

Environmental Impact Assessment (EIA) for the proposed construction,
operation and decommissioning of the Saldanha Regional Marine Outfall
Project of Frontier Saldanha Utilities (Pty) Ltd. at Danger Bay
in the Saldanha Bay region

FINAL EIA REPORT

VOLUME II APPENDIX C

Wetland Impact Assessment

Initial study prepared by Dr Liz Day of Freshwater
Consulting Group for the EIA for the West Coast
Desalination Plant EIA.

Citation:

E, Day. 2012. Wetland Specialist Study as part of the EIA for the proposed construction and operation of a reverse osmosis seawater plant in Saldanha, and associated new infrastructure. The Freshwater Consulting Group, prepared for CSIR.

Study revised by: Luanita van der Walt (CSIR)

DECLARATION OF INDEPENDENCE

This Declaration of Independence was signed by Dr Liz Day for the undertaking of the Wetland Impact Assessment for the West Coast District Municipality Desalination EIA¹. Luanita van der Walt, a CSIR specialist with a background in biogeochemical landscape functionality, compiled the findings of Dr Day's initial study. No declaration of independence has been provided in terms of Chapter 5 of the NEMA given that Dr Day was not responsible for preparing the SRMO Wetland Impact Assessment.

¹ E, Day. 2012. Wetland Specialist Study as part of the EIA for the proposed construction and operation of a reverse osmosis seawater plant in Saldanha, and associated new infrastructure. The Freshwater Consulting Group, prepared for CSIR.

WETLAND IMPACT ASSESSMENT

In 2012, Dr Liz Day undertook a Wetland Impact Assessment as part of the West Coast District Municipality (WCDM) seawater desalination EIA to look at potential impacts associated with the routing or pipeline and electricity infrastructure between Danger Bay (where a desalination plant would be located) and the Besaansklop Reservoir². With the express permission of Dr Day, CSIR has utilised the findings of this initial wetland assessment to make recommendations associated with the currently proposed SRMO. It should be noted that all corridor infrastructure associated with the WCDM desalination plant corridors (i.e. servitude width, type of electricity transmission requirements and methods of construction/installation) are the same as those proposed in the SRMO allowing for accurate comparison of impacts between the two proposed projects. Luanita van der Walt, a CSIR specialist with a background in biogeochemical landscape functionality compiled the findings of Dr Day's initial study. No declaration of independence has been provided in terms of Chapter 5 of the NEMA given that Dr Day was not responsible for preparing the SRMO Wetland Impact Assessment.

This project allowed for assessment of four wetland systems that were identified on the basis of existing maps as potentially affected by some of the proposed alternative alignments for the infrastructure

corridors of the proposed SRMO infrastructure near Saldanha Bay.

The main sources of impacts on freshwater resources are:

- Disturbance of wetland habitat along the disturbed area;
- Compaction of the surface over the pipeline footprint, potentially making re-establishment of wetland plants difficult; and
- Effective infilling of wetland habitat, if infilling of the pipeline trench resulted in a final surface that was raised above pre-construction levels – not only would this result in loss of wetland habitat and the creation of a disturbed terrestrial corridor, prone to alien and weedy plant invasion, but it would potentially contribute to localised habitat fragmentation and changes in flow in channelled portions of the wetland.

The infrastructure corridor would cross through portions of both Wetland 1 and 2 (see *Chapter 12*). In the event that the alignment passed through Wetland 1, the permanent impacts listed above of **High** significance are considered likely.

The impacts identified are however easily mitigated to **Low** significance, both by routing the corridor along the northern side of the road, through the degraded wetland areas north of Wetland 1, and by imposition of simple construction phase best practice pollution and disturbance control measures, restriction of construction activities in wetland areas to outside of the wet season, and rehabilitation of disturbed wetlands north of the road after construction.

² E, Day. 2012. Wetland Specialist Study as part of the EIA for the proposed construction and operation of a reverse osmosis seawater plant in Saldanha, and associated new infrastructure. The Freshwater Consulting Group, prepared for CSIR.

CONTENTS

1. BACKGROUND	4
2. TERMS OF REFERENCE	4
3. APPROACH TO THE STUDY	4
4. ASSUMPTIONS AND LIMITATIONS	5
5. STUDY AREA	5
6. DESCRIPTION OF THE PROPOSED PROJECT FROM A FRESHWATER ECOSYSTEMS PERSPECTIVE	7
7. FRESHWATER ECOSYSTEMS POTENTIALLY AFFECTED BY THE PROPOSED PIPELINE AND ROAD ALIGNMENTS	7
7.1 Definitions	7
7.2 Catchment context	8
7.3 Ecoregion status	8
8. DESCRIPTION OF ASSESSED AQUATIC ECOSYSTEMS	9
8.1 Wetland 1	9
8.2 Wetland 2	12
9. IMPACTS ASSOCIATED WITH THE PROPOSED PIPELINE / ROAD CORRIDORS	14
10. CONCLUSIONS	18
11. REFERENCES	18
12. APPENDIX A: METHODOLOGY FOR THE ASSESSMENT OF WETLAND CONDITION	19

TABLES AND FIGURES

Table 1:	Summary of impacts to freshwater ecosystems associated with the proposed alignment of the proposed SRMO infrastructure.criteria as per Appendix A.	16
Table A1:	List of criteria and attributes considered in the evaluation of PES.	19
Table A2:	Interpretation of PES score.	20
Figure 1:	Aquatic ecosystems potentially affected by the proposed SRMO infrastructure.	6
Figure 2:	Outcome of wetland delineation – Wetland 1 off the Jacobsbaai Road, with the southern portion (green polygon) having been delineated along its northern edge to a high level of confidence and the northern edge being too degraded for delineation to be feasible.	11
Figure 3:	Outcome of wetland delineation attempts – Wetland 2 off the Jacobs Bay Road.	13

ACRONYMS

CBA	Critical Biodiversity Area
NFEPA	National Freshwater Ecosystem Priority Area
PES	Present Ecological State
RHDHV	Royal HaskoningDHV (Pty) Ltd
SRMO	Saldanha Regional Marina Outfall
WCDCM	West Coast District Municipality
NEMA	National Environmental Management Act
CSIR	Council for Scientific and Industrial Research
DWA	Department of Water Affairs
EIA	Environmental Impact Assessment
DWAF	Department of Water Affairs and Forestry
CAPE	Cape Action Plan for the Environment
FCG	Freshwater Consulting Group
HDPE	High Density Polyethylene
GRP	Glass reinforced plastic
NWA	National Water Act

1. BACKGROUND

Frontier Saldanha Utilities ('Frontier Utilities') appointed Royal HaskoningDHV (Pty) Ltd (RHDHV) in 2013 to complete a Pre-Feasibility Study for the Saldanha Regional Marine Outfall (SRMO) Project. The proposed SRMO Project will consist of a pipeline with transfer pump stations located along the pipeline route.

