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Attention: Mr Rory Kew

ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED ESKOM NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE: COMMENTS REGARDING THE PROPOSED SITE AT DYNEFONTEIN.

Dear Mr Kew

Your correspondence entitled *"Proposed site at Duynefontein (existing Koeberg Power Station)"* refers.

Arcus GIBB acknowledges receipt of the above-mentioned documentation. We thank you for your valuable comments and your participation in the Eskom Nuclear Power Station (NPS) Environmental Impact Assessment (EIA) process to date.

Responses to your comments are as follows.

1. Your comment:

Introduction

This submission, drawing heavily upon the Final Scoping Report published by Eskom, will seek to convey the author's concern regarding the impact of the proposed Nuclear 1 facility at the Duynefontein site, both during construction and during operations thereafter.

Specific reference will be made to its potential impact on the Atlantis aquifer, the associated impact on the sensitive and important wetlands within the buffer zone and the potential impact on the flora and fauna. The site falls within an exceptionally low rainfall area, resulting in low groundwater recharge rates and an exceptionally sensitive biome.

The Atlantis aquifer is listed as a sole source, major aquifer, classified as vulnerable to impact. Furthermore there are several red data flora species listed within the immediate vicinity.

A further consideration is the potential impact on the human population residing in close proximity.

In conclusion, it is held that the proposed mitigation steps are not sufficient to adequately mitigate irreparable damage to the groundwater, a situation already evidenced through the impact which the construction of Koeberg 1 and 2 have already had.

Response:

Your concerns regarding the Duynefontein site are noted and responded to in detail in the sections that follow.

The Scoping Phase of the EIA process provides the starting point for detailed specialist studies during the Impact Assessment Phase. As recorded in the Scoping Report, its purpose is to:

- *Ensure that the process is open and transparent and involves the Authorities, proponent and stakeholders;*
- *Identify the important characteristics of the affected environment;*
- *Ensure that feasible alternatives are identified and selected for further assessment;*
- *Assess and determine possible impacts of the proposed project on the biophysical and socio-economic environment and associated mitigation measures; and*
- *Ensure compliance with the relevant legislation.*

As such, the issues identified during the Scoping Phase (including those raised in your letter) are investigated in detail during the impact assessment phase, and the confirmed (peer reviewed) results presented in an integrated manner to assist with the DEA's decision-making. The specialist scientists also provide mitigation measures for the impacts identified in their respective studies. These will also be carried through into the Environmental Management Plan (EMP), which accompanies the Environmental Impact Report (EIR). This process is reflected in the figure below.

