Appendix Q
Freshwater Sawfish

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PACIFIC ALUMINIUM KATHERINE TO GOVE PIPELINE

Freshwater Sawfish Report

Prepared for
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Abbreviations

ABBREVIATION	DESCRIPTION
DEWHA	Department of Environment, Water, Heritage and Arts
EcOz	EcOz Environmental Services
EIS	Environmental Impact Statement
ELA	Eco Logical Australia
KGGP	Katherine to Gove Gas Pipeline
MAGNT	Museum and Art Galleries of the Northern Territory
SEWPaC	Department of Sustainability, Environment, Water, Populations and Communities

1 Introduction

This document contains detail and background that underpin the broad assessment of potential impacts and proposed avoidance and mitigation measures in relation to the Vulnerable Freshwater Sawfish (*Pristis microdon*), outlined in Chapter 10 of the Draft Environmental Impact Statement for the Katherine to Gove Gas Pipeline (KGGP) proposal: Matters of National Environmental Significance.

In addition to detailing current understanding of this species' habitat preferences, behaviour and other ecological features relevant to assessing potential impacts, this Annexe indicates where predictions and assessments in the *KGGP Aquatic Fauna Study 2013* (EcOz 2013, refer to Appendix E of EIS) have been updated by other local experts, and the approach Pacific Aluminium has outlined to reconcile these differences.

The aims of this technical annexe are to provide additional technical information and habitat assessment of the Freshwater Sawfish and its likelihood of occurrence within the Katherine to Gove Gas Pipeline (KGGP) Project area.

2 Literature review

2.1 THE FRESHWATER SAWFISH

The Freshwater Sawfish (*Pristis microdon*) is listed as Vulnerable under both the EPBC Act and the TPWC Act, and is discussed in detail in the following sections.

2.2 ECOLOGY AND THREATS

The Freshwater Sawfish is a large ray capable of growing up to 7 m in length and weighing over 180 kg when mature. It displays a shark-like body with an elongated, flattened snout (rostrum or saw) with 18 to 23 pairs of evenly spaced rostral teeth, and five pairs of gill-openings on the ventral surface of the head.

Sawfish have long gestation periods, give birth to live young, reach sexual maturity relatively late, and breed intermittently (DEWHA 2008). The Freshwater Sawfish has a complex life strategy, utilizing both fresh and marine water environments, although the distribution, abundance and feeding habits, as well as the location of important nursery areas, are largely unknown. The preferred habitat of this species is mud bottoms of river embayments, estuaries and channels where they are not usually associated with riparian vegetation (Wilson 1999). They typically feed on catfish, cherabin (crustaceans), filamentous algae, nematodes and molluscs in soft substratum (Thorburn et. al. 2003; EcOz 2013). Juveniles and sub-adults predominantly occur in the freshwater reaches of tropical rivers and estuaries with tidal connections where they are thought to prefer systems that spread out into broad floodplains during the wet season (Dr Peter Kyne, Charles Darwin University, pers. comm., 12 February 2013). However, specimens have also been found up to 400 km inland in western river systems that do not terminate in extensive floodplains (Thorburn et. al. 2003; Dr Peter Kyne, Charles Darwin University, pers. comm., 12 February 2013).

During the dry season, when waterways and floodplains dry out, juveniles often remain trapped in remnant pools until the following wet season. These remnant (refuge) pools vary greatly in size: from the size of a room to several km long and a few metres wide. As fish mature (around 6-7 years), they are increasingly found downstream in more saline waters. Maturity occurs around seven to eight years of age (Freshwater Sawfish Expert Review Committee 2009) when individuals tend to move to coastal and offshore waters up to 25 m deep (EcOz 2013). Recent studies suggest that mature Freshwater Sawfish inhabit marine waters during the post wet season months and enter less saline waters upriver during the wet season months to pup, with litter sizes ranging from one to 11 (DEWHA 2008, Peverell 2005; Whitty et al. 2008).

Freshwater Sawfish have previously been recorded from the main channels, larger tributaries and backwaters, of lower, middle and upper riverine reaches (EcOz 2013). Specimens have previously been sampled from waters ranging in depth from 0.7-6 m in both tidal and non-tidal reaches with generally low flow rates, and waters of fresh or low salinity (less than 10 parts per thousand) (Thorburn et al. 2003). The species is thought to prefer finer substrates, such as sand and silt, often in deeper sections of the watercourse adjacent to sand or silt shallows, such as sandbars or shallow backwaters, where they have been commonly encountered. The species has been recorded in both turbid and clear waters, and has been found in waters with relatively high dissolved oxygen levels (Thorburn et al. 2003).