It is proposed that the SRMO pipeline will mainly follow the same terrestrial corridor as that proposed in the EIA for the proposed West Coast District Municipality (WCDM) desalination plant potable water pipeline leading to the Besaansklop reservoir. The aforementioned road and pipeline infrastructure alignments could traverse wetlands. As such, their construction could also trigger aspects of the National Environment Management Act (NEMA) or of the National Water Act (Act 36 of 1998). Therefore, CSIR utilised the findings of Day, 2012 to provide specific input on the wetlands / watercourses identified. In terms of the National Water Act (No. 36 of 1998), a Water Use License Application (WULA) must be submitted to the Department of Water Affairs: Western Cape as there will be development within 500 m of wetlands along the Jacobsbaai Road. CSIR understands that Frontier Utilities has appointed a private consultancy firm to load this application with the Provincial Department.

2. TERMS OF REFERENCE

Input into the EIA phase of the project was guided by the following broad Terms of Reference as noted in Day, 2012, which required that the specialist to:

- Assess the condition, Present Ecological State (PES) and Ecological Importance of the four watercourses that have been identified as potentially affected by the routing of a water pipeline;
- Delineate the boundary of the wetlands over a 15m running wetland length at the crossing points, using the DWAF (2005) wetland delineation method as appropriate;
- Determine and assess the potential negative as well as any positive impacts that could result from the proposed crossings over each of the four watercourses, and include mitigation measures where appropriate;
- Report briefly on potential impacts and recommended mitigation measures in terms of
 - Pre-construction (planning and layout)
 - Construction
 - Operational phases.

3. APPROACH TO THE STUDY

The approach to Day, 2012 included the following activities:

- Assessment of existing spatial information relating to wetlands, watercourses and other relevant natural features associated with the site (e.g. NFEPA data and the 1: 50 000 national rivers cover, from the Department of Surveys and Mapping);
- A site visit, carried out on 25 September 2012, during which time:

- the identified wetlands / water courses were assessed, and their Present Ecological State and Ecological Importance assessed, as per the methodology outlined in Appendix A;
- the edge of the wetland was determined on the basis of both plant zonation and soil morphological indicators of wettedness (as per DWAF 2005);
- links to other wetlands / watercourses up- and downstream on the site were identified and assessed;
- Compilation of the present report.

The approach that CSIR adopted for the SRMO Wetlands Impact Assessment was to note all the key impacts and mitigation measures as reported in Day, 2012.

4. ASSUMPTIONS AND LIMITATIONS

- This report focused on the wetlands / watercourses identified by CSIR (2012) in the project Final Scoping Report. Thus although sections of the proposed infrastructure alignments were driven during the site assessment, no effort was made to drive the entire routes. However, CSIR (2012) drew its aquatic ecosystem information largely from the CAPE Finescale Planning Project outcomes, and since mapping in terms of this project included substantial ground-truthing of the overall area (Job *et al.* 2008), fairly high confidence should be attached to its outcomes;
- Input by Freshwater Consulting Group (FCG) into this project did not allow for the collection, identification or detailed description of wetland flora or fauna along the route - it is assumed that the botanical study identified areas in which important red data plant species occur;
- No water quality or other raw data were collected during this study – allusions to water quality in site descriptions is thus based on existing reports or visual observations only;
- Wetlands delineated as part of this study were spatially plotted using data from a hand-held Garmin GPS only, and the plotted edges may thus be somewhat inaccurate. They were however checked against aerial photography and are assumed to be accurate enough for the purposes required in this study.

5. STUDY AREA

Two potential wetlands / watercourses that would be traversed by the proposed pipeline and associated infrastructure have been identified. The proposed SRMO infrastructure and affected aquatic ecosystems are provided in Figure 1.

