LIDDELL

GLENCORE

Indirect Offset

Plan

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1. Purpose

LCO received approval for the extension of Liddell Open Cut Coal Mining Operations under the State *Environmental Planning and Assessment Act 1979* (EPA Act) on 1 December 2014 (DA 305-11-01 Modification 5) and approval under the Commonwealth *Environment Protection Biodiversity Conservation Act 1999* (EPBC Act) on 24 December 2014 (EPBC Approval 2013/6908).

The State and Commonwealth approvals both require the provision of an indirect offset to augment the agreed land-based biodiversity offsets to address the impacts of the project. This indirect offset was agreed to be a financial contribution towards recovery actions for the spotted-tailed quoll (Dasyurus maculatus maculatus) as part of the:

- Final Draft National Recovery Plan for the Spotted-tailed Quoll *Dasyurus maculatus* (Long and Nelson 2008); and/or
- Management actions identified for the spotted-tailed quoll as part of the NSW Biodiversity Conservation Division (BCD) Saving Our Species Project Species Action Statement.

This Indirect Offset Plan (IOP) has been prepared to satisfy the conditions of the State and Commonwealth approvals relating to this financial contribution.

The objective of this IOP is to specify how the $243,000 indirect offset (by way of financial contribution over not more than five years) will be used to support recovery actions for the quoll. The specific requirements of the project approval conditions in relation to this IOP are provided in **Section 2** below, and will be used to define the content of this IOP.

From the Glencore perspective, additional objectives for this IOP include:

- collection and interpretation of data that is relevant locally (in the Middle Foy Brook area), while also contributing to knowledge of this species from a regional perspective;
- collection and interpretation of data which is transferrable and able to inform management actions on other Glencore sites; and
- sharing of project outputs to relevant agencies to allow incorporation into existing management actions for the quoll.

2. Scope

The LCO IOP addresses the relevant components of Conditions 10 and 11 of the EPBC Approval 2013/6908 and Schedule 3 Condition 26 of NSW approval DA 305-11-01 (as modified). The details of these conditions and reference to where they are addressed in this IOP are provided in **Table 2-1**.

Condition	Relevant Section of the IOP
EPBC Approval 6908/2013	
10. To compensate for residual significant impacts on the Spotted-tailed Quoll, the approval holder must provide an Indirect Offset Plan to the Minister for approval, prior to 30 June 2015. This Plan must specify how it will allocate $243 000 over a period of not more than five years for recovery actions for the Spotted-tailed Quoll, as identified in either the Draft National	

Condition	Relevant Section of the IOP
Recovery Plan for the Spotted-tailed Quoll - *Dasyurus maculatus* (K. Long and J. Nelson 2008) or in the NSW Office of Environment and Heritage's Saving Our Species Project Species Action Statement. The Plan must include:	
a detailed description of the actions funding, including location and timing of activities;	Section 6.0
demonstration of how the funded activities are additional to any offset requirements of any existing approval conditions and additional to existing practise or other requirements;	Section 4.0 and Section 6.0
an explanation of how the activities described in the Plan will contribute to conservation of the Spotted-tailed Quoll;	Section 6.0
provisions to ensure appropriate management of funds and that auditable financial records are kept and maintained;	Section 5.0
provision for publication of findings:	Section 7.0
of a standard that would be acceptable for publication in an internationally recognised peer-reviewed scientific journal; and	
together with methodologies and results, on the internet within twelve months of the collection of results and in a form that may be accessed by the public.	
11. The approved Indirect Offset Plan must be implemented.	
DA 3015-11-01 Mod 7	
Spotted-Tailed Quoll Contribution	
Schedule 3 Cond. 26. The Applicant must contribute $200,000 over 5 years towards the implementation of recovery actions under OEH's Saving Our Species Action Statement and/or Final Draft National Recovery Plan for the Spotted-tailed Quoll 2008 for the Spotted-tailed Quoll. The initial payment of at least $50,000 must be made by the end of October* 2015, unless otherwise agreed by the Secretary. The timing and quantum of the subsequent payments is to be determined in consultation with OEH.	Section 5.0

Table 2-1 – Approval Conditions

3. Spotted-tailed Quoll Records from Middle Foy Brook Area

The spotted-tailed quoll (Dasyurus maculatus maculatus) is listed as vulnerable under the Biodiversity Conservation Act 2016 (BC Act) and as endangered under the EPBC Act. There are a number of records of this species in the general locality (defined broadly here as the Middle Foy Brook area, which comprises the land to the east, north-east and north of Lake Liddell/LCO and Mt Owen mine and to the north of the New England Highway). Records of the quoll have been obtained from LCO, the Ravensworth Operations Hillcrest Offset Site and the nearby Mt Owen mine. The location of each of these Glencore-owned mines, and their approved biodiversity offset areas are provided in **Figure 3-1.**

The Middle Foy Brook area contains a number of known records of the quoll, and these are depicted in **Figure 3-2**. These records are current as of October 2014, and include records from BioNet and the various ecological works completed for the relevant local Glencore operations. It is possible that further records of this species have been identified in this area in the intervening period.