The distribution and abundance of Fresh Water Sawfish populations in the NT is currently unknown, mainly due to lack of reliable historical catch and biological data. The Freshwater Sawfish may

potentially occur in all large rivers of northern Australia from the Fitzroy River, Western Australia, to the western side of Cape York Peninsula, Queensland (Thorburn et al 2003). The species has previously been recorded from a number of river systems across the NT (Figure 1) including the Adelaide, Alligator, Daly, Katherine, MacArthur, Mainoru, Robinson, Roper, Wearyan, Wilton and Victoria (Midgley 1979; Thorburn et al. 2003). There is also anecdotal evidence of Fresh Water Sawfish occurring in the Cato, Goyder, and Mainoru rivers of East Arnhem Land, although occurrence in the Goyder and Cato Rivers was from areas far downstream of the proposed pipeline route (EcOz 2013). Of all of these rivers, the pipeline crosses the Cato, Goyder, Mainoru, and Wilton rivers, and crosses tributaries and associated surface waters of the Roper River where the Fresh Water Sawfish has previously been recorded (Thorburn et al. 2003).

3 Habitat assessment

The presence of Fresh Water Sawfish within the Project area was determined through previous assessments undertaken by EcOz Environmental Services (refer to **Appendix E**), and an updated desktop assessment undertaken by Eco Logical Australia (ELA) in conjunction with advice from a local expert on Fresh Water Sawfish (Dr Peter Kyne, Charles Darwin University). The results are presented in the following section.

3.1 BACKGROUND INFORMATION

The KGGP corridor incorporates 29 major river and stream crossings including the King River, Roper Creek, Beswick Creek, Waterhouse River, Flying Fox Creek, Mainoru River, Wilton River, Goyder River, Boggy Creek, Cato River, Giddy River and Latram River. Of these, the Freshwater Sawfish has previously been recorded from Flying Fox Creek (Midgely 1979) approximately 16 km upstream of the proposed pipeline (Figure 1). Flying Fox Creek is a tributary of the Roper River where the Freshwater Sawfish was previously recorded approximately 45 km south, and downstream, of the proposed pipeline route and 220 km inland from the sea (Figure 1). Historical records of Fresh Water Sawfish also exist for the Wilton River within the Museum and Art Galleries of the Northern Territory (MAGNT), and anecdotal records exist for the Cato, Goyder and Mainoru Rivers (EcOz 2013), all of which are traversed by the pipeline.

While the pipeline route avoids crossing large bodies of water it does traverse creek systems upstream of large estuaries. Some of these creeks will hold freshwater all year round while others are likely to be ephemeral and become dry during the dry season. Some crossings may form disconnected billabongs which provide suitable refuge pools for juveniles and sub-adults, and rivers that branch out into broad floodplains during the wet season are likely to provide suitable habitat for Freshwater Sawfish.

As the proposed pipeline corridor does not cross the lower (saline) reaches of estuaries or open coast, it has no potential to impact the habitat of the adult Fresh Water Sawfish. Discussion of potential impacts is therefore limited to juveniles and sub-adults.

3.2 DESKTOP REVIEW

In 2004, EcOz (refer to Appendix E in EIS) identified that a total of 19 of the original water crossing points for the Trans Territory Pipeline (TTP) route where potential habitat for Freshwater Sawfish juveniles and sub-adults may be present (Table 1). Each crossing point was analysed to determine the likelihood of Freshwater Sawfish occurrence. Criteria included:

- Estuarine influence. A crossing point that is connected to an estuary is likely to provide habitat for Fresh Water Sawfish.
- Presence of floodplain habitat surrounding the crossing point. This is good refuge habitat for juvenile and sub-adult Fresh Water Sawfish.
- Presence of billabongs upstream of crossing point providing suitable habitat for juveniles and sub-adults.
- Volume of water at the crossing. Perennial freshwater rivers and creeks are more likely to hold Fresh Water Sawfish.

Subsequently, local expert on freshwater sawfish (Dr Peter Kyne, Charles Darwin University) provided a further assessment on the likelihood of habitat occuring.

3.3 LIKELIHOOD OF FRESHWATER SAWFISH OCCURRENCE WITHIN KGGP PROJECT AREA

Dr Peter Kyne (Charles Darwin University) has made some different conclusions in regard to likely presence of Freshwater Sawfish habitat compared to EcOz in 2004 for seven of the crossings. Table 1includes both assessments and indicates where they differ.

Further analysis of the pipeline crossings (Section 3.3) was undertaken based on updated mapping of the pipeline and watercourse crossings (Figure 2). Updated mapping revealed additional watercourse crossings that were not previously assessed by EcOz (2013), namely King River, Roper Creek, Beswick Creek, Waterhouse River, Chambers River and Bukalorkmi creek.

To provide a finalised assessment, watercourses traversed by the pipeline were assessed for likelihood of Freshwater Sawfish occurrence by combining the original EcOz assessment (Table 1 and Figure 1), seeking expert advice (Table 1) and reviewing updated literature and updated mapping of the proposed pipeline route (Figure 2). A total of 29 watercourse crossings were identified and evaluated based on a using a conservative approach.

