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FORTESCUE METALS GROUP
CHRISTMAS CREEK WATER MANAGEMENT SCHEME
NORTHERN QUOLL ANNUAL MONITORING REPORT 2014

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ecologia Environment
Level 10, Carillon City Office Tower
207 Murray St
PERTH WA 6000
Phone: +61 (0)8 6180 4450
Fax: +61 (0)8 6180 4451
Email: admin@ecologia.com.au

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ACRONYMS

DEC	Department of Environment and Conservation (now DPaW)
DoE	Department of Environment (formerly DSEWPaC)
DPaW	Department of Parks and Wildlife (formerly DEC)
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities (now Department of the Environment)
EPA	Environmental Protection Authority
EP Act	*Environmental Protection Act 1986*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
FMP	Fauna Management Plan – Christmas Creek – Water Management Scheme. (CC-PL-EN-0003_Rev1)
IBRA	Interim Biogeographic Regionalisation for Australia
WC Act	*Wildlife Conservation Act 1950*

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EXECUTIVE SUMMARY

Fortescue Metals Group is developing the Pilbara Iron Ore and Infrastructure Project, which involves a series of iron ore mines (Cloudbreak, Christmas Creek and Solomon) in the Pilbara region of Western Australia. The Christmas Creek mine site is located approximately 110 kilometres north of Newman, on the Roy Hill and Hillside pastoral leases.

The Christmas Creek mine site, in the eastern Pilbara, was approved by both the State and Commonwealth in December 2005 as part of the *Stage B Project: An east-west railway line and Christmas Creek and Mindy Mindy mines* (Ministerial Statement 707; EPBC Approval Decision 2004/1562). Mining commenced in 2008, and has since been predominantly above the water table. To access further ore deposits (located below the water table) approval for increased dewatering was required.

Additional information was provided in the document *Christmas Creek Water Management Scheme: EPBC Fauna Impact Assessment, CC-RP-EN-0014*, and the Minister's delegate approved the project, subject to conditions, on 11 August 2011 under EPBC Act approval 2010/5706. Condition 14 of the EPBC Act approval required the preparation of a Fauna Management Plan (FMP). The FMP (CC-PL-EN-003_Rev2) and qualified expert review of the plan, was approved by DSEWPaC on 12 January 2012. Because environmental factors can influence population monitoring, the Department requested three years of annual monitoring for Northern Quoll to be completed at a reduced scope and intensity (detection of scats only).

Monitoring was conducted in accordance with the objectives and methodology outlined in the fauna monitoring guidelines described in the Christmas Creek Water Management Scheme Fauna Management Plan, as well as in accordance with the EPA's Guidance Statement No. 56 (EPA 2004), Position Statement No. 3 (EPA 2002) and *Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA and DEC 2010). Species specific guidelines for surveying the Northern Quoll (DSEWPaC 2011) were also consulted during the development of survey methods.

Sampling sites were established within the impact zone of the Christmas Creek Mine, using the following two sampling methods:

- Scat search transects; and
- Motion cameras.

No individuals nor secondary evidence (tracks or scats) of the Northern Quoll were recorded during the current survey. As no Northern Quolls have been recorded in the two years of monitoring at Christmas Creek, there is insufficient data to test for significant variation within the Northern Quoll population across the monitoring period. Sampling effort will be repeated during future monitoring and if Northern Quoll are recorded during future monitoring, statistical differences can then be tested for.

The detection of no individuals nor secondary evidence (tracks or scats) of the Northern Quoll are consistent with those expected, with few previous records existing and absence of typical critical habitat within the Project Area suggesting this species is likely to only occasionally occur.

In summary, the annual monitoring detailed in this report satisfies the requirements of the Christmas Creek Fauna Management Plan for 2013/2014 monitoring period. The next monitoring event will be in during winter 2015 (2014/2015 monitoring period).

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1 INTRODUCTION

1.1 PROJECT OVERVIEW

Fortescue is developing the Pilbara Iron Ore and Infrastructure Project, which involves a series of iron ore mines (Cloudbreak, Christmas Creek and Solomon) in the Pilbara region of Western Australia. The Christmas Creek mine site is located approximately 110 kilometres north of Newman, on the Roy Hill and Hillside pastoral leases (Figure 1.1).

The Christmas Creek mine site in the eastern Pilbara was approved by both State and Commonwealth in December 2005 as part of the *Stage B Project: An east-west railway line and Christmas Creek and Mindy Mindy mines* (Ministerial Statement 707; EPBC Approval Decision 2004/1562). Mining commenced in 2008, and has since been predominantly above the water table. To access further ore deposits (located below the water table) approval for increased dewatering was required.

