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Your ref:
Our ref: 613626605

18 June 2021

Wendy Kozak
Roy Hill Iron Ore Pty Ltd
5 Whitham Road
Perth Airport WA 6105

Surface water hydraulic structure vegetation impacts

Dear Wendy

This letter has been prepared in response to comments received from the Department of Water and Environmental Regulation (DWER) addressed to Melissa Hobson at Roy Hill, dated 14th June 2021. The comments relate to an altered surface water regime relative to the Original Proposal. This letter supplements the GHD report titled *Section 38 Referral: Hydraulic Structures* (Rev3, March 2021), providing clarification on vegetation impacts relative to the Original Proposal (2009).

1. Original Proposal surface water management

The Original Proposal presented 31 hydraulic structures to collect, store, convey, and discharge surface water for the purpose of enabling mining activities whilst maintaining flow into the Fortescue Marsh. There was a combination of temporary and permanent structures, including structures retained or reconstructed for mine closure. The structures are illustrated and described in Attachment 1.

2. Revised Proposal surface water management

2.1 Key changes

Surface water management measures have evolved to suit greater detail in mining activities and in response to measured rainfall and runoff data. However, the proposed structures are generally located in accordance with the Original Proposal, returning flows to the same streams that were identified in the Original Proposal. The major changes are:

– Avoidance of the cascading structures. These cascading storages have a significant impact on the water supply to downstream riparian vegetation during their operational period. They also have a catastrophic impact to vegetation in the inundation extents. Avoiding these cascading structures by conveying floodwaters through the mine site and returning flows to downstream waterways is the preferred solution.
– Minimising the use of creek reinstatements over backfilled pits. Reinstating flows over backfilled pits has complications associated with differential settlement, permeability of backfill, flood safety, revegetation issues, and geomorphology issues. For the stage 2 mining region, mine pits will not be backfilled to ground level, further complicating reinstatement. To minimise creek reinstatements over backfill, the creek reinstatements labelled 1 to 7 in the Original Proposal are built over natural ground

by routing the creeks between mining pits, using flood protection bunds where necessary. For example, the temporary diversion of No Name Creek has been avoided by routing No Name Creek between mine pits with the aid of levees and short sections of channel to retain the existing alignment as much as possible.

– Avoiding off-tenement structures. Several structures presented in the Original Proposal are located outside the mining tenement and have been relocated to be within tenement boundaries.
– The addition of a flood protection bund (levee) to Kulkinbah Creek. This levee wasn't identified at the Original Proposal stage but is required to enable access to particular mine pits. Floodwaters are returned to the same waterway (Reporting Location 11).

Other improvement to surface water management include:

– The use of rainfall and stream gauge monitoring data to quantify the catchment runoff response, so that structures are appropriately sized.
– Two-dimensional hydrodynamic modelling to accurately predict flood behaviour and environmental impacts.
– Hydraulic structure designs that cater for the 1% Annual Exceedance Probability (AEP) event in most situations and prevent structural failure under the 0.1% AEP extreme flood.

2.2 Riparian vegetation impacts

In the absence of flood modelling results in the Original Proposal at the reporting locations presented by GHD (2021), a catchment area comparison has been undertaken for three scenarios at the mine closure stage:

– Pre-mine
– Original Proposal (2009)
– Revised proposal

In both the Original Proposal and revised proposal, the catchment area consumed by stage 2 mining pits was deducted from the related catchment areas, to reflect that these pits are not backfilled to the natural surface level and will therefore not produce runoff. All other parts of the catchment were assumed to produce runoff.

Riparian vegetation is reliant on runoff as a water source. The Original Proposal identified that diversion of water has the potential to cause a loss of riparian vegetation. By maintaining catchment areas to be similar to the Pre-mine catchment areas, runoff volumes will be maintained. Referring to Table 1 and Figure 1 in Attachment 2, the revised proposal makes no change to the catchment areas relative to the Original Proposal at 9 of the 11 Reporting Locations.

At Reporting Location 8, the catchment area has been increased by 50%, however this increase brings the proposal catchment area closer to the Pre-mine catchment area.

