Carlton Plain Stage 1

ENVIRONMENTAL MANAGEMENT PLAN

Prepared to meet the requirements of the notice issued under

Section 40(2)(a) of the Environmental Protection Act 1986

issued by the

Western Australian Environmental Protection Authority

September 2019

REV O.2

Prepared for Kimberley Agricultural Investment Pty Ltd by

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DOCUMENT CONTROL

Date	Version	Reviewed / endorsed by
September 25 2017	Draft Rev A	KAI
October 3 2017	Draft Rev B	Submitted to DWER for review
October 25 2017	Draft Rev C	Submitted to DWER for public comment
January 2018	Draft Rev D	Submitted to DWER for EPA approval
February 2018	Rev O	Final
August 2018	Rev O.1	Submitted to DWER and Office of the Appeals Convenor
September 2019	Draft Rev E	KAI
September 2019	Rev O.2	Submitted to DWER and Office of the Appeals Convenor

Summary

Proponent Name	**Kimberley Agricultural Investment Pty Ltd (KAI)**		
EPA Reference	CMS17168		
Purpose of this Environmental Management Plan (EMP)	To meet the requirements of Section 40(2)(a) of the Environmental Protection Act 1986 to provide the Environmental Protection Authority with further information to make its assessment on the above proposal.		
Key Environmental Factors and Objectives	***FACTOR***		***OBJECTIVE***
	Flora and Vegetation		To protect flora and vegetation so that biological diversity and ecological Integrity are maintained.
	Terrestrial Environmental Quality		To maintain the quality of land and soils so that environmental values are protected.
	Terrestrial Fauna		To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.
	Hydrological Processes		To maintain the hydrological regimes of groundwater and surface water so that environmental values are protected.
	Inland Waters Environmental Quality		To maintain the quality of groundwater and surface water so that environmental values are protected.
	Social Surroundings		To protect social surroundings from significant harm.
Summary of key provisions	***CODE***	***FACTOR***	***KEY PROVISIONS***
	CP1.FV.1	Flora and Vegetation	Establish a minimum 100m setback between the Ord River and the boundary of irrigated fields, for the purpose of maintaining riparian function and a biodiversity corridor.
	CP1.FV.2	Flora and Vegetation	No decline in the long term vegetation condition rating in vegetation retention areas, compared to initial 2016 dry season baseline surveys and subsequent 2018 transect establishment surveys.
	CP1.FV.3	Flora and Vegetation	No new Weeds of National Significance, Declared Pest weed species or introduced crop species in vegetation retention areas compared to 2016 dry season baseline surveys and 2018 transect establishment surveys.
	CP1.FV.4	Flora and Vegetation	In the event that decommissioning is to occur, rehabilitate cleared land to a fair-to-good rangeland condition rating within five years of cessation of irrigation [with allowance for tree age where appropriate].
	CP1.TE.5	Terrestrial Environmental Quality	Soil salinity levels do not exceed 400mS/m in surface or 600mS/m in subsurface soils.
	CP1.TE.6	Terrestrial Environmental Quality	Soil sodicity levels five years after commencement of irrigation do not exceed an Exchangeable Sodium Percentage (ESP) of 10 in surface soils or 15 in subsurface soils.
	CP1.TE.7	Terrestrial Environmental Quality	Soil erosion (scour) is minimised where possible on fields, flood protection levees, drainage and other significant infrastructure affecting project environmental outcomes.

	CP1.TE.8	Terrestrial Environmental Quality	Collect baseline soil samples across representative soil types in irrigation and non-development areas, prior to commencement of irrigation.
	CP1.TF.9	Terrestrial Fauna	Control pest or plague fauna as required to minimise negative environmental impacts.
	CP1.HP.10	Hydrological Processes	Undertake a groundwater monitoring program to observe changes in depth, and to better understand the water balance and connection between Carlton Plain Stage 1 groundwater and the Ord River.
	CP1.HP.11	Hydrological Processes	Hillside drainage and internal stormwater drainage network maintained such that there is no tailwater flow through Carlton wetland in any dry season or stormwater flow through the wetland in an average rainfall wet season.
	CP1.IW.12	Inland Waters Environmental Quality	No tailwater discharge to Reedy Creek or Ord River during the dry season.
	CP1.IW.13	Inland Waters Environmental Quality	Establish a farm chemicals water quality testing program on the Carlton Stage 1 wetland to assure no farm water is entering the wetland.
	CP1.IW.14	Inland Waters Environmental Quality	Avoid substantial cattle damage to native vegetation while reducing weed infestations in the Carlton Stage 1 wetland by allowing limited, restricted cattle access for mechanical weed control as part of an integrated weed management approach.
	CP1.IW.15	Inland Waters Environmental Quality	Implement a groundwater monitoring program to observe changes in water quality on Carlton Plain.

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Acronyms and Abbreviations

AER	Annual Environment Report
AHA	Aboriginal Heritage Act 1972
ANZECC	Australian and New Zealand Environment and Conservation Council
DAFWA	(Former) Department of Agriculture and Food Western Australia
DBCA	Department of Biodiversity, Conservation and Attractions
DER	Department of Environmental Regulation
DoW	(Former) Department of Water
DPIRD	Department of Primary Industries and Regional Development
DWER	Department of Water and Environmental Regulation
ECD	Ecological Character Description
EMP	Environmental Management Program/Plan
EPA	Environmental Protection Authority
EP Act	Environmental Protection Act (1986)
EPBC Act	Environment Protection and Biodiversity Conservation Act (1999) (Cwth)
ESP	Exchangeable Sodium Percentage
GL	Gigalitre(s)
ha	Hectare(s)
ILUA	Indigenous Land Use Agreement
KAI	Kimberley Agricultural Investment Pty Ltd
KBC	Kimberley Boab Consulting
km	Kilometre(s)
m3/sec	cubic metres per second (also known as cumec)
MNES	Matter(s) of National Environmental Significance
MG	Miriuwung and Gajerrong (peoples)
MG Corporation	Yawoorroong Miriuwung Gajerrong Yirrgeb Noong Dawang Aboriginal Corporation
NR	Nature Reserve
OFA	Ord Final Agreement
OHS	Occupational Health and Safety
ORFRS	Ord River Floodplain Ramsar Site
PEC	Priority Ecological Community
R&D	Research and development
RiWI Act	Rights in Water and Irrigation Act 1914
WA	Western Australia
WARMS	Western Australian Rangelands Monitoring System

Section 1: Context and scope

1.1 Introduction

Kimberley Agricultural Investment Pty Ltd (KAI) proposes to develop Stage 1 Carlton Plain for irrigated agriculture. Figure 1 indicates the location of the development. Further information relating to the proposal can be found in associated referral documentation submitted to the Western Australian Environmental Protection Authority (EPA) in mid 2017 (Kimberley Boab Consulting [KBC], 2017). Initial referral documentation indicated 3,086ha to be cleared and developed for irrigated agriculture and infrastructure. Figure 2 indicates the development envelope, which equates to the footprint of the Stage 1 area[1].

Revised irrigation planning [since the initial referral] has increased the area to be retained and managed as wetland habitat, and decreased the clearing and development area to 2,945ha. The conceptual development layout is illustrated in Figure 3.

The development entails the clearing, laser levelling and cropping of (freehold) land which is currently grazed in conjunction with surrounding pastoral lease operations; and the construction of water supply channels, drainage and tailwater return systems for surface and pressurised irrigation; sheds; yards; storage dams; hillside drains; levees; roads; pump sites and pipelines. Section 1.2 and Table 1 outline the concept farm design, with Appendix A providing a detailed map inclusive of field drainage and property topographic detail.

Over 60% of the vegetation condition in the development footprint has been classified as being in poor, very poor, degraded or cleared condition, with over 40% exhibiting 20-80% weed coverage (Woodman Environmental, 2016). This landscape is already highly modified by human-induced activity.

It is intended that development will commence in the early dry season (April/May) 2018, subject to required approvals being in place. A water licence will be sought once approval under the Environmental Protection Act 1986 has been obtained. This has not yet been sought because the *Ord Surface Water Allocation Plan* (Department of Water 2013) nominally allocates 115GL per annum to the Carlton Plain and Mantinea sub-area, which KAI over which has freehold and a development option (with the Western Australian Government) respectively. Furthermore, the Ord system is not currently overallocated nor nearing overallocation. Given this context, the imperative for the proponent is to obtain clearing and development approvals rather than access to water *at this stage*. Water access will be secured once Environmental Protection (EP) Act 1986 approval is obtained. It is anticipated that the process for obtaining a water licence under the Rights in Water and Irrigation (RiWI) Act 1914 will commence in 2018.

The environmental factors to be affected by the development, the anticipated impacts, and the parameters integrated into the development design which have been designed to mitigate significant environmental risks are summarised in Table 2. Section 2 addresses the environmental factors in detail, with specific provisions identified for each of the factors.

[1] The terminology used in this document, and in Figures 3 to 8, refers to the development envelope as the Stage 1 development area, as this is the practical language which is applied at operational farm management level.

Figure 1 - Carlton Plain Locality Map

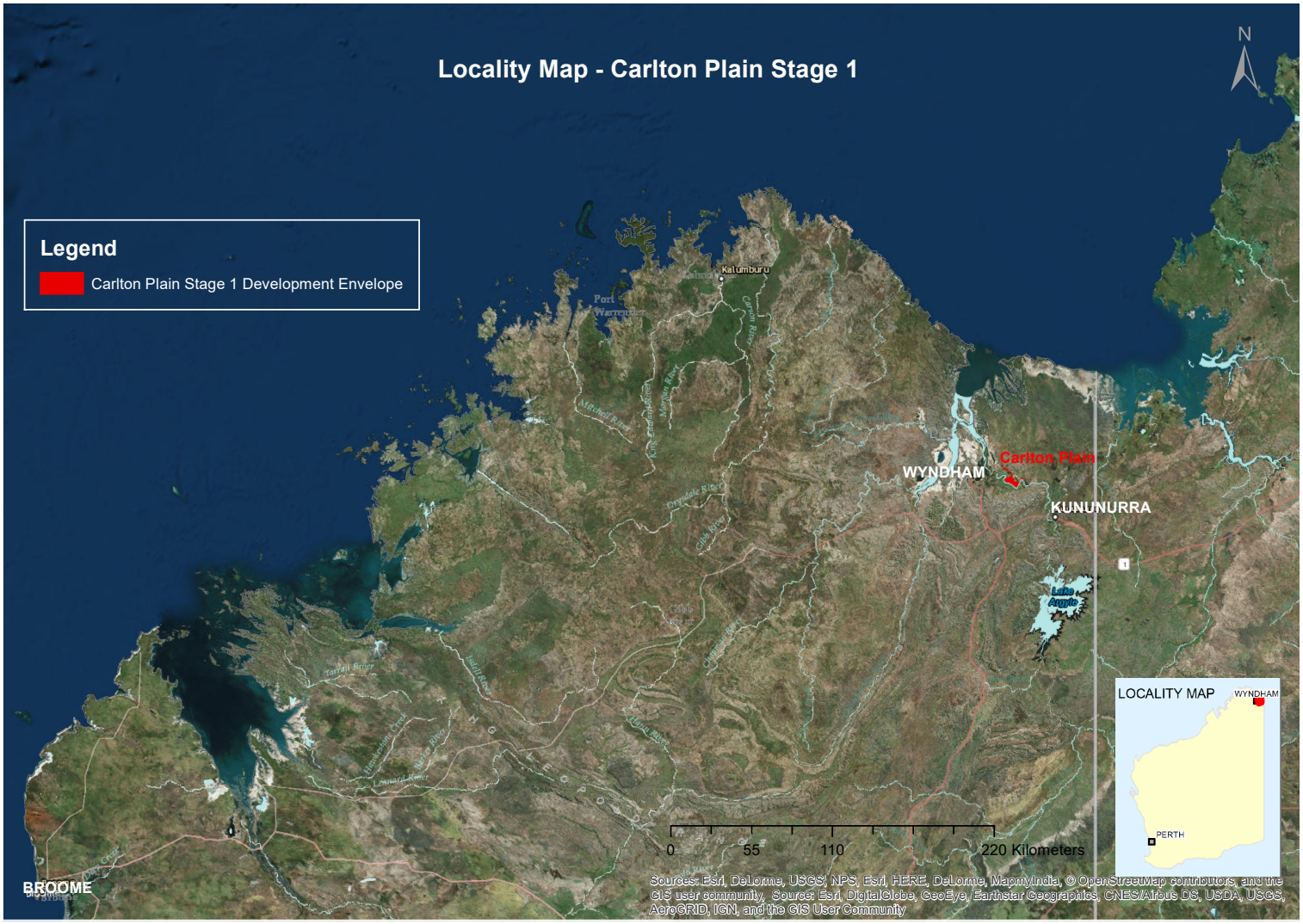
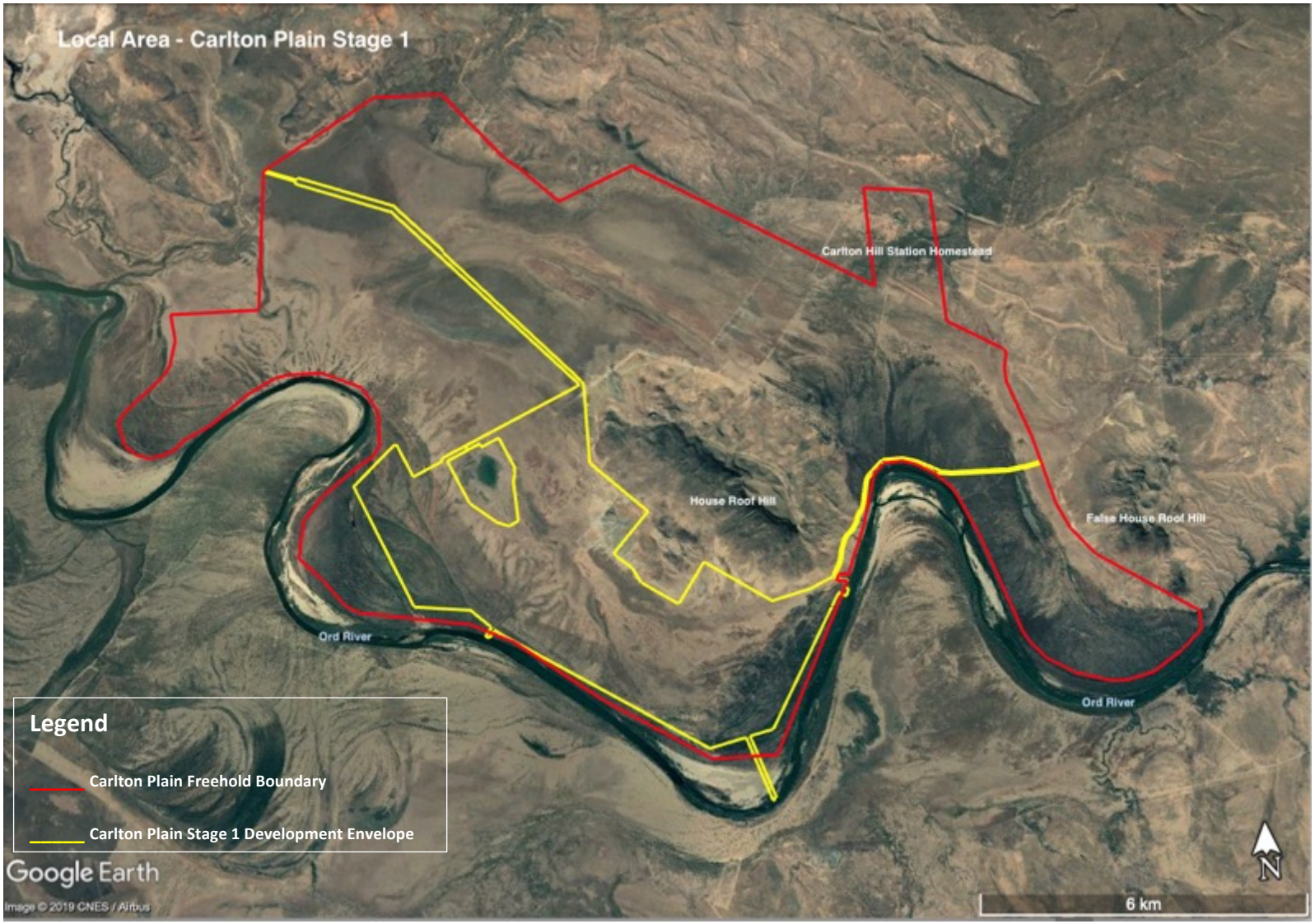


Figure 2 - Carlton Plain Local Area



1.2 Farm design

The development of the Carlton Plain Stage 1 area includes the following activities:

- Clearing and laser leveling of the land and any other works which may be required in order to enable flood-irrigated agriculture to occur;
- Construction of hillside drains to divert runoff from surrounding ranges and protect both irrigation land and new channel infrastructure from inundation;
- Construction of water supply infrastructure, including pumping infrastructure (unlikely to be visible from the lower Ord River) and tailwater recycling facilities;
- Construction of smaller distribution channels off the main supply infrastructure to service agricultural land;
- Construction of levee banks, as required, around the perimeter of the farming land to prevent inundation;
- Enhancing the existing internal drainage system to divert excess stormwater runoff from the developed area and protect irrigated land, channels and farm infrastructure from long term inundation;
- Construction of on-farm capital works required for the planting and farming of crops.
- Construction and operation of groundwater management and disposal infrastructure, including sub-surface drains, groundwater bores and pipelines;
- Construction of suitable internal farm roads;
- Construction of farm sheds and houses, product and input storage facilities;
- Retention of vegetation in areas not required or not considered suitable for irrigated agriculture; and
- Utilisation of water released from Lake Argyle, via the Ord River and Lake Kununurra, pumped from the Ord River to irrigate crops.

