risk to environmental values, should the predictions be incorrect; and
- Whether the mitigation is technically and practically feasible.

(EPA 2016f)

8.3 Receiving environment

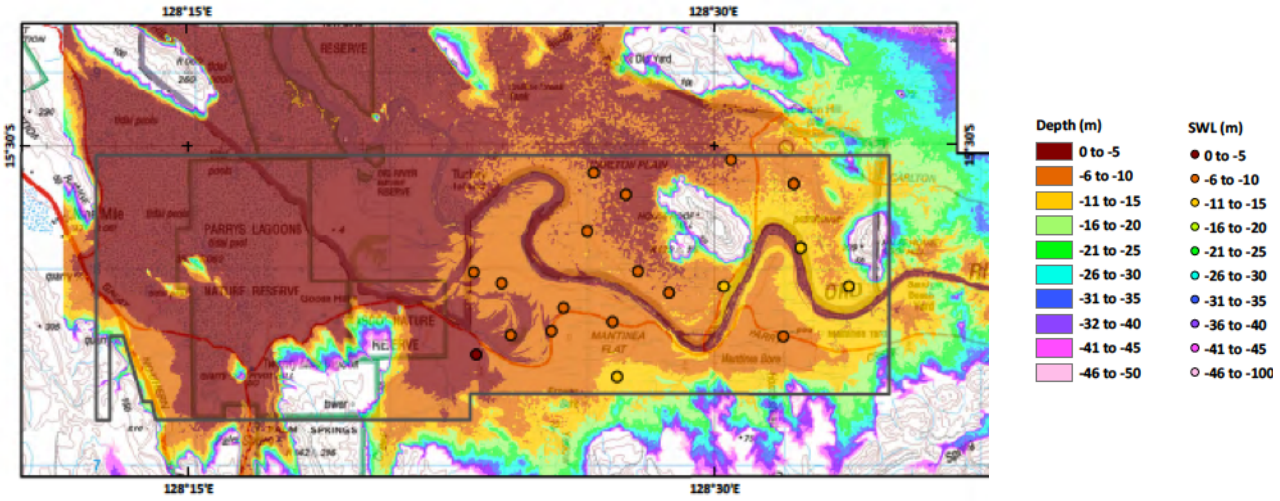
This section takes into account both surface and groundwater impacts which may arise from the development of the Carlton Plain Stage 1 area. It considers both the impacts of in-situ operations, and of abstraction of water from the Ord system, for use in irrigation.

8.3.1 Groundwater

Groundwater conditions under the Carlton (and Mantinea) plains have been the subject of substantial public and private interest for many years, given the proximity to the tidal interchange of the Ord River (see Section 8.3.2) and the low position of both plains in the landscape. Development staging, as discussed in Section 3.2.4, is largely informed by groundwater assessment, monitoring and management advice. Department of Water groundwater monitoring records, including water quality and depth to groundwater, have informed the assessment and staging. Bennett (2016), Hulme (Sustainable Soil Management, 2017), and others have assessed available data, which guides KAI in its decision-making and planning.

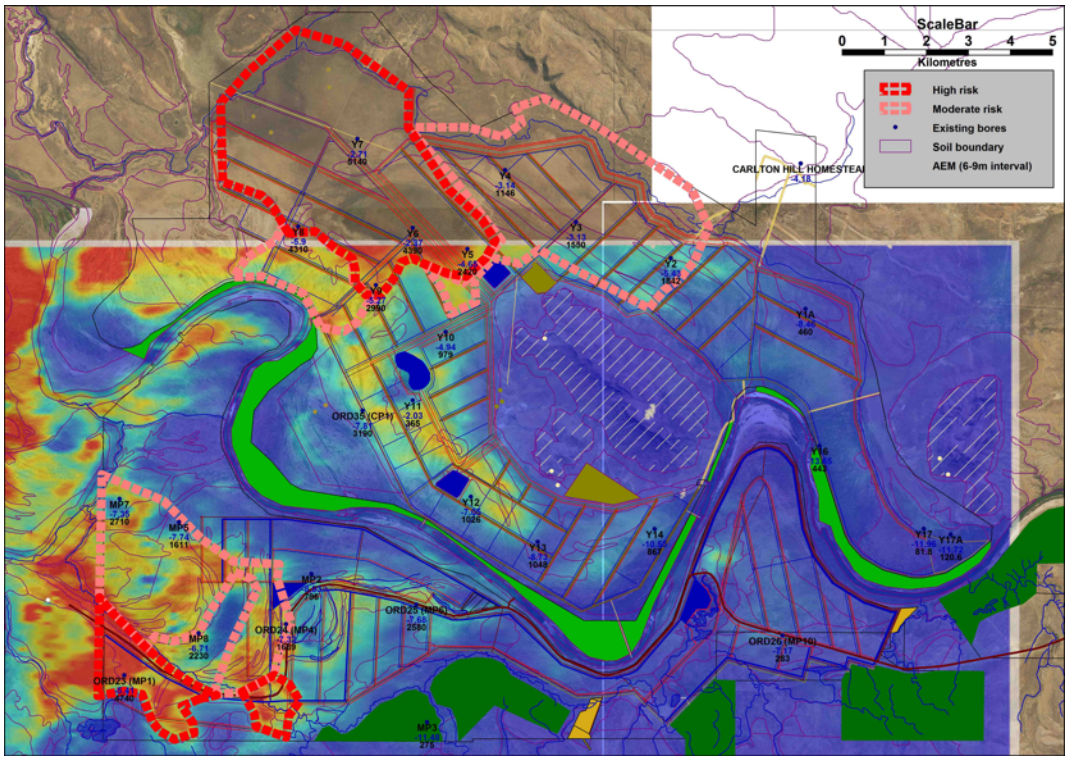
Figure 18 illustrates the airborne electromagnetic assessment of depth to groundwater across the Carlton and Mantinea plains, while Figure 19 depicts a preliminary salinity risk assessment undertaken based on existing data (Bennett 2016). These assessments are being used in further modelling and impact analyses, to inform groundwater modelling and farm design planning. Similar risk and design considerations were applied successfully in Ord Stage II, and will be used in the Carlton Plain and Mantinea development areas to managed salinity risk.

Figure 18 - Depth to water table: Carlton Plain and Mantinea



(Source: Commonwealth of Australia, 2009)

Figure 19 - Inherent salinity risk assessment: Carlton Plain and Mantinea



(Source: Bennett, 2016)

As summarised by Bennett (2016) and illustrated above, western portions of the Mantinea and Carlton Plain development areas can be considered moderate to high risk, dependent upon clay content in soils and depth to the water table, as well as the specific groundwater salinity concentrations.

High risk areas over the Carlton and Mantinea plains are characterised by -

- Clay or gradational (to clay) soil (predominantly Mantinea clay flats)
- Uniformly high salt store from 2m depth to basement rock (based on AEM – Commonwealth of Australia, 2009)

- Shallow watertable (<5m)
- High groundwater salinity (>3000 mS/m, >20,000 mg/L)
- Distance from river (or poor hydraulic connection).

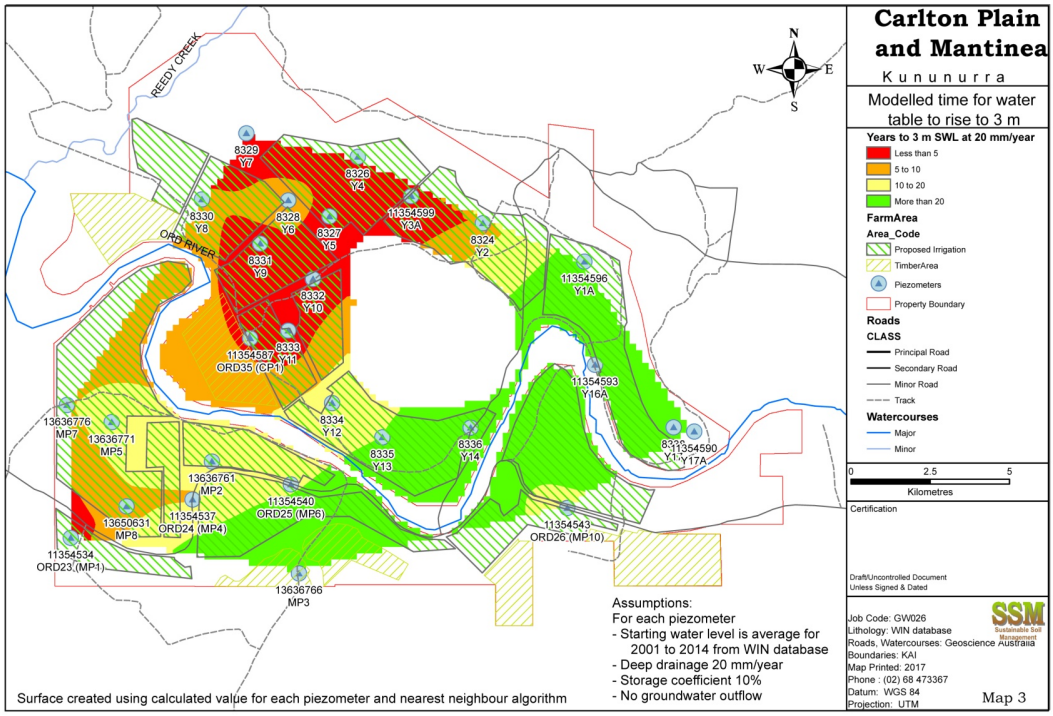
Moderate risk areas include characteristics of

- Generally fine grained or clay soils
- Uniformly moderate salt storage, from 2m depth to basement rock (based on AEM – Commonwealth of Australia, 2009)
- Watertable at 3-10m depth
- Moderate groundwater salinity (1000-2000 mS/m, 6000-12000 mg/L).

(Bennett, 2016)

This assessment is further illustrated in Figure 20 developed by Hulme (2017) during the soils and groundwater assessment undertaken for KAI by Sustainable Soil Management. This assessment is based on existing groundwater data, including depth and salinity levels. KAI has utilised the modelling to inform current planning timeframes. Future monitoring will include the installation of new bores and continuous data loggers to inform the understanding of groundwater in the area, and in particular in relation to understanding what, if any, groundwater interchange occurs with tidal inflow.

Figure 20 - Modelled time for water table rise: Carlton Plain and Mantinea



(Source: Hulme 2017, in Sustainable Soil Management 2017)

For the Carlton Plain Stage 1 area, what can be seen from Figures 18, 19 and 20 is that groundwater salinity risk is minimal in the Carlton Plain Stage 1 proposed irrigated agriculture area.

