Review of Environmental Impact Assessment Report & Environmental Management Programme, and Environmental Authorisation, for Yzermyn underground coal project

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1. Approach to review

This review considers the following core issues related to ‘good practice’ impact assessment and decision making for sustainable development:

a) The requirements of the national competent environmental authority in their letter of rejection of the Environmental Impact Assessment Report (EIAR) for the proposed Yzermyn underground coal mine on 16 May 2014; the Department of Environmental Affairs (DEA) set out a number of required amendments to the EIAR;

b) Comments made by the then Department of Water Affairs (now Department of Water and Sanitation) and by the Department of Mineral Resources (DMR) on the proposed mine application (Appendix B4 of the EIAR);

c) The reliability and adequacy of impact predictions and information provided to the decision maker, taking into account the requirements of the National Environmental Management Act (Act 107 of 1998: NEMA) and the 2010 EIA Regulations;

d) The defensibility of the approach to assessing impacts and evaluating their significance;

e) Whether potentially significant negative impacts have been adequately avoided, minimised and remedied, in line with the national environmental management principles (s2 of NEMA); and

f) Due consideration of all relevant information by the competent authority (Department of Agriculture, Rural Development, Land and Environmental Affairs, Mpumalanga) in reaching a decision to grant environmental authorisation to the proposed mine on the 7 June 2016.

The following documentation was reviewed:

- DEA’s rejection of the EIAR dated 16 May 2014;
- Final Amended Environmental and Social Impact Assessment and Environmental and Social Management Programme (undated), with a number of supporting Appendices prepared by EcoPartners (hereafter referred to as the EIAR): Yzermyn Underground Coal Mine: DEA Reference – 14/12/16/3/3/2/693; and
- Environmental authorisation for Portion 1 of the farm Yzermyn 96 HT within the jurisdiction of Pixley Ka Seme Local Municipality, Mpumalanga province, dated 7 June 2016 (including Annexure 1: Reasons for the decision).
Please note: Time constraints presented limitations to the level of detail of this review, particularly given the volume of material comprising the documentation submitted to the competent environmental authority in applying for environmental authorisation.

2. Authority responses and requirements for additional information

2.1 Comment and/ or rejection by three authorities

The EIA documentation submitted in October 2013 in support of an application to mine coal on Yzermyn raised serious concerns for three competent authorities, namely the then Department of Water Affairs (DWA), Department of Mineral Resources (DMR), and the Department of Environmental Affairs (DEA). The main reasons for their responses (amongst others) are set out below:

2.1.1 DWA (9/01/2014)

The DWA did not support the proposed development, given numerous concerns:

a) The ‘great concern’ about the affected environment, which contains sensitive habitats, threatened (Endangered) ecosystem, adjacent to an existing – and within a proposed - protected environment;

b) Impacts on, proximity to, and risk of drying up of wetlands;

c) Potential impacts on the Assegaai River leading to the Heyshope Dam;

d) Quantities of decant and impacts on water resources;

e) Potential decline in water inputs and deterioration in Present Ecological State and functionality;

f) The fact that a number of critical environments and impacts ‘are still alarming even after mitigation’;

g) Potential long-term impacts on groundwater quality – no proper mitigation measures included and it is not clear what the levels of sulphates would be after mitigation; the plume is predicted to extend 2km downgradient of the mine, depending on permeability of flow pathways;

h) Water quality concerns given downstream Freshwater Ecosystem Priority Areas (FEPAs);

i) The absence of wetland studies in the greater area to be impacted by the mine, cone of depression and groundwater contamination plume, which implies that the overall impacts have not been assessed and there is a wider area of wetlands whose impacts have not been studied or predicted;

j) The applicant’s focus on employment and economic development linked to the mine, failing to counter this argument with current and potential future growth in tourism, with its own employment and economic factors; and

k) The location of the site in a FEPA, with associated concerns about mainly underground water and contamination impacts affecting nearby wetlands and biota.

2.1.2 DMR (04/02/2014)

The DMR directed the applicant to submit a revised EMP, given the following considerations:

a) The location of the mine in a sensitive environment, with unacceptable pollution, ecological degradation or damage;

b) An inadequate rehabilitation plan or plan to avoid, minimise or manage residual or latent impacts;

c) Inadequate details with regard to monitoring; and

d) No measures to manage the decant post-closure of the mine.
2.1.3 DEA (16/05/2014)

The DEA’s letter dated 16/05/2014 in which it rejected the EIAR of October 2013 (‘the original EIAR’) highlighted a number of potential ‘fatal flaws’ (i.e. an impact which is so severe that it would preclude the granting of environmental authorisation) of the proposed project, namely:

a) The irreplaceability of the affected ecosystems. DEA notes that unless ground-truthing has been undertaken to prove that the development does not impact on the reason for the ‘irreplaceability’ classification, this may constitute a fatal flaw;
b) The fact that the site lies in a FEPA priority area, where changes in the water table may have unacceptable downstream impacts; and

c) The fact that the site lies within the Grassland Important Bird Area, recognised at both national and global levels.

According to the DEA’s letter of rejection of the original EIAR, substantial additional information was required to address a number of aspects. The key issues of relevance to this review are listed below, together with an assessment of the adequacy of the amended EIAR’s response to the DEA’s requirements. (In what follows the amended EIAR is referred to as ‘the EIAR’.):

a) The specialist studies must be updated to include assessment of the new alternative layout

Subsequent to the DEA’s letter of rejection, three additional studies/reports were commissioned by EcoPartners, namely:


ii. Scientific Aquatic Services (SAS) June 2014, revised August 2014. Appendix H3 Wetland Ecological Assessment; and


None of these specialist reports has been updated specifically to assess and evaluate the significance of impacts associated with the ‘best environmental option’ (which is the option which was authorised on 7 June 2016 by the Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs). The oft-repeated sentence in the EIAR that ‘The new preferred surface infrastructure has been considered as the best environmental option with the possibility of (Run of Mine) production and sale directly into the market, this implies no wash plant and no generation of discard or residue’ does not provide any information on the probable implications and impacts of this change.

The SAS Wetland Ecological Assessment (June 2014, revised August 2014) reiterates the fact that the proposed project ‘is located within an extremely sensitive area containing extensive wetlands which are presently in very good condition’ and that ‘it is the opinion of the ecologists that the project is regarded as having extremely high impacts...’ (p. vi)

Surface water impacts have not been updated. These were first assessed in a report which formed part of the original EIAR Appendix N (dated August 2013). No subsequent surface water report has been obtained in order to assess the revised surface layout associated with the ‘best environmental option’. EcoPartners itself observe in 8.5.2.2 of the EIAR that the modelling and impact assessment was based on the previous proposed development infrastructure and layout and say that ‘Should this change, the modelling results and associated discussion will need to be updated’ (p. 292).

EcoPartners give undue emphasis to the reduction in surface infrastructure in lowering the potential significance of mining impacts on biodiversity and water resources. They rely
heavily on the two SAS reports as the basis for their conclusions. The EIAR contains a statement in 8.8.4.2 (p. 338) that ‘Significant reduction of this impact will be evident, as the effect will be greatly reduced because less water will be required and the drawdown effect will be limited to the pumping of water for safety reasons only. Stabilisation will occur after (sic) and the drawdown cone will be smaller. In terms of the best environmental option, there will be no residue deposit or washing plant. Two significant water uses will therefor (sic) no longer be applicable.’ The EIAR however provides no information to substantiate this ‘significant’ reduction and changes to the drawdown effect. Moreover, there is no specialist evidence to support claims that the stabilisation will occur faster. Stabilisation in fact remains likely to occur only after 45 years (Appendix F, p 68).

The effects of removing the discard dump and washing plant on water uses and water balance, water resources, drawdown and/or potential for acid mine drainage have thus not been explicitly or adequately assessed. Without specific information to the contrary, it must be assumed that the drawdown effects of the proposed mine as well as the post-closure decant risks remain unchanged, given the ‘general gaining nature of rivers in the W15A catchment’ (Appendix F, p 18). Importantly, these factors play a crucial role in determining the likelihood of significant and unacceptable risks to biodiversity in the wider area and downstream water resources.

According to the EIAR, ‘Potential direct impact on wetlands was reduced from 39.89 ha...to 12.10 ha in the Best Environmental option’ (p. vii). These changes translate into reduced ‘footprint’ impacts only; any changes to indirect impacts on water resources and water-dependent ecosystems including wetlands, as well as downstream water users, are not clear.

The DWA’s concerns (Section 2.1.1) with regard to impacts on freshwater and groundwater resources associated with supporting ecosystems - including some priority supporting ecosystems -, and on water quality, are of crucial importance here, and have not been sufficiently addressed.

b) The biodiversity study must address NEMBA-listed ecosystems (Wakkerstroom/ Luneberg Grassland and possibly also, Paulpietersburg Moist Grassland, Eastern Temperate Freshwater Wetlands and Eastern Highveld Grassland)

Mention is made in the EIAR of Wakkerstroom/ Luneberg Grassland and Paulpietersburg Moist Grassland. However, there is confusion in the EIAR regarding the conservation status of the affected vegetation. In 1.2.3 of the EIAR (Table 1-1, Evaluation of ... national Interest, Impact column) (p. 7) the threatened terrestrial ecosystem status of the area is given as ‘Vulnerable’, while this vegetation type is in fact listed as ‘Endangered’ in the NEMBA listing (2011), as noted later in 7.16.4 (p. 217).

c) A quantification of the dewatering effects on economic activities downstream, including droughts and floods

EcoPartners prepared a report on downstream water activities (Appendix N2). This report is unacceptable; it lacks rigour and a systematic analysis. Furthermore, the report has not been prepared by a suitable specialist with relevant expertise and experience. Appendix N2 makes a number of vague and wholly inadequate and inconclusive statements (examples given below). It gives information on the present ecological state of the affected river systems, and on potential risks of pollution and flow changes, without quantifying the predicted effects on economic activities.
The conclusions and recommendations emerging from this study are wholly inadequate, of little practical application or direct relevance, and lacking explicit predictions. ‘It is recommended that the proposed mine development ensure that water discharged to the rivers are [sic] of such quality that it does not pollute the rivers and affect the downstream water users’ (p. 42). Impacts on springs, boreholes, floods and droughts are not assessed; the study focuses only on surface water resources, ignoring the potential influence of groundwater recharge (the process whereby water moves from the surface to underground) affecting water users. Despite its lack of rigour, many of the statements contained in the report illustrate why a proper assessment of downstream impacts is vital:

- ‘A maximum of 1,152 cattle and 6,810 sheep could be affected should the Yzermyn underground coal mine development reduce the water in the Assegai and Mawandlane rivers significantly. Agricultural activities are water intensive and a reduction in water levels of the Assegai and Mawandlane rivers may place strain on agricultural activities in the area.’ (pp. 21 and 23)
- ‘A reduction in the water quantity of the Assegai and Mawandlane rivers may cause a concern in the area.’ (p. 24)
- ‘A reduction in water levels could impact on the rivers and wetlands of the protected areas.’ (p. 24)
- ‘...irrigation with contaminated water may pose a potential health risk to consumers. Healthy plant growth may also be affected by contaminated water. This may have a drastic affect in the quality of crops produced and the quantity of yield per square meter.’ (p. 27)
- ‘groundwater results indicate that there is no risk of water quality affected during the life of mine. Further studies are being conducted to assess the impact after mine closure.’ (p. 27)
- Elevated levels of iron, manganese and aluminium as a result of acid drainage ‘will affect the quality and quantity of crop production.’ (p. 28)
- ‘Many heavy metals accumulate in the liver and brain and affect the natural functioning of these organs.’ (p. 29)
- ‘The Heyshope Dam is a well-known fishing destination and fish species includes Largemouth Bass, Yellow fish and Carp. Aluminum may cause coagulation of mucus on fish gills and cause respiratory problems. Humans should be careful of eating many of these fish as they will stand a change of getting mercury poisoning.’ (pp. 30-32)

The report concludes that the ‘location of the tributaries on the proposed Yzermyn underground coal mining area effectively create a watershed area around the target area. This greatly enhances the management options for the mine as any possible pollution can be contained within the target area and will not affect the KwaMandlangamansi Protected Environment or any neighbouring area. During the operational phase there is little risk of contamination of the surface water and effective management (e.g. water treatment) could reduce the impact post closure’ (p. 40). No justification for these statements is provided.

As with the previous point (a), the DWA’s concerns (Section 2.1.1) with regard to impacts on freshwater and groundwater resources, and on water quality, are of crucial importance here, and have not been sufficiently addressed.
d) Inclusion of the regionally Critically Endangered and southern African endemic Rudd’s Lark in the EIAR (85% of the global population is confined to a 50km radius around Wakkerstroom)

Rudd’s Lark is mentioned in a table in 7.16.10 (p. 225), which is followed by an unfounded statement that is not supported or justified by specialist studies (faunal specialist studies have not been updated): ‘It is anticipated that the proclaimed protected environment and areas which are located directly adjacent to the mine area will provide suitable and sufficient space for the birds to forage and nest. It should be noted that mining will be underground and the foraging of birds in the area would still be possible’ (p. 226). Crucially, it is not only the footprint impacts on birds but the effect of lights, noise, and changes in total area of available habitat (etc.) that may impact this species. None of these impacts has been addressed.

e) Additional surface and groundwater studies to adequately quantify the acid mine drainage impacts

No additional surface water studies have been undertaken to quantify the acid mine drainage (AMD) impacts and/or their rigorous management.

Of utmost concern is the fact that the EIAR (7.10.5.1) (p. 188) refers only to the discard dump in discussion of AMD potential. This is an unacceptably narrow view of the potential contamination source linked to coal mining.

Appendix H1 Section G (Natural Scientific Services, August 2013), which formed part of the original EIAR draws specific attention to AMD representing the most severe impact of coal mining on water resources. In terms of biodiversity, both fauna and flora are exposed to ground and surface water contamination as the wetlands may be fed by both the shallow weathered aquifers and the deep fractured aquifers. Any contamination within these aquifers will therefore impact on the surface water quality downstream. This contamination will impact on the Present Ecological State of the wetlands and the eco-services the wetland can provide, the main one of which is the maintenance of biodiversity. (p 255)

The DEA therefore specifically required that additional groundwater and surface water studies be undertaken in order to adequately quantify the anticipated impacts of AMD from the proposed mine.

The Delta H report undertaken in August 2014 (Appendix F) after the DEA’s rejection of the original EIAR, states that the predicted post-closure decant rate, i.e. groundwater outflow at ground surface, is strongly dependent on the ‘poorly-defined regional recharge rate and local hydraulic conductivities and therefore burdened with a great uncertainty’ (p 69). However, it assesses the potential post closure impacts of decant from the underground mine voids on the groundwater quality as being ‘highly likely to occur’, ‘Widespread beyond site boundary (regional). Localised if mitigated by treatment of decant’, and ‘long-term with substantial increases of pollutant concentrations in surface waters beyond closure’. ‘The intensity of the impact is likely to be a substantial deterioration in the ambient surface water quality if not mitigated by treatment of decant’ (p 69).

It appears from the Delta H report, therefore, that decant from the underground mine voids is highly likely to occur and that this could substantially increase pollutant concentrations in both surface water and groundwater. It is thus clear that a thorough and detailed analysis of
the potential impacts of AMD on surface and groundwater would have been vital to place the competent authority in a position to make an informed decision as regards environmental authorisation. This was not however done.

This report’s findings are similar to an earlier study by WSP which formed part of the original EIAR (Appendix ‘Adam Smith’ geohydrology impact assessment, dated September 2013). The earlier study concluded that in the long-term, oxidation of sulphide minerals exposed in the walls, roof and floor of the mine workings may lead to AMD. This will affect the quality of water accumulating in the mine workings. Lasting groundwater quality impacts may result, both at the level of the workings, and from surface decant. Normally the groundwater component of stream base flow is comparatively low. However, during the dry season, the groundwater base flow component may become more pronounced when surface runoff is reduced or absent. Model simulations indicate that groundwater contamination will move from the mine workings in a north and northeast direction in the deeper fractured rock aquifer. The plume may extend ‘more than 2km down gradient of the mining operations. Simulations considered the inferred faults to act as preferential paths of groundwater flow.’ (p 20)

To the extent that Appendix H3 (The SAS Wetland Ecological Assessment (June 2014, revised August 2014)) does deal with the dangers posed by decant from the mine, its findings suggest that the DEA’s concern was well founded. The report says ‘...should the project proceed it will have a very high impact on the wetland ecology of the local area. The potential for post-closure decant of water from the underground mine void via the adit and/or unsealed exploration boreholes (Delta H, 2014) is of particular concern, as this will have a long term effect on surface water quality of not only on (sic) the wetlands within the study area, but also on aquatic resources within the greater catchment with special mention of the Assegaaai River’ (p. vi). The study concludes by saying that ‘Should it be considered economically feasible to treat the decant water post-closure until water quality stabilizes, which could take many decades, to pre-mining water quality standards in such a way as to support the post closure land use, which is envisaged to be protected wilderness, the project would be considered feasible’ (p. vi).