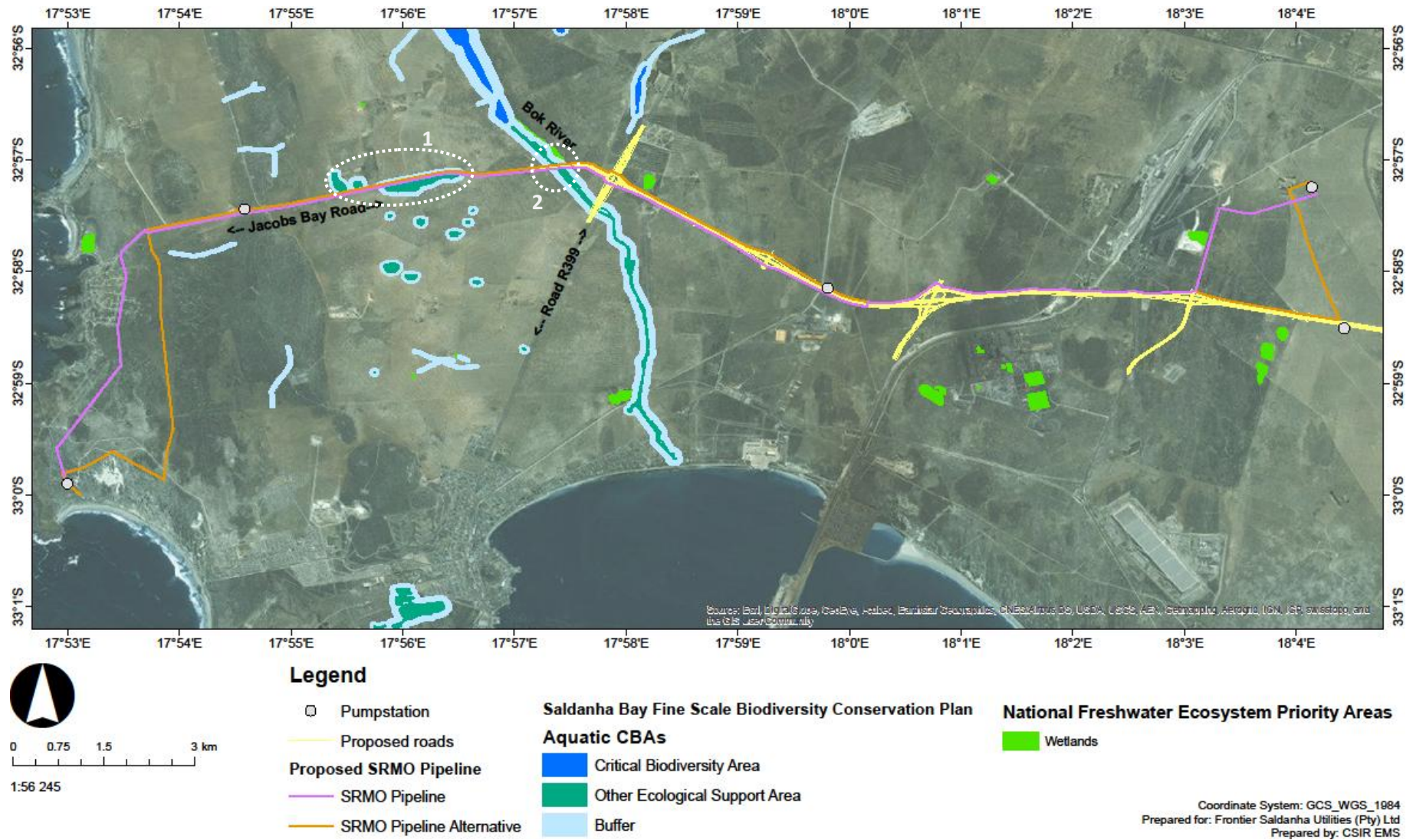


Figure 1: Aquatic ecosystems potentially affected by the proposed SRMO infrastructure.

6. DESCRIPTION OF THE PROPOSED PROJECT FROM A FRESHWATER ECOSYSTEMS PERSPECTIVE

This assessment focuses only on the likely implications of the terrestrial pipeline infrastructure on freshwater ecosystems within the area.

The pipeline will be approximately 27 km long from the Saldanha Separation Plant to the outfall in Danger Bay. The pipe will most likely be constructed from high density polyethylene (HDPE) or will be a glass reinforced plastic (GRP) pipe. Where an existing road runs adjacent to the proposed pipelines, no access road would however be required, and the required servitude width could be reduced 5 - 6 m (G. Schreiner, CSIR, pers. comm.).

Two aquatic ecosystems that may be affected by the SRMO and associated infrastructure were identified along the Jacobs Bay road in the WCDM 10 m servitude. Both pipeline routing alternatives follow the same route along this section of the pipeline (Figure 1).

7. FRESHWATER ECOSYSTEMS POTENTIALLY AFFECTED BY THE PROPOSED PIPELINE AND ROAD ALIGNMENTS

7.1 Definitions

Definitions of surface aquatic ecosystem types referred to in this report are taken from the National Water Act (NWA) (Act 36 of 1998), as outlined below.

The term “**water course**”, as defined by the National Water Act, refers to

- a river or spring;
- a natural channel in which water flows regularly or intermittently;
- a wetland, lake or dam into which or from which water flows; and
- any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.

The NWA defines **wetlands** as:

“land which is transitional between terrestrial and aquatic systems, where the water table is usually at, or near the surface, or the land is periodically covered with shallow water and which under normal circumstances supports, or would support, vegetation adapted to life in saturated soil.”

From a wetland classification perspective, it is noted that the South African National Wetland Classification System (SANBI 2009) defines wetlands as “areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tides does not exceed ten meters.” In this regard, rivers are included in the above definition of wetlands, and they form a subset of the classification of inland wetlands (SANBI 2009).

7.2 Catchment context

The proposed SRMO pipeline routing options lie within DWA quaternary catchment G10M, in the Berg River Water Management Area. One of the wetlands assessed in this study (Wetland 1) lies within minor catchments, which either dissipates or drains directly into the sea to the west. The other assessed area (Wetland 2) is situated in the catchment of the Bok River (Figure 1), which flows south into Saldanha Bay.

7.3 Ecoregion status

An ecoregional classification produced by Kleynhans *et al.* (2005) divided the country's rivers into 31 distinct ecoregions, or groups of rivers which share similar physiography, climate, geology, soils and potential natural vegetation. The present site lies in the South Western Coastal Belt Ecoregion. This ecoregion is characterised by the following broad attributes:

- Comprises mainly plains with a moderate to low relief
- Dominant vegetation type is West Coast Renosterveld although significant areas of Fynbos, Succulent Karoo and Thicket occur
- Mean annual precipitation is Moderate in a limited area in the south, decreasing to low in the north
- Drainage density is low;
- Stream frequency is low/medium;
- Mean annual temperatures are moderate/high.

8. DESCRIPTION OF ASSESSED AQUATIC ECOSYSTEMS

The two aquatic ecosystems identified indicated in Figure 1, are described in detail below.