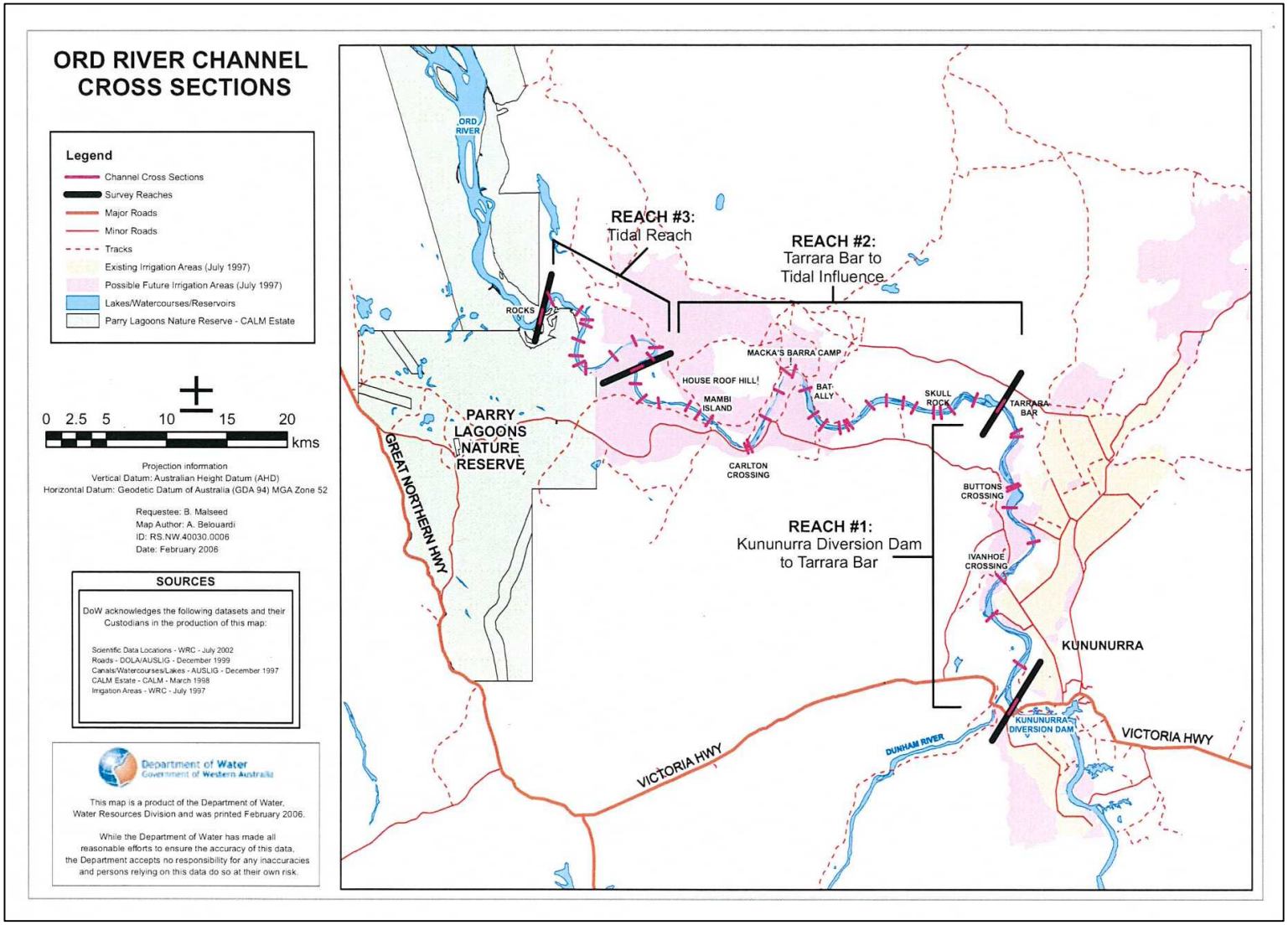
8.3.2 Surface water

Carlton Plain lays immediately north of the lower Ord River, upstream of the tidal interchange and adjacent to the tidal influence zone (see Figure 21). Irrigation water for the development will be sourced from the Ord under a proposed licence through the Department of Water (DoW). Abstraction of water from the lower Ord River for the purpose of irrigating Carlton Plain (and Mantinea) has been allowed for in the *Ord Surface Water Allocation Plan* (DoW 2013).

Tidal and freshwater interplay in the Lower Ord

The Lower Ord River is subject to large tidal currents ensuring "good mixing between freshwater flowing downstream and marine waters entering from Cambridge Gulf" (Gerhke 2009, p8). Tides in the tidal freshwater zone rise and fall up to 6 metres at the interface of the fresh and tidal waters. Spring tides exceed 7 metres (Department of Water, 2012). A full description of the tidal and freshwater zones can be found in Gerhke (2009).

Figure 21 - Extent of 'tidal reach' near the mouth of the Ord River



(Source: Braimbridge and Malseed, 2007)

In modelling a variety of scenarios to inform the *Ord Surface Water Allocation Plan*, the Department of Water (2012; 2013) has assessed the impact of varying lower Ord water levels on the Ord River Floodplain Ramsar Site (ORFRS). The scenarios considered were compared to water flow regimes pre-Ord River Dam regulation included maximum water allocations and high hydroelectric power generation requirements.

The Department found that "changes in dry season flow rates expected under the five scenarios studied will have no significant impact on the range of salinities experienced in the Ord Estuary" (Department of Water 2012; p110). This finding was based on the analysis of the hydrologic and ecological connections between the ORFRS and the Ord Estuary. Tidal movements were determined to have a much greater impact on water levels and ecologies in the ORFRSthan lower Ord flows under the modelled regimes. Subsequent to this finding, the Department determined that the provisions of the *Ord Surface Water Allocation Plan* would have no measurable impacts "on the Ramsar values of the Ord Estuary and associated tidal mud flats" (ibid., p105).

Consequently, the allocation of 115GL to the proposed Carlton Plain and Mantinea irrigation developments has been assessed to not substantially impact on surface water within the area. *The extraction of water for farming as proposed is entirely within already established and agreed parameters.*

Minimum environmental flows for the lower Ord River in normal allocation years are 42 cumecs (m3/s or cubic metres per second), released from the Kununurra Diversion Dam. This minimum flow has been set based upon a thorough government and scientific community analysis of the downstream flora, fauna and river dynamic requirements, including the nearby Ramsar wetlands.

This flow will be maintained even with the development of these lands, as per the planning and provision of *Ord Surface Water Allocation Plan* (DoW 2013), which has been peer reviewed and was open to public consultation.

Floodplain management

Carlton Plain forms part of the lower Ord River flood plain. Exhibiting a generally flat topography (with the exception of sandstone outcrops), ongoing stormwater and flood management will be required. KAI has developed its farm plans, as depicted in **Error! Reference source not found.** and the typical design drawings contained in Section 2.2 following detailed topographical analysis of drainage and flood mitigation requirements. This includes the installation of hillside drains and diversion of flood waters from infrastructure, while maintaining sufficient stormwater flow for the ecological maintenance of areas such as the wetland to the west of the Carlton Plain Stage 1 area. As is undertaken with the Ord Stage 2 lands which it manages, KAI will ensure flood management occurs as an integral part of its operations.

8.4 Potential impacts, predicted outcome and mitigation

The potential impacts and predicted outcomes in relation to surface water hydrology are well understood across the entire Carlton Plain and Mantinea areas. Detailed Ord surface water allocation planning has informed this understanding. Monitoring and management actions per Appendix A – DRAFT Environmental Management Actions have been established based on practices approved by Commonwealth and State regulators in the management of impacts of the Ord Stage 2 development. KAI intends extending these actions to ensure a streamlined environmental management system across its neighbouring properties.

Groundwater management on the Carlton Plain Stage 1 area is not expected to be problematic. Upgraded monitoring bores will be installed in the second half of 2017, with continuous data logging to inform knowledge, planning and decision-making across the Carlton and Mantinea landscapes.

Baseline groundwater quality data will continue to be secured, to add to existing knowledge held by (and publicly available through) DoW.

Other management actions will include baseline and ongoing soil testing to manage sodicity risk (eg, through the application of gypsum) where irrigation water is applied.

9.0 Key Environmental Factor 6 – Inland Waters Environmental Quality

9.1 EPA objective

To maintain the quality of groundwater and surface water so that environmental values are protected. (EPA 2016g)

9.2 Policy and guidance

Environmental impact assessment considerations include

- Application of the mitigation hierarchy to avoid or minimise impacts to inland water environmental quality, where possible;
- The environmental values which are potentially impacted, and their significance;
- The pathways through which water quality may be impacted;
- The significance of the likely change to water quality as well as the environmental values affected by those changes, in the context of the cumulative impacts and other relevant issues;
- Whether the impacts to water quality are considered in the context of any published water quality criteria or standards, or appropriate criteria or standards are developed;
- Whether all analyses are undertaken to a standard consistent with recognised published guidance and appropriate accreditation; and
- The risk to environmental values and whether proposed mitigation is technically and practically feasible.

(EPA 2016g)

9.3 Receiving environment

The inland waters associated with the proposed Carlton Plain Stage 1 development include the adjacent Ord River, the wetland area located on the western boundary of the Stage 1 proposal, and downstream wetlands including Parry Lagoons and the Ord River Floodplain Ramsar Site (ORFRS). These areas will not be 'receiving' KAI's water, but are discussed here in relation to how risk to nearby inland waters is informed by substantial work by the WA Government and others in relation to wetland values.

9.3.1 Ord River

As discussed in Section 8.3.2, the Ord River flows to the south and west of the Carlton Plain Stage 1, and will be the source of irrigation water for the proposed development, under the Ord Surface Water Allocation Plan (DoW, 2013). The abstraction of water from the Ord for the purpose of irrigating Carlton Plain and/or Mantinea has been thoroughly assessed by agencies at State and Commonwealth levels.

Lower Ord Water Quality

Numerous baseline studies and ongoing river water quality assessments inform Lower Ord river management decisions. These include Storey (2002), Wetland Research and Management [WRM]

(2003), WRM (2008), and WRM (2013). GHD commenced lower Ord water quality monitoring for Water Corporation in 2015, in order to meet the requirements of Water Corporation's bulk water licence which allows for irrigation water abstraction from the Ord River. This aligns with the triennial water quality monitoring requirement established following the WRM surveys.

