BROCKMAN RESOURCES LTD

MARILLANA PROJECT
AIRFIELD OPTION ANALYSIS

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1 INTRODUCTION

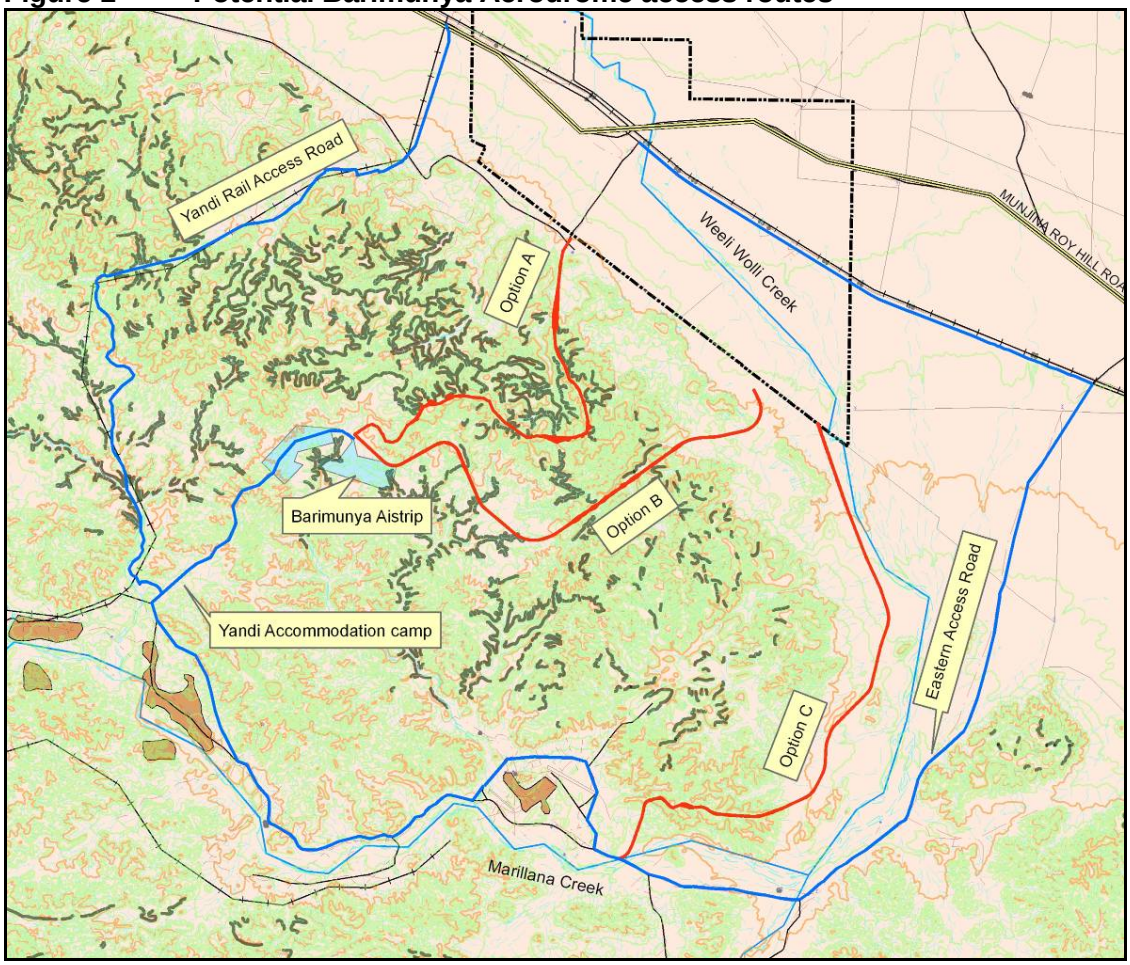
Although only 100km as the crow flies from Newman, Marillana is 250 km from Newman by road (via Auski), and is expected to be a fly-in/fly-out operation, with the accommodation camp on site. There are a number of options to facilitate the fly-in/fly-out component of the operation. These range from accessing existing fly-in/fly-out airstrips via new or existing roads, using the commercial airfield at Newman, and constructing an airstrip on site for the dedicated use of the Marillana Project.

2 OPTION ANALYSIS

2.1 Option 1 - Access to Barimunya Aerodrome

The Barimunya Aerodrome is a dual use (BHPB and Rio) airstrip approximately 9 km south west of the Marillana tenement. Being already dual use, there is a reasonable possibility that access can be negotiated. However, the Hamersley Ranges lie in between, and the development of an access road is problematic. A number of potential routes have been evaluated, from constructing a road directly over the range, to using existing roads (Figure 1). Several of these routes cross the BHPB lease to the south of the Marillana Lease, and have the potential to impact on the BHPB iron ore resource on this lease.

Figure 1 Potential Barimunya Aerodrome access routes



A more detailed contour map is shown in Appendix 1, along with the profiles for each of the three route options.

The key road design parameters used in this analysis for new road construction are

- Road width 6 m
- Shoulder width 2 m
- Total Formation width 10 m
- Maximum slope 10%

For the purposes of this exercise, it has been assumed that access to the camp is from the intersection of Munjina Roy Hill road and the BHPB rail line. All distances have been measured from this point.

2.1.1 Option1a - Shortest direct route

The shortest direct route follows a long spur to the south of Rockhole Bore. This long, narrow spur rises quickly up to the top of the range, but then has to follow the ridge tops, negotiating a number of narrow ridges with cliffs on either side, and one major gully, to reach the Barimunya Airstrip. Some 3.38 M m^3 of fill is required and only 0.15 M m^3 of cut. The majority of the fill is required at the Marillana end of the road in order to reduce the incline of the road up the ridge to the required maximum of 10%.

On the basis that this fill could be sourced from overburden at or near Rockhole bore, it is assumed that the fill would have to be transported an average of 4 km. The total cost of constructing this track is shown below.

Reviewing the profile of the route, up to 40m of fill is required at approximately 2-4km from the start (northern end), and also at one location 7.5 km from the start, where a saddle between two adjacent peaks has to be crossed. For the remainder of the route, less than 10m of cut or fill is required to keep gradients acceptable.

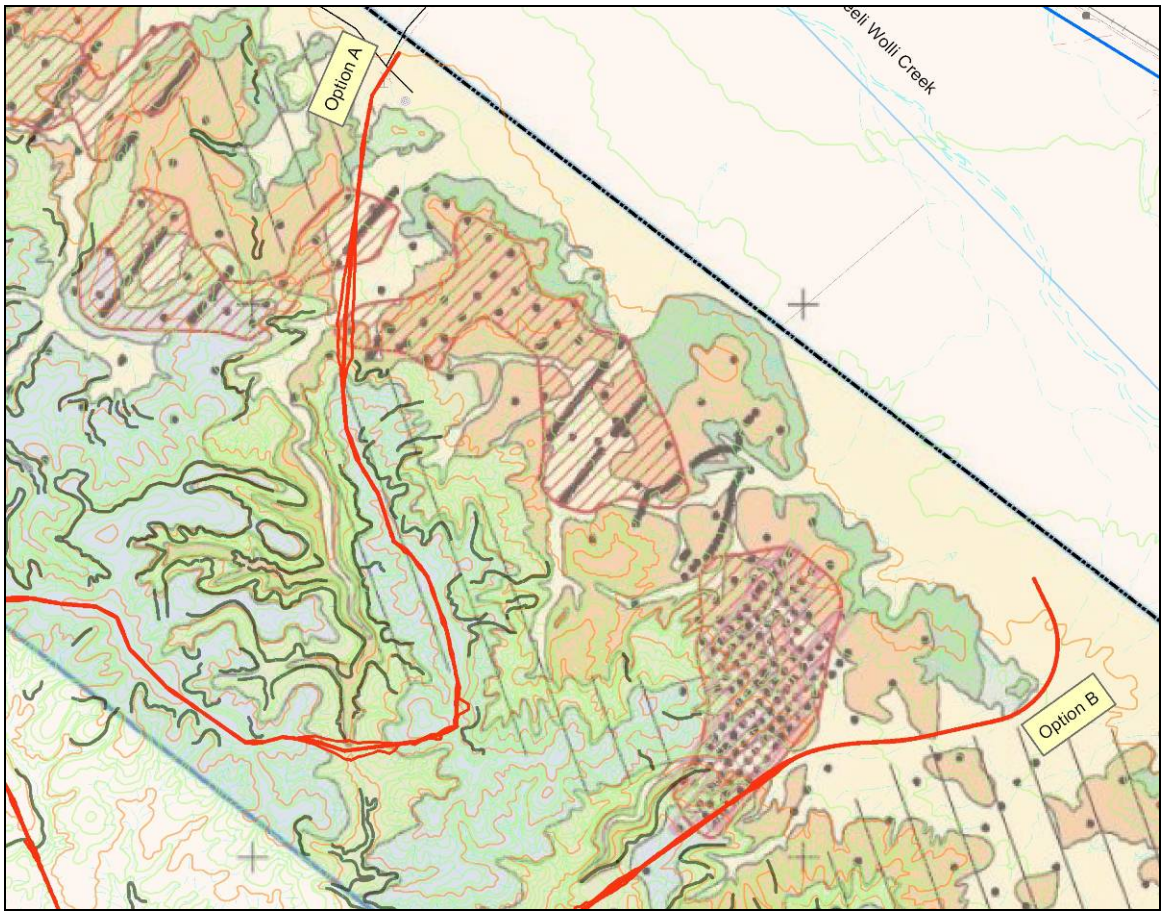
The table below compiles the cost of construction of this route.

