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Memo

To:	Laura Todd	**Company:**	FMG
From:	Vince Piper	**Job No:**	495/A1
Date:	17/12/04	**Doc No:**	144a

Subject: **Stage A: Port and North-South Railway, Potential Cumulative Impact of FMG Railway on the Existing BHPBIO and Approved Hope Downs Railways – PER Addendum**

Laura

We are pleased to attach our surface water assessment of the "Potential Cumulative Impacts of FMG Stage A North-South Railway on the Existing BHPBIO and Approved Hope Downs Railways".

POTENTIAL IMPACTS

Natural drainage features along the proposed FMG railway corridor include major rivers and their tributaries, creeks, floodplains, sheetflow areas, marshes and springs. Inappropriate management of these drainage features could potentially alter existing drainage patterns including flooding characteristics; scour, erosion and siltation of the drainage channels; inundation of upstream areas and water starvation to downstream areas.

The FMG North-South railway corridor essentially runs parallel and in close proximity to the existing BHPBIO and approved HD railway routes. The existing BHPBIO railway formation already causes some interruptions to the surface water environment and the approved HD railway formation will also potentially cause some additional surface water interruptions. To reduce the potential for further surface water impacts, where feasible the FMG rail corridor has generally been located adjacent to the existing BHPBIO and approved HD railway formations.

In some areas, due to topography and other constraints, it has been necessary to deviate the FMG rail corridor away from the other two railway routes. In some cases this has been necessary to reduce the impacts on the natural drainage systems and/or on the existing railway drainage structures. Bridges will be installed over the major river channels and culverts installed at all other drainage crossings. These drainage structures will be located and sized to minimise any adverse impact on the corresponding existing BHPBIO and proposed HD railway bridges and culverts.

PORT HEDLAND AREA

Within the initial 50km from Port Hedland, the FMG, BHPBIO and HD railway routes are mostly located in the South West Creek and South Creek Catchments. Through this area, the North-South railway routes are typically aligned parallel to and away from the main surface drainages. The existing BHBIO railway, after initially passing between the South Hedland and Wedgefield townsite areas, heads southwards predominantly located on the eastern watershed boundary of the South Creek and South West Creek Catchments. Whereas, to avoid impacting on the South Hedland and Wedgefield townsite areas, the FMG and HD railway routes are typically aligned on the western side of the natural surface drainages in South West Creek.

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Through the South West Creek Catchment, the FMG and HD railway formations are located in close proximity to each other, to minimise the combined impacts of the railways on the main flow channels and on the general environment. In this area, the FMG and HD railways will typically be 6 to 8km to the west from the existing BHPBIO railway and due to this separation have no cumulative impacts.

To better avoid surface water impacts in the South West Creek Catchment, the FMG railway alignment has been mainly located slightly to the west (upslope) from the approved HD railway alignment. With this alignment, the FMG railway will generally have no hydraulic impact on the HD railway alignment. The main drainage zone where the FMG and HD railway routes have been separated is where the routes cross South West Creek and North West Coastal Highway, around 15km south of Port Hedland. At this creek crossing, the FMG route has been located around 4km downstream from the HD route, to reduce the impact in the upstream area. The final arrangements for the FMG crossing will be determined at the project detailed design stage such that any potential adverse impacts to the existing flood levels will be managed to acceptable levels.

Upstream from the highway crossing, in the White Hill area, the existing flow distribution patterns are complex as the South West Creek overspills into South Creek during major flood events. To avoid passing through this overspill zone and to avoid adverse hydraulic impact on the HD railway, the FMG railway route has been kept on the western side of South West Creek.

MAJOR RIVER SYSTEMS

South from the Port Hedland area, the North-South railway routes cross several major rivers and their floodplains in the Turner River, Yule River and Upper Fortescue River Catchments. On these major river crossings, FMG will install bridges. To reduce disturbance to the surface water flow patterns, flow directions and existing bridges, where possible the FMG (and HD) rail corridor has been aligned such that the bridges cross perpendicular to the main drainage channels and floodplains.

In the Turner River Catchment, FMG will install bridges over the river channels at Turner River East, Chinnamon Pool, Gillam Creek and Turner River. Through this area, the FMG rail corridor is located downstream (west) from the approved HD railway route, which in turn is located downstream from the existing BHPBIO railway. For the Turner River East, Chinnamon Pool and Gillam Creek bridge crossings, the HD railway route crosses 2 to 3 km downstream from the existing BHPBIO bridges and the proposed FMG bridge crossings are a further 1 to 1.5km downstream. Whereas for the Turner River which flows semi-parallel to the railway routes, the FMG and HD bridge crossings have been spaced with a separation distance of around 8 to 10km between bridges. This distance between the bridges has been necessary to curve the railway routes around 90 degrees for the river crossing.