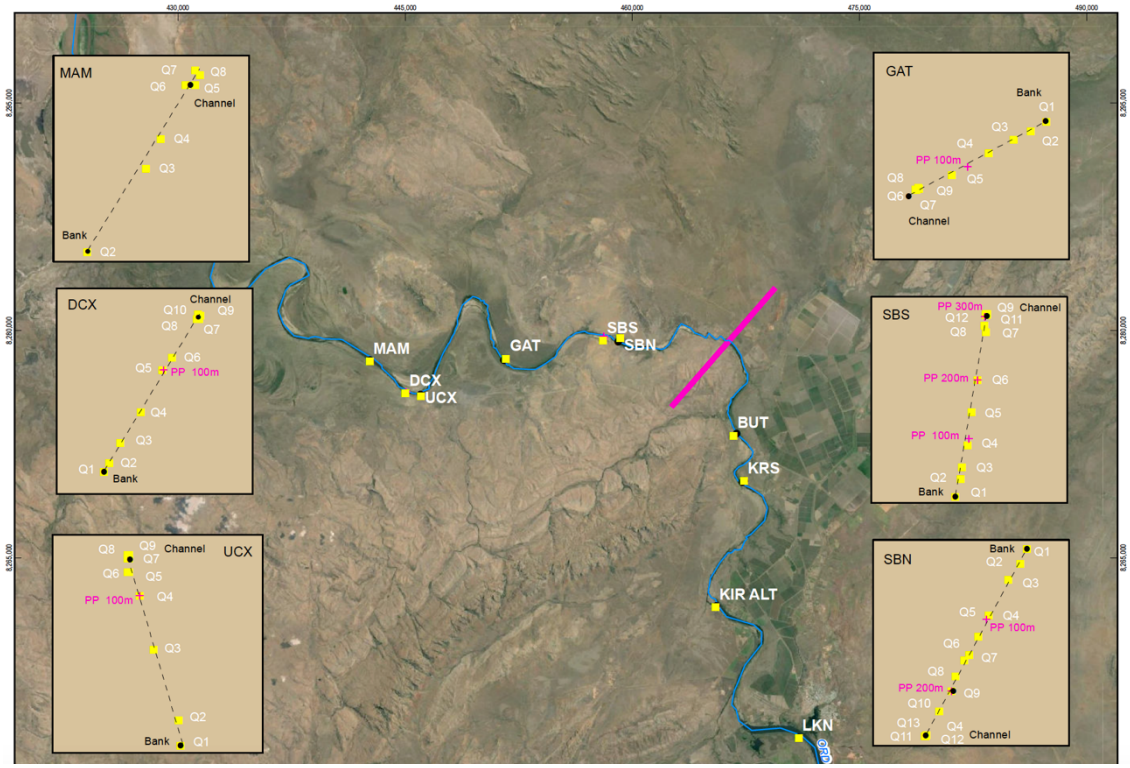
Baseline field surveys of the Ord River were undertaken during the late dry (September/October) seasons of 2009, 2010 and 2011 (WRM 2013b). The surveys included sampling for water quality, aquatic macroinvertebrates and fish at ten potential impact sites along the Lower Ord River as well as appropriate control sites. The sampling was designed to establish benchmarks against which to assess any future changes in aquatic species composition related to reduced flows in the Lower Ord, as a result of water allocations to the Weaber Plain (at the time) or subsequent developments including the Carlton and Mantinea Plains.

Additional field surveys were conducted in October 2011 (WRM 2013b). At each site, water quality variables, including pH, dissolved oxygen and temperature were recorded in situ. Water samples were also taken for laboratory analyses of electrical conductivity, ionic composition and nutrients. Water quality data from 2009, 2010 and 2011 were then plotted and compared across sites and with historical data, and compared to the ANZECC/ARMCANZ (2000) guideline trigger values (TVs) for the protection of aquatic systems in tropical Australia.

For the period 2009-2011, waters at all lower Ord River sites were assessed to be of good biological quality, with high daytime dissolved oxygen levels (5.9 -9.7 mg/L DO); alkaline pH (7.9 - 9.5), low turbidity and low salinity (25.5 - 27.2 mS/m EC; 110 - 170 mg/L TDS) dominated by Na-Cl (reflecting the influence of seawater) (WRM 2013b). This pre-development assessment of lower Ord water quality forms the basis upon which any future change can be considered.

Current monitoring sites are illustrated in Figure 22.

Figure 22 - GHD Lower Ord Monitoring Sites 2015



Specific aims of the GHD study are to

- Gain an understanding of fish, macroinvertebrate and vegetation communities in the Lower Ord River and surrounding free-flowing rivers;
- Identify spatial and temporal changes in macroinvertebrate community structure;
- Identify the potential key impacting processes resulting in changes to aquatic ecosystem health;
- Gather baseline fish data and perform power analysis to inform trigger levels;
- Gather baseline vegetation data to inform future changes to community diversity and structure;
- Recommend where appropriate, revision of the study design or site selection based on prestart site assessment or statistical outcomes.

(GHD, 2017).

Any riverine impacts of abstraction of water for the irrigation of Carlton Plain Stage 1 should be identified through the rigorous monitoring program and statistical data analysis enabled through this government-procured work. Riparian vegetation and macrophyte community health is included in the monitoring program. Given the existence of baseline studies across many years, KAI believes any changes should be detectable in time through the existing monitoring programs implemented by others. Nonetheless, KAI's management practices, outlined in Appendix A, are based directly upon the monitoring and management actions endorsed by the Commonwealth Minister for the Environment through the conditions and plans attached EPBC approvals 2010/5491 and 2014/7143, relating to the Goomig and Knox Plains. The Aquatic Fauna Management Plan approved for the Keep River ensures the application of management and monitoring standards designed to protect listed aquatic MNES, including sawfish and river sharks. These management actions include tailwater recycling to prevent downstream water quality decline.

It is also noted that the lower Ord River has been the receiving environment for Ord River Irrigation Area (ORIA) tailwater since the early 1960s. Environmental management requirements are in place for ORIA farmers, via the Ord Irrigation Cooperative (OIC), which holds the ORIA Stage 1 water licence.

Under OIC's licence, environmental management triggers have been established in line with the ANZECC 95% guidelines (that is, diluted discharge must be at analyte levels lower than those which are safe for at least 95% of all aquatic fauna species).

KAI will adopt the same triggers which govern the upstream ORIA. However KAI will have the additional risk management tool of tailwater return and recycling systems which are not part of the ORIA. Tail water returns systems minimise the risk of nutrients or pesticides entering the Ord river and are a well recognised environmental management strategy.

Lower Ord Water Flows and Ecological Water Requirements

Water flows to the Lower Ord have varied significantly from the natural state since the damming of the Ord River for agriculture in the 1960s and 1970s. Lake Argyle (also known as the Ord River Dam), which first filled in the 1974 wet season, stores 10,700 GL at 100% full. It is often above 100% full with water flowing out its spillway. The construction and operation of the Ord River Dam, the downstream Kununurra Diversion Dam, and the hydro-electric power station situated at the base of the Ord River Dam, have substantially altered the flow regime of the lower Ord River making it flow all year round.

Trayler et al. (2006) describe the seasonality of the Ord River rainfall and pre-regulation flow as follows:

> *Prior to the construction of the [Kununurra Diversion and Ord River] dams, Ord River flows were highly seasonal and very variable. The widespread and intense monsoonal rainfall events of the wet season exceeded the high evaporation rates and generated the large wet season flows. However, if no major monsoonal depressions developed during a wet season and rainfall was limited to local thunderstorm activity, the resultant streamflows were limited.*
>
> *The seasonal variation was also very high. In typical years, over 80% of the annual streamflow occurred between January and March. Streamflow volumes reduced rapidly towards the end of the wet season as evaporation again exceeded rainfall. Although, some streamflow was possible in the early months of the "dry" when late rains occurred, typically little or no flow occurred between May to October.*
>
> *In the dry season pre-damming, the river dried to a series of isolated pools in the deeper parts of the channel, such as on the outside of the meander bends. With little or no dry season flow, the large tidal range within Cambridge Gulf (7 metres at spring tide) pushed salt water well up the river channel. Hydraulic modelling indicates that salt water would have reached beyond Carlton Crossing when river flows reduced to around 2m3.sec-1 at spring tides.*
>
> (Trayler et al. 2006; p19-20)

Construction of the Ord River Dam resulted in large changes in the seasonal pattern of flow in the lower Ord River. Over the 31 years between 1974-5 and 2006, average wet season flows reduced by 67% respectively and average dry season flows increased by 439%.

The lower Ord has changed from a seasonally dry to a perennial river system since damming occurred (Trayler et al. 2006) these changes have transformed the lower Ord River into a 'wet tropics' river from a 'dry tropics' river.

Trayler et al (2006) set the foundation for the determination of ecological water requirements (EWRs) for the lower Ord River. Their report brought together the findings of a large number of scientific

investigations undertaken between 2000 and 2002 in order to summarize the key values and flow related issues for the lower Ord River, under the direction of a scientific panel. Considerations of the expert panel, based on their assessment of potential areas of impact, included –

- Channel dynamics and sedimentation;
- Aquatic and riparian vegetation;
- Fish assemblages;
- Macroinvertebrates;
- Waterbirds;
- Ecological processes; and
- Water quality.

Minimum environmental flows for the lower Ord River in normal allocation years are 42 cumecs (m3/s or cubic metres per second), released from the Kununurra Diversion Dam. This minimum flow has been set based upon a thorough government and scientific community analysis of the downstream flora, fauna and river dynamic requirements, including the nearby Ramsar wetlands.

This flow will be maintain even with the development of these lands, as per the planning and provisions of the *Ord Surface Water Allocation Plan* (DoW 2013).

9.3.2 Lower Ord, Ord River Floodplain Ramsar Site, Parry Lagoons and Ord River Nature Reserve

West of the proposed development area is the Lower Ord Floodplain, which obtained Ramsar listing on 7 June 1990, and comprises slightly over 140,000ha of floodplain and estuarine wetlands. **Error! Reference source not found.** illustrates the location of the ORFRS in relation to the Carlton Plain Stage 1 area.

An Ecological Character Description (ECD) has been prepared for the ORFRS (Hale, 2008). Ecological water requirements were considered prior to the determination of environmental water provisions (Braimbridge & Malseed, 2007; Trayler, Malseed, & Braimbridge, 2006). The ecological water requirements have been provided for in the *Ord Surface Water Allocation Plan* alongside allocations to irrigated agriculture – including the Carlton and Mantinea plains (Department of Water, 2013). A detailed methodology for the allocation plan has been prepared by the Department of Water (2012).

As Hale (2008; p5) describes, the Ord River Floodplain Ramsar Site contains a variety of wetland types and includes inland and estuarine/marine areas. The site comprises:

- Parry Lagoons – including both the permanent (or near permanent) waterholes, such as Marlgu Billabong, as well as the broader area of floodplain within the Parry Lagoons Nature Reserve that are subject to periodic inundation.
- Ord Estuary – as the Ord River within the Ramsar site is under tidal influence, the area from the boundary near Adolphus Island to the Rocks has been grouped as Ord Estuary. In some instances, (e.g. for water quality measurements) this has been divided into two areas: open or outer estuary which is the area from Panton Island downstream to the boundary near Adolphus Island, and the upper estuary; upstream of Panton Island, which has a greater freshwater influence.
- False Mouths of the Ord – the area of extensive intertidal creeks and flats in the north of the site.

