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

CMS17168

October 2017

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

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 vegetation condition rating in vegetation retention areas, based on 2016 dry season baseline surveys.
	CP1.FV.3	Flora and Vegetation	No increase in the proportion of weed coverage ('weed cover class') in vegetation retention areas, based on 2016 dry season
	CP1.FV.4	Flora and Vegetation	In the event that decommissioning is to occur, rehabilitate cleared land to pre-development vegetation condition as recorded by Woodman (2016), 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 6 in surface soils or 15 in subsurface soils.
	CP1.TE.7	Terrestrial Environmental Quality	Soil erosion (scour) is minimised where possible on 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 development.

	CP1.TF.9	Terrestrial Fauna	No reduction in migratory bird numbers on the Carlton wetland and Carlton Stage 1 area, undertaken and reported triennially, following commencement of irrigation.
	CP1.TF.10	Terrestrial Fauna	Control pest or plague fauna as required to minimise negative environmental impacts.
	CP1.HP.11	Hydrological Processes	No exceedance of approved abstraction rate (ML/day), annual limits of other requirements of the provisions of any licences to abstract water issued in line with the *Ord Surface Water Allocation Plan*.
	CP1.HP.12	Hydrological Processes	Hillside drainage and internal stormwater drainage network maintained such that there is no stormwater flow through Carlton wetland in any dry season or in an average rainfall wet season.
	CP1.HP.13	Hydrological Processes	Undertake a three-year baseline groundwater monitoring program then adopt an ongoing monitoring program in line with that undertaken for the Goomig (Weaber Plain) development, in order to better understand the water balance and connection between the groundwater and Ord River.
	CP1.IW.14	Inland Waters Environmental Quality	No tailwater discharge to Reedy Creek or Ord River during the dry season.
	CP1.IW.15	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.16	Inland Waters Environmental Quality	Restrict cattle entry to the Carlton Stage 1 wetland.
	CP1.IW.17	Inland Waters Environmental Quality	Undertake a three-year baseline groundwater monitoring program then adopt an ongoing monitoring program in line with that undertaken for the Goomig (Weaber Plain) development, in order to monitor groundwater 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 3,055ha. 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 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

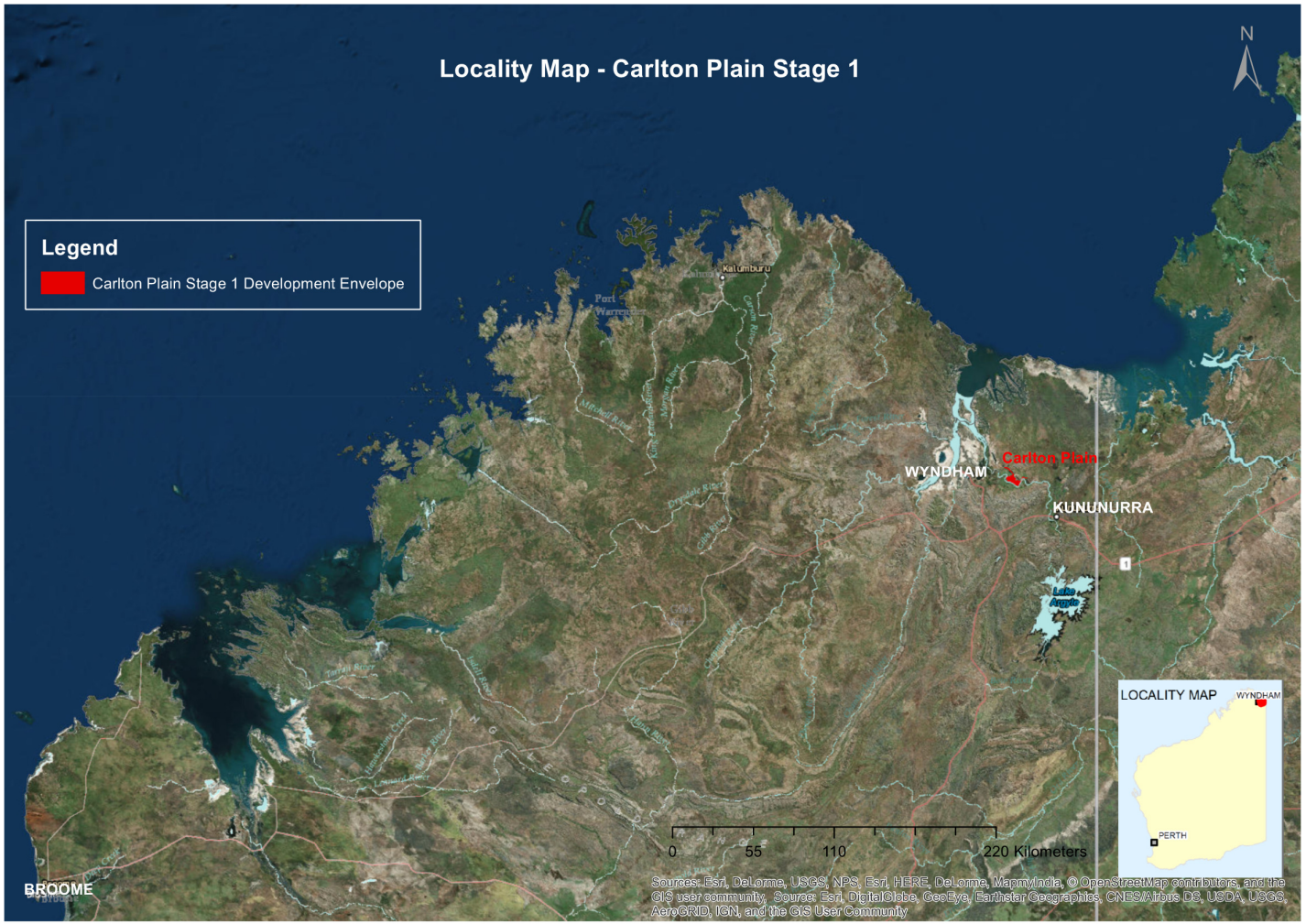
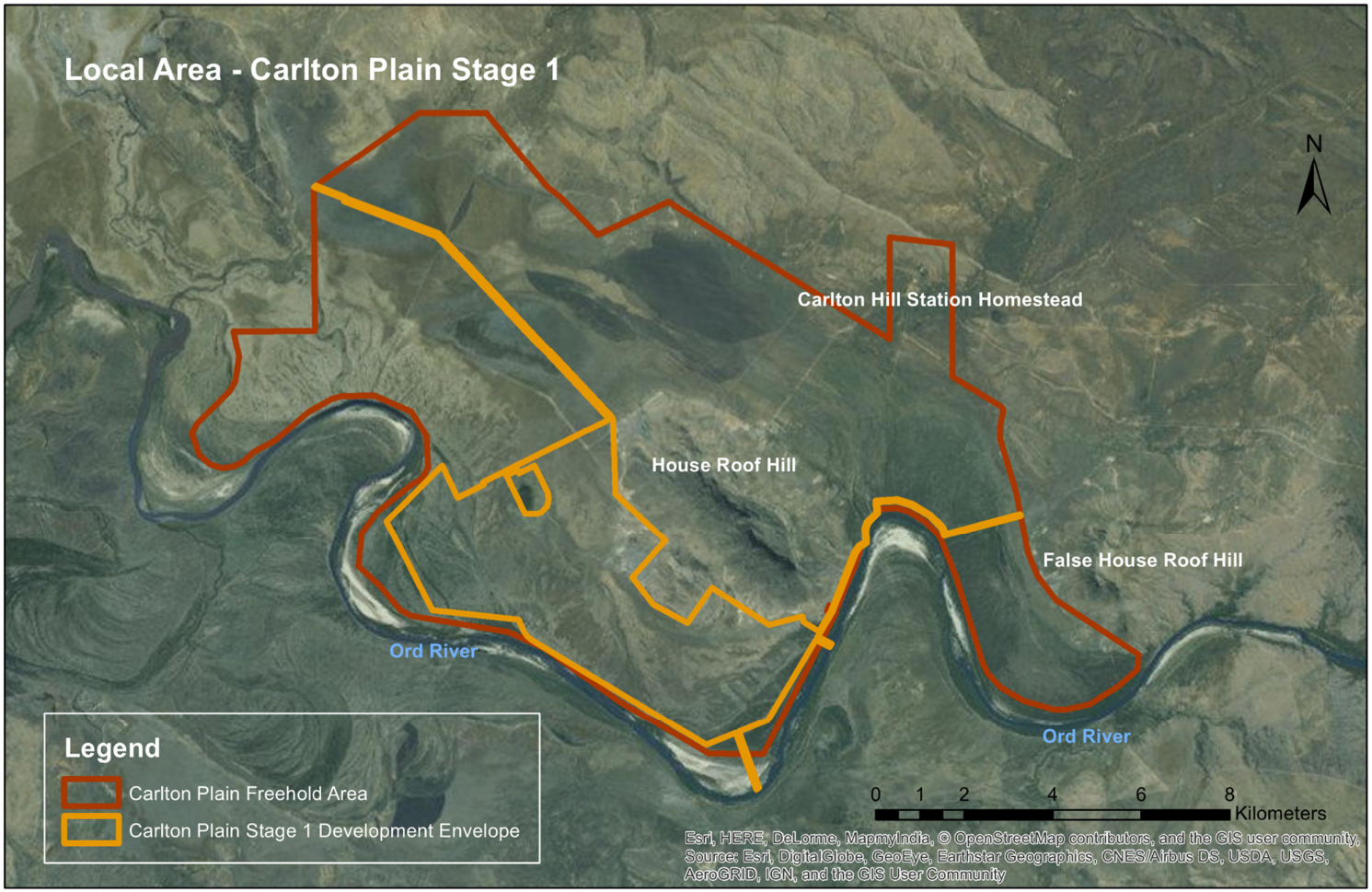


