NSW GOVERNMENT | Office of Environment & Heritage

Your reference: SSD-5144
Our reference: DOC13/77124; FIL13/5729
Contact: David Paull; 4908 6837

Ms Sophie Butcher
Planner, Mining Projects
Department of Planning and Infrastructure
GPO Box 39
SYDNEY NSW 2001

Dear Ms Butcher

RE: REVIEW OF EXHIBITED ENVIRONMENTAL ASSESSMENT FOR MANDALONG SOUTHERN EXTENSION PROJECT (SSD-5144)

I refer to your email dated 28 October 2013, requesting comments from the Office of Environment and Heritage (OEH) on the exhibited Environmental Impact Statement (EIS) for the Mandalong Southern Extension Project submitted by Centennial Coal (SSD-5144).

OEH has previously provided advice as part of the adequacy review of this project (DOC13/25062; 18 June 2013) and has reviewed the EIS (including appendices) in relation to these previous comments. Detailed comments on the EIS are provided in **Attachment A**. In summary, OEH has identified the following biodiversity and Aboriginal cultural heritage issues which do not adequately meet the Director General Requirements for this project:

An assessment of the ecological matters in the EIS indicates that the following matters may require further clarification:

- floristic quadrat data to confirm/dismiss presence of River Flat Eucalypt Forest endangered ecological community
- details of targeted flora surveys
- results of general fauna surveys in rainforest and wet forest stratification units
- survey results for targeted amphibian survey of Mannering and Buttonderry Creeks.

It is understood that the proponent may take the option in this instance of not undertaking this additional survey work. If this is the case, OEH will assume the presence of the species in question.

The following additional actions are requested prior to Conditions of Approval being issued:

1. The provision of a biodiversity offset package to compensate the loss of 15.6 hectares of threatened species habitat. OEH requests that the quantum and like-for-like features of this offset be consistent with current OEH Offset Policy (2013) which requires the use of the BioBanking Assessment Methodology (BBAM).
2. An independent assessment of the surface to seam cracking due to subsidence and subsequent risk assessment for groundwater dependent ecosystems.

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3. Further information on an alternative disposal strategy for waste-water, due to high sensitivity of the threatened ecological communities to high levels of toxic waste water and salt-loads that are proposed to be released into the freshwater system on the eastern side of Muddy Lake.
4. Written confirmation that concerns and requests raised by the Registered Aboriginal Parties (RAPs) have been addressed either by amending the report or process, or providing justification as to why the concerns raised are not considered relevant/valid.

If you require any further information regarding this matter please contact David Paull, Regional Biodiversity Conservation Officer, on 4908 6837.

Yours sincerely

17 DEC 2013

RICHARD BATH
Senior Team Leader Planning, Hunter Central Coast Region
Regional Operations

Enclosures: Attachment A & Appendix 1

ATTACHMENT A

REVIEW OF EXHIBITED ENVIRONMENTAL ASSESSMENT FOR MANDALONG SOUTHERN EXTENSION PROJECT (SSD-5144)

In response to the request on the 28 October 2013 regarding the Environmental Impact Assessment prepared for the proposed Mandalong Southern Extension Project (dated September 2013), the Office of Environment and Heritage (OEH) has provided detailed comments below. It is noted that this project is being assessed by the Department of Planning and Infrastructure (DP&I) as a State Significant Development (SDD-5144) application in accordance with the Part 4.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

THREATENED BIODIVERSITY

A review of the EIS, including Appendix G entitled: 'Flora and Fauna Assessment (RPS Australia, dated August 2013); Appendix H 'Groundwater Impact Assessment' (GHD date August 2013); Appendix I 'Project Environmental Risk Assessment'; Appendix M 'Subsidence Predictions and General Impact Assessment (Ditton Geotechnical Services, dated August 2013); and Appendix O 'Surface Water Impact Assessment' (Umwelt, dated August 2013) was undertaken in accordance with the following legislation and guidelines:

- Threatened Species Assessment Guidelines: The Assessment of Significance (DECC – August 2007)
- Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft (DEC, 2004)
- Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna - Amphibians (DECCW, 2009)
- Biobanking Assessment Methodology and Credit Calculator Operation Manual (BBAM) (DECC 2009).
- NSW State Groundwater Dependent Ecosystem Policy (DLWC)
- State Environmental Planning Policy No. 44 - Koala Habitat Protection

In addition, OEH has new information regarding the water table depth and distribution of Groundwater Dependent Ecosystems (GDEs) in the Project Area from water table modelling project undertaken jointly by OEH and NSW Office of Water (NOW), (Summerell and Mitchell 2011). This modelling was presented to DP&I on the 11th September and should be regarded as being rigorous as it uses a large bore dataset from across the state. **Map 1** (attached) shows the lands in the project area which have a high, moderate and low probability of supporting shallow groundwater systems, indicate that they are likely to support both base-flow and terrestrial GDEs. **Map 2** shows the predicted distribution of GDEs in the project area which uses the Hunter Native Vegetation Mapping Geo-database (Sivertsen *et al.* 2011).

This mapping shows that high probability GDEs are generally associated with alluvial valleys which support the following vegetation communities (as per the EIS):

- MU1 Coastal Wet Gully Forest
- MU5 Alluvial Tall Moist Forest
- MU 41 Swamp Oak Sedge Forest
- Mu42 Riparian Melaleuca Swamp Woodland
- MU43 Wyong paperbark Swamp Forest.

Using the data provided in Appendix G, OEH has determined that all communities, except the latter, are consistent with the definition of threatened ecological communities as listed under the *Threatened Species Conservation Act 1995* (TSC Act).

- MU1 Coastal Wet Gully Forest (*Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions*)
- MU5 Alluvial Tall Moist Forest (River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions)
- MU41 Swamp Oak Sedge Forest (Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions)
- MU42 Riparian Melaleuca Swamp Woodland (Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions).

Assessment of Survey Methodology

OEH notes that for the most part assessment and survey methodologies have been undertaken in a manner which is consistent with the relevant guidelines. There are two main shortfalls which have not been adequately addressed by the proponent.

