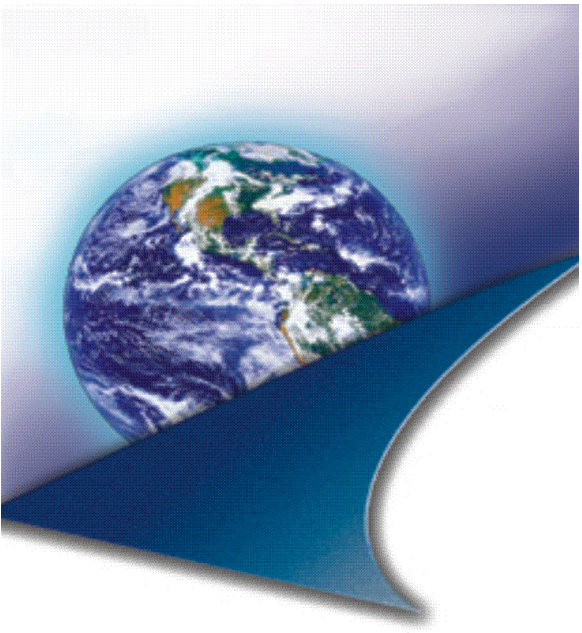


Knight Piésold
CONSULTING

RESCUE AND REHABILITATION PLAN

ANNEXURE B

CONSTRUCTION:

THE NORTHERN AQUEDUCT AUGMENTATION

PHASE 4 PROJECT, KWAZULU-NATAL

EIA Ref Number: **DM/0065/2012**

Date: **May 2013**

On Behalf of: **EThekwini Water & Sanitation**

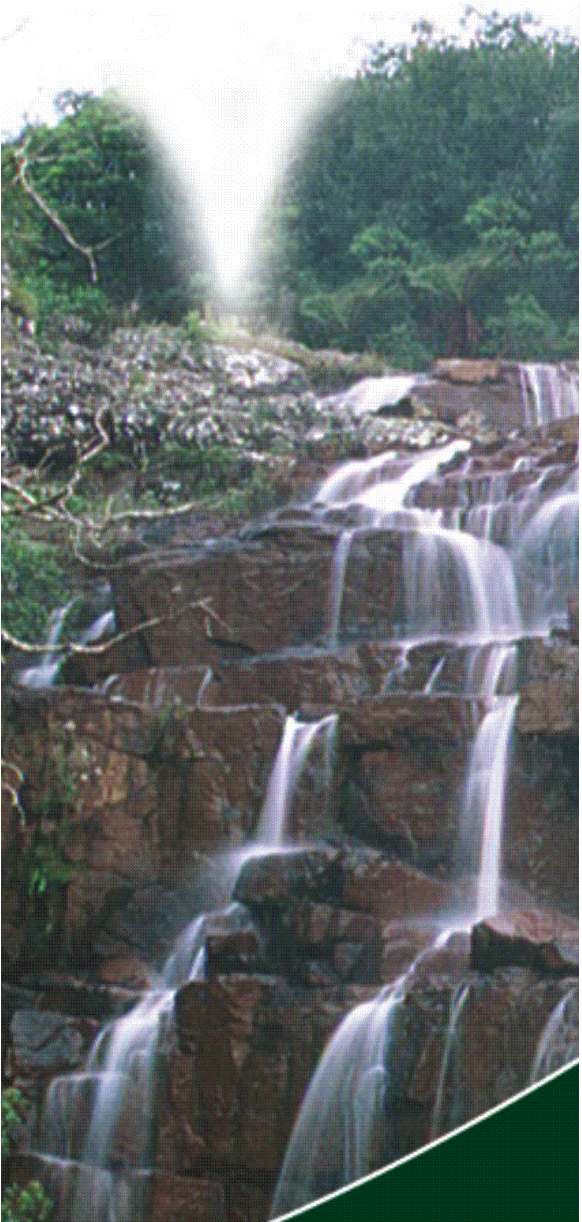
ETHEKWINI MUNICIPALITY

Prepared by:

Knight Piésold Environmental Scientists:
Deepa Seepersad

Biodiversity Specialist:
Dr J.E Granger

KP Ref Number: **303-00213.03**



Tel: +27 31 276 4660
Fax: +27 31 262 2950
P O Box 383 Westville 3630
dseepersad@knightpiesold.com

Contents

i. KEY TO ACRONYMS AND ABBREVIATIONS

Amafa	Amafa AKwaZulu-Natali (heritage regulating authority)
CP	Communications Plan
DAEARD	Department of Agriculture, Environmental Affairs and Rural Development
DAFF	Department of Forestry and Fisheries
DEAT	Department of Environmental Affairs and Tourism
DoA	Department of Agriculture
DWA	Department of Water Affairs
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
KZNW	KZN Wildlife (conservation regulating authority)
EMP	Environmental Management Plan
EPCPD	Environmental Planning and Climate Protection Department (eThekwini Municipality)
ER	Engineers Representative
ESO	Environmental Site Officer
ESR	Environmental Scoping Report
EWS	EThekwini (Municipality) Water and Sanitation
HMP	Heritage Resource Management Plan
IAPs	Interested and Affected Parties
INR	Institute of Natural Resources (specialist)
KP	Knight Piésold Consulting (in reference to the Environmental Consultants)
KP-NC JV	Knight Piésold – Naidu Consulting Joint Venture (Consulting Engineers)
KZN	KwaZulu-Natal
NAA	Northern Aqueduct Augmentation
NEMA	National Environmental Management Act (No. 107 of 1998)
NEMBA	National Environmental Management: Biodiversity Act (No. 10 of 2004)
PPP	Public Participation Process
RoD	Record of Decision (Environmental Authorisation)
RRP	Plant Rescue and Rehabilitation Plan
UKZN	University of KwaZulu-Natal
UW	Umgeni Water
WA	Western Aqueduct (with reference to the eThekwini Municipality pipeline)
WESSA	Wildlife and Environment Society of South Africa

ii. GLOSSARY OF TERMS

a. Parties Involved

Applicant in terms of the National Environmental Management Act (No. 107 of 1998) means a person who has submitted, or intends to submit, an application for environmental authorisation. For the purposes of this document 'Applicant' refers to the eThekwini (Municipality) Water and Sanitation (EWS).

Biodiversity Specialist refers to a member of the Environmental Consulting team (Knight Piésold), suitably qualified in the field of terrestrial ecology, who will monitor the success of rescue and rehabilitation activities associated with flora and fauna.

Consulting Engineer refers to the Engineer appointed by the Applicant, who is responsible for the pipeline design and/or implementation of the project. For the purposes of this document, the term 'Consulting Engineer' refers to Knight Piésold.

Contractor refers to the main Contractor(s) appointed by the Applicant to undertake the construction of the project. The Contractor(s) is required to adhere to the Record of Decision (RoD) and to implement the Environmental Management Plan (EMP). The Contractor(s) shall be responsible for ensuring that all staff, sub-contractors and suppliers appointed by them adhere to the conditions of the EMP.

Engineer's Representative (ER) refers to the individual appointed by the Consulting Engineer to oversee the construction phase of the project, including the rescue and rehabilitation.

Environmental Consultant refers to the individual or company responsible for the development of the Environmental Management Plan (EMP), which includes the Plant Rescue and Rehabilitation Plan. The Environmental Consultant can also fulfil a role in the monitoring and auditing of the EMP and Rescue and Rehabilitation Plan. For the purposes of this document, the term 'Environmental Consultant' refers to Knight Piésold.

Environmental Control Officer (ECO) refers to the individual appointed by the Applicant to independently audit the project in terms of the RoD and the implementation of the EMP. The ECO is to be qualified in the environmental sciences, understand the detailed environmental issues associated with the development, and is to be well versed in the contents of the RoD, EMP and its associated documents. The ECO will be the liaison person between the Environmental Site Officers of the Contractor, Applicant, Consulting Engineer, the Rehabilitation Specialist, the Biodiversity Specialist and the Environmental Consultant.

Environmental Site Officer (ESO) is an individual appointed by the Contractor to represent the contracting team, and is to be responsible for ensuring the day-to-day implementation of the EMP. The ESO is to be qualified in the environmental sciences, informed of the contents of the RoD, well versed in the EMP, and to understand the basic environmental issues associated with the development. The ESO is to liaise with the ECO with regards to any environmental issues.

Rehabilitation Specialist refers to the specialist appointed by the Contractor to undertake the rescue and rehabilitation activities associated with the reinstatement of the working corridor following the construction of the pipeline. The Rehabilitation Specialist shall adhere to the conditions of the RoD and the principles of the EMP and is responsible for ensuring all staff and suppliers appointed by them also adhere to the conditions of the RoD and principles of the EMP.

b. About the Construction Activities

Clearing and grubbing refers the removal of all woody vegetation (including shrubs), but excludes the removal of grass and groundcover vegetation. The Contractor shall not commence clearing or grubbing until the Engineer has designated, in writing and in detail, the exact areas to be cleared or grubbed and the time at which the work is to be started. The Contractor shall ensure that the general shape, profile, and levels of the area are not materially altered during the clearing and grubbing operations.

Construction camp refers to the areas/containers utilised for on-site staff offices as well as to store materials, plant, equipment and ablution facilities (the location of which is agreed to by the Applicant and Environmental Consultants. In this document construction camp / site office will be used interchangeably, but '*site office*' will be the preferred nomenclature.

Construction site refers to the working corridor, site office, stockpile areas, pipeyards, pipe fabrication yards, storage facilities and site access roads. The working corridor shall have a maximum width of 30 metres and a maximum length of 350 metres, but shall be less than this in sensitive areas. The construction site shall be demarcated and signposted by the Contractor. All construction activities shall remain within the confines of the working corridor, construction camp and pipeyards.

Open trench refers to the area within the Working Front where trench excavation and pipe laying activities are occurring. Open trench is be deemed to include: trenching, placing of bedding, pipe laying, placing of selected fill and backfilling to ground level. Backfilling constitutes reinstatement of earth fill material, and does not include rehabilitation measures. An open trench ceases to be open once backfilling has taken place.

Progressive Reinstatement refers to the reinstatement of disturbed areas to topsoil profile on an ongoing basis, immediately after selected construction activities (e.g. backfilling of a trench) are completed. This allows for

passive rehabilitation (i.e. natural recolonisation by vegetation) and active rehabilitation in accordance with the Rescue and Rehabilitation Plan to commence.

Registered servitude is the area of the working corridor that shall be registered as a permanent servitude for the operational phase of the project for the purposes of maintenance and pipe access.

Timeous/ly implies at least 7 working days prior to an activity, or after an instruction or request.