The following points detail the known records of this species from the three Glencore sites:

Liddell Coal Operations

- quolls recorded during ecological survey and monitoring on numerous occasions in LCO, including within operational areas, along Bowmans Creek and in Mountain Block to the north;
- one female and two joeys were recorded and photographed at a den site located near to Bowmans Creek in November 2012;
- a minimum of six individual quolls have been identified (via photographs) at three locations on Bowmans Creek and at four locations at Mountain Block. A high level of activity was observed during the survey period, with 52 separate camera trap station visits attributed to quolls;
- latrine sites have been identified at eight locations at Mountain Block, including one large and regularly used latrine at the top of the hill. A total of six individual quolls were identified using this latrine between 6 and 17 June 2014, with multiple individuals visiting the latrine during a single 24 hour period on three occasions;
- scat samples were collected from seven latrine sites at Mountain Block and Bowmans Creek Riparian Corridor for dietary analysis;
- a den site containing fresh scats was identified under a boulder amongst rock outcropping near the large latrine in Mountain Block. This was monitored with a camera trap which recorded individuals investigating, entering and leaving the den on several occasions;
- movement of an individual from Mountain Block south along Bowmans Creek was recorded on 8 June, however it is likely that other individuals also move along the creek on a regular basis;
- the female recorded breeding in 2012 was not identified in the northern section of Bowmans Creek or Mountain Block, but was recognised from a camera trapping station placed by Enright Land Management approximately 400 metres east of where Umwelt and ELA recorded her in 2012;
- scat samples were collected from four latrine sites along Bowmans Creek, including three previously known and one newly discovered latrine. One previously known latrine showed a high level of activity with many fresh scats and multiple rocks used.

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Ravensworth Operations Hillcrest Offset Site

- three latrine sites, including a large and recently used one, were recorded in the Ravensworth Operations Hillcrest Offset Site. A camera trap was placed on one of these latrines, however no quolls were recorded using the latrine during the survey. Scat samples were collected from two of these latrines for dietary analysis.

Mt Owen Mine

- the species has been recorded regularly at Mt Owen during annual monitoring between 1994 and 2013 (except 1998, 1999 and 2005) in Ravensworth State Forest and surrounding woodland and forest communities, including in mine rehabilitation. There have been a number of unconfirmed sightings of the species within the Mt Owen active mine area;
- one male spotted-tailed quoll was fitted with a radio tracking collar and monitored between October and November 2012. The results indicated that the core habitat for the individual was centred on Ravensworth State Forest, with ancillary habitat in pastures and woodland remnants to the south and east and mine rehabilitation to the west;
- potential den sites in the northern portion of the Mt Owen complex have been identified through radio-tracking;
- a second male was collared and tracked between April and July 2013. Radio-tracking data indicated that habitat for this individual was centred on Ravensworth State Forest along with riparian and woodland habitats associated with Main Creek; and
- other non-tagged individuals have been recorded during camera trapping surveys.

Due to the number of records collected over at least two decades in this area, it is clear that a population of this species is resident in the Middle Foy Brook area. Records of a breeding female, two joeys and multiple males confirm that this population is able to breed in this area. In addition, records of quolls from a variety of tenures in the area (State Forest, agricultural land, operational areas, mine rehabilitation and biodiversity offset areas) shows that this population is making use of all of the habitat types available to it in this area.

A variety of survey methods have resulted in positive identification of this species in the Middle Foy Brook area, including hair tube sampling, spotlighting, camera trapping surveys, latrine searches, cage trapping and predator scat searches.

All of the natural and derived native vegetation communities in the local area provide potential foraging habitat for the quoll. These include derived native grassland, woodland, forest, riparian, rainforest and rehabilitated vegetation. This species has been recorded from operational lands and from non-operational lands in Middle Foy Brook.

There are few areas of intact native vegetation within the central Hunter Valley lowlands (the main Hunter Valley) that are of sufficient size to support the large home range of this species. It is recognised that for a habitat generalist such as the quoll it is difficult to define a regional population. It is likely that the fragmented habitats of the Hunter Valley floor (as well as major road, rail and other infrastructure networks crossing it) would impact genetic exchange from the Barrington Tops area in a southerly direction to individuals of this species in the Wollemi/Yengo National Parks areas. The Barrington Tops and Mount Royal Range areas provide reasonable geographic features with which to bound the population to the north, although there is likely to be no firm discontinuity in species records between the Middle Foy Brook area and habitats to the north of Barrington Tops.

For the purpose of this project, it is taken that a regional population of this species is focused on the footslopes to the south and west of the Barrington Tops and that this may be fragmented from those on the southern side of the Hunter Valley. This area comprises some 1800 km2 of land, of which

approximately 48 per cent is wooded, with about 52 per cent comprising agricultural lands. This regional population includes the Middle Foy Brook local population discussed earlier.

