DOCUMENT 3

IMPACTS OF THIRD PARTY ACCESS ON THE MT NEWMAN SYSTEM OPERATIONAL MODELLING

1. BACKGROUND

1.1 Criterion (b) of section 44G(2) of the Trade Practices Act requires that the Council be satisfied that it would be uneconomical to develop another facility to provide the service.

1.2 In determining whether it would be uneconomical to develop another facility, the Council compares, from a societal perspective, the costs of constructing another facility to provide the service with the costs of access to the present facility. The costs of access include any loss suffered as a result of access and the costs of expansions that are necessary to accommodate access, or to accommodate access with loss to present users.

1.3 The costs of access are also a consideration to be taken into account by the Council in determining whether criterion (f) is satisfied, ie, that access to the service would not be contrary to the public interest.

2. FURTHER MODELLING

2.1 In BHPBIO's submission to the Council dated 3 June 2005, BHPBIO provided a report on certain modelling undertaken in relation to the potential impact of access on BHPBIO's use of the Mt Newman system. This modelling work was based on information, estimates and planning which were current at that time but are now out of date and no longer appropriate. In particular, the previous modelling was undertaken on the basis of BHPBIO's proposed OGW project. As the Council is aware, the OGW project is no longer proceeding and a replacement expansion project, RGP3, has been approved in its place.

2.2 The previous modelling was also undertaken on the basis of sparse knowledge about the nature and specifications of FMG's proposed mine, rail and port operations. Although that knowledge is by no means complete at this time, a number of public announcements have given some clarification about FMG's proposed infrastructure and operating conditions.

2.3 Consequently, to provide the Council with a more up to date and accurate estimate of the costs of access, BHPBIO has had TSG undertake further simulation modelling analysis for a number of possible access scenarios. The objectives of the further modelling are:

(a) to demonstrate the potential consequences for performance of the system as a result of third party access; and

(b) to determine the corrective measures that would need to be taken to alleviate the direct consequences for operational performance that would result from third party access.

2.4 This modelling work has been conducted within the limited time provided by the Council to respond to the its Draft Recommendation.

2.5 In order for the further modelling to be carried out, and in the absence of any indication in the Council's Draft Recommendation about the appropriate position on the issue, the further modelling has been undertaken on the basis of FMG using the last section of the Goldsworthy line to transport ore to Anderson Point, notwithstanding that the service provided by the Goldsworthy line cannot be declared under Part IIIA.[1]

3. SIMULATION MODELLING

3.1 TSG is a consulting firm specialising in simulation modelling and scheduling with particular emphasis on mining, transportation and processing. TSG has constructed a very detailed discrete event simulation model of BHPBIO's Pilbara iron ore operations that captures all activities from mine to ship loading, including rail operations and shipping activities within Port Hedland harbour and the shipping channel. The level of disaggregation of the model permits specific consideration of a single rake of 100 ore wagons or a single ship. This model is used by BHPBIO to test the operational impacts of major investment alternatives and the effects of adjustments to operational protocols and procedures.

3.2 The range of impacts of third party access is potentially broad and some of the interactions are subtle, involving many parts of the operational chain. Consequently, the impacts can only be predicted with reasonable accuracy with the type of detailed simulation performed by the TSG model.

3.3 Further information regarding simulation modelling is provided in Annexure 1.

4. CASES

4.1 The further modelling work undertaken by TSG considers the level of impact upon BHPBIO's iron ore operations at two different levels of third party usage of the Mt Newman Line and the section of the Goldsworthy Line between the Mt Newman Line and Finucane Island. The modelling also considers the measures that would need to be taken to accommodate that impact.

Summary

4.2 The modelling cases are summarised in the table below:

[1] This issue is discussed in detail in Document 6, Identification of the Relevant Service.

CASE	BHPBIO USE	THIRD PARTY USE	FMG TRAIN PERFORMANCE	CORRECTIVE MEASURES
A	RGP3 (129mtpa)	-	-	-
B1	RGP3 (129mtpa)	FMG (45mtpa from Cloud Break)	Same as BHPBIO	**C1**
B2	RGP3 (129mtpa)	FMG (45mtpa from Cloud Break)	20% poorer than BHPBIO	**C2**
D1	RGP3 (129mtpa)	FMG (10mtpa from Mindy Mindy)	Same as BHPBIO	**E1**
D2	RGP3 (129mtpa)	FMG (10mtpa from Mindy Mindy)	20% poorer than BHPBIO	**E2**

Case A : RGP3 (129mtpa)

4.3 Case A, referred to as the base case, represents usage of the Mt Newman Line (and the last section of the Goldsworthy Line between the Mt Newman Line and Finucane Island) by BHPBIO in circumstances in which the RGP3 expansion project is operational and BHPBIO is the only user of those railway lines.

