Section 24G Application Eggland Thornhill within the Kouga Local Municipality, Eastern Cape Province

AQUATIC ASSESSMENT

FOR

CAPE EAPrac

BY

EnviroSci (Pty) Ltd

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DATE

10 March 2020

REVISION 1

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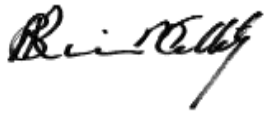
SPECIALIST REPORT DETAILS

This report has been prepared as per the requirements of the Environmental Impact Assessment Regulations and the National Environmental Management Act (Act 107 of 1998), any subsequent amendments and any relevant National and / or Provincial Policies related to biodiversity assessments. This also includes the minimum requirements as stipulated in the National Water Act (Act 36 of 1998), as amended in Water Use Licence Application and Appeals Regulations, 2017 Government Notice R267 in Government Gazette 40713 dated 24 March 2017, which also includes the minimum requirements for a Wetland Delineation Report.

Report prepared by: Dr. Brian Colloty Pr.Sci.Nat. (Ecology) / Member SAEIES.

Expertise / Field of Study: BSc (Hons) Zoology, MSc Botany (Rivers), Ph.D Botany Conservation Importance rating, and has worked as an independent consulting specialist from 1996 to present.

I, **Dr. Brian Michael Colloty** declare that this report has been prepared independently of any influence or prejudice as may be specified by the National Department of Environmental Affairs and or Department of Water and Sanitation



Signed:… …… Date:…10 March 2020……

1. Introduction

CAPE EAPrac appointed EnviroSci (Pty) Ltd to conduct an Aquatic Assessment as part of the Section 24G application being submitted for the **for an existing egg laying facility THORNHILL EGGLAND, within the Kouga Local Municipality** (Figure 1).

The proponent has developed the property, which now requires rectification in terms of Section 24G of NEMA, while the infrastructure in place will also require a Water Use License, if not yet in place.

1.1 Aims and objectives

The aim of this report is to provide an assessment of the state and function of any aquatic habitats that may have been lost, together with an assessment of the potential issues posed by the development. Where possible this report also provides means to avoid additional impacts or issues. This was based on a site visit conducted in summer on 3 December 2019.

1.2 Assumptions and Limitation

To obtain a comprehensive understanding of the dynamics of any aquatic communities within a study site, as well as the status of endemic, rare or threatened species in any area, assessments should always consider investigations at different time scales (across seasons/years) and through replication. However, due to time constraints these long-term studies are not feasible and are thus mostly based on instantaneous sampling.

Therefore, due to the scope of the work presented in this report (activities have commenced), a long-term investigation of the proposed site was not possible and as such not perceived as part of the Terms of Reference. However, a concerted effort was made to assess as much of the potential site, as well as make use of any available literature, species distribution data (Appendix 1) and aerial photography, with particular focus on determining the type and importance of the aquatic systems if any that have been impacted upon by the activities.

It should be emphasised that information, as presented in this document, only has reference to the study area as indicated on the accompanying maps. Therefore, this information cannot be applied to any other area without detailed investigation.

Figure 1: An aerial view of the facilities associated with Thornhill Eggland

2. Terms of Reference

The affected aquatic systems were assessed as follows:

- The assessment was initiated with a review of the available information for the region and activities that had occurred. This will also include review of the development in relation to any conservation plans or assessments known for the area, e.g. Critical Biodiversity Area maps, National Waterbody Inventory etc.
- Determination of the Present Ecological State of any waterbodies incl. wetlands, estimating their biodiversity, conservation importance with regard ecosystem services using recognised PES / EIS assessment methods to determine the state, importance and sensitivity of the respective systems
- Prepared a map demarcating the respective watercourses or wetland/s, within a 500m radius of the study area. This demonstrates, from a holistic point of view the connectivity between the site and the surrounding regions, i.e. the hydrological zone of influence while classifying the hydrogeomorphic type of the respective water courses / wetlands in relation to present land-use and their current state. The maps depicting demarcated waterbodies will be delineated to a scale of 1:10 000, following the methodology described by the DWS.
- Buffer zones were recommended using the Macfarlane & Bredin (2017) approach to indicate any No-go / Sensitive areas around any delineated aquatic zones should these be thought necessary, supported by any relevant legislation, e.g. any bioregional plans, conservation guidelines or best practice if still applicable. Attention was also paid to the presence / absence of any important habitat or species known to occur within the region as indicated in Appendix 1.
- Assessed the potential impacts, based on a supplied methodology, including cumulative impacts and for construction (should any additional activities still be required, particularly if the construction was halted), operations and decommissioning phases.
- Provide mitigations regarding observed impacts, which could negatively affect demarcated wetland or water course areas.
- Supply the client with geo-referenced GIS shape files of the wetland / riverine areas with buffers as required.

3. Project Description

The following main activities have required the need for a Section 24G application:

- 4x hen houses @ 120 000 hens (30 000 hens per house)
- 4x henhouses @ 160 000 (40 000 hens per house).
- Wash facility and RO Plant
- Packing facility
- Offices and parking
- Biological control facilities at entrance gates

4. Relevant legislation and policy

The following is pertinent to this study:

- Section 24 of The Constitution of the Republic of South Africa;
- Agenda 21 – Action plan for sustainable development of the Department of Environmental Affairs and Tourism (DEAT) 1998;
- National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998) inclusive of all amendments, as well as the NEM: Biodiversity Act;
- National Water Act, 1998 (Act No. 36 of 1998);
- Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983); and
- Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).
- Nature and Environmental Conservation Ordinance (No. 19 of 1974)
- National Forest Act (No. 84 of 1998)
- National Heritage Resources Act (No. 25 of 1999)

NEMA and the Conservation of Agricultural Resources Act (CARA), 1983 (Act No. 43 of 1983) would also apply to this project. These Acts have categorised many invasive plants together with associated obligations on the landowner. Several Category 1 & 2 plants were observed in several areas of the site under investigation.

Alien Invasive Plant Species (AIS) within or adjacent the site observed included amongst others:

- *Solanum elaeagnifolium* (Silver-leaf bitter apple)
- *Cyperus rotundus subsp rotundus* (Nut grass)
- *Acacia mearnsii* (Black wattle)
- *Pennisetum clandestinum (Kikuyu)*
- *Solanum maurtianum (Bugweed)*
- *Opuntia ficus-indica (Prickly pear)*
- *Opuntia humifusa (Creeping prickly pear)*
- *Cestrum laevigatum (Inkberry)*
- *Argemone Mexicana (Mexican poppy)*
- *Cirsium vulgare (Scotch Thistle)*
- *Eucalyptus spp*
- *Pinus spp*
- *Plantago lanceolate* (Buckhorn plantain)
- *Arundo donax (Spanish Reed)*

5. Description of the affected environment

5.1 Climate

The site is located within the bimodal rainfall region of South Africa, with a Mean Annual Precipitation (MAP) for the coastal region at ca. 540 mm per annum. Annual average temperatures range between 4.2 and 27 °C, with frost a rare occurrence of no more than 10 days per year (Mucina & Rutherford, 2007).

5.2 Geology and soils

The site is underlain acidic lithosol soils derived from the sandstones of the Table Mountain Group, as well as quarzitic sandstones of the Witteberg Group (Mucina & Rutherford, 2007). The region surrounding the site also includes expected shallow Glenrosa and Mispah soil forms.

5.3 Slope and aspect

The region is characterised by undulating hills, interspersed with steep valleys and low ridges associated with the Loerie/Gamtoos valleys.

5.4 Aquatic environment

The study area is located within the L90C Gamtoos River quaternary catchment as shown in Figure 2, situated within the Southern Eastern Coastal Belt Ecoregion. The study area Subquaternary area has anticipated 135 – 220 mm of Mean Annual Runoff. However, it does not however contain, any wetland clusters, Important Bird Areas or Threatened Ecosystems as listed by NEMA.

The study area does form part of a Strategic Water Resource Area (Surface water) as this catchment forms part of an important water supply to the Gamtoos farming region.

Several waterbodies are also shown in National Wetland Inventory (NWI) Version 5 released by van Deventer *et al*. (2020) (Figure 3). No wetlands (natural or artificial) were indicated in the NWI for the study area, however two Depression / Pans were observed during the site visit and are within 500m of the existing infrastructure (Figure 4). These two pan systems, have however been converted into farm dams (Plate 1), a practice that has occurred within most pans within the region, and the only examples that are in a more natural state are located near St Albans and Jefferys Bay, 20 and 16 km from the site respectively.

The pans were dominated by obligate plant species mostly associated with the Cyperaceae (Nut grass) family and included the following species:

Cyperus textilis

Ficinia litoralis

Tetraria cuspidate

Elegia spp

Carpha spp

Helichrysum cymosum

Scirpus nodusis

Eipschoenus gracilis

No aquatic species of special concern were observed within

Several watercourses were also observed within the region, but none and their associated buffer (18m) were located outside of the development activities (Figure 4). The 18m buffer was based on results obtained from the wetland/riverine buffer model (Macfarlane & Bredin, 2017), using data collected on the state of the systems, hydrogeomorphic type and activities (past and present) that occur.

Based on the aerial images, it could not be determined when the water supply dam was constructed, but it contained no distinctive aquatic habitat, e.g. wetlands or emergent vegetation (Plate 2).

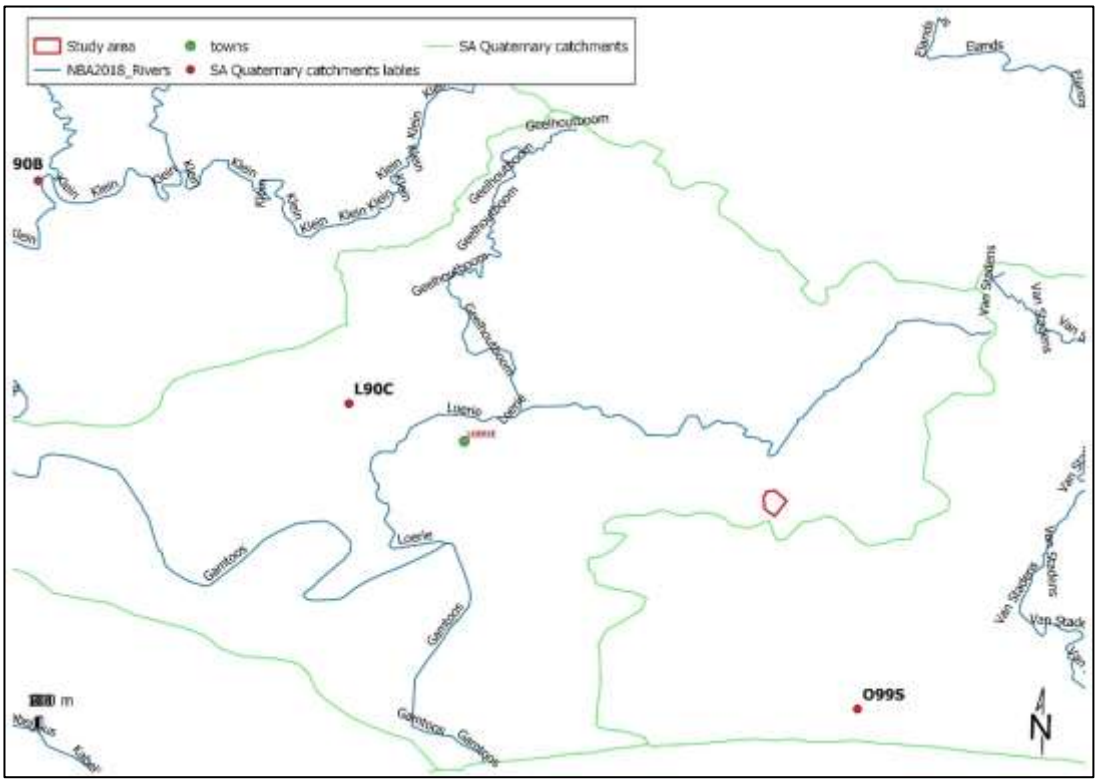


Figure 2: Project locality indicating the various quaternary catchments, mainstem rivers (Source DWS, NWI and NGI)

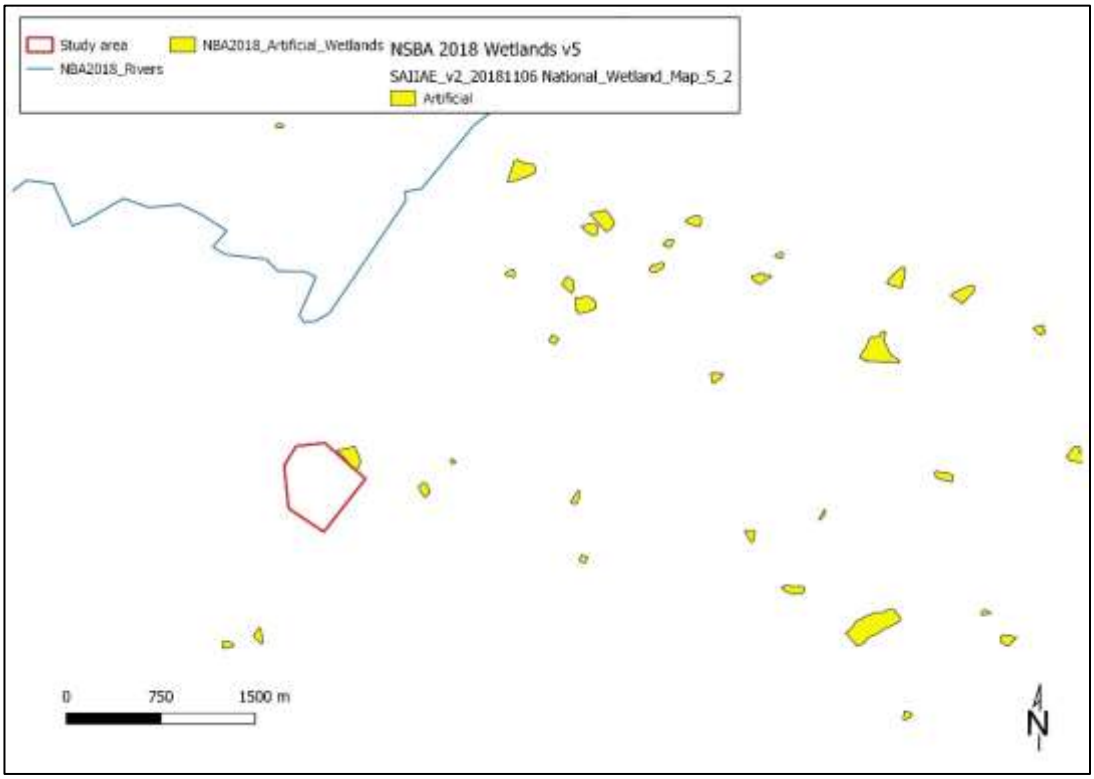


Figure 3: National Wetland Inventory spatial data, for known systems within the region (van Deventer *et al.*, 2020)

Plate 1: A view of the pan, now dam closest to the current operations

Plate 2: The water supply dam with no distinct aquatic habitat other than the open water itself