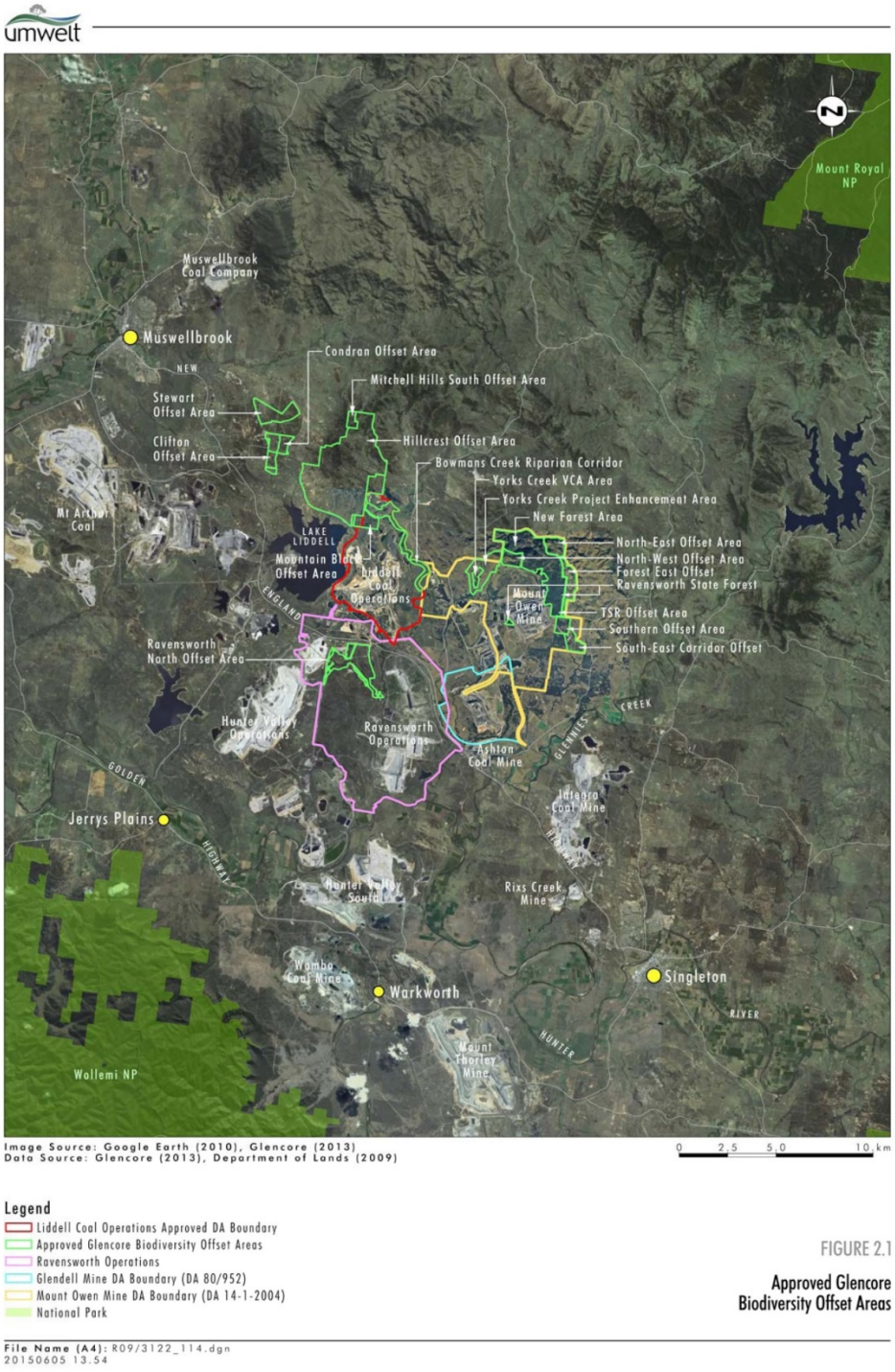

Figure 3-1 – Approved Glencore Biodiversity Offset Areas

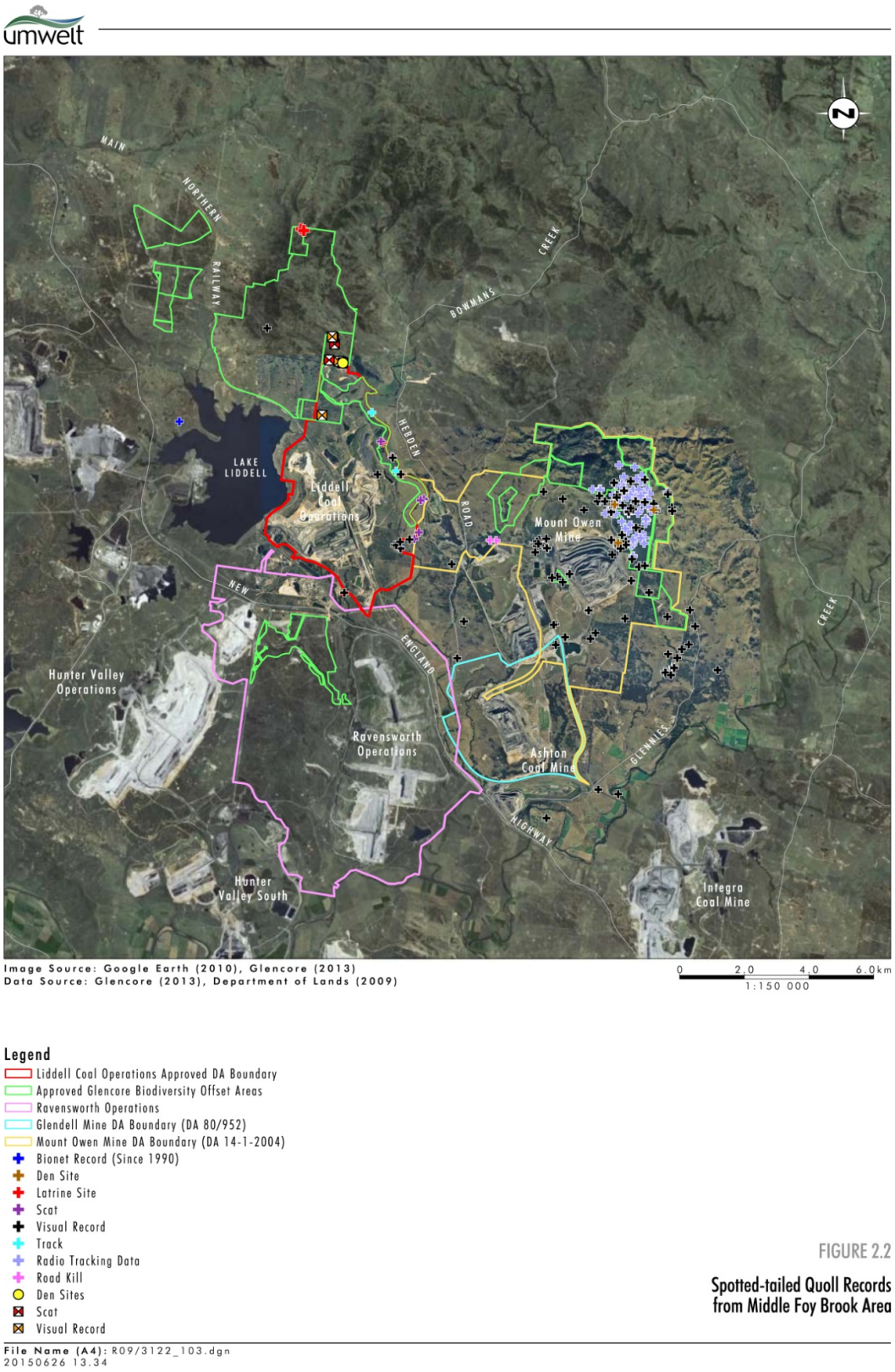

Figure 3-2 – Spotted-tailed Quoll Records from Middle Foy Brook Area

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4. Existing LCO Commitments relating to the Spotted-tailed Quoll

LCO currently has a number of management commitments that relate directly or indirectly to recovery objectives for the quoll. These existing commitments are detailed within the LCO Biodiversity Management Plan and Biodiversity Offset Management Plan and are identified broadly below. Also provided is a cross reference to the relevant recovery action these are contributing to/or in accordance with, as appropriate.

Operational Areas

- detailed pre-clearing and tree felling procedures to ensure minimal direct impact from approved clearing works;
- salvage of key habitat features (such as hollow logs, other fallen timber and boulders) for augmentation of existing habitat (where deemed lacking) or into rehabilitated/regenerated areas (National Recovery Action 3.2 – Maintain and Restore Habitat Corridors and State Management Action 2 – Restoration Projects to Increase Connectivity);
- nest box installation, maintenance and monitoring program to replace hollows lost from approved clearing works. This will occur in post-mining rehabilitated areas as well as regeneration of the biodiversity offset areas (National Recovery Action 3.2 – Maintain and Restore Habitat Corridors and State Management Action 2 – Restoration Projects to Increase Connectivity);
- rehabilitation of post-mining areas to native vegetation (National Recovery Action 3.2 – Maintain and Restore Habitat Corridors and State Management Action 2 – Restoration Projects to Increase Connectivity);
- reconstruction of log and boulder piles (as potential den habitat) where these are deemed lacking (National Recovery Action 3.2 – Maintain and Restore Habitat Corridors and State Management Action 2 – Restoration Projects to Increase Connectivity);
- ongoing ecological monitoring to determine usage of operational areas (National Recovery Action 1.3 – Monitor Population Status);
- grazing and bushfire management;
- pest management to control the presence of predators such as foxes, cats and wild dogs (State Management Action 3 – Implement Predator Control Programs and 4 – Monitor Quoll Populations to Investigate Predator Impacts); and