8.1 Wetland 1

Wetland Name: Kliprug Pan 1

Wetland classification (as per SANBI 2009): Endorheic depression wetland on a Plain landscape setting

Finescale Plan wetland ID code: G10M143

Finescale Plan Natural vegetation type: Saldanha Granite Strandveld

SA Vegetation Type (after Mucina and Rutherford 2009): Langebaan Dune Strandveld

Wetland type (as per CAPE Fine Scale Conservation Plan (Job *et al.* 2008)): Strandveld depression

Typical plant species in this wetland type (after Job *et al.* 2008): *Restios*, *Juncus kraussi*, *Cynodon dactylon*, *Melanthus major*, *Typha capensis*, *Phragmites australis*, *Exomis microphylla*, *Sarcocornia spp.*, *Drosanthemum sp.*, *Lycium cinereum*, *Atriplex spp.*, *Chenolea diffusa*, and *Disphyma crassifolia*.



Photo A:
Looking west along the southern wetland



Photo B:
Fragmentation of southern wetland by minor gravel road



Photo C:
Western portion of southern wetland

Wetland description:

Wetland 1 comprises a relatively large, seasonally inundated depressional wetland (Photos A to C). Under natural circumstances, it probably extended further north, across what is now the Jacobs Bay Road. Both the Jacobs Bay Road and the gravel access road leading south through the pan have however fragmented the wetland, as shown in Figure 2 and Photo B, and the delineation carried out as part of the present project indicates separate polygons, with those on the southern side of the Jacobs Bay Road connecting hydrologically across the gravel road between them via a pipe culvert during periods of high flow.

Strandveld depression wetlands such as this occur primarily on the Saldanha Peninsula and just north of the lower Berg River, and Job *et al.* (2008) describe them as being primarily reliant on precipitation rather than groundwater or surface flow, and usually brackish to saline. In the present case, the wetland appeared to function as a perched system, and did not connect to any channelled outflow. During periods of particularly high surface runoff, it is likely that the wetland

expands its extent of inundation into the surrounding farmland, rarely overtopping to the extent that it drains into the adjacent watersheds.

Typical of other strandveld depressional wetlands, Wetland 1 comprises a mosaic of vegetated and unvegetated areas, with dominant plant species comprising mainly grasses and sedges (e.g. *Cynodon dactylon*, *Sarcocornia* spp., *Juncus acutus* and *Juncus kraussii* as well as annuals such as *Cotula* sp. and various other restios, rushes and sedges.

Many seasonally inundated, seasonally dry, brackish to saline wetlands support a diverse but highly ephemeral invertebrate community, including several taxa believed to be locally and/or regionally endemic. No faunal assessment took place in the present study – in part because of the high level of seasonal flux in invertebrate taxa in such wetlands, which makes extrapolation from a single sampling period to an assumed community structure unreliable.

In addition to fragmentation as a result of roads, which also result in concentration of flows into the pan from pipelines and drainage ditches, Wetland 1 is impacted by grazing, fencing, localised fill and disturbance as a result of grading of the dirt road through it, and probably nutrient enrichment as a result of runoff from livestock grazing areas. Nevertheless, the extent of natural vegetation on the pan to the south of the Jacobs Bay Road and its mosaic, relatively unimpacted physical habitat suggest that the wetland is in a relatively unimpacted condition.

By contrast, the wetlands to the north of the Jacobs Bay Road are highly disturbed, and damage to the wetlands in this area is considered irreversible. Impacts to these wetlands include excavation, livestock trampling, infilling, erosion and changes in inflows.

Wetland delineation: The formal wetland delineation focused on the portion of wetland to the south of Jacobs Bay Road (shown in green in Figure 2), with the disturbed portions of the wetland north of the road being disturbed by road construction, farming and other activities to a point where their delineation in terms of the DWAF (2005) methodology was not considered feasible. Delineation focused on the roadside edge of the southern wetland, both because this edge would be affected by installation of pipelines along the roadside, and because the wetland on its southern boundary has been ploughed and its levels altered by farming.

Augering of wetland soils on the southern wetland showed the development of mottles in the soil on the wetland margins, indicative of seasonally inundated conditions. The northern boundary of the wetland extended right to the edge of a roadside furrow, and road infill thereafter disturbed the surface soils. No temporary wetland conditions were thus noted along this boundary, although they are likely to occur along the southern boundary. The soils were saturated at the time of sampling, and although no impervious surface was found on augering within the top 70cm of the surface, it is assumed that surface flows perch on underlying clays or other material.



Figure 2: Outcome of wetland delineation – Wetland 1 off the Jacobsbaai Road, with the southern portion (green polygon) having been delineated along its northern edge to a high level of confidence and the northern edge being too degraded for delineation to be feasible.

Wetland condition:

Using the PES methodology outlined in Appendix A, the wetlands to the south of the Jacobs Bay Road (shown in green in Figure 2) were accorded a **PES Category B**, indicative of a system that is still largely natural with few modifications from natural and a minor loss of habitat only.

By contrast, the wetlands to the north of the Jacobs Bay Road were accorded a **PES Category E**, indicative of serious modification from natural conditions, with extensive loss of wetland function and habitat.

Wetland Importance:

Using the criteria for wetland importance outlined in Appendix A, the delineated wetland to the south of Jacobs Bay Road, shown in green in Figure 2, was assessed as of **high conservation importance**, on the basis of its size, condition, habitat rarity and possible support of important invertebrate communities.

The wetlands to the north of Jacobs Bay Road were assessed as of low conservation importance on the basis of their level of degradation.

NWA implications of the wetland: Since the wetlands identified above appear to be perched, isolated, depressional wetlands, without channelled outflow, they are not classified as watercourses in terms of the NWA. They are however classified as wetlands in terms of the above legislation.

8.2 Wetland 2

Wetland 2 is identified as the Bok River crossing by the proposed pipeline infrastructure (Figure 1).

Wetland Name: Bok River

Wetland classification (as per SANBI 2009): Channelled valley bottom wetland

Finescale Plan Natural vegetation type: Strandveld Valley Bottom

SA Vegetation Type (after Mucina and Rutherford 2009): Langebaan Dune Strandveld

Wetland type (as per CAPE Fine Scale Conservation Plan (Job *et al.* 2008)): Lowland river³

Typical plant species in this wetland type (after Job *et al.* 2008): *Restios*, *Juncus kraussi*, *Cynodon dactylon*, *Melanthus major*, *Typha capensis*, *Phragmites australis*, *Exomis microphylla*, *Sarcocornia spp.*, *Drosanthemum sp.*, *Lycium cinereum*, *Atriplex spp.*, *Chenolea diffusa*, and *Disphyma crassifolia*.