At Reporting Location 9, the proposal reduces the catchment area by 3%, however the proposed area is much larger than the Pre-mine area. This impact is described by GHD (2021).

Table 1 Catchment area comparison

Reporting Location	Pre-mine catchment area (Ha)	Original Proposal catchment area (Ha)	Revised Proposal catchment area (Ha)	Change relative to Original Proposal
1	26,076	26,061	26,061	0%
2	8,137	8,030	8,030	0%
3	3,634	5,961	5,977	0%
4	470	438	438	0%
5	662	518	518	0%
6	7,472	4,238	4,222	0%

Reporting Location	Pre-mine catchment area (Ha)	Original Proposal catchment area (Ha)	Revised Proposal catchment area (Ha)	Change relative to Original Proposal
7	2,040	1,924	1,924	0%
8	2,611	710	1,062	+50%
9	169	5,148	4,980	-3%
10	5,458	187	187	0%
11	74,842	74,558	74,559	0%
TOTAL	131,571	127,772	127,959	0%

2.3 Sheet flow vegetation impacts

This assessment does not address sheet flow vegetation impacts. Sheet flow vegetation impacts are addressed in Astron's letter dated 13th March 2020, reference 15625-20-BILR-2Rev0_200313.

3. Conclusion

During the operational phase, the Original Proposal featured cascading storages and diversion structures that would have considerable impact on downstream riparian vegetation, by capturing or diverting a large proportion of runoff. The proposed surface water management measures avoid the use of cascading structures and promotes hydraulic structures that return flows to the same waterway in most locations. Consequently, the volume and flow of runoff received by riparian vegetation downstream of the project is maintained close to baseline conditions. Furthermore, the removal of cascading structures in the revised proposal ensures that upstream impacts associated with water ponding are avoided.

During mine closure, the hydrology of the proposed surface water management measures is almost identical to the measures outlined in the Original Proposal, with the revised proposal providing a small improvement to runoff rates and volumes at Reporting Location 8. During closure, the volume and flow of runoff and associated impacts on riparian vegetation is therefore no different to the Original Proposal.

Whilst the revised proposal is expected to impact downstream riparian vegetation in a limited number of locations, the impacts are less than those associated with the Original Proposal. For the entire catchment intersecting with the development envelope, runoff volumes are predicted to change by less than 3% of the Pre-mine conditions.

We trust this meets your requirements. If you have any questions, please do not hesitate to contact the undersigned.

Regards

Digitally signed by Nicholas Deeks
Date: 2021.06.18 16:46:59 +08'00'

