59A Forest Drive
Forest Hills
3610
KwaZulu-Natal
South Africa

Tel: +27 (0) 31 762 2772
Fax: +27 (0) 86 617 8059
Cell: +27 (0) 82 349 7992
E-mail: tep.neilw@futurenet.co.za

Upgrade of the Southern Waste Water Treatment Works: Baseline Biodiversity Assessment

For Royal HaskoningDHV

Tel: +27 31 7195500
SSI House, 6 Payne Street, Pinetown, 3610
PO Box 55, Pinetown, 3600, South Africa

By Dr Neil Wilson

MARCH 2014

Table of Contents

FIGURES:

TABLE:

PLATES:

1. EXECUTIVE SUMMARY

Royal HaskoningDHV appointed The Ecological Partnership to carry out a Biodiversity Assessment in support of the EIA which they are conducting for the upgrade of the Southern Waste Water Treatment Works (SWWTW) in Merewent on the southern side of Durban (Fig. 1).

The Biodiversity Assessment is divided into a Baseline Assessment, which is described in this report and a more detailed assessment, which will be carried out later in the year.

The upgrade involves general, preliminary treatment, primary sedimentation, sludge processing and electrical work activities. The major objective of the whole Biodiversity Assessment is to determine whether the upgrade development in the undeveloped areas of the SWWTW will have a significant negative impact on the biodiversity of these areas.

The methods for the Baseline Biodiversity Assessment involved planning, field and post-field phases:

a) Planning Phase

i) Existing information about the Southern Waste Water Treatment Works (SWWTW) was reviewed.
ii) A GIS study was undertaken to obtain a biophysical overview of the study area.

b) Field & Post-field Phases

i) The SWWTW were visited on 18th February during an organised site visit.
ii) All areas where development is proposed were inspected and the biodiversity was briefly assessed (Fig. 2).
iii) Impacts on the biodiversity were briefly assessed.
iv) Mitigation measures have been recommended.

The footprint of the upgrade development forms the study area for the Biodiversity Assessment. The SWWTW are surrounded by residential and industrial areas (Fig. 3). The northern arm of the canalised Umlaas River forms the eastern boundary of the SWWTW (Fig. 3). The southern arm of the canalised Umlaas River is close to the southern boundary of the SWWTW (Fig. 3). The outfall pipe to the sea passes next to the latter canal (Fig. 3).

The specific areas where the upgrade development will take place are all shown in Figure 2 and the areas where biodiversity maybe affected are shown by waypoints in Figure 3.

The SWWTW are located on the southern side of Durban which has a subtropical climate with hot, humid summers and warm, dry, frost-free winters. This climate has a strong influence on the biodiversity.

Clays and silts of the Harbour Beds underlie the SWWTW area, while dune sands of the Berea Formation underlie the area through which the outfall pipe passes before it reaches the paved section of road near the beach (Fig. 4).

The SWWTW forms part of DMOSS and lies within the 1: 100 year flood-line (Fig. 5). The footprint of the proposed upgrade falls within a Critically Threatened Ecosystem (Fig. 6) and forms part of a Biodiversity Priority Area (Fig. 7).

The footprint of the upgrade development is largely covered by mown lawn together with alien trees, alien invader plants and a few indigenous trees (Plates 1-6). The subtropical climate and the clays, silts and dune sands of the study area have less influence on the biodiversity than the organized, managed and artificial nature of the footprint.

Although the footprint's indigenous biodiversity is very limited, the study area still forms part of a Critically Threatened Ecosystem (Fig. 6) and a Biodiversity Priority Area (Fig. 7), both of which highlight its potential in terms of biodiversity conservation. All the invader plant species mentioned that are also present in areas which will not be upgraded, must be eradicated and should be replaced with indigenous species native to the area to create more of a natural ecosystem with different types of natural habitat. One invader species in particular which is prevalent in the SWWTW, is *Casuarina equisetifolia,* a category 2 plant invader. The SWWTW and the footprint of the upgrade also form part of DMOSS, which emphasizes the importance of the area in terms of open space, especially considering that the area is surrounded by residential and industrial areas (Fig. 5).

The negative impacts on the indigenous biodiversity of the upgrade footprint will be negligible. Several indigenous tree species will be lost. Recommended mitigation would be to plant many more indigenous trees, which are native to the area in undeveloped parts of the SWWTW that will not be upgraded and which will be unlikely to be developed in the future. Further mitigation would be to eradicate all the invader plant species in the SWWTW and replace them with indigenous species, which are native to the area. The rationale is to create more of a natural ecosystem in the SWWTW with different types of natural habitat that will help restore the Critically Threatened Ecosystem (Fig. 6) and contribute effectively to the Biodiversity Priority Area (Fig. 7).

As the tall Monkey Puzzle trees (*Araucaria araucana*) in section N will have to be felled (Fig. 2) and since this species is **Endangered,** a recommended mitigation measure would be to plant an equal number of these trees in an area which is unlikely to be developed in the future, even though this species is not indigenous.

One important positive biodiversity impact of the proposed upgrade is the eradication of alien plant invader species.

2. INTRODUCTION

Royal HaskoningDHV appointed The Ecological Partnership to carry out a Biodiversity Assessment in support of the EIA which they are conducting for the upgrade of the Southern Waste Water Treatment Works (SWWTW) in Merewent on the southern side of Durban (Fig. 1).

The Biodiversity Assessment is divided into a Baseline Assessment, which is described in this report and a more detailed assessment, which will be carried out later in the year.