Table 1 Estimated Cost of Construction – Option 1a

Track Length (km)	Cut (m^3)	Fill (m^3)	Distance to source fill (km)	No of Culverts	Culvert length (m)	Cost to Construct road ($M)	Cost to Source Fill ($M)	Cost Culverts ($M)	Total Cost ($M)
15.36	149,601	3,381,503	4.0	-	-	5.72	46.11		51.83

This route does appear to cross the BHPB iron ore resource, as shown in Figure 2 below. It is noted that the information on the BHPB resource is indicative only, as the information comes from a scanned public document that has been geo-referenced as accurately as possible. Figure 2 shows that the Option 1a route does cross over two pods of the resource, though the drilling is relatively sparse, and outlines are likely to change with more detailed drilling.

Figure 2 Impact on BHPB Iron Ore Resource



2.1.2 Option 1b - Optimal direct route

Further to the east of the most direct route is a second, more gradual spur that provides an alternative route to Barimunya airstrip. The contours here are less dramatic, with a reduced number of cliff faces (as is shown on the figures above as short black lines).

The slope on the initial incline lies within the design criteria, so no additional fill is required here. However, when running along the top of the ridge, several significant creeks and ridges have to be crossed, resulting in cuts of 20m and 30m being required, and fills of nearly 20m. Overall, the cut and fill requirements are fairly evenly balanced, so it is assumed that all fill will be sourced from nearby cuts. A number of the fill situations involve crossing minor gullies, so culverts are required.

The table below compiles the cost of construction of this route.

Table 2 Estimated Cost of Construction – Option 1b

Track Length (km)	Cut (m^3)	Fill (m^3)	Distance to source fill (km)	No of Culverts	Culvert length (m)	Cost to Construct road ($M)	Cost to Source Fill ($M)	Cost Culverts ($M)	Total Cost ($M)
15.97	634,956	681,882	1.0	7	600	10.57	1.61	0.40	12.58

As can be seen from Figure 2 above, this route also clips the edge of the BHPB iron ore resource. This section of the resource has been relatively well drilled, and topography precludes the option of routing the road around the edge of the resource.

2.1.3 Option 1c - Skirting the range

This option is designed to try to avoid the bulk of the range by following Weeli Wolli Creek southwards, but staying on the western side, so that the road does not have to cross either Weeli Wolli Creek, or Marillana Creek. The aim is not to traverse the Hamersley range at all, but to connect to the Yandicoongina access road, and follow it to the Barimunya Airstrip.

The road has been designed to be at least 3m above the contours of Weeli Wolli Creek. This may not be sufficient to protect it from the 100 year flood event, but is sufficient to determine whether the option is worth progressing further.

The topography enables the road to follow Weeli Wolli Creek for the majority of the length. However, where Marillana Creek joins Weeli Wolli Creek, Marillana Creek cuts through the edge of a hill, and the topography is such that there is insufficient room to construct a road along the creek bank. Consequently, the road is forced to climb the hill (a total of about 80m vertical). Hill slopes permit this to occur without significant fill, though there is one creek crossing on the top which does require fill of up to 20m. For the remainder of the route cut and fill depths do not exceed 10m. There are a number of minor gullies flowing off the range which cross the route, and these will require culverts.

The table below compiles the cost of construction of this route. For costing purposes, fill is assumed to be available at no charge from the Yandicoongina waste stockpile.

Table 3 Estimated Cost of Construction – Option 1c

Track Length (km)	Cut (m^3)	Fill (m^3)	Distance to source fill (km)	No of Culverts	Culvert length (m)	Cost to Construct road ($M)	Cost to Source Fill ($M)	Cost Culverts ($M)	Total Cost ($M)
20.35	65,776	622,103	7.0	15	600	6.05	8.93	0.29	15.27

This route does not appear to cross the BHPB iron ore resource.

2.1.4 Option 1d - Via Yandi Rail Spur Access Road

The Yandi Rail Spur Access Road follows the Yandi Rail Spur from the main BHPB rail line at the western edge of the Marillana lease to Yandi. On appearances it would appear to be the logical, least cost route between Marillana and Barimunya. However, a traverse along the road shows a number of major drawbacks, including

- Crossing a major creek where it exists from the Hamersley Range
- 3 km of the road is constructed on the rail formation, is only a single lane wide, and has little to no room for expansion
- Approximately 8km of its 26km length runs in creek channels, and as such would be impacted by any water flow
- The track leaves one creek valley and climbs over a steep ridge for six kilometers before dropping into a second creek valley (on the other side of the watershed) – this section of the track would require some major upgrade work

While it is possible to engineer around the first and last, the second and third points make the road impossible to use for regular traffic under all weather conditions.

It may be possible to avoid some 5.5 km of the in-creek channel track by diverting the road from the top of the ridge (where it is traversing from one side of the watershed to the other) directly to Barimunya Airstrip, but there is still some 1.5km in creek channels and the track on the railway formation that cannot be avoided.

Consequently, this route is not considered a viable option, and has not been costed.

2.1.5 Option 1e - Via existing Marillana to Weeli Wolli road via Gray Crossing (Eastern Access)

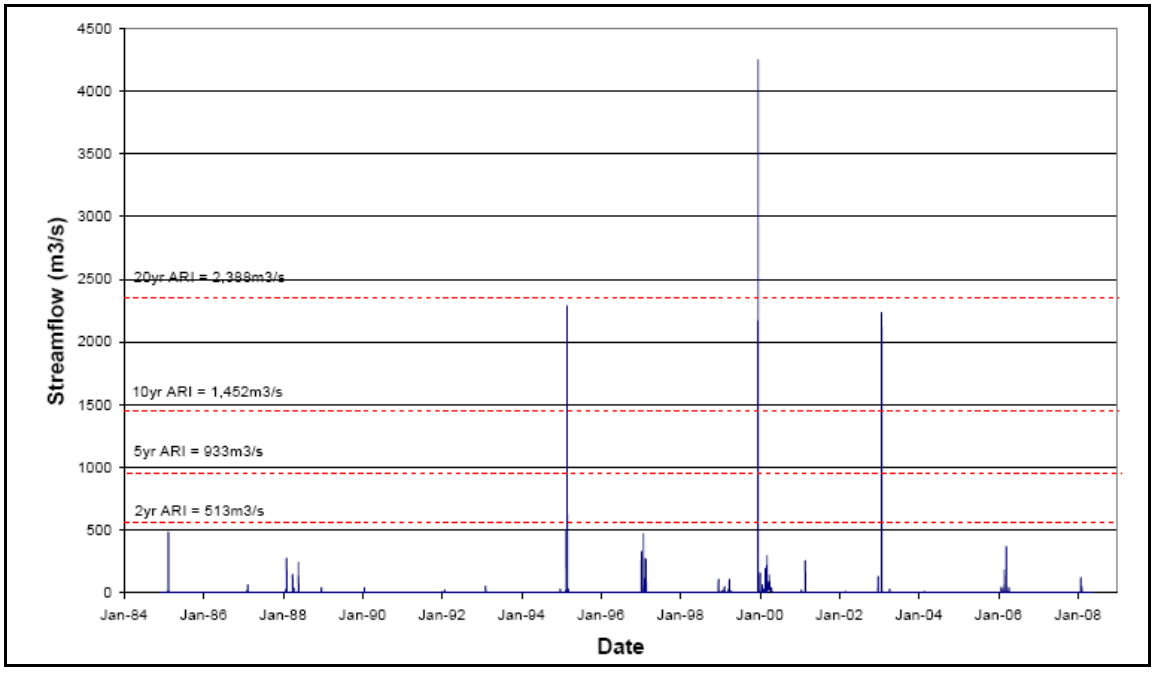
There is an existing track from Munjina Roy Hill Road south, parallel to, and to the east of, Weeli Wolli Creek. This track is well made, and would pose no significant hindrance to regular traffic. It is a through road, and appears to be well-maintained by the local council. Approximately 23 km south of theintersection of this track and Munjina Roy Hill Road, a second track heads west and links through to the Yandicoongina access road. This track crosses both Weeli Wolli Creek (at Gray Crossing) and Marillana Creek (at Kennedy Crossing). While the crossings are well-formed, they do traverse the creek bed. Weeli Wolli Creek currently has a small permanent water flow (courtesy of mine water being discharged higher up the creek, and so is expected to have more significant flows during the wetter months.