Freshwater Sawfish were considered as ‘possibly’ occurring in all perennial watercourses (except for King River which is too far inland and does not have tidal connections), and ‘likely’ to occur in any watercourses where known records exist. The species was considered as unlikely to exist if no tidal connections were present, or if a watercourse was seasonal and likely to completely dry out during the dry season. It should be noted that there is some evidence that Freshwater Sawfish are not associated with areas of riparian vegetation (DSEWPaC 2013; Wilson 1999). However, a conservative approach was taken in assessing likelihood of occurrence so even watercourse crossings with riparian vegetation present may have been assessed as likely or possible due to other favourable aspects such as upstream waterholes or previous known records.

A total of 24 of the 29 water crossings were found to potentially support habitat for Freshwater Sawfish and five water crossings were found unlikely to provide potential habitat (Table 2).

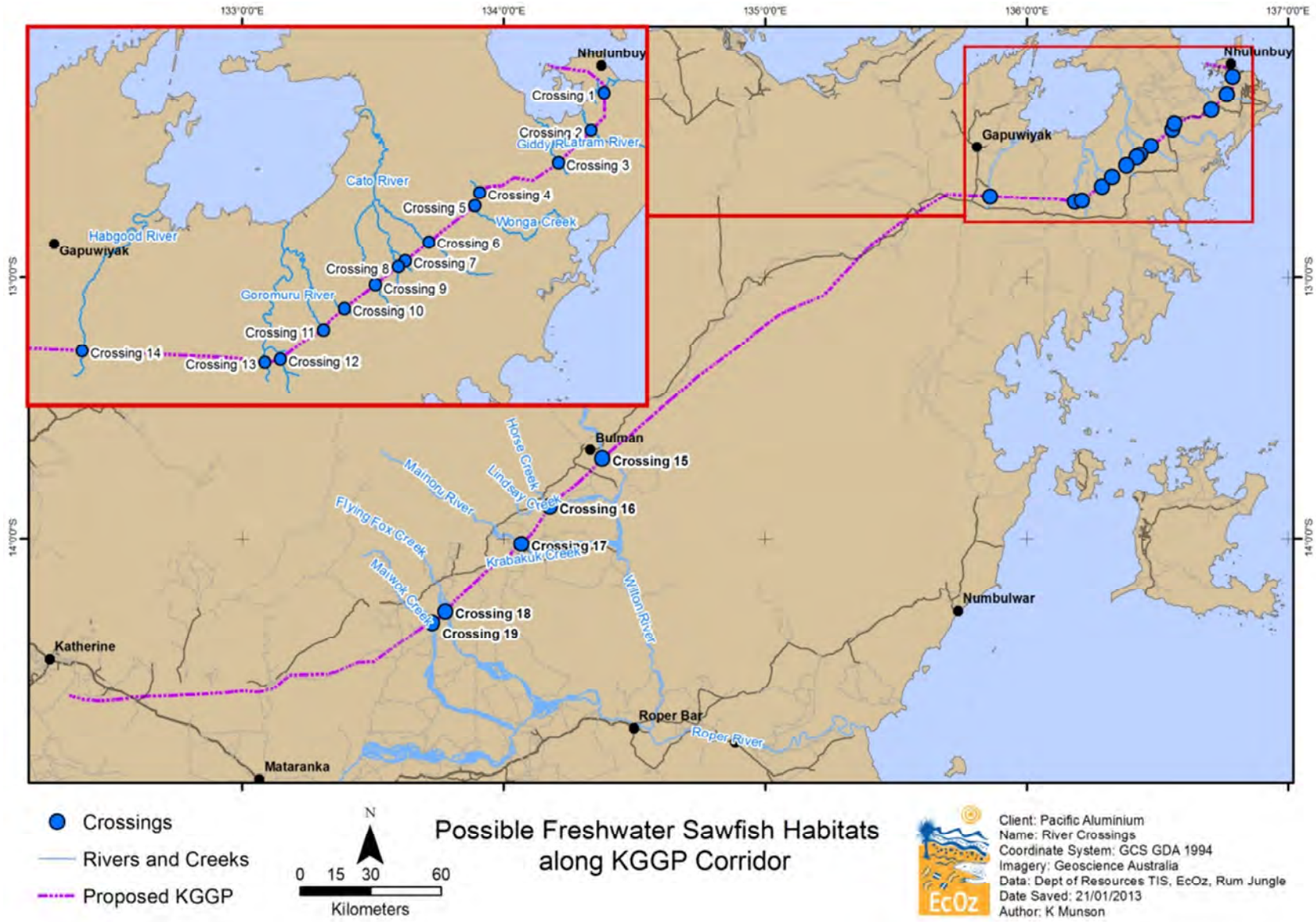

Figure 1: Watercourse Crossings assessed for potential Freshwater Sawfish habitat along the KGGP Corridor by EcOz 2013