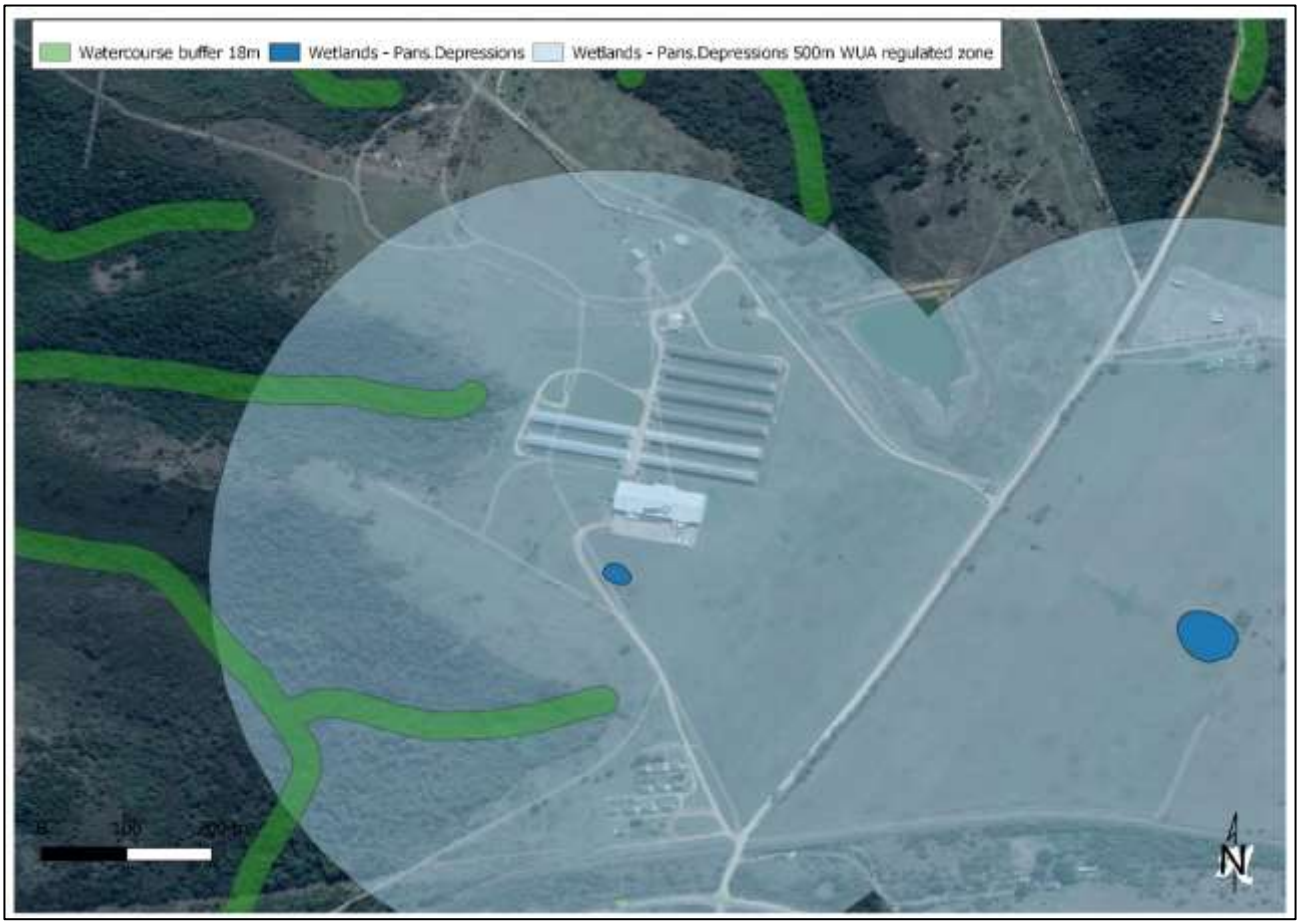


Figure 4: Delineated extent of the pans, known watercourse with 18m buffer and 500m WUA regulated zone

5.4 Present Ecological State and conservation importance (Aquatic environment)

The PES of a river, watercourse or wetland represents the extent to which it has changed from the reference or near pristine condition (Category A) towards a highly impacted system where there has been an extensive loss of natural habit and biota, as well as ecosystem functioning (Category E).

The PES scores have been revised for the country and based on the new models, aspects of functional importance as well as direct and indirect impacts have been included (DWS, 2014 and to an extent revised in the National Spatial Biodiversity Assessment, 2018 data, released 2019). The new PES system also incorporates Ecological Importance (EI) and Ecological Sensitivity (ES) separately as opposed to Ecological Importance and Sensitivity (EIS) in the old model, although the new model is still heavily centred on rating rivers using broad fish, invertebrate, riparian vegetation and water quality indicators. The Recommended Ecological Category (REC) is still contained within the new models, with the default REC being B, when little or no information is available to assess the system or when only one of the above-mentioned parameters are assessed or the overall PES is rated between a C or D.

The PES for the study river system (Subquaternary catchment 90029) was rated as follows (DWS, 2014 /NSBA, 2018) where C = Moderately Modified:

Subquaternary Catchment Number	Present Ecological State	Ecological Importance	Ecological Sensitivity
9009	C	Moderate/Medium	High

These scores were adjusted by observations made in the field, due to the current impacts such as:

- Alien vegetation
- Vegetation clearing
- Impoundments (several above and below the site), and
- Agricultural return flow from the various pivot irrigation systems;

The Present Ecological State for the study area water courses were thus rated as **D = Largely Modified**, i.e. less than 40 % of the natural riparian vegetation remains based on the Riparian Vegetation Responses Assessment Index (VEGRAI) model. This score would also then apply to the riverine wetland (Wetland IHI) based on the impacts observed and the perceived loss in catchment vegetation and wetland aerial cover.

The Ecological Importance and Sensitivity Score were rated as Moderate by DWS for the Subquaternary catchment (2014), due to the importance of the habitat they provide (fish & invertebrates), filter pollutants and support the downstream systems, namely the Loerie River, while forming part of an Upstream Support Area under NFEPA, as shown in Figure 6. This would be substantiated by information collected in the field and the presence of the riverine wetlands observed that would mitigation impacts such as agricultural return flows and trap any sediments within runoff.

Results from the *Wetland* Index of Habitat Integrity (IHI) model based on field data, also indicated that the PES for the two pan was **D = Largely Modified, while the Ecological Importance and Sensitivity score was Moderate.**

The Moderate scores for both the watercourses and the pans was based on the fact that these systems are also located within a Phase 2 FEPA (Figure 6) or Freshwater Ecosystem Priority Area / NFEPA (Nel *et al*., 2011) and Critical Biodiversity Area Type 2 (Berliner and Desmet, 2007) in the Eastern Cape Biodiversity Conservation Plan (Figure 7).

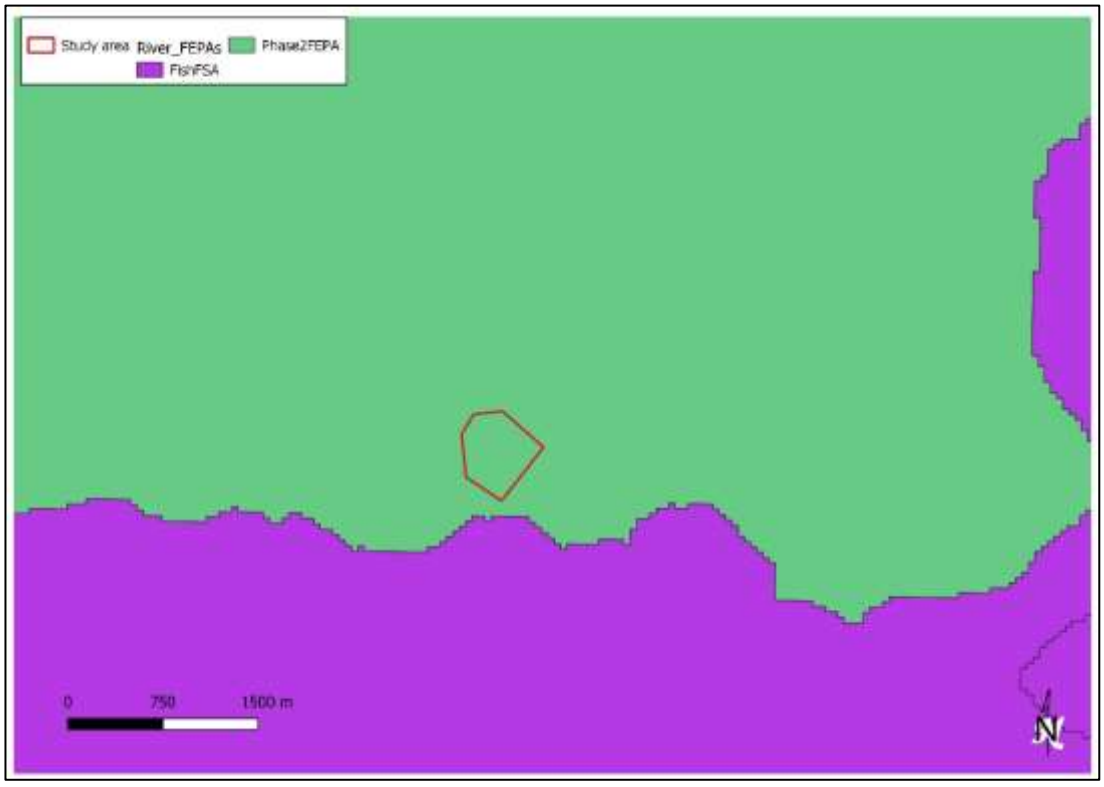


Figure 5: NFEPA Priority Ecosystem Areas (Nel *et al*., 2011)

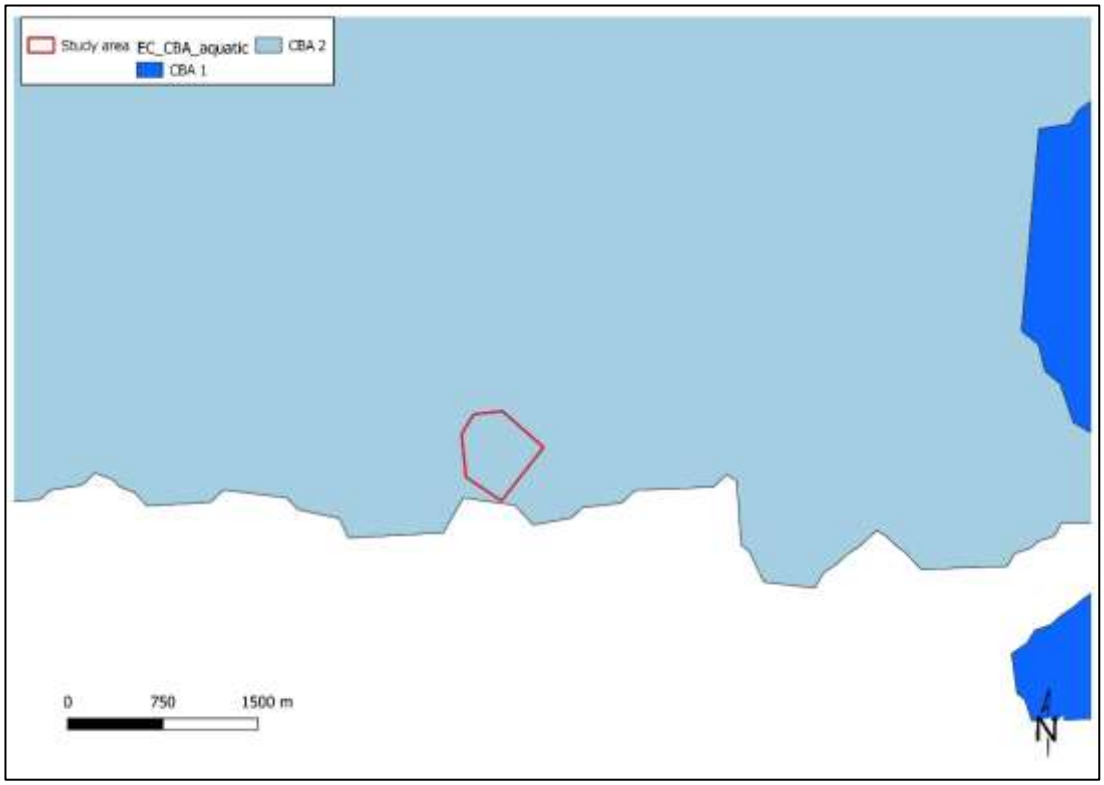


Figure 6: Critical Biodiversity Areas as per the Eastern Cape Biodiversity Conservation Plan (Desmet & Berliner, 2007)

6. Permit requirements

In terms of Water Use Authorisation these applications must be submitted, with the inclusion of any activities within the 500m wetland regulated zone with regard Section 21 c & i water uses, if not yet authorised (See Figure 4). This would also include any abstractive uses form the dam and borehole.

7. Site Sensitivity

Based then on the past status of the environment and the scale past and current disturbance, no sensitive areas would have been affected within the development footprint. However it is recommended that any future activities remain outside of the watercourses and their buffers and the pans and that the surrounding land use remain (grazing) remain unchanged (See Figure 4).

8. Impact Assessment

During the impact assessment a number of potential key issues / impacts were identified and assessed.

- Impact 1: Loss of aquatic riverine and wetland habitat
- Impact 3: Habitat fragmentation
- Impact 4: Impact on baseflow hydrology
- Impact 5: Increase in sedimentation and erosion
- Impact 6: Risks on the aquatic environment due to water quality impacts
- Impact 7: Cumulative impacts

The loss of any Species of Special Concern was not assessed as the habitat are now disturbed and little to no terrestrial habitat remains within the cleared areas

8.1: Impact 1: Loss of aquatic riverine and wetland habitat – Direct Impact

<table>
<tr><td colspan="2">Environmental Impact:
No direct impacts associated with the current activities could be related to the present state and function of the pans (transformation into farm dams), while no impact other than the water supply dam was found to affect the watercourses that surround the development area.</td><td colspan="6">Activity/Aspect & Impact Source:
Due to the nature of the project this would persist in the long term into the operational phase impact. However the affected habitats observed are largely outside of the current activities</td><td>Proposed Mitigation:
• Alien plant regrowth should also be monitored, in any areas that won’t be utilised, as a number of ruderal Alien Invasive species do occur within the plan and the thicket area within the drainage lines.
• No further encroachment must be allowed into the aquatic zones as shown in Figure 4.</td></tr>
<tr><td colspan="9">Impact Significance</td></tr>
<tr><td rowspan="2">Without Mitigation:</td><td>Extent
Site (1)</td><td>Duration
Long-term (4)</td><td>Severity
Moderate (4)</td><td>Reversibility
Completely (0)</td><td>Irreplaceable Loss
Partly (0.5)</td><td>Probability
Definite (5)</td><td colspan="2">Impact Significance
Moderate (47.5)</td></tr>
<tr><td rowspan="2">With Mitigation:</td><td>Extent
Site (1)</td><td>Duration
Long-term (4)</td><td>Severity
Minor (2)</td><td>Reversibility
Completely (0)</td><td>Irreplaceable Loss
Partly (0.5)</td><td>Probability
Probable (3)</td><td colspan="2">Impact Significance
Low (22.5)</td></tr>
<tr><td colspan="4">Potential to Mitigate:
Moderate potential / easy to mitigate</td><td colspan="5">Assessment Confidence:
Complete</td></tr>
</table>

8.2: Impact 2: Habitat fragmentation

Environmental Impact: Based on the information contained within the ECBCP, the study area is within Aquatic Critical Biodiversity Areas. The clearing did result in fragmentation of terrestrial habitats which has resulted in an impact for the pans, but the watercourses still remain intact and connected to other downstream systems	***Activity/Aspect & Impact Source:*** Due to the nature of the project this will persist in the long term into the operational phase impact.	***Proposed Mitigation:*** • Alien plant regrowth should also be monitored, in any areas that won't be utilised, as a number of ruderal Alien Invasive species do occur within the plan and the thicket area within the drainage lines. • No further encroachment must be allowed into the aquatic zones as shown in Figure 5.

