ENVIRONMENTAL IMPACT ASSESSMENT

Second Draft Environmental Impact Assessment Report for the Proposed Construction, Operation and Decommissioning of a Seawater Reverse Osmosis Plant and Associated Infrastructure in Tongaat, Kwazulu-Natal

SECOND DRAFT EIA REPORT

CHAPTER 7: TERRESTRIAL ECOLOGY

GLOSSARY

CVI	Coastal Vulnerability Index
DEA	Department of Environmental Affairs
DP	Drift potential
EIA	Environmental Impact Assessment
Edaphic	Pertaining to soils
ESR	Environmental Scoping Report
ICMA	Integrated Coastal Management Act
Mesic	"dry to moist" non-aquatic or wetland, terrestrial environments
Murmuration	Gathering of birds – particularly starlings
Perigeal	When the moon is most proximal to the Earth
Psammosere	Succession stages of a particular stage associated with a dune environment
RDD	Resultant Drift Direction (a vector addition of wind directions)
SLR	Sea level rise
Seral	Pertaining to succession
Supra-tidal	Above the normal high water mark
TWINSPAN	Two Way Indicator Species Analysis

SUMMARY

As a component of the environmental impact assessment associated with the proposed desalination plant identified for the Tongaat / Desainagar area, a terrestrial ecological assessment has been undertaken to evaluate the likely impacts of the construction and operations of the plant in the prevailing environments. This report details the findings of the terrestrial ecological assessment.

In summary, it can be stated that:

- The terrestrial or mesic portions of the study site exclude wetland and estuarine components, but include portions of the Sea Water Reverse Osmosis Plant and the nearshore coastal environment (beach and dune), as well as portions of the pipeline routes proposed for the delivery of potable water to reservoirs as well as the proposed powerline.
- The proposed desalination plant is anticipated to have "low" or "limited" significance impacts on the mesic terrestrial environment.
- The most sensitive ecological component identified in the study area relates to the beach – dune continuum, where vegetation diversity is the highest encountered within the development footprint and this eco system is most at risk of transformation. However, the proposed tunneling of the seawater intake and brine discharge pipelines under the frontal dune will maintain a low level of impacts on the coastal environment.
- The most significant negative environmental impact relates to the alteration of surface and sub-surface hydrology due to the construction of the stormwater and drainage systems in and around the SWRO plant. This high significance impact is likely to affect the state of the frontal dune unless appropriately managed, which would decrease the impact significance to low.
- In addition, it is critical that surface and subsurface hydrological function be retained, at least in part, to ensure the delivery of freshwater to the frontal dune environment, situated immediately east of the salt water reverse osmosis plant.
- Most impacts can be mitigated through judicious design and planning, as well as management interventions during and post the construction and operational phases of the project. Other factors that should be addressed should the project proceed include the provision of bird flight diverters on all powerlines, with BFD's being positioned strategically along the line route. The redress of exotic invasion and general vegetative and ecological management interventions will be an important component of the post construction and operational management regime.

As a conclusion, the siting of a desalination plant as proposed, cannot be precluded on the grounds of unacceptable impacts on the terrestrial mesic environment.

CONTENTS

TABLES

FIGURES

7.1 INTRODUCTION

This Terrestrial Ecology Specialist Study forms part of the Environmental Impact Assessment process for the proposed desalination facility at Tongaat and provides a review of the terrestrial ecological components of the proposed Tongaat development site as well as of the immediate zone of the proposed seawater intake and brine discharge pipelines and potable water supply pipelines.

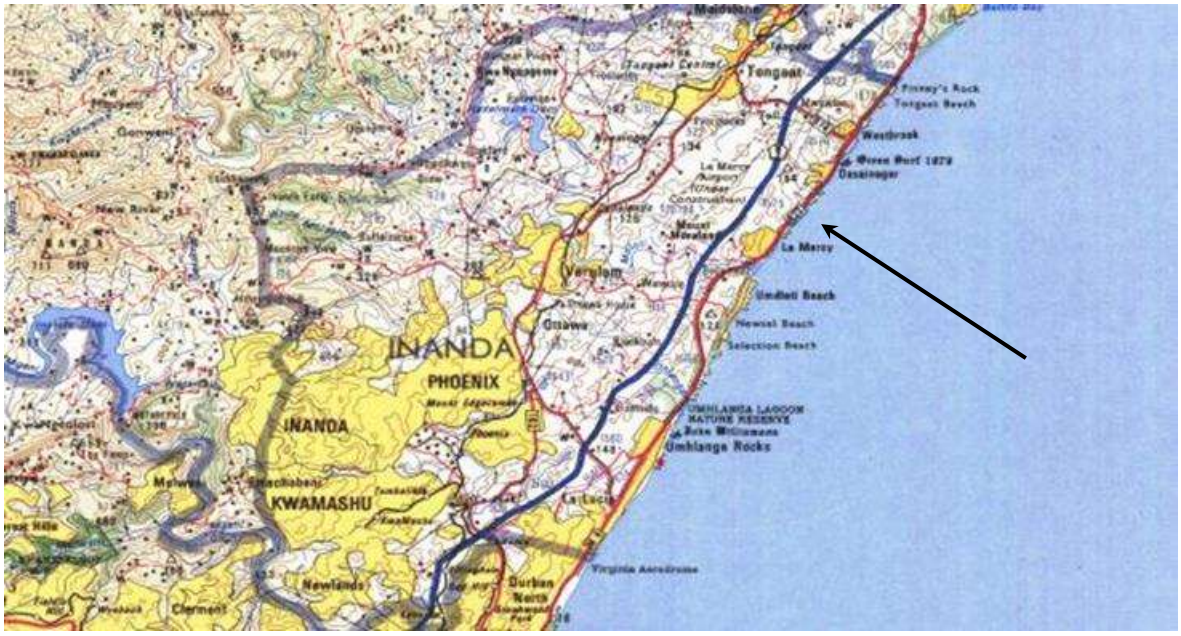

Figure 7.1: Map with arrow indicating site of Tongaat Desalination plant. (Surveyor General 1:250000).

7.1.1 Scope of work and terms of references

This report was compiled through the undertaking of the following actions and tasks, whereby:

1. Consideration was afforded to the findings of the Final Environmental Scoping Report (CSIR 2015), in respect of the terrestrial ecological investigation. Such information included
    a. The nature of the landscape associated with the SWRO plant, the pump station and associated pipelines and infrastructure.
    b. Habitat and related matters identified in the scoping report.
    c. Recommendations for specific investigations and interrogations to be undertaken in the EIR were identified in the scoping report, which have been carried forward.
2. In view of the above, specific consideration was afforded to the coastal dune environment, some portions of the proposed desalination plant, as well as the avifaunal impact of the powerline routes that would serve the desalination plant. Such evaluation included :
    a. A review of pertinent literature, as per the references provided below.
    b. Consideration of aerial imagery pertaining to site from relevant years was undertaken, whereby changes in habitat form, morphology or other variations were noted and interpreted.

c. A site review was undertaken to evaluate and support or dismiss interpretations emanating from evaluation of aerial imagery. Such site review also served to identify any ecological features of significance, and where identified, such features were logged and addressed in this report.

3. Following interpretation of the nature of the receiving environment and the ecological processes inherent within the sites, consideration was given to the anticipated impacts that may arise from the establishment of the proposed plant. Such interpretation included the possible consideration of "fatal flaws", whereby impacts were extremely severe and could not be mitigated.
4. Impacts were rated according to accepted practice which included gauging the level of impact, its duration and extent, as well as the ability to reverse impacts or re-establish the status quo, should the development be decommissioned.
5. Some consideration was given to applicable legislation as it may relate to the receiving environment, as well as the level and severity of the impacts identified and the legal ramifications thereof
6. With the identification of impacts, possible options for mitigation were identified including design and technology alternatives, construction methods and variations to the operations of the plant, as well as the possible option of maintenance of the status quo and the abandonment of the project on the site in question, if fatal flaws were identified.
7. Specific consideration of rehabilitation and mitigation options were identified and proposed in respect of the terrestrial environment that would be both, directly and indirectly affected by the implementation of the desalination project

7.1.2 Study Approach

Significant field reconnaissance has been carried out at the proposed development footprint during the ecological investigation, undertaken during the environmental scoping process. The preliminary findings indicated the following:

1. The stability of the frontal dune at the Tongaat site.
2. The limited impact on the estuarine environments within the Umdloti River system.
3. The highly transformed nature of the receiving environment.

Given the above preliminary findings, specific consideration is given in this investigation to the frontal dune cordon and its drivers, some of the identified habitat forms in and around the site of the SWRO and the general nature of the receiving environment. During the EIA process, the wetland component has been subject to independent specialised investigation (refer to Chapter 8).

In order to ascertain the dynamism within the frontal dune cordon, specific consideration was also given to historical imagery and the identification of any variance that may have arisen along the frontal dune cordon, in particular retreat of the seaward dune toe, increased mobility or other changes.

Within the more landward portions of the study area, consideration was given to the state of natural habitat forms, using historical aerial imagery, before giving further consideration to the present state of these associations and their ecological significance.

The focus of the investigation was to consider the ecological processes inherent within the subject environment, identify the drivers within such environment and therefore evaluate and predict responses to any perturbations that may arise on site should the proposed development be

implemented. The "significance" of the affected habitats would also be determined and allow for the evaluation of the ecological impacts upon the receiving environment.

7.1.3 Information Sources

The following information sources were used for the evaluation of the Tongaat site:

1: Review of specific literature as indicated in the reference section below. Specific consideration was given to dune and coastal issues.

2: Historical aerial imagery as sourced from the Surveyor General's office

3: Data sourced from the National Oceanic and Atmospheric Administration (NOAA) website (www.noaa.gov/slrtrends.html).

4: Further site reconnaissance on 10 March 2015 and 28 April 2015, in addition to site reconnaissance undertaken on 23 February 2015 and during the period August 2013 to September 2013. A further review of specific minor habitat communities along the support infrastructure line routes was undertaken in May and June 2017.

5: Process information sourced from the client.

7.1.4 Assumptions and Limitations

All effort was made to reduce the level of assumption applied to this assessment, however:

1. This assessment was undertaken utilizing both primary data and sourced data. Primary data was obtained during the summer of 2013 and winter of 2015, thus providing some seasonal diversity in respect of floral and faunal species encountered. However, other seasonal variations in species presence and population dynamics may be linked to differing seasonal changes.
2. A conceptual plan of the proposed desalination plant was provided by Umgeni Water. The impacts arising from the project, particularly in and around the dune and beach environments are likely to vary over very short to extensive timeframes (from hourly to periods greater than a decade) and as such, the information below is based upon information collated over the short to medium term. In addition, changes in the design and placement of structures, even if only considered minor, may serve to alter predicted impacts.

7.2 PROJECT DESCRIPTION

The proposed desalination plant will have a capacity to produce 150 ML/day of potable water and will be located at Tongaat, on the north coast, within the region known as Desainagar (See Figure 7.1 above).

The proposed development entails the construction of a pump station at a selected point in close proximity to the beach, enabling sea water to be abstracted via offshore conduits connected to an intake structure about 1000 m offshore. The pump station will be associated with the sea water reverse osmosis (SWRO) plant, lying some 100m from the frontal dune environment. Seawater will be drawn from the ocean through a sea water intake pipeline which will have a diameter of about 1.8 m and will extend approximately 3 km into the marine environment (Figure 7.2).

The SWRO desalination plant is expected to occupy an area of 7 ha within which construction would also take place. Intake water will be treated by reverse osmosis at the proposed plant, with potable water being transferred to reservoirs, through connection to an existing bulk supply line. The proposed desalination plant will be supplied by a new 132 kV transmission line.

Brine, a product of the desalination process, will be returned to the marine environment via a tunnel that would run from the pump station out to the sea, discharging via a diffuser located a distance of about 330 m from the shore. The brine discharge pipeline will lie adjacent to the intake pipeline. The seawater intake and brine discharge pipeline systems will be established through tunnelling from the surfzone to the pump station, in order to place the pipes within the prevailing deeper geology at Tongaat and thereby avoiding excavation of the dune and beach forms. Refer to Chapter 2 Project Description for further details on the proposed process and associated infrastructure, including the selection of alternative routes.

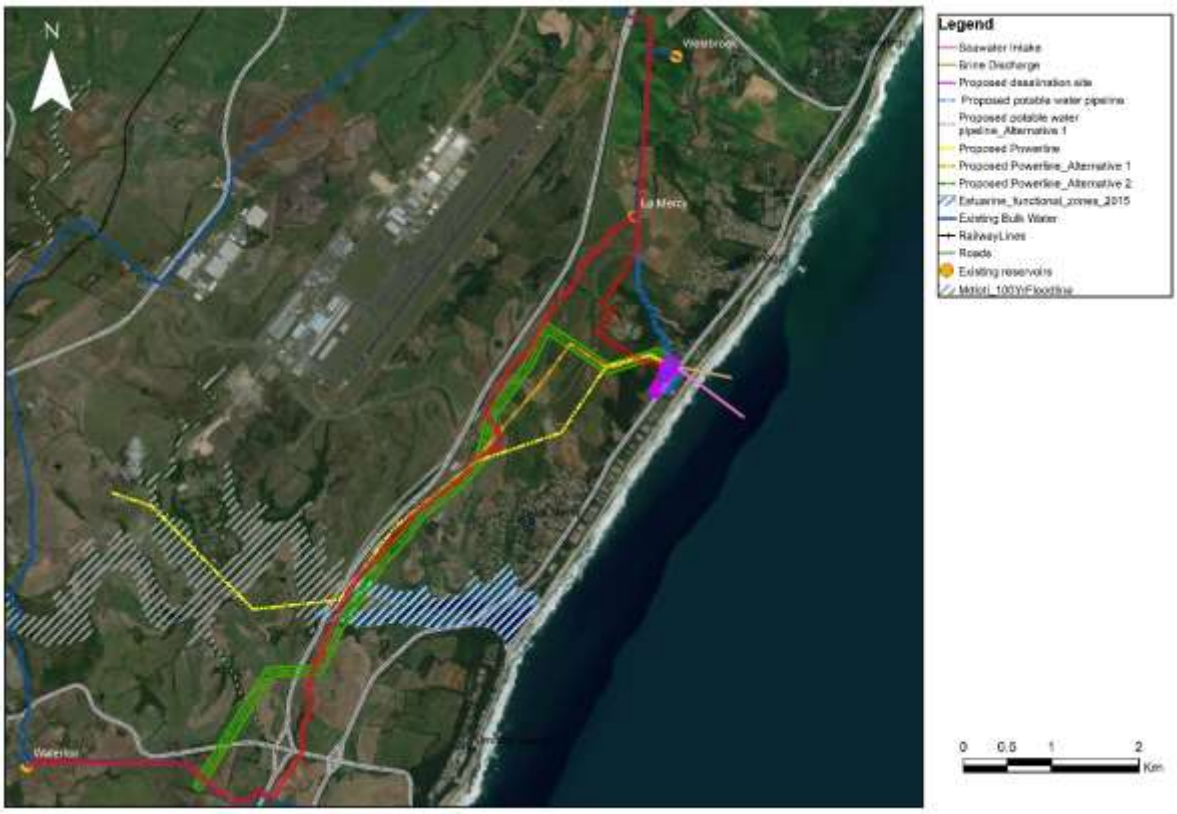

Figure 7.2: Tongaat desalination plant and related infrastructure at regional scale.