Photo D:

Upstream of the Jacobs Bay Road –
valley bottom wetland arrowed



Photo E:

Bermed drainage line downstream of
the Jacobs Bay Road



Photo F:

Culverts downstream of the Jacobs
Bay Road

Wetland description:

Job *et al.* (2008) describe Strandveld valley bottom valley wetlands as being located almost exclusively on the Saldanha Peninsula, and comprising seasonal wetlands, associated with lower foothill and lowland rivers. They are generally fed by hillslope seeps lying on higher ground and are not particularly groundwater-dependent. Most of the valley bottoms have a well-defined channel, but it is likely that historically they lacked a channel and water flowed as diffuse flow through marshy areas. Strandveld valley bottoms tend to be saline, and occur on neutral to alkaline sands or granite-derived soils.

Wetland 2 (delineated on both sides of the Jacobs Bay Road as shown in Figure 3) comprises a minor, seasonally to ephemerally flowing valley bottom wetland (classified as a watercourse in terms of the NWA) (Photos D to F). Although upstream of the farm boundary fence shown in Photo D, the channel retains a relatively natural profile, downstream of the road, the system has been channelised and confined by berms (Photo E). Natural vegetation in the channel has probably

³ Note that rivers were not classified as wetlands in the Finescale Conservation Plan data of Job *et al.* (2008), which relied on a previous version of the National Wetland Classification System.

been impacted by grazing cattle, and although there are patches of *Juncus kraussii* and *Juncus acutus* in places, as well as *Sarcocornia* sp., vegetation in the channel and its surrounds is dominated by grasses (*Cynodon dactylon*), and many bare areas occur, presumably as a result of trampling by cattle. The road itself has had significant effects on wetland condition, with localised surface hardening, channel constriction upstream of the road and concentration of flows downstream (Photo F). Despite the above impacts, the river (particularly upstream of the road) retains at least a moderate level of its natural morphology, and constrictions of flow upstream of the road are largely localised and associated with the road itself.

Wetland delineation: Attempts at formal wetland delineation in the reaches immediately up- and downstream of the road culvert were thwarted by the extent of disturbance associated with the road culvert, with flow being artificially channelled over a concrete lined section, and under the road. Upstream of this “apron”, channelisation was still evident, with the result that, for at least 15m upstream of the road, seasonal to temporary wetland conditions were confined to the channel itself, and did not extend beyond into the margins. Further upstream, a more natural spread of wetlands occurred along the shallow channel margins. The delineated extent of wetlands in the vicinity of the road crossing is shown in Figure 3.



Figure 3: Outcome of wetland delineation attempts – Wetland 2 off the Jacobs Bay Road.

Augering of wetland soils rendered largely useless by changes in channel morphology, concrete and other impacts. Delineation based largely on plant zonation and channel morphology. Note that wetlands extend upstream of northern delineated polygon and downstream of southern delineated polygon as shown in Figure 1. Wetlands were not however formally delineated beyond the marked polygons.

Wetland condition:

Using the PES methodology outlined in Appendix A, the non-perennial Bok River wetlands both north and south of Jacobs Bay Road (shown in green in Figure 3) were accorded a **PES Category C**, indicative of a system that is moderately

modified with some loss of habitat. This accords with the PES status recorded for the system by both Job *et al.* (2008) (Finescale Conservation Plan) and Driver *et al.* (2011) (NFEPA classification). Furthermore, the Bok River is identified by the National Spatial Biodiversity Assessment (Trupie *et al.*, 2004) as a critically endangered river. Critically endangered rivers have an intact length below their conservation target (< 10% of their total length) and have also lost much of their original natural habitat that ecosystem functioning has been degraded and species being lost (Trupie *et al.*, 2004)

Wetland Importance:

Using the criteria for wetland importance outlined in Appendix A, the wetlands associated with the Bok River in these reaches would be assigned only a moderate importance rating, on the basis of their level of impact and the patchiness of wetlands that remain along the channel. However, such a rating takes no account of the regional rarity or degree to which national (and other) conservation targets can be met for this river / wetland type. Taking such issues into account, Driver *et al.* (2011) accorded the Bok River “Phase 2 FEPA status” – and hence relatively **high importance**. Phase 2 FEPA ratings were applied in the NFEPA study to moderately modified rivers (C ecological category) only in cases where it is not possible to meet biodiversity targets for river ecosystems in rivers that are still in good condition (A or B ecological category). Phase 2 FEPA systems are thus examples of threatened system types, often with a restricted range. Driver *et al.* (2011) recommends that they should undergo no further degradation (Driver *et al.* 2011).

NWA implications of the wetland: The Bok River wetlands in the vicinity of the Jacobs Bay Road are classified as a watercourse in terms of the NWA.

9. IMPACTS ASSOCIATED WITH THE PROPOSED PIPELINE / ROAD CORRIDORS

Routing the pipeline corridor along the Jacobs Bay Road (WCDM 10 m servitude) would potentially affect wetlands in the area of Wetlands 1 and 2. Excavation of a pipeline trench, stockpiling of excavated soil and compaction over the pipelines would have the following implications for wetlands:

- Disturbance of wetland habitat along the disturbed area;
- Compaction of the surface over the pipeline footprint, potentially making re-establishment of wetland plants difficult;
- Effective infilling of wetland habitat, if infilling of the pipeline trench resulted in a final surface that was raised above pre-construction levels – not only would this result in loss of wetland habitat and the creation of a disturbed terrestrial corridor, prone to alien and weedy plant invasion, but it would potentially contribute to localised habitat fragmentation and changes in flow in channelled portions of the wetland.