Impact Significance

	Extent	**Duration**	**Severity**	**Reversibility**	**Irreplaceable Loss**	**Probability**	**Impact Significance**
Without Mitigation:	Site (1)	Long-term (4)	Moderate (4)	Completely (0)	Partly (0.5)	Definite (5)	Moderate (47.5)
With Mitigation:	Site (1)	Long-term (4)	Minor (2)	Completely (0)	Partly (0.5)	Probable (3)	Low (22.5)

Potential to Mitigate: Moderate potential / easy to mitigate	***Assessment Confidence:*** Complete

8.3 Impact 3: Impact on baseflow hydrology – direct operational impact

Environmental Impact: Impoundments result in the reduction of baseflow while also reducing flood peaks (rivers require floods to reset sediment build up for example). This includes the water supply dam.	***Activity/Aspect & Impact Source:*** Due to the nature of the project this will persist in the long term in the operational phase impact and is compounded by the existence of several other dams / abstractive users in the catchment.	***Proposed Mitigation:*** • If the current dam is not licensed then DWS should be consulted as part of water use authorisation process who will assist in the determination of a safe abstraction rate that will allow for equitable social and ecological needs within the catchment.

Impact Significance

	Extent	**Duration**	**Severity**	**Reversibility**	**Irreplaceable Loss**	**Probability**	**Impact Significance**
Without Mitigation:	Site (1)	Long-term (4)	Moderate (4)	Completely (0)	Partly (0.5)	Definite (5)	Moderate (47.5)

	Extent	Duration	Severity	Reversibility	Irreplaceable Loss	Probability	Impact Significance
With Mitigation:	Site (1)	Long-term (4)	Minor (2)	Completely (0)	Partly (0.5)	Probable (3)	Low (22.5)
Potential to Mitigate: Moderate potential / easy to mitigate				***Assessment Confidence:*** Complete			

8.4 Impact 4: Increase in sedimentation and erosion – direct operational phase

Environmental Impact: The creation of hard surface areas will result in the increase in runoff, with an increase in erosion and sedimentation impacts downstream. This coupled to the creation of additional roads / access tracks also increases stormwater runoff	***Activity/Aspect & Impact Source:*** Due to the nature of the project this will persist in the long term in the operational phase impact.	***Proposed Mitigation:*** • Suitable stormwater management must be included in the steep access roads, as sediment is currently being washed. This should include swales and or small ponds to trap sediment, coupled to revegetation of bare soil areas with local plant species. • As the development is not allowed to have gutters, any runoff from roof must be captured by vegetated / grassed areas first. This vegetation will then slow and dissipate flows. Some flows do accumulate when leaving the existing parking areas, and this should be managed using grassed swales to prevent the generation of any high velocity flows, but suitable sized not to create any standing waterbodies.

Impact Significance

	Extent	Duration	Severity	Reversibility	Irreplaceable Loss	Probability	Impact Significance
Without Mitigation:	Site (1)	Long-term (4)	Moderate (4)	Completely (0)	Partly (0.5)	Definite (5)	Moderate (47.5)
With Mitigation:	Site (1)	Long-term (4)	Minor (2)	Completely (0)	Partly (0.5)	Probable (3)	Low (22.5)
Potential to Mitigate: Moderate potential / easy to mitigate				***Assessment Confidence:*** Complete			

8.5 Impact 5: Risks on the aquatic environment due to water quality impacts – indirect operational phase

Environmental Impact: This impact is mostly related to activities that would generate return flows, especially if areas are over irrigated or contain any production waste.	***Activity/Aspect & Impact Source:*** Due to the nature of the project this will persist in the long term in the operational phase impact.	***Proposed Mitigation:*** • It is important that no surface water runoff is allowed to be directed into the dam or water courses. Any runoff must therefore be contained in swales or stormwater management features, particularly where runoff is concentrated. This must be sized correctly so as not to create any standing waterbodies. • ***Any wash water from the packhouse should be monitored on a monthly basis (organic loads / bacteria), to ensure that if any discharge reaches the local water courses it is within the acceptable or target water quality limits that will be prescribed by DWS.*** • ***Although the biological control system (drive through dips and sprayers) make use of environmentally sensitive products, any spills from these systems should also not be***

			directed into any water courses and ideally should be captured				
Impact Significance							
Without Mitigation:	**Extent** Site (1)	**Duration** Long-term (4)	**Severity** Moderate (4)	**Reversibility** Completely (0)	**Irreplaceable Loss** Partly (0.5)	**Probability** Definite (5)	**Impact Significance** Moderate (47.5)
With Mitigation:	**Extent** Site (1)	**Duration** Long-term (4)	**Severity** Minor (2)	**Reversibility** Completely (0)	**Irreplaceable Loss** Partly (0.5)	**Probability** Probable (3)	**Impact Significance** Low (22.5)
Potential to Mitigate: Moderate potential / easy to mitigate				***Assessment Confidence:*** Complete			

8.6 Impact 6: Cumulative impacts

Environmental Impact: The cumulative impacts are related to activities already in existence and the unauthorised activities assessed in this report.	***Activity/Aspect & Impact Source:*** Due to the nature of the project this will persist in the long term in the operational phase impact. However, this is mostly related to adjacent terrestrial environments.			***Proposed Mitigation:*** • Alien plant regrowth should also be monitored, and any such species should be removed on an ongoing basis within areas that won't be utilised. • Water use and quality of any return flows should be monitored as this has a direct impact on the quality of the aquatic environment. • Runoff from any areas should be managed using swales to prevent any pollution (organic) of downstream areas.			
Impact Significance							
Without Mitigation:	**Extent** Site (1)	**Duration** Long-term (4)	**Severity** Moderate (4)	**Reversibility** Completely (0)	**Irreplaceable Loss** Partly (0.5)	**Probability** Definite (5)	**Impact Significance** Moderate (47.5)
With Mitigation:	**Extent** Site (1)	**Duration** Long-term (4)	**Severity** Minor (2)	**Reversibility** Completely (0)	**Irreplaceable Loss** Partly (0.5)	**Probability** Probable (3)	**Impact Significance** Low (22.5)
Potential to Mitigate: Moderate potential / easy to mitigate				***Assessment Confidence:*** Complete			

9. Conclusion and Recommendations

The results indicated that no important habitats would have occurred in the past, and the present-day activities would have mostly impacted the terrestrial habitats. It could not be determined when the initial impacts / clearing within the pans and the creation of the water supply dam had occurred, as several of the disturbances had occurred many years ago, however the present activities have not affected any important riverine or wetlands areas.

However it is suggested that the following mitigations be considered:

- Alien plant regrowth should also be monitored, and any such species should be removed on an ongoing basis form areas that won't be utilised.
- Water use and quality of any return flows should be monitored as this has a direct impact on the quality of the aquatic environment.
- Runoff from any areas should be managed using swales to prevent any pollution (organic) of downstream areas.

With this in place the overall significance of the impacts could be reduced to LOW. This only applies to the physical changes to the observed environment, as the maximum allowable change to the hydrological environment (abstraction from dam) that will be allowed, will be determined by the Department of Water and Sanitation during the Water Use Authorisation process for the dam, if no license is in place.

10. References

Agenda 21 – Action plan for sustainable development of the Department of Environmental Affairs and Tourism (DEAT) 1998.

Agricultural Resources Act, 1983 (Act No. 43 of 1983).

Alexander, G. And Marais, J. 2010. A Guide to Reptiles of Southern Africa. Struik Nature, Cape Town. Animal Demography Unit, Department Of Zoology, University Of Cape Town. 2012. Summary Data Of The Frogs Of South Africa, Lesotho And Swaziland. Downloaded From: Http://Adu.Org.Za/Frog_Atlas.Php; Accessed On 2/02/2013.

Berliner D. and Desmet P. 2007. Eastern Cape Biodiversity Conservation Plan: Technical Report. Department of Water Affairs and Forestry Project No 2005-012, Pretoria.

Branch, W.R. 1998. Terrestrial reptiles and amphibians. In: A Field Guide to the Eastern Cape Coast, R. A. Lubke, F. W. Gess and M. N. Bruton (eds.), Grahamstown Centre for the Wildlife Soc. S. Afr., 251 264.

Davies, B. and Day J., (1998). Vanishing Waters. University of Cape Town Press.

Department of Water Affairs and Forestry - DWAF (2005). A practical field procedure for identification and delineation of wetland and riparian areas Edition 1. Department of Water Affairs and Forestry , Pretoria.

Department of Water Affairs and Forestry - DWAF (2008). Manual for the assessment of a Wetland Index of Habitat Integrity for South African floodplain and channelled valley bottom wetland types by M. Rountree (ed); C.P. Todd, C. J. Kleynhans, A. L. Batchelor, M. D. Louw, D. Kotze, D. Walters, S. Schroeder, P. Illgner, M. Uys. and G.C. Marneweck. Report no. N/0000/00/WEI/0407. Resource Quality Services, Department of Water Affairs and Forestry, Pretoria, South Africa.

Driver A., Sink, K.J., Nel, J.N., Holness, S., Van Niekerk, L., Daniels, F., Jonas, Z., Majiedt, P.A., Harris, L. & Maze, K. 2012. National Biodiversity Assessment 2011: An assessment of South Africa's biodiversity and ecosystems. Synthesis Report. South African National Biodiversity Institute and Department of Environmental Affairs, Pretoria.

Du Preez, L. And Carruthers, V. 2009. A Complete Guide To Frogs Of Southern Africa. Struik Nature, Cape Town

Ewart-Smith J.L., Ollis D.J., Day J.A. and Malan H.L. (2006). National Wetland Inventory: Development of a Wetland Classification System for South Africa. WRC Report No. KV 174/06. Water Research Commission, Pretoria.

IUCN (2019). Red List of Threatened Species. IUCN Species Survival Commission, Cambridge Available: http://www.iucnredlist.org/

Kleynhans C.J., Thirion C. and Moolman J. (2005). A Level 1 Ecoregion Classification System for South Africa, Lesotho and Swaziland. Report No. N/0000/00/REQ0104. Resource Quality Services, Department of Water Affairs and Forestry, Pretoria.

Kotze D.C., Marneweck G.C., Batchelor A.L., Lindley D.S. and Collins N. (2008). WET-EcoServices A technique for rapidly assessing ecosystem services supplied by wetlands. WRC Report No: TT 339/08.

Macfarlane, D.M. & Bredin, I.P. 2017. Buffer Zone Guidelines for Rivers, Wetlands and Estuaries Buffer Zone Guidelines for Rivers, Wetlands and Estuaries. WRC Report No TT 715/1/17 Water Research Commission, Pretoria.

Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), as amended.

Minter, L. Burger, M. A. Harrison, J. Braack, H. Bishop, P. & Kloepfer, D. (2004). Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland. Smithsonian Institute.

Mitsch, J.G. and Gosselink, G. (2000). Wetlands 3rd End, Wiley, NewYork, 2000, 920 pg.

Mucina, L., & Rutherford, M.C., 2006. The Vegetation of South Africa, Lesotho and Swaziland, Strelitzia 19, South Africa.

National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended.

National Water Act, 1998 (Act No. 36 of 1998), as amended

Nel, J., Maree, G., Roux, D., Moolman, J., Kleynhans, N., Silberbauer, M. and Driver, A. 2004. South African National Spatial Biodiversity Assessment 2004: Technical Report. Volume 2: River Component. CSIR Report Number ENV-S-I-2004-063. Council for Scientific and Industrial Research, Stellenbosch.

Nel, J.L., Murray, K.M., Maherry, A.M., Petersen, C.P., Roux, D.J., Driver, A., Hill, L., Van Deventer, H., Funke, N., Swartz, E.R., Smith-Adao, L.B., Mbona, N., Downsborough, L. and Nienaber, S. (2011). Technical Report for the National Freshwater Ecosystem Priority Areas project. WRC Report No. K5/1801.

Ollis, D.J., Snaddon, C.D., Job, N.M. & Mbona, N. 2013. Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems. SANBI Biodiversity Series 22. South African National Biodiversity Institute, Pretoria.

Parsons R. (2004). Surface Water – Groundwater Interaction in a Southern African Context. WRC Report TT 218/03, Pretoria.

Ramsar Convention, (1971) including the Wetland Conservation Programme (DEAT) and the National Wetland Rehabilitation Initiative (DEAT, 2000).

Rowntree, K., Wadesone, R. and O'Keeffe, J. 2000. The development of a geomorphological classification system for the longitudinal zonation of South African rivers. South African Geographical Journal 82(3): 163-172.

South African Bird Atlasing Project 2 (SABAP2). 2017. Animal Demographic Unit. Available online: http://sabap2.adu.org.za/

Stuart, C and Stuart, T. 2007. A field guide to the mammals of Southern Africa. Struik Nature, Cape Town.

van Deventer H., Smith-Adao, L. Petersen C., Mbona N., Skowno A., Nel, J.L. (2018) Review of available data for a South African Inventory of Inland Aquatic Ecosystems (SAIIAE). Water SA 44 (2) 184-199.