7.3 DESCRIPTION OF THE AFFECTED ENVIRONMENT

Mesic environments are those environments that are considered to be neither wetland or estuarine and receive a reasonable level of moisture, derived either from the ground or through precipitation.
The mesic environments associated with the Tongaat SWRO plant can be considered to encompass the following habitat forms:

1. The supra tidal and littoral active zone, including the frontal primary dune and secondary dune forms.
2. Portions of the SWRO desalination plant that lie within a paleo dune slack
3. Portions of caneland and secondary vegetated areas associated with the main feed and return pipes from the reverse osmosis plant as well as the potable water pipelines.
4. Portions of caneland and secondary forest and exotic plantation associated with the powerlines serving the SWRO plant

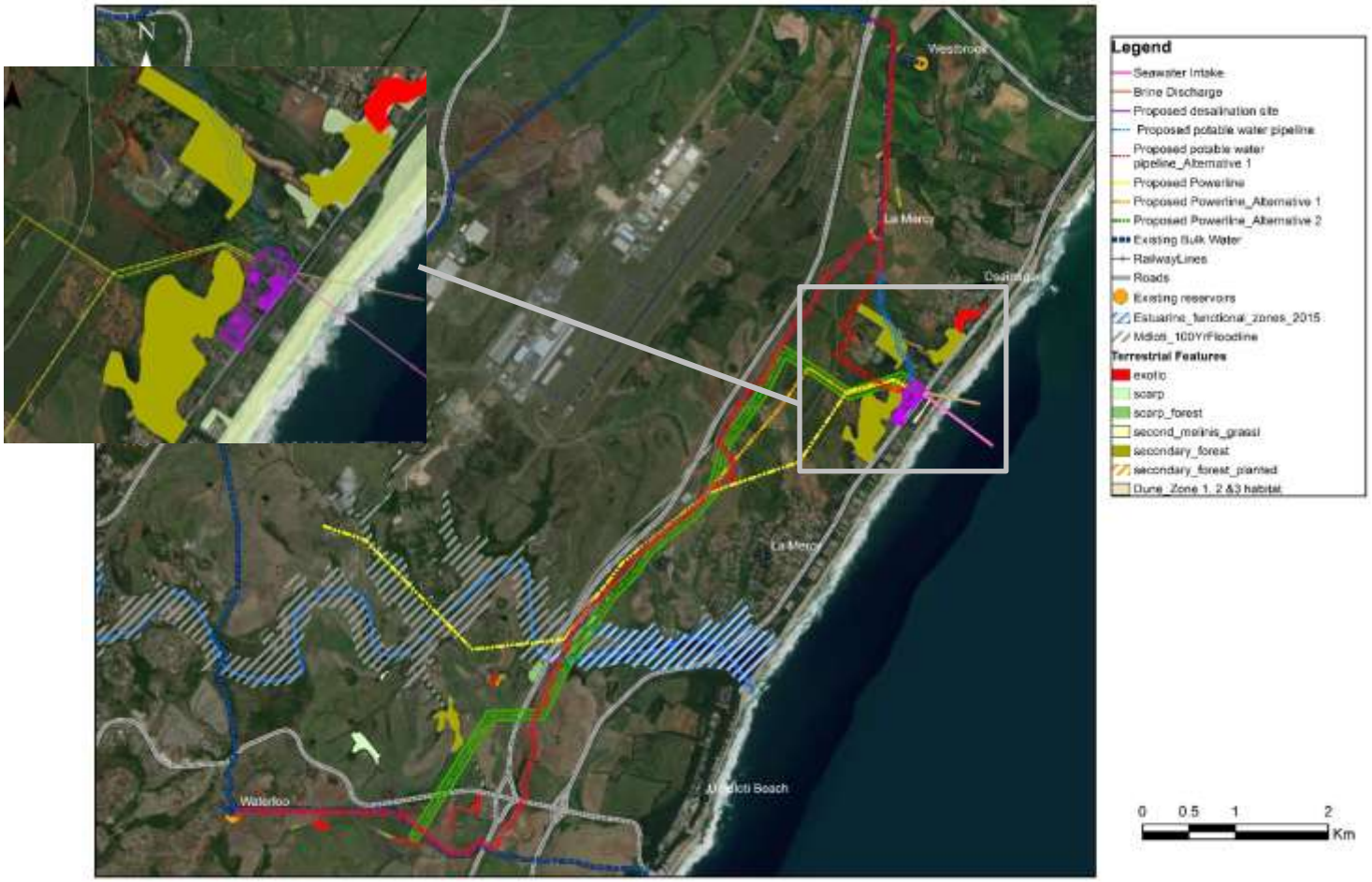

Figure 7.3: Aerial image indicating the proposed SWRO plant and infrastructure and prevailing habitat forms.

Of the above, the coastal component is considered to be of the greatest ecological significance on account of:

- The highly dynamic nature of the coastline in general (Tinley 1980 ; Tsoar 2009 ; Yan 2015)
- The susceptibility of soft coastlines to changes in sediment and vegetation states with concomitant "*knock on effects*" (Yan 2015, Lancaster 2007, Ranwell 1972) that alter beach and dune dynamics at other points of the coastline.
- The vegetated state of the dune cordon, which is shown to encompass the highest botanical diversity across the study site, despite its relatively narrow extent.

The above factors are seen to require specific consideration being afforded to the frontal dune system at Tongaat. Specific consideration is given below to these environments affected by the proposed project.

<u>The Dune Cordon and Beach</u>

The SWRO facility and pump station are proposed to be positioned on an area of land presently under cultivation. From this structure, both the intake and brine discharge pipelines will be tunnelled under the dune and beach form to a point beyond the surf zone (Figure 7.4).

Figure 7.4: Image indicating near shore terrestrial environment and position of the proposed SWRO plant and marine tunnelled pipelines

The dune and beach environments lie upon a shallow sandstone-dolerite geology. Significant subsurface and surface water flow rises from the west and emanates within the beach-dune groundwater lens. Flow is considered extensive and is likely to vary little over time, a situation which has rendered the secondary dune slack to the west of the dunes a most suitable place for the establishment of small scale agricultural enterprises.

The shallow water table and constant supply of water plays a significant role in the stabilization of the dune form. While possibly subject to bouts of erosion on a cyclic basis, as well as significant anthropogenic perturbations which have included the construction of roadways, the borrowing of material for construction purposes and significant urban development, the frontal primary and secondary dune structures appear resilient to such perturbations. A case in point, being the significant erosion experienced along the Kwa Zulu Natal coastline during the 2007 and 2011 erosion events (Smith et al 2011), which saw retreat of up to 20m of beach and dune at certain points along the coastline. While erosion was experienced on the Tongaat beach, in and around the study site, with beach inflation, the dunes have recovered and inflated with obvious stabilization (Figure 7.5).

Figure 7.5: Image indicating recent beach inflation and stabilization along the shore at the subject site.

In further support of the above, comparative consideration was given to aerial imagery of the subject site's dune – beach interface. Georeferenced images of the site were analysed for any significant changes in the stability of the dune form, as well as the nature of the dune form. Such comparative imagery is presented in Figure 7.8 below.

Figure 7.7 indicates the "vegetation line" or seaward extent of "stable dune" in 1983 and in 2009. It is evident that there is little variation between these two dates and a conclusion can be made that the dune system is, in the short to medium term, a stable dune form.

Such stability may arise from a number of factors, including the nature of the prevailing winds within the region and the orientation of the coastline. However, it is likely that a number of factors will be at play along this portion of coastline, including the prevailing wind regime, where, from Figure 7.6, it is evident that a multi-modal wind regime is likely to offer significant variation in terms of dune structure and form (Lancaster 2007). The **dominant factor** in terms of the stability of the dune system is however, expected to be the **relatively proximal groundwater lens** evident at site.

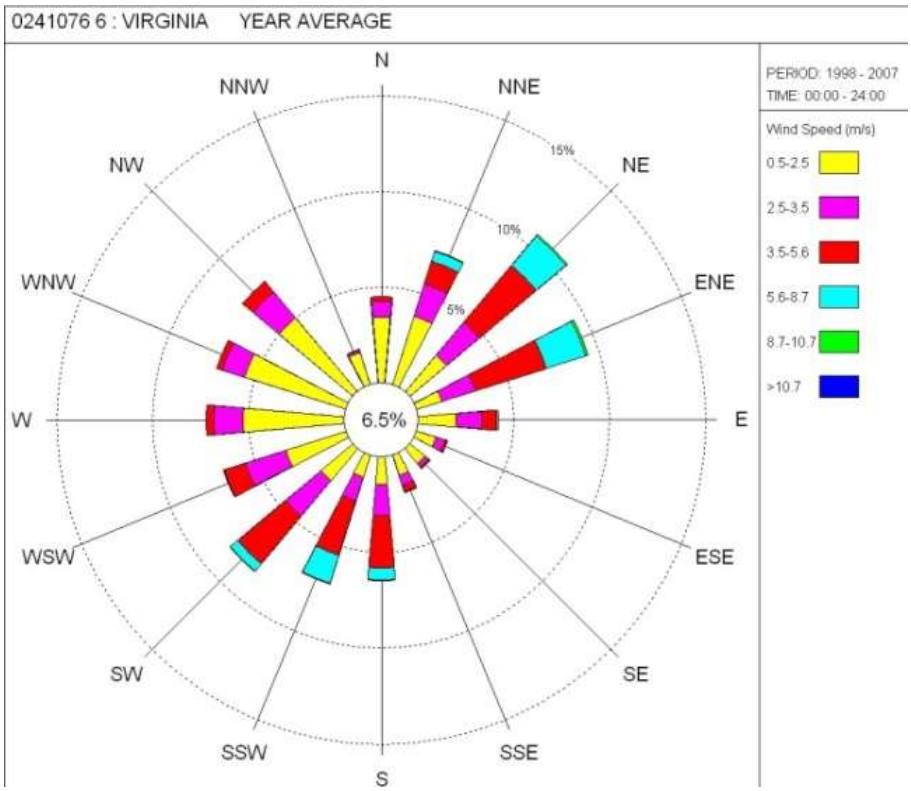

Figure 7.6: Annual Wind Rose 1998 to 2007 for "Virginia Airport Weather Station" indicating general multi modal wind patterns but definitive NE and ENE dominance.

Figure 7.7: Comparative imagery of site in 1983 and 2012, showing little variation in dune cordon

Further consideration of the eThekweni Municipality's sea level rise / coastal vulnerability planning map, as well as the Department of Agriculture and Environmental Affair's Coastal Vulnerability Index (CVI) suggests that a sea level rise of 300mm (approximately 3mm per annum for the next century), will see the loss of most of the frontal dune form. While sea level rise (SLR) for the Durban region is now considered to approximate 1.23 mm/annum (www.noaa /) (which effectively indicates a projected SLR of approximately 123 mm over the next century – just over 30% of the minimum SLR anticipated in the Municipal CVI), the CVI does indicate Bruun Rule aligned impacts on the coastline associated with an accelerated SLR. Under such conditions one may expect dune responses to include reversion to a more mobile state (Tsoar 2009) and landward regression.

Blowout parabolic dunes may also arise under a rising sea level (Yan 2015), with such situations being evident in the northern portions of the La Mercy region, where evidently, groundwater is reduced. *Blow out parabolic dunes* are also evident in the 1983 imagery in Figure 7.7, which suggests that there has been a shift in either resultant drift direction (RDD) or reduced anthropogenic impacts since that time, as such parabolic dunes are significantly reduced in extent. This fact has lessons for management of the dune system, should development proceed along this portion of coastline.

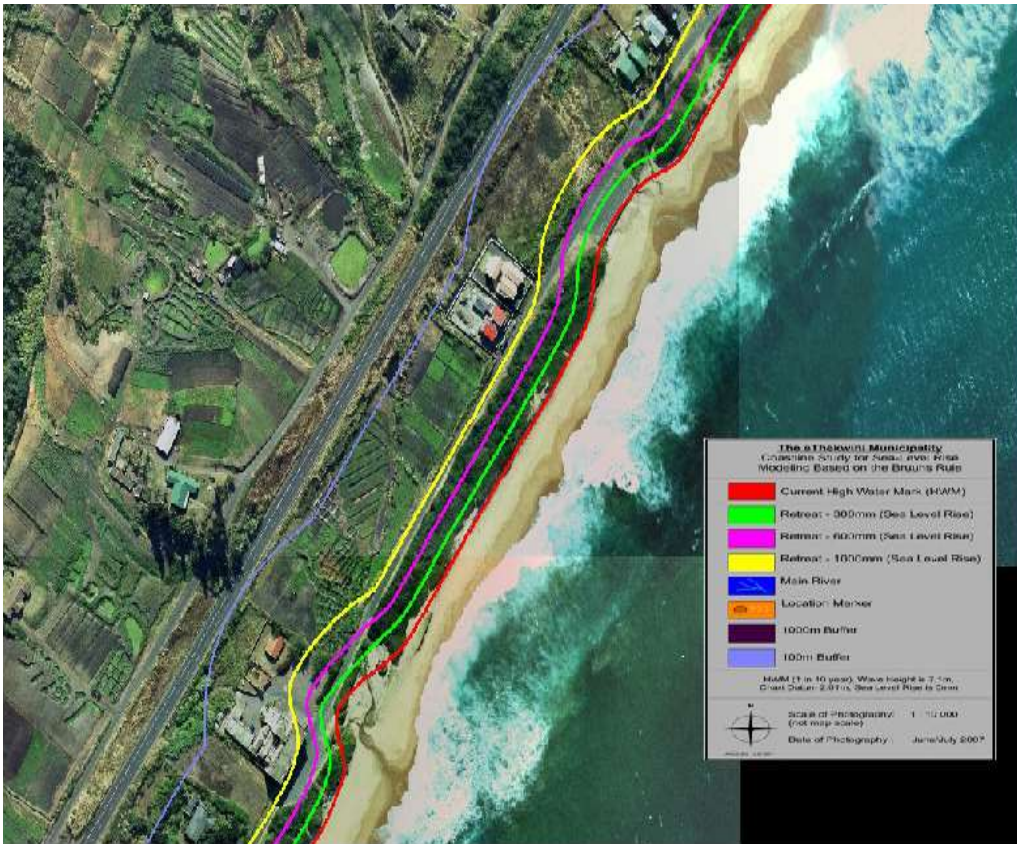

Figure 7.8: Image indicating expected marine inundation under accelerated SLR state as projected by eThekweni Municipality.

The Department of Agriculture and Environmental Affairs has utilized an approach to vulnerability of the coastline to marine storm events by evaluating *inter alia* bathymetry (depth of closure), width of beach, width and state of dunes and other factors. Such information was utilized to class portions of coastline as either *moderate or high risk* areas in respect of their propensity to erode under a marine storm situation. Figure 7.9 below, indicates that the subject site is considered to be a high risk area. Such risk is inherent for infrastructure placed seaward of the primary and secondary dune cordon,

however, as demonstrated above, it is the availability of freshwater that serves to facilitate the recovery of the frontal dune form following erosion periods.

Figure 7.9: Image indicating Coastal Vulnerability Index data for the Tongaat area, establishing the subject site as a "high risk" area.

Despite the above models, the dune and beach environment around the Tongaat site are considered *resilient* and unless there is intention to excavate through the dunes, tunnelling at depths greater than 5m below natural ground level is unlikely to give rise to dune destabilization.

<u>The SWRO Plant</u>

The SWRO plant is proposed to be positioned to the west of the M4, North Coast motorway. The plant, as indicated, lies primarily within highly transformed wetland environments, however some portions of the plant would intrude into mesic portions of the paleo dune landscape.