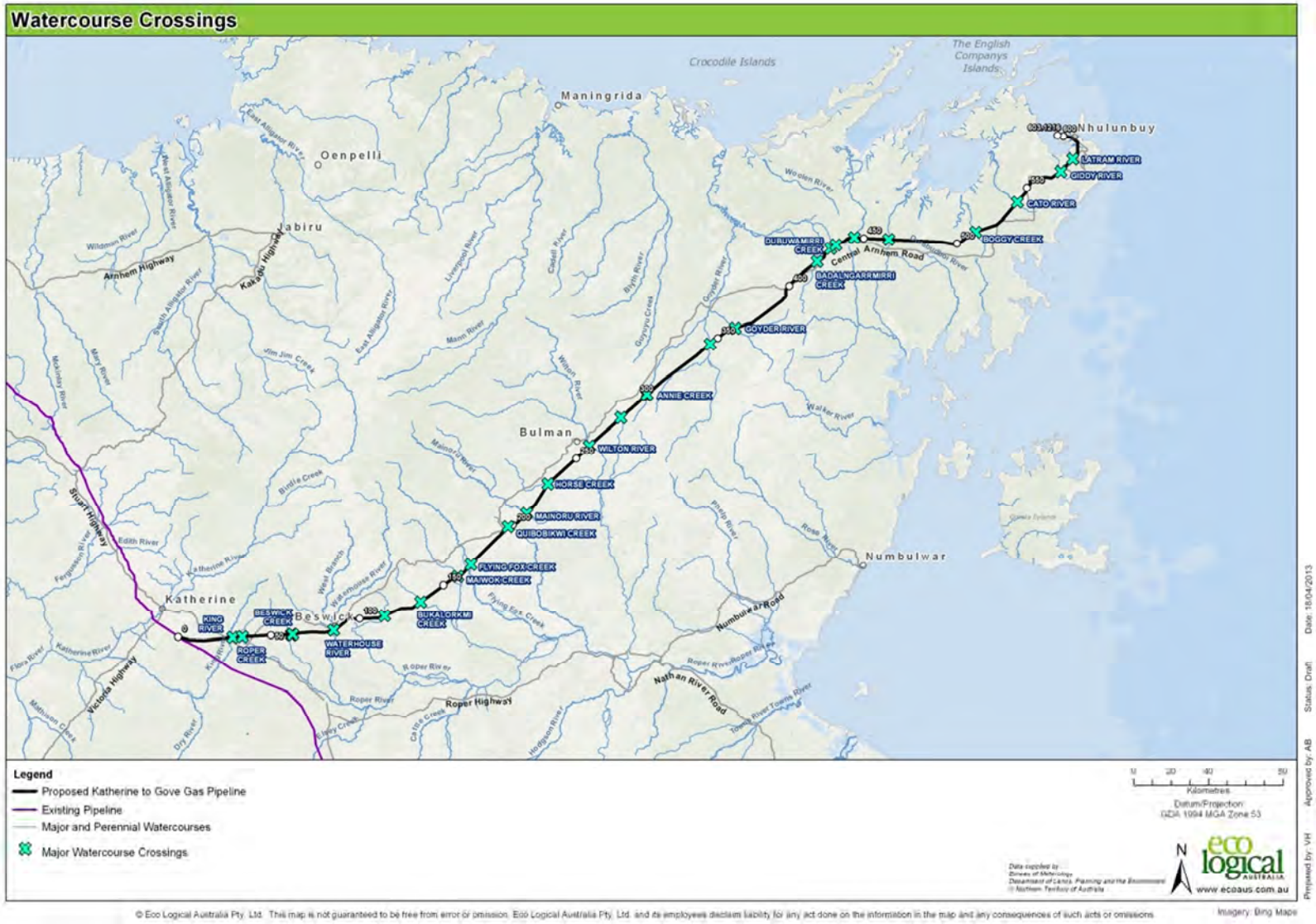

Figure 2: Updated mapping of perennial and non-perennial watercourse crossings

Table 1: Analysis of likelihood of occurrence assessments for Freshwater Sawfish from multiple sources