Figure 2 - Carlton Plain Local Area



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 irrigation of annual crops	1,735ha
Pressurised irrigation of perennial crops	510ha
Infrastructure	810ha
Easements for river access	12ha
Water supply – Pump location	80m wide infrastructure corridor allowed for in clearing area calculations
Annual irrigation water usage	27.6GL
Tailwater recycling facilities	60ha
Access track (on-farm road)	40m wide infrastructure corridor allowed for in clearing area calculations
Stormwater drainage	80m wide infrastructure corridor allowed for in clearing area calculations
Farm outbuildings and worker accommodation	To be determined as required operationally

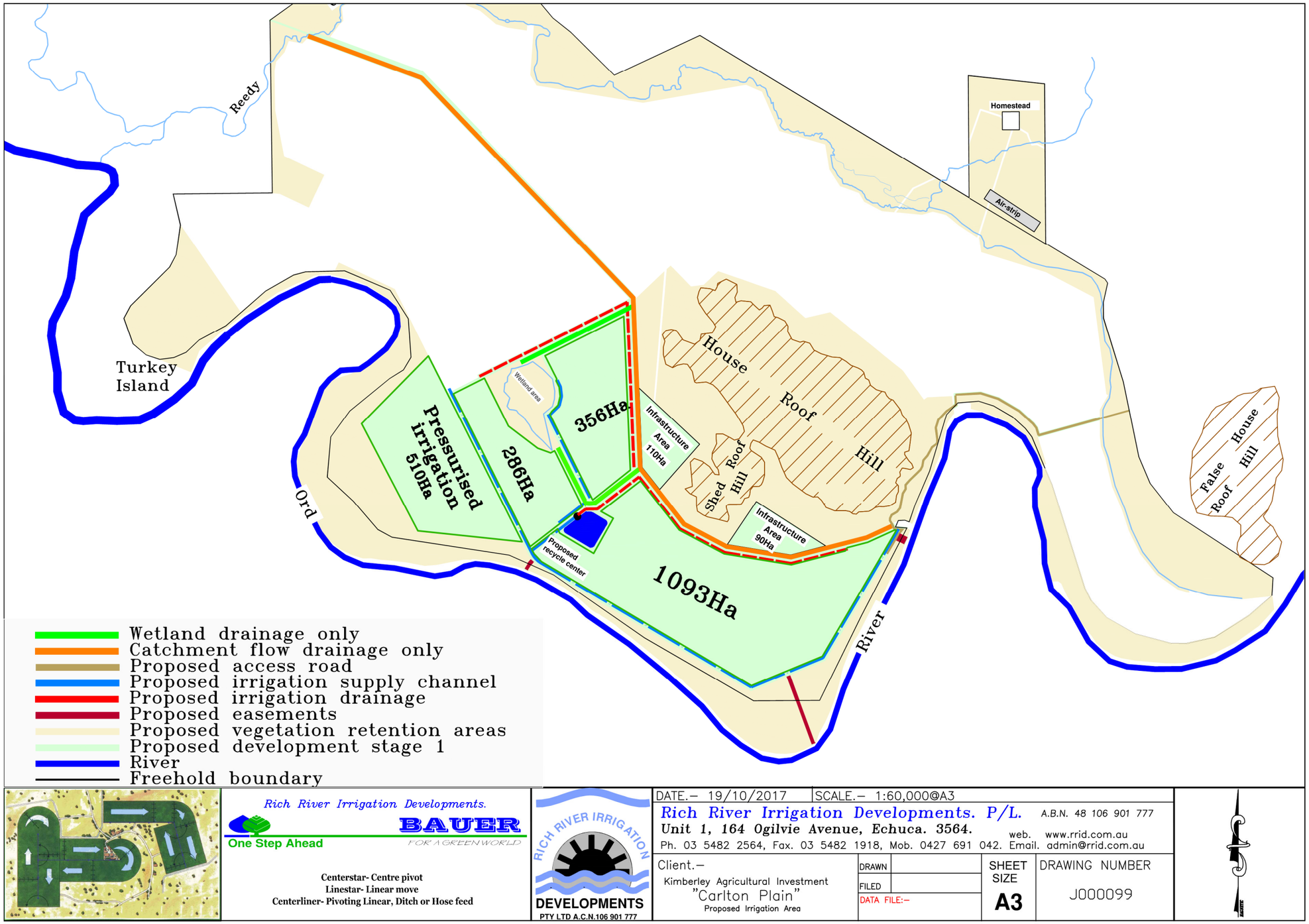
1.3 Environmental management design components

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 grazing on 150ha 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 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