Figure 7.10 below indicates the nature of the prevailing environment in and around the SWRO. Notable is a scrub – secondary dune form to the south west of the site.

While some portions of the site are considered "wooded" in nature, Figure 7.11 below indicates that such habitat is in fact secondary in nature and is not older than 35 years. Much of the wooded environment to the south west of the SWRO plant comprises of former plantation related scrub, with secondary species, primarily *Albizia adianthifolia* being dominant. Exotic, invasive vegetation, in particular *Solanum mauritianum*, is prevalent in this area.

While of limited ecological significance, the vegetated areas to the west of the site do serve to stabilize steeper slopes evident around the proposed position of the SRWO plant. It is therefore evident that these areas should be maintained, if possible, in order to promote stability of steeper slopes.

Figure 7.10. Image indicating nature of the prevailing environment within the proposed SWRO site.

Figure 7.11: 1983 aerial imagery (left) and comparative 2009 imagery of proposed site indicate the presence of secondary nature of habitat.

Potable water pipelines and electrical supply infrastructure

The SWRO will see the establishment of a pipeline to deliver desalinated water to the La Mercy reservoir and to the Waterloo / uMdloti Reservoir from the Tongaat plant and the construction of a 132kV powerline to provide power to the plant from the regional power grid.

The proposed potable water pipeline to the Waterloo Reservoir as well as the powerline will traverse a number of natural and semi-natural forest communities as well as extensive areas of land presently under sugar cane cultivation. The line routes of this support infrastructure are depicted in Figure 7.12 where areas of natural and semi – natural vegetation communities are also highlighted

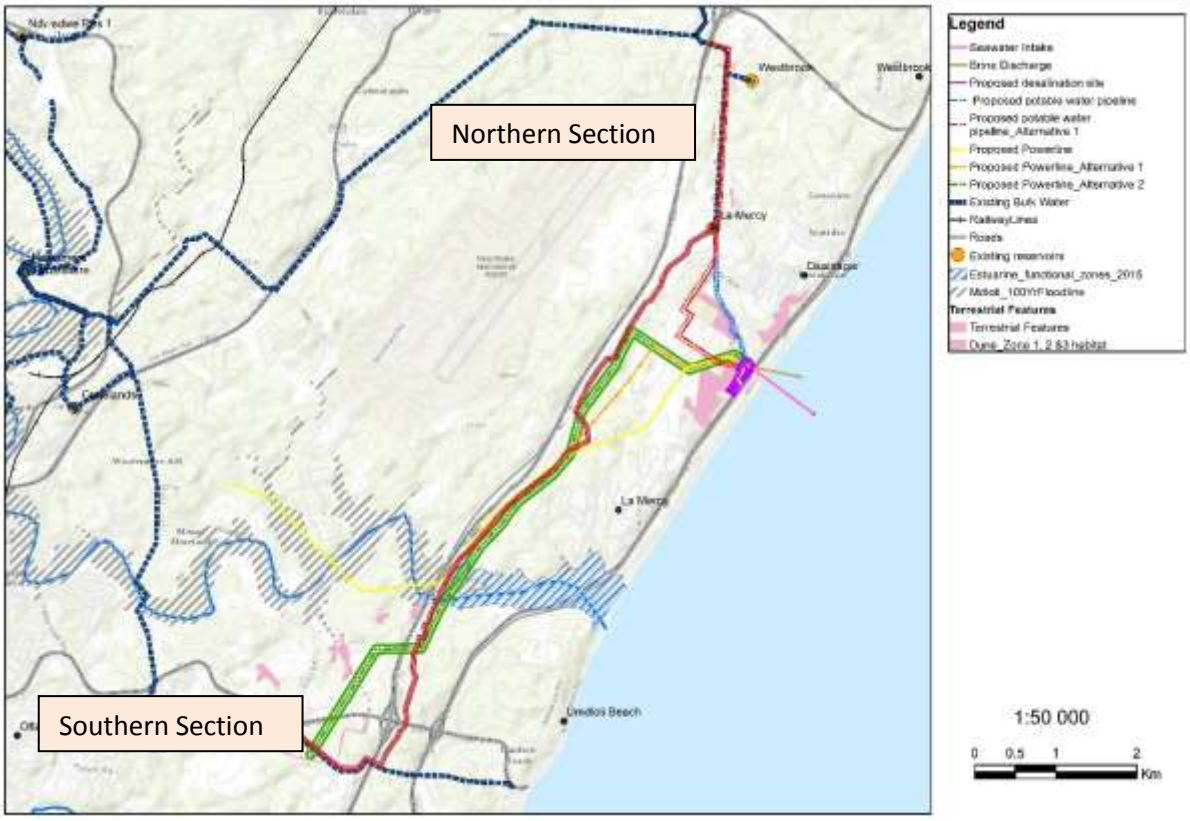

Figure 7.12. Map indicating routes of SWRO support infrastructure in relation to proximal vegetation communities between Tongaat and uMdloti and the designated northern and southern areas.

A quantitative evaluation of the botanical diversity inherent along the pipeline and powerline routes associated with the desalination plant was completed in 2014. A rapid data collection exercise was undertaken where species sampling was implemented at selected sites along the line routes and within the dune community, the SWRO plant and generally across the study area to the Waterloo reservoir. The collected data was subject to specific evaluation, including the use of TWINSPAN (Two Way Indicator Species Analysis), a statistical means of considering the sample sites according to their similarity in vegetative species composition. The sampling sites in the northern and southern components of the study area are shown on Figures 7.13 and 7.14 respectively.

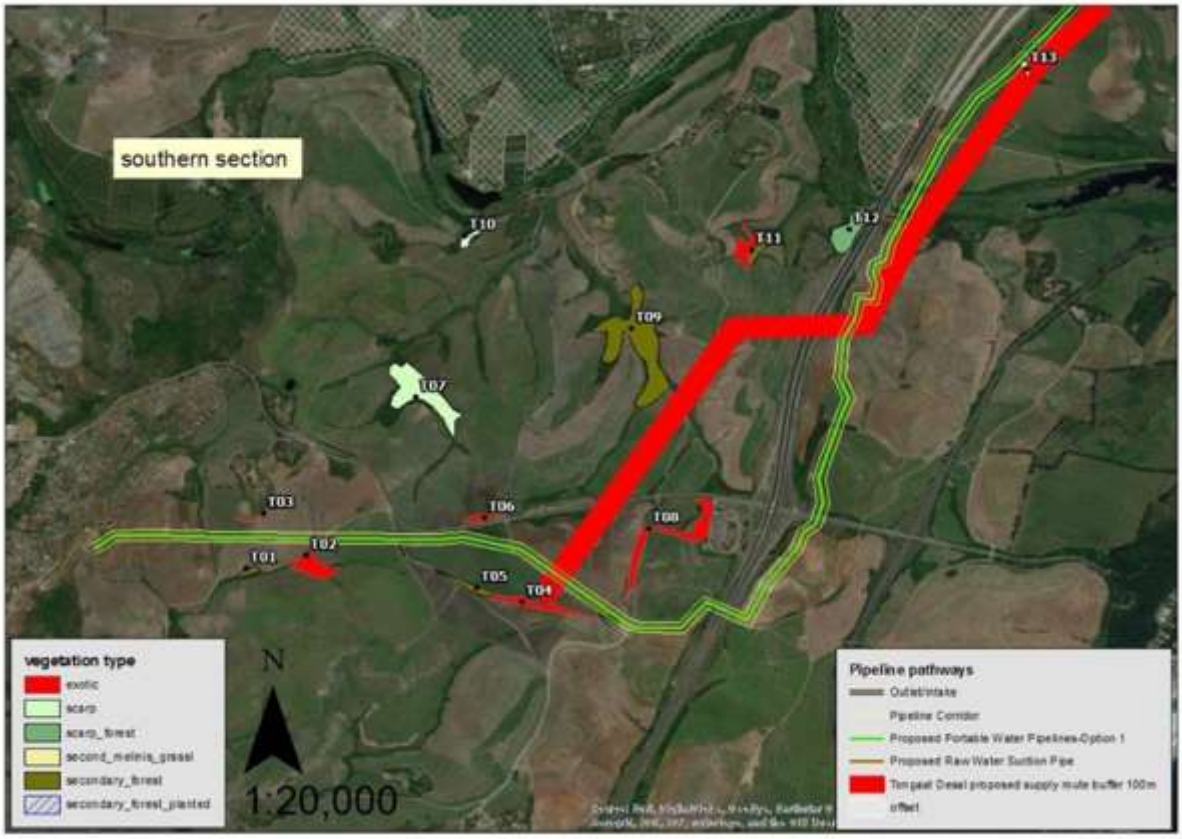

Figure 7.13 Map indicating powerline and water line routes in the southern portion of the study area (uMdloti)

Figure 7.14 Map indicating powerline and water line routes in the northern portion of the study area (Tongaat)

Figure 7.15 indicates a dendrogram summarising the results of the TWINSPAN evaluation for both species associations and site associations.

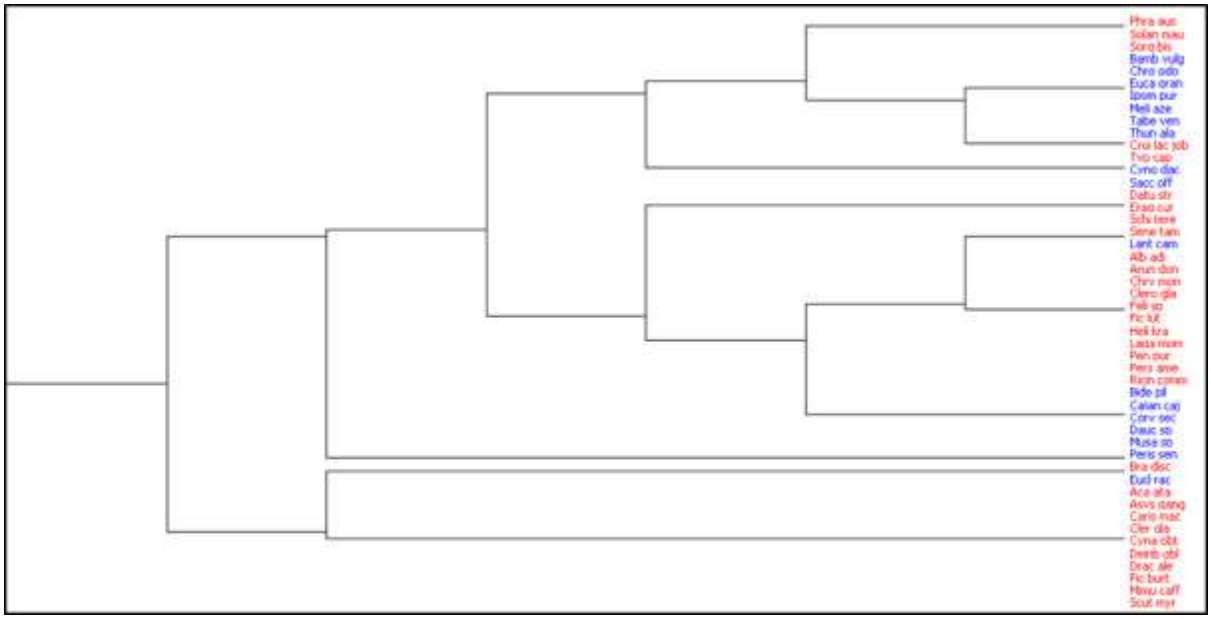

Figure 7.15: TWINSPAN Dendrogram indicating species associations across sample sites at Tongaat

Figure 7.15 presents the evaluated associations between species across all selected sites. Notable results are the identification and correlation of the dune vegetation association with *Acacia ataxacantha*, *Asystasia gangetica* and *Ficus burtt davyii*, showing the unique association of these species within the dune cordon of the study area. Notably *Brachylaena discolor*, has been identified as a singular sample cluster, indicative of its ubiquitous presence across most of the sample sites. *Lantana camara*, an invasive exotic species, is also noted to show a similar trend across the sample sites. The discernment by the analysis of *L camara* (an exotic invasive species common on disturbed lands) and *B discolor* (an indigenous woody species, commonly found as an early seral species) as singular clusters, is indicative of the highly disturbed nature of much of the area under consideration.

Figure 7.16 below indicates the site associations as determined using TWINPSAN. The key species are indicated as being *Asystasia gangetica, Saccarum officinarum* and *Pennisetum purpurea*.

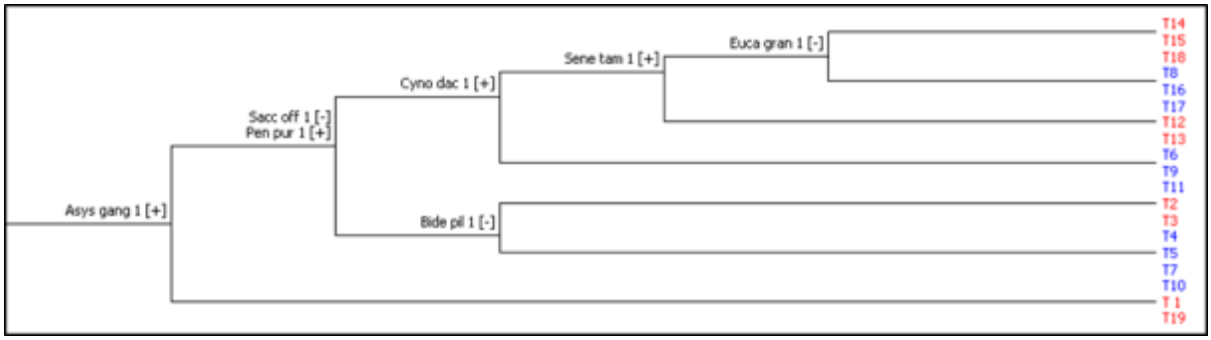

Figure 7.16: TWINSPAN association indicating site associations

Figure 7.16, shows in particular that there is a significant correlation with most site clusters being determined by their placement either landward or seaward of the N2 freeway, a result that would be expected in terms of habitat structure and proximal and distal status from the marine environment.

In furtherance to the above, linear evaluation of data is presented in Figure 7.17 where the presence of exotic and indigenous species were identified at selected points. Figure 7.17 indicates the total number of recorded species at each sample site, as well as the number of exotic species recorded. It is evident that:

- The dune environment holds the highest number of species recorded throughout the study area.
- Site T19 within the cultivated lands to the west of the study site shows the lowest number of recorded species.
- The highest number of exotic species was recorded in and around the SWRO.