4.4 RGP3 is BHPBIO's most recently approved capacity expansion. It is likely to be implemented by 2009. This is the earliest time by which any third party could feasibly use the Mt Newman Service. RGP3 is being used as the base case for this modelling exercise because the previous modelling that was submitted to the Council was based upon the proposed OGW expansion project, which is no longer going ahead.

4.5 The OGW project entailed expansion which would result in a system production of 152mtpa with all iron ore being exported through Port Hedland. The OGW project was abandoned in favour of a series of smaller graduated expansion projects commencing with RGP3.

4.6 RGP3, which has been approved by the Board of BHPBilliton, entails a capacity expansion for Mining Area C (**MAC**) of 20mtpa, resulting in a total annual volume to be shipped on the Mt Newman system of **129mtpa** (comprising 42mtpa from MAC, 42mtpa from Yandi and 45mtpa from Newman). RGP3 also involves the following operational conditions:

(a) trains carrying an average of approximately 33 kilotonnes per trip;

(b) approximately 31 to 33mtpa being carried along the last section of the Goldsworthy Line (after the intersection with the Mt Newman line) for dumping at Finucane Island; and

(c) approximately 96 to 98mtpa being carried along the last section of the Mt Newman Line for dumping at Nelson Point.

4.7 Further details relating to RGP3 are provided in Annexure 2.

4.8 While the implementation of the proposed operational conditions of the RGP3 expansion project have been approved as part of the approval of that project, BHPBIO may seek to modify some of those conditions prior to or after implementation of RGP3 if it discovers a better way to operate the system. For example, while RGP3 predicts that approximately 31-33mtpa will be carried on the final section of the Goldsworthy Line, it may be that this will not be able to be achieved due to the operational restrictions related to the use of the Bing and Boodarie sidings. Also, if BHPBIO is unable to achieve the train speeds on the last section of the Goldsworthy line that have been set as targets under the RGP3 project, this could impact negatively on production performance. BHPBIO is unlikely to be able to determine whether this is possible until the RGP3 project is fully implemented.

4.9 There is a risk that the assumptions used for the base case will not be achievable, necessitating additional capital expenditure to achieve BHPBIO planned production levels. If this occurs, it may result in additional capital expenditure (to that identified in this paper) being required to offset third party effects. However, as the RGP3 operational assumptions represent the current thinking and proposed method of operation, Case A is based upon the operational assumptions and conditions of RGP3 as approved.

4.10 Further, the next expansion after RGP3 may trigger the requirement to spend capital on the last section of the Goldsworthy line. If FMG's production were to use this valuable latent capacity, this would need to be taken into account in any commercial negotiation and/or arbitration for access. No allowance has been made for this issue in the capital estimates in this paper.

Cases B1 and B2 : (129 + 45)

4.11 These cases represent BHPBIO operating under RGP3 and FMG using the Mt Newman Service (and the last section of the Goldsworthy Line, after the intersection with the Mt Newman line) to transport 45mtpa of iron ore from its Chichester Ranges deposits. The transportation of iron ore from FMG's Chichester Ranges deposits is being modelled because FMG has, on a number of occasions and most recently in its submissions in response to the Council's Draft Recommendation, indicated that it may seek to use the Mt Newman Line (and the Goldsworthy Line) for transportation of its Chichester Ranges deposits to its proposed facilities at Anderson Point. These cases have been modelled on the basis of 45mtpa being transported from FMG's Chichester Ranges deposits because this volume reflects FMG's most recent public presentation regarding its mining production by Year 2 of operations at Cloud Break.

4.12 The route of the iron ore being railed by FMG from Cloud Break has been assumed to be along a rail spur from Cloud Break to the southern end of the Shaw siding on the Mt Newman Line, along the Mt Newman Line from the Shaw siding to the Bing siding and along the Goldsworthy Line from the Bing siding to an Anderson Point turnout, located between the Boodarie siding and Finucane Island. BHPBIO has assumed this route in accordance with the declared intentions of FMG but notes that the service provided by the

Goldsworthy Line is not currently able to be declared under Part IIIA as determined by the Council

4.13 B1 assumes that the FMG trains have the same reliability and run times as BHPBIO trains while B2 assumes that FMG train performance is 20% poorer than BHPBIO trains.

Cases D1 and D2 : (129 + 10)

4.14 These cases represent BHPBIO operating under RGP3 conditions and FMG using the Mt Newman Service (and the last section of the Goldsworthy Line) to transport 10mtpa of iron ore from Mindy Mindy (in accordance with FMG's public announcements).

