



Knox Creek Plain

Aquatic Fauna Management Plan

December 2016

Prepared to meet the requirements of EPBC 2014/7143, issued by the Commonwealth Minister for the Environment under the Environmental Protection and Biodiversity Conservation Act 1999

Prepared for Kimberley Agricultural Investment Pty Ltd by



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Acronyms and abbreviations used

AFMP	Aquatic Fauna Management Plan
DAFWA	Department of Agriculture and Food Western Australia
DOEE	Department of Environment and Energy
EMP	Environmental Management Program
EPBC	Environment Protection and Biodiversity Conservation
IRG	Independent Review Group
KAI	Kimberley Agricultural Investment Pty Ltd
M2 Area	Farming area serviced by the M2 Channel in the north-east Kimberley (includes Knox Creek Plain, Weaber Plain and Keep River Plain in the Northern Territory)
MSDS	Material Safety Data Sheets
MNES	Matters of National Environmental Significance
WA	Western Australia
WRM	Wetland Research and Management Pty Ltd

1.0 Introduction

1.1 Purpose and scope of management plan

This Aquatic Fauna Management Plan (AFMP) has been prepared to guide the assessment of, and risk reduction for, aquatic fauna species listed as Matters of National Environmental Significance (MNES) under the Environment Protection and Biodiversity Conservation (EPBC) Act 1999, which may arise from the development of irrigated agriculture on the Knox Creek Plain. The purpose of the AFMP and its actions is to ensure minimal impact upon the following species:

Table 1 - EPBC listed Aquatic MNES relevant to the Knox Creek Plain development

Species	Scientific name	EPBC Classification
Speartooth Shark	<i>Glyphis glyphis</i>	Critically endangered
Northern River Shark	<i>Glyphis garricki</i>	Endangered
Dwarf Sawfish	<i>Pristis clavata</i>	Vulnerable
Freshwater Sawfish , now known as Large-tooth Sawfish	<i>Pristis microdon</i> , now known as <i>Pristis pristis</i>	Vulnerable
Green Sawfish	<i>Pristis zijsron</i>	Vulnerable
Australian Snubfin Dolphin	<i>Orcaella heinsohm</i>	Migratory
Indo Pacific Humpback Dolphin	<i>Sousa chinensis</i>	Migratory

In June 2015, the Commonwealth Minister for the Environment granted Kimberley Agricultural Investment Pty Ltd (KAI) conditional approval to develop 5,570 hectares (former) pastoral land for irrigated agriculture on the Knox Creek Plain, 35 kilometres north-east of Kununurra, Western Australia (see Figure 1). This approval was issued under the EPBC Act 1999. The development area is part of an overall footprint of 12,695 hectares, which includes 6,415 hectares of buffer, with the remaining area being infrastructure corridors and balancing storage facilities.

Condition 15 of EPBC Approval 2014/7143 requires the development of an Aquatic Fauna Management Plan (AFMP) to minimise impacts to aquatic fauna listed under the EPBC Act as MNES. This document meets the requirements of Condition 15, and relates to Condition 14 of the same approval, which requires the establishment of an Independent Review Group (IRG) to review the impacts of the Knox Creek Plain development on aquatic fauna MNES present in the Keep River. [Detailed requirements of the conditions are presented in Section 2 of this AFMP].

Potential threats to listed MNES present in the Keep River arise from the Knox development include stormwater and groundwater discharge, accretion of groundwater in the Keep River, and likely farm chemical use on Knox Creek Plain farmland.

1.2 Project Background

Kimberley Agricultural Investment Pty Ltd (KAI) has a licence under the Western Australian (WA) Lands Administration Act (1987) to develop land for irrigated agriculture on the Knox Creek Plain, located north-northeast of Kununurra in the eastern Kimberley region of WA. The Knox Creek Plain development forms part of the overall *M2 Area*, which comprises over 76 000 ha (including buffers) across the Weaber, Keep River and Knox Creek plains and extends to the Keep River estuary in the Northern Territory.

The development will be supplied with water via a recently constructed major irrigation channel (the 'M2 channel'), which was initially extended from Stock Route Road in Kununurra, through to the end of the Weaber Plain or Goomig Farm Area. This channel was constructed within the parameters of EPBC approval 2010/5491, relating to the Weaber Plain (or Goomig) development. The development of the Knox Creek Plain will see the extension of this channel by approximately 7.5 kilometres. Internal farm channels will extend from this main supply.

An on-farm drainage network will return tailwater from flood-irrigated farms, for internal recycling during the irrigation season. The *Knox Creek Plain Environmental Management Program* (EMP) contains commitments to minimise tailwater flow to the Keep River, via the use of tailwater return systems. Groundwater, surface water and discharge management actions are also contained in the *Knox Creek Plain EMP*, and are referenced requirements of EPBC approval 2014/7143.

The land within and surrounding the Knox Creek Plain Development Area is of traditional and current significance to Aboriginal people, who continue to maintain a strong cultural identity and attachment to the land. The traditional owners of land within the Knox Creek Plain area are the Miriuwung and Gajerrong peoples. The *Ord Final Agreement* (2005), agreed between the Government of Western Australia and Miriuwung and Gajerrong peoples, is the Indigenous Land Use Agreement enabling the development of the Knox Creek Plain for irrigated agriculture.

The environmental and socio-economic setting relating to the development is described in detail in the *Environmental Review and Management Plan/Draft Environmental Impact Statement* (Kinhill, 2000), and the *Knox Creek Plain Public Environment Report* (Kimberley Boab Consulting, 2014).

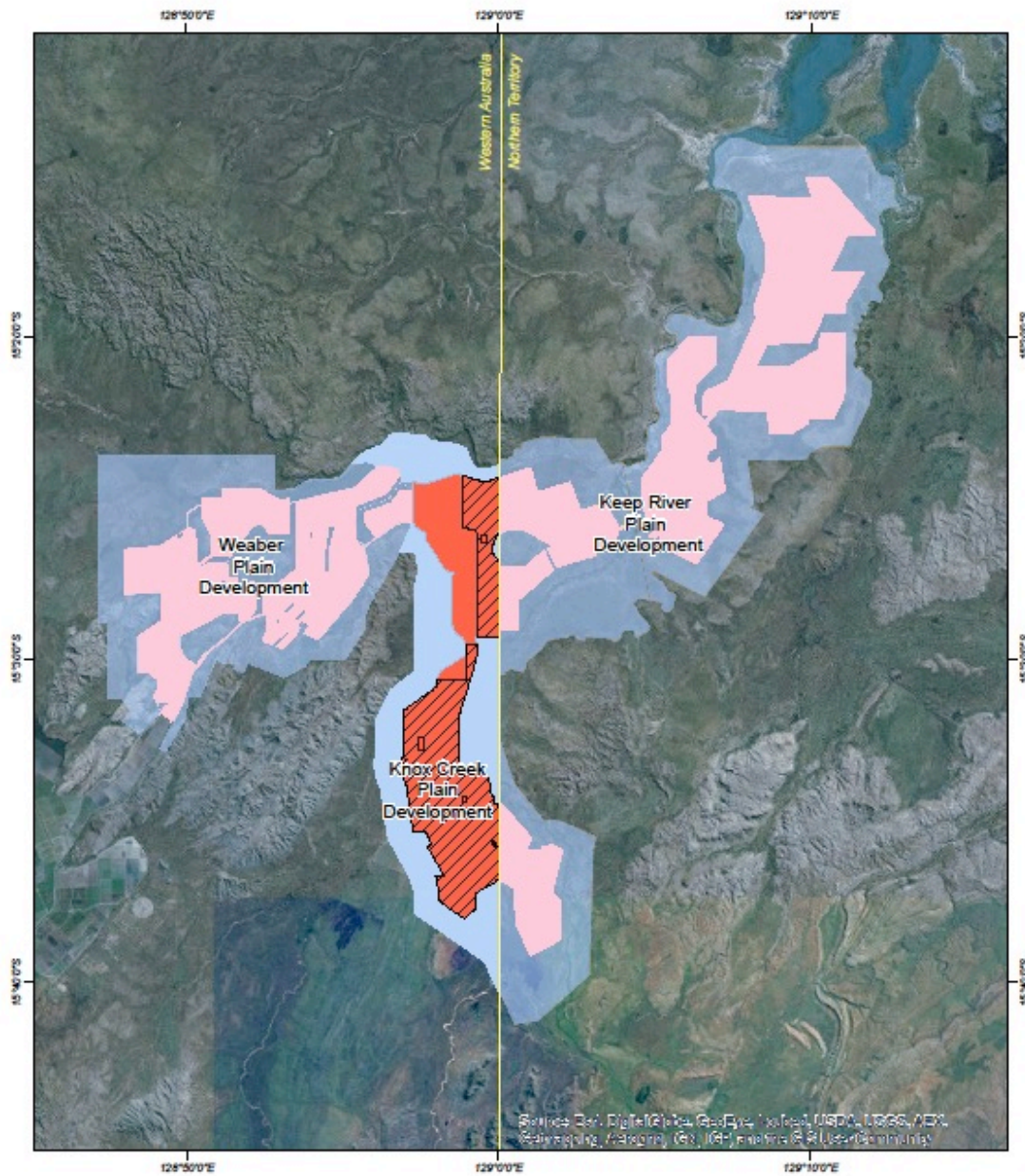
1.3 Location

The Knox Creek Plain is a predominantly flat alluvial plain with little topographical undulation and occasional rocky outcrops. The plain is predominantly covered in black soils comprised mainly of cracking clays, and is bounded to the west by the Pincombe (Goomig) Range. Pincombe (Goomig) Range is comprised of interbedded sandstone and siltstone. The Western Australian/Northern Territory border provides the eastern boundary.

To the north of the project area lays the Keep River, with the Keep River Plain to the north-east, within the adjacent Northern Territory.

The project area and its relativity to the Weaber Plain (Goomig) development area are depicted in Figure 1.