However, this long-term treatment of decant water is not addressed in the EIAR/ EMPr, other than a broad recommendation that ‘the post-closure decant water be treated until legally acceptable water quality stabilizes’ (p812). No explicit provision for a suitable treatment facility is made to treat post-closure decant for a number of decades. Proposed measures to contain and mitigate AMD impacts are also highly questionable, poorly defined, and unreliable. There is thus no assurance that AMD would be appropriately managed, particularly post-closure of the mine. ‘Potential acid mine drainage (AMD) once groundwater levels have recovered (20-50 years after mining ceases) is likely.’ (p 342 of EIAR)

According to the EMPr, monitoring is recommended only for two years post mine closure, which is wholly inadequate in light of the anticipated long-term burden of AMD decant into receiving freshwater systems.

As with the previous points (a) and (c), the DWA’s concerns (Section 2.1.1) with regard to impacts and risks to groundwater resources, and specifically of acid mine drainage and decant on water quality, are of crucial importance here, and have not been sufficiently addressed.
f) All the associated infrastructure requirements for the mine must be addressed in the EIAR and specialist studies (including access roads and pipelines, reservoirs, culverts, bridges, alternative access roads)

The Natural Scientific Services report (Appendix H1, Section G, August 2013) on biodiversity explicitly excludes associated infrastructure and states this clearly as being a limitation: ‘Potential impacts associated with access roads, conveyor routes, pipelines, electricity supply routes etc have not been assessed as part of this assessment.’ (p. 231). This report has not been updated and the impacts of associated infrastructure on this significant biodiversity area have not been assessed.

The scope of other specialist reports appears to be limited to the area affected by the mine infrastructure only; i.e. they too do not cover impacts that would occur beyond this immediate area. It thus does not appear that access roads and pipelines, reservoirs, culverts and bridges have been addressed in the EIAR.

g) Geotechnical study to address issue of mine stability and potential risk of subsidence

The DEA requested that a geotechnical specialist study be included in the revised EIAR to address the issue of mine stability and the potential for subsidence (subsidence is a possible feature of underground coal mining which leaves voids that may collapse and cause the earth surface to subside). Although Appendix H1 Section G, which was included as part of the original EIAR, cited the ‘WSP 2013a’ study as noting a low risk of subsidence, there is no mention of the risk of subsidence in Appendix C3 (the updated Geotechnical Study) despite this request.

h) An indication of the potential significance of cumulative impacts

The EIAR fails to assess cumulative impacts adequately and to evaluate their potential significance reliably.

A cumulative impact is defined in NEMA as ‘the impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.’ According to the NEMA 2010 EIA Regulations, potentially significant cumulative impacts must be assessed (31(2)(l)(i)).

According to the EIAR’s ‘findings recommendations and summary’ section, ‘Although the proposed project will impact on most of the environmental parameters the cumulative impact of the mine and other activities is not considered to be significant. This can mainly be attributed to the low level of impact that the tourism and scattered agricultural activities have on the environment, as well as the limited disturbance of the proposed new underground coal mine (when all mitigation measures are effectively implemented)’ (pp. vi-viii).

Cumulative impacts are poorly, vaguely and in some cases inaccurately described and their potential significance is inadequately evaluated in the EIAR. The EIAR contains several internally contradictory statements and no attempt has been made to provide a single coherent conclusion. For example:

i. With further mining developments in the area, this catchment is likely to come under increased pressure, not only in terms of water abstraction/discharge, but also in
terms of the potential contamination of these rivers by diffuse sources of pollution. (10.3.5) (p. 576);

ii. The cumulative impacts that would result from a combination of the proposed Yzermyn Underground Coal Mine and other existing or proposed future developments in the region include a cumulative impact on surface and groundwater quality as well as cumulative impacts on streams and wetlands. (10.3.6) (p. 576).

iii. In 10.3.11 of the EIAR it is stated that ‘There appear to be two mines within proximity to the proposed target area. The Savmore Colliery underground coal mine (owned by Kangra) located approximately 20km north east of the site, and approximately 35km west of Piet Retief. There also appears to be an opencast coal mine located between the proposed target area and Piet Retief (46km north west of the target area and 5km from Piet Retief), seemingly owned or operated by Jindal Mining SA’ (p. 577) It is not clear if – or how – the impacts of these coal mines are addressed in the EIAR. Also, it is not clear whether this information was provided to specialists and if they were asked to assess cumulative impacts in their studies.

iv. The EIAR omits the conclusion of Natural Scientific Services (Appendix H, Impact Assessment – Section G) that ‘If a significant portion of these (mining) applications are approved, the combined impacts of mining, afforestation and agriculture will have a massive deleterious impact on Biodiversity at provincial and national levels.’ (p. 267)

v. The EIAR fails to take the Loskop Coal Mine into consideration in assessing cumulative impacts, although this mine is specifically mentioned in 4.13.3 where it is stated that it was approved in mid-2010, lies 2km east of the proposed Yzermyn project, and falls in the Mabola Protected Environment (p. 95). This omission is serious and negates any conclusions drawn about the severity of cumulative impacts on biodiversity and water resources. The cumulative impacts on this Protected Environment become increasingly important in this light, but are ignored in the EIAR.

vi. According to 8.5.4.1 of the EIAR, ‘the cumulative impacts with regards to water quality and quantity are expected to be limited’ (p. 298). However, these impacts are not addressed by all of the relevant specialist studies and EcoPartners’ conclusion is thus questionable. Relevant in this regard are the following findings from specialist studies:

- The surface water specialist (Appendix N1) states that the cumulative effects of the mine on water flows is expected to be limited, but this specialist only took into account the proposed mine, urban and agricultural effects (p. 29). Other mining activity in the area was not taken into consideration.
- Neither of the geohydrological assessments (WSP geohydrology impact assessment, Appendix ‘Adam Smith, nor Appendix F: Delta H report) assessed cumulative impacts.
- The wetland assessment (Appendix H3, SAS report, 2014) did not assess cumulative impacts.

i) Irreplaceability of the affected ecosystems

With the exception of an updated wetland study, the biodiversity studies undertaken for the proposed project have not been updated in response to DEA’s point that unless ground-truthing has been undertaken to prove that the development does not impact on the reason for the ‘irreplaceability’ classification, this may constitute a fatal flaw.

For the many reasons set out in Sections 3-5 of this review, concerns remain about the potential harm to the ecosystems surrounding – and ecologically linked to - the site of the
surface mine infrastructure, and the risk of irreversible negative impacts on the reasons for their ‘optimal conservation’ and ‘irreplaceable’ Critical Biodiversity Area classifications in the Mpumalanga Biodiversity Conservation Plan.

j) Effect on the Grasslands Important Bird Area

As noted in (i), the biodiversity studies undertaken for the proposed project have not been updated in response to concerns about the project’s location within the Grassland Important Bird Area (IBA), recognised at both national and global levels.

This IBA is described by Barnes (1998) as one of the most important IBAs in Africa and is considered vital for the conservation of a number locally-, and globally-threatened bird species, as well as for the conservation of other fauna and flora. Thirty-nine bird species of conservation importance occur in this IBA. (Appendix H1, Section f, p. 213)

The EIAR, without specialist substantiation, states that ‘It is anticipated that the proclaimed protected environment and areas which are located directly adjacent to the mine area will provide suitable and sufficient space for the birds to forage and nest. It should be noted that mining will be underground and the foraging of birds in the area would still be possible.’ (p. 226).

Crucially, it is not only the footprint impacts on birds, but the effects of lights, noise, people, blasting and vibration, and changes in total area, fragmentation and integrity of available habitat that may impact these Conservation Important bird species and undermine the integrity of the IBA itself. None of these impacts has been addressed.

k) Layout map of ‘No Go’ areas in the EMPr

DEA requested the applicant to ensure that the EMPr includes a layout map of ‘no-go’ areas clearly identified.

A layout map is included in the EIAR (Figure 11-1, p. 682), to which reference is made (pp. 605-6, p.619, p. 620). This map includes ‘sensitive areas’ as well as ‘no go’ areas; the former are described in terms of ‘No activities are to infringe upon these sensitive areas without authorisation’ (e.g. p. 606). This ‘no go’ map appears to be a replica of Figure 27 in the SAS wetland report (Appendix H3, p. 73), namely ‘Conceptual representation of the wetland systems assessed within the study area with the associated buffer zone’. That is, the ‘no go’ map addresses only channelled valley bottom wetlands (indicated as ‘no development allowed’ on Figure 11-1) and seep wetlands (shown as ‘sensitive area, authorisation required’ on Figure 11-1). No allowance is made for a 100m buffer or setback from these wetlands, as delineated in the SAS report.

Importantly, according to the SAS report: ‘It is essential that the sensitivity maps...be considered during all phases of the development, and with special mention of the planning of surface infrastructure to aid in the conservation of important resources within the study area where possible. As far as possible all mining activity should be excluded from the 100m wetland buffer zone (reviewer’s emphasis). In addition, exemption for all activities within this area will need to be applied for.’ (p. 76) The EIAR’s ‘no go’ map does not show this 100m wetland buffer zone, but instead refers to the seep wetlands as ‘sensitive areas, authorisation required’.
No reference is made in the ‘no go’ map to any other natural resources or biodiversity of significance other than wetlands.

A series of sensitivity maps were prepared by NSS (Appendix H1, Section F). The ‘overall biodiversity sensitivity map’ (p. 227), which combined aquatic and wetland sensitivity, faunal and floral sensitivity, indicates most of the site to lie in either a ‘very high’ or ‘high’ sensitivity category. According to NSS, ‘very high’ sensitive areas ‘must remain undisturbed’ (interpreted by this reviewer to mean ‘no go’), ‘high’ sensitive areas should be ‘subject to limited disturbance and rigorous mitigation’ (Appendix H1, Section F, p. 228). The EIAR gives no explanation or basis for arriving at ‘no go’ areas and ‘sensitive areas’ in light of NSS’s recommendations. The EIAR notes that ‘these maps represents (sic) the findings on the areas focussed on during the previous submission’ (p. 333), apparently dismissing their content without justification; no updated sensitivity maps are, however, provided. Reasons for not including these ‘very high’ sensitivity areas as ‘no-go’ areas are not provided in the EIAR. Moreover, permitting these ‘very high’ sensitivity areas to be harmed provided that harm is authorised (as appears to be the message conveyed in the EIAR) is highly questionable and without foundation.

2.2 Conclusions
This review examines the adequacy of the Final EIAR in meeting the requirements of DEA and in addressing the issues and reservations raised by DMR and DWA. It concludes that none of the requirements or issues has been adequately met. For this reason, the major concerns and issues raised by these authorities remain largely unanswered.

3. Reliability and adequacy of impact predictions and information on which to base a decision

The EIAR is required to provide ‘sufficient reliable and relevant information’ to stakeholders, including decision makers1. An environmental impact assessment report must ‘contain all information that is necessary for the competent authority to consider the application and to reach a decision’ (31(2)).

3.1 Updated information on which to base a decision

As explained above, information submitted to DEA, DMR and DWA in the original EIA/ EMPr was considered by three competent authorities to be inadequate and the EIAR was rejected by the DEA in its letter of 16 May 2014. Deficiencies in the information base noted by these authorities have not been rectified (please refer to Section 2 of this review).

Other respects in which the information contained in the EIAR remained inadequate for purposes of reaching a decision are given below:

a) The NEMA 2010 EIA Regulations R543 of 18 June 2010 require a description and comparative assessment of all alternatives identified during the environmental impact assessment process (31(2)(i)).

The EIAR does not describe discrete project alternatives, but gives alternatives for thirteen different components of the proposed development (Section 4 of the EIAR) (e.g. surface layouts, adit location, mining method, haul road, discard dump, etc.). In each section these alternatives are defined mostly in terms of ‘alternatives considered’ as well as the ‘preferred alternative’. In some sections (e.g. power supply) - a ‘new preferred alternative’ is presented, and in the sections on discard dump/ residue stockpile and transport of discard material the alternatives considered are given, followed by the ‘most viable alternative’ and the ‘new preferred alternative’.

The ‘best environmental option’ is presented as the new preferred alternative, but a consolidated description of the specific components constituting this option is not given. That is, the ‘package’ of different alternative components constituting ‘the best environmental option’ is not clear (other than to say that this option excludes the discard dump and coal washing plant).

Of critical importance, the impacts of this specific option (comprising all of its specific components) are not distinctly assessed.

b) There is confusion between different project alternatives in the specialist reports, most of which were finalised before the ‘best environmental option’ was proposed; the specialist reports have not been updated to assess and evaluate the changed impacts without the discard dump and coal washing plant. The specific impacts associated with the ‘best environmental option’ are therefore impossible to determine with any accuracy. Importantly, the EAP seems not to be appropriately qualified to undertake this task other than in broad terms, lacking the necessary professional insights.

c) The assessment and evaluation of significance of the key issues and impacts is inadequate (please also refer to Section 4 of this review). There is no systematic, explicit or reliable assessment of impacts of the ‘best environmental option’ (the project without the discard dump and coal washing plant) on biodiversity other than, to an extremely limited extent, in relation to wetlands (in the SAS reports). Changes in water requirements, water balance, impacts on surface water and groundwater flows and quality, dependent ecosystems and biodiversity, as well as downstream water users are not adequately addressed; the EIAR focuses inappropriately on the direct ‘footprint’ impacts and ignores wider landscape, indirect and cumulative impacts.

d) Specialist studies have not been updated to predict and assess impacts of the ‘best environmental option’; many of these studies continue to assess impacts on water resources with the coal discard dump and washing plant in place, leading to a lack of clarity on the potential significance of the ‘best environmental option’ impacts and their mitigation. For example, the EIAR (8.7) notes that, Due to the changes in layout and position of the discard dump (residue stockpile), a new geohydrological assessment was required (p. 306). However, the results presented in the EIAR reflect geohydrological assessment based on e.g. seepage from the discard dump post closure. Without a reliable prediction of impacts on biodiversity and water resources, the effectiveness of proposed mitigation measures in reducing these impacts is questionable.

e) The proposed mitigation measures give no assurance of effective minimisation and remedy of significant negative impacts. A number of residual impacts of medium-high or high significance remain (e.g. Tables 10-7 and 10-8 in the EIAR) (pp. 555-573). Based on the evaluation of potential significance of negative impacts by specialists, and contrary to claims in the EIAR (and environmental authorisation), it is improbable that development of this
area could be mitigated to ensure ecologically sustainable development and/or justifiable social and economic development.

3.2 Reliability of information
There is a major disconnect between the recognition by specialists of the significance of the biodiversity and water resources components of the affected area and of likely risks and impacts of the proposed mine on these components, and the findings and conclusions presented in the EIAR. Examples are given hereunder.

a) Section 1.2.3 of the EIAR and Table 1-1 (pp. 6-8) portray an inaccurate and misleading reflection of the significance of impacts on biodiversity and water resources as set out by relevant specialists:

i. ‘The impact on biodiversity due to an underground mine is limited to surface infrastructure and some depletion of water. The threatened terrestrial ecosystem status in this area is “Vulnerable”.’ (p. 7)

The affected ecosystem is in fact listed as ‘Endangered’ in terms of the 2011 NEMBA list of Threatened Terrestrial Ecosystems. Impacts on biodiversity are certainly not limited to ‘surface infrastructure and some depletion of water’, as highlighted in a number of specialist appendices.

ii. ‘The specialist studies conducted found none of the sensitive species of mammals, butterflies, amphibians, reptiles or plants likely to be associated with these ecosystems. It is likely that these ecosystems do not support the biodiversity that is typical of the area as these ecosystems are no longer in their pristine condition.’ (p. 7). Similarly in 7.16.4, the EIAR states that ‘It should be noted that the specialist studies conducted found none of the sensitive species of mammals, butterflies, amphibians, reptiles or plants likely to be associated with these ecosystems. It is likely that these ecosystems do not support the biodiversity that is typical of the area as these ecosystems are no longer in their pristine condition.’ (p. 218)

These statements are gravely misleading and incorrect, and not based on the specialists’ findings. In this respect:

- Appendix H1 Section B states that a high number of species of conservation importance were detected. Approximately half of all potentially occurring bird species, one third of potentially occurring frog species, and a quarter of all potentially occurring mammal and reptile species was observed by NSS and DEC in the study area. Only 15% of potentially occurring butterfly species were observed. (p. 83)

- Appendix H1 Section B explicitly notes that ‘Some species, which are uncommon, migratory, inconspicuous, secretive or otherwise difficult to detect may not have been detected even though they were potentially present on site.’ (p. 81). It also notes that ‘Additional camera-trapping could have increased the probability of recording more carnivore species, while live-trapping for longer periods and at more localities could have increased the probability of recording more rodents, insectivores and other small, terrestrial mammal species (spp.)’ (p. 84). Similarly, 104 bird species (53%) were detected in the study area, of which 18 CI birds have been recorded in or near the mining area. Furthermore, records of CI reptiles and frogs are known to be likely to occur. (p. 104-106)
• Appendix H1 Section B notes 38 ‘conservation importance’ (CI) mammal species potentially occurring in the study area, of which 21 species have been recorded in the broader mine area. Eight CI mammal species - including one Endangered, five Near Threatened and two Data Deficient species - were recorded in the study area; seven of them in or adjacent to the proposed surface infrastructure area. (p. 96)

iii. ‘...there might be 15 years of impacts associated on water quantity and limited impacts on water quality, provided the mitigation of impacts are implemented.’ (p. 7)

This statement is inaccurate and misrepresents the groundwater and hydrological specialists’ findings.