The extent of the proposal elements is summarised in Table 1:

Table 1 - Proposal inclusions

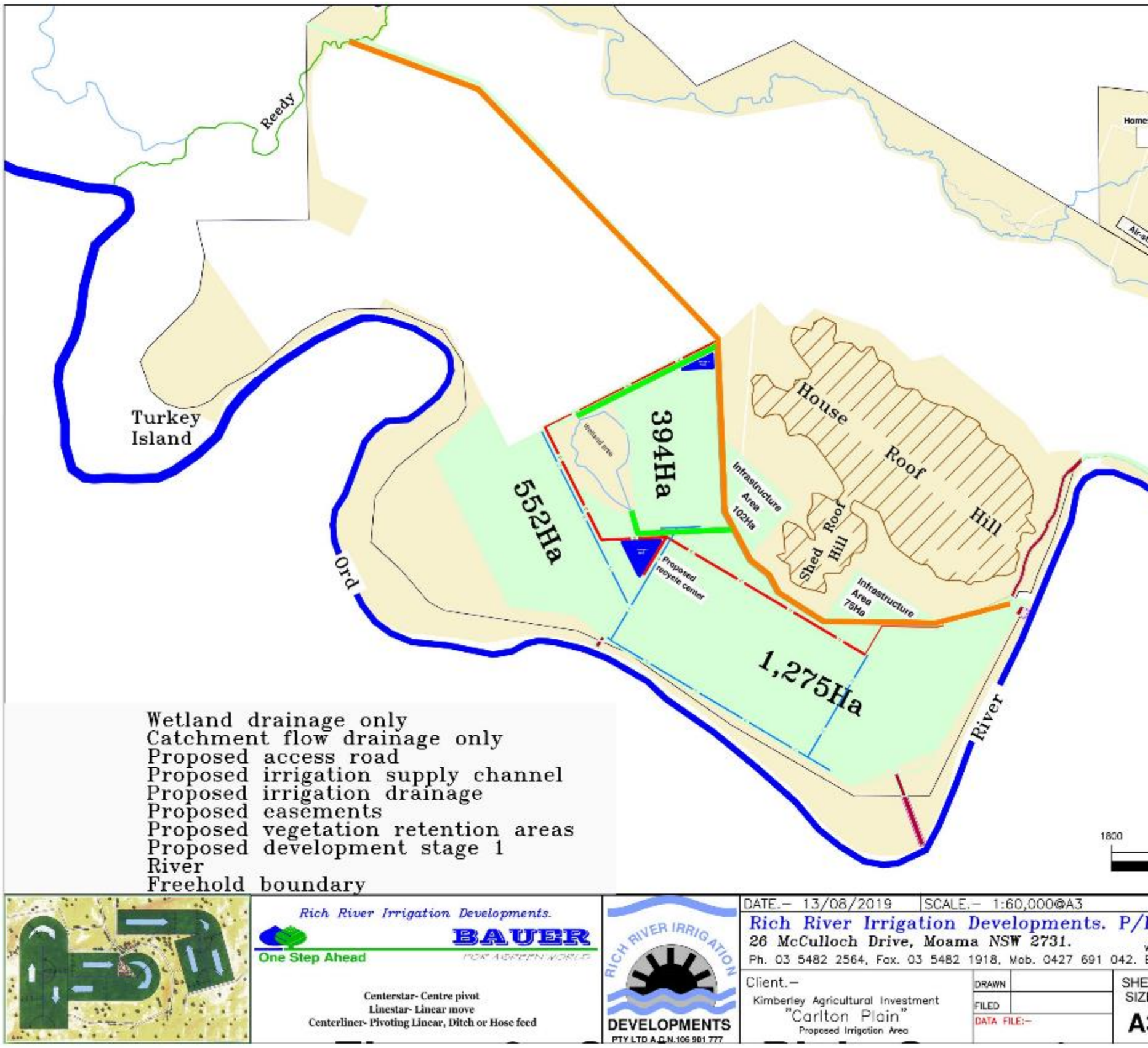
Element	Proposed extent
Surface and pressurized irrigation of annual and perennial crops, including infrastructure areas access, farm outbuildings, drainage and irrigation requirements.	2,945ha
TOTAL DEVELOPMENT AREA	**2,945ha**
Annual irrigation water usage (to be obtained under a Rights in Water and Irrigation (RiWI) Act 1914 licence	27.6GL
Specific inclusions	
Easements for river access (included in infrastructure area, above)	12ha
Water supply – Pump location (included in infrastructure area, above)	80m wide infrastructure corridor allowance
Tailwater recycling facilities (included in infrastructure area, above)	30ha
Access track [on-farm road] (included in infrastructure area, above)	50m wide infrastructure corridor allowance
Stormwater drainage (included in infrastructure area, above)	80m wide infrastructure corridor allowance
Farm outbuildings and worker accommodation	To be determined as required operationally

1.3 Environmental management design components

Environmental management requirements have been strongly incorporated into the proposal design. As reflected throughout this Environmental Management Plan (EMP), these include, but are not limited to, the following activities. Note that many of these activities are not only environmentally driven, they are also economically driven, thus the incentive for KAI as proponent to ensure the provisions are met is a commercial as well as an environmentally moral, ethical and legal one. Economic drivers will contribute substantially to ensuring the environmental management obligations are met. Key inclusions are described briefly below. Table 2 (Section 1.4) summarises KAI's approaches to the management of the environmental factors impacted by the proposal in relation to these and other design elements which address the environmental risks being managed. Section 2 provides further detail on each factor.

- There is approximately 6m natural topography, with westward, drainage (towards Reedy Creek), across the Carlton Plain Stage 1 area. The design complements the existing profile.
- Water supply will be pumped from the Ord River, under a RiWI Act 1914 licence, in compliance with the allocation rules established under the *Ord Surface Water Allocation Plan* (Department of Water, 2013). An application for this licence will be submitted once an environmental approval has been received.
- Tailwater (irrigation runoff) will be recycled through the farm system for environmental benefit and economic efficiency. Tailwater will not be discharged into the Ord River, Reedy (Collins) Creek or the wetland located on the Carlton Plain Stage 1 area.
- Fertiliser and farm chemical application will be undertaken in line with industry best practices. Testing of tailwater (which will be recycled on-farm) for nutrient and chemical properties will be undertaken as part of farm operations, to ensure water quality for farming and environment is maintained.
- Stormwater runoff, following the natural flow of the land (westerly, towards Reedy Creek) will only occur during the wet season.
- Farm design and irrigation drainage flow has been carefully scoped based on natural topography. A detailed concept plan in Appendix A provides an indicator of field flow and drainage towards a central tailwater recycling facility, from where pumping and return will occur. This map includes topographic data.
- Stormwater from farm areas will not enter the Carlton wetland, to ensure any farm chemical and nutrient residue does not enter the wetland. The drainage has been carefully designed to ensure this management feature is in place, as discussed in Section 2.5.
- Riparian management will be congruent with current practices, in order to achieve a balance between vegetation and erosion control, noting that woody weeds present along the lower Ord currently play a role in bank stabilisation. Reduced stocking will occur for environmental and commercial reasons (noting that cattle presence in or near cropping operations is not an ideal crop productivity outcome, it is in KAI's interest to ensure adjacent areas, such as riparian zones, are managed appropriately, with mutual environmental and economic outcomes).

Figure 3 - Carlton Plain Stage 1



1.4 Carlton Plain Stage 1 - Key environmental factors

Table 2 - Proposal factors, impacts and design inclusions to minimise environmental risk

Factor	Proposal activities which would affect the key environmental factor	Site specific environmental value, existing and/or potential uses, ecosystem health condition or sensitive component of the key environmental factor which could be affected	Summary of key design inclusions and management activities to minimise environmental risk
Flora and Vegetation	• Modification of land use from pastoral grazing to irrigated cropping – i.e, removal of cattle from the (already modified) landscape. • Clearing of existing vegetation. • Construction of farm drains, channels, pipelines, levee banks; roads and tailwater recycling infrastructure. • Introduction of crop plant species. • Access to Ord River bank for pump sites.	• Perennial wetland located at approximately 15.532748S 128.450449E. • Ord River, south, east and downstream of Carlton Plain.	• Retention of vegetation zones between areas of high conservation value (eg Ord River) and farming. • Removal of cattle from regular grazing on ~159ha wetland area. No tailwater drainage or discharge to the wetland area or Ord River during the dry season. Stormwater inflow only (as naturally occurs in the wet season).
Terrestrial Environmental Quality	• Clearing, development and drainage of land for agriculture and associated infrastructure.	• Surface and sub-surface soil condition and quality due to land use change and addition of irrigation water.	• Irrigation system design according to soil type and gradient.
Terrestrial Fauna	• Clearing of existing (predominantly low grade / weed dominated habitat due to historical land use). • Creation of additional wetland habitat with irrigation of paddocks and construction of tailwater retention facilities. • Removal of cattle from existing wetland and protection of wetland.	• Transformation of dry to wet habitat through creation of irrigation farms and associated water management infrastructure. • Protection of perennial wetland from existing grazing pressures.	• Removal of cattle from regular grazing on Carlton wetland.
Hydrological Processes	• Removal of perennial vegetation through clearing.	• Changes to drainage and surfacewater flows.	• Tailwater recycling and no tailwater discharge to Ord River during the dry season.

Factor	Proposal activities which would affect the key environmental factor	Site specific environmental value, existing and/or potential uses, ecosystem health condition or sensitive component of the key environmental factor which could be affected	Summary of key design inclusions and management activities to minimise environmental risk
		• Soil salinity and waterlogging risks on lower lying areas of Carlton Plain (not subject to this proposal).	Hillside drains to manage flood risk. • Utilisation of natural topography in drainage / flood management. • Continuation of wet season stormwater flow into existing perennial wetland.
Inland Waters Environmental Quality	• Irrigation tailwater may contain nutrients and/or farm chemical residue which, if not managed or held appropriately on farm, could affect downstream aquatic systems.	• Ord River, Reedy (Collins) Creek, Carlton wetland, groundwater aquifers.	• Tailwater recycling and no tailwater discharge to Ord River during the dry season.
Social Surroundings	• Changing land use from pastoral grazing to intensive agriculture has increased human activity and access.	• Aboriginal heritage sites located within the Carlton Plain freehold area (protected under Aboriginal Heritage Act 1972 and inclusions in the Ord Final Agreement – Indigenous Land Use Agreement).	• Heritage clearance secured through the Yawoorroong Miriuwung Gajerrong Yirrgeb Noong Dawang Aboriginal Corporation (MG Corp) prior to design finalisation.

Section 2: EMP provisions

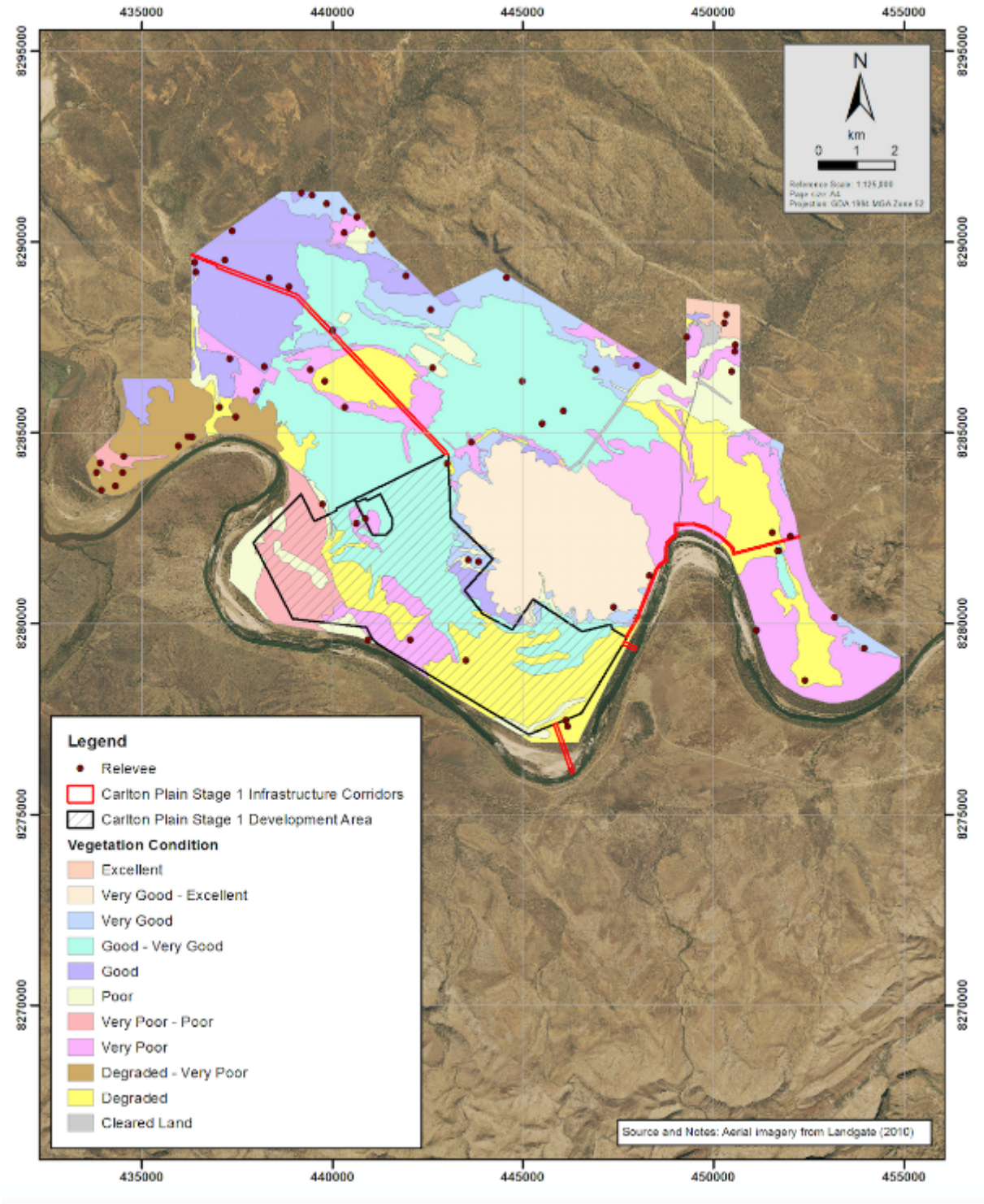
This section presents each factor, with an initial overview of relevant rationale, referrals to studies undertaken, the approach taken to determining appropriate provisions to be applied in managing the environmental risks associated with the proposed development, and other relevant information including assumptions or uncertainties. Further specific detail can be obtained from the Carlton Plain Stage 1 referral documentation.

2.1 Flora and vegetation

Level 1 flora, vegetation condition and weed coverage studies undertaken on Carlton Plain in 2016 (Woodman Environmental, 2016) form the baseline for future comparison and assessment. Referral documentation (KBC, 2017) and associated appendices provide relevant data and baseline mapping. There are no Threatened Ecological Communities on Carlton Plain Stage 1. No priority flora taxa have been recorded on Carlton Plain Stage 1. Over 60% of the 2,945ha identified for clearing for agriculture and associated infrastructure on Carlton Plain Stage 1 has been assessed as being in a degraded, poor, very poor or cleared condition. Approximately 40% has been assessed as exhibiting 20-80% weed coverage.