Figure 1 - Knox Creek Plain location



Legend

- Proposed Knox Plain Development Area
- Approved M2 Development Area
- Weaber and Keep River Plains Development Areas
- Knox Plain Buffer Area
- Weaber and Keep River Plains Buffer Areas

**Knox Creek Plain
Irrigation Development**

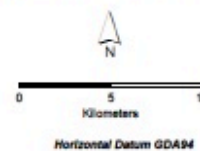
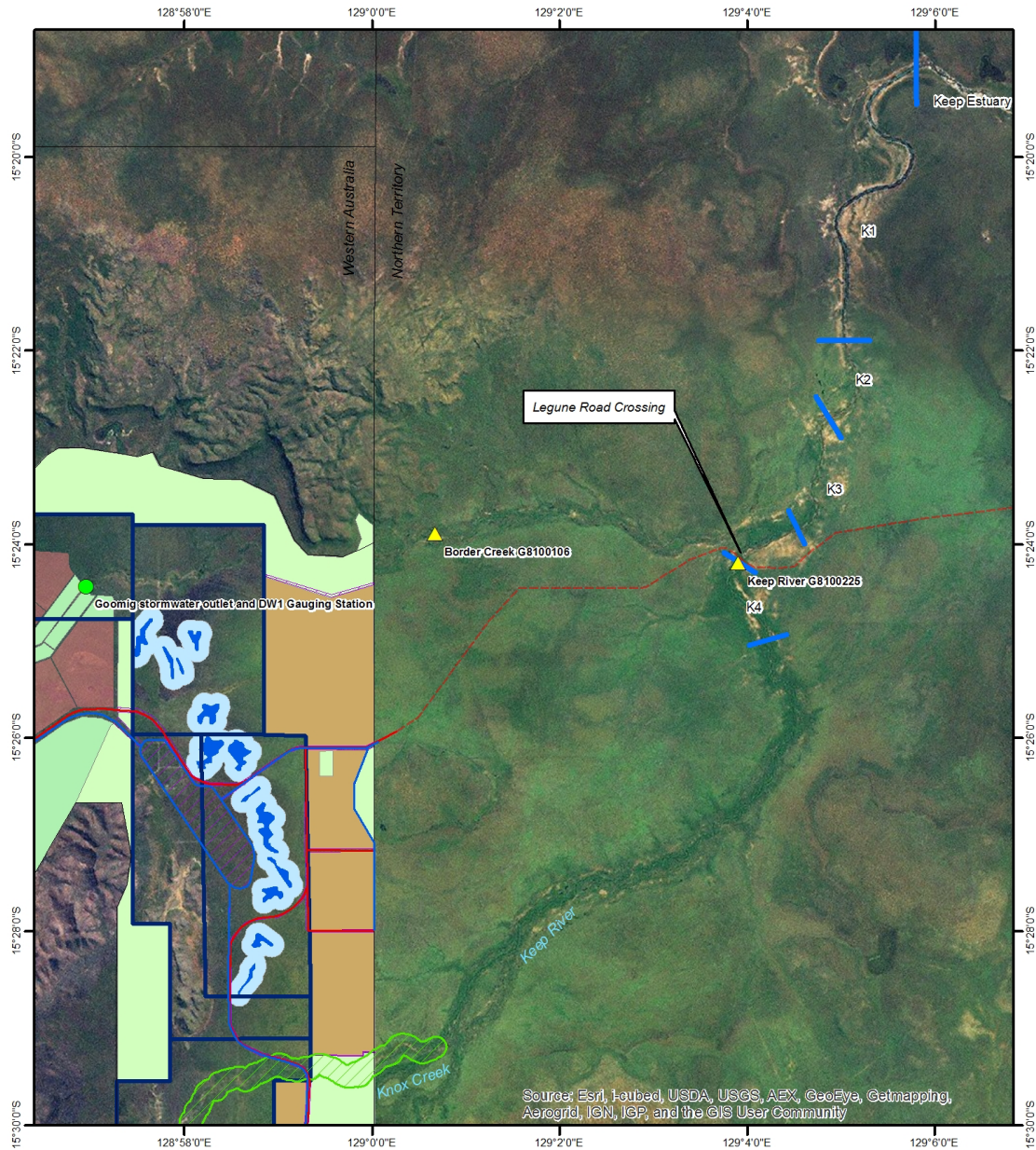


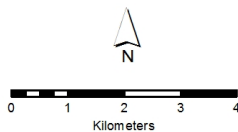
Figure 2 illustrates the proximity of the Knox Creek Plain development to the Keep River, highlighting the location of pools referred to in Condition 15 of EPBC 2014/7143:

Figure 2 - Knox Creek Plain proximity to Keep River pools



Knox Creek Plain Proposed Development and Keep River Pools

Version 2
23 February 2015



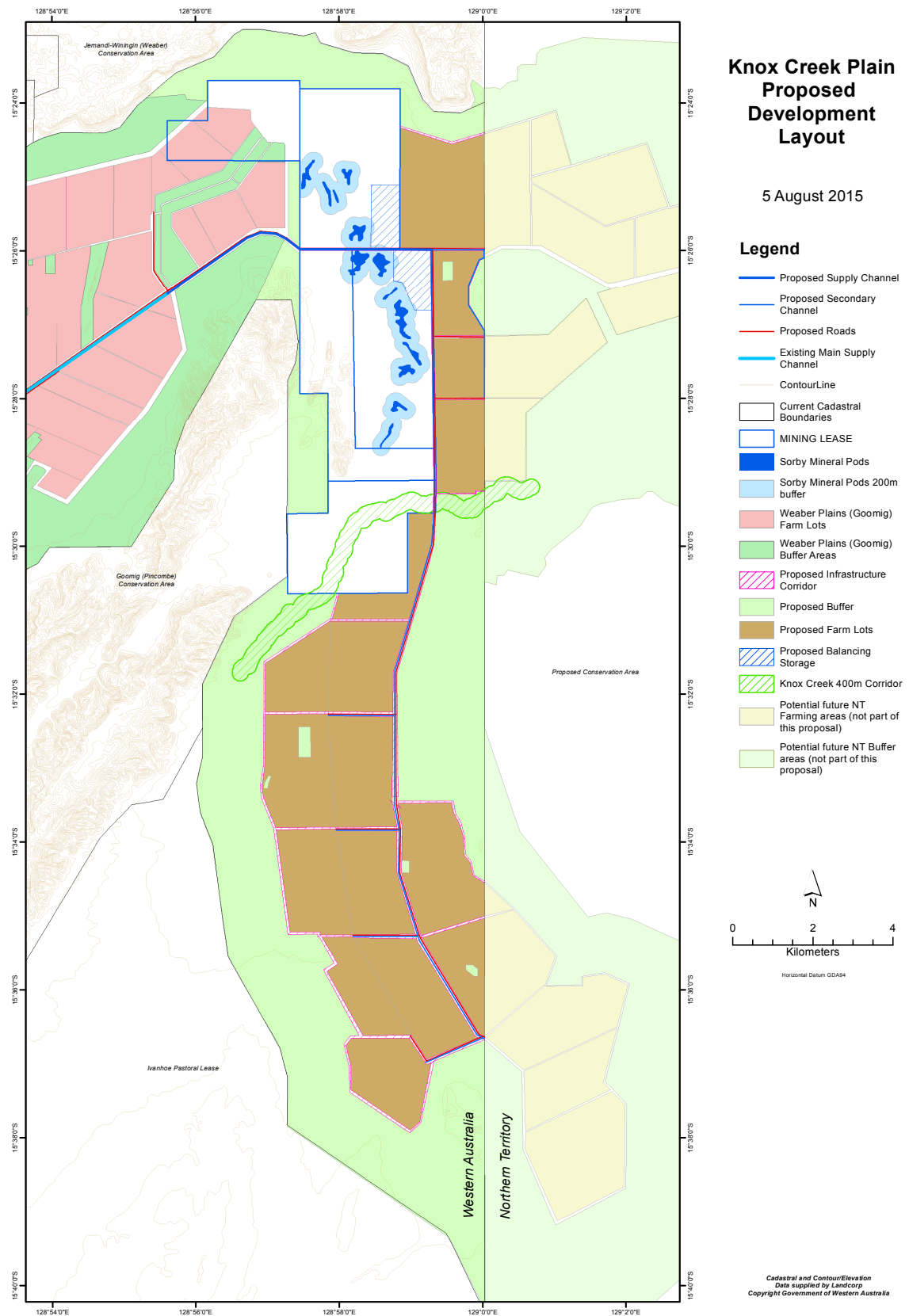
Horizontal Datum: GDA 1994 MGA Z52

Legend

- Pool Limits
- Existing Dry Season Access
- Proposed Supply Channel
- Proposed Roads
- Knox Creek 400m Corridor
- Knox Ck Plain Proposed Farm Lots
- Knox Ck Plain Proposed Buffer Areas
- Proposed Infrastructure Corridor
- Mining Lease
- Sorby Mineral Pools
- Sorby Mineral Pools 200m buffer
- Current Cadastral Boundaries
- Weaver Plains (Goomig) Farm Lots
- Weaver Plains (Goomig) Buffer Areas

The proposed development layout is presented in Figure 3.

Figure 3 - Knox Creek Plain Proposed Development Layout



1.4 Associated and Nearby Approvals

1.4.1 EPBC 2010/5491 and Ministerial Statement 938

The Knox Creek Plain development forms part of the broader 'M2' or 'Ord River Irrigation Area (ORIA) Stage 2'. The M2 area includes Weaber Plain (Goomig); the Knox Creek Plain (WA); and additional proportions of the Knox Creek Plain and Keep River areas in the Northern Territory. Ministerial Statement 938, issued under the Western Australian *Environmental Protection Act 1986*, applies to the M2 area.

KAI has reached agreement with the State of Western Australia to develop the Weaber Plain (Goomig) farm area for irrigated agriculture, and has commenced doing so under existing EPBC Approval 2010/5491 and Ministerial Statement 938. This agreement contractually includes KAI becoming proponent under existing State and Commonwealth environmental approvals for the Weaber Plain (Goomig) development.

In developing the Weaber Plain farms, KAI has adopted the requirements of the management plans established under EPBC 2010/5491, including the *Weaber Plain (Goomig) Aquatic Fauna Management Plan*, and commitments associated with the Weaber Plain (Goomig) Independent Review Group.

It is KAI's intention to manage the Weaber (Goomig) and Knox areas as a unified system. The rationale for doing so is due to the developments being congruently located, both supplied by the M2 channel, both within the Keep River catchment, and with a single land use (broad acre agricultural cropping). These physical parameters are supplemented by the economic and management efficiencies associated with a large scale unified farming system.