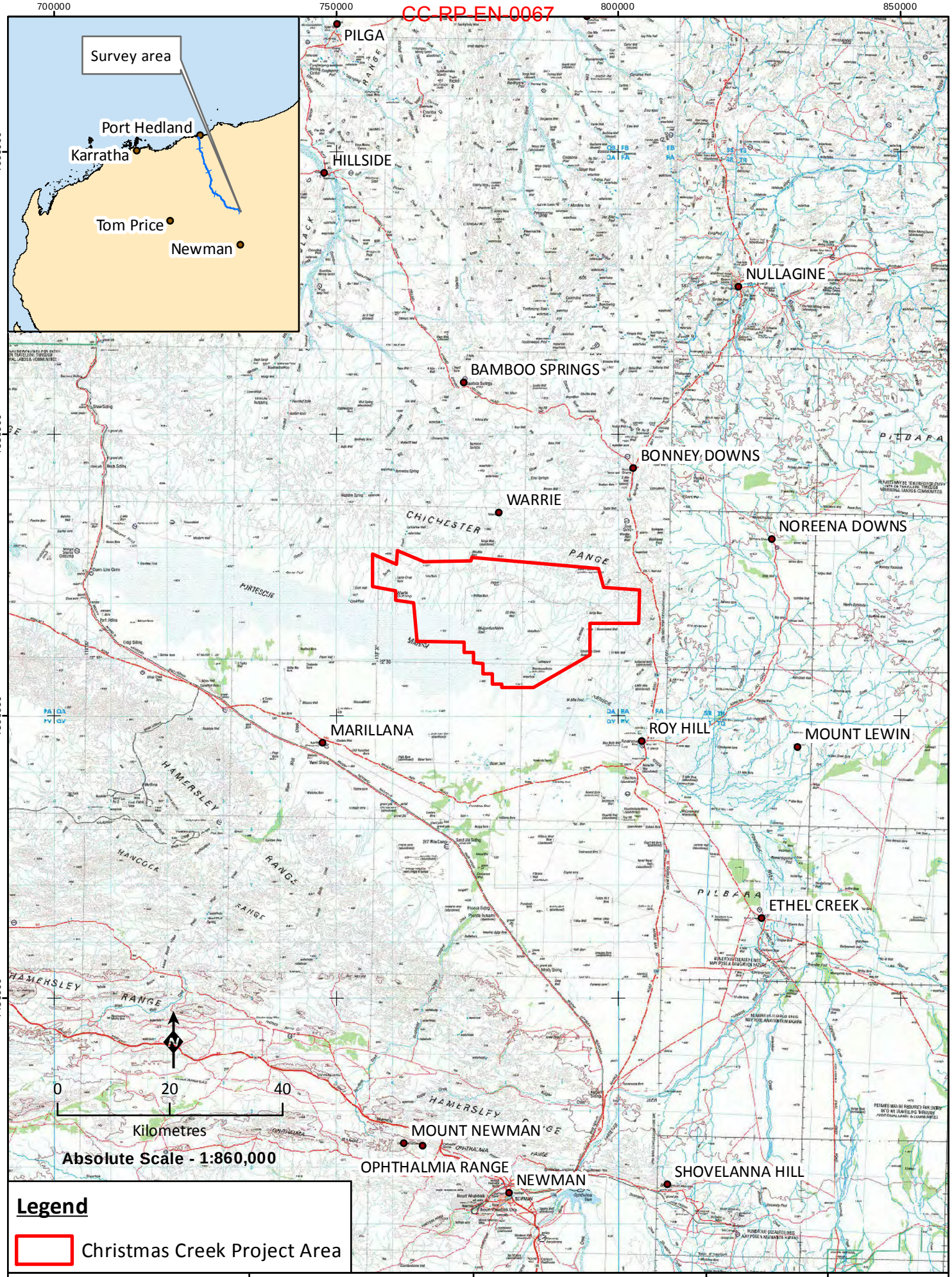
The increased dewatering requirements were met through the development of the Christmas Creek Water Management Scheme, which was referred to the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC - now the Department of the Environment (DoE)) in October 2010. DSEWPaC considered the project a "Controlled Action" to be assessed at the level of Assessment on Preliminary Documents, and requested information on the following matters of national environmental significance:

- Night Parrot (*Pezoporus occidentalis*);
- Northern Quoll (*Dasyurus hallucatus*);
- Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia* (Pilbara form);
- Greater Bilby (*Macrotis lagotis*);
- Mulgara (*Dasycercus cristicauda/blythi*); and
- Pilbara Olive Python (*Liasis olivaceus barronii*).

Additional information was provided in the document *Christmas Creek Water Management Scheme: EPBC Fauna Impact Assessment, CC-RP-EN-0014*, and the Minister's delegate approved the project, subject to conditions, on 11 August 2011 under EPBC Act approval 2010/5706. Condition 14 of the EPBC Act approval required the preparation of the Fauna Management Plan – Christmas Creek – Water Management Scheme. (CC-PL-EN-0003_Rev1) (FMP). The FMP (CC-PL-EN-003_Rev2) and qualified expert review of the plan, was approved by DSEWPaC on 12 January 2012.

Baseline (non-invasive) monitoring, required under the FMP, was completed between November 2012 and June 2013 by *ecologia* Environment (*ecologia*). The baseline monitoring recorded no evidence of Threatened fauna or critical habitat suitable to support Threatened fauna. Therefore, consistent with the FMP, which requires ongoing monitoring be conducted where Threatened fauna species presence has been confirmed, no additional monitoring was recommended by the baseline monitoring report.

However, because environmental factors can influence population monitoring, the Department requested three years of annual monitoring for Northern Quoll to be completed at a reduced scope and intensity, focussing on the detection of scats in drainage line and low hill habitat as mapped by ENV (2012).



Legend

Christmas Creek Project Area

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Location of Christmas Creek Project Area

Figure: 1.1 **Project ID: 1578**	**Drawn: NJ** **Date: 10/03/2014**

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: NJ088

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1.2 SCOPE OF WORK

The scope of work was to conduct an annual monitoring program for the EPBC Act listed Northern Quoll (*Dasyurus hallucatus*). The program was undertaken in accordance with the objectives and methodology described in the Christmas Creek Water Management Scheme Fauna Management Plan and the scope of work (CC-SW-EN-0013_Rev0), as well as in accordance with the EPA's Guidance Statement No. 56 (EPA 2004), Position Statement No. 3 (EPA 2002) and *Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA and DEC 2010).

The monitoring program was conducted:

- during the optimal season of activity (winter) to ensure ideal representation; and
- at Northern Quoll impact monitoring sites demarcated by Fortescue in the scope of work (CC-SW-EN-0013_Rev0) based on the following criteria:
  - (i) results of the baseline survey investigations;
  - (ii) access and heritage (ethnographic and archaeological) constraints;
  - (iii) avoidance of future infrastructure development areas;
  - (iv) Fortescue environment personnel advice; and
  - (v) adherence to statistical design.

1.3 SPECIES INFORMATION

Northern Quoll (*Dasyurus hallucatus*): EPBC Act Endangered, WC Act Schedule 1

The Northern Quoll formerly occurred across northern Australia, from the Pilbara region in Western Australia to south-eastern Queensland. A 75% reduction of available habitat occurred during the 20th century, so that the species is now restricted to the Pilbara and northern Kimberley in Western Australia, and a few discrete populations across the Northern Territory and eastern Queensland (Braithwaite and Griffiths 1994). Northern Quolls are most common on dissected rocky escarpments, but are also found in eucalypt forest and woodland, where they are both arboreal and terrestrial and use a variety of den sites, including rock crevices, tree hollows, logs, termite mounds and goanna burrows (Oakwood 2008).