The upgrade involves the following activities:

a) General

i) Replace the sea outfall pipe above high water level with approximately 70 metres of 1000 ND HDPE pipe onshore. The existing pipeline will be replaced with two 1 metre diameter pipelines.
ii) Upgrade existing pump-stations including the "low-lift" pump-station, which has a capacity of approximately 215 Ml/day under pump discharge.
iii) Construct a second overflow dam before the outfall, with a capacity of 23 Ml.
iv) Construct minor new road-works.
v) Refurbish and upgrade interconnecting pipework on-site.

b) Preliminary Treatment

i) Convert the grit pump to an airlift pump at the inlet works (degritters 5 and 6).
ii) Refurbish and equip the raw sludge pump-station with new pumps.

c) Primary Sedimentation

i) Open up the old channels to the primary settlement tanks and install a side-splitter weir.
ii) Refurbish concrete joints and exposed aggregate on all disused channels.
iii) Refurbish penstocks/side splitter weirs between channels and primary settlement tanks.
iv) Install flow measurement at the primary settlement tanks' splitter boxes.
v) Refurbish/replace bridges for primary settlement tanks.
vi) Replace scum plates for primary settlement tanks.
vii) Remedial concrete work on channels and primary settlement tanks.
viii) Conditional assessment of feed pipes.

a) Sludge Processing (stabilization, dewatering and disposal)

i) Refurbish existing primary digesters, secondary digester, gas holder and thickener.

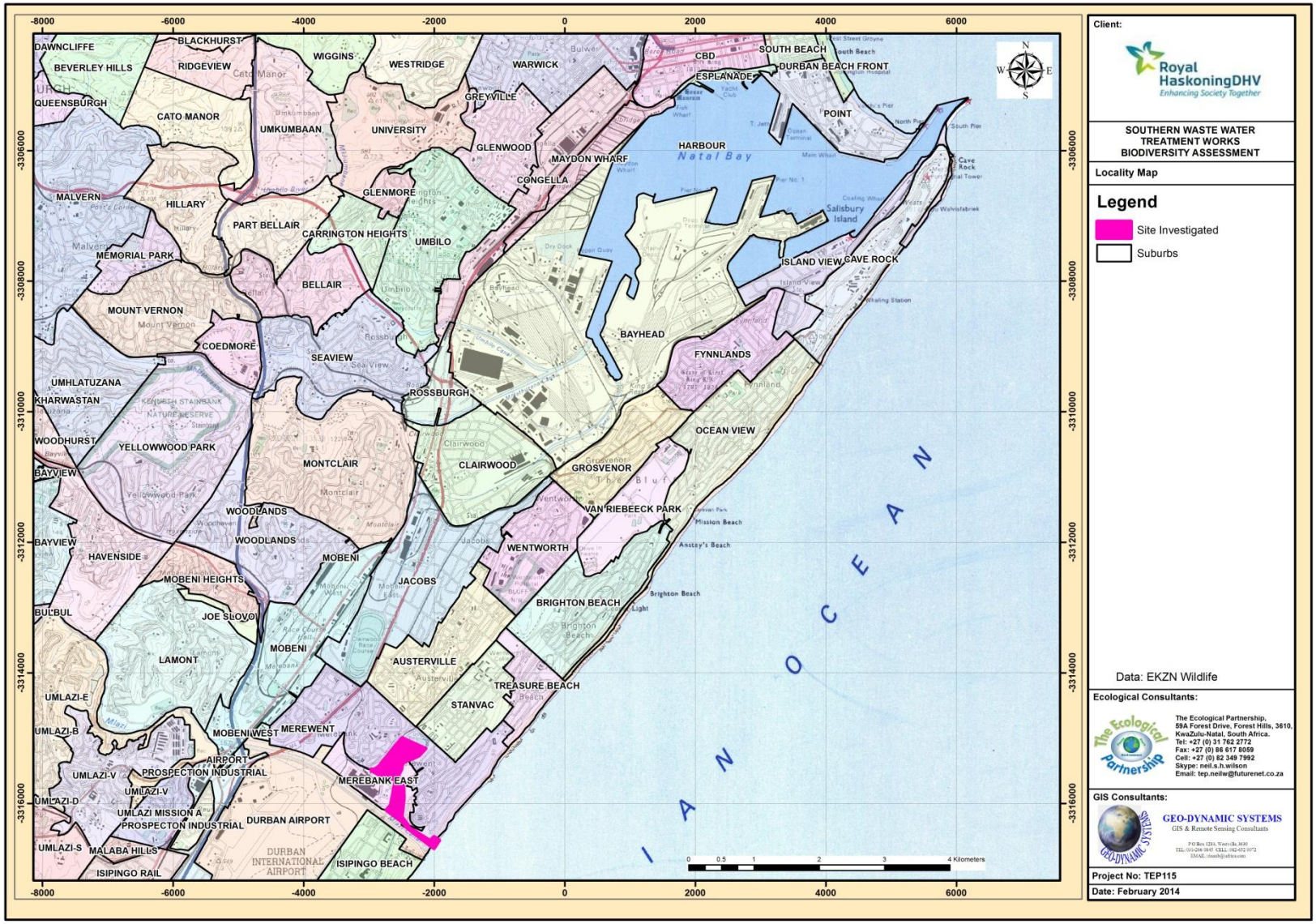

Figure 1: Locality map of the Southern Waste Water Treatment Works (SWWTW) and the outfall pipe to the sea.

ii) Construct two new primary digesters, a new secondary digester and a new thickener.
iii) Establish a new sludge drying facility.
iv) Install an additional primary sludge screen and hydro-cyclones before thickeners.
v) Install new burners, heating pumps and circulation pumps.
vi) Install four new filter belt presses, complete with all dosing equipment and pumps.
vii) Establish supernatant liquor (SNL) return flow pipeline and pump-station.

b) Electrical Work

i) Install a new medium-voltage (MV) cable network.
ii) Upgrade communications on-site.
iii) Install new transformers and switchgear.
iv) Upgrade certain existing motor-control centre (MCC) panels.