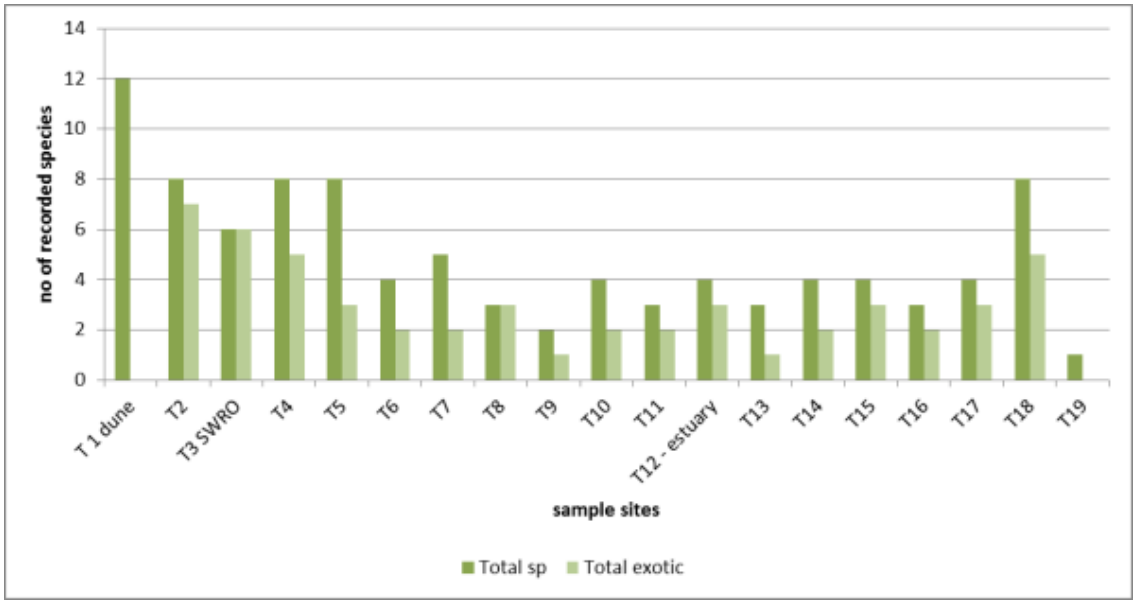

Figure 7.17: Graphic representation of data indicating species numbers (diversity) and exotic species components at sampled sites along route at Tongaat.

These results support the findings of the TWINSPAN evaluation and underscore the significance of the frontal dune habitat, in comparison with the diversity and nature of the balance of the sample sites, where habitat is generally to be considered "depauperated" as a consequence of the cane cultivation practices. Notably, the area traversed at the uMdloti estuary, shows a low diversity and high contribution of exotic species to the habitat in and around the point of traverse by the pipeline under the estuary.

Figure 7.18 below, further highlights the predominance of exotic plant species across the study area, with primarily sugar cane (*S officinarum*) and exotic weeds (*L camara, S mauritianum*) being a significant contributory factors to this result.

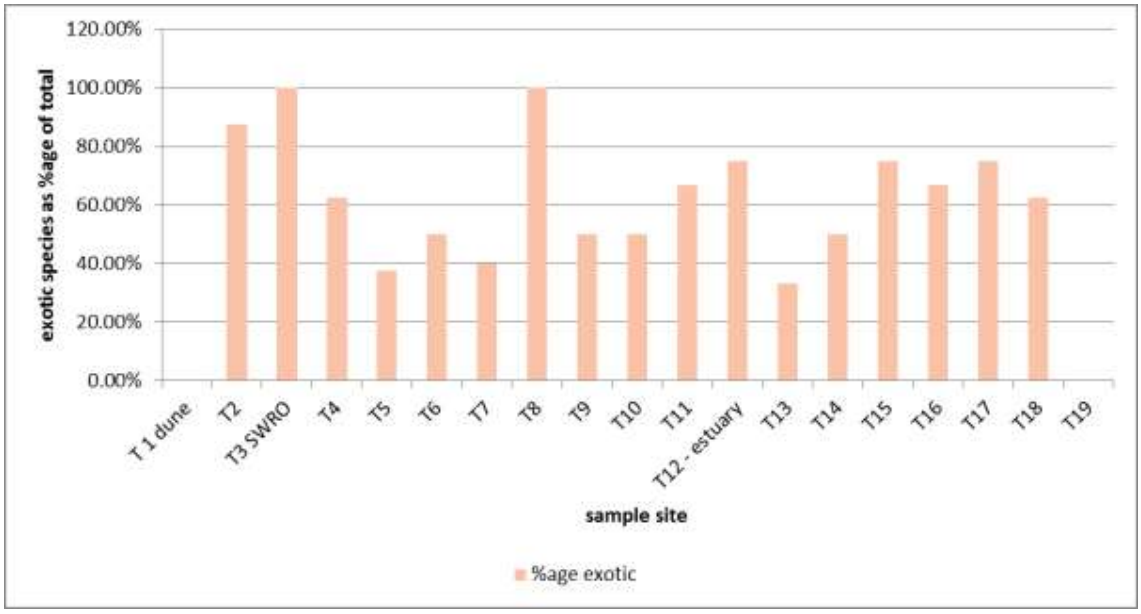

Figure 7.18: Graphic indication of exotic vegetation recorded at sample sites as a percentage of total species recorded.

From the above data, the following statements can be made in respect of the ecology of the Tongaat site:

- **Habitat Status**. The area *in toto* indicates a high degree of transformation and ongoing disturbance.
- The **frontal dune habitat shows the greatest ecological significance** in respect of its value and function, although it is notable that this area is becoming more transgressive with little opportunity for landward expansion. This dune habitat is unlikely to be disturbed by the proposed intake and outfall tunnels, which would be bored through the rock underlying the dune and the beach.
- The following definitive trend can be noted: species diversity declines, moving westward away from the coastline, indicating the predominance of cultivated lands and abandoned, formerly cultivated lands.
- The proposed **site for the SWRO plant shows little ecological significance** from a habitat perspective, however it is notable that **this area or portions thereof, are wetland systems associated with the frontal dune environs and although highly transformed, act as a freshwater reservoir serving the near shore dune** lens. The impacts on freshwater and aquatic ecology associated with the proposed project have been assessed in a separate study (refer to Chapter 8).
- Much of the proposed potable water pipeline and powerline routes are under cultivation and such **habitat structure is compromised** across much of the study area.

Given that much of the land within the study region is of limited habitat value as a consequence of cultivation practices, a more detailed evaluation of the proposed water pipeline and transmission line routes was undertaken in March 2017. This evaluation sought to consider the nature and state of the proximal natural and semi natural habitat forms that are located in close proximity to the line routes.

It is evident that much of the forest habitat evident today was under cultivation as recently as 1968 (Figure 7.19 below). In these instances, the land has been abandoned on account of the reduced viability of farming steeper lands, changes in land ownership and land legal matters, as well as other economic factors. In addition, many areas that constitute "forest", have been subject to invasion by common exotic and invasive species, including *Schinus terebinthifolius* (Brazilian Pepper), *Chromolaena odorata*

(Paraffin weed) and *Lantana camara*. Furthermore, farmers and other land owners have undertaken to plant various exotic and indigenous specimens in order to improve production on certain portions of land or change the nature of the land for other purposes. Typical of the area is the planting of the exotic Beefwood (*Casuarina equisetifolia*) along the coastal dune cordon and at points inland, to act to stabilize shifting sands and as a wind break. *Eucalyptus grandis* and *Bambuza vulgaris* (bamboo) has been planted in areas which have been deemed to be wet or subject to flooding and in many instances, these plants have formed the cornerstone of small forest associations that include a number of indigenous, secondary species – general termed "semi-natural" habitats. In some areas, farmers have established hedgerows of indigenous trees, most commonly *Ficus* spp, in order to demarcate property boundaries and in these instances, these trees have matured into significantly expansive outliers of natural forest, exhibiting closed canopies and emergent seral understory plant communities.

Figure 7.19 View of coastal portion of study area in 1968, left and in 2011, right hand side, indicating the absence of forest in 1968

In addition to the above, it is clear that certain secondary forest forms are of improved significance from an ecological perspective. The importance of secondary forest has historically, been underemphasized. Mc Shea *et al* (2009) have identified secondary forest as being of value in the conservation of biodiversity in particular, with regards to the conservation of small mammals. It follows that a secondary forest within the region should be conserved where:

- The forest form is expansive and covers a significantly large extent of land.
- The forest form has arisen on account of specific landscape factors, in particular within this region, scarp and sandstone outcrops, as well as steeper slopes have given rise to more diverse and species rich habitat forms.
- The forest form performs a particular function, in the region, this being the stabilization of unstable slopes.

The proposed potable water pipeline route is considered to traverse a number of small outliers of natural and semi natural forest forms that are identified in Figures 7.13 and 7.14. Included in these outliers of forested habitat is a large and expansive area of habitat that presently encompasses some 18ha of land immediately west of the SWRO, and may be traversed by the routes taken by the infrastructure. Notably, this forest was absent from the landscape as early as 1968, but has developed to a relatively significant forest system within a period of less than 50 years. As indicated below, this forest form proffers some ecological and environmental services to the region and offers an opportunity to improve forest conservation in the region. Table 7.1 below provides a summary of the finding of each of the proximal forested and natural or semi-natural habitats identified along the routes.

Table 7.1 Description of each of the proximal forested and natural or semi-natural habitats identified along the routes. Colours indicate: High ecological significance Moderate ecological significance and low ecological significance

#	Description of habitat	Significance	Indicative image
T01	Secondary vegetation community comprising primarily of *Ficus natalensis, Clerodendrum glabrum* and *Trema orientalis* on shale cut. Some exotic invasion		
T02	Eucalyptus plantation with other exotic invasive species. *Acacia schweinfurthi* and other early seral species to be noted.		
T03	Exotic and indigenous planting around homestead		
T04	Eucalyptus hedgerow with some secondary indigenous species present (*C glabrum*)		
T05	Hedgerow comprising primarily of indigenous trees, including *Euclea natalensis* and *Ficus spp*		

T06	Secondary and planted vegetation. Highly invaded by *S terebinthifolius*		
T07	Scarp and riverine forest with dense canopies, including Acacia spp, *Ficus sp*, *Cussonia sphaerocephala* and related endemic species. Some peripheral invasion of periphery		
T08	*Eucalyptus sp* hedgerow with some secondary indigenous species		
T09	Mixed scarp to riverine forest habitat. Significant exotic invasion and planting of exotic species including *Bambuza sp*.		

T10	Scarp forest. *Acacia nilotica* dominated but with high potential for diverse secondary vegetation "rebound".		
T11	Mix of exotic and invaded riverine habitat.		
T12	Scarp forest and riverine forest habitat. Some exotic planting and invasive species present, however very diverse with C *macowarii* being noted on ledges.		
T13	Emerging grassland environment dominated by *Melinis repens*		
T14	Large tract of secondary forest habitat (up to 18ha in extent). Area subject to intermittent disturbance from farming activities. Forest has formed after the abandonment of agricultural lands (see Figure 22) and is less than 50 years old. Forest shows some diversity and conformity with a continuum of habitat associated with coastal aspect and proximity. *Carissa macrocarpa, Brachylaena discolor, Chrysanthemoides monilifera* may		

	be identified to the east with a gradation to dominance by *Albizia adianthifolia* evident to the west of the association. This forest association provides significant stabilization at points to the steeper dune environment in this area and the friable soils that comprise this dune form.		
T15	Early secondary vegetation with a mix of exotic planted and invasive species. Exotic species comprise primarily of *C equisetifolia* which has been planted for stabilization purposes		
T16	*Albizia adianthifolia* dominated community associated with road cutting		
T17	Planted hedgerow of mature *Ficus lutea* with emergent understorey		
T18	Planted and successional hedgerow of endemic and exotic invasive species		

T 19	Hedgerow of mixed species		
T20	Woody forest community comprising primarily *A adianthifolia* and *B discolor* as the dominant woody species, with the sporadic presence of *Mangifera indica* (Mango) and other sub-tropical fruit trees. This area has, like other forest communities in the area, only recently shown a woody community structure, following abandonment of the site as a former orchard. As such, the forest community in this area can be considered to have a low diversity, extensive exotic weed invasion and possibly only moderate ecological value.		
T21	Cultivated sugar cane with numerous small seasonal wetland systems associated with drainage lines that serve the uMdloti catchment.		

From Table 7.1, it is clear that two points of improved ecological value have been identified, these being T07 and T12, which are considered to be of significance on account of the species composition and / or extent of area occupied by these forest forms. Both sites are considered to be relic scarp or riverine forest types.

Secondary forest is evident at nine (9) of the identified sites with exotic plantation being evident at 6 of the sites. An area of emergent secondary grassland is also evident, although the significance of this particular area may be questionable.

From Figure 7.13 it is clear that the southern route of the pipeline / powerline will not traverse any of the identified vegetated sites with the exception of T13, which is, as indicated above, an emerging grassland of limited significance, but may be considered to have some longer term value, if placed under management.

Figure 7.14 indicates the forest communities in the north of the study area. Of these sites, only T 14 may be considered to be of relative significance and value, on account of its extent and the stabilization that

this forest form proffers on the prevailing topography. Figure 7.20 below indicates the erosion that has arisen within (now abandoned lands) on account of the clearance of this forest.

Figure 7.20. Gulley erosion where forest has been cleared at Site T14

It is clear from the above, that impacts on ecologically significant vegetation communities in the study area, on account of the alternative route alignments of both the powerlines and potable water pipeline can be considered to be of low significance primarily on account of the following:

- Most of the extant habitat associations proximal to the proposed line routes are to be avoided as per the proposed alternative line route (Alternative 2)
- Those areas of forest determined to be relic habitat are avoided by the linear infrastructure supporting the SWRO
- Those areas that are affected by the infrastructure are considered to be secondary or planted forest forms that are generally subject to high levels of exotic invasion and do not constitute large forest habitats, being limited in area.

<u>Metropolitan open space system (DMOSS)</u>

eThekwini Municipality, through its metropolitan open space system (DMOSS), has identified a number of areas within the municipality that should be subject to formal conservation. Figure 7.21 below indicates that the proposed 132 kV powerline (Initial route) is likely to intersect with a number of DMOSS areas as recorded in the eThekweni Geographic Information System data base. The amended powerline route (Alternative 3) and water pipeline route are only anticipated to intersect the DMOSS areas where these cross the estuary/river. The affected DMOSS areas fall within:

a. Riparian and/or wetland systems associated with the uMdloti River

b. Areas set aside for rehabilitation to natural habitat as a consequence of the establishment of the King Shaka airport.

However, from a terrestrial perspective, given the limited ecological significance of these areas in terms of the habitat, the proposed powerline is unlikely to elicit significant loss of habitat.

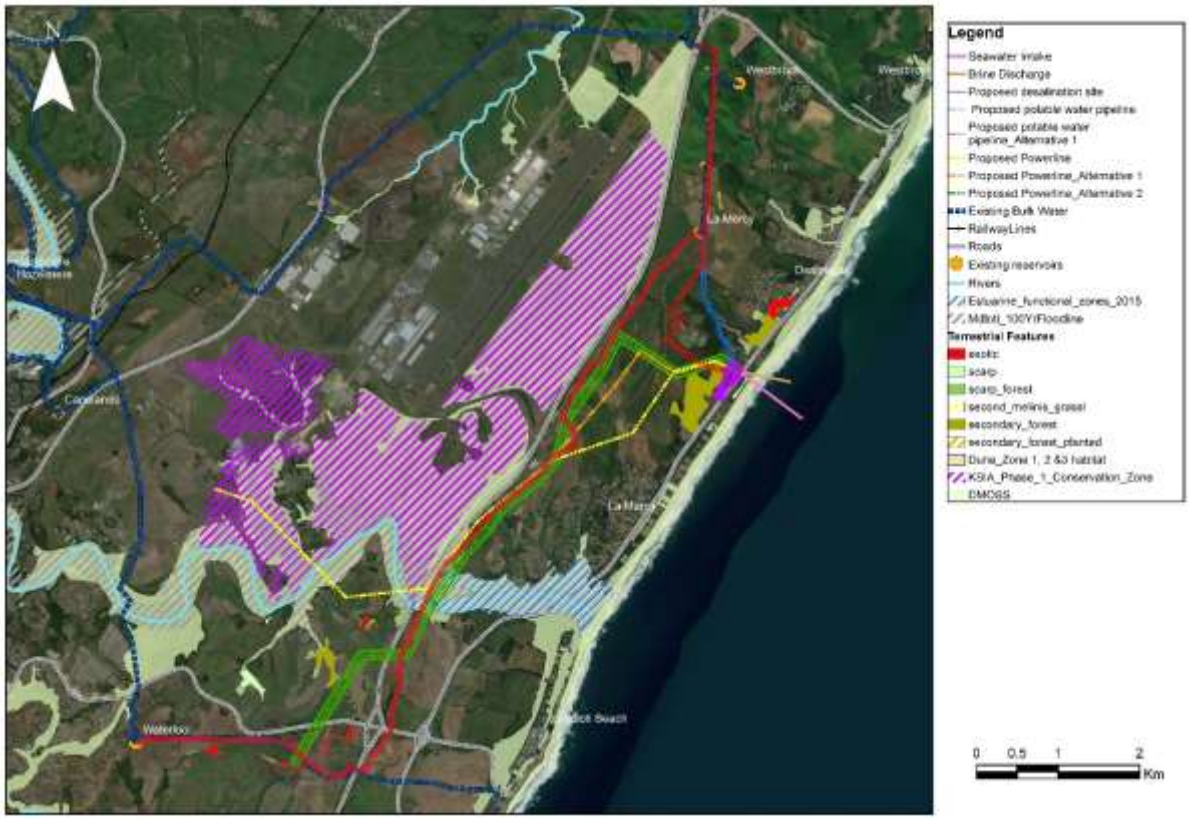

Figure 7.21: Intersection of the proposed powerline routes with DMOSS areas and KSIA Biodiversity Offset.

