



# REPORT

## URS Site Visit Notes

*Prepared for*

**BHP Billiton Mitsubishi Alliance**

Level 33  
Riparian Plaza  
71 Eagle Street  
Brisbane, QLD, 4001

27 February 2009

42626163



Project Manager:

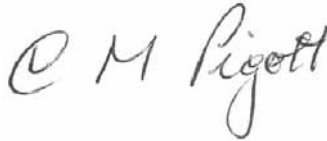


p.p.

Philippa Kassianos  
Senior Water Engineer

URS Australia Pty Ltd  
Level 16, 240 Queen Street  
Brisbane, QLD 4000  
GPO Box 302, QLD 4001  
Australia  
Tel: 61 7 3243 2111  
Fax: 61 7 3243 2199

Project Director:



Chris Pigott  
Senior Principal

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Status: FINAL

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## Cherwell Creek Tributary 1

## Section 1

### 1.1 Cherwell Creek Tributary 1, Site 1

This site is located on a tributary of Cherwell Creek, adjacent to a track crossing, downstream of Peak Downs Highway. This tributary was investigated between E610702, N7550483 and E610567, N7550427 (refer attached figure) February 2007 and E610702, N7550481 in November 2007.

Time of Investigation: 20 – 21 February 2007 and 22 - 23 November 2007

Depth of channel: Minimal - 2m

Width of channel: 3 – 5m

Slope of banks: 30 - 45°

Stability of banks: Moderate: Most areas covered with vegetation (grasses and some trees), however some banks are not vegetated are subject to erosion and this is exacerbated by cattle tracks up and down the banks. Undermining of the banks is occurring at bends.

Substrate: Course gravel and silt bed material.

Water: No water present.

Debris and tree roots: Log jams present (approximately 30% waterway obstruction)

Overbanks: Trees and grasses.

Additional Comments: Meandering – lots of bends. No ponds or riffles. Road crossing would back water up when rains, therefore wider, grassed channel downstream.

#### February 2007

#### Plate 1-1 Cherwell Creek, Tributary 1 Site 1



Looking downstream from fence post



Looking upstream at a log jam.

**Section 1****Cherwell Creek Tributary 1****November 2007****Plate 1-2 Cherwell Creek Tributary 1 Site 1 Upstream**

Looking upstream

**1.2 Cherwell Creek Tributary 1, Site 2**

This site is located on a tributary of Cherwell Creek, adjacent to 12 North Dam (Peak Downs Mine). Location E611684, N7550803 and E612165, N7550658 in February 2007 and at E611793, N7550735 in November 2007 (refer attached figure).

Time of Investigation	20 – 21 February 2007 and 22 - 23 November 2007.
Depth of channel:	Varying between 0.5-1.5 m and 4m (outside bank of 180° bend).
Width of channel:	3.0-4.0m
Slope of banks:	45° -90°
Stability of banks:	Moderate- Most areas covered with vegetation (grasses and some trees), however undermining of the banks is occurring at bends.
Substrate:	Medium to coarse sand. Poorly sorted. Rounded.
Water:	No water present.
Debris and tree roots:	Not present.
Overbanks:	Grass cover, little riparian vegetation.

# Cherwell Creek Tributary 1

# Section 1

**February 2007**

**Plate 1-3 Cherwell Creek Tributary 1 Site 2**



Looking downstream, sandy base

**November 2007**

**Plate 1-4 Cherwell Creek Tributary 1 Site 2 Downstream**



Looking downstream

**Section 1**

**Cherwell Creek Tributary 1**

**Plate 1-5 Cherwell Creek Tributary 1 Site 2 Upstream**



Looking upstream



## Cherwell Creek Tributary 1 South

## Section 2

### 2.1 Cherwell Creek Tributary 1 South, Site 1

This site is located on a tributary of Cherwell Creek, downstream of the study area boundary, at E609339, N7551970 (refer attached figure).