4.15 For these cases the route used by FMG to transport iron ore from Mindy Mindy has been assumed to be along the rail spur from Mindy Mindy to the southern end of the Weeli siding on the Mt Newman Line, along the Mt Newman Line from the Weeli siding to the Bing siding and along the Goldsworthy Line from the Bing siding to an Anderson Point turnout between the Boodarie siding and Finucane Island. This route is the route which has been most recently announced by FMG as its intended route, as testified under oath in the affidavit of Julian Tapp sworn 29 August 2005 and filed in the proceedings in the Federal Court of Australia which relate to the FMG's Part IIIA application to the Council.

4.16 D1 assumes that the FMG trains have the same reliability and run times as BHPBIO trains while D2 assumes that FMG train performance is 20% poorer than BHPBIO trains.

Cases C1, C2, E1, E2

4.17 These cases are corrective measures modelled by TSG that seek to alleviate the direct consequences for operational performance resulting from the respective third party access scenarios, B1, B2, D1 and D2, by adding track infrastructure to bring train travel times back to those in Case A (ie., without FMG traffic).

5. ASSUMPTIONS

Conservative approach

5.1 FMG has made a number of announcements regarding various aspects of its proposed operations. BHPBIO considers that many aspects of FMG's announcements regarding its proposed operations and infrastructure are unrealistic and/or not feasible.

5.2 For example, on the basis of FMG's announcements to date, FMG's dumping rate at Anderson Point has been estimated to be 8000 tonnes/hour, excluding delay hours. BHPBIO considers that this rate of dumping is unworkably high for a new operation and notes that its own maximum dumping rate is only approximately 6,500 tonnes per hour. BHPBIO has asked TSG to use FMG's estimated dumping rate to form the basis of modelling FMG's operations, notwithstanding that it considers that such an assumption is unrealistic. As a result, the modelling outcomes are likely to be conservative.

5.3 There are also some aspects of FMG's proposed operations about which not much at all is known. For example, FMG has not made any statements regarding the nature and size of the proposed marshalling yards at Anderson Point. It is accordingly not known whether the yard will be large enough to hold one train in the dumper while another is queued to dump. However, BHPBIO has asked TSG to model on the basis that FMG's marshalling yard at Anderson Point is large enough to hold one train in the dumper while another is queued to dump. This assumption is also likely to result in the modelling outcomes being conservative. In other words, additional capital would be required to be expended by BHPBIO to mitigate third party effects if these critical assumptions as to dumping rates and marshalling yard specifications are not met.

FMG's proposed rail operations

Cloud Break cases : B1,B2

5.4 BHPBIO has provided to TSG the following assumptions about FMG's rail operations for modelling the B1 and B2 cases. As indicated above, these assumptions are based upon FMG's own announcements, or where no information about FMG's operations is available, BHPBIO's best conservative estimates on the basis of its expertise and experience:

Operational condition	Level of operation
Cars per train	200
Nett wet tonnes per car	115
Tonnes per train	23,000
Annual tonnage	45 mtpa
Loaded train trips per year	1,957
Interaction estimate for schedule calculation	93%
Effective days per year	339
Required trains per day	5.8
Scheduled trains per day	6

Mindy Mindy cases : D1, D2

5.5 BHPBIO has provided to TSG the following assumptions about FMG's rail operations for modelling the D1 and D2 cases. As indicated above, these assumptions are based upon FMG's own announcements, or where no information is available on FMG's operations, BHPBIO's best conservative estimates on the basis of its expertise and experience:

Operational condition	Level of operation
Cars per train	100
Nett wet tonnes per car	115
Tonnes per train	11,500
Annual tonnage	10 mtpa
Loaded train trips per year	870
Interaction estimate for schedule calculation	93%
Effective days per year	339
Required trains per day	2.6
Scheduled trains per day	3

FMG Train assumptions

5.6 BHPBIO has asked TSG to undertake modelling for third party access using two different assumptions as to the operating speeds and reliability of FMG trains. The first assumption for modelling is that FMG trains have the same running times and train reliability as BHPBIO trains (cases B1 and D1) while the second, alternate assumption is that FMG trains have running times and train reliability that are 20% poorer than BHPBIO trains (cases B2 and D2).

5.7 The rationale for these assumptions has previously been explained in Appendix F of the CRA Report submitted to the Council on 3 June 2005. Given the capital cost/reliability trade-off described in Appendix F, FMG's announced capital costs and the fact that BHPBIO bears the brunt of FMG reliability problems, the second assumption results are more likely to be representative of the world with FMG access to the services provided by the Mt Newman Line and the last section of the Goldsworthy Line.

Other assumptions

5.8 BHPBIO has asked TSG to make a number of other assumptions in modelling the third party access scenarios:

(a) where two trains arrive at a junction, the first to arrive receives signal priority (ie., goes first). This assumption is consistent with BHPBIO's current signal priority rule between its own trains, regulatory 'fairness' in resolving any train priority disputes between an access seeker and incumbent and operations in most multi-user systems. Importantly, as explained in BHPBIO's Outline of Principal Submissions in response to the Council's Draft Recommendation, it is the only arrangement that would be sustainable for any period of time in the future; and

(b) track availability reflects 24 x 4 hour track maintenance windows during the year between Bing and Shaw which are needed to perform necessary track maintenance.