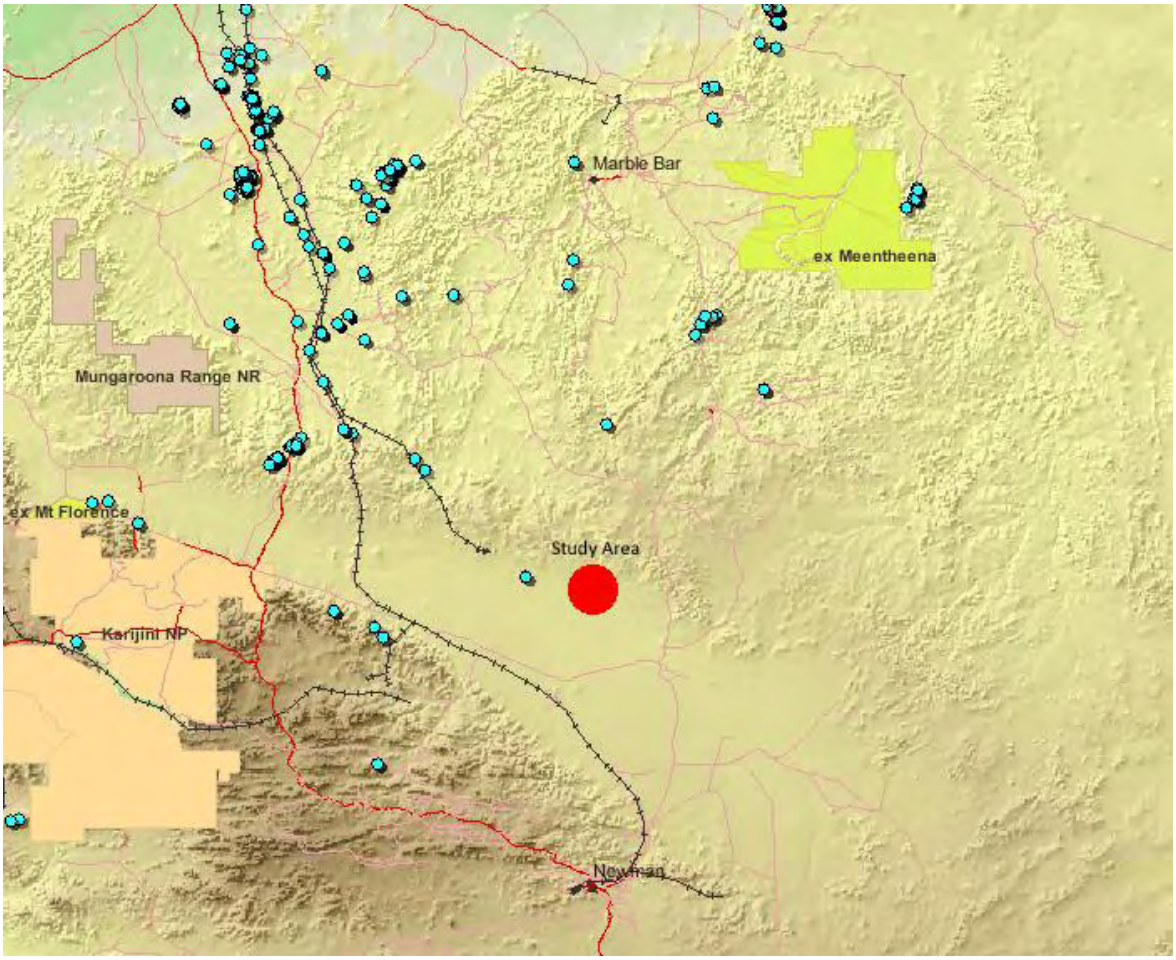
Northern Quolls are the smallest of the Australian quolls, and are nocturnal and opportunistic omnivores feeding primarily on small vertebrates, large insects and soft fruits. Breeding tends to occur near creeklines, where individuals go to drink when water is available.

The most common cause of adult Northern Quoll mortality is predation by dingoes, feral cats, snakes, owls and kites (Maxwell *et al.* 1996; Oakwood 2008). Other causes of mortality include predation by domestic dogs, motor vehicle strikes and pesticide poisoning. The level of predation is increased through the removal of groundcover by fire.

1.3.1 Previous records

Based on the below distribution of Northern Quoll records (Figure 1.2), there is a distinct paucity of records in both the Chichester and Hamersley Range to the immediate north and south of the study area with the exception of one record which occurs within 50 km of the study area. This record is from a WA museum specimen (No. M18909) collected in 1980 and although the co-ordinate that is given is located inside the western mounding area (119°32'00" E, 22°24'00"S), the accuracy of this location is only within 10 km, therefore it cannot be determined if this location is inside or outside of the impact area. The habitat at the given point location was assessed as open stony plain habitat (Figure 1.3) during the current monitoring, which is not considered suitable Northern Quoll habitat.

Additionally, two potential scats were recorded approximately 10 km west of the study area at Cloudbreak (ATA 2006), while a single scat was recorded 55 km to the east (Biota 2005).



Source: Naturemap (DPaW 2014)

Figure 1.2 – Regional NatureMap records of Northern Quoll

Figure 1.3 – Location of 1980 Northern Quoll record from NatureMap

ENV (2012) conducted a Level 2 vertebrate fauna and a targeted NQ survey in July/August 2011 at Christmas Creek, and although a very small area (74 ha) of suitable potential habitat was identified to the north of the study area, no evidence was recorded. A follow up targeted survey consistent with relevant guidelines was also completed, which failed to record any Northern Quoll.

2 SURVEY METHODOLOGY

Monitoring was conducted in accordance with the objectives and methodology outlined in the fauna monitoring guidelines described in the Christmas Creek Water Management Scheme Fauna Management Plan, as well as in accordance with the EPA's Guidance Statement No. 56 (EPA 2004), Position Statement No. 3 (EPA 2002) and *Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA and DEC 2010). Species specific guidelines for surveying the Northern Quoll (DSEWPaC 2011) were consulted during the development of survey methods.

Sampling sites were established within the impact zone of the Christmas Creek Mine, using the following two sampling methods:

- Scat search transects; and
- Motion cameras.

As it is not considered that any suitable habitat for Northern Quoll exists within the survey area, scat searches were completed in drainage line habitat types (consistent with FMP) within the potential drawdown and mounding areas, and in the rocky gorges and breakaways habitat identified by ENV (2012b) just outside of the drawdown and mounding areas to the north. Scat search transects were also conducted in the low hill habitat outside the impact area, however the small area of low hills habitat within the survey area was inaccessible due to the rail infrastructure.