The information sheet for the listing of the Ord River Floodplain as a Ramsar site summarises the physical features of the ORFRS as follows:

> *The Site is comprised of depositional floodplain and estuarine environments associated with the mouth of the Ord River and Cambridge Gulf. There are three relatively distinct wetland units conserved within the Site. The southern part of the Site is dominated by Parry Creek, including a 20 km length of seasonally flowing creek running through upland environments, and an alluvial floodplain complex. The floodplain is inundated to varying degrees during the wet season and when the rain ceases, except for a few permanent and semi-permanent waterholes associated with incised channels and claypans, it quickly dries out. The upstream (southern) portion of the floodplain is freshwater while the lower (northern) sections, if not inundated by saline water, are surrounded by salty soils.*
>
> *Extending north from the floodplain of Parry Creek to the Cambridge Gulf are the lower reaches of the Ord River. The upstream reaches of the Ord River within the Site are permanently fresh, however the downstream reaches, when not in flood, quickly become saline due to tidal influence. The tidal amplitude at the coast can be up to 8m. The upstream end of the river channel is around 150 m wide, increasing to over 5 km wide at the mouth. Processes of sediment deposition dominate along the entire length of the river on the Site, with broad sandy or gravelly spits occurring along the upstream reaches while unstable mud bars and islands are common near the mouth.*
>
> *North from the mouth of the Ord River, the Site extends for some distance around the coast to include the False Mouths of the Ord, which consist of a deltaic maze of channels, tidally inundated coastal mudflats and islands. Only the northernmost channel in this complex receives much freshwater input, which comes from the relatively small and ephemeral Emu, Station and Tanmurra Creeks.*
>
> *The seasonal wetlands south of the Ord River are fresh and sometimes fringed by low shrubs or trees. They are surrounded by a flat, grass-covered plain. The mud flats along the river and the eastern side of Cambridge Gulf support patches of Sporobolus grassland and samphire. They are incised by numerous creeks and channels, along which extensive stands of mangroves grow. Mangroves also grow along the Ord River and the seaward side of the mudflats.*
>
> (Department of Conservation and Land Management 2003; unpaged)

The Department of Water (2012; 2013) has fully assessed the implications of water abstraction from the Ord River upon the ORFRS prior to making provision for potential extraction of 115GL to support the irrigation of the Carlton and Mantinea Plains. Environmental impacts on the River from this water extraction is not in question.

Ord River Floodplain Ramsar Site

The Ord River Floodplain Ramsar Site (ORFRS) is located downstream of Carlton Plain. The Department of the Environment (2011) describes the habitat of the ORFRS as follows:

> *Parry Lagoons, at the southern end of the site, has broad floodplains that periodically flood and dry out and permanent waterholes. North of the lagoons, the site includes the Ord River Estuary leading into the Cambridge Gulf. The north-east end of the site heads around the coast to include a series of extensive intertidal creeks and flats known as the False Mouths of the Ord. The upstream portion of the floodplain and river tends to be freshwater, and becomes more saline as the river approaches the Cambridge Gulf and falls under tidal*

influence.

Mangroves are the most common vegetation in the site, extending from the False Mouths of the Ord to the upstream sections of the estuary. The mangroves form narrow fringes along the intertidal areas, with saltmarsh on higher ground. The intertidal mangroves support many species of birds and bats, and are a breeding area for banana prawns.

The Parry Lagoon floodplains are dominated by grassland, the lower Ord River and Parry Creek by riparian woodland, and the permanent waterholes by aquatic vegetation.

Over 200 species of birds have been recorded within the site including waterfowl, migratory shorebirds, mangrove birds and terrestrial species. The site supports the nationally threatened Australian painted snipe.

The wetlands are habitat for many diadromous fish species (that require migration between marine and more freshwater environments some time during their life), including the nationally threatened species freshwater sawfish, green sawfish and northern river shark. Reptiles that use the site include the freshwater crocodile and saltwater crocodile.

(Department of the Environment, 2011)

Other wetland areas, including the False Mouths of the Ord and the Ord River Estuary are predominantly subject to tidal influences. Hale (2008) notes that the tidal range extends for the entire ORFRS (with the exception of Parry Lagoons) ranging from 7m at the estuary mouth, to 2m spring tides upstream in the lower Ord.

Impact on the ORFRS due to surface water abstraction is not expected given that the Ord River Surface Water Allocation Plan was directly informed by the scientific analyses of the Ramsar site water requirements. As tailwater will not be discharged into the lower Ord River from the Carlton Plain Stage 1 area, water quality impacts are not expected.

9.4 Potential impacts, predicted outcome and mitigation

Given that the abstraction of water for irrigation on the Carlton Plain and Mantinea sites is within the permitted allocations established by governments, taking into account the impacts upon downstream flora, fauna and habitats, there will be no significant impacts upon these off-site factors.

Existing groundwater depth and salinity concentrations lower in the Ord catchment are not anticipated to be impacted substantially by the development of the Carlton Stage 1 area for irrigation. An accelerated and improved monitoring regime will inform the planning and development of other stages across the Carlton and Mantinea plains, and these will consider groundwater change impacts where groundwater risk is higher.

Management actions adopted for the nearby Goomig and Knox developments will nonetheless be applied, per Appendix A, on the basis that these actions have been approved by regulators to minimise known risks, and thus should be applied where practicable and where similar environmental issues require mitigation, management or monitoring.

10.0 Key Environmental Factor 7 – Social Surroundings

10.1 EPA objective

To protect social surroundings from significant harm.

10.2 Policy and guidance

Considerations for Environmental Impact Assessment in relation to the factor *Social Surroundings* include:

- Application of the mitigation hierarchy to avoid or minimise impacts on social surroundings, where possible;
- The aesthetic, cultural, economic and/or social values which may be impacted, and whether those values are significant;
- The contribution implementation of the proposal may make to existing or predicted cumulative impacts to aesthetic, cultural or social values;
- That emissions of noise, odour or dust are considered in the context of relevant legislation, criteria or standards;
- The level of confidence with which the predicted impacts to social surroundings have been made, and what is the risk should those predictions be incorrect; and
- Whether proposed management or mitigation of impacts to aesthetic, cultural, economic and/or social surroundings is technically and practically feasible.

(EPA, 2016h).

10.3 Receiving environment

10.3.1 Aboriginal heritage and culture

KAI will comply with the requirements and expectations of the Ord Final Agreement and the Aboriginal Heritage Act 1972 in relation to Traditional Owners' rights. Not only is there a legal obligation to comply with this, but a moral commitment to do so as well.

KAI has recently (late June 2017) secured Aboriginal heritage clearance from Traditional Owners, and is in the process of formalising this clearance. At the time of preparation of this document, KAI was awaiting a heritage report and formal notification of the heritage clearance.

10.3.2 Amenity

Amenity factors relating to the Carlton Plain and Mantinea sites include public access to recreational fishing and camping in the lower Ord River area, including use of the Mambi Island camping facilities maintained by the Shire of Wyndham East Kimberley (SWEK), situated at -15.3458S, 128.2824E. This campsite, while officially designated through SWEK, is located within the riparian reserve on the southern bank of the Ord River.

Adjacent, small crown leases include 'Hairy Dog's Fishing Camp' and 'Macka's Barra Camp' (although Mackas is no longer operated), located on the south and north sides of the river respectively. Tourism on the lower Ord River is an important aspect of the East Kimberley economy.

KAI does not intend restricting Ord River access to the public, noting however that river access is

currently, and will remain, through private property (either freehold or grazing lease).

10.3.3 Economic

Section 2.0 of this document outlines the scale requirements for agricultural development to succeed in the Ord Valley. The economic benefits to accrue to the region, and to Northern Australia in general, will be substantial if production scale can be achieved. Downstream processing opportunities, including non-farm jobs such as transport, processing and packaging, will begin to emerge.

Without scale, the economic benefits which offer so much promise with soil and water resources available in the East Kimberley, will not be seen.

Carlton Plain Stage 1 is the first of a number of developments will will require approval if the economic benefits are to be obtained.

11.0 Community consultation and engagement on proposal

The Carlton Plain, Mantinea and Tarrara development proposals have been presented to a broad array of stakeholders, including public advertising of the original clearing permit applications through the Department of Environmental Regulation in early 2017. Table 16 provides a summary of the extensive consultation activities undertaken, feedback received and concerns raised (where appropriate), and where in this document issues raised are addressed.

Advice from community and government stakeholders, including responses received by DER during the public comment period for the clearing permit applications, have informed the modification of the original proposals to the Stage 1 development application presented here.

Note that at 20 July 2017, KAI had requested but not received copies of responses provided to DER by agencies and respondents to the public advertising period for the respective clearing permits. As such, Table 16 relies on summary advice provided by DER in the Preliminary Assessment Report for CPS 7399/1 (Carlton Plain), CPS 7400/1 (Mantinea freehold area) and CPS 7401/1 (Mantinea leasehold area).

Table 16 - Summary of public consultation and community engagement: Carlton Plain

Date	Engagement activity which included Carlton Plain discussions / respondent to DER advertising	Matters discussed / concerns / issues raised	Where specific issues are addressed in this document
24/8/16	KAI purchased Carlton Hill, Ivanhoe Station and all freeholds associated with Consolidated Pastoral Company / Terra Firma in the Ord region.	Ongoing responsibilities include regular start of season / end of season discussions regarding land management and progress of each party's farming and/or pastoral activity	Section 3.0.
29/11/16	KAI presentation on Carlton Hill and Mantinea to Shire of Wyndham East Kimberley, MG Corporation, DoW and DAFWA regional managers.		
1/12/16	KAI meeting with MG Corporation re Aboriginal Development Package (ADP) for Mantinea.		
1/12/16	KAI meeting with Shire of Wyndham East Kimberley CEO.		Sections 4.0, 5.0, 6.0, 7.0, 8.0, 9.0.
12/12/16	KAI lodged application with DER to clear approximately 19,000ha of Carlton Hill freehold and Mantinea freehold and leasehold land.		
22/12/16	KAI meeting with DPaW.	Flora and fauna surveys, Ramsar wetlands, *Typhonium*, Parry floodplains, Ivanhoe soils	
1/1/17	KAI lodge application to clear approximately 6,000ha on Tarrara, Carlton Hill pastoral lease (Cockatoo Sands) and subsequent pastoral diversification permit to PLB.		
19/1/17	DER advertised CPS7399/1, CPS7400/1, CPS7401/1 (Carlton Plain and Mantinea) in The West Australian for a 21-day public submission period. Two submissions were subsequently received.	Refer to feedback dated 31/5/17 (date of DER Preliminary Assessment Report relating to clearing permit applications for Carlton Plain, Mantinea and Tarrara. Responses specifically related to Tarrara - CPS 7475/1 – are excluded from this table.	
9/2/17	Briefing to Mike Bowley, DAFWA Regional Manager (one of many such discussions).		Section 3.0.
21/2/17	Briefing to Duncan Palmer, DoW Regional Manager (one of many such discussions).		Tables 5 and 6.
27/2/17	Discussion with Dominique Reeves, MG Corporation, re Mantinea ADP.		Section 10.3.1.
28/2/17	Briefing to John Dong, NT Government Ord Office.		Section 3.0.
9/3/17	Introductory briefing on Carlton and Mantinea to Philip Vincent (MG Corporation A/CEO), Lawford Benning (MG Corporation Chairperson) and Dominique Reeves.	Indigenous employment. Job opportunities for Traditional Owners.	Section 10.3.1. Section 10.3.3.
14/3/17	Meeting with Dominique Reeves (MG Corp) re Carlton Plain heritage clearance.	Heritage clearance - Carlton Plain.	Section 10.3.1.
16/3/17	Briefing to Lorraine Corowa and John Dong, NT Government Ord Office.		Section 3.0.
16/3/17	Presentation to DAFWA regional strategy meeting. Attendees included local agricultural industry representatives, Chamber of Commerce, local government.	Strategies for industry growth in the region.	Section 3.0.
22/3/17	Clontarf visit to KAI farms.	Overview of local Aboriginal employment / career opportunities	Section 10.3.3.
27/3/17	Briefing to Kate Blagrove and Madi Signa - Office of Northern Australia / AusIndustry.		Section 3.0.

