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ENVIRONMENTAL MANAGEMENT PROGRAMME

FOR THE

PROPOSED UPGRADE OF THE MOORDKUIL RAW WATER PUMP STATION ON PORTIONS 15, 24 AND 25 OF THE FARM KLIPHEUVEL NO. 143, KLEINBRAK RIVIER, MOSSEL BAY MUNICIPALITY, WESTERN CAPE

APPLICATION IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998
(ACT NO. 107 OF 1998), AS AMENDED, AND THE ENVIRONMENTAL IMPACT ASSESSMENT REGULATIONS, 2014

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DATE: 26 June 2026

SES REF NO: EMPR/UMPS/MBM/WC/06/26

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Appendix 4 of the EIA Regulations 2014 (as amended 2017).

This Environmental Management Programme has been drafted in accordance with Appendix 4 of the Environmental Impact Assessment Regulations 2014 (as amended 2017). The table below shows how the requirements of Appendix 4 have been included within this Environmental Management Programme.

(1) An EMPr must comply with section 24N of the Act and include— (a)details of– (i)the EAP who prepared the EMPr; and (ii)the expertise of that EAP to prepare an EMPr, including a curriculum vitae;	Appendix G- EAP CV
(b)a detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description;	Section 4 – Description of the Activity
(c)a map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that should be avoided, including buffers;	Section 4 - Description of the Activity
(d)a description of the impact management outcomes, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development including— (i)planning and design; (ii)pre-construction activities; (iii)construction activities; (iv)rehabilitation of the environment after construction and where applicable post closure; and (v)where relevant, operation activities;	Section 9 - Environmental Impact Management: Planning and Design Phase Section 10 - Environmental Impact Management: Pre-construction Phase Section 11 - Environmental Impact Management : Construction Phase Section 12 - Environmental Impact Management : Post Construction Rehabilitation Phase & Operational Phase
(f)a description of proposed impact management actions, identifying the manner in which the impact management outcomes contemplated in paragraph (d) will be achieved, and must, where applicable, include actions to — (i)avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation; (ii)comply with any prescribed environmental management standards or practices; (iii)comply with any applicable provisions of the Act regarding closure, where applicable; and (iv)comply with any provisions of the Act regarding financial provision for rehabilitation, where applicable;	Section 9 - Environmental Impact Management: Planning and Design Phase Section 10 - Environmental Impact Management: Pre-construction Phase Section 11 - Environmental Impact Management: Construction Phase Section 12 - Environmental Impact Management: Post Construction Rehabilitation Phase & Operational Phase
(g)the method of monitoring the implementation of the impact management actions contemplated in paragraph (f);	Section 15 - Roles and Responsibilities Section 17 - Monitoring, Record Keeping and Reporting
(h)the frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f);	Section 15 - Roles and Responsibilities Section 17 - Monitoring, Record Keeping and Reporting
(i)an indication of the persons who will be responsible for the implementation of the impact management actions;	Section 9 - Environmental Impact Management: Planning and Design Phase Section 10 - Environmental Impact Management: Pre-construction Phase Section 11 - Environmental Impact Management: Construction Phase Section 12 - Environmental Impact Management: Post Construction Rehabilitation Phase & Operational Phase Section 15 - Roles and Responsibilities
(j)the time periods within which the impact management actions contemplated in paragraph (f) must be implemented;	Section 9 - Environmental Impact Management: Planning and Design Phase Section 10 - Environmental Impact Management: Pre-construction Phase

	Section 11 - Environmental Impact Management: Construction Phase Section 12 - Environmental Impact Management: Post Construction Rehabilitation Phase & Operational Phase
(k)the mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f);	Section 15 - Roles and Responsibilities Section 17 - Monitoring, Record Keeping and Reporting
(l)a program for reporting on compliance, taking into account the requirements as prescribed by the Regulations;	Section 9 - Environmental Impact Management: Planning and Design Phase Section 10 - Environmental Impact Management: Pre-construction Phase Section 11 - Environmental Impact Management: Construction Phase Section 12 - Environmental Impact Management: Post Construction Rehabilitation Phase & Operational Phase Section 15 - Roles and Responsibilities Section 17 - Monitoring, Record Keeping and Reporting
(m)an environmental awareness plan describing the manner in which— (i)the applicant intends to inform his or her employees of any environmental risk which may result from their work; and (ii)risks must be dealt with in order to avoid pollution or the degradation of the environment; and	Section 15 - Roles and Responsibilities
(n)any specific information that may be required by the competent authority.	tbd

DOCUMENT DETAILS

Project Ref. No:	
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Sharples Environmental Services cc (SES) has been actively engaged since 1998 in the fields of environmental planning, assessment and management. Clients include private, corporate and public enterprises on a variety of differing land use applications ranging from large-scale residential estates and resorts to golf courses, municipal service infrastructure installations and the planning of major arterials. The consultants have over 40+ years of combined experience and operate in the Southern, Eastern and Western Cape regions.

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1. Introduction

Sharples Environmental Services cc (SES) has been appointed *by Neil Lyners and Associates (Pty) Ltd,* on behalf of *the Department of Water and Sanitation,* to complete the Environmental Management Programme (EMPr) as part of the Basic Assessment Process for the proposed upgrade of the Moordkuil Raw Water Pump Station on Portions 15, 24 and 25 of the Farm Klipheuvel No. 143, Kleinbrak Rivier, Mossel Bay Municipality, Western Cape.

The proposed upgrade will trigger listed activities in terms of the Amended Environmental Impact Assessment Regulations of 2014 (GN No. R.324 - 327 of 7 April 2017). Environmental Authorisation is therefore required from the competent authority (Department of Forestry, Fisheries and the Enviornmnet) before construction can commence.

2. About this EMPr

This document is intended to serve as a guideline to be used by *the Department of Water and Sanitation* (Applicant) and any person/s acting on behalf of the *Department of Water and Sanitation*, during the pre-construction, construction, post-construction, and rehabilitation phases of the proposed upgrade and development. This document provides measures that must (where practical and feasible) be implemented to ensure that any environmental degradation that may be associated with the development is avoided, or where such impacts cannot be avoided entirely, are minimised, and mitigated appropriately.

This EMPr has been prepared in accordance with the requirements of an EMPr as specified in the Amended Environmental Impact Assessment Regulations, 2014 (GN No. R. 326 of 7 April 2017), and with reference to the "Guidelines for Environmental Management Programmes" published by the Department of Environmental Affairs and Development Planning (2005).

It is important to note that the EMPr is not designed to manage the physical establishment of the upgrade and development *per se* but should rather be seen as a tool which can be used to manage the environmental impacts of the development.

The rehabilitation, mitigation, management, and monitoring measures prescribed in this EMPr must be seen as binding to the *Department of Water and Sanitation*, and any person acting on its behalf, including but not limited to agents, employees, associates, guests, or any person rendering a service to the development site.

2.1 Important caveat to the report

In the past, some developments have had a devastating impact on the environment even though they have had Environmental Management Programmes in place, while other developments have had a low impact even though no management plans have been compiled.

The Implementing Agent and the attitude of the construction team play an integral role in determining the impact that the development will have on the environment. The ECO (see Chapter 15) needs to ensure that all role-players are "on board" with regard to the constraints that the EMPr places on the development and construction team. The end result relies on cooperation and mutual respect and understanding of all parties involved.

3. How to use this document

It is essential that this EMPr be carefully studied, understood, implemented, and adhered to as far as reasonably possible, throughout all phases of the proposed development. The *Department of Water and Sanitation* must retain a copy of this EMPr, and another copy of this EMPr must be kept on site at all times during the pre-construction, construction, and post-construction rehabilitation phases of the development.

This EMPr must be included in all contracts compiled for contractors and subcontractors employed by the *Department of Water and Sanitation*, as this EMPr identifies and specifies the procedures to be followed by engineers and other contractors to ensure that the adverse impacts of construction activities are either avoided or reduced. *The Department of Water and Sanitation* and any appointed contractors must make adequate financial provision to implement the environmental management measures specified in this document.

This EMPr must be seen as a working document, which may be amended from time to time as needed, in order to accommodate changing circumstances on site or in the surrounding environment, or in order to accommodate requests/ conditions issued by the competent authority, the Department of Forestry, Fisheries and the Environment (DFFE). Amendments to this EMPr must first be approved by the competent authority, in writing.

4. Background and Location of the activity

4.1 Background and description

Sharples Environmental Services cc was appointed by *Neil Lyners and Associates (Pty) Ltd*, on behalf of the *Department of Water and Sanitation*, as the Independent Environmental Assessment Practitioner to conduct the Basic Assessment Report for the Upgrading of the Moordkuil Raw Water Pump Station (Moordkuil Pump Station).

The existing raw water abstraction works (constructed in 1980) was designed to abstract 800 litres per second of water from the Moordkuil river and to pump the water to the Klipheuwel Dam for storage. The Klipheuwel Dam is one of four reservoirs from which Mossel Bay residents receive their water. Only one of the existing two axial pumps is currently operational, which means that the facility is operating at half its original intended design capacity. The existing axial pump station design is outdated and it is not able to be maintained / repaired due to the unavailability of parts and other maintenance restrictions (unable to remove parts easily, axial pumps are not protected from silt and are subject to repeated wear and tear). It is therefore required to upgrade the existing raw water abstraction works and pump station with more modern technology that will be low maintenance, cost effective and efficient (able to abstract water at the full original intended design capacity of 800 litres per second and low maintenance). Please refer to Figure 1 and 2 below for the locality of the Moordkuil Pump Station.

Figure 1: Location of the Moordkuil Pump Station.

Figure 2: Close-up Locality of the Moordkuil Pump Station.

Description of the Proposed Development:

The proposed development project entails the upgrade of the existing Raw Water Abstraction Works and Pump Station. In summary, the following is proposed to be constructed:

- The construction of a new reinforced concrete inlet hopper structure for the pump station;
- The construction of pipe protection ramp structure for the pipes into the existing pump station building.
- An existing informal dirt road off Blesbok Road, provides access to the site. It is proposed to reinstate the existing gravel road (180m long and 3.6m wide) within the same development footprint, which has become almost impassable due to water ingress into the existing layerworks (farmers leaking irrigation channel). The final road is proposed to be 3m wide. 300mm is proposed on each side for the bottom layerworks that have to be wider than the top layerworks to transfer vehicle loads to the soil. The proposed affected area will be 3.6m but the final road will be 3m wide with a stormwarter channel/ditch of about 1m width adjacent. The existing road is approximately 3m wide as well and we can safely assume that its layerworks would also have been similar to the proposed reinstatement design.
- A new concrete road (in an already disturbed area mostly). The new concrete road proposed is has a footprint of approximately 1100m2 and has a width of 3m with a stormwater channel/ditch of about 1m width adjacent.
- Installation of gabions between the cement access road edge and the river;
- Construction of an access ramp to the hopper;
- The construction of a new water meter chamber next to the pump station. The development footprint of the water meter chamber is approximately 20m^2;
- Replacing of three air-valves and construction of new chambers around the air-valves;
- Installation of new pipework, pumps and motor control centers;
- Installation of other mechanical items such as cover, trash-racks, etc.
- Upgrading of the electrical supply and breakers within the existing pump station building;
- Installation of a sediment barrier downstream of the crossing to curb sediment generation in the river;
- Final reinstatement of the river bed to the requirements of the CEMP;

The concrete inlet hopper structure is proposed to be anchored to the bedrock by means of piling foundations. In order to install the piles, a pile rig needs to obtain access in the correct position. It is for this reason that a temporary platform structure is required to be constructed within the Moordkuil River.

The area where the inlet hopper (and the associated pile foundations) is proposed to be constructed is below the 1:10 year floodline, within the river. It is therefore required to construct a coffer dam around the area where the inlet hopper structure is proposed to be built in order to have a dry area for construction and concrete setting.

All of the above, except for the proposed temporary platform, cement access road, new water meter chamber and sediment barrier, are proposed within the existing development footprint.

It is also proposed to demolish the existing underwater cement bag wall, existing above water concrete steps and the existing underwater concrete plinths for the existing pipes.
Please refer to the proposed site layout plans below.

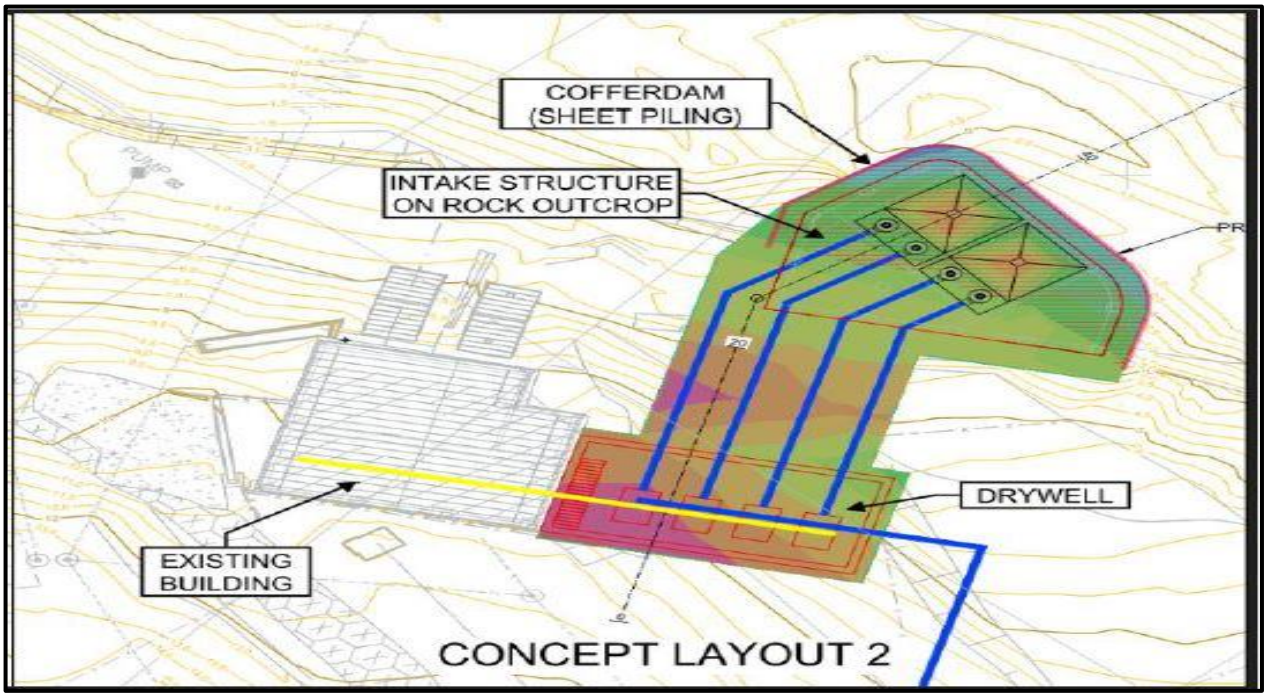


Figure 3: Option 3 - Concept Layout 2

To maximise the value of existing assets, a phased approach will be adopted:

- Phase 1: Utilisation of existing immersible and end-suction pumps that was bought based on the previous (2014 – 2016) investigation.
- Phase 2: Replacement of the immersible pumps with foot valves and installing larger single stage end suction pumps in die drywell. The detailed considerations for this system, such as the operation of the foot valves and the suction pipework priming, will be included in the detailed design report.

Three alternative site camp locations are also proposed, however based on the specialist assessments it was determined that site camp option 3 is the only feasible option. Please refer to the Figures below showing the proposed services layout, the working area and site camps, and Google Earth Imagery of the construction footprint.

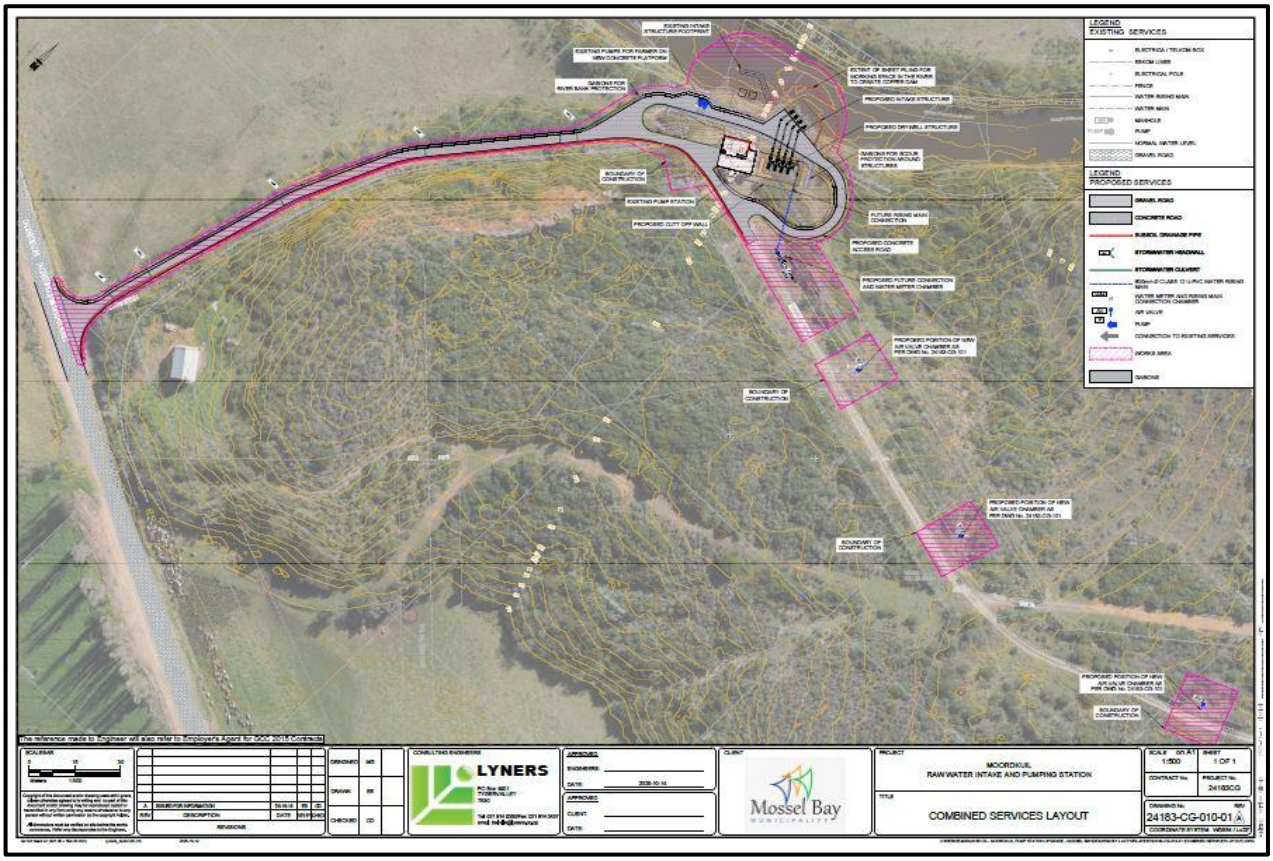


Figure 4: Proposed Services Layout.

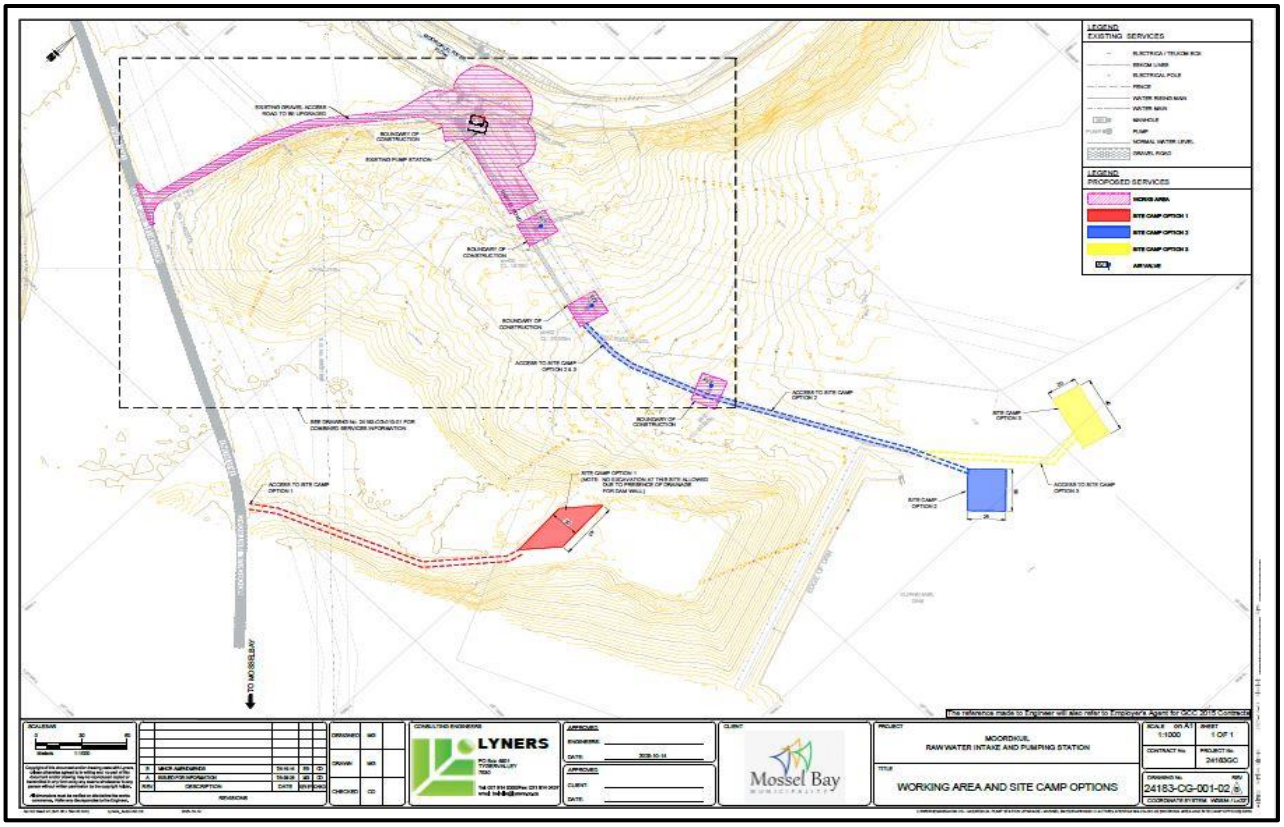


Figure 5: Working Area and Site Camp Locations Layout.

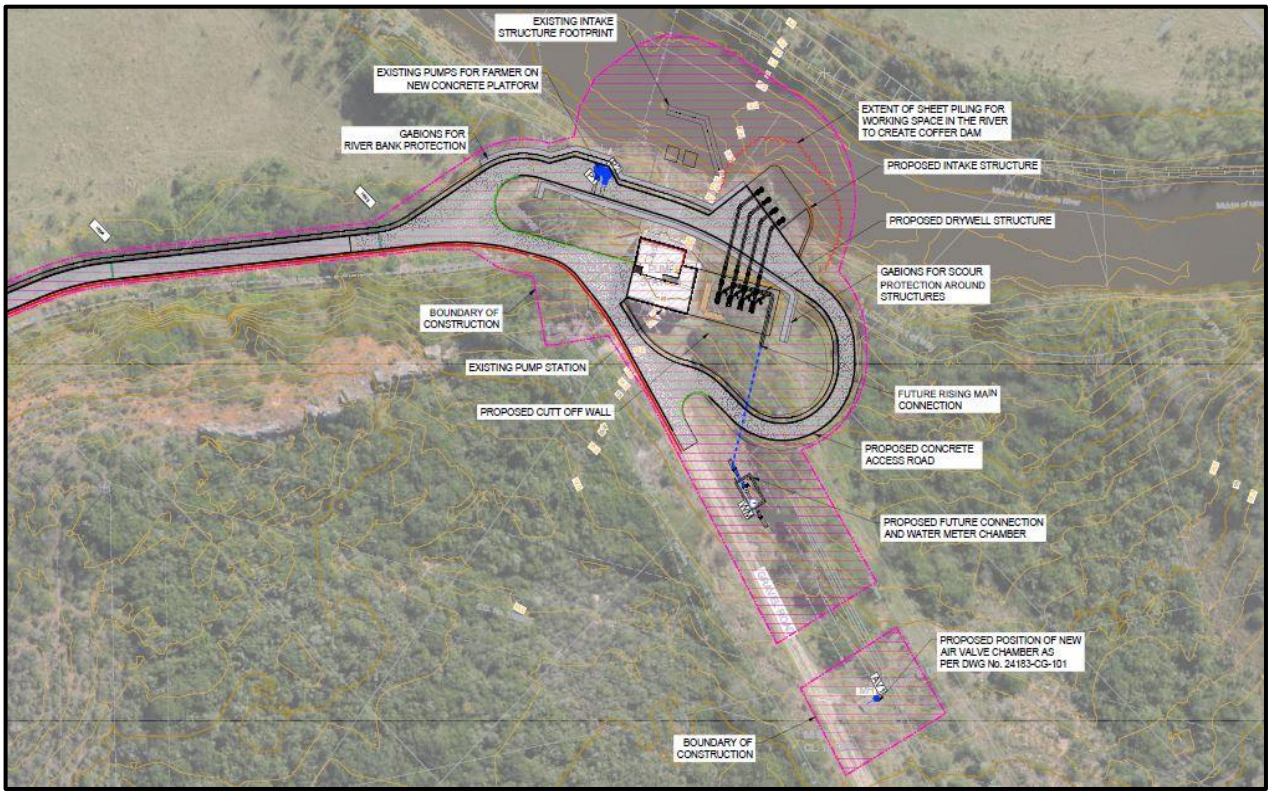


Figure 6: Proposed Upgrades to the Moordkuil Pump Station.

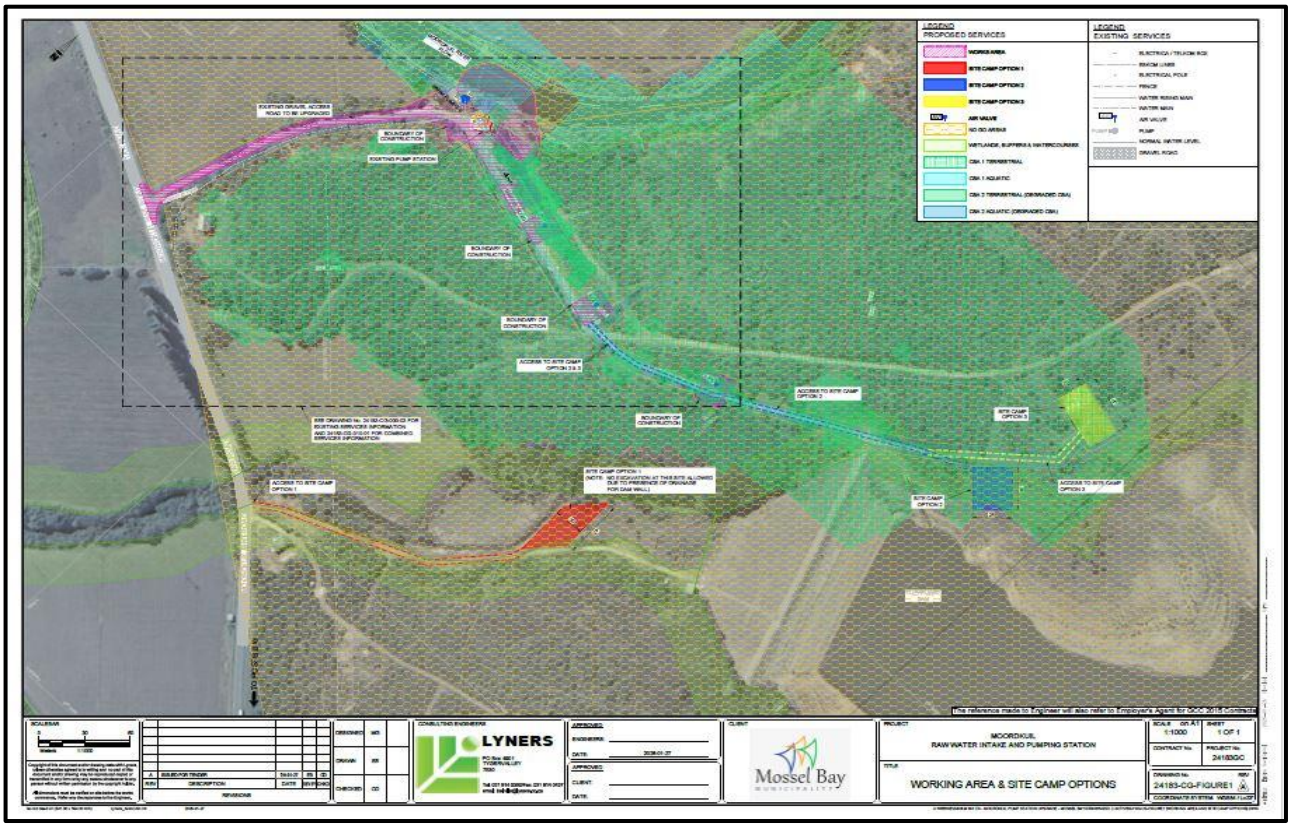


Figure 7: Working Area and Site Camp Locations Layout with all of the Available Biodiversity Information.

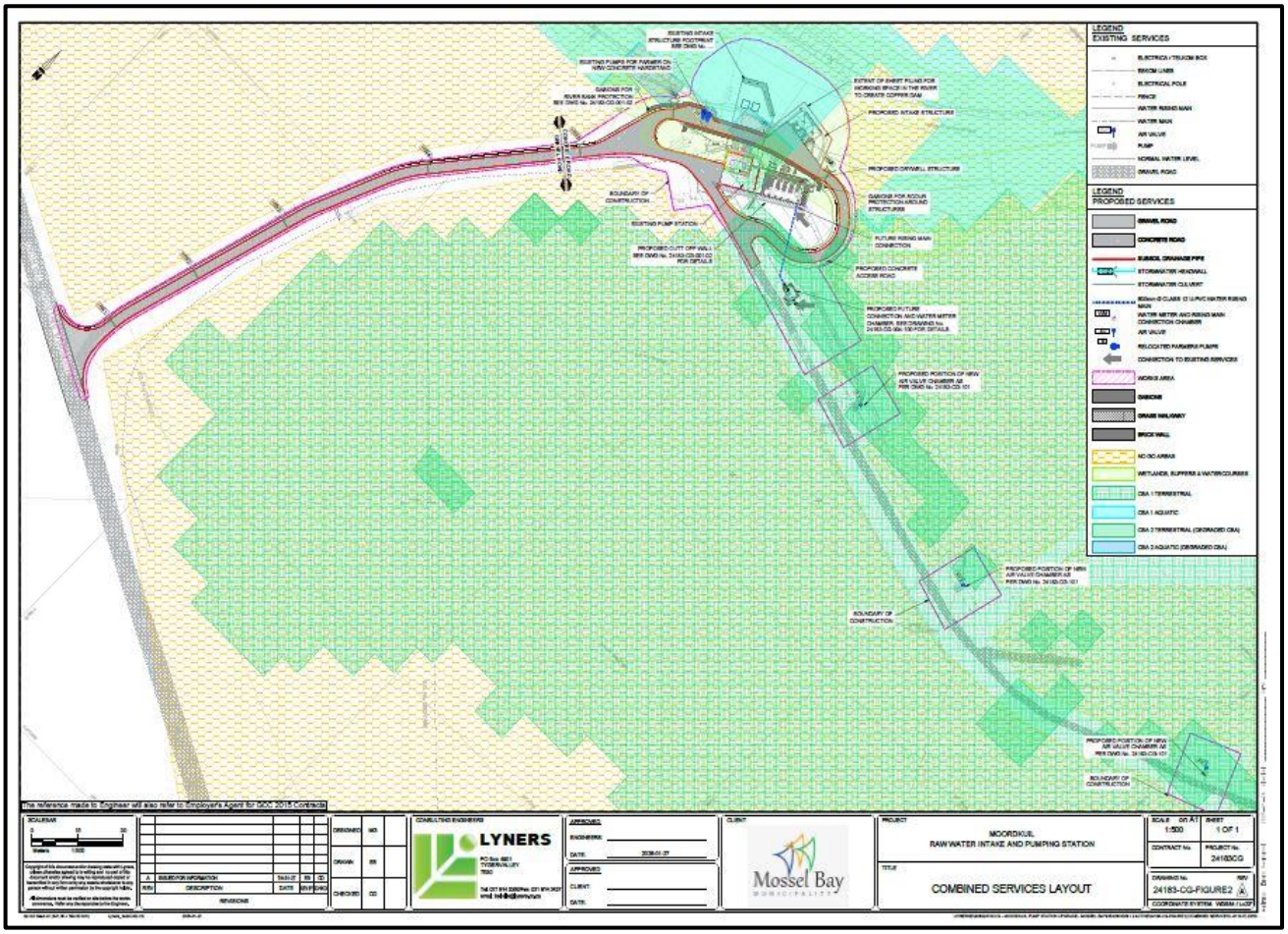


Figure 8: Final Preferred Layout Map showing the Proposed Upgrades to the Moordkuil Pump Station, with all of the Available Biodiversity Information.

Table 1: Summary Table: Site and Erf Details

Province	Western Cape
District Municipality	Garden Route District Municipality
Local Municipality	Mossel Bay Municipality
Ward number	Ward 4
Erf name	Portion 15 of the Farm Klipheuwel No. 143; Portion 24 of the Farm Klipheuwel No. 143; Portion 25 of the Farm Klipheuwel No. 143

6. Legal Framework

6.1 Environmental Impact Assessment Regulations (2017)

The following listed activities, in terms of the amended Environmental Impact Assessment Regulations, 2017 (GN No. R. 324 – 327) will be triggered by the proposed development:

Table 2: Listed activities in terms of the amended Environmental Impact Assessment Regulations (2017)

Listed Activity No(s):	Describe the relevant Basic Assessment Activity(ies) in writing as per Listing Notice 1 (GN No. R. 983)
12	**The development of—** (i)dams or weirs, where the dam or weir, including infrastructure and water surface area, exceeds 100 square metres; or **(ii)infrastructure or structures with a physical footprint of 100 square metres or more;** **where such development occurs—** **(a) within a watercourse;** (b) in front of a development setback; or **(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse; —** excluding— (aa) the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour; (bb) where such development activities are related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies; (cc) activities listed in activity 14 in Listing Notice 2 of 2014 or activity 14 in Listing Notice 3 of 2014, in which case that activity applies; (dd) where such development occurs within an urban area; (ee) where such development occurs within existing roads, road reserves or railway line reserves; or (ff) the development of temporary infrastructure or structures where such infrastructure or structures will be removed within 6 weeks of the commencement of development and where indigenous vegetation will not be cleared.
19	**The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse**; but excluding where such infilling, depositing, dredging, excavation, removal or moving— (a) will occur behind a development setback; (b) is for maintenance purposes undertaken in accordance with a maintenance management plan; (c) falls within the ambit of activity 21 in this Notice, in which case that activity applies; (d) occurs within existing ports or harbours that will not increase the development footprint of the port or harbour; or (e) where such development is related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies.
45	**The expansion of infrastructure for the bulk transportation of water or storm water where the existing infrastructure—** **(i) has an internal diameter of 0,36 metres or more;** or **(ii) has a peak throughput of 120 litres per second or more;** and (a) where the facility or infrastructure is expanded by more than 1 000 metres in length; or (b) where the throughput capacity of the facility or infrastructure will be increased by 10% or more;

	excluding where such expansion— (aa) relates to transportation of water or storm water within a road reserve or railway line reserve; or (bb) will occur within an urban area.
Listed Activity No(s):	Describe the relevant Basic Assessment Activity(ies) in writing as per Listing Notice 3 (GN No. R. 985)
4	**The development of a road wider than 4 metres with a reserve less than 13,5 metres.** **i. Western Cape** i. Areas zoned for use as public open space or equivalent zoning; ii. Areas outside urban areas; **(aa) Areas containing indigenous vegetation;** (bb) Areas on the estuary side of the development setback line or in an estuarine functional zone where no such setback line has been determined; or iii. Inside urban areas: (aa) Areas zoned for conservation use; or (bb) Areas designated for conservation use in Spatial Development Frameworks adopted by the competent authority.
12	**The clearance of an area of 300 square metres or more of indigenous vegetation** except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan. **i. Western Cape** **i. Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004;** **ii. Within critical biodiversity areas identified in bioregional plans;** iii. Within the littoral active zone or 100 metres inland from high water mark of the sea or an estuarine functional zone, whichever distance is the greater, excluding where such removal will occur behind the development setback line on erven in urban areas; iv. On land, where, at the time of the coming into effect of this Notice or thereafter such land was zoned open space, conservation or had an equivalent zoning; or v. On land designated for protection or conservation purposes in an Environmental Management Framework adopted in the prescribed manner, or a Spatial Development Framework adopted by the MEC or Minister.
14	**The development of—** (i) dams or weirs, where the dam or weir, including Infrastructure and water surface area exceeds 10 square metres; or **(ii) infrastructure or structures with a physical footprint of 10 square metres or more;** **where such development occurs—** **(a) within a watercourse;** (b) in front of a development setback; or **(c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse;** excluding the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour. **i. Western Cape** i. Outside urban areas: (aa) A protected area identified in terms of NEMPAA, excluding conservancies; (bb) National Protected Area Expansion Strategy Focus areas; (cc) World Heritage Sites;

	(dd) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; (ee) Sites or areas listed in terms of an international convention; **(ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans**; (gg) Core areas in biosphere reserves; or (hh) Areas on the estuary side of the development setback line or in an estuarine functional zone where no such setback line has been determined.

6.2 Other applicable legislation

The *Department of Water and Sanitation,* is responsible for ensuring that all contractors, labourers and any other appointed person/entity acting on their behalf, remain compliant with the conditions of the received environmental authorisation and water-use authorisations, as well as the provisions of all other applicable legislation, including *inter alia*:

- National Environmental Management Act (NEMA) (Act No 107 of 1998, as amended);
- National Environmental Management Biodiversity Act (Act 10 of 2004);
- National Water Act (Act 36 of 1998)
- National Environmental Management: Waste Act (Act 59 of 2008);
- National Forest Act (Act No 84 of 1998);
- National Heritage Resources Act (Act No 25 of 1999);
- Occupational Health and Safety Act (Act 85 of 1993);

The above listed legislation have general applicability to most development applications, and it is the *Department of Water and Sanitation's* responsibility to ensure that all contractors and employees are aware of their obligations in terms of these Acts. This EMPr does not detract from any other legal requirements.

7. Scope of this EMPr

This EMPr describes the measures that must be implemented in order to avoid, minimise, manage and monitor the potential environmental impacts of the development, during all phases of the project life cycle, namely:

- Planning and Design Phase
- Pre-construction Phase
- Construction Phase
- Operational Phase

General environmental management measures that must be applied throughout the project lifecycle (as and where applicable) are described in Chapter 8. Additional management measures that must be implemented to address specific impacts that may arise during each phase are provided in **Chapters 9-12** of this EMPr.

8. General Environmental Management

The following general management measures are intended to protect environmental resources from pollution and degradation during all phases of the project life cycle. These measures must be implemented as and where applicable, reasonable and practicable during the pre-construction, construction and post-construction and rehabilitation phases of the proposed development.

8.1 Site access and traffic management

The existing access point to the Moordkuil Raw Water Abstraction Works and Pump Station off Blesbok Road must be utilized to access the development site.

In general, all construction vehicles need to adhere to traffic laws. The speed of construction vehicles and other heavy vehicles must be strictly controlled to avoid dangerous conditions for other road users. As far as possible care must be taken to ensure that the local traffic flow pattern is not too significantly disrupted, and all vehicle operators therefore need to be educated in terms of "best-practice" operation to minimise unnecessary traffic congestion or dangers. Construction vehicles must therefore not unnecessarily obstruct the access point or traffic lanes used to access the site. Construction vehicles also need to consider the load carrying capacity of road surfaces and adhere to all other prescriptive regulations regarding the use of public roads by construction vehicles. Adequate signage that is both informative and cautionary to passing traffic (motorists and pedestrians) warning them of the construction activities. Signage would need to be clearly visible and need to include, among others, the following:

- Identifying working area as a construction site;
- Cautioning against relevant construction activities;
- Prohibiting access to construction site;
- Clearly specifying possible detour routes and / or delay periods;
- Possible indications of time frames attached to the construction activities, and;
- Listings of which contractors are working on the site.

Other mitigation measures include:

- ECO to do awareness training with the contractor and labourers before construction commences.
- Ensure appropriate behaviour of operators of construction vehicles.

8.2 Site demarcation

The following areas must be clearly demarcated on site during the pre-construction or construction phases of the development, as appropriate.

8.2.1 Construction working area

Prior to the commencement of any construction activities, the outer boundary of the development area must be surveyed and pegged. The demarcation boundary must be tight around the site, typically allowing a working area of no more than 2.5m around the development footprint or as small as feasibly possible. This demarcation boundary is to ensure that construction activities are restricted to only that area strictly required for the proposed development, and to prevent unnecessary disturbance of soil surfaces and vegetation outside of the development footprint.

8.2.2 No-go areas

Prior to the commencement of any construction activities, all No-Go areas, must be demarcated and must not be disturbed during the construction phase.

No-go areas must be off-limits to all construction workers, vehicles, and machinery during all phases of the development. No vegetation may be cleared from within the no-go areas, and no dumping of any material (waste, topsoil, subsoil etc.) may occur in these areas. Construction workers must be informed

of the no-go areas, and if necessary appropriate signage and/or temporary fencing (e.g., droppers with danger tape) can be used to enforce the no-go areas. All areas outside of the development footprint of the site and a reasonable working are to undertake the upgrades, must be regarded as no-go. Existing access roads, disturbed areas, and areas that won't trigger listed activities are excluded from the no-go areas (i.e if the contractor comes to an agreement with nearby farmers to use fields for storage areas or site camps).

Figure 9: No-Go Map.

Figure 10: Close-up of No-Go Map.

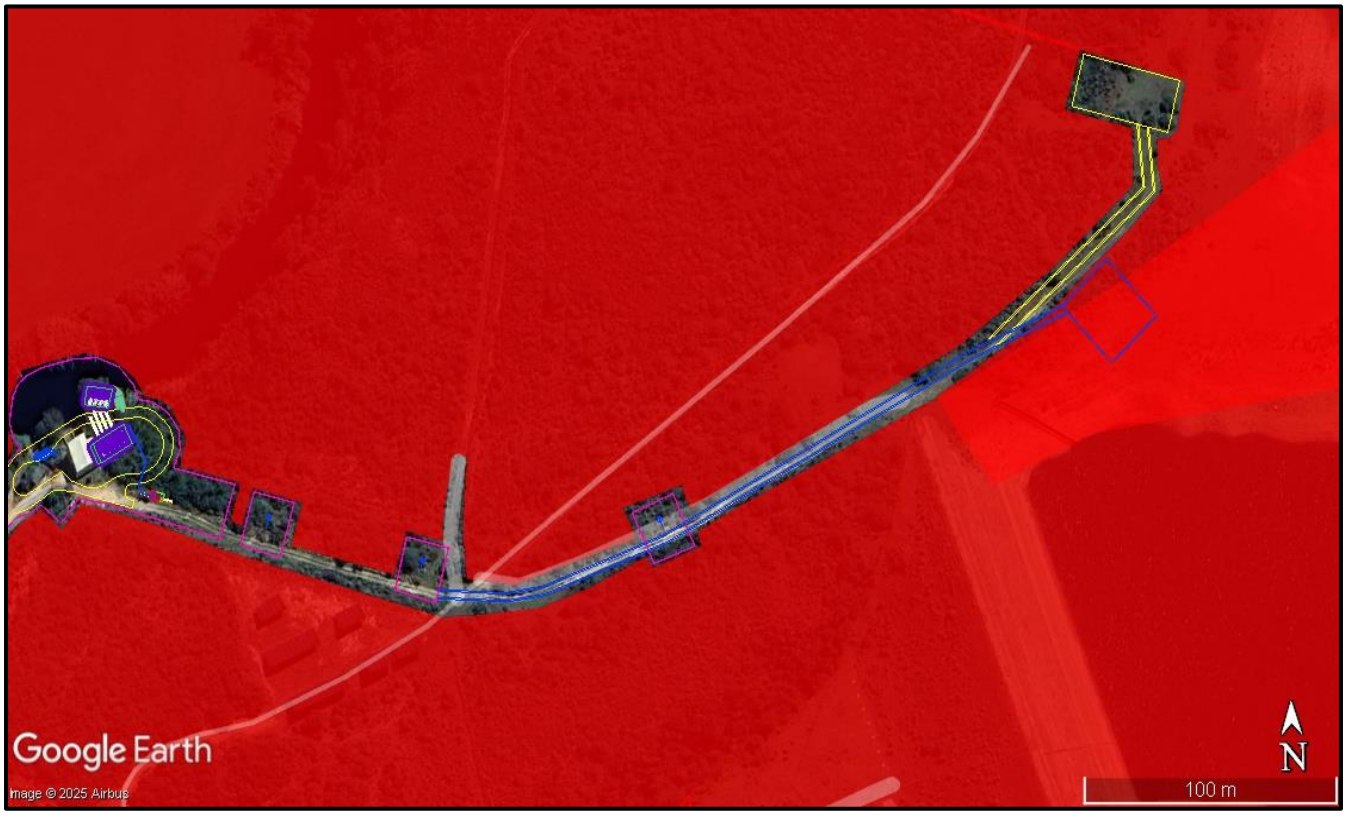


Figure 11: Close-up of No-Go Map.

8.2.3 Demarcation of the site camp

The area chosen for the site camp and associated facilities must be the minimum area reasonably required to accommodate the site camp facilities, and which will involve the least disturbance to the environment. As per the specialist reports, site camp option 3 is the only feasible option and therefore this area should be used for the site camp. Please refer to the Site Layout Plans in Appendix B for the location of site camp option 3. However, if the contractor makes arrangements for other areas which do not trigger listed activities, these areas may also be used.

8.3 Site camp and associated facilities

The following general management measures pertaining to the set-up, operation and closure of a site camp must be applied where appropriate, reasonable and practicable:

8.3.1 Fencing & Security

The site camp area must be secured to prevent any un-authorised individuals from entering the site camp and possibly getting injured or posing a safety and/or security risk. Adequate signage must be displayed, designating the site office / camp as a restricted area to non-personnel. If required, the site camp and associated areas may be fenced off along the demarcated boundaries of these areas, preferably with 2m high fence and shade netting or similar.

8.3.2 Fire Fighting Equipment

No less than 2 fire extinguishers must be present in the site camp. The extinguishers must be in a working condition and within their service period. A fire extinguisher must always be present wherever any "hot works" (e.g., welding, grinding etc.) are taking place. It is recommended that all construction workers receive basic training in fire prevention and basic fire-fighting techniques and are informed of the emergency procedure to follow in the event of accidental fires. No open fires may be made on the construction site during any phase of the project. Construction workers may make small, contained fires (e.g., for warming or cooking purposes), within the site camp provided the small fire is encircled by a corrugated iron structure, drum or similar, to prevent wind-blown cinders from causing fires elsewhere. Such fires may not be left unattended and must be thoroughly extinguished after use. No smoking must be allowed on the construction site. In the case of accidental fires, the contractor must (if required) alert the Local Authority's Fire Department as soon as a fire starts prior to the fire becoming uncontrollable.

8.3.3 Waste Storage Area

Sufficient bins for the temporary storage of construction related waste must be provided inside the site camp and/or at the working area and should be located in such a way that they will present as little visual impact to surrounding residents and road users as possible. Label each waste receptacle for waste separation, and ensure waste is contained either by use of lids or by ensuring waste receptacles are emptied prior to filling up, making them susceptible to wind dispersion. Sufficient signage and awareness should be created to ensure that these bins are properly used.

8.3.4 Hazardous Substances Storage Area

Fuels, chemicals, lubricants and other hazardous substances must be stored in a demarcated, secured and clearly sign-posted area within the site camp away from the watercourses on site. Sufficient signage and awareness should be created to ensure that these bins are properly used. Ensure that when substances are transferred, this is done on an impermeable and/or bunded surface, to contain any spillage. Spillage, should it occur, should be disposed of appropriately.

8.3.5 Potable Water

An adequate supply of potable water must be provided to construction workers at the site camp. It is the Contractors duty to ensure that the labour has adequate access to potable water throughout construction phase, and to monitor weather conditions, to ensure that labour has enough drinking water on hotter days, or construction activity must cease, until conditions are safe to continue.

8.3.6 Ablution Facilities

Chemical toilets should be maintained on the site camp for the duration of the construction phase and rehabilitation, on a level surface and secured from blowing over and located in such a way that the toilets will not cause any form of pollution. As per the SANS10400 requirement, one ablution facility for every 8 male workers and 2 ablution facilities for every 8 female workers will be provided.

The ablution facilities must not be linked to the river or dam system in any way. Toilets must be serviced regularly and kept in an orderly state. The contractor must ensure that no spillage occurs when the toilets are cleaned, serviced or moved. The toilet facilities should be emptied on a weekly basis, by an appropriately registered service provider. Proof of this weekly servicing must be obtained and filed in the Environmental File on site. Performing ablutions outside of the provided toilet facilities is strictly prohibited.

8.3.7 Eating Area & Rest Area

A dedicated area within which construction workers can rest and eat during breaks should be provided within the site camp. Seating and shade should be provided.

8.3.8 Vehicle & Equipment Maintenance Yard

Where possible, construction vehicles and equipment that require repair must be removed from site and taken to a workshop for servicing. If emergency repairs and/or basic maintenance of construction vehicles or equipment are necessary on site, such repair work must be undertaken within the designated maintenance yard area away from any watercourses. Repairs must be conducted on an impermeable surface, and/or a tarpaulin and/or drip trays must be laid down prior to emergency repairs taking place, in order to prevent any fuel, oil, lubricant or other spillages from contaminating the surrounding environment.

8.3.9 House-keeping

The site camp and related site camp facilities must be kept neat and orderly at all times, in order to prevent potential safety risks and to reduce the visual impact of the site during construction.

8.4 Vegetation clearing

Where vegetation must be cleared the following measures must be implemented where applicable, reasonable and practical:

- Where feasible vegetation must simply be trimmed to facilitate access/ construction, rather than being completely cleared or removed.
- Vegetation clearing/trimming must be cleared by hand if possible (i.e. brush cut). Please note that the development footprint is excluded from this requirement. Cleared vegetation should be stockpiled for use as mulch/ brush-packing during rehabilitation of the site. Any alien vegetation that is cleared must be disposed of in consultation with the ECO, unless the cleared alien vegetation does not contain seeds in which case it may be retained for use in site rehabilitation.
- No bulldozing must be undertaken for the purpose of vegetation clearing.
- Only the areas required to accommodate the construction activities and access to the construction site must be cleared/trimmed of vegetation.
- Vegetation outside of the construction footprint, reasonable working area and beyond any No-Go areas must not be cleared.

- Protected tree species that will be affected, namely *Sideroxylon inerme* and *Pittosporum viridflorum* **will require a permit from the department of forestry for trimming or removal**.