(a) Overall survey effort
All vegetation types were adequately sampled during field surveys in terms of effort undertaken for quadrats, though more quadrats could have been undertaken in the Coastal Plains Smooth-barked Apple Woodland Community. It is of concern that no quadrat data is supplied in the EIS as this provides a transparent verification of the condition and types of vegetation communities. Also of concern is the misidentification of one community as being a Threatened Ecological Community (TEC). While consultants are able to reach their independent conclusions regarding the presence of threatened ecological communities, OEH is of the opinion that the Alluvial Tall Moist Forest community in the project area is consistent with the definition of *River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions.* While the authors have stated that they consider it not to be the TEC, due to lack of red gum species and "*the lack of similar flora species*", by examining what information is provided and other known instances of this community in the Lake Macquarie local government area, OEH is of the opinion that it is the TEC. This could be verified by access to the quadrat data (9 quadrats were undertaken). This is a significant issue due to the widespread extent of this community in the subsidence impact area (397 hectares) and its likely reliance on groundwater (i.e. likely GDE).

OEH notes that of the overstorey species in the community description, two out of five canopy dominants are characteristic species of this TEC (*Eucalytus saligna* and *Angophora floribunda*), as are three out of six sub-canopy dominants (*Melaleuca styphelioides, Acmena smithii, Backhousia myrtifolia*), and seven out of 11 ground-layer dominant species (*Adiantum aethiopicum, Entolasia marginate, Lomandra longifolia, Oplismenus aemulus, Pratia purpurascens, Dichondra repens, Imperata cylindrica).*

For fauna survey, overall effort undertaken for field surveys is largely consistent with OEH guidelines, with a stratification design based on vegetation formation. However, OEH notes that rainforest formation types (MU1) did not receive any specific survey effort and that wet forest and Coastal Ranges Open Forest only received a low level of recommended effort compared to actual extent of this formation (over 800 hectares with only two fauna survey sites). Swamp Forest types only received an effort of fauna site for 70 hectares. The survey does suffer from a lack of fauna survey effort in rainforest (at least one), wet forest types (requires five more). These are critical areas for fauna species diversity and the presence of threatened species.

(b) Threatened species surveys
Appendix G identifies three threatened flora species and at least nine threatened fauna species[1] were detected during the surveys within the project area. OEH notes that none were detected within the surface impact area. Table 3 of Appendix G shows how each threatened flora species were targeted during the field surveys, with all except for *Angophora inopina,* receiving targeted survey effort. However, the detail as to how many and distance of random meanders is not provided and OEH requests that this information be supplied prior to Conditions of Approval being issued.

Surveys for threatened fauna species are largely accomplished during the general survey effort as long as methods employed could detect specific target species. Gaps in the survey effort in terms of targeting threatened species detection lie primarily in the lack of targeted effort in areas where threatened amphibian species have previously been found. The Giant Barred Frog, Green-thighed Frog (*Litoria brevipalmata*) and the Green and Golden Frog (*Litoria aurea*) have previously been detected in the vicinity of Buttonderry and Mannering Creeks (NSW Wildlife Atlas Records). This area should have been targeted during field surveys at the appropriate times of year in order to maximise detection of these species.

Assessment of Impact Assessment

OEH notes that only 15.6 hectares of native vegetation will be cleared for the surface infrastructure (comprising of Coastal Foothills Spotted Gum Ironbark Forest). The EIS detected a large number of threatened fauna species occupying this habitat type and so compensatory measures should be provided. OEH notes that there are no compensatory measures proposed for this project.

OEH has reviewed the chapter in Appendix G (section 5) regarding the review of existing wetland monitoring in the project area (locations not provided in the EIS) as well as the impact assessments from increased water discharge and subsidence and on surface threatened species and ecological communities.

(a) Potential Subsidence Impacts

Based on existing monitoring studies of lowland wetlands, populations of *Maundia triglochinoides* and *Melaleuca biconvexa* and groundwater monitoring, the proponent contends that impacts from sub-surface cracking and ponding are not likely to be significant on water-sensitive and dry slopes vegetation communities, including groundwater dependent ecosystems (GDEs).

The following subsidence issues (1-6) were identified in the adequacy review as requiring clarification prior to exhibition of the EIS. Each has been assessed within the relevant EIS documentation.

1. *Inadequate presentation of monitoring data from the existing Mandalong mine to support future mining with wider longwalls than those utilised in the current mine.*

OEH notes that some of this data has been presented in the EIS, however, there is no flow data presented for any of the creeks/streams overlying the expansion area, despite such monitoring having been stated to occur[1]. Results confirm concerns (see below).

2. *Inadequate explanation of subsidence levels over longwall panel 5 of the current mine in relation to subsidence predictions and scant details on the borehole extensometer results in the middle of Mandalong Mine's LW5 to monitor heights of sub-surface fracturing due to the caving or goafing process during mining.*

Data presented in Appendix M show that Panels 5 and 7 recorded measured subsidence and tilt predictions exceeding predictions by >15%. These panels are the maximum width size under the existing approval (160m) and raises concerns about justifications for increasing the panel width in the Southern Extension. Occasional surface cracking is predicted to occur where subsidence exceeds 0.27m (which is most of the existing and proposed southern extension areas) both within the panel areas and outside the sides of the panels where slopes exceed 18 degrees. On flat and undulating areas, cracking is expected to be 10-70mm wide down to depths of 5-15m. This is the zone where the riparian ecosystems and GDEs occur and is of most concern to OEH. While Appendix M states that cracking is unlikely to occur along the water courses where depth of cover exceeds 180m, with regard to 3rd order streams, this is not the case with much shallower cover. The uncertainty associated with impacts of the extent of surface cracking

[1] See Point 5 below.

(particularly on 3rd order streams, where alluvial cover is minimal) could be assisted by the provision of data detailing extent of surface cracking as a result of existing operations.

With regard to sub-surface cracking, OEH acknowledges the data contained within Table 31-32 (Appendix M) showing extent of measured and predicted cracking above Panel 5. It shows that the height of the continuous fracturing in the A Horizon between 59 and 97m below the surface, with the dilated or discontinuous fracture zone estimated to extend to within 15 m of the surface. While within predicted levels, this predicted sub-surface cracking is in contact with the estimated maximum depth of the surface cracking zone.

In modelling the groundwater behaviour for the Mandalong Mine extension, the groundwater report notes:

> *The thickness of Layer 4, and hence the height of the modelled fractured zone,* ***has been set at 140 m*** *and corresponds with the* ***average*** *height of fracturing (both continuous and discontinuous) observed above existing longwalls at Mandalong Mine.*

OEH notes that an **average** fracture zone (not a maximum) has been used in the groundwater modelling. In response to previous problems in the Newcastle coalfields affecting (draining) creeks, OEH notes that a specific assessment of the potential hydraulic connection of longwall mining was undertaken for Bowmans Creek for the Ashton Mine proposal (SCT 2008). SCT (2008) found that the height of cracking above the extraction panel typically extends 1-1.5 times the panel width[2]. It was found that the extent of cracking and interconnection potential above the extraction panels increases with increasing subsidence. If SCT's (2008) worst case scenario of height of cracking 1.5 times panel width is applied to Mandalong mine layout then for many longwall panels (particularly those with the shallower depth of cover) cracking is suggested to reach the surface. Even if a more conservative estimate (height of cracking equals panel width) is applied, cracking is still suggested to reach the surface in some areas of the mine plan. SCT (2008) recommended a conservative approach to undermining the Bowmans Creek alluvium maintaining width to depth ratios of 0.6 – 0.7. Many of the width to depth ratios for the Mandalong extension are much greater than this and in some cases exceed unity (w/d>1).