EcOz ASSESSED CROSSING	LOCATION	LIKELIHOOD OF OCCURRENCE		REASONS / JUSTIFICATION (AS PER ELA / DR KYNES ASSESSMENT)
		EcOz (2013)	ELA / Dr Kyne 2013	
Crossing 1	Latram River	Unlikely	Unlikely	Estuarine. Adults possibly occur. Too saline for juveniles and sub-adults.
Crossing 2	Latram River	Possible	Possible	Middle reaches of estuary. Possible refuge (may be too saline) and likely passageway for juvenile and sub-adults.
Crossing 3	Giddy River	Likely	Likely	Upper reaches of estuary. Possible refuge and likely passageway for juvenile and sub-adults.
Crossing 4	Wonga Creek	Likely	Likely	Numerous crossings off freshwater creek between Crossing 4 and Crossing 5. Upper reaches of estuary that may provide refuge for juveniles and sub-adults in billabongs during the dry season.
Crossing 5	Wonga Creek	Likely	Likely	Upper reaches of estuary that may provide refuge for juveniles and sub-adults in billabongs during the dry season
Crossing 6	Cato River	Likely	Unlikely*	Tidal throughout its short length, and upper reaches (close to the pipeline) would be completely dry by the end of the dry season. Unlikely there would be Freshwater Sawfish anywhere near the pipeline.
Crossing 7	Branch of Cato River	Possible	Unlikely*	Upper reaches of estuary (Cato river). Upper reaches (close to the pipeline) would be completely dry by the end of the dry season. Unlikely there would be Freshwater Sawfish anywhere near the pipeline.
Crossing 8	Branch of Cato River	Possible	Unlikely*	Upper reaches of estuary (Cato river).upper reaches (close to the pipeline) would be completely dry by the end of the dry season. Unlikely there would be Freshwater Sawfish anywhere near the pipeline.
Crossing 9	Cato River	Likely	Unlikely*	Upper reaches (close to the pipeline) would be completely dry by the end of the dry season. Unlikely there would be Freshwater Sawfish anywhere near the pipeline.
Crossing 10	Goromuru River	Unlikely	Unlikely	Upper reaches of large river. Possibly too far upstream and likely to be dry most of the year.

EcOz ASSESSED CROSSING	LOCATION	LIKELIHOOD OF OCCURRENCE		REASONS / JUSTIFICATION (AS PER ELA / DR KYNES ASSESSMENT)
		EcOz (2013)	ELA / Dr Kyne 2013	
Crossing 11	Boggy Creek	Likely	Likely	Upper reaches of large river. Appears to have substantial freshwater that will become disconnected billabongs in the dry season that may provide refuge area for juveniles and sub-adults.
Crossing 12	Branch of Goromuru River	Possible	Possible	Upper reaches of large river. Appears to have substantial freshwater but is possibly too far upstream and may dry out in the dry season.
Crossing 13	Branch of Goromuru River	Possible	Possible	Upper reaches of large river. Appears to have substantial freshwater but is possibly too far upstream and may dry out in the dry season.
Crossing 14	Habgood River	Possible	Possible	Upper reaches of estuary. May be too far upstream but refuge pools occur further upstream which may provide suitable habitat.
Crossing 15	Wilton River	Possible	Likely	Historically recorded in Wilton River (MAGNT ref). Upper reaches of large estuary. Appears to provide suitable refuge pools for juveniles and sub-adults, although may be upstream of escarpment where sawfish are unlikely to pass through.
Crossing 16	Horse Creek	Possible	Possible	Upper reaches of estuary. Floodplain area which may provide suitable habitat for juveniles and sub-adults.
Crossing 17	Mainoru River	Possible	Likely	Anecdotal evidence of occurrence by local land owner (EcOz 2013). Upper reaches of estuary may provide suitable refuge habitat for juveniles and sub-adults.
Crossing 18	Flying Fox Creek	Unlikely	Likely*	Previously recorded within Flying Fox Creek (Midgely 1979). Connects to the Roper River where Freshwater Sawfish have previously been recorded. Likely to have refuge pools that persist through the dry season.
Crossing 19	Maiwok Creek	Possible	Possible	Upper reaches of estuary. Possible juvenile and sub-adult refuge.

Table 2: Final assessment for likelihood of Freshwater Sawfish occurrence in watercourses traversed by Pipeline corridor

River name	Likelihood of occurrence	Freshwater Sawfish habitat
Freshwater river/streams either with permanent water or potentially some pools/waterholes in dry season		
King River	Unlikely	Too far inland with no connection to a tidal river.
Roper Creek	Possible	Connects to Roper River where Freshwater Sawfish have previously been recorded.
Beswick Creek	Possible	Permanent waterholes exist which may provide suitable refuge for juveniles and sub-adults during the dry season.
Waterhouse	Possible	Tidal connections (Roper) and contains waterholes upstream from the pipeline that persist during the dry season (i.e. Alligator waterhole).
Chambers River	Possible	Tidal connections to Roper River where Freshwater Sawfish have previously been recorded.
Bukalorkmi creek	Possible	Middle reaches of watercourse, connects to Roper River and extensive floodplains.
Maiwok Creek	Possible	Connects to a floodplain and permanent waterholes exist at Dulcaruk Billabong that may provide suitable refuge. Tidal connections to Roper River.
Flying Fox Creek	Likely	Freshwater Sawfish previously recorded upstream of the pipeline.
Quibobikwi Creek	Possible	Upper reaches of watercourse, extensive floodplains that have tidal connections (Roper River).
Mainoru River	Likely	Previously recorded. Middle reaches of estuary and connects to tidal river (Roper).
Horse Creek	Possible	Middle reaches of estuary and connects to a floodplain and a tidal river (Roper).
Wilton River	Likely	Previously recorded. Middle reaches, connects to tidal river (Roper)
Jasper Creek	Possible	Upper reaches. Connects to Wilton River which connects to tidal river (Roper)
Annie Creek	Possible	Connects with tidal river (Goyder) and likely to have refuge pools and upstream billabongs that would persist through the dry season providing suitable habitat.
Branch of Annie Creek	Possible	Middle reaches. Connects to Goyder
Goyder River	Likely	Anecdotal evidence exists of occurrence although from downstream of the pipeline. Likely to have refuge pools and upstream billabongs that would persist through the dry season.
Badalngarrmirri Creek	Possible	Upper reaches of Goyder River. May provide refuge pools and upstream billabongs that would persist through the dry season.
Dubumirrami Creek	Possible	Upper reaches of Goyder River. May provide refuge pools and upstream billabongs that would persist through the dry season.
Unnamed watercourse	Possible	Upper reaches