8.5 Topsoil and subsoil management

It is recommended that topsoil be removed from any area where physical disturbance of the surface will occur, including within the footprint of the development site (working area) and possibly within the site camp, ablution area, vehicle maintenance yard, refuelling area and temporary waste storage area. Topsoil removal and stockpiling must be undertaken only after consultation with the ECO.

- Removed topsoil and subsoil must be stockpiled for the duration of the active construction period and utilised for the final landscaping and rehabilitation of disturbed areas on site.
- The removed topsoil must be stockpiled in a berm, in a demarcated area as agreed with the ECO.
- Removed subsoil must be stockpiled separately from topsoil.
- The topsoil & subsoil storage area must be located on a level area outside of any surface drainage channels and at a location where it can be protected from disturbance during construction and where it will not interfere with construction activities.
- Where applicable topsoil and subsoil stockpiles must be adequately protected from being blown away or eroded by storm water. If necessary, shade cloth or other suitable measures must be used to stabilise and protect the stockpile from wind/water erosion. Topsoil stockpiles must not be covered with tarpaulin, as this may smother and decrease the virility of topsoil.
- Handling of topsoil must be minimised as much as possible, and the location of the topsoil berm must be chosen carefully to avoid needing to relocate the topsoil berm at a later date. The ECO must be consulted with regards to the placement of the stockpiles, to ensure that the selected location is in compliance with this EMPr and EA (once granted).
- Ideally, topsoil is to be handled twice only, once to strip and stockpile, and once to replace, level, shape and scarify.
- If soil stockpiles will be stored for an extended period of time, the stockpiles must be kept clear of weeds and alien vegetation growth by regular weeding, (or application of herbicides if agreed with the ECO).

- Spoil material that will not be re-utilised on site may be removed from site and taken to an appropriate site for re-use or disposal.
- Note that the topsoil must be the final layer applied to a rehabilitated/ re-landscaped site, after subsoil/ spoil material has been placed and shaped on the site.

8.6 Integrated waste management approach

It is required that an integrated waste management system is adopted on site. The system must be based on waste minimisation and must incorporate reduction, recycling, re-use and disposal where appropriate. Waste bins for the different categories of recyclable waste (i.e., paper, plastic, metal) must be provided on site. These bins must be emptied, and the waste must be taken to a registered recycling facility. The receipts from the facility must be kept on file and must be available on request. Images 1 and 2 show two such systems within a construction site.

Image 1: Recycling system implemented on a construction site. Skips provided for general waste, plastic, cardboard and metal.

Image 2: Recycling system implemented on a construction site. Lidded bins provided for general waste, plastic, cardboard, and metal.

The non-recyclable and non-reusable waste (e.g., builder's rubble, etc.) generated on site must be stored and disposed of at a landfill site licensed in terms of the applicable legislation.

8.7 Hazardous substances and fuels

If hazardous substances and fuels such as diesel, oil, lubricant, detergents etc. are to be stored on site for construction purposes, a designated area must be set aside for this within the site camp.

- All hazardous substances must be stored in the designated area within the site camp.
- The area selected for storage of hazardous fuels must be located on a level area, well outside of any water courses, water bodies or surface drainage channels.

- The designated area must be clearly demarcated and secured by use of fencing and/or cages, to prevent access by un-authorised persons and/or animals.
- Access to the hazardous material storage area must be restricted to authorised personnel only and must be treated as a no-go zone to unauthorised personnel.
- Appropriate hazard signage indicating the nature of the stored materials must be prominently displayed at the storage area.
- Those persons tasked with handling any hazardous substances must be equipped with the knowledge, equipment, and safety gear necessary to handle the substance/s safely.
- Material Safety Data Sheets (MSDSs) must be available on site for all hazardous chemicals and hazardous substances to be used on site. Where possible and available, MSDSs must additionally include information on ecological impacts and measures to minimise negative environmental impacts during accidental releases or escapes
- Storage vessels of hazardous substances must be situated in an impermeable bunded area large enough to accommodate at least 110% of the capacity of the tank in question. If plastic sheeting is used to line the bunded area, care must be taken to ensure it is not punctured in any way during the course of the construction period.
- Fuel tanks must ideally be elevated so that leaks can easily be detected.
- No smoking may be permitted at or surrounding the area where fuels and hazardous substances are stored.
- Firefighting equipment must be located in close proximity to the storage area.

8.8 Cement and concrete batching

Cement and concrete batching is permitted on site, but may only take place on designated impermeable, bunded surfaces, as agreed with the ECO.

- Cement/ concrete must not be mixed on bare ground.
- Cement/concrete must not be mixed within any drainage lines.
- The impermeable/ bunded area must be established in such a way that cement slurry, runoff and cement water will be contained and will not flow into the surrounding environment or contaminate the soil.
- Cement run-off and excess cement slurry must be collected in the designated impermeable area, allowed to dry and then disposed of at an appropriate facility. Alternately, the contaminated water can be collected in sealed tanks and transported to an appropriate disposal site for disposal.
- Empty cement bags are currently not recycled within the Garden Route and must be disposed of in the un-recyclables waste bins on site.

8.9 Erosion control and stormwater management

Appropriate measures must be implemented to control the flow of storm water across the construction site, to prevent possible flooding, soil loss and dispersion of pollutants. All exposed earth surfaces must also be protected from wind and water erosion. Stripped areas must not remain uncovered for extended periods of time and must be provided with a suitable cover (vegetation, mulch, brush-packing) as soon as possible.

The scale and nature of the erosion and storm water control measures implemented on site must be appropriate to the conditions on site, and sufficient to achieve the desired outcomes (soil preservation, prevention of flooding, storm water control) to the satisfaction of the ECO and consulting engineer.

It may be necessary to implement small-scale erosion protection measures at the construction site, to prevent soil erosion. Such measures may include the use of shade netting, geo-fabric, brush-packing, logs and stakes or similar barriers in areas susceptible to erosion and along exposed slopes. The netting/fabric is placed directly across the path of flow of storm water. Poles and logs, staked in along the contours of a slope susceptible to erosion may also be used.

8.10 Construction near a watercourse

Construction within the vicinity of the aquatic system needs to be conducted in a conscious manner. The Aquatic Biodiversity Impact Assessment completed by Upstream Consulting explains that impacts to the aquatic system can be avoided through the implementation of the mitigation measures and adherence to the EMPr. The following mitigation measures must be adhered to during construction:

- Any contractor found working within No-Go areas must be fined as per fining schedule/system setup for the project.
- It is the contractor's responsibility to continuously monitor the area for newly established alien species during the contract and establishment period, which if present must be removed. A list of these species needs to be added with photos into the EMPr. Removal of these species shall be undertaken in a way which prevents any damage to the remaining indigenous species and inhibits the re-infestation of the cleaned areas. Any use of herbicides in removing alien plant species is required to be investigated by the ECO before use.
- Where vegetation has been cleared in the riparian area it is recommended that cover components be reinstated appropriately. Only indigenous species are to be considered.
- Monitoring by an independent ECO during construction in all phases.
- The construction of both interim and permanent structures within the river channel should be minimized wherever possible, ensuring minimal disruption to flow patterns. In particular, the implementation of erosion control measures on the opposite bank should be avoided.
- **Pollution Prevention:**
    - Establish designated fuelling and maintenance areas away from the watercourse to prevent fuel and oil spills.
    - Store hazardous materials (e.g., cement, fuels, chemicals) in bunded areas away from the river.
    - Implement spill response procedures and have spill kits on-site.
    - Ensure proper waste disposal, including construction debris and domestic waste, to prevent contamination.
- **Stormwater Management:**
    - Design temporary stormwater control measures to prevent runoff from carrying pollutants into the river.
    - Use infiltration trenches or constructed wetlands to filter runoff before it enters the watercourse.
- **Control Water Flow During Construction:** Carefully manage the rate and timing of water released during construction to avoid surges and ensure consistent downstream flow.
- **Regular ECO Water Quality Monitoring:** Conduct monitoring of water quality to track turbidity and contamination levels (this can be done visually and it is expected that the activities will create turbidity during the construction phase).
- **Limit Water Diversion Duration:** Minimize the time the flow is disrupted by construction activities to reduce impact on aquatic ecosystems.
- **Controlled Dewatering:** If contaminated, remove contaminated water onto shore and treat accordingly. Do not discharge untreated contaminated water back into the system

- **Efficient Temporary River Channel Construction:** If required, implement bypasses and pumps with minimal disruption to the river's natural hydrology

8.11 Excavations and Earthworks

Any major earthworks with heavy machinery must be under constant supervision and operators are to be aware of all the environmental obligations, as there is always the potential to inflict damage to the sensitive areas. Any unnecessary or excessive heavy machinery movement must be kept to a minimum i.e., only what is absolutely necessary. Areas to be excavated must be clearly demarcated. It may be necessary to demarcate excavations or earthworks along busier haulage routes with orange barrier netting (or a similar product).

All excavated material must be stored on a flat surface away from any drainage line or area susceptible to erosion. The location must be decided upon in consultation with the ECO. Stored material must be protected from wind and water erosion, and this may entail covering the material with suitable shade cloth material or similar (if and when necessary). The shade cloth may need to be weighed down by logs (or similar material) in such a manner that any stream flow is directed away from the stockpile, reducing the risk of erosion.

8.12 Heritage Resources

Should any heritage resources, including evidence of graves and human burials, archaeological material and paleontological material be discovered during the execution of the activities, all works must be stopped immediately and Heritage Western Cape must be notified without delay.

Heritage Western Cape:
T: 021 483 5059
E: hwc.hwc@westerncape.gov.za

Should any fossils be discovered during excavations, please follow the necessary steps indicated in the Fossil Chance Find Protocol in Appendix H of this EMPr.

8.13 Site closure and rehabilitation

Upon completion of the construction phase, all disturbed areas, including the working area (disturbance corridor), temporary access roads, and all areas utilised for the site camp and associated site camp facilities will require rehabilitation as follows:

- On completion of the construction operations, the site camp area must be cleared of all site camp facilities, ablution facilities, fencing, signage, waste and surplus material.
- All areas within the working area and site camp that have become devoid of vegetation or where soils have been compacted due to construction activities must be scarified or ripped to improve filtration and reduce run-off.
- All demarcation fencing, including all droppers, wires, netting and barrier tape must be removed from site and taken to an appropriate site for re-use or disposal.
- Surfaces are to be checked for waste products from activities such as concreting or asphalting and cleared in a manner approved by the ECO. Any soil contaminated with oil, fuel or other hazardous substance must be collected and disposed of as hazardous waste.
- All construction waste, litter and rubble is to be removed from the site and disposed of at an appropriate facility. Burying or burning of waste or rubble on site is prohibited.

- Topsoil that was removed and stockpiled before construction, must be replaced by spreading it evenly over the areas from which it was removed. This topsoil (and the seedbank it contains) will facilitate the re-vegetation of the site.
- Disturbed areas, especially areas where excavations have taken place, must be shaped as appropriate (original topography must be restored where possible), and covered with a layer of stockpiled topsoil as soon as possible.
- Any topsoil, subsoil or other excavated material that cannot be utilised during site rehabilitation must be removed from the site and disposed of at an appropriate disposal site.
- The disturbed, newly rehabilitated surfaces (particularly steeper slopes and areas recently covered with topsoil) must be protected from wind & water erosion using mulch, brush packing or other appropriate erosion protection measures. Brush-packing/ mulching is done by covering the exposed surface with organic plant material such as branches, plant cuttings and leafy material. Ideally the vegetation removed from site at the start of the construction must be utilised. Brush-packing/ mulching plays a valuable role in erosion control, while also promoting re-vegetation of the site by retaining moisture in the soil, introducing seeds and/or trapping wind-blown seeds and providing organic material (compost) to promote new plant growth.
- Final rehabilitation of the site must be done to the satisfaction of the ECO, and must adhere to all conditions/ requirements of the Environmental Authorisation.
- The location of the site camp must be rehabilitated.

9. Environmental Impact Management Planning and design phase

No direct environmental impacts are associated with the planning and design phase. However, poor planning or inappropriate design decisions in this phase may result in environmental impacts arising during subsequent phases of the project.

Planning and design activities must therefore take into account the environmental constraints and opportunities identified during the Environmental Impact Assessment process, in order to avoid or minimise the potential future impacts of the development. Proper planning is also essential to ensure that adequate provision is made to implement the environmental requirements of this EMPr, and to ensure that the development remains compliant with the received Environmental Authorisation.

The environmental management objectives (goals) during this phase are to:

- Appoint an Environmental Control Officer.
- Environmental Control Officer to conduct an inspection prior to the commencement of construction activities on site

These environmental management outcomes, as well as the management actions that must be implemented in order to achieve the desired outcome and avoid/minimise potential impacts are discussed in more detail below.

OBJECTIVE 1: APPOINTMENT OF AN ENVIRONMENTAL CONTROL OFFICER

Impact Management Objective: ***To appoint a suitably qualified and experienced Environmental Control Officer.***		
Potential impact to avoid	Failure to appoint an ECO will result in non-compliance with the Environmental Authorisation and the requirements of the EMPr.	
Impact Management Outcome	The conditions of Environmental Authorisation and the requirements of the EMPr are implemented and monitored during all phases of the development, which will promote sound environmental management on site.	
IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period
• A suitably qualified and experienced Environmental Control Officer must be appointed before any activities commence on site. • The appointed ECO must adhere to the requirements stated in Chapter 15 and 17 of the EMPr and any other requirements specified in the Environmental Authorisation. • The appointed ECO must be advised of the construction start date, before any activities commence on site so that the ECO can perform a pre-commencement inspection and plan for environmental awareness training of construction workers.	*Department of Water and Sanitation*	During design phase

Performance Indicator	A qualified ECO is appointed prior to the commencement of any construction activities (including pre-construction set-up activities) on site.

OBJECTIVE 2: UPDATE ENVIRONMENTAL MANAGEMENT PROGRAMME

The Environmental Authorisation issued for the development may require certain amendments to be applied to the EMPr. In addition, the final site layout and detailed design may also necessitate the amendment of the EMPr, in order to ensure that the development is accommodated in the EMPr.

***Impact Management Objective:* To ensure the EMPr adheres to the requirements of the Environmental Authorisation and makes provision for the final detailed site layout.**		
Potential impact to avoid	• Failure to update the EMPr in accordance with conditions specified in the EA may result in non-compliance with the EA. • Failure to update the EMPr to accommodate the final detailed site layout may result in non-compliance with the EA.	
Impact Management Outcome	Good environmental management is promoted on site.	
IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period
• An independent Environmental Consultant must be appointed to amend the EMPr. • All amendments to the EMPr specified in the EA must be applied to the EMPr unless agreed otherwise in writing with the Competent Authority. • Amendments to the EMPr must be approved in writing by the Competent Authority. • Public participation may be required on the proposed EMPr amendments. The Competent Authority must be consulted for clarity on these requirements.	*Department of Water and Sanitation*	During design phase
Performance Indicator	An updated EMPr that adheres to the conditions of the EA and that reflects the requirements of the final detailed site layout is approved by the Competent Authority prior to commencing activities on site.	

10. Environmental Impact Management Pre-Construction Phase

Proper set-up during the pre-construction phase can set the foundation for good environmental management during the active construction phase to follow and can avoid potential impacts from arising at a later date.

The Impact Management Objectives for this phase of the project relate to:

- Demarcation of no-go areas and working areas.
- Establishment of site camp and associated site facilities.
- Pre-construction ECO visit.

OBJECTIVE 1: IDENTIFY & DEMARCATE NO-GO AND WORKING AREAS

Impact Management Objective: ***Identify and demarcate no-go areas, working areas and site facilities.***		
Potential impact to avoid	• Insensitive location of working areas and site facilities may result in environmental impacts during construction phase. • Failure to accurately demarcate working areas may result in increased disturbance footprint. • Failure to demarcate no-go (open spaces) areas may result in disturbance to these areas during construction.	
Impact Management Outcome	Future construction activities will be restricted to within the designated areas & environmentally sensitive areas (no-go areas) will be protected from disturbance.	
IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period
• The no-go areas must be identified. • Demarcation of working area and no-go areas must be done in accordance with Section 8.2 of this EMPr. • Site camp facilities must be situated as far away from the No-Go areas as possible, only site camp option 3 as indicated in the Site Layout Plans in Appendix B of this EMPr may be used for the site camp. However, if the contractor makes arrangements for other areas which do not trigger listed activities, these areas may also be used.	Engineer / Contractor	Pre-construction phase (prior to arrival of construction equipment, machinery, or workers on site)
Performance Indicator	No-go areas, working areas and areas for site camp facilities have been identified and appropriately demarcated to the satisfaction of the ECO, before construction activities commence on site.	

OBJECTIVE 2: ESTABLISH ENVIRONMENTALLY SENSITIVE SITE CAMP & SITE FACILITIES

Impact Management Objective: ***To set up and equip the site camp and associated site facilities in a manner that will promote good environmental management.***		
Potential impact to avoid	• Inappropriate siting of site camp facilities may result in impacts to sensitive resources (e.g. contaminated run-off from refuelling area may contaminate soil). • Failure to properly demarcate and set up site facilities may result in disorganised construction activities and unnecessary disturbance to the site. • Failure to provide the necessary site facilities and/or failure to equip these facilities with the necessary equipment/materials may impede good environmental management & compromise ability to respond to emergencies.	
Impact Management Outcome	Site camp facilities do not impact significantly on environment. The equipment required to implement the provisions of the EMPr are provided on site.	
IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period
• The site camp and site facilities described in Section 8 of this EMPr must be provided on site. • The site camp and associated site facilities must be set-up and managed in accordance with the general environmental management measures specified in Section 8 of this EMPr. • Only site camp option 3 as indicated in the Site Layout Plans in Appendix B of this EMPr may be used for the site camp. However, if the contractor makes arrangements for other areas which do not trigger listed activities, these areas may also be used.	Contractor	Pre-construction phase (prior to start of construction activities)
Performance Indicator	Appropriate, well organised and properly equipped site facilities are available on site prior to commencement of construction activities. The location and set up of the facilities does not impact on the natural resources.	

OBJECTIVE 3: PRE-CONSTRUCTION ECO INSPECTION

It is essential that the appointed ECO be advised of the intended construction start date before construction activities commence on site, so that the ECO can conduct an initial site inspection to assess the pre-commencement condition of the site. The ECO can also advise on the appropriate siting and demarcation of the site facilities, and the identification and demarcation of the no-go areas. The ECO may also conduct the first round of environmental awareness training at this stage, if the construction workers are present on site.

Impact Management Objective: ***Environmental Control Officer to conduct an inspection prior to the commencement of construction activities on site.***		
Potential impact to avoid	• Failure to appoint ECO or to notify ECO of commencement prior to commencement will result in non-compliance with the EA. • If a pre-commencement ECO inspection is not performed, the Applicant may be held liable for environmental degradation that took place prior to the Contractor commencing work on site.	
Impact Management Outcome	Good environmental management is promoted and enforced by the ECO during the full pre-construction and construction phases. Site facilities are appropriately located on site. Construction workers receive environmental awareness training before commencing work on site.	
IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period
• The appointed ECO must be advised of the construction start date, before any activities commence on site so that the ECO can perform a pre-commencement inspection and plan for environmental awareness training of construction workers.	Contractor	Start of construction phase
Performance Indicator	A pre-commencement site inspection is conducted by the appointed ECO before construction activities commence on site.	

11. Environmental Impact Management Construction Phase

A number of potential environmental impacts may arise during the construction phase of the development. These impacts have been identified and assessed during the Environmental Impact Assessment process. Environmental Management outcomes and actions that will prevent the identified potential impacts from arising – or where avoidance is not possible, that will minimise and mitigate the impact – are provided in this section.

The environmental management actions and mitigation measures prescribed in this section must be implemented throughout the construction phase, and must be implemented in conjunction with the general management measures specified in Chapter 8 of this EMPr as well as any other conditions stated in the Environmental Authorisation. The Environmental Control Officer must monitor and enforce the implementation of the relevant environmental management measures and may provide guidance on the implementation of these environmental management measures as and when required.

The environmental management objectives (goals) for the Construction phase are:

- Limit the impact on terrestrial biodiversity
- Limit the loss of indigenous flora and SCC
- Prevent direct mortality of, or displacement of fauna
- Prevent contamination of ground water through chemical spills or leaching of chemicals
- Prevent/limit geomorphological changes from erosion and sedimentation
- Prevent/limit changes to the hydrological regime
- Prevent/limit disturbance of aquatic habitat
- Prevent/limit water quality deterioration
- create employment opportunities

The environmental management actions that must be implemented in order to achieve the desired outcomes and avoid/minimise potential impacts are discussed in more detail in the sections below.

OBJECTIVE 1: LIMIT THE IMPACT ON TERRESTRIAL BIODIVERSITY

***Impact Management Objective:* To limit the impact on terrestrial biodiversity from the construction site**	
Potential impact to avoid	• Permanent or temporary loss of indigenous vegetation due to clearance activities. • Permanent or temporary loss of indigenous vegetation outside of the construction footprint.
Impact Management Outcome	Impact on terrestrial biodiversity is limited to the construction footprint and only to what is required to undertake the activities.
IMPACT MANAGEMENT ACTIONS	

Mitigation measure	Responsible party	Time period
• Fence off the construction areas. The thicket/renosterveld outside the construction areas must not be disturbed in any way. • With regards to the site camp options, preference should be given to options 1 and 3. Site option 2, which contains considerably more vegetation and plant species, should not be selected. In the case of site camp option 1 (below the dam wall), a buffer of sufficient width must be maintained between the camp and nearby watercourse. • To mitigate the impact of vegetation clearing, topsoil and seedbearing plant material from the construction areas must be protected and replaced after construction as part of the rehabilitation process. As a duty of care measure, consideration should also be given to S&R of suitable species (e.g. bulbs & succulents). Of course, any replanting of rescued plant material must be done in matching habitats from which the plants originate. Bulbs should be removed along with some soil, placed in gel, bagged and then taken to a nursery for temporary storage or transplanted directly in the receiving area. S&R should be done at an appropriate time of the year, preferably when the soil is wet during the raining season. Ideally, bulbs should be salvaged during leaf fall, but before or after flowering. Please note that a CapeNature permit is needed for the relocation of indigenous plant species. • Allow at least 24 months for the monitoring of rehabilitation success and alien infestation post construction. Keep the project footprint as well as an additional strip of 10-15 m wide clear of invasive aliens.	Contractor	Construction phase
Performance Indicator	Impact on terrestrial biodiversity is limited to the construction footprint and only to what is required to undertake the activities.	

OBJECTIVE 2: LIMIT THE LOSS OF INDIGENOUS FLORA AND SCC

Impact Management Objective: ***To limit the loss of indigenous flora and SCC during the construction process***		
Potential impact to avoid	• Loss of indigenous flora, potential SCC and protected tree species.	
Impact Management Outcome	Only the approved footprint and a reasonable working corridor is disturbed by construction activities.	
IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period
• Fence off the construction areas. The thicket/renosterveld outside the construction areas must not be disturbed in any way.	Contractor	Construction phase

• With regards to the site camp options, preference should be given to options 1 and 3. Site option 2, which contains considerably more vegetation and plant species, should not be selected. In the case of site camp option 1 (below the dam wall), a buffer of sufficient width must be maintained between the camp and nearby watercourse. • To mitigate the impact of vegetation clearing, topsoil and seedbearing plant material from the construction areas must be protected and replaced after construction as part of the rehabilitation process. As a duty of care measure, consideration should also be given to S&R of suitable species (e.g. bulbs & succulents). Of course, any replanting of rescued plant material must be done in matching habitats from which the plants originate. Bulbs should be removed along with some soil, placed in gel, bagged and then taken to a nursery for temporary storage or transplanted directly in the receiving area. S&R should be done at an appropriate time of the year, preferably when the soil is wet during the raining season. Ideally, bulbs should be salvaged during leaf fall, but before or after flowering. Please note that a CapeNature permit is needed for the relocation of indigenous plant species. • Allow at least 24 months for the monitoring of rehabilitation success and alien infestation post construction. Keep the project footprint as well as an additional strip of 10-15 m wide clear of invasive aliens.		
Performance Indicator	Only the approved footprint and a reasonable working corridor is disturbed by construction activities.	

OBJECTIVE 3: PREVENT DIRECT MORTALITY OF, OR DISPLACEMENT OF FAUNA

Impact Management Objective: ***To prevent the direct mortality of, or displacement of fauna during the construction process***			
Potential impact to avoid	• Direct mortality or displacement of fauna due to construction activities.		
Impact Management Outcome	Any animals encountered during construction are relocated to an area outside the construction footprint.		
IMPACT MANAGEMENT ACTIONS			
Mitigation measure		Responsible party	Time period
• The direct mortality of, or displacement of fauna is expected to be "Insignificant" to the receiving environment under both Preferred Alternative layout A and Alternative layout B. It is however advocated that every effort should be made to save and relocate any mammal, reptile, amphibian, bird, or invertebrate that cannot flee of its own accord, encountered during site preparation (i.e., to avoid and minimise the direct mortality of faunal species). These animals should be relocated to an area immediately outside of the project footprint, but under no circumstances any further away.		Contractor	Construction phase
Performance Indicator	Any animals encountered during construction are relocated to an area outside the construction footprint.		

OBJECTIVE 4: PREVENT CONTAMINATION OF GROUND WATER THROUGH CHEMICAL SPILLS OR LEACHING OF CHEMICALS

Impact Management Objective: ***To prevent the contamination of ground water through chemical spills or leaching of chemicals during construction***			
Potential impact to avoid	• During construction it is possible that chemicals (such as oil, fuel and cement) may spill or leach into the surrounding environment, thereby causing contamination and possible mortality of fauna.		
Impact Management Outcome	No ground water is contaminated through chemical spills or leaching of chemicals.		
IMPACT MANAGEMENT ACTIONS			
Mitigation measure		Responsible party	Time period
• Storage of fuel, chemicals and other hazardous substances should be done in suitable secure weatherproof containers with impermeable and bunded floors to limit pilferage or spillage into the environment. • Clean-up of any spillages (e.g. oil, fuel hazardous chemicals and cement) should proceed immediately and the contaminated soil should be removed and disposed of appropriately.		Contractor	Construction phase
Performance Indicator	No ground water is contaminated through chemical spills or leaching of chemicals.		

OBJECTIVE 5: PREVENT/LIMIT GEOMORPHOLOGICAL CHANGES FROM EROSION AND SEDIMENTATION

***Impact Management Objective:* To prevent/limit the geomorphological changes from erosion and sedimentation during construction**		
Potential impact to avoid	• Changes to the form and geomorphological processes from clearing riparian vegetation and construction within the watercourse due to potential erosion and sedimentation from hydrological changes and increased sediment inputs.	
Impact Management Outcome	Sedimentation and erosion during construction is limited.	
IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period
Design phase considerations • **Optimized Placement & Orientation** – Where possible position the cofferdam to minimize disruption to the main flow path and align it with the natural flow direction to reduce turbulence. • **Permeability Considerations** – If necessary, utilise a slotted or porous section to allow controlled water passage and reduce sudden pressure changes. • **Energy Dissipation Structures** – Where necessary consider including stepped weirs, baffles, or flow deflectors to prevent excessive velocity increases and turbulence. • **Scour and Erosion Protection** – Where necessary, design reinforced edges with riprap, gabions, or concrete aprons to prevent localized scour. • **Sediment Transport Management** – Where necessary ensure the structure allows for natural sediment movement to prevent excessive upstream deposition or downstream erosion. **Site Preparation Phase:** • **Establish sediment control barriers:** Install sediment fences, silt curtains, or berms around construction zones to contain sediment and prevent it from reaching water bodies. • **Stabilise disturbed areas:** Apply erosion control techniques such as mulching, vegetation, or geotextiles to stabilize disturbed soils and reduce sediment runoff. **Construction Phase:** • **Sediment trapping measures:** Install sediment traps or basins at strategic points along construction sites to capture and manage sediment and minimise downstream contamination.	Contractor	Construction phase

• **Minimize disturbed areas:** Limit the footprint of the construction zone and avoid unnecessary soil disturbance to reduce the potential for sediment mobilization. • **Monitor sedimentation:** ECO monitor turbidity levels upstream and downstream of construction site to confirm the efficiency of mitigation measures and make adjustments as needed. • **Water diversion techniques:** Divert clean water away from construction areas using berms or temporary channels to prevent sediment-laden water from entering watercourses. • **Control stormwater runoff:** Use temporary sediment control measures, such as erosion mats or check dams, to control runoff and prevent excessive sedimentation during heavy rainfall events. **Operational Phase:** • **Maintain natural water column sediment levels:** Regularly clean and maintain coffer dam, and filtration systems to ensure they continue functioning effectively in capturing sediment and returning captured sediment back to the water column. • **Vegetative stabilization:** Promote the growth of native vegetation in areas susceptible to erosion to stabilize soil and reduce sediment generation over time. • **Revegetation of exposed soils:** In any areas that have been disturbed, replant vegetation and apply soil stabilisation techniques to prevent erosion and further sediment loss. • **Flood Control Measures:** Regularly assess river levels and implement flood mitigation measures as required. • **Maintenance work:** Any work associated with the maintenance of the water column infrastructure should be minimized in both spatial extent and duration. Preferably such work should take place during the drier months (December to April) to reduce hydrological impacts. • **Emergency infrastructure repair:** Any flood damaged infrastructure should be repaired as soon as it is safe, and possible, to do so, to prevent further degradation and hydrological impacts.		
Performance Indicator	Sedimentation and erosion is effectively monitored during construction.	

OBJECTIVE 6: PREVENT/LIMIT CHANGES TO THE HYDROLOGICAL REGIME

***Impact Management Objective:* To prevent/limit changes to the hydrological regime of the Moordkuil River during construction.**		
Potential impact to be avoided	• Changes to the natural movement of water flow through the Moordkuil River and its associated buffer, by construction of infrastructure within the water column and riparian habitat resulting in altered flow patterns, sediment transport and erosion. • Localized scour, sediment deposition upstream, and increased downstream velocity is possible to occur around water column infrastructure.	
Impact Management Outcome	Changes to the hydrological regime of the Moordkuil River is limited to the construction footprint.	
IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period
Design phase considerations: • **Optimized Placement & Orientation** – Where possible position the cofferdam to minimize disruption to the main flow path and align it with the natural flow direction to reduce turbulence. • **Permeability Considerations** – If necessary, utilise a slotted or porous section to allow controlled water passage and reduce sudden pressure changes. • **Energy Dissipation Structures** – Where necessary consider including stepped weirs, baffles, or flow deflectors to prevent excessive velocity increases and turbulence. • **Scour and Erosion Protection** – Where necessary design reinforced edges with riprap, gabions, or concrete aprons to prevent localized scour. • **Sediment Transport Management** – Where necessary ensure the structure allows for natural sediment movement to prevent excessive upstream deposition or downstream erosion. **Site Preparation Phase:** • **Establish Controlled Access Routes:** Limit disturbance to water flow and minimize construction-related runoff. • **Flow Diversion & Bypass Measures:** If possible, install a controlled bypass system (e.g., pipes or channels) to maintain continuous downstream flow. Ensure the bypass capacity matches or exceeds expected base flow conditions. • **Contaminant Spill prevention measures:** Store fuels, cement and chemicals away from the river and have containment measures in place.	Contractor	Construction phase

Construction Phase: • **Control Water Flow During Construction:** Carefully manage the rate and timing of water released during construction to avoid surges and ensure consistent downstream flow. • **Regular ECO Water Quality Monitoring:** Conduct monitoring of water quality to track turbidity and contamination levels. • **Limit Water Diversion Duration:** Minimize the time the flow is disrupted by construction activities to reduce impact on aquatic ecosystems. • **Controlled Dewatering:** If contaminated, remove contaminated water onto shore and treat accordingly. Do not discharge untreated contaminated water back into the system • **Efficient Temporary River Channel Construction:** If required, implement bypasses and pumps with minimal disruption to the river's natural hydrology. **Operational Phase:** • **Flood Control Measures:** Regularly assess river levels and implement flood mitigation measures as required. • **Maintenance work**: Any work associated with the maintenance of the water column infrastructure should be minimized in both spatial extent and duration. Preferably such work should take place during the drier months (December to April) to reduce hydrological impacts.		
Performance Indicator	Water quality monitoring to track turbidity and contamination levels.	

OBJECTIVE 7: PREVENT/LIMIT DISTURBANCE OF AQUATIC HABITAT

***Impact Management Objective:* To prevent/limit the disturbance of the aquatic habitat during construction.**		
Potential impact to be avoided	• The disturbance or loss of aquatic fauna and flora from direct physical destruction or disturbance which can result in further deterioration of aquatic habitat integrity, habitat fragmentation, and a reduction in the supply of ecosystem services.	
Impact Management Outcome	Disturbance of the aquatic habitat is limited to the construction footprint.	
IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period
Design Phase: • A construction method statement must be compiled and available on site. It must consider the no go area and include methods to avoid unnecessary disturbance.	Contractor	Construction phase

Construction Phase: • Any contractor found working within No-Go areas must be fined as per fining schedule/system setup for the project. • It is the contractor's responsibility to continuously monitor the area for newly established alien species during the contract and establishment period, which if present must be removed. A list of these species needs to be added with photos into the EMPr. Removal of these species shall be undertaken in a way which prevents any damage to the remaining indigenous species and inhibits the re-infestation of the cleaned areas. Any use of herbicides in removing alien plant species is required to be investigated by the ECO before use. • Where vegetation has been cleared in the riparian area it is recommended that cover components be reinstated appropriately. Only indigenous species are to be considered. • Monitoring by an independent ECO during construction in all phases. • The construction of both interim and permanent structures within the river channel should be minimized wherever possible, ensuring minimal disruption to flow patterns. In particular, the implementation of erosion control measures on the opposite bank should be avoided. **Operational Phase:** • In the long term, the maintenance and management of the infrastructure should follow an approved Environmental Management Plan for the Operational Phase, which must include the removal of invasive alien vegetation in the riparian zone adjacent to the pump station and access road.		
Performance Indicator	A construction method statement must be compiled and available on site. It must consider the no go area and include methods to avoid unnecessary disturbance.	

OBJECTIVE 8: PREVENT/LIMIT WATER QUALITY DETERIORATION

Impact Management Objective: ***To prevent/limit water quality deterioration during construction.***		
Potential impact to be avoided	• Changes to the natural water quality parameters resulting in reduced ecosystem integrity and decreased biodiversity.	
Impact Management Outcome	Water quality deterioration during construction is limited.	
IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period

Site Preparation & Construction Phase:
 	
• **Pollution Prevention:**
  o Establish designated fuelling and maintenance areas away from the watercourse to prevent fuel and oil spills.
  o Store hazardous materials (e.g., cement, fuels, chemicals) in bunded areas away from the river.
  o Implement spill response procedures and have spill kits on-site.
  o Ensure proper waste disposal, including construction debris and domestic waste, to prevent contamination.
• **Stormwater Management:**
  o Design temporary stormwater control measures to prevent runoff from carrying pollutants into the river.
  o Use infiltration trenches or constructed wetlands to filter runoff before it enters the watercourse.
 	
Operational Phase:
 	
• **Monitoring & Maintenance:**
  o Regularly monitor water quality parameters (e.g., turbidity, dissolved oxygen, nutrients, heavy metals) to detect any degradation.
  o Implement adaptive management strategies if water quality deteriorates over time.
• **Vegetative Buffer Zones:**
  o Maintain or restore riparian vegetation to filter runoff, stabilize banks, and improve water quality.
  o Prevent livestock access to the river and site camps near infrastructure to reduce nutrient loading and bank erosion.
• **Long-Term Pollution Control:**
  o Establish protocols for handling accidental spills or contamination events.
  o Ensure all waste is deposed of at a registered waste disposal site.
	Contractor	Construction phase

Performance Indicator	Water quality monitoring and adherence to Section 8 of this EMPr.	

OBJECTIVE 9: JOB CREATION

Impact Management Objective: ***To create employment opportunities with potential for skills transfer, for members of the local community.***		
Potential impact to be promoted	• Temporary jobs opportunities • There may be opportunities to transfer skills from more experienced workers to less experienced workers.	
Impact Management Outcome	The local community benefits from the employment opportunities created during the construction phase.	
IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period
• No mitigation required for this positive benefit. However, where practical preference must be given to previously disadvantaged individuals from the local community when appointing contractors/ workers. • Skills transfer between members of the workforce should be encouraged.	Contractor	Construction phase
Performance Indicator	The majority of the construction team is from the local community, with preference given to historically disadvantaged individuals. Skills transfer from experienced to less experienced workers is actively encouraged on site.	

12. Environmental impact management post construction rehabilitation phase

After all construction activities have ceased, the sites must be cleared of all construction related equipment, materials, facilities and waste. In addition all disturbed surfaces – including disturbed areas around the structures and all areas utilised for site facilities – must be stabilised, rehabilitated and provided with a suitable cover. All temporary access roads constructed must rehabilitated and access must be restricted from the public.

The environmental management objective (goal) for this phase is to:

- rehabilitate all areas disturbed by construction activities in an environmentally sensitive manner
- Impact on terrestrial biodiversity
- Reduce the loss of indigenous flora and SCC
- Prevent/limit changes to the hydrological regime
- Prevent/limit geomorphological changes from erosion and sedimentation

OBJECTIVE 1: SITE CLOSURE & REHABILITATION

Impact Management Objective: ***To rehabilitate all areas disturbed by construction activities in an environmentally sensitive manner.***		
Potential impact to avoid	• Failure to remove all construction related waste and materials may result in environmental pollution. • Failure to remove all construction related equipment, machinery and site facilities may pose an impact to the natural environment. • Failure to stabilise disturbed surfaces may result in soil erosion and increased storm water run-off, which may limit successful revegetation of the site.	
Impact Management Outcome	The site is neat and tidy, and all exposed surfaces are suitably covered/ stabilised. There is no construction-related waste or pollution remaining on site.	
IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period
• On completion of the construction operations, the site camp area must be cleared of all site camp facilities, ablution facilities, fencing, signage, waste and surplus material. • Surfaces are to be checked for waste products from activities such as concreting or asphalting and cleared in a manner approved by the ECO. • Any contaminated soil must be collected and disposed of as hazardous waste. • All construction waste, litter and rubble are to be removed from the site and re-used elsewhere or recycled/disposed of at an appropriate facility. • Burying or burning of waste or rubble on site is prohibited. • All areas within the working area and site camp that have become devoid of vegetation or where soils have been compacted due to construction activities must be scarified or ripped. • Topsoil removed during the establishment of the site camp and the working area must be spread evenly over the entire site camp area and all other disturbed/ exposed areas after those areas have been ripped, scarified, shaped and contoured (as required). • Where necessary seeding and planting of vegetation can take place after the replacement of the topsoil. Hardy, drought tolerant, non-invasive plant species must be selected. If needed, a layer of mulch can be applied to the newly shaped/ landscaped and topsoiled areas. The mulch will serve to limit erosion and will promote the re-vegetation of the site by retaining moisture in the soil and providing organic material (compost) for new plant growth. Mulched material must be spread to a depth of ± 50mm – a thinner layer is likely to be ineffective in protecting the site, while thicker layers may suppress plant growth.	Contractor	Post-Construction phase

• All exposed soils and recently topsoiled areas are to be re-vegetated or stabilised to the satisfaction of the ECO, to protect these areas from wind and water erosion. No areas are to be left exposed to erosive forces. Erosion protection measures that can be applied include mulching (described above), the placement of geotextile, onion bags filled with wood chips, brush-packing or other similar measures. • Any topsoil, subsoil or other excavated material that cannot be utilised during site rehabilitation must be removed from the site and reused elsewhere on the property or disposed of at an appropriate disposal site. • Where necessary disturbed soils must be revegetated with the local indigenous vegetation such as that which occurs at the site or provided with other suitable cover. • It is recommended that follow-up alien clearing be conducted 6 months after construction is complete.		
Performance Indicator	• All construction-related materials, equipment, facilities, waste and contaminated soils have been removed from the site. • Compacted soils have been scarified/ ripped and stabilised. • All disturbed/exposed surfaces have been provided with a suitable covering and/or stabilised. • No alien vegetation is evident on site.	

OBJECTIVE 2: IMPACT ON TERRESTRIAL BIODIVERSITY

***Impact Management Objective:* To prevent the impact on terrestrial biodiversity during site closure and rehabilitation.**		
Potential impact to avoid	• Increased alien infestation. • Erosion due to poor rehabilitation efforts.	
Impact Management Outcome	Impact on terrestrial biodiversity is prevented.	
IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period
• Monitor the construction footprint and all areas disturbed during construction for rehabilitation success and erosion. Where needed, rehabilitate/revegetate disturbed surfaces expediently. Erosion prevention measures may be needed on steep slopes, such as	Contractor	Post-Construction phase

silt fences, logs or netting, to slow down runoff and potential erosion. Mulching and seeding with indigenous thicket/renosterveld seed may also be needed. • As a long-term maintenance requirement, continue with alien clearing on and around the project footprint, focussing on invasive species such as black wattle, rooikrans, common thorn apple, prickly pear, wild tobacco, castor-oil plant, bugweed and spear thistle. These species are category 1b and 2 invaders that require compulsory control as part of an invasive species control programme. Please note that it is a legal requirement for landowners to clear alien vegetation on their land.		
Performance Indicator	• Alien establishment is prevented • Erosion is monitored during rehabilitation	

OBJECTIVE 3: REDUCE THE LOSS OF INDIGENOUS FLORA AND SCC

Impact Management Objective: ***To prevent the loss of indigenous flora and SCC during site closure and rehabilitation.***		
Potential impact to avoid	• Alien infestation & resulting displacement of indigenous flora	
Impact Management Outcome	Alien infestation and resulting displacement of indigenous flora is prevented.	
IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period
• Monitor the construction footprint and all areas disturbed during construction for rehabilitation success and erosion. Where needed, rehabilitate/revegetate disturbed surfaces expediently. Erosion prevention measures may be needed on steep slopes, such as silt fences, logs or netting, to slow down runoff and potential erosion. Mulching and seeding with indigenous thicket/renosterveld seed may also be needed. • As a long-term maintenance requirement, continue with alien clearing on and around the project footprint, focussing on invasive species such as black wattle, rooikrans, common thorn apple, prickly pear, wild tobacco, castor-oil plant, bugweed and spear thistle. These species are category 1b and 2 invaders that require compulsory control as part of an invasive species control programme. Please note that it is a legal requirement for landowners to clear alien vegetation on their land.	Contractor	Post-Construction phase
Performance Indicator	• Alien establishment is prevented by using indigenous thicket/renosterveld seed for rehabilitation.	

OBJECTIVE 4: PREVENT/LIMIT CHANGES TO THE HYDROLOGICAL REGIME

***Impact Management Objective:* To prevent/limit changes to the hydrological regime of the Moordkuil River during site closure and rehabilitation.**			
Potential impact to be avoided	• Changes to the natural movement of water flow through the Moordkuil River and its associated buffer, by construction of infrastructure within the water column and riparian habitat resulting in altered flow patterns, sediment transport and erosion. • Localized scour, sediment deposition upstream, and increased downstream velocity is possible to occur around water column infrastructure.		
Impact Management Outcome	Changes to the hydrological regime of the Moordkuil River is limited.		
IMPACT MANAGEMENT ACTIONS			
Mitigation measure		Responsible party	Time period
Operational Phase: • **Flood Control Measures:** Regularly assess river levels and implement flood mitigation measures as required. • **Maintenance work**: Any work associated with the maintenance of the water column infrastructure should be minimized in both spatial extent and duration. Preferably such work should take place during the drier months (December to April) to reduce hydrological impacts.		Contractor	Post-Construction phase
Performance Indicator	• Regularly assess river levels and implement flood mitigation measures as required. • Any work associated with the maintenance of the water column infrastructure should be minimized in both spatial extent and duration. Preferably such work should take place during the drier months (December to April) to reduce hydrological impacts.		

OBJECTIVE 5: PREVENT/LIMIT THE GEOMORPHOLOGICAL CHANGES FROM EROSION AND SEDIMENTATION

Impact Management Objective: ***To prevent/limit the geomorphological changes from erosion and sedimentation during site closure and rehabilitation.***			
Potential impact to avoid	• Changes to the form and geomorphological processes from clearing riparian vegetation and construction within the watercourse due to potential erosion and sedimentation from hydrological changes and increased sediment inputs.		
Impact Management Outcome	Sedimentation and erosion is limited.		
IMPACT MANAGEMENT ACTIONS			
Mitigation measure		Responsible party	Time period
Operational Phase: • **Maintain natural water column sediment levels:** Regularly clean and maintain coffer dam, and filtration systems to ensure they continue functioning effectively in capturing sediment and returning captured sediment back to the water column. • **Vegetative stabilization:** Promote the growth of native vegetation in areas susceptible to erosion to stabilize soil and reduce sediment generation over time. • **Revegetation of exposed soils:** In any areas that have been disturbed, replant vegetation and apply soil stabilisation techniques to prevent erosion and further sediment loss. • **Flood Control Measures:** Regularly assess river levels and implement flood mitigation measures as required. • **Maintenance work:** Any work associated with the maintenance of the water column infrastructure should be minimized in both spatial extent and duration. Preferably such work should take place during the drier months (December to April) to reduce hydrological impacts. • **Emergency infrastructure repair:** Any flood damaged infrastructure should be repaired as soon as it is safe, and possible, to do so, to prevent further degradation and hydrological impacts.		Contractor	Post-Construction phase
Performance Indicator	Sedimentation and erosion is effectively monitored post construction.		

13. Emergency Preparedness

13.1 Emergency response procedures

The potential environmental risks that may arise as a result of construction activities must be identified, and appropriate emergency response procedures must be compiled for each emergency scenario. Potential environmental emergencies that require an emergency response include – but are not limited to – unplanned fires, sewage spills, spills of hazardous chemicals, snake bites etc.

- The construction contractor is responsible for ensuring that the requirements of the Occupational Health & Safety Act (OHSA) are adhered to during the construction phase. The Applicant is responsible for ensuring compliance with the OHSA during the undertaking of construction activities.

13.2 Emergency preparedness

The following measures must be implemented, as appropriate, to ensure effective responses to emergencies:

- All workers on site during the construction and maintenance phase must be properly educated about possible emergency incidents that may arise, how to avoid such incidents and how to respond in the event of an incident. "Refresher" training sessions on emergency procedures must be held if needed.
- All workers must ideally be given basic fire-awareness training and advised on basic firefighting and safety techniques. Fire-fighting equipment must be available on site during construction activities (see section 8.3).
- All workers must be trained on how to respond in the event of a spill of a hazardous substance(fuel, chemicals etc.), if hazardous substances are to be used on site.
- A spill kit for containing and/or neutralising spills of hazardous substances (e.g., hydrocarbons) must be available on site at all times, when hazardous substances are present.
- Any incidents of pollution or spillage of hazardous materials during construction must be reported to the ECO as soon as possible. The ECO must then (depending on the nature of the spill) notify the relevant authorities, if needed. A first aid kit must be available on site at all times.
- Emergency contact numbers (including the fire department, police and ambulance) must be prominently displayed on site at all times and regularly updated.
- All emergency incidents must be recorded in a site incident log. The cause of the incident, the measures taken in response to the incident and the efficacy of those measures must also be recorded. This information must be used to inform future emergency preparedness planning, and to avoid prevent similar incidents from arising again.

14. Method statements

The Competent Authority and/or the ECO may require the Applicant or Construction Contractor to submit Method Statements for one or more construction-related activity, or any aspect of the management of the site, before the activity is undertaken or during the performance of the activity if the activity is causing or may cause significant environmental damage or pose a health and safety risk.

Method Statements need not be complex and lengthy, but must clearly state **how**, **when** and **where** the activity concerned will be undertaken, and must specify **who** will be responsible for undertaking each component of that activity. Method Statements must be prepared by the Construction Contractor and submitted to the ECO for approval before undertaking the activity concerned.

The ECO and / or Competent Authority have the authority to request method statements for other activities, including but not limited to:

- Establishment of site camp and stockpile area.
- Cement/ concrete batching, disposal and emergency contingencies.
- Topsoil and sub-soil storage/ stockpiling.
- Storage of fuels and hazardous chemicals and emergency contingencies.
- Waste management system.
- Storm water management and control.
- Emergency preparedness plan / emergency response procedure (see Chapter 13).

The ECO has the authority to prevent activities from being undertaken until such time as a satisfactory Method Statement has been submitted to the ECO and approved by the ECO.

15. Roles and Responsibilities

This EMPr, once approved by the competent authority (DEADP), should be seen as binding to the Applicant, and any person acting on the Applicant's behalf, including but not limited to agents, employees, associates, contractors and service providers.

The Applicant and all other persons who may be directly involved in the development are also bound by their general Duty of Care, as stated in Section 28 of the National Environmental Management Act, 1998:

> ***Duty of Care:***
>
> *"Every person who causes, has caused, or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm cannot reasonably be avoided or stopped, to minimize and rectify such pollution or degradation of the*

15.1 Duties and Responsibilities of the Applicant

The Applicant is ultimately responsible for ensuring that the environmental management measures specified in this EMPr, as well as any other conditions specified by the competent authority, are implemented and adhered to during the construction phase of the proposed development.

The Applicant or party delegated by the applicant is responsible for monitoring during the construction phase. The Applicant must ensure that all appointed service providers, contractors and workers are capable of complying with all statutory requirements of this EMPr and the conditions of the Environmental Authorisation. The Applicant is responsible for ensuring that this EMPr and the conditions of the Environmental Authorisation are implemented and adhered to during construction activities undertaken by the Applicant.

The Applicant or appointed consultant is responsible for identifying emergency situations that may arise during operational activities undertaken by the Applicant and must formulate appropriate emergency response procedures for these emergency scenarios.

15.2 Duties and Responsibilities of the Contractor

The "Construction Contractor" is the entity responsible for undertaking the physical construction of the residential development. The construction contractor is responsible for ensuring that all environmental management measures specified in this EMPr and in the EA are implemented during the pre-construction, construction and post-construction rehabilitation phases, unless agreed otherwise with the Applicant. The contractor will be responsible for all costs incurred in the rehabilitation of the site and for ensuring effective environmental management during construction. The contractor must therefore make adequate financial provision for the implementation of all prescribed measures.

It is strongly recommended that the Construction Contractor appoint an Environmental Site Officer (ESO), who will act as the Contractor's representative to monitor and enforce compliance with the conditions of this EMPr, throughout all phases of construction.

In addition to the above, the Construction Contractor is responsible for the following:

- Identify emergency situations that may arise as a result of construction activities and formulate appropriate emergency response procedures (see Chapter 13).
- Ensure that all construction workers, including sub-consultants and service providers, undergo environmental awareness training prior to commencing work on site, or as soon as possible thereafter (see Chapter 16).
- Compile the required method statements, which must be to the satisfaction of the ECO, before commencing with the activity to be governed by the method statement (Chapter 14).
- Respond to concerns or issues identified by the ECO, as relates to environmental management, and implement the appropriate management or remediation measures, at the Contractor's own expense (unless agreed otherwise)
- Should third parties be called to the site to perform clean up and rehabilitation procedures, the Construction Contractor will be responsible for all associated costs.