Date	Engagement activity which included Carlton Plain discussions / respondent to DER advertising	Matters discussed / concerns / issues raised	Where specific issues are addressed in this document
28/3/17	Briefing to Bronwyn McLean, Grains Research and Development Corporation.	R&D and regional plans	Section 3.0.
29/3/17	Discussion with Ian Baker, NT Farmers.		Section 3.0.
30/3/17	Northern Australia Crop Research Alliance Board meeting .	Discussion on crop expansion opportunities via Carlton Plain project	Section 3.0.
11/4/17	Meeting with SWEK CEO Carl Askew.	Carlton Hill Road	Section 3.0.
13/4/17	Briefing note sent to new Minister for Agriculture Alannah MacTiernan with *Building the Ord* vision document and introductory letter from KAI.		Section 3.0.
20/4/17	Horizon Power and Chinese government delegation briefing.		Section 3.0.
21/4/17	Meeting with MG Corporation regarding Tarrara, Carlton Plain heritage clearance and Mantinea ADP.	Tarrara; heritage clearance Carlton Plain, ADP	Section 10.3.1.
26/4/17	Meeting with MG Corporation to organise Carlton Plain heritage clearance site visit.	Carlton Plain heritage clearance	Section 10.3.1.
28/4/17	Briefing and KAI farming tour: 30 local businesses.		Section 3.0.
1/5/17	Interview with Northern Australia Water Resources Assessment project (Dr Jane Addison) CSIRO.		Section 3.0.
8/5/17	Meeting with WA Government Ord coordination group - LandCorp, Department of Regional Development and Lands, MG Corporation, KAI - regarding progress of all projects associated with KAI's Development Agreement with the State.	Formal meeting on progress of all land development projects	Section 3.0.
10/5/17	Meeting with DAFWA Regional Manager Mike Bowley regarding KAI's regional plans and associated agricultural research and development (R&D).	R&D and regional plans	Section 3.0.
10/5/17	Presentation to Department of Water Ord Stakeholders forum: approximately 60 persons in attendance from industry, community and government. Government attendees included representatives from DoW, DAFWA, DRD, Department of State Development.		Section 3.0.
16/5/17	KAI presentation and bus tour to Kimberley, Pilbara and NT Local Governments. Approximately 100 local government representatives in attendance.	Attendees expressed concern that KAI did not have tenure.	Section 3.0.
17/5/17	Meeting with Dominique Reeves, MG Corporation, re Carlton Plain heritage clearance.		Section 10.3.1.
19/5/17	Community, visitor and corporate tour of KAI operations, organised through Ord Valley Muster.		Section 3.0.
24/5/17	Community, visitor and corporate tour of KAI operations, organised through Ord Valley Muster.		Section 3.0.
31/5/17	Preliminary Assessment Report - DER - Provided to KAI.		Referral prepared in response to DER report.
31/5/17	Submission A - objecting to proposed development.	The scale of KAI's proposed development is amongst the largest seen in WA in several decades.	Noted.
31/5/17	Submission A	The proponent has provided no information on the current environment or likely impacts and without a full assessment via the EP Act and EPBC Act the public will	Surveys were provided to DER with the clearing permit applications. Included with this referral.

Date	Engagement activity which included Carlton Plain discussions / respondent to DER advertising	Matters discussed / concerns / issues raised	Where specific issues are addressed in this document
		have no knowledge of what the impacts of the proposed clearing and subsequent development will be.	
31/5/17	Submission A	The proponent appears to be refusing to refer the proposal to the Federal Environment Minister for decision on any EPBC assessment despite the presence of several Matters of National Environmental Significance (MNES).	Section 9.3.2.
31/5/17	Submission A	The direct, indirect, downstream and cumulative impacts of these three clearing applications are likely to result in serious detrimental environmental impacts.	This statement is broad and not quantified. The potential impacts are considered throughout this document, with quantification where possible.
31/5/17	Submission A	These impacts include:	
31/5/17	Submission A	Extensive impacts on high quality riparian vegetation and threatened species habitat.	Section 9.0.
31/5/17	Submission A	Impacts on water quality and fresh water ecosystems from increase in turbidity, sedimentation, salinisation and chemical run-off.	Section 9.0.
31/5/17	Submission A	Adjacent to internationally significant Ramsar-listed Ord wetlands.	Section 9.3.2.
31/5/17	Submission A	Impacts via increased greenhouse emissions from clearing and burning almost 20,000ha of native woodland.	Reduced to 3,086ha: predominantly grassland which will not require burning of woodland.
31/5/17	Submission A	Due to their scale and impacts the applications should be referred to the EPA for assessment at the PER level.	This referral.
31/5/17	Submission A	Under no circumstances should the DER decide on these applications without a full public examination of the proposal/s and their likely impacts.	Noted. This referral.
31/5/17	Submission B - objecting to proposed development.	The scale and nature of the clearing application will have a significant, detrimental impact on the environment.	This statement is broad and not quantified. The potential impacts are considered throughout this document, with quantification where possible.
31/5/17	Submission B	The proposal is likely to have a significant impact on two wetlands of national importance.	Section 9.0.
31/5/17	Submission B	The proposal is likely to have a significant impact on a Ramsar listed wetland.	Section 9.0.
31/5/17	Submission B	The area is likely habitat for specially protected or threatened fauna including EPBC listed species (30 EPBC Act Listed Species and 41 Migratory Species)	Section 9.3.2.
31/5/17	Submission B	The likelihood of the presence of priority flora and possible Declared Rare Flora [DRF]	Section 4.0.
31/5/17	Submission B	No vegetation surveys are available to comment on.	Surveys were provided to DER. Included with this referral.
31/5/17	Submission B	No fauna surveys are available to comment on.	Surveys were provided to DER. Included with this referral.
31/5/17	Submission B	There is a very high potential for salinity according to reports.	Carlton Plain Stage 1 area shows low salinity risk.
31/5/17	Submission B	There is the potential for significant soil erosion through wind and rain.	Management measures will address erosion.
31/5/17	Submission B	No water licences have been provided.	Water licences will be applied for once EPA development approval is obtained for Carlton and Mantinea lands.
31/5/17	Submission B	The Soil and Land Commissioner has yet to provide advice on this proposal.	See below.
31/5/17	Submission B	We request the proposal be referred by the DER to the Commonwealth and to the WA EPA for assessment. The Department of State Development has recently referred a much smaller application (8ha of vegetation to be cleared) to the Commonwealth - Extension of Moonamang Road to the WA/NT border - for assessment under the EPBC Act 1999.	This referral.
31/5/17	DER comment on public submissions.	Many of the concerns raised in the submissions have been addressed within the relevant clearing Principles. All concerns in relation to end land use impacts have not been addressed in the clearing Principles [and] further assessment under Part IV of the Environmental Protection Act 1986 is required to assess the risks associated with end land use impacts.	This referral.

Date	Engagement activity which included Carlton Plain discussions / respondent to DER advertising	Matters discussed / concerns / issues raised	Where specific issues are addressed in this document
31/5/17	Department of Water advice re CPS7399/1, CPS7400/1, CPS 7401/1.	Ord Water allocation plan recognises proposals to develop 8,200ha on Carlton Plain and 4,200ha on Mantinea. 115GL/yr water allocated to Carlton-Mantinea sub-area, with an additional 281GL/yr available for allocation within the Main Ord sub-area. If KAI requires additional water, it can apply for an allocation from the Main Ord sub-area. There is sufficient water to allocate for this project. Actual granting of a [surface] water licence is subject to an application and assessment process.	Table 6.
31/5/17	Department of Water	If groundwater is required, the proponent will need to apply for a 5C licence to take water and a 26D licence	Groundwater will not be required. Section 2.3.2.
31/5/17	Department of Water	If the proponent needs to disturb the bed and banks of a watercourse it will need to apply for a permit under Section 17 of the RiWI Act.	Bed and Banks permits will be applied for as required. Section 2.3.2.
31/5/17	Department of Water	Legal access to land (such as easements) will need to be demonstrated for any works, access or infrastructure associated with 5C licences or Section 17 permits.	Section 2.3.2.
31/5/17	Department of Water	Water Corporation is responsible for meeting the required environmental flows [of the lower Ord River] and monitoring their effectiveness in preserving the ecological values.	Noted.
31/5/17	Department of Water	The proposed clearing permit area will impact four of the ten riparian vegetation monitoring transects that form part of the lower Ord River ecological monitoring sites. These transects must be retained in their entirety with vegetated buffers in place to reduce impacts including encroachment of weed species. The other monitoring sites (including macroinvertebrates and fish) must also be protected through use of extensive vegetated buffer zones and appropriate clearing and on-farm practices...	Noted. Transect locations will be obtained from DoW. Vegetated zones are retained within the Carlton Plain freehold boundary.
31/5/17	Department of Water	Given the scale and location of the proposed permit boundaries, the clearing poses on-site and off-site risks to groundwater and surface water quality through increased erosion, sedimentation and nutrient levels, and potential changes to hydrological regimes as a result of changes to stormwater velocities and overland flow paths (but not from the take of water from the Ord River which will be regulated and managed under the RiWI Act and the *Ord Surface Water Allocation Plan*). The proposed land use also poses risks to ground and surface water quality from contamination from chemicals and fertilisers.	Sections 5.0, 6.0, 8.0.
31/5/17	Department of Water	Localised groundwater levels and presence of saline sodic soil layers need to be considered to prevent impacts to water quality arising from waterlogging and salinity issues.	Carlton Plain Stage 1 area shows low salinity risk. Section 8.3.1.
31/5/17	Department of Water	Clearing permit boundaries may need to be adjusted… and appropriate management and monitoring measures put in place to reduce these risks to water quality from the clearing and proposed land use.	Carlton Plain Stage 1 footprint reduced from original proposal.
31/5/17	Department of Parks and Wildlife	In addition to the information DPaW provided in relation to impacts associated with the proposed clearing (contained within the relevant Clearing Principles), DPaW also provided the following comment on impacts associated with the end land use:	
31/5/17	Department of Parks and Wildlife	There is… a moderate to high risk of increased levels of nutrients and pesticides from irrigation drainage to the ecology of the lower Ord River. There are already records of concentrations of two agricultural chemicals exceeding guideline levels within the Ord River. In addition, fish kills have been observed and there is	Irrigation will not drain to the lower Ord River. Tailwater recycling will occur on farm. Stormwater flow overland under wet season conditions will occur naturally. KAI understands that the cited records of chemical-related fish kills relate to Endosulfan, which has been banned in Australia for nearly a decade, and the