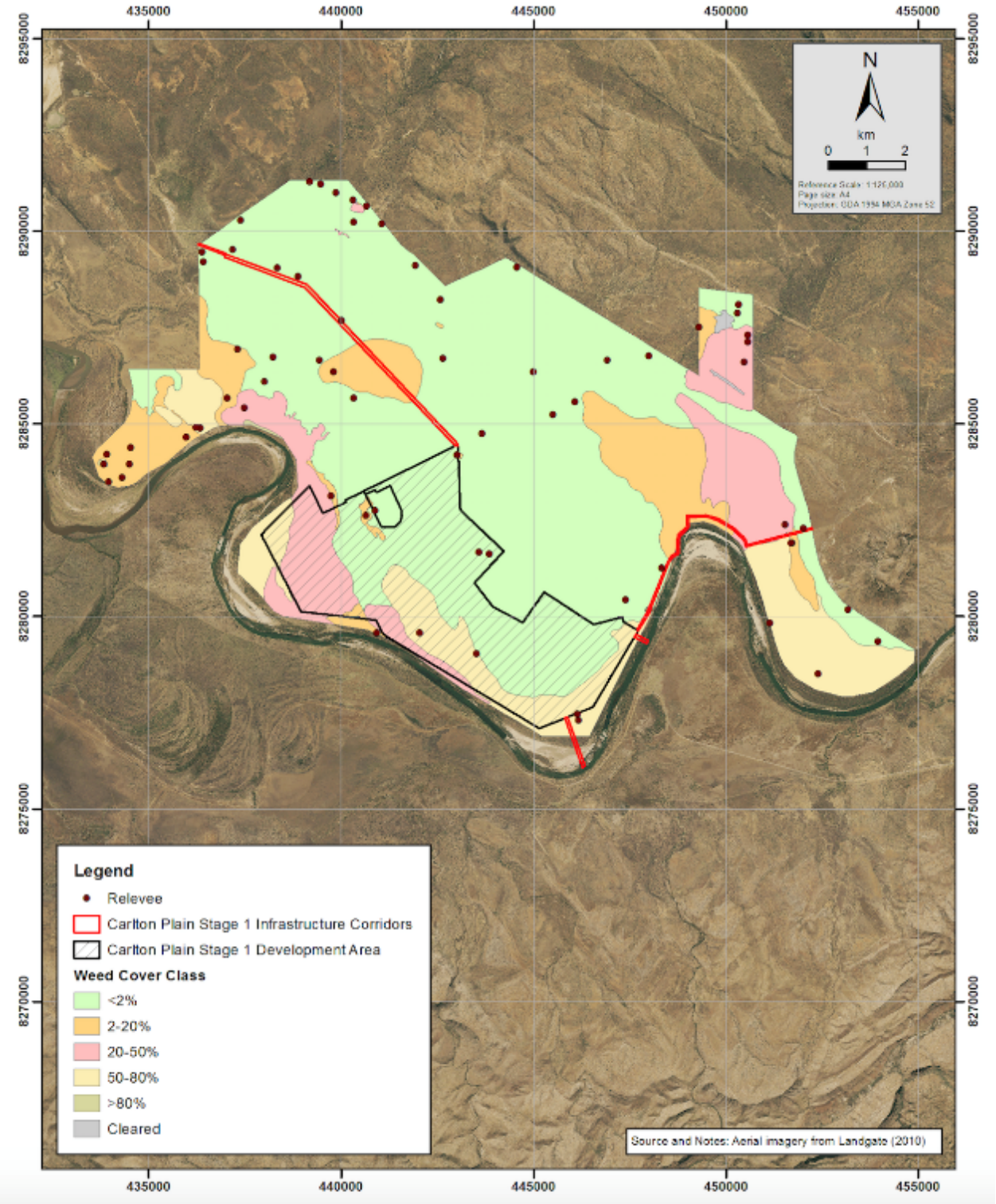
Figures 4 and 5 respectively indicate baseline vegetation condition and weed coverage:

Figure 4 - Baseline vegetation condition (2016)



(Source: Woodman, 2016)

Figure 5 - Baseline weed cover class (2016)



(Source: Woodman, 2016)

2.1.1 Ground disturbing activities

Ground disturbing activities will be undertaken in line with actions established for the Ord Stage II (Goomig / Weaber Plain) development. These acceptable practices address clearing boundary identification, topsoil containment, management and re-spread.

2.1.2 Riparian zone management

KAI will maintain minimum riparian zone setbacks and manage weeds within its freehold boundary, per the actions stipulated in Table 3. However, KAI cannot be responsible for weed control along the banks of the Ord River, primarily as it is not the holder of tenure on the Ord River and has no right nor legal obligation to do so. (Tenure is held by the Department of Water and Environmental Regulation).

Furthermore, given that there is in excess of 50 years of weed growth along parts of the river adjacent to Carlton Plain, including existing, substantial, aged declared weeds and Weeds of National Significance. As a downstream landowner, KAI is subject to the impacts and seed movement caused by land uses and users upstream, particularly where these have not been managed for decades and established 'weeds' (often tree size) assist in maintaining river bank stability. Although it is not the manager of the riverbank, KAI notes that should the tenure holder ever remove the weeds, bank stability will be at risk and scour erosion will occur.

In the portion of the riparian zone that is within KAI's control, KAI will do all that is possible to maintain the health and environmental integrity of the zone. It is not only ecologically and socially responsible to do this, but also economically advantageous that this area be maintained in healthy environmental condition, as further erosion of the Ord River, overgrazing by domestic or native animals (eg cattle or wallabies) or excessive weeds add future management risk and cost. [Note – it is not in KAI's interest to allow cattle near to its irrigated crops due to the risk of crop damage (consumption!) and infrastructure damage – for example, trampling of channels and drains. As such, for very pragmatic reasons, minimal cattle will be grazed within proximity of Carlton Plain Stage 1. This has economic and environmental benefits].

Fencing of the Carlton Stage 1 cropping area from Carlton Hill Station pastoral grazing will restrict cattle access to the river. Furthermore, with the addition of irrigation channels and irrigated crops to the Plain, it is likely that cattle will be less inclined to seek access to the river, with the attraction of water and green crops in accessible areas. KAI will manage this accordingly, through fencing and other control measures.

Riparian zones will be managed to minimise fire, weed, erosion and pest animal risks. Natural drainage is to the north-west, away from the Ord River, and thus any erosive scours in the riparian zone are likely to be caused by the Ord River itself rather than catchment drainage from the Carlton Stage 1 development. Riparian zone management activity is unlikely to prevent any natural erosion caused by the Ord River during the wet season.

Figure 6 illustrates riparian buffer distances, with a minimum setback of 100m from irrigated areas.

2.1.3 Weed management

KAI will manage weeds within the freehold boundary as required under the Biosecurity and Agriculture Management Act 2007 (BAM Act) and where it is otherwise able. Cattle will be utilised as occasional mechanical weed control agents in non-irrigated areas. This is addressed in the provisions in Table 3.

While it may not be desirable to allow cattle access to vegetation zones, in the dry tropic environment that is the Kimberley, with concentrated wet season rainfall, weed control becomes an essential activity. Given the proximity to the Ord River and the downstream wetlands, options available are mechanical (including occasional cattle grazing), or chemical controls. KAI does not wish to use chemical weed control measures in proximity to the Ord River or wetland area, through the vegetation zones. Control of woody weeds which are known to infest pastoral lease areas – and specifically Carlton Hill Station – including *Parkinsonia* (a Weed of National Significance) requires treatment with residual chemicals including *Triclopyr* (Garlon) or *Picloram* (Graslan). Other weeds require regular use of *Glyphosate*. Given the likelihood of continued weed growth if left unmanaged (see baseline mapping, Figure 5); exclusion of cattle from vegetation areas would result in the need for either mechanical (eg tractor-based) or chemical weed control. Using machinery will exacerbate erosion and is not a feasible option. Using chemicals is not environmentally responsible in close proximity to the Ord River or wetlands. Exclusion of cattle from the non-irrigated vegetation zones is thus not a practical option from a

weed management perspective.

2.1.4 Vegetation retention areas

'Vegetation retention areas' have been identified within the Carlton Plain freehold area (as illustrated in Figure 3) to buffer the surrounding areas from the impacts of irrigated agriculture. Carlton Plain is held in freehold by KAI and KAI will continue to graze the land that is not converted to irrigated agriculture. Monitoring of vegetation condition and weed coverage will be undertaken in line with the WA Rangelands Monitoring System (WARMS) – as outlined in Table 3 and Appendix B.

For the reasons discussed in Section 2.1.3, exclusion of cattle from the vegetation zones is not a feasible management option. However, given that it is not in KAI's interest to allow cattle to damage its irrigation infrastructure or eat its crops, it is a reality that KAI will minimise cattle numbers within the vicinity of Carlton Stage 1, and graze only sufficient numbers to control weeds within the vegetation retention areas. Annual condition inspections and reporting, as outlined in the provisions contained in Table 3, address this issue.

2.1.5 Decommissioning and rehabilitation

In the event that the irrigated agricultural system is to be decommissioned, KAI will return the land to its current dryland farming use, congruent with the surrounding landscape, but with the intention of improving the comparative condition and health of the native pastures, and reducing weed coverage. Priority management foci will include landform rectification to the natural state, topsoil retention erosion and weed control. Rehabilitation to native vegetation condition equal to or better than the baseline dry season condition recorded by Woodman (2016) will be undertaken within five years, through natural regeneration (topsoil seedbank) or direct seeding. Revegetation with seedlings is not anticipated due to the abundance of wallabies present on site and the expected low success rate of seedling revegetation. Infrastructure and assets will be recycled or utilised for alternative farming purposes wherever possible, or disposed of appropriately.

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Figure 6 - Carlton Plain Stage 1 Riparian Offsets

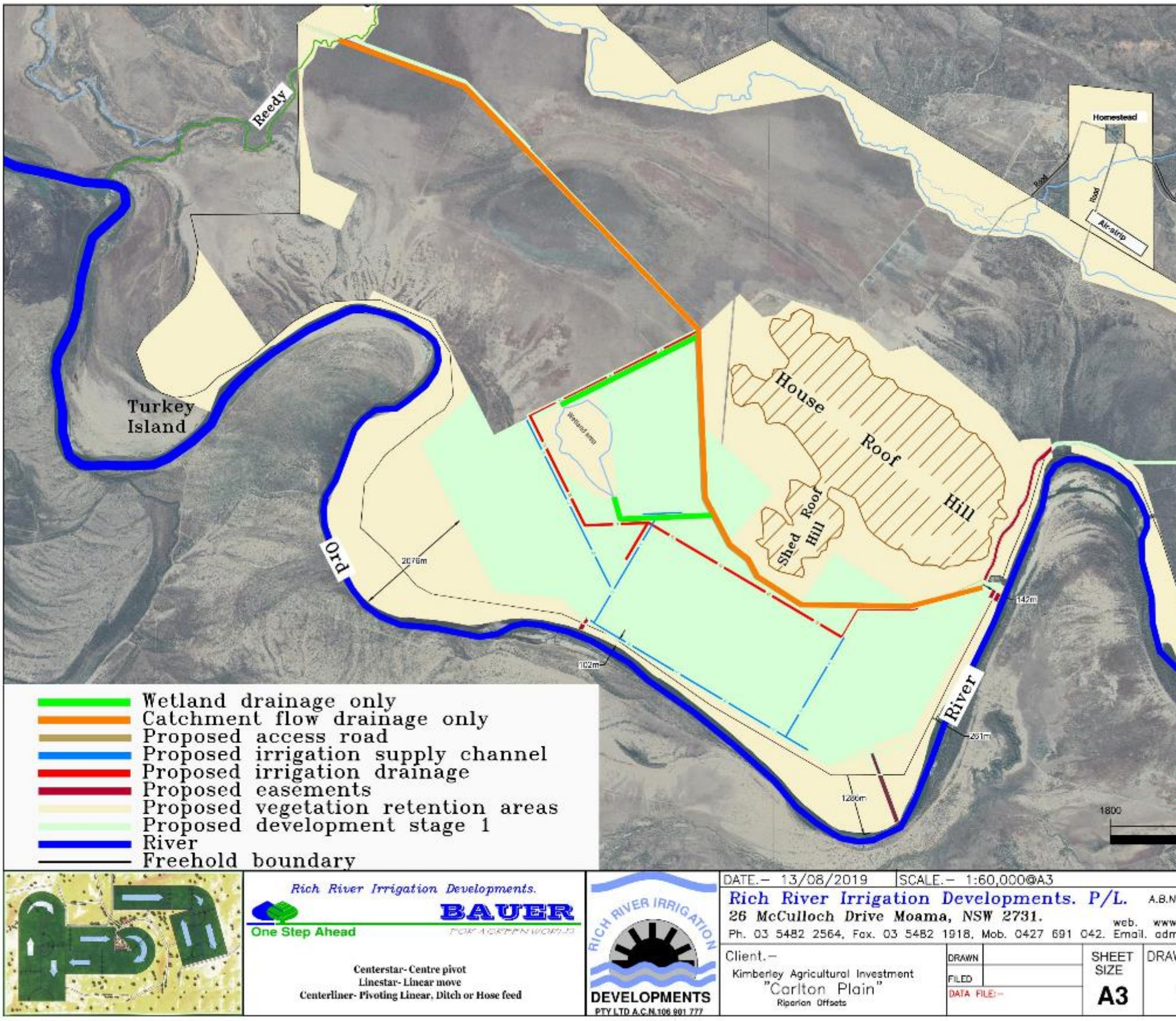


Table 3 - Flora and vegetation provisions

EPA Factor	*Flora and vegetation*
EPA objective	*To protect flora and vegetation so that biological diversity and ecological integrity are maintained.*
Carlton Plain Stage 1 objectives:	• To maintain and improve the ecological condition of the riparian vegetation along the Ord River, and in vegetation retention zones including House Roof Hill and Carlton wetland. • To minimise the impacts of irrigated cropping on adjacent vegetated areas. • To maximise the ecological corridor values of retained vegetation, while minimising weed infestation risks in the tropical environs.
Key environmental values	Flora and vegetation along Ord River, on House Roof Hill, and in nearby conservation reserves.
Key impacts and risks	Habitat loss, degradation and fragmentation; invasive species; inappropriate fire regimes.
Rationale for provisions	CP1.FV.1: Water and Rivers Commission (now DWER) WN12 (2000) recommended riparian corridor of 30-100m; Trayler Malseed and Braimbridge (2006) *Environmental values, flow related issues and objectives for the lower Ord River, Western Australia*: lower Ord pre- and post-dam riparian vegetation and habitat descriptions. CP1.FV.2, CP1.FV.3, CP1.FV.4: Baseline vegetation condition and vegetation community assessments, undertaken in the dry season of 2016, provide the basis for the extent and condition of habitat assessment in vegetation retention areas. Transect establishment surveys, based on WARMS methodology at a minimum of 5 sites, to occur in dry season 2018. Appendix B outlines the methodology. CP1.FV.2, CP1.FV.4: *Western Australian rangelands monitoring system for grasslands: field manual* (Department of Agriculture and Food Bulletin 4741) [WARMS] condition ratings to be applied in ongoing condition assessments and in the event of decommissioning. Modified WARMS methodology to be adopted per the provision detail. CP1.FV.3: *Standard Operating Procedure – Techniques for mapping weed distribution and cover in bushland and wetlands* (DEC Nature Conservation Service Biodiversity SOP No. 22:1) (DEC 2011).

Table 3 - Outcome-based provisions[2]	Flora and vegetation		
	Response actions	*Monitoring*	*Reporting*
CP1.FV.1 Establish a minimum 100m setback between the Ord River and the boundary of irrigated fields, for the purpose of maintaining riparian function and a biodiversity corridor. **Threshold indicator:** 100m minimum clearing distance from the Ord River with the exception of those locations where approvals and required easements to the Ord River for pumps and/or tracks are obtained.	In the event that seasonal river trajectory change impacts upon the ability to meet this [threshold] criterion in some locations, consult with DWER regarding the extent to which mitigation, *if any*, is required, to prevent encroachment of the Ord River into irrigated fields and the inability of the Proponent to inadvertently meet the 100m minimum setback requirement. **Management response**: Liaise with DWER Kununurra regarding cause (e.g., natural river realignment) and determine agreed response, *if any*, given that this provision is related to the initial clearing setbacks.	1. Inspect initial clearing to ensure boundary lines along the Ord River meet requirements. 2. Annual inspections post-wet season to ensure no significant riverine scours or riverine trajectory changes affect irrigated fields on narrow (~100m) boundaries or restrict biodiversity corridors. 3. Measurements to be undertaken using annual GPS field survey at narrowest points.	To be addressed in annual environment report (AER) to be prepared by the proponent and published to its website. Proponent to internally retain photographic records of scours or riverine trajectory changes which may impact upon ability to remain compliant with this criterion. Annual GPS field survey track logs to be retained. Proponent to report substantial changes to river trajectory to DWER Kununurra office within 60 days of wet season rains/flood events or when access becomes available.
CP1.FV.2 No decline in the long term vegetation condition rating in vegetation retention areas, based on initial 2016 dry season baseline surveys and subsequent 2018 transect establishment surveys. **Trigger indicator:** decline in vegetation condition rating in 60% of vegetation retention zone monitoring sites, as assessed during annual dry season inspections. Seasonal conditions including rainfall and fire will be taken into account in condition assessments. The WARMS condition assessment rating method will	Vegetation condition in any given season can be directly affected by one-off incidents such as wildfire and/or poor (or extremely erosive) wet seasons. **Management response**: In the event that condition declines in the vegetation retention areas in relation to the 2016 and subsequent (2018) transect establishment surveys, the proponent will: *1.* Remove cattle if overgrazing is considered a factor if condition has declined. *Occasional*	1. Monitoring program to be established per Appendix B. 2. Comparison of monitoring program outcomes will be made to findings of the WA Rangelands Monitoring System rounds occurring on neighbouring Carlton Hill and Ivanhoe (and other) Stations. This will enable comparison of localised (specific management) versus general regional environmental change	Summary of vegetation condition reporting (in line with the approach outlined in Appendix B) will be included in each AER to be prepared by the proponent and published to its website. Decline in vegetation condition ratings, per the threshold criteria, will be reported to EPA Services in DWER within 30 days of surveys being undertaken.