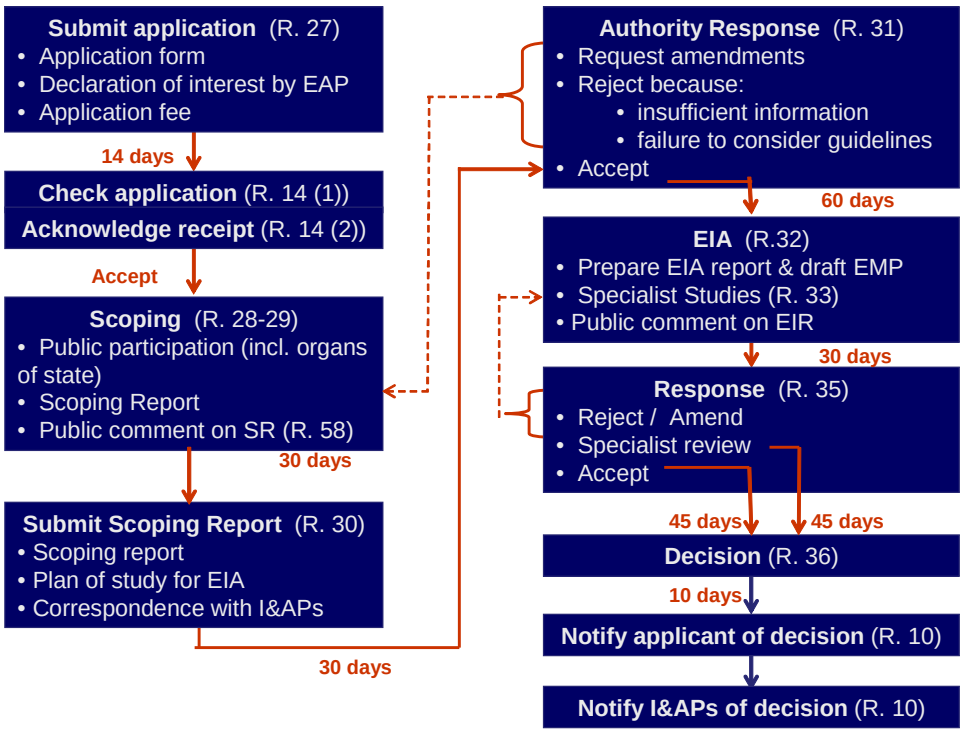

Figure: EIA Process as prescribed by the NEMA EIA Regulations

The full list of specialist studies is presented at this point; specific studies are highlighted in relation to your detailed comments that follow:

- *Geology;*
- *Hydrology;*
- *Geohydrology;*
- *Geotechnical;*
- *Seismic risk;*
- *Marine ecology;*
- *Air quality and climatology;*
- *Health risk assessment;*
- *Noise;*
- *Visual;*
- *Fauna (invertebrates);*
- *Fauna (vertebrates);*
- *Flora;*
- *Freshwater ecology;*
- *Freshwater supply;*
- *Archaeology and heritage;*
- *Social;*
- *Economic;*
- *Oceanography;*
- *Traffic and transport;*
- *Tourism;*
- *Emergency Response;*
- *Site Control/Safety and*
- *Agriculture and Land use.*

For the Dynefontein site in particular, the cumulative effect of the existing Koeberg Nuclear Power Station, the PBMR Demonstration Power Plant (DPP) and the proposed project will be investigated.

2. Your comment

1.1 Duynefontein Site

The site is situated just north of the existing Koeberg nuclear power station and lies within the Cape Floristic Region (CFR), which is largely restricted to the Western Cape and Eastern Cape provinces. The CFR is an exceptionally bio diverse region with very high levels of species endemism.

The CFR has been identified as a global Biodiversity Hotspot by Conservation International (CI; www.biodiversityhotspots.org), and is the focus of a South African government supported initiative, the Cape Action for People and the Environment.

Furthermore, within the 20 km buffer zone exist numerous residential suburbs, from Milnerton, Sunset Beach, Flamingo Vlei, Table View, Parklands, Sunningdale, Bloubergstrand, West Beach, Atlantic Beach, Duynefontein, Melkbos and Atlantis. In addition, most of the land north of Table View is owned in large tracts by property development companies and is destined for future urban development. Thus several thousand households will be placed at further risk through the location of a further nuclear facility at the Duynefontein site.

The West Coast Conservancy also falls within the buffer zone. Within this buffer zone are a number of wetlands which are fed primarily by a seasonally fluctuating water table, forming pools of shallow, brackish water during winter, which provide breeding habitat for frogs as well as numerous aquatic and semi-aquatic invertebrates including crustacean fauna typical of highly seasonal wetland habitat. These pools dry out in summer as the water table recedes. These wetlands are considered of high local, regional and international importance.

The northern sections of the wetlands increasingly have shorter hydro periods represented by seasonally to ephemerally saturated wetland seeps, dominated by stands of *Ficinia nodosus*. This species is indicative of the transitional area occurring between wetland and terrestrial habitats. The northern area has been disturbed by past activities on the site, including serving as a lay-down area during construction of the existing power plant and the wetland seepage line is increasingly (and to some extent, naturally) fragmented with increasing distance extending northwards.

The natural wetlands identified on the site would be sensitive to any activities that resulted in their physical disturbance, drainage, infilling or changes to their natural hydrological regime, as well as any activities that increased their susceptibility to invasion by alien plants.