Time of Investigations:	16th June 2008
Depth of channel:	1-3 m
Width of channel:	2-3m wide base width
Slope of banks:	1 in 3 side slopes
Stability of banks:	Moderate
Substrate:	Sandy material
Water:	None present
Debris and tree roots:	debris and log jams were present
Overbanks:	Trees and grasses
Additional comments:	Evidence of cattle

**Plate 2-1 Cherwell Creek Tributary 1 South Site 1 Upstream**



Looking upstream

**Section 2**

**Cherwell Creek Tributary 1 South**

Plate 2-2

**Cherwell Creek Tributary 1 South Site 1 Downstream**



Looking downstream

## Cherwell Creek Tributary 2

## Section 3

### 3.1 Cherwell Creek Tributary 2, Site 1

This site is located on a tributary of Cherwell Creek, adjacent to Peak Downs Highway. This tributary was investigated between E610688, N7552187 and E610773, N7552307 in February 2007 (refer attached figure).

Time of Investigation	20-21 February 2007.
Depth of channel:	Indeterminate, as no clear channel is evident.
Width of channel:	Indeterminate, as no clear channel is evident.
Slope of banks:	No banks present as such.
Stability of banks:	No defined banks.
Substrate:	Black silty bed material, with patches of coarse gravels.
Water:	No water present.
Overbanks:	Grass and trees
Additional Comments:	2 separate Peak Downs Highway crossings, consisting of 1 Reinforced Concrete Pipe 375mm diameter and 1 Reinforced Concrete Pipe 450mm diameter.

#### **February 2007**

#### **Plate 3-1 Cherwell Creek Tributary 2, Site 1**



Looking downstream, dark silty soil bed material, undefined channel.



**Section 3****Cherwell Creek Tributary 2****Plate 3-2 Cherwell Creek Tributary 2, Site 1**

Looking downstream towards highway.

*June 2008***Plate 3-3 Cherwell Creek Tributary 2, Site 1 Downstream**

Looking downstream

**3.2 Cherwell Creek, Tributary 2, Site 2**

This site is located on a tributary of Cherwell Creek, upstream of Peak Downs Highway. This tributary was investigated at E609654, N7552809 in February 2007 and at E609551, N7553206 in November 2007 (refer attached figure).

Time of Investigation 20 – 21 February 2007 and 22 - 23 November 2007.

Depth of channel: 0.2- 0.5 (shallow banks).

Width of channel: Varying significantly from 1.0m to 3-10m.

Stability of banks: Moderate: Most areas covered with vegetation (grasses).

**Cherwell Creek Tributary 2****Section 3**

Substrate: Silty bed material, with patches of gravel.

Water: February: Ponded translucent brown water.  
November: no water present.

Overbanks: Minimal riparian vegetation, mainly grasses.

**February 2007**

**Plate 3-4 Cherwell Creek Tributary 2, Site 2 towards Dam**



Looking towards dam

**Plate 3-5 Cherwell Creek Tributary 2, Site 2 Away from Dam**



Looking away from dam

**Section 3**

**Cherwell Creek Tributary 2**

*November 2007*

**Plate 3-6 Cherwell Creek T2 Upstream**



**Plate 3-7 Cherwell Creek T2 Downstream**



## Cherwell Creek Tributary 3

## Section 4

### 4.1 Cherwell Creek Tributary 3, Site 1

This site is located on a tributary of Cherwell Creek, adjacent to Peak Downs Highway. This tributary was investigated between E610971, N7552609 and E610906, N7552643 in February 2007 (refer attached figure).

Time of Investigation: 20 - 21 February 2007.

Depth of channel: 0.5m

Width of channel: 2m

Slope of banks: 30 - 45°

Stability of banks: Moderate (where banks are defined).

Substrate: Silty bed material, with patches of gravel.

Water: No water present.

Debris and tree roots: Not present.

Overbanks: Grass and trees.

Additional Comments: Peak Downs Highway crossing consists of 5 Reinforced Concrete Box Culverts 2.1m wide by 1.6-1.8m deep).