[2] *Provision codes are provided for KAI internal management and reference purposes only.*

Table 3 - Outcome-based provisions[2]	Flora and vegetation		
	Response actions	*Monitoring*	*Reporting*
be adopted. **Threshold indicator:** Decline in vegetation condition ratings in a given year, across all monitoring sites on Carlton Plain Stage 1, as assessed during annual dry season inspections, using the modified WARMS program as described in Appendix B, Table B1.3.	*use of cattle are considered essential as a mechanical weed management tool in lieu of chemical weed control, particularly in the vicinity of the Ord River and the Carlton Plain wetland area.* 2. Amend the fire regime if fire is considered a factor in vegetation condition decline. 3. Address weed management, per CP1.FV.3. 4. Establish [annual] targets for vegetation condition improvement based on the extent of variation from vegetation condition goal and current climatic seasonal conditions.	occurring.	
CP1.FV.3 No new Weeds of National Significance, Declared Pest weed species or introduced crop species in vegetation retention areas compared to 2016 dry season baseline surveys and 2018 transect establishment surveys. **Threshold indicator:** No new Weeds of National Significance or Declared Pest weed species established in vegetation retention areas.	Transect establishment and annual visual weed inspections to commence 2018. Triennial weed mapping to be undertaken commencing dry season, 2021. **Management response**: 1. Weed control to be undertaken as required under statutory obligations through the Biosecurity and Agriculture Management (BAM) Act 1987. 2. Physical (including grazing if deemed appropriate) or chemical treatment of declared weeds or Weeds of National Significance if found in Carlton Plain Stage 1 area during annual CP1.FV.2 condition monitoring. 3. Weed control/removal and/or rehabilitation of weed infested areas if weed coverage in vegetation retention areas is shown to	1. Annual inspection monitoring per CP1.FV.2. Photographic and documented records to be retained. 2. Triennial weed assessments in vegetation retention areas, beginning three years after commencement of the clearing and development of farmland (nominally dry season 2021). 3. Transects established under CP1.FV.2 to be assessed annually. Any new weed infestations to trigger further assessment and control per management response actions.	Photographic and documented weed monitoring records to be retained. Weed control records to be retained. Triennial weed survey findings to be reported in the relevant year's AER to be prepared by the proponent and published to the proponent's website. Threshold exceedance (100% of monitoring sites show increased weed coverage) will be reported to DWER within 30 days of surveys being undertaken. Where introduced crop species are identified in the Carlton wetland vegetation retention areas adjacent to the Carlton Stage 1 area, notification to the Department of Biodiversity, Conservation and Attractions

Table 3 - Outcome-based provisions[2]	Flora and vegetation		
	Response actions	*Monitoring*	*Reporting*
	increase. 4. Specific weed control mechanism to be determined on case by case situation, dependent upon location of weed, type of weed, and other environmental risks caused by removal of weed (e.g. exacerbated erosion). 5. In the case where introduced crop species are detected in the vegetation retention area: a) Remove the introduced crop species from the vegetation retention area; b) Investigate whether the species have spread to adjacent environmentally sensitive areas outside of the proponent's freehold area, or the Carlton wetland; c) If the proponent's investigations identify the spread of crop species to adjacent environmentally sensitive areas or the Carlton wetland, notify the Department of Biodiversity, Conservation and Attractions so that it can be determined whether further investigations are warranted for nearby environmentally sensitive areas, including the Parry Nature Reserve d) Where investigations show that the spread of introduced crop species into adjacent or nearby environmentally sensitive areas is attributable to this proposal, the proponent shall liaise with landholders to remove introduced crop species plants.		will occur within 30 days of identification.
CP1.FV.4 In the event that decommissioning is to occur, rehabilitate	Minimum 5-year post-irrigation targets to be applied to this provision are 'fair to good'	1. Detailed decommissioning plan to include rehabilitation	Post-decommissioning AER to include photographic and documentary evidence of

Table 3 - Outcome-based provisions[2]	Flora and vegetation		
	Response actions	*Monitoring*	*Reporting*
cleared land to a fair-to-good rangeland condition rating within five years of cessation of irrigation. **Trigger indicator:** Five years post-rehabilitation WARMS combined vegetation condition and soil erosion targets across 60% of all monitoring sites to have a minimum fair-to-good rating (based on Table B1.4 of Appendix B) [or equivalent Keighery scale 'good to excellent' vegetation condition rating]. **Threshold indicator:** Minimum rating of 'fair' under WARMS method [or equivalent Keighery method] is achieved in only 40% (or less) of all rehabilitation monitoring sites five years after decommissioning.	combined scores for vegetation condition and soil erosion, per the WARMS approach [Appendix B], with a 10-year post-decommissioning target of fair-to-good (WARMS) or Good-Excellent (Keighery scale [Woodman 2016]) across all rehabilitated areas. **Management responses** for decommissioning and rehabilitation will include: 1. Remove and appropriately recycle or dispose of all infrastructure include pipes, culverts and other farm equipment. 2. If not required for non-irrigation use of farm land, return land formation to original topography, per natural contours noted in Appendix B, including the in-fill of drains and channels and removal of hillside and other levee banks. 3. Post-irrigation land use to be congruent with surrounding land use. 4. Monitor for natural revegetation / re-growth and erosion, per methodology contained in Appendix B. In the event that the trigger indicator (60%) of sites do not meet the target condition rating after 5 years, or the threshold (minimum) indicator of only 40% of sites meets the required 'fair to good' rangelands combined erosion/vegetation condition status after five years, the following management	management and weed control. 2. Six-monthly rehabilitation inspections for species type, density, weed coverage, post-decommissioning. 3. Inspections to occur each dry season for five years following decommissioning, reducing to biennially (unless threshold indicator management responses are required), such that ten years' post- decommissioning rehabilitation assessment can occur. 4. Monitoring to include comparison with adjacent landscape through use of WARMS data from nearby sites.	rehabilitation response. Initial post-decommissioning AER to include evidence of appropriate reuse, recycling or disposal of infrastructure. Inability to achieve the threshold 40% 'fair' rating for rehabilitated sites within five years will be reported to DWER within 30 days of surveys being undertaken.

Table 3 - Outcome-based provisions[2]	Flora and vegetation		
	Response actions	*Monitoring*	*Reporting*
	responses will be implemented: 1. Undertake weed management to mitigate rehabilitation and revegetation efforts. 2. Reform land through mechanical means to reduce erosion/scouring if present. 3. Reduce or prevent grazing pressures through feral or domestic animals (cattle). 4. Amend fire regimes to reduce impact on natural regeneration. 5. Consider revegetation, topsoil re-spread (if available) or seeding if considered practicable. 6. Monitor effectiveness of mitigation efforts at beginning and end of each dry season until all monitoring sites meet target 'good' condition status under WARMS condition monitoring guide.		

2.2 Terrestrial environmental quality

The Carlton Plain concept farm design has been developed to the standards applied to the Goomig farmlands, previously approved by the State of Western Australia.

KAI has engaged irrigation planners with membership of the Irrigation Surveyors and Designers Group, the Irrigation Association of Australia, The Institution of Surveyors, and the Spatial Sciences Institute, to design and develop a modern, efficient irrigation system which minimises environmental risk, maximises water use efficiency and minimises ongoing operational costs, while enabling maximum agricultural production. The designers have over seventy years specialist irrigation design experience experience including the farm design work for Goomig and many other large irrigation developments. All aspects of the development design address environmental risk.

2.2.1 Soil erosion

Water erosion risk will be minimised through farm design, particularly in relation to flood water management. Every aspect of KAI's farm design is related to careful water management, drainage and avoiding scour. Failure to manage the erosion risk destroys the economic viability of the farming enterprise if resources are constantly diverted to repairing infrastructure. As such, the economic driver to minimise soil erosion is significant.

Wind erosion risk is not considered substantial due to crop coverage during dry season periods of higher winds.

2.2.2 Soil salinity

Soil salinity risk for the Carlton Plain Stage 1 area has been identified as low (Bennett, 2016; Soil Management Designs, 2017).

The detailed irrigation design will include the following components to ensure no in-field waterlogging from irrigation application or dry season stormwater events. This will assist with preventing groundwater ascensions and thus minimise soil salinity risk:

- Irrigation system developed to meet the size requirement for the farm, and including applicable gradient to soil type;
- Drainage design sizing, slope and location (based on soil type) for the transmission of drainage and stormwater off the fields into a clay lined recycle centre area (tailwater recycling facility);
- Carefully designed sizing and location (based on soil type) for water recycling and supply channel systems to capture and reuse irrigation drainage water and dry season storm water, to allow re-use of captured water;
- Carefully designed recycling pump capacity to allow for the management of drainage, recycled water and dry season stormwater;
- Monitored water application to crop use across the irrigation season; and
- Utilising soil moisture monitoring probes to measure optimum application times for irrigation events.

Differentiating Carlton Plain Stage 1 from Ord Stages 1 and 2 farming is the requirement for KAI to lift (pump) its water up to 20 metres from the Ord River to the fields requiring irrigation, rather than the low-cost gravity-fed irrigation system which occurs elsewhere. This is an expensive, diesel-powered operation which provides maximum incentive for KAI to pump only the amount of water that is necessary, to minimise wastage (and thus maximise efficiency), to retain as much water on-property as is possible, to maximise the quality of that water and to recycle. It is not cost effective to waste or pollute water and necessitate pumping more.

This difference is significant for all aspects of design and for all considerations of environmental impact. Greater efficiency, less water off, less water stored. Better water quality. More incentive to maximise water quality.

2.2.3 Soil sodicity

Soil sodicity risk, particularly on higher clay content soils, will be managed per the actions described in Table 4. Careful water application management, as noted through the points above (Section 2.2.2), will assist in matching water application to crop requirements, which will assist in lowering sodicity risk from irrigation water application.

It should be noted that as with all farmers, it is in the immediate and best interest of the Proponent, KAI, to monitor and manage all soil risks to ensure no productivity losses – which correlates with minimising environmental risks. The economic driver is also the environmental imperative and is a strong factor in ensuring compliance will occur.

2.2.4 Soils rehabilitation and decommissioning

Baseline soil condition testing will be undertaken at project commencement. In the event of decommissioning of the irrigation enterprise, remediation of soils to baseline quality range will be undertaken, utilising appropriate soil treatments.

Table 4 - Terrestrial environmental quality provisions

EPA Factor	*Terrestrial environmental quality*
EPA objective	To maintain the quality of land and soils so that environmental values are protected.
Carlton Plain Stage 1 objective:	To maintain soil productivity and to ensure no decline in soil quality, and in particular no increase in surface and sub-surface salinity on Carlton Plain Stage 1 and adjacent areas, as a direct result of the irrigation development.
Key environmental values	Surface and sub-surface soils. 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).
Key impacts and risks	Soil degradation risks including soil salinisation, soil sodification and other physical and chemical soil changes. 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. Higher (yet still moderate) soil salinity risk occurs to the west of the mid-point of House Roof Hill. Carlton Plain Stage 1 is considered the lowest salinity and sodicity risk in the broader Carlton Plain irrigation area. Soil salinity risk and modelled time to water table rise are presented in figures C.1 and C.2 in Appendix C. Sodicity risk on levee soils on Stage 1 is similarly considered lower than on higher clay content areas. Acid sulphate soil is not considered a risk in the Carlton Plain Stage 1 area, including in the drainage to Reedy Creek, as natural landform and shallow drainage will be utilised. Due to careful farm design, including “cut’n’fill” and laser-graded fields, maintenance of groundcover, and intended wet season cropping regimes, erosion is not considered to be a significant in-field risk. Carlton Plain Stage 1 is a small proportion of the catchment of Reedy (Collins) Creek. Erosion management will occur to minimise loss of topsoil.

EPA Factor	*Terrestrial environmental quality*
Rationale for provisions	CP1.TE.5: Triggers adopted are modified from those applied for soils managed under irrigation on the nearby Weaber Plain (Goomig) development, with triggers for mitigating action informed by the (former) Department of Agriculture and Food Western Australia Farmnote on managing dispersive (sodic) soils (Davies and Lacey, 2010). CP1.TE.6: (former) Department of Agriculture and Food Western Australia Farmnote on managing dispersive (sodic) soils (Davies and Lacey, 2010). Note that this also forms the basis of sodic soils management and environmental provisions applied to the nearby Weaber Plain (Goomig) development.

Table 4 - Outcome-based provisions	**Terrestrial environmental quality**		
	Response actions	*Monitoring*	*Reporting*
CP1.TE.5 Soil salinity levels do not exceed 400mS/m in surface or 600mS/m in subsurface soils. **Trigger indicators**: Trigger levels for soil salinity mitigation are as follows: • topsoils 300 mS/m (ECe) • subsurface soils 500 mS/m (ECe) *Crop yield decline may be utilised as indicator. Soil testing to be undertaken in the event of crop yield decline.* **Threshold indicators**: 400mS/m in surface or 600mS/m in subsurface soils.	Where an exceedance of a trigger value is identified for salinity for surface and sub soil, the following corrective actions will be implemented: 1. Identify the distribution of soil with salinity exceeding trigger levels and increase the sampling density to define the areas above the trigger. 2. Investigate the cause (which could include determining if salinity is due to a rise in the groundwater of whether the soil chemical status is deteriorating as a result of insufficient irrigation). 3. Verify the adequacy of the estimated leaching rate (approximately 100 mm/a) in controlling salinity.	Initial baseline samples, followed by annual soil testing at the end of each dry season following the commencement of irrigation, on a representative sampling regime to be established across soil types, and field locations and gradients. *Appendix C contains initial risk and procedural information, to be refined following baseline soil testing and establishment of soil test locations on farm and in vegetation zones in the 2018 dry season.*	Reporting by exception (that is, exceedances of triggers) in AER to be published on the proponent's website. In the event of exceedance of a trigger and the implementation of remedial response actions, corrective actions to be reported in subsequent AERs until rectification occurs. In the event that trigger levels are observed, the Commissioner for Soil and Land Conservation will be informed within 60 days.

Table 4 - Outcome-based provisions	Terrestrial environmental quality		
	Response actions	*Monitoring*	*Reporting*
	4. Identify whether remedial action is required, such as installation of drainage or pumping systems or higher water use agriculture. 5. Implement remedial actions on a trial basis in areas identified from distribution mapping.		
CP1.TE.6 Soil sodicity levels five years after commencement of irrigation do not exceed an Exchangeable Sodium Percentage (ESP) of 10 in surface soils or 15 in subsurface soils. **Trigger indicators:** ESP 6 in surface soils (<100mm) or ESP10 in subsurface soils (<600mm). *Crop yield decline may be utilised as an indicator. Soil testing to be undertaken in the event of crop yield decline.* **Threshold indicators:** ESP 10 in surface soils and ESP 10 in sub-surface soils.	1. Visually identify and/or map the distribution of soil with sodicity exceeding trigger levels. This may include initial identification through crop productivity decline. 2. Investigate cause(s) (which may include determining if changes are consistent with anticipated initial response to land use change, or whether soil chemical status is deteriorating as a result of insufficient irrigation). 3. Verify the adequacy of the estimated leaching rate (approximately 100 mm/a) in controlling sodicity. 4. Identify whether remedial action is required, such as application of recommended soil ameliorants. 5. Implement remedial action (such as the application of lime or gypsum) on a trial basis in areas identified by distribution mapping.	Initial baseline samples, followed by annual soil testing at the end of each dry season following commencement of irrigation on each farm lot. This provision has been established based on sodicity advice provided by the Department of Agriculture and Food Western Australia (2009) for soil ESP on wheatbelt clay soils. Revision of this provision may be sought upon review of baseline data.	Reporting by exception (that is, exceedances of triggers only) in AER to be published on the proponent's website. In the event of exceedance of a threshold and the requirement to implement responses, corrective actions are to be reported in subsequent AERs until rectification occurs. In the event that trigger levels are observed in samples taken, the Commissioner for Soil and Land Conservation will be informed within 60 days.