The major objective of the whole Biodiversity Assessment is to determine whether the upgrade development in the undeveloped areas of the SWWTW will have a significant negative impact on the indigenous biodiversity of these areas.

3. METHODS

a) Planning Phase

i) Existing information about the Southern Waste Water Treatment Works (SWWTW) was reviewed.
ii) A GIS study was undertaken to obtain a biophysical overview of the study area.

b) Field & Post-field Phases

i) The SWWTW were visited on 18th February during an organised site visit.
ii) All areas where development is proposed were inspected and the biodiversity was briefly assessed (Fig. 2).
iii) Impacts on the biodiversity were briefly assessed.
iv) Mitigation measures have been recommended.

4. RESULTS

a) Study Area

The grounds of the SWWTW together with the outfall pipe to the sea are shown in Figure 3. The SWWTW are surrounded by residential and industrial areas, including the large Engen oil refinery (Fig. 3). The northern arm of the Umlaas River, which has been canalized, forms the eastern boundary of the SWWTW (Fig. 3). The southern arm of the Umlaas River, which has also been canalized, is close to the southern boundary of the SWWTW (Fig. 3). The outfall pipe to the sea passes next to the latter canal (Fig. 3).

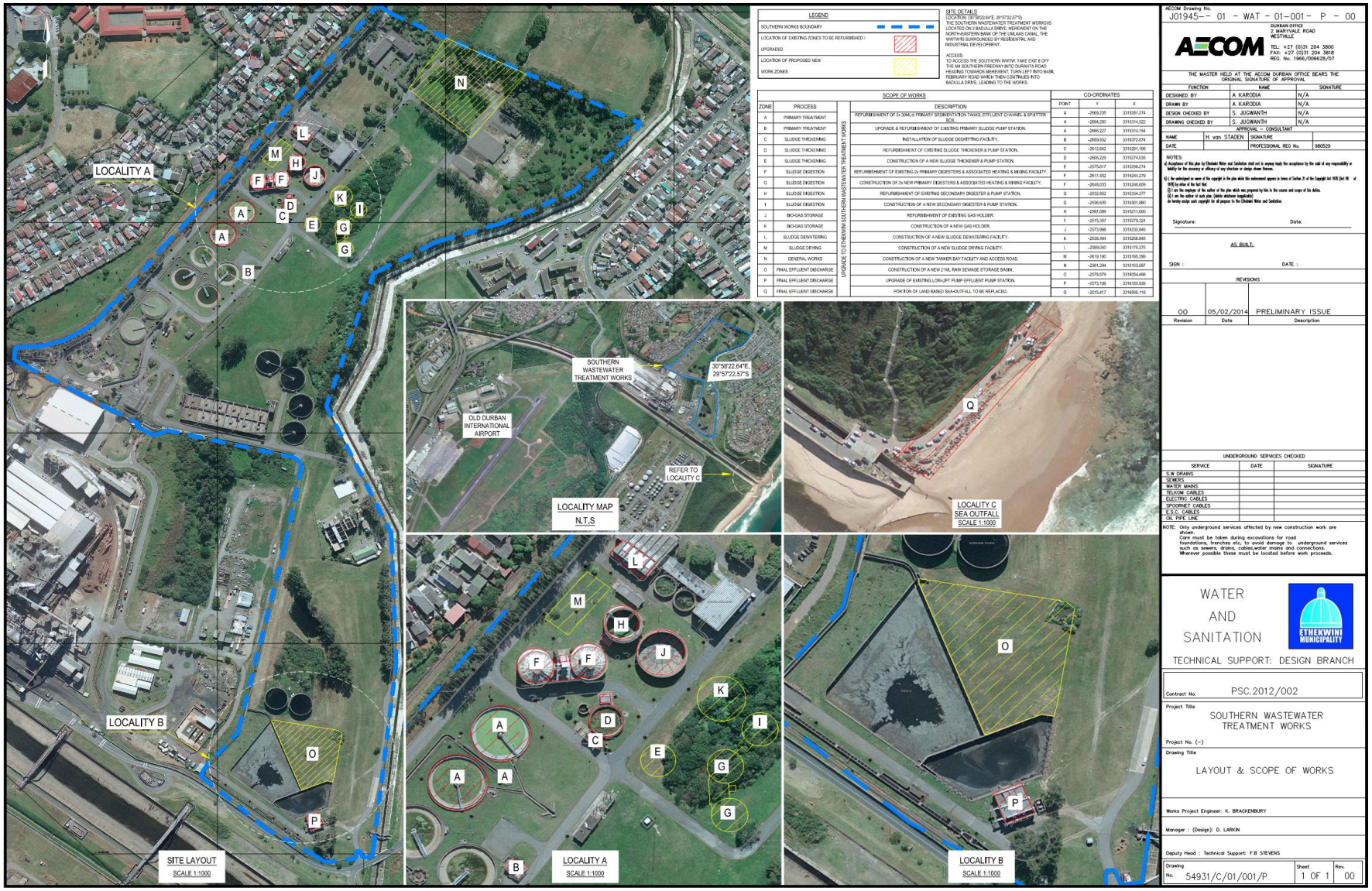

Figure 2: Map showing the layout and scope of works for the proposed upgrade at the SWWTW.

Figure 3: Site map showing the study area at the SWWTW and areas where biodiversity may be affected. The latter areas are marked by waypoints.