- weed control works to maintain habitat integrity.

Biodiversity Offset Areas

- in perpetuity conservation of three biodiversity offset areas, all known habitat for this species (National Recovery Action 3.1 – Protect and Manage Land for Known Populations and 3.2 - Maintain and Restore Habitat Corridors, State Management Action 1 – Negotiate Conservation Agreements to Protect Known Habitat and 2 - Restoration Projects to Increase Connectivity)
- restoration of previously-cleared habitat, particularly along the Bowmans Creek Riparian Corridor (an area of high usage for this species) (National Recovery Action 3.1 – Protect and Manage Land for Known Populations and 3.2 - Maintain and Restore Habitat Corridors, State

Management Action 1 – Negotiate Conservation Agreements to Protect Known Habitat and 2 - Restoration Projects to Increase Connectivity);

- habitat augmentation (where deemed necessary) with key habitat features (such as hollow logs, other fallen timber and boulders) salvaged from the approved disturbance areas (National Recovery Action 3.2 - Maintain and Restore Habitat Corridors, State Management Action 2 - Restoration Projects to Increase Connectivity);
- nest box installation, maintenance and monitoring program to replace hollows lost from approved disturbance areas. This will occur in post-mining rehabilitated areas as well as regeneration areas of the biodiversity offset areas (National Recovery Action 3.2 - Maintain and Restore Habitat Corridors, State Management Action 2 - Restoration Projects to Increase Connectivity);
- reconstruction of log and boulder piles (as potential den habitat) where these are deemed lacking (National Recovery Action 3.2 - Maintain and Restore Habitat Corridors, State Management Action 2 - Restoration Projects to Increase Connectivity);
- ongoing ecological monitoring to determine usage of biodiversity offset areas (National Recovery Action 1.3 – Monitor Population Status);
- grazing and bushfire management;
- pest management to control the presence of predators such as foxes, cats and wild dogs (State Management Action 3 – Implement Predator Control Programs and 4 – Monitor Quoll Populations to Investigate Predator Impacts); and
- weed control works to maintain habitat integrity.