FMG's proposed port operations

5.9 The nature and layout of FMG's proposed port operations will affect the manner in which access will impact upon operations on the Mt Newman Line and the Goldsworthy Line. FMG, however, has not provided detailed information in relation to its proposed port operations. Accordingly, BHPBIO has asked TSG to make the following assumptions in relation to FMG's Port at Anderson Point:

(a) as already noted, that there is sufficient room in the marshalling yard to hold one train in the dumper and one queued to dump (ie., FMG loaded trains may have to wait in passing sidings until there is room in the Anderson Point loop);

(b) that the dumping rate is 8,000tonnes/hr, excluding delay hours, with dumper utilisation of 64%;

(c) that dumper delays and maintenance are the same as experienced for BHPBIO car dumper 4 (plus stockyard delays); and

(d) that berth capacity and operations are not modelled but are instead assumed to be able to deal with FMG's tonnages efficiently.

5.10 While BHPBIO considers that these operational conditions are likely to be unrealistic and unworkable, it has asked TSG to use them for the modelling in order to adopt a conservative approach. The modelling outcomes are accordingly likely to be conservative and may well underestimate the capital expenditure by BHPBIO required to mitigate third party effects.

FMG's proposed mining operations

5.11 FMG's proposed mining operations will also affect the manner in which access will impact upon operations on the Mt Newman Line and the Goldsworthy Line.

Cloud Break

5.12 On the basis of FMG's announcements in respect of its proposed mining operations at Cloud Break (to the extent that they are relevant) and BHPBIO's own expertise and experience, BHPBIO has asked TSG to use the following assumptions in relation to FMG's proposed mining operations at Cloud Break:

(a) that there is sufficient room on track and in the loading loop to receive all empty trains under all conditions (ie., FMG's queue at the mine to load never impacts on the use of the Shaw siding on the Mt Newman Line);

(b) that the loading rate is 10,000tonnes/hr, excluding delay hours, with a loadout utilisation of approximately 50%;

(c) that loadout delays and maintenance are the same as experienced for BHPBIO's Yandi 1 mine (with no ore supply delays); and

(d) that the capacity and operations of mine stockpiles are not modelled but are instead assumed to be able to deal with FMG's tonnages efficiently.

Mindy Mindy

5.13 FMG has not provided any information in relation to its proposed mining operations at Mindy Mindy. Accordingly, based on BHPBIO's own expertise and experience, BHPBIO has asked TSG to use the following assumptions in relation to FMG's mining operations at Mindy Mindy:

(a) that there is sufficient room on track and in the loading loop to receive all empty trains under all conditions (ie., FMG's queue at the mine to load never impacts on the use of the Weeli siding on the Mt Newman Line);

(b) that the loading rate is 2,500tonnes/hr, excluding delay hours, with a loadout utilisation of approximately 46%;

(c) that loadout delays and maintenance are the same as experienced for BHPBIO's Jimblebar mine (plus no ore delays); and

(d) that mine stockpiles capacity and operations are not modelled but are instead assumed to be able to deal with FMG's tonnages efficiently.

6. IMPACTS OF THIRD PARTY ACCESS

6.1 The extent of operational impact of third party access on the Mt Newman and Goldsworthy production systems has been assessed by reference to two key performance indicators (KPIs) for BHPBIO's operations:

(a) **Total Delays on Track** : including all meets and congestion delays incurred during travel time for all trips during the simulation period of one year.

(b) **Average Track Delays per Cycle** : calculated by dividing the Total Delays on Track for the year by the number of loaded train trips achieved over the same year.

6.2 The significance of these KPIs is that additional rail traffic on the lines will contribute to congestion. Congestion results in longer delays to trains on the track which results in lower rolling stock utilisation: a stationary train set is not doing any useful work. The longer the delay, the less useful work the train set is capable of doing in a year and the lower the production output.

6.3 Where different types of trains are mixed, the delays are potentially increased. If one set of trains travels more slowly than the other, or if one set is more likely to break down on track than the other, then the congestion problem is amplified disproportionately to the additional tonnage carried.