• According to Appendix F (Delta H’s geohydrology report, August 2014), groundwater inflows into the proposed underground mine are ‘highly likely’, would be widespread, would extend beyond the site boundaries (i.e. regional), and would endure in the long term beyond mine closure with gradual increase in base flow. (p. 54). The post-closure modelling results indicate that it would take around 45 years for the mine voids to be completely flooded once active dewatering is stopped. Thereafter, decant via the adit and/or unsealed exploration boreholes in the vicinity is likely to occur. The potential post-closure impacts of decant from the underground mine voids on the groundwater quality are described as ‘highly likely’, long term, and may extend from local to regional scales, depending on the effectiveness of mitigation. (p. 69)

In addition, given the low level of confidence in the groundwater model (p. 69), and uncertainty about sources of wetland/river recharge (Appendix H1, Section E, p. 185), there is a high risk of significant and long-term impacts on water quality.

• According to Appendix H1, Section F (Sensitivity Analysis), the proposed mining site is situated in an extremely sensitive and conservation important area, corresponding with the MTPA’s (2013) Mpumalanga Biodiversity Sector Plan, and the DEA et al’s (2013) Atlas of Sensitive Areas for Mining. Most habitat in the proposed underground mining and surface infrastructure areas was assigned a Very High or High sensitivity. Natural Scientific Services conclude that ‘These combined findings suggest that (the project) is fatally flawed.’ (p. 223)

• Appendix H1, Section G (Impact Assessment) similarly concludes that the combined baseline and impact assessments indicate that the proposed project is fatally flawed and should be a ‘no go’ in terms of biodiversity. ‘Due to the HIGH and long-term (if not irreversible) status of this impact in an area far exceeding the study area, the project should be a NO GO’ (reviewer’s emphasis) (p. 253). The specialists, Natural Scientific Services, explicitly state that ‘This is largely because of the impact of the proposed underground mining on the supply of water to the surface water resources (due to the de-watering activities) and the potential groundwater contamination. These aspects will have a significant impact on aquatic and wetland ecosystem functioning and biodiversity in a far greater area than the underground mining area. These and other aspects of the mining project are in strong conflict with international, national and provincial legislation, policies and guideline’. (p. 269)

Furthermore, they note that ‘Most potential impacts of the mining operation had a HIGH overall significance rating, even with mitigation.’ (p. 269)

• The site is located in the Ekangala Grassland Project area as well as the Grassland Important Bird Area, recognised nationally and globally. It is described as one of the most important IBAs in Africa and vital for the conservation of a number of locally and globally threatened bird species and the conservation of other fauna and flora (7.16.10 of the EIAR) (pp. 223-226).
iv. ‘The most significant feature in terms of the freshwater priority area is the habitat for fish. As this is the origin of the system, it is unlikely that it will have a significant impact on the fish population.’ (pp. 7-8)

According to the biodiversity specialists’ report, reduced flow will hinder fish migration and could negatively affect three species of Conservation Importance which have been sampled in the Assegai River catchment. If the flows in these systems change, these species will be lost in these rivers (8.8.4.2) (p. 339). Moreover, changes in water quality conditions could lead to species loss (8.8.4.3) (p. 343). These impacts would undoubtedly be significant. There is therefore no defensible basis for the EAP’s conclusion quoted above.

b) The EIAR (8.5.4.1) states that ‘The potential impact to the watercourse ecology due to changes in flow... has a High environmental significance. This is reduced to Low Medium should mitigation measures be implemented... The operations are expected to lead to a decrease in the water quality, expected to have a High environmental significance, reduced to Medium High should suitable mitigation measures be implemented.’ (p. 298)

This contradicts the findings of Appendix H1, Section G (Impact Assessment). According to the significance ratings in Table 4.1 (p. 238) of this Appendix:

- Impacts on habitat and loss of species are High, but could be reduced to Medium-High with mitigation;
- Decline in water inputs and water quality, leading to deterioration in present ecological state and functionality – are High before and after mitigation.

c) The EIAR repeatedly draws attention to the fact that ‘mining will be underground and that biodiversity on the surface area for the majority of the target and remainder area will for the most part not be disturbed’, and states that, should the ‘best environmental option’ be followed, the ‘total footprint of the proposed project will be reduced to approximately 22.4 ha,..., of which 4.48 ha of wetlands has not yet been previously transformed, of this only 0.072 ha will be impacted on directly.’

- This conclusion fails to take into account any indirect or cumulative impacts on wider ecosystems structure and function, and presents a narrow and misleading picture solely of the ‘footprint’ impacts of mining infrastructure. In addition, this statement is misleading as, according to 4.12 of the EIAR (p. 92), 2.86 ha (0.0724 ha of the Eastern Wetland and 2.79 ha on the Western Wetland) will be impacted on by the revised surface infrastructure layout.

d) The statements made in Appendix H4 (SAS 2014) that ‘The dolerite sills occurring at a depth of around 20 to 30 m and above the coal seams act as an impermeable geological layer which will prevent any drawdown of water from the wetlands and no significant moisture deficit is envisaged which will affect the larger wetland area (Appendix H4, wetland delineation)’, and ‘It can be concluded that the impact on the wetland resources will be limited to the footprint of the proposed surface infrastructure and the immediate surrounds’ (p. 2) are questionable.

- According to Appendix ‘Adam Smith’ (WSP geohydrology impact assessment) there is significant faulting of the surrounding country rock which could act as potential groundwater flow pathways; ‘quantification of the aquifer characteristics of the faults and dolerite intrusions specifically need to be confirmed through additional fieldwork, as both of these could influence groundwater flow patterns and the rate of the spread of contamination and must therefore be confirmed’ (p. 12), as additionally reflected in the
‘low confidence’ levels of the model (Appendix F: geohydrological model) (p. 69). It does not appear as if additional fieldwork has been undertaken.

e) The EIAR (8.5) refers to the surface water assessment (WSP report, Appendix N). No mention is made of the aquatic assessment (Appendix H1 Section D) or other related studies addressing water-dependent ecosystems (i.e. a number of wetland studies) (pp. 291-301). In 8.5.4.1, the EIAR states that ‘During the decommissioning and closure phases, the environmental impacts can be summarised as follows: The continued reduction in flows expected post-closure of the mine is expected to have a Low Medium environmental significance, both with and without mitigation measures; the decrease in the water quality is expected to have a Medium environmental significance, reduced to Low Medium should mitigation measures be implemented.’ (p. 298)

• Importantly, the impact significance of AMD per se has not been assessed (Appendix ‘Adam Smith’) (p. 19), but contamination of aquifers post-mining is rated as being of Medium environmental significance.
• Appendix H1 evaluates impacts on water quality as being of ‘high’ significance both before and after mitigation. This directly contradicts what the EAP has said in the EIAR.

f) According to 8.7.2.3 of the EIAR, ‘The majority (67%) of the Yzermyn coal samples are classified as potentially acid generating and ...should be treated as potentially acid generating with an expected acidic leachate quality.’ (p. 313)

g) The socioeconomic impacts of the proposed project are not addressed in a balanced and objective way, and fail to incorporate relevant findings of the socioeconomic specialist report (Appendix O). The assessment of these impacts, and conclusions drawn by EcoPartners, are thus highly questionable. Moreover, the EIAR (e.g. 4.13) provides a biased view of the ‘no go’ alternative in favour of mining.

• According to the EIAR’s Executive Summary, coal mining ‘will provide a welcome relief in terms of the current account balance, job creation and poverty alleviation.’ (p. iii) This statement appears unduly biased in favour of mining. It effectively ignores a number of key considerations related to employment, poverty alleviation and distributional effects of the costs and benefits of coal mining covered in the socioeconomic specialist study (Appendix O). It fails to compare the current situation - and the alignment of current land uses and economic activities with the NEMA principles - to the alternative of coal mining in the short-term, with its accompanying impacts on livelihoods and income generating potential, as well as social equity effects in the short to longer term.

• Statements in the EIAR that ‘The mine is, therefore, likely to have a considerable positive economic impact on the local population’ (p. vii) does not give an accurate or balanced view: this claim may apply, at best, during the 15-year life of the mine, but in the long term is unlikely to be an optimal land use. The EIAR (8.16.4.5) notes that the return of the local economy to agriculture and tourism is likely to take up to 10 years (or longer depending on the degree of impact of the mine on the local physical environment) (p. 468). Elsewhere in the EIAR the potential ‘long-term to permanent impact’ of negative effects of mining on tourism, with associated impacts on income generation and employment, to Wakkerstroom are noted. (p. 466) The socioeconomic study (WSP, Appendix O) highlights the fact that employment effects are not straightforward – the mine will be operational for 15 years, after which there will be job losses and a reduction in local economic activities and opportunities (p. 34). Moreover, the main livelihoods
prior to mining – agriculture and tourism – may be significantly negatively affected; ecol-tourism has created about 400 jobs in the Wakkerstroom region (4.13.7 of the EIAR, p. 97) and The Wakkerstroom and surrounding conservation areas are significant townscape with a strong future natural based tourist industry (7.18.2, p. 242). In addition, albeit that skills development is recommended in the EIAR, most of the jobs are likely to go to people from outside the area due to a lack of local skills (p. 455 of the EIAR), thereby offering little benefit. The total number of employment opportunities which would be foregone if mining were not to occur is not significant from a regional perspective, and therefore the loss is likely to be of low significance when considered in isolation (Appendix O, p. 36).

- Impacts of mining on tourism to the wider area and associated economic factors, income generation and employment have not been adequately assessed. Numerous sections in the EIAR refer to the moderate to high potential for expansion of tourism and recreation in the affected area, as well as the diversity of natural resources and aesthetic attributes of the area that serve as the foundation for this sector to grow (e.g. 8.10.3.3, 8.16.3.5, 8.16.4.3, 8.16.4.5) and the potential ‘long-term to permanent impact’ on Wakkerstroom. (p. 466 of the EIAR).

- The potential influx of labour and job seekers, with associated negative impacts (e.g. 8.16.3.4, p. 455; 8.16.4.2, p. 457-8; 8.16.4.3, pp. 462, 465, 466-468) is inadequately assessed: most communities and local municipalities expressed concern regarding the potential influx of job seekers and labour into the area, which could affect accessibility to social and basic services, specifically healthcare, housing, water and sanitation, sense of place and social conflict. The EIAR (10.3.11) notes that there could be a cumulative increase in the number of job seekers coming into the area (p. 578), but does not rigorously assess this impact. Moreover, an influx of labour would have indirect impacts on available water resources and biodiversity, compounding impacts of the proposed mine.

- According to the letter from the then DWA, 9/01/2014 (Appendix B4), and from Appendix O, it is apparent that, after the 15-years of mining, mine closure will result in the loss of an estimated 576 direct jobs, and associated indirect employment through contractors and service providers for the mine, as well as affect the increased local population indirectly. The reduction in economic activities within the area is particularly significant for the local communities as they are currently reliant on subsistence agriculture and seasonal farming and mining work. In addition, locally sourced employees may not be able to move to other areas for mining employment (should this even be an option). The loss of employment could, therefore, impact the socio-economic environment through the loss of income and livelihoods, and affect the local economic and quality of life for local populations. Should the operational phase have an impact on tourism, there is likely to be a slow recovery period for this industry in the local area.

h) The EIAR (8.9.3.3) states ‘The NFEPA database does not indicate any wetlands on or adjacent to the study area. No wetlands within the study area are considered important with regards to the conservation of biodiversity’ (p. 359). This reliance on the 2011 National Freshwater Ecosystems Priority Areas database reveals an extremely narrow approach towards evaluating potential impacts associated with the proposed mining activity. It ignores the following points raised in various appendices:

- The Assegai River into which drainage from the site will flow is a FEPA river. (Appendix H1 Section G, p. 260)
The lease area is situated in a FEPA river catchment, and includes several Category 1 Wetland FEPAs. Two FEPA Wetland Clusters are also situated near the eastern boundary of the lease area (Appendix H1, Section F, p. 209).

According to Appendix H1, Section F, sensitivity analysis, ‘Wetlands on site are largely fed by groundwater from the perched, shallow weathered and deeper, fractured aquifers, and are, therefore, sensitive to changes in groundwater levels and water quality. Although the planned surface infrastructure is >1.3km from the nearest FEPA, underground mining would infringe upon the 1km FEPA buffers. The greatest concern regarding the FEPA’s is the potential impact of the mine on the water resources as a result of underground water reduction due to de-watering activities and groundwater contamination due to sulphate seepage from the mine workings and discard facility (WSP, 2013). Both the cone of depression and the groundwater contamination plume, extend to the wetland FEPA’s in the near vicinity.’ (P.209)

A lowering in groundwater level would have a negative impact on all wetlands fed by the shallow aquifer and the springs within the cone of depression. These springs are one of the main sources of water for the wetlands in the area, supplying water during the drier winter months when the wetlands are not fed by rainfall. As the source of water supplying the wetlands is unknown, and because the groundwater levels will be lowered in the shallow and deeper aquifers, one must assume that the wetlands within the cone of depression will be impacted upon and may possibly dry out. This impact will be seasonal, with the most significant effect on wetlands occurring during the dry season (Appendix H1, Section G, p. 243).

The loss or deterioration of the wetlands on the proposed mining site could, depending on the drawdown cone, extend beyond the study area into the wetland FEPAs within the mine lease area and the wetland FEPAs and Wetland Clusters in the immediate surrounds (Appendix H1, Section G, p. 246).

There are ‘six wetlands within the north-east portion of the study area’ which are considered to be in PES Category A/B condition (natural or good) and are classified as Wetland FEPAs (Appendix H3, p. iv).

Wetlands near the base of slopes may obtain water from one or all of the following sources: the shallow aquifer, perched water and springs at higher altitude. The simulation results are considered to indicate that the volume of water available to the wetlands may be reduced by the decline in water level in the shallow aquifer (Appendix ‘Adam Smith’, WSP geohydrology impact assessment, p. 15).

The statement in the EIAR (8.8.4.2) that ‘It is unlikely that the wetlands will be lost; it would rather be similar to drought conditions’ (p. 338) appears to be an unsubstantiated view of the EAP. It is not supported by specialist studies. According to Appendix F, geohydrology (2014), ‘Groundwater dependant eco-systems and yields of (water supply) springs located within the significant zone of dewatering of the shallow aquifer, limited to the site boundaries, could be negatively impacted and some may dry up during the life of mine.’ (p. 53)

3.3 Gaps in information, levels of confidence in predictions, uncertainties

The 2010 NEMA EIA Regulations require that ‘a description of any assumptions, uncertainties and gaps in knowledge’ be included in the EIA report (31(2)(m)).