The specific areas where the upgrade development will take place are all shown in Figure 2 and the areas where biodiversity maybe affected are shown by waypoints in Figure 3.

b) *Climate of the Study Area*

The SWWTW are located on the southern side of Durban. Durban has a subtropical climate with hot, humid summers and warm, dry, frost-free winters. This climate has a profound influence on the biodiversity. The city has an annual rainfall of 1,009 millimetres. Rain falls predominantly in summer (October – March). Mean rainfall ranges from 28 mm in June to 134 mm in January (Table 1). Average rainy days range from 4.5 in June to 16 in November (Table 1). Summers are sunny, hot and humid during the day, but are often relieved by afternoon or evening thunderstorms. Winters are generally warm and sunny (May – August). Spring is in September, while Autumn is in April. Tropical storms and cyclones occasionally affect Durban during the cyclone season from 15th November to 30th April. The average temperature in summer lies around 28 °C and in winter around 20 °C. Record high temperatures range from 33.8 °C in May to 40 °C in October (Table 1). Mean highs range from 22.6 °C in July to 28 °C in February (Table 1). Daily means range from 16.5 °C in July to 24.3 °C in February (Table 1). Mean lows range from 10.5 °C in July to 21.1 °C in January and February (Table 1). Record lows range from 2.6 °C in July and August to 14 °C in January (Table 1). Humidity ranges from 72% in June and July to 80% in January, February and March (Table 1). Mean monthly sunshine hours range from 166.1 in November to 230.4 in July (Table 1). Sunrise during the summer solstice occurs at 04h45 and sunset at 19h00. During the winter solstice, sunrise is at 06h30 and sunset at 17h20.

Table 1: Climate data for Durban (1961 – 1990; data from the World Meteorological Organization and the National Oceanic and Atmospheric Administration.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Record high °C (°F)	36.2 (97.2)	33.9 (93)	34.8 (94.6)	36.0 (96.8)	33.8 (92.8)	35.7 (96.3)	33.8 (92.8)	35.9 (96.6)	36.9 (98.4)	40.0 (104)	33.5 (92.3)	35.9 (96.6)	40.0 (104)
Average high °C (°F)	27.8 (82)	28.0 (82.4)	27.7 (81.9)	26.1 (79)	24.5 (76.1)	23.0 (73.4)	22.6 (72.7)	22.8 (73)	23.3 (73.9)	24.0 (75.2)	25.2 (77.4)	26.9 (80.4)	25.2 (77.4)
Daily mean °C (°F)	24.1 (75.4)	24.3 (75.7)	23.7 (74.7)	21.6 (70.9)	19.1 (66.4)	16.6 (61.9)	16.5 (61.7)	17.7 (63.9)	19.2 (66.6)	20.1 (68.2)	21.4 (70.5)	23.1 (73.6)	20.6 (69.1)
Average low °C (°F)	21.1 (70)	21.1 (70)	20.3 (68.5)	17.4 (63.3)	13.8 (56.8)	10.6 (51.1)	10.5 (50.9)	12.5 (54.5)	15.3 (59.5)	16.8 (62.2)	18.3 (64.9)	20.0 (68)	16.5 (61.7)
Record low °C (°F)	14.0 (57.2)	13.3 (55.9)	11.6 (52.9)	8.6 (47.5)	4.9 (40.8)	3.5 (38.3)	2.6 (36.7)	2.6 (36.7)	4.5 (40.1)	8.3 (46.9)	10.3 (50.5)	11.8 (53.2)	2.6 (36.7)
Rainfall mm (inches)	134 (5.28)	113 (4.45)	120 (4.72)	73 (2.87)	59 (2.32)	28 (1.1)	39 (1.54)	62 (2.44)	73 (2.87)	98 (3.86)	108 (4.25)	102 (4.02)	1,009 (39.72)
Avg. rainy days (≥ 0.1 mm)	15.2	12.9	12.6	9.2	6.8	4.5	4.9	7.1	11.0	15.1	16.0	15.0	130.3
% humidity	80	80	80	78	76	72	72	75	77	78	79	79	77
Mean monthly sunshine hours	184.0	178.8	201.6	206.4	223.6	224.9	230.4	217.0	173.3	169.4	166.1	189.9	2,365.4

c) Geology of the Study Area

Clays and silts of the Harbour Beds underlie the SWWTW area, while dune sands of the Berea Formation underlie the area through which the outfall pipe passes before it reaches the paved section of road near the beach (Fig. 4).

d) Ecological Importance of the Study Area

The SWWTW forms part of DMOSS and lies within the 1: 100 year flood-line (Fig. 5). The footprint of the proposed upgrade falls within a Critically Threatened Ecosystem (Fig. 6) and forms part of a Biodiversity Priority Area (Fig. 7).

e) Brief Description of Biodiversity that will be Affected by the Upgrade

Starting in the north of the SWWTW in area N (Fig. 2), there is a wetland that borders the boundary fence (Figs. 3 & 8). At the edge of the wetland within the SWWTW is a large, mature *Erythrina caffra* (Coast Coral-tree). A 10 metre buffer is recommended from the edge of the wetland that is necessary to protect the wetland and save the Coast Coral-tree (Fig. 8).

Area N is composed of a mowed grass section and many tall, mature trees (Figs. 2 & 3, Plate 1). Several tall *Casuarina equisetifolia* trees are present. These are category 2 plant invaders and must be removed according to the Conservation of Agricultural Resources Act (CARA), No. 43 of 1983 (as amended).

Tall Monkey Puzzle trees (*Araucaria araucana*) belonging to the ancient genus, *Araucaria*, are also present. The species is native to the Chilean and Argentinean Andes, is classified as **Endangered** on the IUCN Red List and is listed in Appendix 1 of CITES.

The Crimson Bottlebrush (*Callistemon citrinus*), which is native to Australia grows in this area as well, as do exotic fir trees of the genus *Abies*, a Magnolia tree (*Magnolia* sp.), two palms, an aloe like tree and another tree with large simple, shiny leaves and big pods, which need to be identified and the indigenous Tree Fuchsia (*Schotia brachypetala*).