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		evidence of bioaccumulation of pesticides in barramundi (*Lates calcarifer*) and freshwater crocodiles (*Crocodylus johnstoni*). Nutrient leaching may also cause eutrophication.	events occurred in the Dunham River approximately 15-20 years ago. Nutrient leaching contributing to eutrophication is not expected, particularly given the 42 m3/s (cumecs) minimum environmental flow in the lower Ord River through the Kununurra Diversion Dam.
31/5/17	Department of Parks and Wildlife	Contaminated stormwater runoff, particularly agricultural (fertilisers and chemicals) may also affect water quality and cause habitat degradation, particularly late in the dry season.	Stormwater runoff will only occur when there is ample rainfall. Ord Stage 1 and Ord Stage 2 experience indicates chemical runoff risk is higher early in the dry season, with very low risk at end of dry season.
31/5/17	Department of Parks and Wildlife	Changes to the hydrology and groundwater level of the area due to vegetation clearing, agriculture and irrigation are a very significant consideration for this proposal, but little information is provided about the likely impacts of the clearing proposal on hydrology of the proposal area or its surrounds.	Carlton Plain Stage 1 design plans include drainage design. Figure 6.
31/5/17	Department of Parks and Wildlife	The risk of groundwater and soil salinity and other hydrological changes including altered drainage patterns, flooding and nutrient enrichment are high in the proposal area, so the potential for secondary impacts from this source is also very high.	Carlton Plain Stage 1 area shows low salinity risk. Figure 8.3.1.
31/5/17	Department of Parks and Wildlife	The Department recommends that this proposal be referred to the EPA as per other Ord Stage 2 developments for consideration of any requirement for formal environmental impact assessment for the following reasons:	This referral.
31/5/17	Department of Parks and Wildlife	The vast extent of proposed clearing and the proposed land use of irrigated agriculture has the potential to have a significant cumulative impact on conservation values in the area and to cause severe land degradation to the site and adjacent areas.	The 'potential' noted here is addressed and quantified throughout this document.
31/5/17	Department of Parks and Wildlife	The complexity of issues, values and sensitivities in this areas.	
31/5/17	Department of Parks and Wildlife	Land development in the Ord River area, especially in relation to the black soil flats, has not included any planning for conservation of these land units. Very little is included in the formal conservation estate, and in general there has been no planning for adequate buffers and corridors linking areas of this land unit.	Black soil is not present on Carlton Plain Stage 1. Vegetated zones are retained within the Carlton Plain freehold boundary.
31/5/17	Department of Parks and Wildlife	The primary impacts to the Ivanhoe Land System PEC from this current single proposal are extremely high, representing ~15% of the total area of the land system mapped in WA.	Black soil is not present on Carlton Plain Stage 1.
31/5/17	Department of Parks and Wildlife	There is a high risk of salinity, altered drainage and flooding, nutrient enrichment and other hydrological issues to the proposal area and the surrounding extremely high conservation values, the Ord River Floodplain Ramsar site, and the nearby nature reserves, as a consequence of this proposal.	Low salinity risk on Carlton Plain Stage 1 – refer to Section 8.3.1.
31/5/17	Department of Parks and Wildlife	Due to the high risk of impacts to Ramsar listed sites (Matters of National Environmental Significance) and to EPBC listed species the proposal requires referral under the EPBC Act to the Department of the Environment and Energy.	Sections 7.0, 9.0.
31/5/17	Department of Parks and Wildlife	Cumulative impacts of Ord agricultural proposals to important values including vegetation, and stable hydrology need to be fully considered and potential for land degradation managed and minimised. Any consideration of approval should include adequate planning fro protected areas, buffers and corridors to maintain the integrity of the biodiversity values associated with this area.	Vegetation (riparian) corridors between the Ord River and the Carlton Plain freehold boundary are outside of KAI's development area (with the exception of minor easements for pipelines, per the proposal design). Vegetated zones are retained within the Carlton Plain freehold boundary.
31/5/17	Commissioner of Soil and Land Conservation Advice - CPS 7399/1 CPS 7400/1 CPS 7401/1.	In addition to the advice provided by the Commissioner of Soil and Land Conservation (CSLC) relating specifically to the impacts of clearing referred to within Principles (g) and (i), advice was also provided relating to the proposed	

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		infrastructure and the end land use associated with the proposed agricultural works.	
31/5/17	Commissioner of Soil and Land Conservation	The Mantinea clays and the Winbidji loams (associated with CPS 7400/1 and CPS 7401/1) have high subsoil salinities that are liable to seriously impact agricultural production under irrigation. Any rise in saline groundwater will seriously affect irrigated agricultural production and compromise the long term sustainability of the affected areas.	Low salinity risk on Carlton Plain Stage 1 – refer to Section 8.3.1.
31/5/17	Commissioner of Soil and Land Conservation	Irrigation salinity and subsoil sodicity are issues that will require management. This typically includes application of additional irrigation water (leaching fraction) in conjunction with groundwater and surface water drainage management. Additionally, the balance of ions in the irrigation water and the soil solution may also require careful management to maintain long term productivity.	Low salinity risk on Carlton Plain Stage 1 – refer to Section 8.3.1.
31/5/17	Commissioner of Soil and Land Conservation	Depending on how the proponent implements the project, these factors when combined may have implications on water quality and quantity downstream of the project as well as the management triggers for the Ord Stage 1 area.	Noted.
31/5/17	Commissioner of Soil and Land Conservation	Clearing and laser levelling:	
31/5/17	Commissioner of Soil and Land Conservation	The preliminary soil surveys undertaken by the Department of Agriculture between 1944 and 1996 point to areas where flood irrigation will be difficult due to surface topography (both very flat grades and undulating land) and soil type (subsoil salinity and texture).	Noted.
31/5/17	Commissioner of Soil and Land Conservation	Irrigation 'block' or farm layout is dependent on careful consideration of these and other factors, in order to minimise excessive infrastructure costs associated with sealing supply channels constructed on leaky soil, excessive cut and fill to laser level undulating and very flat topography and surface and subsurface drainage to manage waterlogging and salinity.	Farm design has carefully considered existing topography and soils. Refer to Figure 4.
31/5/17	Commissioner of Soil and Land Conservation	The proponents recognise that clearing is liable to exacerbate soil erosion and that management of surface water will be required. However, as the detailed planning has not yet been completed, it is not possible from the information provided to assess the efficacy of this strategy.	Specific soil management actions will be included in the Carlton Plain Stage 1 environmental management plan to ensure minimal soil erosion.
31/5/17	Commissioner of Soil and Land Conservation	Construction of Hillside Drains and Levees:	
31/5/17	Commissioner of Soil and Land Conservation	The construction of hillside drains and levees will be critical to minimise the risks associated with soil erosion, sedimentation, nutrient export, groundwater recharge and waterlogging due to surface water run-off from adjacent rangeland, especially during extended wet periods or intense rainfall events typical of this district.	Figure 4.
31/5/17	Commissioner of Soil and Land Conservation	These critical structures also have potential to cause serious soil erosion should they fail or the discharge structures are inadequate.	Noted.
31/5/17	Commissioner of Soil and Land Conservation	As no conceptual or detailed plans for this infrastructure have been provided with these applications, these elements have not been evaluated.	Figure 4.
31/5/17	Commissioner of Soil and Land Conservation	Water supply and water distribution infrastructure:	
31/5/17	Commissioner of Soil and Land Conservation	A conceptual plan for the location of pump stations, supply channels and tailwater storage facilities has not been provided with the clearing permit applications. Due to inherent site characteristics already described, there are considerably higher risks associated with the development of an extensive irrigation project on the application areas, compared with those developed under Ord Stage 1.	Figure 8. Figure 4.

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31/5/17	Commissioner of Soil and Land Conservation	In addition to this, the water requirement for this proposed development is likely to be significantly higher than the water allocation for the area. Therefore, there will be a pressing need to manage transmission losses on this ground alone.	Table 6.
31/5/17	Commissioner of Soil and Land Conservation	On the Carlton Plain side of the river, there are extensive areas of loamy soils (Group A soils of Stoneman). Supply channels traversing these soils will need to be lined, if excessive seepage is to be avoided. This will have an important bearing on irrigation block design.	Clay channel lining and compaction will be implemented to minimise seepage.
31/5/17	Commissioner of Soil and Land Conservation	In the early 1990s, transmission losses in the Ord Stage 1 clay lined channels were measured by GHD for the WA Water Authority. Losses from the Cununurra clay, transitional soils and Aquitaine phase soils were estimated to be around 27%.	Noted. Previous Ord experience has been factored into design.
31/5/17	Commissioner of Soil and Land Conservation	Losses from channels through the Group A soils are liable to be much higher. Where this channel seepage occurs in areas underlain by regolith of moderate to high salinity and with shallow saline water tables, secondary salinity is likely to develop.	Clay channel lining and compaction will be implemented to minimise seepage. Low salinity risk on Carlton Plain Stage 1 – refer to Section 8.3.1.
31/5/17	Commissioner of Soil and Land Conservation	The tailwater storage facilities planned by the applicants may be important for augmenting the irrigation water supplies as well as managing solute concentrations in the irrigation supply water in order to manage sodic soils.	Noted.
31/5/17	Commissioner of Soil and Land Conservation	In the absence of detailed plans it has not been possible to evaluate the likely land degradation risks associated with these key infrastructure components.	Figures 4, 5, 6, 7, 8.
31/5/17	Commissioner of Soil and Land Conservation	Tailwater recycling facilities:	
31/5/17	Commissioner of Soil and Land Conservation	These structures are important elements of the project that minimise off-site impacts of extensive agricultural developments (associated with salinity, sediments, nutrient export) as well as augmenting increasingly valuable water resources.	Noted.
31/5/17	Commissioner of Soil and Land Conservation	Generally these should be designed to have sufficient storage capacity to capture the 'first flush' stormwater runoff and to be integrated with both the supply systems and the storm water management systems.	Tailwater return facilities are an integral part of farm design. Note that the highest environmental risk from stormwater runoff occurs at the end of the wet season (post pre-emergent field preparations) and not the end of the dry season, which, although held as high risk, is generally followed up by substantial rainfall and flushing, and is thus less risk than the early dry season late rains.
31/5/17	Commissioner of Soil and Land Conservation	Beyond the re-use of tailwater on farms, the objectives for tailwater management in these applications are not clear.	
31/5/17	Commissioner of Soil and Land Conservation	Groundwater management and disposal infrastructure:	
31/5/17	Commissioner of Soil and Land Conservation	KAI indicate they will undertake detailed groundwater and soil risk assessment following clearing approval and completion of groundwater modelling.	Low salinity risk on Carlton Plain Stage 1 – refer to Section 8.3.1.
31/5/17	Commissioner of Soil and Land Conservation	The preliminary land resource capability assessment indicates that areas under application to clear are at risk of developing serious salinity problems following clearing and under irrigated agriculture. Therefore, the management of groundwater is a critical element for the long term success of this project.	Low salinity risk on Carlton Plain Stage 1 – refer to Section 8.3.1.
31/5/17	Commissioner of Soil and Land Conservation	Drainage for the management of salinity is notifiable under Regulation 5 of the Soil and Land Conservation Regulations 1992. A detailed assessment of any proposed drainage would be assessed after a Notice of Intent to Drain has been lodged with the Commissioner.	Salinity drainage will not be required for Carlton Plain Stage 1.
31/5/17	Commissioner of Soil and Land Conservation	Failure to successfully manage saline groundwater will have economic consequences for the proponent and environmental consequences for the State.	Low salinity risk on Carlton Plain Stage 1 – refer to Section 8.3.1.
31/5/17	Commissioner of Soil and Land Conservation	Overall conclusions:	