Note that failure to comply with the requirements and conditions of this EMPr and the Environmental Authorisation may result in fines or other penalties being levied against the Construction Contractor by the Competent Authority.

15.3 Duties and Responsibilities of the ECO

The appointed Environmental Control Officer (ECO) is responsible for undertaking regular site visits to monitor and report on the implementation of the EMPr and adherence to the conditions of the Environmental Authorisation during the pre-construction, construction and post-construction rehabilitation phases. The ECO is not required to monitor the site during the operational phase of the development.

Competency of the ECO

The ECO must be independent of the Applicant, Engineer, Construction Contractor and their service providers. The appointed ECO must be suitably qualified and experienced, and must be able to demonstrate that he / she is of sufficient competency to undertake the required task. The ECO should preferably be a resident in close proximity to the development area to ensure quick response if required. The ECO must work in close co-operation with the Construction Contractor, resident engineer or ESO

(where applicable) and all contractors in order to identify potential problems before they occur, and provide suitable guidance as to how the identified problems (environmental impacts) can be avoided.

Duties of the ECO

The duties of the ECO include, but are not limited to:

- Conduct a pre-construction site inspection to ascertain the pre-commencement condition of the site (i.e. the status quo) and determine whether faunal search-and-rescue is required;
- Conduct environmental awareness training (see Chapter 16);
- Undertake regular site visits to monitor compliance with all mitigation, monitoring and management measures contained in the EMPr and the Environmental Authorisation, during the pre-construction, construction and rehabilitation phases of the development (see section below regarding frequency of ECO visits).
- Evaluate the achievement of the performance indicators associated with each impact management outcome specified in this EMPr (Chapters 9-12)
- Liaise with site contractors, engineers and other members of the development team with regard to the requirements of the EMPr;
- Provide guidance as and when required regarding the implementation of the environmental management measures contained in the EMPr and EA, so as to assist the Applicant and contractor in remaining compliant with these measures;
- Assist in finding environmentally acceptable solutions to construction problems;
- Ensure that the working area, site camp facilities, access roads and no-go areas are properly demarcated;
- Ensure that proper topsoil management practices are adhered to on site;
- Ensure that proper waste management & pollution prevention strategies are practised on site;
- Examine method statements;
- Email contractors with potential non compliance notices in case of contravention of the EMPr;
- Ensure satisfactory rehabilitation of disturbed areas on site, after construction is complete;
- Keep detailed records of all site activities that may pertain to the environment, and produce compliance-monitoring reports (ECO Reports) for submission to the Applicant, and the Competent Authority at regular intervals during the construction phase;
- Submit a final post-construction inspection report, within 6 months of completion of the construction phase. The audit report must detail the rehabilitation measures undertaken, describe all major incidents or issues of non-compliance and any issues or aspects that require attention or follow-up.
- All ECO Reports and Inspection Reports must be submitted to the Applicant and Competent Authority.

Frequency of ECO visits

The ECO must conduct weekly site visits during the initial bulk earthworks and establishment of the coffer dam to check compliance with the conditions of the EA and mitigation measures and recommendations of this EMPr. The ECO has the discretion to undertake additional visits if he / she feels this is justified due to the actions of the contractors, and to make *ad hoc* visits in order to ensure compliance.

The ECO must also undertake a final inspection (audit) 6 months of completion of construction activities. The purpose of this final inspection is to ensure that the rehabilitation measures applied at the conclusion

of the construction phase have been sufficient to promote the successful rehabilitation of the site, and to identify any further issues that require attention or follow-up.

Once the footprint has been established and the cofferdam is in place, the site visit frequency can be reduced to two visits per month. Once the cofferdam is removed and activities are limited to the mechanical aspects within the building the visits can be reduced to one visit per month.

Authority of the ECO

The ECO has the authority to recommend that the Engineer suspend all works (or part thereof) occurring on site, should any action being undertaken on site not comply with the environmental requirements, and where such actions pose a serious threat to any element of the surrounding environment.

The ECO has the authority to recommend measures to the Engineer, regarding measures that must be implemented on site in order to ensure compliance with the EMPr and Environmental Authorisation, and/or to prevent environmental degradation or pollution from occurring.

The ECO has the authority to issue verbal and written warnings to contractors. Should verbal and written instructions and/or warnings be ignored, the ECO has the authority to request the Engineer to issue pre-determined fines or other penalties.

16. Environmental Awareness Plan

Environmental Awareness Training must be conducted prior to the commencement of construction activities. It is the applicant's responsibility to familiarise himself/herself with the content and requirements of this EMPr. The applicant is also responsible to ensure that the contractor and all labourers working on site during the construction phase are familiar with the content of this EMPr.

The following actions must be taken to ensure that all relevant parties are aware of their environmental role and duties:

1. This EMPr must be kept on site at all times.
2. The provisions of this EMPr and the conditions of the Environmental Authorisation must be explained in detail to all staff during Awareness Training.
3. Training booklets will be handed out to all labourers and must be explained to them.
4. Weekly checks to be done by the Applicant's environmental representative (where available) who must be on site at all times.
5. The ECO to do frequent site visits, as recommended in Section 15.3 of the EMPr.
6. Monthly monitoring reports to be compiled by the ECO. These reports will be circulated to all parties involved (including the applicant, contractor and the competent authority).

The Construction Contractor must make allowance for all construction site staff, including all subcontractors that will be working at the site, to attend environmental awareness training sessions (undertaken by the ECO) before commencing any work on site. During this training, the ECO will explain the EMPr and the conditions contained therein. Attention will be given to the construction process and how the EMPr fits into this process. Other items relating to sound environmental management which must be discussed and explained during the environmental awareness training sessions include:

- The demarcated "No-Go" areas;
- General do's and don'ts of the site;
- Making of fires;

- Waste management, use of waste receptacles and littering;
- Use of the toilets provided;
- Use and control of construction materials and equipment etc.;
- Control, maintenance and refuelling of vehicles;
- Methods for cleaning up any spillage;
- Access and road safety;
- Emergency procedures (e.g. in case of fire, spillage etc.)
- General "best practice" principles, with regards to the protection of environmental resources.

Environmental awareness training and education must be ongoing throughout the construction phase and must be undertaken regularly if deemed necessary (especially if it becomes apparent that there are repeat contraventions of the conditions of the EMPr), or as new workers come to site. Translators must be utilised where needed. An Environmental Awareness Guideline has been compiled and is included in Appendix F of the EMPr.

17. Monitoring, Record Keeping and Reporting

17.1 Environmental Auditing

In accordance with the requirements of the Amended Environmental Impact Assessment Regulations of 2014 (GN No. R.327 of 7 April 2017), the holder of the Environmental Authorisation (i.e. the Applicant) must, for the period that the Environmental Authorisation is valid, appoint a suitably qualified independent person to conduct an environmental audit to audit compliance with the conditions of the Environmental Authorisation and the EMPr.

The appointed auditor must undertake environmental audits within 6 months after the completion of the rehabilitation measures. Following each audit the environmental auditor must submit an audit report to the Competent Authority (in this instance the DFFE). The Auditor must be independent from the EAP and ECO.

- Environmental auditing and environmental audit reports must adhere to the requirements of the Environmental Impact Assessment Regulations, in particular Section 34 (*Auditing of Compliance with Environmental Authorisation, Environmental Management Programme*) and Appendix 7 (*Objective and Content of Environmental Audit Report*).
- The audit report must provide verifiable findings on the level of compliance with the provisions/ conditions of the Environmental Authorisation and the EMPr, and must also comment on the ability of the measures contained in this EMPr to sufficiently avoid, manage and mitigate environmental impacts.
- Where the findings of the audit report indicate that the impact management measures stated in the EMPr are insufficient to adequately address environmental impacts, recommendations as to how the EMPr must be amended so as to address the identified shortcomings must be made and submitted to the competent authority together with the audit report.

17.2 Construction phase monitoring, reporting and record keeping.

The appointed Environmental Control Officer (ECO) is responsible for monitoring the site at regular intervals during the construction phase, in order to ensure that the provisions of this EMPr and the Environmental Authorisation are adhered to and that sound environmental management is ensuing on site.

The ECO must compile a monthly ECO report detailing the ECO's observations on site, any instances of non-compliance and any issues or aspects that require attention, follow-up or remedial action. The ECO reports must be submitted to the Applicant, and to the Competent Authority as requested by the DEADP in the EA. The ECO inspection reports must include both photographic and written records.

ECO Inspections - Photographic Records

The condition of the surrounding natural environment must be monitored regularly in order to ensure that construction and management activities are not impacting negatively on the condition of the landscape and any sensitive ecosystems. The most effective way to achieve this is by means of a detailed photographic record. In this way, a record of any shift in ecosystem condition can be maintained and potential impacts be detected at an early stage. It is thus recommended that fixed-point photo-monitoring sites could be set up, and photographs should be taken at these sites during each ECO inspection. Where necessary, the entire working area should be well documented and photographed.

ECO Inspections - Written Records

The following record-keeping during the pre-construction, construction and rehabilitation phases of the development is recommended:

- The ECO should complete an ECO Checklist after each ECO site visit.
- The ECO must compile an ECO monitoring report and submit this to the Applicant, the Contractor and the Competent Authority (the latter only if required by the Competent Authority). The monthly reports must be a summary of the ECO inspections from the preceding month and must highlight the key concerns/ issues on site, instances of non- compliance with the EA and EMPr, all instructions issued to the contractor, actions taken and aspects that still require attention.
- All ECO reports and ECO instructions must be retained on file by the Applicant at least for the duration of the construction period (retaining reports for a period of at least 5 years is recommended, in the event that the Competent Authority should request information).
- A record (minutes) of construction site meetings, liaison site meetings between the ECO and resident engineer or contractor, monitoring reports, ECO instructions and ECO observations should be clearly documented and filed on a master file off-site for safe keeping.
- It is recommended that a site register (incident register) should be kept on site at the site office for the recording of any environmental incidents (e.g., fires, spills etc.), observations which are contrary to the stipulations within the EMPr and any other contravention deemed necessary for the attention of the resident engineer. Actions taken to remedy the incidents should also be recorded.
- A complaints register should be kept on site in which complaints by any member of the public should be logged.
- The ECO must compile a final post-construction audit report, within 6 months of completion of each construction phase. The audit report should detail the rehabilitation measures undertaken, describe all major incidents or issues of non-compliance and any issues or aspects that require attention or follow-up.

Construction Phase Record Keeping

A copy of the approved EMPr, the Environmental Authorisation and any relevant construction method statements must be kept on site at all times during pre-construction, construction and rehabilitation

activities. The ECO Reports must be retained by the Applicant for a period of at least 5 years and must be provided to the Competent Authority upon request.

17.3 Corrective Action Procedure

Correction actions need to be followed in the event where there is non-compliance with a condition of the EA and any recommendation and mitigation measure as stipulated in this EMPr in order to rectify the non-compliance and to prevent reoccurrence.

The ECO will be responsible for reporting non-compliance with any condition of the EA and the recommendations and mitigation measures as included in this EMPr. The ECO will also be responsible for the compilation of non-compliance reports and identifying steps to correct the non-compliance.

The ECO must report all non-compliance issues to the contractor whose responsibility it is to correct. A timeframe for the completion of the corrective actions must be agreed to the ECO. Once the corrective actions have implemented the contractor must notify the ECO. The ECO must review the effectiveness of the corrective actions and if it is found to be inadequate, additional measures must be implemented. Only once the corrective actions have been completed to the satisfaction of the ECO will the matter be considered as closed.

In instances where there are repeated instances where the requirements and conditions of this EMPr and the Environmental Authorisation are contravened or not fully complied with, the Construction Contractor may be liable for financial penalties. Penalties shall be issued by the Engineer, in accordance with the Schedule of Fines contained in the table below. Penalties may be issued at the Engineer's discretion, and/or upon the request/ recommendation of the ECO or Competent Authority.

Depending on the nature of transgression, the Engineer and/or ECO may issue one or more warnings to the Contractor prior to the issuing of a fine. Warnings may be given in writing or orally, but oral warnings must be followed up with written confirmation of the warning within 48 hours of the oral warning. The Engineer has the discretion to issue a fine without first issuing a warning, if the severity of the transgression is judged by the Engineer and/or ECO and/or Competent Authority to warrant such action.

The Engineer must ensure that the levying of fines/penalties forms part of the contract between the Construction Contractor and the Engineer and is subject to the provisions of South African contract law.

The table below specifies the transgressions for which the Construction Contractor may incur financial penalties, and the amount of the fines that may be levied. Levying of fines/ penalties is subject to alignment with South African Contractual Law. For repeat offences of the same/ similar transgression by the same party, the value of the fine shall be doubled for each subsequent repeat offence to a maximum value of **R50 000.00** per offence.

Note: "Provisions", as stated in the table below, relates to the requirements specified in this EMPr and any requirements or conditions specified in the EA, as well as any other requirements governing the environmental management aspects of the development, which the Contractor is responsible for implementing.

#	Finable Transgression	Min Fine	Max Fine
1	Failure to notify the ECO of the commencement of construction or pre-construction activities, prior to the commencement of such activities	R1 000	R2 000

2	Failure to comply with the provisions relating to the demarcation of the working area, site camp and associated facilities, and the maintenance of the demarcated boundaries.	R1 000	R5 000
3	Failure to comply with the provisions relating to the demarcation of all "no-go" areas, and the maintenance of the demarcated boundaries.	R2 000	R5 000
4	Failure to provide secured ablution facilities (1:30 ratio) on site.	R500	R15 000
5	Failure to comply with the provisions relating to the clearance of vegetation on site.	R2 000	R5 000
6	Clearance of indigenous vegetation (regardless of the density of alien vegetation present) outside of the demarcated boundaries of the working area and site camp.	R2 500	R15 000
7	Damage to indigenous vegetation in the surrounding areas within No-Go areas	R2 000	R10 000
8	Failure to apply herbicide to alien vegetation when required to do so.	R500	R2 000
9	Failure to adhere to designated access routes and/or the driving of vehicles through undeveloped vegetation outside of the demarcated working area or site camp.	R1 000	R5 000
10	Movement of vehicles and/or construction workers in no-go areas;	R1 000	R10 000
11	Empty cement bags found on site or surrounding vegetation. Open cement bags on site with cement blowing from the bag	R2 500	R15 000
12	Parking or storage of vehicles, machinery, tools and other materials or equipment related to the Contractors operations, within designated "no-go" areas.	R1 000	R10 000
13	Parking or storage of vehicles, machinery, tools and other materials or equipment related to the Contractors operations, outside of the areas demarcated for such parking/storage.	R500	R5 000
14	Failure to comply with the provisions relating to the management of topsoil and subsoil.	R1 000	R5 000
15	Excessive excavation of material in areas not depicted for such purpose / activity on the approved design plans.	R2 500	R10 000
16	Failure to comply with the provisions relating to waste management on site i.e. recycling of waste	R500	R5 000
17	Failure to comply with the provisions relating to the storage, use and management of hazardous substances and fuels on site and/or the spillage of hydrocarbons or hazardous substances on site.	R1 000	R10 000
18	Mixing cement or concrete on bare ground and/or failure to comply with any other provision regarding cement/ concrete batching	R1 000	R5 000
19	Failure to provide adequate fire-fighting equipment (in working order) on site at all times and/or failure to comply with the provisions relating to fire prevention and/or the occurrence of unattended or out of control fires.	R500	R5 000
20	Refuelling of vehicles, machinery or equipment outside of the designated refuelling area.	R500	R2 000
21	Maintenance of vehicles, machinery or equipment outside of the designated maintenance yard, except in emergencies	R500	R2 000
22	Failure to undertake refuelling or repairs over a drip tray or other impermeable bunded surface to collect spilled hydrocarbons (fuels, lubricants, oils etc.) and other hazardous substances; failure to provide drip trays under fuel burning equipment (including pumps and generators) where there is a risk of hydrocarbon leakage.	R500	R2 000
23	Storing / placing fuel containing equipment (i.e. bowsers and other fuel containers) within a drainage line.	R2 500	R10 000

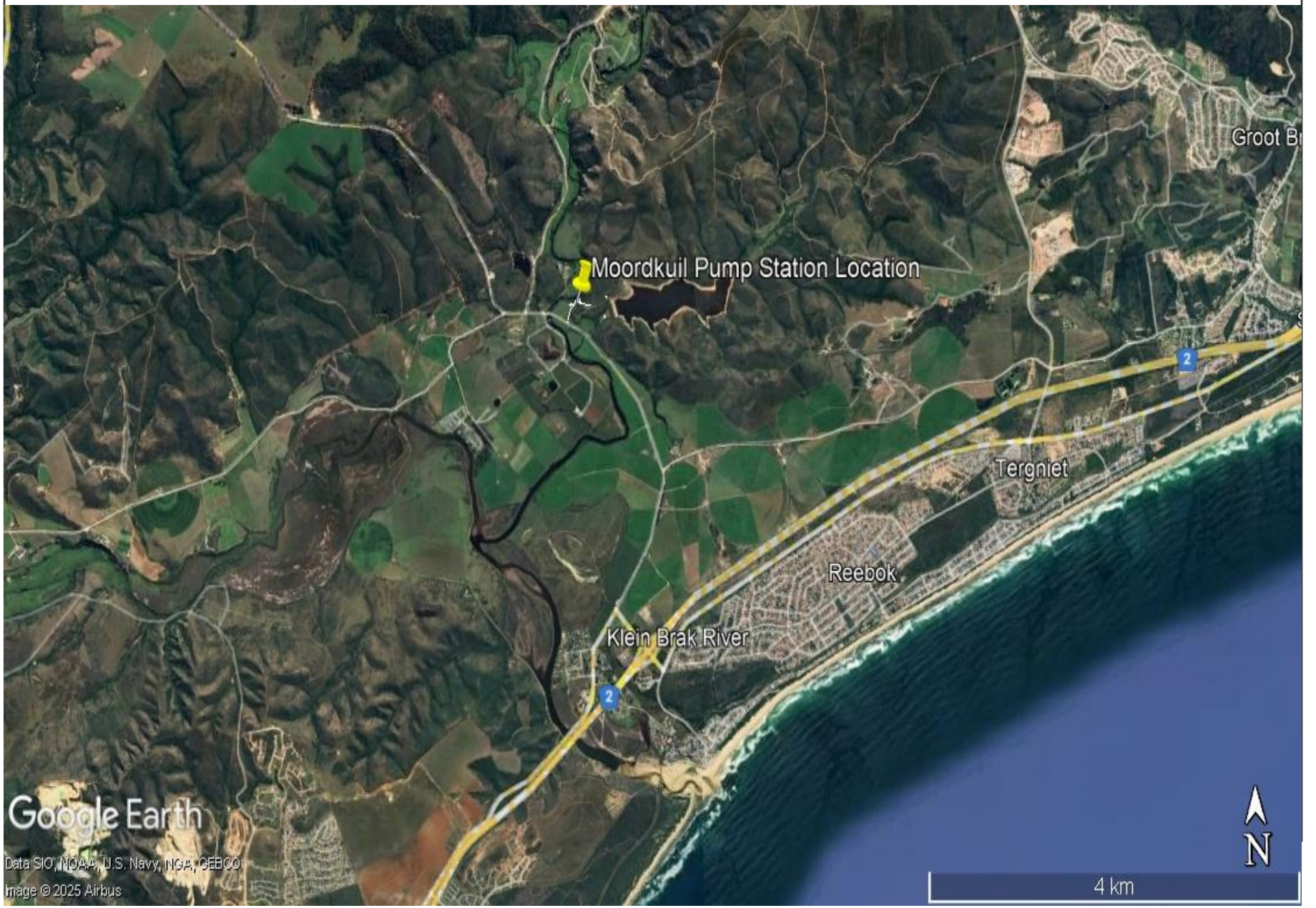
24	Failure to produce a required method statement/s to the engineer's and ECO's satisfaction prior to undertaking the activity concerned and/or failure to adhere to an approved method statement	R1 000	R5 000
25	Waste found to be buried or burnt on site	R5 000	R15 000

18. CONCLUSION

The recommendations and mitigation measures prescribed in this EMPr have been formulated with the intention of addressing potential pre-construction, construction and operational phase impacts on the environment. It is likely that if the conditions, requirements and recommendations of the above EMPr are implemented as described and the relevant stakeholders adhere to the various mitigation measures, then the project will be completed without unforeseen negative environmental impacts. Familiarity with the contents of this EMPr by the contractors and other individuals involved in the development project will assist in achieving "environmental best-practice", which ultimately ensures that the project arrives at a sustainable outcome.

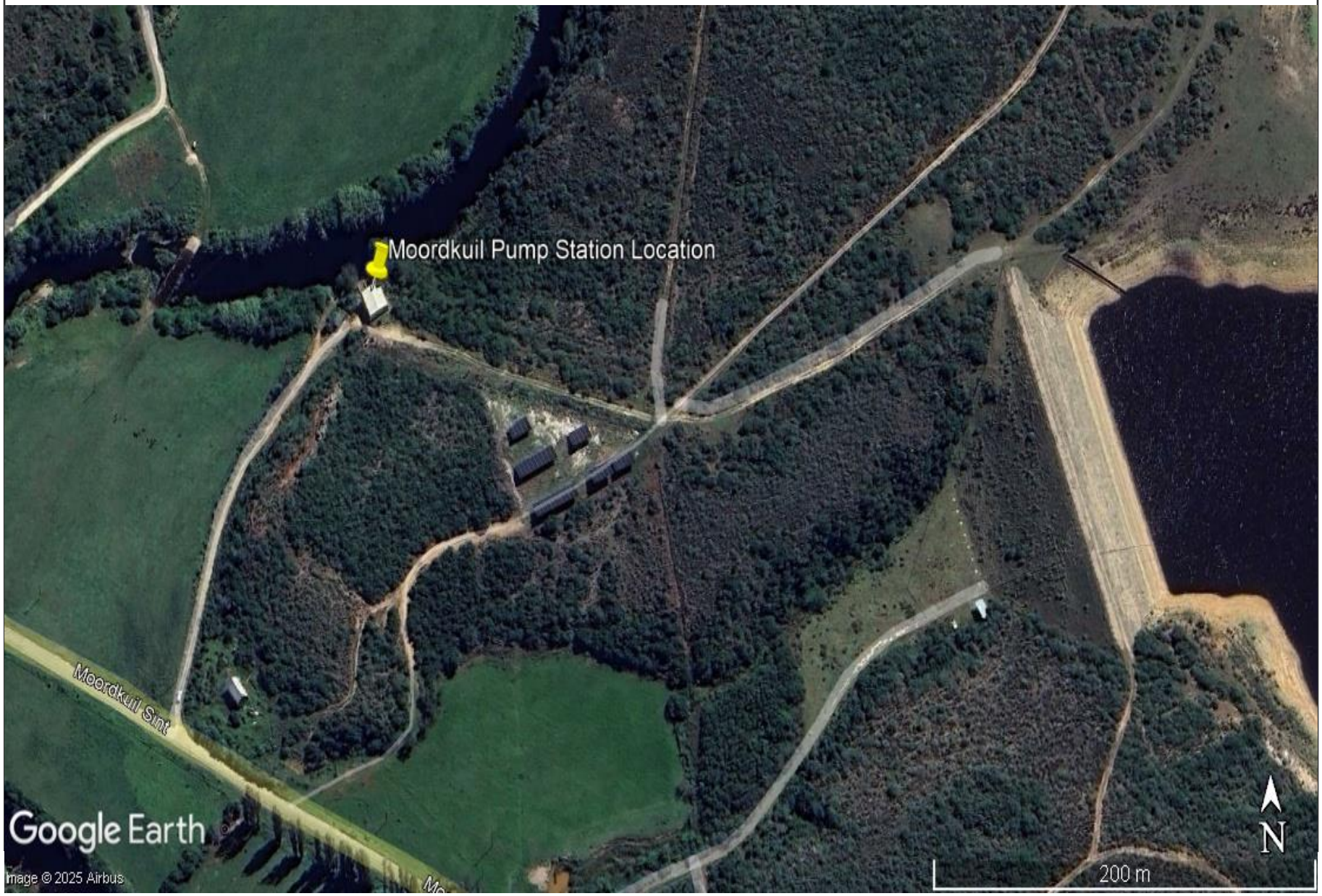
APPENDIX A: LOCALITY MAPS

APPENDIX A1: FIGURE 1:LOCALITY MAP FOR THE PROPOSED UPGRADE OF THE MOORDKUIL RAW WATER PUMP STATION ON PORTIONS 15, 24 AND 25 OF THE FARM KLIPHEUVEL NO. 143, KLEINBRAK RIVIER, MOSSEL BAY MUNICIPALITY, WESTERN CAPE.

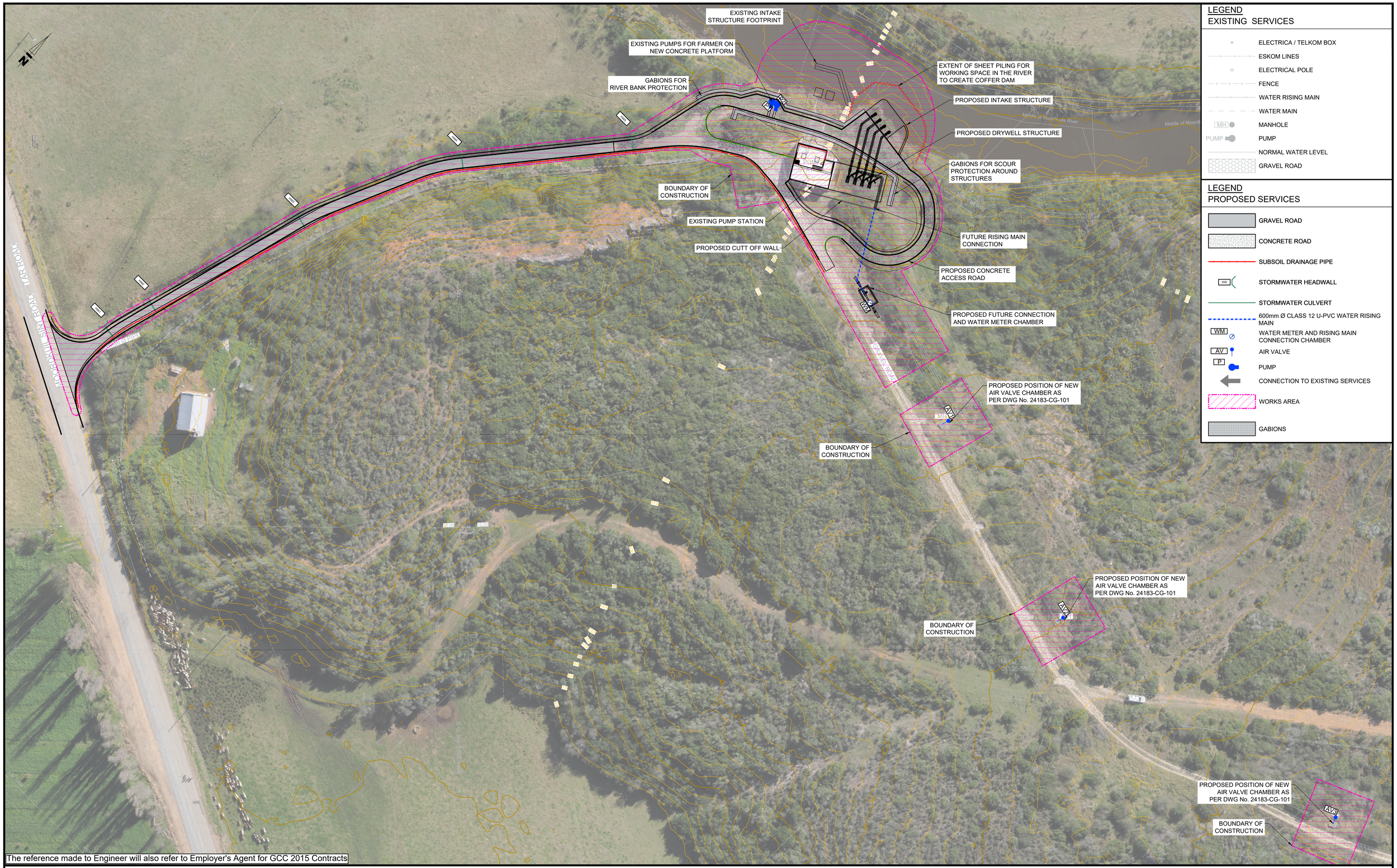


APPENDIX A1: FIGURE 2:LOCALITY MAP FOR THE PROPOSED UPGRADE OF THE MOORDKUIL RAW WATER PUMP STATION ON PORTIONS 15, 24 AND 25 OF THE FARM KLIPHEUVEL NO. 143, KLEINBRAK RIVIER, MOSSEL BAY MUNICIPALITY, WESTERN CAPE.

APPENDIX A1: FIGURE 3:LOCALITY MAP FOR THE PROPOSED UPGRADE OF THE MOORDKUIL RAW WATER PUMP STATION ON PORTIONS 15, 24 AND 25 OF THE FARM KLIPHEUVEL NO. 143, KLEINBRAK RIVIER, MOSSEL BAY MUNICIPALITY, WESTERN CAPE.



APPENDIX B: SITE PLANS



The reference made to Engineer will also refer to Employer's Agent for GCC 2015 Contracts

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Meters 1:500

REV	DESCRIPTION	DATE	REV BY	CHKD
A	ISSUED FOR INFORMATION	'25-10-14	ES	CD

REVISIONS

DESIGNED	MG	
DRAWN	ES	
CHECKED	CD	

CONSULTING ENGINEERS
LYNERS
PO Box 4901
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7530
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email: bellville@lyners.co.za

APPROVED
ENGINEERS:
DATE: 2025-10-14

APPROVED
CLIENT:
DATE:

CLIENT
Mossel Bay MUNICIPALITY

PROJECT
MOORDKUIL
RAW WATER INTAKE AND PUMPING STATION

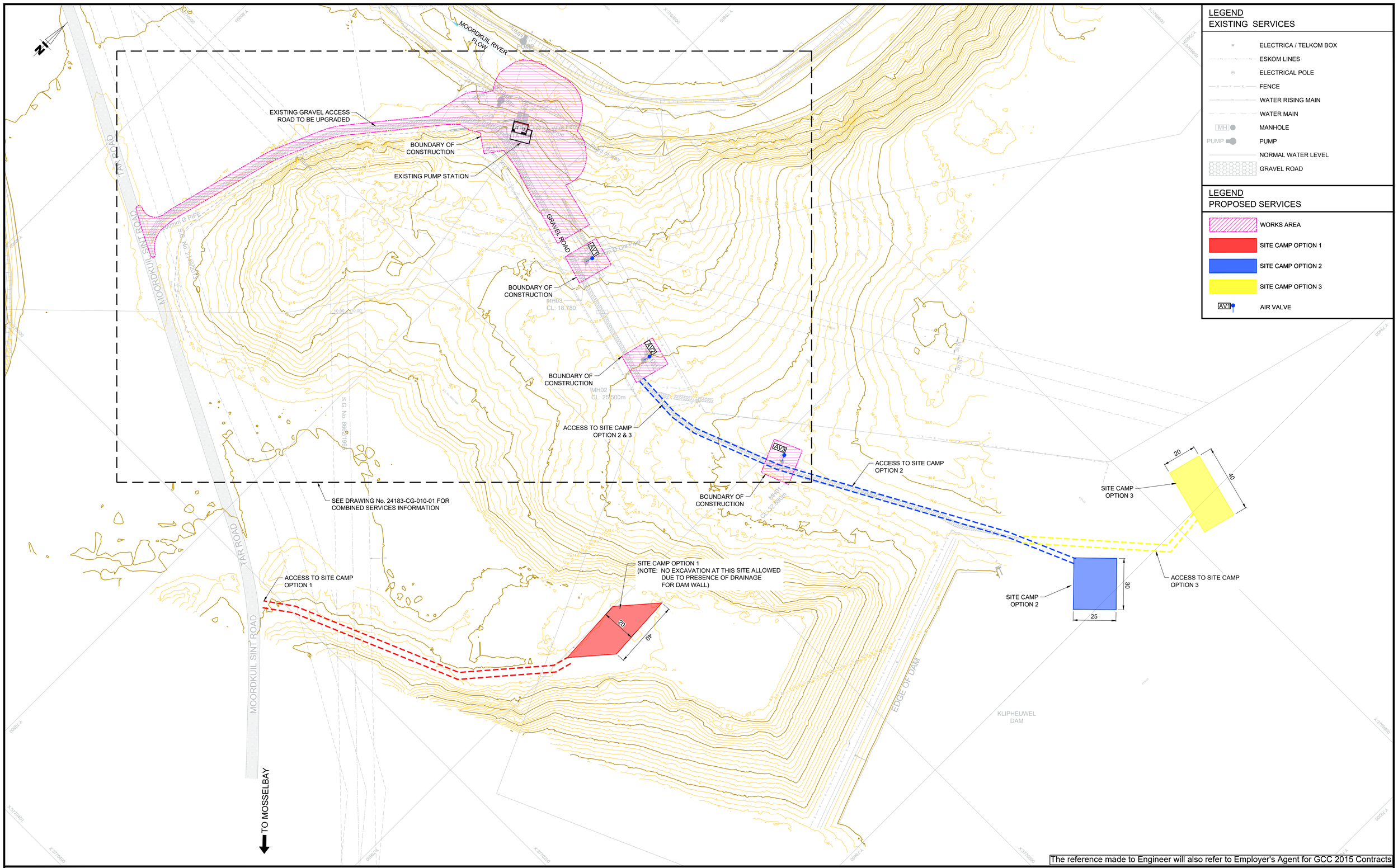
TITLE
COMBINED SERVICES LAYOUT

SCALE	SHEET
1:500 on A1	1 OF 1
CONTRACT No.	PROJECT No. 24183CG

DRAWING No. 24183-CG-010-01 REV A

COORDINATE SYSTEM: WGS84 / Lo23°

Date: 2025-10-14 Checked: Auditing: Matthew Gilmore



LEGEND
EXISTING SERVICES

- ELECTRICA / TELKOM BOX
- ESKOM LINES
- ELECTRICAL POLE
- FENCE
- WATER RISING MAIN
- WATER MAIN
- MANHOLE
- PUMP
- NORMAL WATER LEVEL
- GRAVEL ROAD

LEGEND
PROPOSED SERVICES

- WORKS AREA
- SITE CAMP OPTION 1
- SITE CAMP OPTION 2
- SITE CAMP OPTION 3
- AIR VALVE

The reference made to Engineer will also refer to Employer's Agent for GCC 2015 Contracts

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All dimensions must be verified on site before the works commence. Refer any discrepancies to the Engineer.

REV	DESCRIPTION	DATE	REV BY	CHKD
B	MINOR AMENDMENDS	'25-10-14	ES	CD
A	ISSUED FOR INFORMATION	'25-08-26	MG	CD

REVISIONS

DESIGNED	MG	
DRAWN	MG	
CHECKED	CD	

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APPROVED
ENGINEERS: _____
DATE: 2025-10-14

APPROVED
CLIENT: _____
DATE: _____

CLIENT
Mossel Bay MUNICIPALITY

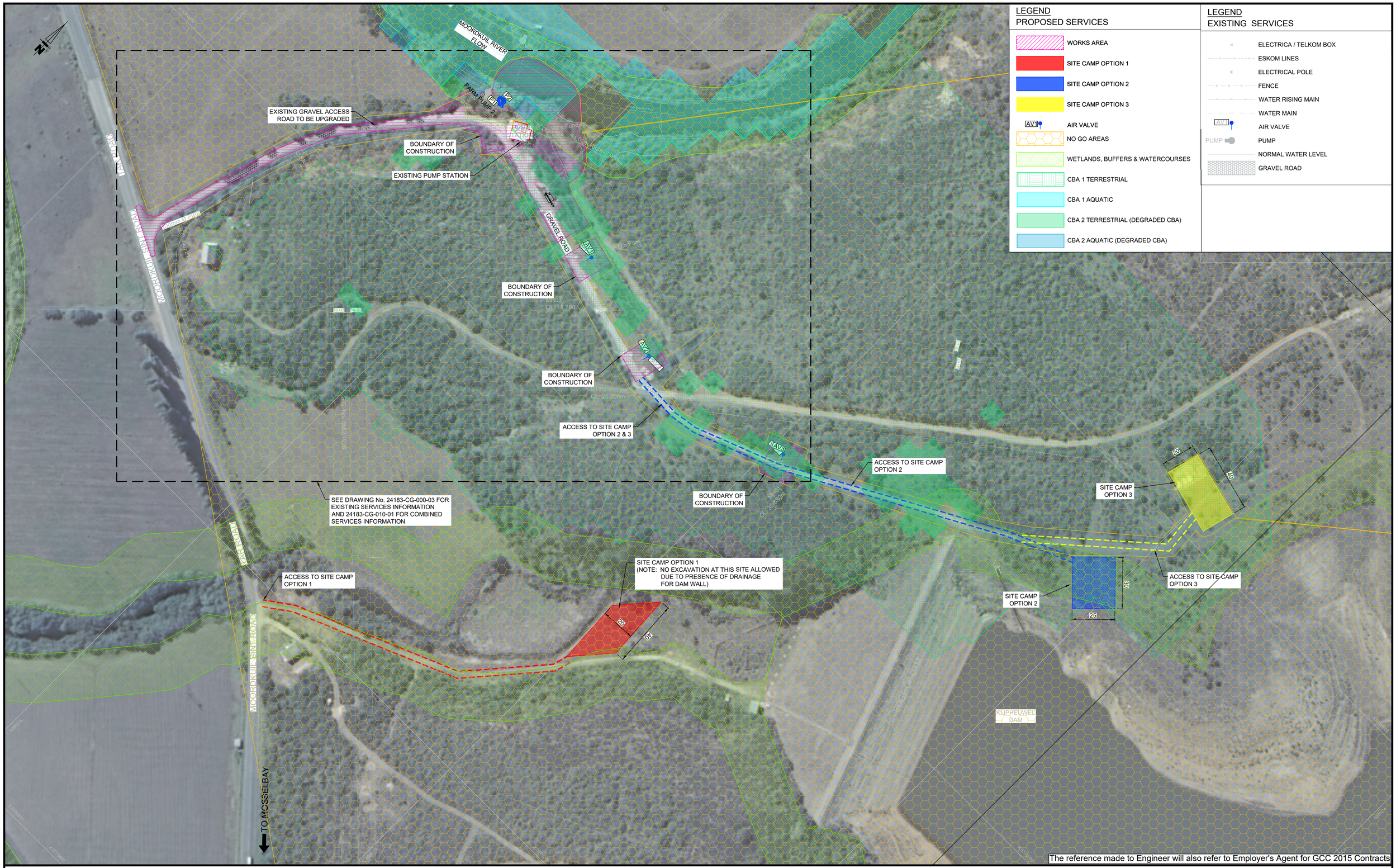
PROJECT
MOORDKUIL
RAW WATER INTAKE AND PUMPING STATION

TITLE
WORKING AREA AND SITE CAMP OPTIONS

SCALE	SHEET
1:1000 on A1	1 OF 1
CONTRACT No.	PROJECT No. 24183GC

DRAWING No. 24183-CG-001-02 REV B
COORDINATE SYSTEM: WGS84 / Lo23°

Date: 2025-10-14 Checked: Auditing: Matthew Gilmore



LEGEND
PROPOSED SERVICES

- WORKS AREA
- SITE CAMP OPTION 1
- SITE CAMP OPTION 2
- SITE CAMP OPTION 3
- AIR VALVE
- NO GO AREAS
- WETLANDS, BUFFERS & WATERCOURSES
- CBA 1 TERRESTRIAL
- CBA 1 AQUATIC
- CBA 2 TERRESTRIAL (DEGRADED CBA)
- CBA 2 AQUATIC (DEGRADED CBA)

LEGEND
EXISTING SERVICES

- ELECTRICA / TELKOM BOX
- ESKOM LINES
- ELECTRICAL POLE
- FENCE
- WATER RISING MAIN
- WATER MAIN
- AIR VALVE
- PUMP
- NORMAL WATER LEVEL
- GRAVEL ROAD

The reference made to Engineer will also refer to Employer's Agent for GCC 2015 Contracts

SCALEBAR
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REV	DESCRIPTION	DATE	REV BY	CHKD
A	ISSUED FOR TENDER	'26-01-27	ES	CD

REVISIONS

DESIGNED	MG	
DRAWN	ES	
CHECKED	CD	

CONSULTING ENGINEERS

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APPROVED
ENGINEERS: _____
DATE: 2026-01-27

APPROVED
CLIENT: _____
DATE: _____

CLIENT
Mossel Bay MUNICIPALITY

PROJECT
MOORDKUIL
RAW WATER INTAKE AND PUMPING STATION

TITLE
WORKING AREA & SITE CAMP OPTIONS

SCALE	on A1	SHEET
1:1000		1 OF 1
CONTRACT No.		PROJECT No.
		24183GC

DRAWING No. 24183-CG-FIGURE1 REV A

COORDINATE SYSTEM: WGS84 / Lo23°

Auditing: Erene Swanepoel Date: 2026-01-26 Checked:

The reference made to Engineer will also refer to Employer's Agent for GCC 2015 Contracts

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REV	DESCRIPTION	DATE	REV BY	CHKD
A	ISSUED FOR INFORMATION	'26-01-27	ES	CD

REVISIONS

DESIGNED	MG
DRAWN	ES
CHECKED	CD

CONSULTING ENGINEERS
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APPROVED
ENGINEERS:
DATE: 2026-01-27

APPROVED
CLIENT:
DATE:

CLIENT
Mossel Bay Municipality

PROJECT
MOORDKUIL
RAW WATER INTAKE AND PUMPING STATION

TITLE
COMBINED SERVICES LAYOUT

SCALE on A1 1:500
SHEET 1 OF 1
CONTRACT No.
PROJECT No. 24183CG
DRAWING No. 24183-CG-FIGURE2
REV A
COORDINATE SYSTEM: WGS84 / Lo23°

Auditing: Eirene Swanepoel 2026-01-26 Checked: Date:

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U:\WERKE\2400\24183 CG - MOORDKUIL PUMP STATION UPGRADE - MOSSEL BAY\DRAWINGS\1.2 ACTIVE\24183-CG-FIGURE2 (COMBINED SERVICES LAYOUT).DWG

APPENDIX C: FINAL PREFERRED LAYOUT WITH ALL BIODIVERSITY INFORMATION

The reference made to Engineer will also refer to Employer's Agent for GCC 2015 Contracts

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Meters 1:500

REV	DESCRIPTION	DATE	REV BY	CHKD
A	ISSUED FOR INFORMATION	'26-01-27	ES	CD

REVISIONS

DESIGNED	MG
DRAWN	ES
CHECKED	CD

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APPROVED
ENGINEERS:
DATE: 2026-01-27

APPROVED
CLIENT:
DATE:

CLIENT
Mossel Bay MUNICIPALITY

PROJECT
MOORDKUIL
RAW WATER INTAKE AND PUMPING STATION

TITLE
COMBINED SERVICES LAYOUT

SCALE on A1 1:500
SHEET 1 OF 1
CONTRACT No.
PROJECT No. 24183CG
DRAWING No. 24183-CG-FIGURE2
REV A
COORDINATE SYSTEM: WGS84 / Lo23°

Auditing: Eirene Swanepoel 2026-01-26 Checked: Date:

iso full bleed a1 (841.00 x 594.00 mm) Lyners_AutoCAD.ctb 2026-01-27

U:\WERKE\2400\24183 CG - MOORDKUIL PUMP STATION UPGRADE - MOSSEL BAY\DRAWINGS\1.2 ACTIVE\24183-CG-FIGURE2 (COMBINED SERVICES LAYOUT).DWG

APPENDIX D: ENVIRONMENTAL AWARENESS GUIDELINE

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TEL: +27 (0) 21 554 5195 **FAX:**+27 (0) 86 575 2869
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ADDRESS: Unit 71, Eden on the Bay, 5 Beach Estate Boulevard
Blouberg, Big Bay, 7441
PO BOX: 443, Milnerton, 7435

ENVIRONMENTAL AWARENESS TRAINING BOOKLET

Environmental Monitor's Foreword

SES is here to ensure that everyone complies with the conditions of "Duty to Care". If these conditions are not complied with the project can be stopped and fines can be issued.

We hope that with your co-operation the project won't be stopped and fines won't be issued, and a successful project can be finished on time.

Notes:

- Workers working on this project must undergo environmental training.

- The information contained in this document should be used during day-to-day activities.

HOW IS THIS PROJECT IMPLEMENTING ENVIRONMENTAL MANAGEMENT?

This project is implementing Environmental Management on an ongoing basis throughout the duration of the project. The following aspects would be implemented to achieve the above stated:

- A dedicated Environmental Manager or Environmental Control Officer appointment to the project to implement and monitor Environmental Management.
- Regular environmental inspection on the site.
- Regular environmental training for workers
- Environmental audits on a regular basis.

WASTE TREATMENT

Refuse:

- Refuse waste includes: waste food, food containers, packaging materials, cans, bottles, newspapers and magazines.
- Day to day household waste should always be disposed of in the containers provided on site by the company.
- No dumping of waste anywhere other than in the bins provided.
- No burning of refuse.
- If there are not enough refuse containers on site, the ECO or supervisor needs to be informed.

Construction Waste:

- Construction waste includes: concrete, steel, cement, rock, pre-coated chips, wood, plastic, empty bags and rubble.
- Construction waste must be discarded in skips located in strategic areas for removal.
- Construction waste must not be discarded in holes or burned on site.

- Small amounts of construction waste should be collected and not discarded into vegetation or down fill slopes.
- Material should only be spoiled if a rehabilitation plan has been designed for the area.

Liquid waste:

- Liquid waste includes: concrete, paint, thinners, diesel, hydraulic fluids, cooking oil, chemicals, other fuel and sewage.
- Use facilities provided for waste.
- The liquid waste should be recycled as far as possible.
- Use chemical toilets and ablution facilities.

INFORM THE ENVIRONMENTAL CONTROL OFFICER (ECO) IMMEDIATELY OF ANY IMMEDIATE OR POTENTIAL ENVIRONMENTAL INCIDENT.

SPECIFIC ENVIRONMENTAL ISSUES

SPESIFIEKE OMGEWINGSKWESSIES
IMIBA ETHILE YEZOBUME BEMEKO YENDALO

The basic Do's and Don'ts towards environmental awareness are as follows:

Die basiese Moets en Moenies van omgewingsbesinning is as volg:

Oondoqo bo mawukwenze no mawungakwenzi kwilinge lezobume be meko yendalo bume ngoluhlobo:

Toilet Facilities:
Toilet Fasiliteite:
Izindlu Zangasese:

DO:
USE THE TOILET FACILITIES PROVIDED - REPORT FULL FACILITIES
MOET:
GEBRUIK MAAK VAN TOILET FASILITEITE WAT VOORSIEN WORD – RAPPORTEER AS FASILITEITE VOL IS
OMAWUKWENZE: SEBENZISA IZINDLU ZANGASESE EZIBONELELWEYO- NIKA INGXELO NGAMALUNGISELELO AGCWELEYO.

DO NOT:
USE THE BUSH
MOENIE:
DIE BOS GEBRUIK NIE
OMAWUNGAKWENZI: UKUSEBENZISA ITYHOLO.

Vehicles operation and maintenance:
Voertuig werking en onderhoud:
Ulawulo nophatho lezithuthi:

DO:
ENSURE THAT VEHICLES AND MACHINERY DO NOT LEAK FUEL OR OILS. REFUELLING, MAINTENANCE, SERVICING OR WASHING MUST BE DONE WITHIN THE DESIGNATED AREA IN THE CONSTRUCTION CAMP AREA ONLY.
MOET:
VERSEKER DAT VOERTUIE EN MASJINERIE NIE OLIES OF BRANDSTOF LEK NIE. VOLMAAK, ONDERHOUD, DIENS OF SKOONMAAK VAN VOERTUIE MOET SLEGS IN AANGEWYSTE AREAS IN DIE KONSTRUKSIE KAMP GESKIED.
OMAWUKWENZE: QINISEKISA IZITHUTHI NOMATSHINI ABAVUZI MAFUTHA OKANYE I OYILE, UKUGALELA, UKUPHATHA, UKULUNGISA OKANYE UKUHLAMBA KUFUNEKA KWENZIWE KUMMANDLA OTYUNJIWEYO KWINKAMPI YOLWAKHIWO KUPHELA NGOKUKHAWULEZILEYO.

DO:
REPORT ALL FUEL OR OIL SPILLS IMMEDIATELY & STOP THE SPILL CONTINUING.
MOET:
RAPPORTEER ENIGE BRANDSTOF OF OLIE STORTE & VERHOED DAT DIE STORT AANHOU.
OMAWUKWENZE: NIKA INGXELO NGE OLI NAMAFUTHA ACHITHEKILEYO, UZE UNQANDE UCHITHEKO LUNGAQHUBEKI.

DO:
PREVENT CONTAMINATION OR POLLUTION OF STREAMS AND WATER CHANNELS.
MOET:
VERHOED DIE KONTAMINASIE EN BESOEDELING VAN STROME & WATERKANALE.
OMAWUKWENZE : NQANDA USULELEKO OKANYE UNGCOLISEKO LWEMILAMBO NEMISELE YAMANZI.

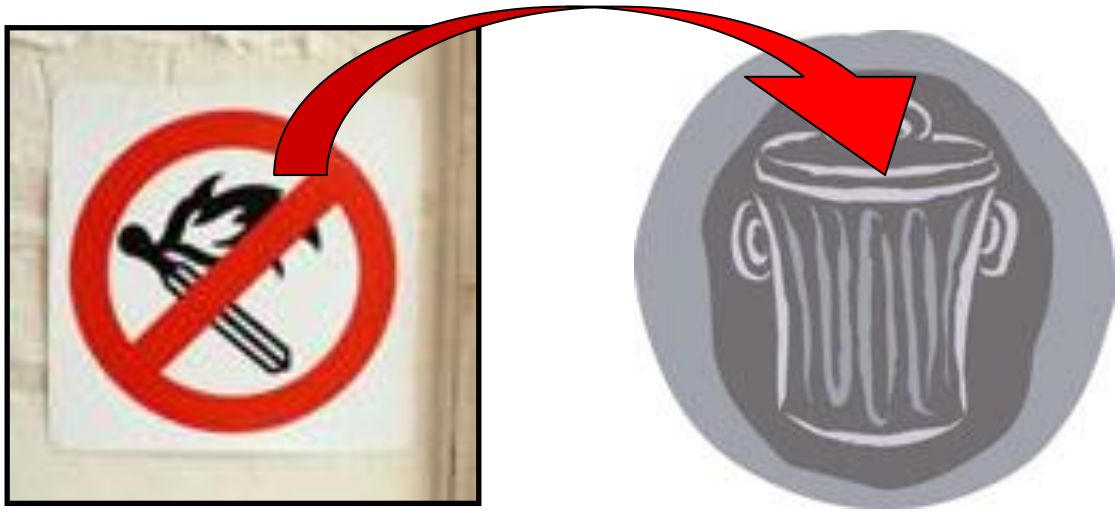
DO NOT:
ALLOW WASTE, LITTER, OILS OR FOREIGN MATERIALS INTO THE STREAM
MOENIE:
TOELAAT DAT AFVALPRODUKTE, GEMORS, OLIES OF VREEMDE MATERIALE IN STROME BELAND NIE.
OMAWUNGAKWENZI: MUSA UKUVUMELA INCITHO, ULAHLO, IOYILE OKANYE EZINYE IZINTO EMILANJENI.