Nick Deeks
Engineering Leader

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Attachments

Attachment 1

Original Proposal Hydraulic Structures

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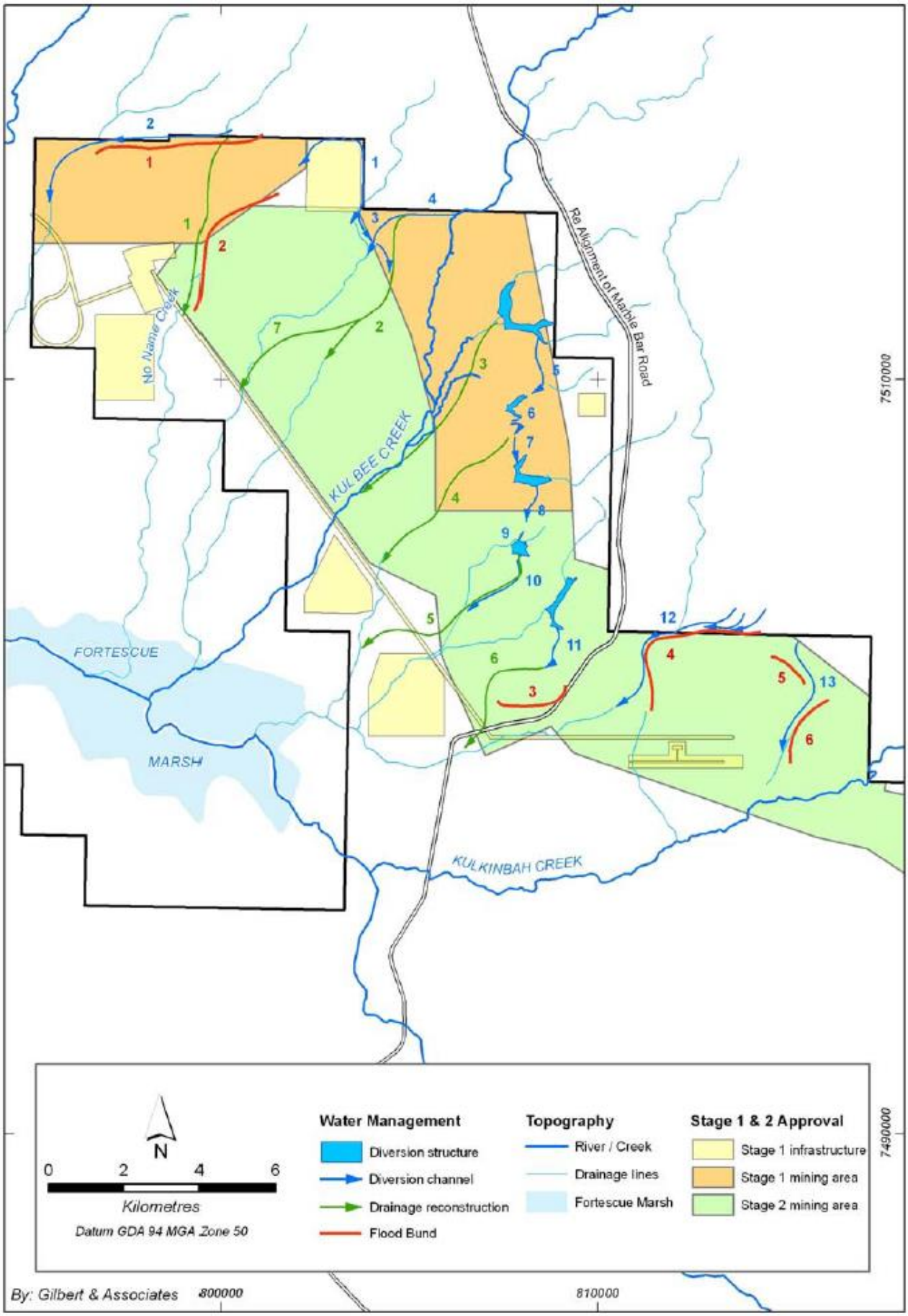