Both Marillana and Weeli Wolli Creeks are expected to flow each year, and as such, crossing these creeks is likely to be an issue. It is not possible to determine the frequency of flow at either Kennedy or Grays crossings, as no gauging station measurements are available at these locations. The nearest gauging station is the Waterloo Gauging Station, located where Weeli Wolli Creek emerges from the Hamersley Ranges to the south of the Marillana Lease. As such, it records water flow that has resulted as a combination of flows from both Weeli Wolli Creek and Marillana Creek, less any water that has seeped into the riverbed in the five kilometers between the crossings and the gauging station. Consequently flows at this station can be taken as a guide only to overall water flows.

Records have been kept at Waterloo Gauging Station for 24 years. Figure 3 below shows the record of flows during that period, along with an estimate from the hydrological modelling of the respective estimated levels for the 2, 5, 10, and 20 year flood events. During this period there was a total of 577 days when water was recorded as flowing, producing an average of 24 days a year. However, this figure is highly skewed by the 2000 event (a 1 in 50 year event?), when water flowed continuously for 198 days. The median figure is only 7 days.

However, rivers can be crossed when there is some water flow. Eliminating those days with water flows of less than $5m^3/s$ reduces the average number of days of significant water flow down to 11 days and the median to just 3 days.

Figure 3 Daily Maximum Streamflow at Waterloo Gauging Station



What this means for Option 1e is that if nothing is done to the river crossings at Kennedy and Gray Crossings, then this route may be impassable a median of 7 days a year, though the period could be up to four months if a significant (>1 in 20 years) storm event occurs.

However, what these figures do not take into consideration is the recent commencement of the Hope Downs operation, whereby excess water from the de-watering operation is discharged into Welli Wooli Creek, resulting in a minor, but almost permanent, water flow at Gray Crossing. Consequently, it is expected that any rainfall event will cause this to rise slightly, and hence it is recommended that a basic floodway be constructed at Gray Crossing, to provide a degree of protection from these flows.

Gray Crossing is approximately 85m wide. A 300mm concrete floodway, with culverts, is estimated to cost in the order of $ 191,000.

This access route does involve using the BHPB rail access road for the first part of the route, and does cross several of the Weeli Wolli distributaries. During the high flood events, these crossings will become impassable. However, in these situations, Gray Crossing will also be impassable, and consequently, no work is required on these crossings.

In the event that Gray Crossing is closed to through traffic, it is possible to acess Barimunya airstrip “the long way around”, vis Auski and the Yandi access road (Option 1f) as a first back-up, with a fall-back to re-routing via Newman as a final backup.

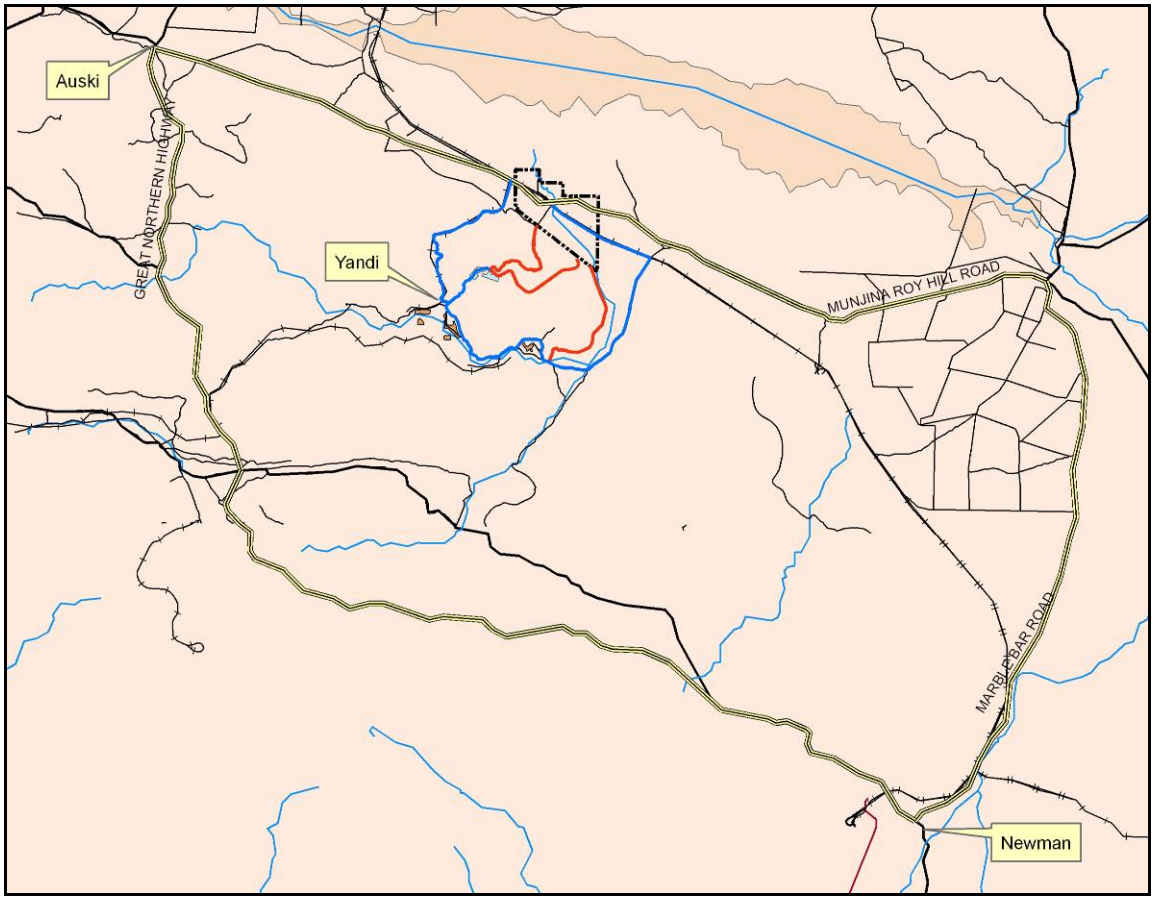
2.1.6 Option 1f - Via Auski, Great Northern Highway, and Yandi Access Road

This option is essentially the fall-back route should weather conditions preclude access to Barimunya Airstrip by other roads. It traverses the gravel road west from Marillana along the Munjina Roy Hill Road to the Auski Roadhouse, then south along the sealed

Great Northern Highway before following the Yandi Access road (unsealed) to Yandi and the Barimunya Airstrip. However, it can also be considered as a route option of its own.

2.2 Option 2 - Access to alternative airstrips via existing roads

Figure 4 Potential alternative airstrip access routes via existing roads



2.2.1 Option 2a - Mt Newman Airstrip

The Mt Newman airstrip is a public access airstrip, and no negotiations are required with potential competitors. Consequently, permission to use this airstrip is not considered to be an issue.

There are two possible routes to Mt Newman from Marillana, west to Auski Roadhouse along the Roy Hill Munjina Road, then south along the Great Northern Highway to Newman, and east from Marillana along the Roy Hill Munjina Road to the Marble Bar Road, then south to Newman.

The western route consists of 61 km of gravel road, and 198 km of paved road. The Roy Hill Munijna Road between Marillana and Auski Roadhouse runs along the side of the Hamersley Ranges, essentially on the very flat deltas formed by minor creeks running off the ranges. As such, it is slightly elevated above the floodplain of the Fortescue Marches, and is unlikely to be impacted by major flooding. There are a small number of minor creek crossings that could do with the installation of culverts to provide greater

serviceability during wet weather, though it is likely that these will be upgraded as part of the general site access improvement program, and hence not directly required for airstrip access purposes.