Date	Engagement activity which included Carlton Plain discussions / respondent to DER advertising	Matters discussed / concerns / issues raised	Where specific issues are addressed in this document
31/5/17	Commissioner of Soil and Land Conservation	The assessment of these applications leads to the following conclusions -	
31/5/17	Commissioner of Soil and Land Conservation	Some of the application areas have moderate to high risk of developing salinity after clearing and also after development for irrigated agriculture.	Carlton Plain Stage 1 identified as generally low environmental risk. Refer to Section 8.3.1.
31/5/17	Commissioner of Soil and Land Conservation	The proposed laser levelling for flood irrigation may cause accelerated soil erosion and sedimentation.	To be managed through careful design based on soil type and topography.
31/5/17	Commissioner of Soil and Land Conservation	The aggregate water requirement for the project is substantially greater than the allocation for these development areas and may have off-site water quality implications.	Table 6.
31/5/17	Commissioner of Soil and Land Conservation	The proposed water supply and distribution infrastructure may cause increased groundwater recharge and associated secondary salinity.	Carlton Plain Stage 1 identified as low salinity risk. Section 8.3.1.
31/5/17	Commissioner of Soil and Land Conservation	As detailed plans have not been developed, it has not been possible to assess the proposed hillside drains and levees, other surface water and groundwater management systems and the tailwater recycling facilities.	Figures 4, 5, 6, 7.
31/5/17	Commissioner of Soil and Land Conservation	Many of the issues identified in this assessment cannot be regulated with conditions of a clearing permit issued under Part V of the Environmental Protection Act 1986. This is unsatisfactory for both the proponent and the State.	This referral.
31/5/17	Commissioner of Soil and Land Conservation	In view of the very large scale of this clearing proposal, the lack of detailed resource information, and lack of detail for the complex interacting component systems such as the water supply, surface water management, groundwater management, drainage and tailwater necessary for sustainable management of the areas under application, I recommend these clearing permit applications be referred to the EPA for further assessment under Part IV of the EP Act 1986. This pathway would de-risk the project and provide certainty for both the proponent and the State.	This referral.
31/5/17	Department of Environmental Regulation final comment.	Noting the above information provided by key stakeholders, it is evident that the proposed end land use for all four applications has the potential to cause significant environmental impacts, including soil erosion, surface water runoff and sedimentation, salinity and fertiliser and chemical runoff into nearby sensitive watercourses and wetlands such as the Ord River Estuary, Ord River and Parry Floodplain. Further information in the form of detailed management plans relating to groundwater management, surface water management, flood management and a nutrient and irrigation management plan would be required to better inform the land use impacts of these applications.	This referral. Environmental management plans will be prepared and submitted for EPA approval as required.
1/6/17	Meeting with NT Farmers - Ian Baker, Greg Owens.		Section 3.0.
2/6/17	Meeting with East Kimberley Chamber of Commerce and Industry President and Treasurer.		Section 3.0.
6/6/17	Briefing to new DAFWA Regional Manager Andrew Hodgson and District Manager Noel Wilson.		Section 3.0.
6/6/17	Interview with Geoff Lawrence, Emeritus professor of agribusiness - study on positives of foreign investment in agriculture.		Section 3.0.
7/6/17	KAI meeting with WA Premier Mark McGowan and Minister for Agricultural Alannah MacTiernan.		Section 3.0.
12/6/17	KAI received DER Preliminary Assessment Report for Carlton Plain, Mantinea and Tarrara proposals. Refer to comments dated 31 May 2017 (above).		Section 3.0.

Date	Engagement activity which included Carlton Plain discussions / respondent to DER advertising	Matters discussed / concerns / issues raised	Where specific issues are addressed in this document
12/6/17	Meeting with Director General of Department of Regional Development, and LandCorp, regarding KAI land development.		Section 3.0.
13/6/17	Meeting with Anthony Sutton and Sally Bowman, Office of the EPA, regarding DER response to Carlton, Mantinea and Tarrara clearing permit applications, and resultant requirement to refer to EPA.		This referral.
21/6/17	Meeting with LandCorp Board regarding KAI developments.		Section 3.0.
22/6/17	Meeting with Water Corporation Board regarding KAI developments.		Section 3.0.
23/6/17	KAI presentation to East Kimberley Chamber of Commerce and Industry members in Kununurra. Approximately 100 local business persons in attendance. Video record of presentation subsequently provided to Ministers and EPA in July 2017.		Section 3.0.
28/6/17	Heritage clearance site visit with Traditional Owners and Anthropologists. Heritage sites identified and verbal heritage clearance provided. (Note - KAI is awaiting formal report as of 19 July 2017).		Section 10.3.1
1/7/17	East Kimberley Chamber of Commerce and Industry video of presentation provided to Minister for Agriculture and Regional Development, and EPA.		Section 3.0.

12.0 Conclusion

Environmental principles established under Section 4A of the EP Act 1986, as listed in Section 2.6, have been considered in the development of the Carlton Plain Stage 1 proposal guiding the environmental assessment process, as follows:

Table 17 - Addressing environmental principles on Carlton Plain

Principle	Conclusion
The precautionary principle	Decades of government sourcing of environmental data and knowledge have been used to inform the Carlton Plain Stage 1 design and boundaries. This is particularly informed by groundwater knowledge and risk (which requires further information and careful planning), and in relation to Ord water usage for irrigation. Future stages will be informed by ongoing environmental assessment, and modified where risk cannot be avoided or mitigated. Land management will be fundamentally based on the precautionary principle. As freehold land owner, KAI has the most to lose if land degradation occurs.
The principle of intergenerational equity	The lower Ord River environs reflect a substantially modified system, as does the Carlton (and Mantinea) Plain following a century of agricultural modifications and grazing. KAI does not anticipate, based on the available environmental assessment data – particularly in relation to downstream impacts on Ramsar sites – that future generations' environmental quality and enjoyment will be substantially impeded by this development. Moreover, there is a risk of reduced economic equity for future generations if areas of the Kimberley which have been earmarked for economic development for many years are restricted. This particularly relates to equity for Aboriginal persons for whom 'inheritance' by way of Native Title benefits (and employment opportunity) is long overdue. Delays in following through on the promise of the Ord Final Agreement are delays in providing Traditional Owners with their hard-fought entitlements.
The principle of the conservation of biological diversity and ecological integrity	As noted above, the Ord system is highly modified, and has resulted in the creation of wetlands and a perennial river system where once these did not exist. The proposed development will not impact substantially on biological diversity and ecological integrity values, either on Carlton Plain itself (a degraded environment) or the nearby Ord River, which has been very modified over recent decades. Section 4.0 and Section7.0, in particular, have illustrated that there is minimal risk to priority flora and fauna species within the region.
Principles relating to improved valuation, pricing and incentive mechanisms	KAI does not seek external support to manage its impacts. Tailwater return systems, for example, will be constructed at substantial additional cost. Having recently secured Carlton Plain in fee simple, KAI has factored in the costs of development and environmental management, and is prepared to meet these requirements if they are on par with the requirements of the nearby Ord Stage 2 lands.
The principle of waste minimisation	KAI's management approach for its irrigated agricultural development centres around minimising water wastage (ie, tailwater), which has a direct benefit to the environment in terms of abstraction impacts and downstream pollution. Tailwater recycling has been factored into KAI's development planning and will be implemented in perpetuity.

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Appendix A – DRAFT Environmental Management Actions

Other attachments:

Electronic version of Figure 3: Carlton Plain Stage 1 Concept Plan

Electronic version of Figure 4: Carlton Plain Overall Concept Plan

Woodman Environmental Consulting – *Mantinea and Carlton Plain Project Level 1 Flora, Vegetation and Fauna Assessment*.

Soil Management Designs – *Soil and Groundwater Risk Assessment: Carlton Plain*

Appendix Table 1 – DRAFT Environmental Management Actions

#	ENVIRONMENTAL FACTORS	DEVELOPMENT ASPECTS	MANAGEMENT OBJECTIVES		MANAGEMENT AND MONITORING ACTIONS	RECORDS TO BE RETAINED	TIMING
1	Soils and erosion	Disturbance of the soil will increase the risk of soil erosion thereby potentially affecting infrastructure and sediment loads in runoff.	Contain disturbance of soils. Prevent runoff from disturbed areas causing erosion. Detect adverse changes to the chemical status of soil (eg salinity, sodicity).	1.1	Visual monitoring of scours and sediment loads in runoff.	Visual inspection records.	Ongoing.
				1.2	First flush water samples to include turbidity, EC, total N, total P, pH and indicator farm chemical analyses (Atrazine). ORIA Stage 1 water quality triggers and targets to be adopted.	Water sample analysis records.	First flush and as possible during wet season.
		Inadequate flushing of irrigated soils may alter the chemical status of the soil (specifically salinity and sodicity) thereby affecting crop yields.		1.3	Surface and subsurface soil monitoring across soil types, including non-irrigated areas. Monitoring to include ESP (sodicity) and soil salinity.	Soil sample analysis records.	Baseline prior to irrigation. Biennial following irrigation commencement.
		Land cultivation, particularly in late wet season/early dry season after pre-seed spraying, with risk of late rains.		1.4	Visual monitoring of compaction of soils.	Visual inspection records.	Ongoing.
2	Dust and particulate generation	Physical disturbance of the land surface, such as earthworks for construction of infrastructure and land-levelling, will generate dust and create exposed areas susceptible to wind erosion.	To ensure dust levels generated by the proposal do not adversely affect the welfare or amenity of nearby residents	2.1	Visual monitoring of dust, and watering down where required/possible.	Dust-related complaints to be recorded.	Ongoing.
		Movement of traffic on unsealed tracks will generate dust.					