Working Corridor is the Temporary Working Space, as agreed to by the affected landowners together with the Registered Servitude. The Working Corridor is the corridor within which work will take place (a maximum width of 30 metres) for the entire length of the pipeline. The entire working corridor, which includes the registered servitude and the temporary working space, shall be rehabilitated.

Working Front is the area of the working corridor where work is actively taking place such as clearing and grubbing, open trench, reinstatement and rehabilitation activities. More than one working front may be active along the route. Every working front is to be temporarily fenced and all construction and rehabilitation related activities are to remain within the confines of the temporary boundary and shall make use of established access routes as determined for each working front. The working front is split into 3 sections:

-Advance work front - the area which is cleared and grubbed and where proving for services takes place. This section length is limited to 250m to 300m.

-Construction work front - is the area where pipe laying activities take place and is limited to 200m (in built up areas) although it can be longer in agricultural areas (up to 500m) and shorter in restricted areas.

-Reinstatement work front – is the area usually no longer than 200m where reinstatement and rehabilitation takes place and lags behind the construction work front.

Temporary Working Space refers to the area of working corridor that will be used for construction purposes but will not be registered as part of the registered servitude during the operational phase of the project. For example, the working corridor may be 30m wide in some instances, and will comprise 12m of the registered servitude, and 18m of temporary working space. The working space is temporary, and permission to occupy this land shall be obtained from the relevant landowners prior to construction on their land. This servitude is to be reinstated and rehabilitated after construction.

c. About the Environment / Rescue & Rehabilitation Activities

Alien species in terms of the National Environmental Management: Biodiversity Act (No. 10 of 2004) means: (a) a species that is not an indigenous species, or (b) an indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by natural means of migration or dispersal without human intervention.

'Back-up' material refers to plants which have been propagated from adult plants growing in and/or rescued from the working corridor. 'Back-up material' may be used to replace the adult plants that are destroyed or are unsuccessfully rescued as a result of the construction activities, or may be used to supplement the returned plants during the rehabilitation phase of the project.

Biodiversity in terms of the National Environmental Management: Biodiversity Act (No. 10 of 2004) means the variability among living organisms from all sources including: terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part and also includes diversity within species, between species, and of ecosystems.

Building and demolition waste in terms of the Waste Management Act (No. 59 of 2008), means waste, excluding hazardous waste, produced during the construction, alteration, repair or demolition of any structure, and includes rubble, earth, rock and wood displaced during that construction, alteration, repair or demolition.

Bushveld/Veld is an area dominated by Valley Bushveld plant species.

Business waste in terms of the Waste Management Act (No. 59 of 2008), means waste that emanates from premises that are used wholly or mainly for commercial, retail, wholesale, entertainment or government administration purposes.

Critically endangered species in terms of the National Environmental Management: Biodiversity Act (No. 10 of 2004) means any indigenous species listed as a critically endangered species in terms of Section 56 of NEMBA.

Domestic waste in terms of the Waste Management Act (No. 59 of 2008), means waste, excluding hazardous waste, that emanates from premises that are used wholly or mainly for residential, educational, health care, sport or recreation purposes.

Endangered species in terms of the National Environmental Management: Biodiversity Act (No. 10 of 2004) means any indigenous species listed as an endangered species in terms of Section 56 of NEMBA.

Environment in terms of the National Environmental Management Act (No. 107 of 1998) means the surroundings within which humans exist and that are made up of: (a) the land, water and atmosphere of the earth, (b) micro-organisms, plant and animal life, (c) any part or combination of (a) and (b) and the inter-relationships among and between them, and (d) the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and wellbeing.

Environmental audit and monitoring is a structured observation, measurement and evaluation of environmental data over a period of time to assess the efficiency of environmental mitigation and rehabilitation measures. The

auditing and monitoring of the site will commence at intervals to be determined by the DAEARD and Environmental Consultant, and will involve a thorough site inspection of the construction activities with reference to the RoD and EMP. A report of the findings of each visit will be compiled and submitted to the Applicant and DAEARD as required.

Environmental audit report in terms of the National Environmental Management Act (No. 107 of 1998) means a document that provides verifiable findings and recommendations for improvement, in a structured and systematic manner, on the performance and compliance of an organization and/or project against environmental policies, objectives, laws, regulations, licenses, permits, conditions of authorisation (RoD), norms and standards.

Environmental incident is an accident or unexpected occurrence, including fires, spills, pollution events, explosions, major emissions, flood events and bank collapse which results in serious or potentially serious negative environmental impacts.

Environmental Report File (ERF) refers to a file that shall be compiled and maintained by the Contractor and which is to be stored at the Site Office. This file shall contain all necessary environmental documentation as stipulated in the RoD and EMP.

Environmental Management Plan (EMP) is a detailed plan of action prepared to organize and co-ordinate environmental mitigation, rehabilitation and monitoring thereof, so that positive impacts are enhanced and negative impacts are minimised or eliminated. The EMP is a legally binding document (although dynamic) and is applicable to the Applicant and all parties appointed by the Applicant.

Fauna and Flora is any individual or group of microorganisms, insects, plants and animals.

Flagged Resource refers specifically to a resource or area identified along the pipeline route by Specialists during the environmental impact assessment. Flagged Resources require specific care and management, and may include noise/dust /nuisance hotspots; grasslands, veld, forest or wetland environments; or areas of archaeological or cultural/heritage importance within the vicinity of or within the working corridor.

Forest refers to an area dominated by herbaceous vegetation, scrub, thicket, and riparian forest species.

Grassland refers to an area dominated by grassland type species, including species associated with bush clumps and termitaria.

Hazardous substances refers to substances including, but not limited to, chemicals, solvents, fuels, oils, and lubricants as liquids, solids or gases that are harmful or potentially dangerous to human and/or environmental health. 'Harmful/dangerous' refers to the substances' inherent chemical and physical composition that could be

toxic, poisonous, explosive, carcinogenic, flammable or radioactive. Used hazardous substances must be disposed of as 'hazardous waste' if no longer needed.

Indigenous species in terms of the National Environmental Management: Biodiversity Act (No. 10 of 2004) means a species that occurs, or has historically occurred, naturally in a free state in nature within the borders of the Republic, but excludes a species that has been introduced in the Republic as a result of human activity.

Inert Waste in terms of the Waste Management Act (No. 59 of 2008), means waste that: (a) does not undergo any significant physical, chemical or biological transformation after disposal, (b) does not burn, react physically or chemically, biodegrade or otherwise adversely affect any other matter or environment with which it may come into contact, and (c) does not impact negatively on the environment because of its pollutant content and because the toxicity of its leachate is insignificant.

Invasive Alien Plant Species / Weeds and Invasive Plants (WIP) refers to an refers to an undesirable plant growth which shall include, but not be limited to, all declared Category 1 & 2 listed invader species as set out in regulations pursuant to the Conservation of Agricultural Resources Act No. 43 of 1983 (CARA). Other vegetation deemed to be invasive alien shall be those plant species that show the potential to occupy in number, any area within the defined construction area and which are declared to be undesirable.

Invasive species in terms of the National Environmental Management: Biodiversity Act (No. 10 of 2004) means any species whose establishment and spread outside of its natural distribution range: (a) threaten ecosystems, habitats or other species or have demonstrable potential to threaten ecosystems, habitats or other species, and (b) may result in economic or environmental harm or harm to human health.

Mitigation refers to measures of environmental management designed to reduce, avoid or remedy undesirable environmental impacts.

Pollution is the contamination of the atmosphere, water or soil by substances or matter which may have a negative/harmful impact on the environment.

Preservation (of trees): no trees shall be cut down until the engineer has given written authorisation for such work to commence. Where the tree to be removed is within a forest or is a protected species, then a permit must be sought and written authorisation obtained from DAFF. Individual trees indicated and marked by the engineer or ECO as trees to be preserved shall be left standing and uninjured. The amount stated in the project specification shall be deducted from the monies due to the contractor as penalty in respect of every tree that is damaged or removed unnecessarily.

Protected Tree is any tree declared to be protected, or belonging to a group of trees, woodland or species declared to be protected, under section 12(1) or 14(2) of the National Forests Act No. 84 of 1998.

Rehabilitation refers to the measures implemented to return an area/site to a status of good environmental health, better than its former status, and striving towards its natural status. Rehabilitation should aim to accelerate the natural succession processes so that the plant community develops in the desired way, as specified in the PRRP.

Riparian habitat in terms of the National Water Act (No. 36 of 1998), includes the physical structure and associated vegetation [riparian vegetation] of the area associated with a watercourse which are commonly characterized by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas.

Riparian vegetation refers to the vegetation occurring within a riparian habitat. Riparian vegetation in terms of removal, storage and replacement is only applied to sedge, grass, ground-cover, reed, bulrush, or herbaceous component of riparian vegetation and excludes the woody component (trees).

Sedges are grass-like plants, often growing in wetland/marshy areas or adjacent to a water body.

Subsoil is the soil horizons between the topsoil horizon and the underlying parent rock. Subsoil often has more clay-like material than the topsoil. Subsoil is of less value to plants, in terms of nutrient (food) and oxygen supply, than topsoil. When subsoil is exposed it tends to erode fairly easily.

Topsoil is the A-horizon of the soil profile. Topsoil is the upper layer of soil from which plants obtain their nutrients for growth. It is often darker in colour, due to the organic (humic) fraction. Where topsoil is referred to, it is deemed to be both the soil and grass / ground cover fraction.

Tree in this document, includes any tree seedling, sapling, transplant or coppice shoot of any age and any root, branch or other part of it.

Waste in terms of the Waste Management Act (No. 59 of 2008), means any substance whether or not that substance can be reduced, reused, recycled and recovered – (a) that is surplus, unwanted, rejected, discarded, abandoned, disposed of; (b) where the generator has no further use of for the purposes of production, reprocessing or consumption; (c) that must be treated or disposed of; or, (d) that is identified as a waste by the Minister, but – (i) a by-product is not considered waste; and (ii) any portion of waste once re-used, recycled and recovered ceases to be waste.

General waste: means waste does not pose an immediate hazard or threat to health or to the environment, and includes – (a) domestic waste, (b) building and demolition waste, (c) business waste, and (d) inert waste. General waste must be disposed of in a permitted landfill.

Hazardous waste: means any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment. Hazardous waste must be disposed of at a permitted facility for the hazardous waste category in question.

Waste water refers to water containing pollutants, including chemicals, oils, fuels, soaps, sewerage, or contaminated sediment.

Water body/course in terms of the National Water Act (No. 36 of 1998) means: (a) a river or spring, (b) a natural channel in which water flows regularly or intermittently, (c) a wetland, lake or dam into which, or from which, water flows, and (d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.