Table 4 - Management-based provisions			
	Management targets	*Monitoring*	*Reporting*
CP1.TE.7 Soil erosion (scour) is minimised where possible on fields, flood protection levees, drainage and other significant infrastructure affecting project environmental outcomes.	**Objective**: Scour risk occurs following significant erosion (rainfall) events. The objective is to minimise any exacerbation of this risk due to the development of farms and the construction of irrigation infrastructure. Farm design has been carefully undertaken to ensure risk is minimised at the outset. *Note that this management requirement is triggered by natural events (generally wet season flooding) but must be managed effectively at the commencement of each irrigation season in order that the irrigation and drainage management, and tailwater recycling system can function as designed. This provision is thus fundamental to the successful implementation of the EMP.* **Management actions**: 1. Assess erosion damage at end of each wet season. 2. Repair any damage to infrastructure and fields. 3. Review and if necessary modify design implications to ensure future wet seasons do not result in same environmental or infrastructure outcomes. 4. Record actions undertaken to repair erosion and prevent future damage. **Targets**: 1. No scours or severe erosion caused by design of irrigation infrastructure. 2. All wet season erosion is repaired prior to commencement of irrigation season in the local area in the dry season immediately following. 3. Nominal target completion dates May/June each year, subject to seasonal conditions.	Visual monitoring post-wet season. Annual inspection (March/April). Monitor completed works for structural soundness in subsequent seasons.	Response and management of significant weather-related environmental impacts is to be addressed in AER to be prepared by the proponent and published to website. Compliance reporting will be incorporated into the AER provide to DWER.
CP1.TE.8 Collect baseline soil samples across representative soil types in irrigation and non-development areas, prior to commencement of irrigation.	Collect baseline soil samples prior to commencing irrigation. Sampling to include EC, pH, ESP, nutrients, across irrigation and vegetation zones. Soils sampling procedure is contained within Appendix C (section C.3).	Sites and sampling regime to be established and recorded for future reference.	Compliance with soil sampling requirements to be included in the AER.

2.3 Terrestrial fauna

2.3.1 Impacts to conservation significant fauna

Conservation significant fauna known to be present within the region include migratory birds and (non-terrestrial) aquatic fauna in the Ord River. These have been widely documented. KAI will comply with the *Ord Surface Water Allocation Plan* (DoW, 2013) abstraction rules, which have been developed with full assessment by State and Commonwealth governments of the impact on aquatic Matters of National Environmental Significance (MNES) present in the Ord River. There will be no dry season discharge to the Ord River. All tailwater will be recycled. There is an economic imperative for doing to (the cost of pumping water from the Ord River is more expensive than recycling it – which will ensure that recycling occurs). Any stormwater flow to the Ord system will only occur during the wet season, downstream of the tidal interchange, through the Reedy (Collins) Creek confluence, where maximum dilution will occur.

Modification of the landscape through the introduction of irrigated crops and additional water sources has been shown to increase native birds and mammals, particularly migratory birds listed under the Commonwealth Environment Protection and Biodiversity Conservation (EPBC) Act 1999.

The implementation of management practices which have been deemed by the EPA and the Commonwealth Department of the Environment and Energy 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. As discussed in other sections of this EMP, 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.

2.3.2 Pest fauna species

Pest fauna management will be undertaken within the statutory requirements of the Biosecurity and Agriculture Management Act 2007 or the Wildlife Conservation Act 1950.

Table 5 - Terrestrial fauna provisions

EPA Factor	*Terrestrial fauna*		
EPA objective	To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.		
Carlton Plain Stage 1 objective:	To maintain and enhance habitat for terrestrial and avian fauna species, in particular migratory birds listed as Matters of National Environmental Significance.		
Key environmental values	Terrestrial and avian fauna listed as Matters of National Environmental Significance, including migratory birds.		
Key impacts and risks	Clearing of vegetation and introduction of additional water to the landscape changes fauna habitats. Native bird populations are known to increase, including migratory birds.		
Rationale for provisions	CP1.TF.9: Maintaining habitat quality includes management of pest animals to minimise grazing pressure (whether from domestic, pest or native animals), in balance with objectives related to weed control and erosion, and targets for improved native vegetation condition. Appropriate licences will be secured and best practice advice on fauna management will be obtained from the Departments of Water and Environmental Regulation (DWER), Biodiversity, Conservation and Attractions (DBCA), and Primary Industries and Regional Development (DPIRD) as required.		
Management-based provision			
	Management targets	***Monitoring***	***Reporting***
CP1.TF.9 Control pest or plague fauna as required to minimise negative environmental impacts.	Native vegetation and habitat destruction in vegetation and riparian zones is reduced to a sustainable or locally acceptable level. Control pest or plague fauna through restricting access (where possible) including mustering, or culling if necessary (with appropriate licences if required). CP1.FV.2, CP1.FV.3 and CP1.FV.4 native vegetation and weed management objectives are supported through plague fauna management.	Regular visual monitoring as part of ongoing farm management. See also vegetation monitoring guide provided in Appendix B. Record pest fauna damage and numbers (where possible) including that caused by birds, wallabies and cattle.	Include any fauna pest control summary information in AER. Document mitigation efforts and outcomes. Pest fauna management will be reported to DBCA and licences obtained if required.

2.4 Hydrological processes

2.4.1 Surface water use

KAI will apply to the Department of Water and Environmental Regulation (DWER) for an annual water entitlement, consistent with the *Ord Surface Water Allocation Plan 2013* (Department of Water, 2013) and the requirements of the Rights in Water and Irrigation (RiWI) Act 1914. A nominal allocation of 115GL (with a 95% reliability) has been indicated for the Carlton Plain and Mantinea agricultural areas[3]. KAI has engaged in preliminary discussions with the DoW relating to securing an annual water entitlement, location of pumping stations, and compliance with Ord River water quality requirements. These discussions will continue throughout 2017 and 2018 and appropriate water licences will be sought.

Given that the allocation for this geographic area is included in the *Ord Surface Water Allocation Plan 2013,* that the Ord system is neither overallocated nor nearing overallocation, and that KAI has tenure or an option over the entire Carlton-Mantinea sub-area, access to water is not considered to be a restricting factor for this development. Thus, priority is on securing environmental approval.

KAI will seek an annual water entitlement of up to 27.6GL for the Carlton Plain Stage 1 area, as discussed in the referral documentation (KBC, 2017) and presented in Table 6. Crop water usage requirements will be negotiated with the DWER under the RiWI water licensing requirements. An operating strategy, including monitoring and reporting requirements, will be agreed under the license arrangements. A streamlined annual report, integrated with the reporting referred to in this EMP, will be prepared.

Table 6 - Anticipated crop water use: Carlton Plain Stage 1

Crop type and usage consideration	Total usage (megalitres - ML)
Annual cropping under surface irrigation:	
1,742ha @ 8 ML/ha (e.g. cotton)	13,936
40% double cropping = 696.8ha @ 6 ML/ha	4,181
Distribution losses @ 10%	1,812
Perennial cropping under pressure irrigation:	
510ha @ 15 ML/ha (e.g. mangoes / citrus)	7,650
TOTAL WATER REQUIREMENT CARLTON PLAIN STAGE 1	**27,579ML**
	~ *27.6GL*
AVERAGE WATER REQUIREMENT PER HECTARE	**12.25ML/ha**

KAI notes that the Carlton Plain Stage 1 development is *downstream* of the Tarrara Bar gauging station, where a minimum dry season (environmental) flow of 42 cubic metres per second (m3/s or cumecs) is required under the *Ord Surface Water Allocation Plan 2013.* This flow rate is regulated through the Kununurra Diversion Dam by Water Corporation. KAI will negotiate water release requirements with Water Corporation when a licence is secured through DWER under the RiWI Act. Metering on pumps will be undertaken as required by the DWER under licence conditions.

Abstraction rates will be congruent with the release negotiated with Water Corporation and any RiWI licence issued, such that the 42m3/s flow rate at Tarrara Bar is maintained as required under the *Ord Surface Water Allocation Plan 2013.* In the event that DWER applies seasonal restrictions on water licence holders in under the

[3] In relation to the 115GL nominally allocated to the Carlton-Mantinea sub-region under the *Ord Surface Water Allocation Plan*, KAI is the freehold owner of the entire Carlton Plain proposed irrigation area, and has a development option with the WA government over the Mantinea lease area, in addition to holding pastoral leases around both properties. KAI does not envisage any future water demand conflicts for the remainder of the 115G nominal allocation.

Ord Surface Water Allocation Plan 2013, KAI will adhere to this requirement under any licence that is issued.

2.4.2 Floodplain management

Three considerations in relation to flood management have been factored into the design of the Carlton Stage 1 development:

2.4.2.1 Catchment interaction with the Ord River

The existing topography falls from east to west throughout the area, with approximately six metres of natural fall throughout the Stage 1 development area. The design thus compliments the existing profile of the area. Pumps and infrastructure (eg diesel tanks) will be located above the 2006 flood level, as marked at Macka's Barra Camp. There are no impediments to flood flow proposed due to the main supply channels following the natural topography of the site and flowing to the west.

Figure 7 illustrates the movement of surface water across Carlton Plain Stage 1, incorporating natural catchment flow with farm design, and indicating the movement of flow away from the Ord River, towards Reedy Creek.

2.4.2.2 Watershed from vegetation retention areas and House Roof Hill

To the north of the proposal (House Roof Hill), hillside drains will manage the watershed and contain flows, directing these as close as possible to traditional paths, including the flow of water to the Carlton wetland.

On the south and east sides of the development, the main supply channel and road are located on the 'high line'. The storm water external to the irrigation area naturally flows away from the proposed development, towards the Ord River.

Hillside drains proposed for flood management are illustrated in Figure 8. This figure provides a westward facing perspective to augment the surface water plan provided in Figure 7.

2.4.2.3 Internal (farm) storm water management

Wet season stormwater will be captured in the farm drainage system and will enter the hillside drainage system. Farm stormwater will not pass through the wetland, so as to not deposit farm nutrients or any residual agricultural chemicals into the wetland. Farm stormwater will drain away from the site through the western portion of Carlton Plain into Reedy (also known as Collins) Creek – which is the natural way that the storm water in this area flows. In the event of unseasonal (dry season) stormwater flows, recycling and pump capacity has been designed to be sufficient to ensure on-farm capture, to minimise loss of nutrient-enriched stormwater from farms.

Figure 7 - Carlton Plain Surface Water Plan

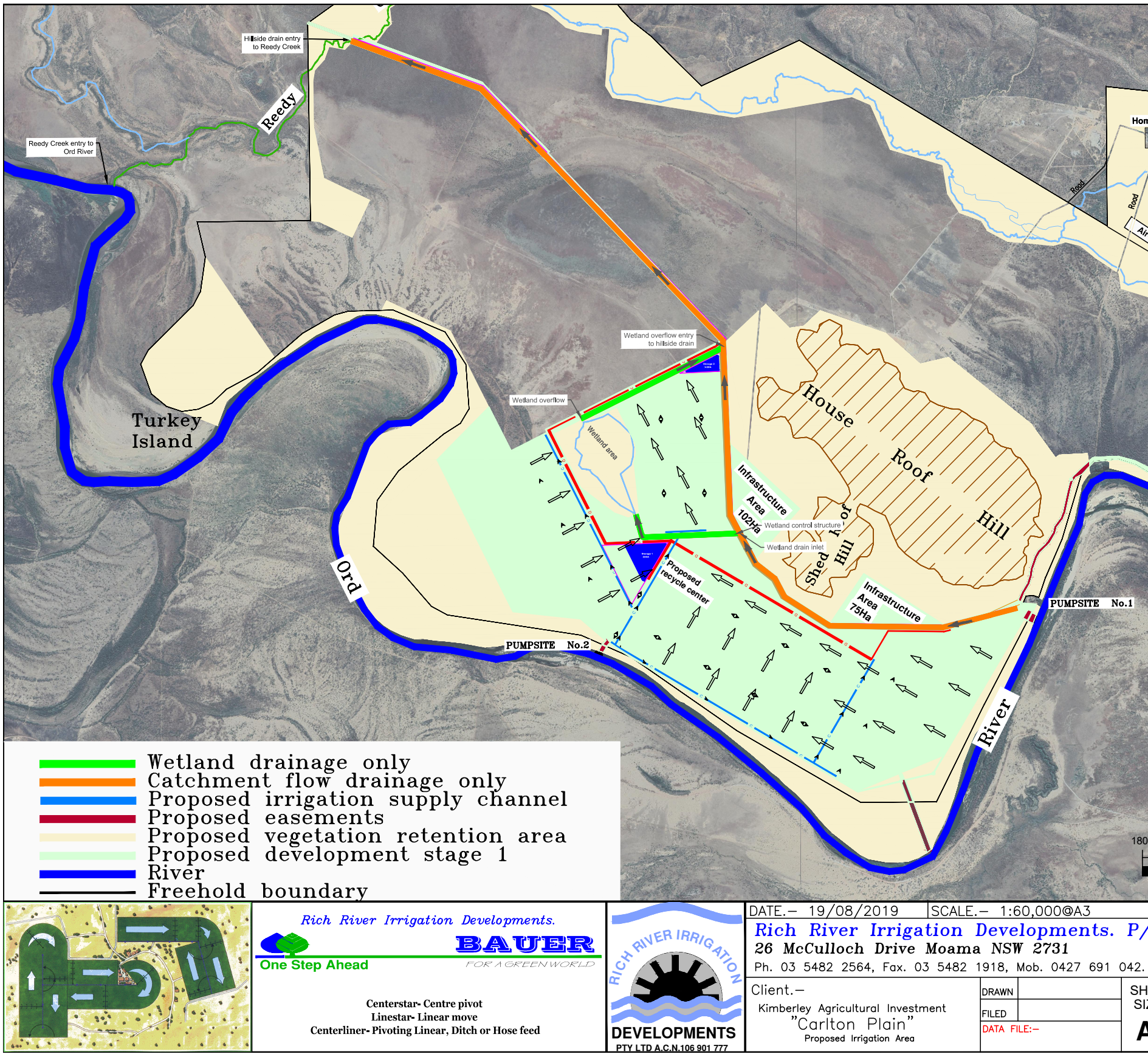
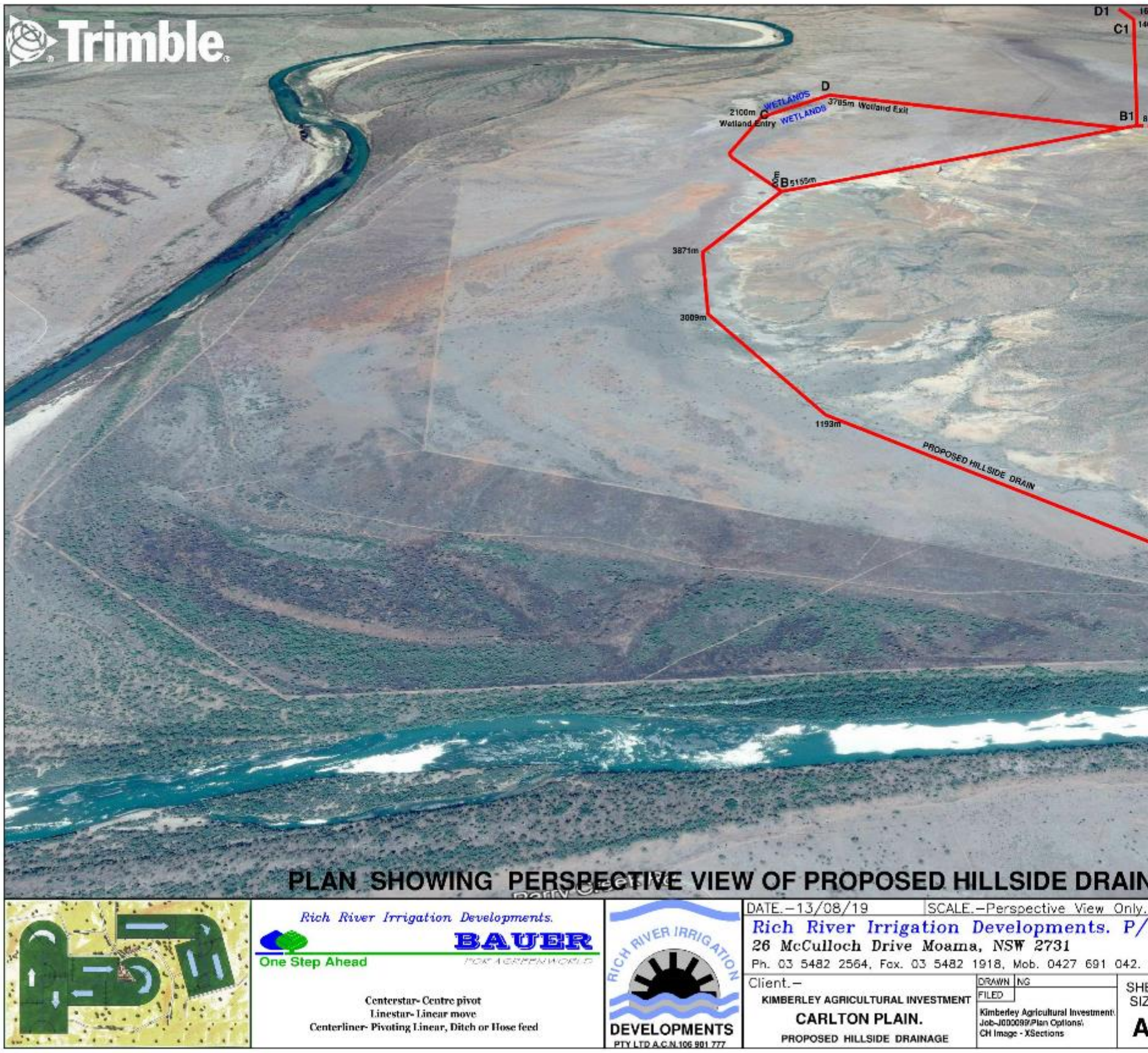


Figure 8 - Hillside drainage for flood water management



2.4.3 Groundwater management

The Carlton Plain Stage 1 area is not considered to be at high risk of groundwater salinity (Bennett 2016; Soil Management Designs, 2017), as discussed in the referral documentation (KBC, 2017). Water table monitoring is being undertaken, including the use of dataloggers to understand the extent (if any) of tidal influence and Ord River connection with groundwater across the Carlton and Mantinea Plains, will be undertaken, along with an initial baseline and ongoing water quality monitoring program.