EPBC 2014/7143 references to 'similar conditions held by the proponent' are treated in this AFMP and in practical management as referring to the Weaber Plan EPBC 2010/5491 approval.

1.4.2 Water Licence SWL179228

The Western Australian Department of Water has approved the *Goomig-Knox Farm Areas Operating Strategy* in relation to surface water allocation licence SWL179228, issued to KAI under the *Rights in Water and Irrigation Act 1914*. The associated annual water entitlement will increase in a staged approach during the development of the Weaber and Knox areas for irrigated agriculture.

1.4.3 Sorby Hills – EPBC 2011/6230

The proposed Sorby Hills silver, lead and zinc mine, covered by Ministerial Statement 964 and EPA Report 1491, and EPBC Approval 2011/6230, is adjacent to the north-west of the Knox Creek Plain development. The Sorby Hills mining tenements cover approximately 1800 hectares of the Keep River Catchment, Border Creek and Knox Creek catchments. (http://www.environment.gov.au/cgi-bin/epbc/epbc_ap.pl?name=current_referral_detail&proposal_id=6230).

The Sorby Hills mine proposal includes an artificial wetland to the south-east corner of the Sorby development area, and a stormwater diversion bund on the southern and western boundaries to direct catchment stormwater to the south of the Sorby lease area, towards the Knox Creek. KAI will take into account the Sorby design when completing its design for the Knox Creek Plain development, as the diversion of water around the Sorby site has implications for both volumes and quality of stormwater flowing to Knox Creek and the Keep River.

1.4.4 Project Sea Dragon [Legune Station] – EPBC 2015/7527

Stage 1 of the Project Sea Dragon aquaculture project was referred to the Department of the Environment in July 2015 (http://www.environment.gov.au/cgi-bin/epbc/epbc_ap.pl?name=current_referral_detail&proposal_id=7527). This development is

proposed to be located approximately 40 kilometres to the north-east of the Knox Creek Plain, partially within the Keep River catchment.

Both the Sorby Hills and Project Sea Dragon proposals are referenced here as they demonstrate that agricultural development on the Knox (and Weaber) Plain is not the sole source of development-related impact upon the health of the Keep River or its aquatic fauna. In particular, potential water quality impacts arising from the Sorby Hills mine development, including the diversion of stormwater due to the construction of a levee bank to the south of the Sorby area, will be carefully considered by KAI in order to ensure the catchment-related implications of the proposed mine are not deemed to be KAI's responsibility.

1.5 Associated Aquatic Fauna Surveys

Numerous aquatic fauna surveys have been conducted in the Keep River and surrounding waterways during the development of the nearby Weaber Plain (Goomig) farmlands. A list of specific research is provided in Table 2.

Table 2 - Recent Keep River and local waterways aquatic fauna studies

Author	Year	Study	Coverage / further information
Bennett and George	2014	Goomig Farmlands development: baseline water quality in the lower Keep River	Keep River
Larson	1999	Keep River Aquatic Fauna Survey	Keep River
Storey et al.	2005	Aquatic Fauna Survey of the Ord Stage II M2 Area	M2 area
Wetland Research and Management	2010	ORIA Stage II Expansion Aquatic Fauna Surveys - Late Wet Season Sampling 2009 Final Report	Keep River
Wetland Research and Management	2011	ORIA Stage II Expansion Weaber Plain / Keep River Water Quality and Aquatic Fauna Sampling 2009-2010	Keep River
Wetland Research and Management	2013a	Keep River Baseline Aquatic Fauna and Targeted Fish Surveys September/October 2011	Keep River
Wetland Research and Management	2013b	ORIA Stage II Expansion Lower Ord River Aquatic Fauna Monitoring - Synthesis of Baseline Surveys	Lower Ord
Wetland Research and Management	2014	ORIA Stage II Expansion - Keep River Baseline Aquatic Fauna and Targeted Fish Surveys September/October 2013	Keep River
Wetland Research and Management	2015a	ORIS Stage II M2 Expansion – Risk Assessment of Weaber Plain Development on Keep River Listed Species	Risks to aquatic MNES associated with Weaber Plain development
Wetland Research and Management	2015b	ORIA Stage II Expansion – Knox Creek Plain Baseline Aquatic Fauna Surveys 2014	Control site added to Weaber Plain baseline studies

Sawfish (*Pristis*) species have been identified throughout the studies listed above. River sharks (*Glyphis* spp.) have not been identified in surveys of the Keep River. As described in the Weaber Plain (Goomig) *Aquatic Fauna Management Plan* (Department of State Development, 2014), the *Glyphis* and *Pristis* species are naturally uncommon, and are well adapted to living in environments with highly variable salinity, flow regimes and turbidity, “which suggests they will have a degree of tolerance to changes in water quality in the event of a potential impact” (ibid., p4).

Similarly, the Australian Snubfin and Indo-Pacific Humpback dolphins have not been recorded across the multiple studies undertaken.

Notably, research in Northern Australia, summarised by the Great Barrier Reef Marine Park Authority (GBRMP, 2012) indicates the Australian Snubfin and Indo-Pacific Humpback dolphins tend to remain in or return to their birthplace, and live in small, geographically isolated populations. These research findings have implications for the presence (or otherwise) of these species in the Keep River estuary and river mouth.

Given that no dolphins have been observed in the Keep River during the surveys listed in Table 2, and their preference for remaining in small family groups, it appears unlikely that the Australian Snubfin and Indo-Pacific Humpback dolphins are present in the Keep River or estuary.

Nonetheless, Table 3 provides a summary of local records, general and Knox Creek Plain development-related threats to the listed MNES:

Table 3 - EPBC-listed threatened and migratory aquatic fauna species

Species	Scientific name	EPBC listing	Keep River records / likelihood of occurrence / habitat preferences	Current local threats	Potential threats associated with Knox Creek Plain development
Speartooth Shark	<i>Glyphis glyphis</i>	Critically endangered	Not recorded in the Keep River or estuary in formal targeted surveys in 1999, 2003, 2005, 2011, 2012 and 2013 (WRM, 2014). Limited likelihood of occurrence.	Not known to be present locally.	Stormwater from Knox Creek Plain flowing to Keep River. Increased groundwater discharge to K4 pool. Introduction of aquatic weeds and pests.
Northern River Shark	<i>Glyphis garricki</i>	Endangered	Not recorded in the Keep River or estuary in formal targeted surveys in 1999, 2003, 2005, 2011, 2012 and 2013 (WRM, 2014). Limited likelihood of occurrence.	Not known to be present locally.	Stormwater from Knox Creek Plain flowing to Keep River. Increased groundwater discharge to K4 pool. Introduction of aquatic weeds and pests.
Dwarf Sawfish	<i>Pristis clavata</i>	Vulnerable	Common in the Keep River estuary (WRM, 2014). All records of <i>P. clavata</i> are from the estuary (<i>ibid.</i>).	Recreational fishing. Habitat degradation.	Stormwater from Knox Creek Plain flowing to Keep River. Increased groundwater discharge to K4 pool. Introduction of aquatic weeds and pests.
Freshwater Sawfish, now known as Largetooth Sawfish	<i>Pristis microdon,</i> now known as <i>Pristis pristis</i>	Vulnerable	Occurs at least to 60km upstream of the Keep River estuary (WRM, 2014). All records of <i>P. pristis</i> are from the Keep River (<i>ibid.</i>).	Recreational fishing. Habitat degradation.	Stormwater from Knox Creek Plain flowing to Keep River. Increased groundwater discharge to K4 pool. Introduction of aquatic weeds and pests.
Green Sawfish	<i>Pristis zijsron</i>	Vulnerable	One recorded female in the upper Keep River estuary in 2013 (WRM, 2014). Considered 'likely to have been a vagrant' by WRM (2014, p21) due to the majority of <i>P. zijsron</i> in Australia being located in the Gulf of Carpentaria.	Recreational fishing. Habitat degradation.	Stormwater from Knox Creek Plain flowing to Keep River. Increased groundwater discharge to K4 pool. Introduction of aquatic weeds and pests.

(continued)

Species	Scientific name	EPBC listing	Keep River records / likelihood of occurrence / habitat preferences	Current local threats	Potential threats associated with Knox Creek Plain development
Australian Snubfin Dolphin	<i>Orcaella heinsohm</i>	Migratory	Not observed in Keep River or estuary in previous surveys (Storey, 2014, pers. comm). A review of spatial distribution data for Australian Snubfin Dolphins in Northern Australian waters indicated a habitat preference close to river mouths, in near-shore estuarine waters (Parra et al, 2006).	Habitat loss and degradation. Cumulative impacts from catchment runoff (GBRMPA, 2012).	Stormwater from Knox Creek Plain flowing to Keep River.
Indo Pacific Humpback Dolphin	<i>Sousa chinensis</i>	Migratory	No records of observation in Keep River or estuary. A review of spatial distribution data for Indo-Pacific Humpback Dolphins in Northern Australian waters indicated a habitat preference in near-shore estuarine waters (Parra et al, 2006).	Habitat loss and degradation. Cumulative impacts from catchment runoff (GBRMPA, 2012).	Stormwater from Knox Creek Plain flowing to Keep River.

2.0 EPBC 2014/7143 Aquatic Fauna Management Conditions

A summary of KAI's approach to addressing Conditions 14 and 15 of the Knox Creek Plain EPBC Approval 2015/7143 is presented in Table 4. Note that Condition 15 detail is presented first, as it contains the substantive requirements of this Aquatic Fauna Management Plan.