The western route consists of 76 km of the Roy Hill Munjina Road along the flood plains adjacent to the Fortescue Marches, followed by similar, very flat country south to Newman. The first section is known to be flood prone, with the Weeli Wolli Creek flood report indicating water depths of over 1m during the 100 year flood event. There are several "small" creek crossings that do not look like major issues. However, should these flow, the water will be in sheet flow, and major stretches of water will occur. The road is also built on clay, and there is evidence of deep rutting after only minor rainfall events. Converting this road to an all-weather road would be extremely difficult with building it up and sealing it. Consequently, whilst this route may result in a 30 minute shorter trip under good conditions to Newman, the potential for significant outages due to rain, and slower travel times due to deteriorating road conditions, it is not considered a viable long term transport route.

2.3 Option 3 - On-site Airstrip

2.3.1 Airstrip accessibility

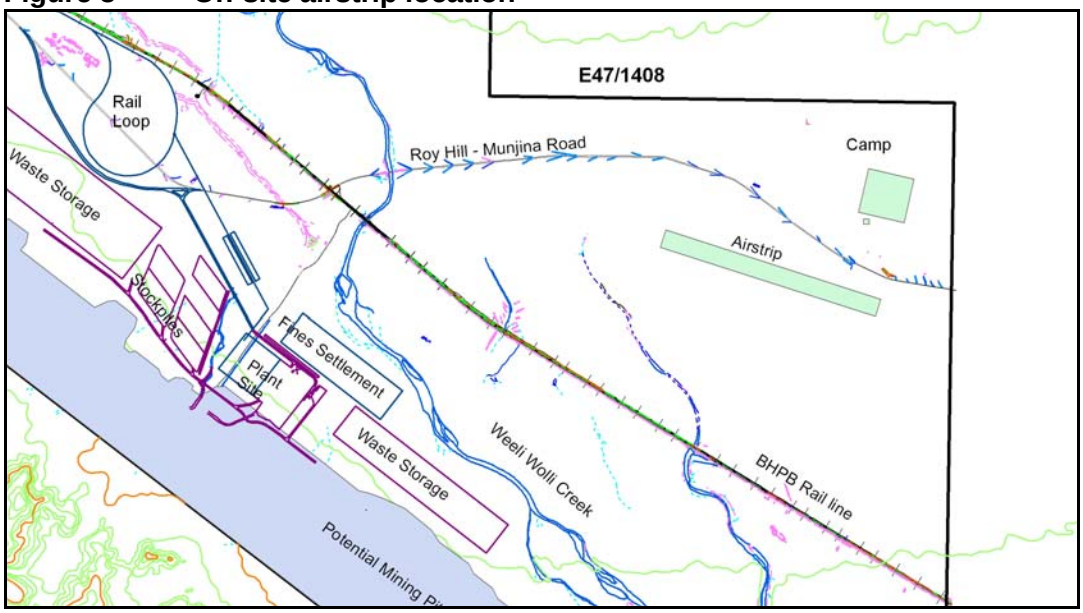
The proposed location for the on-site airstrip lies within the floodplain from Weeli Wolli Creek. In the 1 in 10 year flood event, the area is expected to be partly submerged, whilst in the 1 in 50 year flood event, it is likely to go 1.6m under water.

If the accommodation camp is located on the same side of Weeli Wolli Creek as the mine/plant, personnel will need to cross Weeli Wolli Creek on Munjina Roy Hill Road to reach the airstrip. The water flow data from the Waterloo Gauging Station discussed in Section 2.1.5 suggests that there will be a median of 7 days a year when water might be flowing (remembering that the gauging station is some 20km upstream, and further infiltration will occur). While it is possible that the airstrip may be submerged in a 1 in 20 year flood event, access to the strip will be cut off due to Weeli Wolli Creek flooding prior to that occurring, so inundation of the airstrip will not be the primary cause of loss of access.

The Waterloo Gauging Station does only measure water flowing down Weeli Wolli Creek. At Marillana short term storm events can cause significant runoff from the ranges directly to the south of the lease. This water discharges into Weeli Wolli Creek and will also have an impact on access across it.

Consequently, it is recommended that a floodway be constructed across Weeli Wolli Creek at Munjina Roy Hill Road to provide greater accessibility to the airstrip, and to reduce road maintenance after storm events. With a width of 40m, the floodway is estimated to cost $ 96,000.

Figure 5 On-site airstrip location[1]

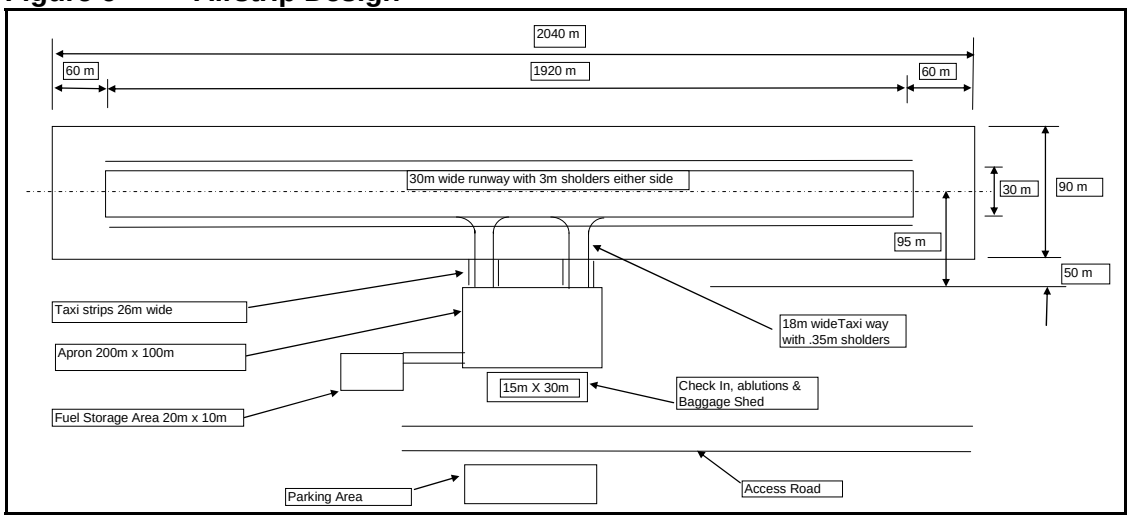


[1] Note: the layout above was extracted from the Jan 09 EPA referral for the location of the airstrip, the locations of other infrastructure (such as the camp) may well change prior top being finalised.

2.3.2 Airstrip design

Airstrip construction in Western Australia is controlled by the Civil Aviation Safety Authority ("CASA"). The CASA document *Manual of Standards part 139 – Aerodromes* (otherwise known as MOS139), defines the standards for airstrip construction relevant to the class of aircraft that will be using it. The standard commuter aircraft to the Pilbara are Class 3C aircraft (BAE146, Fokker F50 and Fokker F100), which require a sealed runway. The general design parameters are shown on Figure 6 below. The runway length is 1920 m, width 30m, and an additional 90 m by 60 m Runway End Safety Area (RESA) undershoot and over-run areas will be provided at the runway strip ends.

Figure 6 Airstrip Design



Provision has been made for a 100m x 200 m apron suitable for two jet aircraft plus general aviation parking. ,

The airstrip will be constructed by stripping off the top 100 mm of topsoil, laying down a 250 mm sub base, 300 mm base course, and two-coat sealing. This means that the

airstrip itself will be approximately 500 mm above the surrounding plain, thereby providing some level of protection from the 1 in 20 year flood event. Topsoil stripped for the airstrip area will be stockpiled along the southern boundaries as further flood protection 1.0 to 1.5m high. The design of higher flood protection levees has not been conducted and is contingent on more detailed flood modelling using the Jan 09 contour data.

It is assumed that overburden material from the mining operation will be available and suitable for use, once crushed, as the foundations for the airstrip. The airstrip will also be surrounded by a stock fence.

To cost to construct the airstrip has been estimated to be:

Clear & grub airstrip, strip topsoil	$ 249,000
Construct sub base and base course	$ 6,371,000
Seal	$ 3,227,000
Infrastructure and access	$ 924,000
Stock fencing	$ 399,000
	$ 11,170,000

2.3.3 Airstrip Equipment

To operate a remote airstrip the following equipment is required:

Power supply and lighting design	$ 15,600
Main Genset (33KVA)	$ 75,000
Standby genset (33KVA)	$ 35,000
Airport Lighting (Labour and materials), incl AFRU, EL, PAPI	$ 416,000
Non Directional Beacon (100km/h rated)	$ 390,000
Airport Equip testing (Flight testing etc)	$ 120,000
	$ 1,051,600

With the airstrip being located remote to the main operation, power will be supplied from local onsite generators.