Areas K, I, G and E are largely taken up with mown grass together with an oval area overlapping with areas K and I and projecting south to area G (Fig. 2, Plates 2 & 3). The oval area is infested with alien plant invaders, including the following (Fig. 2): Bug Weed (*Solanum mauritianum*, category 1 invader), Indian Shot (*Canna indica*, category 1 invader), Castor-oil Plant (*Ricinus communis*, category 2 invader), Peanut Butter Cassia (*Senna didymobotrya*, category 3 invader), Mulberry (*Morus alba*, category 3 invader) and Seringa (*Melia azedarach*, category 3 invader). All these invaders must be eradicated. The indigenous Common Reed (*Phragmites australis*) is also present.

An indigenous, tall, mature Natal Fig (*Ficus natalensis*) is growing just north of area K at waypoint 258 (Figs. 2 & 3, Plate 2).

Area M is composed of cut grass together with a Magnolia tree (*Magnolia* sp.) and a palm, which needs to be identified (Fig. 2, Plate 4). Waypoint 259 marks this area (Fig. 3).

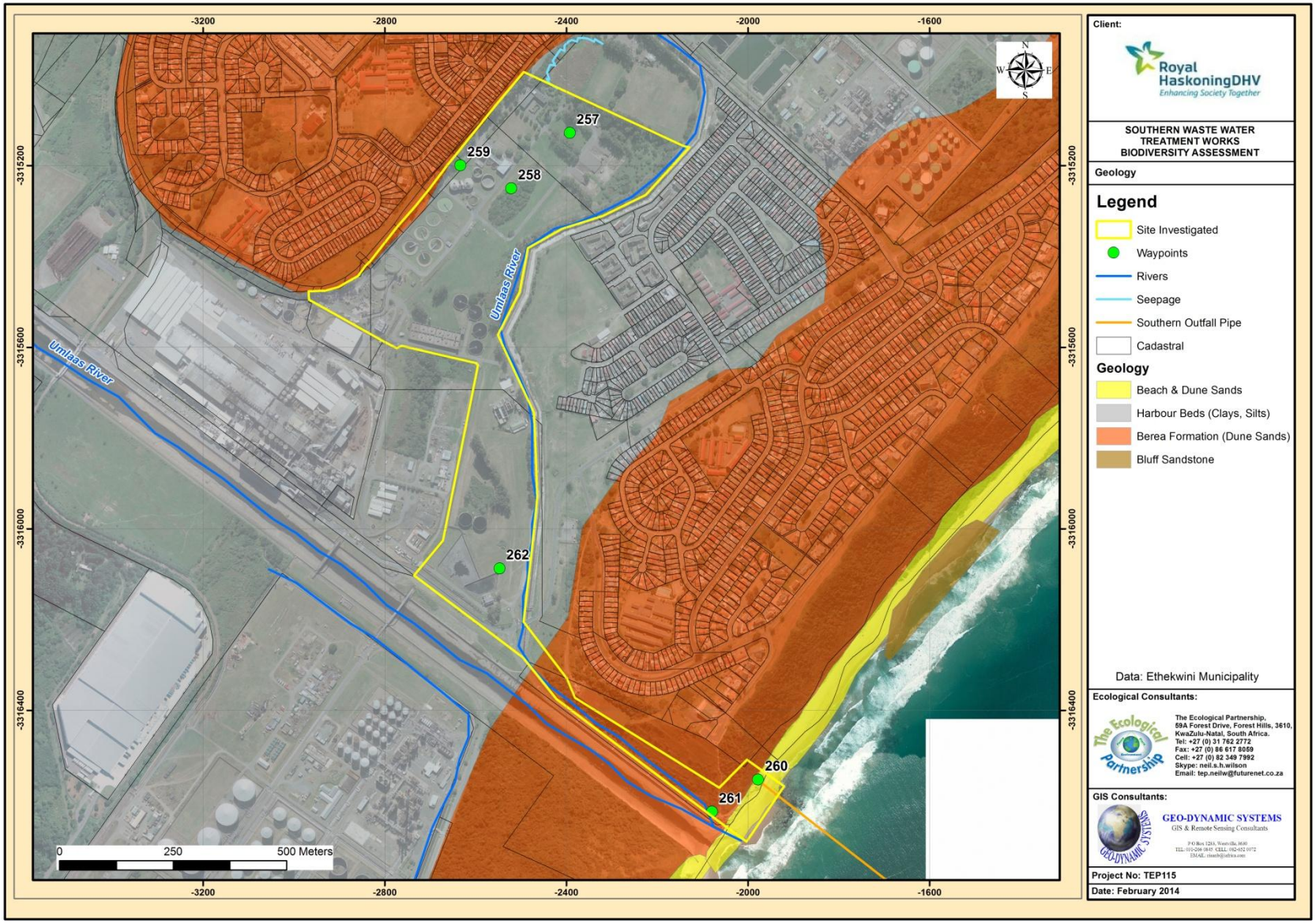

Figure 4: Geology of the study area.

