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BC Iron Nullagine Project – Extension Areas (Bonnie East, Warrigal North and Coongan,): Northern Quoll Regional Analysis

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1 Introduction

BC Iron is investigating an extension of its Nullagine Iron Ore Project (NIOP) in the eastern Pilbara. This extension involves three prospective areas (Bonnie East, Warrigal North and Coongan; hereafter referred to as 'study areas') that lie close to existing operations. The environmental impact assessment (EIA) of these areas is well underway and includes a Level 1 (sensu EPA 2004) fauna survey (Bancroft and Bamford 2013). The assessment has highlighted the potential occurrence of the Northern Quoll (Dasyurus hallucatus) in the region, and the species was recorded in the original fauna investigations for the current mining operations (Everard and Bamford 2009). Subsequently there have been only scattered regional records based on the presence of scats (Bamford et al. 2012). The quoll is a species of national environmental significance (NES; species listed under the Environment Protection and Biodiversity Conservation Act 1999, the EPBC Act) and is also listed as Schedule 1 (rare and likely to become extinct) and ranked as Endangered under the Western Australian Wildlife Conservation Act 1950. It was considered that further information as to the availability of potential core Northern Quoll 'habitat' (i.e. sheltering/denning areas) in the region would be beneficial to the environmental impact assessment process. Bamford Consulting Ecologists (BCE) was commissioned by Strategen Environmental Consultants (on behalf of BC Iron) to undertake this investigation and this report delivers the results.

2 Background: Northern Quoll studies in the region

The Northern Quoll has been the subject of extensive targeted surveys in the NIOP area and surrounds. The most recent survey results are presented by Bamford *et al.* (2012) and Bancroft and Bamford (2013), and a summary of investigations to date follows.

The Northern Quoll was recorded in the initial fauna surveys in 2008 (for EIA for the original NIOP proposal) and, as result, a management programme was developed (Strategen 2010a, b). Despite extensive survey effort, no quolls have been recorded since the 2008 survey, although small numbers of scats have been found suggesting that the species is still present but is virtually undetectable (see Bamford *et al.* 2012 for details of survey effort and findings). Bamford *et al.* (2012) attributed the lack of records to dry conditions and extensive fires experienced in the region between the 2008 survey and the first of the management programme surveys in 2010. They suggested that it is likely that the region currently represents marginal habitat for the Northern Quoll (on the eastern edge of the species' range) and that it is colonised on an episodic basis as populations expand during periods (years or decades) of favourable conditions (e.g. consistent rainfall, minimal burning of habitat due to wildfire).

The Bonnie East, Warrigal North and Coongan study areas were searched for signs of Northern Quoll as part of the EIA (Bancroft and Bamford 2013); with no records returned.

3 Methods

Spatial analysis was used to predict Northern Quoll habitat within the study areas and surrounds. The central tenet of this approach is the strong affinity that Pilbara populations of the Northern Quoll have for rocky habitats with a high degree of relief; including gorges, steep gullies, breakaways, cliff lines and mesa edges (DSEWPaC 2013). Contour data, GIS software (Quantum GIS 1.8.0-Lisboa, QGIS 2013) and validation from field personnel (familiar with the Northern Quoll and the study areas that comprise the NIOP Extension proposal) were used to identify these features, as outlined below.

Elevation contours (at 5 m intervals) were provided by BC Iron. The contours covered the three study areas (Bonnie East, Warrigal North and Coongan) and some surrounding lands as shown in Figure 1. An initial aim of the study was to provide a 15 km 'regional' buffer (as per EPA 2004) around each study area. The limits of the provided contour data meant that this was not possible; however a c. 5 km buffer for most boundaries of most of the study areas was achieved and was considered to provide reasonable regional context. Thus the entire extent of the supplied contour data (c. 27 km by 14 km; c. 37 000 ha) was used for the analysis and is hereafter referred to as the 'analysis area'.

Preliminary spatial analysis was undertaken on several portions (test areas) of the analysis area to determine the suitability of the 5 m interval contour data. Results from these test areas were validated by personnel familiar with Northern Quoll, the site, its landforms and the areas known to have supported Northern Quoll previously. It was felt that the data did indeed produce an acceptable and realistic model for quoll habitat prediction. Several iterations of the test and validation procedure were conducted in order to refine the parameters to be used in the final analysis.