Table 4-6: Schedule of Drainage Control Structures

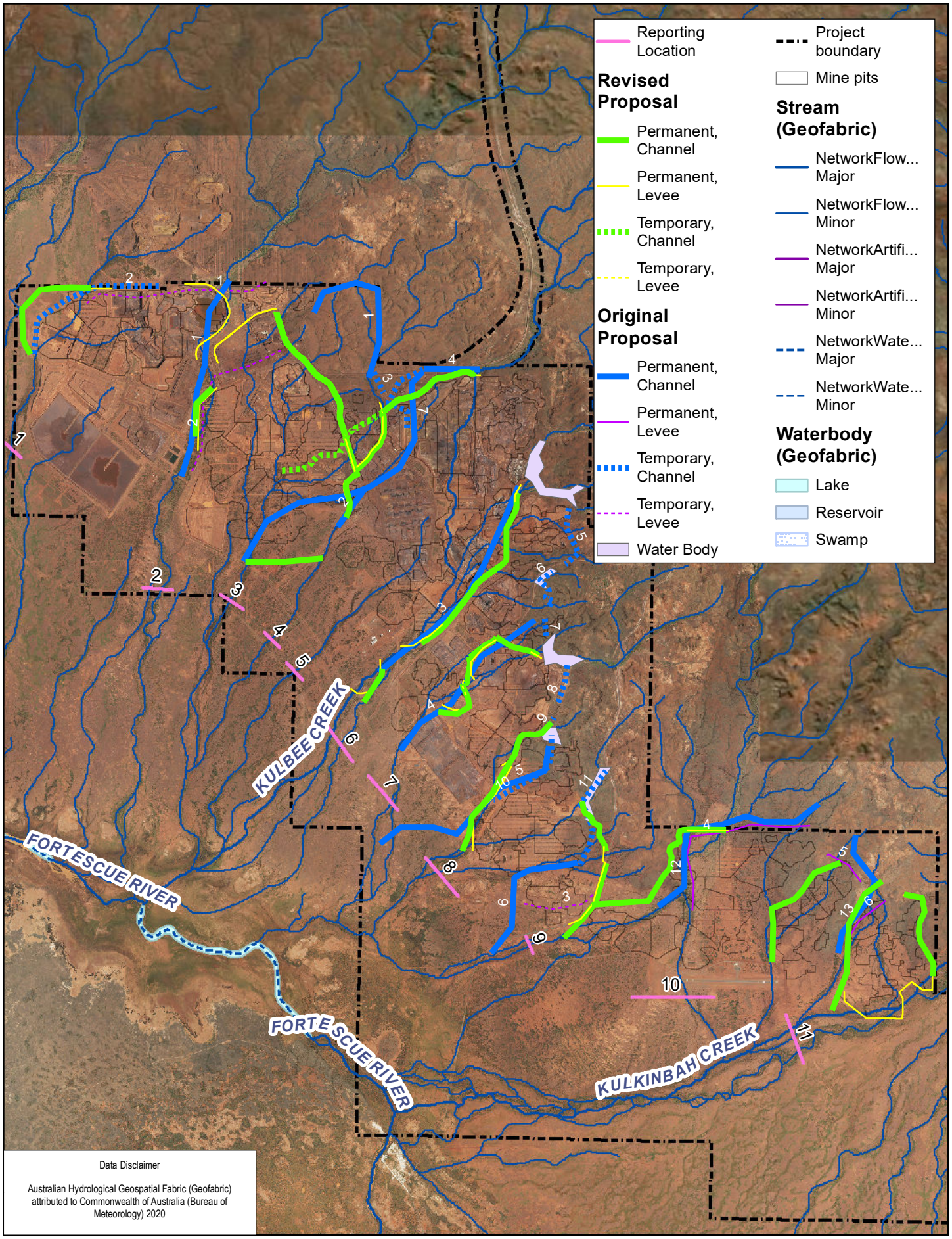
STRUCTURE DESIGNATION	FUNCTION	CONSTRUCTION
Diversion channel 1	Divert upslope runoff around out of pit waste dump.	Project development (Year 1 or earlier)
Diversion channel 2	Temporary diversion of Un-named tributary around Stage 1 mine area.	Project development (Year 1 or earlier)
Flood bund 1	Cut-off embankment for diversion channel 2 and isolation bund to protect of Stage 1 mine area from local flooding	Project development (Year 1 or earlier)
Diversion channel 3 and 4	Diversion of Kulbee Creek around Stage 1 mine area.	Year 3 or earlier
Drainage reconstruction channel 1	Reconstruction of un-named tributary over backfilled mine area.	Year 3 or later
Flood bund 2	Drainage control and isolation bund to protect mine areas from local flooding.	Year 3 or later
Temporary diversion channel 5 and associated diversion structures	Diversion of a tributary of Kulbee Creek around Stage 1 mine area.	Year 5 or earlier
Drainage reconstruction channel 2	Reconstruction of tributary of Kulbee Creek over backfilled mine area.	Year 6 or later
Temporary diversion channel 6 and associated diversion structures	Diversion of second tributary of Kulbee Creek around Stage 1 mine area.	Year 8 or earlier
Temporary diversion channel 7 and associated diversion structures	Diversion of third tributary of Kulbee Creek around Stage 1 mine area.	Year 9 or earlier
Drainage reconstruction channel 3	Reconstruction of tributary of Kulbee Creek over backfilled mine area.	Year 10 or later
Temporary diversion channel 8 and associated diversion structures	Diversion of fourth tributary of Kulbee Creek around Stage 1 mine area.	Year 10 or earlier
Temporary diversion channels 9 and 10 and associated diversion structures	Diversion of fifth tributary of Kulbee Creek around Stage 2 mine area.	Year 10 or earlier
Temporary diversion channel 11 and associated diversion structures	Diversion of fifth tributary of Kulbee Creek around Stage 2 mine area.	Year 11 or earlier
Flood bund 3	Drainage control and isolation bund to protect mine areas from local flooding.	Year 11 or earlier
Drainage reconstruction channel 4	Reconstruction of tributary of Kulbee Creek over backfilled mine area.	Year 11 or later
Flood bund 4	Drainage control and isolation bund to protect mine areas from local flooding.	Year 12 or earlier
Permanent diversion channel 12	Diversion of local water courses around Stage 2 mine area	Year 12 or earlier
Flood bund 5 and 6	Drainage control and isolation bund to protect mine areas from local flooding.	Year 13 or earlier
Permanent diversion channel 13	Diversion of local water courses around Stage 2 mine area	Year 13 or earlier
Drainage reconstruction channel 5	Reconstruction of tributary of Kulbee Creek over backfilled mine area.	Year 13 or later
Drainage reconstruction channel 6	Reconstruction of tributary of Kulbee Creek over backfilled mine area.	Year 13 or later