#### **February 2007**

#### **Plate 4-1 Cherwell Creek Tributary 3, Site 1 Downstream**



Looking downstream, brown silty soil and sparse gravel



**Section 4****Cherwell Creek Tributary 3****Plate 4-2 Cherwell Creek Tributary 3, Site 1 Culvert Crossing Peak Downs Highway**

Culvert crossing Peak Downs Highway

**Plate 4-3 Cherwell Creek Tributary 3, Site 1 Culvert Crossing**

Culvert crossing and creek



Five box culverts

**4.2 Cherwell Creek Tributary 3, Site 2**

This site is located on a tributary of Cherwell Creek, upstream of the Peak Downs Highway, at E610645, N75533304 (refer attached figure).

Time of Investigation: 20 - 21 February 2007.

Depth of channel: 0.5m

Width of channel: 0.5m

Slope of banks: 30 - 45°

Stability of banks: Moderate. Most areas covered with grasses, some evidence of erosion due to cattle.

## Cherwell Creek Tributary 3

## Section 4

Substrate: Silty bed material, with gravel.  
Water: No water present.  
Overbanks: Grasses.

**February 2007**

**Plate 4-4 Cherwell Creek Tributary 3, Site 2**



Looking downstream

**Section 5****Cherwell Creek Tributary 4****5.1 Cherwell Creek Tributary 4 South, Site 1**

This site is located on a tributary of Cherwell Creek, and falls within the study area (north of Harrow Creek and south of Cherwell Creek), at E615628, N7548170 (refer attached figure).

Time of Investigations:	17th June 2008
Depth of channel:	3-5 m
Width of channel:	1m wide base width
Slope of banks:	1 in 4 side slopes
Stability of banks:	Good (well grassed and vegetated)
Substrate:	Sandy material
Water:	None present
Debris and tree roots:	-
Overbanks:	Trees and grasses
Additional comments:	Reduced contributing catchment area as a result of mining operations.

**Plate 5-1 Cherwell Creek Tributary 4 South, Site 1 upstream**



Looking upstream (upstream of new back access road)

## Cherwell Creek Tributary 4

## Section 5

### Plate 5-2 Cherwell Creek Tributary 4 South, Site 1 downstream



Looking downstream (downstream of new back access road).

### 5.2 Cherwell Creek Tributary 4 North, Site 1

This site is located on a tributary of Cherwell Creek, and falls within the study area (north of Harrow Creek and south of Cherwell Creek), at E614379, N7548582 (refer attached figure).

Time of Investigations:	17th June 2008
Depth of channel:	2-3 m
Width of channel:	0-1m wide base width
Slope of banks:	1 in 4 side slopes or less
Stability of banks:	Good (well grassed and vegetated)
Substrate:	Sandy material
Water:	None present
Debris and tree roots:	-
Overbanks:	Trees and grasses
Additional comments:	Reduced contributing catchment area as a result of mining operations.



**Section 5**

**Cherwell Creek Tributary 4**

**Plate 5-3 Cherwell Creek Tributary 4 North, Site 1 upstream**



Looking upstream (upstream of new back access road)

**Plate 5-4 Cherwell Creek Tributary 4 North, Site 1 downstream**



Looking downstream (downstream of new back access road)

## 6.1 Nine Mile Creek Site

This site is located on Nine Mile Creek, upstream of the confluence with Cherwell Creek, between E611079, N7549220 and E610551, N7548825 (refer attached figure).

Time of Investigation:	20 – 21 February 2007.
Depth of channel:	Varying between 1.5 m and 3-4m (outside bend in one small part of the site).
Width of channel:	5-8m at stream channel
Slope of banks:	45 – 90°
Stability of banks:	Moderate: most areas covered with vegetation (grasses and trees), however undermining of the banks is occurring at bends.
Substrate:	Sandy bed material.
Water:	No water present.
Debris and tree roots:	None present.
Overbanks:	Large trees and grasses.

**Plate 6-1**      **Nine Mile Creek**



Both looking downstream

## Section 7

## Horse Creek

## 7.1 Horse Creek Site 1

This site is located on the upper reach of Horse Creek. Located at E607960, N7555558 (refer attached figure).