7. ANALYSIS OF RESULTS

45 mtpa from Cloud Break

7.1 The following table provides the results of operational modelling for third party access scenarios B1 and B2 and the respective corrective measures required (C1 and C2) to alleviate the direct operational performance consequences from such access:

BHPBIO - NCC Submissions
Simulation Results - Cloud Break Cases
2-Jan-06

		CASE A	CASE B1	CASE B2	CASE C1	CASE C2
Case		FC_RGP3_09	FC_RGP3_19	FC_RGP3_20	FC_RGP3_24	FC_RGP3_23
built from		J0098 RGP3_36	FC_RGP3_09	FC_RGP3_19	FC_RGP3_19	FC_RGP3_19
Key Settings						
Mine Production						
BHPBIO Total	Mtpa	129	129	129	129	129
FMG						
Mindy Mindy	Mtpa	0	0	0	0	0
Cloud Break	Mtpa	0	45	45	45	45
FMG Total	Mtpa	0	45	45	45	45
Total	Mtpa	129	174	174	174	174
Train Performance		As per BHPB	As per BHPB	20% poorer	As per BHPB	20% poorer
Additional Rail Infrastructure						
DT Bing to Mooka		No	No	No	No	Yes
DT Mooka to Walla		No	No	No	Yes	Yes
DT Walla to Abydos		No	No	No	Yes	Yes
DT Abydos to Spring		No	No	No	Yes	Yes
DT Spring to Garden		No	No	No	Yes	Yes
DT Garden to Shaw		No	No	No	No	Yes
Output KPI's						
(Average of 10 seeds)						
BHPBIO Trains Only :-						
Sum of all delays on track.	hrs/yr	9,186	12,105	14,067	9,049	8,779
Number of Empty + Loaded Trips.	No./yr	7,794	7,710	7,642	7,794	7,812
Average Track Delays per Trip.	hrs/trip	1.18	1.57	1.84	1.16	1.12
Average Track Delays per Cycle.	hrs/cycle	2.36	3.14	3.68	2.32	2.25
% difference from Base Case		0.0%	33.2%	56.2%	-1.5%	-4.6%

Case A

7.2 Under Case A, the average track delays per cycle for BHPBIO trains is **2.36 hours** and the total delays on track for BHPBIO trains is **9,186 hours** per annum.

7.3 These figures are the average of 10 simulated "runs" or "seeds" through modelling. The reason that an average of 10 seeds is used is because, in light of the complexity of the model and the stochastic nature of the simulation process, each seed produces a slightly different answer. The average of all the runs is a better comparative measure of the differences between the cases.

Cases B1 and B2

7.4 Under Case B1, the average track delays per cycle for BHPBIO trains is **3.14 hours** and the total delays on track for BHPBIO trains is **12,105 hours** per annum. Accordingly, as a result of an additional 45mtpa being carried on the Mt Newman and Goldsworthy systems from Cloud Break, the average track delays per cycle for BHPBIO trains is increased by approximately **47 minutes** or approximately **33%**.

7.5 Under Case B2, the average track delays per cycle for BHPBIO trains is **3.68 hours** and the total delays on track for BHPBIO trains is **14,067 hours** per annum. Accordingly, as a result of an additional 45mtpa being carried on the Mt Newman and Goldsworthy systems from Cloud Break (where FMG trains are assumed to perform 20% poorer than BHPBIO trains), the average track delays per cycle for BHPBIO trains is increased by approximately **79 minutes** or approximately **56%**.

Cases C1 and C2

7.6 Cases C1 and C2 represent the corrective measures required to alleviate the direct operational performance consequences from the third party access scenarios in Cases B1 and B2 respectively. In order to offset the impacts of third party access, TSG calculated the additional track infrastructure required to bring travel times and total delays back to within 5% of what they were in Case A.

7.7 The different options modelled by TSG were undertaken on the basis of seeking to double track those areas of the Mt Newman Line that attract the greatest delays on track (ie., the most number of meets or other on track delays) under RGP3. In addition, the "fix" alleviates congestion caused by third party access on both the Mt Newman Line and the last section of the Goldsworthy Line.

7.8 The results of the modelling are that:

(a) approximately **136 km** of double tracking between Mooka and Garden is required to offset the impact of third party access scenario Case B1. This amount of double tracking results in the average track delays per cycle being reduced to 2.32 hours and delays on track being reduced to 9,049 hours; and

(b) approximately **152 km** of double tracking between Bing and Shaw is required to offset the impact of third party access scenario Case B2. This amount of double tracking results in the average track delays per cycle being reduced to 2.25 hours and delays on track being reduced to 8,779 hours.