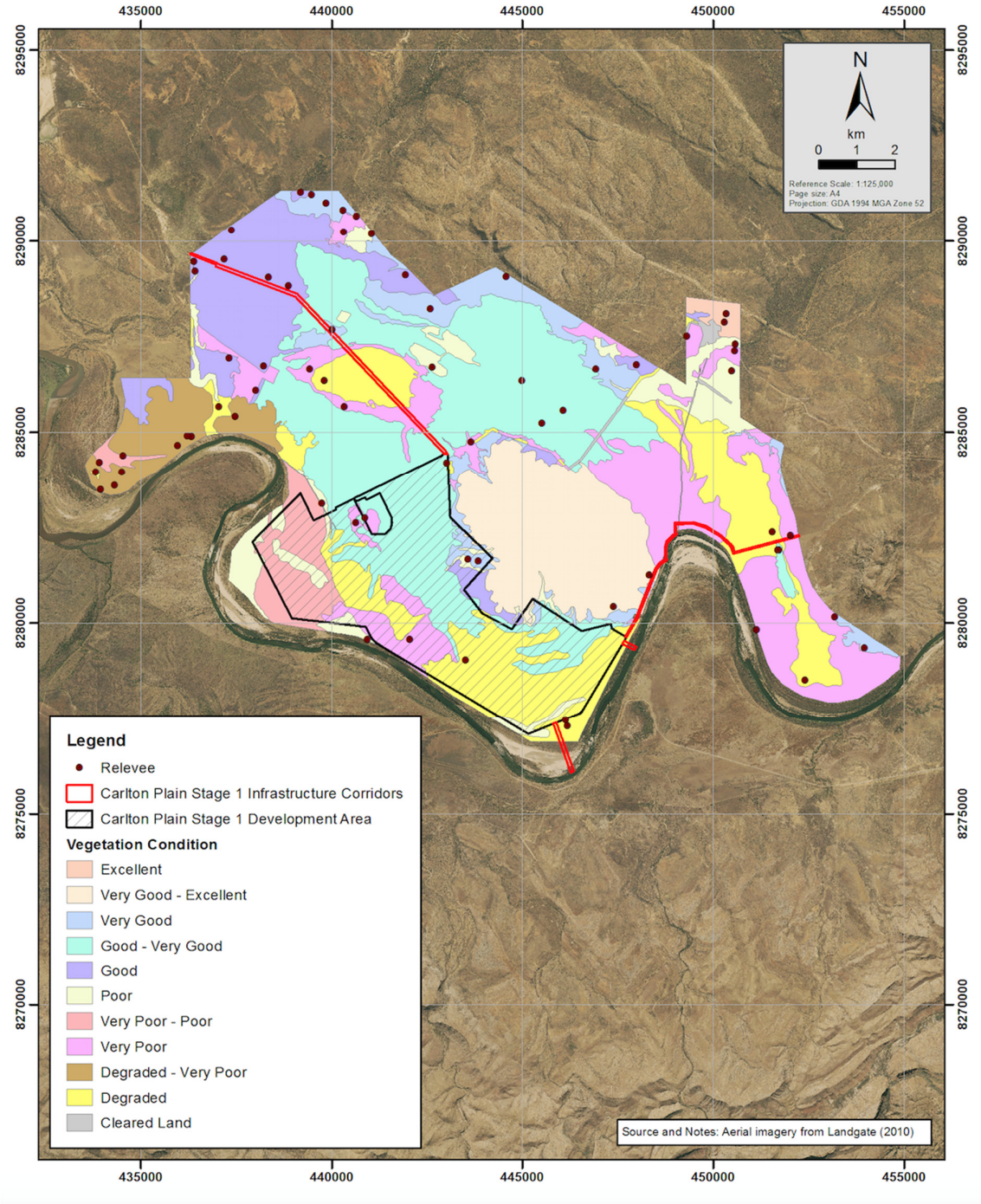
This section presents each factor, with an initial overview of relevant rationale, referrals to studies undertaken, the approach taken to determining appropriate provisions to be applied in managing the environmental risks associated with the proposed development, and other relevant information including 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 3,055ha 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.

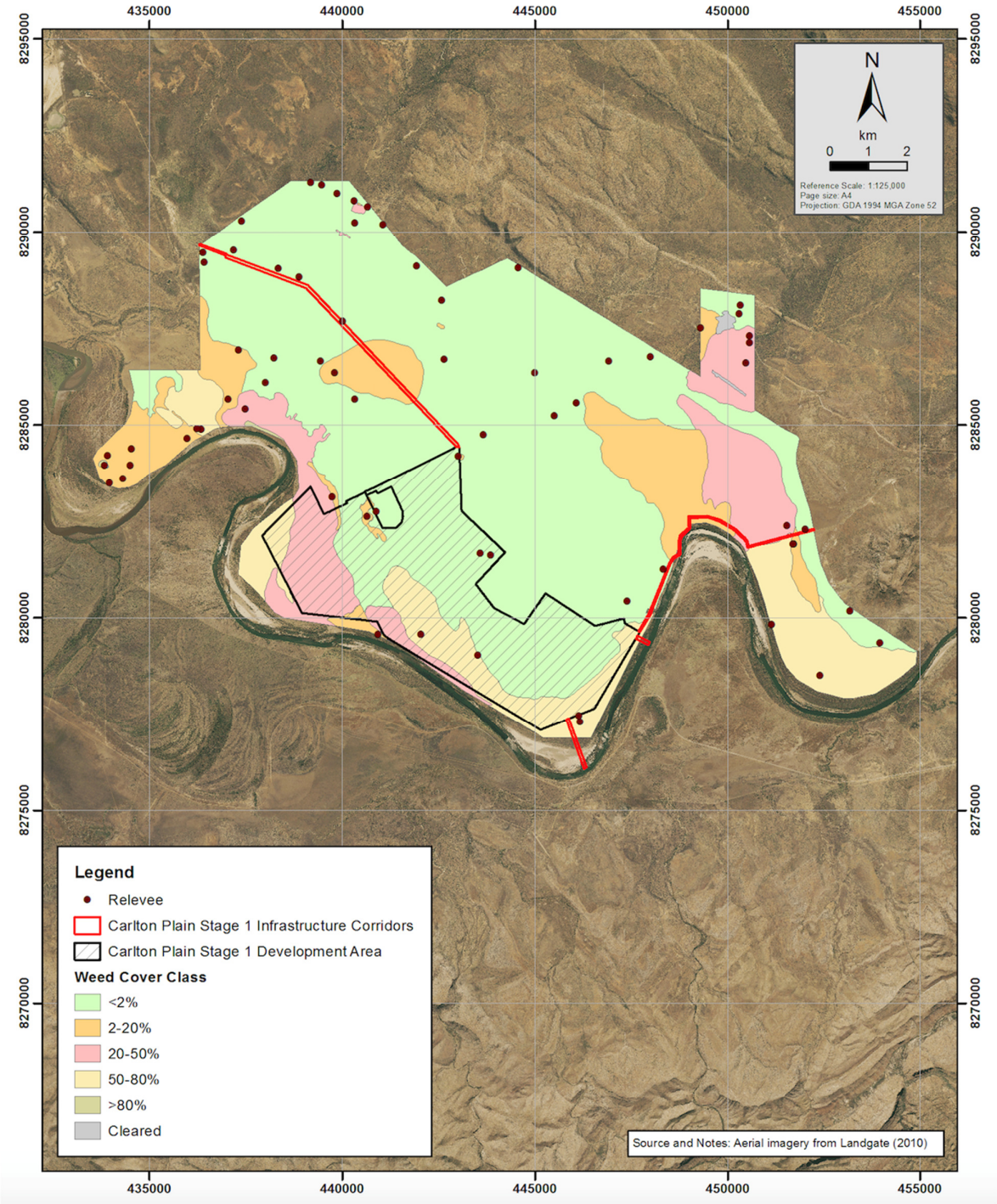
Figures 4 and 5 respectively indicate baseline vegetation condition and weed coverage:

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, 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.

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.

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) – three yearly on grassland sites and five-yearly on shrubland areas.

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. 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