River name	Likelihood of occurrence	Freshwater Sawfish habitat
Habgood River	Possible	Upper reaches of estuary with tidal connections.
Latram River	Possible	Middle reaches of estuary. Lower reaches may be too saline for juveniles and sub-adults, but middle to upper reaches may provide suitable refuge.
Non-freshwater (ie estuaries) or rivers/streams likely to have no water at all in dry season		
Buckingham River	Possible	Upper reaches of estuary.
Goromuru River	Unlikely	Upper reaches of large river. Possibly too far upstream and likely to be dry most of the year.
Branch of Goromuru River	Unlikely	Upper reaches of large river. Possibly too far upstream and likely to be dry most of the year.
Branch of Goromuru River	Unlikely	Upper reaches of large river. Possibly too far upstream and likely to be dry most of the year.
Boggy Creek	Possible	Upper reaches of large river. Appears to have substantial freshwater that will become disconnected billabongs in the dry season that may provide refuge.
Cato River	Unlikely	There is anecdotal evidence of Freshwater Sawfish occurring in the Cato River, however these records are from far downstream of the proposed pipeline. The upper reaches are likely to be completely dry during the dry season, and it is unlikely that the sawfish occurs in this watercourse anywhere near the pipeline.
Giddy River	Possible	Upper reaches of estuary. Possible refuge and likely passageway for juvenile and sub-adults
Wonga Creek	Possible	Upper reaches of estuary that may provide refuge for juveniles and sub-adults in billabongs during the dry season

4 Assessment of potential impact

An assessment of the watercourse crossings, potential Freshwater Sawfish habitat, construction methods and potential impacts to the Freshwater Sawfish is provided in Table 3.

The key threats to the Freshwater Sawfish from the proposed action have been identified as:

- Barriers to movement (such as poorly constructed stream crossings and culverts).
- Disturbance of refuge pools or waterholes.
- Degradation of in-stream habitat caused by vegetation clearing.
- Degradation of water quality as a result of chemical contamination.

Potential impacts to the Freshwater Sawfish will be avoided through construction timing and methods. Construction activities will be undertaken during the dry season. Within seasonal, ephemeral and/or temporary waterways, any potential impacts to the Freshwater Sawfish or its habitat will be completely avoided. The potential impacts to Freshwater Sawfish within permanent rivers and/or streams will be greatly reduced, due to lower flow regimes. Any work on culverts during the dry season is unlikely to affect Freshwater Sawfish, except in areas that sustain refuge pools that may be considered large enough to support such animals over the dry season.

Where total avoidance of potential Freshwater Sawfish habitat is not possible (i.e. at major, permanent watercourses that do not dry up during the dry season), the Horizontal Directional Drilling (HDD) method will be used for the construction of watercourse crossings, and construction will be completed in as short a timeframe as possible. Horizontal Directional Drilling is the preferred method where the long term stability of the crossing is of concern or for ecological reasons, particularly to protect significant riparian vegetation or conservation values. The confirmation of crossings requiring HDD is the subject of further consideration during both the engineering and design phase of the KGGP project.

Project design of the pipeline route will ensure that the pipeline will not cross or disturb any temporary pools or billabongs associated with river that may represent potential Freshwater Sawfish refuge during the dry season. Pre-clearance inspections will be undertaken at river crossings prior to survey and pegging of the ROW and any construction activity to confirm no waterholes or pools that may provide potential refuge for the Freshwater Sawfish are likely to be affected by construction. In the event that a potential refuge waterhole or pool is encountered at a crossing that was not planned for HDD, construction methodology will be reviewed for potential to undertake HDD or avoid waterhole.