No levels of confidence are given in predictions of impacts in the EIAR, and there are numerous assumptions and gaps in information that make the prediction of impacts and risks questionable. In addition, many of the specialist studies highlight the need for additional studies to be undertaken to
improve predictions. Examples of these uncertainties and gaps in information, which make the impact predictions and conclusions drawn in the EIAR questionable, are given below:

a) The hydrological assessment (Appendix N1) notes that ‘Due to a lack of flow gauges in the vicinity of the proposed mine development, the model was calibrated based on flow measurements made during the dry season at a single point in time’ (p. 12). This study identifies the need for ‘additional flow measurements for calibration purpose, ...,including wet season flows’, to ‘ensure the validity of the model.’ (p. 12)

b) The initial geohydrology impact assessment (WSP, Appendix ‘Adam Smith’, September 2013) notes that ‘Quantification of the aquifer characteristics of the faults and dolerite intrusions specifically need to be confirmed through additional fieldwork. Both of these could influence groundwater flow patterns and the rate of the spread of contamination and must therefore be confirmed. Measured inflow during the mining operation may differ significantly from the model results. This is because the model is not able to account for specific water-bearing features with characteristics that vary from the average considered in the model simulations. Highly transmissive water-bearing features may be present at Yzermyn even though there is no data to confirm this. The impact on water level in the shallow aquifer will depend on the connectivity between the two aquifers. This could not be quantified from the fieldwork programme or other geohydrology studies.’ (p. 15)

c) The subsequent geohydrology specialist report, Appendix F (Delta H Numerical Groundwater Model report, August 2014)
   • Notes that ‘In the absence of drawdown data observed in a monitoring borehole (other than the abstraction borehole itself), no storativity values could be determined with any degree of confidence from the tests’ (p. 14). (Storativity values relate to the physical properties – including porosity - that characterize the capacity of an aquifer to release groundwater.) It also highlights low confidence in impact predictions, stating that ‘...the values presented are by definition of low confidence...and should be verified once more water level measurements, hydraulic conductivities (especially of faults and contact zones to dolerite dykes or sills) and groundwater monitoring data become available’. (p. 69)
   • It states further that ‘The absence of seasonal groundwater elevation (measurements cover 2013 and 2014 dry seasons only) and spring (discharge) data preclude the development of a transient groundwater flow model, which could capture the seasonal variability of water levels and associated mine inflows. Considering the large area of interest and the limited monitoring (single season) data, deficiencies in hydrogeological information for the Yzermyn aquifer limit the confidence of the model predictions.’ (p. 2)
   • Notes that ‘The predicted post-closure decant rate, i.e. groundwater outflow at ground surface, is strongly dependent on the poorly defined regional recharge rate and local hydraulic conductivities and therefore burdened with a great uncertainty.’ (p. 69)
   • Makes a number of recommendations for additional monitoring of groundwater levels and quality to update and improve the confidence of the model predictions and to predict more reliably the rate of mine flooding and quality of decant. (p. 69)

d) Appendix H1 Section G notes that ‘the source of water for the wetlands is unknown’ (p. 231) – both on site and within the cone of depression from mining. The specialists state that this project could impact on wetlands fed by the shallow aquifer within an area of 5,398ha, and wetlands fed by springs sourced in the deeper aquifer within an area of approximately 7,977ha. (P. 233)

e) The assessment conducted of the wetland resources (Appendix H3) was conducted at the beginning of the dry winter season in May 2014 which limited the use of vegetation indicators
for the assessment. Aspects of the ecology of these systems, some of which may be important, may have been overlooked as a result of the season in which the extensive field survey was conducted. The specialist notes that ‘A more reliable assessment would have required that at least one assessment of the greater proposed surface footprint area be undertaken during the high flow (rainy) season, when certain aspects of hydrology and vegetation communities may be more accurately assessed.’ (p. 15)

f) The EIAR states that ‘It must be noted that the simulated timeframe of mine flooding is highly sensitive to assigned aquifer porosities and regional recharge rates; both of which are poorly defined input parameter into the numerical model. The predicted rate of mine flooding should therefore be re-evaluated once groundwater abstractions from the mine voids cease and groundwater monitoring data of the water table rebound become available’ (8.7.4.3, p. 323).

g) There is no reliable information on the impact of mining on springs (‘fountains’) on which there is high reliance by local people as a source of water (7.20.2.7) (p. 181). According to the EIAR (7.10.4), water is not generally sourced from boreholes but from springs that are used for domestic and livestock watering purposes (p. 181). Twenty-three springs were identified by WSP in the project area. These springs are also a water source for wetlands (7.15.1.1, p. 206). According to the EIAR, a lowering of groundwater levels will have a negative impact on springs within the cone of depression, and drawdown of more than 5m is expected to reduce or dry up springs (8.8.4.2, p. 337). Moreover, possible decant points for the project include the ‘potential connection to existing springs’ (8.8.4.3, p. 342). As noted in the EMPr, ‘There is currently no information available on the flow rate of the fountains. It is recommended that the fountains be re-visited before mining commences to measure and record flow rates. This information is vital to determine the impact of mining on fountains in future.’ (p. 726) No such studies have been undertaken.

h) The risk of downstream flooding and damage to infrastructure is not addressed in the EAIR.
   • ‘...should the dewatering volumes be discharged to Catchment 19 as is proposed, this will increase the flood risk to downstream infrastructure (8.5.4.1). In 6.5.3.1 it is stated that ‘With regards to the impacts of the dewatering volumes on the downstream infrastructure associated with Catchment 19, two road bridges are located across the watercourse adjacent to and at a distance of 5 km northeast of the proposed mine. In addition a farm house is located in close proximity to this watercourse 5 km northeast of the proposed mine. The increase in flow volumes as a result of dewatering to this watercourse, should this option be followed is expected to alter the flood risk to the associated infrastructure.’ (p. 295)

i) Impacts of mining on tourism to the wider area and associated economic factors, income generation and employment have not been adequately assessed. Numerous sections in the EIAR refer to the ‘moderately high potential for tourism and recreation in the affected area, due to the location within an existing tourism route, as well as the diversity of avifauna, aesthetic values and the opportunities for activities such as hiking or bird-watching’ (e.g. 8.10.3.3, p. 383), the ‘strong future natural based tourist industry’ (7.18.2, p. 242), ‘loss of tourism and associated economic and social impacts’ (e.g. 8.16.3.5, p. 456, and the potential long-term to permanent impact on Wakkerstroom. (p. 466)
   • From Appendix O, p. 20, it is clear that the tourism sector performs a significant role within the local economy of Wakkerstroom, due to the historical, archaeological, scenic and ecological features in the area. A high concentration of tourists visits the area for scenery, fishing, mountain biking, off-road trails and heritage aspects, as well as birding.
j) From Appendix H1 (Section G: Impact Assessment by Natural Scientific Services, 2013)

- It is uncertain whether the drawdown cone extends into the quaternary catchments V31A and W42A (as the groundwater model did not extend into these catchments). This study identifies the need for further investigations due to the sensitive nature of these catchments and associated watercourses (FEPA rivers and wetlands) (p.246).
- All the assumptions made in the groundwater report apply to this assessment as the results of the WSP, 2013 groundwater model are dependent on these (p. 233). (There are uncertainties associated with the assumption of a continuous, un-fractured dolerite sill in the WSP 2013 groundwater study, p. 12; these uncertainties and low levels of confidence remain in the later geohydrological report, as noted earlier in this review.
- The source of water for the wetlands identified within the study area and within the greater cone of depression is unknown; but based on this uncertainty, it is anticipated that the impact on wetlands will extend into and beyond the greater mine lease area (p. 246).

k) According to Appendix N (surface water assessment), the modelling and impact assessment was based on the then proposed development infrastructure and layout. As noted above, the EAP said that ‘Should this change, the modelling results and associated discussion will need to be updated.’ This model has not been updated. Furthermore, due to a lack of flow gauges in the vicinity of the proposed mine development, the model was calibrated based on flow measurements made during the dry season at a single point in time. To ensure the validity of the model, additional flow measurements for calibration purposes are required, including wet season flows (p. 12). These additional measurements have not been made.

l) The EIAR (8.6) notes that ‘Due to the changes in layout and position of the discard dump (residue stockpile), a new conceptual storm water management plan was required’ (p. 301). However, no new plan has been provided. Appendix E is a conceptual stormwater plan dated 3 March 2014, prepared by Highlands Hydrology (Pty) Ltd. There are a few non perennial streams in the vicinity of the site with the perennial Mawandlane stream flowing approximately 300 metres to the east of the proposed surface infrastructure. All of these streams flow in a northerly direction, and are located to the east of quaternary catchment W51A (Assegai River Catchment). This stormwater plan is based on the discard dump facility and associated pollution control dams. It has not been updated in light of the best environmental option.

m) In order to assess and evaluate the potential significance of impacts on water flow, the reserve must be determined (i.e. the quantity and quality of water required to satisfy basic human needs and to protect aquatic ecosystems to secure ecologically sustainable development and use of the water resource, as defined in the National Water Act No. 36 of 1998). In this case, the impacts have been assessed without this benchmark. The EMPr states that a ‘reserve determination should be undertaken for the main systems impacted on by the drawdown cone’ (p. 637) and recommends the undertaking of ‘Rapid III Reserve Determination prior to obtaining WULA’, to make sure that ‘The minimum flow requirements, as per the reserve determination’ are met (p. 627). However, without the reserve determination there is little confidence that impacts would be manageable to ensure minimum flow requirements.

n) Potential acid mine drainage (AMD) and associated pollution is possible from coal stockpiles on site, underground workings, and decant from underground workings 20-50 years post closure. Predictions regarding this AMD are currently unreliable: The EMPr states that ‘The predicted rate of mine flooding and quality of decant should be re-evaluated once more site-specific groundwater monitoring and geochemical data become available’, (p. 323) given the current geohydrological model limitations. No such re-evaluation appears to have been undertaken.
3.4 Competence of the Environmental Assessment Practitioner

The NEMA 2010 EIA Regulations (R543) require that details of the EAP who compiled the report are provided, including the expertise of the EAP to carry out an EIA (31(2)(a)(iii)).

From the information provided in the EIAR and associated appendices, and a search of relevant data bases on-line, it does not appear that Charlaine Baartjies (the founder and managing director of EcoPartners) is professionally registered with the SA Council for Natural Scientific Professions. With a primary training in Geology (natural science), and now acting as a paid Environmental Assessment Practitioner and involved in preparing associated reports, such professional registration is a legal requirement in terms of the SA Natural Scientific Professions Act (Act 27 of 2003, s18(2) and 20(1): 

*Only a registered person may practise in a consulting capacity.*) Furthermore, San Oosthuizen – also a natural scientist – appears not to be SACNASP registered. Geologists, Zoologists and Environmental Scientists are explicitly listed in Schedule 1 of this Act as requiring registration.

According to the NEMA 2010 EIA Regulations, the EAP ‘must perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant’ (17(c)). The use and interpretation of information provided by the specialists, and conclusions drawn by the independent environmental consultant, are questionable. The EIAR draws on numerous specialists’ findings without integrating these different reports. In places the EAP seems to draw selectively on – and/ or gives undue emphasis to – the findings, effectively downplaying the potential severity and consequences of negative impacts of the project.

According to NEMA, sustainable development requires ‘the integration of social, economic and environmental factors in the planning, implementation and evaluation of decisions to ensure that development serves present and future generations’ (Section 1 of NEMA). An integration of different specialist studies is thus essential to understanding how the interdependent ecosystems function, and how changes could affect the current and downstream users of any ecosystem services (i.e. the benefits derived from biodiversity and ecosystems).

In this EIAR, impacts and risks to surface water, wetland and groundwater systems, prepared by different consultancies, have not been integrated by EcoPartners to arrive at a reliable conclusion regarding their potential significance. These different systems are interdependent; impacts on one system may affect another. Ensuring that data and findings from different specialist studies are integrated is therefore crucial in EIAs². The impacts and risks are likely principally as a result of habitat loss, loss of landscape character and sense of place, changes in flow and/ or connectivity, changes in surface water resources and/ or groundwater quality (e.g. by contamination as a result of acid mine drainage: AMD). The different studies have been reported on separately – but often overlap, preventing an integrated understanding of how the mine and its surface works may interact with the affected ecosystems – locally, and at a landscape and catchment scale. As an example of the complexity – and lack of integration or synthesis of studies, and with specific reference to water resources and associated water-dependent ecosystems, the following specialist studies were commissioned (in addition to one on the discard dump area which is not included):

- Appendix entitled ‘Adam Smith’ 3 September 2013. WSP. Geohydrology Impact Assessment: The Terms of Reference for this study are described only as ‘geohydrological baseline assessment and the geohydrological impact assessment’.
- WSP 16 August 2013. WSP. Appendix N1 Hydrological Assessment. The scope of this work was ‘to determine the potential impacts of the mining activities on the local and regional surface water in terms of both quantity and quality-related impacts’.

4. Assessment and evaluation of impacts

The assessment of indirect and induced, as well as of cumulative impacts, is inadequate.

As an introduction to this section, it is noted that the proposed mining area is widely recognised as having some of the most sensitive and unique biodiversity in the country. It is acknowledged as having high biodiversity irreplaceable within the Mpumalanga Biodiversity Conservation Plan. The National Spatial Biodiversity Assessment identifies the area as important for biodiversity conservation, and both the National Protected Areas Expansion Strategy and the Mpumalanga Protected Area Expansion Strategy identify this area as important for protected area expansion on account of the largely un-fragmented and intact grassland ecosystem. The area is also identified as important for water yield within the larger primary water catchment and as a Freshwater Ecosystem Priority Area 3. It is crucial to note that significant portions of the proposed Yzermyn underground coal mine project lease area are recognised in the Mpumalanga Biodiversity Sector Plan as being ‘irreplaceable’ and ‘optimal’ Critical Biodiversity Areas (e.g. Appendix H1, Section F). These areas are vulnerable not only to direct impacts, but to the more insidious indirect and induced negative impacts of coal mining activities.

Of the utmost concern in this review, therefore, is that the EiAR takes the stance that mining is underground, and for this reason, impacts on biodiversity and water resources would not be significant. For example, in 7.16.7 of the EiAR, responses to statements on the biodiversity significance of the affected area (e.g. ‘irreplaceable’ and ‘optimal’ areas in terms of systematic biodiversity planning, Critical Biodiversity Area, Important Bird Area, Freshwater Ecosystem Priority Area) repeatedly note that ‘It is important to note that mining will be underground and that biodiversity on the surface area for the majority of the target and remainder area will for the most part not be disturbed. The most viable surface layout reduced the footprint area for the surface infrastructure from 80.9 ha to 47.2 ha.’ and ‘Should the Best Environmental Option be followed the total footprint of the proposed project will be reduced to approximately 22.4 ha.’ (p. 222)
4.1 Consistency with the NEMA principles and EIA Regulations requirements

4.1.1 NEMA principles
The NEMA principles (section 2 of NEMA) are widely regarded as being South Africa’s ‘sustainable development’ benchmark, and are a fundamental frame of reference for assessing and evaluating impacts in EIA. Of grave concern is the fact that no explicit reference is made in the EIAR to the NEMA principles or evaluation of impacts in terms of consistency with these principles.

a) The EIAR notes s24 of the Constitution and requirements for ecologically sustainable development while ‘prompting (sic) justifiable economic and social development’. Apart from a passing mention of the NEMA principles – noting that ‘Section 2 of NEMA sets out principles for sustainable integrated environmental governance; the principles are further detailed in subsequent sections of NEMA’ – there is no interrogation or application of these principles to the assessment and evaluation of impacts. This is a critical omission.

b) The following statements in the EIAR are unsubstantiated and have no defensible foundation without explicit reference to the NEMA principles.
   - ‘The national interest has been assessed and the benefit of the Yzermyn Underground Coal Mine to the people of South Africa has been illustrated and clear mitigation measures and recommendations under which conditions this project would be a sound development project in the best interest of South Africa (including the environment and its people) was provided.’ (p. ii, p. 813)
   - The development of the area can be mitigated to ensure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development. (p. ix, p. 804)

c) The NEMA principles require, amongst other things:
   - that the disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied;
   - that pollution and degradation of the environment are avoided, or, where they cannot be altogether avoided, are minimised and remedied;
   - that the disturbance of landscapes and sites that constitute the nation’s cultural heritage is avoided, or where it cannot be altogether avoided, is minimised and remedied;
   - that the costs of remediying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects must be paid for by those responsible for harming the environment.

In the above regard, the EIAR ignores the need to remedy significant residual negative impacts after exhausting measures to avoid and minimise them, thus failing to internalise environmental costs that would have to be borne by local communities and the broader public, contrary to the polluter or environmental degrader taking responsibility for – and rectifying – these impacts, as included in the NEMA principles. In effect, the applicant would be benefitting from the project at the expense of local communities and the wider public.

i. The term ‘remedy’ does not appear in the EIAR, and based on the specialist reports, there are a number of residual negative impacts which remain of ‘medium high’ or ‘high’ significance after proposed mitigation – these impacts must be remedied.

ii. 8.10.1 in the EIAR states that ‘Offsetting should take place to address any impacts deemed to be unacceptable which cannot be mitigated through the other mechanisms in

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the mitigation hierarchy. The objective of biodiversity offsets should be to ensure no net loss of biodiversity’ (p. 372). However, no compensation or offsets are discussed in this regard, other than for the involuntary resettlement of a nearby homestead.

iii. In 8.8.2 of the EIAR, it is stated that ‘in terms of offsets, no national or Mpumalanga provincial guidelines (NNS, MTPA pers. comm., 2013) currently exist for wetland offset projects’ (p. 327). This is incorrect and outdated information: a national guideline for wetland offsets was published in 2014 by SANBI and the Department of Water Affairs (now Department of Water and Sanitation).

In terms of these national guidelines, impacts on the affected wetlands would in all likelihood trigger offset requirements, given the status of these wetlands. The feasibility of offsets must be investigated during the EIAR process to ascertain if the negative impacts could be effectively compensated, and/or whether these impacts would constitute ‘non-offsettable’ harm (in which case the ‘no project’ option should be selected). If they could be offset, appropriate measures would need to be incorporated into the mitigation measures and EMPr. None of these steps has been taken.

d) The EIAR fails to take ‘a risk-averse and cautious approach’ to the assessment and evaluation of impacts, as required in terms of s2 of NEMA, taking into account the limits of current knowledge about the consequences of decisions and actions. Given the gaps in and unreliability of information, such an approach is essential in particular to drawing conclusions about the sustainability of the proposed project and in recommending mitigation measures that give strong assurance of outcomes. This approach is lacking from the EIAR (although it has been taken in some of the specialist studies). The NEMA principles also highlight the need to pay special attention to sensitive, vulnerable, highly dynamic or stressed ecosystems, such as (amongst others) wetlands, especially where they are subject to significant development pressure. This particular mining project, with its potential to harm FEPA wetlands and river systems in an area where cumulative effects pose a significant threat to water resources, requires that specific attention be paid to these freshwater environmental components.

e) Section 2 of NEMA also stipulates that responsibility for the environmental health and safety consequences of a projector activity exists throughout its life cycle. Some of the key risks and impacts associated with mining are likely to materialise after mine closure. Insufficient attention is paid to this in the EIAR and inadequate provision is made in the EMPr to manage and remedy such key risks and impacts with any assurance.