11. Appendix 1: Species Checklists

Source SANBI ADU http://vmus.adu.org.za/index.php?database Accessed 23 November 2019

AMPHIBIANS			
Brevicepitidae	*Breviceps adspersus*	Bushveld Rain Frog	Least Concern
Bufonidae	*Sclerophrys capensis*	Raucous Toad	Least Concern
Heleophrynidae	*Heleophryne hewitti*	Hewitt's Ghost Frog	Critically Endangered
Hyperoliidae	*Hyperolius marmoratus*	Painted Reed Frog	Least Concern (IUCN ver 3.1, 2013)
Pipidae	*Xenopus laevis*	Cape Clawed Toad	Least Concern
Pyxicephalidae	*Amietia delalandii*	Delalande's River Frog	Least Concern (2017)
Pyxicephalidae	*Amietia fuscigula*	Cape River Frog	Least Concern (2017)
Pyxicephalidae	*Cacosternum boettgeri*	Common Caco	Least Concern (2013)
Pyxicephalidae	*Cacosternum nanum*	Bronze Caco	Least Concern (2013)
Pyxicephalidae	*Strongylopus fasciatus*	Striped Stream Frog	Least Concern
Pyxicephalidae	*Strongylopus grayii*	Clicking Stream Frog	Least Concern
REPTILES			
Agamidae	*Agama aculeata aculeata*	Common Ground Agama	Least Concern (SARCA 2014)
Agamidae	*Agama atra*	Southern Rock Agama	Least Concern (SARCA 2014)
Chamaeleonidae	*Bradypodion sp. (Groendal)*	Groendal Dwarf Chameleon	
Chamaeleonidae	*Bradypodion taeniabronchum*	Elandsberg Dwarf Chameleon	Endangered (SARCA 2014)
Colubridae	*Dispholidus typus typus*	Boomslang	Least Concern (SARCA 2014)
Cordylidae	*Pseudocordylus microlepidotus microlepidotus*	Cape Crag Lizard	Least Concern (SARCA 2014)
Elapidae	*Naja nivea*	Cape Cobra	Least Concern (SARCA 2014)
Gekkonidae	*Afroedura nov sp. 1 (Kouga)*	Flat Gecko sp. 1 (Kouga)	
Lacertidae	*Pedioplanis burchelli*	Burchell's Sand Lizard	Least Concern (SARCA 2014)
Lacertidae	*Tropidosaura gularis*	Cape Mountain Lizard	Least Concern (SARCA 2014)
Lamprophiidae	*Lycodonomorphus rufulus*	Brown Water Snake	Least Concern (SARCA 2014)
Lamprophiidae	*Psammophylax rhombeatus*	Spotted Grass Snake	Least Concern (SARCA 2014)
Scincidae	*Acontias orientalis*	Eastern Legless Skink	Least Concern (SARCA 2014)
Testudinidae	*Chersina angulata*	Angulate Tortoise	Least Concern (SARCA 2014)
Viperidae	*Bitis arietans arietans*	Puff Adder	Least Concern (SARCA 2014)
LEPIDOPTERA			
HESPERIIDAE	*Spialia sataspes*	Boland sandman	Least Concern (SABCA 2013)
HESPERIIDAE	*Tsitana uitenhaga*	Uitenhage sylph	Least Concern (SABCA 2013)

LYCAENIDAE	*Aloeides aranda*	Aranda copper	Least Concern (SABCA 2013)
LYCAENIDAE	*Aloeides damarensis damarensis*	Damara copper	Least Concern (SABCA 2013)
LYCAENIDAE	*Aloeides depicta*	Depicta copper	Least Concern (SABCA 2013)
LYCAENIDAE	*Aloeides juana*	Juana copper	Least Concern (SABCA 2013)
LYCAENIDAE	*Aloeides pallida liversidgei*	Giant copper	Least Concern (SABCA 2013)
LYCAENIDAE	*Cacyreus marshalli*	Common geranium bronze	Least Concern (SABCA 2013)
LYCAENIDAE	*Capys alpheus alpheus*	Orange banded protea	Least Concern (SABCA 2013)
LYCAENIDAE	*Chrysoritis beulah*	Beulah's opal	Least Concern (SABCA 2013)
LYCAENIDAE	*Chrysoritis chrysaor*	Burnished opal	Least Concern (SABCA 2013)
LYCAENIDAE	*Chrysoritis zeuxo cottrelli*	Cottrell's daisy copper	Least Concern (SABCA 2013)
LYCAENIDAE	*Lachnocnema durbani*	D'Urban's woolly legs	Least Concern (SABCA 2013)
LYCAENIDAE	*Lampides boeticus*	Pea blue	Least Concern (SABCA 2013)
LYCAENIDAE	*Lepidochrysops sp.*		
LYCAENIDAE	*Lepidochrysops ketsi ketsi*	Ketsi blue	Least Concern (SABCA 2013)
LYCAENIDAE	*Lepidochrysops patricia*	Patricia blue	Least Concern (SABCA 2013)
LYCAENIDAE	*Lepidochrysops poseidon*	Baviaanskloof blue	Least Concern (SABCA 2013)
LYCAENIDAE	*Lepidochrysops robertsoni*	Robertson's blue	Least Concern (SABCA 2013)
LYCAENIDAE	*Lepidochrysops variabilis*	Variable blue	Least Concern (SABCA 2013)
LYCAENIDAE	*Leptomyrina lara*	Cape black-eye	Least Concern (SABCA 2013)
LYCAENIDAE	*Tarucus thespis*	Vivid dotted blue	Least Concern (SABCA 2013)
LYCAENIDAE	*Thestor murrayi*	Murray's skolly	Least Concern (SABCA 2013)
LYCAENIDAE	*Trimenia argyroplaga argyroplaga*	Large silver-spotted copper	Least Concern (SABCA 2013)
NYMPHALIDAE	*Acraea neobule neobule*	Wandering donkey acraea	Least Concern (SABCA 2013)
NYMPHALIDAE	*Aeropetes tulbaghia*	Table mountain beauty	Least Concern (SABCA 2013)
NYMPHALIDAE	*Charaxes pelias*	Protea charaxes	Least Concern (SABCA 2013)
NYMPHALIDAE	*Danaus chrysippus orientis*	African monarch, Plain tiger	Least Concern (SABCA 2013)
NYMPHALIDAE	*Hypolimnas misippus*	Common diadem	Least Concern (SABCA 2013)

NYMPHALIDAE	*Junonia hierta cebrene*	Yellow pansy	Least Concern (SABCA 2013)
NYMPHALIDAE	*Pardopsis punctatissima*	Polka dot	Least Concern (SABCA 2013)
NYMPHALIDAE	*Precis archesia archesia*	Garden commodore	Least Concern (SABCA 2013)
NYMPHALIDAE	*Precis octavia sesamus*	Gaudy Commodore	Least Concern (SABCA 2013)
NYMPHALIDAE	*Pseudonympha magus*	Silver-bottom brown	Least Concern (SABCA 2013)
NYMPHALIDAE	*Pseudonympha trimenii ruthae*	Trimen's brown	Least Concern (SABCA 2013)
NYMPHALIDAE	*Stygionympha vigilans*	Western hillside brown	Least Concern (SABCA 2013)
NYMPHALIDAE	*Stygionympha wichgrafi williami*	Wichgraf's hillside brown	Least Concern (SABCA 2013)
NYMPHALIDAE	*Vanessa cardui*	Painted lady	Least Concern (SABCA 2013)
PAPILIONIDAE	*Papilio demodocus demodocus*	Citrus swallowtail	Least Concern (SABCA 2013)
PIERIDAE	*Belenois aurota*	Brown-veined white	Least Concern (SABCA 2013)
PIERIDAE	*Pontia helice helice*	Common meadow white	Least Concern (SABCA 2013)
PIERIDAE	*Teracolus eris eris*	Banded gold tip	Least Concern (SABCA 2013)
AVES (BIRDS)			
Common_group	**Common_species**	**Genus**	**Species**
Apalis	Bar-throated	*Apalis*	*thoracica*
Apalis	Yellow-breasted	*Apalis*	*flavida*
Barbet	Acacia Pied	*Tricholaema*	*leucomelas*
Barbet	Black-collared	*Lybius*	*torquatus*
Batis	Cape	*Batis*	*capensis*
Bishop	Southern Red	*Euplectes*	*orix*
Bokmakierie	Bokmakierie	*Telophorus*	*zeylonus*
Boubou	Southern	*Laniarius*	*ferrugineus*
Brownbul	Terrestrial	*Phyllastrephus*	*terrestris*
Bulbul	Cape	*Pycnonotus*	*capensis*
Bunting	Cinnamon-breasted	*Emberiza*	*tahapisi*
Bunting	Golden-breasted	*Emberiza*	*flaviventris*
Bush-shrike	Olive	*Telophorus*	*olivaceus*
Buzzard	Jackal	*Buteo*	*rufofuscus*
Buzzard	Steppe	*Buteo*	*vulpinus*
Camaroptera	Green-backed	*Camaroptera*	*brachyura*
Canary	Brimstone	*Crithagra*	*sulphuratus*
Canary	Cape	*Serinus*	*canicollis*
Canary	Forest	*Crithagra*	*scotops*
Canary	Yellow-fronted	*Crithagra*	*mozambicus*
Chat	Anteating	*Myrmecocichla*	*formicivora*
Chat	Familiar	*Cercomela*	*familiaris*

Cisticola	Grey-backed	*Cisticola*	*subruficapilla*
Cisticola	Lazy	*Cisticola*	*aberrans*
Cisticola	Levaillant's	*Cisticola*	*tinniens*
Cisticola	Zitting	*Cisticola*	*juncidis*
Coot	Red-knobbed	*Fulica*	*cristata*
Cormorant	Reed	*Phalacrocorax*	*africanus*
Cormorant	White-breasted	*Phalacrocorax*	*carbo*
Coucal	Burchell's	*Centropus*	*burchellii*
Crane	Blue	*Anthropoides*	*paradiseus*
Crested-flycatcher	Blue-mantled	*Trochocercus*	*cyanomelas*
Crow	Cape	*Corvus*	*capensis*
Crow	Pied	*Corvus*	*albus*
Cuckoo	Black	*Cuculus*	*clamosus*
Cuckoo	Klaas's	*Chrysococcyx*	*klaas*
Cuckoo	Red-chested	*Cuculus*	*solitarius*
Cuckoo-shrike	Black	*Campephaga*	*flava*
Cuckoo-shrike	Grey	*Coracina*	*caesia*
Dove	Laughing	*Streptopelia*	*senegalensis*
Dove	Lemon	*Aplopelia*	*larvata*
Dove	Red-eyed	*Streptopelia*	*semitorquata*
Dove	Tambourine	*Turtur*	*tympanistria*
Drongo	Fork-tailed	*Dicrurus*	*adsimilis*
Duck	African Black	*Anas*	*sparsa*
Duck	Yellow-billed	*Anas*	*undulata*
Eagle	African Crowned	*Stephanoaetus*	*coronatus*
Eagle	Martial	*Polemaetus*	*bellicosus*
Eagle	Verreaux's	*Aquila*	*verreauxii*
Eagle-owl	Spotted	*Bubo*	*africanus*
Egret	Cattle	*Bubulcus*	*ibis*
Firefinch	African	*Lagonosticta*	*rubricata*
Fiscal	Common (Southern)	*Lanius*	*collaris*
Fish-eagle	African	*Haliaeetus*	*vocifer*
Flycatcher	African Dusky	*Muscicapa*	*adusta*
Flycatcher	Fiscal	*Sigelus*	*silens*
Flycatcher	Spotted	*Muscicapa*	*striata*
Goose	Egyptian	*Alopochen*	*aegyptiacus*
Goose	Spur-winged	*Plectropterus*	*gambensis*
Goshawk	African	*Accipiter*	*tachiro*
Goshawk	Southern Pale Chanting	*Melierax*	*canorus*
Grassbird	Cape	*Sphenoeacus*	*afer*
Grebe	Little	*Tachybaptus*	*ruficollis*
Greenbul	Sombre	*Andropadus*	*importunus*
Guineafowl	Helmeted	*Numida*	*meleagris*
Gull	Kelp	*Larus*	*dominicanus*
Harrier	Black	*Circus*	*maurus*
Harrier-Hawk	African	*Polyboroides*	*typus*
Heron	Black-headed	*Ardea*	*melanocephala*

Heron	Grey	*Ardea*	*cinerea*
Honeyguide	Greater	*Indicator*	*indicator*
Honeyguide	Lesser	*Indicator*	*minor*
Honeyguide	Scaly-throated	*Indicator*	*variegatus*
Hoopoe	African	*Upupa*	*africana*
Hornbill	Crowned	*Tockus*	*alboterminatus*
Ibis	African Sacred	*Threskiornis*	*aethiopicus*
Ibis	Hadeda	*Bostrychia*	*hagedash*
Indigobird	Dusky	*Vidua*	*funerea*
Kestrel	Rock	*Falco*	*rupicolus*
Kingfisher	Brown-hooded	*Halcyon*	*albiventris*
Kingfisher	Half-collared	*Alcedo*	*semitorquata*
Kingfisher	Malachite	*Alcedo*	*cristata*
Kingfisher	Pied	*Ceryle*	*rudis*
Kite	Black-shouldered	*Elanus*	*caeruleus*
Kite	Yellow-billed	*Milvus*	*aegyptius*
Lapwing	Blacksmith	*Vanellus*	*armatus*
Lapwing	Crowned	*Vanellus*	*coronatus*
Lark	Red-capped	*Calandrella*	*cinerea*
Longclaw	Cape	*Macronyx*	*capensis*
Marsh-harrier	African	*Circus*	*ranivorus*
Martin	Brown-throated	*Riparia*	*paludicola*
Martin	Rock	*Hirundo*	*fuligula*
Masked-weaver	Southern	*Ploceus*	*velatus*
Moorhen	Common	*Gallinula*	*chloropus*
Mousebird	Red-faced	*Urocolius*	*indicus*
Mousebird	Speckled	*Colius*	*striatus*
Neddicky	Neddicky	*Cisticola*	*fulvicapilla*
Olive-pigeon	African	*Columba*	*arquatrix*
Oriole	Black-headed	*Oriolus*	*larvatus*
Palm-swift	African	*Cypsiurus*	*parvus*
Paradise-flycatcher	African	*Terpsiphone*	*viridis*
Pigeon	Speckled	*Columba*	*guinea*
Plover	Three-banded	*Charadrius*	*tricollaris*
Prinia	Karoo	*Prinia*	*maculosa*
Puffback	Black-backed	*Dryoscopus*	*cubla*
Quelea	Red-billed	*Quelea*	*quelea*
Raven	White-necked	*Corvus*	*albicollis*
Robin-chat	Cape	*Cossypha*	*caffra*
Rock-thrush	Cape	*Monticola*	*rupestris*
Rush-warbler	Little	*Bradypterus*	*baboecala*
Saw-wing	Black (Southern race)	*Psalidoprocne*	*holomelaena*
Scrub-robin	Brown	*Cercotrichas*	*signata*
Scrub-robin	White-browed	*Cercotrichas*	*leucophrys*
Seedeater	Streaky-headed	*Crithagra*	*gularis*
Sparrow	Cape	*Passer*	*melanurus*
Sparrow	House	*Passer*	*domesticus*

Sparrow	Southern Grey-headed	*Passer*	*diffusus*
Sparrowhawk	Black	*Accipiter*	*melanoleucus*
Sparrowhawk	Little	*Accipiter*	*minullus*
Spoonbill	African	*Platalea*	*alba*
Spurfowl	Red-necked	*Pternistis*	*afer*
Starling	Black-bellied	*Lamprotornis*	*corruscus*
Starling	Cape Glossy	*Lamprotornis*	*nitens*
Starling	Common	*Sturnus*	*vulgaris*
Starling	Pied	*Spreo*	*bicolor*
Starling	Red-winged	*Onychognathus*	*morio*
Stilt	Black-winged	*Himantopus*	*himantopus*
Stonechat	African	*Saxicola*	*torquatus*
Stork	White	*Ciconia*	*ciconia*
Sugarbird	Cape	*Promerops*	*cafer*
Sunbird	Amethyst	*Chalcomitra*	*amethystina*
Sunbird	Collared	*Hedydipna*	*collaris*
Sunbird	Greater Double-collared	*Cinnyris*	*afer*
Sunbird	Grey	*Cyanomitra*	*veroxii*
Sunbird	Malachite	*Nectarinia*	*famosa*
Sunbird	Orange-breasted	*Anthobaphes*	*violacea*
Sunbird	Southern Double-collared	*Cinnyris*	*chalybeus*
Swallow	Barn	*Hirundo*	*rustica*
Swallow	Greater Striped	*Hirundo*	*cucullata*
Swallow	Lesser Striped	*Hirundo*	*abyssinica*
Swallow	White-throated	*Hirundo*	*albigularis*
Swamp-warbler	Lesser	*Acrocephalus*	*gracilirostris*
Swift	Alpine	*Tachymarptis*	*melba*
Swift	Horus	*Apus*	*horus*
Swift	Little	*Apus*	*affinis*
Swift	White-rumped	*Apus*	*caffer*
Tchagra	Southern	*Tchagra*	*tchagra*
Teal	Cape	*Anas*	*capensis*
Thrush	Olive	*Turdus*	*olivaceus*
Tinkerbird	Red-fronted	*Pogoniulus*	*pusillus*
Tit-babbler	Chestnut-vented	*Parisoma*	*subcaeruleum*
Trogon	Narina	*Apaloderma*	*narina*
Turaco	Knysna	*Tauraco*	*corythaix*
Turtle-dove	Cape	*Streptopelia*	*capicola*
Wagtail	Cape	*Motacilla*	*capensis*
Warbler	Knysna	*Bradypterus*	*sylvaticus*
Warbler	Victorin's	*Cryptillas*	*victorini*
Waxbill	Common	*Estrilda*	*astrild*
Waxbill	Swee	*Coccopygia*	*melanotis*
Weaver	Cape	*Ploceus*	*capensis*
Weaver	Dark-backed	*Ploceus*	*bicolor*
Weaver	Spectacled	*Ploceus*	*ocularis*
Weaver	Thick-billed	*Amblyospiza*	*albifrons*