Further mitigation measures for residual impacts will focus around ensuring that there are no barriers to movement so any Freshwater Sawfish occurring upstream of the pipeline are able to move back downstream the following wet season. Rehabilitation to stabilise banks prior to onset of following wet season will minimise any potential impacts from erosion or increased sedimentation which may affect water quality, and have knock on effects to prey species composition.

Residual impacts may occur to any Freshwater Sawfish that occur upstream of the proposed pipeline. However, as long as no barriers to movement exist in the waterway when construction is completed, and the sawfish can move back downstream, any residual impacts are expected to be low. Residual impacts to the Freshwater Sawfish downstream of the pipeline may arise from erosion and increased

sedimentation, or chemical contamination of the watercourse. These impacts will be reduced through management measures implemented within Environmental Management Plans and may include:

- Rehabilitation works will commence as soon as practical after the disturbance, and will focus on maximising rehabilitation success through undertaking rehabilitation progressively immediately following completion of construction in an area and adequately stabilising disturbed areas prior to the wet season.
- The existing quality of surface water will be maintained by minimising the potential for water contamination and over extraction, and prevention of cross catchment transfer of water.
- Minimising the amount of vegetation that is permanently cleared, and avoiding clearing large trees on river banks.

As a result of the mitigation and management measures, any residual impacts to the Freshwater Sawfish (if present) are expected to be low.

Table 3: Impact assessment of watercourse crossings for the KGGP

Watercourse Crossing	Likelihood of occurrence of Freshwater Sawfish	Construction methods	Flow regime during the dry season (Construction period)	Impact to Freshwater Sawfish	Avoidance and mitigation measures
Roper Creek	Possible	Open trench	Seasonal and irregular rivers and streams	Unlikely	
Beswick Creek	Possible	Open Trench	Seasonal and irregular rivers and streams	Unlikely	Construction during the dry season will minimise any potential impacts as watercourse is likely to be dry. Permanent pools and waterholes may be present along the creek nearby that may provide potential Freshwater Sawfish refuge Rehabilitation will aim to stabilise banks prior to onset of wet season.
Water House River	Possible	HDD	Permanent rivers and streams	Unlikely	HDD construction methods will AVOID Freshwater Sawfish habitat.
Chambers River	Possible	Open trench	Seasonal and irregular rivers and creeks	Unlikely	Construction during the dry season will minimise any potential impacts as watercourse is likely to be dry. Rehabilitation will aim to stabilise banks prior to onset of wet season.
Bukalorkmi creek	Possible	Open trench	Seasonal/intermittent freshwater ponds and marshes	Unlikely	Construction during the dry season will minimise any potential impacts as watercourse is likely to be dry. Rehabilitation will aim to stabilise banks prior to onset of wet season.
Maiwok Creek	Possible	Open Trench	Seasonal/intermittent freshwater ponds and marshes	Unlikely	Construction during the dry season will minimise any potential impacts as watercourse is likely to be dry. Rehabilitation will aim to stabilise banks prior to onset of wet season.
Flying Fox Creek	Likely	Open Trench	Seasonal and irregular rivers and streams	Unlikely	Construction during the dry season will minimise any potential impacts as watercourse is likely to be dry. Permanent pools and waterholes may be present along the creek nearby that may provide potential Freshwater Sawfish refuge Rehabilitation will aim to stabilise banks prior to onset of wet season.
Quibobikwi Creek	Possible	Open trench	Seasonal and irregular rivers and creeks, seasonal/intermittent freshwater ponds and marshes	Unlikely	Construction during the dry season will minimise any potential impacts.
Mainoru River	Likely	HDD	Permanent rivers and streams	Unlikely	HDD construction methods will AVOID any potential impacts to Freshwater Sawfish.

Watercourse Crossing	Likelihood of occurrence of Freshwater Sawfish	Construction methods	Flow regime during the dry season (Construction period)	Impact to Freshwater Sawfish	Avoidance and mitigation measures
Horse Creek	Possible	Open Trench	Riverine floodplains, seasonally flooded grassland, savanna	Unlikely	Construction during the dry season should minimise any potential impacts to Freshwater Sawfish as long as floodplain areas that provide potential refuge are avoided.
Wilton River	Likely	HDD	Permanent rivers and streams	Unlikely	HDD construction methods will AVOID any potential impacts to Freshwater Sawfish.
Jasper Creek	Possible	Open trench	Seasonal and irregular rivers and creeks	Unlikely	Construction during the dry season will minimise any potential impacts as watercourse will be dry.
Annie Creek	Possible	Open trench	Seasonal and irregular rivers and streams	Unlikely	Construction during the dry season will minimise any potential impacts as watercourse is likely to be dry, or flow regime greatly reduced thereby prohibiting Freshwater Sawfish passage/occurrence. Rehabilitation will aim to stabilise banks prior to onset of wet season. This will minimise down-stream impacts from erosion or sedimentation.
Branch of Annie Creek	Possible	Open trench	Seasonal and irregular rivers and streams	Unlikely	Construction during the dry season will minimise any potential impacts as watercourse will be dry.
Goyder River	Likely	HDD	Permanent rivers and streams	Unlikely	HDD construction methods will AVOID any potential impacts to the Freshwater Sawfish.
Badalngarram Creek	Possible	Open trench	Seasonal and irregular rivers and streams	Unlikely	Construction during the dry season will minimise any potential impacts as watercourse is likely to be dry.
Dubumirrami Creek	Possible	Open trench	Seasonal and irregular rivers and streams	Unlikely	Construction during the dry season will minimise any potential impacts as watercourse is likely to be dry.
Unnamed watercourse	Possible	Open trench	Seasonal and irregular rivers and streams	Unlikely	Construction during the dry season will minimise any potential impacts as watercourse is likely to be dry.
Buckingham River	Possible	Open trench	Seasonal and irregular rivers and streams	Unlikely	Construction during the dry season will minimise any potential impacts as watercourse is likely to be dry.