Wetland in terms of the National Water Act (No. 36 of 1998) means land which is transitional between terrestrial and aquatic systems and where the water table is at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soils.

Wetland Vegetation refers to vegetation which is indicative of a wetland environment and typically adapted to life in saturated soils, for example: sedges, rushes, reeds, hydrophilic grasses and ground-covers.

iii. LIST OF SUPPORTING DOCUMENTATION

The information contained in this Rescue and Rehabilitation Plan for the Northern Aqueduct Augmentation (NAA) Phase 4 project is derived from the Basic Environmental Assessment Report (BAR) as well as the specialist investigations that were commissioned during the Basic Assessment Process. The EMP reflects the standard and specific conditions of the Record of Decision, and includes four Annexure reports: A: Spoil Disposal Management Plan, B: Rescue and Rehabilitation Plan, C: Communications Plan and D: Heritage Management Plan. This report is derived from information in the following reports:

- Environmental Basic Environmental Assessment Report: Northern Aqueduct Augmentation Project; Phase 4 *Knight Piésold* 2013.
- A Basic Assessment of the Plant Communities Intersected by Phase 4 of the Northern Aqueduct Augmentation (Phase 4) and a Brief Account of their possible roles in determining Biodiversity.

- Frog Specialist Report for Wetland Areas adjacent to Eastbury Drive and possible impact of Phase 4 on the Northern Aqueduct Augmentation (NAA Ph4) Determining the presence of the critically endangered Pickersgill's Reed Frog, *Hyperolius pickersgilli.*
- Desktop Survey of the Proposed Northern Aqueduct Augmentation, Phase 4, KwaZulu-Natal.
- Northern Aqueduct Augmentation Phase 4: Report on the Public Participation for the Basic Assessment Study.

iv. FOREWORD

This Rescue and Rehabilitation Plan (RRP) forms part of the *Environmental Management Plan (EMP) for the Northern Aqueduct Augmentation Phase 4 Project (*Knight Piésold, 2013). The Rescue and Rehabilitation activities are therefore to be conducted in accordance with the conditions of the RoD and mitigation measures in the EMP. This RRP is relevant to all areas directly affected by the construction activities of the NAA Phase 4 project.

The attention paid to the environmental issues associated with the NAA Phase 4 Project during the Environmental Basic Assessment has continued a precedent, which was set during the Western Aqueduct Project, in terms of environmental ethos and care for the rescue and rehabilitation phase of the project. The objective of the RRP is to mitigate impacts associated with the construction activities of the NAA Phase 4, restore impacted sites to their original status, and where practically possible, improve impacted sites to a condition greater than their original status, thereby contributing towards the regional conservation targets set by KZN Wildlife (KZNW).

The emphasis of the RRP is on re-vegetation and habitat rehabilitation following the construction of the pipeline, and therefore focuses on plant species. By providing suitable habitat, it is envisaged that the restored site will encourage bird, insect, reptile, fish, and animal species to repopulate the area. The RRP also includes conditions for the control of invasive alien plant species and requires that the Contractor formulate a programme to reduce the establishment and distribution of invasive alien plants as a consequence of the disturbances caused by the construction activities.

During the rescue operations, the construction of the pipeline, and the rehabilitation of the site, fauna may be encountered that will require rescue and relocation. A suitable organization has been identified and is to be consulted in such an event, and the procedure is described in detail in the Environmental Management Plan (EMP). The organization is called FreeMe KZN Wildlife Rehabilitation Centre and the contact number is 033 330 3036 or 083 325 9947 (Roz).

1.1 Project Detail

The project information is summarised in the table (**1.1**) below.

Table 1.1 Summary of Project Information

PROJECT: EIA No.: DM/0065/2012	Northern Aqueduct Augmentation Phase 4
APPLICANTS	EThekwini Water and Sanitation (EWS)
CONTACT PERSON (APPLICANT)	Monte Montemerano Tel: 031 311 8742, Fax: 031 311 8545 MontyMo@dmws.durban.gov.za
NATURE OF THE DEVELOPMENT	Steel gravity-fed potable water pipeline project
PIPELINE LENGTH	5 linear kilometres
JURISDICTION	EThekwini Municipality
CURRENT LAND USES	Predominantly road reserve, existing electrical servitude, open space
LISTED ACTIVITY IN TERMS OF THE NEMA (No. 107 of 1998, revised June 2010)	Regulation No. R 544 (Listing Notice 1, Activities 9, 11, 18 & 37) Regulation No R 545 (Listing Notice 2, Activity 10)
INDEPENDENT ENVIRONMENTAL CONSULTANTS	Knight Piésold (Pty) Ltd. Contact: Deepa Seepersad Tel: 031 276 4660, Fax: 031 262 2950 dseepersad@knightpiesold.com PO Box 383, Westville 3630

2. ROLES AND RESPONSIBILITIES

The holder of the environmental authorisation (the Applicant) is responsible for ensuring compliance with the Conditions of the Record of Decision, and subsequently the mitigation measures of the Environmental Management Plan, by any person acting on his/her behalf, including, but not limited to, an agent, contractor, sub-contractor, employee or person rendering a service to the holder of the authorisation.

2.1 Applicant

For the purposes of this document, 'Applicant' refers to the Client, eThekwini Municipality Water and Sanitation, who must ensure that the Conditions of the RoD (and all subsequent amendments) are adhered to at all times throughout the lifetime of the project. This implies that the Applicant shall ultimately be responsible for ensuring that best environmental practice is applied to rehabilitate biodiversity resources which may be directly, or indirectly, impacted as a consequence of the NAA Phase 4 construction activities.

2.2 Consulting Engineer

For the purposes of this document, the term 'Consulting Engineer' refers to the *Knight Piésold - Naidu Consulting Joint Venture (KP-NC JV)*. The Consulting Engineer, as an agent of the Applicant, is legally and contractually bound to adhere to the Conditions of the RoD, and likewise, all consulting engineering services provided to the Applicant in fulfilment of their appointment shall be in accordance with the Conditions of the RoD.

2.3 Contractor

For the purposes of this document, the term 'Contractor' refers to the main contractor(s) appointed to undertake the construction of the project, or portion of the construction of the project. Given this role, the Contractor must ensure that the construction footprint and methodologies reflect the requirements of design which will accommodate biodiversity issues wherever possible or as required, and that all construction staff are inducted in best practice to reduce impacts to biodiversity. The Contractor must ensure that the reinstatement of the construction footprint is of a standard suitable for rehabilitation.

2.4 Environmental Consultant

For the purposes of this document, the term 'Environmental Consultant' refers to *Knight Piésold* Consulting, who is the company responsible for the development of the EMP and its annexures. Given this role, the Environmental Consultant must ensure that the biodiversity issues, as determined by the Biodiversity Specialist during the EIA, are communicated to the Consulting Engineer such that these resources can be accommodated in the design and alignment of the pipeline. The Environmental Consultant must ensure that the mitigation and management options for the conservation of biodiversity resources, as determined by the Biodiversity Specialist, are reflected in this RRP. The Environmental Consultant must also ensure that the relevant authorities are informed of the presence and impacts to biodiversity resources within the construction footprint. The Environmental Consultant is responsible for ensuring the objectives of the RRP are carried out through provision of information to the Consulting Engineer for inclusion in the contract document, and through recommendations on the qualifications or experience for a Rehabilitation Specialist (as part of the contract team).

2.5 Environmental Control Officer

The ECO provides input and environmental guidance on site in order to ensure adherence to the EMP and general project environmental sustainability, and will monitor and audit construction activities in relation to their compliance with the EMP and its supporting documents. Given this role the ECO will monitor the rescue and rehabilitation activities, and will document the procedures and outcomes in the audit process. The ECO must communicate the discovery of new biodiversity issues to the Environmental Consultants such that the Biodiversity Specialist can be consulted and a way forward determined.

2.6 Biodiversity Specialist

The Biodiversity Specialist (as identified by the Environmental Consultants) is to ensure that all biodiversity resources are clearly communicated to the Environmental Consultants such that the Consulting Engineers can accommodate these in the design and routing of the pipeline. The Biodiversity Specialist will advise on the rescue and rehabilitation processes, and will provide input into the implementation of the RRP. The Biodiversity Specialist is to ensure that the requirements of the Conservation Authority (KZNW) are understood and met by the project team, that the necessary permits are in place for the rescue and relocation of Red Data / Rare / Endangered Plant Species, and that suitable mitigation or management options are clearly communicated in the RRP.

2.7 Rehabilitation Specialist

For the purposes of this document, the term 'Rehabilitation Specialist' refers to the main specialist appointed as a Sub-Consultant to the Contractor to undertake the rescue and rehabilitation activities associated with the reinstatement of the working corridor following the installation of the pipeline. The Rehabilitation Specialist is required to adhere to the Environmental Management Plan (EMP) and is responsible for ensuring all sub-specialists, suppliers and staff appointed by them also adhere to the conditions of the EMP. The Rehabilitation Specialist is responsible for ensuring that all the necessary permits and licenses are in place prior to the removal and relocation of Red Data / Rare / Endangered plant species, and that the objectives of the RRP are met in the reinstatement of the construction footprint through the propagation and planting of suitable plant stock.

2.8 Department of Agriculture, Environmental Affairs and Rural Development

The DAEARD are the Environmental authority in KZN who will ensure compliance with the EMP and general environmental sustainability. Given this role, the DAEARD must audit the environmental monitoring process and reports prepared by the ECO, including documentation pertaining to biodiversity conservation and the rescue and rehabilitation activities. The DAEARD will implement disciplinary action (legal action, such as the suspension of works) on the Developer if non-compliance with the RRP is deemed severe enough.

3. PROJECT DESCRIPTION

3.1.1 Project Context

In June 2012, the *Knight Piésold* Environmental Division was appointed to undertake the necessary environmental investigations associated with the eThekwini Municipality Water and Sanitation (EWS) proposal to construct a ~5km bulk water pipeline to be known as Phase 4 of the Northern Aqueduct Augmentation (NAA) Project.

Because the construction of the WA (Phase 2) has been put on hold, an alternative link (NAA Phase 4 (or the Engineers Phase 3) is currently being proposed. This is to provide water from the EXISTING NAX into NAA Phase 1, so that Cornubia and other developments in the north of Durban, can be provided with water within the next 18

months, as the construction of the WA Ph2 will only reach the starting point of the NAA Ph2 (at Emachobeni) in five years time (optimistically).