Scat search transects are located in areas that will permit repeatable survey effort across the monitoring period, ensuring any resulting data to be analysed statistically.

Motion cameras were installed at 20 locations within the drainage line and rocky gorge habitats, and baited with sardines to act as an attractant.

The monitoring survey was conducted during the dry season in June 2014, which is appropriate to maximise the likelihood of recording Northern Quolls, in accordance with DSEWPaC's guidelines (DSEWPaC 2011). Survey timing and duration is summarised in Table 2.1.

Table 2.1 – Summary of survey timing and duration for each monitoring survey

Survey	Survey Dates	Duration (days)	Person Days
Northern Quoll	10-16 June 2014	7	14

Habitat condition was also used to determine the location of the monitoring sites. Habitat condition was assessed whilst on site based on the below criteria (Table 2.2) and good to excellent habitat was selected to increase the likelihood of capturing individuals from local populations.

Table 2.2 – Habitat condition categories

Habitat condition	Criteria
Excellent	Vegetation is pristine or nearly so*, no obvious sign of damage caused by modern humans or introduced fauna (cattle, feral cat, dog, rabbit). No signs of recent, extensive fires.
Very good	Some relatively slight signs of damage caused by the activities of modern humans. e.g. damage to tree trunks by repeated fires, no significant signs of introduced fauna or occasional vehicle tracks.
Good	More obvious signs of damage caused by the activities of modern humans, including some obvious impact to vegetation structure such as that caused by low levels of grazing or by selective logging. Some tracks or secondary evidence of introduced fauna. Some signs of recent fires.

Habitat condition	Criteria
Poor	Still retains basic vegetation structure or ability to regenerate it after very obvious impacts of modern humans such as partial clearing or very frequent fires. Presence of introduced fauna.
Very poor	Severely impacted by grazing, introduced fauna, fire, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management.
Completely degraded	Areas that are completely or almost completely without vegetation communities and are heavily impacted by extensive fires and/or introduced species e.g. cattle pasture.

*Assessment of vegetation condition follows the Trudgen scale (Department of Environmental Protection 2000)

The suitability of habitat for each species was assessed using the categories as provided in Table 2.3.

Table 2.3 – Characteristics and suitability of potential habitat for Northern Quoll

Species	Low suitability	Moderate suitability	High suitability
Northern Quoll	Rocky plain or creekline with limited shelter (tree hollows, crevices etc); mainly used for dispersal.	Rocky gully with some trees with hollows and crevices. Water may be present.	Rocky gorge with numerous boulders, permanent or semi-permanent water pools with high density of medium sized crevices, caves and eucalypt trees with hollows.

Note: Categories and habitat descriptions are based on current knowledge of the species

2.1.1 Timing

Northern Quolls were monitored during the dry season from 10-16 June 2014. This period is aligned with the commencement of the Northern Quoll mating season, with activity levels nearing their annual peak (particularly for males).

2.1.2 Monitoring site selection

Fourteen Northern Quolls scat-search transects were established along major drainage lines and rocky gorge terrain throughout the study area. The rocky gorge terrain is typically suitable for denning, while the drainage lines may provide foraging or dispersal opportunities. Each transect was searched on foot for scats by an experienced zoologist. The locations of each transect are mapped in Figure 2.1 - Figure 2.3 and the distance of each transect shown in Table 2.4.

Motion cameras were installed at twenty locations throughout the study area, in the drainage line and rocky gorge habitats that were identified as being potentially suitable for Northern Quoll. This included three motion camera locations in the previously identified (ENV 2012) potential shelter/den rocky gorge habitat located north of the study area, as well as seventeen motion camera locations spread across the drainage line habitats that dissect the study area. Cameras were secured to a suitably located tree using elastic straps. The area directly in front of the camera was baited using sardines as an attractant, which were crushed and spread across the field of view so as to ensure the scent would remain in place over a long period of time and continue to attract any nearby Northern Quolls to the camera site. Locations of motion cameras are shown in Table 2.5 and mapped in Figure 2.1 - Figure 2.3. Photographs of Motion Camera locations are provided in Appendix B.

2.1.3 Survey effort

A total of 52.5 hours of scat-searches was completed during the survey, totalling a distance of 137.0 km (Table 2.4). Motion cameras were deployed at 20 locations for six nights, totalling 2,880 recording hours (Table 2.4).

Table 2.4 – Length of scat-search transects within the study area

Transect	Transect Length (km)	Search Time (Min)
Transect 01	13.4	225
Transect 02	11.6	215
Transect 03	9.8	170
Transect 04	10.1	185
Transect 05	6.2	135
Transect 06	10.3	190
Transect 07	8.4	205
Transect 08	7.8	175
Transect 09	5.6	115
Transect 10	11.2	300
Transect 11	13.6	300
Transect 12	14.5	320
Transect 13	7.4	150
Transect 14	7.1	465
Total	**137.0**	**3150**

Datum: GDA 94, Zone: 50K

Table 2.5 – Locations of motion cameras within the study area

Motion Camera	Coordinates			Motion Camera	Coordinates	
	Easting	Northing			Easting	Northing
NQ MC01	760353	7525665		NQ MC11	791797	7525400
NQ MC02	760524	7522199		NQ MC12	791810	7525472
NQ MC03	764015	7525178		NQ MC13	791506	7525161
NQ MC04	768092	7524427		NQ MC14	782757	7515564
NQ MC05	765174	7523774		NQ MC15	788580	7512316
NQ MC06	769482	7523306		NQ MC16	786020	7515431
NQ MC07	773875	7522850		NQ MC17	792322	7510699
NQ MC08	774827	7518851		NQ MC18	792896	7512257
NQ MC09	777224	7518558		NQ MC19	795842	7519050
NQ MC10	778140	7518132		NQ MC20	791082	7513902

Datum: GDA 94, Zone: 50K

2.2 ANIMAL ETHICS

All monitoring was conducted as per *ecologia*'s Animal Ethics Code of Practice, which conforms to Section 5 of the Australian code of practice for the care and use of animals for scientific purposes (NHMRC 2004). In all cases, fauna were identified in the field and released at the point of capture.