Table 4 - Summary of Aquatic Fauna Management Requirements

#	Condition	Where addressed in AFMP
15A	The person taking the action must implement the action in accordance with Sections 7, 8 and 9 of the Knox Creek Plain Environmental Management Program May 2015, to minimise impacts on listed threatened and migratory species in the Keep River.	Section 3.1
15B	In order to mitigate impacts to listed threatened and migratory species in the Keep River from impacts resulting from the action, the person taking the action must prepare an Aquatic Fauna Management Plan (AFMP), in consultation with the IRG. The AFMP must be submitted for approval by the Minister. The person taking the action must not commence clearance of the Development Area until the AFMP is approved by the Minister. The approved AFMP must be implemented. If a condition of another approval held by the proponent requires an AFMP, the proponent may meet the relevant requirements of both conditions by submitting a single plan. If a single plan is submitted, the plan must identify to which approval the sections of the plan relate. The AFMP must include:	Section 3.2 Table 5 Action AFMP1
15B(i)	A targeted, non-lethal baseline surveying program for listed threatened species that are likely to occur in the Keep River. This must include the critically endangered Speartooth Shark (<i>Glyphis glyphis</i>), the endangered Northern River Shark (<i>Glyphis garricki</i>), the vulnerable Dwarf Sawfish (<i>Pristis clavata</i>) and the vulnerable Freshwater Sawfish (<i>Pristis Microdon</i>), now known as Largetooth Sawfish (<i>Pristis pristis</i>). The methodology of the baseline surveying program must be developed in consultation with the IRG. Surveys must be conducted over a period of 3 years and must be undertaken in the four Keep River pools (K1, K2, K3 and K4) and at least three sites in the Keep River estuary.	Section 3.2 Table 5 Action AFMP2
15B(ii)	An outcome based risk assessment which is based on data collected during the baseline monitoring program and other relevant data to determine the potential risks to the listed threatened species named in Condition 15.B.i above as well as for the listed vulnerable Green Sawfish (<i>Pristis zijsron</i>) and the listed migratory Australian Snubfin Dolphin (<i>Orcaella heinsohm</i>) and Indo Pacific Humpback Dolphin (<i>Sousa chinensis</i>), at an individual and local population level.	Section 3.2 Table 5 Action AFMP3 Section 5.0 / Table 8
15B(iii)	Seasonal, site-specific baseline water quality and flow trigger values for the Keep River listed threatened and migratory species determined with reference to the ANZECC guidelines and the advice of the IRG. Until trigger values are established with the advice of the IRG, ANZECC guidelines trigger values for systems with high conservation/ecological value (as defined in the ANZECC guidelines) must be used. Sample analytes must also be determined with the advice of the IRG.	Section 3.2 Table 5 Actions AFMP4 and AFMP5 Section 3.3 / Table 6

(continued)

#	Condition	Where addressed in AFMP
15B(iv)	A monitoring program for the Keep River, Keep River pools, on the Development Area, and of relevant groundwater sites and parameters to be undertaken to monitor water quality and flow with the purpose of enabling early detection of changes so that corrective action can be taken to ensure that trigger values are not exceeded during construction and operation.	Section 3.2 Table 5 Action AFMP6
15B(v)	A method or mechanism for predicting, modelling and/or monitoring the water quality of the seasonal first flush of water capable of detecting water quality trigger levels for listed threatened and migratory species, developed in consultation with the IRG. This may include onsite monitoring.	Section 3.2 Table 5 Action AFMP7
15B(vi)	A targeted aquatic fauna monitoring program to be undertaken during construction and operation to measure the success of management measures to inform an adaptive management approach.	Section 3.2 Table 5 Action AFMP8
15B(vii)	Details of management objectives, management actions, performance standards, corrective actions should trigger values be reached, adaptive management and contingency measures to mitigate impacts on listed threatened and migratory species in the Keep River from changes to flow, water quality from surface water, stormwater and groundwater during construction and operation.	Section 3.3 Triggers – Table 6 Management Responses – Table 7
14A	The person taking the action must appoint an Independent Review Group (IRG) to review the impacts of the action on aquatic listed threatened and migratory species. The IRG must be established prior to the submission of the Aquatic Fauna Management Plan (referred to in Condition 15) to the Minister for approval. If a condition of another approval held by the proponent requires an IRG identical in nature, the proponent may meet the relevant requirements of both conditions by appointing a single IRG. The IRG must be established by the person taking the action in accordance with the following requirements:	Section 4.0
14A(i)	The IRG must be funded, resourced and managed by the person taking the action.	Appendix A
14A(ii)	The IRG must consist of independent scientific and technical experts, of whom at least one must be a Glyphis and Pristis expert and two must be technical experts with at least five years experience in northern Australian surface water and groundwater hydrology approved by the Minister.	Appendix A
14A(iii)	Terms of Reference for the IRG must be prepared by the person taking the action and submitted for approval by the Minister. The Terms of Reference must include the frequency of proposed meetings, tenure of membership, and chairing and quorum arrangements. The Terms of Reference must be approved by the Minister in writing prior to the submission of the Aquatic Fauna Management Plan to the Minister for approval.	Appendix A
14A(iv)	The IRG must provide advice to the person taking the action on any revisions to the Aquatic Fauna Management Plan. The advice of the IRG must also be provided to the Minister.	Appendix A
14A(v)	The IRG must assess any exceedances of trigger values and advise changes to the person taking the action as required.	Appendix A
14A(vi)	The Minister may seek advice from the IRG at any time.	Appendix A

3.0 Aquatic Fauna Management

3.1 Compliance with Knox Creek Plain Environmental Management Program

Sections 7, 8 and 9 of the *Knox Creek Plain EMP*, as referenced in Condition 15A, comprise the following EMP sub-plans:

EMP Section 7 - Surface Water Management Sub-plan

EMP Section 8 - Groundwater Management Sub-plan

EMP Section 9 - Discharge Management Sub-plan

The approved *Knox Creek Plain EMP* (May 2015) is attached as Appendix B. The monitoring and management actions outlined in the EMP will be undertaken as stipulated in the document, and audited and reported under the requirements of Ministerial Statement 938.

KAI will utilise the expertise of the Knox Creek Plain IRG to review surface and groundwater management practices in relation to the impact on MNES known to inhabit the Keep River. In particular, the advice of the IRG will be called upon, as required under the EMP,

- to review discharge management decision-making in relation to impacts on MNES in the Keep River;
- to consider and/or recommend remedial actions in the event of increasing trends in the concentration of analytes being monitored in groundwater;
- following the exceedance of triggers for a particular chemical over two consecutive years; and
- in relation to monitoring after the implementation of remedial actions.

The EMP sub-plans will be implemented however no additional management or monitoring actions above those stipulated in the EMP will be mandated unless instructed by the Minister or in the event of a revision of the EMP document. Should a revision to the EMP occur, the surface water, groundwater and discharge management sub-plans will be referred to the IRG for consideration and advice. The actions are not repeated herewith in order to avoid administrative (audit and reporting) duplication.

Annual reporting of compliance with the *Knox Creek Plain EMP* will be submitted to the IRG and the Department of the Environment and Energy by 31 March of the year following the calendar year reporting period. This will include a review of compliance with Sections 7,8 and 9 addressing water-related issues which have the potential to impact upon aquatic MNES.

3.2 Aquatic Fauna Management Actions

Table 5 presents the management requirements associated with potential impacts of the Knox Creek Plain development on the aquatic MNES in the Keep River, and addresses the specific management requirements of Condition 15B.

The water quality triggers and management responses associated with the monitoring of water quality under this AFMP is further discussed in Section 3.3.

Table 5 - Knox Creek Plain Aquatic Fauna Management Actions

Condition	Requirement	Action #	Action	Timing	Notes / Commentary
Management					
15B	In order to mitigate impacts to listed threatened and migratory species in the Keep River from impacts resulting from the action, the person taking the action must prepare an Aquatic Fauna Management Plan (AFMP), in consultation with the IRG. The AFMP must be submitted for approval by the Minister. The person taking the action must not commence clearance of the Development Area until the AFMP is approved by the Minister. The approved AFMP must be implemented. If a condition of another approval held by the proponent requires an AFMP, the proponent may meet the relevant requirements of both conditions by submitting a single plan. If a single plan is submitted, the plan must identify to which approval the sections of the plan relate. The AFMP must include:	AFMP1	Prepare Aquatic Fauna Management Plan, seek IRG endorsement and submit to Minister for approval.	September 2015	This document.
15B(i)	A targeted, non-lethal baseline surveying program for listed threatened species that are likely to occur in the Keep River. This must include the critically endangered Speartooth Shark (<i>Glyphis glyphis</i>), the endangered Northern River Shark (<i>Glyphis garricki</i>), the vulnerable Dwarf Sawfish (<i>Pristis clavata</i>) and the vulnerable Freshwater Sawfish (<i>Pristis Microdon</i>), now known as Largetooth Sawfish (<i>Pristis pristis</i>). The methodology of the baseline surveying program must be developed in consultation with the IRG. Surveys must be conducted over a period of 3 years and must be undertaken in the four Keep River pools (K1, K2, K3 and K4) and at least three sites in the Keep River estuary.	AFMP2	Adopt the findings of the targeted, non-lethal baseline surveying program for for the Speartooth Shark (<i>Glyphis glyphis</i>), Northern River Shark (<i>Glyphis garricki</i>), Dwarf Sawfish (<i>Pristis clavata</i>) and the Freshwater Sawfish (<i>Pristis microdon</i>) in the Keep River, completed as a requirement of EPBC 2010/5491 (Weaber Plain development).	Completed (via Weaber Plain conditions).	This condition has been met through the completion of Keep River baseline surveying in 2013, as prescribed in EPBC Approval 2010/5491. The baseline aquatic fauna study (WRM 2014) is attached as Appendix C. The methodology for the baseline aquatic fauna surveying was approved by the Weaber Plain IRG in 2011.