Attachment 2

Revised proposal hydraulic structures

Table 2 Changes to surface water diversion structures

Original Proposal Structure	Revised Proposal
Diversion channel 1	No longer required
Diversion channel 2	Retained. Same function, alignment refined, now permanent
Flood bund 1	Retained. No longer diverts No Name Creek, shortened to suit Diversion Channel 2, now permanent
Diversion channel 3 and 4	Retained. Channel 3 relocated further to the west and lengthened. Channel 4 realigned to avoid mine pits
Drainage reconstruction channel 1	Reconstruction no longer required as original creek largely retained. Minor deviations to creek alignment to protect pits from flooding.
Flood bund 2	Retained. Realigned to suit mining activities, now permanent.
Temporary diversion channel 5 and associated diversion structures	No longer required, to avoid construction of cascading structures
Drainage reconstruction channel 2	Retained.
Temporary diversion channel 6 and associated diversion structures	No longer required, to avoid construction of cascading structures
Temporary diversion channel 7 and associated diversion structures	No longer required, to avoid construction of cascading structures
Drainage reconstruction channel 3	Retained.
Temporary diversion channel 8 and associated diversion structures	No longer required, to avoid construction of cascading structures
Temporary diversion channels 9 and 10 and associated diversion structures	No longer required, to avoid construction of cascading structures
Temporary diversion channel 11 and associated diversion structures	No longer required, to avoid construction of cascading structures
Flood bund 3	Retained and now permanent. Realigned to suit pits
Drainage reconstruction channel 4	Retained
Flood bund 4	Retained
Permanent diversion channel 12	Retained and lengthened to suit pits
Flood bund 5 and 6	Bund 5 abandoned in favour of a permanent diversion channel that returns flow to same stream. Bund 6 no longer required, replaced by a permanent diversion channel providing same function.
Permanent diversion channel 13	Retained
Drainage reconstruction channel 5	Retained but truncated to return flow to same waterway
Drainage reconstruction channel 6	Retained but realigned to suit pits
Drainage reconstruction channel 7	Realigned to avoid pits and reinstate flows to the stream that discharges to Reporting Location 3
[Not identified in Original Proposal]	New permanent flood bund at Kulkinbah Creek (reporting Location 11). Flow returned to same stream.