Fauna

The study area around the Tongaat – uMdloti – King Shaka airport can generally be considered to be impecunious in respect of the prevalence of natural mesic habitat, with the exception of the frontal dune cordon and wetland areas that lie to the west. The extensive transformation of land as a result of initially agricultural activities and more recently urban settlement, has, as outlined above created small, isolated refugia that are not considered suitable for either of the above land uses.

As such, most of the larger faunal species encountered in this region are likely to be associated with secondary habitats or alternatively, associated with the wetland and riparian environments located within the region. Common mammalian species encountered in such environments may include common duiker (*Sylvicapra grimmia*), bushbuck (*Tragelaphus scriptus*) and blue duiker (*Philantomba monticola*), the latter being identified as rare in the South African Red Data Book (Appendix II CITES) and classed as vulnerable in terms of NEMBA (2004) list of Threatened or Protected Species (TOPS). Such species are most likely to be associated with areas of significant forest cover (both plantation and secondary forest), with forays into canelands and even urban gardens. Other smaller mammals regularly encountered in the region include members of the Viverridae, both banded mongoose (*Mungos mungo*) common to drier mesic environs and the water mongoose (*Atilax paludinosus*) associated with wetland environments, as well as the large grey mongoose (*Herpestes ichneumon*). These species are generally common within the study area, being able to adapt to peri-urban

environments, such as the Tongaat – Desainagar region. Smaller rodents including the striped mouse (*Rhabdomys pumilio*) and the multi mammate mouse (*Mastomys natalensis*) are common to the region and are likely to be encountered in both forested, scrub and grassland environments.

Within wetland areas, two mustelids, namely the Cape clawless otter (*Aonyx capensis*) and the striped weasel (*Poecigale albinucha*) are likely to be encountered. The latter mustelid (the smallest African mustellid) is listed as "vulnerable" in terms of the South African RDB listings. *P albinucha* is noted to have a wide distribution although occurring at very low densities, with recent sitings within the north coast region indicating that the species is adapting well to urban environments where the cessation of farming practices has led to more stable wetland habitat and possible increases in prey items (personal observation).

Reptile species encountered within the region are generally considered to include commonly encountered ophidians (snakes) and saurids (lizards). A number of relatively common snake species are encountered in the region, the most prominent being the green mamba (*Dendroaspis angusticeps*) which is often encountered in forested environments proximal to the coastline and the black mamba (*Dendroaspis polylepis*), a species which generally favours the inland canelands and secondary grasslands, west of the N2 freeway. A specimen of *Varanus nilotica* (water monitor) was identified adjacent to the freeway in the form of "road-kill". This reptile, although generally associated with wetland areas, is often encountered in vegetated areas some distance from water. Within wetland and riparian environments the most commonly encountered terrapin *Pelomedusa subrufa*, has been observed at a number of points within the uMdloti catchment and is likely to be encountered within the study site where lacustrine environments are present.

Anuran (frog) populations within the study area are primarily confined to wetland habitats associated with the uMdloti River, as well as wetlands around the Mount Moreland region. Some anurans may however be found in mesic environments within the study area, including the bush squeaker (*Arthroleptis wahlbergii*) and to a lesser extent, the guttural toad (*Amietophrynus gutturalis*). Neither of the above species are of conservation significance, however within wetland environments the critically endangered Pickersgill's reed frog (*Hyperolius pickersgilli*) has been identified within wetlands at Mount Edgcombe and as far north as Richards Bay, but more specifically in and around reed swamp habitat in Mount Moreland and parts of the uMdloti River. Other species of anuran that may be encountered within wetland areas include *H marmoratus* and *Afrixalus fornasinii*. A specimen of *Hemisus guttatus* (the spotted shovel nosed frog) has been identified by the writer in the Maidstone area in 2010 and as such, this species of frog, considered to be "vulnerable" in terms of its conservation status (du Preez et al 2009) may be encountered within the broader region.

EKZN Wildlife's data base of species (Minset) identified 5 faunal species that may be considered to be associated with the region and require particular consideration. These species comprise primarily of the lower taxa (invertebrates) and are listed below in Table 7.1. Comment on their presence or the likelihood of their presence within the study area is also contained within this table.

Table 7.2: MINSET data from EKZN Wildlife indicating conservation worthy species within the Desainagar region

Species	Taxa	Habitat requirement	Comment and threat from development
Edouardia conulus	Mollusc Conical bark snail	Forest – primarily Zululand	Low likelihood as at southern limit of range and habitat is deficient
Gullela separate	Mollusc.	Primarily highly humic forested areas	Low likelihood on account of transformation of environment
Doratogonis falcatus	Millipede	Narrow distribution in the Tugela valley area	Unlikely presence. Not noted from south of the Tugela valley, a bushveld habitat.
Doratogonis cristulatus	Mollusc	Distribution around Durban	Likely – recorded from Durban gardens. IUCN Red List identifies this species as being of "least concern".
Euonyma lymneaeformis	Mollusc	Mainly Podocarp forest and sometimes grassland	Possible presence in residential gardens. May be present on the SWRO plant site.

Table 7.2 indicates that of the 5 species considered to be of conservation significance that may be encountered in the subject area, *Euonyma lymneaeformis* and *Doratogonis cristulatus* are likely to be present in the subject area. These species, both molluscs and terrestrial snails, are considered in the IUCN Red Data list as being *of least concern*. It is suggested that the presence of these species may be evident within the moist environments around the SWRO plant site.

No avifauna common to the subject site is listed within the NEMBA list of threatened or protected species however, some consideration of the avifauna present should be provided. Notably the uMdloti River has been subject to a number of bird counts, from 1978 (Begg) to 2008 (Demetriades and Forbes). While species numbers and diversity appear to have fluctuated, the uMdloti system is supportive of a relatively high diversity of species with Demetriades and Forbes stating that the system is deserving of a "high significance" rating (Demetriades and Forbes 2008).

The Mount Moreland wetland system (combining wetland systems locally known as "Lake Victoria" and "Froggy Pond"), lies within the uMdloti catchment and comprises of sedge swamp environments spatially linked to the uMdloti River. The system is a noted Important Bird Area (IBA) of Global significance, on account of the presence of large flocks of barn swallow (*Hirundo rustica*) which roost in the vegetation during the summer months. Such populations give rise to the presence of a number of predatory raptors, including the African marsh harrier (*Circus ranivorus*). The use of this area as a roost by an extensive population of *H rustica*, identifies this wetland system as being of ecological significance, however anthropogenic influences and urban sprawl into the north coast region will be having possibly latent, but definite impacts on the ecological function of this system, which are being compounded over time.

It is evident that the proposed powerline will traverse lands within the Mount Moreland wetland system and traverse portion of the uMdloti River, where avian diversity is greatest. Powerlines offer some threat to larger birds, in particular herons and storks that may either directly strike live overhead wires or alternatively be subject to electrocution when alighting from towers. Although not well documented, powerlines may also alter behaviour in certain avian species, allowing for changes in predatory behaviour by certain species, which in turn influences ecological aspects within the region (Tryjanowski et al 2012).

The above information indicates that while transformation of habitat on account of the establishment of the plant in the Tongaat area is unlikely to lead to significant impacts on fauna, a precautionary approach should be implemented in respect of avifauna within the uMdloti River area where powerlines are to be established as well as possible impacts arising from construction on taxa such as the anurans.

7.4 IDENTIFICATION OF KEY ISSUES AND POTENTIAL IMPACTS

7.4.1 Identification of Key issues during the Scoping Phase

The construction phase of the desalination plant at Tongaat is likely to affect the following ecological components:

- In the event of activities undertaken in the vicinity of the dune cordon during the design of the seawater intake and brined discharge tunnels, the frontal dune cordon could be subject to destabilisation. While progradation of the dune is being noted at present, this area is highly vulnerable to coastal erosion. Excavations or any other intrusive activities around this dune cordon and removal of plant material would seriously destabilise this dune;
- The establishment of the desalination plant within a wet dune slack to the west of the dune will require surface and sub-surface drainage to a significant level of engineering. The impact of such drainage and changes in hydrology at this point may have a significant effect on frontal dune structure and function; and
- The desalination plant will require significant earthworks in order to establish a working platform. Such excavation may induce instability in the western paleo dune ridge which may in turn, (or as a result of) may lead to the loss of a moderately significant portion of secondary dune forest and scrub.

The operational phase impacts are considered to include the following:

- Depending on the level of activities undertaken in the vicinity of the dune cordon during the design phase, destabilisation of the dune may arise in the short or long term. This may require the artificial stabilisation of this dune with concomitant "downstream" effects.

Given the above information, the following issues need due consideration in the environmental impact process:

- The nature and structure of the frontal dune cordon. Consideration should be given to cyclic erosion periods and dune / beach response to this harmonic, as well as long terms climate change effects based on historical data for this area;
- The most appropriate method of establishing a pipe system through the dune cordon will need to be identified, given that the geology in this area is shallow, while the dune systems are steep but stabilized by high levels of freshwater inundation;
- Pre-emptive consideration of the impacts of stabilizing the frontal dune and its effects to the northern and southern dune and beach dynamics;
- The nature and structure of the secondary coastal forest forms proximal to the desalination plant should be given due consideration, particularly in respect of their role in stabilization of this land form; and
- A review of the nature and origin of surface waters within the site of the desalination plant should be undertaken to ensure that a thorough understanding of the nature of the hydrological relationship between the frontal dune and more elevated environments is understood.

7.4.2 Key issues identified during public consultation

The following key terrestrial ecological issues have been identified during the public consultation:

- Potential impacts on existing natural/ indigenous coastal and/or dune forest(s) and vegetation. KwaZulu-Natal coastal forests are listed under NEMBA as endangered ecosystems and must receive highest priority for protection, whether in the planning of new conservation areas, or control of development and land use change.
- Destruction of the primary dune during construction.
- Potential infringement of the proposed project on the DMOSS area.
- Potential impacts of the proposed potable water pipelines to La Mercy Reservoir on the forest and associated fauna.
- Impacts of climate change – sea level rise and coastal erosion – on the integrity of the dune system which will be largely destroyed or destabilised within the construction footprint of the linear infrastructure
- Repetitive disruption to the rehabilitated footprint within the frontal dune in the event of maintenance or pipe replacement.
- Potential impact of the proposed project, including proposed powerlines, on fauna (e.g. Blue Duiker, Banded Mongoose, Vervet Monkeys, reptiles and amphibians) and avifauna (over 50 species present).
- Presence of any species of conservation significance such as protected trees in terms of the National Forests Act, 1998 (Act No. 84 of 1998).

7.4.3 Key issues identified during terrestrial specialist investigation

From a mesic ecological perspective the proposed development of a desalination plant is considered to have limited ecological significance on the prevailing habitat forms within the region. The greatest significance associated with the project's implementation is likely to be associated with the frontal and secondary dune cordon, with limited significance being accorded to the balance of the development footprint.

7.4.3.1 The Dune Environment

As indicated above, the dune and beach environment at Tongaat is considered to show the most significance in terms of its eco-geomorphological function. The primary, stable dune, with associated hummock or embryonic dunes and narrow beach are considered stable, despite the propensity for this area to be subject to some significant wave attack during high marine storm events. The SWRO plant at Tongaat is expected to be located landward of the frontal dune cordon. Activities associated with the design phase of the seawater intake and brine discharge tunnels (i.e. topographical survey and core drilling on the beach) would therefore be the only component to directly affect the psammoseral environment. However, indirect impacts may arise on the dune form should injudicious placement of infrastructure occurs. The following key issues were identified:

1. The seawater intake and brine discharge pipelines are planned to be tunnelled under the psammoseral environment, in which case impacts on the dune system are anticipated to be negligible. However, in the event of high impact activities being undertaken on the frontal dune during the design phase, mobilization of the dune form could be expected. The likelihood of re-establishing a stable, vegetated dune in this area is limited, primarily by the propensity for disturbance on dunes in the area to revert to a parabolic system, when disturbance arises.
2. The supratidal beach environment at Tongaat is a thin veneer of sand overlying a sandstone-dolerite geology. It is evident that the **pipelines should be positioned within the stable geology**. Placement of the pipelines within the soft dune and beach environment has the

potential to disrupt littoral drift and hence proximal sediment budgets associated with both beach and dune forms.

3. The **wetland environment lying to the west of the dune cordon is a key driver in the stability of the dune system**. This wetland system effectively provides a regular and sustained level of freshwater supply to the dune form, maintaining psammoseral vegetation in a verdant state, while also allowing for the invasion of vegetation onto establishing and embryonic dunes as they arise, following erosion events. It follows that maintenance of the frontal dune cordon in an ecologically functional state is to be determined by the maintenance of surface and sub-surface flow in a seaward direction.

Upon decommissioning of the plant, the tunnels and the remainder of the marine infrastructure are planned to be left in place. This would limit human intrusion during the decommissioning phase and associated impacts on the dune cordon and beach environment are therefore anticipated to be negligible.
Based on the above, the following potential impacts have been assessed as part of the EIA:

Construction Phase

- Potential disturbance of the frontal dune in the event of activities undertaken on the frontal dune during the design phase (i.e. topographical survey and core drilling on the beach), would lead to the destabilisation of the present stable state of the dune and the likely establishment of a parabolic blow out dune.
- Disturbance of the supra-tidal beach environment due to surveys carried out on the beach during the design phase, may lead to variations in beach sediment dynamics.
- The redirecting of surface and subsurface flow on account of the establishment of stormwater and drainage systems in and around the proposed SWRO plant is likely to affect the state of the frontal dune through its impact on *soil- plant* water relations and the possible drying and loss of stability in this dune system as the psammoseral environment changes.
- Traffic, if any, across the dune face at the present access to the beach may see small changes in beach sediment dynamics, with a possible likelihood of increased blow outs in and around the frontal dune form.