More recently Tammetta (2012) provided an equation for estimating the height of complete groundwater drainage above mined longwall panels. If Tammetta's (2012) equation is used for the Mandalong Mine extension proposal a more conservative estimate of complete groundwater drainage is achieved, however, complete drainage is still predicted to go up to 2m – 9m below the surface for some longwalls. This clearly puts at risk any GDE's above such panels (i.e. complete drainage of aquifers) and if fracturing also occurs in streamlines to 10m, then the stream itself could be fractured and drained. Such a situation already has several precedence's for longwall mining with relatively shallow depths of cover (e.g. Bowmans Creek, Diega Creek, South Wambo Creek).

Given that DgS (2013) suggest that the dilated or discontinuous fracture zone is estimated to extend to within 15m of the surface. While the groundwater traces included in the EIS and End of Panel Reports (e.g. end of panel report for LW 12) suggest minimal impact to the alluvial aquifer over existing mined panels, OEH notes:

- impacts to aquifers at the 30-50m levels (eg BH17, BH21, GWB22B – see Figure 1)
- the increase in panel widths to 200m
- width to depth ratios approaching or exceeding unity
- location of faults and geological structures within the project area
- interaction between faults and groundwater levels (see Figure 1).

[2] This work was previously referred to in the Bulli Seam PAC report.

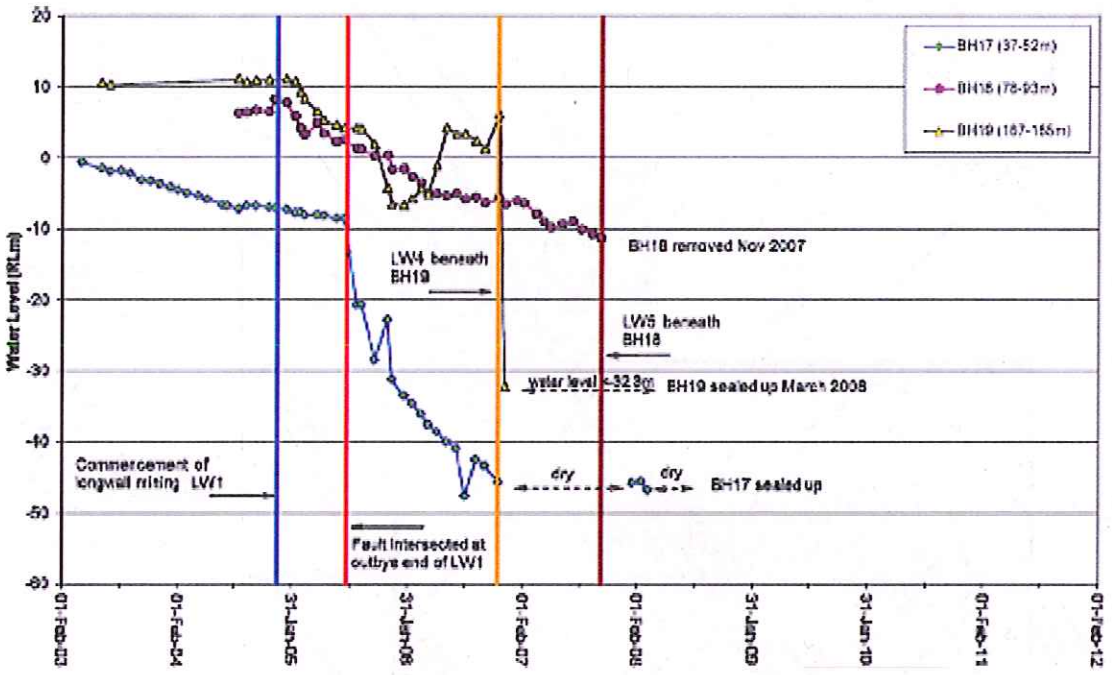

Figure A6: Overburden – Hydrograph Bores BH17 – 19

Figure 1. Groundwater behaviour over previous Mandalong longwalls. Source Mandalong LW12 End of panel report.

For these reasons, OEH believes a detailed review of the potential for surface to seam (or GDE aquifer to seam) fracturing and complete groundwater drainage is required prior to any approval of the current mine plan.

3. *Inadequate assessments of faults and their potential interaction with subsidence and groundwater aquifer impacts over existing and proposed longwalls.*

There appears to be little to no assessment of the extent of existing faults and lineaments in the geology of the proposed project area (e.g. see Figure 1) or how they might affect subsidence estimation, groundwater flow paths or surface fracturing as a result of mining. This was raised in the adequacy review by OEH but has not been adequately addressed the exhibited EIS. Section 9 of the EIS simply states:

> *"DgS (2013) advises that the presence of geological structures should be viewed with caution in regards to potential interaction with surface watercourses. Undermining significant faults may result in higher continuous fracture connectivity and water inflow in the mine workings."*

DgS (2013) have not modelled the potential interaction of faults and geological structures above the mine plan (that are industry/peer reviewed). OEH also notes that the DgS (2013) methodology appears to be the same as that employed at West Wallsend Colliery which underestimated subsidence and their related impacts to Sugarloaf SCA. The End of Panel Report for West Wallsend LW38 noted:

- the predicted mean and Upper 95% Confidence Limit of First Maximum Subsidence at XLs 1 and 2 (see in Table 2B) under predict the measured subsidence for the first 700 m of longwall retreat by 0.4 m to 0.6 m (a prediction exceedence of 20% to 30%)
- another prediction exceedence (15% to 25%) also occurred near McArthy's dam at XL5
- the measured centreline tilts and strains at the finishing end of LW38 were 1.4 to 2.3 times the predicted values, and is probably due to discontinuous behaviour within relatively steep terrain.