4.1.2 NEMA 2010 EIA Regulations requirements

a) The need for, and desirability of, the proposed mine (which must be established in terms of the NEMA 2010 EIA Regulations, 31(2)(f)) is inadequately assessed. The legacy effects of the proposed mine and ability to sustain the ecological basis which underpins local livelihoods in the long term are not addressed. Moreover, the EIAR fails to evaluate the consistency of the application with relevant policies, plans and guidelines pertaining at the time of submission. The ‘desirability’ section of the EIAR essentially repeats the contents of the ‘need’ section, and does not respond to the key considerations required in terms of DEA’s 2010 national guideline on Need and Desirability; no reference is made to this guideline.

According to the national Need and Desirability guideline (DEA (2008)) the concept of ‘need and desirability’ relates to, among other things, the nature, scale and location of the development

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being proposed, as well as the wise use of land. The concept of ‘need and desirability’ can be explained in terms of the general meaning of its two components, in which need primarily refers to time, and desirability to place (i.e. is this the right time and is it the right place for locating the type of land-use/activity being proposed?). In order to interpret the EIA Regulations’ requirement to consider ‘need and desirability’ properly, it is necessary to turn to the principles contained in NEMA, which serve as a guide for the interpretation, administration and implementation of NEMA and the EIA Regulations (author’s emphasis). Ultimately development must not exceed ecological limits (in order to secure ecological integrity), while the proposed actions of individuals must be measured against the short-term and long-term public interest.

The Need and Desirability guideline also explicitly asks the following questions:

- What measures were taken to ensure that the environment will be held in public trust for the people, that the beneficial use of environmental resources will serve the public interest, and that the environment will be protected as the people’s common heritage?
- Are the mitigation measures proposed realistic and what long-term environmental legacy and managed burden will be left?
- What measures were taken to ensure that the costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects will be paid for by those responsible for harming the environment?

These questions are either poorly or not adequately answered in the EIAR.

According to the EIAR, ‘The provision of coal for energy use in South Africa and the ability to provide electricity to rural areas where the major source of energy is wood/ other fuel burning will have a positive effect on the overall ambient air quality’ (p. 804). This statement ignores, amongst other factors, the potential for alternative forms of energy generation which may be localised and have advantages over the continued use of coal in thermal power stations. It also disregards the fact that other more acceptable coal reserves could provide such benefits, and that the majority of coal which will be mined at Yzerfontein will in any event be exported (EIAR p. 6).

b) The EIAR fails to address explicitly the degree to which the impact of the proposed mine can be reversed, as required in the NEMA 2010 EIA Regulations (31(2)(l)(v)).

While the impact rating table (Table 2-3 of the EIAR) (pp. 26-27) looks to some extent at reversibility in terms of the duration of impacts, explicit statements with regard to the degree to which impacts can be reversed are missing from the EIAR except in the assessment of Visual Impacts (8.14.4).

This omission is serious: impacts that are irreversible may, depending on the value of the affected environment and unless they can be adequately remedied through replacement or substitution of affected resources, constitute an unacceptable impact that is in conflict with the objective of ecologically sustainable development. (The need to maintain natural capital underpins the notion of ecologically sustainable development, as reflected in a wide range of literature; e.g. the International Association for Impact Assessment’s Special Publication No. 3, Biodiversity in Impact Assessment, 2005; the United Nations Sustainable Development Goals, 2015; Gibson, R.B., Hassan, S. and Tansey, J. 2005. Sustainability Assessment: Criteria, Processes and Applications, Earthscan. London).
c) The EIAR fails to address explicitly the degree to which the impacts of the proposed mine may cause irreplaceable loss of resources, as required in the NEMA 2010 EIA Regulations(31(2)(l)(vii)). Loss of irreplaceable resources would constitute an unacceptable impact that is in direct conflict with the objective of ‘ecologically sustainable development’ as required by the Constitution of South Africa. (Please refer to the above point: loss of irreplaceable resources is in conflict with, and undermines, sustainable development goals, as reflected in literature.)

The DEA raised the issue of the irreplaceability of the affected ecosystems in its rejection of the earlier EIAR, stating that unless ground-truthing has been undertaken to prove that the development does not impact on the reason for the ‘irreplaceability’ classification, this may constitute a fatal flaw (Section 2.1.3).

The term ‘irreplaceable’ comes up repeatedly in descriptions of the affected area (e.g. 3.1.25.10, p. 33; 7.11, p. 188-9; 7.12, p. 191; and 7.16.7, p. 220). However – and of the utmost importance and relevance for decision making - the EIAR does not indicate how much of the proposed mining area affects ‘irreplaceable’ habitat. Instead, it states that ‘It is important to note that mining will be underground and that biodiversity on the surface area for the majority of the target and remainder area will for the most part not be disturbed...Should the Best Environmental Option be followed the total footprint of the proposed project will be reduced to approximately 22.4 ha’ (7.16.7) (p. 222).

It appears that, with the exception of Appendix H1, Section G (Impact Assessment) which notes the risk of irreplaceable loss of wetlands, none of the specialists was asked to assess whether impacts would result in loss of irreplaceable resources.

The EAIR states:

- that ‘Significant portions of the proposed Yzermyn Underground Coal Mine Project lease area are recognized in the MBSP as Irreplaceable and Optimal Critical Biodiversity Areas’ (7.16.8) (p. 222).
- with reference to ‘irreplaceable’ areas, is says that ‘100% of what remains must be protected to achieve biodiversity targets’ and ‘must be managed for biodiversity conservation’ (7.16.7.4) (pp. 221-222). It also notes that ‘Optimal CBAs have an irreplaceability of less than 80%, but collectively these areas incorporate the most biodiversity in the smallest area and, therefore, provide the most cost-effective options for biodiversity conservation’ (7.16.8) (p. 222).
- that ‘The drawdown cone will result in the loss or deterioration of wetlands within the Irreplaceable habitat (Mpumalanga Biodiversity Sector Plan) to the south of the underground mining and lease areas’ (8.8.4.2; reviewer’s emphasis) (p. 338).

4.2 Evaluating the significance of impacts

NEMA defines ‘evaluation’ as the process of ascertaining the relative importance or significance of information, in the light of people’s values, preferences and judgements (author’s emphasis), in order to make a decision.

According to international good practice (e.g. Ehrlich and Ross 2015), and the then Department of Environmental Affairs and Tourism’s IEM Guideline Series, an EIA must identify the impacts that matter most and whether they would be acceptable to society – it is not simply a technical or scientific exercise. In this regard, drawing on indicators of societal importance of affected areas (e.g.

5 The significance spectrum and EIA significance determinations, Impact Assessment and Project Appraisal, 33:2, 87-97, DOI: 10.1080/14615517.2014.981023

6 Impact significance, IEM Information Series 5, Department of Environmental Affairs and Tourism, 2002.
their recognition in strategic policies or plans, as also set out in DEA’s Need and Desirability guideline) is crucial. In this particular case, due regard for the joint DEA, DMR, Chamber of Mines, SA Mining and Biodiversity Forum and SANBI’s Mining and Biodiversity Guideline on mainstreaming biodiversity into the mining sector (2013), as well as numerous other ‘societal indicators’ or formal recognition of societal value (e.g. conservation plans, protected area expansion plans, etc.) is essential.

In this regard, the NSS report on Impact Assessment (Appendix H1, Section G) clearly sets out the extent of negative impacts on biodiversity of national and provincial importance:

- ‘The loss or deterioration of wetlands in areas that are formally Protected and of Highest Biodiversity Importance according to the Mining and Biodiversity Guideline.’ (p. 246)
- ‘The loss or deterioration of the wetlands will extend beyond the study area and will extend into the wetland FEPAs within the mine lease area and the wetland FEPAs and Wetland Clusters in the immediate surrounds. These systems are also the start of the catchment that feeds the Assegai River FPEA, and a decline in water input will, therefore, result in a decrease in flow of this river system.’ (p. 246)
- ‘The drawdown cone will result in the loss of fountains and the resultant decline in water input for wetlands in the Kwamandhlangamisi Protected Environment to the east, and the proposed Mabola Protected Environment.’ (p. 246) [The Mabola Protected Environment was declared on 22 January 2014.]

Twelve ‘Conservation Important’ (CI) animal species were found in, or adjacent to the proposed surface infrastructure area’ (Appendix H1, Section B, p. 96). ‘A staggering 38 CI mammal species potentially occur in the study area...’ and ‘Seven of the 10 CI mammal species were recorded in, or adjacent to the proposed surface infrastructure area’. (p. 96). Furthermore, 18 CI bird species have been recorded in or near the study area (p. 100), at least 7 reptile species may occur in the project area (p. 104), and five CI frog species may occur (p. 105).

According to Appendix H1, Section G, the combined Baseline and Impact Assessments indicate that the proposed project is fatally flawed, and should be ‘NO GO’ in terms of Biodiversity: ‘The main recommended mitigation measure is to avoid all areas of Very High and High sensitivity. This would make the project a No Go as almost the entire undermining area is rated as having a Very High or High sensitivity.’ (p. 241)

Significant impacts on aquatic and wetland ecosystem functioning and biodiversity in a far greater area than the underground mining area are in strong conflict with international, national and provincial legislation, policies and guidelines. A high number of Conservation Important species were detected, and most habitat in the proposed underground mining and surface infrastructure areas was assigned a Very High or High sensitivity. Most potential impacts of the mining operation had a HIGH overall significance rating, even with mitigation. Moreover, the cumulative impacts of numerous mining applications in the study region are noted to be of serious concern.

The EIAR makes no reference to societal values in evaluating impact significance and acceptability, and gives insufficient recognition to the conservation importance of the affected area to the people of the region and country. All of the protection/conservation statuses/recognition of importance given to this area highlight that it constitutes an area whose loss would justifiably be regarded as ‘irreplaceable’.
The approach to evaluating impact significance in the EIAR is flawed and based on simple arithmetic averaging of sums of severity, duration and extent ‘divided by 3’. **This approach fails to address limits/ thresholds of acceptability or societal values.** Moreover, considerations that are central to decision making for sustainable development (e.g. the degree to which impacts are reversible and/ or would result in irreplaceable loss of resources) become ‘hidden’ in these significance ratings and, unless explicitly highlighted in the EIAR (which is not the case here), are not made known to the decision maker.

Some examples of inadequate evaluation of significance are given below:

i. The EIAR claims that *‘The most significant risks to biodiversity are significantly reduced, as the bulk of the infrastructure is developed on areas that has (sic) already been transformed through agricultural development. It can also be seen from historical photos that the biodiversity in these areas are not pristine and is significantly fragmented.’* (18.3) (p. 812)

This statement focuses only on direct ‘footprint’ impacts and ignores indirect and cumulative impacts, as well as the considerable importance of the affected ecosystems to South African society, as recognised in the spectrum of strategic conservation reports for the area.

ii. The statement taken from the Wetland Delineation ‘report’ (described as ‘*a brief opinion on the wetland conditions within the area to be disturbed*’) is taken out of context in applying its findings to conclude that *‘the significance of this impact is considered very low and will not significantly affect local, regional, provincial or national conservation initiatives for wetland, floral species conservation, faunal species conservation and aquatic resource conservation.’* (p. 2) This SAS letter by no means applies to biodiversity in a wider context.

5. **Mitigation and management of impacts – levels of confidence and risks**

The sensitivity and considerable value of the receiving environment, and its vulnerability to direct, indirect and cumulative impacts and risks, underlie the need for a comprehensive, explicit and rigorous EMPr, containing enough checks and balances to give assurance that potential impacts and risks would be effectively and timeously managed to avert serious and irreversible harm, and/ or loss of irreplaceable assets.

Mitigation recommendations emerge from the EIAR. As the basis for sound environmental management, the EIAR *‘is essential in establishing foundations for the EMPr’*. Where the findings of the EIA lack clarity, mitigation measures lack specificity.

In this case, the ‘Biodiversity Management Plan’ (pp. 605-618) and ‘Wetlands’ (pp. 618-625) lack explicit outcomes, measures are generic and unacceptably vague, fail to set out specific measures, and in many instances are unlikely to be feasible at all. In short, these measures provide no assurance whatsoever that significant impacts and risks – some of which could be irreversible or cause irreplaceable loss – would be effectively managed.

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Although monitoring is included in the EMPr (which is to be found in respect of the ‘best environmental option’ at pp. 683 to 778), the specific indicators to be monitored, their frequency and evaluation/response to findings is not provided. (In this respect, the comments of DMR (Section 2.1.2) with regard to inadequate monitoring details and/or measures to manage decant after mine closure, are relevant.) As such, monitoring per se is of little practical value and provides no guarantees of effective or adaptive management and/or of the outcome of management.

Examples of such statements include:

- **it is recommended that this no-go map be considered during all development phases to aid in the conservation of floral habitat within the study area;**
- **Demarcation of sensitive areas may be considered;**
- **Areas of increased ecological importance and sensitivity should be considered during all phases of planning and construction activities;**
- **Ensure rocks, trees and vegetation is not destroyed in any manner;**
- **Ensure that no decant occurs throughout the life and post-closure of the facility and implement groundwater level management as per the recommendations of the geohydrological report. (This is impossible; decant is probable and would need to be managed for up to 45 years post mine closure.);**
- **...ensure runoff and decant of water into wetland resources is prevented, and The treated decant emanating from the treatment plant must be discharged to the adjacent hillslope seepage wetlands. These two actions are in direct conflict;**
- **Measures to minimise impacts on water quality on nearby adjacent rivers must be ensured;**
- **Undertake regular audits to ensure structures and fences are free from animals and plants;**
- **It must be ensured that the process water system is managed in such a way as to prevent discharge to the receiving environment;**
- **Implement monitoring programme of groundwater plume (no details of this programme given);**
- **In the event of monitoring detecting groundwater contamination (should it become evident that significant impacts (such as the formation of Acid Mine Drainage) on the aquatic ecology of the Mkuzase and Mawandlane Rivers and the unnamed tributaries of the Assegai River and their associated floodplains are taking place, ‘consideration should be given to dewatering of the contaminated aquifers and boreholes downgradient of the relevant TSF. The term ‘TSF’ is not defined or explained. In addition, the likely feasibility and implications of such dewatering are not addressed;**
- **Rehabilitation must ensure that wetland structure and function are reinstated in such a way as to ensure the ongoing functionality of the larger wetland system at pre mining levels. No specific measures are provided;**
- **Implement regular groundwater monitoring programme as per the recommendations of the geohydrological report. No specifics are given;**
- **Implement regular monitoring of water quality and toxicity of the PCD and open pit post-closure in order to ensure runoff and decant of water into wetland resources is prevented. No specifics are given, and it must be noted that monitoring alone does not prevent runoff and decant;**
- **Calculate reserve determination and ensure compliance;**
- **Measure flow rates of all fountains/ springs within the area;**
- **Groundwater - Continue water monitoring programme for at least two years post closure. The 2013 geohydrology impact assessment report recommends at least 5 years after mining ceases (Appendix ‘Adam Smith’). However, since decant is likely to occur from 20-50 years post-closure, such monitoring seems of little value; and**
- **An alternative source of water supply should be provided for groundwater users (springs) if they are impacted on by the proposed mining activity. The ‘action required’ bears no relation to this mitigation measure: to ‘implement stormwater management plan as per Appendix E’.**
In some cases, the EMPr contains phrases which permit non-compliance by couching recommendations in terms such as ‘if this cannot be avoided, then...’. This approach gives little assurance that significant impacts would be effectively avoided or mitigated. For example (reviewer’s emphases):

- **No mining or construction may occur within 1 km radius of existing FEPA wetlands without authorisation. If this cannot be avoided, permission for exemption from the guideline will have to be applied for prior to construction.** (p. 619)
- A 100 m buffer should be delineated around the Mkuzase and Mawandlane Rivers and associated channelled valley bottom wetlands (System 1 wetlands). No disturbance should occur within this buffer without authorisation. A 100 m buffer should be delineated around the seep wetlands (System 2 wetlands). No disturbance should occur within this buffer **without authorisation.** (p. 619)
- **It must be ensured that, as far as possible, all proposed infrastructure is placed outside of sensitive faunal habitat areas such as the lower foothill river wetlands and associated buffer zone.** (p. 620)
- **...ensuring that all infrastructure remains outside of wetland boundaries as far as possible.** (p. 620)

### 6. Adequacy of decision

In terms of the NEMA, s2, the social, economic and environmental impacts of activities, including disadvantages and benefits, must be considered, assessed and evaluated, and decisions must be appropriate in the light of such consideration and assessment. Furthermore, in terms of Section 6(2)(e)(iii) of the Promotion of Administrative Justice Act, Act 3 of 2000, an administrative action may be reviewed if – amongst others – irrelevant considerations were taken into account or relevant considerations were not considered.