It is thus proposed that a new 1.2m pipe be laid in parallel with the existing pipelines (to remove the bottleneck in the system) **between Duffs Road and Phoenix 2 Reservoir**. This pipeline forms Phase 4 of the NAA and is required to be commissioned at the same time as NAA Ph 1, i.e. 2014. The existing two pipes within the servitude will continue to be used (current daily volume approximately 50,000m^3). The new bigger pipe will merely augment the existing pipelines which are presently a bottleneck in the system. The old pipes are much smaller (450 – 500mm) in diameter, and as such when the new pipe is tied into the system, the water will prefer the path of least resistance, and thus most of it, will 'choose' the bigger pipe. The ultimate 30-year demand in the system will result in a total flow of about 120,000 m^3 per day, of which 100,000 m^3 per day will flow in the new (bigger) pipe as a result of its lower friction loss.

***This Rescue and Rehabilitation Plan must be implemented by the ECO and Rehabilitation Specialist in conjunction with the Rehabilitation Specifications compiled for the contract documentation.*

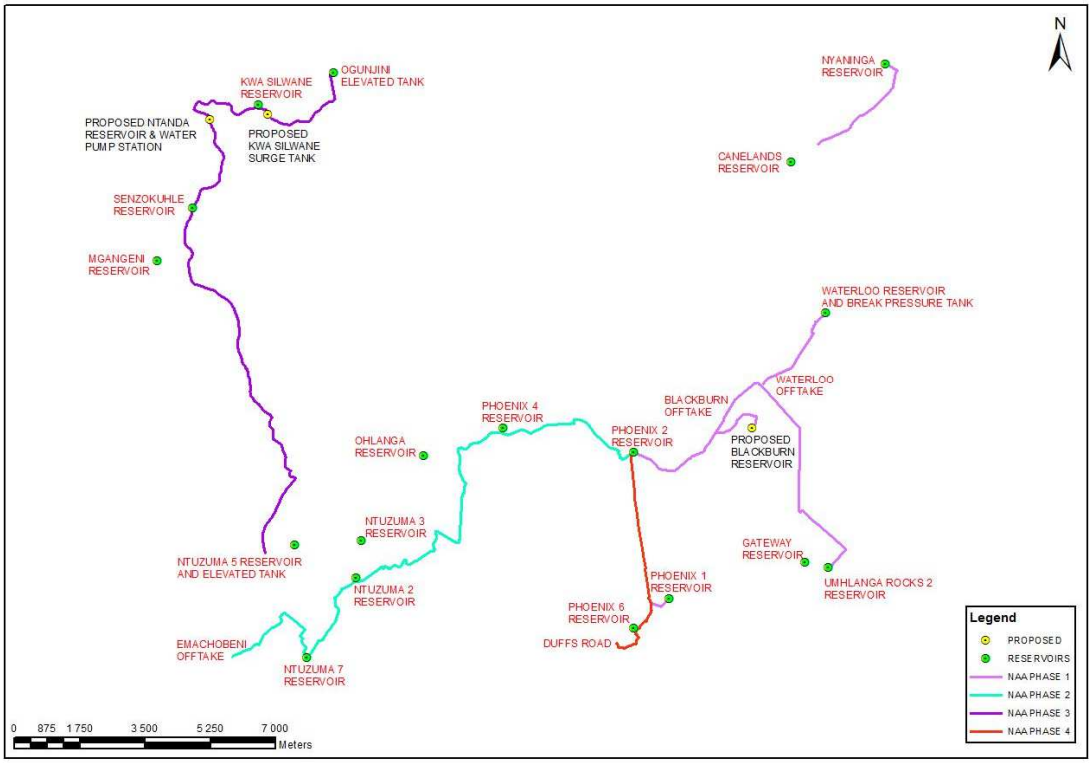


Figure 1. Study Area

3.1.2 Climatic Overview

The Durban area falls within the sub-tropical summer rainfall area, and mean annual precipitation is often over 1000mm (as much as 1200mm at the coast). Most of the rainfall is recorded between the months of November and May, which are most often the hottest months of the year (Mean daily max: 28°-30° at the coast). The months of June, July and August are often recorded as the coolest months of the year (Mean daily min: 8°-10°). The

climate capability rating is C1, where climatic limitations to productivity are considered 'none' to 'slight', humidity levels however do exceed 72% in summer.

In January solar radiation loads at the coast exceed 25MJ.m-2.day-1. In July values are likely to be between 14-15 MJ.m-2.day-1 at the coast, and 15-16 MJ.m-2.day-1 further inland. The lower levels along the coast are a result of greater cloud cover.

3.1.3 Habitat Potential

The corridor of the proposed route for Phase 4 of the NAA occurs within the vegetation type which was mapped (scale 1: 250 000) and described by Mucina & Rutherford (2006) as: CB3: KwaZulu-Natal Coastal Belt. These authors state that: "Some primary grassland dominated by *Themeda triandra* still occurs in hilly, high-rainfall areas where pressure from natural fire and grazing regimes prevailed. At present the KwaZulu-Natal Coastal Belt is affected by an intricate mosaic of very extensive sugarcane fields, timber plantations, and coastal holiday resorts, with interspersed secondary *Aristida* grasslands, thickets and patches of coastal forest".

Only a few small portions of vegetation which occur within the corridor namely Short Moderately Disturbed Coastal Forest, Short Dense Thicket and Short Dense Riparian Thicket (polygon 36) correspond to any of the indigenous communities cited by Mucina & Rutherford. The areas mapped as Short Dense Disturbed Grassland & Subsistence cultivation Mosaic could possibly be considered to be a degraded stage of secondary *Aristida* grassland but this can only be substantiated by undertaking an assessment of the species composition of these areas in late spring/early summer after they have been burnt during the preceding winter but such an investigation was beyond the scope of the fieldwork undertaken for this report. The primary relevance of the work of Mucina & Rutherford (2006) for this report lies in the fact that these authors categorised the conservation status of KwaZulu-Natal Coastal Belt as Endangered.

Superimposing the corridor on the 2011 D'MOSS maps revealed that most of the corridor crosses land which does not form part of D'MOSS. However, comparatively small portions of six different D'MOSS categories do occur within the corridor. These six categories and their equivalents which were mapped for this report are presented and commented on briefly in **Table 3.1** below and are also shown in **Figure 2**.

Table 3.1. D'MOSS categories intercepted by the corridor of Phase 4 of the NAA and the equivalent categories in which they are mapped for NAA Phase 4.

D'MOSS category	Map units as recognised for this report	Comments
Freshwater Wetland: Umhlangane River	High Dense *Phragmites australis* Reedbed-Cultivation Mosaic & High Dense Riparian *Phragmites australis* Reeds (Polys.6, 7 & 8)	Two very distinct components of the floodplain and banks of the Umhlangane River which probably provide habitat for at least a number of different spp. of fauna and which require different approaches to rehabilitation included in single D'MOSS category
Forest transitional : Umhlangane River	Short Moderately Disturbed Coastal Forest	D'MOSS and vegetation category typifications agree but boundaries of polygons within the corridor differ.
Coastal Forest Mt Moriah	Short Dense Riparian Thicket	Certainly not forest within the corridor. Therefore, may support some spp. of flora and fauna which are not forest spp.
Freshwater wetland: drainage line	Short Dense Disturbed Riparian Thicket	D'MOSS categorisation fails to indicate dominance of woody spp. Such information highly relevant for determining rehabilitation treatment.
Terrestrial Recreational Parkland: Ghandi Luthuli Park	Short Dense Grassland, Wetland: *Typha capensis* & *Phragmites australis,* Stream & Streambanks & Short Dense Thicket	D'MOSS polygon and description fails to reveal existence of different habitats at least two of which i.e. *Typha capensis* & *Phragmites australis,* Stream & Streambanks may provide habitat for a Red Data frog sp (alternatives to the rerouting of this section of the pipeline have been proposed).)
Terrestrial Secondary Grassland: Ghandi Luthuli Park	Short Dense Grassland, Short Dense Thicket & Low mown Dense Grassland (existing servitude)	D'MOSS fails to recognise three very different vegetation types/habitats which are likely to support a number of different spp. of flora & fauna. Also, two of the three vegetation types recognised for this report require different rehabilitation treatments.

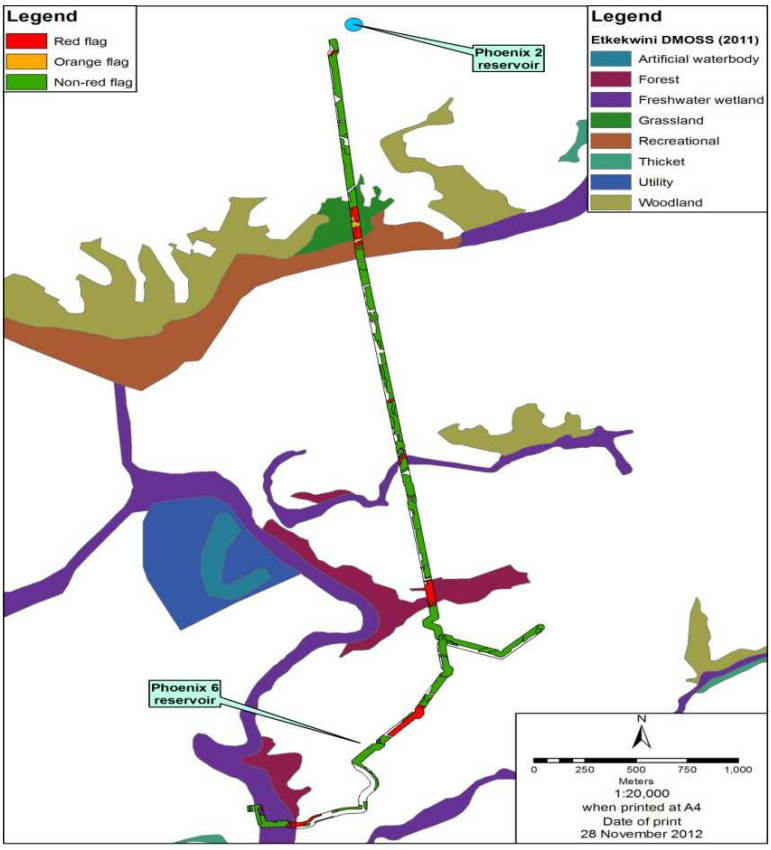


Figure 2. The 40m-wide corridor assessed for Phase 4 of the NAA superimposed on the D'MOSS categories it crosses.

4. VEGETATION TYPES AND PLANTS AND ANIMALS OF CONSERVATION CONCERN LISTED IN KZN WILDLIFE'S MINSET DATABASE

The table below consists of flora and fauna of conservation concern encountered along the proposed project route. Tabulated mitigation measures need to be adhered to during the construction phase of the project.