2.3 MONITORING TEAM AND LICENCES

Field survey team members are listed in Table 2.6. The monitoring survey was conducted under DPaW Regulation 17 Licence SF009862.

Table 2.6 – Field survey personnel

Survey Member	Qualification	Experience
Damien Cancilla	BSc (Hon)	9 years
Matthew Macdonald	PhD	4 years

755000 760000 765000 770000

7525000 7520000 7515000

NQ MC1 NQ MC2 NQ MC3 NQ MC4 NQ MC5 NQ MC6

Transect 01 Transect 02 Transect 03 Transect 04 Transect 05

Legend

- Impact Area (Dry Climate Mounding)
- Impact Area (Wet Climate Drawdown)
- LOM Footprint
- Tracks

Christmas Creek Habitat Mapping

- Cleared and Developed
- Drainage Line and Surrounding Alluvial Plain
- Low Hill
- Marsh
- Northern Quoll - Potential shelter/den habitat
- Stoney Plain

Northern Quoll transects

- Transect 01
- Transect 02
- Transect 03
- Transect 04
- Transect 05
- Transect 06
- Transect 07
- Transect 08
- Transect 09
- Transect 10
- Transect 11
- Transect 12
- Transect 13
- Transect 14
- Motion camera

N

0 1 2

Kilometres

Absolute Scale - 1:50,000

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Location of scat-search transects and motions cameras at Christmas Creek – Map A

Figure: 2.1
Project ID: 1599

Drawn: BG
Date: 23/06/2014

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: BG345

A3

770000 775000 780000 785000 790000

7525000 7520000 7515000

Legend

- Impact Area (Dry Climate Mounding)
- Impact Area (Wet Climate Drawdown)
- LOM Footprint
- Tracks

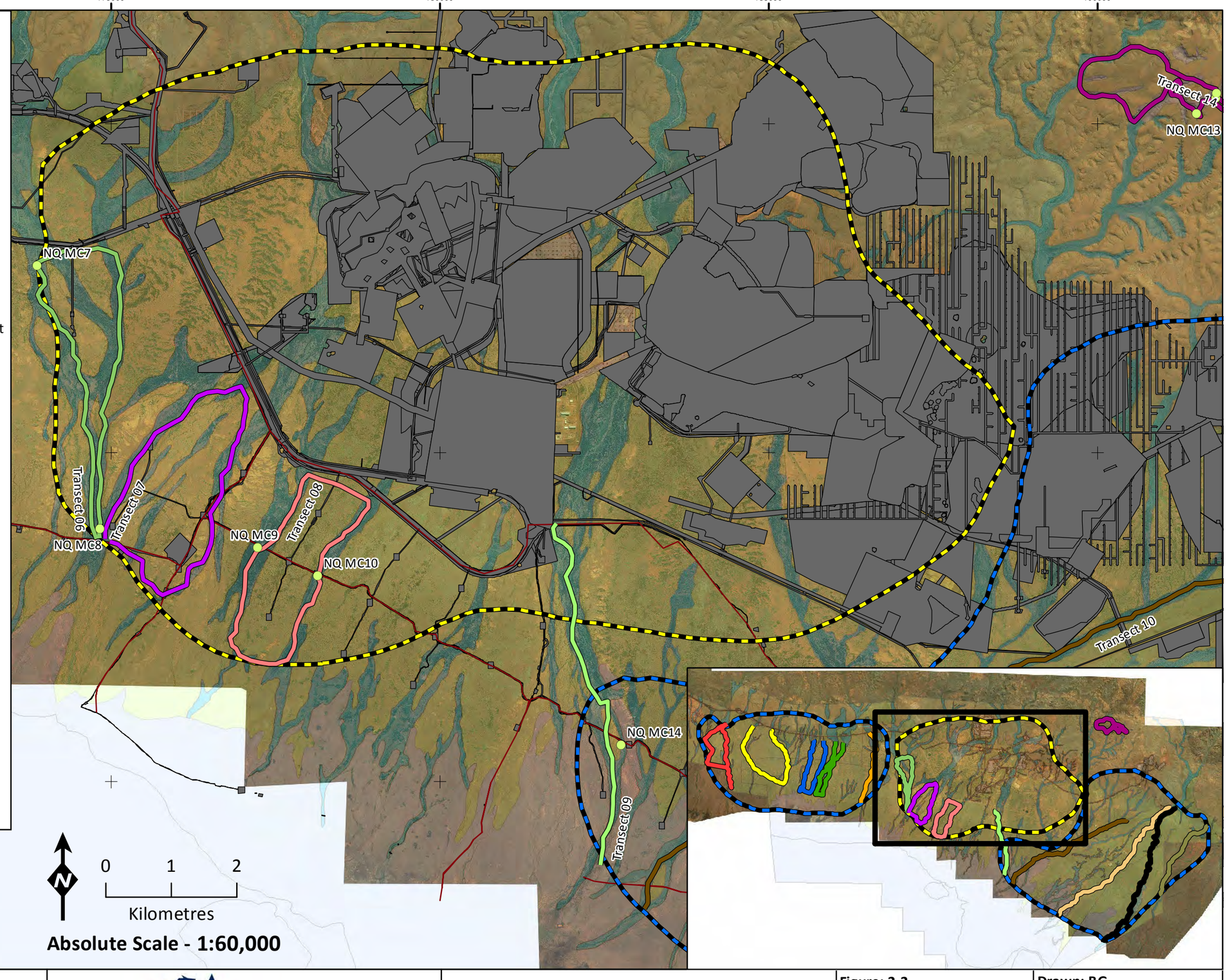
Christmas Creek Habitat Mapping

- Cleared and Developed
- Drainage Line and Surrounding Alluvial Plain
- Low Hill
- Marsh
- Northern Quoll - Potential shelter/den habitat
- Stoney Plain

Northern Quoll transects

- Transect 01
- Transect 02
- Transect 03
- Transect 04
- Transect 05
- Transect 06
- Transect 07
- Transect 08
- Transect 09
- Transect 10
- Transect 11
- Transect 12
- Transect 13
- Transect 14

Motion camera



N

0 1 2

Kilometres

Absolute Scale - 1:60,000

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FMG Fortescue The New Force in Iron Ore