Due to the low groundwater risk on the Carlton Stage 1 area, it is not expected that deep drainage for salinity mitigation will be required in this development area. Acid sulphate soils are therefore not expected to be exposed.

Groundwater monitoring undertaken under the provisions of this EMP will inform future proposed developments on other parts of the Carlton and Mantinea Plains, for which groundwater risk is considered higher than on the Carlton Stage 1 project.

Figure 9 illustrates current and proposed bore locations to be utilised in the baseline and ongoing monitoring program. Monitoring has commenced on existing bores, where accessible and structurally sound.

Appendix D provides the groundwater monitoring regime which has been adopted on the nearby Goomig farmlands (after Lillicrap et al, 2015), which is proposed for modification for application to Carlton Plain. Bores have and/or are proposed to be established as follows –

- **High intensity bores**: *including dataloggers*. All Carlton Plain Stage 1 bores will have dataloggers installed and be re-bored in the 2018.
- **Low intensity bores**: *do not include loggers, but are tested for depth and quality. There will be no 'low intensity' bores on Carlton Plain Stage 1.*
- **Reference bores**: *not located on the development area. Nearby DWER-owned Mantinea bores are considered to be regional reference bores in this context. Water quality sampling by KAI has been undertaken on Mantinea since 2016. DWER and its predecessors have monitored regional bores for decades.*
- **Pumped groundwater discharge bores**: *to be installed if groundwater pumping is ever required.*

In the case of Carlton Plain, it is not anticipated that groundwater pumping and discharge will be required, based on the risk assessment, as mapped in Appendix C. In the event that indications of groundwater rise are noted, KAI will manage through the use of deep-rooted perennial (tree) crops wherever possible.

2.4.4 Ord River bank disturbances

Figure 10 illustrates the proposed locations of pump and Ord River access track sites.

Figure 9 – Monitoring bore locations: Carlton Plain

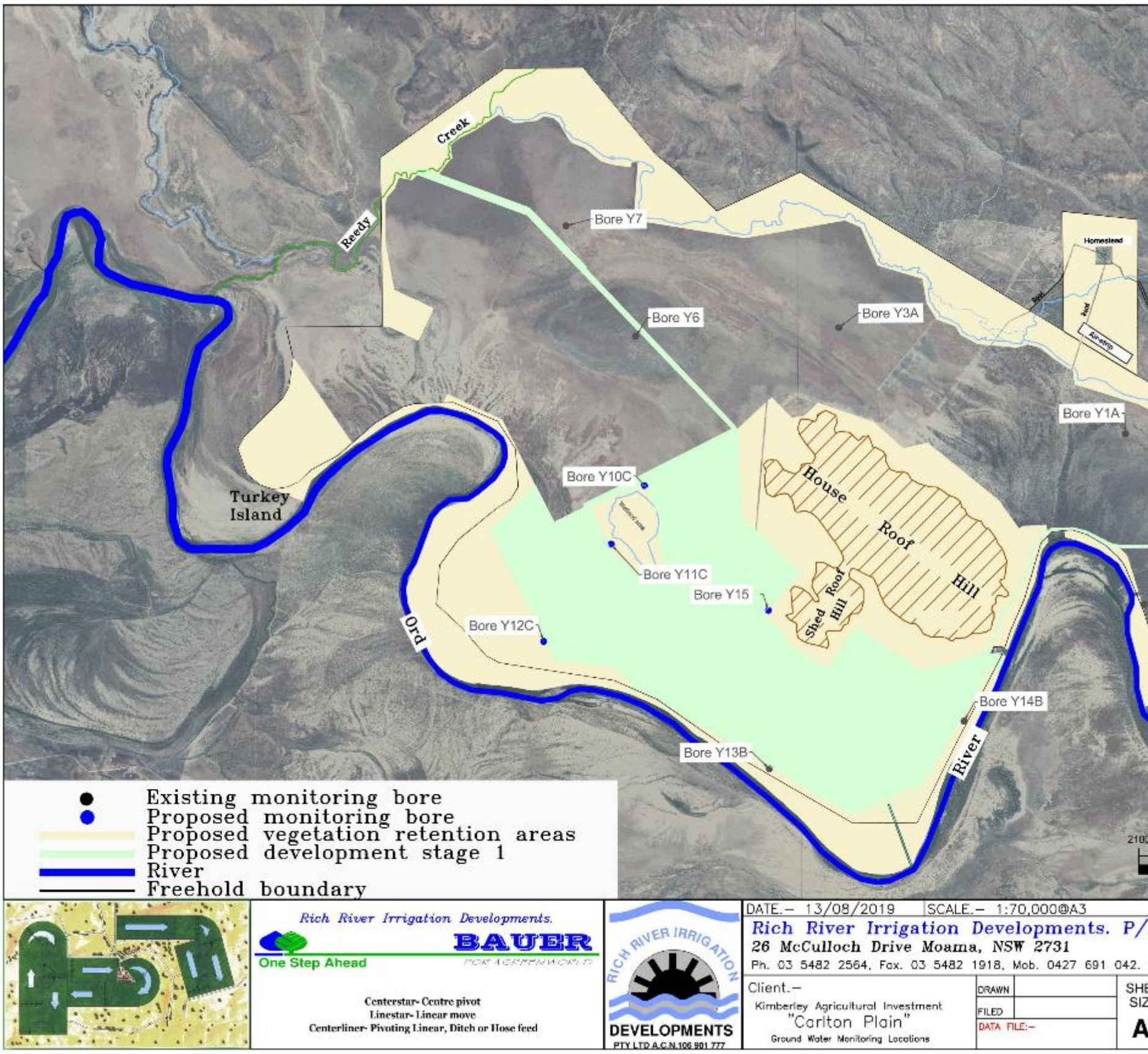


Figure 10 - Proposed locations of Ord River bank disturbances

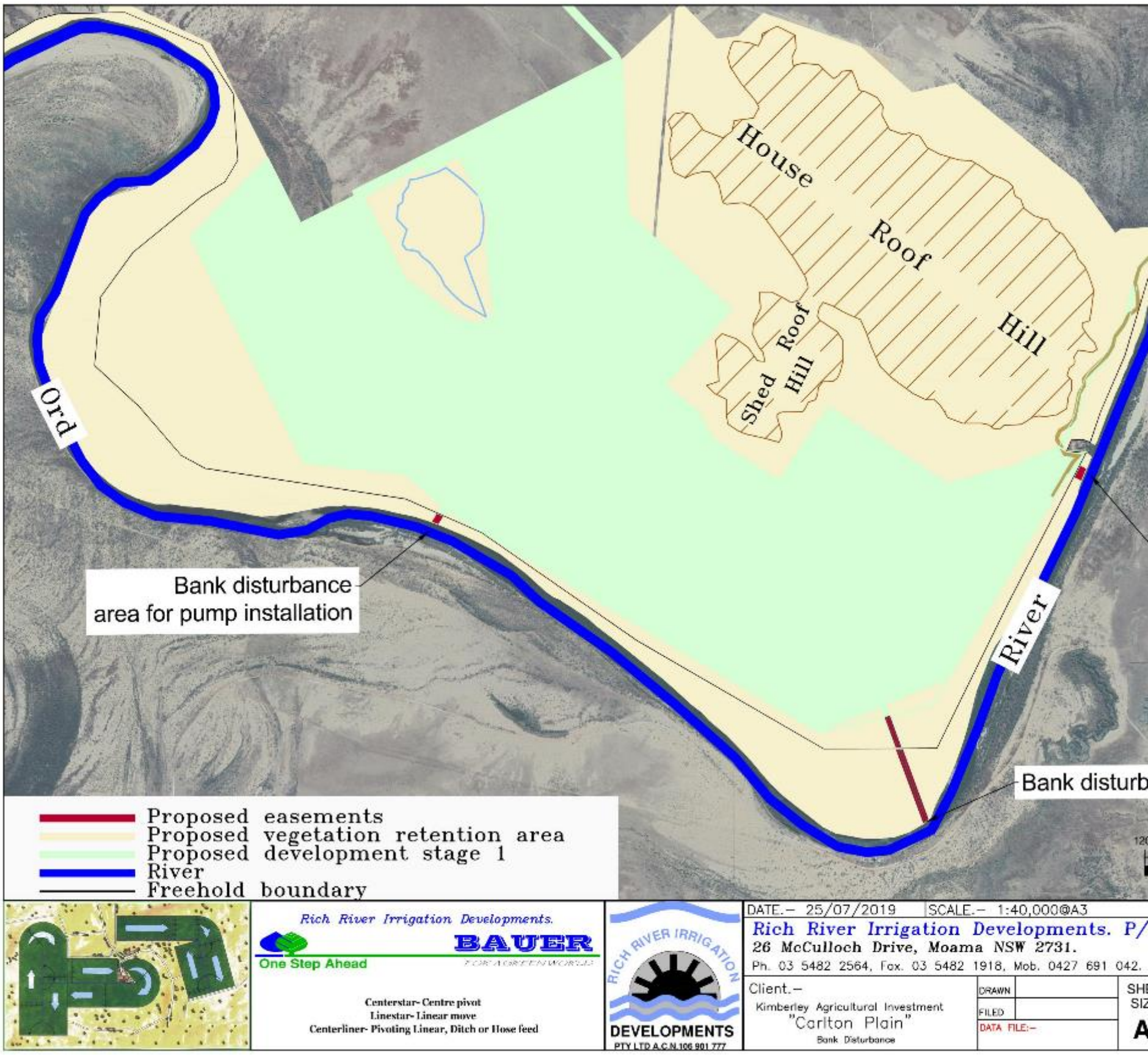


Table 7 - Hydrological processes provisions

EPA Factor	*Hydrological processes*
EPA objective	To maintain the hydrological regimes of groundwater and surface water so that environmental values are protected.
Carlton Plain Stage 1 objectives:	To comply with the provisions of the *Ord Surface Water Allocation Plan 2013* in relation to the Carlton-Mantinea sub-area; to ensure flood management does not negatively impact upon environmental values or farm infrastructure; and to ensure that depth to groundwater under Carlton Plain is not negatively impacted by the development of the Stage 1 area.
Key environmental values	Surface and groundwater dependent ecosystems, including those associated with the Ord River and wetlands in the lower Ord environs. Aquatic fauna listed under the EPBC Act 1999, which may be present in the Ord River. Water quality supporting environmental, social/recreational (including fishing) and agricultural uses.
Key impacts and risks	Groundwater: groundwater rise and associated salinity and waterlogging. Further illustration of groundwater risk is provided in Appendix C. Surfacewater: fresh water flow regimes in the lower Ord River and associated wetlands (including Carlton wetland). Floodplain management: scour and erosion; turbidity and sedimentation downstream to Reedy Creek in the wet season.
Rationale for provisions	CP1.HP.10: Groundwater: Adoption of the processes and monitoring regime implemented in the nearby Weaber Plain (Goomig) and Knox Creek Plain areas under the requirements of EP Act 1986 and EPBC Act 1999 approvals, informed by Lillicrap et al (2015) and CyMod (2014). Guidance provided by preliminary groundwater assessments of Carlton Plain (Soil Management Designs, 2017) and Mantinea (Raper et al, 2014). CP1.HP.10: Ord Irrigation Cooperative (OIC) Ord Stage 1 Licence to Take Water SWL156287(3) groundwater trigger level 2mbgl has been endorsed by DWER and the State Administrative Tribunal and is thus considered an acceptable threshold within the Ord River catchment. See Appendix E. CP1.HP.11: Floodplain management: Best practice irrigation management, including elements based on the Weaber Plain (Goomig) design, and Murray-Darling Basin irrigation management. Refer to Section 2.4.2 and Figures 8 for explanation of flood management design. CP1.HP.11: Kununurra airport longterm mean annual rainfall 871.7mm; median annual rainfall 757.9mm. Wyndham long term mean annual rainfall 856mm; median annual rainfall 684.7mm. 'Average rainfall wet season' therefore considered to be 700-900mm in this location, midway between Kununurra and Wyndham.

Table 7 - Outcome-based provisions	Hydrological processes		
	Response actions	***Monitoring***	***Reporting***
CP1.HP.10 Undertake a groundwater monitoring program to observe changes in depth, and to better understand the water balance and connection between Carlton Plain Stage 1 groundwater and the Ord River. **Trigger indicator:** Groundwater depth 3 metres below ground level (mbgl). **Threshold indicator**: Groundwater depth 2mbgl	**Management responses:** • Manage water levels to remain below the root zone of crops – through irrigation techniques, use of trees in the farming system, pumping (ie, dewatering, per the provisions allowed for on the nearby Goomig development), or deep drainage. • In the event that saline water accretion occurred and discharge was required, disposal downstream below the tidal zone, subject to water quality assessment and approval by DWER, would be considered. *Further response actions will be determined upon analysis of logger data three years after installation. Preliminary analyses indicate low groundwater risk in the Carlton Stage 1 area and a very low likelihood of groundwater reaching 3m SWL within 20 years.*	Groundwater monitoring for depth and water quality, utilising the regime recommended by Lillicrap et al, 2015 for the nearby Goomig farmlands (refer to Appendix D). Bores on Carlton Plain Stage 1 will be re-bored and have data loggers installed in 2018. New bores as indicated in Figure 9 will also be installed. Locations: Initially as per Figure 9, with modifications considered (and reported in the AER) as farms are constructed. Management action review: Triennially.	Groundwater monitoring will be addressed in AER to be prepared by the proponent and published to its website. Regular reporting will confirm that monitoring has occurred. Detail on findings will be provided by exception – that is, where anomalies occur they will be reported. Threshold reporting will occur should groundwater depth rise to 2mbgl. DWER will be advised should groundwater levels near trigger or thresholds. Groundwater monitoring records will be retained.

Management-based provision			
	Management targets	***Monitoring***	***Reporting***
CP1.HP.11 Hillside drainage and internal stormwater drainage network maintained such that there is no tailwater flow through Carlton wetland in any dry season or stormwater flow through the wetland in an average rainfall wet season.	No flow of tailwater into Carlton wetland during the dry season. Minimal flow of stormwater into Carlton wetland during the wet season. Repair hillside drain or internal drainage network in the event of above average rainfall or intense storm event causing farm tailwater or stormwater flow through Carlton wetland.	Annual post-wet season inspections to occur to assess any erosion damage to infrastructure which may result in water from irrigation farms entering Carlton wetland. In the event of dry season flow to Carlton wetland, water quality samples to be taken, with testing for farm chemicals (nominally Atrazine), total N and total P, EC and pH. Samples to be compared to routine testing taken under CP1.IW.14.	Post- wet season drainage maintenance be addressed (by exception) in the AER to be prepared by the proponent and published to website. That is, only extreme events causing compliance issues or triggering contingency action responses to be included in AER. Inspection and maintenance records to be maintained. Photographic evidence to be retained. Water quality monitoring records to be retained where necessary and reported to DWER.