Table 4.1. Vegetation types and plant and animal species of conservation concern listed in KZN Wildlife's Minset database which do or may occur within the 40m-wide corridor assessed for Phase 4 of the NAA.

Category or Taxon	KZNW conservation status	Map units this report in which category or taxon does or may occur	Specific/micro-habitats	Predicted impacts due to construction	Proposed mitigation measures
Flora					
Kwazulu-Natal Coastal Belt Grassland	Critically Endangered	-	-	Complete removal when clearing & grubbing takes place	If possible, burn off in winter (July-August) and have plant specialist search during spring (late October-November) to locate and rescue species of conservation concern. Local people may want some surplus plants for traditional purposes. Rehabilitate with appropriate methods as soon as possible after trench has been backfilled and topsoil spread.
Subtropical Alluvial Vegetation (natural)	Endangered	All polygons mapped as wetland	-	-	Negotiate narrowing of construction corridor with project engineer. Rescue wetland plant species for later use in rehabilitation.
Southern Mesic Coastal Lowlands Forest	Critically Endangered	-	-	-	Rescue & rehabilitate as prescribed in this Plant Rescue & Rehabilitation Plan
Barleria natalensis	Extinct	Grassland	Grassland	Scott-Shaw (1999) states that although extinct in the Verulam & Stanger areas where it occurred, it should still be searched for.	If possible, burn off grassland areas in winter (July-August) and have plant specialist search during spring (late October-November) search for species of conservation concern with close attention being given to all species of *Barleria* which may be encountered. Specialist to inspect or at least obtain photographs of specimens which may be lodged in herbaria.
Vernonia africana	Extinct	Grassland	Grassland	Scott-Shaw (1999) states that	If possible, burn off grassland areas in winter

Category or Taxon	KZNW conservation status	Map units this report in which category or taxon does or may occur	Specific/micro-habitats	Predicted impacts due to construction	Proposed mitigation measures
				although extinct in the Verulam & Mt. Edgecombe areas where it occurred, it should still be searched for.	(July-August) and have plant specialist search during spring (late October-November) search for species of conservation concern with close attention being given to all species of *Vernonia* which may be encountered. Specialist to inspect or at least obtain photographs of specimens which may be lodged in herbaria.
Fauna					
Edouardia conulus (Conical Bark Snail)	Scarce	Forest, thicket & wooded grassland	Lives under stones	Very little suitable habitat which has not already been transformed occurs along the route.	Likelihood of encountering this snail is considered remote.
Euonyma lymneaeformis (Lymnaeid Awl Snail)	Locally common	Forest to grassland	Logs, stones & leaf-litter	Removal of logs, leaf-litter and stones in wooded vegetation types.	Stockpile logs, leaf-litter and stones separately from top and sub-soil and re-distribute these items across those portions of the corridor in which they were encountered immediately prior to implementing rehabilitation treatments.
Cochlitoma semidecussata (formerly *Arachatina semidecussata*) (Durban Agate Snail)	Rare, limited distribution in KZ-N	Coastal lowland and scarp forest	Lives in leaf litter	Destruction of leaf litter. However, given the extent to which potential habitat has already been transformed, likelihood of encountering this snail is remote (D. Herbert, pers. com.)	Likelihood of encountering this snail is considered remote.
Gnomeskelus spectabilis (millipede)	IUCN Not evaluated. KZN endemic	Forest	Inhabits leaf litter	Clearing & grubbing resulting in destruction and removal of leaf litter	When clearing & grubbing are undertaken leaf litter and topsoil to be stacked in a single row along outer margin of corridor & left undisturbed until rehabilitation commences.

Category or Taxon	KZNW conservation status	Map units this report in which category or taxon does or may occur	Specific/micro-habitats	Predicted impacts due to construction	Proposed mitigation measures
Doratogonus cristulatus Cristulate Black Millipede	IUCN: Least concern. KZN endemic	In Coastal & Mistbelt Forest & forest ecotones	Inhabits leaf litter	Clearing & grubbing resulting in destruction and removal of leaf litter.	When clearing & grubbing are undertaken leaf litter and topsoil to be stacked in a single row along outer margin of corridor & left undisturbed until rehabilitation commences.
Doratogonus falcatus (millipede)	IUCN: Least concern. KZN endemic .	Savanna & Valley Bushveld	Inhabits leaf litter	Clearing & grubbing resulting in destruction and removal of leaf litter.	When clearing & grubbing are undertaken leaf litter and topsoil to be stacked in a single row along outer margin of corridor & left undisturbed until rehabilitation commences.
Doratogonus peregrinus (Wandering Black Millipede)	IUCN Not evaluated. KZN endemic	Forest &	Inhabits leaf litter	Clearing & grubbing resulting in destruction and removal of leaf litter.	When clearing & grubbing are undertaken leaf litter and topsoil to be stacked in a single row along outer margin of corridor & left undisturbed until rehabilitation commences.
Bittacus zulu (Zulu Hanging Fly)	Status uncertain due possibly to, as yet, insufficient collecting but thus far appears to be highly localised.	Short dense grassland esp. in Ghandi-Luthuli Park	In grassland beneath large *Acacia* spp. trees i.e. shaded habitat.	If this species does occur, it is likely to move to avoid disturbance.	Given the extent to which most of the vegetation along the route has been transformed and the extent and intensity of development it is considered unlikely that this insect will be present along the route.
Durbania amakosa (Amakosa Rocksitter Butterfly)	Vulnerable	Rocky outcrops in grassland. Almost no such habitat present in corridor.	Usually inhabits rocky ledges and grassy hillsides.	If this species does occur, it is likely to move to avoid disturbance.	ECO to be competent to identify. Construction activities in vegetation type where encountered to cease immediately and guidance of appropriate specialist to be sought.
Atyoida serrata (Large Freshwater Shrimp)	Rare. Very restricted distribution in Durban area.	Streams	In crevices & beneath rocks in fast-flowing streams	Unlikely to be present in the river and streams which are crossed by the route.	None
Hyperolius pickersgilli (Pickersgill's Reed Frog) (an alternative route	Endangered	Wetlands	Breeds in thick emergent vegetation	Removal of vegetation essential for breeding.	Prior to construction commencing across wetlands – especially wetland immediately north of Eastbury Drive – must be

Category or Taxon	KZNW conservation status	Map units this report in which category or taxon does or may occur	Specific/micro-habitats	Predicted impacts due to construction	Proposed mitigation measures
has been proposed to avoid the Wetland near Eastbury Drive)					searched by amphibian specialist and any animals found: captured & relocated. (an alternative route has been proposed to avoid the Wetland near Eastbury Drive)
Bradypodion melanocephalum [KwaZulu (Black-headed) Dwarf Chameleon]	Restricted RSA endemic- Vulnerable to Threatened	Drainage lines, forest edge and wetland edge	Drainage lines, forest edge and wetland edge	Destruction of habitat, disruption of breeding.	Check with appropriately qualified specialist as to whether species is known to or might occur along the route. Specialist to advise whether search and rescue measures are required.
Anthropodes paradisea (Blue Crane)	Vulnerable, populations declining but where present may be common resident. Endemic	Wetlands	Vleis & grassland	The likelihood of encountering this species or disrupting feeding or breeding habitat along the route is considered highly remote given the extent to which potential habitat has been transformed and the high density of human settlement.	ECO be able to identify this species and if it is encountered all construction activities in the vegetation type in which the bird has been seen / found must stop immediately and the advice of a suitably qualified specialist sought.
Balearica regulorum (Southern Crowned Crane)	Endangered but where present may be a common localised resident.	Wetlands	Marshes, dams & adjoining grassland	As above.	As above.
Eupodotis caerulescens (Blue Korhaan)	Near threatened but where present may be locally common, endemic	Short grassland	Short open grassland	As above	As above.
Neotis denhami (Stanley's Bustard)	Near threatened, uncommon	Short grassland	Open grassland	As above	As above.

5. CONDITIONS FOR APPROPRIATE RESCUE ACTIVITIES

'Rescue' in the case of flora, is often perceived to be the digging up of important plants shortly before a working corridor is created, and either replanting the plants nearby in a similar habitat or transferring them to a holding nursery where they can be maintained until such time as it is appropriate to return them to the place(s) from which they were removed. In addition to the above definition 'rescue' can also mean the collection of the relevant plant-parts such as seeds, bulbs, cuttings, scions, tillers etc. at a seasonally appropriate time of the year prior to construction by a qualified specialist for the purposes of propagation. This material is typically taken to a facility where they have the best chance of growing into adult plants. Following construction and reinstatement of the site these adult plants can be used to re-establish the presence of the species at those places where the parent plant(s) occurred when the working corridor was first created. Both the physical removal of plants located on the working corridor and the collection of plant materials for propagation are considered methods of plant species rescue for the purposes of this RRP. Three categories of plant species are to be rescued prior to construction:

- Red Data / Rare / Endangered plant species for conservation purposes
- Indigenous and / or endemic plant species for propagation purposes
- Alien ornamental or garden variety plant species on personal request by the landowner

Plants of all Red Data / Rare / Endangered species which are removed from the working corridor are to be maintained in an appropriate holding nursery in accordance with the recommendations in **Section 4** below, and when they are deemed to be in a healthy state which is likely to ensure that they will survive, be used in the rehabilitation of the working corridor.

Timing of flora 'rescue' is essential as it may take a year or more to produce juvenile plants from propagation material to a stage where they can be planted in the field with reasonable expectations of survival. Therefore it is essential that collection of propagation material of all species that are to be used for rehabilitation along the entire route be planned well in advance. Expertise in the field of rescue and rehabilitation is thus essential.

5.1 Guidelines for Category A: Red Data plant species

5.1.1 Red Data / Rare / Endangered Plant Species

The first and most important category is the **Red Data / Rare / Endangered plant species category** which are species that are either predicted or known to occur at one or more localities along the route. Species in this category are to be appropriately removed as whole plants, and later returned to site in accordance with the Rescue and Rehabilitation contract.

As a precaution, in the event that whole plants do not survive removal, propagation material in the form of seeds, cuttings etc. may be removed from these plants (or if necessary from other adult plants growing nearby) timeously, so that well established young plants are available as replacements when replanting.

5.1.2 Licensing / Permission Procedures for Relocation / Removal

The Rehabilitation Specialist is to be made responsible for any / all licensing requirements or procedures associated with the removal, handling, storage, propagation and relocation of any Red Data / Rare / Endangered plants as determined by DAFF (for trees) and / or KZN Wildlife (all other plants). The necessary authorizations are to be obtained prior to any rescue activities taking place.