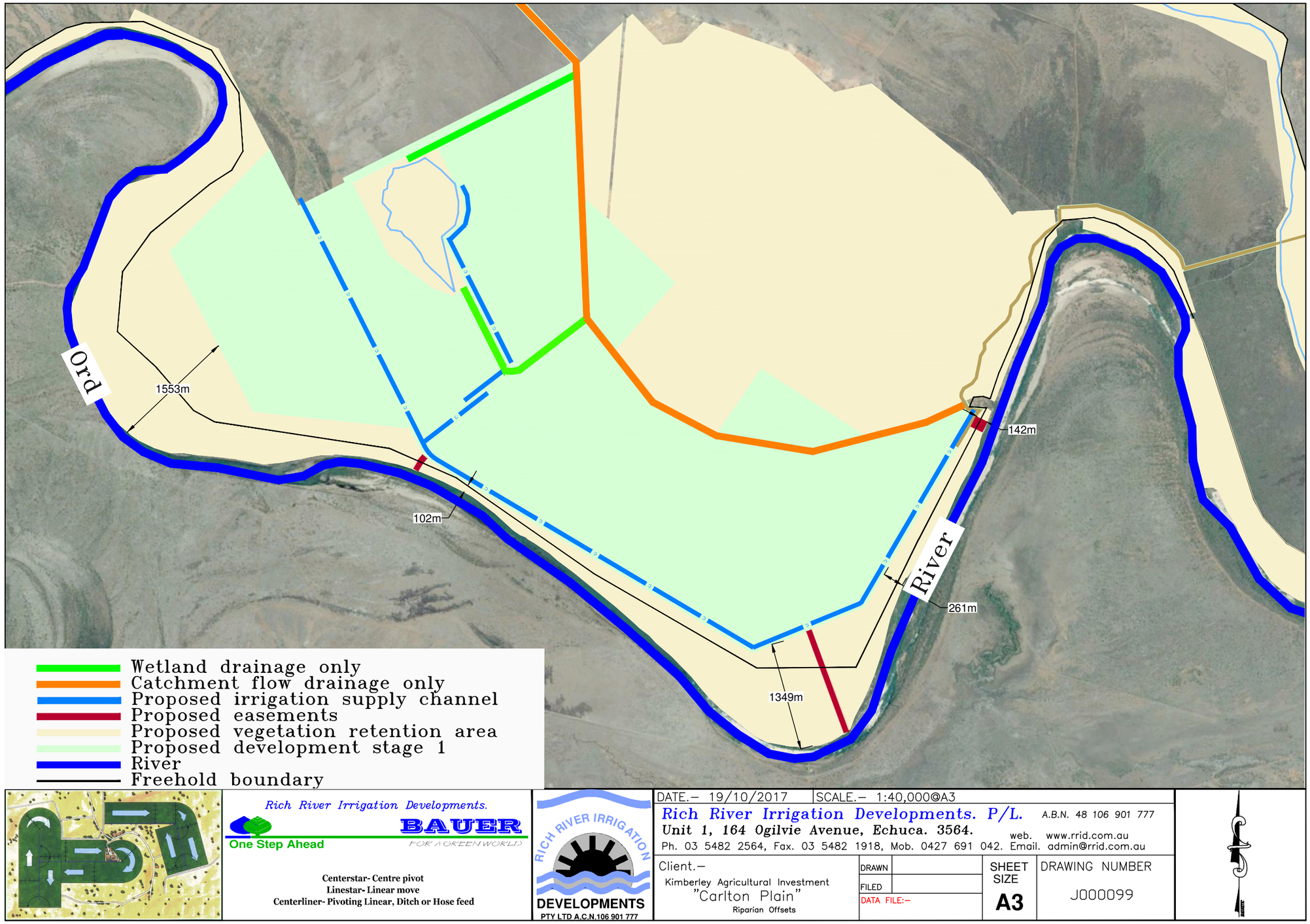


Table 3 - Flora and vegetation provisions

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.		
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 in vegetation retention areas, and for rehabilitation in the event of decommissioning.		
Outcome-based provisions[2]			
Environmental criteria	***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 criterion]**	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	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)	To be addressed in annual environment report (AER) to be prepared by the proponent and published to website. Proponent to internally retain photographic records of scours or riverine trajectory changes which may impact upon ability to remain compliant

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

EPA Factor	*Flora and vegetation*		
	Proponent to inadvertently meet the 100m minimum setback requirement.	boundaries or restrict biodiversity corridors.	with this criterion. Proponent to report substantial changes to river trajectory to DWER Kununurra office following wet season rains/flood events.
CP1.FV.2 No decline in the vegetation condition rating in vegetation retention areas, based on 2016 dry season baseline surveys. **[Trigger criterion]**	Response triggers (minimum requirements) to be adopted. Nominally, the triggers will be the vegetation class ratings given for individual areas in Woodman (2016). Vegetation condition in any given season can be directly affected by one-off incidents such as wildfire, which would immediately imply non-compliance with a threshold based provision, hence this provision is deemed to be trigger-based. In the event that condition declines in the vegetation retention areas in relation to the 2016 baseline surveys, the proponent will: 1. Remove cattle if overgrazing is considered a factor if condition has declined. 2. Amend the fire regime if fire is considered a factor in condition decline. 3. Address weed management, per CP1.FV.3. 4. Establish interim target for vegetation condition improvement based on extent of variation from vegetation condition goal and current climatic seasonal conditions.	1. Annual visual monitoring. Photographic records to be retained. 2. Vegetation condition surveys of vegetation retention areas, in line with WA Rangelands Monitoring System monitoring rounds occurring on neighbouring Carlton Hill and Ivanhoe Stations. 3. Baseline study relevees (as a minimum) to be checked in ongoing surveys.	Summary of vegetation condition reporting (in line with WA Rangelands Monitoring System rounds) will be included in AER to be prepared by the proponent and published to proponent's website.

EPA Factor	*Flora and vegetation*		
CP1.FV.3 No increase in the proportion of weed coverage ('weed cover class') in vegetation retention areas, based on 2016 dry season baseline surveys. **[Trigger criterion]**	Response triggers (minimum requirements) to be applied to this provision are the proportion weed cover classes as assessed by Woodman (2016). Management responses will include - 1. Physical (including grazing) or chemical treatment of declared weeds or Weeds of National Significance if found in Carlton Plain Stage 1 area during annual visual monitoring. 2. Mechanical weed removal and/or rehabilitation of weed infested areas if weed coverage in vegetation retention areas is shown to increase during triennial surveys.	1. Annual visual monitoring. Photographic records to be retained. 2. Triennial weed surveys of vegetation retention areas, beginning three years after commencement of clearing and development of farmland (nominally dry season 2021). 3. Baseline study relevees (as a minimum) to be checked in ongoing surveys.	Photographic weed monitoring records to be retained. Triennial weed survey findings to be reported (by exception) in the relevant year's AER to be prepared by the proponent and published to the proponent's website.
CP1.FV.4 In the event that decommissioning is to occur, rehabilitate cleared land to pre-development vegetation condition as recorded by Woodman (2016), within five years of cessation of irrigation [with allowance for tree age where appropriate]. **[Trigger criterion]**	Minimum 5-year post-irrigation targets (minimum thresholds) to be applied to this provision are the vegetation condition ratings for each habitat area, as assessed by Woodman (2016). Management responses 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 A, including the in-fill of drains and channels and removal of hillside and other levee	1. Six-monthly rehabilitation inspections for species type, density, weed coverage. 2. Inspections to occur pre and post- dry season for five years following decommissioning. 3. Monitoring to include comparison with adjacent landscape.	Post-decommissioning AER to include photographic evidence of rehabilitation response. Initial post-decommissioning AER to include evidence of appropriate reuse, recycling or disposal of infrastructure.

EPA Factor	Flora and vegetation		
	banks. 3. Post-irrigation land use to be congruent with surrounding land use. 4. Monitor for natural revegetation / re-growth and erosion.		

2.2 Terrestrial environmental quality

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:

- Adequate irrigation system and applicable gradient to soil type;
- Adequate 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);
- Adequate design sizing and location (based on soil type) for water recycling and supply channel system to capture and reuse irrigation drainage water and dry season storm water, to allow re-use of captured water;
- Adequate recycling pump capacity to allow for the management of drainage, recycled water and dry season stormwater;
- Monitoring water application to crop use across the irrigation season; and
- Utilising soil moisture monitoring probes to measure optimum application times for irrigation events.

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 value 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.		
Key impacts and risks	Soil degradation risks including soil salinisation, soil sodification and other physical and chemical soil changes.		
Rationale for provisions	CP1.TE.5: Interim triggers adopted are those applied for soils managed under irrigation on the nearby Weaber Plain (Goomig) development. *Triggers will be refined as frequent soil testing indicates actual soil quality for Carlton Plain soils over time.* 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.		
Outcome-based provisions			
Environmental criteria	***Response actions***	***Monitoring***	***Reporting***
CP1.TE.5 Soil salinity levels do not exceed 400mS/m in surface or 600mS/m in subsurface soils. **[Trigger criterion]**	Interim trigger levels for soil salinity are as follows: • salinity levels of topsoils do not exceed 400 mS/m (ECe) • salinity levels of subsurface soils do not exceed 600 mS/m (ECe) for two of three samples. Where an exceedance of a trigger value is identified for salinity for surface and sub soil, the following corrective actions will be implemented:	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. *This provision and triggers to be reviewed upon analysis 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 trigger and the implementation of remedial response actions, corrective actions to be reported in subsequent AERs until rectification occurs.