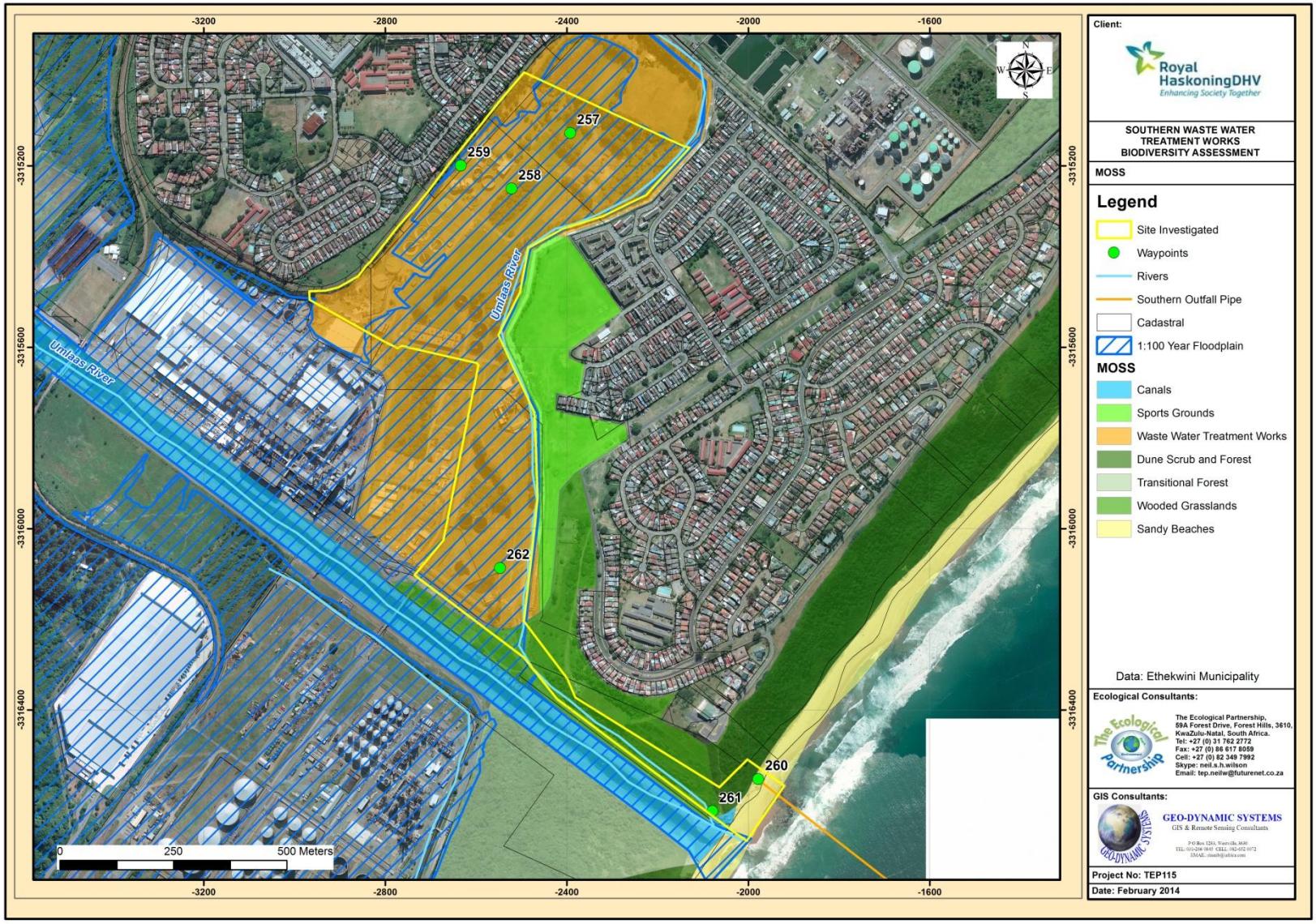

Figure 5: Map showing the **Durban Metropolitan Open Space System (DMOSS)** areas which include the SWWTW and outfall pipe area to the sea.