The above impacts would be considered highly undesirable in the case of the delineated wetland 1 on the southern side of the Jacobs Bay Road. The impacts are likely to be permanent and of medium intensity, and although taking place within

only a small portion of the wetland, would be considered as taking place at a regional scale, given the conservation importance of Wetland 1. The overall significance of the above impacts in this area would be considered high.

In the case of the wetlands north of wetland 1, on the northern side of the Jacobs Bay Road, although the impacts would still be negative, their scale and intensity would all be low, given the extent of degradation that has already occurred in this area. The overall significance of the above impacts in this area would be considered medium to low.

In the case of wetland 2, comprising the Bok River valley bottom wetland, installation of the pipelines would be likely to trigger most of the above impacts, over a highly localised area, but nevertheless an area with implications for flow along the channel. Creation of a raised mound over the pipeline to ensure sufficient cover would potentially result in pooling of flows upstream of the culvert. The intensity of these impacts is considered low, and they would occur at a very local scale. They would however affect a system earmarked for long-term improvement and would thus, without mitigation measures, be considered of at least medium significance.

Mitigation measures:

The following mitigation measures are recommended, if the Jacobs Bay Corridor is selected for the pipeline corridor:

- Avoidance of wetland 1 on the southern side of the road, by routing the pipelines along the northern side of the Jacobs Bay Road only;
- Compilation of, and strict adherence to, a construction phase environmental management programme, which outlines measures to:
 - prevent the passage of sediment or other contaminated material into adjacent wetlands;
 - minimise the disturbance footprint;
 - ensure that all wetlands south of the road are treated as no go areas – including the wetland margins in the southern road reserve;
- Managing the timing of construction through wetland areas such that it takes place outside of the wet season, and preferably during late summer / autumn, so that the period before plants re-establish in the wet season is limited;
- Rehabilitation of disturbed areas so that pre-construction levels are achieved, and such that the pipeline does not result in the creation of a longitudinal raised mound – this measure could entail spreading of excess fill into disturbed terrestrial areas; fill should not be spread into any wetland areas.

Recommended alternative

In the case of the Jacobs Bay Road Corridor, avoidance of Wetland 1 is considered crucial.

Impact summary

A summary of the impacts associated with each of the proposed alternative corridors assessed in this report is provided in Table 1. Rating criteria are as per the specifications of CSIR, reiterated in Appendix A of this report.

Table 1: Summary of impacts to freshwater ecosystems associated with the proposed alignment of the proposed SRMO infrastructure.criteria as per Appendix A.

Nature of impact	Status (Negative or positive)	Extent	Duration	Intensity	Probability	Reversibility	Irreplaceability	Significance (no mitigation)	Mitigation/Management Actions	Significance (with mitigation)	Confid level
CONSTRUCTION PHASE											
Jacobs Bay Corridor (assuming unmitigated alternative is along southern side of the road)											
Wetland 1 Wetland disturbance, compaction and infilling	Negative	Regional	Permanent	Medium	High	Low	High – wetland 1 is considered of high ecological importance	High	<ul style="list-style-type: none"> Avoidance of wetland 1 by routing pipeline along northern side of road Implement measures to prevent contamination of wetlands with construction material and minimise disturbance footprint, as per CEMP Time construction within wetland areas for outside of the wet season Rehabilitate disturbed areas north of the road such that pre-construction levels are retained along the pipeline corridor and wetlands are not thus infilled. 	Low	Medium – visual assessments only

Nature of impact	Status (Negative or positive)	Extent	Duration	Intensity	Probability	Reversibility	Irreplaceability	Significance (no mitigation)	Mitigation/Management Actions	Significance (with mitigation)	Confid level
Wetland 2 Wetland disturbance, compaction and infilling	Negative	Local	Permanent	Low to medium	High	Medium to high	Medium to high – system earmarked for rehabilitation	Medium	<ul style="list-style-type: none"> Implement measures to prevent contamination of wetlands with construction material and minimise disturbance footprint, as per CEMP Time construction within wetland areas for outside of the wet season Rehabilitate disturbed areas such that pre-construction levels are retained along the pipeline corridor and wetlands are not thus infilled 	Low	Medium – visual assessments only

10. CONCLUSIONS

This report has been prepared to inform both the environmental impact assessment phase of the proposed SRMO project, and future applications to the DWA for a Water Use Licence and/or General Authorisation for the crossing of watercourses and/or other wetland types.

Avoidance of Wetland 1 on the southern side of the road, by routing the pipelines along the northern side of the Jacobsbaai Road is considered crucial. Although the assessed pipeline corridor along the Jacobsbaai Road cross through Wetland 2 (which is of high conservation importance), effective mitigation is considered possible in all cases.

11. REFERENCES

- Department of Water Affairs and Forestry (DWAF). 2005. A practical field procedure for identification and delineation of wetland riparian areas. Department of Water Affairs and Forestry, Pretoria, South Africa.
- Day. 2012. Wetland Specialist Study as part of the EIA for the proposed construction and operation of a reverse osmosis seawater plant in Saldanha, and associated new infrastructure. The Freshwater Consulting Group, prepared for CSIR.
- Driver, A, Nel, J.L., Snaddon, K., Murray, K., Roux, D., Hill, L., Swartz, E.R., Manuel, J. and Funke, N. 2011. Implementation Manual for Freshwater Ecosystem Priority Areas. WRC Report No. 1801/1/11. ISBN 978-1-4312-0147-1. Pretoria.
- Job, N., Snaddon, K., Day, E. (Liz), Nel, J. and Smith-Adao, L. 2008. CAPE Fine Scale Conservation Plan for the Sandveld / Saldanha planning domain. Freshwater Ecosystems. Report to CAPE.
- Job, N., Snaddon, K., Day, L., Nel, J. Smith-Adoa, L. and Kotze, I. 2008. The Freshwater Consulting Group and CSIR. C.A.P.E. fine-scale biodiversity planning project: Aquatic Ecosystems of the Sandveld – Saldanha Planning Domain.
- Kleynhans, CJ, Thirion, C and Moolman, J 2005. A Level I River 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, South Africa.
- Kleynhans, CJ, Thirion, C and Moolman, J 2005. *A Level I River 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, South Africa.
- Kleynhans, N. 1999. A Procedure for the Determination of the Ecological Reserve for the Purposes of the National Water Balance Model for South African Rivers.
- SANBI (South African National Biodiversity Institute) 2009. Further Development of a Proposed National Wetland Classification System for South Africa. Primary Project Report. Prepared by the Freshwater Consulting Group (FCG) for the South African National Biodiversity Institute (SANBI).
- Turpie, J.K. 2004. South African National Spatial Biodiversity Assessment 2004: Technical Report. Volume 3: Estuary Component. Pretoria: South African National Biodiversity Institute.