Time of Investigation 20 – 21 February 2007 and 22 - 23 November 2007.

Depth of channel: 0.5 – 1.0m

Width of channel: 1.0m at stream channel downstream of the track crossing. 3.0m at stream channel upstream of the track crossing (measured 20 - 21 February).

Slope of banks: 45°

Stability of banks: Moderate: Most areas covered with vegetation (grasses).

Substrate: Silty bed material deposited upstream of the track crossing, gravel downstream of the track crossing.

Water: February: Pool of cloudy brown water upstream of the track crossing – not permanent.

November: Ponded water backed up by road crossing upstream (orangy brown).

Debris and tree roots: February: Small exposed tree roots downstream of the track crossing. November: A number of log jams were present – obstructing approximately 30-50% waterway area.

Overbanks: Some trees, mainly grasses.

Additional comments: Profile of the creek is altered by the track in this location.

**November 2007****Plate 7-1 Horse Creek Site 1 Downstream from crossing**

Downstream from road crossing

## 7.2 Horse Creek Site 2

This site is located downstream of Site 1 and was investigated at location E608218, N7557405 (refer attached figure).

Time of Investigation	22-23 November 2007 and 16th June 2008
Depth of channel:	1.2m
Width of channel:	3.0m
Slope of banks:	90°
Stability of banks:	Poor: undermining and over bank erosion.
Substrate:	Clay.
Water:	Upstream: Opaque (0.5m depth). Downstream: no ponded water.
Debris and tree roots:	None.
Overbanks:	Grassed overbanks. Sparse riparian vegetation.
Additional comments:	Track and cow path causing water to pond upstream. High amounts of fine suspended solids.

### November 2007

**Plate 7-2 Horse Creek Site 2 Upstream**



Looking upstream

## 7.3 Horse Creek Site 3

This site is located at E608192, N7559349 (refer attached figure).

Time of Investigation	22 - 23 November 2007.
Depth of channel:	0.4m (downstream), 4m (upstream).



**Section 7****Horse Creek**

Width of channel:	4.5m
Slope of banks:	45°
Stability of banks:	Moderate.
Substrate:	Sandy.
Water:	No water present.
Debris and tree roots:	A number of log jams were present – obstructing approximately 70% waterway area.
Overbanks:	Varying heights.
Additional comments:	More riparian vegetation than previously seen on Horse Creek and its tributaries.

**Plate 7-3 Horse Creek Site 3 Downstream**

Looking downstream

**Plate 7-4 Overbank Erosion**

## 7.4 Horse Creek Site 4

Horse Creek was investigated between E608696, N7559458 and E608584, N7559362 (refer attached figure).

Time of Investigation 20 – 21 February 2007

Depth of channel: 2.5-3m and 4m (outside bend in one small part of the site).

Width of channel: 3-5m at stream channel.

Slope of banks: 45°, with some outside bends up to 90°.

Stability of banks: Moderate. Most areas covered with vegetation (grasses and some trees), however some banks that are not vegetated are subject to erosion and this is exacerbated by cattle tracks up and down the banks.

Undermining of the banks is occurring at bends.

Substrate: Gravel and rocky bed material (D50 ≈ 15-20cm).

Water: No water present and little evidence of pools/riffles.

Debris and tree roots: Log jam present – obstructing approximately 20% waterway area.

Overbanks: Some trees, mainly grasses.

### Plate 7-5 Horse Creek Site 4



Weathered basalt on bend

## Section 7

## Horse Creek

## Plate 7-6 Horse Creek Site 4



Rock bed material, approximately 15-20cm

## 7.5 Horse Creek Site 5

This site is located near where the power lines cross Horse Creek. Horse Creek was investigated between E609307, N7559692 and E609249, N7559550 (refer attached figure).

Time of Investigation 20 – 21 February 2007.

Depth of channel: Varying between 1-2 m and 3-4m (outside bend in one small part of the site).

Width of channel: 2–3m at stream channel, >5m at top of the banks.