Operational Phase

- Provided there is no disturbance to the frontal dune form during construction (i.e. tunnelling of the marine pipelines) and limitation on human intrusion into the dune cordon and onto the supra tidal beach environment, the operational phase of the project is unlikely to see significant variation in the dune environment.
- During extreme erosion events, scour of beach and undercutting of dunes may arise, leading to the potential exposure of the marine pipelines if they are not positioned deeper than 5m below natural ground level, or within the prevailing geology.

Cumulative impacts

- The dune systems of the La Mercy – Desainagar area have been subject to significant perturbations ranging from marine storm events to, of recent, urban development in and along the coastline. Such phenomena have resulted in alteration of the dune form, including loss of habitat and the wholesale removal of the dune structure. The proposed development is therefore to be seen as being of minor cumulative significance on the beach – dune environment in the area, primarily on account of the low level of intrusion into the area in question.

7.4.3.2 Other Inland Mesic Areas

The balance of the mesic environments associated with the Tongaat site are considered to be of limited ecological significance, with only limited areas of natural habitat being present within the development footprint and such habitat being shown to be secondary in nature. The evident impacts arising on the mesic environment, landward of the beach and dune system are provided below.

Construction Phase

- Disturbance of secondary forest habitat. Several areas of natural and semi-natural secondary forest habitat have been identified in and around the SWRO plant and in the vicinity of the proposed powerline and the potable water pipeline that is to be positioned in a north westerly direction leading from the SWRO plant (Figures 7.19 and &.22). It is evident that while such habitat is of limited ecological significance, these forest communities, particularly in the community to the south west of the SWRO, do play a significant role in maintaining surface stability and retarding erosion. With significant cut operations being expected in the vicinity of the proposed SWRO plant, the loss of such habitat may exacerbate slumping and collapse of paleo-dune formation in this vicinity.
- Within cultivated lands along the potable water pipeline and powerline routes, the alteration of edaphics at depth, may result in variation in soil nutrient levels, permeability and related factors.
- The disturbance of surface areas will alter general seral traits (vegetation succession) within sites not presently under cultivation or intended to be under cultivation following construction. As such, these areas may be predisposed to exotic weed invasion.
- Where topography is altered and a more significant grade is established on slopes, erosion may arise.
- Localised fauna may be ousted from refugia or mortalities may arise on account of general land clearance activities, excavation activities, increased traffic and other actions associated with the construction phase.
- Towers and pylons should be placed on level areas to avoid the necessity for cut and fill operations and destabilization of such slopes.

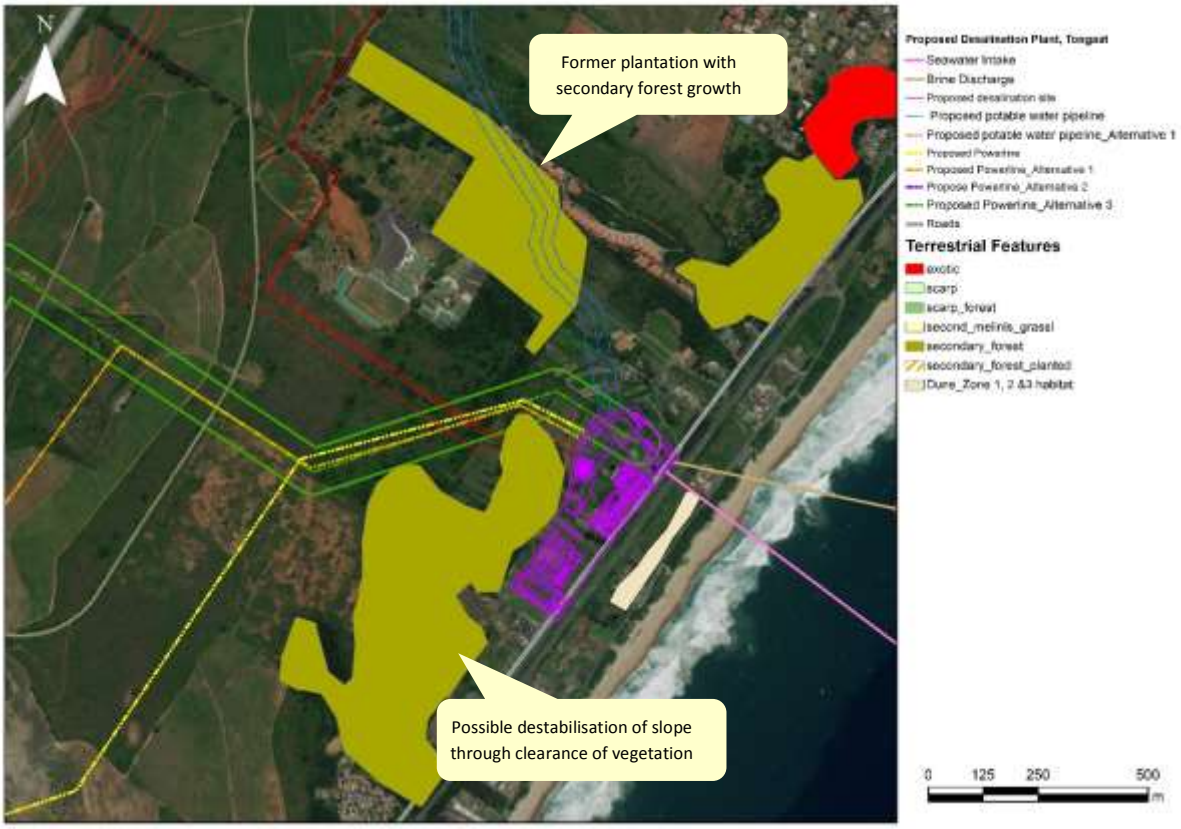

Figure 7.22: Image indicating secondary forest form structures around proposed SWRO site.

Operational Phase

- Much of the proposed pipeline is not anticipated to undergo significant management interventions during the operational phase. As such the affected land is likely to revert to a secondary vegetation form unless returned to cultivation.
- Areas in and around the SWRO plant are likely to be subject to ecological change on account of the increase in anthropogenically driven disturbance associated with the operations of the facility, in particular movement of persons around the facility. Such changes are likely to impact primarily upon existing cultivated lands, which are likely to be abandoned and would give rise to secondary seral growth forms.
- Noise factors arising from the plant may impact fauna, affecting either their energy budgets, reproductive success and long term survival (Radle 2007). Perturbation of fauna due to noise associated with the proposed project have been assessed as part of the Noise Specialist study (refer to Chapter 9).
- Powerlines may affect avian behaviour and give rise to the death or injury of birds which may roost or alight from conductors. Such impacts may in particular be expected in and around the uMdloti River.

Decommissioning Phase

- The removal of the infrastructure associated with the potable water pipeline will give rise to a deficit in edaphic material and would require the import of material to address such deficit. As per the construction and operation phase, a further alteration of the seral processes associated with the surface vegetative cover is likely to arise should the potable water pipelines and SWRO plant be removed / demolished.

Cumulative impacts

- The bulk of the affected mesic environment presently lies under cultivated lands. Such lands are subject to regular and catastrophic disturbance effectively placing them under a dynamic regime which establishes an early seral stage of secondary coastal habitat. The pipelines are unlikely to alter such regimen, while the SWRO plant is expected to alienate a portion of agricultural land from the prevailing land use of agriculture and as such remove such lands from any natural seral or ecological process. As such, cumulative impacts will relate to the loss of unencumbered farmlands to an urban / service infrastructure land use. Refer to Chapter 12 Socio-economic impact assessment for further details.

7.5 PERMIT REQUIREMENTS

The proposed layout and development of the desalination plant is considered to elicit compliance with the following legislation.

7.5.1 Integrated Coastal Management Act (Act 24 of 2008 & Act 36 of 2014) (ICMA)

The ICMA seeks to govern various activities in and around the coastal zone of South Africa. The term "coastal zone" is prescribed in the Act to include the exclusive economic zone, "coastal public property" and "coastal protection zone". The Act is relatively new and is complex in both interpretation and implementation, with an evident inability to integrate coastal science with legislation. A number of regulations are associated with the Act and the Act has recently been amended (Act 36 of 2014), of particular relevance is Section 1 of the Act, which gives consideration to the reclamation of the seashore and coastal property. In particular this Section states that "no organ of state may reclaim land for the development of state infrastructure, unless authorised by the Minister". The following is also pertinent to the proposed desalination plant:

- Outfalls: Requirement for a coastal authorization in terms of Section 69 of the ICMA. The permitting of marine outfalls or discharge of materials into the sea from a terrestrial source requires a discharge permit in terms of Section 69 of the ICMA. The nature of the discharge and other requirements must be considered by the Coastal and Biodiversity Management Sub-Directorate of the KZN Department of Economic Development, Tourism and Environmental Affairs (KZN DEDTEA) prior to the issuing of a permit. This permitting process is undertaken by the KZN DEDTEA

7.5.2 The Conservation of Agricultural Resources Act (43 of 1983)

The control of agricultural land and its transformation to other land uses fall under the jurisdiction of this Act. An application for the release of agricultural land, particularly in respect of the establishment of the SWRO plant, will require the authorization of the Minister. An application should be sent to the Department of Agriculture Forestry and Fisheries.

7.5.3 The National Forest Act (Act 84 of 1998)

This Act serves to manage forests and forest products at a National level. Permitting for the following actions are required:

- **Protected Trees**. Protected trees, (in particular *Mimusops caffra* and *Sideroxylon inerme*), which are listed in terms of the Act, require permit applications if they are to be removed.

Such specimens are to be identified in respect of the final layout of the desalination plant and pipeline/powerline routes, to identify whether there is a need to apply for such permit.

- **Clearance of Natural Forest.** Where "three or more indigenous trees form a contiguous canopy" the legal definition of "forest" applies. If "forest" is to be disturbed then a permit is required prior to such disturbance. In this regard, a permit is likely to be required for construction within/in the vicinity of the desalination plant site and along the proposed pipeline routes. Upon final survey and confirmation of the line, consideration is given to the presence of forest as per the NFA, and a suitable permit application made.

7.5.4 The KZN Provincial Conservation Act (Act 29 of 1992)

This Provincial Act identifies a number of threatened or protected species that require consideration and permitting, before their removal or destruction. Such permit requirements will apply to, in particular, species within the wetland environments. No species proclaimed in the Provincial TOPS have been identified. If a permit is required from the Provincial conservation body, EKZN Wildlife should be contacted (refer to EMP for details).

The study area has been identified as "northern coastal forest" by the Provincial authority and is considered to be critically endangered. However, as demonstrated above, this area is highly transformed with little evidence of primary or indeed secondary habitat being established, with the exception of the frontal dune form and a minor portion of secondary forest in and around the SWRO plant. No "grassland" components were identified within the study area while the forest component is not considered to align with primary "northern coastal forest".

7.5.5 The National Environmental Management Biodiversity Act (Act 10 of 2004)

The NEM Biodiversity Act seeks to safeguard the biodiversity of South Africa, through various provisions including the listing of species and habitats that should be protected. The list of threatened or protected species (TOPS), published in 2004, identifies those species that should be subject to protection within the country. No species identified on site, or with the potential to be present on site in respect of the NEMBA listed species, are contained within this listing.

While the National List of Threatened Ecosystems also identifies "northern coastal grasslands" as being critically endangered, it is evident as per 6.5.4 above, that conservation safeguards in terms of NEMBA do not apply to the study site.

<u>KZN Systematic Conservation Plan</u>
Ezemvelo KZN Wildlife (Biodiversity Conservation Planning Division) developed three conservation plans for the province:

- KZN Marine Systematic Conservation Plan 2012
- KZN Freshwater Systematic Conservation Plan 2007
- KZN Terrestrial Systematic Conservation Plan 2010

The Terrestrial Systematic conservation plan (Minimum Selection surface) published in 2010 identifies Critical Biodiversity areas (CBA1 Mandatory, CBA2 Mandatory, CBA3 Optimal and Biodiversity area) within the entire study area. The process of conservation planning involves extensive mapping of vegetation types, transformation, species data, ecological processes and threats. This information is then used to identify Critical Biodiversity Areas (CBAs) and Critical Ecological Support Areas (CESAs). A CBA is considered a significant area and that needs to be kept in a near natural state to ensure the

continued functioning of ecosystems. A CBA represents the best choice for achieving biodiversity targets. CESAs are not essential for achieving targets, but they play a vital role in the continued functioning of ecosystems.

The construction of the proposed desalination plant would occur in an area which has been identified as CBA1 by the EKZNW Terrestrial Systematic Conservation Plan. Special mitigation measures would therefore have to be considered to safeguard this feature, in which case development could be permitted in the area. In the vicinity of the proposed desalination plant, the potable water pipeline would also cross areas identified as CBA1. This also applies to the proposed powerline route. However, as demonstrated above, this area is highly transformed with little evidence of important species.

7.5.6 Off Road Vehicles Regulations of 1998 (GN 1379)

The control of vehicles within the coastal zone is governed by the ORV regulations of NEMA, published in 2001 GN 1379 December 2004. These regulations serve to govern the operation of vehicles on the beach and dune forms of the coast. A permit will be required in order to place a vehicle on the beach.

7.6 ASSESSMENT OF IMPACTS AND IDENTIFICATION OF MANAGEMENT ACTIONS

From Section 7.4, the following provides some further consideration of the impacts that have been identified and the possible measures that can be taken to address negative impacts or externalities at the design stage of the project, as well as the management interventions that can be instituted. Refer to Chapter 4 of the Draft EIA Report for a description of the methodology adopted for the assessment of impact significance.

A summary of the overall impact significance rating with and without mitigation is given in Table 7.2.

7.6.1 The Coastal Environment

7.6.1.1 Potential impact 1 (Construction Phase)

Disturbance of the frontal dune leading to slumping and aeolian driven transgression, in the event of human activities carried out in that area.

The seawater intake and brine discharge pipelines are planned to be tunnelled under the dunes, i.e. from the surfzone to the pump station. Tunnelling will maintain the integrity of the dune structure landward of the dune face and maintain (in general) subsurface hydrology beneath the frontal and primary dune. The presence of a shallow supratidal beach will require that such tunnelling be undertaken within the rock geology underlying the dune and beach. Limited human activity on the coastal environment is planned to be carried out during topographical surveys and geotechnical studies as part of the design phase. Potential disturbance of the frontal dune would therefore remain local and be of low intensity and short term duration.

As discussed above, excessive low threshold - medium term disturbance (e.g. "trampling") or high level-short term disturbance (e.g. "excavation") on the frontal dune and beach would result in increased mobility of the dune form, manifest in parabolic dune establishment and on shore drift. Such impacts would affect South Beach Rd, immediately to the west of the dune and possibly result in increased mobility and change in morphology of the dune cordon at this point. Given that the seawater intake and

brine discharge pipelines sections seaward of the pump station would be tunnelled, it is not expected to have high levels of disturbance neither excessive low threshold disturbance on the coastal environment.

Given the proposed tunnelling of the marine pipelines and the limited disturbance associated with the proposed topographic surveys and geotechnical investigations (core drilling on the beach at points to be determined. It is anticipated that 1 to 2 boreholes would be drilled on the beach in order to retrieve rock core samples) during the design phase, potential disturbance of the frontal dune and associated indirect impacts such as slumping and aeolian driven transgression are anticipated to be of **low** significance before mitigation.

The following management actions are recommended:

> **Key Management Actions**. Maintaining a narrow working corridor during tunnelling operations. During topographic surveys and geotechnical investigations, vegetation lying seaward of the proposed pump station should be maintained and where necessary enhanced through both cordoning and planting of the area in order to prevent undue destabilisation of the dune frontage. This action in itself has ramifications for the equilibrial state of the dune beach interface, however given the transformed nature of the frontal dune system such actions should be undertaken within the ambit of a dune management protocol.