It does not appear that the competent authority has given due consideration to the previous comments and requirements of other authorities (Section 2 refers).

In this instance, there appear to be examples both of irrelevant or questionable information being taken into account in decision making, as well as numerous highly relevant considerations that were not taken into account. Sections 3 to 5 of this review, as they apply to the adequacy of the EIAR, are apposite.

Examples are given below.

a) The Environmental Authorisation’s Annexure 1: Reasons for the Decision states (amongst other things) that:

i. ‘The amended EIR identified all relevant environmental legislation and guidelines that have been considered in the preparation of the Amended EIR dated January 2015.’ [4(c) of Annexure 1: Reasons for the decision].

While this may be the case, the absence of any explicit consideration of the NEMA principles is a considerable shortcoming, as is the failure of the EIAR to consider the national Wetlands Offset and Need and Desirability Guideline.

ii. ‘The methodology used in assessing the potential impacts identified in the Amended EIR and the specialist studies have been adequately indicated’ [4(d) of Annexure 1].
The fact that the methodology used has been ‘adequately indicated’ does not imply that it reflects ‘good practice’ or that the substantive content of the EIAR is of a sufficient standard to inform decision making. That is, the indication of methodology alone is an insufficient basis on which to judge the adequacy of the EIAR. Given the deficiencies noted in Sections 2-5 of this review, the fact that the methodology has been ‘adequately indicated’ provides no assurance of the quality of the EIAR.

iii. ‘The identification and assessment of impacts are detailed in the Amended EIR dated January 2015 and sufficient assessment of the key identified issues and impacts have (sic) been completed’ [(r) of Findings, Annexure 1: Reasons for the decision].

This point, as has been explained in detail above, is incorrect.

iv. ‘The procedure followed for impact assessment is adequate for the decision-making process’ [(s) of Annexure 1].

This point is also demonstrably incorrect.

v. ‘According to the independent EAP, the information contained in the Amended EIR is accurate and credible’ [(t) of Annexure 1];

The competent authority was duty bound to consider for himself the degree to which he could place reliance on the information, given the several internally contradictory findings contained in the EIAR and specialist reports. As is demonstrated above, the information contained in the EAIR is in several material respects not accurate and credible.

and

vi. ‘The proposed mitigation of impacts identified and assessed adequately curtails the identified impacts. EMPr measures for the pre-construction, construction and rehabilitation phases of the development were proposed and included in the BAR and will be implemented to manage the identified environmental impacts during the construction process’ [(u) of Annexure 1].

As explained above, many of the impacts were not assessed adequately, or in some cases, at all which makes it impossible to determine whether the proposed mitigation measures are adequate.

In short, several of the statements in the Environmental Authorisation (EA) are strongly disputed.

Moreover, it is of concern that mitigation of impacts in the EA omits any mention of operational phase mitigation measures. It thus appears as if EMPr measures need only be applied during the construction phase of the project.

In addition, mention is erroneously made of ‘the BAR’ (this application is not a Basic Assessment Report), suggesting confusion with another application.
b) The competent authority states that, in reaching its decision, it has taken into account ‘the objectives and requirements of relevant legislation, policies and guidelines, including section 2 of the National Environmental Management Act, 1998’ (Act 107 of 1998, or ‘NEMA’) [3(g) of Annexure 1 of the EA].

Given that the EIAR does not incorporate the NEMA principles or explicitly address the impacts of the proposed mining project in relation to these principles as the core informant of the sustainability of a proposed development, it is unclear on what basis the competent authority reached its decision.

The EA lists the numerous societal values of the affected area (e.g. having the ‘highest importance for biodiversity’ in terms of the national Mining and Biodiversity Guideline, being ‘important and necessary in terms of the Mupumalanga Biodiversity Conservation Plan’, being located within a Critical Biodiversity Area and recognised as ‘Irreplaceable and Optimal’ for achieving conservation targets in the province, and the Endangered status of the affected grasslands. However, it does not appear to have related these values to the Constitutional and NEMA requirements of ‘ecologically sustainable development’ when evaluating impacts.

c) The following statements in the EA are extracted from sections in the EIAR (e.g. Summary, 18.2.1.4 and 18.3), which in turn have been taken predominantly from one specialist ‘report’: the SAS Wetland Delineation letter (Appendix H4):

i. ‘The historical transformation of the environment in this area indicates that disturbance to biodiversity will be limited’; ‘the ecosystem is fragmented and has been disturbed by previous mining and agricultural practices’; and

ii. ‘Due to the degraded nature of the wetlands, the very limited ecological importance and sensitivity of the area, and the low level of ecoservice provision of the wetlands which will be directly affected, the significance of this impact is considered very low and will not significantly affect local, regional, provincial or national conservation initiatives for wetlands, floral species conservation, faunal species conservation and aquatic resource conservation.’

This information is contradicted by specialists’ findings which take a broader and more defensible view of the impacts of the proposed mine on biodiversity generally, and state that:

- less than 2% of the total footprint area has been transformed by recent crop cultivation, and alien flora occur in isolated patches, mainly along riparian areas. According to this report, significant portions of the proposed mining area are recognized in the Mupumalanga Biodiversity Sector Plan as Irreplaceable and Optimal Critical Biodiversity Areas or ‘CBAs’ (irreplaceable CBAs are “considered critical for meeting biodiversity targets and thresholds which are required to ensure the persistence of species and the functioning of ecosystems; ‘optimal’ CBAs have an irreplacability of less than 80%, but collectively these areas incorporate the most biodiversity in the smallest area and, therefore, provide the most cost-effective options for biodiversity conservation). (Appendix H1, Section F, p. 215);

- wetlands onsite support many CI (Conservation Important) faunal species such as the *Vulnerable* African Grass-owl, *Near Threatened* Half-collared Kingfisher and *Serval*, and the *potentially occurring Critically Endangered Rough-haired Golden Mole and Vulnerable Marsh Sylph butterfly*. (Appendix H1, Section F, p. 217); and

- the levels of ecological and socio-cultural service provision by the wetlands on site are considered to be moderately high (Appendix H3, p. iv]).

d) There are considerable environmental risks associated with the proposed development due to information gaps and uncertainties, and –where they are stated – relatively low levels of
confidence in impact predictions. Furthermore, the proposed mitigation and management measures are unacceptably vague and lacking in detail, leave large scope for deviation from recommendations and give no assurance of successful mitigation. There are unacceptably low levels of assurance of the outcomes and feasibility of mitigation measures. Many of these measures would not be able to be audited or enforced given their vagueness and lack of explicit and quantifiable performance targets. The EA appears to overlook these risks.

e) The EA states that, should the PES score of any A or B wetland drop below 20% of the baseline, ‘a biodiversity offset agreement must be negotiated with the relevant competent authority within the timeframe stipulated by the competent authority.’ (3.39)

This approach to offsets is wholly inappropriate and reactive; offsets are only to be used once all efforts to avoid and minimise impacts have been exhausted, and where it is certain that offsets are not being used to compensate for unacceptable negative impacts on irreplaceable biodiversity. Furthermore, it must be ensured that suitable offset options are available in the landscape.

In this case, and based on specialist reports (Appendix H1, Section G: Impact Assessment), this project will impact on wetlands fed by the shallow aquifer, within an area of approximately 5,398ha, and wetlands fed by springs sourced in the deeper aquifer, within an area of approximately 7,977ha. The possibilities for offsets of this extent within the same catchment are unlikely. As this proposed project is at the head of catchment W51A and will impact on water resources downstream and may also impact on catchments V31A and W42A (p. 246), no wetland could be offset to the same value and ecological state (Natural to Largely Natural) as those that would be lost.

f) In reaching its decision, the competent authority states that the project’s need and desirability was ‘sufficiently addressed’, based on the fact that South Africa ‘is heavily reliant on thermal coal for power generation’, and that ‘both local and international markets are highly dependent’ on South Africa’s providing coal. Statements that the exploitation of new coal reserves ‘is therefore a prerequisite in meeting this demand’ are flawed, particularly given the country’s current drop in energy demand domestically, international pressure to move away from coal and fossil fuels in light of the 2015 Paris Agreement which South Africa has signed, as well as alternative and more appropriate locations where coal could be exploited without significant environmental damage at unacceptable public cost and risk. As examples: Goldman Sachs published a recent report on the global coal and gas trade, noting that ‘demand for thermal coal is declining, a trend that appears to be ‘irreversible’8; South Africa’s thermal coal prices have ‘begun to sag’ as it becomes ‘less attractive for importers’ as it becomes less cost-effective9; and South Africa’s coal-fired path is at risk of ‘becoming a dead end’10.

g) According to the EA ‘...the methodology used in assessing the potential impacts identified in the Amended EIR dated January 2015 (sic) and the specialist studies have been adequately indicated’. Whilst the methodology used may well have been indicated, the findings of the EIAR are inadequate and questionable in many fundamental respects.

The conditions of the EA are wholly inadequate to give any assurance that the proposed mine would not result in unacceptable and significant impacts on biodiversity, water resources and the socioeconomic environment in the longer term. The scope of the EA appears to focus

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predominantly on surface infrastructure impacts, neglecting likely indirect and cumulative impacts which extend beyond the 'footprint' and may only become evident some distance away and at some future time.

a) The EA repeatedly refers to the total footprint of the mine surface infrastructure as being 22.4 ha (e.g. p12, p20).

b) The EA’s condition of ‘no-go 100m buffers’ and no construction within a 1 km radius of FEPA wetland/ riverine FEPA is relevant only to surface water and direct ‘footprint’ impacts of mine infrastructure.

Importantly, the impact of mining cannot be assessed with reference only to its surface infrastructure. The potential negative indirect impacts associated with underground mining on, for example, a FEPA, and the negative effects of drawdown of groundwater on wetlands, will not be prevented. Crucially, the significance of direct impacts on water resources is rated as High without mitigation and High with mitigation (Appendix H1, Section G), and is predicted to lead to a decline in water inputs and in water quality, with resultant deterioration in Present Ecological State and Functionality (p. 254).

c) The EA requires an ‘amendment to’ the EMPr for the best environmental option prior to commencing the activity (3.15). This ‘amendment’ seems to comprise only two aspects, namely (i) an amendment of the layout plan for the mine’s surface infrastructure (Annexure 2 of the EA) and (ii) the need to prepare a ‘maintenance management plan’ for ‘biodiversity-sensitive areas’ including wetlands located within the surface boundary area in order to define wetlands to be included as part of a no-go area and to ensure the integrity of biodiversity sensitive features ‘which will not be directly impacted on’.

It would thus appear that the competent authority has accepted the EMPr as submitted, with only these two amendments.

The EMPr falls far short of addressing the wider range of biodiversity and water resources (amongst other) impacts and these limited proposed amendments do not remedy that. The scope of management extends only to direct impacts and to the area delineated on Annexure 2 of the EA, namely the 22.453 ha of the surface mine infrastructure.

d) The EA fails to ask for explicit, measurable actions and outcomes required of management, and/or for clear monitoring programmes and indicators to track potential direct and indirect impacts.

e) The EA fails to challenge a number of proposed mitigation measures that may have considerable harmful consequences (e.g. dewatering the aquifer should evidence of groundwater contamination by AMD be detected, p. 721).

f) With regard to environmental management and monitoring, an Environmental Control Officer must be appointed only ‘for the construction phase of the development’ (3.17) to ensure compliance with the EMPr provisions; the ECO shall remain employed ‘until all rehabilitation measures, as required for implementation are completed and the site is ready for operation’ (3.21). Responsibility for environmental management during the operational and closure phases of the mine, when potentially highly significant impacts are predicted, is not specified at all.

g) According to the EA, no surface water generated may be channelled directly into any wetland or watercourse, and all surface runoff must be managed ‘...and cleaned where applicable’ prior to entering any natural drainage system or wetland ‘so as not to impact on the natural hydrology...’
and morphology of the watercourses’ (3.40). This condition fails entirely to address the ecological integrity and biota of the receiving watercourses.

h) A ‘plant rescue and protection plan’ must be compiled and submitted with the Maintenance Management Plan, with focus on conserving important species from areas to be transformed (3.56). No assessment or evaluation of the feasibility of such action and/or of suitable receiving areas for these plants has been undertaken. Moreover, the subsequent condition (3.57) requires that a permit must be obtained for ‘removal or destruction of indigenous protected and endangered plant and animal species’ – neither condition gives assurance that threatened species would be conserved.

i) Quarterly audit reports must be provided during the operational phase (3.24) and by the wetland specialist (3.38) to document compliance with the EA conditions and requirements of the EMPr. Given the lack of specificity of both the EA conditions and the EMPr, and the absence of explicit management targets that must be achieved, these audits give little assurance of sufficiently rigorous environmental management to meet the NEMA requirements.

7. Conclusions of this review

The review concludes that:

a) The required amendments to the EIAR for the proposed Yzermyn underground coal mine which were stipulated by the national environmental authority in its letter of 16 May 2014, have not been made.

b) The comments of DMR and DWA on the proposed mining project have not been given due attention in revising the EIAR.

c) The quality of the EIAR is poor. The identification, assessment and evaluation of potentially significant impacts and risks to the environment of the mining proposal, and to interested and affected parties, are neither systematic nor adequate. There is little clarity in the way that information on different project alternatives is presented, and there are potentially serious gaps and deficiencies in that information.

The EIAR fails to interrogate and evaluate the effect of mine-associated impacts on the regional (Mpumalanga) or national ability to achieve conservation targets for terrestrial and freshwater systems, and/or the impacts and risks to highly threatened species (including globally threatened species) of conservation concern.

Specialist reports have raised the risks of impacts beyond the ‘footprint’ area of the surface mining infrastructure. Despite this, the EIAR looks predominantly at the direct ‘footprint’ impacts on biodiversity and water resources. The EIAR largely ignores the current role of the mining site in maintaining landscape-scale conservation values and the direct, indirect and cumulative effects of the proposed mine on – and potentially irreplaceable loss of - what is nationally and provincially recognised as a priority area for conservation. In short, the requisite relevant information to inform decision making, applying the NEMA principles, is lacking or absent.

d) The quality of the EMPr is similarly poor, lacking explicit management targets or intended outcomes, and presenting unacceptably vague mitigation and management measures, some of which are inappropriate. Monitoring requirements are inadequate.
e) The EA does not appear to have taken into account all relevant considerations, including the earlier concerns and issues raised by DEA, DMR and/ or DWA. It seems to rely unquestioningly on the text provided in the EIAR, without applying its mind to the information shortcomings and findings of a number of specialist reports. Like the EIAR, the EA’s principal focus is on the direct ‘footprint’ impacts of the proposed mining infrastructure.

f) The EA gives no assurance that the short-term mining project will not result in potentially irreversible impacts and loss of explicitly recognised irreplaceable – and clearly valued – natural resources, including those on which more sustainable livelihoods (e.g. nature-based tourism) depend. This renders the EA incompatible with both the Constitution and NEMA.
Curriculum Vitae - Susie Brownlie

A Resumé

PERSONAL DETAILS

1. Name of Firm: deVilliers Brownlie Associates
2. Name: SUSAN FRANCES BROWNLIE
3. Gender: Female
4. Date of Birth: 11 November 1957
5. Country of Citizenship/Residence: South Africa/United Kingdom
6. Languages:

<table>
<thead>
<tr>
<th>Language</th>
<th>Speaking</th>
<th>Reading</th>
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<tr>
<td>English</td>
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<td>Excellent</td>
<td>Excellent</td>
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<td>Afrikaans</td>
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<td>French</td>
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7. Educational Background

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<tr>
<th>School/University Attended</th>
<th>Degree/Certificate or Other education obtained</th>
<th>Year Obtained</th>
</tr>
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<tbody>
<tr>
<td>Herschel School, Cape Town, South Africa</td>
<td>Matriculation</td>
<td>1974</td>
</tr>
<tr>
<td>University of Cape Town, South Africa</td>
<td>Bachelor of Science (BSc) Zoology, Chemistry, Mathematics</td>
<td>1977</td>
</tr>
<tr>
<td>University of Cape Town, South Africa</td>
<td>Bachelor of Science Honours (BScHons) Zoology</td>
<td>1978</td>
</tr>
<tr>
<td>University of Cape Town, South Africa</td>
<td>Masters of Science (MSc) Environmental Studies, with distinction</td>
<td>1982</td>
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8. Other Training and Professional Courses Undergone

<table>
<thead>
<tr>
<th>Training/Course Provider</th>
<th>Name of the Training or Professional Course</th>
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<tbody>
<tr>
<td>Soils</td>
<td>Cedara Agriculture School, Pietermaritzburg, South Africa</td>
</tr>
<tr>
<td>Natural Resource Conflict Management</td>
<td>University of Cape Town, South Africa</td>
</tr>
<tr>
<td>Pasture Science</td>
<td>University of Pretoria, South Africa</td>
</tr>
<tr>
<td>Strategic Environmental Assessment for Developing Countries</td>
<td>International Association for Impact Assessment</td>
</tr>
<tr>
<td>Basic Copy Editing and Proofreading</td>
<td>McGillivray Linnegar Assiciaes</td>
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9. Professional Registration

<table>
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<tbody>
<tr>
<td>Interim Certification Board for Environmental Assessment Practitioners, South Africa</td>
<td>Since 2007</td>
</tr>
<tr>
<td>South African Council for Natural Scientific Professions; Registered Professional Natural Scientist with the [Registration No. 400246/05]</td>
<td>Since 2005</td>
</tr>
</tbody>
</table>
10. Membership of Societies and Other Activities of Public Importance

- Co-chair of the Biodiversity and Ecology Section of the International Association for Impact Assessment (IAIA) 2008-2011.
- Past Director of the Environmental Defence Fund, Centre for Environmental Rights, South Africa (2009/10).
- Member of the Civil Society Environmental Expert Panel for the Centre for Environmental Rights, South Africa (2011-2015).
- Member of the Advisory Committee/ Group for the international Business and Biodiversity Offsets Programme (BBOP) 2006-2016.
- Past Board Member and Past Chairperson of the Southern African Institute of Ecologists and Environmental Scientists (SAIE&ES), South Africa.
- Board Member of the Interim Certification Board for Environmental Assessment Practitioners, South Africa.
- Past Board Member and Deputy Chair of Board of CapeNature.
- Past Board Member of the Flora Conservation Committee, Member of the Advisory Committee of the Cape Conservation Unit, and Member of the Advisory Committee of the Conservation Unit, Botanical Society of South Africa.
- Member of the South African Affiliate of the International Association for Impact Assessment (IAIAsa).
- Member of the Advisory Group for South Africa’s Environmental Impact Assessment and Management Strategy (EIAMS) formulation (2010-2014).