Slope of banks: 45°, with some outside bends up to 90°

Stability of banks: Moderate. Most areas covered with vegetation (grasses and some trees), however some banks that are not vegetated are subject to erosion and this is exacerbated by cattle tracks up and down the banks. Undermining of the banks is occurring at bends.

Substrate: Gravelly bed material mixed with sand.

Water: Some pools of translucent brown water present – not permanent.

Debris and tree roots: A number of log jams were present – obstructing approximately 40-70% waterway area. Deposition of sediment and rocks (approx D50 ≈ 20cm) was present upstream of these log jams.

Overbanks: Some trees, mainly grasses

Additional comments: In some of the deeper pools, small fish, large tadpoles, yabbies, prawns and crabs were identified.

## Horse Creek

## Section 7

Plate 7-7 Horse Creek Site 5



Log jam. Looking west from log jam.

Plate 7-8 Horse Creek Site 5



Pool, just near power line, looking east.

## 7.6 Horse Creek Site 6

This site is located at E609878, N7560360 (refer attached figure). It is upstream of the road crossing which consists of two 3m wide by 1.8m high culverts (located at E609997, N7560449). The distance from the obvert to the road crest is 1m.

Time of Investigation 22 - 23 November 2007 and 16th June 2008

Depth of channel: 1.0 – 2.0m

Width of channel: Varies between 2.0 – 5.0m

Slope of banks: 90°

Stability of banks: Moderate: direct bank scour, undermining and some overland erosion. Evidence of disturbance by cattle.



**Section 7****Horse Creek**

Substrate:	Moderately to poorly sorted. Angular to subangular. Varying from granules to very large pebbles (1 – 40mm).
Water:	No water present.
Debris and tree roots:	Minimal downstream with slightly more upstream.
Overbanks:	Grasses with sparse riparian vegetation.
Additional comments:	Non-uniform.

**November 2007****Plate 7-9 Horse Creek Site 6 Downstream**

Looking upstream

**Plate 7-10 Horse Creek Site 6 Upstream**

Looking downstream at pool

## Horse Creek

## Section 7

### Plate 7-11 Culverts on Horse Creek (Site 6)



Horse Creek crossing culverts, looking downstream

*June 2008*

### Plate 7-12 Horse Creek Site 6 Upstream



Looking upstream from road crossing

**Section 8****Horse Creek Tributary 1****8.1 Horse Creek Tributary 1, Site 1**

This site is located on a tributary of Horse Creek at E607682, N7554376 (refer attached figure).

Time of Investigation: 20 – 21 February 2007

Depth of channel: 0.2 – 0.3m.

Width of channel: 1m at stream channel.

Slope of banks: 30 - 45°

Stability of banks: Moderate, most areas covered with grasses, adjacent to the track, no bank is present due to cattle interference.

Substrate: Fine gravel and silt bed material.

Water: Some pools of light brown opaque water present – not permanent.

Debris and tree roots: No debris or tree roots present.

Overbanks: Mainly grasses.

Additional comments: Profile of the creek is altered by the track and cattle interference in this location.

**Plate 8-1 Horse Creek Tributary 1 Site 1**

Horse Creek tributary

## Horse Creek Tributary 1

## Section 8

### Plate 8-2 Horse Creek Tributary 1 Site 1



Ponded water



**Section 9****Horse Creek Tributary 2****9.1 Horse Creek Tributary 2 Site 1**

This site is located on a tributary of Horse Creek, just upstream of a farm dam (refer attached figure).

Time of Investigation 22 - 23 November 2007

Depth of channel: 0.5 – 1.0m

Width of channel: 3.0 - 4.0m

Slope of banks: 1:2 – 1:3 (highly variable looking downstream).

Stability of banks: Poor: Interference from cattle.

Substrate: Muddy.

Water: Opaque.

Debris and tree roots: None.

Overbanks: Grassed overbanks. No riparian vegetation.

Additional comments: Embankment of dam is on creek therefore if the rainfall is high enough water will flow into another channel.