With the effective implementation of the above key mitigation measures, impacts associated with disturbance to the frontal dune are predicted to remain of **low** significance.

7.6.1.2 Potential impact 2 (Construction Phase)

Disturbance of the supra-tidal beach environment associated with topographical survey and geotechnical investigation during the design phase, leading to variations in beach sediment dynamics.

While disturbance of the supra tidal beach environment is not considered to be of a similar significance to disturbance of the dune form, it remains probable and is assessed to be of low intensity and medium term as these two eco-geomorphological components are inter dependent. It is recommended that disturbance of this environment be limited, where possible. The affected beach area will remain localised and may return to a stable state under a beach inflation state. Given that the pipelines are planned to be tunnelled 10 to 15 m below ground, impacts on coastal processes due to scouring on the beach is improbable.

Without mitigation, the impacts associated with disturbance to the supratidal beach environment during the construction phase are predicted to be of a **low** negative significance.

> **Key Management Actions**. Limit the construction footprint to the minimum required.
> Ensure that within the beach and supratidal beach environment, such pipes are laid at a depth greater than 5m below mean sea level or within the underlying dolerite geology.

With the effective implementation of the above key mitigation measures, impacts associated with disturbance to the supra-tidal beach environment are predicted to remain of **low** significance.

7.6.1.3 Potential impact 3 (Construction Phase)

The redirecting of surface and sub-surface flow due to the construction of the stormwater and drainage systems in and around the SWRO plant is likely to affect the state of the frontal dune.

The stabilised dune cordon lying east of South Beach Road is considered "stable" and "resilient" on account of the regular flow of freshwater at surface and subsurface level from inland environs into the sub surface dune environment. Recharge of the subsurface freshwater lens at this point is a significant driver in maintaining the stability of the dune and its ability to recover from erosion events. While some alteration of the surface hydro-dynamics is evident along this portion of coastline, such alteration has been effectively minor and intermittent across this portion of coastline and there remains a net movement of freshwater into the dune cordon. A significantly large level of change, such as the infrastructure proposed, will have a significant effect (high intensity) on the hydrological regimen, at a localised level on portions of the dune cordon. A proposal of the nature envisaged would require diversion of surface flows as well as significant drainage and redirection of sub surface flow, effectively altering the recharge of the near shore freshwater lens.

> **Key Management Actions**: The maintenance of recharge of the frontal dune cordon will require some consideration of the subsurface geology and geohydrology within the SWRO plant as well as the dune slack, proximal to the frontal dune cordon. Consideration of subsurface flow rates and the position of the freshwater lens at points close to the dune should be given and incorporated into final design. The objective of such evaluation should be to ensure that there is no significant alteration in rates or volumes of inflow of freshwater to the frontal dune cordon. In and around the proposed SWRO plant, stormwater management planning should allow for the distribution of surface flow from the site in a manner akin to that presently evident.
>
> The maintenance of freshwater inflow into the dune cordon should be subject to monitoring through various mechanisms including monitoring of sub surface flow regimen and identification of vegetation senescence in and around the dune environment.

The alteration of subsurface flow has the potential to lead to **high** significance impact on the frontal dune form. However, with the effective implementation of the above key management actions (i.e. suitable planning and management), such impacts can be significantly mitigated, rendering the impact of **low** significance.

7.6.1.4 Potential impact 4 (Construction Phase)

Potential traffic across the dune face at the present access to the beach may result in increased slumping and transgression on the dune face at this point and changes in the beach profile.

Disturbance of dune crusting (induration) as well as trampling of vegetation would facilitate dune instability and increase dune mobility. As a site specific impact associated only with the dune and beach environment, such impacts are expected to be of medium term duration and may be manifest for a reasonable period of time following the design phase, depending on the level of traffic occurring (i.e. destabilised portions of the dune and back beach). However, given the proposed tunnelling of the marine pipelines and the low levels of human traffic expected in the affected beach-dune environment, such impacts are of low probability.

As the affected environment is subject to both regular and intermediate disturbance from anthropogenic and natural factors, as well as catastrophic marine impacts, the significance of impacts arising from additional traffic on the beach and dune form is considered to be **low**.

> **Key Management Actions:** Activities in these environments should be actively minimised through the management of entry to the beach and dune environment for all activities (i.e. cordoning off the area). It is also proposed that only the most essential working corridor be identified and utilised during the design phase.

The impacts associated with expected low levels of traffic and movement of personnel during the design phase are predicted to remain of **low** negative significance with the implementation of mitigation measures.

7.6.2 The Inland Mesic Environments

7.6.2.1 Potential impact 5 (Construction Phase)

Disturbance of secondary forest habitat is expected with the establishment of the SWRO plant (to the south west of the proposed site) and with the establishment of the potable water pipeline and powerlines to the north west of the SWRO plant. The proposed potable water pipeline to the La Mercy Reservoir traverses a forest community that lies within a shallow valley (Figure 7.22). Following correspondence received in August 2016 from an affected landowner, this section was re-routed (Proposed Potable water pipeline - Alternative 1) to avoid a housing development proposed on Erf 36/776 (refer to Chapter 2 Section 2.4.6.3 for further details). The proposed powerline corridor also crosses a small portion of the secondary forest habitats to the west of the proposed desalination plant but avoids traversing a paleo scarp form associated with the south western extent of the site. Some minor areas of natural and semi natural forest form will possibly be subject to disturbance with the establishment of the supporting linear infrastructure. Such disturbance will include possible alteration of slopes adjacent to the SWRO, as well as excavation and stabilisation at this point as well as the clearance of habitat

The impact is likely to be of low intensity on account of the secondary nature of this environment, although any alteration of the landscape around the SWRO will have a long term duration. As demonstrated, these areas are recently afforested under a seral process, following cultivation. Given the above, the disturbance of the secondary forest habitat associated with the construction of the proposed SWRO plant and associated linear infrastructure is anticipated to be of **medium** significance for both the initial and alternative pipeline and powerline routes.

> **Key Management Actions:** Ensure that the final alignment of the proposed powerline avoids the secondary forest habitats located in the vicinity of the desalination plant (T14) and key features along the line route between the SWRO and the uMdloti reservoir (scarp forest forms at T09, T12). With respect to site T14, , it is recommended to incorporate a retaining system into the design in order to maintain present grades encountered around this forested area and to prevent slumping should senescence arise within this vegetation community.
>
> Active replanting under a horticultural regime may be incorporated into the planning and construction phase in order to establish a semi natural system, reflective of typical dune forest systems within the region. It is also recommended to monitor and advise on the status of the secondary forest system in this area.

Additional Management Actions: The "enhancement" of the identified secondary forest system at T14 may be construed or argued to provide an ecological benefit and "offset" in part, in respect of the loss of other vegetation communities in the region. This forest form may be allowed to extend where possible in order to enhance and improve the presence of forest environments in the region.

With the effective implementation of the above recommendations, disturbance of the secondary forest habitat is expected to be of **low** significance, primarily on account of the fact that stabilisation of the affected land arises and that the area maintains a "forest form" in keeping with the present seral processes.

Removal/disturbance of indigenous vegetation during construction activities

The proposed desalination plant site is currently used for agriculture and most of the proposed pipeline and powerline routes run along current infrastructural service lines. The, impacts on the identified forest forms is expected to be minimal although some small secondary and planted communities to the north of the SWRO may be affected by pipelines. Furthermore, with the exception of some secondary forests in the vicinity of the proposed plant, the recommended routes are largely located within cane lands which are of limited conservation significance. The loss of some indigenous species is however, considered probable and this results in an overall **very low** significance for all alternatives.

The proposed re-routing of the powerline to avoid the Lake Victoria is beneficial in respect of the mitigation of impact on the aquatic environment. Notably, the terrestrial environment has been transformed by agricultural activities in this region and offers little ecological significance or importance.

Key Management Actions: Undertake a search and rescue of indigenous species.

Following the installation of the proposed pipelines and powerline, re-vegetate the surface with a fast growing coastal grass such as *S. secundatum*.

With the effective implementation of the above key mitigation measures, the overall significance of this impact remains **very Low**.

7.6.2.2 Potential impact 6 (Construction Phase)

Disturbance of surface areas during construction activities will alter general seral traits (vegetation succession) within sites not presently under cultivation or intended to be under cultivation following construction. As such disturbed areas may be predisposed to exotic weed invasion.

It is understood that exotic weed invasion is driven by disturbance and it is evident within the area that there is a high level of exotic plants prevalent across the affected environment (if not under cultivation), driven primarily by urban and agricultural activities. Accordingly, the development of infrastructure of the nature contemplated has a high probability of giving rise to extensive weed invasion that may have long term impacts, unless managed. The potential intensity of such impacts is considered low as the affected areas are generally isolated and as sound vegetation management can address such impacts, they may be considered highly reversible.

Without mitigation, the potential for exotic weed invasion within disturbed areas is therefore anticipated to be of **low** significance for all components of the proposed project.

Key Management Actions: Following the clearance of vegetation, open and bare areas not identified for the continuance of cultivation should be subject to re-vegetation using a rapid germination species such as a mix of graminoids (*Digitaria spp; Eragrostis spp*) or active vegetation with appropriate herb and woody species.

With the effective implementation of the above management action, the alteration of seral traits associated with disturbance of surface areas is expected to remain of **low** significance.

7.6.2.3 Potential impact 7 (Construction Phase)

Where topography is altered and a more significant grade is established on slopes, erosion may arise.

This impact may be applicable across the development footprint but is considered to be of low significance. On account of the expected advent of re-vegetation and stabilisation of disturbed areas, either through seral process or through a managed intervention. Such impacts must however be considered probable as some areas within the various development footprints will be affected, i.e. areas with slopes >12˚ are likely to be prone to erosion if not suitably stabilized.

Key Management Actions: Where extensive cut and fill operations are evident and it is clear that slopes will be excessive (approximately >18˚), appropriate engineering interventions should be considered to address potential erosion risks.

Where slopes are not subject to redress by engineering interventions, the use of geofabric stabilising materials or re-vegetation of embankments should be set in place.

The impacts associated with increased erosion during the construction phase at the proposed SWRO plant site and along the proposed pipeline and powerline routes (Initial and alternative routes) are predicted to be of a **low** negative significance following the effective implementation of the above mitigation measures.

7.6.2.4 Potential impact 8 (Construction Phase)

During construction, localised fauna may be ousted from refugia and potential mortalities may arise.

Local fauna are evidently associated with some portions of the development footprint. Such fauna will have adapted to the urban – agricultural environment that prevails and have a high probability of being ousted from the secondary forests and cane-lands on and around the proposed SWRO site. Larger fauna, particularly smaller mammals, may reside in the dense refugia that lie within the secondary forest identified and as such, the removal of such refugia may affect their presence within the mesic environments. Wetland environments will generally be affected by the establishment of the powerline serving the facility and as such the footprint of towers, as well as possible access roads to such towers may have minor, temporary impacts on fauna. These impacts are considered to be of short term duration as it will only last for the duration of the construction phase. Due to the limited prevalence of natural refugia, particularly within the mesic environment, it is evident that such impacts are of a low significance for all component of the proposed project (i.e. SWRO site, initial and alternative powerline and potable water pipeline routes).

Key Management Actions: The prudent alignment of pipelines and powerlines to ensure the avoidance of potential faunal refugia including steeper slopes and thickets of vegetation (if and where such associations are identified, no matter how small), may reduce the incidence of mortalities or ousting of species from specific areas.

A preliminary review of sites and pipeline routes prior to construction will allow for the identification of fauna that may be traversing or within particular areas, prior to the commencement of construction. Depending upon the nature of species that may be identified, specific actions can be taken to address any faunal presence that arises within the development footprint.

The impacts associated with disturbance of fauna refugia during the construction phase are predicted to be of a **low** negative significance with the effective implementation of the mitigation measures proposed for all alternatives.

7.6.2.5 Potential impact 9 (Construction Phase)

Within cultivated lands along the potable water pipeline routes and at the location of the powerline towers, the alteration of edaphics at depth, may result in variation in soil nutrient levels, permeability and related factors.

Excavation, infill and compaction of soils associated with the pipeline routes and the powerline towers will result in changes to soil form and state. Such changes are considered to be minor and generally isolated to points of pipeline establishment, as well as being associated with working areas and access roads to the pipelines. These impacts are considered of low intensity and significance.

Key Management Actions: It is recommended to ensure that the infilling of soils aligns with existing soil horizons and that topographic sculpting is implemented to align the surfaces of affected areas with the prevailing surfaces.

The impacts associated with the alteration of edaphics at depth during construction are predicted to be of a **low** negative significance with the effective implementation of the mitigation measures proposed. The impact significance is anticipated to be the same for the initial and the alternative pipeline and powerline routes.

7.6.2.6 Potential impact 10 (Operation Phase)

Most of the pipeline and powerline routes proposed will not be subject to management interventions during the operational phase**. However, where required, such interventions will alter seral processes. It is probable that the affected land will revert to a secondary vegetation form** unless management interventions are not undertaken during the operational phase or if the affected area is returned to cultivation (i.e. existing land use). Most of the affected pipeline and powerline routes will, under normal operating procedures be returned to farmers for continued cane operations, while the balance of the mesic environment is considered to revert to urban states. Those lands not falling under cultivation or "urban development" will be subject to ongoing management by the operator which may include cutting and felling of vegetation that affects line servitudes and avoids the establishment of vegetation that may affect pipeline or powerline operations. Some level of management is therefore important. Without the implementation of management actions, the impact significance rating of undertaking servitude vegetation management is anticipated to be **low** for all alternatives. Some key mana

Key Management Actions: It is recommended to monitor and manage pipeline and powerline servitudes and land under the management of the SWRO operator, for secondary seral growth to facilitate management and maintenance operations, while also allowing for the preservation and enhancement of natural seral processes.

The impacts associated with the disturbance of vegetation during the operational phase are predicted to be of a **low** negative significance with the effective implementation of the mitigation measures proposed.

7.6.2.7 Potential impact 11 (Operations Phase)

Areas in and around the proposed SWRO plant are likely to be subject to ecological change on account of the increase in anthropogenically driven disturbance associated with the operations of the facility.

This would include impacts associated with the operations and in particular, movement of persons around the facilities. Such changes are probable and likely to impact primarily upon existing cultivated lands which are likely to be abandoned and would give rise to secondary seral growth forms. This impact is however expected to be of 'low' intensity and highly reversible with the adoption of the following management measures. Other factors may include electrical light pollution (ELP). This aspect is dealt with as part of the Visual Impact assessment study (refer to Chapter 10)

Without the implementation of mitigation actions, the potential ecological change in areas around the proposed SWRO plant is anticipated to be of **low** significance.

> **Key Management Actions**: Management of lands not under cultivation but falling within the management jurisdiction of the proposed SWRO plant should be subject to generalised land management regimen, including exotic weed control, habitat and vegetation management regimen.

The impacts associated with anthropogenic disturbance as a result of the operation of the proposed SWRO plant are predicted to be of a **low** negative significance with the effective implementation of the key mitigation measures proposed.

7.6.2.8 Potential impact 12 (Operations Phase)

Noise, arising in particular from the reverse osmosis plant may have a negative impact on animal behaviour, breeding and give rise to a stressed population within the region.