EPA Factor	*Terrestrial environmental quality*		
	1. Identify the distribution of soil with salinity exceeding target/trigger levels by and increase the sampling density to define the areas above the threshold (trigger value) as defined at ECe 90%. 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. 4. Identify whether remedial action is required, such as installation of drainage systems. 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 6 in surface soils or 15 in subsurface soils. **[Trigger criterion]**	Trigger level actions for exceedances of ESP include: 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 (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).	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. This provision may be revised 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.

EPA Factor	*Terrestrial environmental quality*		
	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.		
Management-based provisions			
Management actions	***Management targets***	***Monitoring***	***Reporting***
CP1.TE.7 Soil erosion (scour) is minimised where possible on flood protection levees, drainage and other significant infrastructure affecting project environmental outcomes. **[Trigger criterion]**	Repair scours following significant erosion (rainfall) events. 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.	Visual monitoring post-wet season. Annual inspection (March/April).	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.
CP1.TE.8 Collect baseline soil samples across representative soil types in irrigation and non-development areas, prior to commencement of development.	For baseline reference. Sampling to include EC, pH, ESP, nutrients.	Sites and sampling regime to be established and recorded for future reference, and retained within rehabilitation plan (CP1.TE.9)	To be addressed in AER to be prepared by the proponent and published to website.

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: Carlton Plain is located adjacent to the Ord River and near to the Parry Lagoons and Ord River Nature Reserve and Ord River Floodplain Ramsar Site. These areas are known to provide habitat to migratory birds listed under the Environment Protection and Biodiversity Conservation (EPBC) Act 1999. Furthermore, it is known anecdotally from the experiences of Ord Stage 1 and Ord Stage 2 that the addition of permanent water supply to the Kimberley landscape via irrigated agriculture provides additional habitat for wetland birds, including migratory birds listed under the EPBC Act. As such, these provisions seek to establish a dry season baseline then continue to monitor wetland bird numbers as irrigation develops on Carlton Plain. The *Survey Guidelines for Australia's threatened birds* (Department of the Environment, Water, Heritage and the Arts, 2010) will inform surveys to be undertaken.		
Outcome-based provisions			
Environmental criteria	***Response actions***	***Monitoring***	***Reporting***
CP1.TF.12 No reduction in migratory bird numbers on the Carlton wetland and Carlton Stage 1 area, undertaken and reported triennially, following commencement of irrigation. **[To become a threshold criterion once baseline numbers are established].**	Threshold contingency response: If a decline in migratory bird numbers on Carlton Stage 1 area or Carlton wetland is recorded, investigate if statistically valid, consider whether seasonal or other factors are at play, review any agricultural activity which may be a factor. If all non-agricultural factors are ruled out, undertake a detailed review of farm management activity which may impact on bird breeding	Bird counts to be undertaken at the end of the dry and wet seasons on Carlton Plain Stage 1 and Carlton wetland, with baseline counts occurring prior to the commencement of irrigation (2018). Triennial counts of migratory birds in wet and dry seasons. Provision to be revisited after 3 surveys (6 years after baseline) to consider whether continuation is required	Migratory bird counts to be included in the proponent's AER in the years that bird counts occur.

EPA Factor	*Terrestrial fauna*		
	and migrating cycles, liaise with EPA and implement changes accordingly.		
Management-based provisions			
Management actions	***Management targets***	***Monitoring***	***Reporting***
CP1.TF.10 Control pest or plague fauna as required to minimise negative environmental impacts. **[Trigger criterion]**	Trigger responses, should pest fauna cause noticeable environmental degradation: Overgrazing or native vegetation destruction in vegetation and riparian zones is reduced to a sustainable or locally acceptable level.	Regular visual monitoring as part of ongoing farm management.	Include any fauna pest control summary information in AER.

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.*

[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.

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 Flooding from 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.

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.

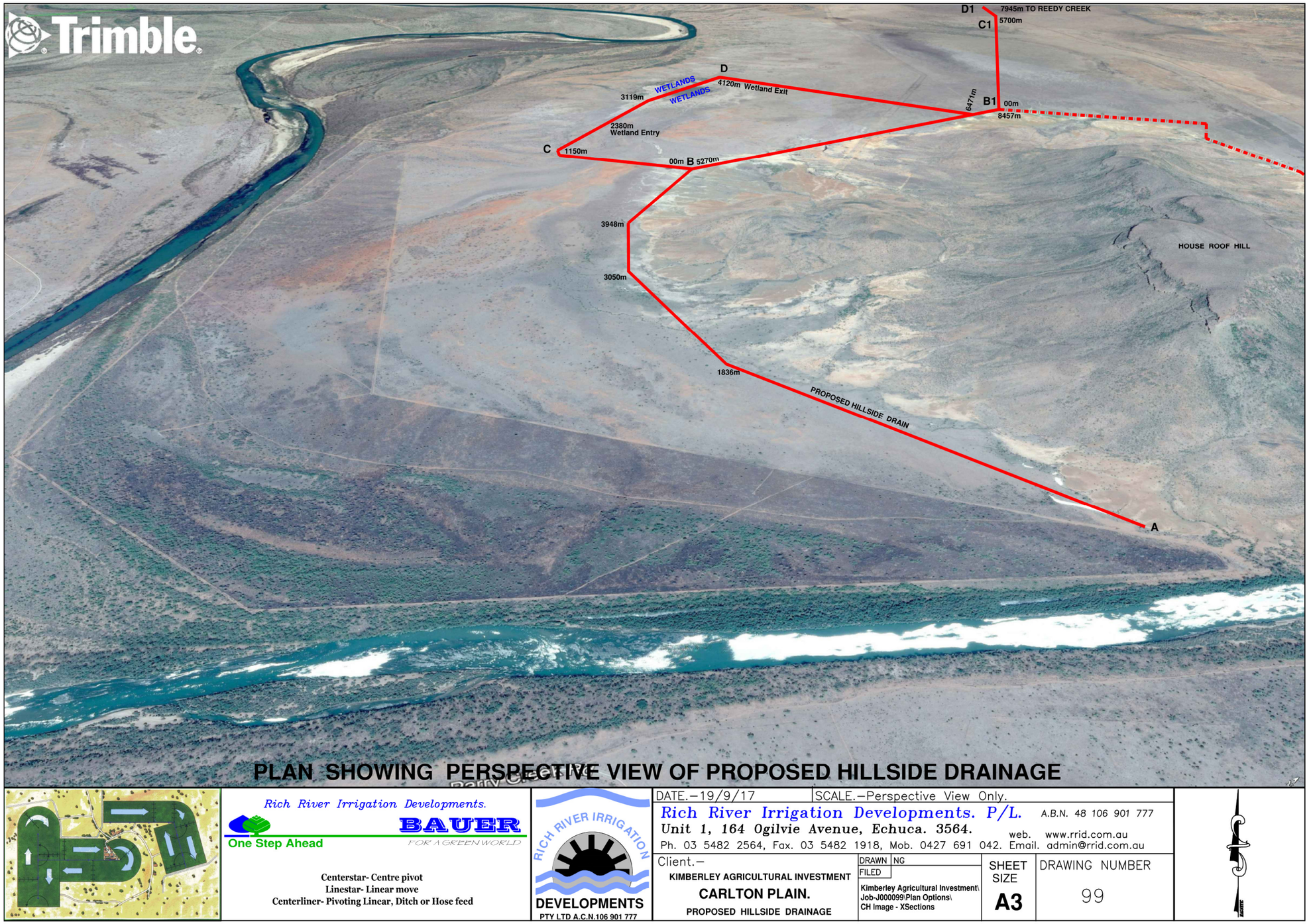
On the south and east sides of the development, the main supply channel and road are located on the 'high line'. The storm water external to the irrigation area naturally flows away from the proposed development, towards the Ord River.

Hillside drains proposed for flood management are illustrated in Figure 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 - 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.

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 8 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.

2.4.4 Ord River bank disturbances

Figure 9 illustrates the proposed locations of pump and Ord River access track sites.