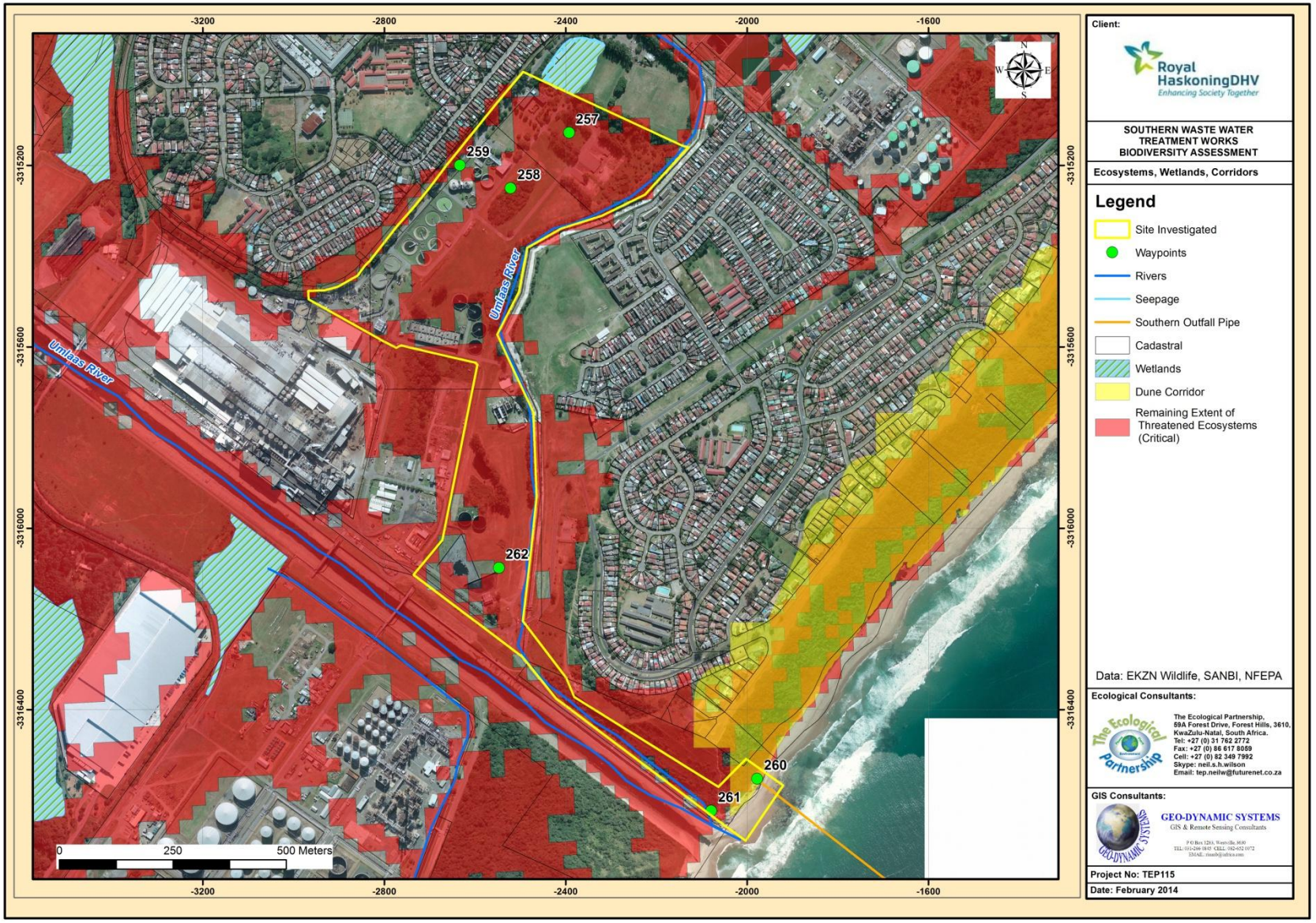

Figure 6: Map showing **Threatened Ecosystems** which include the SWWTW and outfall pipe area to the sea.

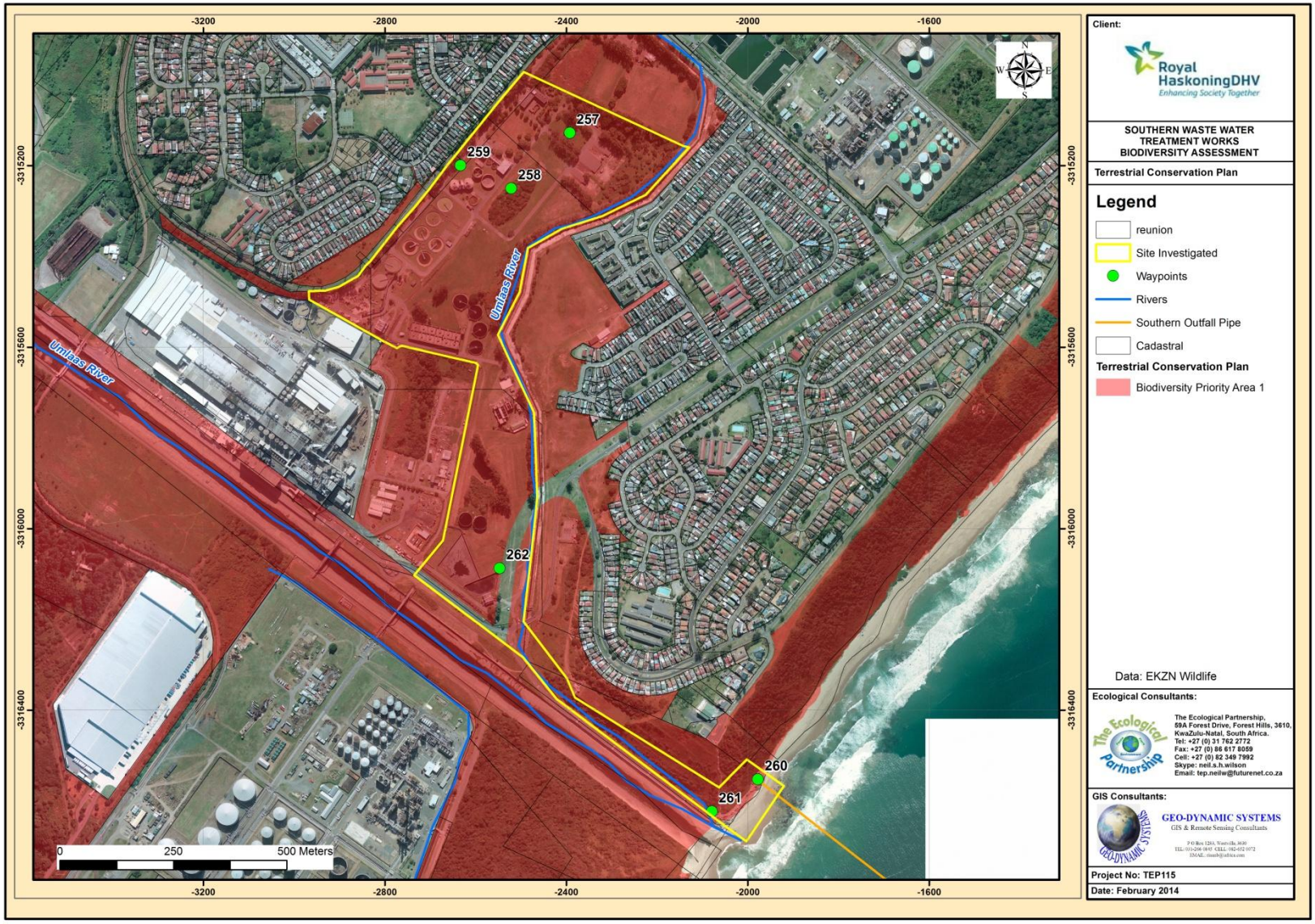

Figure 7: Map showing **Biodiversity Priority Areas** of Ezemvelo KZN Wildlife's Terrestrial Conservation Plan, which includes the SWWTW and outfall pipe area to the sea.

Figure 8: Map showing the wetland which borders area N (Fig. 2) and the recommended 10 metre buffer.

Plate 1: View of area N in the northern part of the SWWTW where development is proposed. As can be seen this area has many trees which will have to be felled.