Weaver	Village	*Ploceus*	*cucullatus*
White-eye	Cape	*Zosterops*	*virens*
Whydah	Pin-tailed	*Vidua*	*macroura*
Wood-dove	Emerald-spotted	*Turtur*	*chalcospilos*
Wood-hoopoe	Green	*Phoeniculus*	*purpureus*
Woodland-warbler	Yellow-throated	*Phylloscopus*	*ruficapilla*
Woodpecker	Cardinal	*Dendropicos*	*fuscescens*
Woodpecker	Knysna	*Campethera*	*notata*
Woodpecker	Olive	*Dendropicos*	*griseocephalus*

Assessment Report for Expansion of Eggland Thornhill within the Kouga Local Municipality, Eastern Cape Province

AQUATIC ASSESSMENT

FOR

CAPE EAPrac

BY

EnviroSci (Pty) Ltd

Dr Brian Colloty

1 Rossini Rd
Pari Park
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6070

DATE

10 March 2020

REVISION 1

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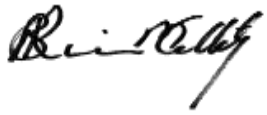
SPECIALIST REPORT DETAILS

This report has been prepared as per the requirements of the Environmental Impact Assessment Regulations and the National Environmental Management Act (Act 107 of 1998), any subsequent amendments and any relevant National and / or Provincial Policies related to biodiversity assessments. This also includes the minimum requirements as stipulated in the National Water Act (Act 36 of 1998), as amended in Water Use Licence Application and Appeals Regulations, 2017 Government Notice R267 in Government Gazette 40713 dated 24 March 2017, which also includes the minimum requirements for a Wetland Delineation Report.

Report prepared by: Dr. Brian Colloty Pr.Sci.Nat. (Ecology) / Member SAEIES.

Expertise / Field of Study: BSc (Hons) Zoology, MSc Botany (Rivers), Ph.D Botany Conservation Importance rating, and has worked as an independent consulting specialist from 1996 to present.

I, **Dr. Brian Michael Colloty** declare that this report has been prepared independently of any influence or prejudice as may be specified by the National Department of Environmental Affairs and or Department of Water and Sanitation



Signed:… …… Date:…10 March 2020……

1. Introduction

CAPE EAPrac appointed EnviroSci (Pty) Ltd to conduct an Aquatic Assessment for **the continued expansion of the egg laying facility THORNHILL EGGLAND, within the Kouga Local Municipality** (Figure 1).

The proponent has developed the property, however continued expansion with two more houses triggers the following listed activity under the National Environmental Management Act – Listing Notice 2, namely

The expansion and related operation of facilities for the concentration of poultry, excluding chicks younger than 20 days, where the capacity of the facility will be increased by—

(i) more than 1 000 poultry where the facility is situated within an urban area; or

(ii) more than 5 000 poultry per facility situated outside an urban area.

1.1 Aims and objectives

The aim of this report is to provide an assessment of the state and function of any aquatic habitats that may be lost, together with an assessment of the potential issues posed by the development. Where possible this report also provides means to avoid additional impacts or issues. This was based on a site visit conducted in summer on 3 December 2019.

1.2 Assumptions and Limitation

To obtain a comprehensive understanding of the dynamics of any aquatic communities within a study site, as well as the status of endemic, rare or threatened species in any area, assessments should always consider investigations at different time scales (across seasons/years) and through replication. However, due to time constraints these long-term studies are not feasible and are thus mostly based on instantaneous sampling.

Therefore, due to the scope of the work presented in this report (significant portions of the site have already been developed for the same purposes as that proposed), a long-term investigation of the site was not possible and as such not perceived as part of the Terms of Reference. However, a concerted effort was made to assess as much of the potential site, as well as make use of any available literature, species distribution data (Appendix 1) and aerial photography, with particular focus on determining the type and importance of the aquatic systems that may be impacted upon by the activities.

It should be emphasised that information, as presented in this document, only has reference to the study area as indicated on the accompanying maps. Therefore, this information cannot be applied to any other area without detailed investigation.

Figure 1: An aerial view of the current facilities associated with Thornhill Eggland and the two proposed houses (blue rectangles)

2. Terms of Reference

The affected aquatic systems were assessed as follows:

- The assessment was initiated with a review of the available information for the region and activities that had occurred. This will also include review of the development in relation to any conservation plans or assessments known for the area, e.g. Critical Biodiversity Area maps, National Waterbody Inventory etc.
- Determination of the Present Ecological State of any waterbodies incl. wetlands, estimating their biodiversity, conservation importance with regard ecosystem services using recognised PES / EIS assessment methods to determine the state, importance and sensitivity of the respective systems
- Prepared a map demarcating the respective watercourses or wetland/s, within a 500m radius of the study area. This demonstrates, from a holistic point of view the connectivity between the site and the surrounding regions, i.e. the hydrological zone of influence while classifying the hydrogeomorphic type of the respective water courses / wetlands in relation to present land-use and their current state. The maps depicting demarcated waterbodies will be delineated to a scale of 1:10 000, following the methodology described by the DWS.
- Buffer zones were recommended using the Macfarlane & Bredin (2017) approach to indicate any No-go / Sensitive areas around any delineated aquatic zones should these be thought necessary, supported by any relevant legislation, e.g. any bioregional plans, conservation guidelines or best practice if still applicable. Attention was also paid to the presence / absence of any important habitat or species known to occur within the region as indicated in Appendix 1.
- Assessed the potential impacts, based on a supplied methodology, including cumulative impacts and for construction (should any additional activities still be required, particularly if the construction was halted), operations and decommissioning phases.
- Provide mitigations regarding observed impacts, which could negatively affect demarcated wetland or water course areas.
- Supply the client with geo-referenced GIS shape files of the wetland / riverine areas with buffers as required.

3. Project Description

The Assessment is being submitted for the proposed expansion of the Eggland facility with an additional two chicken houses (Figure 1). The proposed new houses will each contain a maximum of 40 000 hens totalling 80 000 lay hens.

4. Relevant legislation and policy

The following is pertinent to this study:

- Section 24 of The Constitution of the Republic of South Africa;
- Agenda 21 – Action plan for sustainable development of the Department of Environmental Affairs and Tourism (DEAT) 1998;
- National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998) inclusive of all amendments, as well as the NEM: Biodiversity Act;
- National Water Act, 1998 (Act No. 36 of 1998);
- Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983); and
- Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).
- Nature and Environmental Conservation Ordinance (No. 19 of 1974)
- National Forest Act (No. 84 of 1998)
- National Heritage Resources Act (No. 25 of 1999)

NEMA and the Conservation of Agricultural Resources Act (CARA), 1983 (Act No. 43 of 1983) would also apply to this project. These Acts have categorised many invasive plants together with associated obligations on the land owner. Several Category 1 & 2 plants were observed in several areas of the site under investigation.

Alien Invasive Plant Species (AIS) within or adjacent the site observed included amongst others:

- *Solanum elaeagnifolium* (Silver-leaf bitter apple)
- *Cyperus rotundus subsp rotundus* (Nut grass)
- *Acacia mearnsii* (Black wattle)
- *Pennisetum clandestinum (Kikuyu)*
- *Solanum maurtianum (Bugweed)*
- *Opuntia ficus-indica (Prickly pear)*
- *Opuntia humifusa (Creeping prickly pear)*
- *Cestrum laevigatum (Inkberry)*
- *Argemone Mexicana (Mexican poppy)*
- *Cirsium vulgare (Scotch Thistle)*
- *Eucalyptus spp*
- *Pinus spp*
- *Plantago lanceolate* (Buckhorn plantain)
- *Arundo donax (Spanish Reed)*

5. Description of the affected environment

5.1 Climate

The site is located within the bimodal rainfall region of South Africa, with a Mean Annual Precipitation (MAP) for the coastal region at ca. 540 mm per annum. Annual average temperatures range between 4.2 and 27 °C, with frost a rare occurrence of no more than 10 days per year (Mucina & Rutherford, 2007).

5.2 Geology and soils

The site is underlain acidic lithosol soils derived from the sandstones of the Table Mountain Group, as well as quarzitic sandstones of the Witteberg Group (Mucina & Rutherford, 2007). The region surrounding the site also includes expected shallow Glenrosa and Mispah soil forms.

5.3 Slope and aspect

The region is characterised by undulating hills, interspersed with steep valleys and low ridges associated with the Loerie/Gamtoos valleys.

5.4 Aquatic environment

The study area is located within the L90C Gamtoos River quaternary catchment as shown in Figure 2, situated within the Southern Eastern Coastal Belt Ecoregion. The study area Subquaternary area has anticipated 135 – 220 mm of Mean Annual Runoff. However, it does not however contain, any wetland clusters, Important Bird Areas or Threatened Ecosystems as listed by NEMA.

The study area does form part of a Strategic Water Resource Area (Surface water) as this catchment forms part of an important water supply to the Gamtoos farming region.

Several waterbodies are also shown in National Wetland Inventory (NWI) Version 5 released by van Deventer *et al*. (2020) (Figure 3). No wetlands (natural or artificial) were indicated in the NWI for the study area, however two Depression / Pans were observed during the site visit and are within 500m of the proposed infrastructure (Figure 4). These two pan systems, have however been converted into farm dams (Plate 1), a practice that has occurred within most pans within the region, and the only examples that are in a more natural state are located near St Albans and Jefferys Bay, 20 and 16 km from the site respectively.

The pans were dominated by obligate plant species mostly associated with the Cyperaceae (Nut grass) family and included the following species:

Cyperus textilis

Ficinia litoralis

Tetraria cuspidate

Elegia spp

Carpha spp

Helichrysum cymosum

Scirpus nodusis

Eipschoenus gracilis

No aquatic species of special concern were observed within

Several watercourses were also observed within the region, but none and their associated buffer (18m) were located near the proposed development activities (Figure 4). The 18m buffer was based on results obtained from the wetland/riverine buffer model (Macfarlane & Bredin, 2017), using data collected on the state of the systems, hydrogeomorphic type and activities (past and present) that occur.

Based on the aerial images, it could not be determined when the approved water supply dam was constructed, but it contained no distinctive aquatic habitat, e.g. wetlands or emergent vegetation (Plate 2).

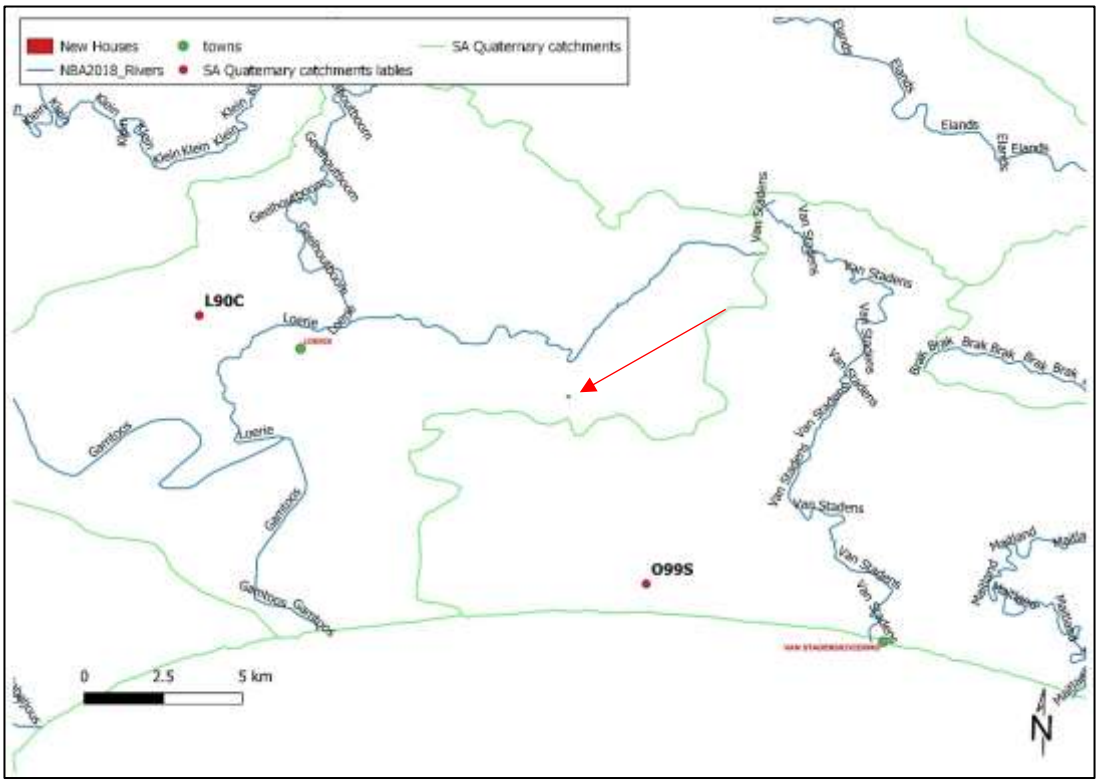


Figure 2: Project locality (red arrow) indicating the various quaternary catchments, mainstem rivers (Source DWS, NWI and NGI)