5. Spotted-tailed Quoll Recovery Actions

The intention of the actions proposed as part of the IOP are to be in addition to the existing commitments discussed in Section 3 so as to ensure additional benefit to this species from this program. The approval conditions for this project require that the financial contribution be invested to progress recovery actions for the quoll. Recovery actions to be considered are those defined within the Draft National Recovery Plan for the Spotted-tailed Quoll - Dasyurus maculatus (Long and Nelson 2008) or in the BCD Saving Our Species Project Species Action Statement. These are provided in detail in the sections below.

5.1 Draft National Recovery Plan Objectives

The *Final Draft of the National Recovery Plan for the Spotted-tailed Quoll Dasyurus maculatus* (Long and Nelson 2008) was released in August of 2008. The overall objective of this recovery plan is to increase knowledge of the distribution, ecology, status of populations, and impact of threatening processes on quoll populations and to reduce the impact of threatening processes throughout the species' range and subsequently halt the current decline in its distribution and abundance.

The specific recovery objectives deemed most relevant to the funding program projects presented in this IOP are discussed in **Section 6** below.

5.2 BCD Saving Our Species Management Actions

BCD has developed the Spotted Tailed Quoll Saving Our Species Strategy including a number of management objectives and conservation actions required to manage critical threats. This action statement aims to ensure that the species is secure in the wild in NSW and that it's NSW geographic range is extended or maintained. Given its known breeding status, number of confirmed individuals and persistence in proximity to existing mining operations, this Middle Foy Brook population of quolls has been taken to be an 'important population' and treated accordingly in relation to the management actions.

6. Proposed Funding Program

6.1 Funding Requirement

The State approval requires the proponent to contribute a total of $200,000 towards this program, while an additional $43,000 is required by the EPBC approval. This makes a total of $243,000 to be provided over a period of five years. An initial $50,000 was paid on the 30 June 2016 in agreement with NSW DPE, with the timing and amount of the remaining payments agreed in consultation with BCD and the Commonwealth Department of Agriculture, Water and the Environment (DAWE) as per Table 6.1 below.

6.2 Fund Management

LCO is responsible for managing the funding and execution of this project. To this end, implementation of the IOP is treated as its own internal project, complete with allocated budget, project manager, formalised tracking of expenditure and progress reporting to BCD and DAWE. All parties involved in this project will be required to track expenditure of budgets and provide progress reports to contribute to the annual progress reporting to BCD and DAWE.

6.3 Auditing of Expenditure

Glencore will provide proof of the internal securing/allocation of the funding for LCO to complete this project to BCD and DAWE as required above. This has included confirmation of provision of the initial $50,000 by the end of June 2016, as documented in annual reporting and verified during 3 yearly independent compliance audits as required by Schedule 5 Condition 4 of DA305-11-01.

7. Project Tasks

A number of tasks are underway as part of this project as follows:

- develop individual recognition software (based on data from camera traps);
- develop and implement a standard camera trapping methodology for spotted-tailed quolls;
- derive key demographic information for population viability assessments (from relatively poorly understood populations);
- increase understanding of habitat connectivity in contemporary landscapes; and

- increase knowledge of habitat use by female quolls at the interface of agro-ecosystems and conservation areas.

These tasks link to objectives of the National Recovery Actions and State Management Actions for this species. They also link to ongoing management of Glencore biodiversity offset and operational areas in order to assist the persistence of this population in the Middle Foy Brook area.

7.1 Project Relationships

The completion of the various tasks comprising this project will require involvement from a number of stakeholders. These will primarily be LCO staff, quoll researchers from the University of New England (UNE) and the Invasive Animals Cooperative Research Centre (IACRC).

A PhD student specifically sourced for this project and enrolled at UNE will complete the majority of the tasks. Dr Guy Ballard, Dr Peter Fleming, Dr Gerhard Kortner and Dr Karl Vernes, all of whom are quoll researchers associated with the IACRC project based at UNE, will supervise this student.

The PhD student and their supervisors will be responsible for the completion of the research and field-based components of this project. LCO will manage and facilitate all onsite requirements for this student, under the relevant agreements/contracts.

7.2 Project Outline

Table 7-1 below outlines the actions proposed over the five year period of this IOP. Details on the methodologies proposed for each action are provided in the sections below. An approximate budget for each action is provided, as is a brief note on the expected outcomes and relevant Recovery/Management Actions.

Year	Completed By	Approximate Timing / Season	Task	Approximate Cost ($)	Expected Outcome	Relevant Recovery/Management Action
1 (FY2016/ 2017)	IAL	No seasonal requirement	Develop software to allow identification of individual quolls from camera trap images	Specialist programmer / consultant: $1400/day for 51.5 days = $78,200. IACRC/IAL funding administration and development of scientific paper: $7,800. Project total: $80,000	Algorithm-based software that will be accessible to third parties (under licence/agreement). Published peer-reviewed paper.	Contribute to National Recovery Action 1.2 and 2.5
2 – 5 (FY2017/ 2018 – FY2020/ 2021)	UNE	No seasonal requirement	Development of standard camera trapping protocol based on project above. Implement cross tenure monitoring program (Royal National Park, Wollemi National Park and Middle Foy Brook Area) integrating live trapping, camera trapping, population viability and genetic analysis.	2018 Budget: Purchase camera traps; hardware; consumables; transport, DNA analysis; Accommodation. $54,387.00 2019 Budget: consumables; transport; accommodation; DNA Analysis. $20,182.00 2020 Budget: consumables; transport; accommodation; DNA Analysis. $20,989.00 2021 Budget: consumables; transport;	Standard camera trapping methodology for survey and monitoring of quolls. Derive key demographic information for population viability assessments (from relatively poorly understood populations). Increase understanding of habitat connectivity in contemporary landscapes Published peer-reviewed paper.	National Recovery Action 1.1, 1.2, 1.3, 2.2, 2.4, 5.1