Location of scat-search transects and motions cameras at Christmas Creek – Map B

Figure: 2.2
Project ID: 1599

Drawn: BG
Date: 23/06/2014

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: BG346

A3

775000 780000 785000 790000 795000 800000

7525000 7520000 7515000 7510000

Legend

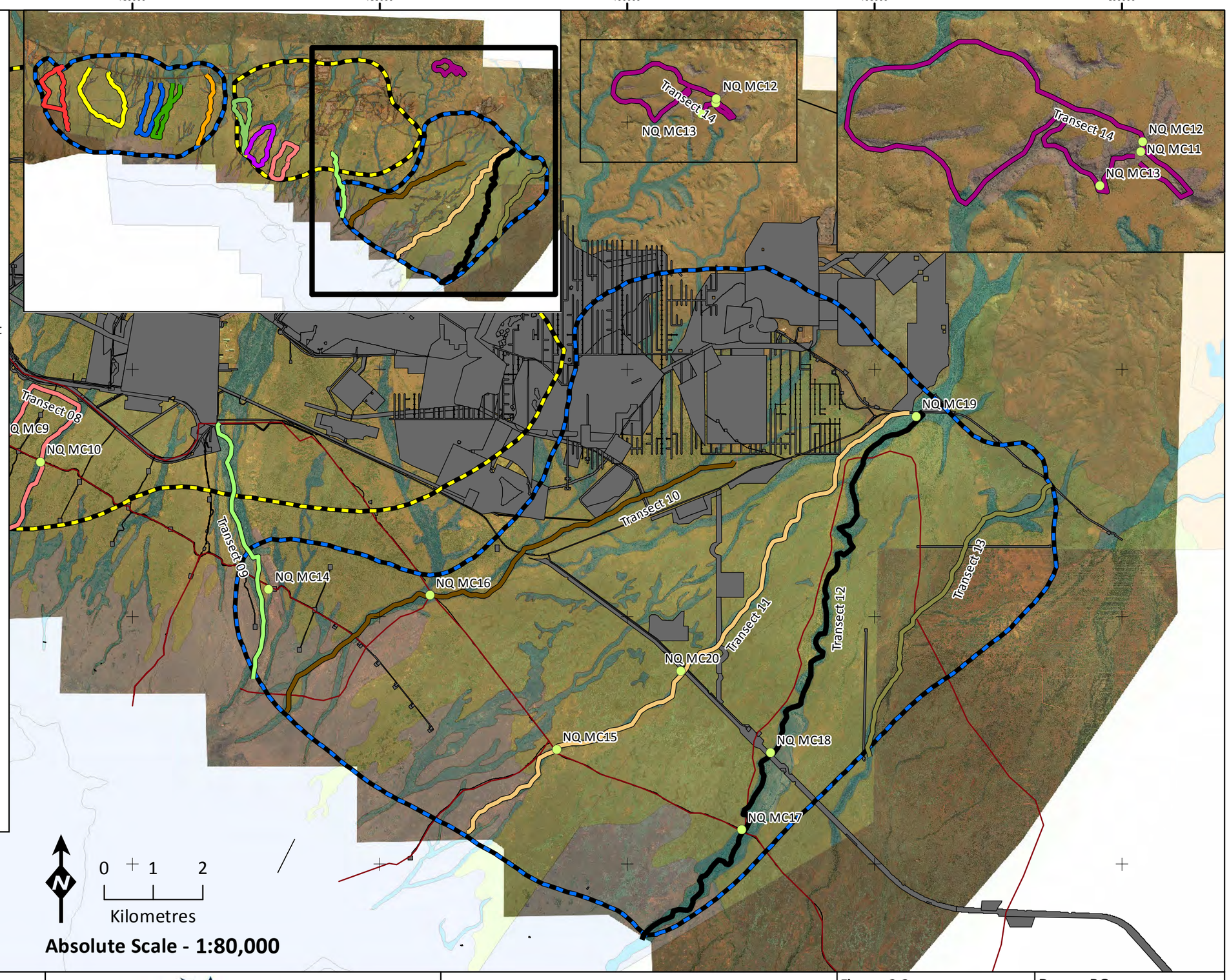
- Impact Area (Dry Climate Mounding)
- Impact Area (Wet Climate Drawdown)
- LOM Footprint
- Tracks

Christmas Creek Habitat Mapping

- Cleared and Developed
- Drainage Line and Surrounding Alluvial Plain
- Low Hill
- Marsh
- Northern Quoll - Potential shelter/den habitat
- Stoney Plain

Northern Quoll transects

- Transect 01
- Transect 02
- Transect 03
- Transect 04
- Transect 05
- Transect 06
- Transect 07
- Transect 08
- Transect 09
- Transect 10
- Transect 11
- Transect 12
- Transect 13
- Transect 14
- Motion camera



N

0 1 2

Kilometres

Absolute Scale - 1:80,000

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FMG Fortescue The New Force in Iron Ore

Location of scat-search transects and motions cameras at Christmas Creek – Map C

Figure: 2.3
Project ID: 1599

Drawn: BG
Date: 23/06/2014

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: BG347

A3

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3 RESULTS

3.1 NORTHERN QUOLL RECORDS

No individuals or secondary evidence of the Northern Quoll were recorded during the current survey.

3.2 STATISTICAL ANALYSES

As no Northern Quolls have been recorded in the two years of monitoring at Christmas Creek, there is insufficient data to test for significant variation within the Northern Quoll population across the monitoring period. However, the detection of Northern Quolls during future monitoring surveys will enable statistical analyses to be carried out by applying a variety of analysis methods (Henderson and Seaby 2008; Quinn and Keough 2002). This information will then be analysed with environmental attributes to permit an accurate determination of impact (if any) to be made.

3.3 ADDITIONAL NON-TARGET SPECIES RECORDED

During the survey, four species of conservation significance were recorded: the Peregrine Falcon (WC Act Schedule 3), Rainbow Bee-eater (EPBC Act Migratory), Australian Bustard (DPaW Priority 4) and Western Pebble Mouse (DPaW Priority 4). Ten records of feral cat were recorded from the study area from both motion cameras and walking transects. Details of non-target, conservation significant and feral pest fauna species recorded are listed in Table 3.1.