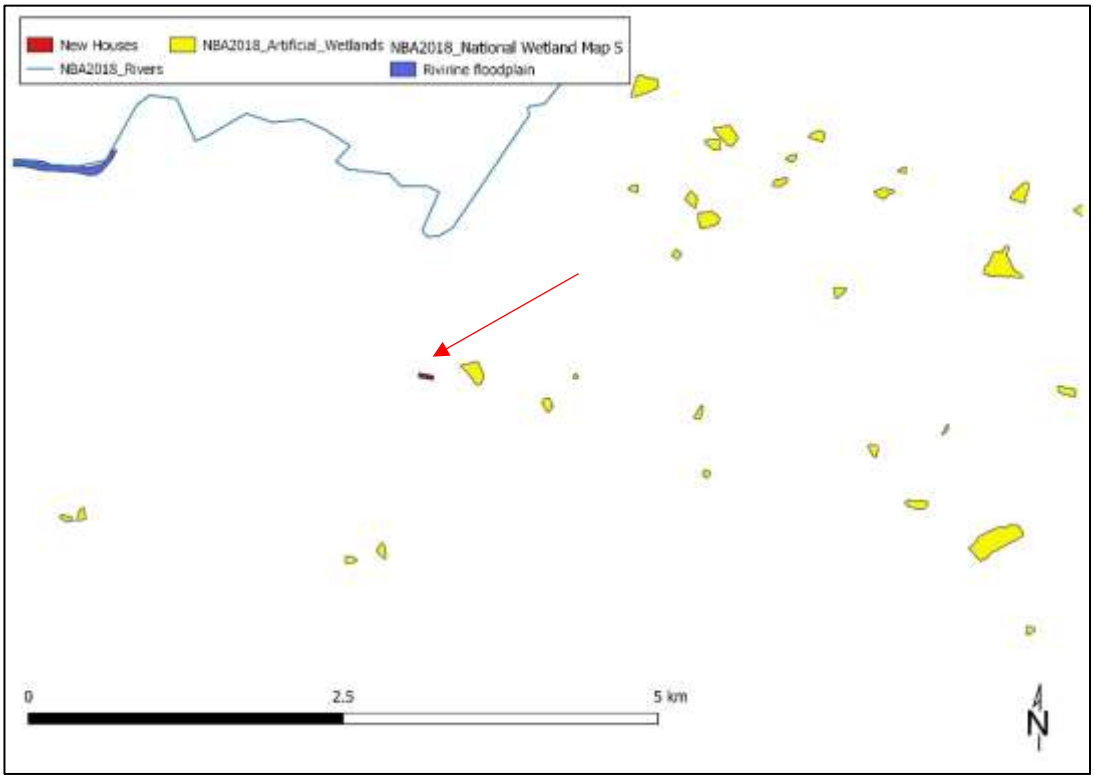


Figure 3: National Wetland Inventory spatial data, for known systems within the region and the site indicated by the red arrow (van Deventer *et al*., 2020)

Plate 1: A view of the pan, now dam closest to the current operations

Plate 2: The approved water supply dam with no distinct aquatic habitat other than the open water itself

Figure 4: Delineated extent of the pans, known watercourse with 18m buffer and 500m WUA regulated zone in relation to the proposed houses

5.4 Present Ecological State and conservation importance (Aquatic environment)

The PES of a river, watercourse or wetland represents the extent to which it has changed from the reference or near pristine condition (Category A) towards a highly impacted system where there has been an extensive loss of natural habit and biota, as well as ecosystem functioning (Category E).

The PES scores have been revised for the country and based on the new models, aspects of functional importance as well as direct and indirect impacts have been included (DWS, 2014 and to an extent revised in the National Spatial Biodiversity Assessment, 2018 data, released 2019). The new PES system also incorporates Ecological Importance (EI) and Ecological Sensitivity (ES) separately as opposed to Ecological Importance and Sensitivity (EIS) in the old model, although the new model is still heavily centred on rating rivers using broad fish, invertebrate, riparian vegetation and water quality indicators. The Recommended Ecological Category (REC) is still contained within the new models, with the default REC being B, when little or no information is available to assess the system or when only one of the above-mentioned parameters are assessed or the overall PES is rated between a C or D.

The PES for the study river system (Subquaternary catchment 90029) was rated as follows (DWS, 2014 /NSBA, 2018) where C = Moderately Modified:

Subquaternary Catchment Number	Present Ecological State	Ecological Importance	Ecological Sensitivity
9009	C	Moderate/Medium	High

These scores were adjusted by observations made in the field, due to the current impacts such as:

- Alien vegetation
- Vegetation clearing
- Impoundments (several above and below the site), and
- Agricultural return flow from the various pivot irrigation systems;

The Present Ecological State for the study area water courses were thus rated as **D = Largely Modified**, i.e. less than 40 % of the natural riparian vegetation remains based on the Riparian Vegetation Responses Assessment Index (VEGRAI) model. This score would also then apply to the riverine wetland (Wetland IHI) based on the impacts observed and the perceived loss in catchment vegetation and wetland aerial cover.

The Ecological Importance and Sensitivity Score were rated as Moderate by DWS for the Subquaternary catchment (2014), due to the importance of the habitat they provide (fish & invertebrates), filter pollutants and support the downstream systems, namely the Loerie River, while forming part of an Upstream Support Area under NFEPA, as shown in Figure 6. This would be substantiated by information collected in the field and the presence of the riverine wetlands observed that would mitigation impacts such as agricultural return flows and trap any sediments within runoff.

Results from the *Wetland* Index of Habitat Integrity (IHI) model based on field data, also indicated that the PES for the two pan was **D = Largely Modified, while the Ecological Importance and Sensitivity score was Moderate.**

The Moderate scores for both the watercourses and the pans was based on the fact that these systems are also located within a Phase 2 FEPA (Figure 6) or Freshwater Ecosystem Priority Area / NFEPA (Nel *et al*., 2011) and Critical Biodiversity Area Type 2 (Berliner and Desmet, 2007) in the Eastern Cape Biodiversity Conservation Plan (Figure 7).

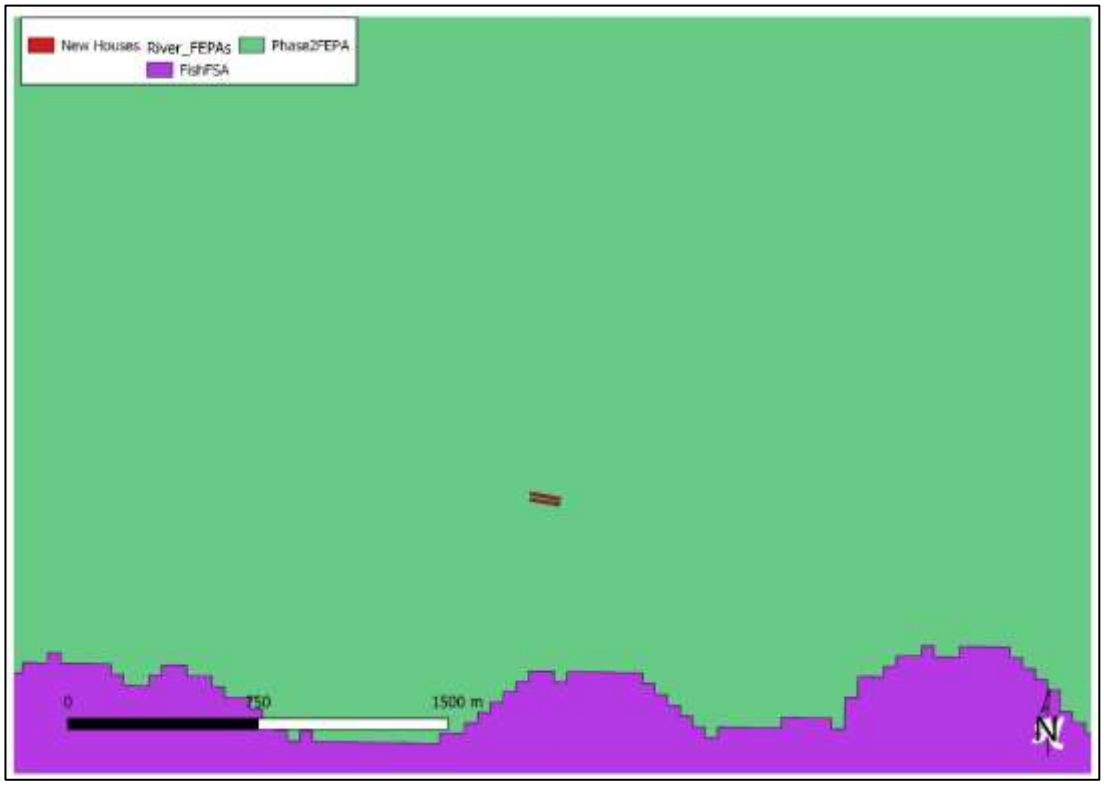


Figure 5: NFEPA Priority Ecosystem Areas (Nel *et al*., 2011)

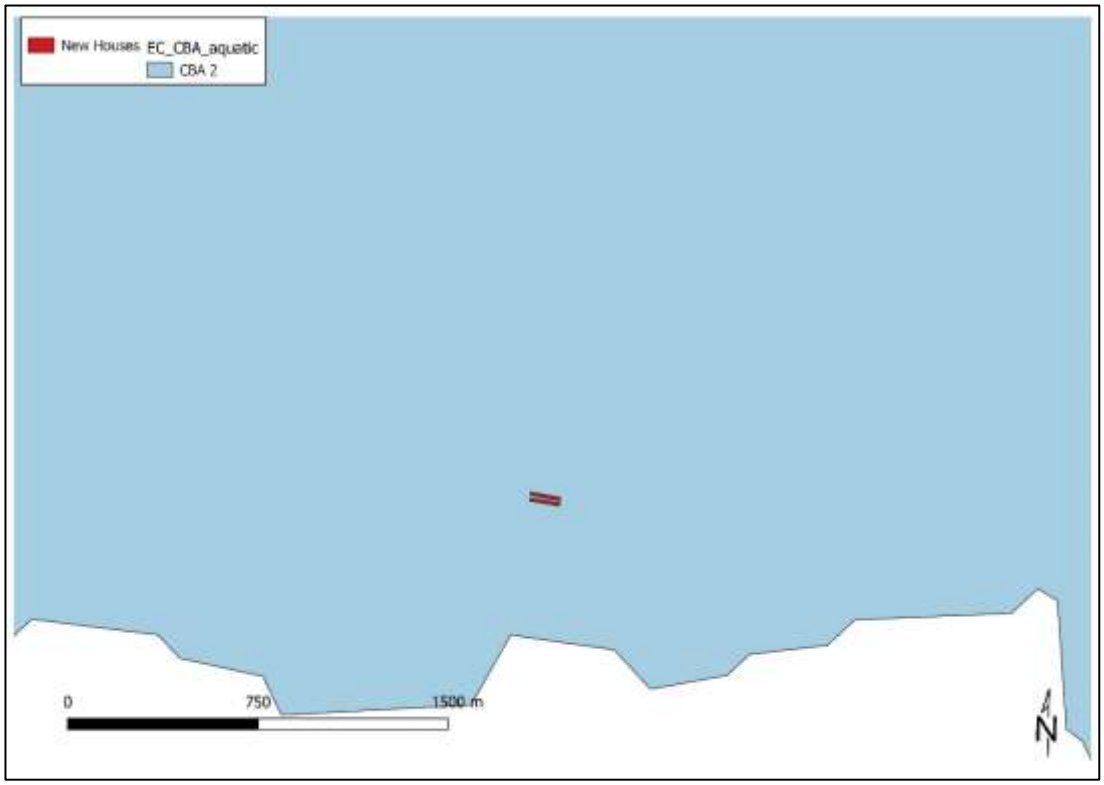


Figure 6: Critical Biodiversity Areas as per the Eastern Cape Biodiversity Conservation Plan (Desmet & Berliner, 2007)

6. Permit requirements

In terms of Water Use Authorisation these applications must submitted, with the inclusion of any activities within the 500m wetland regulated zone with regard Section 21 c & i water uses, if not yet authorised (See Figure 4). This would also include any abstractive uses form the dam and borehole however the dam is authorized alongside abstraction rights from the river.

7. Site Sensitivity

Based then on the past status of the environment and the scale past and current disturbance, no sensitive areas would will be affected within the development footprint. However it is recommended that any future activities remain outside of the watercourses and their buffers and the pans and that the surrounding land use remain (grazing) remain unchanged (See Figure 4).

8. Impact Assessment

During the impact assessment a number of potential key issues / impacts were identified and assessed.

- Impact 1: Loss of aquatic riverine and wetland habitat
- Impact 3: Habitat fragmentation
- Impact 4: Impact on baseflow hydrology
- Impact 5: Increase in sedimentation and erosion
- Impact 6: Risks on the aquatic environment due to water quality impacts
- Impact 7: Cumulative impacts

The loss of any Species of Special Concern was not assessed as the habitat are now disturbed and little to no terrestrial habitat remains within the cleared areas:

8.1: Impact 1: Loss of aquatic riverine and wetland habitat – Direct Impact

<table>
<tr><td colspan="2">Environmental Impact:
No direct impacts associated with the proposed activities as no additional or new impacts on the aquatic environment would occur unless the proposed layouts are expanded or additional roads or construction laydown areas are placed within any of the delineated areas</td><td colspan="2">Activity/Aspect & Impact Source:
Due to the nature of the project this would persist in the long term into the operational phase impact. However the affected habitats observed are largely outside of the proposed activities</td><td colspan="4">Proposed Mitigation:
• Alien plant regrowth should also be monitored, in any areas that won’t be utilised, as a number of ruderal Alien Invasive species do occur within the plan and the thicket area within the drainage lines.
• No further encroachment must be allowed into the aquatic zones as shown in Figure 4.</td></tr>
<tr><td colspan="8">Impact Significance</td></tr>
<tr><td rowspan="2">Without Mitigation:</td><td>Extent
Site (1)</td><td>Duration
Long-term (4)</td><td>Severity
Minor (2)</td><td>Reversibility
Completely (0)</td><td>Irreplaceable Loss
Partly (0.5)</td><td>Probability
Probable (3)</td><td>Impact Significance
Low (22.5)</td></tr>
<tr><td rowspan="2">With Mitigation:</td><td>Extent
Site (1)</td><td>Duration
Long-term (4)</td><td>Severity
Minor (2)</td><td>Reversibility
Completely (0)</td><td>Irreplaceable Loss
Partly (0.5)</td><td>Probability
Probable (3)</td><td>Impact Significance
Low (22.5)</td></tr>
<tr><td colspan="4">Potential to Mitigate:
Moderate potential / easy to mitigate</td><td colspan="4">Assessment Confidence:
Complete</td></tr>
</table>

8.2: Impact 2: Habitat fragmentation

Environmental Impact: Based on the information contained within the ECBCP, the study area is within Aquatic Critical Biodiversity Areas. The proposed activities will not result in additional fragmentation	***Activity/Aspect & Impact Source:*** Due to the nature of the project this will persist in the long term into the operational phase impact.	***Proposed Mitigation:*** • Alien plant regrowth should also be monitored, in any areas that won't be utilised, as a number of ruderal Alien Invasive species do occur within the plan and the thicket area within the drainage lines. • No further encroachment must be allowed into the aquatic zones as shown in Figure 5.

Impact Significance

	Extent	**Duration**	**Severity**	**Reversibility**	**Irreplaceable Loss**	**Probability**	**Impact Significance**
Without Mitigation:	Site (1)	Long-term (4)	Minor (2)	Completely (0)	Partly (0.5)	Probable (3)	Low (22.5)
With Mitigation:	Site (1)	Long-term (4)	Minor (2)	Completely (0)	Partly (0.5)	Probable (3)	Low (22.5)

Potential to Mitigate: Moderate potential / easy to mitigate	***Assessment Confidence:*** Complete

8.3 Impact 3: Impact on baseflow hydrology – direct operational impact

Environmental Impact: Impoundments result in the reduction of baseflow while also reducing flood peaks (rivers require floods to reset sediment build up for example). This includes the water supply dam.	***Activity/Aspect & Impact Source:*** Due to the nature of the project this will persist in the long term in the operational phase impact and is compounded by the existence of several other dams / abstractive users in the catchment.	***Proposed Mitigation:*** • If the current dam is not licensed then DWS should be consulted as part of water use authorisation process who will assist in the determination of a safe abstraction rate that will allow for equitable social and ecological needs within the catchment.