2.5 Inland waters environmental quality

2.5.1 Groundwater quality

As discussed previously, Figure 9 illustrates current and proposed bore locations to be utilised in the Carlton Plain Stage 1 groundwater monitoring program. Monitoring has commenced on existing bores, where accessible and structurally sound. Regional reference bore monitoring has also commenced, along with analysis of decades of historical data compiled by the Western Australian government and others.

The Carlton Plain Stage 1 area is not considered to be at high risk of groundwater salinity (Bennett 2016; Soil Management Designs, 2017) – see Appendix C. Additional monitoring, including dataloggers to understand the extent (if any) of tidal influence and Ord River connection with groundwater across the Carlton and Mantinea Plains, will be undertaken.

A groundwater monitoring program modelled on that applied to the Goomig (Weaber Plain) development, under a monitoring regime approved by the Commonwealth Department of the Environment approval EPBC 2010/5491, has been modified and applied to Carlton Stage 1. This will be followed by the implementation of an ongoing monitoring program based on that recommended by the (then) Department of Agriculture and Food Western Australia (Lillicrap et al 2015). The ongoing groundwater regime will include 'high intensity' bores (that is, those with dataloggers capturing daily records); 'low intensity' bores (monitored manually, six-monthly/seasonally or thereabouts); and regionally-located 'reference bores', and will include not only the Carlton Stage 1 area, but the broader Carlton Plain, and nearby Mantinea Plain bores (Refer to Lillicrap et al 2015 for further information on bore regimes). (Noting that as Carlton Plain Stage 1 is a single, ~3,000ha farm, the Goomig / Weaber approach has been scaled).

Due to the low groundwater risk on the Carlton Stage 1 area, it is not expected that deep drainage for salinity mitigation will be required in this development area.

Groundwater monitoring undertaken under the provisions of this EMP will inform future proposed developments on other parts of the Carlton and Mantinea Plains, for which groundwater risk is considered higher than on the Carlton Stage 1 project.

2.5.2 Surface water quality

In addressing the management of inland water quality, some underpinning issues must be acknowledged:

- KAI is a downstream water user. The water KAI will use, taken from the Ord River, includes discharge from upstream users.
- KAI cannot be responsible for Ord River water quality under these circumstances.
- KAI is adopting the same water quality standards as the upstream water users who release into the Ord River (see Appendix E).

Nonetheless, KAI will not be discharging farm water into the Ord River (see further discussion below), and will maintain water quality on farm to ensure its farm productivity does not decline. The economic driver for healthy water and a healthy environment is paramount.

Furthermore, with any water quality sampling, the distance from the Kimberley to laboratories in Perth creates a delay of a minimum of one to two weeks between sampling and the receipt of results. This is a consideration in the timing response requirements for KAI's management considerations.

2.5.3 Impacts to seasonal wetland

As described in Section 2.4.2, KAI will manage stormwater flow in the wet and dry seasons to ensure farm stormwater does not enter the Carlton wetland, however ample stormwater from non-farmed areas will supply the wetland and maintain wetland functions.

Drainage out of the wetland will be prevented in the dry season via the construction of control structures, enabling a permanent wet area for native fauna. Cattle – currently a substantial threat to the wetland – will be prevented from access for the majority of the time, but will be utilised for weed and fire risk management (as an alternative to chemical weed control) on an occasional basis. This has been discussed previously in this document in relation to vegetation management.

No irrigation drainage water (tailwater) is to enter the wetland site.

The wetland supply and exit drains will be designed to complement existing slopes into the wetland. The velocity of water being introduced into the wetland will thus be similar to the existing environment.

Figure 11 illustrates the wetland water management infrastructure design.

Figure 11 - Carlton Plain wetland management

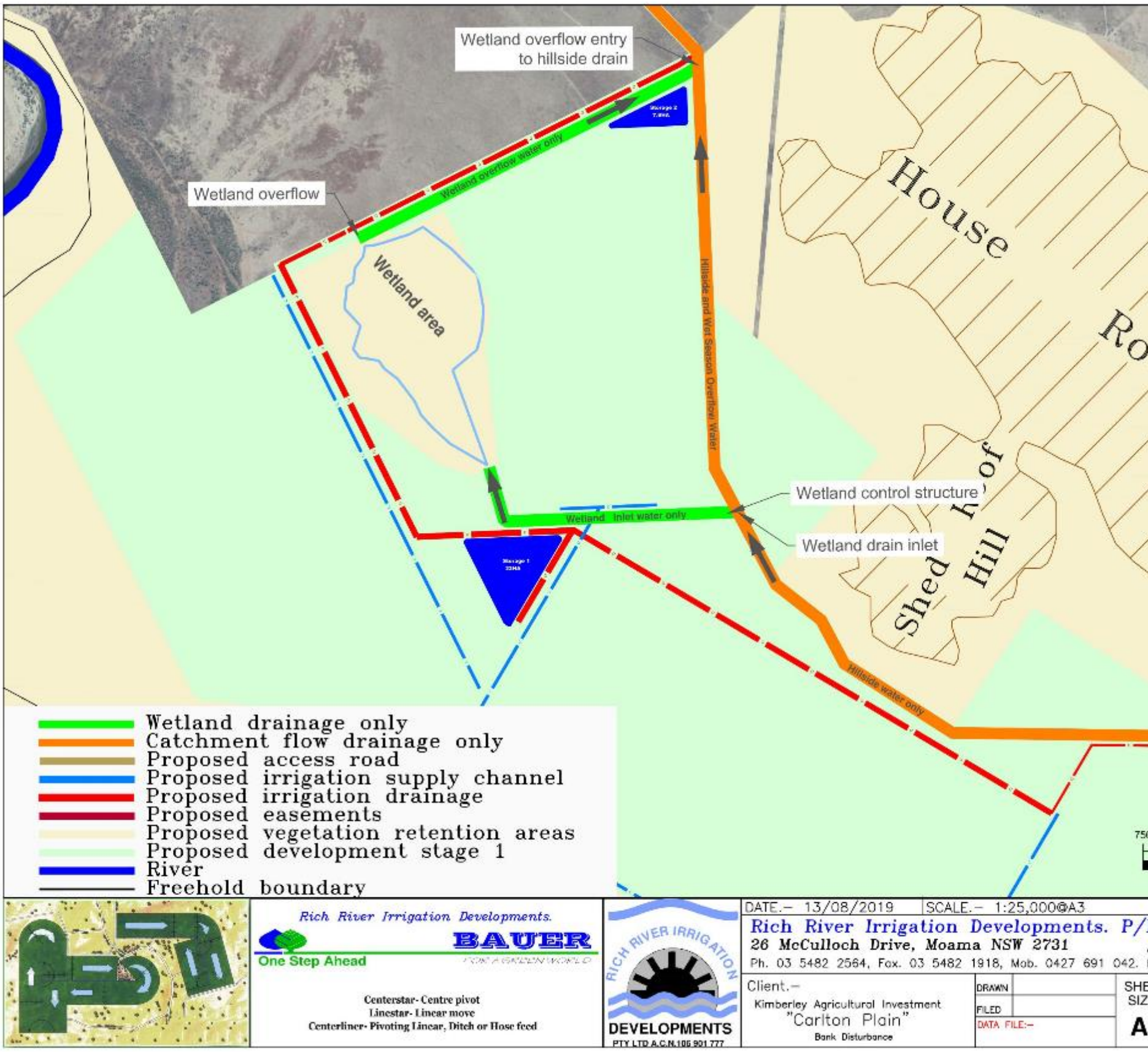


Table 8 - Inland waters provisions

EPA Factor	*Inland waters environmental quality*
EPA objective	To maintain the quality of groundwater and surface water so that environmental values are protected.
Carlton Plain Stage 1 objective:	To protect the Carlton wetland, Ord River and downstream wetland areas, including the Parry Lagoons and Lower Ord Floodplain Ramsar Sites from the impacts of the agricultural development.
Key environmental values	Aquatic fauna listed as Matters of National Environmental Significance, present in the Ord River or utilising wetland habitat in associated area.
Key impacts and risks	Surface water: fertiliser and farm chemical risk management through tailwater management; stormwater discharge following unseasonal rain; floodplain management.
Rationale for provisions	Groundwater: Water quality regime informed by Lillicrap et al 2015. Refer also to Table 7. CP1.IW.12: Tailwater management informed by Ord Stage 2 and best practice irrigation management from around Australia. Tailwater return systems, minimising nutrient export and chemical loss to waterways, are standard in through-flow irrigation systems, restricting discharge. CP1.IW.12; CP1.IW.13: Trigger and pollution reporting standards per Ord Stage 1 DWER water licence SWL156287(3) – refer to Appendix E. CP1.IW.14: As discussed in relation to vegetation management, weed control options in the tropical environment are chemical, mechanical (including cattle or machines – eg tractors), or fire. Controlled grazing can be the most benign option if undertaken carefully. An appropriate mix, designed to minimise environmental impact, will be adopted within an adaptive management approach. CP1.IW.15: Carlton Plain is located immediately upstream of highly saline groundwater aquifers and tidal interchange areas. Water quality will be an issue should water table accretion occur.

Continued over

Table 8 Outcome-based provisions	Inland waters		
	Response actions	***Monitoring***	***Reporting***
CP1.IW.12 No tailwater discharge to Reedy Creek or Ord River during the dry season. **Trigger indicator:** Dry season flow of tailwater west of the point located at approximately 15.470324S 128.406378E (western end of Carlton Stage 1 drain). **Threshold indicator**: Dry season flow of tailwater downstream of the point located at approximately 15.474723S 128.407478 (500m downstream of the trigger indicator point).	**Threshold contingency action:** In the event of an accidental flow of tailwater, release fresh water through to Reedy Creek to enable flushing to the Ord River.	Visual and system records to show no tailwater flows to Reedy (Collins) Creek system. In the event of tailwater losses, take lower Ord River samples (below Reedy Creek confluence) daily for 7 days then weekly for 4 weeks, testing for N, P, TSS and Atrazine (as an indicator farm chemical). Apply Ord Stage 1 water licence trigger levels and pollution reporting levels to incident reporting.	Report any dry season flow to Reedy (Collins) Creek system to DWER within 30 days. Reporting to include response actions implemented and results of water testing if in exceedance of triggers or pollution reporting levels per Appendix E. (Refer to Section 3.1 for incident reporting protocols).
CP1.IW.13 Establish a farm chemicals water quality testing program on the Carlton Stage 1 wetland to assure no farm water is entering the wetland. **Trigger indicators:** Per table E.1, Appendix E. **Threshold indicators**: Per table E.1, Appendix E.	Objective: To confirm (by monitoring) that no farm chemicals are entering Carlton wetland. If farm chemicals (other than nutrients, which could be naturally sourced – ie, through fauna) are identified in wetland monitoring, determine source. Follow-up investigations, including whether one-off incident or system design fault. If design (or construction) fault, reconsider design to ensure farm water not entering wetland. **Threshold contingency action:** In the event of a pesticide or herbicide being detected in Carlton wetland, follow-up monitoring to occur, with design repairs and/or consideration of freshwater inflow to dilute	Baseline water sampling of total N, total P, EC, pH and TSS prior to irrigation commencing. Testing per Table E.1, Appendix E. Bi-monthly monitoring in dry season once irrigation commences, and in the season prior to irrigation. Inclusion of indicator farm chemical (atrazine – if used) once farming commences. If atrazine is not in use, alternative herbicide or pesticides to be analysed in samples and reported accordingly. *Note that nutrients cannot be traced to farm usage given the high density of bird life occupying the wetland.*	To be reported in AER to be prepared by the proponent and published to website. Any recordings of indicator farm chemicals to be included in annual reporting. Trigger and pollution levels per Appendix E to be applied to reporting.

	remaining chemical residue.		
	Management targets	***Monitoring***	***Reporting***
CP1.IW.14 Avoid substantial cattle damage to native vegetation while reducing weed infestations in the Carlton Stage 1 wetland by allowing limited, restricted cattle access for mechanical weed control as part of an integrated weed management approach.	Adopt an adaptive, integrated weed management approach using mechanical and/or chemical means. Weed control by cattle (as a preference to chemical (herbicide or fire) will be required in the Carlton wetland but with reduced stock numbers (compared to historical grazing) and with the period of access limited in order to avoid excessive habitat damage. Cattle will not be present in the wetland on a full time grazing basis. Adaptive management to be applied, with appropriate mix of techniques to minimise environmental risk to native habitat and inland waters.	Pre- and post- cattle access weed and native vegetation condition inspections to be undertaken. Monitoring of vegetation condition to occur during cattle presence in Carlton wetland. To be undertaken in conjunction with CP1.FV.3.	To be addressed in AER to be prepared by the proponent and published to website. Annual wetland condition photographic records in annual report. Baseline photos from 2016 to be utilised and compared in future reporting.
CP1.IW.15 Implement a groundwater monitoring program to observe changes in water quality on Carlton Plain.	This provision integrates with CP1.HP.10. Salinity monitoring will be a priority due to the known saline risk environment in the vicinity of Carlton Plain. KAI will monitor the regional bore network for statistically significant changes in the already high aquifer electrical conductivity. Indicators to be determined following analysis of 2018 sample data following re-drilling of existing and construction of new bores per Figure 9.	Water quality sampling will be undertaken twice-yearly, at the commencement of the dry season (when access allows), and following the end of the cropping season, prior to the commencement of the wet season. Locations: Initially as per Figure 9, with modifications considered (and reported in the AER) as farms are constructed. Management action review: Triennially. In situ monitoring for EC, pH. Testing regime for farm chemicals to be determined upon commencement of irrigation.	Groundwater monitoring will be addressed in AER to be prepared by the proponent and published to its website. Regular reporting will confirm that monitoring has occurred. Detail on findings will be provided by exception – that is, where anomalies occur they will be reported. Groundwater monitoring records to be retained.

5.6 Social surroundings

2.6.1 Aboriginal heritage and culture

Heritage clearance was secured with MG Corporation mid-2017. This document is confidential.

The overarching Indigenous Land Use Agreement – the Ord Final Agreement – which paved the way for the freeholding of the Carlton Plain land parcel (and other Ord Stage 2 land areas – Goomig, Knox, Mantinea, Ord West Bank and Packsaddle), was signed by Traditional Owners in 2005 and underpins the agricultural development occurring in the Ord region.

2.6.2 Impacts and amenity (Ord River)

KAI does not anticipate significant amenity issues in relation to the Ord River. Minimal direct visual impact will occur, primarily because Carlton Plain sits some 20 metres higher than the river level. River users will, however, have sight of pumping infrastructure.

Section 3: Reporting and review of the EMP

3.1 Reporting

Three tiers of reporting apply to this EMP:

1) **Internal KAI environmental reporting**: All staff will be obligated to report any environmental incidents or concerns to their manager, for follow-up by environmental management officers.
2) **Routine/ongoing compliance and annual reporting**: An Annual Environmental Report (AER) addressing compliance with this EMP, will be prepared, provided to DWER, and uploaded to KAI's website by 31 March each year, for the previous calendar year. The AER will address compliance with provisions of this plan, and report by exception on anomalies or non-compliances. A Compliance Assessment Plan will be developed in relation to this EMP, with the AER meeting the requirements of the associated Compliance Assessment Report. Relevant departments and agencies will be notified should thresholds or incidents occur in relation to factors associated with their remit.
3) **Incident reporting**: in the event of an environmental incident considered to be a serious breach of this EMP, with a direct and consequential environmental impact, KAI will provide an initial notification to the EPA within seven (7) days, followed by a written report within 30 days. Monitoring results and rectification or mitigation proposals will be included with the full report. [It should be noted that on some occasions it is not possible to have all monitoring data – for example, water quality testing results – returned within these time frames, due to the remoteness of the locality and the inaccessibility of some locations, particularly during the wet season. If this is an issue in the event of an incident occurring, the EPA will be notified of the reasons and the expected delay time].

3.2 Review program

Review of this EMP will occur on a regular basis. Formal approval will be sought from the EPA via DWER where changes to the EMP are required.

It is expected that a thorough review will occur after approximately five years from the commencement of farming, and/or when KAI proceeds with associated developments proposed on Carlton Plain and in the nearby Mantinea Plains area.