Given that certain species are only distinguishable at certain times of year, and that seed is seasonally dependent, rescue operations ahead of the active sites (fenced corridor) will be permitted provided that the necessary permission is obtained from the relevant landowners to access private properties. The process of announcement is via the ECO, and is documented in the EMP. All staff will still be required to adhere to the EMP, and are to carry identification on their persons. Similarly, all stationary vehicles must display identification boards on the dash boards.

5.1.3 Record Taking on Site Prior to Removal

The Rescue and Rehabilitation Contract is to specify a means of recording the original location of each rescued plant. It is recommended that prior to the removal of Red Data/rare/endangered plants from the field; the localities shall be recorded by way of:

- 1. Recording the coordinates – in decimal degrees – of their individual locations
- 2. Taking photographs such as may be useful in relocating their original positions
- 3. Installing temporary markers (e.g. wooden poles) and/or marking existing features (e.g. a large boulder) with non-permanent paint where possible.

5.1.4 Location, Identification and Coding of Plants

The Rescue and Rehabilitation Contract is to specify a means of labelling / identifying each rescued plant. It is recommended that at the time of removal, every Red Data / rare / endangered plant be allocated a unique code and this code recorded on a label which is attached to the plant and entered into an appropriately designed register, together with the following information:

- GPS coordinates
- Type of habitat e.g. open grassland, rock clump etc.
- State of the plant i.e. flowering, leafless, shedding seed etc.

The register can serve as an inventory of stock being held at the nursery and will also form the base-line records for monitoring mortality of plants brought to the nursery and of any plants propagated from plants removed from the field.

5.2 Guidelines for Category B: Indigenous / Endemic Plant Species

5.2.1 Indigenous and / or Endemic Plant Species

The second category is other **indigenous, and/or endemic plant species** which currently occur along or in close proximity to the route. Plants species in this category may be removed as whole plants, and parts such as seeds, cuttings, bulbs, scions, tillers etc. for propagation purposes for the rehabilitation phase. The main reason for collecting and harvesting these species is for propagation or rehabilitation purposes.

Indigenous/endemic plant species occurring on the working corridor may be rescued, and later returned to the site to supplement the rehabilitation planting. Three methods of rescue are deemed appropriate in this instance:

- Seeds: may be collected from the existing indigenous vegetation occurring on the working corridor and propagated at a suitable facility. Once the plants have reached an appropriate size, these can be returned to the site during the rehabilitation activities.
- Slips/sprigs/cuttings: may be collected from adult plants occurring on the working corridor and propagated at a suitable facility. Once the plants have reached as appropriate size, these can be returned to the site during the rehabilitation activities.
- Whole plants: may be rescued and removed from the working corridor, and held at a suitable facility. These plants are to be watered, and are to be protected from frost, wind and direct sunlight until such time as they are replanted on the reinstated site. Seed, slips, sprigs or cuttings (if appropriate) may be collected from these plants and propagated as 'backup material' for the rehabilitation of the site.

5.2.2 Licensing / Permission Procedures for Relocation / Removal

The Rehabilitation Specialist is to be made responsible for any/all licensing requirements or procedures associated with the removal, handling, storage, propagation and relocation of any Protected Indigenous plants as determined by DAFF (for trees) and / or KZN Wildlife (all other plants). The necessary authorizations are to be obtained prior to any rescue activities taking place.

Given that certain species are only distinguishable at certain times of year, and that seed is seasonally dependent, rescue operations ahead of the active sites (fenced corridor) will be permitted provided that the necessary permission is obtained from the relevant landowners to access private properties. The process of announcement is via the ECO, and is documented in the EMP. All staff will still be required to adhere to the EMP, and are to carry

identification on their persons. Similarly, all stationary vehicles must display identification boards on the dash boards.

5.2.3 Record Taking on Site Prior to Removal

The Rescue and Rehabilitation Contract is to specify a means of recording the general area of the route from which the rescued plants, seed or plant material originated. It is recommended that this is undertaken to prevent the use of material originating from a one area being used in the rehabilitation of other distinctly different areas of the pipeline route.

5.2.4 Location, Identification and Coding of Plants

The Rescue and Rehabilitation Contract is to specify a means of labelling/identifying each batch of rescued plants, seeds or plant material in relation to the area from which they originated. The register can serve as an inventory of stock being held at the nursery and can inform the specific return of rescued plants and their propagated offspring to locations similar to their original sites.

5.3 Guidelines for Category C: Alien Ornamental / Garden Variety Species

The third category is the **alien ornamental or garden variety plant species** which may need to be removed and maintained temporarily, or relocated in agreement with the respective landowners where necessary. These will need to be assessed and the relocation or replacement processes determined on a case by case basis.

6. CONDITIONS FOR HOLDING AND PROPAGATION FACILITIES

6.1 Rescued Plants

The Rehabilitation Specialist is to be made responsible for the removal and maintenance of the rescued plants at a suitable nursery facility, until such time as they may be required for rehabilitation of the site. The Rescue and Rehabilitation Contract is to set criteria for facilities and staff.

Where possible, new plants are to be propagated from the rescued plants in order to create ‘back-up material’ (refer Glossary). Adult plants (either rescued from site or propagated from rescued plants) that are not required for use in the rehabilitation programme may be offered to suitable institutions such as SANBI, eThekwini Botanical Gardens, KZN Wildlife, WESSA, the University of KwaZulu-Natal or similar which maintain botanical gardens for education and research purposes.

6.2 Propagated Plants

The Rehabilitation Specialist will produce the required quantities of plants of the various species to be used in the rehabilitation programme. Material to be used for the purpose of propagating new plants may be collected from three categories of plants namely:

- from adult plants in the field which have been identified for removal prior to construction
- from adult plants in the field growing in the vicinity of the working corridor

NOTE: whole plants from adjacent sites may not be removed or damaged in any way, and collection of propagation material from these sites is subject to permission from the land owner in question from plants which are being maintained at existing nurseries or appropriate facilities

Plants to be used in the rehabilitation programme to either replace or increase the size of an existing population may not be propagated from material which comes from localities or habitats which are vastly distant and/or different from those which are found within the working corridor. It is likely that such plants are genetically quite distinct from the plants which occur along the route of the aqueduct.

It may be the case with some species that they can only be propagated using specialized techniques or facilities (e.g. eThekwini Municipality's tissue culture facility). The Rescue and Rehabilitation Contract should make provision for the Rehabilitation Specialist to appoint other specialists or institutions who have such knowledge and facilities to undertake this work in their own capacity.

In the case of plant species where propagation of 'back-up' material can be more economically produced by a source other than the Rehabilitation Specialist, it is recommended that the plants so-produced be hardened-off at a holding facility close to site. Having all the material together at a single dispatching point is likely to result in less logistical problems than are likely to occur if particular quantities of different species have to be brought to the site from different dispatching points.

7. CONDITIONS FOR APPROPRIATE REHABILITATION ACTIVITIES

Three categories of plant species are to be used for rehabilitation:

- Red Data / Rare / Endangered plant species rescued from site
- Indigenous and / or endemic plant species
- Alien ornamental or garden variety plant species on personal request by the landowner only

7.1 Guidelines for Determining Success

It is recommended that the success of rehabilitation be based on an agreed measure, and that this is clearly defined in the Rescue and Rehabilitation Contract. The following should be considered the minimum requirements for success:

- In the opinion of the Biodiversity Specialist or his / her representative the Red Flag Sectors at least 60% of the ecological functionality in comparison to neighbouring undisturbed areas of similar composition and quality.
- In the opinion of the Biodiversity Specialist or his / her representative the non-Red Flag Sectors have established 80% aerial cover with suitable species.

7.2 Guidelines for Site Preparation

7.2.1 Clearing of Alien Plant Species and Debris

Prior to the re-vegetation of the disturbed construction corridor, it is possible that alien vegetation may have started to establish itself as a result of the disruption to the environment within and surrounding the corridor, the movement of soils, or anthropogenic sources as a result of construction activities. This and other debris will need to be cleared. Herbicides are likely to be the most effective means of implementing alien plant control. It is essential that suitable / safe herbicides be identified prior to the commencement of activities, and those personnel who use them and who supervise their use, be thoroughly trained. The Rescue and Rehabilitation Contract should require that a list specifying the herbicides to be utilized for the duration of the project be compiled and distributed to the ECO and Biodiversity Specialist for approval prior to use. The improper use of herbicides can be detrimental to the immediate and surrounding environment, and as such, proper care must be taken when handling and using herbicides. To ensure that the reinstatement and re-vegetation process is successful, it is essential that all alien plant species within the construction corridor be removed prior to any re-vegetation activities occurring. For a list of alien plant species please refer to **Annexure A**.

7.2.2 Topsoil Testing

It is important that the soils are suitable for the planned re-vegetation activities, and it is recommended that the Rescue and Rehabilitation Contract include the collection and laboratory analysis of soil samples across the whole route where rehabilitation is to occur (at least 1 per Red Biodiversity Sector) in order to establish baseline data to determine soil improvement and / or conditioning requirements during rehabilitation. Samples of topsoil taken from within the construction corridor before construction commences should be analyzed for plant nutritional status by a recognized / reputable soil testing laboratory.

7.2.3 Sourcing Additional Topsoil

Should it be necessary to obtain additional topsoil for rehabilitation in areas that have been classified as Red Flag Sectors, then such soil should be obtained from a geologically comparable area. The Rescue and Rehabilitation

Contract should make provision for such activities and include the analyses of samples of any soil which has been obtained from outside the construction corridor which is to be used for rehabilitation.