Impact Significance

	Extent	**Duration**	**Severity**	**Reversibility**	**Irreplaceable Loss**	**Probability**	**Impact Significance**
Without Mitigation:	Site (1)	Long-term (4)	Moderate (4)	Completely (0)	Partly (0.5)	Definite (5)	Moderate (47.5)
With Mitigation:	Site (1)	Long-term (4)	Minor (2)	Completely (0)	Partly (0.5)	Probable (3)	Low (22.5)

Potential to Mitigate: Moderate potential / easy to mitigate	***Assessment Confidence:*** Complete

8.4 Impact 4: Increase in sedimentation and erosion – direct operational phase

Environmental Impact: The creation of hard surface areas will result in the increase in runoff, with an increase in erosion and sedimentation impacts downstream. This coupled to the creation of additional roads / access tracks also increases stormwater runoff	***Activity/Aspect & Impact Source:*** Due to the nature of the project this will persist in the long term in the operational phase impact.	***Proposed Mitigation:*** • Suitable stormwater management must be included in the steep access roads, as sediment is currently being washed. This should include swales and or small ponds to trap sediment, coupled to revegetation of bare soil areas with local plant species. • As the development is not allowed to have gutters, any runoff from roof must be captured by vegetated / grassed areas first. This vegetation will then slow and dissipate flows. Some flows do accumulate when leaving the existing parking areas, and this should be managed using grassed swales to prevent the generation of any high velocity flows, but suitable sized not to create any standing waterbodies.

Impact Significance

	Extent	**Duration**	**Severity**	**Reversibility**	**Irreplaceable Loss**	**Probability**	**Impact Significance**
Without Mitigation:	Site (1)	Long-term (4)	Moderate (4)	Completely (0)	Partly (0.5)	Definite (5)	Moderate (47.5)
With Mitigation:	Site (1)	Long-term (4)	Minor (2)	Completely (0)	Partly (0.5)	Probable (3)	Low (22.5)

Potential to Mitigate: Moderate potential / easy to mitigate	***Assessment Confidence:*** Complete

8.5 Impact 5: Risks on the aquatic environment due to water quality impacts – indirect operational phase

Environmental Impact: This impact is mostly related to activities that would generate return flows, especially if areas are over irrigated or contain any production waste.	***Activity/Aspect & Impact Source:*** Due to the nature of the project this will persist in the long term in the operational phase impact.	***Proposed Mitigation:*** • It is important that no surface water runoff is allowed to be directed into the dam or water courses. Any runoff must therefore be contained in swales or stormwater management features, particularly where runoff is concentrated. This must be sized correctly so as not to create any standing waterbodies. • ***Any wash water from the packhouse should be monitored on a monthly basis (organic loads / bacteria), to ensure that if any discharge reaches the local water courses it is within the acceptable or target water quality limits that will be prescribed by DWS.*** • ***Although the biological control system (drive through dips and sprayers) make use of environmentally sensitive products, any spills from these systems should also not be directed into any water courses and ideally should be captured***

Impact Significance

	Extent	**Duration**	**Severity**	**Reversibility**	**Irreplaceable Loss**	**Probability**	**Impact Significance**
Without Mitigation:	Site (1)	Long-term (4)	Moderate (4)	Completely (0)	Partly (0.5)	Definite (5)	Moderate (47.5)

	Extent	Duration	Severity	Reversibility	Irreplaceable Loss	Probability	Impact Significance
With Mitigation:	Site (1)	Long-term (4)	Minor (2)	Completely (0)	Partly (0.5)	Probable (3)	Low (22.5)
Potential to Mitigate: Moderate potential / easy to mitigate				***Assessment Confidence:*** Complete			

8.6 Impact 6: Cumulative impacts

Environmental Impact: The cumulative impacts are related to activities already in existence and the increased in the number of houses	***Activity/Aspect & Impact Source:*** Due to the nature of the project this will persist in the long term in the operational phase impact. However, this is mostly related to adjacent terrestrial environments, although transformation has already taken place.	***Proposed Mitigation:*** • Alien plant regrowth should also be monitored, and any such species should be removed on an ongoing basis within areas that won't be utilised. • Water use and quality of any return flows should be monitored as this has a direct impact on the quality of the aquatic environment. • Runoff from any areas should be managed using swales to prevent any pollution (organic) of downstream areas.

Impact Significance							
	Extent	**Duration**	**Severity**	**Reversibility**	**Irreplaceable Loss**	**Probability**	**Impact Significance**
Without Mitigation:	Site (1)	Long-term (4)	Moderate (4)	Completely (0)	Partly (0.5)	Definite (5)	Moderate (47.5)
With Mitigation:	Site (1)	Long-term (4)	Minor (2)	Completely (0)	Partly (0.5)	Probable (3)	Low (22.5)
Potential to Mitigate: Moderate potential / easy to mitigate				***Assessment Confidence:*** Complete			

9. Conclusion and Recommendations

The results indicated that no important habitats will be affected by the expansion of the two lay houses. However it is suggested that the following mitigations be considered:

- Alien plant regrowth should also be monitored, and any such species should be removed on an ongoing basis form areas that won't be utilised.
- Water use and quality of any return flows should be monitored in accordance with existing rights, as this has a direct impact on the quality of the aquatic environment.
- Runoff from any areas should be managed using swales to prevent any pollution (organic) of downstream areas.

With this in place the overall significance of the impacts could be reduced to LOW. This only applies to the physical changes to the observed environment, as the maximum allowable change to the hydrological environment (abstraction from dam) that will be allowed, will be determined by the Department of Water and Sanitation during the Water Use Authorisation process for the dam, if no license is in place.

10. References

Agenda 21 – Action plan for sustainable development of the Department of Environmental Affairs and Tourism (DEAT) 1998.

Agricultural Resources Act, 1983 (Act No. 43 of 1983).

Alexander, G. And Marais, J. 2010. A Guide to Reptiles of Southern Africa. Struik Nature, Cape Town. Animal Demography Unit, Department Of Zoology, University Of Cape Town. 2012. Summary Data Of The Frogs Of South Africa, Lesotho And Swaziland. Downloaded From: Http://Adu.Org.Za/Frog_Atlas.Php; Accessed On 2/02/2013.

Berliner D. and Desmet P. 2007. Eastern Cape Biodiversity Conservation Plan: Technical Report. Department of Water Affairs and Forestry Project No 2005-012, Pretoria.

Branch, W.R. 1998. Terrestrial reptiles and amphibians. In: A Field Guide to the Eastern Cape Coast, R. A. Lubke, F. W. Gess and M. N. Bruton (eds.), Grahamstown Centre for the Wildlife Soc. S. Afr., 251 264.

Davies, B. and Day J., (1998). Vanishing Waters. University of Cape Town Press.

Department of Water Affairs and Forestry - DWAF (2005). A practical field procedure for identification and delineation of wetland and riparian areas Edition 1. Department of Water Affairs and Forestry , Pretoria.

Department of Water Affairs and Forestry - DWAF (2008). Manual for the assessment of a Wetland Index of Habitat Integrity for South African floodplain and channelled valley bottom wetland types by M. Rountree (ed); C.P. Todd, C. J. Kleynhans, A. L. Batchelor, M. D. Louw, D. Kotze, D. Walters, S. Schroeder, P. Illgner, M. Uys. and G.C. Marneweck. Report no. N/0000/00/WEI/0407. Resource Quality Services, Department of Water Affairs and Forestry, Pretoria, South Africa.

Driver A., Sink, K.J., Nel, J.N., Holness, S., Van Niekerk, L., Daniels, F., Jonas, Z., Majiedt, P.A., Harris, L. & Maze, K. 2012. National Biodiversity Assessment 2011: An assessment of South Africa's biodiversity and ecosystems. Synthesis Report. South African National Biodiversity Institute and Department of Environmental Affairs, Pretoria.

Du Preez, L. And Carruthers, V. 2009. A Complete Guide To Frogs Of Southern Africa. Struik Nature, Cape Town

Ewart-Smith J.L., Ollis D.J., Day J.A. and Malan H.L. (2006). National Wetland Inventory: Development of a Wetland Classification System for South Africa. WRC Report No. KV 174/06. Water Research Commission, Pretoria.

IUCN (2019). Red List of Threatened Species. IUCN Species Survival Commission, Cambridge Available: http://www.iucnredlist.org/

Kleynhans C.J., Thirion C. and Moolman J. (2005). A Level 1 Ecoregion Classification System for South Africa, Lesotho and Swaziland. Report No. N/0000/00/REQ0104. Resource Quality Services, Department of Water Affairs and Forestry, Pretoria.

Kotze D.C., Marneweck G.C., Batchelor A.L., Lindley D.S. and Collins N. (2008). WET-EcoServices A technique for rapidly assessing ecosystem services supplied by wetlands. WRC Report No: TT 339/08.

Macfarlane, D.M. & Bredin, I.P. 2017. Buffer Zone Guidelines for Rivers, Wetlands and Estuaries Buffer Zone Guidelines for Rivers, Wetlands and Estuaries. WRC Report No TT 715/1/17 Water Research Commission, Pretoria.

Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), as amended.

Minter, L. Burger, M. A. Harrison, J. Braack, H. Bishop, P. & Kloepfer, D. (2004). Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland. Smithsonian Institute.

Mitsch, J.G. and Gosselink, G. (2000). Wetlands 3rd End, Wiley, NewYork, 2000, 920 pg.

Mucina, L., & Rutherford, M.C., 2006. The Vegetation of South Africa, Lesotho and Swaziland, Strelitzia 19, South Africa.

National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended.

National Water Act, 1998 (Act No. 36 of 1998), as amended

Nel, J., Maree, G., Roux, D., Moolman, J., Kleynhans, N., Silberbauer, M. and Driver, A. 2004. South African National Spatial Biodiversity Assessment 2004: Technical Report. Volume 2: River Component. CSIR Report Number ENV-S-I-2004-063. Council for Scientific and Industrial Research, Stellenbosch.

Nel, J.L., Murray, K.M., Maherry, A.M., Petersen, C.P., Roux, D.J., Driver, A., Hill, L., Van Deventer, H., Funke, N., Swartz, E.R., Smith-Adao, L.B., Mbona, N., Downsborough, L. and Nienaber, S. (2011). Technical Report for the National Freshwater Ecosystem Priority Areas project. WRC Report No. K5/1801.

Ollis, D.J., Snaddon, C.D., Job, N.M. & Mbona, N. 2013. Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems. SANBI Biodiversity Series 22. South African National Biodiversity Institute, Pretoria.

Parsons R. (2004). Surface Water – Groundwater Interaction in a Southern African Context. WRC Report TT 218/03, Pretoria.

Ramsar Convention, (1971) including the Wetland Conservation Programme (DEAT) and the National Wetland Rehabilitation Initiative (DEAT, 2000).

Rowntree, K., Wadesone, R. and O'Keeffe, J. 2000. The development of a geomorphological classification system for the longitudinal zonation of South African rivers. South African Geographical Journal 82(3): 163-172.

South African Bird Atlasing Project 2 (SABAP2). 2017. Animal Demographic Unit. Available online: http://sabap2.adu.org.za/

Stuart, C and Stuart, T. 2007. A field guide to the mammals of Southern Africa. Struik Nature, Cape Town.

van Deventer H., Smith-Adao, L. Petersen C., Mbona N., Skowno A., Nel, J.L. (2018) Review of available data for a South African Inventory of Inland Aquatic Ecosystems (SAIIAE). Water SA 44 (2) 184-199.

11. Appendix 1: Species Checklists

Source SANBI ADU http://vmus.adu.org.za/index.php?database Accessed 23 November 2019

AMPHIBIANS			
Brevicepitidae	*Breviceps adspersus*	Bushveld Rain Frog	Least Concern
Bufonidae	*Sclerophrys capensis*	Raucous Toad	Least Concern
Heleophrynidae	*Heleophryne hewitti*	Hewitt's Ghost Frog	Critically Endangered
Hyperoliidae	*Hyperolius marmoratus*	Painted Reed Frog	Least Concern (IUCN ver 3.1, 2013)
Pipidae	*Xenopus laevis*	Cape Clawed Toad	Least Concern
Pyxicephalidae	*Amietia delalandii*	Delalande's River Frog	Least Concern (2017)
Pyxicephalidae	*Amietia fuscigula*	Cape River Frog	Least Concern (2017)
Pyxicephalidae	*Cacosternum boettgeri*	Common Caco	Least Concern (2013)
Pyxicephalidae	*Cacosternum nanum*	Bronze Caco	Least Concern (2013)
Pyxicephalidae	*Strongylopus fasciatus*	Striped Stream Frog	Least Concern
Pyxicephalidae	*Strongylopus grayii*	Clicking Stream Frog	Least Concern
REPTILES			
Agamidae	*Agama aculeata aculeata*	Common Ground Agama	Least Concern (SARCA 2014)
Agamidae	*Agama atra*	Southern Rock Agama	Least Concern (SARCA 2014)
Chamaeleonidae	*Bradypodion sp. (Groendal)*	Groendal Dwarf Chameleon	
Chamaeleonidae	*Bradypodion taeniabronchum*	Elandsberg Dwarf Chameleon	Endangered (SARCA 2014)
Colubridae	*Dispholidus typus typus*	Boomslang	Least Concern (SARCA 2014)
Cordylidae	*Pseudocordylus microlepidotus microlepidotus*	Cape Crag Lizard	Least Concern (SARCA 2014)
Elapidae	*Naja nivea*	Cape Cobra	Least Concern (SARCA 2014)
Gekkonidae	*Afroedura nov sp. 1 (Kouga)*	Flat Gecko sp. 1 (Kouga)	
Lacertidae	*Pedioplanis burchelli*	Burchell's Sand Lizard	Least Concern (SARCA 2014)
Lacertidae	*Tropidosaura gularis*	Cape Mountain Lizard	Least Concern (SARCA 2014)
Lamprophiidae	*Lycodonomorphus rufulus*	Brown Water Snake	Least Concern (SARCA 2014)
Lamprophiidae	*Psammophylax rhombeatus*	Spotted Grass Snake	Least Concern (SARCA 2014)
Scincidae	*Acontias orientalis*	Eastern Legless Skink	Least Concern (SARCA 2014)
Testudinidae	*Chersina angulata*	Angulate Tortoise	Least Concern (SARCA 2014)
Viperidae	*Bitis arietans arietans*	Puff Adder	Least Concern (SARCA 2014)
LEPIDOPTERA			
HESPERIIDAE	*Spialia sataspes*	Boland sandman	Least Concern (SABCA 2013)
HESPERIIDAE	*Tsitana uitenhaga*	Uitenhage sylph	Least Concern (SABCA 2013)