Condition	Requirement	Action #	Action	Timing	Notes / Commentary
Condition	Requirement	Action #	Action	Timing	Notes / Commentary
15B(ii)	An outcome based risk assessment which is based on data collected during the baseline monitoring program and other relevant data to determine the potential risks to the listed threatened species named in Condition 15.B.i above as well as for the listed vulnerable Green Sawfish (<i>Pristis zijsron</i>) and the listed migratory Australian Snubfin Dolphin (<i>Orcaella heinsohm</i>) and Indo Pacific Humpback Dolphin (<i>Sousa chinensis</i>), at an individual and local population level.	AFMP3	Undertake an outcome-based risk assessment for the vulnerable Green Sawfish (<i>Pristis zijsron</i>) and the listed migratory Australian Snubfin Dolphin (<i>Orcaella heinsohm</i>) and Indo Pacific Humpback Dolphin (<i>Sousa chinensis</i>), at an individual and local population level. This assessment is to be appended to the outcome-based risk assessment completed for the Speartooth Shark (<i>Glyphis glyphis</i>), Northern River Shark (<i>Glyphis garricki</i>), Dwarf Sawfish (<i>Pristis clavata</i>) and the Freshwater Sawfish (<i>Pristis microdon</i>) under EPBC 2010/5491.	Prior to the commencement of irrigation.	An outcome-based risk assessment for the Speartooth Shark (<i>Glyphis glyphis</i>), Northern River Shark (<i>Glyphis garricki</i>), Dwarf Sawfish (<i>Pristis clavata</i>) and the Freshwater Sawfish (<i>Pristis microdon</i>) in the Keep River has been completed as a requirement of the Weaber Plain EPBC Approval 2010/5491 (Wetland Research and Management, 2015), and has been modified to accommodate the addition of the Knox Creek Plain development. Refer to Section 5.0 for further discussion.
15B(iii)	Seasonal, site-specific baseline water quality and flow trigger values for the Keep River listed threatened and migratory species determined with reference to the ANZECC guidelines and the advice of the IRG. Until trigger values are established with the advice of the IRG, ANZECC guidelines trigger values for systems with high conservation/ecological value (as defined in the ANZECC guidelines) must be used. Sample analytes must also be determined with the advice of the IRG.	AFMP4	Adopt the seasonal, site-specific baseline water quality trigger values for the Keep River, established by the Weaber Plain IRG under the requirements of EPBC 2010/5491 (see Table 6).	Prior to the commencement of irrigation.	Seasonal, site-specific trigger values for the Keep River have been agreed by the Weaber Plain IRG (December 2014). These have been derived from the baseline monitoring undertaken over three years and are presented in Table 6. The baseline aquatic fauna study is attached as Appendix C, and the baseline water quality study attached as Appendix D. The adoption of ANZECC guidelines is discussed in these reports.
		AFMP5	Adopt the sample analytes agreed by the Weaber Plain IRG under the requirements of EPBC 2010/5491, where crops are the same across both the Weaber and Knox plains. Determine analytes for monitoring, in conjunction with the Knox IRG, in relation to any additional crops grown or chemicals used on the Knox Creek Plain which are not grown or used on the Weaber Plain.	Prior to the commencement of 'new' crop types or the application of 'new' herbicides or pesticides.	It is intended that a streamlined program for river monitoring and water quality analysis will be undertaken to cover the requirements of EPBC 2014/7143 and EPBC 2010/5941.

Condition	Requirement	Action #	Action	Timing	Notes / Commentary
15B(vii)	Details of management objectives, management actions, performance standards, corrective actions should trigger values be reached, adaptive management and contingency measures to mitigate impacts on listed threatened and migratory species in the Keep River from changes to flow, water quality from surface water, stormwater and groundwater during construction and operation.		Refer to Section 3.3. Management objectives relate to maintaining water quality at analyte levels below the locally-derived triggers contained in Table 6. Management responses are per the focus-action-limit table contained in Table 7.		The key contingency measure endorsed by the Minister under the conditioned requirements of EPBC 2010/5491 (Weaber Plain) is to flush appropriate volumes of fresh (Ord River) water through the M2 channel to the Keep River system. Flushing requirements have been established through bathymetric studies of the Keep River pools. This quantifies the requirement for a 100% pool flush in the event of an incident which threatens water quality and thus listed aquatic and migratory fauna.
Monitoring					
15B(iv)	A monitoring program for the Keep River, Keep River pools, on the Development Area, and of relevant groundwater sites and parameters to be undertaken to monitor water quality and flow with the purpose of enabling early detection of changes so that corrective action can be taken to ensure that trigger values are not exceeded during construction and operation.	AFMP6	Monitor water quality in the Keep River pools, tailwater quality in the farming area, and groundwater quality at reference and farm bores.	Bi-annually (April / May and October / November) commencing prior to clearing.	Water quality monitoring program to include Electrical Conductivity (EC), pH, total Nitrogen and total Phosphorus, and Atrazine as an indicator of farm chemical traces in water.
		AFMP7	Locations of stormwater and tailwater monitoring sites on the Knox Creek Plain development area, and bores across the development and in adjacent locations, to be reviewed by the IRG.	Prior to the commencement of irrigation on the Knox Creek Plain.	Groundwater monitoring to include EC, pH and depth to water table, as per Knox Creek Plain EMP Table 14, Item 4. Atrazine monitoring to occur with samples from nominated sentinel bores downstream of the Knox Creek Plain development area.
		AFMP8	The Knox Creek Plain IRG to assess the suitability of the bores located on the Knox Creek Plain to continue to be considered reference bores for the Weaber Plain development.	Within 12 months of the commencement of clearing of the Knox Creek Plain development.	This action is included in order to inform the quantity and locations of additional monitoring bores across the Knox Creek and Weaber Plains, taking into account the accumulated groundwater impacts of both developments.
15B(v)	A method or mechanism for predicting, modelling and/or monitoring the water quality of the seasonal first flush of water capable of	AFMP9	Develop or adopt a mechanism for predicting and modelling the water quality of the first flush of stormwater from Knox	Prior to the commencement of irrigation. To	Knox Creek Plain and Keep River water quality monitoring results will be incorporated into the dilution calculations

Condition	Requirement	Action #	Action	Timing	Notes / Commentary
	detecting water quality trigger levels for listed threatened and migratory species, developed in consultation with the IRG. This may include onsite monitoring.		farms. Modelling to be informed by monitoring (AFMP6) capable of detecting analytes at concentrations established as triggers under AFMP4.	be updated annually, prior to the first expected seasonal stormwater flow.	for the Keep River. This will include changes to groundwater inflow into the Keep River, which is expected to increase due to land clearing. Groundwater volume and quality implications on aquatic MNES will be considered in predicting water quality in the Keep River. These calculations will be compared to the locally derived triggers contained in Table 6. Once the calculations have been applied and a risk assessment undertaken, management responses will be as per the focus/action/limit approaches (Table 7).
15B(vi)	A targeted aquatic fauna monitoring program to be undertaken during construction and operation to measure the success of management measures to inform an adaptive management approach.	AFMP10	Integrate the Sandy Creek reference site and Milligan's Lagoon, Knox-adjacent Keep River, and Knox Creek Plain Spring, into the aquatic fauna ongoing monitoring regime established under the Weaber Plain EPBC approval 2010/5491.	Annually in the late dry season beginning after the commencement of irrigation. If there is no detectable effect, then frequency is reduced to three-yearly.	Refer to Section 3.4.
N/A	Determine an appropriate Keep River groundwater discharge location if triggers indicate that groundwater disposal is required.	AFMP11	Consult with the IRG to determine the location of an appropriate groundwater discharge point, should, in the future, monitoring indicates that the height and/or quality of groundwater necessitate a requirement for pumping and piping to the Keep River.	Prior to the commencement of the pumping and piping of groundwater for discharge to the Keep River.	Groundwater disposal will not be required for many years, and will be assessed independently at the appropriate time.

3.3 Water Quality Monitoring and Mitigation

As required under Conditions 15B(iv) and (v), KAI will monitor water quality in tailwater, at stormwater discharge points (when accessible), and in the Keep River, in order to inform the calculation of dilution ratios in the Keep River. The objective of the water monitoring program is to protect MNES in the Keep River, by ensuring concentrations of nominated analytes do not exceed those determined (through the derivation of local trigger levels via the three-year baseline monitoring program) to be the maximum permitted to maintain the health of EPBC-listed aquatic fauna in the Keep River. The premise is that the maintenance of water quality below analyte trigger levels derived under ANZECC water quality standards will ensure the MNES present in the Keep River are not negatively impacted by the Knox Creek Plain development. Monitoring for aquatic fauna, as required under Condition 15B(vi) will seek to confirm that management approaches are working, and to rule out other sources of impact upon the MNES (eg, seasonal factors).

The associated management objective is, in the event of water quality monitoring or derived calculations indicating that analyte levels exceed the locally-derived triggers contained in Table 6, due to KAI's farming activities, the Proponent will release sufficient water from the Ord River, via the M2 channel, to dilute the water within the Keep River pools, to analyte levels below the local triggers. This is based on the triggers being derived for local aquatic circumstances under ANZECC guidelines, informed by Appendices C and D.

EPBC 2014/7143 Condition 15B(iii) and associated action AFMP4 require the adoption of the locally-derived, seasonal aquatic fauna trigger values agreed for the Keep River by the Weaber Plain Independent Review Group. KAI will monitor the analytes listed below as indicators of overall riverine water quality. Atrazine has been selected as the base farm chemical indicator given its likely use on farms and slower degradation time compared to other chemicals. Other herbicides and pesticides may be tested, depending upon usage on the Knox Creek Plain and on recommendation from the IRG.

In-situ testing

- pH
- Electrical Conductivity (EC)
- Turbidity
- Dissolved Oxygen

Laboratory-analysed testing

- Total Nitrogen
- Total Phosphorus
- Atrazine

The seasonal, site-specific triggers for these analytes are provided in Table 6. KAI will regularly monitor for and respond to the specific water quality indicators in **red**. That is, during the dry season, KAI will monitor the K4 pool, upstream of the Legune Road crossing and downstream of Knox Creek, and the K3 pool, where Border Creek enters the Keep River.

Monitoring of the K3 and K4 pools during the **dry season**, after a flow event from the Knox Creek Plain, will provide a sound indication of whether detrimental impacts may occur to aquatic MNES, and trigger the mitigation actions described in Table 7. (Downstream of these sites – K2 pool, K1 pool, and estuary sites are subject to tidal interchange and thus natural dilution).

Flows from the Knox Creek Plain will be monitored by gauging station(s) to be constructed at discharge points. A recently upgraded flow gauging station at the K4 pool will also inform management responses.

Note that monitoring of the water quality of the pools in the **wet season** is neither physically possible (due to access issues) or scientifically warranted where seasonal rainfall results in substantial stormwater flow through the Keep River system, and a resultant significant dilution of stormwater originating from farmlands.

The IRG, with each review of trigger level exceedances, will review this approach to monitoring and analysis to advise on its adequacy and suitability. In doing this, the IRG will monitor the performance of the Proponent. In the event that the Proponent fails to meet its obligations under this AFMP or related conditions under EPBC 2014/7143, the IRG is obliged to report any concerns or failures to the Minister. Performance will be assessed by the IRG in relation to (1) implementing the required risk avoidance actions, such as the installation and use of tailwater recycling; (2) the degree to which water quality monitoring has occurred; (3) the occurrence and frequency of water quality triggers being exceeded; and (4) the timeliness and appropriateness of the management responses and any subsequent post-incident monitoring.