12. APPENDIX A: METHODOLOGY FOR THE ASSESSMENT OF WETLAND CONDITION

The desk-top Present Ecological State (PES) methodology, adapted from Appendix W4 of the DWA Resource Directed Measures for Water Resources: Wetland Ecosystems (DWAF 1999), was used to assess PES for all the wetlands considered in this report. The methodology is based on a comparison of the current attributes of the wetland against those of a desired baseline or reference condition.

In order to be able to complete the PES assessment, the evaluator needs to take cognisance of the type of functions and services that the wetland would normally provide, or is required to provide. In this manner an assessment of deviation between the desired condition and that observed at the time of evaluation may be made. The services that wetlands provide may be broadly divided into ecological, functional and socio-cultural groups. While certain hydrological and hydraulic services provided by wetlands are often largely a factor of physical storage capacity, the ecological functioning, and socio-cultural benefits provided by the wetland depend to a large degree on the hydrological attributes of the wetland. If these are impaired in any sustained manner, the consequence may be, for example, that vegetative processes will be impaired, with knock-on effects in terms of habitat provision, biogeochemical cycling and production, as well as loss of aesthetic value.

The method requires the scoring of attributes associated with a particular criterion (see Table A1). The mean of all scores is then used to place the wetland in a conservation class (see Table A2).

Table A1: List of criteria and attributes considered in the evaluation of PES.

Criteria and attributes	Relevance
Hydrological	
Flow Modification	<ul style="list-style-type: none"> flows reduced by abstraction (surface and/or groundwater, upstream or within wetland) or impoundment (dams, weirs or spillways), alien plant infestation or silviculture; increased runoff from hardened catchment, agricultural drains, effluent disposal or change in watershed:wetland ratio; alteration in flow regime (timing, duration, frequency, volume or velocity); outflows constricted by vegetation; and altered inundation pattern of wetland habitats resulting in floristic changes or incorrect cues to biota.
Permanent Inundation	<ul style="list-style-type: none"> impoundment or water level regulation resulting in destruction of natural wetland habitat.
Water Quality	
Water Quality Modification (nutrient loading and/or toxics and/or faecal pollution)	<ul style="list-style-type: none"> from surface or groundwater point and/or diffuse sources (agricultural activities, human settlements, industrial or wastewater effluent); internal loading from accumulated sediments; aggravated by volumetric decrease in flow delivered to the wetland (scored under flow modification); and change in ambient (desired) salinity as a consequence of altered freshwater or marine intrusion.
Sediment Load	<ul style="list-style-type: none"> reduction due to upstream retention by impoundment; and

Criteria and attributes	Relevance
Modification	<ul style="list-style-type: none"> increase due to land use practices such as overgrazing, unnatural rates of erosion or in-filling, and resulting in atypical accretion and/or turbidity.
Hydraulic/Geomorphic	
Canalisation/culverts	<ul style="list-style-type: none"> desiccation, shrinkage, altered inundation patterns and changes in habitats; and point discharges as opposed to broad or sheet flows.
Topographic Alteration/Habitat Fragmentation	<ul style="list-style-type: none"> consequence of infilling, ploughing, dykes, causeways, trampling, bridges, roads, railway lines and other substrate disruptive physical changes that alter wetland habitat either directly or through changes in inundation patterns.
Biotic	
Terrestrial Encroachment	<ul style="list-style-type: none"> desiccation of wetland and/or encroachment of terrestrial plant species due to changes in hydrology, geohydrology or geomorphology, resulting in a change from wetland to terrestrial (upland) habitat and associated loss of wetland function.
Loss of Shoreline (riparian) and/or fringing Vegetation (indigenous)	<ul style="list-style-type: none"> loss or reduction in herbaceous or woody vegetation cover, and/or increased distance between upland vegetation and permanent water; switch from macrophyte to algal dominance; loss of critical riparian or upland vegetation as a consequence of development, farming activities, grazing or firewood collection affecting wildlife habitat, overland attenuation of flows, input of organic matter or increased potential for erosion; loss of shading.
Invasive Plant Encroachment	<ul style="list-style-type: none"> altered habitat characteristics through changes in community structure and/or water quality (oxygen reduction and shading).
Faunal Disturbance/ Alien Fauna	<ul style="list-style-type: none"> faunal disturbance due to human presence, domestic animals, noise, light, footpaths, roadways, airports, electricity servitudes; presence of alien fauna affecting faunal community structure (e.g. top down imbalance due to coarse fish, excessive zooplankton grazing etc; bird predation; gerbils); and atypical fauna due to human presence.
Overutilisation of biota	<ul style="list-style-type: none"> overgrazing, fishing, mowing, burning or harvesting leading to alterations and imbalances in community structure and foodweb interactions.
Scoring guidelines: natural, unmodified = 5; Largely natural = 4, Moderately modified = 3; largely modified = 2; seriously modified = 1; critically modified = 0.	

Table A2: Interpretation of PES score.