While indeterminate, such impacts are to be noted. As mentioned above, the impacts of the proposed project on the surrounding noise sensitive areas and sensitive human receptors is the subject of a separate specialist study (Chapter 9 of this Draft EIA Report). From an ecological perspective the issue of noise arising from the SWRO site in particular is considered to be of a low-medium intensity, on account of the already highly transformed nature of the site. Species that are sensitive to noise and in particular to specific frequencies may be affected by the operation of the SWRO. Such impacts will of course arise for the duration of the lifetime of this project (i.e. long term) and mitigation will be dependent only upon the ability to abate such noise.

The following management actions are recommended:

> **Key Management Actions:** Noise abatement measures should be implemented accordingly. Refer to Chapter 9 Noise specialist study for further details.
>
> **Additional Management Actions:** Possible monitoring for behavioural changes in local fauna could be undertaken.

The impacts of noise on fauna resulting from the operation of the proposed SWRO plant are predicted to be of a **low** negative significance without and with the implementation of key management actions.

7.6.2.9 Potential impact 13 (Operations Phase)

The powerlines serving the facility are likely to pose a potential hazard to, in particular, avian species in and around the uMdloti River valley.

Such structures may give rise to the death or injury of primarily large birds that roost or perch on or near conductors. Bird flight behaviour may also alter as a consequence of the placement of powerlines, particularly where such powerlines traverse flight corridors such as valleys and lie proximal to the wetland areas of Mount Moreland. Located south of Mount Moreland, Lake Victoria is also an important roosting area for Barn Swallows, supporting the largest number of these common migratory birds in South Africa. Given the presence of a relatively high number of larger avian species within and around the uMdloti River valley, the potential impact of the proposed 132kV line on local avian populations is anticipated to be of medium intensity and will be of long term duration. The impact can be mitigated through the use of bird flight diverters, while some adaptation from resident populations to the presence of such structures may arise over time. The impacts on avifauna as a result of the operation of the transmission lines are predicted to be of a **medium** negative significance without mitigation measures. The following management actions are recommended:

> **Key Management Actions:** Bird flight diverters should be positioned where powerlines traverse valleys, ridges or extensive open fields, are proximal to open water or wetland environs and lie adjacent to scarps. Use of non-delta configuration towers, and roosting prevention to be applied on towers, as this is where many of the bird mortalities arise (in particular in the Mdloti River valley area)

The impacts on avifauna as a result of the operation of the transmission lines are predicted to be of a **low** negative significance with the effective implementation of proposed mitigation measures.

It is also recommended to undertake monitoring for behavioural changes and avian mortalities along powerlines. Such monitoring may include *inter alia*, the recording of bird collisions and mortalities identified along powerline routes (where they may occur), as well as consideration of behavioural changes in the murmuration of barn swallows in and around the Mount Moreland area. Presently, monitoring of the impact of the King Shaka Airport on avifauna is undertaken and as such, this monitoring could be expanded to take account of the proposed powerlines.

7.6.2.10 Potential impact 14 (Decommissioning Phase)

The removal of the infrastructure associated with the proposed SWRO plant and pipelines is expected to give rise to the need to import material and "resculpt" the affected land. It is not expected that such import of material and topographic resculpting of the site would be a significant impact. It is however likely that alternative land uses to those prevailing today will be implemented at decommissioning. The impacts associated with the decommissioning of the SWRO site are therefore anticipated to be of short term duration and of **low** negative significance.

The same status can be attributed to the powerlines and potable water pipelines, which upon decommissioning will probably revert to the same land use that is in place today, or alternatively to another form of land use.

Although the decommissioning of infrastructure will arise at a point expected to be in excess of 25 years from establishment, thus making predictions and forecasts of this nature highly uncertain, some mitigation measures are presented below.

> **Key Management Actions**: Management of lands following decommissioning should be undertaken to allow for reversion of land to cultivation, an alternate land use or reversion to a sere, in line with local vegetation dynamics.

The impacts on surface vegetation as a result of the removal of infrastructure during the decommissioning phase are predicted to be of a **low** negative significance without and with the effective implementation of the mitigation measures proposed.

Table 7.3: Impact assessment summary table

#	Impact description	Status	Extent	Duration	Reversibility	Potential Intensity	Probability	Significance (without mitigation)	Mitigation	Significance (with mitigation)	Confidence level
CONSTRUCTION PHASE (Initial and Alternative pipeline and powerline routes)											
Coastal Environment											
1	Disturbance of the frontal dune, leading to slumping and Aeolian driven transgression in the event of human activities carried out in that area (i.e. topographic surveys and geotechnical investigations) (Direct impact). Long term disturbance has significant ramifications for the general stability of the affected area (Indirect impact)	Negative	Local (2)	Long Term (4)	Low reversibility	Medium (4)	Low probability (0.25)	Low (2.5)	Limit the construction footprint to the minimum required. Only use the most essential working corridor. Maintain and enhance vegetation in affected areas, where applicable, through both cordoning and planting of the area in order to prevent undue destabilisation of the dune frontage.	Low	High
2	Disturbance of the supra-tidal beach environment associated with topographical survey and geotechnical investigation during the design phase, leading to variations in beach sediment dynamics. (Direct Impact)	Negative	Local (2)	Long Term (4)	Low reversibility	Medium (4)	Low probability (0.25)	Low (2.5)	Limit the construction footprint to the minimum required. Ensure pipeline is buried at depth greater than 5m below amsl or within the underlying dolerite geology within the beach and supratidal beach environment.	Low	High

#	Impact description	Status	Extent	Duration	Reversibility	Potential Intensity	Probability	Significance (without mitigation)	Mitigation	Significance (with mitigation)	Confidence level
3	The redirecting of surface and sub-surface flow due to the construction of the stormwater and drainage systems in and around the SWRO plant is likely to affect the state of the frontal dune (Direct Impact).	Negative	Local (2)	Long Term (4)	Low reversibility	High (8)	Highly Probable (0.75)	High (10.5)	The maintenance of recharge of the frontal dune cordon will require some consideration of the subsurface geology and geohydrology within the SWRO plant as well as the dune slack, proximal to the frontal dune cordon. Consideration of subsurface flow rates and the position of the freshwater lens at points close to the dune should be given and incorporated into final design. The objective of such evaluation should be to ensure that there is no significant alteration in rates or volumes of inflow of freshwater to the frontal dune cordon. In and around the proposed SWRO plant, stormwater management planning should allow for the distribution of surface flow from the site in a manner akin to that presently evident. The maintenance of freshwater inflow into the dune cordon should be subject to monitoring through various mechanisms including monitoring of sub surface flow regimen and identification of vegetation senescence in and around the dune environment.	Low	High

#	Impact description	Status	Extent	Duration	Reversibility	Potential Intensity	Probability	Significance (without mitigation)	Mitigation	Significance (with mitigation)	Confidence level
4	Increased slumping and transgression on the dune face and changes in the beach profile due to potential traffic across the dune face at the present access to the beach (Direct impact). Disturbance of dune crusting (induration) as well as trampling of vegetation will facilitate dune instability and increase dune mobility (Direct and Indirect Impacts).	Negative	Local (2)	Long Term (4)	Low reversibility	Medium (4)	Low Probability (0.25)	Low (2.5)	Manage pedestrian traffic through dune cordon and collate traffic to stabilised points. Only use the most essential working corridor.	Low	Medium
Other Mesic Environments											
5a	Disturbance of secondary forest habitat and associated potential alteration of slopes, is expected with the establishment of the SWRO plant (to the south west of the proposed site) and with the establishment of the potable water pipeline to the north west of the SWRO plant and potentially the proposed powerline.	Negative	Local (2)	Long Term (4)	Moderate reversibility	Low (1)	Highly probable (0.75)	Medium (5.25)	With respect to the scrub forest and secondary vegetation evident in the south west, it is recommended to incorporate a retaining system into the design in order to maintain present grades encountered around this forested area and to prevent slumping should senescence arise within this vegetation community. Stabilisation of the affected land and maintain a "forest form" in keeping with the present seral processes. Active replanting under a horticultural regime may be incorporated into the planning and construction phase in order to establish a semi natural system, reflective of typical dune forest systems within the region. Ensure that the final alignment of the proposed powerline avoids the secondary forest habitats.	Low	Medium

#	Impact description	Status	Extent	Duration	Reversibility	Potential Intensity	Probability	Significance (without mitigation)	Mitigation	Significance (with mitigation)	Confidence level
									It is also recommended to monitor and advise on the status of the secondary forest system in this area.		
5b	Removal/disturbance of indigenous vegetation during construction activities	Negative	Local (2)	Short Term (2)	Moderate reversibility	Medium-Low (2)	Probable (0.5)	Low (3)	Undertake a search and rescue of indigenous species. Following the installation of the proposed pipelines and powerline, re-vegetate the surface with a fast growing coastal grass such as *S. secundatum*.	Very Low	High
6	Disturbance of surface areas will alter general seral traits (vegetation succession) within sites not presently under cultivation or intended to be under cultivation following construction. As such these areas may be predisposed to exotic weed invasion (Direct and Indirect Impacts).	Negative	Site specific (1)	Medium Term (3)	Highly reversible	Low (1)	Highly Probable (0.75)	Low (3.75)	Following the clearance of vegetation, open and bare areas not identified for the continuance of cultivation should be subject to re-vegetation using a rapid germination species such as a mix of graminoids (*Digitaria spp ; Eragrostis spp*) or active vegetation with appropriate herb and woody species	Low	Medium
7	Where topography is altered and a more significant grade is established on slopes, erosion may arise (Direct Impact)	Negative	Site specific (1)	Short Term (2)	Highly reversible	Low (1)	Probable (0.5)	Low (2)	Where extensive cut and fill operations are evident and it is clear that slopes will be excessive (approximately >18°), appropriate engineering interventions should be considered to address potential erosion risks. Where slopes are not subject to redress by engineering interventions, the use of geofabric stabilising materials or re-vegetation of embankments should be set in place	Low	High

#	Impact description	Status	Extent	Duration	Reversibility	Potential Intensity	Probability	Significance (without mitigation)	Mitigation	Significance (with mitigation)	Confidence level
8	During construction, localised fauna may be ousted from refugia and potential mortalities may arise (Direct and Indirect Impacts)	Negative	Local (2)	Short term (2)	Low reversibility	Medium-Low (2)	Probable (0.5)	Low (3)	The prudent alignment of pipelines and powerlines to ensure the avoidance of potential faunal refugia including steeper slopes and thickets of vegetation. Preliminary review of sites prior to construction to identifty fauna present on site. Depending upon the nature of species that may be identified, specific actions can be taken to address any faunal presence that arises within the development footprint.	Low	Medium
9	Disturbance of general surface environment within cultivated lands along the potable water pipelines and at the location of the powerline towers. Alteration of edaphics at depth may result in variation in soil nutrient levels, permeability and related factors (Direct Impact)	Negative	Site specific (1)	Medium Term (3)	Highly reversible	Low (1)	Highly probable (0.75)	Low (3.75)	Stockpile soil horizons (O, A and B) accordingly during excavation and backfill stockpiled materials in accordance with the prevailing horizons (topographic sculpting).	Low	High
OPERATIONAL PHASE (Initial and Alternative pipeline and powerline routes)											
Other Mesic Environments											
10	Potential for the **pipeline and powerline routes** to revert to secondary vegetation form if management interventions are required (Direct Impact).	Negative	Local (2)	Medium Term (3)	Moderate reversibility	Low (1)	Probable (0.5)	Low (3)	Implement vegetation management regime with exotic weed control measures. It is recommended to monitor and manage pipeline and powerline	Low	Medium

#	Impact description	Status	Extent	Duration	Reversibility	Potential Intensity	Probability	Significance (without mitigation)	Mitigation	Significance (with mitigation)	Confidence level
									servitudes and land under the management of the SWRO operator, for secondary seral growth to facilitate management and maintenance operations, while also allowing for the preservation and enhancement of natural seral processes		
11	Areas in and around the SWRO plant are likely to be subject to ecological change due to the increase in anthropogenically driven disturbance associated with the operations of the facility. Such changes are likely to impact primarily upon existing cultivated lands, which are likely to be abandoned and would give rise to secondary seral growth forms (Direct Impact).	Negative	Site specific (1)	Long Term (4)	Highly reversible	Low (1)	Probable (0.5)	Low (3)	Vegetation management with emphasis on exotic weed control	Low	Medium
12	Noise, arising in particular from the SWRO plant may have a negative impact on animal behaviour, breeding and give rise to a stressed population within the region (Direct and Indirect Impacts).	Negative	Local (2)	Long Term (4)	Low reversibility	Medium-Low (2)	Probable (0.5)	Low (4)	Establishment of noise abatement procedures at the proposed SWRO plant – refer to Noise specialist study	Low	Low
13	The powerlines serving the facility are likely to pose a potential hazard to, in particular, avian species in and around the uMdloti River valley and Lake Victoria (i.e. death or injury of primarily large birds) (Direct Impact).	Negative	Local (2)	Long Term (4)	Moderate reversibility	Medium-Low (4)	Highly Probable (0.75)	Medium (7.56)	Establish bird flight diverters where powerlines traverse valleys or extensive open fields, are proximal to open water or wetland environments and lie adjacent to scarps.	Low	High

#	Impact description	Status	Extent	Duration	Reversibility	Potential Intensity	Probability	Significance (without mitigation)	Mitigation	Significance (with mitigation)	Confidence level
DECOMMISSIONING											
Other Mesic Environments											
20	The removal of the infrastructure associated with the pipeline will give rise to a deficit in edaphic material and would require the import of material to address such deficit. A further alteration of the seral processes associated with the surface vegetative cover is likely to arise should the pipeline and SWRO be removed / demolished. (Direct and Indirect Impacts)	Negative	Site specific (1)	Short Term (2)	Highly reversible	Low (1)	Probable (0.5)	Low (2)	Management of lands following decommissioning should be undertaken to allow for reversion of land to cultivation, an alternate land use or reversion to a sere in line with local vegetation dynamics	Low	Medium

7.7 CONCLUSION AND RECOMMENDATION

The proposed desalination plant at Tongaat is noted to have the bulk of its infrastructure established proximal to the psammosere and beach environment. The proposed SWRO plant is placed within the paleo dune slack, which includes highly transformed wetland systems. Limited natural habitat prevails across the subject site, with the exception of the dune cordon and some communities of secondary dune forest, lying to the west and north of the SWRO plant. Cultivated lands also lie west of the SWRO plant, with urban infrastructure including the national N2 freeway and existing service infrastructure also being prevalent. In general, the primary dune and supratidal beach environment can be considered the most significant mesic ecological environment affected by the desalination plant and its related infrastructure.

The seashore and dune form at Tongaat has however been shown to be "robust" and able to rebound from significant erosion events on the coastline. Over 30 years, the dune form has shown little retreat and has shown improved stability. Such stability has been attributed to the recharge of freshwater from surface and groundwater reserves that lie inland of the dune. In this regard it is predicted that any alteration of the freshwater flow regime near the dune system, will destabilize the frontal dune.

The terrestrial ecological assessment study shows that the proposed desalination plant is anticipated to have low or limited significance impacts on the mesic terrestrial environment. Most impacts can be mitigated through judicious design and planning, as well as management interventions during and post the construction and operational phases of the project. Although leading to similar level of impact significance (i.e. low significance), the proposed potable water pipeline Alternative 1 and the proposed powerline Alternative 2 are recommended. The tunnelling of the marine pipelines under the dune form is likely to maintain a low level of impact associated with the project, while other mitigation measures are related to vegetation management and should be on-going through the lifetime of the project. Given the above, it is evident that the siting of a desalination plant in the manner proposed cannot be precluded on the grounds of impacts on the terrestrial mesic environment.

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