Table 6 - Locally-derived Keep River trigger values to be applied (as approved by the Weaber Plain IRG)

Site	Season	Trigger	In situ pH	EC (mS/m)	Turbidity (NTU)	In situ dissolved oxygen mg/L	Total N	Total P	Atrazine (ug/L)
K4	Wet	Lower Focus	6.3			Insufficient Data (IND)			
K4	Wet	Lower Action	5.65			IND			
K4	Wet	Lower Limit	5.53			IND			
K4	Wet	Upper Focus	7.5	29	446	IND	2.48	0.13	
K4	Wet	Upper Action	8.1	34	941	IND	6.96	0.343	
K4	Wet	Upper Limit	8.62	42	2545	IND	9.25	0.485	0.7
K4	Dry	Lower Focus	7.4			23			
K4	Dry	Lower Action	7.25			9			
K4	Dry	Lower Limit	7.17			6			
K4	Dry	Upper Focus	7.9	85	120	62	0.44	0.04	
K4	Dry	Upper Action	8.1	94	262	87	0.85	0.045	
K4	Dry	Upper Limit	8.64	96	287	120	0.98	0.067	0.7
K3	Wet	Lower Focus	7.46			IND			
K3	Wet	Lower Action	7.25			IND			
K3	Wet	Lower Limit	7.2			IND			
K3	Wet	Upper Focus	8.06	23	190	IND	0.5	0.038	
K3	Wet	Upper Action	8.81	45	200	IND	0.55	0.047	
K3	Wet	Upper Limit	8.89	58	203	IND	0.55	0.05	0.7
K3	Dry	Lower Focus	7.7			22			
K3	Dry	Lower Action	7.49			8			
K3	Dry	Lower Limit	7.31			3			
K3	Dry	Upper Focus	8.2	434	17	78	0.39	0.013	
K3	Dry	Upper Action	8.55	697	265	105	0.51	0.029	
K3	Dry	Upper Limit	9.11	991	289	124	0.69	0.039	0.7
K2	Wet	Lower Focus	7.18			IND			
K2	Wet	Lower Action	7.11			IND			
K2	Wet	Lower Limit	7.09			IND			
K2	Wet	Upper Focus	7.64	49	250	IND	0.47	0.03	
K2	Wet	Upper Action	8.06	85	264	IND	0.49	0.06	
K2	Wet	Upper Limit	8.29	107	269	IND	0.5	0.069	0.7

Site	Season	Trigger	In situ pH	EC (mS/m)	Turbidity (NTU)	In situ dissolved oxygen mg/L	Total N	Total P	Atrazine (ug/L)
K2	Dry	Lower Focus	7.94			35			
K2	Dry	Lower Action	7.66			13			
K2	Dry	Lower Limit	7.49			11			
K2	Dry	Upper Focus	8.39	2158	13	100	0.35	0.01	
K2	Dry	Upper Action	8.59	2992	15	125	0.44	0.015	
K2	Dry	Upper Limit	8.78	3267	152	142	0.76	0.02	0.7
K1	Wet	Lower Focus	7.58			IND			
K1	Wet	Lower Action	7.5			IND			
K1	Wet	Lower Limit	7.49			IND			
K1	Wet	Upper Focus	8.2	161	462	IND	0.44	0.042	
K1	Wet	Upper Action	8.44	1196	494	IND	0.68	0.071	
K1	Wet	Upper Limit	8.5	1482	506	IND	0.78	0.082	0.7
K1	Dry	Lower Focus	8.18			41			
K1	Dry	Lower Action	7.96			17			
K1	Dry	Lower Limit	7.19			15			
K1	Dry	Upper Focus	8.41	4166	12	116	0.4	0.009	
K1	Dry	Upper Action	8.55	5091	28	154	0.51	0.02	
K1	Dry	Upper Limit	8.93	5489	65	162	0.75	0.301	0.7
E1	Wet	Lower Focus	7.8			IND			
E1	Wet	Lower Action	7.62			IND			
E1	Wet	Lower Limit	7.51			IND			
E1	Wet	Upper Focus	8.14		458	IND	0.41	0.06	
E1	Wet	Upper Action	8.5		585	IND	0.47	0.075	
E1	Wet	Upper Limit	8.69		603	IND	0.49	0.08	0.01
E1	Dry	Lower Focus	8.1			28			
E1	Dry	Lower Action	8.05			21			
E1	Dry	Lower Limit	7.96			17			
E1	Dry	Upper Focus	8.4		439	111	0.79	0.035	
E1	Dry	Upper Action	8.53		645	130	1.15	0.073	
E1	Dry	Upper Limit	8.64		3984	146	1.85	0.145	0.01

(Triggers agreed by the Weaber Plain IRG, December 2014. Source: Bennett and George, 2014).

The management responses and mitigation measures developed in relation to these triggers are based on a focus-action-limit tiered approach.

When a 'focus' trigger is expected to be exceeded following a dry season flow of water from the Knox development or after initial rains and 'first flush' stormwater runoff or late (post-spraying) wet season rainfall, KAI will be on alert and respond according to the approach presented in Table 7.

An 'action' trigger is one which initiates management taking action to prevent further declines in water quality.

A 'limit' trigger represents the value at which expected (or actual) quantity of an analyte reaches the 99.7% percentile for the known concentrations of that analyte in the respective Keep River pool. These

values have been derived under the oversight of the Weaber Plain Independent Review Group, under the requirements of the Weaber Plain Aquatic Fauna Management Plan (Strategen/DSD, 2014).

3.4 Aquatic Fauna Monitoring and Mitigation

The purpose of the *water quality monitoring program* discussed in Section 3.3 is to ensure water quality remains consistent with natural levels, and thus poses no artificially-induced threat to listed MNES within the Keep River.

The *aquatic fauna monitoring program* objective is “to monitor change in aquatic macroinvertebrate and fish species assemblages, especially those that may influence distribution and abundance of other species listed for conservation significance (i.e. through loss of important prey species), in locations which will be directly or indirectly impacted by the Knox Creek Plain development, additional to those for which baseline surveys have been conducted under the Weaber Plain EPBC approval” (WRM, 2015a, p1).

An initial base year of surveying has occurred on control sites added to the Keep River aquatic fauna health assessment program, and will be extended when development of the Knox Creek Plain commences. Late dry Season (September – October) is considered appropriate timing for detecting and predicting impacts as it allows for the integration of the effects of any discharge from the development that might have occurred in the previous late wet or early dry seasons (March to mid-year). Sampling at the end of the dry season corresponds with sampling for the Weaber Plain aquatic fauna and water quality monitoring program, and will generally allow for access to the Keep River for pre-first flush stormwater runoff.

The effects of evapo-concentration in remnant pools throughout the dry season are expected “to pose the highest risk to ecological health, especially given the lower water levels and hence reduced capacity for dilution of contaminants, and reduced ability for fauna to move between pools and avoid water quality issues” (WRM, 2015a, p1). This reflects naturally occurring changes.

Data collected during the baseline surveys, prior to irrigation, will establish benchmark conditions at exposed sites as well as reference sites. Future monitoring at these sites, conducted using the same design and methodology, can then be used to discriminate changes resultant of the development from natural changes, such as climatic variability.

The first baseline aquatic fauna study of additional control sites required due to the Knox Creek Plain development is attached as Appendix E.

It is intended that the water quality monitoring program described in Section 3.3 will provide the earliest indicators of potential risk to aquatic MNES, and that the responses included in Table 7 will mitigate risks. The aquatic fauna monitoring program will verify the efficacy of the on-farm risk aversion activities (eg, tailwater recycling) and dilution calculation and risk assessment through the requirements of Condition 15B(v). In the event that aquatic fauna monitoring indicates statistically significant declines in the presence or activity of listed MNES, this will be assessed within the geographic and river usage context, informed directly by the IRG. This includes the small footprint (approximately 10% of the Keep River catchment) occupied by KAI’s farming interests, the presence of other agricultural, mining and aquacultural industries within the catchment, seasonal conditions, and the impact of recreational fishing. As such, the aquatic fauna monitoring will be used to inform KAI’s management practices where there is a direct or indirect link between these practices and the Keep River water quality and MNES presence, however it will also consider other possible threatening processes which may have affected any noted change.

Table 7 - Aquatic Fauna Water Quality Monitoring - Management Responses to Triggers

	Practical considerations	Alert process	Management response	Reporting	IRG review	
FOCUS	<p>Precautionary alert: 80th percentile concentration predicted in the K4 or K3 pool of the Keep River, after a dry season flow from the Knox Creek Plain or after first-flush or late wet season rains. This means that when the modelled concentration of the agreed analyte (eg Atrazine) reaches the Keep River or is predicted to reach the 80th percentile trigger, an alert is raised, identifying that there is a potential risk. Using the model required under Condition 15B(iv), KAI will calculate the dilution factor of the analyte in the K3 and pools, based on the volume of water flowing in, the concentration of chemical in the water exiting the Knox Creek Plain, and the dilution of the tides.</p>	<p>The Approval holder will already be 'on watch' regarding flow from the Knox Creek Plain the Keep River during times of risk (eg within a month of Atrazine application if heavy rainfall and stormwater runoff is expected).</p>	<p>Approval holder's representative to monitor situation. Senior management to be alerted.</p>	<p>Approval holder to monitor situation - ie, rainfall, Knox and Border Creek flows, tides, Keep River flows, and prepare for anticipated changes (if any) and ACTION RESPONSE (below).</p>	<p>Annual Environmental Report to include summary of days when 80th percentile trigger was reached and nature and duration of the exceedences. AER to be provided to IRG by 31 March of the following calendar year.</p>	<p>IRG to consider annual reporting on trigger monitoring and action, and consider any changes to procedures in annual review. Approval holder and IRG to agree on any modifications to monitoring, management and reporting procedures.</p>

(continued)