Capacity for 170,000l of aviation fuel will be installed on site, to cover for those situations when access to site by heavy vehicles is precluded by road conditions, and the airstrip is still operating. Estimated cost $139,000.

A terminus building will be required, to be constructed on an elevated pad. Estimated cost $204,000.

In summary, the total capital cost of equipping the airstrip is $ 1,614,600.

3 COST EVALUATION

3.1 Accuracy of the estimate

It is noted that all costs contained in this document are conceptual in level only, and are bare costs only. No allowance has been made for accuracy provisions or for contingencies.

3.2 Operating Cost

3.2.1 Transit Durations

To calculate transit times for the various routes, assumptions have been made on the average speed a bus would achieve. Assuming that road conditions are good, and that, as the distances are reasonable, that the bus will attain cruising speed for a substantial portion of the time, the expected average speeds are shown in Table 4.

Table 4 Expected transit speeds

Road type	Examples	Speed
Sealed road	Great Northern Highway	100 k/h
Unsealed road	Auski to Marillana via Roy Hill-Munjina Road	75 k/h
Formed track		55 k/h

Using these speeds, and distances measured predominantly with GIS systems, the approximate transit durations (rounded up to the nearest quarter hour) have been calculated and are shown in Table 5 below. The assumption has also been made that each employee is effectively paid for the time they spend travelling once they get off the plane to camp, and the reverse. Using an average annual salary of $104,000 per year, this is equivalent to $50/hour. With a 2 on 1 off roster, each person will fly in and out 17.3 times, so the average annual cost for each person is $1,730 per hour of travel, or $865,000 per year for a crew of 500 people. Only the travel time has been calculated here: the time spent waiting for buses/planes is common to all scenarios, and hence has not been included.

Table 5 Expected transit durations and personnel costs

Option	Total Distance (km)	Trip Duration (hr)	Total Personnel costs ($M/y)
1a - Shortest Direct Route	19.4	0.50	0.43
1b - Optimal direct route	28.5	0.50	0.43
1c - Skirting the range	34.4	0.75	0.65
1e - Via existing Marillana to Weeli Wolli road via Gray Crossing	76	1.00	0.87
1f - Via Auski, Great Northern Highway, and Yandi Access Road	169	2.25	1.95
2a - Via Auski to Newman	259	3.00	2.60
4 – Local airstrip	5	0.25	0.22

3.2.2 Transport costs

Each option requires the use of buses to transport personnel to and from the airstrip. For the purposes of this exercise, it has been assumed that only 45 seater buses will be used, and that plane arrivals will be timed such that only one bus need run to each plane (In reality several different size buses will probably be used, but the differential evaluation is likely to be the same).

Operating costs for the bus has been calculated as

		Cost/km
Fuel usage	2 km/l @ $0.80/l	$ 0.40
Maintenance	$2,000/service every 10,000km	$ 0.20
Tyres	$8,000/set every 50,000km	$ 0.16
Total		$ 0.76

Table 6 Expected transport costs

Option	Total Transport costs ($M/y)
1a - Shortest Direct Route	0.008
1b - Optimal direct route	0.011
1c - Skirting the range	0.013
1e - Via existing Marillana to Weeli Wolli road via Gray Crossing	0.030
1f - Via Auski, Great Northern Highway, and Yandi Access Road	0.066
2a - Via Auski to Newman	0.101
4 – Local airstrip	0.002

3.2.3 Road Maintenance costs

For those options for which road are constructed for the project, road maintenance costs will have to be borne entirely by the project.

For those options which are using existing gravel roads it might be expected that the local council may request assistance with the upkeep of those roads. However, as these roads will most likely have increased traffic due to the requirement to road freight in fuel and other consumables, it is likely that this assistance will be requested anyway, and so this cost is not a direct result of personnel transport.

The sum of $50,000 has been assumed for road maintenance costs for each option.

3.2.4 Airstrip Management costs

No airstrip management costs have been estimated. It is anticipated that baggage handling may be handled by camp staff.

If aircraft require re-fueling on site, specialist personnel may be required, in which case camp costs will increase by approximately $50,000 per person, and $10,000 in opex per person per year.

It is not known whether remote management of the airstrip from Newman will incur a management cost.

3.2.5 Summary of operating costs

Table 7 Summary of annual operating costs

Option	Total Personnel costs ($M/y)	Total Transport costs ($M/y)	Total road maintenance costs ($M/y)	Total annual costs ($M/y)
1a - Shortest Direct Route	0.43	0.008	.050	0.49
1b - Optimal direct route	0.43	0.011	.050	0.49
1c - Skirting the range	0.65	0.013	.050	0.71
1e - Via existing Marillana to Weeli Wolli road via Gray Crossing	0.87	0.030		0.90
1f - Via Auski, Great Northern Highway, and Yandi Access Road	1.95	0.066		2.02
2a - Via Auski to Newman	2.60	0.101		2.70
4 – Local Airstrip	0.22	0.002		0.22

3.3 Capital Cost

Below is a summary of the total capital costs estimated for each option. As noted previously, these are Bare Costs, with no accuracy provision or contingency allowances. Items that are common to all scenarios (such as bus purchase) have been ignored.

Table 8 Summary of capital costs ($M)

Option	Road Construction	Floodway construction	Airfield Construction	Total Capital
1a - Shortest Direct Route	51.83			51.83
1b - Optimal direct route	12.58			12.58
1c - Skirting the range	15.27			15.27
1e - Via existing Marillana to Weeli Wolli road via Gray Crossing		0.19		0.19
1f - Via Auski, Great Northern Highway, and Yandi Access Road				0.00
2a - Via Auski to Newman				0.00
4 – Local Airstrip		0.10	12.78	12.88

3.4 Cashflow Analysis

Table 9 below summaries the capital and operating cost estimates for each option, and evaluates the total cash cost of each, disregarding the impact of cashflow discounting.

Table 9 Cash Flow Analysis ($M)

Option	Total Capital	Total Annual Opex	Undiscounted Total Cash Cost		
			5 year	10 year	20 year
1a - Shortest Direct Route	51.83	0.49	54.28	56.74	61.65
1b - Optimal direct route	12.58	0.49	15.05	17.52	22.47
1c - Skirting the range	15.27	0.71	18.84	22.40	29.54
1e - Via existing Marillana to Weeli Wolli road via Gray Crossing	0.19	0.90	4.67	9.15	18.12
1f - Via Auski, Great Northern Highway, and Yandi Access Road	0.00	2.02	10.08	20.16	40.32
2a - Via Auski to Newman	0.00	2.70	13.51	27.01	54.02
3 – Local Airstrip	12.88	0.22	13.97	15.07	17.25

The table indicates that Option 1e provides the least cash negative solution in the short term, due to the low capital cost, and Option 3 the least cash negative solution in the long term due to the low operating cost and comparatively low capital cost. Option 1b is slightly more expensive, but does come with the advantage that it does not involve crossing Weeli Wolli Creek, and as such provides greater accessibility to the nominated airstrip during times of heavy rainfall.

3.5 Risk and opportunity analysis

3.5.1 Option 1b - Optimal route to Barimunya

The key risks for this option are

- BHPB may not grant permission to traverse their lease on the designed route, due to the potential impact on their resource
- Approval to use the Barimunya airstrip has not been investigated
- Road construction costs could increase substantially during the detailed design phase if the topography does not suit the proposed road construction
- Environmental approvals would be required for this route

The key opportunities are

- The potential exists to share flights with other operations, and reduce overall flight costs by maximising seat capacity utilisation

3.5.2 Option 1e - Eastern Access Road to Barimunya

The key risks for this option are

- Increased traffic on the access road may prompt the local council to request assistance with the annual maintenance cost
- Approval to use the Barimunya airstrip has not been investigated
- Significant rainfall events may preclude use of this road for extended periods of time
- The condition of this road during normal rainfall events is not known (parts of the orad are on the larger floodplain, and the road may become impassable with average rainfall events)

The key opportunities are

- The potential exists to share flights with other operations, and reduce overall flight costs by maximising seat capacity utilisation
- Should this option prove to be sub-optimal in the future, it does not jeopardise the construction of an onsite airstrip at a later date.

3.5.3 Option 3 - Onsite airstrip

The key risks for this option are

- With airstrips nearby at Barimunya and Cloudbreak, there is the possibility that CASA and other relevant regulatory authorities may opt to decline the application for the licence to construct and operate another airstrip in the region.
- CASA may require additional protection against flood events (to raise the strip a further 0.5m will cost an additional $5.4M)
- Airstrip management costs have not been quantified.
- Siting the airstrip on site will restrict other infrastructure (such as tailings dams).