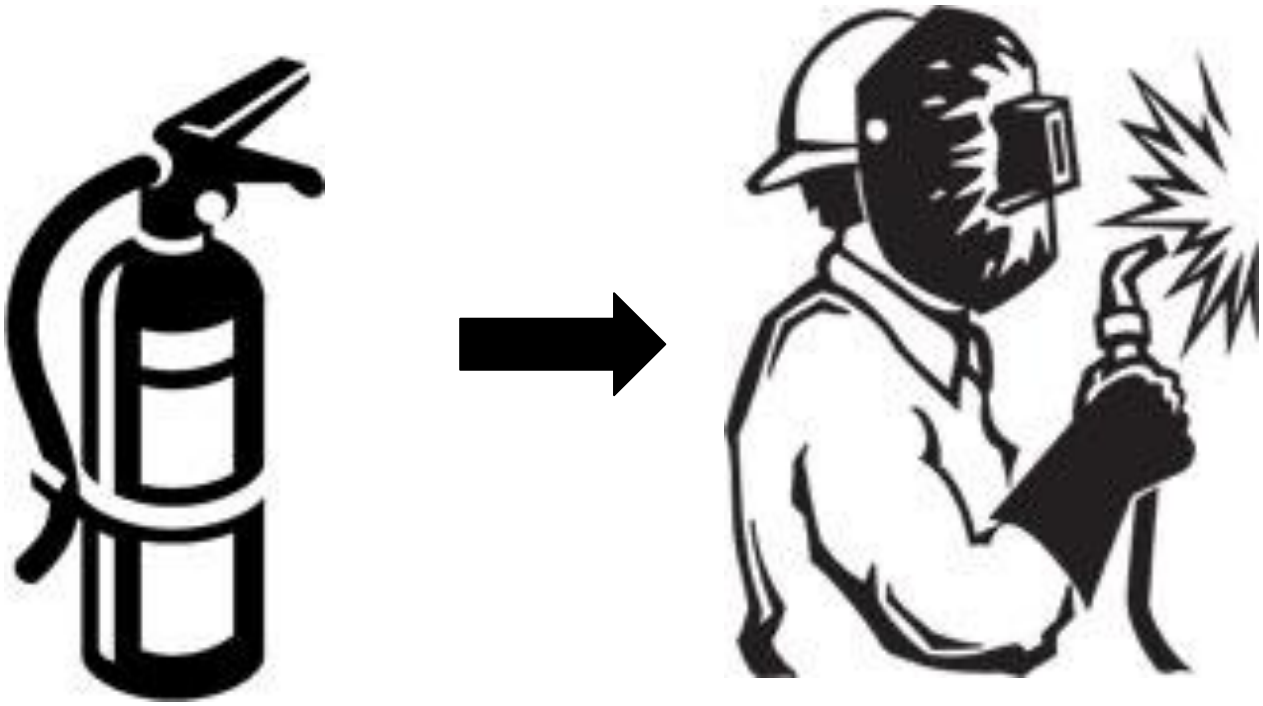
Fire Control:
Vuur Beheer:
Ulawulo Lemililo:

DO:
DISPOSE OF CIGARETTES AND MATCHES CAREFULLY. (Littering is an offence.)
MOET:
GOOI SIGARETTE & VUURHOUTJIES OP GEPASTE MANIER WEG WEG (rommelstrooi is 'n oortreding)
OMAWUKWENZE: LAHLA ISIGARETE NOOMATSHISI NGONONOPHELO (ukulahla lityala).

DO:
ENSURE A WORKING FIRE EXTINGUISHER IS IMMEDIATELY AT HAND IF ANY "HOT WORK" IS UNDERTAKEN e.g. welding, grinding, gas cutting etc.
MOET:
VERSEKER DAT 'N WERKENDE BRANDBLUSSER BYDERHAND IS INDIEN "WARM WERK" GEDOEN WORD bv. Sweiswerk.
OMAWUKWENZE: QINISEKISA ISICIMA-MLILO ESISEBENZAYO SISESANDLENI UKUBA KUKHO UMSEBENZI "OTSHISAYO" OWENZIWAYO, umz. ukuwelda, ugubo, ukuqhawula ugesi, njl.

DO NOT:
MAKE ANY FIRES
MOENIE:
ENIGE VURE MAAK OF ENIGEIETS VERBRAND NIE
OMAWUNGAKWENZI: UKWENZA IMILILO OKANYE UTSHISE NOKUBA YINTONI.





Fencing and Restricted Areas:
Omheining en Beperkte Areas:
Ubiyelo Nemimanndla Engavumelekanga:

DO:
CONFINE WORK AND STORAGE OF EQUIPMENT TO WITHIN THE IMMEDIATE WORK AREA.
MOET:
BEPERK ALLE WERK EN STOOR VAN GEREEDSKAP TOT IN DIE GEGEWE WERKAREA.
OMAWUKWENZE:GCINA UMSEBENZI NEZIXHOBO ZOKUSEBENZA NGAKUMMANDLA OKUSETYENZELWA KUWO.

DO NOT:
ENTER ANY FENCED OFF OR MARKED AREA. SUCH AREAS HAVE BEEN MARKED WITH "NO-GO AREA" SIGNS AND SHOULD BE ADHERED TO.
MOENIE:
ENIGE OMHEINDE OF GEMERKTE AREAS BINNEGAAN NIE. SULKE AREAS IS MET "NO-GO AREA" TEKENS GEMERK EN MOET GEHOORSAAM WORD.
OMAWUNGAKWENZI: MUSA UKUNGENA KWI NDAWO EBIYIWEYO OKANYE EPHAWULWEYO. IMIMANDLA ENJALO IPHAWULWE NGAMAGAMA ATHI **" NO-GO AREA**".

NO-GO AREA

Safety:
Veiligheid:
Ukhuseleko:

DO:
USE ALL SAFETY EQUIPMENT AND COMPLY WITH ALL SAFETY PROCEDURES.
MOET:
GEBRUIK ALLE VEILIGHEIDSGEREEDSKAP EN VOLDOEN AAN ALLE VEILIGHEIDS PROSEDURES.
OMAWUKWENZE: SEBENZISA ZONKE IZIXHOBO ZOKHUSELEKO, UZE UTHOBELE YONKE IMIGAQO YOKHUSELO.

Driving and Dust:
Bestuur en Stof:
Uqhubo Nothuli:

DO:
DRIVE ON DESIGNATED ROUTES ONLY.
MOET:
NET OP AANGEWYSTE ROETES BESTUUR.
OMAWUKWENZE: QHUBA KWIMIMANDLA EPHAWULWEYO KUPHELA.

DO NOT:
SPEED OR DRIVE RECKLESSLY
MOENIE:
JAAG OF ROEKELOOS BESTUUR NIE.
OMAWUNGAKWENZI: SUKUQHUBA NGESANTYA ESIPHEZULU OKANYE NGOKUNGAKHATHALI.

DO NOT:
ALLOW CEMENT TO BLOW AROUND.
MOENIE;
TOELAAT DAT SEMENT WEGWAAI NIE.
OMAWUNGAKWENZI: MUSUKUVUMELA ISAMENTE ISASAZWE.

DO NOT:
CAUSE EXCESSIVE DUST
MOENIE:
OORDREWE STOF VEROORSAAK NIE.


SLOW


PPC

Vegetation protection:
Plantegroei Beskerming:
Ukhuselo Lwezityalo:

DO NOT:
DAMAGE OR REMOVE ANY VEGETATION WITHOUT DIRECT INSTRUCTION.
MOENIE:
ENIGE PLANTEGROEI SONDER DIREKTE INSTRUKSIE BESKADIG OF VERWYDER NIE.
OMAWUNGAKWENZI: MUSA UKUTSHABALALISA OKANYE USUSE NASIPHINA ISITYALO NGAPHANDLE KOMYALELO.

Animals:
Diere:
Izilwanyana:

DO NOT:
INJURE, CAPTURE/SNARE, FEED OR CHASE ANIMALS – this includes birds, frogs, snakes, lizards, tortoises, etc.
MOENIE:
ENIGE DIERE BESEER, VANG, VOER OF JAAG NIE – dit sluit in: voëls, paddas, slange akkedisse, skilpaaie ens.
OMAWUNGAKWENZI: MUSA UKWENZAKALISA, UKUBAMBA, UKONDLA OKANYE UKULEQA IZILWANYANA- okuquka iintaka, amasele, iinyoka, amacilikishe, izikolopati.

DO:
REPORT ANY INJURY OF AN ANIMAL.
MOET:
DIE BESERING VAN 'N DIER RAPPORTEER.
OMAWUKWENZE: XELA NASIPHI ISENZAKALO SESILWANYANA.

Preventing Pollution:
Voorkoming van Besoedeling:
Ukhuselo Longcoliseko:

DO:
CLEAR YOUR WORK AREAS OF LITTER AND BUILDING RUBBLE AT THE END OF EACH DAY – use the waste bins provided and ensure that litter will not blow away.
MOET:
RUIM NA ELKE DAG DIE WERK AREA OP EN GOOI ENIGE ROMMEL WEG IN DIE GEGEWE HOUERS – maak seker dat rommel nie kan wegwaai nie.
OMAWUKWENZE: COCA INDAWO OSEBENZA KUYO, IZINTO EZILAHLIWEYO NENKUNKUMA YOKWAKHA QHO EKUPHELENI KWEMINI-sebenzisa imigqomo yenkunkuma uze uqiniseke ukuba inkunkuma ayivuthuzwa ngumoya.

DO NOT:
ALLOW WASTE BINS TO OVERFLOW OR WASTE TO BLOW AROUND.
MOENIE:
TOELAAT DAT ROMMELHOUERS OORVLOEI OF DAT ROMMEL ROND WAAI NIE.
OMAWUNGAKWENZI: MUSA UKUVUMELA IMIGQOMO YENKUNKUMA IGCWALE KAKHULU OKANYE INKUNKUMA ISASAZEKE.

DO NOT:
LITTER OR LEAVE FOOD LAYING AROUND
MOENIE:
ROMMEL OF KOS LAAT RONDLÊ NIE.
OMAWUNGAKWENZI: MUSA UKUNGCOLISA OKANYE USHIYE UKUTYA KULELE INDAWO YONKE.

DO NOT:
BURY ANY LITTER OR WASTE IN THE GROUND.
MOENIE:
ENIGE ROMMEL OF GEMORS IN DIE GROND BEGRAWE NIE.
OMAWUNGAKWENZI: MUSA UKUNGCWABA INKUNKUMA EMHLABENI.


GLASS
CARDBOARD
PAPER

APPENDIX E: CURRICULUM VITAE OF AUTHORS

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CURRICULUM VITAE

MICHAEL JON BENNETT

PERSONAL

Profession: Principle Environmental Assessment Practitioner and Senior Environmental Control Officer, Sharples Environmental Services cc, George
Possion: Director – George
Nationality: South African
Date of Birth: 22 October 1985
Languages: English (read, write and speak) & Afrikaans (read, write and speak)
Marital Status: Single
Drivers License: Code B
Health: Excellent
EAPASA Reg: 2021/3163
IAIASA Membership: 7334

WORK EXPERIENCE

2014 – Present: Sharples Environmental Services cc, George, WC
Environmental Assessment Practitioner

I have gained extensive experience in assessments and monitoring and have worked on a variety of multidisciplinary projects and am proficient in:

- Basic Assessments Reports
- Water Use Authorisation Applications
- Environmental Monitoring and Reporting
- Environmental Management Programmes
- Environmental Control Officer Training
- Conducting Outeniqua Sensitive Coastal Area licensing applications

2016 – 2017: Sharples Environmental Services cc, Cape Town, WC
Intrim Office Manager, Environmental Assessment Practitioner

2011 – 2014: Peninsula Permits & NCC Group, Cape Town, WC
Environmental Control Officer

TERTIARY EDUCATION

2010 University of Cape Town

- I hold a Bachelor of Science Degree specialising in Environmental and Geographic Science & Ocean and Atmospheric Science

PROJECTS

2024 George George Municipality

- Basic Assessment Report for the proposed upgrade of the Gwaing wastewater treatment works on the remainder of erf 464, George, Western Cape

2024 George 3MP Sales and Education Services

- Basic Assessment Report for the proposed mixed-use development on erf 998 and the remainder of the farm zandhoogte no. 139, Tergniet, Mossel Bay, Western Cape

2024 Mossel Bay Hartland lifestyle estate

- Part II amendment of the appeal environmental authorisation issued on 18 august 2009 (as amended) and the EMPr for the proposed residential development on a portion of the farm vaale valley 219, Mossel Bay - Hartland lifestyle estate

2024 George George Municipality

- Basic Assessment Report for the proposed upgrading of the Herold's Bay pump station and associated rising main as well as the development of new associated infrastructure on erf 116, remainder of erf 95, remainder of farms 236 and 237 and portions 10, 35 and 37 of farm brakfontein no. 236, Herold's Bay, George, Western Cape

2024 George George Municipality

- Part II Amendment of Environmental Authorisation for proposed development of a Photovoltaic Solar Plant on erf 2819, George, Western Cape

2024 George George Municipality

- Basic Assessment Report for the proposed repair and rehabilitation of flood damage along the Camphersdrift River in the Van Riebeeck Park (Project 28(3)), George, Western Cape

2024 Plettenberg Bay The More Family Collection

- Basic Assessment Report for the proposed expansion of the Milkwood Manor and parking on erf 10190, remainder of erf 2066 and the remainder of erf 706, Plettenberg Bay, Western Cape

2023 George Urban Country Estate (Pty) Ltd

- Basic Assessment Report for the proposed residential development on erf 19374 (remainder erf 6182, erven 6179 and 6156), George, Western Cape

2023 George George Municipality

- Basic Assessment Report for the Upgrading of the Eden Pumpstation, George, Western Cape

2023 Mossel Bay Paprenax Trading 6 cc

- Amendment of Environmental Authorisation (Part 2, Substantive amendment) for the proposed establishment of a filling station and associated business infrastructure on a portion of erf 13996, Kwanonqaba, Mossel Bay, Western Cape

2023 George George Municipality

- Basic Assessment Report for proposed upgrade of the Schaapkop Pumpstation rising main on remainder of erf 464 and erf 13486, George, Western Cape

2023 George Garden Route Gateway Plaza

- Basic Assessment Report for proposed mixed-use development on portions 278 and 282 of farm Kraaibosch no. 195, George, Western Cape

2023 George George Municipality

- Basic Assessment Report for proposed development of a Photovoltaic Solar Plant on erf 2819, George, Western Cape

2023 George EARP Construction

- Basic Assessment Report for the proposed commercial development on portion 49 of Farm Hansmoeskraal 202, George, Western Cape

2022 George Pieter Koen Development Company

- Basic Assessment Report for the proposed residential development on Portion 21 of the Farm Kraaibosch No. 195 (Pieter Koen), George, Western Cape

2022 Mossel Bay Dalmar

- Amendment of Environmental Authorisation (Part 2, Substantive amendment) for the Proposed Residential Development On A Portion Of The Farm Vaale Valley 219, Mossel Bay (Hartenbos Landgoed II), Western Cape

2022 George Dalmar

- Amendment of Environmental Authorisation Proposed Development of Herold's Bay Country Estate on A Portion of Portion 7 of The Farm Buffelsfontein No. 204, Herold's Bay, Western Cape

2022 George Pieterkoen Trust

- Basic Assessment Report for the proposed residential development on Portion 21 of the Farm Kraaibosch No. 195 (Pieter Koen), George, Western Cape

2022 Still Bay W. Nel & Irma Oosthuizen Trust IT 1596/2008

- Basic Assessment Report for the development of 5 residential units on erven 4139, 4140, 4141, 4142, 4143, 4144, 4145 (Erf 3997), Still Bay West, Western Cape

2022 George Octo Trading 377 cc

- Section 24 G Retrospective Environmental Authorisation for the alleged unlawful construction of a road clearance of vegetation to establish a house on remainder of Farm Holle Kloof 91 and Portion 1 of the Farm Plattekloof 131, Waboomskraal, George, Western Cape

2022 Knysna CapeNature

- Basic Assessment Report for the Proposed development on Portions 38 and 39 of Farm 205 and Remainder of Farm 211, Goukamma Nature Reserve, Knysna, Western Cape

2021 Prince Albert Jurie Klue

- Section 24 G Retrospective Environmental Authorisation for the alleged unlawful clearance of vegetation on Farm Angliers Bosch (Fernkloof), Remainder of Farm 157, Klaarstroom, Prince Albert, Western Cape

2021 Mossel Bay Mossel Bay Municipality

- Basic Assessment Report for the proposed Dana Bay Emergency Access Road on Remainder of Portion 7 of the Farm 225, Dana Bay, Mossel Bay, Western Cape

2021 Willowmore LEZMIN 2087cc

- Basic Assessment Report for the proposed development of Portion 1 of the Farm Matjiesfontein No. 206, Baviaanskloof, Division Willowmore, Eastern Cape

2020 Sedgefield Knysna Municipality

- Basic Assessment Report for the proposed housing development on erven 3861, 3865, 3866, 3917, 3918 and 5010 in Sedgefield, Knysna, Western Cape

2020 Mossel Bay Paprenax Trading 6 cc

- Basic Assessment Report for the proposed establishment of a filling station and associated business infrastructure on a portion of erf 13996, Kwanonqaba, Mossel Bay, Western Cape

2020 Ladismith Department of Transport and Public Works

- Maintenance Management Plan for the periodic maintenance of Trunk Road 31, section 4, km 30.8 to km 76.06, Barrydale to Ladismith, Western Cape

2020 Knysna Knysna Municipality

- Maintenance Management Plan for the Maintenance of the potable water pipeline system on Erven 4197, RE/1352, RE/1351, RE/1146 and 1316 in Knysna, Western Cape

2020 Humansdorp Kouga Municipality

- Environmental Control Officer for the Phase 1A of New municipal 66kV double circuit overhead line between the Melkhout substation at Humansdorp and the main intake substation at Jefferys Bay, Eastern Cape

2020 Humansdorp Kouga Municipality

- Environmental Control Officer for the Construction of a new 22kv overhead powerline between Melkhout substation and Allison Street, Humansdorp, Eastern Cape

2020 Knysna Knysna Municipality

- Environmental Control Officer for the Charlesford raw water pumping scheme: Upgrade and refurbishment of pumpstation: Mechanical and electrical, Knysna, Western Cape

2020 Seweweekspoort, Department of Transport & Public Works

- Amendment of Environmental Authorisation (Part 2, Substantive amendment) for the flood damage repairs to road structures on MR309 in Seweweekspoort, Western Cape

2019 – 2021 Seweweekspoort, Department of Transport & Public Works

- Environmental Control Officer for the flood damage repairs to road structures on MR309 in Seweweekspoort, Western Cape

2019 George George Municpality

- Environmental Control Officer for the Raising of the Garden Route Dam Spillway on Portion 3/352, Remainder of 536 of Erf 221, Erf 3055 and Erf 3056, George, Western Cape

2019 Laingsburg Department of Agriculture

- Environmental Control Officer for the Construction Of Erosion Prevention Structures Within The One In Ten Year Flood Line Of The Buffels River, Laingsburg, Western Cape

2019 Williston Williston Municipality

- Environmental Control Officer for the Upgrading of bulk water network in Williston – Phase 3, Williston, Northern Cape

2019 George George Municipality

- Environmental Control Officer for the construction of new 66kV overhead line between Ballots Bay and Glanwood substations, George, Western Cape

2019 Oudtshoorn Department of Transport & Public Works

- Environmental Control Officer for the Periodic maintenance of Trunk Road 31, Section 6, km 23.3 to km 47.8 Calitzdorp to Oudtshoorn, Western Cape

2019 Kleinbrak Mossel Bay Municipality

- Environmental Control Officer for the Upgrading of Beyers Street, Klienbrak River, Western Cape

2019 George Outeniqua Eye Clinic Body Corporate

- Environmental Control Officer for the proposed expansion of parking area on erf 5950 and part of remainder erf 464, George, Western Cape

2019 Mossel Bay Hey Innovations

- Basic Assessment Report for the proposed establishment of a residential development on Erf 2839, Great Brak River, Western Cape

2019 Oudtshoorn Oudtshoorn Municipality

- Environmental Management Programme for the Blossoms Emergency Supply Scheme, Oudtshoorn, Western Cape

2019 Humansdorp Clinkscales Maughan-Brown

- Environmental Management Programme for the proposed construction of a new 22kV overhead powerline between Melkhout Substation and Allison Street, Humansdorp, Eastern Cape

2019 George PN&MR Lotter Family Trust

- Addendum to the Environmetnal Management Programme for the Establishment of a Township (Rivendale) on Portions 5, 15, 16 and 31 of the Farm Hansmoeskraal 202, Western Cape

2019 Oudtshoorn Department of Transport and Public Works

- Basic Assessment Report for the Proposed Maintenance Activities of Trunk Road 33/4 between km 4.6 and km 14.4, Meiringspoort, Western Cape

2019 George Dynarc Capital

- Substantive amendment of environmental authorisation for the proposed Development of Portion 130, 131 and 132 of the Farm Gwayang 208

2019 George Department of Transport & Public Works

- Basic Assessment Report for the proposed Upgrading of Bridge No. 2221 on Trunk Road 2/9 at km 15.1 over the Maalgate River.

2018 - 2019 Oudtshoorn Department of Transport and Public Works

- Maintenance Management Plan for the proposed periodic maintenance of Trunk Road 31, section 6, km 23.3 to km 47.8, Western Cape

2018 - 2019 Humansdorp Clinkscales Maughan-Brown

- Applicability of the EIA regulations Checklist for the proposed new 22kV overhead line between Melkhout Substation and Allison Street, Eastern Cape

2018 - 2019 Knysna Knysna local Municipality

- Applicability of the EIA regulations Checklist for the proposed Rheenendal infill housing, subdivision and rezoning of portions of erf 42, 36 and 387 as well as erven 535, 536, 553, 54, 393, 406, 672, 673 and 68, Rheenendal, Western Cape

2018 - 2019 Knysna Knysna local Municipality

- Applicability of the EIA regulations Checklist for the proposed infill housing and subdivision of erven in Welsyndorp and the rezoning and subdivision of erven in Bosdorp, Karatara, Western Cape.

2018 Port Elizabeth ACSA P.E.

- Applicability of the EIA regulations Checklist for the proposed ACSA Port Elizabeth Airport Photovoltaic Plant, Eastern Cape Province

2018 Mossel Bay TopUp Prop Inv.

- Applicability of the EIA regulations Checklist for the proposed Farm Stall Centre and filing Station on Portion 65 of the Farm Hartenbosch 217, Hartenbos

2018 George Outeniqua Eye Clinic Body Corporate

- Basic Assessment Report for the proposed expansion of parking area on erf 5950 and part of remainder erf 464

2018 Beaufort West Beaufort West Municipality

- Environmental Control Officer for the First and Second Environmental Audit for the provision of adequate water supply within the jurisdiction of the Beaufort West municipality

2018 Mossel Bay Element Consulting Engineers

- Environmental Management Programme update for the replacement of 22kV overhead powerline between Power Town and Hartenbos and between Hartenbos and the Hartenbos sewage substation and the construction of a new 22kV overhead power line between the Midbrak and Kleinbrak Substations.

2018 Mossel Bay Element Consulting Engineers

- Environmental Control Officer for the construction of a new 22kV overhead power line between the Midbrak and Kleinbrak Substations

2018 Mossel Bay Element Consulting Engineers

- Environmental Control Officer for the Upgrade of Amy Searle Canal – Phase 5, Great Brak River

2018 Gouritsmond Hessequa Consulting Engineers

- Environmental Control Officer for the Upgrade and expansion of the Gouritsmond Water Water Treatment Works on remainder of erf 140, Gouritsmond

2018 George Biprops 14

- Environmental Control Officer for the residential development on portion 5 of the farm Kraaibosch No. 195, Groenkloof Woods: Phase C & D

2018 Knynsa Knysna Municipality

- Environmental Control Officer for upgrading of Knysna bulk water supply scheme: phase 2B

2018 Plettenberg Bay Bitou Municipality

- Environmental Control Officer for the upgrade of the Kranshoek Bulk Water Supply Scheme: Construction of Pipelines, reservoirs and associated infrastructure near Plettenberg Bay.

2018 Mossel Bay SMEC

- Environmental Control Officer for the Upgrade of Kusweg and associated infrastructure in Rheebok

2017 George EARP Construction

- Invasive Alien Management Plan for the proposed residential development on portions 21, 23, 24 & 48 of Farm Hansmoeskraal 202 near George

2017 Mossel Bay Mossel Bay Municipality

- Environmental Control Officer for the development of the new Mossel Bay municipal cemetery on erf 2001/0

2017 Knynsa Knysna Municipality

- Environmental Control Officer for the remedial work to prevent further settlement of the low-lift pump sump and retaining wall at Gouna River Pump Station

2017 Knynsa Knysna Municipality

- Environmental Control Officer for upgrading of Knysna bulk water supply scheme: phase 1

2017 George Biprops 14 (Pty) Ltd

- Environmental Control Officer for the residential development on portion 5 of the farm Kraaibosch No. 195

2017 Still Bay Hessequa Municipality

- Environmental Control Officer for the construction of a reservoir, booster pump station and associated infrastructure in Melkhoutfontein near Still Bay

2016 - 2017 Heidelberg Department of Transport & Public Works

- Environmental Control Officer for the flood damage repairs to structures in the Central Eden District Municipality Region, Heidelberg North

2016 - 2017 Riversdale Department of Transport & Public Works

- Environmental Control Officer for the flood damage repairs to structures in the Central Eden District Municipality Region, Riversdale East area

2016 - 2017 Still Bay Department of Transport & Public Works

- Environmental Control Officer for the upgrade of main road 332 near Still Bay

2016 - 2017 Mossel Bay The South Cape College

- Environmental Control Officer for the extension of the South Cape College: Phase 3, Mossel Bay Campus

2016 - 2017 Klein Brak Mossel Bay Municipality

- Environmental Control Officer for the removal of obstructions in the lower floodplain of the Klein Brak River Estuary

2016 Prince Albert Milway Trade and Invest 1014cc

- Basic Assessment for the proposed guest lodge on remainder of Farm Rietpoort 13

2016 Plettenberg Bay Bitou Municipality

- Basic Assessment for the proposed Qolweni phase 5 development near Plettenberg Bay

2016 Mossel Bay Element Consulting Engineers

- Environmental Management Programme for the replacement of 22kV overhead powerline between Power Town and Hartenbos and between Hartenbos and the Hartenbos sewage substation

2016 George SMEC

- Environmental Policy for the resurfacing of York Street, George

2016 Mossel Bay Department of Transport & Public Works

- Maintenance Management Plan for proposed upgrade of Louis Fourie Road.

2016 George Oaklands Bridge Country Estate HOA

- Maintenance Management Plan for proposed repair and maintenance of the riverbank at Oaklands Bridge Country Estate in Heather Park

2016 Gouritz Department of Transport & Public Works

- Update of the Maintenance Management Plan for proposed repair and maintenance of the Gouritz River Bridge bank protection along the R325 near Gouritzmond

2016 George Ivorybell Investment (Pty) Ltd

- Outeniqua Sensitive Coastal Area Environmental Impact Report for the proposed new house on erf 379 in Heralds Bay

2016 George George Municipality

- Environmental Assessment Report for the substantive amendment of environmental authorisation of the proposed upgrade and extension of the overhead power lines and associated substations

2016 Oudtshoorn SA Army Infantry School

- Environmental Control Officer for the construction of a fighting in built up areas (FIBUA) range on portion 10 of the farm Blaauwtjes Drift 110 in Oudtshoorn

2015 - 2016 Gouritz Department of Transport & Public Works

- Environmental Control Officer for the repair and maintenance of the Gouritz River Bridge bank protection along the R325 near Gouritzmond

2015 - 2016 Albertinia Garden Route Game Lodge (Pty) Ltd

- Environmental Control Officer for the five new units at the Garden Route Game Lodge

2015 - 2016 Mossel Bay Element Consulting Engineers

- Environmental Control Officer for the replacement of 22kV overhead powerline between Power Town and Hartenbos and between Hartenbos and the Hartenbos sewage substation

2014 - 2016 Plettenberg Bay Chauke Quanity Surveyers

- Environmental Control Officer for the Qolweni and Kwanokuthula High Density Units and engineering services

2016 Plettenberg Bay Bitou Municipality

- Environmental Control Officer for the civil engineering works for Kwanokuthula Phase 4 and the extension of Sishuba Street

2014 - 2016 Mossel Bay The South Cape College

- Environmental Control Officer for the extension of the South Cape College, Mossel Bay Campus

2016 George SMEC

- Environmental Control Officer for the resurfacing of York Street

2014 - 2015 Mossel bay The Muller Murray Trust

- Environmental Control Officer for the construction of gravity pipeline from the Nautilus take-off to the Boggomsbaai Reservoir phase 2

2015 Swellendam Casidra SOC Ltd

- Environmental Control Officer for the Grootvaderbos Groynes in the Buffeljags River

2015 George Element Consulting Engineers

- Environmental Control Officer for the upgrading and extension of overhead power lines and substations: construction of a new 66kV overhead line between Protea and Ballots Bay substation

2014 - 2015 George Department of Transport & Public Works

- Environmental Control Officer for the flood damage repair projects in the George and Knysna local municipal areas

2015 George BDE Consulting Engineers (Pty) Ltd

- Environmental Control Officer for the photovoltaic solar plant for the ACSA George Airport

2015 Heidelberg Bergstan South Africa

- Environmental Control Officer for the Duiwenhoks River stabilization works: Sites B31, B38 and B39

2015 Krakeel Element Consulting Engineers

- Environmental Control Officer for the construction of filling station at SSK Tuinrote Agri on portion 5 of the farm no. 320

2014 - 2015 Herbertsdale SMEC

- Environmental Control Officer for the flood damage repairs to structures in the Eden region: Herbertsdale area

2014 - 2015 George Department of Transport & Public Works

- Environmental Control Officer for the flood damage repair projects in the George and Knysna local municipal areas

2015 George SMEC

- Environmental Control Officer for the improvements to the Pacaltsdorp interchange and new pedestrian bridge

2014 - 2015 Still Bay De Villiers & Moore Consulting Engineers

- Environmental Control Officer for the Still Bay 66kV substation and overhead powerline

2014 Beaufort West Worley Parsons Consulting Engineers

- Environmental Control Officer for the Nelspoort bulk water supply scheme northeast of Nelspoort

APPENDIX F: NO-GO MAP

APPENDIX D3: FIGURE 1: No Go Areas.

APPENDIX G: SITE SPECIFIC ALIEN AND INVASIVE SPECIES MANAGEMENT PLAN

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ADDRESS: Tableview, Cape Town, 7441
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SITE SPECIFIC ALIEN AND INVASIVE SPECIES MANAGEMENT PROGRAMME

FOR THE

THE PROPOSED UPGRADE OF THE MOORDKUIL RAW WATER PUMP STATION ON PORTIONS 15, 24 AND 25 OF THE FARM KLIPHEUVEL NO. 143, KLEINBRAK RIVIER, MOSSEL BAY MUNICIPALITY, WESTERN CAPE

Produced as part of a Basic Assessment EIA Application for Environmental Authorisation in terms of the National Environmental Management Act (Act 107 of 1998) and the amended (April 2017) Environmental Impact Assessment Regulations, 2014

SUBMITTED TO STIAAN KOTZE (skotze@dffe.gov.za) FOR APPROVAL

PREPARED FOR: Department of Water and Sanitation
Mr. Glenn Daniell
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Bellville
7530

DATE: 26 June 2026

SES REF NO: AMP/MPS/MBM/06/26
DFFE REF.NO.: TBC

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Section	
1	**PROJECT DETAILS**

PROJECT DETAILS:		
Project Name:	**THE PROPOSED UPGRADE OF THE MOORDKUIL RAW WATER PUMP STATION ON PORTIONS 15, 24 AND 25 OF THE FARM KLIPHEUVEL NO. 143, KLEINBRAK RIVIER, MOSSEL BAY MUNICIPALITY, WESTERN CAPE**	
DFFE Reference Number:	**TBC**	
Erf Name and Portion Number:	• **Portion 15 of the Farm Klipheuvel No. 143** • **Portion 24 of the Farm Klipheuvel No. 143** • **Portion 25 of the Farm Klipheuvel No. 143**	
SG Codes:	**Portion 15 of the Farm Klipheuvel No. 143**	**C05100000000014300015**
	Portion 24 of the Farm Klipheuvel No. 143	**C05100000000014300024**
	Portion 25 of the Farm Klipheuvel No. 143	**C05100000000014300025**
GPS Co-ordinates:	**Centre point of site:**	**340 03' 11.62"S** **220 08' 07.22"E**
Municipality:	**Mossel Bay Municipality**	
Province:	**Western Cape**	
Applicant:	**Department of Water and Sanitation**	
EAP:	**Sharples Environmental Services cc** **EAP: Michael Jon Bennett (EAPASA: 2021/3163)** **Candidate EAP: Christiaan Smit (EAPASA: 2024/8297)**	
Date:	**26 June 2026**	
Conditions of Use:	**This report is the intellectual property of Environmental Services cc (SES), who may make allowance to publish it, in whole provided that:** **a) Approval for copy is obtained from SES.** **b) SES is acknowledged in the publication.** **c) SES is indemnified against and claim for damages that may result from publication of specifications, recommendations or statements that is not administered or controlled by SES.** **d) That approval is obtained from SES if this report is to be used for the purposes of sale, publicity or advertisement.** **SES accepts no responsibility for failure to follow the recommended program.**	

Section 2	PURPOSE OF THIS ALIEN AND INVASIVE SPECIES MANAGEMENT PLAN

This Alien and Invasive Species Management Plan has been prepared for the Department of Water and Sanitation, for the construction and post construction rehabilitation activities associated with the proposed upgrade of the Moordkuil Raw Water Pump Station on Portions 15, 24 and 25 of the Farm Klipheuvel No. 143, Kleinbrak Rivier, Mossel Bay Municipality, Western Cape.

This Alien and Invasive Species Management Plan has been compiled in accordance with:

- The National Environmental Management: Biodiversity Act (Act 10 of 2004);
- The Alien and Invasive Species Regulations, 2014 (as Amended);
- And the EMPr.

The purpose of this Alien and Invasive Species Management Plan is to:

- Identify listed alien invasive species present on site;
- Provide a method statement for clearing of alien and invasive species;
- Prevent further spread of alien and invasive species;
- Ensure legal compliance;
- Promote indigenous vegetation recovery.

Section 3	LEGISLATIVE CONTEXT

This plan complies with:

- **The Constitution of South Africa:**

Section 4 of the Constitution guarantees everyone the right to an environment that is not harmful to their health or well-being. The constitution also mandates that the environment be protected for present and future generations through reasonable legislative and other measures, which includes preventing pollution and degradation. It promotes sustainable development and, where appropriate, the sustainable use of natural resources to ensure "ecologically sustainable development".

- **The National Environmental Management Act, 1998 (Act No. 107 of 1998):**

The Duty of Care is contained in Section 28 of the National Environmental Management Act, 1998 (Act 107 of 1998). In terms of Section 28(1), every person who causes, has caused, or may cause significant pollution or environmental degradation has a legal obligation to take reasonable measures to prevent such pollution or degradation from occurring, continuing, or recurring. Where harm to the environment cannot be prevented, Section 28(2) requires that reasonable measures be taken to minimise and rectify the pollution or degradation.

- **The National Environmental Management: Biodiversity Act (Act No. 10 of 2004):**

In terms of Section 73 of the National Environmental Management: Biodiversity Act (NEMBA), the landowner or person in control of land has a legal duty of care to take reasonable steps to prevent the spread of listed invasive species occurring on the property and to control or eradicate such species in accordance with the Alien and Invasive Species Regulations. Failure to comply with this obligation may result in enforcement action by the competent authority.

The implementation of this Alien and Invasive Species Management Plan is intended to give effect to the landowner's statutory duty under Section 73 of NEMBA.

- **NEMBA: Alien Species Regulations:**

Category 1a Listed Invasive Species:
(1) Category 1a Listed Invasive Species are those species listed as such by notice in terms of section 70(1)(a) of the Act as species which must be combatted or eradicated.
(2) A person in control of a Category 1a Listed Invasive Species must—
(a) immediately take steps to combat or eradicate listed invasive species in compliance with sections 75(1), (2) and (3) of the Act; and

(b) allow an authorised official to inspect a property as provided for in terms of section 31K of the National Environmental Management Act and to monitor, assist with or implement the combatting or eradication of the listed invasive species.
(3) If an Invasive Species Management Programme has been developed in terms of section 75(4) of the Act, a person must combat or eradicate the listed invasive species in accordance with such programme.

Category 1b Listed Invasive Species
(1) Category 1b Listed Invasive Species are those species listed as such by notice in terms of section 70(1)(a) of the Act as species which must be controlled.
(2) A person in control of a Category 1b Listed Invasive Species must control the listed invasive species in compliance with sections 75(1), (2) and (3) of the Act.
(3) If an Invasive Species Management Programme has been developed in terms of section 75(4) of the Act, a person must control the listed invasive species in accordance with such programme.
(4) A person contemplated in sub-regulation (2) must allow an authorised official to inspect a property as provided for in terms of section 31K of the National Environmental Management Act and to monitor, assist with or implement the control of the listed invasive species, or compliance with the Invasive Species Management Programme contemplated in section 75(4) of the Act.
(5) The Minister may require any person to develop a Category 1b Control Plan for one or more Category 1b species, which plan must be submitted to the Minister for approval, and such Control Plan must include the following:
(a) species identification;
(b) extent of invasion;
(c) control measures to be used;
(d) an action plan or schedule including time-frames for the clearing of each species;
(e) whether or not any species can be utilized as biomass; and
(g) any other information which the Minister may require.

Category 2 Listed Invasive Species
(1) Category 2 Listed Invasive Species are those species listed by notice in terms of section 70(1)(a) of the Act as species which require a permit to carry out a restricted activity within an area specified in the Notice or an area specified in the permit, as the case may be.
(2) Unless otherwise indicated in the Notice, no person may carry out a restricted activity in respect of a Category 2 Listed Invasive Species without a permit.
(3) A person in control of a Category 2 Listed Invasive Species, or person in possession of a permit, must ensure that the specimens of the species do not spread outside of the land or the area specified in the Notice or permit.
(4) Unless otherwise specified in the Notice, any species listed as a Category 2 Listed Invasive Species that occurs outside the specified area contemplated in sub-regulation (1), must, for purposes of these regulations, be considered to be a Category 1b Listed Invasive Species and must be managed according to Regulation 3.
(5) Notwithstanding the specific exemptions relating to existing plantations in respect of Listed Invasive Plant Species, any person or organ of state must ensure that the specimens of such Listed Invasive Plant Species do not spread outside of the land over which they have control, or the specified area on such land, where any restricted activity is authorised in respect of any Listed Invasive Plant Species

Category 3 Listed Invasive Species
Category 3 Listed Invasive Species are species that are listed by notice in terms of section 70(1)(a) of the Act, as species which are subject to exemptions in terms of section 71(3) and prohibitions in terms of section 71A of Act, as specified in the Notice.
(2) Any plant species identified as a Category 3 Listed Invasive Species that occurs in riparian areas, must, for the purposes of these regulations, be considered to be a Category 1b Listed Invasive Species and must be managed according to regulation 3.

- **Regulation 7 (Control of listed invasive species)**

Regulation 7 of the Alien and Invasive Species Regulations under the National Environmental Management: Biodiversity Act requires that listed invasive species must be controlled in a manner that reduces their population, prevents their spread, and minimizes their ecological and socio-economic impacts.

Control measures must be appropriate to the species concerned and may include mechanical, chemical or biological methods, implemented in accordance with best environmental practice and applicable

permit conditions. Ongoing monitoring and follow-up clearing are required to ensure that regrowth is addressed and long-term control is achieved.

The implementation of this Management Plan ensures compliance with the control obligations prescribed under Regulation 7.

Section 4	SITE DESCRIPTION

Locality and Project Description:
Sharples Environmental Services cc (SES) have been appointed by Lyners Engineers on behalf of the Department of Water and Santiation to compile the Basic Assessment Report of the proposed upgrade of the Moordkuil Raw Water Pump Station on Portions 15, 24 and 25 of the Farm Klipheuvel No. 143, Kleinbrak Rivier, Mossel Bay Municipality, Western Cape. This Alien and Invasive Species Management Plan will accompany the Environmental Management Programme of the proposed development and will be implemented during the construction and post-construction rehabilitation phases of the development. Please refer to the figures below for the locality of the site.

Figure 1: Locality Map of Moordkuil Pump Station.

Figure 2: Close-up Locality Map of the Moordkuil Pump Station.

The proposed development project entails the upgrade of the existing Raw Water Abstraction Works and Pump Station. In summary, the following is proposed to be constructed:

- The construction of a new reinforced concrete inlet hopper structure for the pump station;
- The construction of pipe protection ramp structure for the pipes into the existing pump station building.
- The reinstatement of the existing gravel access road from Blesbok Road to the site (180m long and 3.6m wide) by reinstating the existing gravel road, within the same development footprint, which has become almost impassable due to water ingress into the existing layerworks (farmers leaking irrigation channel). The final road is proposed to be 3m wide. 300mm is proposed on each side for the bottom layerworks that have to be wider than the top layerworks to transfer vehicle loads to the soil. The proposed affected area will be 3.6m but the final road will be 3m wide. The existing road is that its layerworks would also have been similar to the proposed reinstatement design.
- A new concrete road (in an already disturbed area mostly). The new concrete road proposed is approximately 900m2 and ranges in width from 3m to 7.4m (in order for a 5 ton truck to turn around);
- Installation of gabions between the cement access road edge and the river;
- Construction of an access ramp to the hopper;
- The construction of a new water meter chamber next to the pump station. The development footprint of the water meter chamber is approximately 24m2;
- Replacing of three air-valves and construction of new chambers around the air-valves;
- Installation of new pipework, pumps and motor control centers;
- Installation of other mechanical items such as cover, trash-racks, etc.
- Upgrading of the electrical supply and breakers within the existing pump station building;
- Installation of a sediment barrier downstream of the crossing to curb sediment generation in the river;
- Final reinstatement of the river bed to the requirements of the CEMP;

The concrete inlet hopper structure is proposed to be anchored to the bedrock by means of piling foundations. In order to install the piles, a pile rig needs to obtain access in the correct position. It is for this reason that a temporary platform structure is required to be constructed within the Moordkuil River.

The area where the inlet hopper (and the associated pile foundations) is proposed to be constructed is below the 1:10 year floodline, within the river. It is therefore required to construct a coffer dam around the area where the inlet hopper structure is proposed to be built in order to have a dry area for construction and concrete setting.

All of the above, except for the proposed temporary platform, cement access road, new water meter chamber and sediment barrier, are proposed within the existing development footprint.

It is also proposed to demolish the existing underwater cement bag wall, existing above water concrete steps and the existing underwater concrete plinths for the existing pipes.

Please refer to the proposed site layout plans below.

Upon recommencement of the project in late 2024, an underwater survey was undertaken to assess changes in the riverbed topography since 2014. ASP Tech, who undertook the initial sedimentation study, was subsequently appointed by Lyners to conduct a Verification Study to evaluate, among other factors, the appropriateness of the original intake structure in light of the updated bathymetry survey. The resulting report is provided as Appendix G6. During the verification study on the riverbed topography a significant rock outcrop upstream of the proposed intake structure was identified. As a result, it was determined that the outcrop would need to be removed, and the intake structure enlarged beyond the dimensions proposed in the 2014 – 2016 feasibility study to ensure effective operation.

An alternative solution involves relocating the intake structure directly onto the rock outcrop, which presents several technical and economic advantages:

- Improved Foundation Conditions: Relocating the intake would result in more favourable geotechnical conditions, potentially yielding a cost saving of approximately R1.7 million.
- Operational Continuity: By situating the intake upstream at the rock outcrop, it may be possible to maintain operation of the existing pump station throughout the construction period.
- Minimal Disruption to Adjacent Infrastructure: The nearby farmers' pump station, located just downstream of the existing station, would remain unaffected.

Should the existing pump station remain operational during construction, an estimated cost saving of approximately R24.5 million could be realized over the 18-month construction period by avoiding the need to purchase water from the Wolwedans Dam and the associated saving in chemicals at the water treatment works.

A new dry well pump station could be constructed at an estimated cost of approximately R2.4 million. This facility would enable continuous operation of the existing pump station with minimal interruption of the water abstraction during the construction phase. An additional benefit of constructing a permanent dry well is that it would allow the end-suction pumps to be installed at a lower elevation. This could possibly eliminate the requirement for immersible pumps within the intake structure in the future and enable the use of foot valves in combination with a priming system. A new dry well will also provide additional space for the installation of the proposed electrical equipment as the existing MCC room is very small.

Based on the abovementioned, Option 3 (wetwell on rock outcrop with drywell next to pump station, Concept Layout 2) is recommended for implementation for the Moordkuil Pump Station upgrade, as it offers the lowest capital and operational costs, best operational reliability, and acceptable environmental impact.

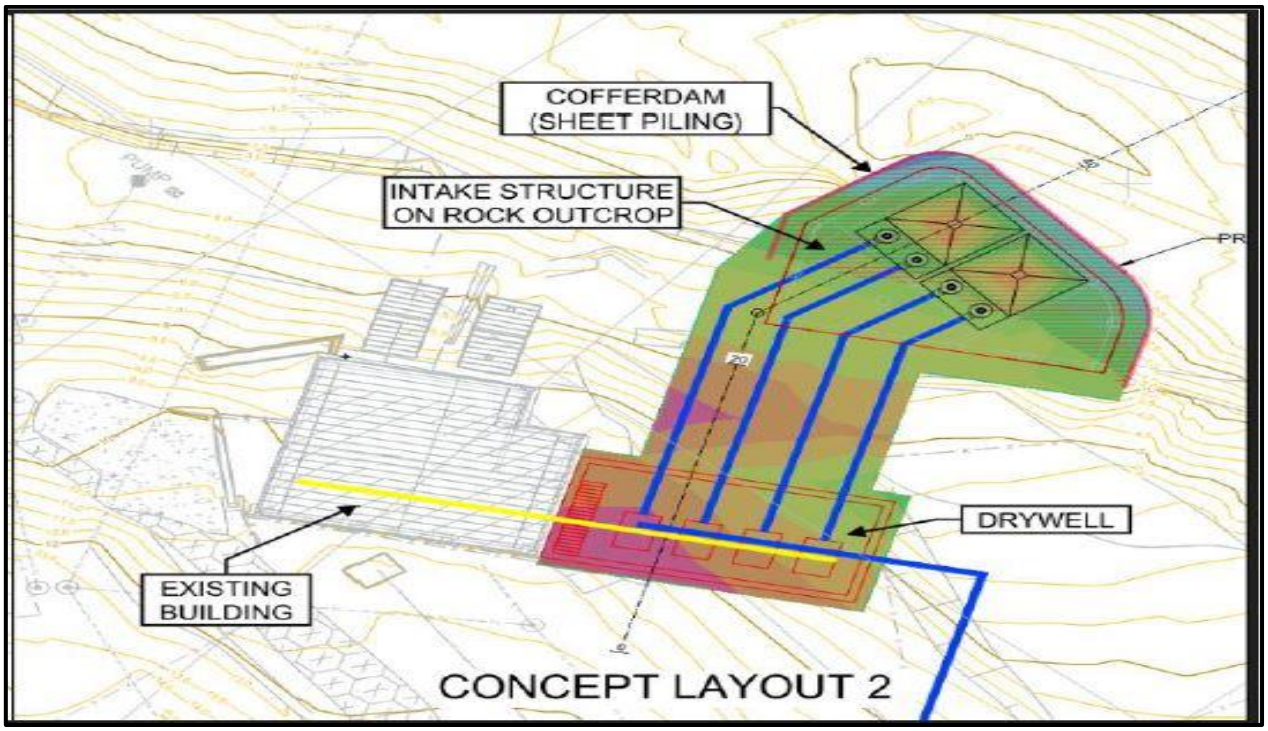


Figure 3: Option 3 – Concept Layout 2.

To maximise the value of existing assets, a phased approach should be adopted:

- Phase 1: Utilisation of existing immersible and end-suction pumps that was bought based on the previous (2014 – 2016) investigation.
- Phase 2: Replacement of the immersible pumps with foot valves and installing larger single stage end suction pumps in die drywell. The detailed considerations for this system, such as the operation of the foot valves and the suction pipework priming, will be included in the detailed design report.

The hydraulic design ensures the intake structure is self-scouring and resilient to sediment deposition. The civil design provides for robust, flood-resistant structures, with careful integration of new and existing facilities to maintain operational continuity during construction.

The mechanical design supports both current and future pump configurations, with appropriate safety margins for motor sizing and lifting equipment.

The electrical design requires upgrading of the transformer and cabling to accommodate increased power demand, with a focus on direct online (DOL) drives for reliability and ease of maintenance.

The control system will be kept as simple as possible, with automated protection, measurement, and reporting. Remote monitoring will be implemented for real-time status updates, but remote control will not be enabled, as per client requirements.

Three alternative site camp locations are also proposed, however based on the specialist assessments it was determined that site camp option 3 is the only feasible option. Please refer to the Figures below showing the proposed services layout, the working area and site camps, and Google Earth Imagery of the construction footprint.