Year	Completed By	Approximate Timing / Season	Task	Approximate Cost ($)	Expected Outcome	Relevant Recovery/Management Action
				accommodation; DNA Analysis. $22,189.00 Project total: $118,000		
3 - 5	UNE	No seasonal requirement	Trap and track (using telemetry collars or camera trapping) 6 female quolls for 3 years. Assess habitat use by female spotted-tailed quolls.	2019 Budget: Purchase collars, hardware; transport; accommodation; $15,820.00 2020 Budget: collars; transport; accommodation. $14,893.00 2021 Budget: collars; transport; accommodation. $15,487.00 Project total: $45,000	Increase knowledge of habitat use by female quolls in human modified landscapes. Published peer-reviewed paper.	National Recovery Action 1.2, 1.3, 4.1 and 4.3.

Table 8-1 – Proposed Timing, Actions, Approximate Costs and Expected Outputs

Note that the approximate budget allows for a minor contingency for under costing and/or unexpected expenses. Costs can be refined upon acceptance of the proposed methodology and additional effort (on a number of currently proposed actions) can be expended to ensure the full contribution is expended.

Further detail on each of the proposed actions is provided in the sections below.

7.3 Task 1 – Development of Individual Recognition Software for Quolls

An algorithm to identify individual quolls will be developed through partnership of LCO with IAL. This process will utilise images of quolls from a number of sources, primarily the BCD Wildcount Program, the Invasive Animals CRC Predators, Prey, Plants & People Project (currently operating from UNE), and from Glencore. These images will be analysed and the software algorithm developed and tested by IAL under a research contract with LCO.

As part of the process, IAL will supply/sub-contract a computer programmer to design and construct the software package. Quoll recognition software requires a specialist algorithm and associated software to run the algorithm. The proposed consultant has already developed algorithms for facial recognition of dingoes and other wild dogs, and so has a framework on which to develop new algorithms for quoll recognition. This will shorten the process and reduce the possible cost. It is proposed to utilise the LCO Offset funding to tailor this to Quoll recognition. Using spot patterns is a different process to using facial differences, but the concept is similar.

The proposed funding for this task (see **Table 8-1**) will be split into two milestone payments. IAL has a developed a contract which provides for an upfront payment of $50,000, and a payment of the difference ($30,000) on completion and supply of the software to IAL.

The key outcome of this project will be the development of software that enables identification of individuals (based primarily on spot patterns) from camera trap images. The software will be available under licence to BCD and IACRC. It will be freely available through their websites (both are public organisations) and will be publicised in any associated media or written publications at no charge because it will be a recognised public goods. This is not withstanding existing background intellectual property (IP) of the consultant and IP sharing arrangements between IACRC and its partner organisations being University of New England (UNE) and NSW Department of Primary Industries. IAL will also publish a peer-reviewed scientific paper on the algorithm, its application and limitations.

7.3.1 Location of Proposed Action

The majority of data used will be sourced from Glencore-controlled areas within the Middle Foy Brook area, as well as the BCD Wildcount Program. This fauna monitoring program uses camera traps at approximately 200 sites within parks and reserves across eastern NSW (http://www.environment.nsw.gov.au/animals/wildcount.htm). Additional suitable data will be sourced from IACRC and UNE projects (~400 permanent camera locations) to broaden the geographic range of images and increase the number of individuals used in the analysis. The Glencore data will have been collected from operational areas, non-operational areas, biodiversity offset areas and other suitable Glencore-owned lands from the LCO, Mt Owen and Ravensworth North Operations.

7.3.2 Timing of Proposed Action

The initial software build was completed on 30 June 2017 and the final instalment of funding (totalling $80,000) completed 31 July 2017. The software has since been under user testing and refinement

phase in conjunction with BCD. Progress with release of the software and associated scientific paper is tracked in annual reporting.

7.3.3 Justification of Proposed Action

The ability to efficiently identify individual quolls from camera trapping data will greatly increase the interpretative power and cost-efficiency of this survey method. Individual-based data will provide information on a variety of ecological topics such as (but not limited to):

- population size/density;
- habitat usage/preferences;
- population dynamics (such as breeding, recruitment/dispersal, population age classes);
- tracking of individual movements between camera stations; and
- individual survival.

Key to this component of the project is the ability to share the resulting software (under proposed licence/agreement) with relevant agencies and research/conservation organisations to ensure maximum benefit to all parties participating in quoll research and conservation activities.

7.3.4 Contribution of Proposed Action to STQ Conservation Outcomes

As described above, the development and sharing of software (as suitable) that enables the identification of individual quolls from camera trapping data will benefit research and conservation efforts for this species across its range. The software will be able to be applied without geographic restriction, and thus will provide benefit to this species across its range.

This software will contribute to National Recovery Action 1.2 - Field Surveys and Mapping of Poorly Known Populations and it will assist with the National Recovery Action 2.5 – Population Demographics. Generally, however, this software will assist in any of the National or State actions where individual or population-based information is beneficial.

7.4 Task 2 – Surveying/Monitoring STQ populations

As described above, the development and sharing of software (as suitable) that enables the identification of individual quolls from camera trapping data will benefit research and conservation efforts for this species across its range. The software will be able to be applied without geographic restriction, and thus will provide benefit to this species across its range.