Although no wetlands occur on or in the immediate vicinity of the approximate extent of the proposed building platform, which comprises a previously levelled disturbed environment, significant wetlands do exist within the buffer zone, which have not been considered as part of the Final Scoping Report.

The Duynefontein Site (existing Koeberg Power Station) overlies two aquifer systems, namely the southern extent of the upper-lying primary or intergranular Atlantis Aquifer and the deeper-lying weathered and fractured-rock (secondary) aquifer system of the Malmesbury Group. The primary aquifer system towards the eastern parts of the study area is therefore classified as a major aquifer system vulnerable to anthropogenic impacts (Parsons and Flanagan, 2006).

With respect to vulnerability, the aquifers at Koeberg and Thyspunt are rated as Most Vulnerable, with the other three sites rated as Least Vulnerable (Parsons and Conrad, 1998).
The area is characterized with low rainfall (MAP less than 500 mm) and besides the Salt and Diep Rivers, there are no notable surface water features. High ‘coefficient of variation’ (CV) numbers indicates that the watercourses in these catchments are generally non-perennial.

However, within the buffer zone significant water features exist, such as the Flamingo Vlei and river, which feeds it, together with the watercourse through to the Milnerton lagoon.

Response:

Thank you for the information presented above. All concerns and information will be provided to the respective specialist. The following specialist studies will undertake detailed assessments of the aspects mentioned, for integration into the EIR:

- *Fauna (Vertebrates);*
- *Fauna (Invertebrates);*
- *Flora;*
- *Social,*
- *Economic;*
- *Freshwater Ecology;*
- *Hydrology; and*
- *Geohydrology.*

Detailed impact assessments will be conducted for all three site alternatives, and presented in an integrated manner to the Department of Environmental Affairs (DEA) for consideration during environmental authorisation.

3. Your comment

Freshwater supply

Duynefontein falls within the Berg WMA. DWAF's National Water Resource Strategy (2004) water requirement projections show that there is no allowance for water requirements for power generation in this WMA. Duynefontein receives its water from one source via the local authority.

The Aquarius well field that previously supplied Koeberg power station, which is approximately six km to the northeast of Koeberg, is presently not utilized because of poor water quality. An investigation has been lodged into finding alternative water supply options to ensure the availability of water and the provision of another pipeline or alternative supply options.

Reticulated municipal water is available to most smallholdings in the study area from a pipeline constructed during 2002, but is used to a limited extent by the smallholdings because of the high cost thereof. Groundwater is still the preferred choice for water supply (Parsons and Flanagan, 2006).

Thermal power stations, whether coal-fired, gas, oil or nuclear, require large quantities of water during construction and for cooling purposes. However, South Africa is a water stressed country, which poses challenges for the supply of water.

The water consumption of the Koeberg 900 MW PWR units 1 and 2 is fed by two pipes, namely a 150 mm pipe, supplies water to the owner controlled area outside the security fence and a 250 mm pipe, which supplies water to the existing Koeberg site.

The two units jointly use approximately 15,000 m^3 of freshwater per month on average. This number fluctuates depending on plant outages. In 1998 a 500 mm diameter supply pipe was installed in the eastern road reserve along the R27, to augment the water requirements in Atlantis.

Community Supply

The local Authorities supply the required water to the residential areas of Bloubergstrand, Melkbosstrand, Van Riebeeckstrand, and Duynefontein whilst farms utilize both harvested (rain) and extracted (groundwater) water.

Atlantis is supplied with groundwater extracted from two well fields namely the Silwerstroom and Witzand well fields managed by the City of Cape Town: Bulk Water Supply and supported by the Council for Science and Industrial Research (CSIR). The Silwerstroom well field is located approximately 12 km north of the existing power station and Witzand well field is located approximately six km north of the power station. In 1995, an estimated 2.0 and 3.3 Mm3 were extracted from the two well fields.