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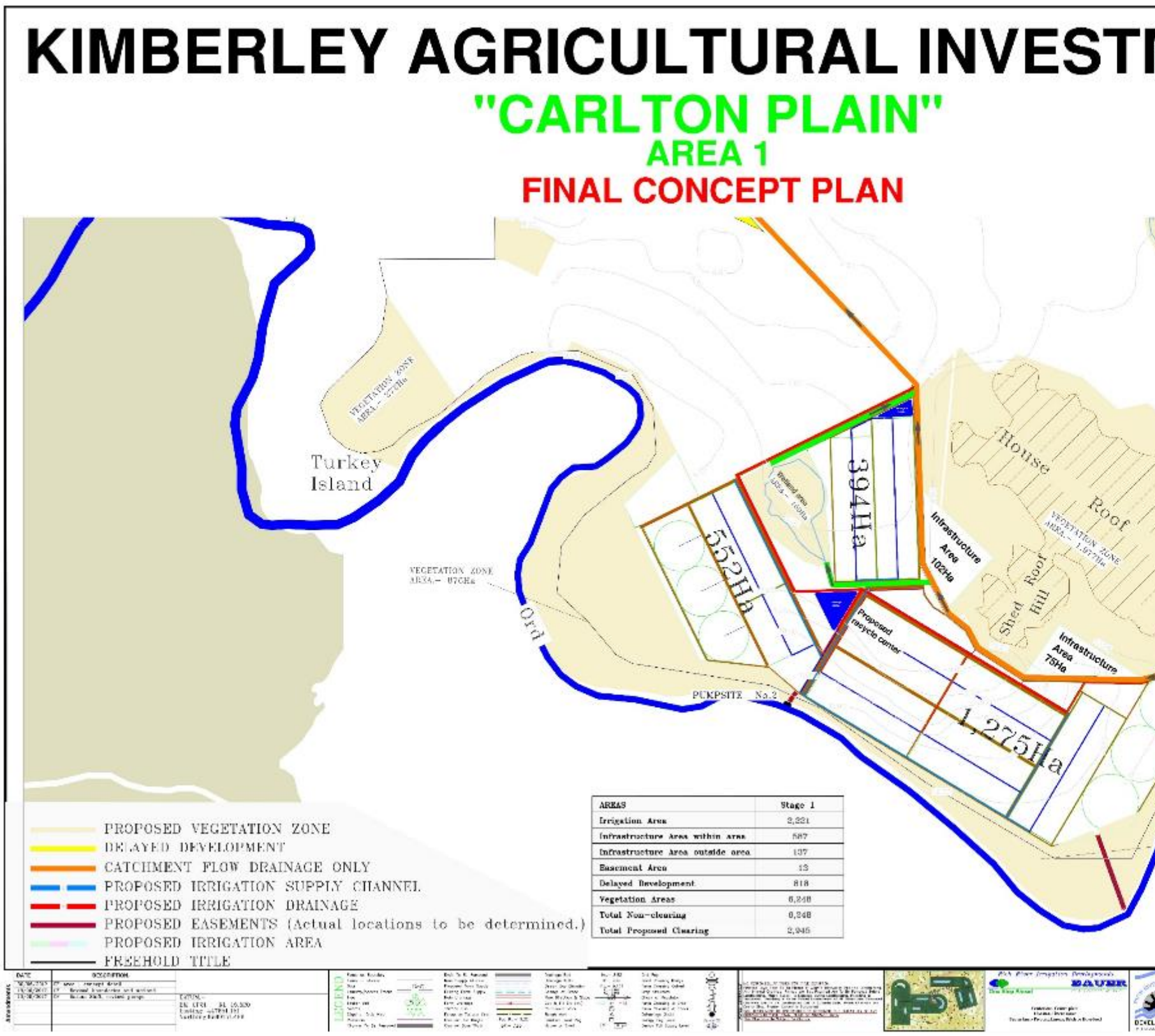
Appendices

Appendix A – Detailed Carlton Plain Stage 1 Concept Plan



Appendix B – Land and Vegetation Condition

B.1 Tables and process for condition assessment

Derived from WARMS rangelands monitoring (with more frequent re-inspection).

Refer to *Western Australian rangelands monitoring system for grasslands: field manual* (Department of Agriculture and Food, 2008, Bulletin 4741) for further methodological detail.

Process to be adopted:

1. Minimum of 5 condition monitoring sites to be established in vegetation retention areas adjacent to Carlton Hill Stage 1 area, during the 2018 dry season.
2. Sites to be established based on a combination of representative soil and vegetation types, practical accessibility, proximity to river, House Roof Hill and wetland areas,
3. GIS location data to be recorded.
4. 10m x 10m transect area to be identified.
5. Vegetation type, condition, weed presence and erosion to be recorded.
6. Photographic records to be retained.
7. Repeat assessment to be undertaken prior to August 31 of each calendar year.

Table B1.1 Quantitative measure of area affected by erosion

(after Payne et al, 1998)

Rating	Severity	% of transect area affected
0	No accelerated erosion	0
1	Slight erosion	<10
2	Minor erosion	10-25
3	Moderate erosion	25-50
4	Severe erosion	50-75
5	Extreme erosion	75-100

Table B1.2 Qualitative assessment of type of erosion present

Rating	Erosion characteristics present
A	Micro-terracing / sheeting
B	Scalding / capping
C	Pedestalling
D	Rilling / Guttering
E	Guttering / gullying
F	Accelerating accretion of soil material

Table B1.3 Vegetation condition rating

(after Payne et al, 1979)

Rating	Description
1	**Excellent.** Nearly all plants present are desirable species and ground cover is optimal for the site.
2	**Good.** Most plants present are desirable, with intermediate perennials and annual types increasing in frequency. A few undesirable species may be present.
3	**Fair.** Intermediate value species usually predominate; desirable and undesirable species occupy similar proportions of the available ground space. Small patches of bare ground may be present.
4	**Poor.** Undesirable and intermediate species predominate in the stand; desirable species are very infrequent and may occur only in small patches. The overall stand may be sparse or patchy with frequent small areas of bare ground.
5	**Very poor.** Undesirable species or bare ground predominates; there are few intermediate species and virtually no desirable species in the stand.

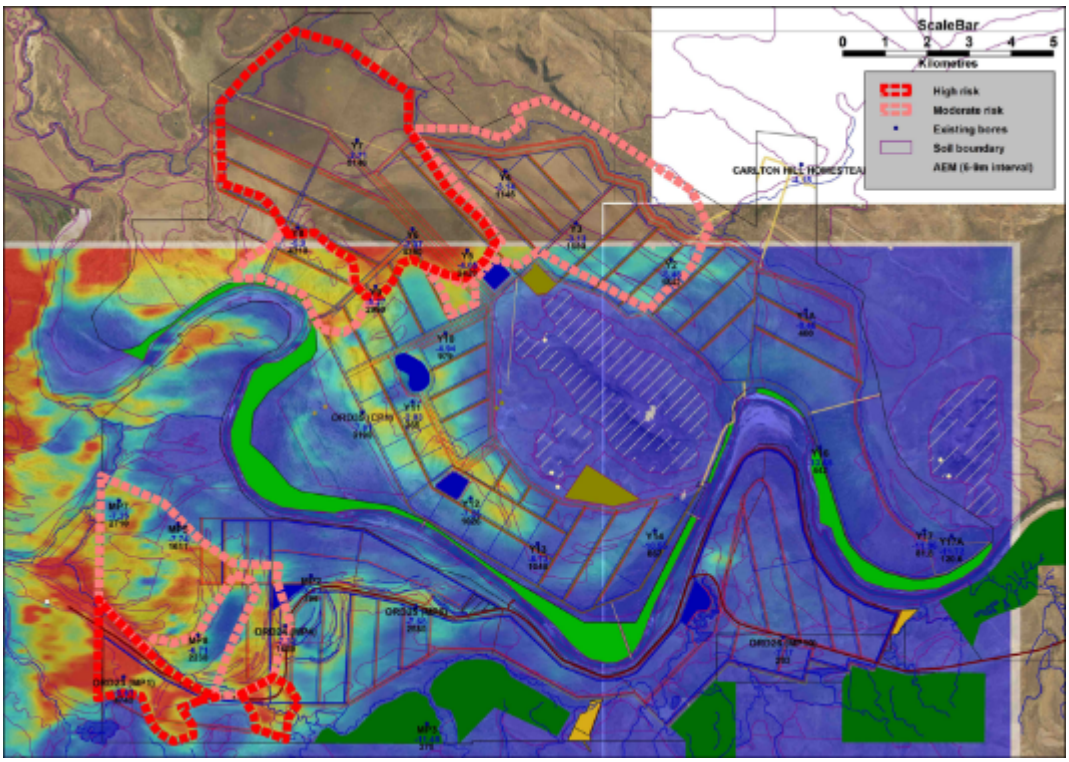
Table B1.4 Matrix to determine resource condition based on combined scores for soil erosion and vegetation condition

(after Payne et al, 1998)

		Vegetation Condition		
		1 or 2	**3**	**4 or 5**
Extent of Soil Erosion	**0**	Good (1)	Fair (2)	Poor (3)
	1 or 2	Good (1)	Fair (2)	Poor (3)
	3	Fair (2)	Poor (3)	Poor (3)
	4 or 5	Poor (3)	Poor (3)	Poor (3)

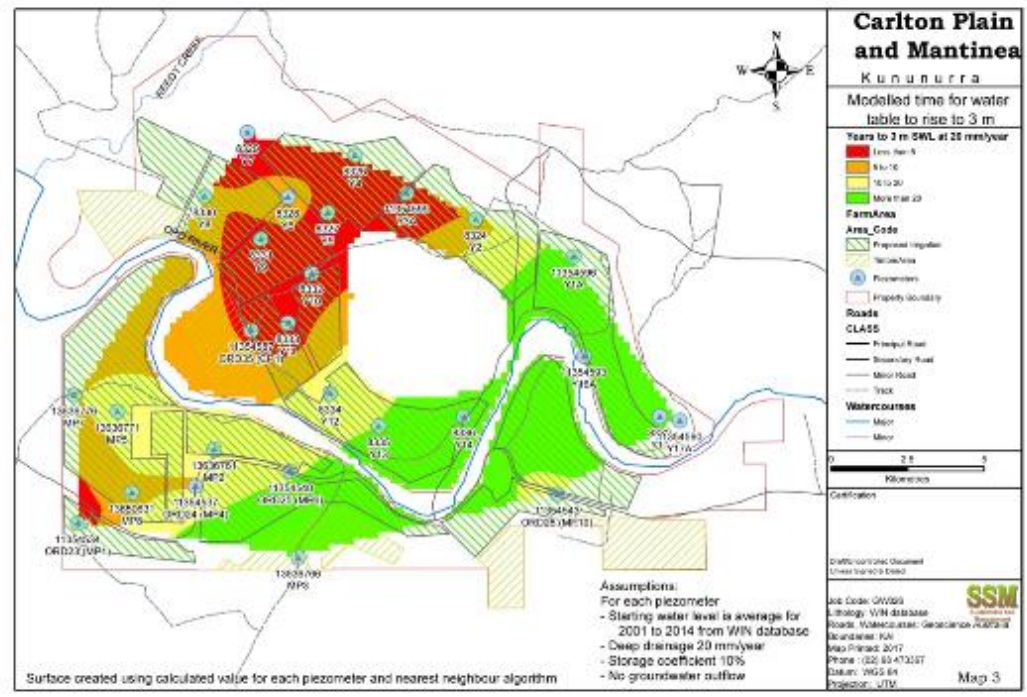
Appendix C – Soils Monitoring

Figure C.1 Salinity Risk – Carlton Plain



Bennett, 2016

Figure C.2 Modelled time to groundwater rise – Carlton Plain



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

Soils Sampling Procedure

Monitoring of both soil and subsoil salinity and sodicity will commence 12 months prior to operation of irrigation infrastructure, and be undertaken at the end of each irrigation season.

Monitoring frequencies will increase if trigger values are exceeded and will be ongoing until remediation actions are considered successful.

Samples for surface soil will be taken from between 0–10 cm, while samples for subsoil will nominally be taken at 60 cm. Surface and subsoil monitoring of all parameters will take place within the irrigation area, with a focus on clay soils. Surface samples for analysis will be made up of at least 20 sub-samples distributed across the sample sites and lumped for analysis. Subsurface samples will be made up of at least 5 samples per site.

Surface and sub soil salinity should be conducted by soil sampling, laboratory measurement and reported as SI units in mS/m. Industry standard soils analysis (eg through CSBP laboratories or similar) will be undertaken, with a 'comprehensive test' including exchangeable cations to ensure Exchangeable Sodium Percentage (ESP) is determined.

Soil sodicity will be evaluated using ESP based on results of Smolinski et al (2011).

A database will be established and maintained by KAI. Results from the surface and subsoil monitoring will be stored on this database and used to inform management of any changes to soil chemistry within the Development area. Plots of salinity (ECe and ESP) versus sampling date (months/years since baseline measurement) for each of the sample sites will reported annually. The database and graphs will be kept on site and will be made available on request.

Appendix D- Ongoing (post-baseline) bore monitoring regime

Description	High- intensity bores	Low- intensity bores (Not on CP Stage 1)	Reference bores* (Not on CP Stage 1)	Pumped groundwater discharge* (Not on CP Stage 1)
EC, 25°C	Seasonal	Annual	Seasonal	Continuous
pH	Seasonal	Annual	Seasonal	Monthly
Chloride mg/L (ion selective electrode)	Seasonal	Annual	Seasonal	Monthly
ORP as standard hydrogen electrode	Seasonal	Annual	Seasonal	Monthly
Alkalinity (as CaCO3 mg/L)	Seasonal		Seasonal	Monthly
Acidity (as CaCO3 mg/L)	Seasonal		Seasonal	Monthly
Water level	Loggers	Seasonal	Loggers	Continuous (flow rate)
Aluminium	Triennial		Triennial	Annual
Alkalinity, total (as CaCO3 mg/L)	Triennial		Triennial	Annual
Arsenic	Triennial		Triennial	Annual
Boron	Triennial		Triennial	Annual
Beryllium	Triennial		Triennial	Annual
Calcium	Triennial		Triennial	Annual
Cadmium	Triennial		Triennial	Annual
Chloride	Triennial		Triennial	Annual
Cobalt	Triennial		Triennial	Annual
Carbonate	Triennial		Triennial	Annual
Chromium	Triennial		Triennial	Annual
Copper	Triennial		Triennial	Annual
EC, 25°C	Seasonal		Seasonal	Monthly
Fluoride	Triennial		Triennial	Annual
Iron	Triennial		Triennial	Annual
Hardness, total (as CaCO3 mg/L)	Triennial		Triennial	Annual
Bicarbonate	Triennial		Triennial	Annual
Mercury	Triennial		Triennial	Annual
Potassium	Triennial		Triennial	Annual
Lithium	Triennial		Triennial	Annual
Magnesium	Triennial		Triennial	Annual
Manganese	Triennial		Triennial	Annual
Molybdenum	Triennial		Triennial	Annual
Sodium	Triennial		Triennial	Annual

Description	High- intensity bores	Low- intensity bores (Not on CP Stage 1)	Reference bores* (Not on CP Stage 1)	Pumped groundwater discharge* (Not on CP Stage 1)
Nickel	Triennial		Triennial	Annual
Nitrogen, total	Annual	Triennial	Annual	Monthly
Nitrogen – ammonia	Triennial		Triennial	Monthly
Nitrogen – oxidised nitrogen	Triennial		Triennial	Monthly
Nitrogen – total organic	Triennial		Triennial	Annual
Lead	Triennial		Triennial	Annual
pH	Triennial		Triennial	Annual
Phosphorus, persulphate total	Annual	Triennial	Annual	Monthly
Phosphorus, soluble reactive	Triennial		Triennial	
Selenium	Triennial		Triennial	Annual
Silicon	Triennial		Triennial	Annual
Sulfate, sulfur expressed as sulfate	Triennial		Triennial	Annual
TDS	Triennial		Triennial	Annual
Uranium	Triennial		Triennial	Annual
Vanadium	Triennial		Triennial	Annual
Zinc	Triennial		Triennial	Annual
Selected farm chemical hazards	Annual	Triennial	Annual	Monthly

Source: Lillicrap et al, 2015.

Appendix E – Trigger and pollution reporting levels for water

Table E.1 Ord Stage 1 Reporting Levels – SWL156287(3)

Parameter	Trigger Level	Pollution Reporting Level
Parameters measured at groundwater sites		
Groundwater levels (mbgl)	2	NA
Nutrients monitored in surface water sites		
Total nitrogen (TN mg/L)	0.85	7.4
Total phosphorus (TP mg/L)	0.11	1.2
Total suspended solids (TSS mg/L)	58	844
Chemicals monitored in surface water sites		
Atrazine (ug/L)	13	13

Source: *Annexure to Licence to Take Water SWL156287(3) issued to Ord Irrigation Cooperative under the Rights in Water and Irrigation Act 1914.*