Table 3.1 – Non-targeted species records

Species	Coordinates		Record
	Easting	Northing	
Conservation Significant Species			
Peregrine Falcon (*Falco peregrinus)*	768090	7524065	Individual observed
Peregrine Falcon (*Falco peregrinus)*	767864	7521580	Individual observed (same individual as above record)
Rainbow Bee-eater (*Merops ornatus)*	760396	7523357	2 individuals observed
Rainbow Bee-eater (*Merops ornatus)*	781990	7518474	Individual observed
Rainbow Bee-eater (*Merops ornatus)*	795836	7519108	2 individuals observed
Australia Bustard (*Ardeotis australis)*	792255	7515011	Individual observed
Australia Bustard (*Ardeotis australis)*	795006	7513049	2 individuals observed
Australia Bustard (*Ardeotis australis)*	787527	7515899	2 individuals observed
Western Pebble Mouse (*Pseudomys chapmani)*	790679	7526168	Inactive Mound
Western Pebble Mouse (*Pseudomys chapmani)*	791445	7525717	Inactive Mound
Feral Pest Species			
Cat (*Felis catus)*	774832	7520101	Multiple tracks and scats in area
Cat (*Felis catus)*	782509	7515750	Multiple tracks and scats in area
Cat (*Felis catus)*	782567	7514353	Multiple tracks and scats in area
Cat (*Felis catus)*	782419	7513693	Multiple tracks and scats in area
Cat (*Felis catus)*	768092	7524427	Motion Camera
Cat (*Felis catus)*	765174	7523774	Motion Camera
Cat (*Felis catus)*	795842	7519050	Motion Camera
Cat (*Felis catus)*	791797	7525400	Motion Camera
Cat (*Felis catus)*	791810	7525472	Motion Camera
Cat (*Felis catus)*	791506	7525161	Motion Camera

Datum: GDA 94, Zone: 50K

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4 DISCUSSION

4.1.1 Targeted Northern Quoll monitoring

No Northern Quoll or secondary evidence was recorded during the current survey. Diurnal walking transects proved a successful method in recording tracks and scats of small mammals species of similar size to Northern Quoll, with multiple cat tracks and scats recorded from four areas of the major creeklines that were searched. Motion cameras also recorded cats at six locations confirming that the cameras were capable of recording Northern Quoll if present.

No critical habitat for Northern Quoll occur in the impact areas, so consistent with the FMP, habitats targeted included drainage lines within the impact areas, and rocky gorges and low hills outside the impact areas. Scat search transects were not completed in the low hills habitat type within the impact areas as they were unable to be accessed, due to the presence of active rail infrastructure.

Drainage line habitat types do not support permanent Northern Quoll populations and are typically only used by Northern Quoll to move through the landscape, between areas of suitable rocky habitat, where they can find shelter in any available rocky crevices or tree hollows in the surrounding eucalypts. Only three creeklines within the Christmas Creek mine site consist of large eucalypt lined creeklines with semi-permanent pools and fallen logs and tree hollows; Sandy Creek, Shaggy Creek and Christmas Creek drainage lines. The remaining drainage lines consisted of relatively dense mulga woodland which does not provide the necessary refuge habitat (large fallen logs and tree hollows) and is therefore of limited value as potential Northern Quoll habitat. The drainage line habitat in the Christmas Creek survey area does not connect areas of suitable rocky habitat and would only be used very rarely by individuals moving through the Fortescue Marsh between the Chichester and Hamersley Ranges.

Rocky gorge habitat is considered optimal habitat for the Northern Quoll; however, this habitat does not occur within the study area and has only been recorded in a small area to the north of the study area. Monitoring transects were conducted in this area, despite it being outside the impact areas, but again Northern Quoll were not recorded.

Despite the large amount of survey effort that has been conducted in this area (*ecologia* 2013; ENV 2012a, b), the lack of Northern Quoll records indicates that this species does not inhabit the Christmas Creek Water Management Scheme impact areas.

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5 CONCLUSION

The survey methods adopted by *ecologia* for the annual Christmas Creek targeted Northern Quoll monitoring program followed methodology outlined in the Christmas Creek Water Management Scheme Fauna Management Plan (CC-PL-EN-003_Rev1) and are in accordance with state and federal guidelines, including the EPA's Guidance Statement No. 56 (EPA 2004), Position Statement No. 3 (EPA 2002) and *Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA and DEC 2010). Species specific guidelines for surveying the Pilbara Olive Python (DSEWPaC 2011) were consulted during the development of survey methods. These methods were deemed suitable for detecting the presence of the Northern Quoll, when suitable habitats for the species are present.

No Northern Quolls were observed within the study area. The habitats targeted included low hills, drainage lines and rocky gorge habitat. As no Northern Quolls have been recorded in the two years of monitoring at Christmas Creek, there is insufficient data to test for significant variation within the Northern Quoll population across the monitoring period. Sampling effort at the scat-search transects and motion camera sites will be repeated during future monitoring. If Northern Quolls are recorded during future monitoring surveys, statistical differences can then be tested for.

The detection of no individuals nor secondary evidence (tracks or scats) of the Northern Quoll are consistent with those expected, with few previous records existing and absence of typical critical habitat within the Project Area suggesting this species is likely to only occasionally occur.

In summary, the annual monitoring detailed in this report satisfies the requirements of the Christmas Creek Fauna Management Plan for 2013/2014 monitoring period. The next monitoring event will be in during winter 2015 (2014/2015 monitoring period).

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APPENDIX A WEATHER DATA DURING SURVEY

Weather data during the survey taken from the Newman weather station (BoM station 007176).

Date	Minimum temperature (°C)	Maximum temperature (°C)	Rainfall (mm)
10/6/14	10.9	23.2	0
11/6/14	16.0	22.2	0
12/6/14	5.6	19.0	0
13/6/14	4.4	18.9	0
14/6/14	6.7	18.6	0
15/6/14	2.9	19.4	0
16/6/14	2.6	20.4	0

Weather data during the survey taken from the Marble Bar weather station (BoM station 4106).