7.9 In both Cases C1 and C2, the average track delays per cycle are now within 5% of the base case (Case A).

10 mtpa from Mindy Mindy

7.10 The following table provides the results of operational modelling for third party access scenarios D1 and D2 and the respective corrective measures required (E1 and E2) to alleviate the direct operational performance consequences from such access. Case A remains unchanged:

BHPBIO - NCC Submissions
Simulation Results - Mindy Mindy Cases
2-Jan-06

		CASE A	CASE D1	CASE D2	CASE E1	CASE E2
Case		FC_RGP3_09	FC_RGP3_10	FC_RGP3_15	FC_RGP3_14	FC_RGP3_18
built from		J0098 RGP3_36	FC_RGP3_09	FC_RGP3_10	FC_RGP3_10	FC_RGP3_10
Key Settings						
Mine Production						
BHPBIO Total	Mtpa	129	129	129	129	129
FMG						
Mindy Mindy	Mtpa	0	10	10	10	10
Cloud Break	Mtpa	0	0	0	0	0
FMG Total	Mtpa	0	10	10	10	10
Total	Mtpa	129	139	139	139	139
Train Performance		As per BHPB	As per BHPB	20% poorer	As per BHPB	20% poorer
Additional Rail Infrastructure						
DT Spring to Garden		No	No	No	No	Yes
DT Garden to Shaw		No	No	No	Yes	Yes
DT Shaw to Hesta		No	No	No	Yes	Yes
DT Hesta to Cowra		No	No	No	Yes	Yes
DT Cowra to Gidgi		No	No	No	Yes	Yes
DT Gidgi to Yandi Junction		No	No	No	No	Yes
Output KPI's						
(Average of 10 seeds)						
BHPBIO Trains Only :-						
Sum of all delays on track.	hrs/yr	9,186	10,748	11,529	9,241	9,292
Number of Empty + Loaded Trips.	No./yr	7,794	7,770	7,710	7,786	7,786
Average Track Delays per Trip.	hrs/trip	1.18	1.38	1.50	1.19	1.19
Average Track Delays per Cycle.	hrs/cycle	2.36	2.77	2.99	2.37	2.39
% difference from Base Case		0.0%	17.4%	26.9%	0.7%	1.3%

Cases D1 and D2

7.11 Under Case D1, the average track delays per cycle for BHPBIO trains is **2.77 hours** and the total delays on track for BHPBIO trains is **10,748 hours** per annum. Accordingly, as a

result of an additional 10mtpa being carried on the Mt Newman and Goldsworthy systems from Mindy Mindy, the track delays per cycle for BHPBIO trains would be increased by approximately **25 minutes** or approximately **17%**.

7.12 Under Case D2, the track delays per cycle for BHPBIO trains is **2.99 hours** and the total delays on track for BHPBIO trains is **11,529 hours** per annum. Accordingly, as a result of an additional 10mtpa being carried on the Mt Newman and Goldsworthy systems from Mindy Mindy (where FMG trains are assumed to perform 20% poorer than BHPBIO trains), the track delays per cycle for BHPBIO trains would be increased by approximately **38 minutes** or approximately **27%**.

Cases E1 and E2

7.13 Cases E1 and E2 represent the corrective measures required to alleviate the direct operational performance consequences from the third party access scenarios in Cases D1 and D2 respectively. In order to offset the impacts of third party access, TSG used the same process described above.

7.14 The results of the modelling are that:

(a) approximately **44 km** of double tracking between Garden and Gidgi is required to offset the impact of third party access scenario Case D1. This amount of double tracking results in the average track delays per cycle being reduced to 2.37 hours and delays on track being reduced to 9,241 hours; and

(b) approximately **66.5 km** of double tracking between Spring and Yandi Junction is required to offset the impact of third party access scenario Case D2. This amount of double tracking results in the average track delays per cycle being reduced to 2.39 hours and delays on track being reduced to 9,292 hours.

7.15 In both Cases E1 and E2, the average track delays per cycle are now within 2% of the base case (Case A).

8. CONCLUSIONS

8.1 It is clear from TSG's modelling analysis that BHPBIO's rail infrastructure does not have the capacity to absorb third party traffic without significant adverse impacts on BHPBIO's throughput of iron ore.

8.2 These direct operational performance consequences may, however, be offset by significant additional track infrastructure.

8.3 To accommodate 45 mtpa from Cloud Break on the Mt Newman and Goldsworthy production systems, 152 km of double tracking is required (assuming FMG uses trains that perform 20% poorer than BHPBIO's trains). That is, all of the Mt Newman line that FMG would use, would need to be replicated to accommodate this extra volume of iron ore. To accommodate 10mtpa from Mindy Mindy on the Mt Newman and Goldsworthy systems,

44 km of double tracking would be required (assuming FMG uses trains of equal performance to BHPBIO's trains).

8.4 There is a degree of uncertainty in the extent of the fixes required as:

(a) the stochastic nature of the simulation analysis combined with the integer nature of adding whole sections of double tracking between the existing passing sidings, results in the simulated fixes being within +/-5% of the performance of the base case.