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Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

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Section 38
Surface Water Hydrology

MINE CLOSURE HYDRAULIC STRUCTURES ORIGINAL AND PROPOSED

Project No. **613626605**
Revision No. **0**
Date **18/06/2021**

FIGURE 1

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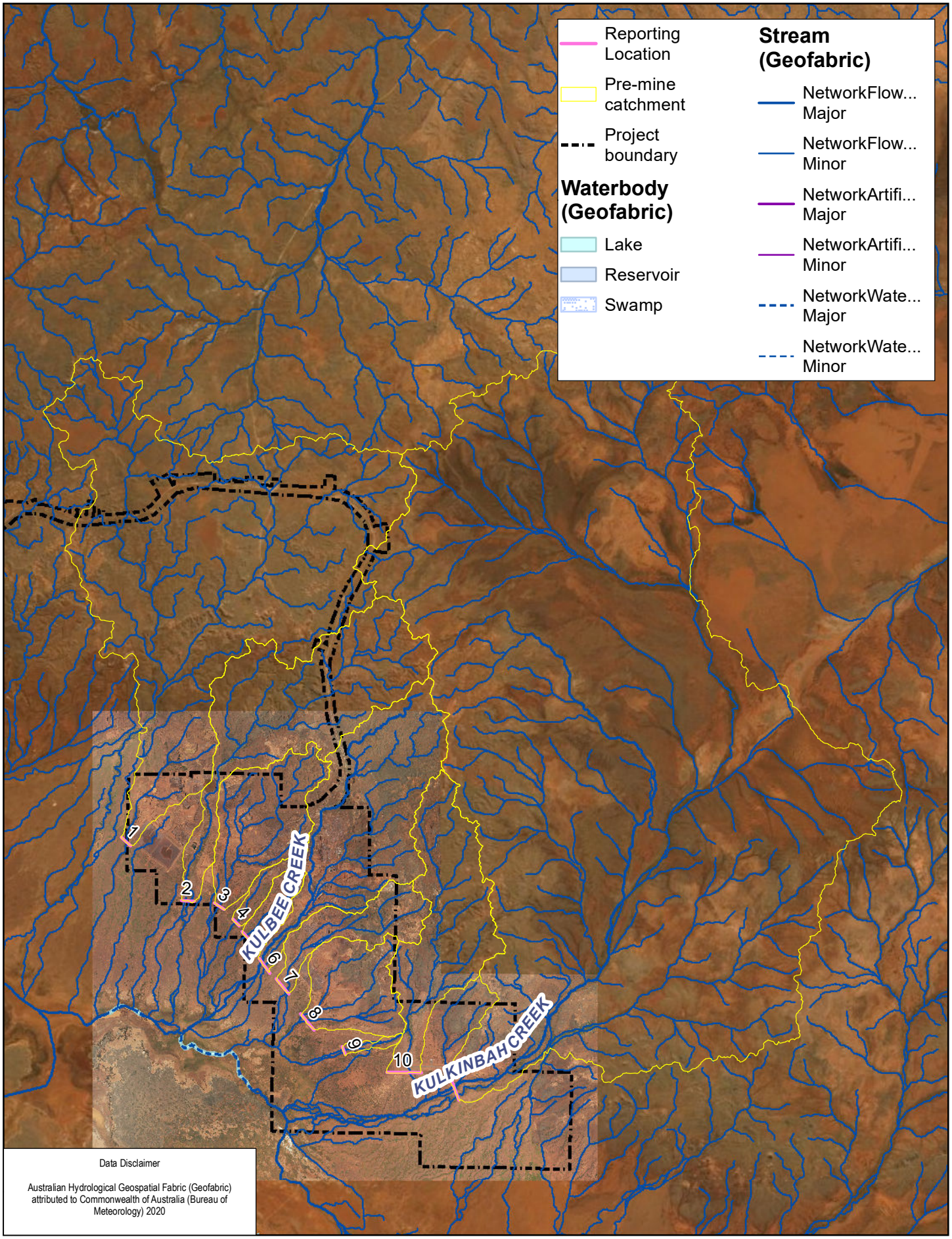
Data source: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: ndeeks



Data Disclaimer

Australian Hydrological Geospatial Fabric (Geofabric) attributed to Commonwealth of Australia (Bureau of Meteorology) 2020

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Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

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Section 38
Surface Water Hydrology

Project No. **613626605**
Revision No. **A**
Date **17/06/2021**

PRE-MINE CATCHMENTS

FIGURE 2

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Data source: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: ndeeks