11. Key Areas of Expertise

- Environmental assessment for sustainable development at strategic (policy, plan, programme) and project levels, with a focus on biodiversity and ecosystem services.
- Biodiversity offsets and compensatory conservation at project and policy levels.
- Conservation of biodiversity and important ecosystem services, and the integration of biodiversity considerations into spatial and integrated development planning.
- Review of environmental assessment at strategic and project levels.
- Teaching environmental assessment and review at project and strategic levels, biodiversity-inclusive impact assessment and management (including ecosystem services and biodiversity offsets), at undergraduate and postgraduate levels.

12. Employment Record

<table>
<thead>
<tr>
<th>Dates</th>
<th>Organization</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992- date</td>
<td>deVilliers Brownlie Associates</td>
<td>Member of a 2-person consultancy in environmental assessment and management.</td>
</tr>
<tr>
<td>1989-1991</td>
<td>Natal Parks Board</td>
<td>Senior professional officer, responsible for environmental assessments on all developments within Board areas, participating in planning and zonation of reserves, commenting on environmental assessments prepared for projects affecting the environment in the KwaZulu Natal Province</td>
</tr>
<tr>
<td>1988</td>
<td>University of Cape Town, South Africa</td>
<td>Researcher, environmental degradation of estuaries and socioeconomic factors affecting degradation</td>
</tr>
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13. Countries of Work Experience

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<tr>
<th>Country</th>
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<tr>
<td>South Africa</td>
<td>1982-1986, 1988-present</td>
</tr>
<tr>
<td>England</td>
<td>1987</td>
</tr>
<tr>
<td>Africa: Lesotho, Swaziland, Botswana, Zambia, Mozambique, Uganda</td>
<td>Short-term projects, 1992- present</td>
</tr>
<tr>
<td>Asia: India</td>
<td>Short-term projects, 2014- present</td>
</tr>
</tbody>
</table>

14. Publications and Other Details


Brownlie S 2011, with contributions from Garth Mortimer, Anthony Mietas, Sakkie du Toit, Nik Wullschleger, Rodney Cronwright, Charl de Villiers, Rudolph Röschter, and Jeffrey Manuel. Top-down, bottom-up, or both? Lessons from the Upper Breede River area, Western Cape, South Africa. Case study in Ecoregional economic development cases; a background document to ‘Ecoregional Economic Development - An integrated spatial planning approach’, prepared by CREM, SevS, Institute for Environmental Studies, VU University (IVM), The Netherlands.


Annual Conference of the International Association for Impact Assessment. 20-23 April 2015. Florence, Italy.


In addition to the above, Susie was:

- A contributor to a paper entitled ‘Resilience Thinking Improves SEA: a Discussion Paper’ by Slootweg and Jones; this paper won the IAIA’s Best Paper of 2011 Award.

15. **Additional experience as an independent advisor or review consultant**

<table>
<thead>
<tr>
<th>Project or Product</th>
<th>Client</th>
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<tbody>
<tr>
<td>Proposed extension and upgrade to Potsdam wastewater treatment works</td>
<td>Ninham Shand (environmental consultants)</td>
<td>2001</td>
</tr>
<tr>
<td>The Swaziland Electricity Board, as a member of an Advisory Panel, on the Fourth Eskom Feeder project, Swaziland.</td>
<td>Burrow Binnie, Swaziland (environmental consultants)</td>
<td>2001</td>
</tr>
<tr>
<td>Subject</td>
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<tr>
<td>Monitoring and Evaluation aspects of managing the Peninsula Mountain Chain, Western Cape, and the approach to the preparation of a Conservation Development Framework</td>
<td>SA National Parks 2001</td>
<td></td>
</tr>
<tr>
<td>The Scoping and Environmental Impact Assessment phases of the Proposed Protea Parkways Toll Road project on the national N1 and N2 roads (2001-2002).</td>
<td>Crowther Campbell (environmental consultants) 2001-02</td>
<td></td>
</tr>
<tr>
<td>Review of appeal on environmental authorization of major housing development, Garden Route, Western Cape</td>
<td>Department of Environmental Affairs and Development Planning 2002</td>
<td></td>
</tr>
<tr>
<td>Draft guidelines on consideration of biodiversity in Environmental Impact Assessment, and in Strategic Environmental Assessment, as one of ten international reviewers. These Voluntary Guidelines were adopted by COP-8, Convention on Biodiversity (2006)</td>
<td>Convention on Biological Diversity 2005-6</td>
<td></td>
</tr>
<tr>
<td>EIA of proposed golf estate, Garden Route</td>
<td>Department of Environmental Affairs and Development Planning 2009-10</td>
<td></td>
</tr>
<tr>
<td>‘Ecosystem Services: A Briefing Paper for the Mining and Metals Sector’ prepared for ICMM</td>
<td>Scott Wilson Ltd 2010</td>
<td></td>
</tr>
<tr>
<td>Draft IFC Performance Standard 6</td>
<td>IAIA’s Biodiversity and Ecology Section and the Business and Biodiversity Offsets Programme 2011</td>
<td></td>
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<tr>
<td>EIAs of proposed commercial and infrastructure developments, Western Cape</td>
<td>Department of Environmental Affairs 2011</td>
<td></td>
</tr>
<tr>
<td>Sustainable Development Strategy for Vedanta Mining Company</td>
<td>Endemic Vision Environmental Services (environmental consultants) 2012</td>
<td></td>
</tr>
<tr>
<td>Environmental Impact Assessment and Management Strategy (EIAMS) for South Africa (member of Advisory Group)</td>
<td>Department of Environmental Affairs 2010-14</td>
<td></td>
</tr>
<tr>
<td>A ‘Best Practice Guidance Manual’ for incorporating biodiversity considerations in Strategic Environmental Assessment and land use planning, prepared by the Wildlife Institute of India as part of the Indo-German Environment Partnership, for the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)</td>
<td>GIZ India 2014-15</td>
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16. **Teaching, training and capacity building**

<table>
<thead>
<tr>
<th>Subject</th>
<th>Date(s)</th>
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<tbody>
<tr>
<td>Convened and/ or contributed to courses on applied ecology, ecology in environmental assessment and management, review of environmental assessment and/ or environmental management frameworks, for postgraduate students in the Department of Environmental and Geographical Science (2000-2013) and the Department of Town and Regional Planning (2007-2015) at the University of Cape Town, and the University of Free State (2011-2015).</td>
<td>2000-2016</td>
</tr>
<tr>
<td>Run a 1-day course for SADC delegates on an IUCN course on wetlands and freshwater systems, on environmental assessments and their review, and run workshops and training courses on biodiversity offsets both internationally (IAIA conferences and for the Business and Biodiversity Offsets Programme) and in South Africa.</td>
<td>2000</td>
</tr>
</tbody>
</table>
Participated in organizing, attended, presented at, and prepared proceedings of, the IPIECA, ICMM, IAIA and CNOOC workshop on Impact Assessment, Biodiversity and the Extractive Industries in Beijing, China  2009

Assisted in running a workshop on biodiversity-inclusive impact assessment and biodiversity offsets in Kampala, Uganda, for BBOP  2009

Invited speaker at the Sixth Trondheim Conference on Biodiversity, Trondheim, Norway: ‘Engaging the business sector’.  2010

Facilitated a workshop with Conservation International, De Beers Family of Companies and the Business and Biodiversity Offsets Programme on biodiversity offsets.  2011

IUCN-invited speaker at an International Workshop on Best Practices for Mainstreaming Biodiversity Conservation into Mining Sector held in New Delhi, India. Appointed to prepare Proceedings of that Workshop by IUCN  2014

Invited speaker at, and participant in, BBOP’s No Net Loss Summit in London.  2014

Ran a half-day workshop on biodiversity offsets for officials from various government departments (Water and Sanitation, Mineral Resources, Environmental Affairs, Agriculture, Fisheries and Forests) and state-owned enterprises in Gauteng province  2014

Facilitated a 2-day workshop in Mpumalanga province for WWF-SA’s Grasslands Programme on developing a unified approach with regard to civil society engagement with the mining sector.  2014

<table>
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<th>17. Relevant Experience</th>
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<tr>
<td><strong>Name of assignment or project:</strong></td>
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<td><strong>Date:</strong></td>
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<td><strong>Location:</strong></td>
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<td><strong>Client:</strong></td>
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<tr>
<td><strong>Project description:</strong></td>
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<tr>
<td><strong>Position held:</strong></td>
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<tr>
<td><strong>Activities performed:</strong></td>
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| **Name of assignment or project:** | The design of a biodiversity offset for the Spring Grove Dam, KwaZulu Natal province, South Africa. |
| **Date:** | 2010-2014 |
| **Location:** | KwaZulu Natal, South Africa |
| **Client:** | Trans-Caledon Tunnel Authority (TCTA) and Institute of Natural Resources |
**Name of assignment or project:** Design of biodiversity offset for the proposed national toll highway project, Wild Coast, South Africa  
**Date:** 2014  
**Location:** Wild Coast, South Africa  
**Client:** South African National Roads Agency Ltd  
**Project description:** Design and implementation of a biodiversity offset for the national Wild Coast Toll Road.  
**Position held:** Independent environmental consultant, part of a team  
**Activities performed:** Visit to the affected area, engagement with key stakeholders, review of the specialist studies and EIA report as the basis for determining the need for and size of biodiversity offset required. Investigation of options in the landscape for suitable offsets, and identification of optimum sites, applying a number of selection criteria to ensure additionality, feasibility and long-term contributions to conservation. Consideration and recommendations given with regard to administrative/ institutional arrangements and financial implications/ provision needed to ensure successful implementation.

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**Name of assignment or project:** Design of biodiversity offset for the proposed limestone quarry and cement factory at Saldanha, South Africa  
**Date:** 2013-15  
**Location:** Saldanha, South Africa  
**Client:** Afrisam (Pty) Ltd  
**Project description:** Design and implementation plan for a biodiversity offset for the proposed Saldanha Cement Factory, limestone/ clay quarries and associated infrastructure  
**Position held:** Independent environmental consultant, part of a team  
**Activities performed:** Visit to the affected area, engagement with key stakeholders. Critical review of the EIA report and application of the mitigation hierarchy, and of specialist reports on flora and vegetation as the basis for determining the need for and size of biodiversity offset required. Consideration of indirect and probable cumulative impacts, as well as rehabilitation feasibility, in offset design. Investigation of options in the landscape for suitable offsets, and identification of optimum sites, applying a number of selection criteria to ensure additionality, feasibility and long-term contributions to conservation. Consideration and recommendations given with regard to administrative/ institutional arrangements and financial implications/ provision needed to ensure successful implementation.

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**Name of assignment or project:** The feasibility of a biodiversity offset for Frontier Saldanha Utilities’ pipeline
### Project 1: Investigation into the feasibility of a biodiversity offset for Frontier Saldanha Utilities’ pipeline and associated infrastructure, as part of the Marine Outfall project

- **Date:** 2015
- **Location:** Saldanha, South Africa
- **Client:** Frontier Saldanha Utilities (Pty) Ltd
- **Project description:** Investigation into the feasibility of a biodiversity offset for Frontier Saldanha Utilities’ pipeline and associated infrastructure, as part of the Marine Outfall project
- **Position held:** Independent lead environmental consultant
- **Activities performed:** High-level review of the EIA and specialist reports, updating botanical and biodiversity planning information and checking application of the mitigation hierarchy. Determination of offsetability of probable residual negative impacts and of a reliable measure of these impacts. Investigate and evaluate availability of spatial options to meet offset requirements. Recommendations for steps to be taken should an offset be pursued by the proponent.

### Project 2: Internal review of the Scoping and EIA process for a proposed Zinc mine in the Gamsberg, Northern Cape, and of biodiversity offsets design, South Africa

- **Date:** 2012-2013
- **Location:** Cape Town, South Africa
- **Client:** ERM Southern Africa (Pty) Ltd and Vedanta - Zinc International (Pty) Ltd
- **Project description:** Proposed Zinc Mine
- **Position held:** Independent reviewer and offset design advisor
- **Activities performed:** Internal review of Scoping and EIA documentation, with particular focus on the review of the biodiversity assessment, and interdependencies between various biodiversity specialist studies and other studies on water resources and social aspects (i.e. ecosystem services linkages). Advised on biodiversity offset design and implementation planning.

### Project 3: The design of a biodiversity offset for Coal of Africa’s Vele Mine, South Africa

- **Date:** 2012
- **Location:** Mapungubwe, South Africa
- **Client:** Department of Environmental Affairs
- **Project description:** The design of an appropriate biodiversity offset as part of retrospective environmental authorization of the Vele Coal Mine
- **Position held:** Independent environmental consultant, part of a team
- **Activities performed:** Critical review of the EIA and specialist reports. Determination of a reliable measure of the residual negative impacts of the mining operation. Visit to the mine site and adjacent World Heritage Site to investigate and evaluate options to meet offset requirements. Recommendations for a range of offset measures and sites to be pursued by the mining company.

### Project 4: Evaluation of the feasibility of a Botswana diamond mine’s achieving No Net Loss status with regard to biodiversity

- **Date:** 2012-13
- **Location:** Jwaneng, Botswana
- **Client:** Debswana
- **Project description:** No Net Loss biodiversity offset investigation for Debswana’s Jwaneng Mine
- **Position held:** Independent environmental consultant, part of a team
- **Activities performed:** Site visit, meeting with key stakeholders, and synthesis of available...
information on relevant baseline biodiversity information. Assessed residual negative impacts of mining operations, both retrospectively for existing impacts, and prospectively for any significant planned impacts e.g. as part of mine expansion to give an estimate of the residual biodiversity losses that would indicate the nature and scale of offset needed. Existing conservation and rehabilitation activities undertaken by the mine taken into account in working out any additional offset requirements to counterbalance anticipated residual impacts.