7.2.4 Soil Preparation (Fertilisers, Soil Ameliorants, Compost, Mulch)

Red Flagged Sectors may not have any fertilizers or soil ameliorants added to the soil originating from the site or soil introduced to the site unless on specific instruction by the Biodiversity Specialist as a result of the soil testing results. For non-Red Flag Sectors, it is recommended that the data obtained from samples taken within the construction corridor and any additional topsoil be used as a basis for determining if any fertilizers and / or soil ameliorants, such as lime (to adjust the pH) are to be added to any soil obtained from outside the construction corridor. The decision to adjust soil chemical status must be taken in consultation with the Biodiversity Specialist. Plant nutrient status of the soil must also be determined. The following topsoil cover is necessary:

- On areas where the gradient is 1:5 or less, topsoil must not be less than 150mm deep
- On slopes of between 1:5 and 1:3, topsoil should be between 80 and 100mm deep
- On shorter slopes steeper than 1:3, where the use of geo-fabric is deemed unnecessary, topsoil to a depth not exceeding 80mm should be placed on the slope
- On longer slopes steeper than 1:3, where the use of geo-fabric is deemed necessary, no topsoil may be placed on the slope

7.3 Rehabilitation Methodologies for Planting

7.3.1 Hydro-seeding

7.3.1.1 Methodology

The Rescue and Rehabilitation Contract should consider appropriate sites for hydro-seeding. Hydro-seeding should only be used on slopes deemed of a gradient suitable to this methodology. It is important that the Supplier's recommendations are taken into consideration when hydro-seeding, and the Rescue and Rehabilitation Contract should describe an appropriate methodology for the sites in question and a suitable seed mix. It is recommended that indigenous seeds be used where possible. Areas to be hydro-seeded are typically lightly watered before planting to ensure that seed material does not come into contact with dry ground. A mulch or cellulose pulp (consisting of wood shavings, shredded straw, shredded paper or cotton waste) is usually added to the mix. A tackifier agent (e.g. molasses) may be added to assist in the binding of the seed to the mulch to ensure a successful micro climate for germination to occur. In addition to the cellulose pulp/mulch, compost (consisting of chicken manure, kraal manure, sugar cane filter cake or mushroom compost) can be incorporated too.

7.3.1.2 Establishment & Maintenance

The Rescue and Rehabilitation Contract should stipulate a measure for establishment success, as well as a maintenance programme for the re-vegetated areas. Typically, the soil should be kept moist for the first two weeks after hydro-seeding to ensure seed germination. Thereafter irrigation is applied at pre-determined intervals

dependent on the mix and the season until reasonable ground cover has been obtained. The Rescue and Rehabilitation Contract should stipulate a measure of establishment success. Watering should be gentle so as not to encourage the development of rill erosion. Any erosion damage as a result of irrigation should be repaired and areas reseeded. Adequate measures to prevent the re-colonisation of declared weeds and undesirable alien invasive species should be included in the Contract.

7.3.2 Grassing & Sodding

7.3.2.1 Methodology

The Rescue and Rehabilitation Contract should consider appropriate sites for grassing and sodding. Fertilizer is usually applied to areas in preparation of the sods, so it is important that this is considered when assessing site appropriateness. It is recommended that only sods 100% true to type and species, free of disease and weeds and in a good visible growing condition, be accepted on site. Sods should be of a uniform thickness and density, and it is recommended that they comprise indigenous species where possible. The prepared sites are to be watered well prior to the laying of the sods. Sods should be tapped down with the back of a spade, timber pummel or similar. The final level of the ground should not be greater than 50mm higher than the surrounding ground level. Sods are to be secured (for example by means of wooden stakes) on slopes of a steeper gradient.

7.3.2.2 Establishment & Maintenance

The Rescue and Rehabilitation Contract should stipulate a measure of establishment success, as well as a maintenance programme for the re-vegetated areas. The sods should be maintained by weeding and watering until the laid sods are successfully established (visibly growing). Watering should be gentle so as not to encourage the development of rill erosion. Any erosion damage as a result of irrigation should be repaired and areas re-sodded. Adequate measures to prevent the re-colonisation of declared weeds and undesirable alien invasive species should be included in the Contract.

7.3.3 Runners, Sprigs & Plugs

7.3.3.1 Methodology

The Rescue and Rehabilitation Contract should identify appropriate sites / areas along the route where runners, sprigs and plugs can or should be used in rehabilitation. Only plants free of disease and in a good visible growing condition may be accepted on site, and it is further recommended that mostly (only) indigenous plant species are used, and preferably those varieties specific to the area. It is advised that at planting, every cavity into which a plug is planted be filled with a moisture absorbent (hydroscopic) gel or equivalent. Plant species and spacing will depend on the nature of the receiving environment (e.g. veld, pasture, grassland, wetland or forest). When dealing with the 'sensitive' grassland, wetland or forest environments, the Rescue and Rehabilitation Contract should set site specific conditions.

Where there is a risk of erosion due to gradient and soils, erosion control measures should be required by the Contract. When using runners / sprigs / plugs for rehabilitation, berms are typically selected as an erosion control measure. Berms should be of a suitable material, and should be placed at pre-determined intervals at right-angles to the slope. Berms are typically laid in a shallow trench of a depth of approximately ⅓ of the height of the berm. The trench may be lined with geo-textile, which would wrap over the berm and be anchored into the slope above it. Where logs are used to create berms these should be anchored using sharpened wooden stakes. Where rocks are used to create berms, the size of the rocks used to form the core should be such that the diameter of the core is not less than 15cm. Smaller rocks are usually used to fill gaps between core rocks and if a geo-textile is not used, these should be of a size that they would not be easily washed from between the larger rocks.

7.3.3.2 Establishment & Maintenance

The Rescue and Rehabilitation Contract should stipulate a measure of establishment success, as well as a maintenance programme for the re-vegetated areas. Watering should be gentle so as not to encourage the development of rill erosion. Any erosion damage as a result of irrigation should be repaired and areas re-vegetated. Adequate measures to prevent the re-colonisation of declared weeds and undesirable alien invasive species should be included in the Contract.

7.3.4 Hand Broadcasting

7.3.4.1 Methodology

The Rescue and Rehabilitation Contract should identify appropriate sites for hand-broadcasting. The areas to be hand broadcasted should be lightly watered before planting to ensure that seed material does not come into contact with dry ground. The seed mixture should be evenly broadcasted over the entire surface area to be grassed. A mechanical seeding device may be used in order to ensure a uniform distribution of grass seed over the entire area to be rehabilitated. The grass seed is lightly worked into the upper layer of the topsoil usually by means of hand labour (using a rake). The seeded area is normally watered daily until all planting has been completed. Thereafter watering is carried out as per the establishment and maintenance requirements.

7.3.4.2 Establishment & Maintenance

The Rescue and Rehabilitation Contract should stipulate a measure of establishment success, as well as a maintenance programme for the re-vegetated areas. The soil is usually kept moist for the first two weeks after hand broadcasting to ensure seed germination. Thereafter irrigation is applied at pre-determined intervals until reasonable ground cover is obtained. The amount of irrigation to be applied will be the difference between rainfall recorded on site and the minimum requirement.

Watering should be gentle so as not to encourage the development of rill erosion. Any erosion damage as a result of irrigation should be repaired and areas re-vegetated. Adequate measures to prevent the re-colonisation of declared weeds and undesirable alien invasive species should be included in the Contract.

8. CONDITIONS FOR APPROPRIATE ALIEN PLANT CONTROL

The Rescue and Rehabilitation Contact should require an Alien Invasive Plant Control Programme describing the means of effectively managing the active sites following rehabilitation activities for a pre-determined period of time, or until project handover.

Herbicides are likely to be the most effective means of implementing alien plant control. However, especially in sectors where invasions of alien problem species such as wattle and gum exist, removal of the present crop by mechanical means could provide valuable resources to neighbouring communities, at the same time as providing some temporary employment. It is essential for rehabilitated areas to be monitored and for there to be regular follow-up treatments with alien plant control. Suitable / safe herbicides must be identified for use in the various sectors, and those personnel who use them and who supervise their use, be thoroughly trained. Proof of this training of personnel in the application and supervision of herbicides should be documented, filed and retained by the Rehabilitation Specialist for the duration of the Contract. Failure to heed this guideline could, amongst other things, result in damage to gardens, orchards and plantations and lead to costly litigation.

The Alien Invasive Plant Control Programme is to include a list of the herbicides which will be used on site. All herbicides must be selective and non-residual in nature and applied only by a licensed operator as per the legal requirements of the Conservation of Agriculture Resources Act, No 43 of 1983 and the Fertilisers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, No 36 of 1947.

In this regard it needs to be appreciated that the appropriate herbicides for a particular sector cannot always be determined on the basis of alien problem species which may be found growing in the sector before the plants are disturbed, as turning over of the topsoil and the movement of vehicles and personnel may cause species which were not previously found growing in a particular sector, to ‘appear’ after or even during disturbance.

9. DETAILS TO BE INCLUDED IN CONTRACT

9.1 General

The work to be executed under the contract should include the rescue of Red Data / Rare / Endangered plant species from Flagged Resource sites and the rescue of indigenous plant species or materials from the working corridor prior to construction, together with the progressive rehabilitation of the entire working corridor as the construction fronts progress along the route.

The contract is to reflect the conditions of this RRP, and the responsibilities defined for the role players. All activities described in the contract are to be undertaken in accordance with the EMP for EWS's NAA Phase 4 Project.

9.2 Rescue and Rehabilitation Programme

On appointment of a Rehabilitation Specialist, a detailed rescue and rehabilitation programme is to be designed and submitted as required by the contract for approval by the Environmental Control Officer (ECO) and the Engineer's Representative (ER). As soon as the ECO and ER have approved the rescue and rehabilitation programme, it will become contractually binding and may not be changed without the approval of the ECO and ER. The degree of detail required in the programme must be sufficient to permit an accurate assessment of progress to within a time period not exceeding one week.

9.3 Progress Control

The contract documentation should define suitable progress reporting structures. The Rehabilitation Specialist is to submit copies of the programme with a progress report to the ECO and ER at pre-determined intervals. Should any critical activities be behind programme, the Rehabilitation Specialist must submit a written report with the programme stating the measures that will be taken to bring those activities back on programme in a manner as described by the contract.

The Rehabilitation Specialist shall carry out the works expeditiously in order to complete the rescue and rehabilitation within the programmed time. The contract should stipulate the penalty or fine processes associated with delays or non-compliances associated with the EMP, as documented in the EMP.

9.4 Site Meetings

The Rehabilitation Specialist, ECO and other persons who may be nominated by the ER shall be required to attend site meetings, the intervals, the date and place for which will be set either in the contract or by the ECO in consultation with the Rehabilitation Specialist. The main purpose of the site meetings will be to review and discuss delays (if any), progress, programme and problems directly associated with the execution of the works.