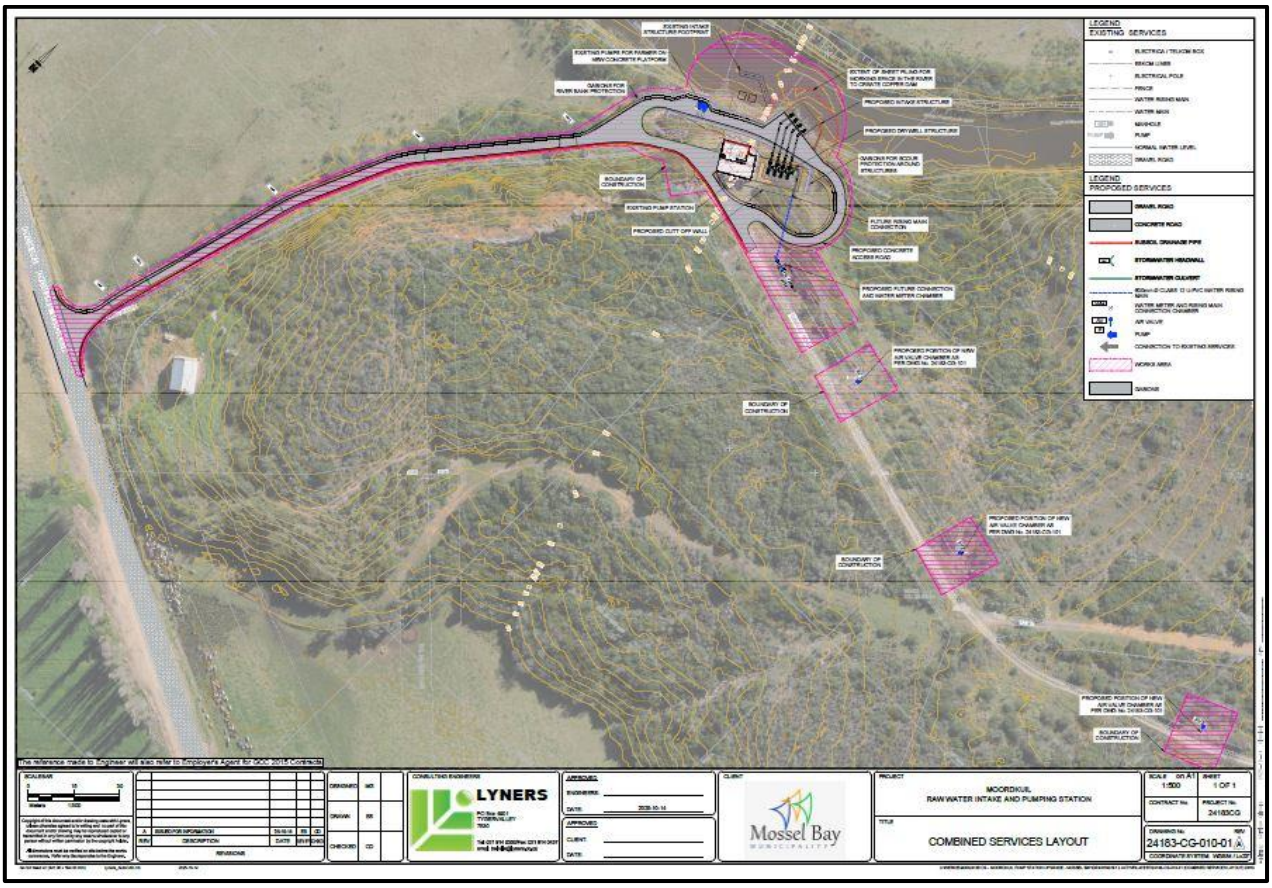


Figure 4: Proposed Services Layout.

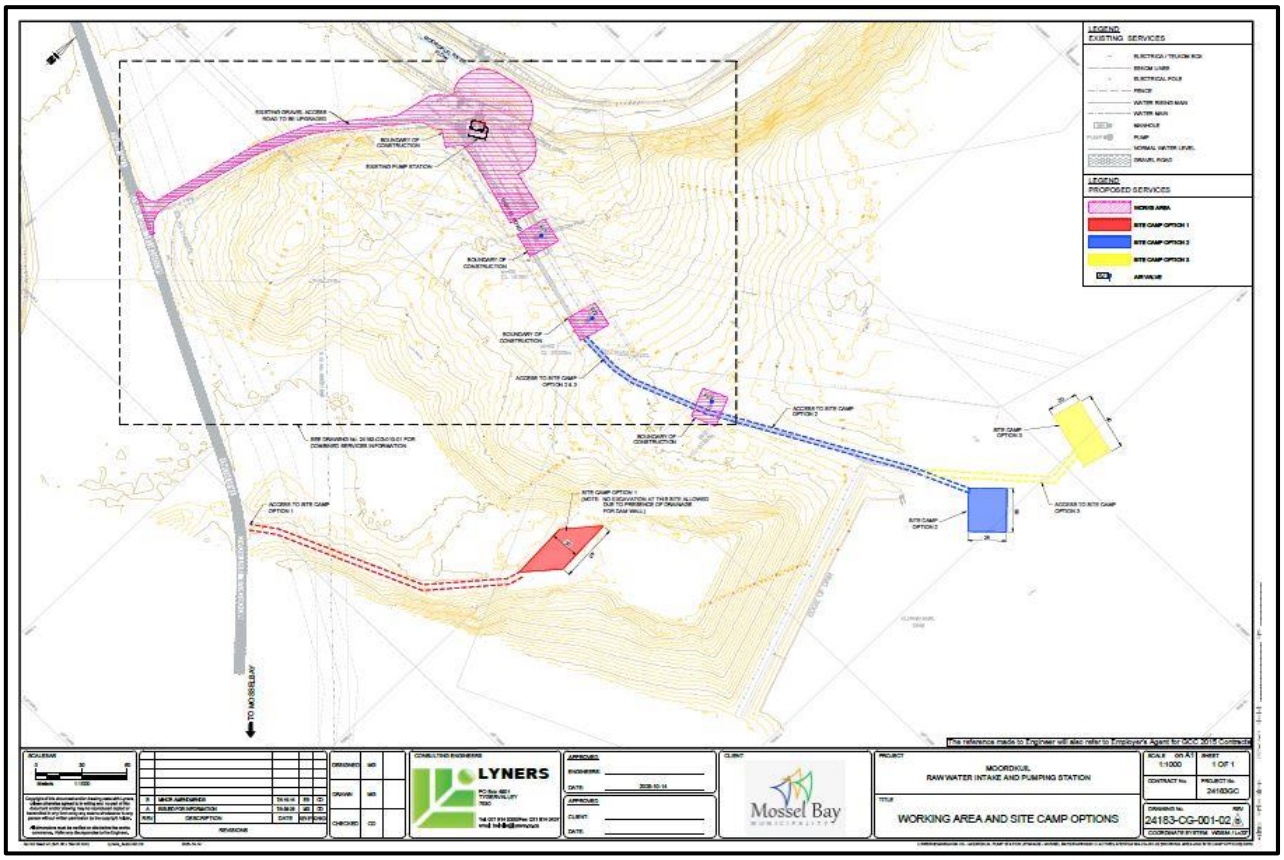


Figure 5: Working Area and Site Camp Locations Layout.

Terrestrial biodiversity (vegetation):

The site (Moordkuil Pump Station & access road) lies inside transformed or degraded thicket (Figures 6-10). The vegetation changes into senescent renosterveld further up the hill slope along the route for the rising main. A large patch of good quality Albany thicket was noted on the southern side of the bypassing farm road (Figure 11). The vegetation directly adjacent to the existing infrastructure and access road is quite degraded with a notable presence of weeds and aliens, such as *Acacia mearnsii*, *Nicotiana glauca*, *Solanum mauritianum* and *Verbena bonariensis*. Patches of thicket on the edges of the project footprint are populated by typical thicket species, such as *Sideroxylon inerme*, *Grewia occidentalis*, *Searsia pallens*, *Euclea undulata* and *Azima tetracantha*. Disturbances noted include the presence of farm roads, water pump infrastructure, pastures, fence lines, remains of demolished buildings and alien species. There is also a small solar plant located next to the rising main route.

Transformed or disturbed areas were selected for the site camp options (Figures 12-14). Site camp option 1 (below dam wall) is mainly covered by grasses, weeds and pioneer shrubs, such as *Cenchrus clandestinus*, *Stenotaphrum secundatum, Juncus acutus, Cyperus textilis, Nidorella ivifolia, Senecio rosmarinifolius* and *Vachellia karroo*. It also lies in close to a watercourse with *Cyperus textilis* and *Typha capensis.* Site camp options 2 and 3, which contain scattered thicket/renosterveld elements or regrowth, are more diverse. Indigenous species recorded here include *Dicerothamnus rhinocerotis, Oedera genistifolia, Scolopia zeyheri, Searsia pallens, Ruschia tenella* and *Cotyledon orbiculata*. Site camp option 3 also contains the remains of demolished farm buildings. The botanical attributes of the study area are presented in Figure 15.

Figure 6: Access road to the pump station, fringed by a pasture and degraded thicket/thicket regrowth.

Figure 7: Embankment on western side of pump station, covered by pioneer shrubs and reeds.

Figure 8: Thicket on eastern side of pump station and position of temporary access to construction site.

Figure 9: Degraded vegetation on eastern side of pump station.

Figure 10: Route for rising main, fringed by Vachellia karroo, Searsia pallens, S. rehmanniana, Euclea undulata and Athanasia trifurcata.

Figure 11: Good quality thicket with Aloe arborescens on the southern side of pump station site.

Figure 12: Site camp option 1, below the Klipheuwel Dam wall (34° 03' 17" S; 22° 08' 17" E).

Figure 13: Site camp option 2, above Klipheuwel Dam (34° 03' 10" S; 22° 08' 23.5" E).

Figure 14: Site camp option 3 (34° 03' 07.5" S; 22° 08' 24" E).

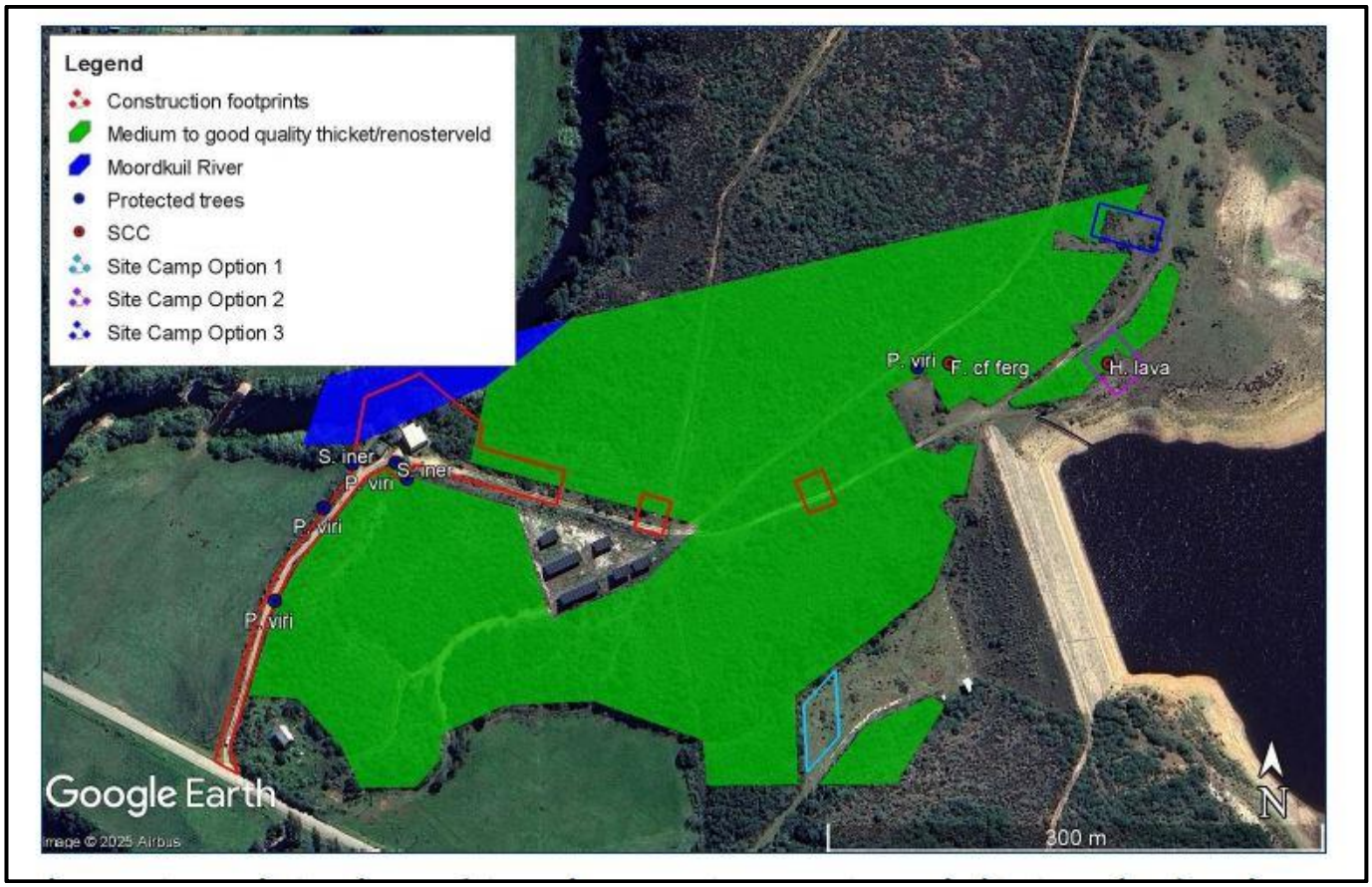


Figure 15: Botanical attributes of the project area. The untoned areas inside the project footprint are transformed or highly degraded.

Plant species:

The following indigenous tree and shrub species were recorded on site, namely *Athanasia trifurcata, Dicerothamnus rhinocerotis, Senecio rosmarinifolius, Helichrysum rosum, Metalasia pungens, Eriocephalus africanus, Oedera genistifolia, Chrysocoma ciliata, Nidorella ivifolia, Berkheya heterophylla, Vachellia karroo, Indigofera nigromontana, Rhynchosia caribaea, Searsia pallens, S. rehmanniana var. glabrata, S. lucida, Lauridia tetragona, Gymnosporia buxifolia, Putterlickia pyracantha, Mystroxylon aethiopicum, Scolopia zeyheri, Buddleja saligna, Euclea undulata, Pittosporum viridiflorum, Olea europaea, Azima tetracantha, Ruschia tenella, Lampranthus emarginatoides, Delosperma neethlingiae, Drosanthemum parvifolium, D. floribundum, Carpobrotus deliciosus, Cotyledon orbiculata, Crassula perforata, C. nudicaulis, C. subulata, C. muscosa, Sideroxylon inerme, Gnidia squarrosa, Grewia occidentalis, Carissa bispinosa, Diospyros dichrophylla, Abutilon sonneratianum, Hermannia holosericea, H. lavandulifolia, Rubus rigidus, Asparagus suaveolens, A. aethiopicus, A. multiflorus, A. mariae, Leonotis ocymifolia, L. leonurus, Lycium cinereum, Solanum africanum, S. linnaeanum, Polygala myrtifolia, P. ericifolia, Myrsine africana, Phylica cf axillaris, Cynanchum ellipticum, C. viminale, Gomphocarpus physocarpus, Rhoicissus digitata, Acalypha capensis, Pavonia columella, Hypoestes forskaolii* and *H. aristata*.

Hemicryptophytes and geophytes recorded *include Cyperus textilis, C. polystachyos, Juncus acutus, Typha capensis, Stenotaphrum secundatum, Chloris gayana, Setaria megaphylla, Cynodon dactylon, Phragmites australis, Oxalis caprina, Cyanella lutea, Freesia cf fergusoniae, Watsonia laccata* and *Bobartia robusta*. *Freesia cf fergusoniae* and *Bobartia robusta* are regional endemics recorded in the upper (renosterveld) parts of the site. Figure 16 shows a few of the indigenous species recorded.

Floristic affinity with both Albany thicket and Mossel Bay Shale Renosterveld is strong with several important taxa recorded, including *Dicerothamnus rhinocerotis, Eriocephalus africanus, Putterlickia pyracantha, Euclea undulata, Olea europaea, Cotyledon orbiculata, Crassula perforata, Grewia occidentalis, Carissa bispinosa* and *Diospyros dichrophylla*. Two Species of Conservation Concern (SCC) were recorded, namely *Hermannia lavandulifolia* (VU) and *Freesia cf fergusoniae* (VU). According to the online Red List of South African Plants, they are under threat from crop cultivation, overgrazing, urban developments and alien infestation. Fortunately, both species are still frequently encountered in the Mossel Bay area, with a high number of iNat records. All the other recorded species are widespread and common. Two protected tree

species (in terms of the National Forests Act 84 of 1998) were recorded, namely *Sideroxylon inerme* (milkwood) and *Pittosporum viridiflorum* (kasuur). Both these tree species are common in the region, but their removal requires a permit from the Department of Forestry.

Figure 16: A few indigenous species recorded on site, with Delosperma neethlingiae (top left), Pittosporum viridiflorum (top right), Leonotis leonurus (middle left), Searsia rehmanniana (middle right), Watsonia laccata (bottom left) and Oedera genistifolia (bottom right).

<u>Alien Invasive Species:</u>

On 18 September 2020, the Minister of Environmental Affairs published the Alien and Invasive Species Regulations ("the Regulations") which came into effect on the 18 October 2020 in a bid to curb the negative effects of IAPs. The Regulations call on landowners and sellers of land alike to assist the Department of Environmental Affairs to conserve our indigenous fauna and flora and to foster sustainable

use of our land. Non-adherence to the Regulations by a landowner or a seller of land can result in a criminal offense punishable by a fine of up to R 5 million (R10 million in case of a second offence) and/or a period of imprisonment of up to 10 years.

- Category 1a and 1b listed invasive species must be controlled and eradicated.
- Category 2 plants may only be grown if a permit is obtained, and the property owner ensures that the invasive species do not spread beyond his or her property.
- The growing of category 3 species is subject to various exemptions and prohibitions.

Invasive aliens were recorded throughout the site especially along the access road and around the pump station, including *Acacia mearnsii (black wattle, category 2), A. cyclops (rooikrans, 1b), Datura stramonium (common thorn apple, 1b), Opuntia ficus-indica (prickly pear, 1b), O. monacantha (prickly pear, 1b), Persicaria lapathifolia (spotted knotweed), Cestrum laevigatum (inkberry, 1b), Anredera cordifolia (Madeira vine, 1b), Erigeron bonariensis (flax-leaf fleabane), Nicotiana glauca (wild tobacco, 1b), Ricinus communis (castor-oil plant, 2), Solanum mauritianum (bugweed, 1b), Cirsium vulgare (spear thistle, 1b), Verbena bonariensis (purple top, 1b), Physalis peruviana (gooseberry), Xanthium spinosum (spiny cocklebur, 1b), Tagetes minuta (khaki weed), Cenchrus clandestinus (kikuyu, 1b in protected areas), Paspalum urvillei (giant paspalum)* and *Saccharum officinarum (sugarcane)*. Figure 17 shows a few of the alien species. As indicated above, over half are Category 1b and 2 invaders. In terms of the National Environmental Management: Biodiversity Act (NEMBA) (Act 10 of 2004) Alien and Invasive Species List (2016), category 1b invasive species require compulsory control as part of an invasive species control programme. Also, the harbouring of category 2 species, such as black wattle and castor-oil plant, is prohibited without a permit. Black wattle, which is indicative of past disturbances, is considered a serious threat to the environment and very difficult to control. The presence of the woody aliens also presents a fire risk.

Figure 17: Alien species recorded on site, with Xanthium spinosum (top left), Ricinus communis (top right), Opuntia monacantha (bottom left) and Solanum mauritianum (bottom right).

Section 5	ALIEN SPECIES IDENTIFIED ON SITE

The following alien species were identified by the specialist as occurring on site:

Table 1: Alien Invasive and Other Weed Species and Status:

SCIENTIFIC NAME	COMMON NAME	FAMILY	STATUS
Acacia mearnsii	Black Wattle	Fabaceae	CARA 2
Acacia cyclops	Rooikrans	Fabaceae	CARA 1b
Datura stramonium	common thorn apple	Solanaceae	CARA 1b
Opuntia ficus-indica	prickly pear	Cactaceae	CARA 1b
Opuntia monacantha	prickly pear	Cactaceae	CARA 1b
Persicaria lapathifolia	spotted knotweed	Polygonaceae	unlisted
Cestrum laevigatum	inkberry	Solanaceae	CARA 1b
Anredera cordifolia	Madeira vine	Basellaceae	CARA 1b
Erigeron bonariensis	flax-leaf fleabane	Asteraceae	unlisted
Nicotiana glauca	wild tobacco	Solanaceae	CARA 1b
Ricinus communis	castor-oil plant	Euphorbiaceae	CARA 2
Solanum mauritianum	bugweed	Solanaceae	CARA 1b
Cirsium vulgare	spear thistle	Asteraceae	CARA 1b
Verbena bonariensis	purple top	Verbenaceae	CARA 1b
Physalis peruviana	gooseberry	Solanaceae	CARA 1b
Xanthium spinosum	spiny cocklebur	Asteraceae	CARA 1b
Tagetes minuta	khaki weed	Asteraceae	weed
Cenchrus clandestinus	kikuyu	Poaceae	CARA 1b (in protected areas)
Paspalum urvillei	giant paspalum	Poaceae	CARA 1b
Saccharum officinarum	sugarcane	Poaceae	unlisted

Section 6	MANAGEMENT OBJECTIVES

OBJECTIVE 1:ERADICATE CATEGORY 1B SPECIES:		
Category 1b species identified on site must be controlled and eradicated in terms of the Alien and Invasive Species Regulations.		
Management Actions:		
1.	Baseline Survey	• Conduct a site walk-through prior to vegetation clearing. • Identify and map all Category 1b species. • Record density and extent (GPS and photo record).
2.	Control Methods	• Control methods must adhere to Section 7 of this Alien Management Plan. • Chemical treatment (registered herbicides only) applied to cut stumps where required. It is important to note that Chemical treatment (pesticides and herbicides) must adhere to the DFFE Pesticide Policy attached as Appendix C to this Alien Management Plan.
3.	Timing of Clearing	• Prioritise removal before seed set. • Avoid clearing during heavy rainfall periods to prevent soil erosion.
4.	Disposal	All plant material must be: • Removed from site, or • Stacked and dried in a demarcated area (if safe), or • Disposed of at a registered waste facility where necessary. • No dumping in natural areas or watercourses.
5.	Monitoring	• Clearing activities to be supervised by the ECO. • Monthly monitoring during construction. • Biannual monitoring post-construction (recommended for 3 years).
OBJECTIVE 2: PREVENT REGROWTH		
Regrowth is common due to seed banks and stump resprouting.		
Management Actions:		
1.	Follow-Up Clearing:	• First follow-up within 6–8 weeks of initial clearing. • Subsequent follow-ups every 3–6 months during first year. • Thereafter annually for at least 3 years.
2.	Stump Treatment:	• Immediate application of systemic herbicide to cut surfaces. • Ensure no untreated stumps remain.
3.	Seed Bank Management	• Disturbed soil areas must be stabilised quickly. • Avoid unnecessary soil disturbance.

4. Record Keeping:	• Maintain register of cleared areas. • Record regrowth hotspots and treatment dates.
OBJECTIVE 3: PREVENT SPREAD TO ADJACENT NATURAL VEGETATION	
Special care must be taken to protect surrounding indigenous vegetation and aquatic buffers.	
Management Actions:	
1. Demarcation:	• Clearly demarcate approved development footprint. • No clearing outside approved areas.
2. Vehicle & Equipment Hygiene:	• Construction vehicles must arrive free of soil and plant material. • No storage of contaminated soil near natural vegetation
3. Stockpile Management:	• No stockpiling within 10–20 m of watercourses or buffers. • Prevent wind or water dispersal of seeds.
4. Stormwater Control	• Install erosion control measures. • Prevent runoff transporting invasive seeds.
5. Immediate Removal	• Any new alien growth in buffer areas must be removed immediately.
OBJECTIVE 4: RESTORE INDIGENOUS VEGETATION	
Rehabilitation reduces invasion risk and promotes ecological stability.	
Management Actions:	
1. Topsoil Management:	• Strip and stockpile topsoil separately. • Replace topsoil during rehabilitation phase.
2. Revegetation:	• Encourage natural regeneration where feasible. • Supplement with locally indigenous species if required. • Avoid planting invasive or ornamental species.
3. Erosion Control:	• Use brush packing where appropriate. • Install silt fencing and berms where necessary.
4. Rehabilitation Monitoring:	• Assess vegetation cover percentage. • Ensure no new alien dominance.
5. Success Criteria:	• No Category 1b regrowth. • Indigenous vegetation cover stabilised. • No active erosion.
OBJECTIVE 5: ENSURE COMPLIANCE WITH DFFE CONDITIONS	
The Alien Management Plan forms part of the EMPr and must comply with DFFE requirements.	
Management Actions:	
1. Integration into EMPr:	• This Alien Management Plan forms part of the approved EMPr. • Binding on the Applicant and all contractors.
2. ECO Monitoring:	• Monthly monitoring during construction. • Post-construction monitoring every 6 months for 3 years (recommended).
3. Reporting:	• Alien clearing activities to be included in ECO reports. • Non-compliance to be recorded and corrective action implemented immediately.

4.	Training:	• Contractors and workers must receive environmental induction. • Awareness of listed invasive species and legal obligations.
5.	Legal Compliance:	• Compliance with: o NEMBA (Act 10 of 2004) o Alien & Invasive Species Regulations o NEMA Duty of Care (Section 28)
6.	Responsibility:	• The Applicant remains legally responsible for ongoing control of invasive species.

Section 7	CLEARING METHODOLOGY

Management measures for the site
All vegetation clearance must be undertaken with utmost care to ensure that only that vegetation, which needs to be removed, is removed.

Eradication of alien plants must be completed in such a manner that indigenous vegetation is not damaged.

It is important to remove both young plants (saplings) and old trees that are seed bearing. Different strategies can be employed to remove different species, but all methods will involve manual labour as mechanical means other than chain saws and brush cutters, should be used where necessary. It is important to tackle the smaller, more dispersed plants first, and then the larger stands of alien vegetation.

To ease the removal of the alien plants present on the site, it is recommended that all alien plants be removed during the initial site clearing activities at the start of the construction process rather than during the operational phase of the development.

1. Clearing of small alien plants
The best method of clearing small plants is by hand pulling them. They must then be stacked for removal to a recognised waste site, or alternatively mulched on site. Mulched material can be used as a ground cover where necessary.

2. Clearing of alien trees
Alien trees must be cut down with chain saws and then chopped into smaller portions. Some species of alien plants like Black Wattle trees are coppicing species and will re-grow from roots and stumps. This means that a chemical such as Roundup or Garlon will need to be used to prevent the trees from re-sprouting. These chemicals can either be sprayed onto the stump with a knapsack sprayer or painted on with a paintbrush. Another alternative to prevent re-growth is to strip the bark from the remaining part of the stump.

3. Methods for controlling alien vegetation
Biological control, chemical control, mechanical clearing, and burning have all been used with varying results. Each method has been successful but nearly all require follow-up control. The most successful clearing projects have included an integrated approach to account for initial clearing and continued management.

3.1 Mechanical control:

- Mature non-coppicing trees must be cut as low as possible and no herbicide treatment is needed on the cut stumps.
- Debris may be removed immediately from site to be burned in a safe area, mulched or used as firewood.
- Large branches should be used as firewood.
- Smaller branches should be mulched.
- Alien material containing seed must be removed from the site and burned.
- Should debris be left on site:
- In sparser areas, where felled debris will not hinder follow-up operations, plants can be felled and left in situ.

- In dense areas, stack debris in rows five metres apart parallel to the contours to facilitate follow-up operations.
- Low density seedling regeneration must be hand pulled.
- Hand pulling around pockets of indigenous vegetation (1m swathe around clumps) is important so as to not damage indigenous vegetation pockets.

3.2 Chemical control

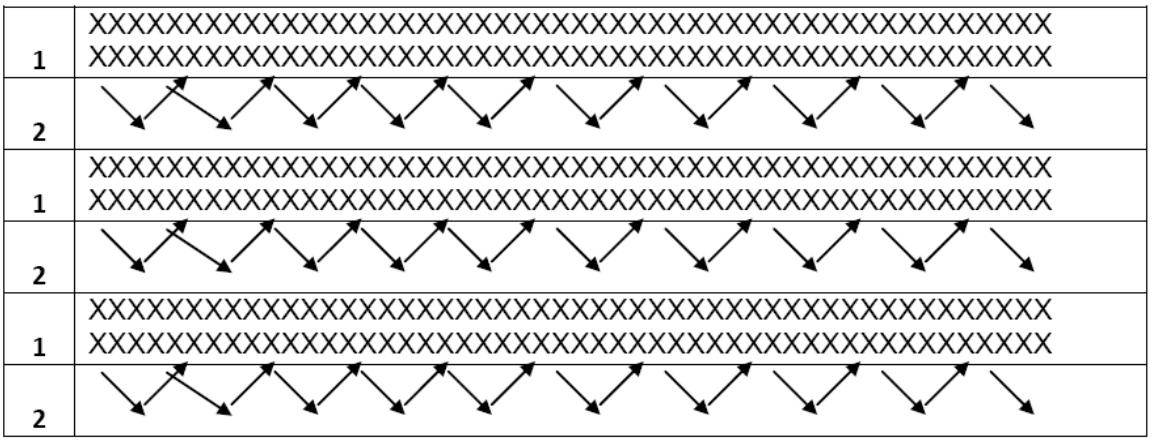
- Follow-up visitation no later than three months after initial operation.
- Follow-up control will be needed because soil stored seed may stay dormant in soil for up to 50 years.
- Follow-up control will involve a combination of hand pulling and foliar spraying.
- Seedlings, saplings and coppice can be foliar sprayed.
- Follow-up spray operation when sufficient regeneration has taken place.
- Blanket or foliar spray.
- All chemical control must adhere to the DFFE Pesticide Policy attached as Appendix C to this report.

3.3 Tools

- Loppers, bow saws and chainsaws
- 12 –15 litre back pack spray units
- Flat fan nozzles or solid cone and 1 bar constant flow valves.

3.4 Team composition

- 6 persons, each being equipped with a lopping shear, bow saw and herbicide applicator, must first sweep through the area in individual lanes 5 metres apart. These persons target all plants less than 8 cm in basal diameter, felling, stacking and applying herbicide. De-branching should only be used to facilitate stacking of larger branches.
- 2 chainsaw operators thereafter follow through these lanes felling all plants more than 8 cm in basal diameter. Two assistants are responsible for stacking and herbicide application.
- For the denser areas, methodology must follow the illustration below. All rows are five metres wide. Swathes labelled 1 must be cut first and the debris placed back into these swathes. Thereafter debris generated in swathes labelled 2, must be placed into swathes labelled 1.



3.5 Follow up

Once the source of the problem has been removed, namely the seed bearing trees, it is important to follow up on any seedlings and saplings that may have grown in the interim. If this is not done the effort of the removal of the adult trees will have been wasted, as the alien vegetation problem will intensify.

Section 8 IMPLEMENTATION PROGRAMME

Phase	Activity	Timeframe
Construction Phase	Initial clearing	Construction duration - ongoing
Post Construction Rehabilitation Phase	Follow up clearing and rehabilitation	3 months post construction
Monitoring Phase	Annual monitoring	1-3 years post construction

Section 9 MONITORING AND REPORTING

Monitoring of alien clearing activities will be undertaken by the appointed Environmental Control Officer (ECO) during the monthly ECO site inspections conducted for the duration of the construction phase. This Alien and Invasive Species Management Plan forms part of the Environmental Management Programme (EMPr) and will be implemented and monitored as part of the broader environmental compliance monitoring framework for the project.

During construction, the ECO will:

- Verify that clearing is undertaken in accordance with the approved methodology;
- Confirm correct herbicide application and disposal of plant material;
- Record areas cleared and any regrowth observed;
- Include findings and recommendations in the monthly ECO compliance reports.

Post-construction monitoring will also be undertaken by the ECO. It is recommended that the ECO be appointed to monitor and report on the implementation of the Alien and Invasive Species Management Plan at least once every six (6) months for a minimum period of three (3) years following completion of construction.

Post-construction monitoring will focus on:

- Identification and treatment of regrowth;
- Monitoring of seed bank emergence;
- Verification of rehabilitation success;
- Ensuring no new infestations establish on site.

Where regrowth is identified, follow-up clearing shall be undertaken promptly to ensure long-term control and compliance with Section 73 of the National Environmental Management: Biodiversity Act.

Section 10	RESPONSIBILITIES

Applicant – Department of Water and Sanitation

The Department of Water and Sanitation, as the Applicant and landowner (or authority responsible for the project), shall:

- Ensure implementation of this Alien and Invasive Species Management Plan;
- Allocate adequate financial and human resources for clearing and follow-up activities;
- Appoint a suitably qualified contractor to undertake alien clearing;
- Appoint an independent Environmental Control Officer (ECO) to monitor compliance;
- Ensure that clearing operations comply with the approved EMPr, NEMBA, and AIS Regulations;
- Ensure post-construction monitoring is undertaken for a minimum period of three (3) years;
- Ensure corrective action is taken where non-compliance or regrowth is identified.

Contractor

The appointed Contractor shall:

- Implement clearing strictly in accordance with this Management Plan;
- Ensure workers are informed of alien species identification and control methods;
- Apply herbicides in accordance with manufacturer specifications and legal requirements;
- Prevent the spread of seeds or vegetative material during clearing;
- Dispose of cleared biomass responsibly;
- Undertake follow-up clearing where instructed;
- Maintain records of clearing activities for submission to the ECO.

Environmental Control Officer (ECO)

The appointed ECO shall:

- Monitor implementation of this Plan during monthly construction site visits;
- Verify that clearing methods are appropriate and legally compliant;
- Record areas cleared and any regrowth observed;
- Include compliance findings in monthly ECO reports;
- Conduct post-construction monitoring at least once every six (6) months for three (3) years;
- Provide recommendations for corrective action where necessary.

Environmental Assessment Practitioner (EAP)

The EAP shall:

- Ensure this Plan forms part of the approved EMPr;
- Provide guidance where amendments are required;
- Assist the Applicant in ensuring compliance with regulatory requirements where necessary.

Appendix A1: CV of Author

GEORGE
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CURRICULUM VITAE

MICHAEL JON BENNETT

PERSONAL

Profession: Principle Environmental Assessment Practitioner and Senior Environmental Control Officer, Sharples Environmental Services cc, George
Possion: Director – George
Nationality: South African
Date of Birth: 22 October 1985
Languages: English (read, write and speak) & Afrikaans (read, write and speak)
Marital Status: Single
Drivers License: Code B
Health: Excellent
EAPASA Reg: 2021/3163
IAIASA Membership: 7334

WORK EXPERIENCE

2014 – Present: Sharples Environmental Services cc, George, WC
Environmental Assessment Practitioner

I have gained extensive experience in assessments and monitoring and have worked on a variety of multidisciplinary projects and am proficient in:

- Basic Assessments Reports
- Water Use Authorisation Applications
- Environmental Monitoring and Reporting
- Environmental Management Programmes
- Environmental Control Officer Training
- Conducting Outeniqua Sensitive Coastal Area licensing applications

2016 – 2017: Sharples Environmental Services cc, Cape Town, WC
Intrim Office Manager, Environmental Assessment Practitioner

2011 – 2014: Peninsula Permits & NCC Group, Cape Town, WC
Environmental Control Officer

TERTIARY EDUCATION

2010 University of Cape Town

- I hold a Bachelor of Science Degree specialising in Environmental and Geographic Science & Ocean and Atmospheric Science

PROJECTS

2024 George George Municipality

- Basic Assessment Report for the proposed upgrade of the Gwaing wastewater treatment works on the remainder of erf 464, George, Western Cape

2024 George 3MP Sales and Education Services

- Basic Assessment Report for the proposed mixed-use development on erf 998 and the remainder of the farm zandhoogte no. 139, Tergniet, Mossel Bay, Western Cape

2024 Mossel Bay Hartland lifestyle estate

- Part II amendment of the appeal environmental authorisation issued on 18 august 2009 (as amended) and the EMPr for the proposed residential development on a portion of the farm vaale valley 219, Mossel Bay - Hartland lifestyle estate

2024 George George Municipality

- Basic Assessment Report for the proposed upgrading of the Herold's Bay pump station and associated rising main as well as the development of new associated infrastructure on erf 116, remainder of erf 95, remainder of farms 236 and 237 and portions 10, 35 and 37 of farm brakfontein no. 236, Herold's Bay, George, Western Cape

2024 George George Municipality

- Part II Amendment of Environmental Authorisation for proposed development of a Photovoltaic Solar Plant on erf 2819, George, Western Cape

2024 George George Municipality

- Basic Assessment Report for the proposed repair and rehabilitation of flood damage along the Camphersdrift River in the Van Riebeeck Park (Project 28(3)), George, Western Cape

2024 Plettenberg Bay The More Family Collection

- Basic Assessment Report for the proposed expansion of the Milkwood Manor and parking on erf 10190, remainder of erf 2066 and the remainder of erf 706, Plettenberg Bay, Western Cape

2023 George Urban Country Estate (Pty) Ltd

- Basic Assessment Report for the proposed residential development on erf 19374 (remainder erf 6182, erven 6179 and 6156), George, Western Cape

2023 George George Municipality

- Basic Assessment Report for the Upgrading of the Eden Pumpstation, George, Western Cape

2023 Mossel Bay Paprenax Trading 6 cc

- Amendment of Environmental Authorisation (Part 2, Substantive amendment) for the proposed establishment of a filling station and associated business infrastructure on a portion of erf 13996, Kwanonqaba, Mossel Bay, Western Cape

2023 George George Municipality

- Basic Assessment Report for proposed upgrade of the Schaapkop Pumpstation rising main on remainder of erf 464 and erf 13486, George, Western Cape

2023 George Garden Route Gateway Plaza

- Basic Assessment Report for proposed mixed-use development on portions 278 and 282 of farm Kraaibosch no. 195, George, Western Cape

2023 George George Municipality

- Basic Assessment Report for proposed development of a Photovoltaic Solar Plant on erf 2819, George, Western Cape

2023 George EARP Construction

- Basic Assessment Report for the proposed commercial development on portion 49 of Farm Hansmoeskraal 202, George, Western Cape

2022 George Pieter Koen Development Company

- Basic Assessment Report for the proposed residential development on Portion 21 of the Farm Kraaibosch No. 195 (Pieter Koen), George, Western Cape

2022 Mossel Bay Dalmar

- Amendment of Environmental Authorisation (Part 2, Substantive amendment) for the Proposed Residential Development On A Portion Of The Farm Vaale Valley 219, Mossel Bay (Hartenbos Landgoed II), Western Cape

2022 George Dalmar

- Amendment of Environmental Authorisation Proposed Development of Herold's Bay Country Estate on A Portion of Portion 7 of The Farm Buffelsfontein No. 204, Herold's Bay, Western Cape

2022 George Pieterkoen Trust

- Basic Assessment Report for the proposed residential development on Portion 21 of the Farm Kraaibosch No. 195 (Pieter Koen), George, Western Cape

2022 Still Bay W. Nel & Irma Oosthuizen Trust IT 1596/2008

- Basic Assessment Report for the development of 5 residential units on erven 4139, 4140, 4141, 4142, 4143, 4144, 4145 (Erf 3997), Still Bay West, Western Cape

2022 George Octo Trading 377 cc

- Section 24 G Retrospective Environmental Authorisation for the alleged unlawful construction of a road clearance of vegetation to establish a house on remainder of Farm Holle Kloof 91 and Portion 1 of the Farm Plattekloof 131, Waboomskraal, George, Western Cape

2022 Knysna CapeNature

- Basic Assessment Report for the Proposed development on Portions 38 and 39 of Farm 205 and Remainder of Farm 211, Goukamma Nature Reserve, Knysna, Western Cape

2021 Prince Albert Jurie Klue

- Section 24 G Retrospective Environmental Authorisation for the alleged unlawful clearance of vegetation on Farm Angliers Bosch (Fernkloof), Remainder of Farm 157, Klaarstroom, Prince Albert, Western Cape

2021 Mossel Bay Mossel Bay Municipality

- Basic Assessment Report for the proposed Dana Bay Emergency Access Road on Remainder of Portion 7 of the Farm 225, Dana Bay, Mossel Bay, Western Cape

2021 Willowmore LEZMIN 2087cc

- Basic Assessment Report for the proposed development of Portion 1 of the Farm Matjiesfontein No. 206, Baviaanskloof, Division Willowmore, Eastern Cape

2020 Sedgefield Knysna Municipality

- Basic Assessment Report for the proposed housing development on erven 3861, 3865, 3866, 3917, 3918 and 5010 in Sedgefield, Knysna, Western Cape

2020 Mossel Bay Paprenax Trading 6 cc

- Basic Assessment Report for the proposed establishment of a filling station and associated business infrastructure on a portion of erf 13996, Kwanonqaba, Mossel Bay, Western Cape

2020 Ladismith Department of Transport and Public Works

- Maintenance Management Plan for the periodic maintenance of Trunk Road 31, section 4, km 30.8 to km 76.06, Barrydale to Ladismith, Western Cape

2020 Knysna Knysna Municipality

- Maintenance Management Plan for the Maintenance of the potable water pipeline system on Erven 4197, RE/1352, RE/1351, RE/1146 and 1316 in Knysna, Western Cape

2020 Humansdorp Kouga Municipality

- Environmental Control Officer for the Phase 1A of New municipal 66kV double circuit overhead line between the Melkhout substation at Humansdorp and the main intake substation at Jefferys Bay, Eastern Cape

2020 Humansdorp Kouga Municipality

- Environmental Control Officer for the Construction of a new 22kv overhead powerline between Melkhout substation and Allison Street, Humansdorp, Eastern Cape

2020 Knysna Knysna Municipality

- Environmental Control Officer for the Charlesford raw water pumping scheme: Upgrade and refurbishment of pumpstation: Mechanical and electrical, Knysna, Western Cape

2020 Seweweekspoort, Department of Transport & Public Works

- Amendment of Environmental Authorisation (Part 2, Substantive amendment) for the flood damage repairs to road structures on MR309 in Seweweekspoort, Western Cape

2019 – 2021 Seweweekspoort, Department of Transport & Public Works

- Environmental Control Officer for the flood damage repairs to road structures on MR309 in Seweweekspoort, Western Cape

2019 George George Municpality

- Environmental Control Officer for the Raising of the Garden Route Dam Spillway on Portion 3/352, Remainder of 536 of Erf 221, Erf 3055 and Erf 3056, George, Western Cape

2019 Laingsburg Department of Agriculture

- Environmental Control Officer for the Construction Of Erosion Prevention Structures Within The One In Ten Year Flood Line Of The Buffels River, Laingsburg, Western Cape

2019 Williston Williston Municipality

- Environmental Control Officer for the Upgrading of bulk water network in Williston – Phase 3, Williston, Northern Cape

2019 George George Municipality

- Environmental Control Officer for the construction of new 66kV overhead line between Ballots Bay and Glanwood substations, George, Western Cape

2019 Oudtshoorn Department of Transport & Public Works

- Environmental Control Officer for the Periodic maintenance of Trunk Road 31, Section 6, km 23.3 to km 47.8 Calitzdorp to Oudtshoorn, Western Cape

2019 Kleinbrak Mossel Bay Municipality

- Environmental Control Officer for the Upgrading of Beyers Street, Klienbrak River, Western Cape

2019 George Outeniqua Eye Clinic Body Corporate

- Environmental Control Officer for the proposed expansion of parking area on erf 5950 and part of remainder erf 464, George, Western Cape

2019 Mossel Bay Hey Innovations

- Basic Assessment Report for the proposed establishment of a residential development on Erf 2839, Great Brak River, Western Cape

2019 Oudtshoorn Oudtshoorn Municipality

- Environmental Management Programme for the Blossoms Emergency Supply Scheme, Oudtshoorn, Western Cape

2019 Humansdorp Clinkscales Maughan-Brown

- Environmental Management Programme for the proposed construction of a new 22kV overhead powerline between Melkhout Substation and Allison Street, Humansdorp, Eastern Cape

2019 George PN&MR Lotter Family Trust

- Addendum to the Environmetnal Management Programme for the Establishment of a Township (Rivendale) on Portions 5, 15, 16 and 31 of the Farm Hansmoeskraal 202, Western Cape

2019 Oudtshoorn Department of Transport and Public Works

- Basic Assessment Report for the Proposed Maintenance Activities of Trunk Road 33/4 between km 4.6 and km 14.4, Meiringspoort, Western Cape

2019 George Dynarc Capital

- Substantive amendment of environmental authorisation for the proposed Development of Portion 130, 131 and 132 of the Farm Gwayang 208

2019 George Department of Transport & Public Works

- Basic Assessment Report for the proposed Upgrading of Bridge No. 2221 on Trunk Road 2/9 at km 15.1 over the Maalgate River.

2018 - 2019 Oudtshoorn Department of Transport and Public Works

- Maintenance Management Plan for the proposed periodic maintenance of Trunk Road 31, section 6, km 23.3 to km 47.8, Western Cape

2018 - 2019 Humansdorp Clinkscales Maughan-Brown

- Applicability of the EIA regulations Checklist for the proposed new 22kV overhead line between Melkhout Substation and Allison Street, Eastern Cape

2018 - 2019 Knysna Knysna local Municipality

- Applicability of the EIA regulations Checklist for the proposed Rheenendal infill housing, subdivision and rezoning of portions of erf 42, 36 and 387 as well as erven 535, 536, 553, 54, 393, 406, 672, 673 and 68, Rheenendal, Western Cape

2018 - 2019 Knysna Knysna local Municipality

- Applicability of the EIA regulations Checklist for the proposed infill housing and subdivision of erven in Welsyndorp and the rezoning and subdivision of erven in Bosdorp, Karatara, Western Cape.

2018 Port Elizabeth ACSA P.E.

- Applicability of the EIA regulations Checklist for the proposed ACSA Port Elizabeth Airport Photovoltaic Plant, Eastern Cape Province

2018 Mossel Bay TopUp Prop Inv.

- Applicability of the EIA regulations Checklist for the proposed Farm Stall Centre and filing Station on Portion 65 of the Farm Hartenbosch 217, Hartenbos

2018 George Outeniqua Eye Clinic Body Corporate

- Basic Assessment Report for the proposed expansion of parking area on erf 5950 and part of remainder erf 464

2018 Beaufort West Beaufort West Municipality

- Environmental Control Officer for the First and Second Environmental Audit for the provision of adequate water supply within the jurisdiction of the Beaufort West municipality

2018 Mossel Bay Element Consulting Engineers

- Environmental Management Programme update for the replacement of 22kV overhead powerline between Power Town and Hartenbos and between Hartenbos and the Hartenbos sewage substation and the construction of a new 22kV overhead power line between the Midbrak and Kleinbrak Substations.

2018 Mossel Bay Element Consulting Engineers

- Environmental Control Officer for the construction of a new 22kV overhead power line between the Midbrak and Kleinbrak Substations

2018 Mossel Bay Element Consulting Engineers

- Environmental Control Officer for the Upgrade of Amy Searle Canal – Phase 5, Great Brak River

2018 Gouritsmond Hessequa Consulting Engineers

- Environmental Control Officer for the Upgrade and expansion of the Gouritsmond Water Water Treatment Works on remainder of erf 140, Gouritsmond

2018 George Biprops 14

- Environmental Control Officer for the residential development on portion 5 of the farm Kraaibosch No. 195, Groenkloof Woods: Phase C & D

2018 Knynsa Knysna Municipality

- Environmental Control Officer for upgrading of Knysna bulk water supply scheme: phase 2B

2018 Plettenberg Bay Bitou Municipality

- Environmental Control Officer for the upgrade of the Kranshoek Bulk Water Supply Scheme: Construction of Pipelines, reservoirs and associated infrastructure near Plettenberg Bay.

2018 Mossel Bay SMEC

- Environmental Control Officer for the Upgrade of Kusweg and associated infrastructure in Rheebok

2017 George EARP Construction

- Invasive Alien Management Plan for the proposed residential development on portions 21, 23, 24 & 48 of Farm Hansmoeskraal 202 near George

2017 Mossel Bay Mossel Bay Municipality

- Environmental Control Officer for the development of the new Mossel Bay municipal cemetery on erf 2001/0

2017 Knynsa Knysna Municipality

- Environmental Control Officer for the remedial work to prevent further settlement of the low-lift pump sump and retaining wall at Gouna River Pump Station

2017 Knynsa Knysna Municipality

- Environmental Control Officer for upgrading of Knysna bulk water supply scheme: phase 1

2017 George Biprops 14 (Pty) Ltd

- Environmental Control Officer for the residential development on portion 5 of the farm Kraaibosch No. 195

2017 Still Bay Hessequa Municipality

- Environmental Control Officer for the construction of a reservoir, booster pump station and associated infrastructure in Melkhoutfontein near Still Bay

2016 - 2017 Heidelberg Department of Transport & Public Works

- Environmental Control Officer for the flood damage repairs to structures in the Central Eden District Municipality Region, Heidelberg North

2016 - 2017 Riversdale Department of Transport & Public Works

- Environmental Control Officer for the flood damage repairs to structures in the Central Eden District Municipality Region, Riversdale East area

2016 - 2017 Still Bay Department of Transport & Public Works

- Environmental Control Officer for the upgrade of main road 332 near Still Bay

2016 - 2017 Mossel Bay The South Cape College

- Environmental Control Officer for the extension of the South Cape College: Phase 3, Mossel Bay Campus

2016 - 2017 Klein Brak Mossel Bay Municipality

- Environmental Control Officer for the removal of obstructions in the lower floodplain of the Klein Brak River Estuary

2016 Prince Albert Milway Trade and Invest 1014cc

- Basic Assessment for the proposed guest lodge on remainder of Farm Rietpoort 13

2016 Plettenberg Bay Bitou Municipality

- Basic Assessment for the proposed Qolweni phase 5 development near Plettenberg Bay

2016 Mossel Bay Element Consulting Engineers

- Environmental Management Programme for the replacement of 22kV overhead powerline between Power Town and Hartenbos and between Hartenbos and the Hartenbos sewage substation

2016 George SMEC

- Environmental Policy for the resurfacing of York Street, George

2016 Mossel Bay Department of Transport & Public Works

- Maintenance Management Plan for proposed upgrade of Louis Fourie Road.