This software will contribute to National Recovery Action 1.2 - Field Surveys and Mapping of Poorly Known Populations and it will assist with the National Recovery Action 2.5 – Population Demographics. Generally, however, this software will assist in any of the National or State actions where individual or population-based information is beneficial.

7.4.1 Location of Proposed Action

It is proposed to set up sites within Royal National Park, Wollemi National Park and in the Middle Foy Brook offset areas. These areas are known to contain a population of quolls, and these have been recorded in the area by way of a variety of survey methods including live trapping, camera trapping, spotlighting, scat collection and hair funnels. If deemed beneficial to the study, access to suitable surrounding private properties will be sought to add to the area covered by this project.

7.4.2 Timing of Proposed Action

It is proposed to complete these works over at least a four year period of testing, data collection and refinement, data assessment and reporting commencing in FY2017/18 of this project. Completion is expected in year FY2020/21.

7.4.3 Justification of Proposed Action

The development of this standardised survey/monitoring methodology will benefit research, impact assessment and conservation/management actions for the quoll by defining a consistent and reliable approach to detecting the presence of this species through the use of camera traps.

It will also derive key demographic information for population viability assessments (from relatively poorly understood populations), and increase our understanding of habitat connectivity in contemporary landscapes.

7.4.4 Contribution of Proposed Action to STQ Conservation Outcomes

Task 2 will contribute directly to the following National Recovery Plan Objectives and Actions:

Objective 1: Determine the distribution and status of Spotted-tailed Quoll populations throughout the range, and identify key threats and implement threat abatement management actions.

Action 1.1 Develop targeted survey techniques and monitoring protocols.

Action 1.2 Undertake field surveys and mapping in areas where the distribution and status of populations are poorly known.

Action 1.3 Develop and implement a program to monitor Spotted-tailed Quoll population status, determine factors influencing habitat quality, identify threats and implement management actions at representative sites throughout the species' range.

Objective 2. Investigate key aspects of biology and ecology of the Spotted-tailed Quoll to acquire targeted information to aid recovery.

Action 2.2 Conduct genetic analyses to determine genetic variation between populations and identify appropriate genetic management units.

Action 2.4 Investigate population demographics, particularly age-specific survival rates, juvenile dispersal and reproductive life span, to facilitate population viability modelling and conservation management.

Objective 5. Determine and manage the threat posed by introduced predators (foxes, cats, wild dogs) and of predator control practices on Spotted-tailed Quoll populations.

Action 5.1 Monitor the abundance of Spotted-tailed Quolls and introduced predators in areas with and without predator control programs.

7.5 Task 3 – Assess Habitat Use by Female STQ

It is proposed to substitute the use of camera traps to assess habitat use by female quolls in human-modified landscape of the Middle Foy Brook Area. This is proposed as an alternative to the original method of using GPS-VHF collars, as the collar units that are currently available have proven to be unreliable in collecting data during 2019.

Camera traps will provide detection data on known individual female quolls (determined from live trapping) and allow for detailed analyses on habitat use of these quolls. The camera have been

proportionally allocated across various habitat types to assess use and preference (by integrating live trapping and camera data).

This alternative method is expected to be more reliable in providing the required spatial data for the project, as camera traps have already proven effective at detecting quolls during fieldwork completed for Task 2 above. The collars units may be revisited later in the study as means to obtain finer-scale spatial data, assuming more suitable collar units can be sourced.

Spatial data will be collected for the purpose of developing further understanding of how female quolls use non-conservation lands and to understand their minimum habitat requirements.

As with the previous PhD task, UNE will recruit a suitable student who will operate under a research agreement between LCO and UNE. The student will be provided with necessary equipment and site access to undertake the project. In return, they will undertake the collection and processing of the spatial data derived from camera trapping, including annual progress summaries

7.5.1 Location of Proposed Action

The approved Glencore biodiversity offset areas and other suitable surrounding Glencore-owned lands in the Middle Foy Brook area will be targeted for these works. These areas are known to contain a population of quolls. If sufficient numbers of female quolls cannot be identified and captured here, then female quolls identified in either the Wollemi NP or Mt Royal NP will be sought instead.

7.5.2 Timing of Proposed Action

The timing of these works is programmed to commence in FY2018/19 and finish during FY2020. This allows this component to benefit from the development of the individual recognition software (Task 1) and the completion of at least the first year of the monitoring required for Task 2.

7.5.3 Justification of Proposed Action

Completion of this project will serve to increase understanding of habitat connectivity in the human modified landscape and importantly add to the currently limited knowledge of habitat used by female Spotted-tailed Quolls.

7.5.4 Contribution of Proposed Action to STQ Conservation Outcomes

This task will directly address the following National Recovery Plan actions:

Objective 1: Determine the distribution and status of Spotted-tailed Quoll populations throughout the range, and identify key threats and implement threat abatement management actions.

Action 1.2 Undertake field surveys and mapping in areas where the distribution and status of populations are poorly known.

Action 1.3 Develop and implement a program to monitor Spotted-tailed Quoll population status, determine factors influencing habitat quality, identify threats and implement management actions at representative sites throughout the species' range.

Objective 4. Evaluate and manage the risk posed by silvicultural practices.

Action 4.1 Develop guidelines on minimum habitat requirements that can be used to direct the formation of habitat retention prescriptions or other requirements in commercially harvested forests.

Action 4.3 Determine disturbance thresholds of female Spotted-tailed Quolls to refine habitat retention prescriptions or other requirements in harvested areas.