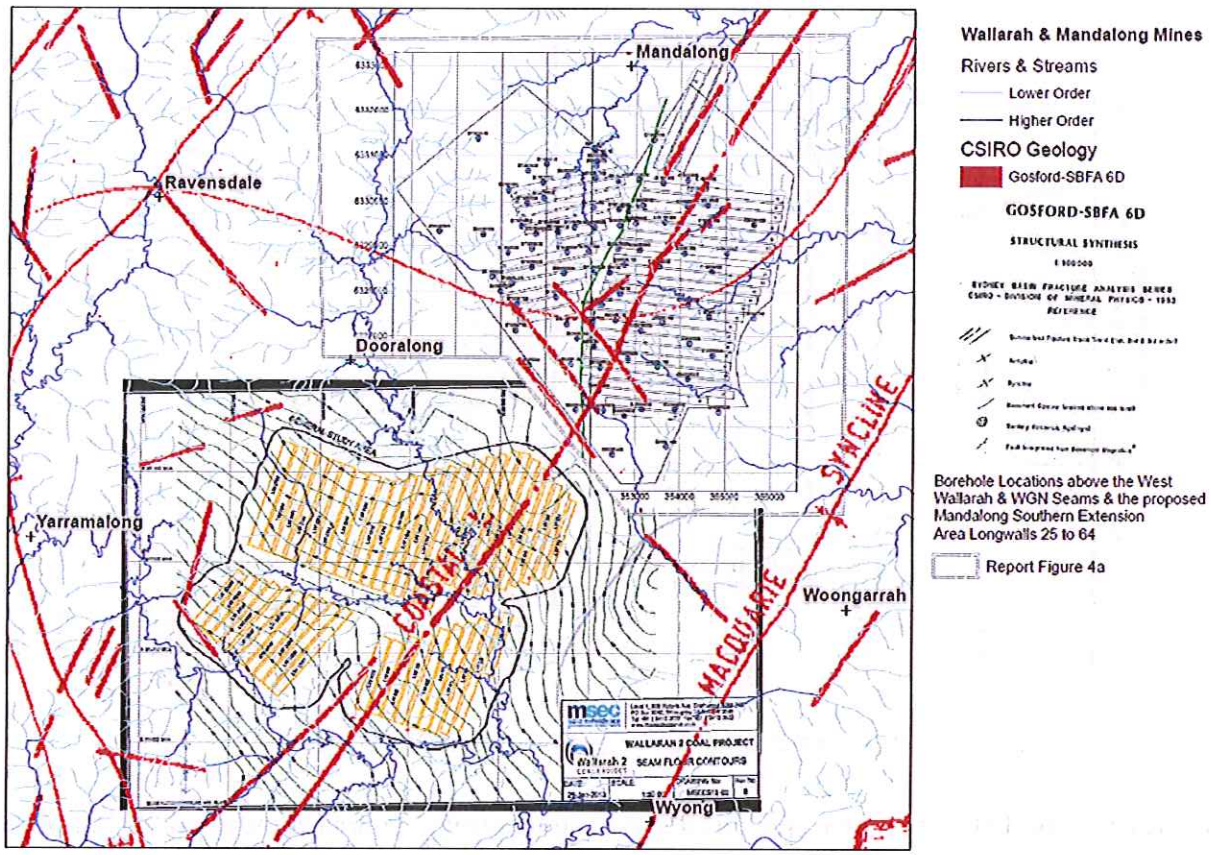

Figure 2 Faults/lineaments identified by Mauger et al (1984) in relation to the proposed Wallarah2 (yellow longwalls) and Southern Extension of Mandalong Mine (black longwalls).

Such recent experience with the DgS subsidence model raises the potential for subsidence to be underestimated at Mandalong South in the current proposal.

OEH notes there is no risk assessment for specific faults and known geological structures especially where they potentially under lie or interact with streams or GDE's (particularly for the shallower depths of cover) over the project area. The lack of such a detailed risk assessment is considered a significant deficiency in the exhibited EIS.

4. *No baseline water level monitoring of the vast majority of GDEs over the proposed mine plan or how they have responded over the existing workings.*

The lack of GDE water level monitoring for the proposal was raised in the adequacy review but not addressed in the exhibited EIS. As the GDEs in the project area are also EECs, this is an issue of concern to OEH.

5. *Virtually no gauging data for almost all 3rd order and above streams above the expanded proposal. This will hinder any assessment of impact (e.g. loss of water) in these major streams.*

In earlier Mandalong End of panel reports, two stream flow monitors were stated to have been installed in mid-January 2002 in Stockton and Moran's Creeks. Flow data for Wyee Creek (Stn211001) is also available and covering approximately 20 years of record (November 1958 to July 1979). None of this flow data has been provided to help inform the EIS and the observed data do not appear to have been used to calibrate/validate any of the hydrological models used in the EIS. The lack of flow data across the project area will hinder any assessment of impact (e.g. loss of water) or recovery (if impacts are subsequently remediated) in these major streams. The lack of flow monitoring for the proposal was raised in the adequacy review but not addressed in the exhibited EIS.

Appendix O also makes the statement that:

> *"It is understood that watercourses within the Southern Extension Area are ephemeral, with periods of limited or no flow during periods of low rainfall. The ephemeral nature would suggest that dependence on flows within the watercourses to downstream agricultural users is likely to be limited".*

OEH notes that the term 'ephemeral' has not been defined appropriately or applied appropriately to the third order and above streams above the project area. A *perennial* stream or *perennial* river can be defined as "*a stream or river (channel) that has continuous flow in parts of its bed all year round during years of normal rainfall*". '*Perennial*' streams are contrasted with '*intermittent*' streams which normally cease flowing for weeks or months each year, and with '*ephemeral*' channels that flow only for hours or days following rainfall. During unusually dry years, a normally perennial stream may cease flowing, becoming intermittent for days, weeks, or months depending on severity of the drought. The boundaries between perennial, intermittent, and ephemeral channels are indefinite, and subject to a variety of identification methods (but they all require some assessment of actual flow).

OEH questions why the EIS uses the phrase "*It is understood that watercourses ... are ephemeral*" when the stream description provided clearly aligns with an intermittent stream. If the Wyee gauging data is used, monitoring over the period November 1958 to July 1979 identified zero flows on approximately 25% of the days with recorded flows. Again this is indicative of an intermittent stream and not a stream that flows "*only for hours or days following rainfall*". A recent visit to Morans Creek by OEH also identified flows in the upstream drainage line despite a week since rainfall fell in the area. Based on an analysis of flows for the Wyee Creek records (Stn211001), if as little as 0.5ML/day is lost as a result of undermining, Wyee Creek would cease to flow more often than it was measured to have flowed (75% of the time over the period November 1958 to July 1979).