2016 George Oaklands Bridge Country Estate HOA

- Maintenance Management Plan for proposed repair and maintenance of the riverbank at Oaklands Bridge Country Estate in Heather Park

2016 Gouritz Department of Transport & Public Works

- Update of the Maintenance Management Plan for proposed repair and maintenance of the Gouritz River Bridge bank protection along the R325 near Gouritzmond

2016 George Ivorybell Investment (Pty) Ltd

- Outeniqua Sensitive Coastal Area Environmental Impact Report for the proposed new house on erf 379 in Heralds Bay

2016 George George Municipality

- Environmental Assessment Report for the substantive amendment of environmental authorisation of the proposed upgrade and extension of the overhead power lines and associated substations

2016 Oudtshoorn SA Army Infantry School

- Environmental Control Officer for the construction of a fighting in built up areas (FIBUA) range on portion 10 of the farm Blaauwtjes Drift 110 in Oudtshoorn

2015 - 2016 Gouritz Department of Transport & Public Works

- Environmental Control Officer for the repair and maintenance of the Gouritz River Bridge bank protection along the R325 near Gouritzmond

2015 - 2016 Albertinia Garden Route Game Lodge (Pty) Ltd

- Environmental Control Officer for the five new units at the Garden Route Game Lodge

2015 - 2016 Mossel Bay Element Consulting Engineers

- Environmental Control Officer for the replacement of 22kV overhead powerline between Power Town and Hartenbos and between Hartenbos and the Hartenbos sewage substation

2014 - 2016 Plettenberg Bay Chauke Quanity Surveyers

- Environmental Control Officer for the Qolweni and Kwanokuthula High Density Units and engineering services

2016 Plettenberg Bay Bitou Municipality

- Environmental Control Officer for the civil engineering works for Kwanokuthula Phase 4 and the extension of Sishuba Street

2014 - 2016 Mossel Bay The South Cape College

- Environmental Control Officer for the extension of the South Cape College, Mossel Bay Campus

2016 George SMEC

- Environmental Control Officer for the resurfacing of York Street

2014 - 2015 Mossel bay The Muller Murray Trust

- Environmental Control Officer for the construction of gravity pipeline from the Nautilus take-off to the Boggomsbaai Reservoir phase 2

2015 Swellendam Casidra SOC Ltd

- Environmental Control Officer for the Grootvaderbos Groynes in the Buffeljags River

2015 George Element Consulting Engineers

- Environmental Control Officer for the upgrading and extension of overhead power lines and substations: construction of a new 66kV overhead line between Protea and Ballots Bay substation

2014 - 2015 George Department of Transport & Public Works

- Environmental Control Officer for the flood damage repair projects in the George and Knysna local municipal areas

2015 George BDE Consulting Engineers (Pty) Ltd

- Environmental Control Officer for the photovoltaic solar plant for the ACSA George Airport

2015 Heidelberg Bergstan South Africa

- Environmental Control Officer for the Duiwenhoks River stabilization works: Sites B31, B38 and B39

2015 Krakeel Element Consulting Engineers

- Environmental Control Officer for the construction of filling station at SSK Tuinrote Agri on portion 5 of the farm no. 320

2014 - 2015 Herbertsdale SMEC

- Environmental Control Officer for the flood damage repairs to structures in the Eden region: Herbertsdale area

2014 - 2015 George Department of Transport & Public Works

- Environmental Control Officer for the flood damage repair projects in the George and Knysna local municipal areas

2015 George SMEC

- Environmental Control Officer for the improvements to the Pacaltsdorp interchange and new pedestrian bridge

2014 - 2015 Still Bay De Villiers & Moore Consulting Engineers

- Environmental Control Officer for the Still Bay 66kV substation and overhead powerline

2014 Beaufort West Worley Parsons Consulting Engineers

- Environmental Control Officer for the Nelspoort bulk water supply scheme northeast of Nelspoort

Appendix A2: EAPASA REGISTRATION OF AUTHOR:

Environmental Assessment Practitioners Association of South Africa

Registration No. 2021/3163

Herewith certifies that

MICHAEL JON BENNETT

is registered as an

Environmental Assessment Practitioner

Registered in accordance with the prescribed criteria of Regulation 15. (1) of the Section 24H Registration Authority Regulations (Regulation No. 849, Gazette No. 40154 of 22 July 2016, of the National Environmental Management Act (NEMA), Act No. 107 of 1998, as amended).

Effective: 01 April 2026

Expires: 31 March 2027

Chairperson

Registrar

SAQA
SOUTH AFRICAN QUALIFICATIONS AUTHORITY

Appendix B: Botanical Impact Assessment

Botanical Impact Assessment

Proposed upgrading of Moordkuil Pump Station, Mossel Bay

18 June 2026

Author details

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SACNASP Reg. No.	400073/98 (Ecological Science)
Area of Specialisation	Botanical surveys

Mark Berry is an independent botanical specialist with over 25 years of experience mainly in the Western Cape, but also in the adjacent provinces, Free State and KwaZulu-Natal. He is also experienced in undertaking/compiling Environmental Impact Assessments (EIA's), Environmental Management Programmes (EMPr's), Environmental Control Officer (ECO) duties, audits, land use surveys and due diligence investigations. CV is available upon request.

Citation of report

Berry, M.G. 2026. Botanical impact assessment: proposed upgrading of Moordkuil Pump Station, Mossel Bay. MB Botanical Surveys, Somerset West.

Declaration of Independence

I Mark Gerald Berry, as the appointed Specialist hereby declare/affirm the correctness of the information provided or to be provided as part of the application, and that I:

- in terms of the general requirement to be independent:
  - **other than fair remuneration for work performed in terms of this application, have no business, financial, personal or other interest in the development proposal or application and that there are no circumstances that may compromise my objectivity**; or
  - ~~am not independent, but another specialist (the "Review Specialist") that meets the general requirements set out in Regulation 13 has been appointed to review my work (Note: a declaration by the review specialist must be submitted)~~;
- in terms of the remainder of the general requirements for a specialist, have throughout this EIA process met all of the requirements;
- have disclosed to the applicant, the EAP, the Review EAP (if applicable), the Department and I&APs all material information that has or may have the potential to influence the decision of the Department or the objectivity of any report, plan or document prepared or to be prepared as part of the application; and
- am aware that a false declaration is an offence in terms of Regulation 48 of the EIA Regulations, 2014 (as amended).

Signature of the Specialist:	
Name of Company:	MB Botanical Surveys
Date:	18 June 2026

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1. Introduction

Proposed development and area assessed

This report investigates the botanical impacts of the proposed upgrading of the Moordkuil Pump Station near Mossel Bay. The raw water pump station is situated on the left bank of the Moordkuil River, 3 km north of Klein Brak River (**Figure 1-1**). Stretches of degraded thicket and renosterveld were encountered on the site. The aim of the study, which was requested by SES (EAP) on behalf of applicant (Mossel Bay Municipality), is to determine the botanical value of the affected area, the anticipated impact imposed by the project, and to recommend mitigation measures.

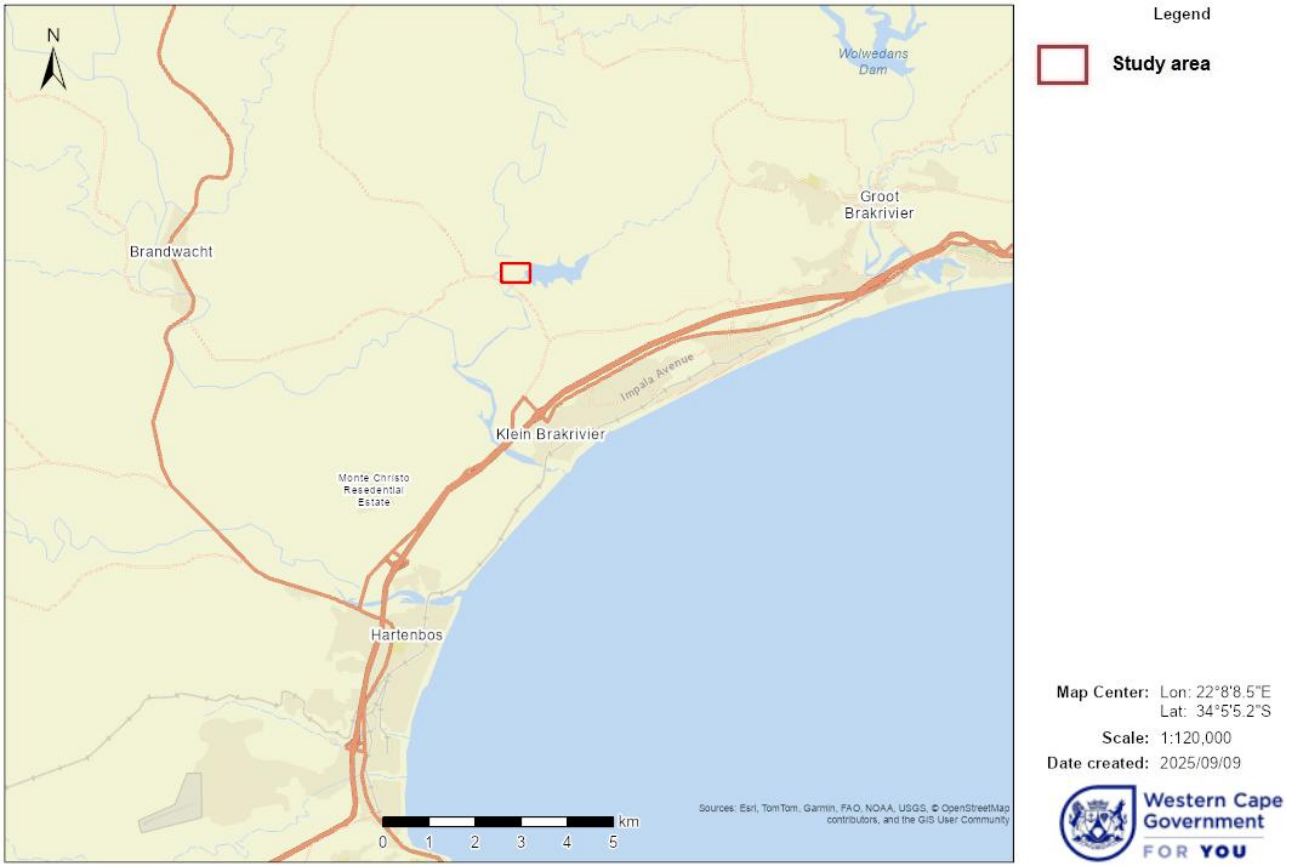

Figure 1-1: Satellite photo showing the location of the site (outlined in red) north of Klein Brak River in the Mossel Bay area.

The applicant wishes to upgrade the raw water abstraction works and pump station on Portions 15, 24 and 25 of Farm Klipheuvel 143, Mossel Bay. The current preferred design alternative has changed from the previous alternative (Alternative B) in that the area previously allocated for the temporary pumps will now accommodate the permanent pumps. Additional infrastructure includes the resurfacing of the access road to the pump station and the installation of a rising main towards the Klipheuwel Dam east of the site. See **Figure 1-2** for further details. Three possible sites are also investigated for the placement of a site camp for the duration of the construction phase.

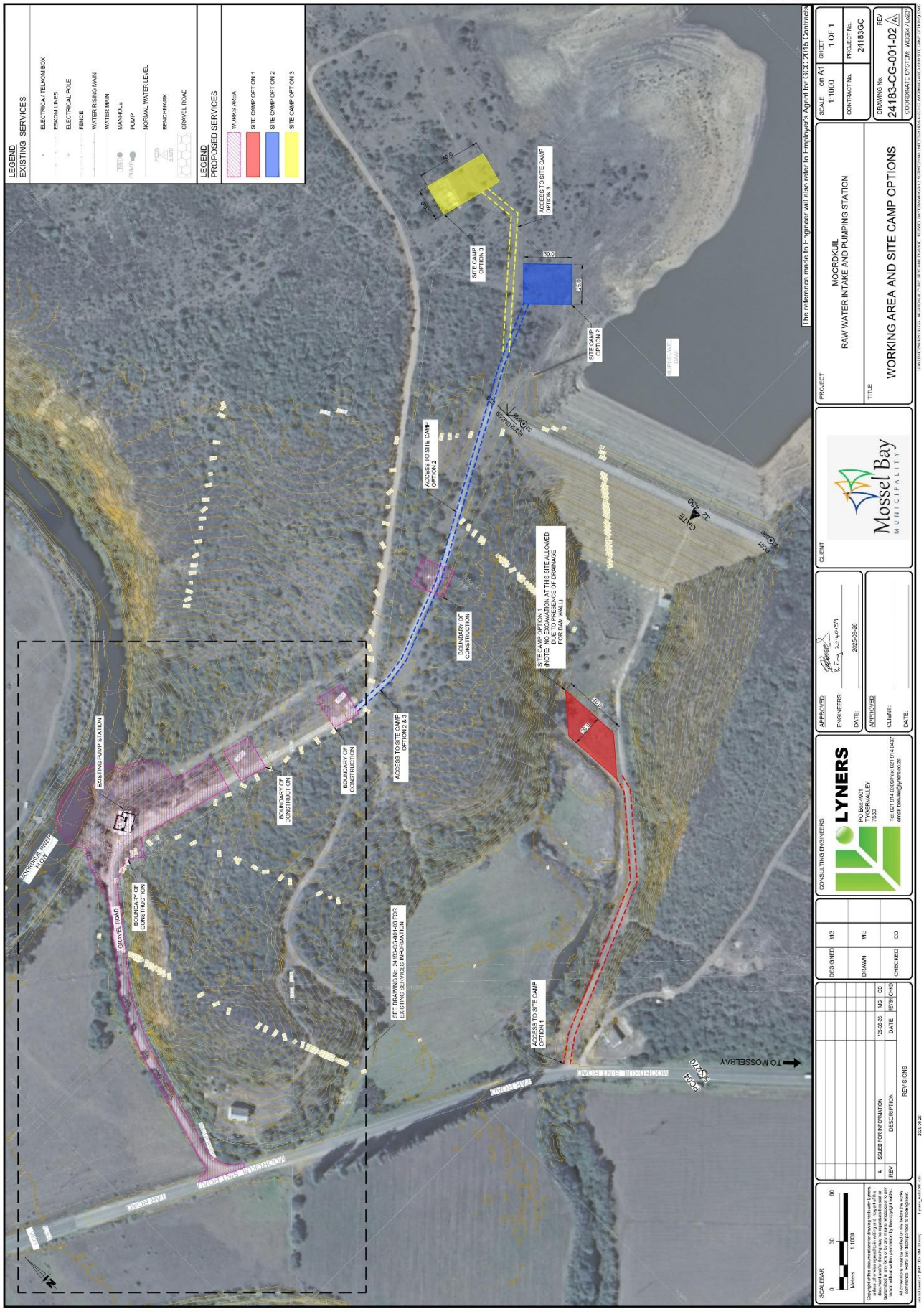

Figure 1-2: Project details.

According to the two Screening Reports, generated by the EAP (SES) on 9 June 2026 for the project, the site has been mapped as Medium sensitive in the plant species theme, and Very High sensitive in the terrestrial biodiversity theme. The Very High sensitivity is ascribed to the possible presence of threatened vegetation types and the encroachment of the site on the biodiversity network. As a result, MB Botanical Surveys was contracted to undertake a botanical assessment of the project area.

Terms of Reference

The terms of reference agreed upon for this botanical study include:

- Adhere to the EAP's terms of reference for the study, including a *status quo* assessment, followed by either a Compliance Statement or a Botanical Impact Assessment Report, depending on the outcome of the *status quo* assessment;
- Identify and describe biodiversity patterns at a community and ecosystem level (main vegetation type, plant communities & threatened/vulnerable ecosystems), at species level (Species of Conservation Concern & protected species) and in terms of significant landscape features;
- Describe the sensitivity of the site and its immediate surroundings;
- Map or describe the presence of invasive alien plants;
- Review the relevant biodiversity plans compiled in terms of the National Environmental Management Biodiversity Act (Act 10 of 2004);
- Make recommendations with regards to the protection/management of biodiversity; and
- Adhere to the NEMA and CapeNature guidelines for biodiversity assessments.

Limitations and Assumptions

The following limitations and assumptions apply to the study:

- Since fieldwork was carried out in autumn and late winter, flowering plants that only flower at other times of the year (e.g. late spring to summer), such as certain bulb species (notably from the Iridaceae and Orchidaceae families), may have been missed. The overall confidence in the completeness and accuracy of the botanical findings is however considered to be good.

Notwithstanding the above limitation and the fact that the affected vegetation is degraded where most of the work will take place, the specialist is of the opinion that the survey and findings are adequate to aid decision making. However, a follow-up botanical survey later in spring should contribute towards the current species list.

Disclaimer & Use of this report

Any person using or referring to this report, do so at their own risk. The author will not accept liability for any loss or damage arising from this report or its content. This report reflects the professional judgment of its author. The information and recommendations

presented are specific to the project and site at hand and do not extend to future developments or neighbouring sites. Use of this report is therefore restricted.

2. Site Sensitivity Verification

The Department of Environmental Affairs online Environmental Screening Tool indicates that the plant species theme is of High sensitivity for the project area (see the Screening Reports, generated by the EAP on 9 June 2026). **Annexure 1** lists the threatened species and their sensitivity from the Screening Reports. The Screening Reports further indicate that the terrestrial biodiversity theme is of Very High sensitivity. This rating is ascribed to the possible presence of a terrestrial critical biodiversity area (CBA1), a degraded terrestrial critical biodiversity area (CBA2) and two threatened vegetation types (Garden Route Granite Fynbos & Groot Brak Dune Strandveld).

In circumstances where the *status quo* assessment proves the contrary to the above (i.e. where the site is deemed to be of Low sensitivity in respect of both themes, the GN320 of 2020 requires that a Terrestrial Biodiversity Compliance Statement is submitted as set out by the National Environmental Management Act (NEMA) (Act No. 107 of 1998) Regulations of 2020. If the above is confirmed, then a biodiversity assessment will be required. The latter seems to be more appropriate in this instance.

3. Methodology

The methodology used in this terrestrial biodiversity compliance assessment, including a desktop background assessment and one site visit, is outlined in the subsections below.

Desktop assessment

A brief review of online (e.g. Google Earth, iNaturalist.org & CapeFarmMapper) and desktop resources (available literature & reports) was undertaken to determine the nature of the site, the expected vegetation type(s), the presence of natural vegetation remnants and species of conservation concern (SCC), hydrological features, and the significance of the site in terms of biodiversity planning.

Site survey

Botanical surveys of the site were undertaken on 26 March and 28 August 2025 by the author. A qualitative assessment of the type and condition of affected vegetation on site, disturbances and presence of alien species, SCC and protected tree species was carried out. The paths walked during the survey are shown in **Figure 3-1**. Plant species not identified in the field, were collected and/or photographed and identified at the office and Compton (Kirstenbosch) Herbarium. The 2018 South African Vegetation Map and the latest floristic taxonomic literature and reference books were used for the purpose of this specialist study. Any plants classified as rare or endangered in the Red List of South African

Plants online database[1] are highlighted. The assessment follows the relevant national guidelines/protocols for biodiversity assessments as listed in the Government Gazette No. 43110 on 20 March 2020.

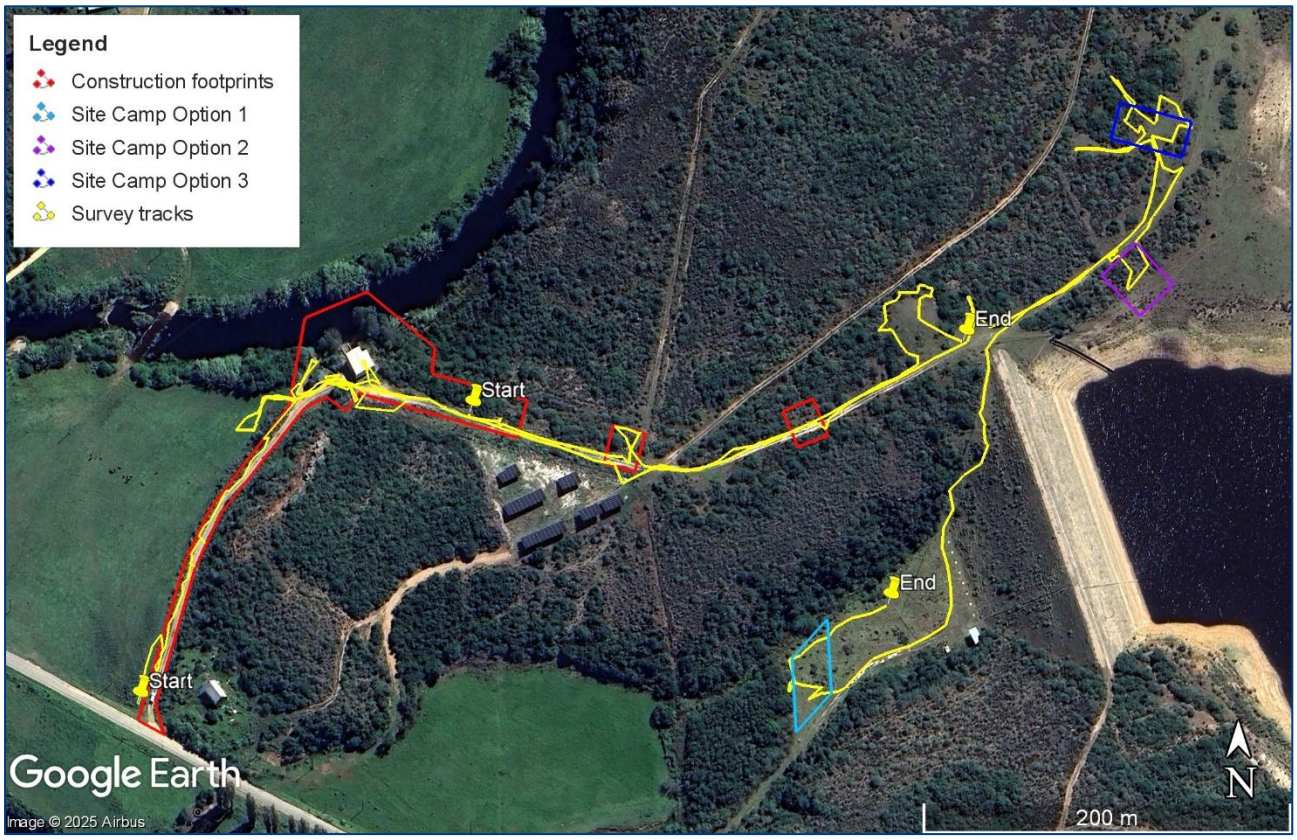

Figure 3-1: Satellite photo showing the survey tracks on site.

The following information was recorded during the site visit:

1. The condition of the vegetation. Is the vegetation either disturbed or degraded? A disturbed or degraded area could range from agricultural fields (fallow land), or areas previously disturbed by mining activities, to an area that has been severely eroded or degraded as a result of bad land management or alien infestation.
2. Species diversity (alpha diversity). This refers to the numbers of different indigenous plant species occurring on site.
3. Species of Conservation Concern (SCC), endemics, as well as protected tree species occurring on site. This would include near threatened, rare, vulnerable, endangered or critically endangered species. SCC and protected tree species were mapped using GPS Tracks Pro v4.9.5 software on an iPhone 16 Pro. Accuracy is given as ±5 m.
4. Identification of the vegetation type(s) and communities (if discernible) on the site. This would include trying to establish the known range of a vegetation type and

[1] Threatened Species Programme | SANBI Red List of South African Plants

whether or not it is vulnerable, endangered or critically endangered.

5. Connectivity with (or isolation from) nearby natural vegetation.

Data analysis

Site ecological importance (SEI) of the affected (receptor) area has been determined by applying the criteria described in the Species Environmental Assessment Guideline (SANBI, 2020). See **Annexure 2** for a description of the SEI methodology. The impact assessment methodology is described in **Annexure 3**.

4. Literature Study

A desktop literature review was undertaken during the biodiversity assessment using both online resources and existing maps and reports. A summary of the most relevant information to this assessment is presented below. Some of the information was ground-truthed during the site survey.

Location, topography & land use

The study site is located on the edge of the Moordkuil River floodplain, 3 km north of Klein Brak River (**Figure 4-1**). The surrounding landscape to the north and east is hilly. The hillslopes north of the Klipheuwel Dam rise to 168 m above sea level, while the landscape flattens out downstream towards the south and the confluence with the Brandwag River. The site is covered by tracts of degraded thicket and also renosterveld on the slopes above the site. Two of the proposed site camp options are located inside pastures on the floodplain. Dairy farms have transformed much of the surrounding landscape north of the N2, with only the hilly areas and steeper slopes remaining untransformed. Botlierskop Private Game Reserve is located just over a kilometre away to the north.

Hydrology

According to CapeFarmMapper, the pump station is located on the edge of a NFEPA estuarine wetland associated with the Moordkuil River (**Figures 4-1** & **4-2**). The National Freshwater Ecosystem Priority Areas (NFEPA) project provides strategic spatial priorities for conserving South Africa's freshwater ecosystems and supports sustainable use of water resources. These priority areas are commonly referred to as NFEPA's. One of the site camp options is also located next to a non-perennial watercourse coming from the Klipheuwel Dam. The above wetland and watercourse have been included in the Western Cape biodiversity network.

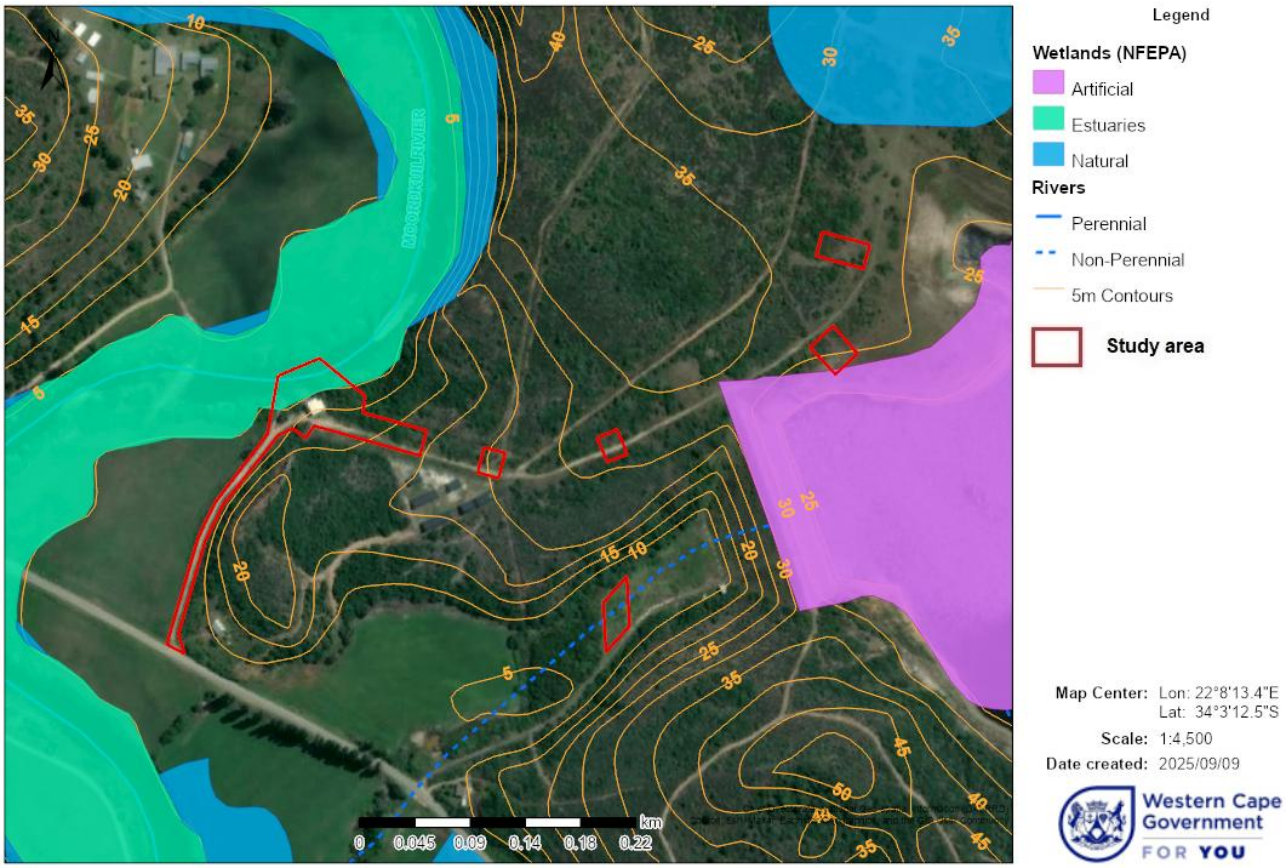

Figure 4-1: Combined topography and hydrology map.

Figure 4-2: Moordkuil River with one of the water abstraction pipes.

Climate

The mean annual rainfall for the site, which is located on the Garden Route coastal plain, is 444 mm (as per CapeFarmMapper climatic data for 1950 to 2000). The peak rainfall periods are the months of March and October-November (i.e. bimodal rainfall regime), while the driest periods are the summer and winter months. The study area lies in a transitional area between the winter and summer rainfall regions. Mean daily maximum and minimum temperatures are 23.4°C and 10.2°C for February and July, respectively (as per CapeFarmMapper climatic data).

Geology

According to the 3422 AA Mossel Bay 1:50 000 geological map, the site lies on the boundary between alluvium and Enon Formation (conglomerate, breccia & sandstone) (**Figure 4-3**). The latter belongs to the Uitenhage Group (Jurassic to Cretaceous age) of sediments. The cobblestones found in the Enon conglomerate originate from the Table Mountain Group sandstones (Viljoen, 1993). Enon conglomerate is an important source of stone aggregate, which is mined at several quarries found in the area (Viljoen, 1993). The latter typically supports Albany thicket and renosterveld in the Mossel Bay area.

Figure 4-3: Exposed Enon conglomerate on a 'koppie' north of the site.

Biodiversity Planning Context

The study site is located in a renosterveld-thicket environment on the Southern Cape

coastal plain. The indigenous species recorded on site are typical renosterveld and thicket species, such as *Elytropappus rhinocerotis, Eriocephalus africanus, Sideroxylon inerme, Mystroxylon aethiopicum* and *Azima tetracantha*. The 2018 SA Vegetation Map has incorrectly mapped the main vegetation type on site as Garden Route Granite Fynbos, with the pump station area encroaching on Groot Brak Dune Strandveld (**Figure 4-4**). Vlok has mapped it as Brandwag Fynbos-Renoster-Thicket (see CapeFarmMapper online data). The main vegetation type here should rather be mapped as Mossel Bay Shale Renosterveld, with strong elements (patches) of Albany thicket. This error is repeated in the 2024 beta version of the SA Vegetation Map. Mossel Bay Shale Renosterveld occurs on the undulating hills and valleys from the Kruisrivier near Riversdale to Botterberg, west of the Robinson Pass, centred on the Gouritz River (Mucina, 2006). The renosterveld is described as a medium dense, medium tall cupressoid-leaved shrubland dominated by renosterbos (Mucina, 2006). Thicket patches are common within the unit.

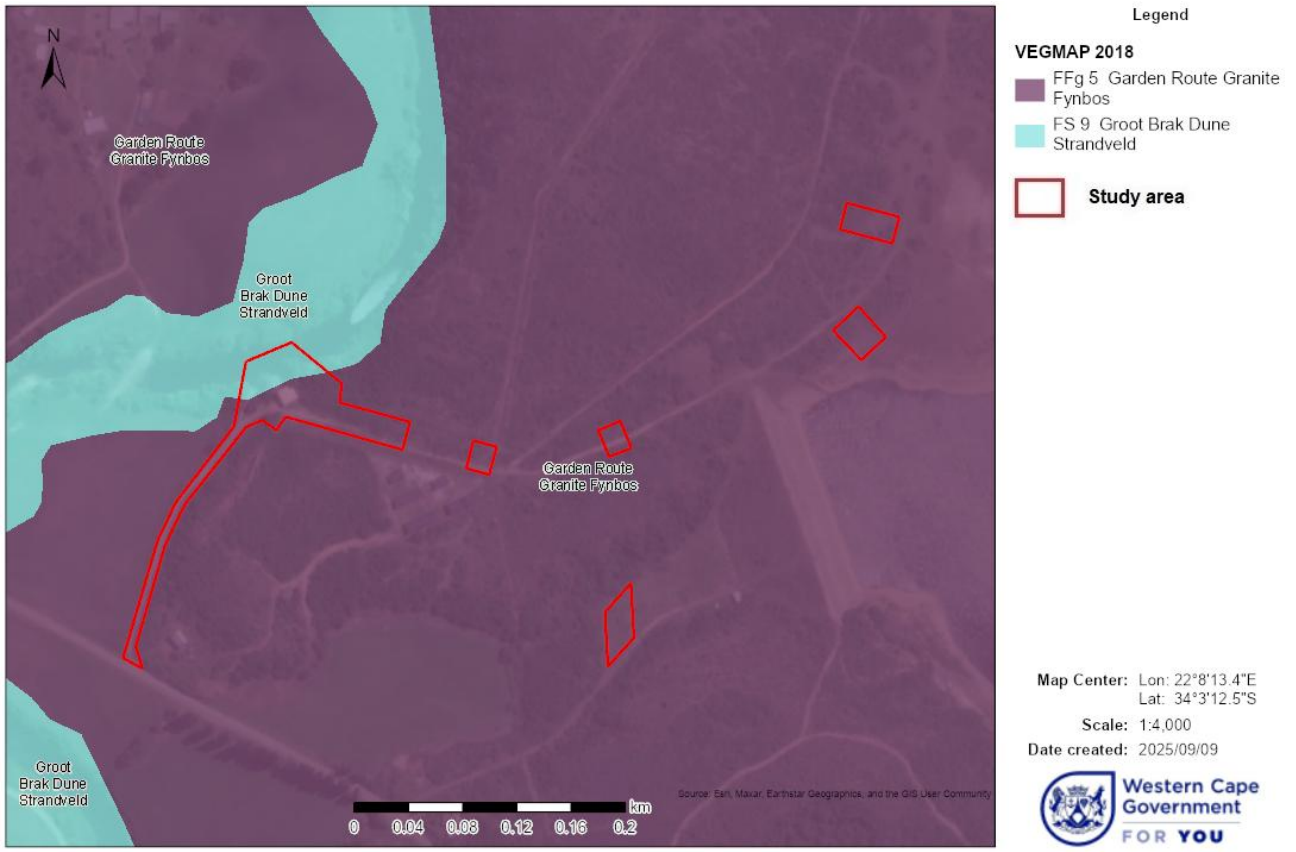

Figure 4-4: Extract of the 2018 SA Vegetation map.

Being part of the Fynbos Biome, Mossel Bay Shale Renosterveld is maintained by a regular fire regime. Unfortunately, landscape fragmentation is disrupting this 'maintenance' requirement, often leading to localised species loss and bush encroachment or alien infestation (pers. obs.). Due to its transformed state, Mossel Bay Shale Renosterveld is currently listed as Critically Endangered in the Revised National List of Threatened Ecosystems (DEA, 2022). A large percentage of it has been transformed in the past for pastures and croplands (Mucina, 2006). Only 38% of Mossel Bay Shale Renosterveld is still

left, while 0.2% is currently protected[2]. The ecosystem is also degraded by erosion and overgrazing (Mucina, 2006). The unit is narrowly distributed with high rates of habitat loss in the past 30 years, placing it at risk of collapse[3].

Figure 4-5: Extract of the Western Cape biodiversity network map.

A large part of the project area falls inside the Western Cape biodiversity network. The pipeline route and two of the camp site options fall inside a terrestrial critical biodiversity area (CBA) and degraded critical biodiversity areas (CBA2) (**Figure 4-5**). The pumpstation itself and camp site option below the dam wall encroach on aquatic (river) CBA's and degraded aquatic CBA's. Reasons for the mapped units include the presence of a climate adaption corridor, ecological processes (FEPA river corridor), threatened vegetation type (albeit the wrong type), threatened vertebrate habitat (bontebok), estuary (Klein Brak Estuary), river types (ephemeral upper foothill river & permanent lower foothill river), wetland types (channelled & unchannelled valley bottom wetlands) and water resource protection (Southern Coastal Belt). It was previously noted that most of the intact vegetation in the Mossel Bay interior is found on the steeper hill slopes. These areas are thus considered of great value in the biodiversity network. The CBA2's correspond with transformed areas, such as pastures and roads. The Moordkuil River has

[2] Ecosystem Detail - Biodiversity BGIS
[3] Ecosystem Detail - Biodiversity BGIS

been mapped as an aquatic CBA. The closest protected area to the site is the Doring River Wilderness Area, located 15 km away to the north.

CBA's are defined as areas in a natural condition that are required to meet biodiversity targets, for species, ecosystems or ecological processes and infrastructure (Pool-Stanvliet, 2017). These sites are selected for meeting national targets for species, habitats and ecological processes (Pool-Stanvliet, 2017). Many of these areas support known occurrences of threatened plant species, and/or may be essential elements of designated ecological corridors. Loss of designated CBA's is therefore not recommended. ESA's, on the other hand, are supporting zones required to prevent the degradation of CBA's and Protected Areas.

5. Results

In order to fulfil in the requirements of the terrestrial biodiversity and plant species protocols, this section describes the vegetation (terrestrial biodiversity) and plant species encountered in two subsections. In the plant species subsection specific reference is made to species of conservation concern (SCC) and protected tree species.

Terrestrial biodiversity (vegetation)

The site (Moordkuil Pump Station & access road) lies inside transformed or degraded thicket (**Figures 5-1** to **5-5**). The vegetation changes into senescent renosterveld further up the hill slope along the route for the rising main. A large patch of good quality Albany thicket was noted on the southern side of the bypassing farm road (**Figure 5-6**). The vegetation directly adjacent to the existing infrastructure and access road is quite degraded with a notable presence of weeds and aliens, such as *Acacia mearnsii, Nicotiana glauca, Solanum mauritianum* and *Verbena bonariensis.* Patches of thicket on the edges of the project footprint are populated by typical thicket species, such as *Sideroxylon inerme, Grewia occidentalis, Searsia pallens, Euclea undulata* and *Azima tetracantha*. Disturbances noted include the presence of farm roads, water pump infrastructure, pastures, fence lines, remains of demolished buildings and alien species. There is also a small solar plant located next to the rising main route.

Transformed or disturbed areas were selected for the site camp options (**Figures 5-7** to **5-9**). Site camp option 1 (below dam wall) is mainly covered by grasses, weeds and pioneer shrubs, such as *Cenchrus clandestinus, Stenotaphrum secundatum, Juncus acutus, Cyperus textilis, Nidorella ivifolia, Senecio rosmarinifolius* and *Vachellia karroo*. It also lies in close to a watercourse with *Cyperus textilis* and *Typha capensis*. Site camp options 2 and 3, which contain scattered thicket/renosterveld elements or regrowth, are more diverse. Indigenous species recorded here include *Dicerothamnus rhinocerotis, Oedera genistifolia, Scolopia zeyheri, Searsia pallens, Ruschia tenella* and *Cotyledon orbiculata*. Site camp option 3 also contains the remains of demolished farm buildings. The botanical attributes of the study area are presented in **Figure 5-10**.

Figure 5-1: Access road to the pump station, fringed by a pasture and degraded thicket/thicket regrowth.

Figure 5-2: Embankment on western side of pump station, covered by pioneer shrubs and reeds.

Figure 5-3: Thicket on eastern side of pump station and position of temporary access to construction site.

Figure 5-4: Degraded vegetation on eastern side of pump station.

Figure 5-5: Route for rising main, fringed by *Vachellia karroo, Searsia pallens, S. rehmanniana, Euclea undulata* and *Athanasia trifurcata*.

Figure 5-6: Good quality thicket with *Aloe arborescens* on the southern side of pump station site.

Figure 5-7: Site camp option 1, below the Klipheuwel Dam wall (34° 03′ 17″ S; 22° 08′ 17″ E).

Figure 5-8: Site camp option 2, above Klipheuwel Dam (34° 03′ 10″ S; 22° 08′ 23.5″ E).

Figure 5-9: Site camp option 3 (34° 03′ 07.5″ S; 22° 08′ 24″ E).

Figure 5-10: Botanical attributes of the project area. The untoned areas inside the project footprint are transformed or highly degraded.

Plant species

The following indigenous tree and shrub species were recorded on site, namely *Athanasia trifurcata, Dicerothamnus rhinocerotis, Senecio rosmarinifolius, Helichrysum rosum, Metalasia pungens, Eriocephalus africanus, Oedera genistifolia, Chrysocoma ciliata, Nidorella ivifolia, Berkheya heterophylla, Vachellia karroo, Indigofera nigromontana, Rhynchosia caribaea, Searsia pallens, S. rehmanniana* var. *glabrata, S. lucida, Lauridia tetragona, Gymnosporia buxifolia, Putterlickia pyracantha, Mystroxylon aethiopicum, Scolopia zeyheri, Buddleja saligna, Euclea undulata, Pittosporum viridiflorum, Olea europaea, Azima tetracantha, Ruschia tenella, Lampranthus emarginatoides, Delosperma neethlingiae, Drosanthemum parvifolium, D. floribundum, Carpobrotus deliciosus, Cotyledon orbiculata, Crassula perforata, C. nudicaulis, C. subulata, C. muscosa, Sideroxylon inerme, Gnidia squarrosa, Grewia occidentalis, Carissa bispinosa, Diospyros dichrophylla, Abutilon sonneratianum, Hermannia holosericea, H. lavandulifolia, Rubus rigidus, Asparagus suaveolens, A. aethiopicus, A. multiflorus, A. mariae, Leonotis ocymifolia, L. leonurus, Lycium cinereum, Solanum africanum, S. linnaeanum, Polygala myrtifolia, P. ericifolia, Myrsine africana, Phylica cf axillaris, Cynanchum ellipticum, C. viminale, Gomphocarpus physocarpus, Rhoicissus digitata, Acalypha capensis, Pavonia columella, Hypoestes forskaolii* and *H. aristata*.

Hemicryptophytes and geophytes recorded include *Cyperus textilis, C. polystachyos, Juncus acutus, Typha capensis, Stenotaphrum secundatum*, *Chloris gayana, Setaria megaphylla, Cynodon dactylon, Phragmites australis, Oxalis caprina, Cyanella lutea, Freesia cf fergusoniae, Watsonia laccata* and *Bobartia robusta*. *Freesia cf fergusoniae* and *Bobartia robusta* are regional endemics recorded in the upper (renosterveld) parts of the site. **Figure 5-11** shows a few of the indigenous species recorded.

Floristic affinity with both Albany thicket and Mossel Bay Shale Renosterveld is strong with several important taxa recorded, including *Dicerothamnus rhinocerotis*, *Eriocephalus africanus, Putterlickia pyracantha, Euclea undulata, Olea europaea, Cotyledon orbiculata, Crassula perforata, Grewia occidentalis, Carissa bispinosa* and *Diospyros dichrophylla*. Two Species of Conservation Concern (SCC) were recorded, namely *Hermannia lavandulifolia* (VU) and *Freesia cf fergusoniae* (VU). According to the online Red List of South African Plants, they are under threat from crop cultivation, overgrazing, urban developments and alien infestation. Fortunately, both species are still frequently encountered in the Mossel Bay area, with a high number of iNat records. All the other recorded species are widespread and common. Two protected tree species (in terms of the National Forests Act 84 of 1998) were recorded, namely *Sideroxylon inerme* (milkwood) and *Pittosporum viridiflorum* (kasuur). Both these tree species are common in the region, but their removal requires a permit from the Department of Forestry.

Figure 5-11: A few indigenous species recorded on site, with *Delosperma neethlingiae* (top left), *Pittosporum viridiflorum* (top right), *Leonotis leonurus* (middle left), *Searsia rehmanniana* (middle right), *Watsonia laccata* (bottom left) and *Oedera genistifolia* (bottom right).

Invasive aliens were recorded throughout the site especially along the access road and around the pump station, including *Acacia mearnsii* (black wattle, category 2), *A. cyclops* (rooikrans, 1b), *Datura stramonium* (common thorn apple, 1b), *Opuntia ficus-indica* (prickly pear, 1b), O. *monacantha* (prickly pear, 1b), *Persicaria lapathifolia* (spotted knotweed), *Cestrum laevigatum* (inkberry, 1b), *Anredera cordifolia* (Madeira vine, 1b), *Erigeron bonariensis* (flax-leaf fleabane), *Nicotiana glauca* (wild tobacco, 1b), *Ricinus communis* (castor-oil plant, 2), *Solanum mauritianum* (bugweed, 1b), *Cirsium vulgare*

(spear thistle, 1b), *Verbena bonariensis* (purple top, 1b), *Physalis peruviana* (gooseberry), *Xanthium spinosum* (spiny cocklebur, 1b), *Tagetes minuta* (khaki weed), *Cenchrus clandestinus* (kikuyu, 1b in protected areas), *Paspalum urvillei* (giant paspalum) and *Saccharum officinarum* (sugarcane). **Figure 5-12** shows a few of the alien species. As indicated above, over half are Category 1b and 2 invaders. In terms of the National Environmental Management: Biodiversity Act (NEMBA) (Act 10 of 2004) Alien and Invasive Species List (2016), category 1b invasive species require compulsory control as part of an invasive species control programme. Also, the harbouring of category 2 species, such as black wattle and castor-oil plant, is prohibited without a permit. Black wattle, which is indicative of past disturbances, is considered a serious threat to the environment and very difficult to control. The presence of the woody aliens also presents a fire risk.

Figure 5-12: Alien species recorded on site, with *Xanthium spinosum* (top left), *Ricinus communis* (top right), *Opuntia monacantha* (bottom left) and *Solanum mauritianum* (bottom right).

Site Ecological Importance

In order to demonstrate the biodiversity sensitivity of the project area, a site ecological importance (SEI) map was prepared (**Figure 5-13**). This map considers the biodiversity importance of the receptor area and its resilience to impacts. The receptor area is described as the affected habitats (i.e. transformed/degraded areas, Moordkuil River & thicket/renosterveld). Most of the project footprint scored a Very Low value, while the

thicket/renosterveld and riverine areas scored High and Medium values, respectively. These values were influenced by the size of areas in question, threat status and condition of the vegetation, potential presence of SCC, and connectivity with the biodiversity network. The results of the SEI analysis are presented in **Table 5-1**.

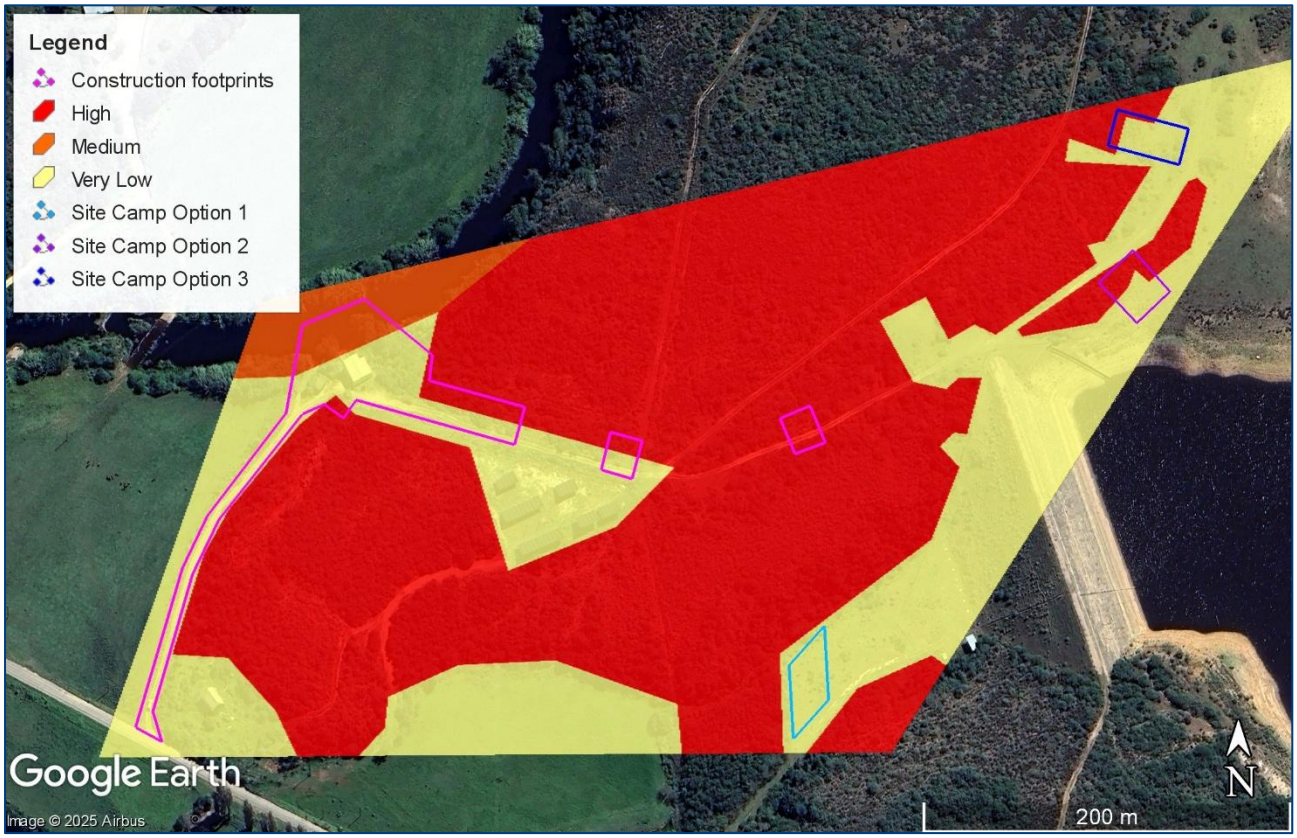

Figure 5-13: Site ecological importance (SEI) map of the project area.

Table 5-1: SEI analysis.

	CI	FI	BI	RR	SEI
Medium to good quality thicket/renosterveld	High	High	High	Medium	High
Moordkuil River corridor	High	High	High	High	Medium
Transformed or highly degraded areas	Low	Low	Low	Very High	Very Low

6. Potential Impacts

Terrestrial biodiversity (vegetation)

With the information in hand, it is impossible to determine how much natural vegetation will be affected by the project. However, encroachments of thicket/renosterveld and riverine vegetation is expected. Fortunately, most of these encroachments will occur in degraded or regrowth vegetation next to existing infrastructure and farm roads. Post

construction recovery is also expected to be quick if allowance is made for rehabilitation and alien control. Pioneer tree and shrub species, such as *Vachellia karroo, Searsia* spp, *Dicerothamnus rhinocerotis*, *Eriocephalus africanus* and *Athanasia trifurcata*, will populate the disturbed areas again within a couple of years. The affected vegetation is also well represented on the surrounding hills. With regards to the design alternatives for the pump station, the current preferred alternative will not result in a significantly greater impact than the previous alternative (Alternative B).

With regards to the site camp options, options 1 and 3 are more degraded or disturbed, and mainly covered by grasses and scattered pioneer shrubs/trees. Site option 2 contains considerably more vegetation and plant species. It is therefore recommended that site options 1 and/or 3 be considered for the site camp. Proper fencing will be needed around the site camp to prevent damage to the adjacent vegetation. In the case of option 1 below the dam wall, consideration must be given to an adjacent watercourse/wetland. During the construction phase care must be exercised to avoid the unnecessary disturbance of the adjacent vegetation. Proper fencing will be needed in this regard. As an indirect impact, earthworks will provide ideal conditions for the establishment of invasive alien species. The presence of aliens, such as black wattle, wild tobacco and a plethora of herbaceous species, will exacerbate this impact. **Table 6-1** summarises the impact on terrestrial biodiversity.

Table 6-1: Impact on terrestrial biodiversity.

Phase	Construction Phase	Operational Phase
Nature of impact(s)	- Clearing of mostly degraded thicket/renosterveld. - Temporary impact on the functionality of biodiversity network. - Increased opportunity for alien infestation. - Pollution of aquatic systems.	- Increased alien infestation. - Erosion due to poor rehabilitation efforts.
Extent of impact	Project footprint & immediate surroundings	Project footprint & immediate surroundings
Duration	Medium	Long term
Intensity	Medium	Low
Probability of occurrence	High	Medium
Degree of reversibility	Medium	High
Irreplaceability of resource	Medium	Medium-low
Mitigatory potential	High	High
Significance before mitigation	Medium-low	Low
Significance after mitigation	Low	Low

The project area is located partly inside a CBA corridor that runs along the foothills of the

Mossel Bay interior and connects with Outeniquas (Doringrivier Wilderness Area & Ruitersbos Nature Reserve) to the north. Apart from providing a backbone to the local biodiversity network, the corridor serves as an important passage along which fauna can migrate between the mountain and the foothills and along the foothills itself. With the project located close to the southern edge of the corridor one can expect a temporary impact on its functionality. The only mitigation measures would be to rehabilitate the disturbed areas post construction, encourage the re-establishment of indigenous vegetation on the disturbed surfaces (where practical), and implement alien control.