- Delays in access to the airstrip after a flood event is not known – substantial restoration may be required before CASA permits aircraft to land again

4 CONCLUSIONS

The key conclusions drawn from this evaluation are:

- Construction of a road directly from Marillana direct to Barimunya
    - has a high initial capital cost ($12.58M),
    - has a high uncertainty on that capital cost due to the nature of the terrain the road has to traverse, and
    - has a moderate operating cost ($ 0.49 M per year)
- use of the eastern access road to Barimunya
    - is a low capital cost option ($ 0.19M)
    - only adds half an hour to the transit time compared to that above
    - the total transit cost is estimated to be $ 0.9 M per year
    - will have access issues due to flooding of the Weeli Wolli and Marillana Creek crossings a median of 7 days a year
- construction of an onsite airstrip
    - has a high initial capital cost ($12.88M)
    - has a low operating cost ($0.22M per year)
    - the above figures do not include costs for operating the airstrip (these have yet to be defined)
    - has access restrictions during those times that Weeli Wolli Creek floods (expected to be less than the same restrictions for the eastern access road to Barimunya)
    - has an inherent risk that the airstrip will be flooded during a 1 in 20 year flood event

5 RECOMMENDATIONS

It is recommended that the Eastern Access Road to Barimunya be adopted as the preferred access to an airstrip.

During the next phase of the project,

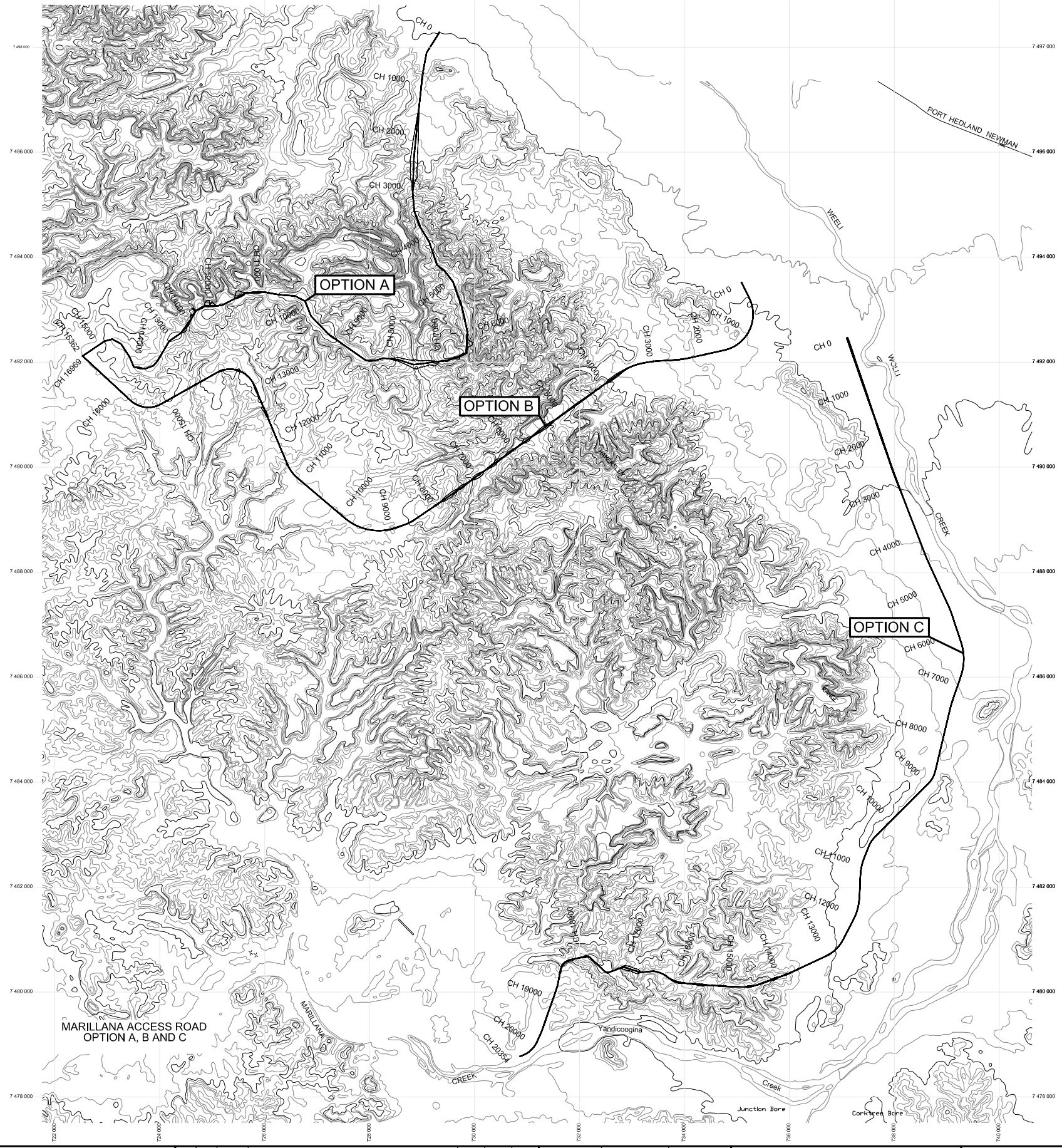
- the current operators of the Barimunya airstrip should be approached, and an agreement for the use of the Barimunya Airstrip progressed

- a route analysis should be conducted, to determine actual road levels with respect to the creeks, so as to determine the actual potential impact of the 1 in 2 year flood event

- discussion should be held with the East Pilbara Shire Council regarding the potential use of this road as an access route.

APPENDIX 1
BARIMUNYA AIRSTRIP ACCESS ROAD DESIGN

1872 Marillana -Mine Site to Airport Road - Study 23 Feb 09								
Options	**Descriptions**	**Length**	**Cut**	**Fill**	**Culvert**	**Culvert**	**Culvert**	**Remarks**
		kM	**M3**	**M3**	**No off**	**Size M**	**Length m**	
A	North Route	15.36	149,601	3,381,503	0	Nil	Nil	This route is the shortest and starts off one third of the distance down the BRM/BHP boundary and ends at the Airport. This route transits between two peaks - chainages 7000 to 8000. A large volume of fill is required here and at chainages 1800 to 3000 to provide acceptable grades. The quantity of fill could be reduced but there would be at a proportionally increase in cut. The depth of fill at chainages 2700 and 7520 is 40m. At chainage 11300 to 11400 the dept of fill is 10. In all other locations the fill is less than 10m. The maximum cut is 10m at chainage 6500. No culverts are required along the route.
B	Centre Route	16.97	634,956	681,882	7	600	420	This route is 1.6 kM longer than option A and starts half way down the BRM/BHP boundary and ends at the airport. It has a near balance cut to fill with maximum cut of 30m at chainages 7500 to 7800 where it cuts through a knoll. There is a cut of 20m between chainages 7300 and 7400 and a 10m cut between chainages 4500and 4800. All other cuts are less than 10m. Maximum fill is 18m at chainage 6600 with fill of 16m at chainage 5850. There is fill of 10m between chainages 3700 and 3900 and 8m at chainage 1250. The fill in other section is less than this. The quantity of cut could be reduced but because of the terrain, this would probably increase the fill quantities by 50%. This route crosses streams at 7 locations.
C	Southern Route	20.35	65,776	622,103	15	600	306	This route starts two thirds down the BRM/BHP boundary and ties into the existing road to the airport near Junction Central. This is the longest route but has the least cut and fill quantities. The quantities are based on the road being a minimum of 3m above the adjacent river and that this will be above the 1 in 10 year flood level. This of course will need to be checked with a hydrological study if this option goes ahead.There is a 10m high cut at chainage 2000 and 20m deep fill at chainage 3500. In all other locations the cut and fill is less tha 8m. There are 15 stream crossings along this route. This appears to be the least cost option assuming that any cost to the project of upgrading the existing road between Junction Central and the airport is low. Mine waste may be readily available at little or no cost from existing adjacent mines though crushing may be required. Topographical, geotechnical and hydrological surveys will be required as well as a site visit by Ausenco's civil engineer if this Option is to proceed further.



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	1872-000-002 TO 04	MARILLANA ACCESS ROAD SECTIONS	A	RAS	FEB09	ISSUED FOR CLIENT REVIEW	.	.	.

DRAWN	RSORTO	FEB 09
CHECKED	.	.
DESIGNED	.	.
DES. APPR	.	.
PROJ APPR	.	.