The final analysis was conducted systematically across the full extent of the contour data (i.e. the analysis area) and comprised the following steps:

- Data were converted from Microstation (dxf) format, as exported from the Gemcom Surpac[™] mining software package, to ESRI shapefile format;
- Geometry of the contour lines was cleaned to remove superfluous vertices and attributes;
- Data were imported into GRASS database format to enable analysis using GRASS functions;
- Conversion of data from vector line to vector point data;
- Surface interpolation of vector data points to create a digital elevation model (DEM) using regularized spline with tension method (GRASSWiki 2013);
- Generation of slope values from the DEM elevation raster map;
- Refinement of the DEM slope values. It was determined (through the validation process noted above) that areas within the DEM that had a slope of greater than 15° were most likely to 'capture' the landscape features that were best suited to Northern Quoll. This was deliberately generous to ensure that even marginally potential habitat was identified and to reduce the instance of a Type II error (i.e. reducing false negatives). Thus, any portion of the DEM with a slope greater than 15° was considered to be 'potential core quoll habitat';
- Conversion of the floating point slope cell data to integer values and reclassification into seven slope classes;

- Conversion of classified raster slope data to vector polygon data and calculation of polygon areas (ha);
- Spatial analysis (union, clip, join) to generate statistics for the potential core quoll habitat areas.

Ultimately this produced a map (and quantification) of the potential core Northern Quoll habitat for the analysis area (the 'region') and each of the survey areas (Bonnie East, Warrigal North and Coongan).

4 Results

Potential core Northern Quoll habitat for the NIOP Extension analysis area is shown in Figure 1, with individual maps for each of the study areas (and their surrounds) in Figure 4 (Coongan), Figure 2 (Bonnie East), and Figure 3 (Warrigal North). Full-resolution maps are also provided as separate files. Potential core Northern Quoll habitat is clearly concentrated along the more deeply dissected drainage systems and steep-sided mesa edges; habitat known to be highly desirable to Northern Quoll generally (DSEWPaC 2013) and within the bounds of the analysis area (Bamford *et al.* 2012).

It is acknowledged that the mapping represents a prediction and that Northern Quoll may occur outside of the habitat areas identified; however it is also considered that the analysis (and, hence, maps) does provide an excellent, standardised indication as to the landscape features that are likely to be the most desirable to Northern Quoll. Field-truthing of maps (and, therefore, validation of the method) in areas where Northern Quoll are known to occur could be used to further refine the technique; this was outside the scope of the present study.

A summary of the habitat areas is presented in Table 1. For the region (i.e. the entire analysis area), potential core Northern Quoll habitat was 2.4% of the total area. At 3.0% and 1.4%, respectively, the Coongan and Bonnie East survey areas had a similar representation of potential quoll habitat. The Warrigal North survey area, however, had a disproportionately higher extent of potential core quoll habitat (10.4%) when compared with the regional value. It is the higher suitability of the Warrigal North survey area for Northern Quoll that is responsible for percentage of potential core quoll habitat for all survey areas (4.3%) exceeding the regional value (i.e. 2.4%).

These finding reinforce the assertion of Bancroft and Bamford (2013): that the Warrigal North study area may be the most important of the three study areas with respect to potential core Northern Quoll habitat.

Although a 15 km regional buffer (as per EPA 2004) around each study area was not achieved (due to a lack of detailed contour data), it is likely that the occurrence of potential core quoll habitat is similar at this regional scale. The land systems (*sensu* Payne 2004) within the study areas (Robe, Rocklea and Wona, see Bancroft and Bamford 2013) extend in a continuous manner for at least 15-25 km from the centre of the analysis area. It can therefore be reasonably assumed that the landscape is broadly similar across this extent and that the availability of potential core quoll habitat could be expected to be similar to that estimated in this study (i.e. approximately 2.4% of the total land area, see Table 1).

 Table 1. The total area, and area of potential core Northern Quoll habitat, within the Bonnie East,

 Warrigal North and Coongan survey areas, and the region (analysis area).

Site	Total Area (ha)	Potential Core Northern Quoll Habitat	
		Area (ha)	Percentage (of Total)
Bonnie East survey area	1481.5	21.4	1.4%
Warrigal North survey area	758.9	78.6	10.4%
Coongan survey area	369.5	11.0	3.0%
All survey areas (total)	2609.9	111.0	4.3%
Analysis area	37 465.8	914.0	2.4%



Figure 1. Potential core Northern Quoll habitat in the NIOP Extension analysis area.



Figure 2. Potential core Northern Quoll habitat in the Bonnie East study area and surrounds.



Figure 3. Potential core Northern Quoll habitat in the Warrigal North study area and surrounds.



Figure 4. Potential core Northern Quoll habitat in the Coongan study area and surrounds.

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