Plant species

The impact on plant species, including potential SCC and protected tree species, is also expected to be of low significance, with mitigation. This is due to the presence of mostly widespread and common thicket/renosterveld species. Two SCC were recorded on site, namely *Hermannia lavandulifolia* (VU) and *Freesia cf fergusoniae* (VU). Both observed occurrences can be avoided. *Polygala pubiflora* (VU) and *Trichodiadema burgeri* (VU) were also recorded by the author on an adjacent farm. Fortunately, all of them are still frequently encountered in suitable habitats in the Mossel Bay area. **Table 6-2** summarises the impact on plant species.

Table 6-2: Impact of the project on flora, SCC & protected tree species.

Phase	Construction Phase	Operational Phase
Nature of impact(s)	- Loss of indigenous flora, potential SCC & protected tree species	- Alien infestation & resulting displacement of indigenous flora
Extent of impact	Project footprint & immediate surroundings	Project footprint & immediate surroundings
Duration	Medium	Long term
Intensity	Medium	Low
Probability of occurrence	High	Medium
Degree of reversibility	Medium	High
Irreplaceability of resource	Medium	Medium-low
Mitigatory potential	High	High
Significance before mitigation	Medium-low	Low
Significance after mitigation	Low	Low

Given their habitat preferences and known iNaturalist records, the probability of SCC listed in the Screening Report to occur on site is indicated in **Annexure 1**. Three species, including two sensitive species which names are withheld, have a medium to high probability to occur on the site or surrounding area. To mitigate the impact, topsoil from the construction areas should be protected and replaced after construction as part of the rehabilitation process. As a duty of care measure, consideration could also be given to

search and rescue (S&R) of suitable species (e.g. bulbs & succulents). Of course, any replanting of rescued plant material must be done in matching habitats from which the plants originate. Two protected tree species will probably be affected, namely *Sideroxylon inerme* and *Pittosporum viridiflorum*. A permit will be needed for their removal.

The **cumulative botanical impact** of the project is expected to be equivalent to the impact on terrestrial biodiversity and plant species described above, i.e. the continued erosion of Albany thicket and/or Mossel Bay Shale Renosterveld, the biodiversity network, as well as the loss of plant species. In this instance, the slight loss of biodiversity and resultant cumulative impact will be acceptable (with mitigation), due to the transformed or degraded state of the affected vegetation and the nature of the project. A large part of the site can be rehabilitated and some of the vegetation restored.

7. Recommended Mitigation Measures

The following mitigation measures are recommended to ensure that the impact on terrestrial biodiversity and plant species is minimised during the **construction phase**:

- Fence off the construction areas. The thicket/renosterveld outside the construction areas must not be disturbed in any way.
- With regards to the site camp options, preference should be given to options 1 and 3. Site option 2, which contains considerably more vegetation and plant species, should not be selected. In the case of site camp option 1 (below the dam wall), a buffer of sufficient width must be maintained between the camp and nearby watercourse.
- To mitigate the impact of vegetation clearing, topsoil and seedbearing plant material from the construction areas must be protected and replaced after construction as part of the rehabilitation process. As a duty of care measure, consideration should also be given to S&R of suitable species (e.g. bulbs & succulents). Of course, any replanting of rescued plant material must be done in matching habitats from which the plants originate. Bulbs should be removed along with some soil, placed in gel, bagged and then taken to a nursery for temporary storage or transplanted directly in the receiving area. S&R should be done at an appropriate time of the year, preferably when the soil is wet during the raining season. Ideally, bulbs should be salvaged during leaf fall, but before or after flowering. Please note that a CapeNature permit is needed for the relocation of indigenous plant species.
- Allow at least 24 months for the monitoring of rehabilitation success and alien infestation post construction. Keep the project footprint as well as an additional strip of 10-15 m wide clear of invasive aliens.

Mitigation measures recommended for the **operational phase**:

- Monitor the construction footprint and all areas disturbed during construction for rehabilitation success and erosion. Where needed, rehabilitate/revegetate

disturbed surfaces expediently. Erosion prevention measures may be needed on steep slopes, such as silt fences, logs or netting, to slow down runoff and potential erosion. Mulching and seeding with indigenous thicket/renosterveld seed may also be needed.

- As a long-term maintenance requirement, continue with alien clearing on and around the project footprint, focussing on invasive species such as black wattle, rooikrans, common thorn apple, prickly pear, wild tobacco, castor-oil plant, bugweed and spear thistle. These species are category 1b and 2 invaders that require compulsory control as part of an invasive species control programme. Please note that it is a legal requirement for landowners to clear alien vegetation on their land.

8. Conclusion & Recommendations

This report sets out the results from a desktop study, as well as two field surveys undertaken on 26 March and 28 August 2025, to ascertain terrestrial biodiversity and plant species constraints and possible impacts associated with the proposed upgrading of the Moordkuil Pump Station on Portions 15, 24 and 25 of Farm Klipheuvel 143, north of Klein Brak River.

The site proposed for the project lies inside transformed or degraded Albany thicket and Mossel Bay Shale Renosterveld. The latter is currently listed as Critically Endangered. The site is also partly located inside the Western Cape biodiversity network, with most of it mapped as terrestrial and aquatic critical biodiversity areas (CBA) or degraded critical biodiversity areas (CBA2). Two SCC were recorded on site, namely *Hermannia lavandulifolia* (VU) and *Freesia cf fergusoniae* (VU). Both observed occurrences can be avoided. Two protected tree species (*Sideroxylon inerme* & *Pittosporum viridiflorum*) are also present on the site.

With regards to the Screening Reports, I do not disagree with the general ratings of High for plant species and Very High for terrestrial biodiversity. However, these ratings do not always take localised disturbances (transformations) on the ground into account, such as farm roads, cleared/degraded areas or incorrectly mapped vegetation types. For example, Garden Route Granite Fynbos and Groot Brak Dune Strandveld do not occur here. One can therefore argue that the ratings should be lower for certain areas of the site. Given the transformed or degraded state of the vegetation, the impact on terrestrial biodiversity and plant species is of medium-low significance, prior to mitigation. With mitigation, this impact can be lowered further.

It is therefore recommended that the proposed project be considered for approval, but subject to the proposed mitigation measures listed above.

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Annexure 1: Threatened plant species as listed in Screening Reports (species in bold were recorded on site)

Sensitivity	Feature(s)	Probability of presence on site or surrounding area
Medium	*Polygala pubiflora*	High
Medium	Sensitive species 642	Medium
Medium	Sensitive species 18	Medium
Medium	Sensitive species 85	Low

Annexure 2: Site Ecological Importance

Site Ecological Importance (SEI) is considered to be a function of the biodiversity importance (BI) of the receptor (e.g. SCC, the vegetation community or habitat type present on site) and its resilience to impacts (receptor resilience or RR) as follows:

SEI = BI + RR

BI in turn is a function of conservation importance (CI) and the functional integrity (FI) of the receptor as follows:

BI = CI + FI

Conservation importance (CI) is evaluated in accordance with recognised established internationally principles and criteria for the determination of biodiversity-related value, including the IUCN Red List of Species, Red List of Ecosystems and key biodiversity areas. CI is defined here as: "The importance of a site for supporting biodiversity features of conservation concern present, e.g. populations of SCC (CR, EN, VU & NT), Rare species, range-restricted species, and areas of threatened ecosystem types, through mainly natural processes". Fulfilling criteria to evaluate CI do not rely on a single specific threshold for each of the above defining characteristics but can act in combination or in isolation, providing a more robust evaluation of CI (Table 1).

Table 1: Conservation importance (CI) criteria.

CI	Criteria
Very high	Confirmed or highly likely occurrence of CR, EN, VU or Extremely Rare or Critically Rare species that have a global EOO of <10 km^2. Any area of natural habitat of a CR ecosystem type or large area (>0.1% of the total ecosystem type extent) of natural habitat of EN ecosystem type.
High	Confirmed or highly likely occurrence of CR, EN and VU species that have a global EOO of >10 km^2. IUCN threatened species (CR, EN & VU) must be listed under any criterion other than A. If listed as threatened only under Criterion A, include if there are less than 10 locations or <10 000 mature individuals remaining. Small area (>0.01% but <0.1% of the total ecosystem type extent) of natural habitat of EN ecosystem type or large area (>0.1%) of natural habitat of VU ecosystem type. Presence of Rare species.
Medium	Confirmed or highly likely occurrence of populations of NT species, threatened species (CR, EN & VU) listed under Criterion A only and which have more than 10 locations or more than 10 000 mature individuals. Any area of natural habitat of threatened ecosystem type with status of VU. Presence of range-restricted species. >50% of receptor contains natural habitat with potential to support SCC.
Low	No confirmed or highly likely populations of SCC. No confirmed or highly likely populations of range-restricted species.

CI	Criteria
	<50% of receptor contains natural habitat with limited potential to support SCC.
Very low	No confirmed and highly unlikely populations of SCC. No confirmed and highly unlikely populations of range-restricted species. No natural habitat remaining.

Functional integrity (FI) of the receptor (e.g. the vegetation community or habitat type) is defined here as the receptors' current ability to maintain the structure and functions that define it, compared to its known or predicted state under ideal conditions. Ecological processes can be considered to be mostly intact and functional if the receptor area has low levels of current ecological disruptors, has good connectivity to other areas and is a relatively large area. As for CI, the fulfilling criteria to evaluate FI do not rely on a single specific threshold for each of the above defining characteristics but can act in combination or in isolation (Table 2).

Table 2: Functional integrity (FI) criteria.

FI	Criteria
Very high	Very large (>100 ha) intact area for any conservation status of ecosystem type or >5 ha for CR ecosystem types. High habitat connectivity serving as functional ecological corridors, limited road network between intact habitat patches. No or minimal current negative ecological impacts with no signs of major past disturbance (e.g. ploughing).
High	Large (>20 ha but <100 ha) intact area for any conservation status of ecosystem type or >10 ha for EN ecosystem types. Good habitat connectivity with potentially functional ecological corridors and a regularly used road network between intact habitat patches. Only minor current negative ecological impacts (e.g. few livestock utilising area) with no signs of major past disturbance (e.g. ploughing) and good rehabilitation potential.
Medium	Medium (>5 ha but <20 ha) semi-intact area for any conservation status of ecosystem type or >20 ha for VU ecosystem types. Only narrow corridors of good habitat connectivity or larger areas of poor habitat connectivity and a busy used road network between intact habitat patches. Mostly minor current negative ecological impacts with some major impacts (e.g. established population of alien and invasive flora) and a few signs of minor past disturbance. Moderate rehabilitation potential.
Low	Small (>1 ha but <5 ha) area. Almost no habitat connectivity but migrations still possible across some modified or degraded natural habitat and a very busy used road network surrounds the area. Low rehabilitation potential. Several minor and major current negative ecological impacts.
Very low	Very small (<1 ha) area. No habitat connectivity except for flora with wind-dispersed seeds. Several major current negative ecological impacts

Recalling that biodiversity importance (BI) is a function of conservation importance (CI) and the functional integrity (FI) of a receptor, BI can be derived from a simple matrix of CI and FI as follows:

Biodiversity importance		**Conservation importance**				
		Very high	High	Medium	Low	Very low
Functional integrity	Very high	Very high	Very high	High	Medium	Low
	High	Very high	High	Medium	Medium	Low
	Medium	High	Medium	Medium	Low	Very low
	Low	Medium	Medium	Low	Low	Very low
	Very low	Medium	Low	Very low	Very low	Very low

Receptor resilience (RR) is defined here as: "The intrinsic capacity of the receptor to resist major damage from disturbance and/or to recover to its original state with limited or no human intervention." The fulfilling criteria to evaluate RR are based on the estimated recovery time required to restore an appreciable portion of functionality to the receptor (Table 3) and will require justification by the specialist.

Table 3: Receptor resilience (RR) criteria.

RR	Criteria
Very high	Habitat that can recover rapidly (<5 years) to restore >75% of the original species composition and functionality of the receptor functionality, or species that have a very high likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a very high likelihood of returning to a site once the disturbance or impact has been removed.
High	Habitat that can recover relatively quickly (5-10 years) to restore >75% of the original species composition and functionality of the receptor functionality, or species that have a high likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a high likelihood of returning to a site once the disturbance or impact has been removed.
Medium	Will recover slowly (>10 years) to restore >75% of the original species composition and functionality of the receptor functionality, or species that have a moderate likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a moderate likelihood of returning to a site once the disturbance or impact has been removed.
Low	Habitat that is unlikely to be able to recover fully after a relatively long period: >15 years required to restore ~ less than 50% of the original species composition and functionality of the receptor functionality, or species that have a low likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a low likelihood of returning to a site once the disturbance or impact has been removed.
Very low	Habitat that is unable to recover from major impacts, or species that are unlikely to remain at a site even when a disturbance or impact is occurring, or species that are unlikely to return to a site once the disturbance or impact has been removed.

Finally, after the successful evaluation of both BI and RR as described above, it is possible to evaluate the **site ecological importance (SEI)** from the final matrix as follows:

Site ecological importance		Biodiversity importance				
		Very high	High	Medium	Low	Very low
Receptor resilience	Very low	Very high	Very high	High	Medium	Low
	Low	Very high	Very high	High	Medium	Very low
	Medium	Very high	High	Medium	Low	Very low
	High	High	Medium	Low	Very low	Very low
	Very high	Medium	Low	Very low	Very low	Very low

Table 4: Guidelines for interpreting SEI in the context of the proposed development activities.

SEI	Interpretation in relation to proposed development activities
Very high	Avoidance mitigation - no destructive development activities should be considered. Offset mitigation not acceptable/not possible (i.e. last remaining populations of species, last remaining good condition patches of ecosystems/unique species assemblages). Destructive impacts for species/ecosystems where persistence target remains.
High	Avoidance mitigation wherever possible. Minimisation mitigation - changes to project infrastructure design to limit the amount of habitat impacted; limited development activities of low impact acceptable. Offset mitigation may be required for high impact activities.
Medium	Minimisation and restoration mitigation - development activities of medium impact acceptable followed by appropriate restoration activities.
Low	Minimisation and restoration mitigation - development activities of medium to high impact acceptable followed by appropriate restoration activities.
Very low	Minimisation mitigation - development activities of medium to high impact acceptable and restoration activities may not be required.

Annexure 3: Impact Assessment Methodology

Each issue that is identified consists of components that on their own or in combination with each other give rise to potential impacts, either positive or negative, from the project onto the environment or from the environment onto the project. In the EIA the significance of the potential impacts is considered before and after identified mitigation is implemented, for direct, indirect, and cumulative impacts, in the short and long term.

A description of the nature of the impact, any specific legal requirements and the stage (construction/decommissioning or operation) were given. The following criteria will be used to evaluate the significance of each issue that was identified:

Nature: This is an appraisal of the type of effect the activity is likely to have on the affected environment. The description includes what is being affected and how. The nature of the impact will be classified as positive or negative, and direct or indirect.

- **Extent and location**: This indicates the spatial area that may be affected (**Table 1**).

Table 1: Geographical extent of impact

Rating	Extent	Description
1	Site	Impacted area is only at the site – the actual extent of the activity.
2	Local	Impacted area is limited to the site and its immediate surrounding area
3	Regional	Impacted area extends to the surrounding area, the immediate and the neighbouring properties.
4	Provincial	Impact considered of provincial importance
5	National	Impact considered of national importance – will affect entire country.

- **Duration**: This measures the lifetime of the impact (**Table 2**).

Table 2: Duration of Impact

Rating	Duration	Description
1	Short term	0–3 years, or length of construction period
2	Medium term	3–10 years
3	Long term	>10 years, or entire operational life of project.
4	Permanent – mitigated	Mitigation measures of natural process will reduce impact – impact will remain after operational life of project.
5	Permanent – No mitigation	No mitigation measures of natural process will reduce the impact after implementation – impact will remain after operational life of project.

- **Intensity/severity**: This is the degree to which the project affects or changes the environment; it includes a measure of the reversibility of impacts (**Table 3**).

Table 3: Intensity of Impact

Rating	Intensity	Description
1	Negligible	Change is slight, often not noticeable, natural functioning of environment not affected.
2	Low	Natural functioning of environment is minimally affected. Natural processes can be reversed to their original state.
3	Medium	Environment remarkably altered, still functions, if in modified way. Negative impacts cannot be fully reversed.
4	High	Natural functions and processes disturbed – potentially ceasing to function temporarily.
5	Very high	Natural functions and processes permanently cease, and valued, important, sensitive or vulnerable systems or communities are substantially affected. Negative impacts cannot be reversed.

- **Potential for irreplaceable loss of resources**: This is the degree to which the projectwill cause loss of resources that are irreplaceable (**Table 4**).

Table 4: Potential for irreplaceable loss of resources.

Rating	Potential for irreplaceable loss	Description
1	Low	No irreplaceable natural resources will be impacted.
3	Medium	Natural resources can be replaced, with effort.
5	High	There is no potential for replacing a particular vulnerable resource that will be impacted.

- **Probability**: This is the likelihood or the chances that the impact will occur (**Table 5**).

Table 5: Probability of Impact

Rating	Probability	Description
1	Improbable	Under normal conditions, no impacts expected.
2	Low	The probability of the impact to occur is low due to its design or historic experience.
3	Medium	There is a distinct probability of the impact occurring.
4	High	It is most likely that the impact will occur.
5	Definite	The impact will occur regardless of any prevention measures.

- **Confidence**: This is the level of knowledge or information available, the specialist had in his/her judgement (**Table 6**).

Table 6: Confidence in level of knowledge or information

Rating	Confidence	Description
	Low	Judgement based on intuition, not knowledge/information.
	Medium	Common sense and general knowledge inform decision.
	High	Scientific/proven information informs decision.

- **Consequence**: This is calculated as extent + duration + intensity + potential impact on irreplaceable resources.

- **Significance**: The significance will be rated by combining the consequence of the impact and the probability of occurrence (i.e. consequence x probability = significance). The maximum value which can be obtained is 100 significance points (**Table 7**).

Table 7: Significance of issues (based on parameters)

Rating	Significance	Description
1-14	Very low	No action required.
15-29	Low	Impacts are within the acceptable range.
30-44	Medium-low	Impacts are within the acceptable range but should be mitigated to lower significance levels wherever possible.
45-59	Medium-high	Impacts are important and require attention; mitigation is required to reduce the negative impacts to acceptable levels.
60-80	High	Impacts are of great importance, mitigation is crucial.
81-100	Very high	Impacts are unacceptable.

- **Cumulative Impacts**: This refers to the combined, incremental effects of the impact. The possible cumulative impacts will also be considered.

Appendix C: DFFE Pesticide Policy:

forestry, fisheries & the environment

Department:
Forestry, Fisheries and the Environment
REPUBLIC OF SOUTH AFRICA

ENVIRONMENTAL PROGRAMMES PESTICIDE POLICY FOR THE CONTROL OF ALIEN INVASIVE SPECIES

Originated By:		**Reviewed By:**	**Recommended By:**	**Approved By:**
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12.5 Do not mix pesticide concentrates together before adding them to the tank. Consult product labels. 29

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DOCUMENT CONTROL PAGE

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TERMINOLOGY

Abbreviations

Acronym	Meaning
AIS	Alien Invasive Species
CD: NRM	Chief Directorate: Natural Resource Management
COIDA	Compensation for Occupational Injuries and Diseases Act (COIDA) (Act 130 o9f 1993)
DDG	Deputy Director General
DFFE	Department of Forestry, Fisheries and the Environment
DG	Director General
D: N, S & WP	Director: National, Southern & Western Programmes
EDC	Endocrine disrupting chemical
EP	Environmental Programmes
EPWP	Expanded Public Works Programmes
ESRA	Environmental Social Risk Assessment
FAO	Food and Agriculture Organization
GHS	UN Global Harmonization System of Classification and Labelling of Chemicals, known as the Purple book
HA	Hectare
HHP	Highly hazardous pesticide
IPM	Integrated Pest Management
MANCO	Management Committee
NEM:BA	National Environmental Management: Biodiversity Act
NRM	Natural Resource Management
OHS	Occupational Health and Safety
PIC	Prior informed consent
POE-T	Polyethoxylated tallow amine
PPE	Personal Protective Equipment
SCM	Supply Chain Management
SDS	Safety Data Sheet
SP	Service Provider
SPCA	Society for the Prevention of Cruelty to Animals
WFW	Working for Water
WHO	World Health Organization

Terminology

Terminology	Definition
Absorption route	Includes ingestion, inhalation or absorption through the skin or mucous membranes of the pesticide
Acute toxicity	Acute toxicity refers to those adverse effects occurring following oral or dermal administration of a single dose of a substance, or multiple doses given within 24 hours, or an inhalation exposure of 4 hours.
Bioaccumulation	Bioaccumulation is the process by which toxins enter the food web by building up in individual organisms
Biological exposure index	Value for assessing biomonitoring results, intended as a reference guideline for use in the likelihood of adverse health effects. It generally represents the level of metabolites that are most likely to be observed in the specimens collected from employees exposed to pesticides with

	inhalation exposure at the occupational exposure limit or body burden threshold
Biomagnification	Biomagnification is the process by which toxins are passed from one trophic level to the next (and thereby increase in concentration) within a food web.
Biomonitoring	Biomonitoring is a tool of health-related environmental monitoring with which populations are examined for their exposure to pollutants from the environment using bioassays. A component of medical surveillance.
Biopesticide	Biopesticides are certain types of pesticides derived from such natural materials as animals, plants, bacteria, and certain minerals.
Carcinogenicity	Is any pesticide or mixtures of pesticides that induces cancer or increase the incidence of cancer as classified by GHS as either category 1 (known carcinogen) or category 2 (suspected carcinogen) and falls in hazard group 2
CAS number	Chemical identity number or name given to each pesticide which is its unique identifying number in accordance with the nomenclature systems of the International Union of Pure and Applied Chemistry
Container Management Programme	The Container Management Programme should provide for the safe, effective and responsible management of all of the empty pesticide containers from the collection to the disposal.
Developmental and reproductive toxicity	**Developmental toxicity** pertains to adverse toxic effects to the developing embryo or foetus. Chemicals cause developmental toxicity by two ways. They can act directly on cells of the embryo or foetus causing cell death or cell damage, leading to abnormal organ development. A chemical might also induce a mutation in a parent's germ cell which is transmitted to the fertilized ovum. Some mutated fertilized ova develop into abnormal embryos. **Reproductive toxicity** is defined as adverse effects of a chemical substance on sexual function and fertility in adult males and females, as well as developmental toxicity in the offspring
Ecotoxicity	Ecotoxicology is the study of toxic effects caused by natural or man-made substances on biota.
Engineering control measures	Control measures that remove or reduce exposure of persons to pesticides by means of engineering methods, a step in the Hierarchy of Control
Environmental fate	The environmental fate of pesticides depends on the physical and chemical properties of the pesticide as well as the environmental conditions. ... Once a pesticide has been released into the environment, it can be broken down by exposure to sunlight (photolysis) exposure to water (hydrolysis)
Exposed	Exposed to a highly hazardous pesticide or Hazardous chemical agent
GHS concentration limit	Minimum concentration of a pesticide, expressed as a percentage to trigger the classification that a pesticide can be classified as highly hazardous
Hazard class	The nature of a physical, health or environmental hazard under the GHS
Hazard classification	GHS hazard classes and hazard categories assigned to various pesticides
Hazard category	A division of the hazard criteria within the hazard class in the GHS where these hazard categories compare hazard severity within the hazard class, this is not a comparison of hazard categories
Hazard pictogram	Graphical composition, including a symbol plus graphical elements such as border, background pattern or colour that is intended to convey specific

	information, that is assigned in the GHS to a hazard class or hazard category
Hazard statement	A statement assigned in GHS to a hazard class or hazard category describing the nature of the hazards of the pesticides, including degree of hazard if appropriate
Hazardous chemical waste	Hazardous chemical waste is defined as a chemicals/pesticides that pose a hazard to human health or the environment when improperly managed.
Hierarchy of Control	The hierarchy of control is a system for controlling risks that pesticides pose. The hierarchy of control is a step-by-step approach to eliminating or reducing risks and it ranks risk controls from the highest level of protection and reliability through to the lowest and least reliable protection.
Highly hazardous Pesticide	HHP's are pesticides that are acknowledged to present particularly high levels of acute or chronic hazards to health or environment according to internationally accepted classification systems such as WHO or Global Harmonized System (GHS)
Integrated Pest Management	IPM is an ecosystem-based strategy that focuses on long-term prevention of pests or their damage through a combination of techniques such as biological control, habitat manipulation, modification of cultural practices, and use of resistant varieties. Pesticides are used only after monitoring indicates they are needed according to established guidelines, and treatments are made with the goal of removing only the target organism. Pest control materials are selected and applied in a manner that minimizes risks to human health, beneficial and nontarget organisms, and the environment
Medical surveillance	A planned programme or periodic examination, which may include clinical examinations, biological monitoring or medical tests of employees by an occupational health practitioner or in prescribed cases, by an occupational medicine practitioner.
monitoring	Planning, carrying out and recording results of a measurement programme
OEL	Occupational exposure limit is the limit value set by the Minister, which represents the airborne concentration of a pesticide, where the exposure standard can be, a) an eight-hour time-weighted average, b) a ceiling limit, c) a short-term exposure limit
Obsolete pesticide	Obsolete pesticides are defined by the FAO as stockpiled pesticides that can no longer be used for their original purpose or any other purpose and therefore require proper disposal.
Persistent Organic Pollutants	Persistent organic pollutants (POPs) are toxic chemicals that adversely affect human health and the environment around the world.
Pesticide Lifecyle Management	Pesticide lifecycle management encompasses a range of elements from legislation, regulation, manufacturing, application, risk reduction, monitoring, and enforcement to disposal of pesticide waste.
Precautionary principle	Essentially the precautionary principle directs that action be taken to reduce risk from pesticides in the face of uncertain but suggestive evidence of harm
Precautionary statement	A phrase prescribed by GHS that describes recommended measures that should be taken to minimise or prevent adverse effects resulting from exposure to pesticides or improper handing or storage or pesticides
Prior informed consent procedure	The Prior Informed Consent (PIC) procedure is a means of sharing information globally regarding certain chemicals and pesticides that have

	been considered hazardous to human health and/or the environment by the Conference of the Parties.
Risk assessment	A programme to determine any risk from exposure to a pesticide and the steps taken to remove, reduce control or mitigate suck risks posed by sais pesticide
Safety data sheet	SDS, a document that is aligned to the GHS providing information on hazard classification, properties of pesticides, procedures for handling and working with pesticides in a safe manner and the ecotoxicity information on pesticides and emergency information and numbers for accidental spillages
sensitizer	A pesticide that causes people to develop allergic skin reactions in normal tissue after repeated exposure, includes dermal and respiratory sensitizers
signal word	The word 'danger' or 'warning' used on GHS labels to indicate to the reader the potential hazard as well as the potential severity
Toxicity rating	The quality of being poisonous, especially the degree of virulence of a toxic microbe or of a poison.
Waste management Programme (WMP)	A WMP prescribes measures for the collection, temporary storage and safe disposal of the waste streams associated with the project and includes provisions for the recovery, re-use and recycling of waste

LIST OF RELEVANT LEGISLATION

National Water Act, 1998 (Act 36 of 1998)

National Forest Act, 1998 (Act 84 of 1998)

National Environmental Management Act, 1998 (Act 107 of 1998)

National Environmental Management Act, 1998 (Act 107 of 1998): *Regulations to domesticate the requirements of the Rotterdam Convention on the prior informed consent procedure to certain hazardous chemicals and pesticides in International Trade, 2021, published as Government Notice No. 413 of 12 May 2021*

National Environmental: Waste Act, 2014 (Act 26 of 2014)

Occupationall Health and Safety Act, 1993 (Act 85 of 1993)

Occupational Health and Safety Act, 1993 (Act 85 of 1993): *Hazardous Chemical Agent Regulations, 2021, published as Government Notice No. R280 of 29 March 2021*

Farm Feeds, Fertilizers, Agricultural Remedies and Stock remedies Act, 1947 (Act 36 of 1947)

National Aviation Act. 1962 (Act 74 of 1962)

SABS 072: (The Code of Practise for the Safe Handling of Pesticides)

SANS 10228:2010 (The Code of Practise for the Identification and Classification of Dangerous Goods for transport)

SANS 10118:2011 Edition 3.01: The Aerial Application of Pesticides.

SANS 10206:2010 The handling, storage and disposal of Pesticides.

OHSAS 45001:2016: Health and Safety Management Component (Clause 8.1)

PURPOSE:

To provide guidelines and practical advice to departmental staff and service providers on current pesticides available, international obligations and biomonitoring requirements with regards to using some pesticides that have health impacts and mitigation measures for these.

APPLICATION:

The EP Pesticide Policy will apply to all persons who use pesticides to carry out work for the Department as part of their work as an employee or Service Provider either directly or as a contractor or subcontractor.

INTRODUCTION:

The EP Pesticide Policy complies with all international conventions on pesticide management such as the Stockholm convention[1], Rotterdam convention[2], Basel convention[3] and Bamako[4] convention.

The Stockholm convention deals with persistent organic pollutants such as the dirty dozen that have been banned internationally due to their impacts on human health and these have all been removed from the EP pesticide policy as the EP pesticide policy follows the precautionary principle of the Hierarchy of Control in the Code of Conduct of Pesticide Management[5] which eliminates and substitutes all highly hazardous pesticides (HHP's) as the first stage of mitigation for protection of human health and the environment.

The Rotterdam convention deals with Prior Informed Consent (PIC) pesticides through Annexure III where all pesticides listed under Annexure III have been banned thus their import into the receiving country has to be approved by the receiving country and be reported to the Rotterdam secretariat and all conditions regarding their import needs to be met. Paraquat has currently been listed under Annexure III and thus removed from the EP policy due to the Precautionary Principle adopted.

The Basel Convention deals with trans boundary movement of hazardous chemical wastes, disposal of empty pesticide containers, obsolete pesticide disposal and pesticide container management.

The Bamako Convention is specific to Africa and is related to the Basel Convention regarding all the categories listed above and includes the banning of pesticides being imported into Africa that are close to their expiry date making Africa a dumping ground for near expired pesticides. Both of these conventions are critical for implementation in the EP Pesticides Policy for implementation of the container management programme for empty pesticide containers.

The EP Pesticide Policy aims to implement pesticide lifecycle management by implementing all the stages the pesticide might pass through from when the pesticide is procured to its degradation in the environment after use, or its destruction as an unused or obsolete product. For the purposes or this

policy, the life cycle includes procurement, distribution, storage, transport, use and final disposal or the pesticide product and/or its container[5].

The Service Provider is responsible for the procuring pesticides and may make use of the RT12 (Transversal Contract by national Treasury) to procure pesticides as the same price as government, providing that National Treasury approval is in place and that the pesticides are only used for this Project. The Service Provider is required to Comply to the Departments EP Pesticide Policy. The Department shall, whenever requested by the Service Provider, facilitate the process of obtaining approval from National Treasury for the Service Provider to use RT12 (Transversal Contract by National Treasury) to procure pesticides at the same price as government. The Service Provider will not only be responsible for procuring pesticides but also to implement, manage, store, handle, transport and dispose of the empty pesticide containers and obsolete pesticides in line with the EP Pesticide Policy implementing responsible container management programmes and adopting responsible pesticide lifecycle management.

OBJECTIVES FOR THE USE OF PESTICIDES FOR INVASIVE ALIEN SPECIES CONTROL

1. To implement a long-term strategy for the initial and long-term control of invasive alien species.
2. To ensure the safety of operators involved in the control operations and public in the operational area in compliance with the EP biomonitoring protocols[6]for pesticides in hazard groups 1-6 and 9 & 10 (Annexure 1), Regulations for Hazardous Chemicals Agents[7] and Guidelines for Personal Protection when handling and Applying Pesticides[8].
3. To ensure that there is minimal environmental impact in the short-term and that there are no long-term adverse effects on the environment resulting from the application of pesticides, to humans and the environment, environmental risk assessments are required for pesticides in hazard groups 7 and 8[6] (Annexure 1).
4. To ensure that the application takes place in the most cost effective way within objectives 2 and 3, taking the recommendations into account as listed in the **WFW Species and Pesticide list** spreadsheet that accompanies this policy.
5. To attain these objectives DFFE EP management shall be responsible for:
   5.1 Determining areas and species to be controlled and setting priorities.
   5.2 Deciding upon appropriate methods of pesticide and biopesticide control.
   5.3 Drawing up short and long-term control programmes.
   5.4 Selection of suitable pesticides and biopesticides.
6. Establishing training requirements for EP personnel and contractors and ensuring that the training takes place
7. Costing control programmes.
8. Sourcing suitable pesticide and biopesticide equipment suppliers and obtaining product and equipment at the best prices. Ensuring compliance to government transversal contracts, such as RT 12.
9. Ensuring that pesticide applications take place within all relevant legislation, including international legislation and conventions.
10. Ensuring proper medicals, biomonitoring and medical surveillance is done on all pesticide operators and staff exposed to pesticides in compliance to legislative requirements[6,7,9].

METHODS OF CONTROL

A. Invasive Alien Plants

1. Selection of appropriate methods of control shall be based on the following criteria:
    - Species to be controlled
    - Size of target plants
    - Density of stand
    - Accessibility of terrain
    - Environmental safety
    - Disposal of dead vegetation

1.1 Species to be controlled.

1.1.1 Pesticides selected for control shall be registered for use on that species under the conditions specified under Act 36, the label and minor use registrations.

1.1.2 Selection should be based on the WfW species and pesticide spreadsheet, Croplife suggestions, minor use registrations, labels and information brochures issued by suppliers.

1.2 Size of plants.

The following methods of control are appropriate for age or size target plants:

1.2.1 Seedlings.

1.2.1.1 *Hand pulling or hoeing*. Hand pulling should be carried out in sparse stands under conditions where seedlings are easily removed from the soil. Operators should be supplied with suitable gloves or other hand protection[6]. Hoeing is also most suited to sparse stands. Seedlings should be severed below the soil surface or removed from the soil. Soil disturbance should be minimized to reduce re-germination.

1.2.1.2 *Foliar applications of pesticides/ biopesticides* can be carried out in dense stands or open stands. For dense stands suitable fan nozzles for overall application should be fitted. Sprayers should be fitted with pressure or flow regulators. In stands where individual plants are treated solid cone nozzles should be fitted. This is the same for biopesticide applications, except the carrier is a medium grade mineral oil such as canola oil.

1.2.2 Saplings.

1.2.2.1 *Hand pulling, hoeing or brashing*. Where appropriate hand pulling or hoeing should be carried out as recommended for seedlings. Brashing is recommended for Eucalyptus species seedlings. Brashing is done using a hand saw or hatchet. The programme does not currently use this method.

1.2.2.2 *Foliar sprays*. Overall application or individual plant spraying can be carried out, depending on the density of the stand. Fan nozzles should be fitted for overall spraying and solid cone nozzles for individual plant treatment. Pressure or flow regulators should be fitted to sprayers for overall application Spraying should be restricted to plants waist height or lower, but ensure there is sufficient foliage to carry the applied pesticide to the root system. Foliar applications should not be done with volatizing pesticides due to human health inhalation risk being too high to mitigate[9], alternative methods should be implemented here.

1.2.2.3 *Basal stem treatments*. Applications using pesticides registered for this method that DO NOT use diesel as a carrier are allowed (such as Turbador). No diesel applications allowed due to environmental risks. Stems with a diameter up to 50 mm should be treated to a height of 250 mm and stems above 50mm diameters to a height of 500 mm. This method is only suitable for stems up to 100 mm in diameter with smooth live bark. Application is by means of a low pressure coarse droplet spray from a narrow angle, solid cone nozzle.

1.2.2.4 *Cut stump treatments*. Stems should be cut as low as practical as stipulated on the label and in the EP best practices guidelines. Pesticides are applied in water as recommended for the pesticide. No diesel applications are allowed. The gel applications need to be painted on the whole cut surface and should be 10mm in thickness. Biopesticides can be applied using the same method as for pesticides, but in canola oil as the carrier.

1.2.2.5 *Mature trees*. These should be regarded as trees above shoulder height or robust bushes 12-18 months or older.

1.2.2.6.1 *Strip barking*. Bark must be removed from approximately waist height to the bottom of the stem. All bark must be removed to below ground level for good results. Where clean de-barking is not possible due to crevices in the stem or where exposed roots are present, a combination of bark removal and basal stem treatments should be carried out. Handsaws (such as silky zubats) or hatchets (silky nata hatchets) should be used for de-barking.

1.2.2.6.2 *Ring barking*. A band of bark is removed around the stem, 10cm wide and situated as close to the ground as possible. Ensure all bark, phloem and cambium tissue is removed within the band.

1.2.2.6.3 *Frilling or partial frilling*. Cuts should be made through the bark into the sapwood by means of a bush knife or light axe and a suitable pesticide applied into the cuts. In a full frill the cuts join or overlap along the circumference of the stem. This is the standard method for most species to be frilled. A partial frill has cuts spaced along the stem circumference and is only used where a pesticide is very effective on a particular species.

1.2.2.6.4 *Stem injection*. Pesticide solutions are applied directly into pre-mad

holes in the stem and cladodes of certain cactus species using a sheep dose applicator. This application method is only used on rare occasions when biocontrol is not available for the species as biocontrol is the preferred method.

1.2.2.11 *Soil application*. Pesticide granules are applied directly to the soil under the trees in the dosage rates stipulated on the label. This method is mostly used for bush encroachers. Care must be taken when applying and the application must be timed with the rainfall. Risk assessments must be done for all soil applications as all the soil application pesticides fall within hazard criterion 7 and 8 (Annexure 1).

1.3 Density of stands.

1.3.1 Overall applications can be made to dense stands of seedlings or saplings. Where other desirable vegetation is present (e.g. grass cover), selective pesticides that will not damage the grass or other desirable vegetation cover should be applied. Fan nozzles and pressure regulators should be fitted to sprayers. The non-target species kill rate and acceptable non target criteria must be agreed to prior to application. Aerial applications with biopesticides can also be used. Risk assessments must be done to determine the acceptable non target criteria.

1.3.2 Where dense stands of big trees, resulting in a large bio-mass, treatment of standing trees may be appropriate to obviate the problem of disposing of felled trees. Where there is a danger of dead trees falling into water courses they should be cut down and removed and the stumps treated with a suitable pesticide. Risk assessments must be done if there is a risk to riparian areas and a rehabilitation plan be put into place to mitigate these risks.

1.4 Accessibility of terrain.

1.4.1 In inaccessible areas such as mountainous areas or where no access roads exist, methods of control where a minimum amount of transportation of equipment and pesticide is involved should be given preference. Appropriate gel applied pesticides should be considered or nomix products.

1.5 Environmental considerations.

1.5.1 Protection of the environment is of prime importance. Riparian areas, where most alien vegetation infestations occur, require a particularly careful approach. Only pesticides that are approved for use in riparian areas should be used. Only aquatic safe products that are polyethoxylated tallow amine free can be used in riparian and aquatic systems. Consult the technical manager for these products. Washing of equipment or disposal of waste spray mixture or washings is prohibited in or near water courses where contamination of water can occur, including aquifer or ground water contamination[5-9].

1.6 Desirable vegetation.

1.6.1 Where desirable vegetation is present, e.g. grass cover in pastures or the margins of forests, methods of control must be selected that will cause minimum damage to the desirable vegetation. Alternative methods to foliar spraying should be adopted where there is a danger of damage to adjacent desirable plants occurring. The non-target species kill rate must also be determined prior to the control after a risk assessment (ESRA) is done.

1.7 Disposal of vegetation.

1.7.1 Where possible utilizable wood should be removed after felling from properly stacked and piled wood sources. Brush piles in certain environmental conditions is not ideal, and in these situations, the brush/cut biomass should be removed or spread out over the entire area to minimise the risks.

1.7.2 Brushwood is often burned on purpose or accidentally. If burning is planned, brushwood should be spread out rather than stacked to limit soil damage as intense fires result in stacked brushwood destroying soil structure and preventing grass establishment for many years.

1.7.3 If there is a danger of damaging fires, unusable trees should be left standing as this will result in a less intense fire. This can only be done for wood in landscape areas.

1.7.4 Felled trees or trees in danger of falling in water courses should be removed so that they do not cause blockages with resulting problems of flooding and damage to infrastructure such as roads and fences. The felled trees should not be stacked within 20m of the riverbank/shore to comply with the National Water Act.

B. Non Plant Invasives

1. Selection of appropriate methods of control shall be based on the following criteria:
   - Priority species
   - Availability of best practise
   - Availability of registered pesticides
   - Integrated Pest Management Practices

1.1 Priority species

1.1.1 Priority species will be guided by the National Environmental Management: Biodiversity Act, 10 of 2004, Alien and Invasive Species Lists, 2016.

1.1.2 Priority species will be divided into categories as listed in the AIS lists as follows;

1.1.2.1 List 1: National list of Invasive Terrestrial and Freshwater Plant Species

1.1.2.2 List 2: National list of Invasive Marine Plant Species

1.1.2.3 List 3: National list of Invasive Mammal Species
1.1.2.4 List 4: National list of Invasive Bird Species
1.1.2.5 List 5: national list of Invasive Reptile Species
1.1.2.6 List 6: National list of Invasive Amphibian Species
1.1.2.7 List 7: National list of Invasive Freshwater Fish species
1.1.2.8 List 8: National list of Invasive Terrestrial Invertebrate Species
1.1.2.9 List 9: National list of Invasive Freshwater Invertebrate Species
1.1.2.10 List 10: National list of Invasive Marine Invertebrate Species
1.1.2.11 List 11: National list of Invasive Microbial Species

1.1.3 At least one species should be selected for control from each list based on their priority within their list and their risk to human health and the environment

1.1.4 Pesticides selected for control of priority species must be registered for use on the selected species under Act 36 of 1947.

1.1.5 Selection should be based on the WfW species and pesticide spreadsheet, Croplife suggestions, minor use registrations, labels and information brochures issued by suppliers.

1.2 Availability of best practise

1.2.1 Best practice methods contains integrated methods with a portion of pesticides in some form, whether by spraying, baiting or treatment of waterbodies with piscicides. Strict guidelines need to be adhered to when implementing these.

1.3 Availability of registered pesticides

1.3.1 Registered pesticides for non-plant programmes are not readily available in South Africa.

1.3.2 There are a variety of rodenticides registered for mice control with varying effectiveness but huge impacts on non-target organisms such as birds as brodifacoum, coumatetralyl and difenacoum are secondary poisoners and anti-coagulants but cholecalciferol is not and should be the preferable product (see WFW species and pesticide spreadsheet).

1.3.3 Avicides are generally used in the form of baiting and there is currently only one avicide registered as a restricted use pesticides for the use on house crows and is held by the City of Cape Town. The health impacts of this avicide is concerning and relates to the operators and the utmost care needs to be taken when applying the bait, thus the EP biomonitoring protocols need to be strictly adhered to[6], as well and the PPE guidelines[14].

1.3.4 Piscicides are generally applied as solutions to waterbodies to control invasive alien fish and once the invasive alien fish have been removed from the system, a solution of potassium permanganate is released into the system to render the piscicide inert. There is currently only one piscicide registered under an emergency registration in South Africa as a restricted use pesticide for the control of invasive alien fish.

1.4 Integrated Pest Management (IPM) Practises

1.4.1 (IPM) in relation to non-plant invasives relates to a combination of control methods utilised to combat these species to reduce the amount of pesticides needed for their management and/or control

1.4.2 Mammals are generally controlled using a combination of trapping and shooting as pesticides are considered inhumane by organizations such as the SPCA

1.4.3 Birds are generally controlled with a combination of trapping using a Judas bird, baiting with pesticide laced bait, and nest destruction and egg removal from nests.

1.4.4 Invertebrates such as invasive wasps are controlled by fumigating their nests

1.4.5 Amphibians are caught and humanely exterminated.

LONG TERM CONTROL PROGRAMMES

2.1 In areas where after initial control of alien vegetation has taken place and regrowth of the species and/or other undesirable vegetation will occur, the programme should be so structured that a minimum of regrowth will occur and a follow-up programme will be actioned. The following must be taken into consideration:

2.1.1 *Species coppicing*. Many species coppice from cut stumps and/or roots. Cut stumps must be thoroughly treated within 15 minutes of cutting according to label recommendations to minimise regrowth. Root coppice from species such as grey poplar (*Populus canescens)* and silver wattle (*Acacia dealbata)* occurs rapidly and control measures must be undertaken before plants become too large to be controlled with foliar sprays. Coppicing stumps should be treated before coppice reaches head height. Biopesticides should also be considered where practical and available.

2.1.2 *Seedling control*. Germination of Acacia species takes place rapidly after a fire and control measures must be put in place as soon as possible to minimise the quantity of pesticide used and the cost of application. Selective pesticides should be used where there is a danger of damage to grass present. Biopesticides should also be considered.

2.1.3 *Burning*. Burning should be considered part of the control programme to get rid of unwanted brushwood or to stimulate even growth of seedlings so that follow-up control measures are easier.

2.1.4 *Rehabilitation*. Where the danger of erosion exists or where the re-establishment of pastures is desired after clearing, rehabilitation of the area with grasses or other suitable plants should be carried out. The advice of pasture / rehabilitation / ecology experts should be sought in planning this operation. Other erosion control measures such as the building of weirs should be undertaken where necessary.

2.1.5 *Monitoring*. Monitoring of control and/or eradication programmes should be done to ensure extirpation of the invasive alien species from the area/catchment

and reported to DFFE Biosecurity unit for compliance with the NEM:BA AIS regulations promulgated in 2014.

2.1.6 *Data reporting*. All data should be reported to DFFE National Office and kept on file to comply with reporting requirements.

SELECTION OF PESTICIDES

3.1 Pesticides are selected in accordance with the "WfW species and pesticide spreadsheet" by the Technical unit. The selection of pesticides should be based on the following criteria and any deviation from this point must be approved by the management committee (MANCO). Consult the NRM Technical Advisor.

3.1.1 *State Tender*. Most of the pesticides are found on The State Tender Contract – RT 12. These pesticides must be purchased in accordance with the correct procurement procedures as laid down by the department and National Treasury. The status of the State Tender Contract changes from time to time and it is therefore imperative that the latest version is used. For the latest version please contact your Regional DFFE:NRM Office.

3.1.2 *Efficacy*. Where alternative products are available for the same purpose, advice should be sought on the efficacy of these products under the prevailing application conditions. Biopesticides should be the priority as the environmental impacts are limited after biocontrol.

3.1.3 *Cost*. Where different methods of application exist the cost of application and retreatment, in addition to the cost of the product shall be taken into consideration in deciding on which pesticide to apply. The non-target effects and toxicity to human health and the environment should also be taken into account when deciding on a product. The ecotoxicity and environmental fate for all the pesticides is available in the species and pesticide spreadsheet. Biopesticides should be considered, but biocontrol is the priority if available for the species under investigation.

3.2 Operator safety.

3.2.1 All measures must be taken to ensure the safety of the operators[6,8] and where choices exist preference should be given to the safest product. Check the label colour band.

3.2.2 The following table gives the toxicity rating according to the label colour band according to the WHO Recommended Classification of Pesticides by Hazard[10]:

BLUE	**SLIGHTLY HAZARDOUS - CAUTION**
YELLOW	**MODERATELY HAZARDOUS - HARMFUL**
RED	**TOXIC TO VERY TOXIC**

The new GHS labelling guidelines indicate that the labels will not have colour bands anymore but will have 6 compulsory label elements as follows[9]:

1. *Signal word*
   Indicates relative level of hazard. ''Danger'' is used for most severe instances while ''Warning'' is less severe.
2. *Symbols* (hazard pictograms)
   Convey health, physical and environmental hazard information with red diamond pictograms. May use a combination of one to five symbols.
3. *Product name or identifiers*
   Identifies the chemical or substance. Should match the product name or identifier used on the SDS.
4. *Hazard statements*
   Phrases that describe the nature of the hazardous products and often the degree of the hazard.
5. *Precautionary statements*
   Phrases associated with each hazard statement that describe general preventative, response, storage or disposal precautions.
6. *Manufacturer Information*
   Company name, address & telephone number

An example of a new GHS pesticide label with the 6 compulsory label elements.

3.2.3 Label recommendations regarding safety must be strictly observed in line with legislation[6-10].

3.3 Environmental safety.

3.3.1 Pesticides that have the least impact on the environment shall be used where no effective biopesticides or biocontrol is available.

3.3.2 Every precaution shall be taken to ensure that these products are safely stored, handled and applied.

3.4 Availability.

3.4.1 Products should be readily available from suppliers in the areas of use to limit quantities stored in line with legislative requirements[3,4].

TRAINING

All contractors (or one of their employees) who apply pesticide for gain in the EP Programme must attend and pass the approved WfW Limited Pest Control Certified Pesticide Course or its equivalent.
All Project Managers, in order to effectively manage the pesticide operations in their projects, must attend and pass the approved Pest Control Operators Course or its equivalent.
Operating teams shall be trained in the following aspects of pesticide use. Teams must receive training before commencing operations. Training shall be appropriate for the situations where teams will operate and specialized training or teams operating under specialized conditions, e.g. indigenous forests or soil applied pesticides, may be necessary.

4.1 Supervisors. Team supervisors shall receive training in the following:

4.1.1 Pesticide awareness. Basic training on the mode of action of pesticides, safety and human health impacts.

4.1.2 Operator safety. Handling of concentrates and spray mixtures, personal hygiene and protective clothing.

4.1.3 Safe storage of product at depots and operational sites and spray mixtures at operational sites in line with the international conventions and Waste Management Programme[11].

4.1.4 Mixing. Handling of concentrates and mixing techniques and safety procedures.

4.1.5 Safety procedures to be observed during transportation of product, spray mixtures, equipment and personnel in line with legislative requirements[3,4].

4.1.6 Care and maintenance of application equipment, saws etc.

4.1.7 Record keeping in respect of quantities of product/spray mixtures used, area treated, person hours per area/operation, stock control.

4.1.8 Planning. Advanced planning for follow-up operations, transportation, equipment and spares requirements, product procurement and availability. Team management.

4.1.9 First aid. Actions to be taken in case of accidental contamination, suspected and actual poisoning, chronic poisoning, eye contamination and other physical injuries.

4.1.10 Health of operators. Persons unsuitable for use as application operators, e.g. chronically ill, persons with disabilities, pregnant women .Allergic reactions. Wearing of protective apparel. Hygiene[5-9].

4.1.11 Disposal of general waste.

4.1.12 Disposal of pesticide waste, triple rinsing procedures and management of pesticide spillage according to best management practise and Waste Management Programme[3,4,11].

4.1.12 Managing major and minor spills, accident sites.

4.1.13 Calibrating application equipment.

4.1.14 Environmental safety.

4.1.15 Application techniques. Correct application to obtain most cost effective results.

4.1.16 Suitable and unsuitable application conditions.

4.2 Operators. Operators should receive training in the following:

4.2.1 Pesticide awareness - the purpose and functioning of pesticides and the need for correct application.

4.2.2 Pesticide applicator – ensure knowledge of pesticides and human health impacts and environmental impacts.

4.2.3 Safe handling of concentrates and spray mixtures, toxicity of pesticides, protective clothing, safe application, personal hygiene and disposal of waste in line with legislative requirements[6-10].