Figure 8 – Monitoring bore locations: Carlton Plain

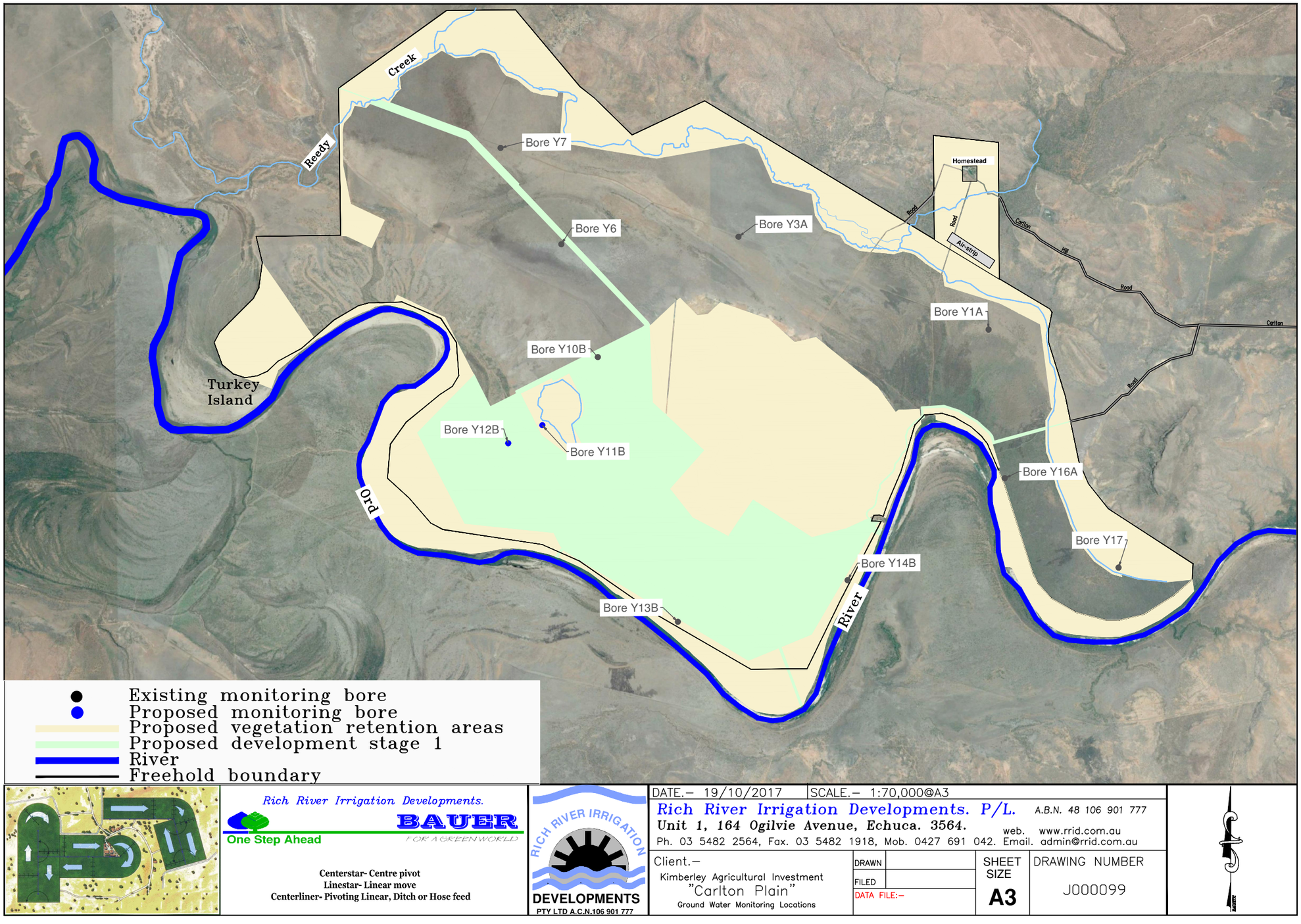


Figure 9 - Proposed locations of Ord River bank disturbances

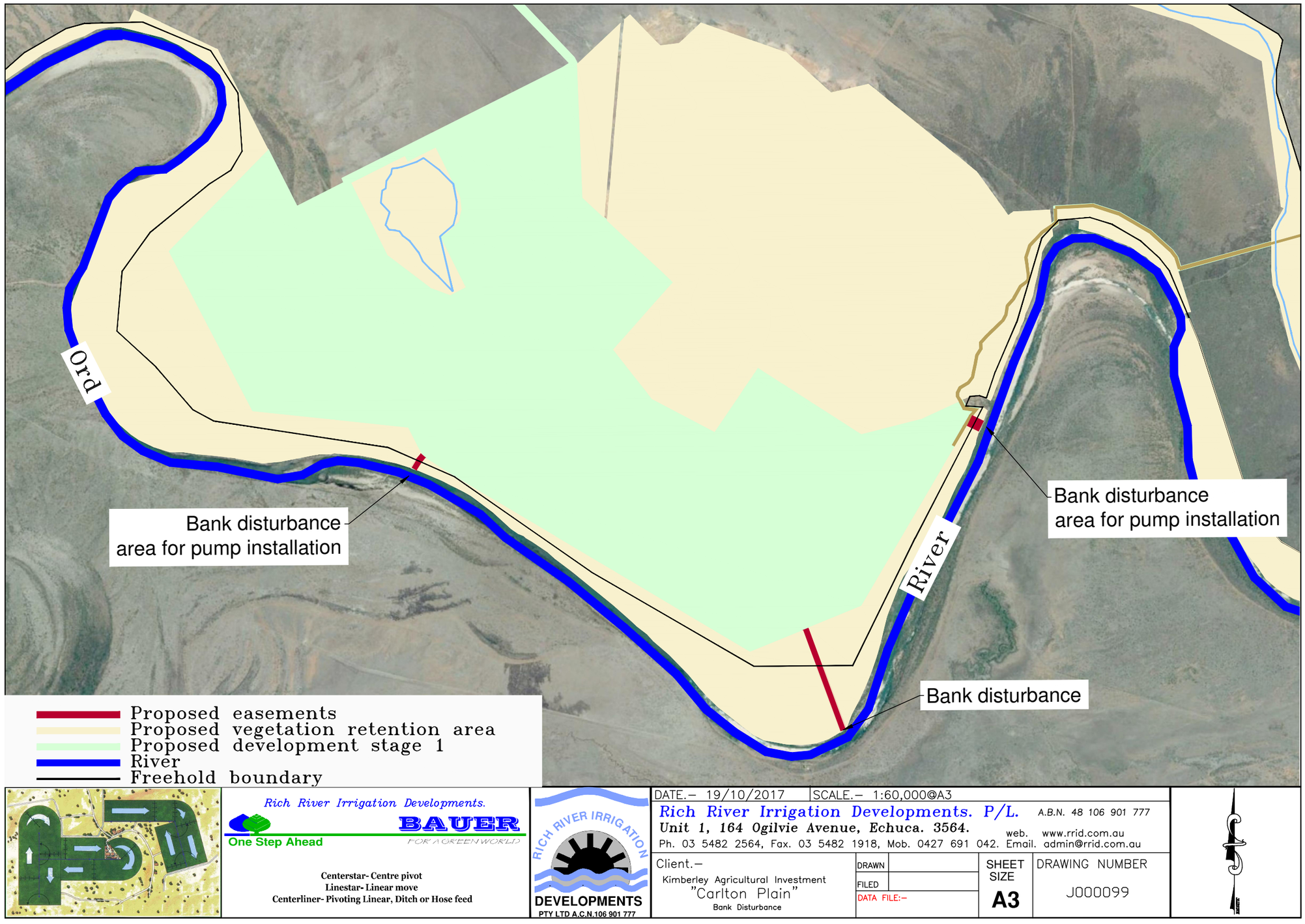


Table 7 - Hydrological processes provisions

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. Surfacewater: Fresh water flow regimes in the lower Ord River and associated wetlands (including Carlton wetland). Floodplain management: scour and erosion.		
Rationale for provisions	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. Guidance provided by preliminary groundwater assessments of Carlton Plain (Soil Management Designs, 2017) and Mantinea (Raper et al, 2014). Compliance with the provisions of the *Ord River Surface Water Allocation Plan 2013*. 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 Figure 7 for explanation of flood management design.		
Outcome-based provisions			
Environmental criteria	***Response actions***	***Monitoring***	***Reporting***
CP1.HP.11 No exceedance of approved abstraction rate (ML/day), annual limits of other requirements of the provisions of any licences to abstract water issued in line with the *Ord Surface*	Threshold contingency actions do not apply if in exceedance of water licence.	As stipulated in any operating strategy approved under water licence.	As required under any water licence issued under RiWI Act 1914.