Date	Minimum temperature (°C)	Maximum temperature (°C)	Rainfall (mm)
10/6/14	12.1	29.0	0
11/6/14	15.5	29.5	0
12/6/14	13.3	23.8	0
13/6/14	11.2	22.3	0
14/6/14	11.9	23.2	0
15/6/14	10.9	24.1	0
16/6/14	7.3	24.6	0

APPENDIX B MOTION CAMERA SITE PHOTOS

Motion Camera Site	Site photo
NQ MC01	
NQ MC02	

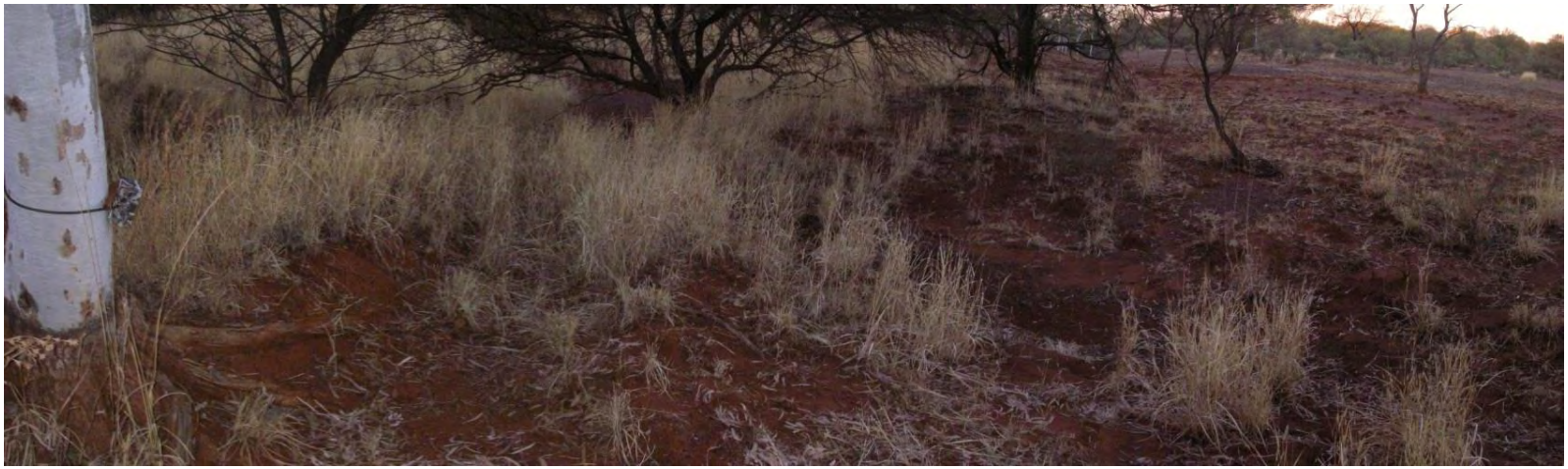
Motion Camera Site	Site photo
NQ MC03	
NQ MC04	

Motion Camera Site	Site photo
NQ MC05	
NQ MC06	

Motion Camera Site	Site photo
NQ MC07	
NQ MC08	

Motion Camera Site	Site photo
NQ MC09	
NQ MC10	

Motion Camera Site	Site photo
NQ MC11	
NQ MC12	

Motion Camera Site	Site photo
NQ MC13	
NQ MC14	

Motion Camera Site	Site photo
NQ MC15	
NQ MC16	

Motion Camera Site	Site photo
NQ MC17	
NQ MC18	

Motion Camera Site	Site photo
NQ MC19	
NQ MC20	

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APPENDIX C MOTION CAMERA PHOTO RECORDS

Magpie Lark – NQ MC17

Whistling Kite – NQ MC16

Cat – NQ MC04

Cow – NQ MC14

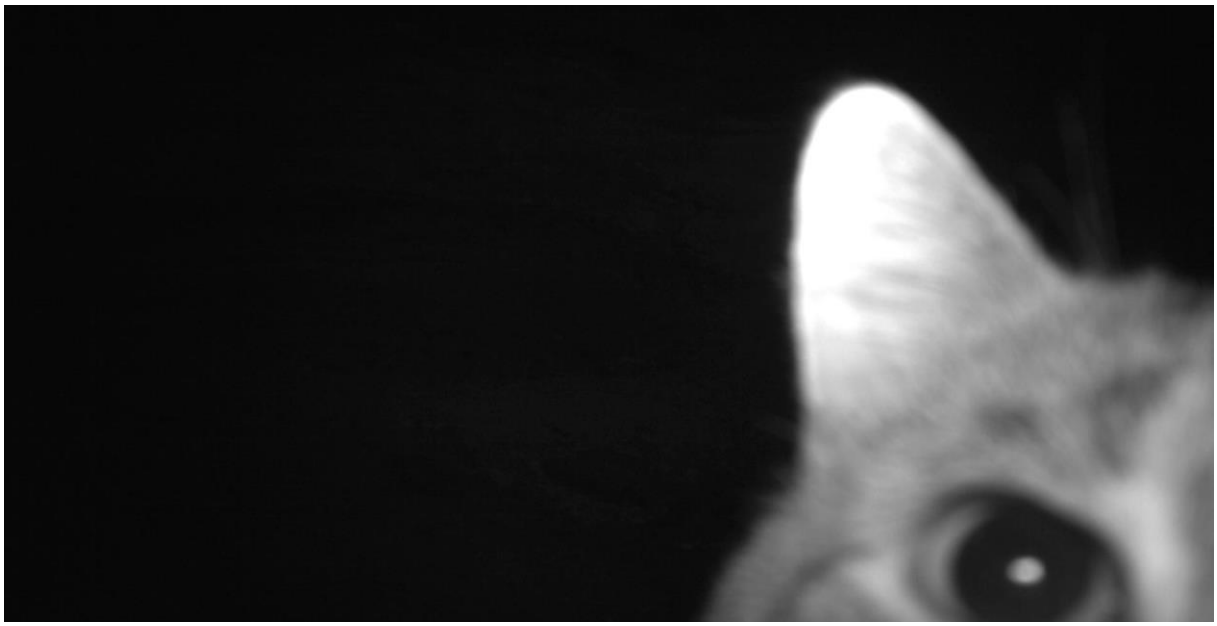
Cat (Black tail bottom left corner) – NQ MC14

Cat – NQ MC05

Cat – NQ MC12

Cat – NQ MC13

Grey Shrike Thrush – NQ MC S13



Cat – NQ MC11

Cat – NQ MC06

Cow – NQ MC06