	Practical considerations	Alert process	Management response	Reporting	IRG review	
ACTION	<p>Action #1: 95% percentile concentration predicted in the K4 or K3 pool of the Keep River, after a dry season flow from the Knox Creek Plain or after first-flush or late wet season rains. When the modelled concentration of a specified analyte is predicted to, or actually reaches, the 95th percentile trigger, the approval holder will flush the system with fresh water from the Ord, via the M2 channel, to ensure analyte concentration is below the 95th percentile value.</p>	<p>Actual concentrations will not be known for up to two weeks after samples are taken. There is a maximum 72 hour time lag from release of water from the Ord River and that water reaching the Keep River via the M2 channel network.</p>	<p>Approval holder to monitor and calculate (using model) the volume of water required to dilute the Keep River pools to maintain or reduce analyte level(s) below 95th percentile.</p>	<p>Approval holder to, taking account of practical considerations, monitor and make predictions based on predicted rainfall, flows and tides. Approval holder will release freshwater (from M2 channel) to ensure 95th percentile is not exceeded. The timing of the release will account for any time lag in releasing water from the M2 channel and this water reaching Border Creek or Keep River, to prevent exceedence of the 95th percentile value. Approval holder to take water quality samples at normal monitoring sites to monitor water quality changes due to water release.</p>	<p>Annual Environmental Report to record the days and environmental conditions when 95th percentile trigger was reached (predicted or measured), the nature and duration of exceedences, and action taken by the approval holder in response to predicted and actual exceedences of the 95th percentile trigger. AER to be provided to IRG by 31 March of the following calendar year. Approval holder to report actual or predicted exceedences to the DoEE within 10 days of measuring or predicting the exceedence, outlining the scale of the actual or predicted breach, action taken and timing of response.</p>	<p>IRG to consider annual reporting on trigger predictive and actual monitoring and action, and consider any changes to procedures in annual review. Approval holder and IRG to agree on any modifications to predictive, monitoring, management and reporting procedures.</p>
LIMIT	<p>Action #2: Limit. When an agreed concentration limit (99.7th percentile) is predicted in the Keep River following a flow event from the Knox Creek Plain farmlands – ie, an expected compliance breach.</p>	<p>Actual concentrations will not be known for some time (a minimum of two weeks) after samples are taken. Also note that there is a minimum of 48-72 hour time lag in release of water from the Ord River and it reaching the Keep River via the M2 channel network.</p>	<p>Approval holder to monitor and calculate volume of water required to dilute the Keep River to analyte levels to maintain or reduce below 95th percentile.</p>	<p>Proponent to release freshwater (from M2 channel) to dilute below the 95th percentile. This will take into account any practical considerations in releasing water from the M2 channel and this water reaching Border Creek or Keep River. Approval holder to take water quality samples within 48 hours of completion of flush. Approval holder to immediately take water quality samples at the DW1 Gauging Station, Border Creek and in the Keep River, at normal sampling sites.</p>	<p>Annual Environmental Report to record the days and environmental conditions when 99.7th percentile trigger was reached (predicted or measured), and action taken by approval holder. AER to be provided to IRG by 31 March of the following calendar year. Approval holder to report actual or predicted breach to DoEE and the IRG within 2 days of the knowledge of the breach, outlining the scale of the actual or predicted breach, action taken and timing of response.</p>	<p>IRG to consider annual reporting on any breaches and approval holder responses and consider any changes to procedures in annual review. Approval holder, DoEE and IRG to agree on any modifications to monitoring, management and reporting procedures, including review of this Plan.</p>

In the event that groundwater discharge into the K4 pool negatively affects water quality to the detriment of listed aquatic fauna, the management responses will mimic those outlined in Table 7. This will be undertaken under the watch of the Knox Creek Plain Independent Review Group.

4.0 Independent Review Group

Condition 14 of EPBC 2014/7143 requires the establishment of an Independent Review Group (IRG) to review the impacts of the Knox Creek Plain development on the listed aquatic and migratory species. Further detail regarding the role of the IRG is contained in the attached Terms of Reference (Appendix A), approved by the Minister for the Environment on November 24, 2015.

Any revisions to this AFMP will be reviewed by the IRG prior to submission to the Minister for approval.

5.0 Aquatic Fauna Risk Assessment

An outcome-based assessment of the risk to listed aquatic fauna in the Keep River is a requirement of Condition 15(B)ii of EPBC 2014/7143.

The risk assessment updates and augments the Weaber Plain listed species risk assessment conducted as a requirement of EPBC 2010/5491 (WRM, 2015b). The WRM (2015b) analysis of the risk of the Weaber Plain agricultural development to *Pristis* species present in the Keep River is updated to include the Knox Creek Plain development, in Tables 8 and 9.

The residual risk (following implementation of controls including tailwater return systems; see below) on *Pristis* species is either low or very low for stormwater runoff, groundwater discharge and groundwater accession. It is not expected that the development of the Knox Creek Plain will significantly alter this residual risk classification, given duplicate management and monitoring approaches across both the Weaber and Knox areas.

Farm chemical loss to aquatic systems is considered the most significant risk to downstream aquatic fauna *if appropriate controls are not implemented*. In line with good farm practices, KAI's management of the Knox Creek Plain farmlands will include adherence to the following risk avoidance and minimisation strategies:

1. Adherence to product label (application rate) and Material Safety Data Sheets (MSDS) requirements. This is a legal requirement and applies across all industries.
2. Pre-spraying noting of climatic conditions – ie, wind and rain risk.
3. Tailwater return and recycling systems in place.
4. Distance to the Keep River and lack of soil saturation during the dry season. Any localised spills can be managed without risk of immediate transport to the River.
5. Enhanced rates of chemical biodegradation due to very high Kimberley UV levels.
6. Time lapse between the application of chemicals/fertilisers (early-mid dry season) and wet season stormwater flow to the Keep River.

The combination of seasonal conditions and appropriate management practices reduce the inherent risks associated with the farm chemicals used.

Monitoring of total nitrogen, total phosphorus and Atrazine (as an indicator chemical) continues across the dry season, and where possible in the wet season, in on-farm tailwater, stormwater runoff (in the wet season) and the Keep River. Turbidity within the Keep River is monitored during seasonal

monitoring rounds, with a particular focus during the initial development years. Soil-sediment adsorbed nitrogen and phosphorus will continue to be assessed through total N and total P monitoring.

In the event that KAI observes, either directly or through monitoring, or predicts through risk calculations, that there exists a threat to aquatic fauna in the Keep River, management actions including M2 channel flushing will be implemented.

Furthermore, WRM (2015b) notes that [because] “there is no evidence that *Glyphis* sharks occur in the Keep River, it is therefore difficult to assess risk for a species, albeit acknowledged to be rare, that appears not to occur in the system” (WRM, 2015b, pVII). This logic can also be applied to the presence (or absence) of Australian Snubfin and Indo-Pacific Humpback dolphins in the Keep River. To date, neither dolphin species has been recorded in Keep River monitoring (Andrew Storey, WRM, 2015, pers.comm).

As such, specific risk assessments for these species would be particularly speculative. Nonetheless, the risk avoidance strategies and mechanisms outlined above, combined with the monitoring described in this AFMP and the associated management responses (per Table 7) are designed to minimise risk to the listed aquatic MNES, across all species, by maintaining river health consistent with natural conditions (including seasonal variability).

Table 8 - Weaber Plain and Knox Creek Plain Risk Assessment – *P. pristicus* and *P. clavata* – in relation to stormwater and groundwater discharge

Stormwater and Groundwater Discharge: Summary of inherent (i.e. without controls) and residual (i.e. with controls) risk assessment ratings for largemouth sawfish (*P. pristicus*) and dwarf sawfish (*P. clavata*) (Risk ratings: E = Extreme, H = High, M = Medium, L = Low, V = Very low), refer to Tables 1, 2 & 3 for definitions of Consequence and Likelihood for each numeric score.

Table derived and modified from WRM 2015a.

Aspect	Threats and potential impacts	Inherent Risk						Controls	Residual Risk							
		Season	Species	Scale	Consequence	Likelihood	Inherent Risk		Season	Species	Scale	Consequence	Likelihood	Residual Risk		
Stormwater and groundwater discharge	High inherent risk from stormwater and ground water discharge due to absence of tailwater retention system, with irrigation tail water, rich in nutrients and sediments, entering the Keep River pools throughout the dry season. Build-up of nutrients and sediment in these pools posed a high risk of eutrophication and algal blooms, with potential for fish kills from oxygen stress or toxic algae. Potential for late dry season flushing of additional contaminants in the advent of a storm on the Weaber or Knox Plains introduced an additional high level of risk in the late dry season. Inherent risk during the wet season was much lower due to natural dilution of any releases by wet season flows when the Keep River is flowing.	Dry season	Pristis pristicus	Individual	4	4	H	Adoption of tail water re-use system in farm design, and capacity to store up to 25 mm of stormwater runoff greatly reduces risk as there will be no loss of tail water in the dry season. When combined with the proposed surface water and groundwater quality monitoring program, with flow-weighted sampling of the Keep River and Knox and Border Creeks, in conjunction with the dilution calculations based on actual and/or expected water quality and flow, the dry season risk is even further reduced. Consequence of any event may be high, but likelihood is very low. Stormwater will generally occur when runoff from the broader Border and Knox Creeks and Keep River catchments are also flowing, thus ensuring wet season dilution. A number of other contingency actions can be implemented to ensure sufficient dilution and flushing of stormwater from Keep River (e.g. release of water from M2 channel).	Dry season	Pristis pristicus	Individual	3	2	L		
				Population	3	4	M				Population	2	2	V		
			Pristis clavata	Individual	5	4	E			Pristis clavata	Individual	3	2	L		
				Population	5	4	E				Population	2	2	V		
			Wet season	Pristis pristicus	Individual	4	2			L	Wet season	Pristis pristicus	Individual	3	1	V
					Population	3	2			L			Population	2	1	V
		Pristis clavata		Individual	5	2	M		Pristis clavata	Individual		3	1	V		
				Population	5	2	M			Population		2	1	V		

Table 9 - Weaber Plain and Knox Creek Plain Risk Assessment - *P.pristis* and *P.clavata* – in relation to groundwater accession

Groundwater accession: Summary of inherent (i.e. without controls) and residual (i.e. with controls) risk assessment ratings for largemouth sawfish (*P. pristis*) and dwarf sawfish (*P. clavata*) (Risk ratings: E = Extreme, H = High, M = Medium, L = Low, V = Very low), refer to Tables 1, 2 & 3 for definitions of Consequence and Likelihood for each numeric score.

Table derived and modified from WRM 2015a.