EPA Factor	*Hydrological processes*		
Water Allocation Plan. **[Threshold criterion]**			
CP1.HP.12 Hillside drainage and internal stormwater drainage network maintained such that there is no stormwater flow through Carlton wetland in any dry season or in an average rainfall wet season. **[Threshold criterion]**	Threshold contingency action: repair hillside drain or internal drainage network in the event of above average rainfall or intense storm event causing farm stormwater flow through Carlton wetland.	Annual post-wet season inspections to occur.	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.
Management-based provisions			
Management actions	***Management targets***	***Monitoring***	***Reporting***
CP1.HP.13 Undertake a three-year baseline groundwater monitoring program then adopt an ongoing monitoring program in line with that undertaken for the Goomig (Weaber Plain) development, in order to better understand the water balance and connection between the groundwater and Ord River. **[Trigger criterion]**	Interim water depth trigger for action: 3 metres SWL. *Further response actions will be determined upon analysis of baseline data after three years. Preliminary analyses indicate low groundwater risk in the Carlton Stage 1 area and a very low likelihood of groundwater reaching 3m SWL prior to the completion of the baseline studies.*	Groundwater monitoring for depth (and water quality), with the ongoing, post-baseline regime per that recommended by Lillicrap et al, 2015 (refer to Appendix B). Timing: Twice-yearly, at the commencement of the dry season (when access allows), and follow the end of the cropping season, prior to the commencement of the wet season. Locations: Initially as per Figure 8, with modifications as farms are constructed. Management action review: Triennially.	Groundwater monitoring will be addressed in AER to be prepared by the proponent and published to website. 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.

1.5 Inland waters environmental quality

2.5.1 Groundwater quality

As discussed previously, Figure 8 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.

The Carlton Plain Stage 1 area is not considered to be at high risk of groundwater salinity (Bennett 2016; Soil Management Designs, 2017). 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 three-year baseline 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, will be adopted for 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); on-farm bores; and regionally-located 'reference bores'. (Refer to Lillicrap et al 2015 for further information on bore regimes).

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.

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.

No irrigation drainage water 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 10 illustrates the wetland water management arrangements.

Figure 10 - Carlton Plain wetland management

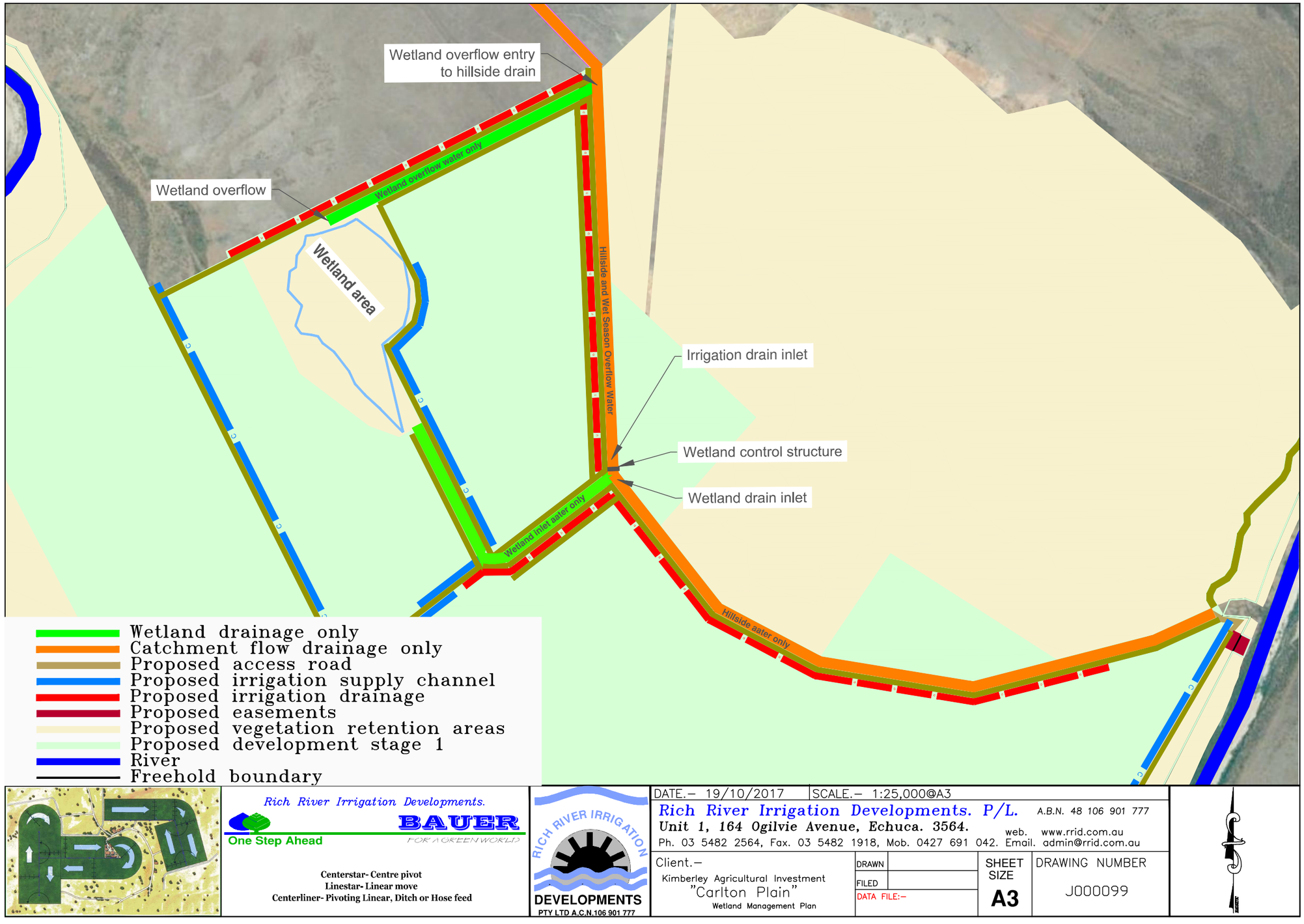


Table 8 - Inland waters provisions

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 areas		
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. Surface water: 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.		
Outcome-based provisions			
Environmental criteria	***Response actions***	***Monitoring***	***Reporting***
CP1.IW.14 No tailwater discharge to Reedy Creek or Ord River during the dry season. **[Threshold criterion]**	Threshold contingency action: In the event of tailwater flow to the Ord River, liaise with Water Corporation to release additional water through Ord Diversion Dam for flushing if required (eg if on very low tides).	Visual and system records to show no tailwater flows to Reedy (Collins) Creek system. In the event of an tailwater losses, take lower Ord River samples daily for 7 days then weekly for 4 weeks, testing for N, P and indicator farm chemicals, and compare to base data from Ord Irrigation and Water Corporation.	Report any dry season flow to Reedy (Collins) Creek system to DWER within 30 days. (Refer to Section 3.1 for incident reporting protocols).
CP1.IW.15 Establish a farm chemicals water quality testing program on the Carlton Stage	Threshold contingency action:	Baseline water sampling of total N, total	To be reported in AER to be prepared