Since the term 'ephemeral' appears to be a highly inappropriate description of the 3rd order and above streams of the area, so too is the conjecture '*dependence on flows within the watercourses to downstream agricultural users is likely to be limited'.* Stock watering would clearly be an important function that such streams support. Indeed the EIS (Appendix O) contradictorily identifies:

> *"The Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources (2009) allows access to water within South Lake Macquarie for basic landholder rights of 0.07 ML/day, with extraction licences totalling 169 unit shares in the South Lake Macquarie water source of a 169 ML/year total surface water entitlement. The surface water entitlement is used almost entirely for irrigation purposes."*

In addition to anthropogenic uses, these streams (including refugial pools) also potentially provide significant habitat for aquatic and semi-aquatic (e.g. frog) species which have been poorly described for the project area.

As far as Jilliby State Conservation Area is concerned, OEH is satisfied that subsidence impacts are likely to be negligible.

(b) Potential impacts from increased water discharge into Muddy Creek

1. *Hydrological modelling to determine water levels and volumes in Muddy Lake (and the effect an increased discharge will have) are based on averages and not peak mine discharges and therefore underestimate potential adverse impacts of mine water disposal.*

Since peak discharges are not modelled the full range of potential adverse consequences has not been adequately considered.

The following water quality impact issues were identified in the adequacy review as requiring clarification prior to exhibition of the EIS. Each has been assessed within the relevant EIS documentation.

2. *Inadequate description of the new Dirty Water Dam operational plan, particularly how discharges associated with the emergency overflow spillway will operate and how this might impact areas downstream, particularly Moran's Creek and ultimately Lake Macquarie.*

This has not been adequately addressed in the EIS.

3. *Inadequate experimental design to assess impact of current discharge on aquatic ecology Insufficient description of current impacts on Aquatic Ecology, and limited effort to predict the impact of an increased discharge volume of mine water and its associated effects. A more comprehensive description of the water quality data collected is required as is an appropriate comparison to the ANZECC Guidelines. Further Ecotoxicology assessments of the proposed mine water discharges should also be undertaken given that chronic toxicity effects have been measured for fish and crustaceans.*

Where comparisons with ANZEEC values are provided in Appendix O, ranges are given instead of discrete values. The graphs show that at most all seven sites, threshold values may be exceeded for electrical conductivity, total dissolved solids, Manganese and Iron. Monitoring data of discharge from LDP001 show that the mean electrical conductivity of the discharge to be 3947 µS/cm. In relation to this, the EIS makes the statement:

> *"Based on the salt balance modelling, the average salinity at LDP001 is predicted to be approximately 3,300 mg/L or about 4,900 µS/cm. Therefore, it is expected that the EC at LDP001 and at downstream reaches of the unnamed creek will not have a toxic impact on downstream freshwater ecosystems since it is below the threshold level of 5,500 µS/cm as identified by Kefford et al. (2004).*

This assessment is simply mis-leading as the paper referenced does not say this, instead it shows that the relationship between the maximum mean EC and LC_{50} acknowledges that salinity may affect the distribution of taxa at levels below their acute lethal tolerance. The study (Kefford *et al.* 2004) suggests that acute lethal effects of salinity impose an upper level on the distribution of macro-invertebrate taxa, but below this upper limit other effects (such as sub-lethal, indirect and effects of low salinity [BJK personal communication] may influence macro-invertebrate distribution further.

Muddy Lake is a SEPP14 wetland system that maintains a balance between estuarine/tidal influences from the east and freshwater influence/influx from the west. It supports both estuarine (mangrove) and freshwater (Swamp Forest) communities on an east to west gradient, the latter, which are also threatened ecological communities, may be sensitive to elevated levels of salinity, potentially causing decline in the extent and changes in the species composition of freshwater dependent ecosystems. The freshwater nature of the western portions of the wetland are evidenced by a record of the Freckled Duck (*Strictonetta naevosa*), a freshwater dependent species.

There remain a number of deficiencies in the EIS with respect to providing a detailed assessment of the potential impacts of changes in water quality upon riparian and ecological factors. This is primarily due to inadequate number of surface water quality monitoring points, which are not located in key ecologically-sensitive areas, such as Muddy Lake or Porter's Creek Wetland. The assessment in Appendix G (section 5.4.5) evaluates the possible impact of increasing the total flow into Muddy Lake, though does not address water quality.

In a recent review of saline discharges in the Hunter River catchment it was found that mine water toxicity was an important issue for the ecological health of the river (Krogh et al 2013). Conductivity and bicarbonate ions in particular were identified as an emerging issue causing mortality in aquatic species in both the USA and Australia (Kefford et al 2013, Farag & Harper 2012, OEH 2012, Cardno Ecology Lab Pty Ltd 2010). Cardno Ecology Lab Pty Ltd (2010) found that discharge waters from mines in the Hunter and Illawarra/Macarthur regions induced deleterious responses in a range of aquatic biota.

The high bicarbonate alkalinity recorded for the mine water also suggests that bicarbonate ions could be an important ecological health issue for the Mandalong mine discharge. Farag and Harper (2012) constructed a database of toxicity evaluations of sodium bicarbonate (NaHCO3) on aquatic life and used these data to establish acute and chronic criteria for the protection of aquatic life. Chronic toxicity was observed at concentrations that ranged from 450 to 800 milligrams NaHCO3 per litre (also defined as 430 to 657 milligrams HCO3- per litre or total alkalinity expressed as 354 to 539 milligrams CaCO3 per litre) and the specific concentration depended on the sensitivity of the four species of invertebrates and fish exposed. Acute and chronic criteria of 459 and 381 milligrams NaHCO3 per litre, respectively, were calculated to protect 95 per cent of the most sensitive species (Farag and Harper 2012). More recently, OEH (2012) also found toxic effects of West Cliff mine water, citing bicarbonate as an important potential contributor to the toxic effects. Other potential toxicants found in the mine water at levels exceeding the ANZECC/ARMCANZ (2000) guidelines were aluminium, nickel, zinc, cobalt and copper (OEH 2012).

Toxicity tests (see Appendix P) indicated acute lethal toxicity effects for larval fish for a range of mine water dilutions down to 25% and acute toxicity in *Paratya* in undiluted mine water. Nickel levels could also potentially be exerting toxic effects given the levels measured in the LDP001 discharge. Only limited estimates of dilution have been provided for the receiving environment and it is unlikely that much dilution is achieved under dry weather conditions until the effluent reaches Muddy Lake.