		Inherent Risk						Residual Risk						
Aspect	Threats and potential impacts	Season	Species	Scale	Consequence	Likelihood	Inherent Risk	Controls	Season	Species	Scale	Consequence	Likelihood	Residual Risk
Groundwater rise and accession to river	Inherent risk from increased baseflow due to groundwater accession was assessed as being very low, principally due to the small relative increase in baseflows predicted, but also the relatively small increases in nutrients, salinity etc. Particularly in the estuary, given natural tidal mixing and flushing, the increases in flows and nutrients/salinity were not seen as a risk. Similarly the concerns raised by DotE regarding effects on fish passage, freshwater interface in the estuary and turbidity levels in the estuary were also shown not to be issues. Therefore, inherent risk was deemed to be very low.	Dry season	Pristis pristis	Individual	2	2	V	The Groundwater Management Plan is the main control to be used to manage groundwater levels and baseflows into the river. The plan is required to monitoring groundwater levels and salinity across the Weaber and Knox Plains to maintain viability of agricultural production. This provides a strong incentive to maintain groundwater levels at an acceptable level, with numerous contingencies available to manage levels if they appear to be rising. Although these controls and contingencies are primarily to protect agricultural production, they also protect the aquatic ecology of the Keep River, and thereby listed species in the system. These controls further reduce the risk to listed species from groundwater accession, which was already considered very low.	Dry season	Pristis pristis	Individual	2	2	V
				Population	2	2	V				Population	2	2	V
			Pristis clavata	Individual	2	2	V			Pristis clavata	Individual	2	2	V
				Population	2	2	V				Population	2	2	V
		Wet season	Pristis pristis	Individual	1	2	V		Wet season	Pristis pristis	Individual	1	2	V
				Population	1	2	V				Population	1	2	V
			Pristis clavata	Individual	1	2	V			Pristis clavata	Individual	1	2	V
				Population	1	2	V				Population	1	2	V

6.0 Reporting

Condition 3 of EPBC 2014/7143 requires that

By 31 March of each year after the commencement of the action, the person taking the action must publish a report on their website addressing compliance with the conditions of this approval over the previous 12 months, including implementation of any management plans as specified in the conditions. Non-compliance with any of the conditions of this approval must be reported to the Department within 2 days of the person taking the action becoming aware of the non-compliance and at the same time as the compliance report is published. The person taking the action must continue to publish the report until such time as agreed in writing by the Minister or the approval has expired.

KAI will integrate the reporting across all approvals, including Statement 938, EPBC 2010/5491 and SWL179228, as well as EPBC 2014/7143, such that an environmental report published by 31 March each year covers all reporting requirements. Reports will be available at www.kai-australia.com.au

In addition, annual audit requirements under Statement 938 will result in the auditing of compliance with the surface water management, groundwater management and discharge management sub-plans of the EMP, all of which are referenced in EPBC 2014/7143 due to their potential impact on downstream (Keep River) water quality and thus aquatic MNES.

7.0 Review and Revision

This *Knox Creek Plain Aquatic Fauna Management Plan* will be reviewed and revised at intervals supported by the Knox Creek Plain Independent Review Group. The IRG will maintain an overview of the implementation of the plan and under its terms of reference empowered to make recommendations to the approval holder on the timing and nature of any review (consistent with the approval conditions).

Updates to the AFMP will be informed by monitoring and management undertaken to date, in particular in response to the exceedence of ACTION and LIMIT triggers.

The IRG will consider and make recommendations to the approval holder on any review of the plan prior to submission to the Minister for approval.

8.0 References

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- Wetland Research and Management. (2014). *ORIA Stage II - Keep River Baseline Aquatic Fauna and Targeted Sawfish Survey September/October 2013*. WRM, Perth.
- Wetland Research and Management, 2015a, *ORIA Stage II Expansion – Knox Creek Plain Baseline Aquatic Fauna Surveys 2014*. WRM, Perth.

Wetland Research and Management, 2015b, *ORIA Stage II M2 Expansion – Risk Assessment of Weaber Plain Development on Keep River Listed Species*. WRM, Perth.

9.0 Appendices

Appendix A – Knox Creek Plain Independent Review Group Approved Terms of Reference



Terms of Reference

Independent Review Group – Knox Creek Plain August 2015

1.0 Background

Kimberley Agricultural Investment Pty Ltd (KAI) has received conditional approval from the Minister for the Environment to develop the Knox Creek Plain for irrigated agriculture. EPBC Approval 2014/7143 permits allows for the development of 12,695 hectares of predominantly black soil alluvial plains located 35 kilometres north-east of Kununurra, Western Australia. This 12,695 hectares includes 5,570 hectares of farms, 6,415 hectares of buffer and 710 hectares of infrastructure (including a balancing storage area).

The Minister for the Environment considered there is potential for impact from the Knox Creek Plain development upon downstream aquatic fauna Matters of National Environmental Significance (MNES) listed under the EPBC Act 1999.

Condition 14 of EPBC Approval 2014/7143 requires the establishment of an Independent Review Group (IRG), to review impacts of the Knox Creek Plain development on aquatic fauna MNES, as follows -

Condition 14 – Independent Review Group

The person taking the action must appoint an Independent Review Group (IRG) to review the impacts of the action on aquatic listed threatened and migratory species. The IRG must be established prior to the submission of the Aquatic Fauna Management Plan to the Minister for approval. If a condition of another approval held by the proponent requires an IRG identical in nature, the proponent may meet the relevant requirements of both conditions by appointing a single IRG.

The IRG must be established by the person taking the action in accordance with the following requirements:

- i) The IRG must be funded, resourced and managed by the person taking the action.*
- ii) The IRG must consist of independent scientific and technical experts, of whom at least one must be a Glyphis and Pristis expert and two must be technical experts with at least five years experience in northern Australian surface water and groundwater hydrology, approved by the Minister.*
- iii) Terms of Reference for the IRG must be prepared by the person taking the action and submitted for approval by the Minister. The Terms of Reference must include the frequency of proposed meetings, tenure of membership, and chairing and quorum arrangements. The Terms of*

- Reference must be approved by the Minister in writing prior to the submission of the Aquatic Fauna Management Plan to the Minister for approval.*
- iv) *The IRG must provide advice to the person taking the action on any revisions to the Aquatic Fauna Management Plan. The advice of the IRG must also be provided to the Minister.*
- v) *The IRG must assess any exceedances of trigger values and advise changes to the person taking the action as required; and*
- vi) *The Minister may seek advice from the IRG at any time.*

In line with this condition, and in consideration of the references to the IRG in relation to Aquatic Fauna Management (EPBC 2014/7143 Condition 15), the terms of reference and operational arrangements for the Knox Creek Plain Independent Review Group are as follows:

2.0 Functions of the Knox Creek Plain IRG

The IRG will

- 2.1 Review and provide advice on the Knox Creek Plain Aquatic Fauna Management Plan (and any subsequent revisions to that plan), prior to submission of the plan by the proponent to the Minister for approval.
- 2.2 Consider and assess the contribution of the Knox Creek Plain development to any exceedances of Keep River water quality trigger values.
- 2.3 In relation to EPBC 2014/7143 Aquatic Fauna Management (Condition 15),
- a) Provide advice to the Proponent on the methodology for the baseline survey program required under condition 15B(i).
- b) Provide advice to the Proponent on Keep River trigger levels and analytes to be monitored, per condition 15B(iii).
- c) Provide advice to the Proponent on a method or mechanism for predicting, monitoring and/or modeling the water quality of the season first flush of water from the Knox Creek Plain, per condition 15B(v).

3.0 Membership of the IRG

The IRG will consist of the following members:

Mandatory

- 1 x Independent Chairperson
- 1 x *Glyphis* and *Pristis* expert
- 2 x Technical experts with a minimum of 5 years experience in Northern Australian hydrology

Optional

- Up to 2 other individuals with Northern Australia hydrology or farming expertise

IRG membership will be nominated by the Proponent, and will commence upon endorsement by the Minister for the Environment.

Members will be initially appointed for a period of three (3) years, with extension considered on recommendation of the Proponent to the Minister.

4.0 Operations and executive support to the IRG

4.1 Meeting frequency and quorum arrangements

The Knox Creek Plain IRG will meet (at least) annually to consider the impact of the Knox Creek Plain development on the aquatic MNES present in the Keep River. This will include review of annual water quality monitoring results and any exceedances of trigger levels in the Keep River.

The Proponent may invite its consultants, staff and/or other advisors to attend IRG meetings to discuss impacts and/or present research findings relating to aquatic MNES present in the Keep River.

In person, telephone or videoconference meetings are acceptable. Out-of-session decisions will be ratified at the subsequent formal meeting.

A quorum will comprise the Chairperson and at least two of the three mandatory members. Out-of-session consideration of Knox Creek Plain-related aquatic fauna matters will require the same quorum review, and will be ratified at subsequent IRG meetings.

Members unable to attend a meeting may provide written advice, via the Chairperson, for consideration at that IRG meeting.

4.2 Executive support

Executive support will be provided by KAI as Proponent. Draft meeting records will be distributed within one week of Knox Creek Plain IRG meetings. Meeting records will be finalised and distributed upon approval from the Chairperson on behalf of IRG members.

Meeting records will be distributed to IRG members and the Department of the Environment on request.

All IRG meeting and travel costs will be met by the Proponent. Remuneration arrangements will be negotiated between the Proponent and individual IRG members.

4.3 Conflict resolution

Where a conflict of interest occurs for an IRG member, the member should self-identify. The Chairperson of the IRG will decide if the IRG member who has identified a conflict of interest should be excluded from involvement in the matter being discussed.

The IRG will conform to its Terms of Reference. In the event that a member of the IRG has concerns with IRG decisions, functions and/or progress being made, these concerns shall be brought to the attention of the Chairperson, who will take appropriate action.

4.4 Transparency and confidentiality

KAI is a corporate entity with an explicit commercial interest in the agricultural development of the Knox Creek Plain. IRG matters deemed confidential by KAI will be treated as such by the IRG members.

Appendix B – Knox Creek Plain Environmental Management Program (August 2015)

Appendix C - ORIA Stage II - Keep River Baseline Aquatic Fauna and Targeted Sawfish Survey September/October 2013 (WRM 2014)

Appendix D - Goomig Farmlands development: baseline water quality in the lower Keep River (Bennett and George, 2014)

Appendix E - ORIA Stage II Expansion – Knox Creek Plain Baseline Aquatic Fauna Surveys 2014 (WRM 2015a)