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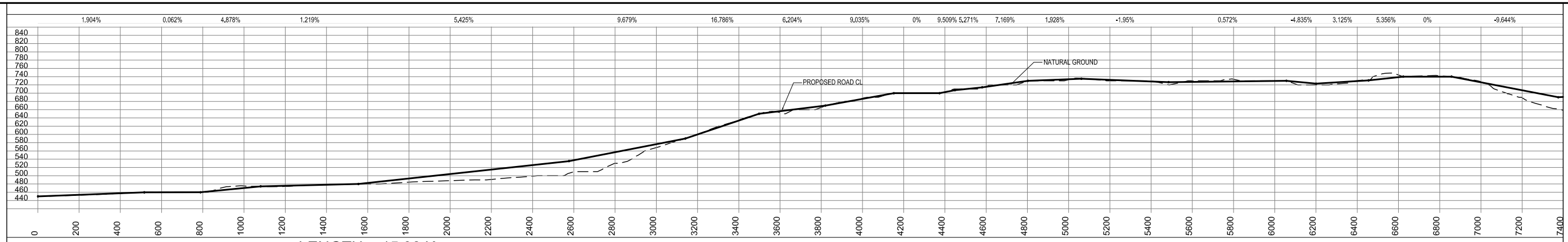
CLIENT: MARILLANA IRON ORE PROJECT

TITLE:
BROCKMAN RESOURCES
MARILLANA IRON ORE PROJECT
MARILLANA ACCESS ROAD LAYOUT
OPTIONS A, B AND C

PROJECT No	SCALE	SIZE
1872	1:5000	A1

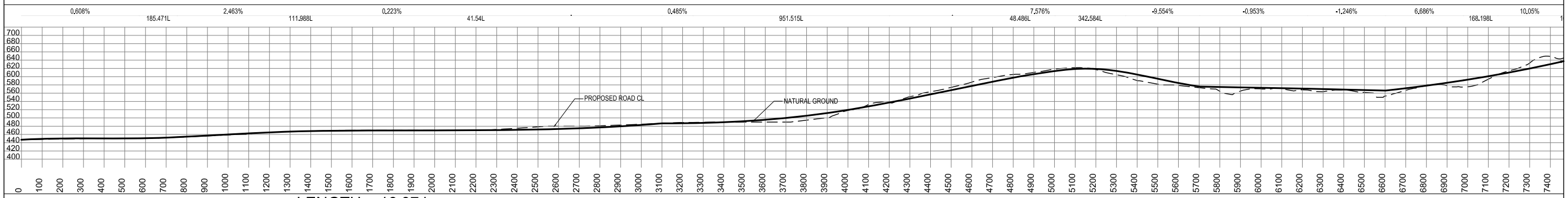
DRAWING No	REV
1872-000-001	A



MARILLANA ACCESS ROAD

OPTION A

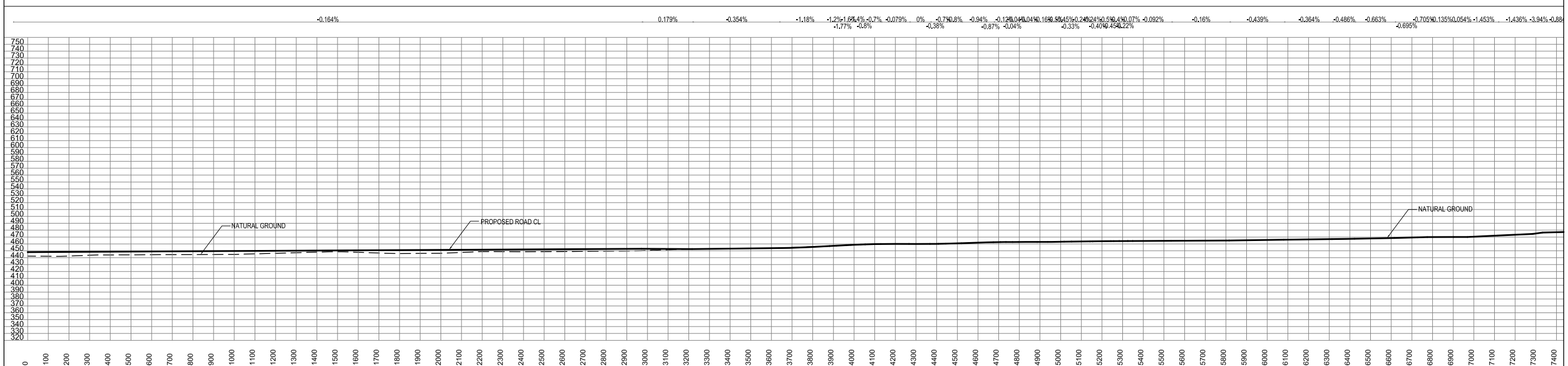
LENGTH = 15.36 Kms
C = -149,601.323 m3
F = 3,381,503.239 m3
B = 3,231,901.917 m3



MARILLANA ACCESS ROAD

OPTION B

LENGTH = 16.97 kms
CUT = - 634,955.937 cu
FILL = 681,882.194 cu
BAL CUT/FILL = 46,926.257 cu



MIRALLANA ACCESS ROAD

OPTION C

LENGTH = 20.354 Kms
C = - 65,776.321 m3
F = 622,102.728 m3
B = 556,326.407 m3

SHEET 1

REF	DRAWING No.	REFERENCE DRAWING	No	BY	DATE	REVISION DETAILS	CHKD	ENG	APPR
	1872-000-001	MARILLANA ACCESS ROAD LAYOUT	A	RAS	FEB09	ISSUED FOR CLIENT REVIEW			

DRAWN	RSORTO	FEB 09
CHECKED		
DESIGNED		
DES. APPR		
PROJ APPR		

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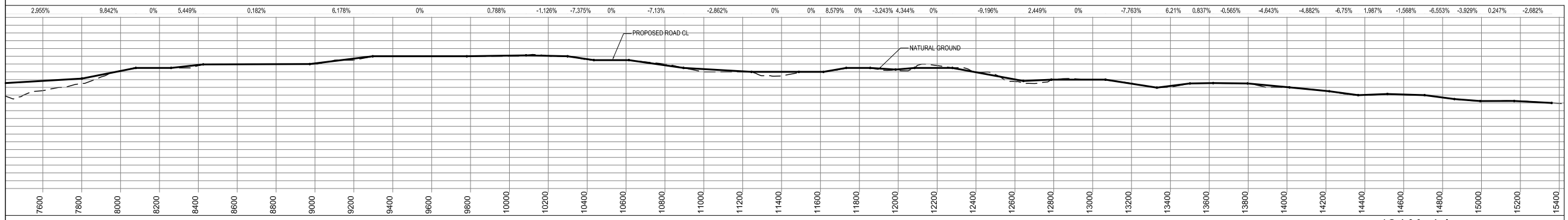
TITLE: BROCKMAN RESOURCES
MARILLANA IRON ORE PROJECT
ACCESS ROAD SECTIONS
OPTIONS A, B AND C - SHEET 1

PROJECT No	SCALE	SIZE
1872	AS SHOWN	A1

DRAWING No: 1872-000-002

REV: A



MARILLANA ACCESS ROAD

OPTION A

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Vertical Scale 1:250
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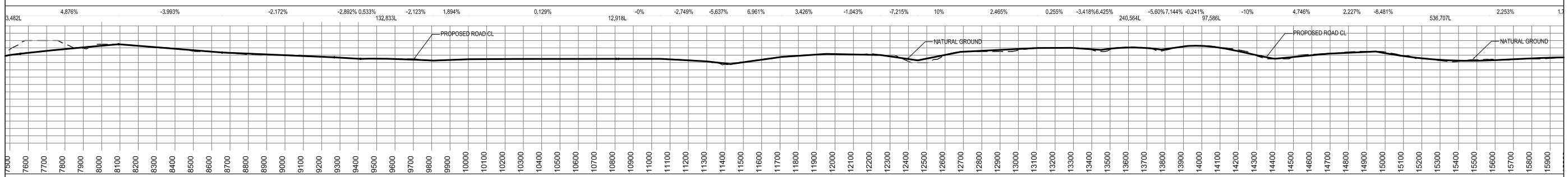
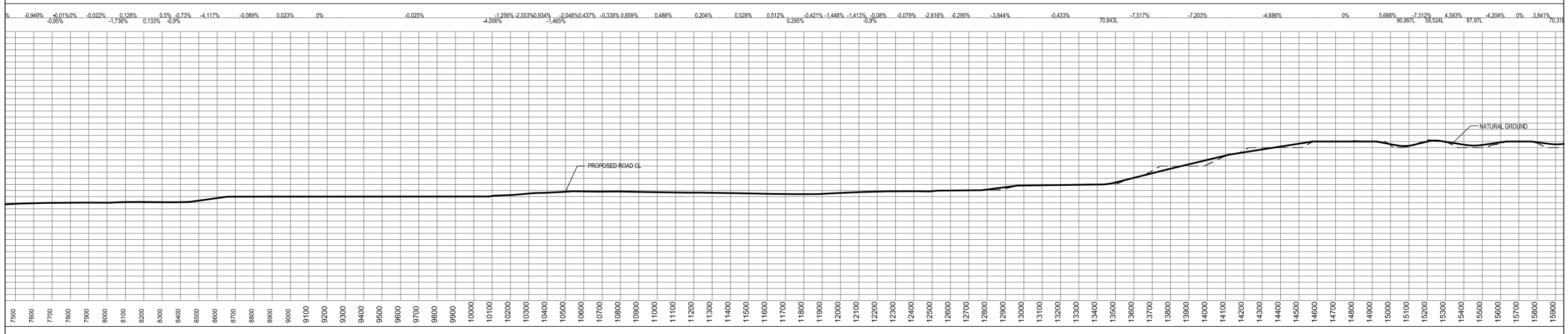