According to Chapter 3 of the ANZEEC guidelines on aquatic ecosystems, for 'Condition 1' ecosystems, (which would apply to Muddy Lake SEPP14 wetland), *"the guidelines advise that there should be no change from ambient conditions, unless it can be demonstrated that such a change will not compromise the maintenance of biological diversity in the system*". This cannot be demonstrated in the EIS for Muddy Lake as there are no baseline data provided.

OEH does not support the magnitude of increased disposal of potentially toxic mine water to the drainage line leading to Muddy Lake. The contaminant loads involved are considered to be significant and likely to lead to degradation of both stream and downstream freshwater wetland habitats. OEH believes that some form of treatment is required to reduce the salt and contaminant load to the receiving environment.

Request for additional Information

OEH is unable to make a determination of the adequacy of the environmental impact assessment or provide recommended conditions of approval until the following data is provided:

1. floristic quadrat data to confirm/dismiss presence of River Flat Eucalypt Forest EEC
2. details of targeted flora surveys
3. results of general fauna surveys in rainforest and wet forest stratification units
4. survey results for targeted amphibian survey of Mannering and Buttonderry Creeks.

The proponent may take the option in this instance of not undertaking this additional survey work, in which case, OEH will assume the presence of the species in question. The following additional actions are requested prior to Conditions of Approval being issued:

1. An offset package to compensate the loss of 15.6 ha of threatened species habitat. OEH request that the quantum and like-for-like features of this offset be consistent with current OEH Offset Policy (2013) which requires the use of the BioBanking Assessment Methodology (BBAM, see **Appendix 1**).
2. Independent assessment of the surface to seam cracking due to subsidence and subsequent risk assessment for groundwater dependent ecosystems.
3. Due to high sensitivity of the threatened ecological communities/species to the toxicity and salt-loads in the waste water that are proposed to be released into Muddy Lake, OEH requests that further information be provided on an alternative disposal strategy/treatment for this waste-water.

References

Cardno Ecology Lab Pty Ltd (2010). *Effects of mine water salinity on freshwater biota investigations of coal mine water discharge in NSW.* Australian Coal Association Research Program and Cardno (NSW) Pty Ltd Trading as Cardno Ecology Lab, Brookvale, New South Wales.

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Summerell, G.K. and Mitchell, M. 2011. Terrain modelling to derive a groundwater surface for NSW upland areas using the SRTM-S adaptively smoothed vegetation offset DEM. Paper presented to the 19th International Congress on Modelling and Simulation, Perth Australia, 12-16 December 2011.

ABORIGINAL CULTURAL HERITAGE

A preliminary review of Volume 4 Appendix K Heritage Impact Assessment of the Mandalong Southern Extension EIS, was undertaken to assess the potential impacts of the project on Aboriginal cultural heritage, in accordance with OEH's Aboriginal cultural heritage assessment guidelines and the requirements of Part 6 of the *National Parks and Wildlife Act 1974* (NPW Act).

Aboriginal cultural heritage assessment

OEH acknowledges that the Aboriginal cultural heritage assessment has been undertaken in accordance with OEH's assessment guidelines. The results of the Aboriginal cultural heritage assessment undertaken for the project area are also acknowledged.

OEH acknowledges that the proponent has developed management strategies to address the possibility that any Aboriginal objects located within the project area may be impacted by the development proposal. OEH accordingly supports the management recommendations for Aboriginal cultural heritage provided in Sections 6.7.1, 6.9 and 7.8 of the EIS.

OEH notes a number of concerns have been raised by registered Aboriginal parties (RAPs) regarding the Aboriginal cultural assessment for this project. OEH understands that these concerns are the same that were raised to OEH during 2013 as formal complaints against the proponent and consultant for this project. Of particular concern to OEH is the claim, voiced by a number of RAPs, that a large number of sites with a potentially high to very high significance rating and which were identified as such during the survey have not been included in the final assessment. Further issues raised in the comments by RAPs section of the

document include a failure to properly consult with all stakeholders and exclusion from assessment process.

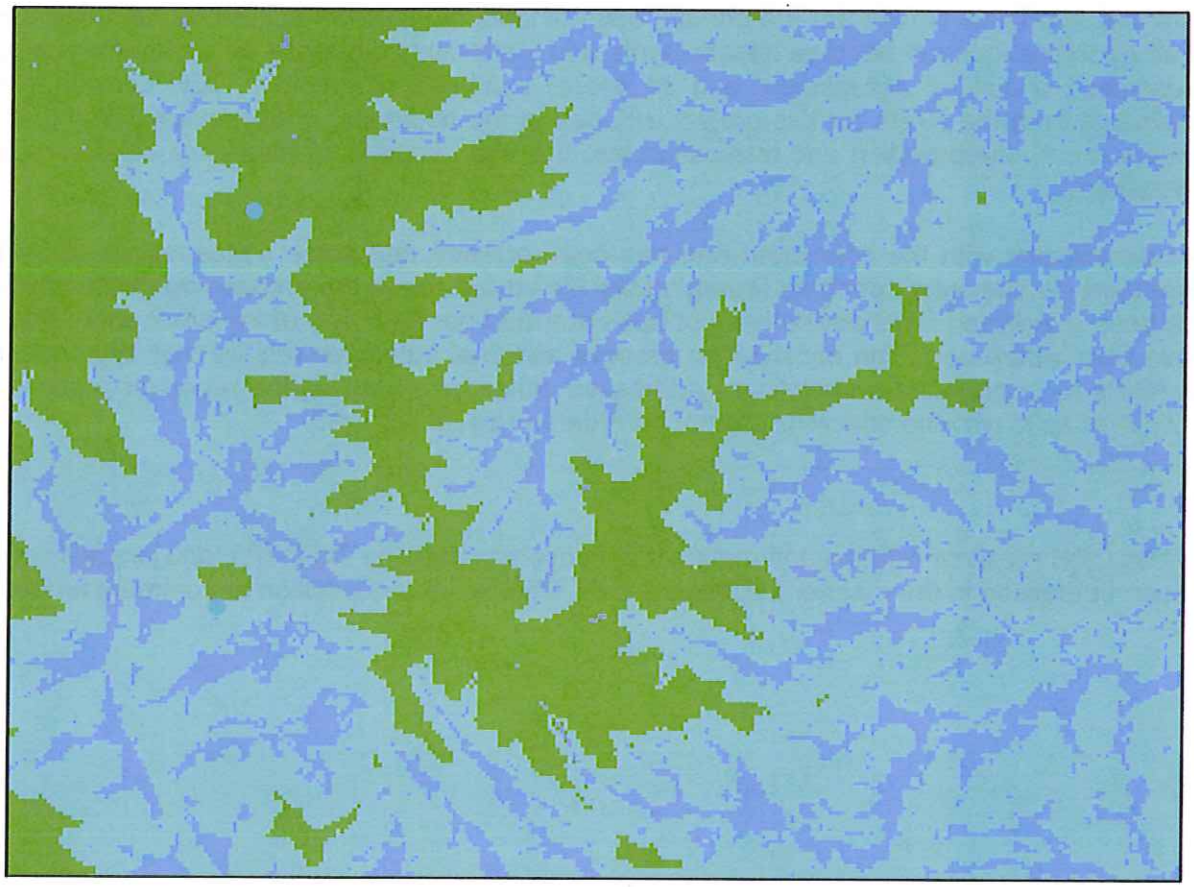
OEH considers that Aboriginal people are the primary determinants of their own cultural significance. OEH requires that all Aboriginal cultural heritage assessments and statements comprise an archaeological and scientific assessment, a cultural assessment and an overall synthesis of the two. OEH considers that response statements from the RAPs for this project included in the document under review show that an inadequate assessment, interpretation and integration into the final product, of Aboriginal cultural values has been undertaken.