Response:

Thank you for the information presented above. All concerns and information will be provided to the respective specialist. The following specialist study will conduct a detailed assessment of the aspects mentioned:

- *Freshwater Supply.*

In light of the potential negative effects of sourcing local freshwater, a desalinisation plant forms part of the associated infrastructure of the proposed Nuclear-1 power station, and this is planned provide the freshwater requirements for the power station. The impacts of the desalinisation plant are being investigated in this EIA process.

4. Your comment:

Geohydrology

The geohydrological information was taken from SRK (2007b).

(i) Groundwater occurrence
The Duynefontein site overlies two aquifer systems, namely the southern extent of the upper-lying primary or intergranular Atlantis Aquifer (colloquially referred to as the 'Aquarius Aquifer') and the deeper-lying weathered and fractured-rock (secondary) aquifer system of the Malmesbury Group.

The Atlantis Aquifer is classified as a sole source aquifer system (Parsons, 1995) and is classified as highly vulnerable, where vulnerable is defined as the tendency or likelihood for contamination to reach a specified position in the ground water system after the introduction at some location above the upper most aquifer (SRK, 2007b).

The Atlantis Aquifer is an important and significant primary aquifer with two well fields (Witzand and Silwerstroom) situated north of the Site supplying a water source to the surrounding towns, predominantly to Atlantis. The thickness of the primary aquifer at the Site is approximately 13 m, the groundwater level is some seven metres below ground level and the overall thickness of the sediments is approximately 20 m. The thickness of the secondary, fractured aquifer is not known. Groundwater is interpreted to flow in a southwesterly direction, away from two significant well fields that supply drinking water to Atlantis and surrounding areas.

Atlantis is largely dependent on groundwater for its water supply. Based on Parsons' (1999) estimated groundwater usage figures, about 8.5 Mm3 per annum of groundwater is abstracted from the primary aquifer system.

Groundwater is also used in the study area as a source of water to smallholdings and for brick making and sand mining (Parsons and Flanagan, 2006). Groundwater is predominantly used for smallscale vegetable farming, water for horses and irrigation of commercial lawn.

Twelve boreholes were initially drilled to supply process water at the Koeberg NPS, but they have not been used during the past few years as a result of high EC levels (Parsons and Flanagan, 2006). Average recharge of the aquifer was estimated to range between 10 and 30 % of the MAP.

Groundwater potential

Yields of >10 L/s are obtained from production boreholes in the Witzand and Silwerstroom Well fields north of the Site. Boreholes drilled into sands along the north-eastern parts of the study area were reported to yield in excess of five L/s (Parsons, 2002). However, boreholes drilled into the Malmesbury Group Aquifer yield considerably less, i.e. < 2 L/s. This is consistent with the findings by Meyer (2001) in his assessment of the Malmesbury Group Aquifer. Exploration boreholes drilled in the shale at the regional landfill site yielded between 0.1 and 0.3 L/s (Parsons and Flanagan, 2006).

Four exploration boreholes were drilled at the planned Koeberg 165 MW Pebble Bed Modular Reactor (PBMR) Unit 3 site and baseline groundwater quality data was obtained (Africon, 2001). Tritium data indicated that groundwater in the Malmesbury Group Aquifer is saline and not recharged, which indicates stratification in age and quality between the primary sediments and the secondary aquifer.

Geotechnical characteristics

The Duynefontein site is geotechnically complex when compared with the other identified sites. The area exhibits a fairly constant water table approximately seven meters below surface. As a result, the choice of the exact position of the nuclear island on the site will be critical. The main structures require rock foundations, the relative depth to the rock and the overburden must be accurately established with respect to the over burden (sand) thickness across the site.

Slope stability below the water table is likely to be a constant problem and therefore the need for dewatering and/or support (lateral) for excavations will be required. Permanent support systems will be required to be designed for variable groundwater and loading (soil and external) conditions. In addition, deep excavations into rock will similarly be subject to groundwater intrusion. The erosion potential of the surficial horizons is significant and hence surface stabilization measures will be necessary.