9.5 Route Priorities for Rescue and Rehabilitation

The pipeline route has been prioritised in terms of terrestrial and aquatic biodiversity significance. Certain environmentally sensitive portions of the route require more careful environmental management and rehabilitation work than other sectors. A Flag System was used to differentiate between more important and less important sectors of the pipeline and included three coded situations:

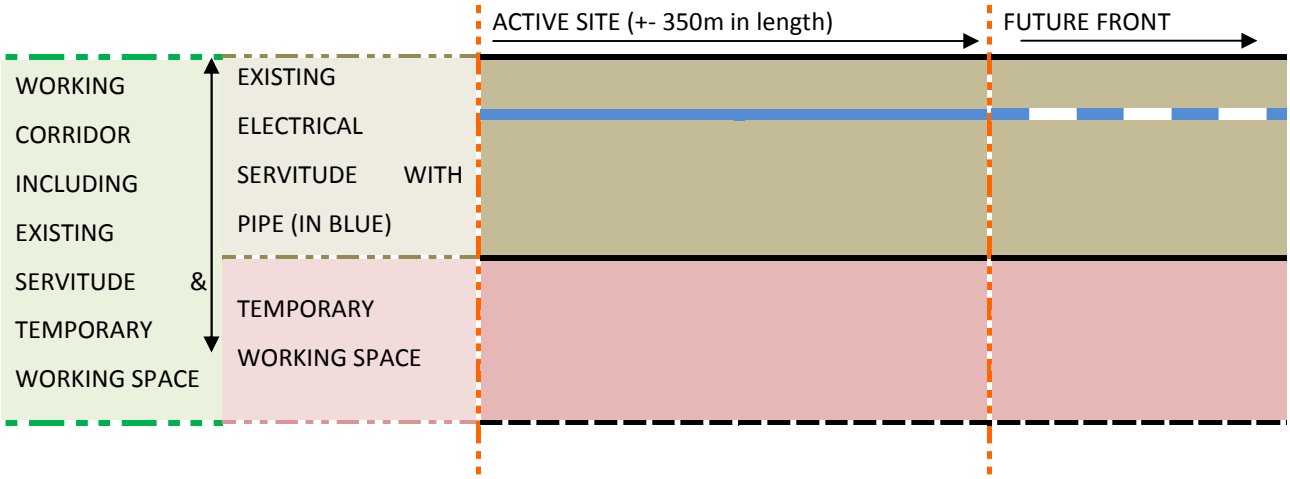
G⚑ Green Flag: Requires basic rescue and rehabilitation activities given that the status of the receiving

environment is not considered a priority in terms of biodiversity significance.

O⚑ Orange Flag: Requires intermediate rescue and rehabilitation activities given that the status of the receiving environment shows potential in terms of biodiversity significance.

R⚑ Red Flag: Requires specific and careful rescue and rehabilitation activities given that the status of the receiving environment contributes significantly to the preservation of fauna and flora species.

The Rescue and Rehabilitation Contract is to specify rescue and rehabilitation techniques and methodologies to



reach desired outcomes that appropriately reflect the biodiversity significance of the sites in question.

9.6 Servitude and Fencing

The new pipeline will generally be constructed within existing electrical servitude. In addition to this, a temporary working space of up to 20 metres in width may be negotiated with land owners in certain instances, for the purpose of facilitating the installation of the NAA Phase 4 pipeline. The working space and existing electrical servitude are collectively termed the 'working corridor'. There may be one or more active sites of construction at various locations along the working corridor.

Figure 3.1: Schematic representation of the working corridor (which comprises the existing electrical servitude and temporary working space for the entire route), and an active site.

The active sites will be a maximum of 350 metres in length by 30 metres in width, and will be temporally fenced by the Contractor, as instructed by the ER. All rehabilitation activities (with the exception of certain rescue and all maintenance period activities) and staff are to be limited to the active sites within the working corridor, and may not trespass into private property at any time. The active site may only be accessed along working corridor routes determined by the Contractor and approved by the ECO and ER.

9.7 Supporting legislation

The Conservation of Agricultural Resources Act (CARA), No. 43 of 1983, including Regulations 15 and 16 amended in May 2001. Regulations 15 and 16 of CARA specify that alien plant species are grouped according to the three categories listed below:

- Category 1 plants: alien plant species listed in this category are classified as weeds; they are prohibited on all land and water surfaces in South Africa; the plant species listed in this category must be controlled or eradicated.
- Category 2 plants: include most alien plant species that have commercial or utility value; these listed plant species are only allowed in areas demarcated by the administering authority, and provided a permit has been applied for and issued by the administering authority. The spread of these plant species must be prevented.
- Category 3 plants: include most ornamental alien plant species; these plant species may no longer be planted but existing plants may remain; they are prohibited within the floodlines of wetlands and watercourses.
- National Environmental Management: Biodiversity Act (NEMBA), No. 10 of 2004.
- Fertilisers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, No 36 of 1947.

10.REFERENCES

Department of Water and Forestry website. http://www.dwaf.gov.za accessed on 9/01/2009.

Nichols, G. (2002). Departmental specification: Revegetation specification for civil engineering construction projects. eThekwini Municipality, Environmental Management Branch.

Nichols, G. (2005). Growing Rare Plants: A practical handbook on propagating the threatened plants of southern Africa.

Department of Agriculture website. *Weeds and Invasive Plants*. http://www.agis.agric.za/agisweb/wip accessed on 9/01/2009

Edwards, D. 1983. A broad-scale structural classification of vegetation for practical purposes. *Bothalia* 14, 3&4: 705 -712.

Granger, J.E. (1984 unpublished). A physiognomic-structural scheme for mapping the vegetation occurring in the Cathkin Key Area.

Granger, J.E. (2012). A Basic Assessment of the Plant Communities intersected by Phase 4 of the Northern Aqueduct Augmentation (NAA PH4) and A brief Account of their Possible Roles in Determining Biodiversity.

Mucina, L. and Rutherford, M.C. (eds.) 2006 Vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.

.

ADDENDUM A:

Weeds and Invasive plants that can be found in KwaZulu-Natal

TABLE B.1: WEEDS AND INVASIVE PLANTS OF KWAZULU-NATAL

SPECIES	CATEGORY		*SPECIES*	CATEGORY	
Acacia longifolia	1		*Achyranthes aspera*	1	
Ageratina adenophora	1		*Ageratina riparia*	1	
Ageratum conyzoides	1		*Ageratum houstonianum*	1	
Albizia lebbeck	1		*Albizia procera*	1	
Anredera cordifolia	1		*Araujia sericifera*	1	
Ardisia crenata	1		*Argemone mexicana*	1	
Argemone ochroleuca	1		*Arundo donax*	1	
Azolla filiculoides	1		*Bryophyllum delagoense*	1	
Caesalpinia decapetala	1		*Campuloclinium macrocephalum*	1	
Canna indica	1		*Cardiospermum grandiflorum*	1	
Cereus jamacaru	1		*Cestrum aurantiacum*	1	
Cestrum elegans	1		*Cestrum laevigatum*	1	
Cestrum parqui	1		*Chromolaena odorata*	1	
Cinnamomum camphora	1		*Cirsium vulgare*	1	
Convolvulus arvensis	1		*Cortaderia jubata*	1	
Cortaderia selloana	1		*Cuscuta campestris*	1	
Cuscuta suaveolens	1		*Cytisus scoparius*	1	
Datura ferox	1		*Datura inoxia*	1	
Datura stramonium	1		*Echium plantagineum*	1	
Echium vulgare	1		*Egeria densa*	1	
Eichhornia crassipes	1		*Hakea sericea*	1	
Harrisia martinii	1		*Hedychium coccineum*	1	
Hedychium coronarium	1		*Hedychium flavescens*	1	
Hedychium gardnerianum	1		*Lantana camara*	1	
Macfadyena unguis-cati	1		*Myriophyllum aquaticum*	1	
Myriophyllum spicatum	1		*Nerium oleander*	1	
Nicotiana glauca	1		*Opuntia aurantiaca*	1	
Opuntia ficus-indica	1		*Opuntia humifusa*	1	
Opuntia imbricata	1		*Opuntia monacantha*	1	
Opuntia stricta	1		*Parthenium hysterophorus*	1	

Passiflora suberosa	1		*Passiflora subpeltata*	1	
Pennisetum setaceum	1		*Pereskia aculeata*	1	
Pistia stratiotes	1		*Pittosporum undulatum*	1	
Psidium X durbanensis	1		*Pueraria montana*	1	
Rivina humilis	1		*Rosa rubiginosa*	1	
Rubus cuneifolius	1		*Salvinia molesta*	1	
Schinus terebinthifolius	1		*Sesbania punicea*	1	
Solanum elaeagnifolium	1		*Solanum mauritianum*	1	
Solanum seaforthianum	1		*Solanum sisymbriifolium*	1	
Sphagneticola trilobata	1		*Tecoma stans*	1	
Thevetia peruviana	1		*Tithonia diversifolia*	1	
Tithonia rotundifolia	1		*Toxicodendron succedaneum*	1	
Triplaris americana	1		*Ulex europaeus*	1	
Xanthium spinosum	1		*Xanthium strumarium*	1	
Acacia dealbata	1	2	*Leucaena leucocephala*	1	2
Eugenia uniflora	1	3	*Ipomoea alba*	1	3
Schinus terebinthifolius	1	3	*Sphagneticola trilobata*	1	3
Tamarix ramosissima	1	3			
Acacia decurrens	2		*Acacia mearnsii*	2	
Acacia melanoxylon	2		*Acacia saligna*	2	
Agave sisalana	2		*Casuarina cunninghamiana*	2	
Eucalyptus camaldulensis	2		*Eucalyptus grandis*	2	
Gleditsia triacanthos	2		*Nasturtium officinale*	2	
Pinus canariensis	2		*Pinus elliottii*	2	
Pinus halepensis	2		*Pinus patula*	2	
Pinus radiata	2		*Pinus taeda*	2	
Populus X canescens	2		*Populus alba*	2	
Psidium guajava	2		*Ricinus communis*	2	
Robinia pseudoacacia	2		*Salix babylonica*	2	
Salix fragilis	2		*Sorghum halepense*	2	
Acacia baileyana	3		*Acacia elata*	3	
Acacia podalyriifolia	3		*Ailanthus altissima*	3	

Bauhinia purpurea	3		*Bauhinia variegata*	3	
Cotoneaster franchetii	3		*Cotoneaster pannosus*	3	
Eriobotrya japonica	3		*Grevillea robusta*	3	
Ipomoea indica	3		*Ipomoea purpurea*	3	
Jacaranda mimosifolia	3		*Ligustrum japonicum*	3	
Ligustrum lucidum	3		*Ligustrum ovalifolium*	3	
Ligustrum sinense	3		*Lilium formosanum*	3	
Melia azedarach	3		*Mimosa pigra*	3	
Morus alba	3		*Nephrolepis exaltata*	3	
Phytolacca dioica	3		*Plectranthus comosus*	3	
Pontederia cordata	3		*Psidium cattleianum*	3	
Psidium guineense	3		*Pyracantha angustifolia*	3	
Pyracantha crenulata	3		*Senna bicapsularis*	3	
Senna didymobotrya	3		*Senna pendula*	3	
Syzygium cumini	3		*Syzygium jambos*	3	
Toona ciliata	3				