#	ENVIRONMENTAL FACTORS	DEVELOPMENT ASPECTS	MANAGEMENT OBJECTIVES		MANAGEMENT AND MONITORING ACTIONS	RECORDS TO BE RETAINED	TIMING
		Vegetation clearing and burning will generate dust and smoke particles and create exposed areas susceptible to enhanced wind erosion.		2.2	Visual monitoring of smoke and ash during burning events.		As required.
		Crop harvesting and burning will generate dust and smoke particles and create exposed areas susceptible to enhanced wind erosion.					
3	Weed and pest management	Storage, handling and application of chemicals (including herbicides, pesticides, fertilisers and hydrocarbons) may lead to contamination of off-site areas (including groundwater and watercourses).	To ensure that chemical use in the project area does not adversely affect the health, welfare or amenity of the environment.	3.1	Compliance with chemical handling statutory requirements.	Certification records for personnel handling farm chemicals (eg ChemCert).	Ongoing.
				3.2	Apply farm chemicals using best practice techniques.	Retain records of timing, application rate, method of application and active ingredients of chemicals used in farming operations.	Ongoing.
4	Fire	Ignition of fuel or oil spills/leakages during re-fuelling of clearing or farming equipment, or ignition of other material during other clearing or farming activities with an ignition source.	To prevent long, high intensity, wildfires. To prevent fire damage to sites of cultural significance. To protect built infrastructure from fire.	4.1	Obtain SWEK fire permits for all scheduled burning activities.	Fire permits.	As required.
		Burning of vegetation as part of initial vegetation clearing activities.		4.2	Maintain firebreaks on all dryland areas, including vegetation retention areas, and around flammable materials.	Visual inspection records.	As required.

#	ENVIRONMENTAL FACTORS	DEVELOPMENT ASPECTS	MANAGEMENT OBJECTIVES		MANAGEMENT AND MONITORING ACTIONS	RECORDS TO BE RETAINED	TIMING
		Burning of crops as part of harvesting (e.g. sugar cane).		4.3	Ensure best practice fire prevention and control management (eg fire extinguishers on plant and equipment and in crib rooms).	Evidence of serviced or in-date fire extinguishers.	Ongoing.
		Storage and handling of flammable material on-site during construction.					
5	Weeds, plant pathogens and pest animals	Human activity in the project area will increase the risks associated with weeds and will increase the risk of introducing feral species which may compete for habitat and food and prey on native species.	To prevent the introduction of new weed, plant pathogen and pest animal species to the project area. To identify and implement quick control of potential incursions for the containment of inadvertent biosecurity breaches. To minimise the risk of weed species spreading to downstream reserves. To minimise the effect of pest animals on native fauna.	5.1	Ensure all personnel are inducted on biosecurity management.	Induction records.	Annually at season start.
		Vehicles/machinery and personnel movements could import and/or spread weeds and plant pathogens.		5.2	Undertake control of declared weeds or Weeds of National Significance where present in farming areas or vegetation retention areas.	Weed control records (photographs and GPS coordinates).	As required.
				5.3	Visual monitoring for new introduced plant or pest animal species in farm areas or vegetation retention areas.	Visual inspection records.	As required.
6	Surface water	Increased rates of erosion or deposition will affect the stability and function of natural watercourses.	Minimise the potential for sedimentation of nearby waterways. Minimise the potential for chemical contaminants to enter nearby waterways. Minimise the potential for deterioration to the biological health	6.1	Construct rock protection to minimise erosion risk on channels, drains and other water movement infrastructure.	Visual records (photographs).	As required.
		Contamination of drainage water may cause a decline in water quality in natural		6.2	Re-use tailwater on-farms.	Tailwater recycling facilities in operation.	From commencement

#	ENVIRONMENTAL FACTORS	DEVELOPMENT ASPECTS	MANAGEMENT OBJECTIVES		MANAGEMENT AND MONITORING ACTIONS	RECORDS TO BE RETAINED	TIMING
		watercourses.	of downstream riverine environments				of irrigation.
		The likely causes of disturbance that may accelerate the rate of surface water quality change are:					
		Increase in the volume of water flowing along Collins/Reedy Creek from drainage discharge;					
		Exposure of erodible surfaces from clearing and farming activities; and,					
		Alteration of flood hydrography and increase in runoff from improved drainage network throughout the catchment.					
		Stormwater contamination due to late wet season rains (following preparatory cultivation and/or pre-emergent spraying) or in first-flush stormwater runoff at beginning of wet season.		6.3	Monthy monitoring of total N, total P, EC, pH, Atrazine (as indicator chemical) and turbidity in tailwater and in stormwater runoff (when access is possible during the wet season).	Water sample analysis records.	Monthly from commencement of irrigation.
		Flow of stormwater from the project area to the Ord River.	To ensure any project-attributable changes to water quality within the lower Ord River system does not adversely affect the downstream environment, including Parry Lagoons and the Lower Ord Floodplain Ramsar Site.	6.4	Monthy monitoring of total N, total P, EC, pH, Atrazine (as indicator chemical) and turbidity in the lower Ord River, adjacent to and downstream of Mantinea and Carlton Plain (when access is possible during the wet season).	Water sample analysis records.	Commencing twelve months prior to irrigation to establish a baseline, continuing during farming operations.

#	ENVIRONMENTAL FACTORS	DEVELOPMENT ASPECTS	MANAGEMENT OBJECTIVES		MANAGEMENT AND MONITORING ACTIONS	RECORDS TO BE RETAINED	TIMING
7	Groundwater	Clearing and irrigation of agricultural lots will increase groundwater recharge, leading to a rise in groundwater levels, potentially resulting in waterlogging and salinisation of soils.	To ensure changes to the groundwater regime (depth and quality) resulting from the development activity does not significantly adversely affect vegetation (including crops) or fauna habitat within the project area or the downstream riverine environment and its flora and fauna.	7.1	Delayed development of high-risk area in NW section of Carlton Plain.	Completion of groundwater monitoring and modifications to design plans if required to minimise groundwater risk.	By 30 June 2017.
				7.2	Installation of additional or use of current piezometers across Carlton Plain and Mantinea..	Piezometer locations recorded / mapped.	Twelve months prior to irrigation commencement.
		Application of agricultural fertilisers and farm chemicals may lead to a change and/or contamination of surface and groundwater.		7.3	Bi-annual monitoring of EC, pH and depth to groundwater.	Monitoring records.	Beginning and end of each dry season.
		Spills of hydrocarbons or chemicals may lead to contamination of groundwater.		7.4	Annual monitoring of general groundwater chemistry including total N and total P.	Sample analysis records.	Beginning and end of each dry season.
				7.5	Preparation of detailed groundwater management plan if required following completion of groundwater modelling.	Detailed groundwater management plan prepared and actions implemented.	Prior to the commencement of irrigation.
				7.6	Detailed management plan to include groundwater discharge options, taking into account acid sulphate soils risks.	Detailed groundwater management plan prepared and actions implemented.	Discharge options to be implemented at suitable timing requirement (to be determined).
8	Biodiversity and habitat management	Clearing of the project area will remove available habitat, which has the potential to affect biodiversity.	Prevent disturbance occurring outside the project areas specified in Figures 2 and 3 (Carlton Plain and Mantinea	8.1	Delineate clearing boundaries.	GPS and photographic records of clearing boundary flagging and adherence.	Ongoing during clearing.

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			Concept Plans).				
		Clearing of specific habitat may impact upon Priority flora species including *Typhonium*.		8.2	Undertake wet season surveys to inform Priority flora protection actions, and modify farm design or management arrangements to minimise risk to identifed Priority flora.	Wet season flora and vegetation surveys.	Wet season 2017.
		Clearing of specific habitat may impact upon Priority fauna species including *avi-fauna*.		8.3	Undertake wet season surveys to inform Priority fauna protection actions, and modify farm design or management arrangements to minimise risk to identifed Priority fauna and avi-fauna.	Wet season fauna and avi-fauna surveys.	Wet season 2017.
				8.4	Prepare detailed management plans and/or specific procedures for significant flora, fauna or vegetation-related environmental risks identified during initial assessment and monitoring processes.		Prior to the commencement of clearing.
9	Indirect impact areas	Clearing may increase erosion, lead to sedimentation of surface water and rising of the groundwater table, and provide favourable conditions for establishment of weeds, plant pathogens and pest animals in downstream, offsite impact areas.	To protect the environmental values of the Ord River, the Lower Ord Floodplain Ramsar Site, Parry Lagoons and Ngamoowalem Conservation Park, including the protection of heritage sites, vegetation communities,	9.1	Implementation of on-farm management requirements in order to minimise off-site impacts.	Records as above.	Ongoing from commencement of clearing.

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		Storage and application of chemicals and fuels within farming areas may contaminate neighbouring sites (through transportation by wind or water) and groundwater if spillage occurs.	watercourses, wetlands, native fauna and flora.				
		Vehicle movements may result in erosion, introduce or spread weeds or plant pathogens, facilitate the movement of introduced fauna, and impact on native fauna.					
		Vegetation burning as part of initial vegetation clearing in farm areas and/or burning of crops as part of the harvesting activities may increase the risk of fire outbreaks in adjacent reserves, and may affect vegetation and fauna habitat through deposition of ash.					
		Irrigation of agricultural lots may increase accessions to groundwater and may lead to a rise in groundwater levels beneath adjacent reserves, potentially resulting in waterlogging and increased salinisation.					
10	Cultural heritage community amenity	Clearing of land and construction of infrastructure for farms may impact upon heritage sites.	To protect Aboriginal heritage and practice of culture, and to not limit access to lower Ord River recreational activities for the wider community.	10.1	Undertake heritage surveys as required under Ord Final Agreement and/or Aboriginal Heritage Act.	Survey documentation.	Prior to commencement of clearing.
		Development of land may reduce areas available for cultural practices.		10.2	Modify project footprint if required or otherwise seek approval from Traditional Owners in order to	Traditional Owner approval of modified footprint or other mitigation measure.	Prior to commencement of clearing.

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					minimise impact to heritage sites.		
		Development of farms may affect access to lower Ord River camp sites and recreational fishing areas.		10.3	Inform public of continued access arrangement to lower Ord recreational areas.		Prior to project commencement and as required.
11	Management and Reporting	Statutory responsibilities to be adhered to.	For all staff to comply with statutory responsibilities with environmental outcomes.	11.1	Induct all employees on environmental management requirements and statutory responsibilities.	Documentation pertaining to any breaches of statutory responsibilities.	At all times.
		Employees may inadvertently create environmental risk if not properly aware of obligations, procedures.	To minimise environmental risk through employee error and to maximise outcomes for biodiversity through staff understanding of risks and responsibilities.			Employee induction records.	Annually at season start.
		Inadequate management planning and monitoring results in unanticipated environmental risk eventuating.	To minimise environmental risk due to lack of impact understanding or appropriate procedures.	11.2	Prepare detailed management plans and/or specific procedures for significant environmental risks identified during assessment and monitoring processes.	Management plans prepared in consultation with relevant government agencies.	As required.
		Inadequate reporting to regulators results in risks not being identified or rectified in a timely manner.	To minimise environmental risk due to lack of external review of environmental monitoring or management activities.	11.3	Implement a single reporting process for all environmental approvals, including water licences, based on calendar year (season), with reporting to regulators by 31 March of the following year.	Retain all records from management actions stipulated above.	Annual.