Liquefaction of the water bearing sands poses a medium risk as historical evidence of “soil-boils” and surface cracking under seismic conditions have been observed in the Cape Town area. Therefore there appears to be the need to undertake significant de-watering to ensure stability of the nuclear island, which has a high likelihood of damaging the aquifer, as happened during the construction of Koeberg. This will materially impact the quality of the groundwater, which has been demonstrated to be heavily relied upon as a primary source of water by local residents and small-scale farming. This is an environmental sensitive area, with demonstrated low rainfall.

Impact on Groundwater quality

Possible project impacts on the geo-hydrology are related to the two main phases of development, namely, the construction and operational phases. The NPS will require approximately 8000 m3/day, which will add additional pressure to scarce freshwater resources.

With the acknowledged and observed changes to the environment the Western Cape is set to become dryer, placing more reliance on groundwater. Estimates of recharge (as a percentage of rainfall) in the study area were presented by Bredenkamp and Vandoolaeghe (1982), Vandoolaeghe and Bertram (1982), Bertram et al. (1983), Fleisher (1990), and others. Average recharge was estimated to be between 10 and 30 % of MAP, with Fleisher (1990) suggesting it to be 16 % of MAP.

Vandoolaeghe and Bertram (1982) classified the groundwater of this aquifer (Atlantis) as Class A type [electrical conductivity (EC) < 70 mS/m]. The Atlantis Aquifer is classified as a sole source aquifer system (Parsons, 1995). Although smallholdings in the study area are dependent on groundwater, a reticulated pipeline was constructed during 2002. The primary aquifer system towards the eastern parts of the study area is therefore classified as a major aquifer system vulnerable to anthropogenic impacts (Parsons and Flanagan, 2006).

Based on groundwater monitoring undertaken by (Dames and Moore, 1977 and 1978) it was apparent that dewatering processes during construction of the Koeberg 900 MW PWR Units 1 and 2 resulted in saline intrusion, evident by an increase in salinity in the groundwater at the monitoring boreholes. Sulphate (SO4) concentrations also increased from 40 to > 400 mg/L subsequent to the dewatering phase (Dames and Moore, 1977d).

Tritium data indicated that groundwater in the Malmesbury Group Aquifer is saline and not recharged, which indicates stratification in age and quality between the primary sediments and the secondary aquifer.

Future pumping and dewatering may disturb this stratification and inflow of saline groundwater into the upper primary aquifer may occur. During construction the dewatering process may lower the groundwater table, which may impact on surrounding ground water users and reduce the occurrence of surface water features as these may dry up.

Furthermore, during construction, the absence of fresh water at the sites may result in abstraction from the groundwater, with groundwater being possibly used to meet potable water demands, or construction demands, which may impact the environment in one or more of the following ways:

- lowering of the groundwater table
- sea water intrusion
- drying-up of coastal springs
- increased drawdown
- ingress of saline groundwater
- drying up of wetlands
- the reduction in borehole yield or the complete drying up of existing boreholes, which are heavily relied upon by the surrounding communities.

Natural groundwater flow and flow direction may be obstructed by infrastructure, thereby negatively impacting on surface water features recharged by groundwater. The NPS and associated infrastructure may result in the destruction of dune areas and surface / groundwater abstraction may lead to the disruption of waterways ultimately affecting the freshwater ecosystem. Surface or ground water interactions may be disrupted by the construction of roads and pipelines across wetland or groundwater areas, which could negatively impact both the infrastructure through continual seepage as well as the ecological processes associated with the surface water features. The disposal of wastewater, which does not meet the DWAF's requirement, may result in the contamination of local groundwater, placing further pressure on scarce water resources. Permanent structures may pose a potential disruption to the water table. There is also the possibility of spillage of hydrocarbons and other hazardous chemicals, which will contaminate the soil, surface and groundwater.