OEH has had discussions with the consultant and has been advised that some concerns raised by the RAPs for this project, in particular concerns regarding significant failures in the archaeological survey and reporting have been addressed. This advice has not been qualified nor have any of the other shortcomings identified above been addressed. The consultation process and final outcomes require that any concerns raised by the RAPs for a project are specifically addressed either by amending the report or process, or providing justification as to why the concerns are not considered relevant or valid.

Conclusion

Until such time as OEH receives written confirmation that concerns raised by the RAPs, and requests of the RAPs, have been addressed in the manner identified above, OEH is not in a position to comment further on this document.

MAP 1: Water Table depth of Alluvial Aquifer in Project Area (Category 1: 0-8m – High probability GDE; Category 2: 8-12m – Medium probability GDE; Category 3: >12m – Low probability GDE)



Legend

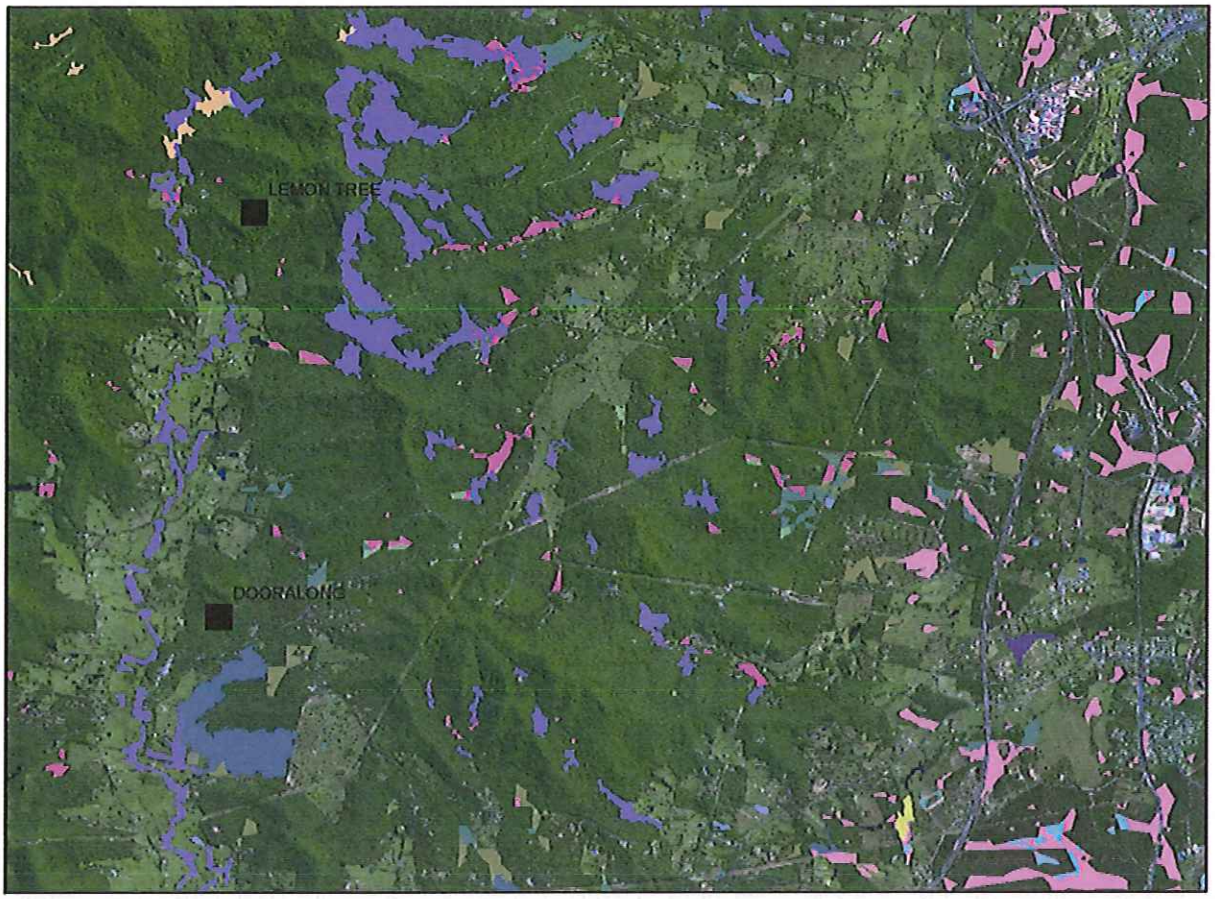
Depth to Groundwater

1

2

3

MAP 2: Mapped High Probability Groundwater Dependent Ecosystems



Legend

- Bangalow Palm/ Coachwood/ Sassafras gully warm temperate rainforest of the Central Coast
- Blackbutt/ Turpentine/ Sydney Blue Gum mesic tall open forest on ranges of the Central Coast
- Jackwood/ Lilly Pilly/ Sassafras riparian warm temperate rainforest of the Central Coast
- Narrow-leaved Apple/ Parramatta Red Gum/ Persoonia oblongata heathy woodland of the Howes Vall*
- Paperbarks/ Woollybutt swamp forest on coastal lowlands of the Central Coast
- Prickly-leaved Paperbark/ Flax-leaved Paperbark swamp forest on poorly drained soils of the Ce*
- Scribbly Gum/ Red Bloodwood/ Angophora inopina heathy woodland on lowlands of the Central Coast
- Smooth-barked Apple/ Red Bloodwood/ Brown Stringybark/ Hairpin Banksia heathy open forest of c*
- Smooth-barked Apple/ Red Mahogany/ Swamp Mahogany/ Melaleuca sieberi heathy swamp woodland of *
- Smooth-barked Apple/ Turpentine/ Blackbutt open forest on ranges of the Central Coast
- Spotted Gum/ Broad-leaved Mahogany/ Grey Gum grass/ shrub open forest on Coastal Lowlands of t*
- Spotted Gum/ Broad-leaved Mahogany/ Red Ironbark shrubby open forest
- Swamp Mahogany/ Flax-leaved Paperbark swamp forest on coastal lowlands of the Central Coast
- Sydney Blue Gum/ Lilly Pilly mesic tall open forest of coastal ranges and tablelands escarpment
- Tallowwood/ Smooth-barked Apple/ Blackbutt grass tall open forest of the Central and lower Nor*
- Turpentine/ Rough-barked Apple/ Forest Oak moist shrubby tall open forest of the Central Coast

APPENDIX 1

CHECKLIST OF INFORMATION REQUIRED WHEN UTILISING THE BIOBANKING ASSESSMENT METHODOLOGY & SUBMITTING THE BIOBANKING ASSESSMENT TO OFFICE OF ENVIRONMENT AND HERITAGE (OEH) USING THE BIOBANKING CREDIT CALCULATOR VERSION 2.0

The *Assessors' Guide to Using the BioBanking Credit Calculator v.2* has been finalised and it is now available for download from the Office of Environment and Heritage website. The guide provides information on the operation and use of the web-based BioBanking Credit Calculator v2.0.

To summit your assessment to OEH open your assessment in *Edit* mode. Navigate to the *Assessment details* page and select the *Submit* button in the top right hand corner. A *Submit the assessment for approval* box will appear (Figure 1), where you can confirm submission (*OK* button) or cancel submission (*Cancel* button). Once a case has been submitted to OEH, the status of the case will change in your *My work* tab from *Work in progress (WIP)* to *submitted*. Please note that you cannot make any edits to an assessment that has been submitted, although you will be able to view the assessment.

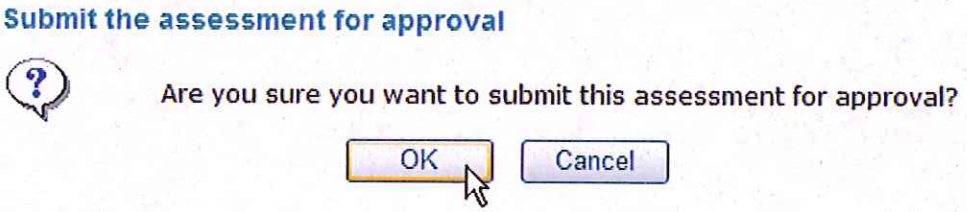


Figure 1: Menu box in the BioBanking Credit calculator v. 2 that enables an assessment to be submitted to OEH.

The following documentation must be submitted with your Environmental Impact Statement or Environmental Assessment report (in hard copy and soft copy):

- BioBanking Assessment Report including a list of dominant indigenous species for overstorey, mid-storey and ground cover for each vegetation type and, where required:
  - local benchmark data;
  - request for increase in gain of site value;
  - a description of the proposed development;
  - measures to avoid and mitigate the impacts of development;
  - an assessment of indirect impacts;
  - a statement of on-site measures;
  - a description of the application of the BioBanking Assessment Methodology, including details of and assumptions made in utilising the methodology, such as (but not limited to) placement of assessment circles, remnant value, connectivity and reasoning behind selection of vegetation types in the Biometric Vegetation Type database;
  - plot and transect values including a list of the indigenous plant species identified in each of the plots; and
  - a description of targeted threatened flora and fauna surveys, and any general baseline surveys (incl. vegetation specific surveys). These should be also be provided schematically.

  and

  Where required, the BioBanking Assessment Report should also include:
  - expert reports;
  - an application for a determination on red flag areas;
  - more appropriate use of local data for vegetation types, benchmarks or threatened species;
  - environmental contributions accompanied by a BioBanking Agreement Credit Report (if applicable); and
  - an application for deferred retirement arrangements (if applicable).

- Copies of completed field data sheets, and updated with correct plant taxonomy in instances where field names have been used.

- Maps (soft copy as A4 jpgs) of:
  - offset site / BioBanking Agreement boundary or development footprint;
  - vegetation zones;
  - management zones;
  - and where required:
    - existing waste;
    - existing erosion; and
    - existing structures (in waterways)

- Separate shape files should be supplied for all the maps mentioned above plus:
  - plots and transects;
  - assessment circles;
  - species polygons;
  - polygons for adjacent remnant area; and
  - the location or habitat area of sensitive species, and the management area related to that sensitive species (as this information cannot be displayed publicly).

All maps must include:

- a title (as per the names above);
- the site's name, location and lot/Deposited Plan (DP) numbers;
- the scale;
- the date it was prepared; and
- a legend.

Boundaries and zones must be confirmed on the site using a GPS. This information should be digitised onto an ortho-rectified aerial photo or SPOT-5 image. Maps must be easily readable and submitted to OEH as a Geographic Information System (GIS) file that is ESRI compatible. Shape files must use GDA94 datum. Name each shape file as: 'biobank site name_descriptor'. For example, 'Hill Farm_photo points' or 'Hill Farm_management zones'.

Photo points should be named A, B, C, D, E, F, G, etc. Photo points should be located in areas where change is expected, i.e. where replanting, natural regeneration, intensive weeding or other active management actions are to be carried out. As a rough guide, include at least one photo point in each management zone where active management actions will be undertaken. Boundaries and zones must be confirmed on the site using a GPS. This information should be digitised onto an ortho-rectified aerial photo or SPOT-5 image. Maps must be easily readable and submitted to OEH as a Geographic Information System (GIS) file that is ESRI compatible.

Shape files must use GDA94 datum. Name each shape file as: 'biobank/development site name_descriptor'. For example, 'Hill Farm_photo points' or 'Hill Farm_management zones'.

Additional requirements for offset sites that may be required (based on liaison with OEH):

- completed biobanking agreement management action template (provided in Word format), and
- Biodiversity Credits Pricing Spreadsheet.

Once the case has been received OEH will review the data entered, and any supporting documentation. For State Significant Development (SSD), State Significant Infrastructure and residual Part 3A (under the *Environmental Planning and Assessment Act 1979*) this review will take place during the assessment of the Environmental Impact Statement or Environmental Assessment report (for Part 3A matters).