8. Communication of Outcomes of Proposed Actions

8.1 Reporting

An annual progress report will be prepared to provide BCD and DoE with budget tracking and proof of expenditure as well as a progress report addressing works completed and preliminary results of each of the tasks.

At the end of the five-year period, a detailed IOP outcomes document will be prepared to report on all of the above tasks, their outcomes and implications for recovery actions for the quoll. This report will be made available on the LCO website within twelve months from the completion of data collection.

The anticipated outcomes of each of the tasks are included below:

Task 1 – Individual recognition software (including published scientific paper) allowing software-based recognition of individual quolls from camera trap images. This software package will be distributed (via mutual agreement) between NSW BCD and IACRC websites;

Task 2 - Development and recommendation of a robust methodology for detecting quolls through camera trapping surveys, as well as at least one published peer-reviewed scientific paper identifying key demographic information for population viability assessments (from relatively poorly understood populations), and discussion of findings relating to habitat connectivity in contemporary landscapes;

Task 3 –Peer-reviewed scientific paper discussing the findings on the types of habitats utilised by the female quolls, and associated understanding of habitat connectivity in the human modified landscape;

In addition to the above outcomes, opportunities will be sought to communicate target aspects of this project to relevant conferences (such as the Hunter Environment Coal Group, Mining Conferences, EIANZ, Minerals Council), industry training days and other media opportunities.

Role	Accountabilities for this document
Operations Manager	Sufficient time and resources are allocated to allow for the implementation of the IOP.
Environment & Community Manager	Allocate sufficient resources and time for the implementation of the IOP programs. Management of project relationships with NSW Invasive Animals Cooperative Research Centre (IACRC), and University of New England (UNE). Periodically review progress against performance indicators and completion criteria. Internal and external reporting requirements are met, including necessary revisions of the IOP. All relevant records are effectively maintained.

Environment & Community Officer	Coordinate day to day implementation of the IOP. Coordinate monitoring activities as per the IOP and Glencore standards. Coordinate reporting requirements relating to the IOP.
All Persons	Undertake activities directly in accordance with the requirements of the IOP, as directed by the Environment and Community Manager and Officers. Any potential or actual issues, including environmental incidents, are reported to their immediate supervisor.

9. Roles and Responsibilities

10. Document Information

10.1 Related Documents

Related documents, listed in ***Table 10-1*** below, are *documents* directly related to or referenced from within this document.

Number	Title
LIDOC-90533967-797	Environmental Management Strategy
LIDOC-90533967-3755	Biodiversity Offset Management Plan

Table 10-1 – Related documents

10.2 Reference Information

Reference information, listed in ***Table 10-2*** below, is *information* that is directly referred to for the development of this document.

Reference	Title
Long, K. And Nelson, J. 2008.	National Recovery Plan for the Spotted tailed Quoll Dasyurus maculatus. Department of Sustainability and Environment, Melbourne.
York, P. 2014.	Mt Owen Mine Spotted tailed Quoll Study. Life of Mine 2014 Conference Brisbane, QLD.

Table 10-2 – Reference information

10.3 Change Information

Full details of the document history are recorded in the document control register, by version. A summary of the current change is provided in ***Table 13-3*** below. Example detail shown below.

Version	Date	Review Team	Change Details
1.0	29/06/2015	Umwelt, LCO	New document to meet conditions of EPBC consent
2.0	11/02/2016	B de Somer, R Vere, G Ballard	Address OEH & DOE review comments. Incorporate program recommendations from Dr Guy Ballard (UNE). Accountabilities updated.
3.0	22/04/2016	B.de Somer, P. Fleming (DPI)	Updates to project details and budget for Quoll recognition software (Sections 6.2 – 6.7)
4.0	10/10/2016		Migrated to new Document Management system. No content change.
5.0	25/08/2017	B. de Somer, G. Ballard (UNE), P Fleming (DPI)	Update sections 3, 4, 6 and 7. Particularly incorporation of revised funding programs in Section 6. Address DoE comments
6.0	9/09/2019	B de Somer H Frazer	Minor updates to Section 1 and Section 6 to reflect DA Modification 7 approval and updates to project timeframes to reflect progress with projects.
7.0		B de Somer L Depczynski	Update Section 7.5 with alternate monitoring methodology for Task 3.

Table 13-3 – Change information

Appendix A - DPIE Correspondence

Planning and Assessments
Energy and Resource Assessments
Contact: Anthony Barnes
Phone: 8289 6709
Email: anthony.barnes@planning.nsw.gov.au

Ms Hayley Frazer
Environment and Community Coordinator
Liddell Coal Operations – Glencore
PO Box 7
Singleton NSW 2330

Dear Ms Frazer

Liddell Colliery Continued Operations (DA 305-11-01)
Approval of Biodiversity Management Plan and Indirect Offset Plan

I refer to your email dated 9 May 2019, submitting revised Management Plans for approval in accordance with conditions 26 and 29 of Schedule 3 of Liddell Colliery Continued Operations' development consent.

The Department has reviewed the revised plans and considers that the Biodiversity Management Plan and Indirect Offset Plan are consistent with the relevant consent conditions. Therefore, the Secretary has approved these plans.

Please ensure these plans are published on Liddell Colliery's website at your earliest convenience.

Please contact Anthony Barnes at the above if you have any enquiries.

Yours sincerely

17/12/2019

Matthew Sprott
Director
Resource Assessments
as nominee of the Secretary

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