EPA Factor	*Inland waters environmental quality*		
1 wetland to assure no farm water is entering the wetland. **[Threshold criterion]**	If farm chemicals (other than nutrients, which could be naturally sourced – ie, through fauna) are identified in wetland monitoring, source to determined. Follow-up investigations, including whether one-off or design fault. If design (or construction) fault, reconsideration of design to be investigated to ensure farm water not entering wetland, per original specification.	P, EC, pH, prior to irrigation commencing. Bi-monthly monitoring in dry season once irrigation commences. Inclusion of indicator farm chemicals (to be determined) once farming commences. *Note that nutrients cannot be traced to farm usage given the high density bird life occupying the wetland.*	by the proponent and published to website. Any recordings of indicator farm chemicals to be included in annual reporting.
Management-based provisions			
Management actions	***Management targets***	***Monitoring***	***Reporting***
CP1.IW.16 Restrict cattle entry to the Carlton Stage 1 wetland. **[Trigger criteria]**	Trigger criteria for action: utilise cattle for temporary weed control (as a preference to chemical or fire); but limit the period of access in order to avoid habitat damage. Aim for no significant physical damage to the wetland by cattle. It should be noted however that cattle are a part of the management system and will be utilised as a preference to chemical control for weed and fire risk management when required, but not on a full-time grazing basis. (This is not ideal for the environment or for nearby crops).	Visual monitoring to be undertaken.	To be addressed in AER to be prepared by the proponent and published to website. Photographic records in annual report. Baseline photos from 2016 to be utilised and compared in future reporting.
CP1.IW.17 Undertake a three-year baseline groundwater monitoring program then adopt an ongoing monitoring program in line with that undertaken for the Goomig (Weaber	Following baseline studies, triggers will be established for management actions to be applied	Groundwater monitoring for water quality parameters, with the ongoing (post-baseline) regime per that recommended by Lillicrap et al, 2015	Groundwater quality anomalies be addressed in AER to be prepared by the proponent and published to website.

EPA Factor	*Inland waters environmental quality*		
Plain) development, in order to monitor groundwater quality on Carlton Plain. **[Trigger criteria]**	1) Avoid or mitigate groundwater contamination by agricultural chemicals or fertilisers. 2) Avoid or mitigate the exacerbation of natural soil salinity risk.	(refer to Appendix B). Timing: Twice-yearly, at the commencement of the dry season (when access allows), and follow the end of the cropping season, prior to the commencement of the wet season. Locations: Initially as per Figure 8, with modifications as farms are constructed. Management action review: Triennially.	Groundwater monitoring records to be retained.

2.6 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 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.
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 where changes to the EMP are required. Initial review will occur following baseline studies for a number of the key provisions, as indicated.

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.

Baseline studies, particularly in relation to groundwater, obtained through the provisions of this EMP, will inform future development proposals.

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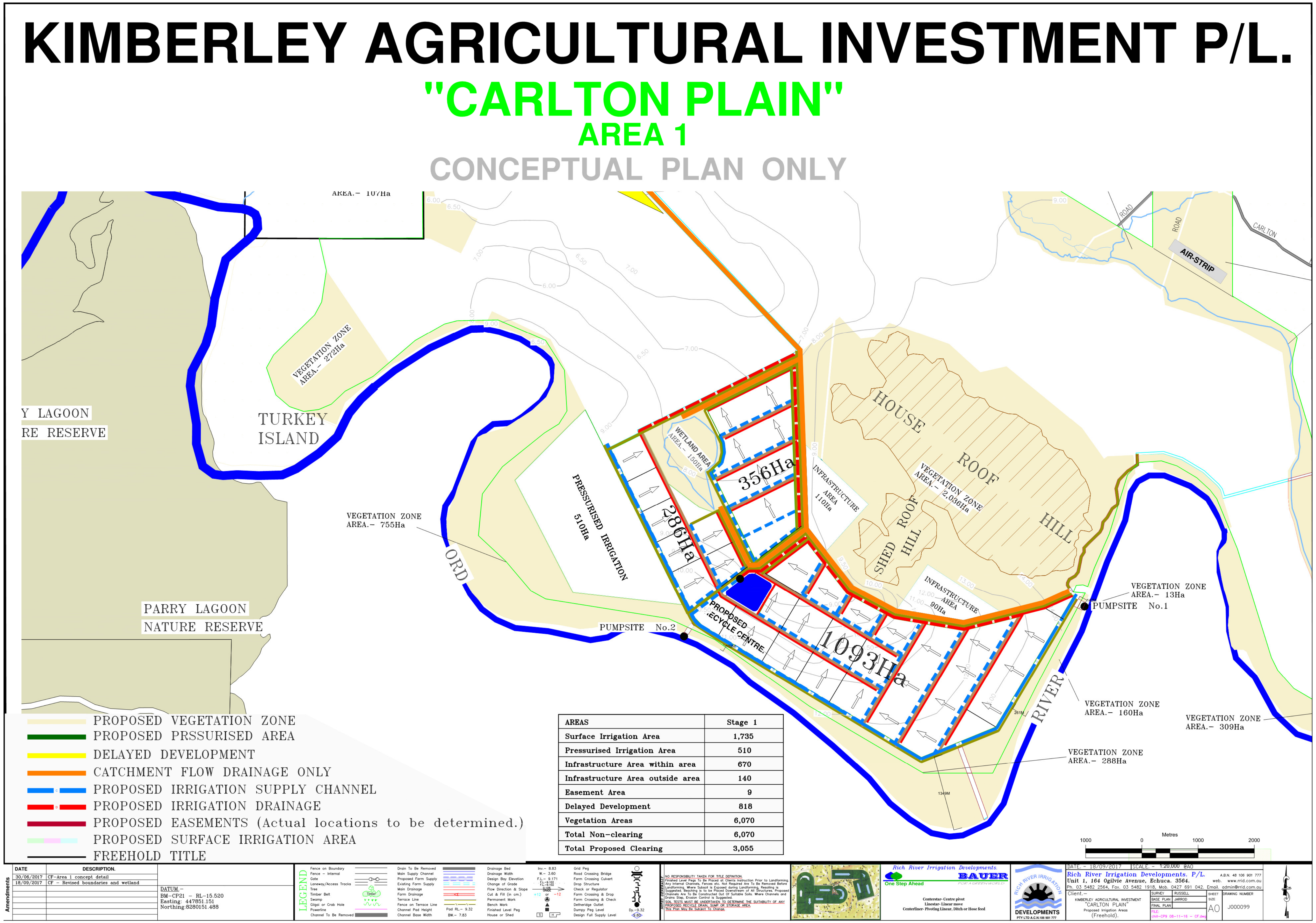
Appendices



AREAS	Stage 1
Surface Irrigation Area	1,735
Pressurised Irrigation Area	510
Infrastructure Area within area	670
Infrastructure Area outside area	140
Easement Area	9
Delayed Development	818
Vegetation Areas	6,070
Total Non-clearing	6,070
Total Proposed Clearing	3,055

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

Description	High- intensity bores*	Low- intensity bores	Farm Bores**	Reference bores*	Pumped groundwater discharge***
Field measurements					
EC, 25°C	Seasonal	Annual	Annual	Seasonal	Continuous
pH	Seasonal	Annual	Annual	Seasonal	Monthly
Chloride mg/L (ion selective electrode)	Seasonal	Annual	Annual	Seasonal	Monthly
ORP as standard hydrogen electrode	Seasonal	Annual	Annual	Seasonal	Monthly
Alkalinity (as CaCO3 mg/L)	Seasonal			Seasonal	Monthly
Acidity (as CaCO3 mg/L)	Seasonal			Seasonal	Monthly
Water level	Loggers	Seasonal	Seasonal	Loggers	Continuous (flow rate)
Description	**High- intensity bores***	**Low- intensity bores**	**Farm Bores****	**Reference bores***	**Pumped groundwater discharge*****
Laboratory measurements					
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

Description	High- intensity bores*	Low- intensity bores	Farm Bores**	Reference bores*	Pumped groundwater discharge***
Manganese	Triennial			Triennial	Annual
Molybdenum	Triennial			Triennial	Annual
Sodium	Triennial			Triennial	Annual
Nickel	Triennial			Triennial	Annual
Nitrogen, total	Annual	Triennial	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	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	Triennial	Annual	Monthly

Source: Lillicrap et al, 2015.