LYCAENIDAE	*Aloeides aranda*	Aranda copper	Least Concern (SABCA 2013)
LYCAENIDAE	*Aloeides damarensis damarensis*	Damara copper	Least Concern (SABCA 2013)
LYCAENIDAE	*Aloeides depicta*	Depicta copper	Least Concern (SABCA 2013)
LYCAENIDAE	*Aloeides juana*	Juana copper	Least Concern (SABCA 2013)
LYCAENIDAE	*Aloeides pallida liversidgei*	Giant copper	Least Concern (SABCA 2013)
LYCAENIDAE	*Cacyreus marshalli*	Common geranium bronze	Least Concern (SABCA 2013)
LYCAENIDAE	*Capys alpheus alpheus*	Orange banded protea	Least Concern (SABCA 2013)
LYCAENIDAE	*Chrysoritis beulah*	Beulah's opal	Least Concern (SABCA 2013)
LYCAENIDAE	*Chrysoritis chrysaor*	Burnished opal	Least Concern (SABCA 2013)
LYCAENIDAE	*Chrysoritis zeuxo cottrelli*	Cottrell's daisy copper	Least Concern (SABCA 2013)
LYCAENIDAE	*Lachnocnema durbani*	D'Urban's woolly legs	Least Concern (SABCA 2013)
LYCAENIDAE	*Lampides boeticus*	Pea blue	Least Concern (SABCA 2013)
LYCAENIDAE	*Lepidochrysops sp.*		
LYCAENIDAE	*Lepidochrysops ketsi ketsi*	Ketsi blue	Least Concern (SABCA 2013)
LYCAENIDAE	*Lepidochrysops patricia*	Patricia blue	Least Concern (SABCA 2013)
LYCAENIDAE	*Lepidochrysops poseidon*	Baviaanskloof blue	Least Concern (SABCA 2013)
LYCAENIDAE	*Lepidochrysops robertsoni*	Robertson's blue	Least Concern (SABCA 2013)
LYCAENIDAE	*Lepidochrysops variabilis*	Variable blue	Least Concern (SABCA 2013)
LYCAENIDAE	*Leptomyrina lara*	Cape black-eye	Least Concern (SABCA 2013)
LYCAENIDAE	*Tarucus thespis*	Vivid dotted blue	Least Concern (SABCA 2013)
LYCAENIDAE	*Thestor murrayi*	Murray's skolly	Least Concern (SABCA 2013)
LYCAENIDAE	*Trimenia argyroplaga argyroplaga*	Large silver-spotted copper	Least Concern (SABCA 2013)
NYMPHALIDAE	*Acraea neobule neobule*	Wandering donkey acraea	Least Concern (SABCA 2013)
NYMPHALIDAE	*Aeropetes tulbaghia*	Table mountain beauty	Least Concern (SABCA 2013)
NYMPHALIDAE	*Charaxes pelias*	Protea charaxes	Least Concern (SABCA 2013)
NYMPHALIDAE	*Danaus chrysippus orientis*	African monarch, Plain tiger	Least Concern (SABCA 2013)
NYMPHALIDAE	*Hypolimnas misippus*	Common diadem	Least Concern (SABCA 2013)

NYMPHALIDAE	*Junonia hierta cebrene*	Yellow pansy	Least Concern (SABCA 2013)
NYMPHALIDAE	*Pardopsis punctatissima*	Polka dot	Least Concern (SABCA 2013)
NYMPHALIDAE	*Precis archesia archesia*	Garden commodore	Least Concern (SABCA 2013)
NYMPHALIDAE	*Precis octavia sesamus*	Gaudy Commodore	Least Concern (SABCA 2013)
NYMPHALIDAE	*Pseudonympha magus*	Silver-bottom brown	Least Concern (SABCA 2013)
NYMPHALIDAE	*Pseudonympha trimenii ruthae*	Trimen's brown	Least Concern (SABCA 2013)
NYMPHALIDAE	*Stygionympha vigilans*	Western hillside brown	Least Concern (SABCA 2013)
NYMPHALIDAE	*Stygionympha wichgrafi williami*	Wichgraf's hillside brown	Least Concern (SABCA 2013)
NYMPHALIDAE	*Vanessa cardui*	Painted lady	Least Concern (SABCA 2013)
PAPILIONIDAE	*Papilio demodocus demodocus*	Citrus swallowtail	Least Concern (SABCA 2013)
PIERIDAE	*Belenois aurota*	Brown-veined white	Least Concern (SABCA 2013)
PIERIDAE	*Pontia helice helice*	Common meadow white	Least Concern (SABCA 2013)
PIERIDAE	*Teracolus eris eris*	Banded gold tip	Least Concern (SABCA 2013)
AVES (BIRDS)			
Common_group	**Common_species**	**Genus**	**Species**
Apalis	Bar-throated	*Apalis*	*thoracica*
Apalis	Yellow-breasted	*Apalis*	*flavida*
Barbet	Acacia Pied	*Tricholaema*	*leucomelas*
Barbet	Black-collared	*Lybius*	*torquatus*
Batis	Cape	*Batis*	*capensis*
Bishop	Southern Red	*Euplectes*	*orix*
Bokmakierie	Bokmakierie	*Telophorus*	*zeylonus*
Boubou	Southern	*Laniarius*	*ferrugineus*
Brownbul	Terrestrial	*Phyllastrephus*	*terrestris*
Bulbul	Cape	*Pycnonotus*	*capensis*
Bunting	Cinnamon-breasted	*Emberiza*	*tahapisi*
Bunting	Golden-breasted	*Emberiza*	*flaviventris*
Bush-shrike	Olive	*Telophorus*	*olivaceus*
Buzzard	Jackal	*Buteo*	*rufofuscus*
Buzzard	Steppe	*Buteo*	*vulpinus*
Camaroptera	Green-backed	*Camaroptera*	*brachyura*
Canary	Brimstone	*Crithagra*	*sulphuratus*
Canary	Cape	*Serinus*	*canicollis*
Canary	Forest	*Crithagra*	*scotops*
Canary	Yellow-fronted	*Crithagra*	*mozambicus*
Chat	Anteating	*Myrmecocichla*	*formicivora*
Chat	Familiar	*Cercomela*	*familiaris*

Cisticola	Grey-backed	*Cisticola*	*subruficapilla*
Cisticola	Lazy	*Cisticola*	*aberrans*
Cisticola	Levaillant's	*Cisticola*	*tinniens*
Cisticola	Zitting	*Cisticola*	*juncidis*
Coot	Red-knobbed	*Fulica*	*cristata*
Cormorant	Reed	*Phalacrocorax*	*africanus*
Cormorant	White-breasted	*Phalacrocorax*	*carbo*
Coucal	Burchell's	*Centropus*	*burchellii*
Crane	Blue	*Anthropoides*	*paradiseus*
Crested-flycatcher	Blue-mantled	*Trochocercus*	*cyanomelas*
Crow	Cape	*Corvus*	*capensis*
Crow	Pied	*Corvus*	*albus*
Cuckoo	Black	*Cuculus*	*clamosus*
Cuckoo	Klaas's	*Chrysococcyx*	*klaas*
Cuckoo	Red-chested	*Cuculus*	*solitarius*
Cuckoo-shrike	Black	*Campephaga*	*flava*
Cuckoo-shrike	Grey	*Coracina*	*caesia*
Dove	Laughing	*Streptopelia*	*senegalensis*
Dove	Lemon	*Aplopelia*	*larvata*
Dove	Red-eyed	*Streptopelia*	*semitorquata*
Dove	Tambourine	*Turtur*	*tympanistria*
Drongo	Fork-tailed	*Dicrurus*	*adsimilis*
Duck	African Black	*Anas*	*sparsa*
Duck	Yellow-billed	*Anas*	*undulata*
Eagle	African Crowned	*Stephanoaetus*	*coronatus*
Eagle	Martial	*Polemaetus*	*bellicosus*
Eagle	Verreaux's	*Aquila*	*verreauxii*
Eagle-owl	Spotted	*Bubo*	*africanus*
Egret	Cattle	*Bubulcus*	*ibis*
Firefinch	African	*Lagonosticta*	*rubricata*
Fiscal	Common (Southern)	*Lanius*	*collaris*
Fish-eagle	African	*Haliaeetus*	*vocifer*
Flycatcher	African Dusky	*Muscicapa*	*adusta*
Flycatcher	Fiscal	*Sigelus*	*silens*
Flycatcher	Spotted	*Muscicapa*	*striata*
Goose	Egyptian	*Alopochen*	*aegyptiacus*
Goose	Spur-winged	*Plectropterus*	*gambensis*
Goshawk	African	*Accipiter*	*tachiro*
Goshawk	Southern Pale Chanting	*Melierax*	*canorus*
Grassbird	Cape	*Sphenoeacus*	*afer*
Grebe	Little	*Tachybaptus*	*ruficollis*
Greenbul	Sombre	*Andropadus*	*importunus*
Guineafowl	Helmeted	*Numida*	*meleagris*
Gull	Kelp	*Larus*	*dominicanus*
Harrier	Black	*Circus*	*maurus*
Harrier-Hawk	African	*Polyboroides*	*typus*
Heron	Black-headed	*Ardea*	*melanocephala*

Heron	Grey	*Ardea*	*cinerea*
Honeyguide	Greater	*Indicator*	*indicator*
Honeyguide	Lesser	*Indicator*	*minor*
Honeyguide	Scaly-throated	*Indicator*	*variegatus*
Hoopoe	African	*Upupa*	*africana*
Hornbill	Crowned	*Tockus*	*alboterminatus*
Ibis	African Sacred	*Threskiornis*	*aethiopicus*
Ibis	Hadeda	*Bostrychia*	*hagedash*
Indigobird	Dusky	*Vidua*	*funerea*
Kestrel	Rock	*Falco*	*rupicolus*
Kingfisher	Brown-hooded	*Halcyon*	*albiventris*
Kingfisher	Half-collared	*Alcedo*	*semitorquata*
Kingfisher	Malachite	*Alcedo*	*cristata*
Kingfisher	Pied	*Ceryle*	*rudis*
Kite	Black-shouldered	*Elanus*	*caeruleus*
Kite	Yellow-billed	*Milvus*	*aegyptius*
Lapwing	Blacksmith	*Vanellus*	*armatus*
Lapwing	Crowned	*Vanellus*	*coronatus*
Lark	Red-capped	*Calandrella*	*cinerea*
Longclaw	Cape	*Macronyx*	*capensis*
Marsh-harrier	African	*Circus*	*ranivorus*
Martin	Brown-throated	*Riparia*	*paludicola*
Martin	Rock	*Hirundo*	*fuligula*
Masked-weaver	Southern	*Ploceus*	*velatus*
Moorhen	Common	*Gallinula*	*chloropus*
Mousebird	Red-faced	*Urocolius*	*indicus*
Mousebird	Speckled	*Colius*	*striatus*
Neddicky	Neddicky	*Cisticola*	*fulvicapilla*
Olive-pigeon	African	*Columba*	*arquatrix*
Oriole	Black-headed	*Oriolus*	*larvatus*
Palm-swift	African	*Cypsiurus*	*parvus*
Paradise-flycatcher	African	*Terpsiphone*	*viridis*
Pigeon	Speckled	*Columba*	*guinea*
Plover	Three-banded	*Charadrius*	*tricollaris*
Prinia	Karoo	*Prinia*	*maculosa*
Puffback	Black-backed	*Dryoscopus*	*cubla*
Quelea	Red-billed	*Quelea*	*quelea*
Raven	White-necked	*Corvus*	*albicollis*
Robin-chat	Cape	*Cossypha*	*caffra*
Rock-thrush	Cape	*Monticola*	*rupestris*
Rush-warbler	Little	*Bradypterus*	*baboecala*
Saw-wing	Black (Southern race)	*Psalidoprocne*	*holomelaena*
Scrub-robin	Brown	*Cercotrichas*	*signata*
Scrub-robin	White-browed	*Cercotrichas*	*leucophrys*
Seedeater	Streaky-headed	*Crithagra*	*gularis*
Sparrow	Cape	*Passer*	*melanurus*
Sparrow	House	*Passer*	*domesticus*

Sparrow	Southern Grey-headed	*Passer*	*diffusus*
Sparrowhawk	Black	*Accipiter*	*melanoleucus*
Sparrowhawk	Little	*Accipiter*	*minullus*
Spoonbill	African	*Platalea*	*alba*
Spurfowl	Red-necked	*Pternistis*	*afer*
Starling	Black-bellied	*Lamprotornis*	*corruscus*
Starling	Cape Glossy	*Lamprotornis*	*nitens*
Starling	Common	*Sturnus*	*vulgaris*
Starling	Pied	*Spreo*	*bicolor*
Starling	Red-winged	*Onychognathus*	*morio*
Stilt	Black-winged	*Himantopus*	*himantopus*
Stonechat	African	*Saxicola*	*torquatus*
Stork	White	*Ciconia*	*ciconia*
Sugarbird	Cape	*Promerops*	*cafer*
Sunbird	Amethyst	*Chalcomitra*	*amethystina*
Sunbird	Collared	*Hedydipna*	*collaris*
Sunbird	Greater Double-collared	*Cinnyris*	*afer*
Sunbird	Grey	*Cyanomitra*	*veroxii*
Sunbird	Malachite	*Nectarinia*	*famosa*
Sunbird	Orange-breasted	*Anthobaphes*	*violacea*
Sunbird	Southern Double-collared	*Cinnyris*	*chalybeus*
Swallow	Barn	*Hirundo*	*rustica*
Swallow	Greater Striped	*Hirundo*	*cucullata*
Swallow	Lesser Striped	*Hirundo*	*abyssinica*
Swallow	White-throated	*Hirundo*	*albigularis*
Swamp-warbler	Lesser	*Acrocephalus*	*gracilirostris*
Swift	Alpine	*Tachymarptis*	*melba*
Swift	Horus	*Apus*	*horus*
Swift	Little	*Apus*	*affinis*
Swift	White-rumped	*Apus*	*caffer*
Tchagra	Southern	*Tchagra*	*tchagra*
Teal	Cape	*Anas*	*capensis*
Thrush	Olive	*Turdus*	*olivaceus*
Tinkerbird	Red-fronted	*Pogoniulus*	*pusillus*
Tit-babbler	Chestnut-vented	*Parisoma*	*subcaeruleum*
Trogon	Narina	*Apaloderma*	*narina*
Turaco	Knysna	*Tauraco*	*corythaix*
Turtle-dove	Cape	*Streptopelia*	*capicola*
Wagtail	Cape	*Motacilla*	*capensis*
Warbler	Knysna	*Bradypterus*	*sylvaticus*
Warbler	Victorin's	*Cryptillas*	*victorini*
Waxbill	Common	*Estrilda*	*astrild*
Waxbill	Swee	*Coccopygia*	*melanotis*
Weaver	Cape	*Ploceus*	*capensis*
Weaver	Dark-backed	*Ploceus*	*bicolor*
Weaver	Spectacled	*Ploceus*	*ocularis*
Weaver	Thick-billed	*Amblyospiza*	*albifrons*

Weaver	Village	*Ploceus*	*cucullatus*
White-eye	Cape	*Zosterops*	*virens*
Whydah	Pin-tailed	*Vidua*	*macroura*
Wood-dove	Emerald-spotted	*Turtur*	*chalcospilos*
Wood-hoopoe	Green	*Phoeniculus*	*purpureus*
Woodland-warbler	Yellow-throated	*Phylloscopus*	*ruficapilla*
Woodpecker	Cardinal	*Dendropicos*	*fuscescens*
Woodpecker	Knysna	*Campethera*	*notata*
Woodpecker	Olive	*Dendropicos*	*griseocephalus*