**Plate 9-1 Horse Creek Farm Dam**



Panoramic of dam

## Horse Creek Tributary 2

## Section 9

**Plate 9-2 Horse Creek Tributary 2 Upstream**



Just upstream of dam

**Plate 9-3 Horse Creek Tributary 2 Downstream**



Downstream of dam

### 9.2 Horse Creek Tributary 2, Site 2

This site is located approximately 300 m upstream of the confluence of Tributary 2 with Horse Creek.

Located at E608868, N7559202 (refer attached figure).

Time of Investigation 21 - 22 February 2007 and 16th June 2008.

Depth of channel: 1.5 - 2m

Width of channel: 2.0m

Slope of banks: Difficult to assess due to the vegetation cover.

Stability of banks: Moderate. Most areas covered with vegetation (grasses), but some bare areas.

Substrate: Gravely sand.

**Section 9**

**Horse Creek Tributary 2**

Water: No water present.  
Debris and tree roots: Grass within the stream channel.  
Overbanks: Some trees, mainly grasses.

**February 2007**

**Plate 9-4 Horse Creek Tributary 2 Site 2**



Pool upstream of crossing

**Plate 9-5 Horse Creek Tributary 2 Site 2**



Looking upstream from crossing

## Horse Creek Tributary 2

## Section 9

June 2008

**Plate 9-6** Horse Creek Tributary 2 Site 2 Upstream



Looking upstream

**Plate 9-7** Horse Creek Tributary 2 Site 2 Downstream



Looking downstream



**Section 10****Horse Creek Tributary 3****10.1 Horse Creek Tributary 3, Site 1**

This site is located on a tributary of Horse Creek (refer attached figure).

Time of Investigation 22 - 23 November 2007

Depth of channel: Less than 0.5m

Width of channel: 1.0m (smaller in some sections)

Slope of banks: 90°

Stability of banks: Poor: some grass vegetation.

Water: Brown (0.2m deep)

Debris and tree roots: None

Overbanks: Minimal overbank vegetation. Some grassed overbanks.

Additional comments: Creek ends downstream may have been earthworks.

**Plate 10-1 Horse Creek Tributary 3 Downstream**

Looking downstream

## Horse Creek Tributary 4

## Section 11

### 11.1 Horse Creek Tributary 4, Site 1

This site is located on a tributary of Horse Creek, at E610596, N7559140 (refer attached figure).

Time of Investigation	22 - 23 November 2007
Depth of channel:	0.5 – 0.7m
Width of channel:	3.0m
Slope of banks:	90o
Stability of banks:	Poor: some grass vegetation.
Substrate:	Poorly sorted. Cobbles. Subrounded to subangular.
Water:	No water present.
Debris and tree roots:	Minimal.
Overbanks:	Grassed overbanks. No riparian vegetation.

#### Plate 11-1 Horse Creek Tributary 4 Downstream



Looking downstream

### 11.2 Horse Creek Tributary 4, Site 2

This site is located on a tributary of Horse Creek. Located at E610083, N7559948 (refer attached figure). A farm dam exists just upstream of Site 2.

Time of Investigation	22 - 23 November 2007
Depth of channel:	0.5 – 1.0m
Width of channel:	4.0m
Slope of banks:	90o
Stability of banks:	Poor: high level of cattle interference

**Section 11**

**Horse Creek Tributary 4**

Substrate: Muddy  
Water: Translucent (yellow/green)  
Debris and tree roots: None  
Overbanks: Grasses with sparse riparian vegetation  
Additional comments: Water backed up from dam.