In the Yule River Catchment, FMG will install bridges over the river channels at Coorong Creek, Yule River and several branches of Coonarrie Creek. Through this area, the FMG rail corridor is now located upstream (east) from the existing BHPBIO railway with a typical separation distance of around 1km. The approved HD railway route is located 1 to 5km west (mostly downstream) from the existing BHPBIO railway. However, where the railway routes climb into the main Chichester Ranges, these separation distances vary significantly. For the Coorong Creek, Yule River and Coonarrie Creek branch crossings, the FMG railway bridges will be aligned with the existing BHPBIO bridges and typically around 1km upstream. Whereas the HD bridges are typically located downstream (west) from the BHPBIO bridges. However, because the Coonarrie Creek main channel flows semi-parallel and in between the BHPBIO and HD railway routes, the required HD bridge crossing locations in this area have been independently located with no requirement to correspond with those on the existing BHPBIO railway.

In the Upper Fortescue River Catchment, FMG will install bridges over three main channels of Weeli Wolli Creek. Through the Weeli Wolli Creek area discharge zone, the FMG rail corridor is located upstream (south) and adjacent to the existing BHPBIO railway, whereas the HD railway route diverges to the south from the FMG and BHPBIO railway routes. The FMG railway bridges will be aligned with the corresponding existing BHPBIO bridges. The HD bridge crossing locations in this area have been independently located with no requirement to correspond with those on the existing BHPBIO railway.

The final arrangements for the FMG bridge crossings will be determined at the project detailed design stage such that any potential adverse impacts to the existing flood levels and existing bridges will be managed to acceptable levels. Engineering methods employed to manage potential adverse impacts include the provision of guide banks, hydraulically streamlined flow areas and riprap or similar scour protection blankets.

SMALLER FLOW CHANNELS

The FMG, BHPBIO and HD railway routes cross numerous smaller channels where culverts will be installed to allow drainage to pass. The potential impacts of the FMG culverts, which include raised upstream water levels and scour, will be managed such that they are localised to each culvert installation. Hence, the impacts from the FMG culvert crossings are unlikely to effect the corresponding culvert crossings located under the nearby railway routes. However, where the railway alignments are in very close proximity, the backwater from a downstream culvert may have a minor effect on the water levels in the corresponding upstream culvert.

SHEETFLOW AREAS

Along the FMG North-South railway corridor, the main sheetflow areas with dependent downstream vegetation are located along the flanks of the Fortescue Marshes. Through this area, the FMG railway corridor has been predominantly located parallel to the existing BHPBIO and the approved HD railway routes. Drainage arrangements through the adjacent embankments need to be matched. Where sheetflow culverts have not been installed under the existing BHPBIO railway formation, there is no advantage to installing such culverts under the adjacent FMG railway, unless BHPBIO plans to retrofit culverts. At the project detailed design stage, FMG will locate sheetflow culverts to match those in the adjacent railway formations. As sheetflow discharges are relatively small, no measurable cumulative impacts will occur between corresponding culverts.

FORTESCUE MARSHES

The Fortescue Marshes act as an extremely large receiving basin for surface water runoff from the Upper Fortescue River Catchment. The FMG rail corridor crosses through an elevated section of the Fortescue Marshes upstream from the Goodiadarrie Hills and adjacent to the existing BHPIO and approved HD railway routes. At this location, natural drainage through the railway zone would predominantly be as a result of differences in water storage levels between the upstream and downstream marsh areas, rather than due to large-scale floodwater drainage. As a result, flows through the large railway culverts would be relatively low volume and slow moving. FMG will install drainage culverts under their railway formations at the lowest levels of the marsh crossing to match those in the existing BHPBIO and approved HD railways. As culvert discharges will be relatively small, no measurable cumulative impacts will occur between corresponding culverts.

CONCLUSIONS

The FMG North-South railway corridor essentially runs parallel and in close proximity to the existing BHPBIO and approved HD railway routes. The existing BHPBIO railway formation already causes some interruptions to the surface water environment, and the approved HD railway formation will also potentially cause some additional surface water interruptions. To reduce the potential for further surface water impacts, where feasible the FMG rail corridor has generally been located adjacent to the existing BHPBIO and approved HD railway formations.

FMG will locate and size drainage structures to minimise any adverse impact on the corresponding existing BHPBIO and proposed HD railway bridges and culverts. The final arrangements for the FMG structures will be determined at the project detailed design stage such that any potential adverse impacts to the existing flood levels will be managed to acceptable levels. Engineering methods employed to manage potential adverse impacts include the provision of guide banks, hydraulically streamlined flow areas and riprap or similar scour protection blankets.

The FMG railway formation and drainage structures will potentially cause some increased interruptions and localised impacts to the existing surface water flow environment, however these impacts will be managed to acceptable levels.

Regards,
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Vince

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