(b) all the simulated fixes were confined to the Mt Newman line. Analysis shows that under **predicted** performance measures, the small section of the Goldsworthy line involved could handle the increased traffic. There is a real risk, however, that this predicted performance will not be achieved, thereby requiring double tracking of that Goldsworthy segment. This is particularly due to the physical layout of the Mt Newman and Goldsworthy systems and in particular the location and nature of the sidings at Bing and Boodarie that play a crucial role in minimising delays at the port; and

(c) in some of the cases, the simulated fixes resulted in some small isolated sections of track which remain single track being required to carry additional traffic. The practicalities of operating such a complex system mean that in practice it is likely that these small sections would also have to be double tracked, although this is not included in the analysis.

ANNEXURE 1

SIMULATION MODELLING

Why simulation modelling is done

1. Simulation modelling can assist business decision making in respect of complex systems such as mining, manufacturing, logistical or transportation systems. It can be used for analysing and quantifying risks, analysing expansion options and system performance, optimising system operation and the handling of unplanned failures to any part of the system.

2. Modelling techniques provide a business with a rational and quantitative process for increasing the business' understanding of the potential consequences of a range of alternate proposals, from a change in operational philosophies through to the commissioning of new infrastructure and its interaction with existing infrastructure and operations. As in most complex systems, there is often a range of differing views as to the best way to solve any problem. Simulation modelling assists in decision making by allowing for the evaluation of a wide range of scenarios, together with providing reasons as to why some options performed better than others.

How modelling works

3. Simulation is the technique of building a computer model that imitates the behaviour of a real or proposed system to enable the study of the behaviour of the system under specific conditions and based on pre-determined assumptions. Simulation modelling is used to evaluate designs and analyse systems that are too complex for analysis using traditional methods. It is generally performed using specialised computer software that is programmed to represent the relevant activities, their interdependence, the operational rules and the performance data that together characterise how the system behaves.

4. Discrete event simulation works in the following way. Each physical item (truck, rake, reclaimer, ship, etc.) is modelled as a discrete entity, with its own uniquely defined set of properties or attributes (speed, material type, reliability, carrying capacity, etc.). These entities act out the operational activities that make up the processes being modelled. They consume discrete periods of time for each activity and incur delays that can be logically induced (eg. bin empty, no rake etc.) or randomly induced (eg. breakdown, failures, etc.) all of which are dependent on the data and rule settings that are defined for that process. This combination of logical and random events is designed to reflect the most likely operational environment.

5. Simulation models can vary greatly in terms of their level of detail, from simple high level representations of a process down to very large and very detailed representations of all the activities that make up the process being studied. Typically they are built “fit for purpose” with enough detail to encapsulate the issues and emulate the behaviour of the process being

modelled such that the end user gains sufficient insight to assist his decision making, taking into account the consequences of the decision.

Limitation of modelling

6. Simulation models are typically built with stochastic inputs, ie. random events such as breakdowns are programmed into simulation models using probability functions. As a result of these stochastic inputs, modelling outputs are also stochastic. Stochastic outputs are best represented as a distribution of predicted results, rather than a definitive or single point answer.

7. Simulation models can also have very different levels of detail in their calculations of predicted performance. High level models typically have many assumptions, and it may not be apparent to the decision maker just how much influence some of these assumptions may have on the outcome of the analysis. To assess the influence of different assumptions, a set of sensitivity cases can be run with a possible range of input values to see if the input has a large or small impact on the objective function. Where inputs are sensitive (i.e. a small change in the input leads to a large change in the output), then typically more work has to be done to prove up what will be achievable post implementation.

8. Ultimately, the accuracy of the model outputs is dependant on the quality of its inputs (including any underlying assumptions).

BHPBIO system

9. Simulation modelling reflects almost all of the features of the vertically integrated mine, rail and port operations including the following particular features:

How approaching trains pass each other on the mainline

10. As the main rail line (mainline) from the mines to the port is a single track, when trains approach each other, one train has to come to a stop in a passing siding to allow the other train to pass (this is called a “meet”). The more times trains are stopped, the lower the trip efficiency as measured in terms of tonnes delivered over time taken to transport the tonnes.

How the marshalling yard activities are constrained by resources

11. When trains arrive at the port, they are split into individual rakes for dumping. Rakes typically contain around 100 cars that stay together while being dumped. Following the dumping, 1, 2 or 3 rakes are put together to form a new train which is then tested prior to departure from the port. Compressor cars are required to be attached to each rake prior to dumping to maintain air pressure for the brakes as the cars are being indexed through the dumpers. All these activities take place in the marshalling yard, and require shunt locomotives to move the rakes and compressor cars around.

12. These, and other, yard resources constrain the performance of the yard's operation when concurrent jobs result in concurrent demand for the same resources, particularly where

some of the jobs are on opposite sides of the yard, resulting in a demand for the resources that exceeds availability.