Plate 2: View of areas K, I, G and E, which are largely covered by mown grass, together with an oval area overlapping with areas K and I and projecting south to area G (Fig. 2). The oval area is infested with alien plant invaders and can be seen in the centre of the plate. The tall Natal Fig can be seen to the left of the oval invader area.

Plate 3: Closer view of the oval area which is dominated by alien plant invaders.

Plate 4: View of the cut grass and Magnolia tree (*Magnolia* sp.) in area M (Fig. 2). Note the invasive tall Casuarina trees in the left of the field of view along the boundary of the SWWTW. These should all be removed and replaced with indigenous trees native to the area.

Area O is largely composed of cut grass, together with an island dominated by plant invaders in the north-eastern corner (Fig. 2, Plate 5). Waypoint 262 marks the south-eastern corner of this area (Fig. 3). The following declared plant invaders are present: Bug Weed (*Solanum mauritianum*, category 1 invader), Indian Shot (*Canna indica*, category 1 invader), Castor-oil Plant (*Ricinus communis*, category 2 invader), Mulberry (*Morus alba*, category 3 invader) and Seringa (*Melia azedarach*, category 3 invader). All these invaders must be eradicated.

A flock of Grey Crowned Crane (*Balearica regulorum*) were feeding in the grassed area just north-east of area O at the time of the site visit. This threatened species is classified as **Vulnerable** (McCann, 2000).

The outfall pipe leaves the SWWTW near area O and passes towards the southern arm of the canalised Umlaas River (Fig. 3). The outfall pipe is buried under a mown strip of grass next to the canal and passes south-eastwards towards the beach (Fig. 3, Plate 6). Before reaching the beach just passed waypoint 261, the outfall pipe veers north-east under road paving to waypoint 260 (Fig. 3). At waypoint 260 the pipeline passes south-eastwards under the beach sand, into the intertidal zone and then out to sea for 4 km (Fig. 3, Plate 7). Only the section of pipeline under the road paving will be upgraded and hence there are no biodiversity issues to mention.

5. DISCUSSION

a) Biodiversity

The footprint of the upgrade development is largely covered by mown lawn with alien trees, alien invader plants and a few indigenous trees also present (Plates 1-6). The subtropical climate and the clays, silts and dune sands of the study area have less of an influence on the biodiversity than the organized, managed and artificial nature of the footprint.

Although the footprint's biodiversity is very limited, the study area still forms part of a Critically Threatened Ecosystem (Fig. 6) and a Biodiversity Priority Area (Fig. 7), both of which highlight its potential in terms of biodiversity conservation. All the invader plant species mentioned in Section 4(e) that are also present in areas which will not be upgraded, must be eradicated and should be replaced with indigenous species native to the area to create more of a natural ecosystem with different types of natural habitat. One invader species in particular which is prevalent in the SWWTW, is *Casuarina equisetifolia*, a category 2 plant invader. The SWWTW and the footprint of the upgrade also form part of DMOSS, which emphasizes the importance of the area in terms of open space, especially considering that the area is surrounded by residential and industrial areas (Fig. 5).

b) Impacts of the Proposed Upgrade & Recommended Mitigation Measures

The negative impacts on indigenous biodiversity will be negligible. Several indigenous tree species will be lost. Recommended mitigation would be to plant many more indigenous trees which are native to the area in undeveloped parts of the SWWTW, which will not be upgraded. Further mitigation would be to eradicate all the invader plant species in the SWWTW and replace them with indigenous species, which are native to the area. The rationale is to create more of a natural ecosystem in the SWWTW

Plate 5: View of area O, which is largely covered by cut grass, together with an island dominated by plant invaders, part of which can just be seen in the top right of the field of view (Fig. 2).

Plate 6: View of the mown strip of grass next to the Umlaas canal where the outfall pipe is buried on its way to the beach and sea (Fig. 3).

Plate 7: The outfall pipe passes from the concrete slab in the foreground under the beach sand, into the intertidal zone and then out to sea for 4 km (Fig. 3).

with different types of natural habitat that will help restore the Critically Threatened Ecosystem (Fig. 6) and contribute effectively to the Biodiversity Priority Area (Fig. 7).

As the tall Monkey Puzzle trees (*Araucaria araucana*) in section N will have to be felled (Fig. 2) and since this species is **Endangered,** a recommended mitigation measure would be to plant an equal number of these trees in an area which is unlikely to be developed in the future, even though this species is not indigenous.

One important positive biodiversity impact of the proposed upgrade is the eradication of alien plant invader species.

6. CONCLUSION

The negative impacts on indigenous biodiversity will be negligible. The footprint of the upgrade development is largely covered by mown lawn with alien trees, alien invader plants and a few indigenous trees also present.

Although the biodiversity of the upgrade footprint is very limited, the study area still forms part of a Critically Threatened Ecosystem and a Biodiversity Priority Area, both of which highlight its potential in terms of biodiversity conservation. All the invader plant species in the SWWTW must be eradicated and should be replaced with indigenous species native to the area to create more of a natural ecosystem with different types of natural habitat. The SWWTW and the footprint of the upgrade also form part of DMOSS, which emphasizes the importance of the area in terms of open space.

Recommended mitigation measures would be to plant many more indigenous trees which are native to the area in undeveloped parts of the SWWTW to replace those lost due to the upgrade. The rationale is to create more of a natural ecosystem that will help restore the Critically Threatened Ecosystem, of which the SWWTW forms a part, and contribute effectively to the Biodiversity Priority Area in Ezemvelo KZN Wildlife's Terrestrial Conservation Plan.

One important positive biodiversity impact of the proposed upgrade is the eradication of alien plant invader species.

7. LITERATURE CITED

McCann, K. 2000. Grey Crowned Crane. In: *The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland*. Barnes, K. N. (ed.). Pp 94. BirdLife South Africa, Johannesburg, South Africa.