Response:

Thank you for the information presented above. All concerns and information will be provided to the respective specialist. The following specialist studies will include detailed assessments of the aspects mentioned, for integration into the EIR:

- *Freshwater Ecology;*
- *Hydrology;*
- *Geotechnical aspects; and*
- *Geohydrology.*

Detailed impact assessments will be undertaken for all three site alternatives as well as for impacts that could occur during construction and operation phases of the project, and presented in an integrated manner to the DEA for consideration during environmental authorisation.

5. Your comment:

Potential Impact on Freshwater ecosystems

The destruction of wetlands may be inevitable in order to accommodate the various structures required for the proposed NPS. All wetlands located on the sites, would be potentially vulnerable to physical disturbance during construction or subsequent phases, which could lead to the following:

- Hydrological changes, particularly associated with the creation of preferential runoff pathways and erosion may result in drying up of wetlands, sedimentation or flooding of the various wetlands depending on its location relative to the runoff patterns;
- Drainage of wetlands resulting from dewatering activities could result in temporary or permanent impacts to wetland systems;
- Changes to the hydrological function of wetlands will affect species associated with wetland habitats;
- Construction activities entail repeated vehicle entrainment over particular areas, which results in compaction and ultimately reduces the permeability of the soil. Reduced permeability may result in decreased infiltration into groundwater reserves and may induce surface flooding and erosion; and
- Possible treatment of sewage could result in nutrient enrichment and alteration in the hydrological regime, which will facilitate the proliferation of alien and other invasive plant species.

Response:

Thank you for the information presented above. All concerns and information will be provided to the respective specialist. The following specialist studies will undertake detailed assessments of the aspects mentioned, for integration into the EIR:

- *Freshwater Ecology;*
- *Hydrology;*
- *Flora; and*
- *Geohydrology.*

Detailed impact assessments will be conducted for all three site alternatives as well as for impacts that could occur during construction and operation phases of the project, and presented in an integrated manner to the DEA for consideration during environmental authorisation. Recommendations will also be provided regarding preferred options for situating the power station buildings and associated infrastructure, as well as measures/methods that should be followed during construction to limit the disturbance to surrounding areas.

6. Your comment:

Human population:
The human population is now significant within the second Duynefontein buffer zone (5km to 16km). Placing the proposed PWR (Nuclear 1) at the site will only serve to exacerbate the risks to this population.

Response:

Thank you for the information presented above. The following specialist studies will undertake detailed assessments of issues related to potential positive and negative effects of the proposed power station on human populations surrounding the three alternative sites, for integration into the EIR:

- *Human Health Risk Assessment (HHRA);*
- *Traffic and transportation;*
- *Air Quality;*
- *Visual;*
- *Noise;*
- *Social;*
- *Economic;*
- *Heritage and Archaeology;*
- *Agriculture; and*
- *Tourism.*

In addition, specialist studies have assessed the following in relation to the proposed power station:

- *Hydrology;*
- *Geohydrology;*
- *Geology;*
- *Seismic Risk;*
- *Geotechnical aspects;*
- *Emergency Response; and*
- *Site Control/Safety.*

7. Your comment:

Flora:

Daines and Low (1993) recorded 279 species for the Koeberg site, of which eight were on the Red Data list. As a result of the name changes and new information on species distributions, the number of species when recalculated is 274 (SaSFlora,1998 - 2007).

The number of threatened species is 11, which are as follows:

Amphibolia laevis, Dorotheanthus apetalus, Elegia recta, Euphorbia caput-medusae subsp. marlothiana vingerpol (sensu SaSFlora, 1998 to 2007), Gethyllis ciliaris kukumakranka, Helichrysum cochleariforme duineteebossie, Hermannia procumbens var. procumbens, Lachnaea grandiflora grootletjiesbos, Leucadendron levisanus, Nemesia strumosa, balsamienie and *Psoralea repens*. West Coast endemics include *Amphibolia laevis* (extends as far north as Vredendal (Goldblatt and Manning, 2000)), *Hermannia procumbens, Leucadendron levisanus* (Cape Flats to Koeberg and Mamre) and *Nemesia strumosa*.