How train departures at the port are constrained waiting for rakes

13. As illustrated in the animation, trains cannot depart the port until enough rakes have been unloaded and they become available to form new trains. In this way, any delays that occur prior to, and during, dumping operations will impact on the departure time of the next empty train out to the mines.

How dumping operations require stockpiles and shared equipment

14. Even though a dumper may have received the next rake to dump, dumping cannot commence until both a suitable stockpile and a route (consisting of a set of conveyors linking a dumper to a stacker) that can reach the selected stockpile, are available.

15. A "suitable" stockpile is one that:

- contains the right product;
- is still in the process of being blended;
- has room for the contents of the rake; and
- is able to be reached by a stacker.

16. In the case of ore from the Newman mining area the process is more complex, as the ore carried from that area is run of mine (ROM) ore and as such has not yet been crushed or screened to separate lump from fines. Accordingly, for each rake of ore from the Newman mining area, at least two suitable stockpiles need to be identified – one for the lump and one for the fines that will be produced following crushing and screening at the port, as well as a route from the car dumper that enables the ROM ore to proceed to the crushing and screening plant and then on to the stockpiles.

17. Not all stackers can be serviced from all dumpers, and similarly not all stackers can be serviced from all crushing and screening plants. As there are three car dumpers, one car dumper may be using a conveyor that another car dumper may need in order to be able to reach a suitable stockpile. It is in this way that stockpile choices and conveyor choices induce delays in the unloading of rakes and further delay departures of empty trains.

18. Where a stacker is unavailable, this impacts on the ability of the car dumper to operate, which in turn leads to train queues building up.

How random events cause delays

19. As well as these logically induced constraints in the model, such as suitable stockpiles and sharable conveyors causing delays, randomly induced constraints also cause delays. These random events simulate equipment breakdowns and operational delays such as blocked

chutes and conveyor run-offs. These random events are modelled using Monte Carlo simulation techniques and they represent the actual historical equipment up times and down times as have been measured by BHPBIO's delay accounting systems.

How shiploading operations are impacted by uncompleted stockpiles

20. Shiploading operations require suitable stockpiles and a route consisting of a set of conveyors starting with a reclaimer that can reach the suitable stockpile and ending with a shiploader. A pile that is suitable for reclaiming is one that:

- contains the right product; and
- has been fully blended and is ready for reclaiming; or
- is already partly reclaimed.

21. It is only when reclaimable stockpiles are fully reclaimed that a footprint then becomes available to be stacked to. Further, footprints are usually allocated an ongoing product designation, so as to prevent any floorstock contamination of a new stockpile.

22. This process has a significant impact on shiploading operations. This is because low shipping demand means that there are fewer stockpiles available to be stacked, thereby impacting on dumping performance, and high shipping demand means that there are fewer stockpiles available to reclaim from, thereby impacting on shiploading performance.

23. Because there is a fixed fleet of rolling stock operating within the confines of the total system, the rail operations are physically contained inside a closed-loop system; ie. trains on route to the mines cannot depart the port until they are unloaded, and trains on route to the port cannot depart the mines until they are loaded.

24. Also due to the variable number of meets that can occur on each trip, the actual time it takes to travel from the port to the mines, and also from the mines to the port, is highly variable. In addition, train loading and unloading facilities are impacted by equipment performance and reliability issues, as well as stock levels and available yard space in which to unload the products. There is therefore a high level of unpredictability around when a train will arrive at a destination and also when it may depart again.

25. By design, the model takes a total integrated system approach to all the activities and their performance and constraints, that results in ore flowing from the mines all the way through to the ships departing the channel.

ANNEXURE 2

RGP3 also entails the following expansions or modifications to the current BHPBIO system:

(a) additions, modifications and upgrades to processing plants, stockpiles and train loading circuits;

(b) expansion of mining and processing capabilities;

(c) new and extended mainline sidings;

(d) extension of balloon loop at MAC;

(e) a new locomotive preparation facility at Nelson Point;

(f) purchase of additional mainline locomotives, ore cares and track maintenance equipment;

(g) at Finucane Island:

  (i) rebuilding existing Berth C to accommodate 250,000 dwt vessels;

  (ii) joining Berths C and D to allow Shiploaders 3 and 4 to access either berth; and

  (iii) constructing a new stockyard row over the existing Goldsworthy Plant footprint;

(h) at Nelson Point:

  (i) modifying car dumper 1 to increase throughput capacity to 10,000 tph;

  (ii) modifying car dumper 2 and car dumper 3 cells to accommodate the larger SD70 locomotives;

  (iii) upgrading selected chutes along shiploading routes to improve flow characteristics; and

  (iv) providing a direct shipped ore route from car dumper 2 to Shiploader 2 and introducing proportional splitters into the South Yard; and

(i) port works including upgrading general, electrical and control systems infrastructure and improving dust control measures.