Score	Wetland Description	PES Category	
> 4	Unmodified or approximates natural condition	A	Acceptable Condition
> 3 <=4	Largely natural with few modifications, minor loss of habitat	B	
> 2 <=3	Moderately modified with some loss of habitat	C	
= 2	Largely modified with loss of habitat and wetland functions	D	
> 0 < 2	Seriously modified with extensive loss of habitat and wetland function.	E	Unacceptable Condition
0	Critically modified. Losses of habitat and function are almost total, and the wetland has been modified completely.	F	

A2. Approach to assessment of wetland importance

A number of protocols have been developed in South Africa for the assessment of wetland ecological importance. These include:

- DWAF (1999)'s protocol for assessing wetland ⁴Ecological Importance and Sensitivity (EIS), itself an adaptation of a methodology developed by Kleynhans (1996). The methodology was developed specifically for valley bottom and floodplain wetlands;
- Southern Waters' (2000) refinement of the EIS protocol, to include an assessment of socio-cultural and functional attributes;
- Ewart-Smith and Ractliffe (2003)'s methodology, which adapts all of the above methodologies for use in assessing wetlands where data are limited (see Box A1).

Of these approaches, the first two are based on the presence of *inter alia*, rare species, biodiversity, bird migration route nodes and sensitivity to water quality changes. One of the limitations of such an approach is that fairly detailed information is required on the character, flora and fauna, as well as seasonal variability and water quality of the system, to fulfill the requirements of the assessment. Moreover, the EIS assessment protocol was developed specifically for floodplain wetlands, and does not apply to other wetland types, omitting key functions of other wetland types such as groundwater recharge and focusing entirely on floodplain function.

Partly because of the problem of applying a floodplain wetland protocol to a different wetland type, and partly because not all of the data needed to make the EIS assessments are available for all of the systems in the present study area (e.g. limited data for wetlands in general in the Western Cape make interpretations of endemism in wetland faunal communities difficult), Ewart-Smith and Ractliffe's (2003) approach was used in this study, to provide a general overview of wetland importance and function.

It should be noted with regard to the importance criteria used in this study that they primarily allow a reflection of relative importance between wetlands. An importance assignment of "Low" does not however imply that conservation of the wetland in question is unnecessary – it rather reflects the importance of the system in relation to other wetlands.

⁴ DWAF (1999) defines Ecological Importance as "an expression of its importance to the maintenance of ecological diversity and functioning on local and wider scales" and Ecological Sensitivity as "the system's ability to resist disturbance and its capability to recover from disturbance once it has occurred".

Box A1 Approach to assessment of wetland importance, as developed by Ewart-Smith and Ractliffe (2003)

This assignment of conservation importance had as a starting point the recognition that almost any wetland habitat, degraded or pristine, is conservation-worthy because of its contribution to biotic diversity, its function, or the limited size and current rate of loss or degradation of wetlands of all types.

The following criteria are used to assign low, moderate or high conservation importance to wetlands identified in the study area (note that the overall importance rating is the highest rating achieved for any criterion):

1 Low conservation importance:

- does not provide ecologically or functionally significant wetland habitat, because of extremely small size or degree of degradation, and/or
- of extremely limited importance as a corridor between systems that are themselves of low conservation importance.

2 Moderate conservation importance:

- provides ecologically significant wetland habitat (e.g. locally important wetland habitat types), and/or
- fulfils some wetland functional roles within the catchment, and/or
- acts as a corridor for fauna and/or flora between other wetlands or ecologically important habitat types, and/or
- supports (or is likely to support) fauna or flora that are characteristic of the region and/or
- provides habitat to indigenous flora and fauna, and/or
- is a degraded but threatened habitat type (e.g. seasonal wetlands), and/or is degraded but has a high potential for rehabilitation, and/or
- functions as a buffer area between terrestrial systems and more ecologically important wetland systems, and/or
- is upstream of systems that are of high conservation importance.

3 High conservation importance:

- supports a high diversity of indigenous wetland species, and/or
- supports, or is likely to support, red data species;
- supports relatively undisturbed wetland communities, and/or forms an integral part of the habitat mosaic within a landscape, and/or
- is representative of a regionally threatened / restricted habitat type, and/or
- has a high functional importance (e.g. nutrient filtration; flood attenuation) in the catchment, and/or
- is of a significant size (and therefore provide significant wetland habitat, albeit degraded or of low diversity).

Liz Day

CURRICULUM VITAE

Name	Elizabeth Day (née Reynolds)
Date of birth	3 May 1968
Place of birth	Zimbabwe
Nationality	South African
Position in company	Founding member

KEY QUALIFICATIONS

- Bachelor of Arts (English), University of Cape Town, 1989
- Bachelor of Science (Zoology (with distinction) and Environmental and Geographical Science); University of Cape Town; 1992
- Bachelor of Science (honours- Zoology, first class); University of Cape Town, 1993
- PhD (Zoology); University of Cape Town, 1998

KEY WORK EXPERIENCE

1999- present Specialist consultant on freshwater ecosystems; co-founder of the Freshwater Consulting Group
1997 - 1999 Senior Consultant for Southern Waters Ecological Research and Consulting cc
1994 - 1996 Scientific Officer on Water Research Commission Project, Freshwater Research Unit, UCT.

SUMMARY OF RELEVANT EXPERIENCE

Over 12 years' experience in aspects of aquatic ecology, specialising in:

- urban river and wetland management and rehabilitation
- urban stormwater design with respect to freshwater ecosystems
- water quality
- environmental impact assessments; baseline and situation assessments
- SASS5 biomonitoring
- Catchment and River Management Plans
- urban river and wetland mapping and biodiversity planning

Compiled over 200 specialist riverine ecology technical reports, 7 scientific papers (5 in international literature), 20 popular biological articles published in local environmental magazines, scripts for eight environmental documentaries. *Ad hoc* lecturer in freshwater ecology at UCT and PennTech; member of UNESCO urban aquatic habitat working group; co-author on 2 Water Research Commission reports; Steering Committee member of Western Cape Wetlands Forum, lead author on chapter in UNESCO Sustainable Management of Urban Aquatic Ecosystems.

PROFESSIONAL AFFILIATIONS

- Member of IAIA
- Member of SAIEES
- Registered Professional Natural Scientist by SACNASP (Reg No 400270/08) for fields of Biological Science, Ecological Science and Zoological Science