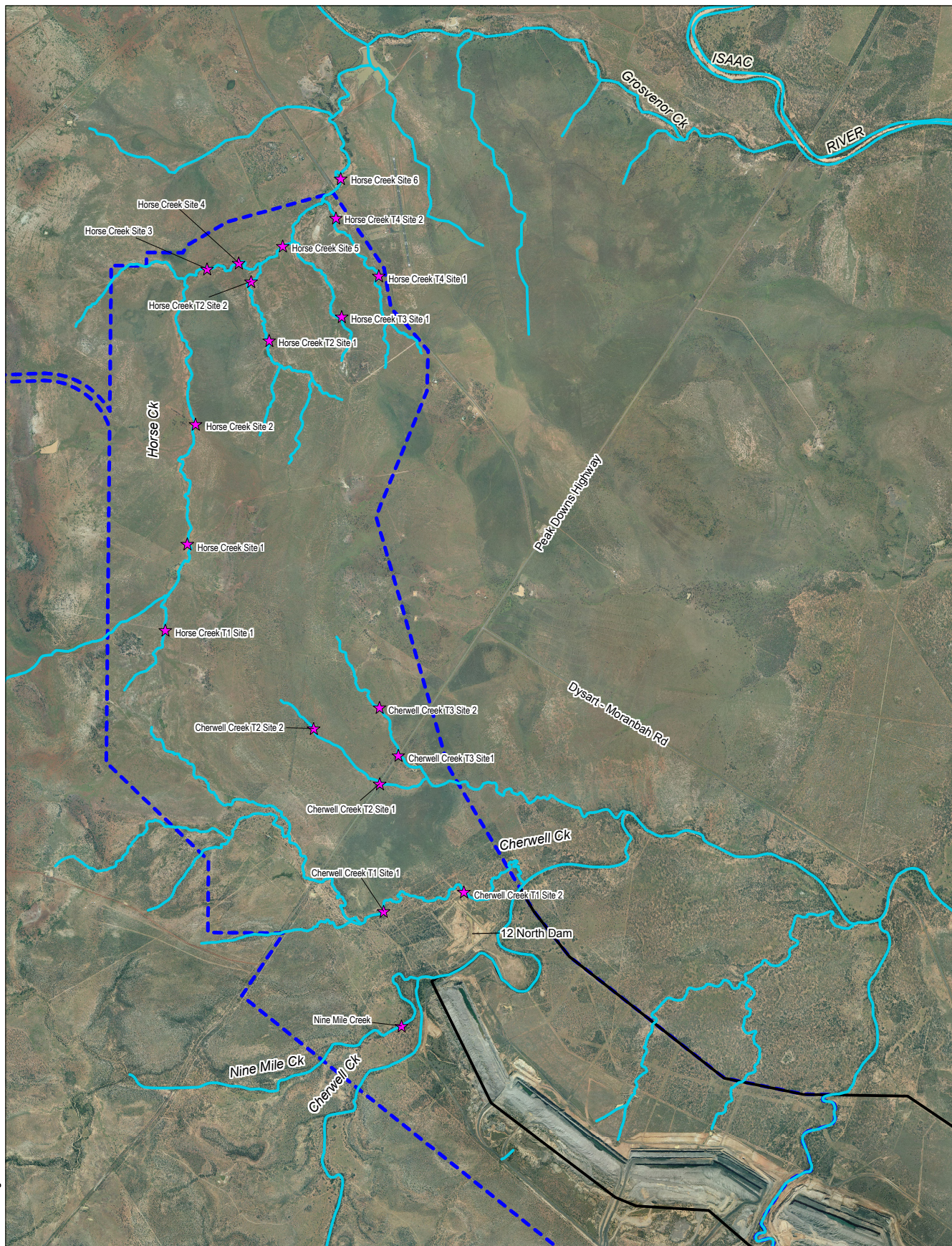
**Plate 11-2 Horse Creek Tributary 4 Site 2, Farm Dam**



Dam looking upstream

Figure





0 1.25 2.5km



Scale 1:75 000 (A4)

Datum: AGD84 AMG Zone 55

Source: Client supplied aerial photo, November 2007

- ★ Identification Points
- ▭ Study Area
- Drainage Features

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Client  BHP Billiton Mitsubishi Alliance  	Project  CAVAL RIDGE PROJECT SURFACE WATER SITE VISIT ASSESSMENT		Title  SURFACE WATER SITE VISIT IDENTIFICATION POINTS	
	Drawn: VH Job No: 4262 6158 /6163	Approved: RS File No: 42626158-g-187.wor	Date: 08-05-2008	Figure: 1