Response:

Thank you for the information presented above. The following specialist studies will undertake detailed assessments of the aspects mentioned, for integration into the EIR:

- *Freshwater Ecology;*
- *Flora;*
- *Marine Ecology; and*

8. Your comment:

Vertebrate Fauna:

The site lies within the Cape Floristic Region (CFR), which is largely restricted to the Western Cape and Eastern Cape provinces. The CFR is an exceptionally bio diverse region with very high levels of species endemism. The CFR has been identified as a global Biodiversity Hotspot by Conservation International and is the focus of a South African government supported initiative, the Cape Action for People and the Environment.

Features of special significance with respect to species and ecosystem processes include the following (Harrison, 2007):

- Reptiles: Several potentially threatened species are likely to occur;
- Birds: Several threatened seabird species occur on the coast, e.g., Crowned Cormorant *Phalacrocorax neglectus* (Vulnerable), Bank Cormorant *Phalacrocorax coronatus* (Near Threatened), Capian Tern *Hydroprogne caspia* (Near Threatened). Several species of raptor, some of which are threatened, and waterbirds are among the species, which could be problematic in terms of interactions with electrical installations. Several threatened species of raptor occur on site (Eskom undated), some of which may breed on site, e.g., Black *Harrier Circus maurus* (Near Threatened);
- Mammals: The only threatened species likely to occur is the Whitetailed Rat *Mystromys albicaudatus* (Endangered);
- Ecosystem processes: The sandy dunes are vulnerable to mechanical disturbance, especially the sparsely vegetated, high dunes near the coast. It is important to allow mobile dunes to remain mobile, without artificial barriers to the movement of sand, and to avoid causing vegetated dunes to become mobile through disturbance.

Response:

Thank you for the information presented above. The following specialist studies will undertake detailed assessments of the aspects mentioned, for integration into the EIR:

- *Fauna (Vertebrates);*
- *Fauna (Invertebrates);*
- *Flora;*
- *Marine Ecology; and*
- *Freshwater Ecology.*

9. Your comment:

Mitigation Actions

We have to ask whether the significant findings regarding the aquiver impacts have been satisfactorily mitigated in the Final Scoping Report. This Report suggests that Mitigation Measures during construction will include a Dewatering Cut-off/diaphragm wall and Water level monitoring. It is respectively argued that this is not sufficient. It is highly unlikely that the construction will be suspended should groundwater levels be seen to decline during construction, thus to monitor the loss does not play a proactive role in protecting against the loss of groundwater.

Furthermore, monitoring the loss of groundwater plays no role in replacing this scarce resource once lost. In addition, there is no mention of ongoing groundwater quality assessments to assess whether saline intrusion is occurring. In the event that this monitoring is undertaken, and salt-water intrusion into the aquifer is observed, no mitigation or contingency plans are stated as to how this will be curtailed so as to prevent permanent damage to the primary aquifer.

Response:

> *As described previously, the specialist studies undertaken for this EIA will include mitigation measures for each of the impacts identified during the EIA process. Mitigation measures will not simply involve monitoring (although this may form part of the specialist recommendations), but will provide practical preventative methods for minimising the impact of the proposed project on the ecological, social and economic environment. Mitigation measures will be carried through into the Environmental Management Plan (EMP) that accompanies the Environmental Impact Report (EIR), and therefore will form a central part of the the DEA environmental authorisation process.*

The project team would like to assure you that Interested and Affected Parties (I&APs) comments are important to us and that your continued involvement in this process as an I&AP is valued. Your comments will be captured in an addendum to the FSR as well as utilised in future phases of the EIA, which will be submitted to the decision-making authority in due course.

Please do not hesitate to contact us at any stage should you require any additional information regarding this proposed project. We thank you for providing us the opportunity to respond to these comments and look forward to your ongoing involvement in the project.

Yours sincerely
For and on behalf of Arcus GIBB (Pty) Ltd

Jaana-Maria Ball

Nuclear-1 EIA Project Manager