<table>
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<tr>
<th>Name of assignment or project:</th>
<th>Review of the current practices, challenges and opportunities for biodiversity offsets, to mainstream best practice offsets in France</th>
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<tr>
<td>Date:</td>
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<tr>
<td>Location:</td>
<td>Cape Town, South Africa</td>
</tr>
<tr>
<td>Client:</td>
<td>Wildlife Conservation Society (WCS) and Agence Française de Développement (AFD)</td>
</tr>
<tr>
<td>Project description:</td>
<td>Review of current practices, challenges and opportunities for biodiversity offsets to mainstream best practice in France</td>
</tr>
<tr>
<td>Position held:</td>
<td>Independent environmental consultant, part of a team</td>
</tr>
<tr>
<td>Activities performed:</td>
<td>Review and synthesis of current practice, policies, laws and directives in South Africa, Brazil, USA and in the EU, and reporting on a potential optimum AFD strategy for biodiversity offsets, as member of the WCS team.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name of assignment or project:</th>
<th>Description and analysis of case studies around the world involving biodiversity offsets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date:</td>
<td>2008-09</td>
</tr>
<tr>
<td>Location:</td>
<td>Cape Town, South Africa</td>
</tr>
<tr>
<td>Client:</td>
<td>Forest Trends, Business and Biodiversity Offsets Programme</td>
</tr>
<tr>
<td>Project description:</td>
<td>Description and analysis of case studies from around the world involving biodiversity offsets</td>
</tr>
<tr>
<td>Position held:</td>
<td>Independent environmental consultant</td>
</tr>
<tr>
<td>Activities performed:</td>
<td>Undertook research, interviews and capturing detailed case studies from around the world on biodiversity offsets and compensation work, as well as shorter vignettes. Case studies were structured to distil out the ‘lessons learned’, as well as highlight strengths and weaknesses in different approaches.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name of assignment or project:</th>
<th>Provincial guidelines on biodiversity offsets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date:</td>
<td>2007-2015</td>
</tr>
<tr>
<td>Location:</td>
<td>Western Cape, KwaZulu-Natal and Gauteng provinces, South Africa</td>
</tr>
<tr>
<td>Client:</td>
<td>Department of Environmental Affairs and Development Planning, Ezemvelo KZN Wildlife and Gauteng Department of Agriculture and Rural Development</td>
</tr>
<tr>
<td>Project description:</td>
<td>Drafting and updating of guidance on biodiversity offsets</td>
</tr>
<tr>
<td>Position held:</td>
<td>Independent lead environmental consultant, working with team</td>
</tr>
<tr>
<td>Activities performed:</td>
<td>Synthesis of best practice approaches to biodiversity offsets internationally, and of biodiversity planning and priorities, EIA requirements and other legal requirements pertaining to biodiversity management in South Africa. Taking this South African context into account, and engaging with key stakeholders, conservation agencies and biodiversity specialists, designing a simple approach to biodiversity offsetting that would meet the desired endpoint of No Net Loss in relation to biodiversity targets. Guidance prepared for three provinces, draft policy prepared for one province. Updated Guidelines for the Western Cape province.</td>
</tr>
<tr>
<td>Name of assignment or project:</td>
<td>Wetland offsets: a best-practice guideline for South Africa</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>----------------------------------------------------------</td>
</tr>
<tr>
<td>Date:</td>
<td>2012-2014</td>
</tr>
<tr>
<td>Location:</td>
<td>South Africa</td>
</tr>
<tr>
<td>Client:</td>
<td>EcoPulse Environmental Consulting Services, South African National Biodiversity Institute</td>
</tr>
<tr>
<td>Project description:</td>
<td>Preparing guidelines and a methodology for offsetting impacts on wetlands, South Africa</td>
</tr>
<tr>
<td>Position held:</td>
<td>Independent environmental consultant, member of a team</td>
</tr>
<tr>
<td>Activities performed:</td>
<td>Identifying the legal and policy framework for wetland offsets, and giving input into the development of a protocol to determine when offsets would be required, tied to the application of the mitigation hierarchy and early identification of ‘non offsetable’ wetlands. Determining a methodology and steps for setting appropriate offset ratios/ size, and the different components of offset design and implementation planning, monitoring and verification that need to be addressed. Providing guidance on ‘offset receiving areas’ in the landscape, tied to biodiversity and freshwater ecosystem priority areas. Engaging relevant stakeholders through the guideline development process.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name of assignment or project:</th>
<th>Undertake scoping, strategy development and design of the GEF-funded project on mainstreaming biodiversity into land use regulation and management at the municipal scale for SANBI, South Africa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date:</td>
<td>2013-14</td>
</tr>
<tr>
<td>Location:</td>
<td>Various district municipalities and regions, South Africa</td>
</tr>
<tr>
<td>Client:</td>
<td>South African National Biodiversity Institute</td>
</tr>
<tr>
<td>Project description:</td>
<td>Undertake scoping, strategy development and design of the GEF-funded project on mainstreaming biodiversity into land use regulation and management at the municipal scale</td>
</tr>
<tr>
<td>Position held:</td>
<td>Independent environmental consultant, member of a team</td>
</tr>
<tr>
<td>Activities performed:</td>
<td>Field work and interviews to identify projects with most potential in various districts, and a SWOT analysis of proposals in two components: land use management, permitting and enforcement; and conservation and sustainable use of biodiversity on private and communal lands. Preparation of log frameworks and supporting document required by the GEF for their evaluation purposes.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name of assignment or project:</th>
<th>Minimum requirements for incorporating biodiversity considerations in land use planning and integrated environmental management, South Africa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date:</td>
<td>2013-2014</td>
</tr>
<tr>
<td>Location:</td>
<td>Cape Town, Pretoria</td>
</tr>
<tr>
<td>Client:</td>
<td>Department of Environmental Affairs and Tourism</td>
</tr>
<tr>
<td>Project description:</td>
<td>Preparation of national ‘minimum requirements’ for consideration of biodiversity in impact assessment and land use planning</td>
</tr>
<tr>
<td>Position held:</td>
<td>Lead consultant</td>
</tr>
<tr>
<td>Activities performed:</td>
<td>Synthesis of global and national ‘best practice’ and preparation of materials setting out ‘minimum requirements’ for both practice and information gathering</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name of assignment or project:</th>
<th>Inspection of a thermal power plant project in South Africa and review of EIA.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date:</td>
<td>2010-2012</td>
</tr>
<tr>
<td>Location:</td>
<td>South Africa and Washington D.C., USA</td>
</tr>
<tr>
<td>Client:</td>
<td>World Bank Inspection Panel</td>
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<tr>
<td>-------------------------</td>
<td>-------------------------------------------------</td>
</tr>
<tr>
<td>Project description:</td>
<td>Thermal power project</td>
</tr>
<tr>
<td>Position held:</td>
<td>Member of Inspection Panel</td>
</tr>
<tr>
<td>Activities performed:</td>
<td>Critical review of EIA and documents prepared by World Bank Management in relation to the thermal power project. Meetings with stakeholders who requested the Inspection to identify key issues and concerns. Review of EIA and relevant documentation, research and reports linked to these concerns. Working with other team members and specialists to distil out the main findings and recommendations, and responsible for drafting and revising the report of the Inspection Panel for presentation to World Bank Management.</td>
</tr>
</tbody>
</table>

| Name of assignment or project: | Preparation of Environmental Management Frameworks for two municipal regions, South Africa |
| Date:                         | 2009-15                                       |
| Location:                     | Saldanha Bay and Drakenstein municipalities, South Africa |
| Client:                       | Department of Environmental Affairs and Development Planning |
| Project description:          | Preparation of environmental management frameworks to inform environmental decision making |
| Position held:                | Independent lead environmental consultant      |
| Activities performed:         | Research on, and application of, best practice strategic environmental assessment and spatial planning. Gathering and synthesising relevant environmental information, including on background trends, stakeholder engagement to undertake visioning and scoping exercises, and to invite comment on draft documentation. Co-ordinating specialist input to address information or data gaps, preparing GIS overlays of different management categories and geographical areas, supported by strategic environmental management plans. |

| Name of assignment or project: | Evaluation of Business and Biodiversity Initiatives and subsequent strategy formulation, for GreenChoice, Conservation International, WWF’s Green Trust and the Critical Ecosystem Partnership Fund, South Africa |
| Date:                         | 2009                                          |
| Location:                     | Cape Town, South Africa                       |
| Client:                       | WWF South Africa                              |
| Project description:          | Evaluation of Business and Biodiversity Initiatives and subsequent strategy formulation, for GreenChoice, Conservation International, WWF’s Green Trust and the Critical Ecosystem Partnership Fund |
| Position held:                | Independent environmental consultant, part of team |
| Activities performed:         | Critically examined the portfolio of initiatives supported by the GreenChoice programme, interviewed key stakeholders and evaluated their success and outcomes. Drafted a report summarizing the findings of the evaluation, together with a set of key recommendations for improving or changing these initiatives. |

| Name of assignment or project: | Preparation of a Sustainable Utilization Plan for the Berg Water Project, South Africa |
| Date:                         | 2007-11                                       |
| Location:                     | Franschhoek, Western Cape, South Africa       |
| Client:                       | Trans-Caledon Tunnel Authority                |
| Project description:          | Prepare a Sustainable Utilization Plan for the Berg Water Project |
| Position held:                | Independent environmental consultant          |
| Activities performed:         | Advisory role on the scope and content of the sustainable utilization plan |
(SUP). Take into account the policy, planning and legal requirements, constraints and opportunities, and determine appropriate sustainability criteria. Advise on the preparation of the SUP, management, monitoring and evaluation, of the area and in particular the dam’s catchment, and institutional arrangements, taking into consideration stakeholder and local community aspirations for the area. Reviewed draft Terms of Reference for specialist studies as well as draft specialist reports. Participate in specialist workshops. Review and comment on the draft SUP.

<table>
<thead>
<tr>
<th>Name of assignment or project:</th>
<th>Land consolidation and stewardship strategy and implementation programme, Garden Route Initiative, South Africa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date:</td>
<td>2008</td>
</tr>
<tr>
<td>Location:</td>
<td>Garden Route, South Africa</td>
</tr>
<tr>
<td>Client:</td>
<td>South African National Parks</td>
</tr>
<tr>
<td>Project description:</td>
<td>Land consolidation and stewardship strategy and implementation programme, Garden Route Initiative, South Africa</td>
</tr>
<tr>
<td>Position held:</td>
<td>Independent environmental consultant, member of team</td>
</tr>
<tr>
<td>Activities performed:</td>
<td>Review of instruments for biodiversity conservation, land stewardship and of existing biodiversity spatial planning products; Input into workshops on the technical or practical aspects of land consolidation and stewardship; Input into documents on technical and practical aspects of land consolidation and stewardship. Explore implementation scenarios and options, including use of stewardship programme. Prepare principles, implementation priorities and an implementation plan, with required actions, timeframes and responsibilities, and key performance indicators for monitoring and evaluation purposes.</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Name of assignment or project:</th>
<th>Strategic Environmental Assessment Guidelines, South Africa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date:</td>
<td>2007</td>
</tr>
<tr>
<td>Location:</td>
<td>Pretoria, South Africa</td>
</tr>
<tr>
<td>Client:</td>
<td>Department of Environmental Affairs, Council for Scientific and Industrial Research</td>
</tr>
<tr>
<td>Project description:</td>
<td>Preparation of national Strategic Environmental Assessment guidelines</td>
</tr>
<tr>
<td>Position held:</td>
<td>Independent environmental consultant, member of team</td>
</tr>
<tr>
<td>Activities performed:</td>
<td>Synthesis and distilling out best practice elements of SEA from around the world, workshopping with key stakeholders, addressing SEA at both plan and policy levels. Drafting of guidance material, presenting different models and approaches, and setting out key steps. Undertook a ‘roadshow’ of presenting this material in different provinces around the country.</td>
</tr>
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<table>
<thead>
<tr>
<th>Name of assignment or project:</th>
<th>Situation Analysis and Guidance on Biodiversity, Impact Assessment and Decision Making in Southern Africa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date:</td>
<td>2006-07</td>
</tr>
<tr>
<td>Location:</td>
<td>Cape Town, South Africa</td>
</tr>
<tr>
<td>Client:</td>
<td>IAIA’s Capacity Building for Biodiversity in Impact Assessment programme</td>
</tr>
<tr>
<td>Project description:</td>
<td>Situation Analysis and preparation of guidance on biodiversity, impact assessment and decision making in Southern Africa</td>
</tr>
<tr>
<td>Position held:</td>
<td>Independent environmental consultant, part of team with Southern African Institute for Environmental Assessment</td>
</tr>
<tr>
<td>Activities performed:</td>
<td>A situation analysis of the current state of consideration of biodiversity and ecosystem services in impact assessment and decision making in Southern Africa made up the first step of this work, to identify the main shortcomings in practice. Following on from this work, and drawing on global best practice on biodiversity-inclusive impact assessment and decision making, detailed</td>
</tr>
</tbody>
</table>
guidance and a 3-day pilot training course was prepared on project-level and strategic-level assessment and decision making, taking biodiversity and ecosystem services into account.

<table>
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<tr>
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<th>Location:</th>
<th>Client:</th>
<th>Project description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent review of the Pebble Bed Modular Nuclear Reactor EIA, South Africa</td>
<td>2006-08</td>
<td>Pretoria and Cape Town, South Africa</td>
<td>Department of Environmental Affairs</td>
<td>Independent review of the EIA for the proposed Pebble Bed Modular Nuclear Reactor plant</td>
</tr>
<tr>
<td>Position held: Member of an independent environmental consulting team</td>
<td>Activities performed: Critical review and comment on the EIA process, public participation processes, access to information and transparency, and all specialist reports. Integration of different specialist review findings within the team and preparation of a review report for the national department.</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Name of assignment or project</th>
<th>Date:</th>
<th>Location:</th>
<th>Client:</th>
<th>Project description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guidelines for involving biodiversity specialists in EIA processes, South Africa</td>
<td>2005</td>
<td>Cape Town, South Africa</td>
<td>CSIR and Department of Environmental Affairs and Development Planning</td>
<td>Preparation of guidelines for involving biodiversity specialists in all stages of the EIA process</td>
</tr>
<tr>
<td>Position held: Independent lead environmental consultant</td>
<td>Activities performed: Stakeholder engagement, research on international ‘best practice’ approaches, preparation of guidelines</td>
<td></td>
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<td></td>
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</tbody>
</table>

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<tr>
<th>Name of assignment or project</th>
<th>Date:</th>
<th>Location:</th>
<th>Client:</th>
<th>Project description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position held: Member of a team</td>
<td>Activities performed: Visited the sites with other team members, undertook critical review of the EIA processes and scope to date, interviewed key ministries involved in or responsible for decision making on the proposal. Road and rail/ port options were addressed, and private versus public infrastructure use. Brainstorming sessions to arrive at recommendations for addressing key issues and concerns, and drafting a report setting out the need for a Strategic Environmental Assessment rather than individual EIAs.</td>
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</tbody>
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<thead>
<tr>
<th>Name of assignment or project</th>
<th>Date:</th>
<th>Location:</th>
<th>Client:</th>
<th>Project description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Draft Guidelines for the Review of Environmental Impact Assessments, Cape Town</td>
<td>2001</td>
<td>Cape Town, South Africa</td>
<td>City of Cape Town</td>
<td>Draft guidelines for the review of EIAs</td>
</tr>
<tr>
<td>Position held: Lead environmental consultant</td>
<td>Activities performed:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Name of assignment or project: Independent review of the Pebble Bed Modular Nuclear Reactor EIA, South Africa

Date: 2006-08
Location: Pretoria and Cape Town, South Africa
Client: Department of Environmental Affairs
Project description: Independent review of the EIA for the proposed Pebble Bed Modular Nuclear Reactor plant
Position held: Member of an independent environmental consulting team
Activities performed: Critical review and comment on the EIA process, public participation processes, access to information and transparency, and all specialist reports. Integration of different specialist review findings within the team and preparation of a review report for the national department.

Name of assignment or project: Guidelines for involving biodiversity specialists in EIA processes, South Africa

Date: 2005
Location: Cape Town, South Africa
Client: CSIR and Department of Environmental Affairs and Development Planning
Project description: Preparation of guidelines for involving biodiversity specialists in all stages of the EIA process
Position held: Independent lead environmental consultant
Activities performed: Stakeholder engagement, research on international ‘best practice’ approaches, preparation of guidelines

Name of assignment or project: Review of the impact assessment for transport options, heavy mineral sand mining in Mozambique

Date: 2003
Location: Xai Xai, Mozambique
Client: Netherlands EIA Commission
Project description: Review of the EIA for transport options associated with heavy mineral sand mining in Mozambique.
Position held: Member of a team
Activities performed: Visited the sites with other team members, undertook critical review of the EIA processes and scope to date, interviewed key ministries involved in or responsible for decision making on the proposal. Road and rail/ port options were addressed, and private versus public infrastructure use. Brainstorming sessions to arrive at recommendations for addressing key issues and concerns, and drafting a report setting out the need for a Strategic Environmental Assessment rather than individual EIAs.

Name of assignment or project: Draft Guidelines for the Review of Environmental Impact Assessments, Cape Town

Date: 2001
Location: Cape Town, South Africa
Client: City of Cape Town
Project description: Draft guidelines for the review of EIAs
Position held: Lead environmental consultant
Activities performed: |
Activities performed: Review and synthesis of international best practice, decision-making and EIA principles, as well as existing review guidelines, both in South Africa and elsewhere in the world. Draft guidelines with systematic and defensible review steps, supported by appendices with additional guidance. These Guidelines have subsequently been adopted for use by the Department of Environmental Affairs and Development Planning, Western Cape

Name of assignment or project: Review of the Specialist and Key Issue Reports, and EIA Report for the proposed mining on the Eastern Shores of Lake St Lucia, KwaZulu-Natal, South Africa

Date: 1990-1991
Location: Pietermaritzburg, KwaZulu Natal, South Africa
Client: Natal Parks Board
Project description: Proposed mining on the Eastern Shores of Lake St Lucia, KwaZulu Natal
Position held: Senior Environmental Officer
Activities performed: Internal review of specialist, key issue and EIA reports for the proposed mining project. Co-ordinating and integrating inputs from various specialists, and preparation of detailed comment and recommendations for uptake by the EIA consultants. In addition, preparation of material to present at hearings, capturing key issues and concerns of the Natal Parks Board.