Watercourse Crossing	Likelihood of occurrence of Freshwater Sawfish	Construction methods	Flow regime during the dry season (Construction period)	Impact to Freshwater Sawfish	Avoidance and mitigation measures
Habgood River	Possible	Open Trench	Seasonal/intermittent freshwater ponds and marshes	Unlikely	Construction during the dry season will minimise any potential impacts as watercourse is likely to be dry.
Latram River	Possible	HDD	Permanent river	Unlikely	HDD construction methods will avoid any potential impacts to the Freshwater Sawfish.
Boggy Creek	Likely	HDD	Permanent river/stream	Unlikely	HDD construction methods will avoid any potential impacts to the Freshwater Sawfish.
Giddy River	Possible	HDD	Upper reach of estuary	Unlikely	HDD construction methods will AVOID any potential impacts to Freshwater Sawfish.
Wonga Creek	Possible	Open Trench	Seasonal and/or irregular river and stream	Unlikely	Construction during the dry season will minimise any potential impacts as watercourse is likely to be dry.

5 Conclusions

The conclusions of the technical annexe are as follows:

- The Freshwater Sawfish has previously been recorded from watercourses within the KGGP Project area.
- The Freshwater Sawfish is considered likely to occur within 24 watercourses that will be traversed by the pipeline.
- Impacts to the Freshwater Sawfish will be avoided at all watercourse crossings where the species is considered likely or possible to occur as a result of the watercourse being dry at the time of construction or avoidance of impacts or HDD construction methods being employed at crossings where flows are anticipated.
- Pre-clearance surveys ahead of construction should be undertaken to identify any waterholes or pools that may provide potential Freshwater Sawfish refuge at these crossing for assessment of whether can avoid by moving crossing within Pipeline corridor or if consideration of HDD required.
- Implementation of terrestrial and aquatic fauna management and hydrology and water quality management should ensure no significant impacts to the Freshwater Sawfish.

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ecological AUSTRALIA

HEAD OFFICE
Suite 4, Level 1
2-4 Merton Street
Sutherland NSW 2232
T 02 8536 8600
F 02 9542 5622

SYDNEY
Level 6
299 Sussex Street
Sydney NSW 2000
T 02 8536 8650
F 02 9264 0717

ST GEORGES BASIN
8/128 Island Point Road
St Georges Basin NSW 2540
T 02 4443 5555
F 02 4443 6655

CANBERRA
Level 2
11 London Circuit
Canberra ACT 2601
T 02 6103 0145
F 02 6103 0148

NEWCASTLE
Suites 28 & 29, Level 7
19 Bolton Street
Newcastle NSW 2300
T 02 4910 0125
F 02 4910 0126

NAROOMA
5/20 Canty Street
Narooma NSW 2546
T 02 4476 1151
F 02 4476 1161

COFFS HARBOUR
35 Orlando Street
Coffs Harbour Jetty NSW 2450
T 02 6651 5484
F 02 6651 6890

ARMIDALE
92 Taylor Street
Armidale NSW 2350
T 02 8081 2681
F 02 6772 1279

MUDGEE
Unit 1, Level 1
79 Market Street
Mudgee NSW 2850
T 02 4302 1230
F 02 6372 9230

PERTH
Suite 1 & 2
49 Ord Street
West Perth WA 6005
T 08 9227 1070
F 08 9322 1358

WOLLONGONG
Suite 204, Level 2
62 Moore Street
Austinmer NSW 2515
T 02 4201 2200
F 02 4268 4361

GOSFORD
Suite 5, Baker One
1-5 Baker Street
Gosford NSW 2250
T 02 4302 1220
F 02 4322 2897

DARWIN
16/56 Marina Boulevard
Cullen Bay NT 0820
T 08 8989 5601

BRISBANE
PO Box 1422
Fortitude Valley QLD 4006
T 0400 494 366