MARILLANA ACCESS ROAD

OPTION B



MIRALLANA ACCESS ROAD

OPTION C

SHEET 2

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	1872-000-001	MARILLANA ACCESS ROAD LAYOUT	A	RAS	FEB09	ISSUED FOR CLIENT REVIEW			

DRAWN	RSORTO	FEB 09
CHECKED		
DESIGNED		
DES. APPR		
PROJ APPR		

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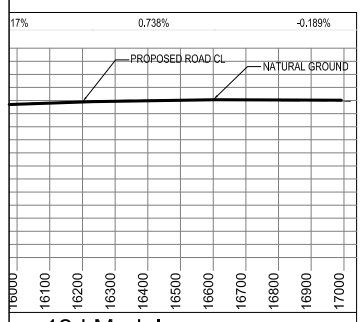
TITLE:
BROCKMAN RESOURCES
MARILLANA IRON ORE PROJECT
ACCESS ROAD SECTIONS
OPTIONS A, B AND C - SHEET 2

PROJECT No	SCALE	SIZE
1872	AS SHOWN	A1

DRAWING No: 1872-000-003

REV: A



12d Model
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Vertical Scale 1:250
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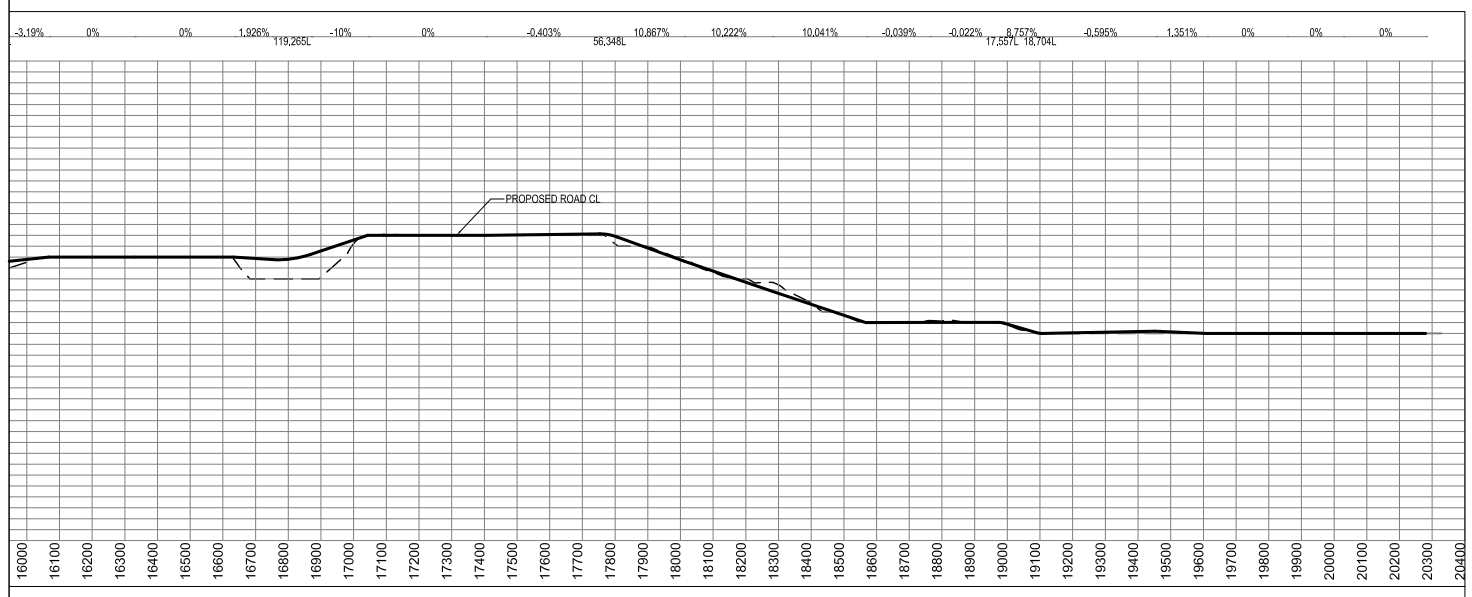

MIRALLANA ACCESS ROAD

OPTION C

12d Model
Horizontal Scale 1:500
Vertical Scale 1:150
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SHEET 3

REF	DRAWING No.	REFERENCE DRAWING	No	BY	DATE	REVISION DETAILS	CHKD	ENG	APPR
	1872-000-001	MARILLANA ACCESS ROAD LAYOUT	A	RAS	FEB09	ISSUED FOR CLIENT REVIEW			

DRAWN	RSORTO	FEB 09
CHECKED		
DESIGNED		
DES. APPR		
PROJ APPR		

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TITLE: BROCKMAN RESOURCES
MARILLANA IRON ORE PROJECT
ACCESS ROAD SECTIONS
OPTIONS A, B AND C - SHEET 3

PROJECT No	SCALE	SIZE
1872	AS SHOWN	A1

DRAWING No: 1872-000-004

REV: A

APPENDIX 2
TRANSIT COST CALCULATIONS

Average Salary ($/yr)	$	100,000
Cost/hr		50.00
Average trips per year		34.67
Number of employees		500

Road Type	Average Speed kph
Sealed	100
Unsealed	75
Track	50

Bus cost ($/km)	$	0.76
Number of trips		514.00

assume 75% occupancy

	Track Type	Average Speed (kph)	Distance (km)	Trip Duration (hrs)	Trip Duration (rounded)	Total Transit Time (Hrs)	Total personnel Transit Cost ($)	Total Bus Transit Cost ($)
1a - Shortest Direct Route			**19.4**	**0.36**	**0.50**	**8,667**	**433,333**	**7,578**
Camp to start of access road	Unsealed	75	4	0.05				
Access Road	Track	50	15.4	0.31				
1b - Optimal direct route			**28.5**	**0.49**	**0.50**	**8,667**	**433,333**	**11,133**
Camp to start of access road	Unsealed	75	11.5	0.15				
Access Road	Track	50	17	0.34				
1c - Skirting the range			**34.4**	**0.59**	**0.75**	**13,000**	**650,000**	**13,438**
Camp to start of access road	Unsealed	75	14	0.19				
Access Road	Track	50	20.4	0.41				
1e - Via existing Marillana to Weeli Wolli road via Gray Crossing			**76**	**0.90**	**1.00**	**17,333**	**866,667**	**29,689**
Camp to start of Marillana -Weeli Wolli Road	Unsealed	75	16	0.21				
Marillana -Weeli Wolli Road to Yandicoongina	Unsealed	75	27	0.36				
Yandicoongina to Barimunya Airstrip	Sealed	100	33	0.33	0.01			
1f - Via Auski, Great Northern Highway, and Yandi Access Road			**169**	**2.03**	**2.25**	**39,000**	**1,950,000**	**66,018**
Camp to Auski	Unsealed	75	61	0.81				
Auski to Yandi Turnoff	Sealed	100	56	0.56				
Yandi Turnoff to Yandi	Unsealed	75	42	0.56				
Yandi to Barimunya Airstrip	Sealed	100	10	0.10				
2a - Via Auski to Newman			**259**	**2.79**	**3.00**	**52,000**	**2,600,000**	**101,176**
Camp to Auski	Unsealed	75	61	0.81				
Auski to Newman	Sealed	100	198	1.98				
3 - Local Airstrip			**5**	**0.07**	**0.25**	**4,333**	**216,667**	**1,953**
camp to Airstrip	Unsealed	75	5	0.07				