4.2.4 Application techniques. Correct, thorough application. Preventing waste.

4.2.5 Care of equipment. Cleaning and disposal of washings.

4.4.6 Cleaning of empty containers. Triple rinse procedure and proper disposal of empty containers[3,4,11].

COSTING OPERATIONS OR PROGRAMMES

5.1 Prior to the commencement of any control operations or programmes an assessment shall be made on the cost, based on the following:

5.1.1 Cost of pesticides and co-formulants.

5.1.2 Quantity, to be based on:

5.1.1.1 Method of application

5.1.1.2 Size and density of target plants.

5.1.1.3 Size and density of the non-plant infestation

5.1.1.3 Dilution rates

5.1.3 Adjuvant/surfactants required.

5.1.4 Personnel costs. Number of person hours per area/operation.

5.1.5 Cost of equipment, spares and maintenance.

5.1.6 Cost of transportation, storage and other incidental costs.

5.2 Follow-up treatments such as seedling and/or coppice control must be similarly costed and built into the total cost of the control operation.

5.3 The cost of the biomonitoring and medical surveillance of spray operators and workers should be built into the overall cost of the control operation.

PROVISION OF EQUIPMENT

6.1 Application equipment shall be standardised and obtained from approved suppliers.

6.2 Use of the following brand of knapsacks has been approved. CP 3, CP 15, Matabi, Solo, AgrimexA18, Osatu. (On placing an order for knapsacks, ensure the quote includes the approved nozzles and pressure regulator or constant flow valves, and a replacement set.)

6.2.1 Where appropriate sprayers must be fitted with pressure regulators or flow regulators.

6.2.2 Spares must be readily available and spares such as nozzles, plumbers tape, nuts, screws, hose and washers must be carried with teams. Suppliers must be consulted on spares requirements.

6.2.3 The following nozzles or their equivalents shall be used as standard: TG-1, FL-5VS and TF-VS2 or their equivalents.

6.3 The teams should have the necessary tools, e.g. spanners, screwdrivers, pliers, to carry out necessary maintenance and repairs in the field.

6.4 Malfunctioning nozzles should be replaced in the field and no attempt should be made to clean them. Cleaning should be done at the workshop/store using preferably compressed air and water.

6.5 Small hand held sprayers should be standardised on to Polispray or equivalent and Hack-pack applicators.

6.6 Suitable plastic measuring cylinders, beakers and mixing containers must be available and only used for pesticide mixing.

6.7 Containers must always be provided for clean water for personal use.

STORAGE, HANDLING AND TRANSPORTATION

7.1 Storage.

All storage facilities shall comply with the requirements of Croplife South Africa[11], Regulations for Hazardous Chemical Agents 2021[7], Occupational Health and Safety Act 85 of 1993, FAO Pesticide Storage and Stock Control Manual[12] and the FAO Guidelines for retail distribution of Pesticides with particular Reference to Storage and Handling at the Point of Supply to Users in Developing Countries[13]. These can be summarised as follows:

7.2 Isolation.

Where possible, a store should preferably be a separate building and should not be sited near a dwelling house, hospitals, schools, shops, food markets, livestock buildings or where fodder, fuel or other flammable materials are stored[12]. A minimum of five meters between the store and the other buildings is recommended. If part of a complex, the store must be totally sealed off from the rest of the complex, i.e. no free movement of air between the storage area and the rest of the complex. **The store should be far away from watercourses, wells and other supplies of water for domestic and stock animal use that could be contaminated by spillages or leaks from the store[12,13]. The site should not be in an area with high groundwater levels which may be subject to seasonal flooding nor adjacent to areas subject to seasonal flooding.**

7.3 Accessibility.

When planning a store bear in mind the ease of access for delivery or dispatch. Also consider the possibility of a fire and the need to be able to approach the building from all sides. There should be easy access for pesticide delivery vehicles. There should be access on at least three sides of the building for fire-fighting vehicles and equipment in an event of an emergency.

7.4 Construction.

7.4.1 Floor.

Earth, timber, bitumen, PVC or linoleum, coarse unscreened or disintegrating concrete is not acceptable. The floor should be made of impervious material or of slats over a concrete-lined sump into which chemical spills can drain to be neutralised. The floor area should be slightly raised at the edges to prevent spills from leaking out of the building and flood water from getting in[12]. Another option is smooth screeded concrete, however sealed, steel container floors are also acceptable. The doorway should be bunded to a minimum height of 200 mm and this, as well as all wall to floor joints, should be made watertight. The purpose of the bund is to contain spills or fire water which could cause damage to the environment and prevent water (e.g. flood run-off) entering the store.

7.4.2 Walls.

Walls should preferably be brick or concrete block with airbricks or vents 200 mm from the floor and near or at roof level. Containers are acceptable if there is adequate ventilation 200 mm from floor level and near roof level. The container should where possible be placed in a shaded area. If this is not possible ensure good permanent ventilation. The store walls should have outside sills that drain spilled chemicals into a sump. Internal walls should be smooth and free from cracks and ledges to allow for easy cleaning[12]. There should be walls between sections to act as fire breaks.

7.4.3 Roof.

The roof should be constructed of a light material, possibly glass fibre or asbestos substitute which collapses in an event of a fore to allow smoke and fumes to get out and avoid explosions. The material should be firm however so that it is not blown away during severe wind or storms. The roof should be leak-free and have some form of insulation to maintain temperatures at a reasonable level. Vent in the roof will allow for the escape of hot air during the summer months.

7.4.4 Doors.

Steel doors with an effective locking system are preferred. A wooden door should have a security gate to reduce the risk of forced entry. Containers with fitted security gates can be left open to cool the contents during the heat of the day .Only authorized personnel should have access to keys and be allowed in the store. There should be an emergency exit in addition to the entry and exit doors, preferably at the other end of the store.

7.4.5 Windows.

It is important to note that windows should not be built into a store it there are alternative means of ventilation and lighting; otherwise they should be shaded (or

prevent sunlight from heating the pesticides causing them to degrade and/or volatise) and barred or burglar bars installed to prevent unauthorised entry[12].

7.4.6 Lighting.

There should be sufficient lighting (200 lux) to allow for reading of product labels. If electric lighting is required it must be secure in order to reduce fire risk. Electric fittings should be mineral insulated or armoured cable should be used with flame/dust-proof fittings[12]. The mains control should be outside the store itself.

7.4.7 Sanitation.

Staff should have immediate access to washing facilities with running water, soap and towels. They should be encouraged to use it frequently. An eye wash bottle or similar object must be available at all times for the flushing of contamination from the eyes should it occur. A shower facility is recommended.

7.4.8 *Ventilation*

Ventilation if one of the most important requirements within the store as it prevents the build-up of vapours. Toxic vapours may affect the health of the store workers and flammable vapours are a fire risk. Ventilation also keeps the store as cool as possible. This is important as pesticides deteriorate more slowly and therefore last longer in a cooler environment. Many pesticides are destabilised by high temperatures, which in exceptional cases may even case explosions. The ventilation area should be equivalent to 1/150 of the floor area, or outside doors should be open for at least six hours per week. Exhaust fans should be fitted to large stores, preferably on a time-delay switch. Roof- and floor-level ventilation is required to extract light fumes, hot air and heavy vapours[12].

7.5 Equipment.

7.5.1 Equip the room with a table of suitable strength and height to facilitate reading of labels, decanting and measuring out of Pesticides.

7.5.2 Measuring jugs, funnels, pumps and buckets must be kept on hand and kept specifically for the purpose of measuring out Pesticides. Do not use household items for this purpose.

7.5.3 For the sake of good housekeeping, have on hand a broom, spade and a supply of dry fine soil as absorbent material to contain and absorb spills (spill kit). This is available in “kit form” from a number of suppliers.

7.6 Handling.

7.6.1 The handling of pesticides concentrates requires strict precautions and personnel handling product concentrates must be fully aware of precautions to be observed.

7.6.2 Suitable protective clothing must be available and use thereof is compulsory.

7.6.2.1 Chemical resistant plastic aprons, butile rubber gloves or chemical resistant nitrile gloves and eye protection and half-face respirator must be worn when handling concentrates[6,8,14].

7.6.3 Adequate hygiene aids such as plentiful water, soap, towels and eye wash must be readily available.

7.6.4 Suitable absorbent material such as fine dry soil and cleaning equipment must be available to handle accidental spillage, including hazardous materials spill kits[12,13].

7.6.5 In the case of spillage, the spill must be contained immediately and cleaned up with absorbent material such as fine dry soil and the relevant spill kit. The contaminated material should then be disposed of according to the guidelines[7,12,13].

7.6.6 Concentrates should if possible be decanted in a safe, suitable place and not in the field. Such a handling and mixing area should have a hard impermeable floor, be bunded and have an adequate sump to accommodate run-off from washing, flooding or fire containment. A $1m^3$sump /$10m^2$floor space is recommended.

7.6.7 Concentrates and mixtures should never be decanted into or be mixed in drinking bottles or other food containers.

7.6.8 Suitable equipment must be available to prepare spray mixtures. These include plastic measuring cylinders and beakers, mixing containers (buckets) and funnels.

7.7 <u>In the field the following must be observed:</u>

7.7.1 If concentrates must be handled in the field, observe the precautions listed under 7.6.1, 7.6.2, 7.6.3, 7.6.4, 7.6.5, 7.6.6, 7.6.7 and 7.6.8

7.7.2 Spray mixtures must be kept in leak-proof, non-spill containers. The containers should be kept away from personal belongings, foodstuff, drinking water and eating and living areas.

7.7.3 Containers should stand on suitable absorbent material, for example, a large piece of thick hessian sack, which will absorb minor drips, out of direct sunlight in a cool place.

7.7.4 Containers must be kept at least 20m away from water bodies to prevent possible contamination.

7.7.5 Filling sites should be selected to prevent damage to desirable vegetation and to enable spillage to be cleaned up and disposed of.

7.7.6 Spray mixture containers must be clearly labelled and only reused for the specific pesticide.

7.7.7 Application equipment and containers should not be cleaned on site but at a suitable designated area at the store.

7.7.8 Suitable protective clothing, overalls, rubber boots, gloves and eye protection must be worn by operators when handling and applying Pesticides[6,8,14].

7.8 <u>Transportation</u>[5,7].

7.8.1 Pesticides and application equipment must be carried on a separate vehicle or in a part of the vehicle isolated from people, food and clothing.

7.8.2 Vehicles should carry absorbent material to absorb any spillage.

7.8.3 Pesticides and equipment must be secured to prevent spillage and damage.

7.8.4 Pesticides, spray mixtures and equipment must not be left unattended where there is a danger of theft or abuse.

7.8.5 Pesticides should not be left uncovered in the sun but in shaded areas and covered.

7.9 <u>Disposal</u>[11,12,13,15].

7.9.1 A designated officer should be responsible to ensure that pesticide containers are correctly and safely disposed of, according to Croplife guidelines.

7.9.2 Empty containers must be triple rinsed and disposed of after use and not be used for any other purpose. Under no circumstances may containers be taken home for personal use.

7.9.3 Empty containers should be returned to the store for safe keeping and disposal under the Waste Management Programme.

7.9.4 Where arrangements have been made containers should be returned to the supplier.

7.9.5 Containers that have to be destroyed should be triple rinsed, punctured and flattened. See attached pamphlets for details of triple rinsing and details of accredited suppliers in the Waste Management Programme for collection of empty containers.

7.9.5 Only sufficient spray mixture that can be used in a day should be prepared. Left- over material should be returned to the depot for safe storage and re-use in the spray mixture the following day.

7.9.6 Certain spray mixtures should not be left standing overnight and should be safely disposed of. Consult the product label. If mixtures can be left overnight with no adverse effects, they should be kept to reduce costs and pollution from pesticide and wash water.

PUBLIC SAFETY

8.1 Due regard must be paid at all times to the health and safety of the public.

8.2 Public should be kept out of operational areas where any hazards exist. Warning notices should be displayed to this effect where necessary.

8.3 Pesticides must only be applied strictly according to label recommendations.

8.4 Product and spray mixtures should be stored so that they are inaccessible to the public.

8.5 Treatment of areas within 50 m of habitations, schools, hospitals and public areas (e.g. parks) should be avoided or only carried out in consultation with the parties effected.

8.6 Public should be informed of control operations in their area by means of verbal communication, notices, pamphlets, the press etc prior to the commencement of spray operations.

ENVIRONMENTAL SAFETY

Most alien vegetation control operations are carried out in riparian situations which are regarded as environmentally sensitive. Non-plant control operations need to follow the same instructions in order to minimize the impact of the operation on the natural environment the following must be observed.

9.1 Area contamination must be minimised by careful accurate application with a minimum amount of pesticide to achieve good control.

9.2 All care must be taken to prevent contamination of any water bodies. This includes due care in storage, application, cleaning equipment and disposal of containers, product and spray mixtures.

9.3 Equipment should be washed where there is no danger of contaminating water sources and washings used in the next spray mix.

9.4 To avoid damage to indigenous or other desirable vegetation product should be selected that will have the least effect on non-target vegetation.

9.4.1 Coarse droplet nozzles should be fitted to avoid drift onto neighbouring vegetation, e.g. TG-1 or equivalent.

9.5 Only polyethoxylated tallow amine free, or aquatic safe herbicide formulations should be used in the riparian and aquatic environments so as to limit the impact on aquatic invertebrates.

APPLICATION

10.1 Equipment.

Only application equipment and accessories specified (see PROVISION OF EQUIPMENT) shall be used by operating teams.

10.1.1 Equipment shall be inspected regularly between and during applications and necessary repairs carried out[12].

10.1.2 Leaking sprayers or sprayers not applying correctly should be withdrawn until repairs have been carried out. Spare applicators and parts should always be available so as not to impede operations[12,13].

10.1.3 Ensure that correct nozzles are fitted and pressure settings are checked regularly.

10.1.4 Where possible use low water volumes to keep turn around (refilling) time down to a minimum. Caution must be observed to limit drift when using minimum output nozzles[12].

10.1.5 Always ensure that knapsacks are filled to 70% capacity. In aquatic programmes, never fill the knapsacks more than 50% to increase buoyancy of the sprayer in aquatic environments.

10.1.6 Equipment must be emptied and cleaned thoroughly after spraying ceases. Spray mixture must not be left in the apparatus overnight.

10.1.7 Apparatus should be stored under lock and key when not in use.

10.2 Rates of Application.

10.2.1 Products shall be mixed and applied at rates recommended on the label. This shall not be deviated from without consultation with Working for Water Technical Advisor and suppliers.

10.2.2 Applications should be checked regularly to ensure that they comply with recommendations.

10.3 Precautions.

10.3.1 Appropriate protective clothing must be changed and washed regularly and should be removed immediately if contaminated[6-9].

10.3.2 Spillage must be attended to immediately and appropriately disposed of[3,4,7,1,12,13].

10.3.3 Application teams must be trained to avoid damage to non-target species.

10.3.4 Contamination of all water bodies must be strictly avoided.

10.3.5 Hygiene aids - clean water, soap, towels and eye wash must always be available to spray operators.

10.4 Adjuvants.

10.4.1 Where recommended adjuvants (wetting and spreading agents) should be added to spray mixtures. Adjuvants should always be mixed in accordance with label recommendations. Recommended adjuvant must be used as stipulated on the pesticide label.

10.4.2 Dye must be added to all applications where the product has no built in dye to ensure that no target species are missed and plants are correctly treated.

10.4.3 In areas where alkaline water is used for spraying the use of a buffering agent may be necessary. Consult the product label. Buffers should always be added to the water before the herbicide.

10.4.4 In sensitive areas where drift must be controlled, the use of drift control agents may be necessary. Seek expert advice on the use of these agents.

10.5 Water Sources.

10.5.1 Only clean water may be used for spray mixtures.

10.5.2 Where particulate matter occurs in water, e.g. water drawn from rivers, the water must be filtered to avoid nozzle blockages.

10.5.3 Funnels with filters should be used for filling or filters should be fitted in the application equipment.

10.5.4 Where large volumes of water are transported, tankers or tanks should be fitted with buffer plates particularly where operating in rough terrain.

10.5.5 The product label should be consulted regarding the quality of water suitable for the specific pesticide.

WEATHER CONDITIONS

11.1 Applications should not be carried out under unfavourable weather conditions that could affect the control obtained or endanger nearby desirable vegetation, water bodies or personnel.

11.2 Label recommendations regarding suitable application conditions must be followed.

11.3 The following conditions must be taken into consideration, depending on the method of application.

11.3.1 Application to wet or dew covered plants.

11.3.2 Imminent rain, moist or humid conditions.

11.3.3 Wind conditions <15km/h

11.3.4 Hot, dry conditions and volatility of active ingredients under high temperatures

11.4 Conditions of target plants.

11.4.1 Poor results may result if target plants are not in a suitable condition for treatment. The following conditions may result in poor control.

11.4.1.1 Water stressed plants.

11.4.1.2 Water logged plants.

11.4.1.3 Dormant plants.

11.5 Seasonal variability. Some non-plant invasive species do not feed on bait in some seasons due to high availability of food.

MIXING PESTICIDES

12.1 Mixing must take place according to label instructions.

12.2 Suitable protective clothing must be worn when handling pesticide concentrates[8,14].

12.3 Liquid pesticide concentrates should be added to the half full tank of water which is then topped up with water.

12.4 Adjuvants should be added to the tank as per the label instruction prior to the addition of the pesticide when buffering and afterwards for adjuvants and dyes.

12.5 Do not mix pesticide concentrates together before adding them to the tank. Consult product labels.

12.6 Proper mixing in knapsacks and hand held applicators is difficult and spray mixtures should be mixed in bulk containers or if necessary (e.g. wettable powders) buckets before pouring into the knapsacks or hand held applicators.

12.7 Spray mixtures should be agitated continuously as recommended. This is essential after they have been standing for a while.

CALIBRATION

13.1 Application equipment must be correctly calibrated to obtain optimum results and prevent wastage through over-application.

13.2 Calibration should be carried out in the area to be treated.

13.3 Calibration should be checked frequently during application. The following should be checked:

13.3.1 Correct spray pressure.

13.3.2 Correct nozzle size and spray pattern.

13.3.3 Correct nozzle output.

13.3.4 Volume of application over a specific area.

ESTIMATED VOLUMES OF PRODUCT PER HECTARE

THIS IS FOR PLANNING PURPOSES AND TO BE USED, AS A GUIDE TO CALCULATE THE REQUIRED HERBICIDE NEEDED TO TREAT THE INTENDED AREA. (THIS IS NOT FOR CALIBRATION PURPOSES.)
AS THERE IS NO OR LITTLE DIFFERENCE IN HERBICIDE USE FOR A CLOSED OR DENSE STAND, THE VOLUMES PER HECTARE ARE GIVEN FOR A DENSE / CLOSED STAND OF THE SPECIFIC SPECIES. FOR LOWER INFESTATIONS, VOLUMES SHOULD BE REDUCED ACCORDINGLY.
THE % FIGURE OF THE DENSE/CLOSED APPLICATION RATE FOR THE LOWER INFESTATION GROUPS IS CALCULATED AT THE MID POINT OF THE DESITY RANGE. IE MEDIUM, 25% TO 50% THE MID POINT IS 37.5%
THEREFORE IF THE RECOMMENDED RATE IS 6 LITRES OF A SPECIFIC PRODUCT PER HECTARE, THE RATE FOR A MEDIUM DENSITY WILL BE 37.5% OF THE 6 LITRES. THIS WILL BE EQUAL TO 2.25 LITRES PER HECTARE.

DENSE	=	75 % OF CLOSED
MEDIUM	=	40 % OF CLOSED
SCATTERED	=	15 % OF CLOSED
VERY SCATTERED	=	3 % OF CLOSED
OCCASIONAL	=	1 % OF CLOSED
RARE	=	1 % OF CLOSED

- **FOR WATER BASED APPLICATIONS, A SUITABLE ADJUVANT (WETTER) SHOULD BE ADDED WHERE RECOMMENDED ON THE LABEL. THE WETTER QUANTITIES CAN BE CALCULATED AS A RATIO (%) OF THE HERBICIDE QUANTITY, AS THE LABEL PRESCRIBES. E.G. IF HERBICIDE IS 1% MIX AND WETTER IS 0.1%, HALF THE HERBICIDE QUANTITY IS THE WETTER QUANTITY. OR IT CAN BE CALCULATED AS % WETTER REQUIRED X TOTAL MIXTURE TO BE APPLIED / HA = Lt (0.1% X 300Lt =1.5Lt)**

  RATE PER HECTARE FOR DENSE / CLOSED STAND – 1.75 l / ha

HERBICIDE DOSAGE AND LITRES PER HECTARE SUMMARY

The list of PESTICIDES, BIOCONTROL and BIOPESTICIDES are available in the WfW species and herbicide spreadsheet obtainable from the Technical Manager. Please ensure that you have the latest version. The following page contains a table of active ingredients and a list of some brand names that can be used. For more examples please consult the “Master species and herbicides spreadsheet” issued by the Technical Unit. This guide is updated from time to time, as new pesticides are being developed and registered as an ongoing process.

However before choosing other products please consult the National Office Technical Advisor. *The * indicates the Biopesticides available*.

Table 1: Herbicide Table

Active ingredients	**Trade names**	**Restrictions**	**Comments**	**Hazard criteria**
*Cylindrobasidium leave**	Stumpout	None	Only registered for *A. Cyclops, A. mearnsii, A. dealbata, A. decurrans. A. melanoxylon, A. pycnantha*	None
*Colletrotrichum acutatum**	Hakea gummosis	Grahamstown hakea resistant to pathogen	Only used on *Hakea sericea*, *H. drupacea* and *H. sericifolia* Effective on all growth stages	None
*Puccinia eupatori**	Leaf pathogen		Only for *C. macrocephalum*	None
*Uromycladium tepperianum**	Rust fungus		Only for *A. saligna*	None
*Cercospora rodmannii**			Only for *E. crassipes*	None
*Mycovellociella lantanae**	Leaf pathogen		Only for *L. camara*	None
*Pasalora agaritinae**	Leaf pathogen		Only for *A. adenophera*	None
*Entyloma ageratinae**	Leaf pathogen		Only for *A. riparia*	None
*Puccinia abrupt**	Leaf pathogen		Only for *P. hysterophorus*	None
*Puccinia xanthii**	Leaf pathogen		Only for *P. hysterophorus*	None

Active ingredients	**Trade names**	**Restrictions**	**Comments**	**Hazard criteria**
*Prospodium transformans**	Leaf pathogen		Only for *T. sans*	None
Triclopyr 270 g/L + Clopyralid 90g/L	Confront Astra	Eye irritant, skin irritant Don't use in aquatic environments		2- acute toxicity to mammals and birds GHS 07 WARNING  5 – Developmental and reproductive toxicity GHS08 DANGER  8 – Persistence in soil/water and soil absorption potential& biomagnification & bioaccumulation GHS09 WARNING 
Fluroxypyr 200g/L	Starane Tomahawk Voloxypyr	Exclusion period	Limited species on Starane and Voloxypyr Flammable	8 – Persistence in soil/water and soil absorption potential& bio magnification & bioaccumulation GHS09 WARNING 
Picloram 80g/L + Fluroxypyr 80g/L	Plenum	Don't use in aquatic environments Eye and skin irritant	Toxic to aquatic invertebrates	2- acute toxicity to mammals and birds GHS 07 WARNING 

Active ingredients	Trade names	Restrictions	Comments	Hazard criteria
				3 - Carcinogenicity GHS07 WARNING  6 – Endocrine Disrupting Chemicals (EDC) GHS08 DANGER  7 – Acute toxicity to aquatic organisms GHS09 WARNING  8 – Persistence in soil/water and soil absorption potential& bio magnification & bioaccumulation GHS09 WARNING 
Picloram (as potassium salt) 54g/L + Triclopyr (as triethylamine salt) 46g/L	Kaput gel	Limited species registered currently	No mixing necessary	2- acute toxicity to mammals and birds GHS 07 WARNING  3 - Carcinogenicity GHS07 WARNING 

Active ingredients	**Trade names**	**Restrictions**	**Comments**	**Hazard criteria**
				5 – Developmental and reproductive toxicity GHS08 DANGER  6 – Endocrine Disrupting Chemicals (EDC) GHS08 DANGER  7 – Acute toxicity to aquatic organisms GHS09 WARNING  8 – Persistence in soil/water and soil absorption potential& bio magnification & bioaccumulation GHS09 WARNING 
2-4D (as dimethyl amine salt) 480g/L	2,4D 2,4D Amine	Limited registrations, herbaceous species	Weedy species such as *D. ferox*	2- acute toxicity to mammals and birds GHS 07 WARNING  3 - Carcinogenicity GHS07 WARNING

Active ingredients	Trade names	Restrictions	Comments	Hazard criteria
				 5 – Developmental and reproductive toxicity GHS08 DANGER  8 – Persistence in soil/water and soil absorption potential& bio magnification & bioaccumulation GHS09 WARNING 
Glyphosate (as isoproplyamine salt) 360g/L	Enviro-glyphosate	Not to be used in riparian or aquatic environments, unless tallow amine free adjuvants incorporated	Ensure polyethoxylated tallow amine free as some of the products are toxic to aquatic environments	2- acute toxicity to mammals and birds GHS 07 WARNING 
Glyphosate (as isopropylamine salt) 480g/L	Seismic	Only seismic tallow amine free and recommended for aquatic weed control	Polyethoxylated tallow amine free only	2- acute toxicity to mammals and birds GHS 07 WARNING 
Glyphosate (as sodium salt) 500g/L	Kilo	Kilo registered for aquatic weeds, polyethoxylated tallow amine free. 3km exclusion zone for aerial applications	Poisonous if swallowed, eye irritant	2- acute toxicity to mammals and birds GHS 07 WARNING 

Active ingredients	**Trade names**	**Restrictions**	**Comments**	**Hazard criteria**
Glyphosate (as sodium salt) 700g/L	Kilo max	Registered for aquatic weeds Polyethoxylated tallow amine free Aerial spray exclusion zones	Eye irritant	2- acute toxicity to mammals and birds GHS 07 WARNING 
Imazapyr 100 g/L	Chopper Hatchet	Hatchet, limited registrations	Poisonous if swallowed	2- acute toxicity to mammals and birds GHS 07 WARNING  8 – Persistence in soil/water and soil absorption potential& bio magnification & bioaccumulation GHS09 WARNING 
Imazapyr 250g/L	Format	Consult the technical unit for minor use registrations		2- acute toxicity to mammals and birds GHS 07 WARNING  8 – Persistence in soil/water and soil absorption potential& bio magnification & bioaccumulation GHS09 WARNING 

Active ingredients	**Trade names**	**Restrictions**	**Comments**	**Hazard criteria**
Chlorimuron ethyl 500g/L	Extreme Nicanor	Bush encroachment only	Consult technical unit for assistance	2- acute toxicity to mammals and birds GHS 07 WARNING  7 – Acute toxicity to aquatic organisms GHS09 WARNING 
Metsulfurion methyl 600g/L	Brushoff Climax	28 days withholding period	Eyes, nose skin irritant	2- acute toxicity to mammals and birds GHS 07 WARNING  7 – Acute toxicity to aquatic organisms GHS09 WARNING 
Picloram (as potassium salt) 240g/L	Access Browser	Not to be used as foliar applications		2- acute toxicity to mammals and birds GHS 07 WARNING  3 - Carcinogenicity GHS07 WARNING  6 – Endocrine Disrupting Chemicals (EDC)

Active ingredients	**Trade names**	**Restrictions**	**Comments**	**Hazard criteria**
				GHS08 DANGER  7 – Acute toxicity to aquatic organisms GHS09 WARNING  8 – Persistence in soil/water and soil absorption potential& bio magnification & bioaccumulation GHS09 WARNING 
Tebuthiuron 200g/kg	Molopo	Bush encroachment only Consult the technical unit PRIOR to application	Extremely residual in soil, acutely toxic	2- acute toxicity to mammals and birds GHS 07 WARNING  7 – Acute toxicity to aquatic organisms GHS09 WARNING  8 – Persistence in soil/water and soil absorption potential& bio magnification & bioaccumulation GHS09 WARNING

Active ingredients	**Trade names**	**Restrictions**	**Comments**	**Hazard criteria**
				
Tebuthiuron 500g/L	Molopo	Bush encroachment only Consult the technical unit PRIOR to application	Extremely residual in soil, acutely toxic	2- acute toxicity to mammals and birds GHS 07 WARNING  7 – Acute toxicity to aquatic organisms GHS09 WARNING  8 – Persistence in soil/water and soil absorption potential& bio magnification & bioaccumulation GHS09 WARNING 
Tebuthiuron 800g/kg	Molopo Limpopo	Bush encroachment only Consult the technical unit PRIOR to application	Extremely residual in soil, acutely toxic	2- acute toxicity to mammals and birds GHS 07 WARNING  7 – Acute toxicity to aquatic organisms GHS09 WARNING  8 – Persistence in soil/water and soil absorption

Active ingredients	Trade names	Restrictions	Comments	Hazard criteria
				potential& bio magnification & bioaccumulation GHS09 WARNING 
Triclopyr (as butoxy ethyl ester) 240g/L	Ranger	Eye irritant Volatile over 25 degrees	Toxic to fish and animals Skin and eye irritant	2- acute toxicity to mammals and birds GHS 07 WARNING  5 – Developmental and reproductive toxicity GHS08 DANGER  8 – Persistence in soil/water and soil absorption potential& bio magnification & bioaccumulation GHS09 WARNING 
Triclopyr (as butoxy ethyl ester) 480g/L	Garlon Triclon Viroaxe	Volatile over 25 degrees Do not use in riparian and aquatic environments Diesel mix not allowed	Toxic to fish and animals Skin and eye irritant Poisonous if swallowed	2- acute toxicity to mammals and birds GHS 07 WARNING  5 – Developmental and reproductive toxicity GHS08 DANGER

Active ingredients	**Trade names**	**Restrictions**	**Comments**	**Hazard criteria**
				 8 – Persistence in soil/water and soil absorption potential& bio magnification & bioaccumulation GHS09 WARNING 
Triclopyr (as pyridyloxy compound) 360 g/L	Lumberjack Timbrel	Adjuvant as indicated on the label	Skin, eye irritant, burns Flammable Possible weed resistant	2- acute toxicity to mammals and birds GHS 07 WARNING  8 – Persistence in soil/water and soil absorption potential& bio magnification & bioaccumulation GHS09 WARNING 
Triclopyr (as butoxy ethyl ester) 240g/L + Aminopyralid 30g/L	Garlon max	Volatile over 25 degrees Do not use in riparian and aquatic environments Diesel mix not allowed	Toxic to fish and animals Skin and eye irritant Poisonous if swallowed	2- acute toxicity to mammals and birds GHS 07 WARNING  5 – Developmental and reproductive toxicity GHS08 DANGER 

Active ingredients	Trade names	Restrictions	Comments	Hazard criteria
				7 – Acute toxicity to aquatic organisms GHS09 WARNING  8 – Persistence in soil/water and soil absorption potential& bio magnification & bioaccumulation GHS09 WARNING 
Triclopyr (as thiethyl ammonium) 120g/L + Aminopyralid (as triisopropanol) 12g/L	Confront super	Eye irritant, skin irritant Don't use in aquatic environments	Limited registrations	2- acute toxicity to mammals and birds GHS 07 WARNING  5 – Developmental and reproductive toxicity GHS08 DANGER  7 – Acute toxicity to aquatic organisms GHS09 WARNING  8 – Persistence in soil/water and soil absorption potential& bio

Active ingredients	Trade names	Restrictions	Comments	Hazard criteria
				magnification & bioaccumulation GHS09 WARNING 
Bromacil 250g/L + Tebuthioron 250g/L	Bundu	Bush encroachers only		2- acute toxicity to mammals and birds GHS 07 WARNING  7 – Acute toxicity to aquatic organisms GHS09 WARNING  8 – Persistence in soil/water and soil absorption potential& bio magnification & bioaccumulation GHS09 WARNING 
Wetter/Adjuvant	H&R crop oil BP crop oil Actipron super	Ensure the adjuvant used is the approved adjuvant as per the relevant herbicide label	Please see the master species and herbicide list for which formulations require adjuvants	
Blue/red/white dye	Ecoblue Ecowhite	Only marker dyes or pigments to be used, not food colouring		

Active ingredients	Trade names	Restrictions	Comments	Hazard criteria
Blue Dye =Approximately 0.5% per litre water	**Medium = 37.5% of Closed/Dense**			
Medium = 37.5% of Closed/Dense	**Medium = 37.5% of Closed/Dense**	**Medium = 37.5% of Closed/Dense**		
Red Dye (diesel) = Approximately 0.5% per litre diesel.	Very Scattered = 3% of Closed/Dense			
	Occasional = 0.5% of Closed/Dense			
	Rare = 0.5% of Closed/Dense			

Table 2: Pesticide table

Active ingredients	Trade names	Restrictions	Comments	Hazard criteria
Brodifacoum 0.025g/kg	Pest off bait	Control of mice on off-shore Islands	Secondary poisoner Anti-coagulant	2- acute toxicity to mammals and birds GHS 07 WARNING  7 – Acute toxicity to aquatic organisms GHS09 WARNING  8 – Persistence in soil/water and soil absorption potential& bio magnification & bioaccumulation GHS09 WARNING 

Active ingredients	Trade names	Restrictions	Comments	Hazard criteria
2,2,2-trichloroethyylidene	Alphachloralose	To not use near water bodies. Toxic if swallowed. Inhalation risk CNS depressant	Used as a sedative in invasive bird control such as Mallard control programmes	2- acute toxicity to mammals and birds GHS06 – DANGER  GHS 07 WARNING  7 – Acute toxicity to aquatic organisms GHS09 WARNING  8 – Persistence in soil/water and soil absorption potential& bio magnification & bioaccumulation GHS09 WARNING 
3-chloro-p-toluidine hydrochloride	DRC-1336/Starlicide	Toxic if swallowed Toxic in contact with skin Skin irritation, eye irritation Inhalation risk Toxic to aquatic environments 4	Avicide powder to mix into bait to control corvids	2- acute toxicity to mammals and birds GHS06 – DANGER  GHS 07 WARNING  7 – Acute toxicity to aquatic organisms GHS09 WARNING  8 – Persistence in soil/water and soil

Active ingredients	Trade names	Restrictions	Comments	Hazard criteria
				absorption potential& bio magnification & bioaccumulation GHS09 WARNING 
1,2,12,12a-tetrahydrochromeno[3,4-b]furo[2,3-h]chromen-6(6aH)-one	Rotenone	Toxic if swallowed Causes skin and eye irritation Toxic to aquatic environments	Used to control invasive fish, monitoring programmes necessary to ensure recovery after potassium permangate recovery process implemented	2- acute toxicity to mammals and birds GHS06 – DANGER  GHS 07 WARNING  7 – Acute toxicity to aquatic organisms GHS09 WARNING  8 – Persistence in soil/water and soil absorption potential& bio magnification & bioaccumulation GHS09 WARNING 

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ANNEXURE 1: CHEMICAL GROUPS AND HAZARD GROUPS OF PESTICIDES

This must be read in conjunction with the International Chemical Groups and Hazard groups and listed in *UN, 2011. Globally Harmonised System of Classification and Labelling of Chemicals (GHS). 4th Revised Edition. United Nations, New York and Geneva, 2011.*

HERBICIDES FOR ALIEN PLANT CONTROL

						PPE			Medical Biomonitoring		Frequency and Duration		
	Chemical group	**MOA**	**Examples**	**Hazard Group**	**Hazard Criterion**	**Type**	**Pictogram**	**Classification**	**Blood**	**Urine**	**Blood**	**Urine**	**Environmental monitoring**
1	Imidazolinones	Group 2: ALS: AHAS inhibitors	Imazapyr (Chopper, Hatchet, Arsenal)	2	**<u>Acute toxicity to mammals and birds</u>** **GHS07** **WARNING**  H319 (causes serious eye irritation) H335 (Respiratory irritant) H315 (causes skin irritation)	1.Chemically resistant nitrile gloves 2.Type 3 and Type 4 protective clothing  3.Safety boots 4.Face & Eye protection 5.Half-face respirators 6.Particulate air filters for respirators 7.Apron/ Knapjack 8. Long-sleeved shirts	     	EN 374:2016 EN 14605:2005 EN 345: 1993 EN ISO 20345 EN 166:2001 EN 140, EN149, EN 143:200 R95, R99, R100	N/A	5cc fresh urine sample refrigerated. Tested using ELIZA dipstick test	N/A	1.All workers need to be tested before they start working. 2.If the worker sprays 8 hours per day for 5 days per week, an additional test is needed every 2 years. 3. All workers need to be tested once they leave they programme	

				8	**<u>Persistence in soil/water and soil absorption potential & bio magnification & bioaccumulation</u>** **GHS09** **WARNING**  H412 (harmful to aquatic life with long lasting effects)								Hazard criterion 7 and 8 are linked to environmental risks
2	Sulfonylureas	Group 2: ALS: AHAS inhibitors	Metsulfuron-methyl (Brush-off, Climax, Forester, Extreme, Nikanor)	7	Acute toxicity to aquatic organisms GHS09 WARNING  H400 (Very toxic to aquatic life)								
				2	Acute toxicity to mammals and birds GHS07 WARNING  H315 (causes skin irritation) H335 (Respiratory tract irritant) H319 (Causes serious eye irritation)	1.Chemically resistant nitrile gloves 2.Type 3 and Type 4 protective clothing  	  	EN 374:2016 EN 14605:2005 EN 345: 1993	N/A	5cc fresh urine sample refrigerated. Tested using ELIZA dipstick test	N/A	1.All workers need to be tested before they start working. 2.If the worker sprays 8 hours per day for 5 days per week, an additional test is needed every 2 years. 3. All workers need to be	

						3.Safety boots 4.Face & Eye protection 5.Half-face respirators 6.Particulate air filters for respirators 7.Apron/ Knapjack 8. Long-sleeved shirts	  	EN ISO 20345 EN 166:2001 EN 140, EN149, EN 143:200 R95, R99, R100				tested once they leave they programme	
	Carboxylic acids	Group 4: Synthetic auxins	Picloram (Access, Browser, Scrubber)	2	Acute toxicity to mammals and birds GHS07 WARNING  H302 (harmful if swallowed) H312 (harmful in contact with skin) H319 (Causes serious eye irritation) H332 (harmful if inhaled)	1.Chemically resistant nitrile gloves 2.Type 3 and Type 4 protective clothing  3.Safety boots 4.Face & Eye protection	   	EN 374:2016 EN 14605:2005 EN 345: 1993 EN ISO 20345		5cc fresh urine sample refrigerated. Tested using ELIZA dipstick test		1.All workers need to be tested before they start working. 2.If the worker sprays 8 hours per day for 5 days per week, an additional test is needed every year. 3. All workers need to be tested once they leave they programme	

						5.Half-face respirators 6.Particulate air filters for respirators 7.Apron/ Knapjack 8. Long-sleeved shirts	 	EN 166:2001 EN 140, EN149, EN 143:200 R95, R99, R100					
				3	Carcinogenicity GHS07 WARNING  H335 (May cause respiratory irritation)	Same as above	Same as above	Same as above	20cc fresh blood sample. AChE tests done with Test-Mate model 400 device		1.All workers need to be tested before they start working. 2.If the worker sprays 8 hours per day for 5 days per week, an additional test needs to be done every 2 years.. 3. All workers need to be tested once they leave the programme		

				6	Endocrine Disrupting Chemicals (EDC) GHS08 DANGER  H370 (causes damage to organs – lungs)	1.Chemically resistant nitrile gloves 2.Type 3 and Type 4 protective clothing  Type 5 protective clothing  3.Safety boots 4.Face & Eye protection 5.Half-face respirators 6.Particulate air filters for respirators 7.Apron/ Knapjack 8. Long-sleeved shirts	     	EN ISO 20345 EN 166:2001 EN140 EN 149 EN 143:2000 R95, R99, R100	20cc fresh blood sample. AChE tests done with Test-Mate model 400 device		1.All workers need to be tested before they start working. 2.If the worker sprays 8 hours per day for 5 days per week, an additional test needs to be done every 2 years.. 3. All workers need to be tested once they leave the programme		

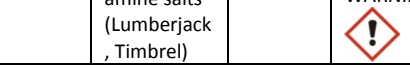
				7	Acute toxicity to aquatic organisms GHS09 WARNING  H400 (Very toxic to aquatic life)								
				8	Persistence in soil/water and soil absorption potential & bio magnification & bioaccumulation GHS09 WARNING  H410 (Very toxic to aquatic life with long lasting effects) H412 (harmful to aquatic life with long lasting effects)								
	Phenoxy acids	Group 4: Synthetic auxins	Alkylchloro phenoxy (2,4D)	2	Acute toxicity to mammals and birds GHS07 WARNING  H302 (Harmful if swallowed) H317 (May cause an allergic reaction)	1.Chemically resistant nitrile gloves 2.Type 3 and Type 4 protective clothing 	 	EN 374:2016 EN 14605:2005 EN 345: 1993		5cc fresh urine sample refrigerated. Tested using ELIZA dipstick test		1.All workers need to be tested before they start working. 2.If the worker sprays 8 hours per day for 5 days per week, an additional test is needed every year.	

					H318 (causes serious eye damage)	3.Safety boots 4.Face & Eye protection 5.Half-face respirators 6.Particulate air filters for respirators 7.Apron/ Knapjack	   	EN ISO 20345 EN 166:2001 EN 140, EN149, EN 143:200 R95, R99, R100				3. All workers need to be tested once they leave they programme	
				3	Carcinogenicity GHS07 WARNING  H335 (May cause respiratory irritation)	1.Chemically resistant nitrile gloves 2.Type 3 and Type 4 protective clothing  3.Safety boots 4.Face & Eye protection 5.Half-face respirators	   	EN 374:2016 EN 14605:2005 EN 345: 1993 EN ISO 20345 EN 166:2001	20cc fresh blood sample. AChE tests done with Test-Mate model 400 device		1.All workers need to be tested before they start working. 2.If the worker sprays 8 hours per day for 5 days per week, an additional test needs to be done every 2 years.. 3. All workers need to be tested		

						6.Particulate air filters for respirators 7.Apron/ Knapjack	 	EN 140, EN149, EN 143:200 R95, R99, R100			once they leave the programme	
				5	Developmental & Reproductive toxicity GHS08 DANGER  H361 (Suspected of damaging fertility or the unborn child)	1.Chemically resistant nitrile gloves 2.Type 3 and Type 4 protective clothing  Type 5 protective clothing  3.Safety boots 4.Face & Eye protection 5.Half-face respirators 6.Particulate air	     	EN ISO 20345 EN 166:2001 EN140 EN 149 EN 143:2000 R95, R99, R100	20cc fresh blood sample. AChE tests done with Test-Mate model 400 device		1.All workers need to be tested before they start working. 2.If the worker sprays 8 hours per day for 5 days per week, an additional test needs to be done every 2 years.. 3. All workers need to be tested once they leave the programme		

						filters for respirators 7.Apron/ Knapjack 8. Long-sleeved shirts							
				8	Persistence in soil/water and soil absorption potential & bio magnification & bioaccumulation GHS09 WARNING  H412 (Harmful to aquatic life with long lasting effects)								
			Pyridine compounds as butoxy ethyl esters (Garlon 4, Garlon max, Nuvogon, Triclon, Viroaxe, Triclomax, Turbador)	2	Acute toxicity to mammals and birds GHS07 WARNING  H302 (Harmful if swallowed) H317 (May cause an allergic reaction)	1.Chemically resistant nitrile gloves 2.Type 3 and Type 4 protective clothing 	  	EN 374:2016 EN 14605:2005 EN 345: 1993		5cc fresh urine sample refrigerated. Tested using ELIZA dipstick test		1.All workers need to be tested before they start working. 2.If the worker sprays 8 hours per day for 5 days per week, an additional test is needed every 2 years. 3. All workers need to be	

					H319 (causes serious eye irritation) H373 (May cause damage to organs – heart, liver, kidneys)	3.Safety boots 4.Face & Eye protection 5.Half-face respirators 6.Particulate air filters for respirators 7.Apron/ Knapjack	  	EN ISO 20345 EN 166:2001 EN 140, EN149, EN 143:200 R95, R99, R100				tested once they leave they programme	
				5	Developmental and Reproductive toxicity GHS08 DANGER  H360 (May damage fertility or the unborn child)	1.Chemically resistant nitrile gloves 2.Type 3 and Type 4 protective clothing  Type 5 protective clothing  3.Safety boots	   	EN ISO 20345 EN 166:2001 EN140 EN 149 EN 143:2000 R95, R99, R100	20cc fresh blood sample. AChE tests done with Test-Mate model 400 device		1.All workers need to be tested before they start working. 2.If the worker sprays 8 hours per day for 5 days per week, an additional test needs to be done every 5 years.. 3. All workers need to be tested once they		

						4.Face & Eye protection 5.Half-face respirators 6.Particulate air filters for respirators 7.Apron/ Knapjack 8. Long-sleeved shirts	 				leave the programme		
				8	Persistence in soil/water and soil absorption potential & bio magnification & bioaccumulation GHS09 WARNING  H411 (Toxic to aquatic life with long lasting effects)								
	Quinoline carboxylic acid	Group 4: Synthetic auxins	Pyridine compounds such As Triclopyr as amine salts (Lumberjack, Timbrel)	2	Acute toxicity to mammals and birds GHS07 WARNING 	1.Chemically resistant nitrile gloves 2.Type 3 and Type 4		EN 374:2016 EN 14605:2005		5cc fresh urine sample refrigerated. Tested using		1.All workers need to be tested before they start working. 2.If the worker sprays	

					H302 (Harmful if swallowed) H317 (May cause an allergic reaction) H318 (Causes serious eye damage) H315 (Causes skin irritation) H335 (may cause respiratory irritation) H336 (may cause drowsiness or dizziness) H360 (may damage fertility or the unborn child)	protective clothing  3.Safety boots 4.Face & Eye protection 5.Half-face respirators 6.Particulate air filters for respirators 7.Apron/ Knapjack		EN 345: 1993 EN ISO 20345 EN 166:2001 EN 140, EN149, EN 143:200 R95, R99, R100		ELIZA dipstick test		8 hours per day for 5 days per week, an additional test is needed every 2 years. 3. All workers need to be tested once they leave they programme	
				8	Persistence in soil/water and soil absorption potential & bio magnification & bioaccumulation GHS09 WARNING  H411 (Toxic to aquatic life with								

					long lasting effects)								
	Quinoline carboxylic acid	Group 4: Synthetic auxins	Pyridine compounds such as fluroxypyr (Tomahawk, Starane, Voloxypyr)	8	Persistence in soil/water and soil absorption potential & bio magnification & bioaccumulation GHS09 WARNING  H411 (Toxic to aquatic life with long lasting effects)								
	Quinoline carboxylic acid	Group 4: Synthetic auxins	Pyridine compounds such as Aminopyralids (Sendero)	2	Acute toxicity to mammals and birds GHS07 WARNING  H315 (Causes skin irritation H318 (causes serious eye damage) H319 (Causes serious eye irritation) H335 (may cause respiratory irritation)	1.Chemically resistant nitrile gloves 2.Type 3 and Type 4 protective clothing  3.Safety boots 4.Face & Eye protection 5.Half-face respirators 6.Particulate air	    	EN 374:2016 EN 14605:2005 EN 345: 1993 EN ISO 20345 EN 166:2001 EN 140, EN149, EN 143:200		5cc fresh urine sample refrigerated. Tested using ELIZA dipstick test		1.All workers need to be tested before they start working. 2.If the worker sprays 8 hours per day for 5 days per week, an additional test is needed every 2 years. 3. All workers need to be tested once they leave they programme	

						filters for respirators 7.Apron/ Knapjack		R95, R99, R100					
				7	Acute toxicity to aquatic organisms GHS09 WARNING  H400 (Very toxic to aquatic life)								
				8	Persistence in soil/water and soil absorption potential & bio magnification & bioaccumulation GHS09 WARNING  H411 (Toxic to aquatic life with long lasting effects)								
	Combinations	Group 4: Synthetic auxins	Quinoline carboxylic acid such as Picloram + Pyridine compound such as Fluroxypyr (	2	Acute toxicity to mammals and birds GHS07 WARNING  H302 (harmful if swallowed)	1.Chemically resistant nitrile gloves 2.Type 3 and Type 4 protective clothing	 	EN 374:2016 EN 14605:2005		5cc fresh urine sample refrigerated. Tested using ELIZA		1.All workers need to be tested before they start working. 2.If the worker sprays 8 hours per day for 5 days	

			Plenum, Gladiator)		H312 (harmful in contact with skin) H319 (Causes serious eye irritation) H332 (harmful if inhaled)	 3.Safety boots 4.Face & Eye protection 5.Half-face respirators 6.Particulate air filters for respirators 7.Apron/ Knapjack		EN 345: 1993 EN ISO 20345 EN 166:2001 EN 140, EN149, EN 143:200 R95, R99, R100		dipstick test		per week, an additional test is needed every 2 years. 3. All workers need to be tested once they leave they programme	
				3	Carcinogenicity GHS07 WARNING  H335 (May cause respiratory irritation)	1.Chemically resistant nitrile gloves 2.Type 3 and Type 4 protective clothing  3.Safety boots		EN 374:2016 EN 14605:2005 EN 345: 1993 EN ISO 20345	20cc fresh blood sample. AChE tests done with Test-Mate model 400 device		1.All workers need to be tested before they start working. 2.If the worker sprays 8 hours per day for 5 days per week, an additional test needs to be done		

						4.Face & Eye protection 5.Half-face respirators 6.Particulate air filters for respirators 7.Apron/ Knapjack	  	EN 166:2001 EN 140, EN149, EN 143:200 R95, R99, R100			every 2 years.. 3. All workers need to be tested once they leave the programme		
				6	Endocrine Disrupting Chemicals (EDC) GHS08 DANGER  H370 (causes damage to organs – lungs)	1.Chemically resistant nitrile gloves 2.Type 3 and Type 4 protective clothing  Type 5 protective clothing  3.Safety boots 4.Face & Eye protection	   	EN ISO 20345 EN 166:2001 EN140 EN 149 EN 143:2000 R95, R99, R100	20cc fresh blood sample. AChE tests done with Test-Mate model 400 device		1.All workers need to be tested before they start working. 2.If the worker sprays 8 hours per day for 5 days per week, an additional test needs to be done every 2 years.. 3. All workers need to be tested once they leave the		

						5.Half-face respirators 6.Particulate air filters for respirators 7.Apron/ Knapjack 8. Long-sleeved shirts	 				programme		
				7	Acute toxicity to aquatic organisms GHS09 WARNING  H400 (Very toxic to aquatic life)								
				8	Persistence in soil/water and soil absorption potential & bio magnification & bioaccumulation GHS09 WARNING  H410 (Very toxic to aquatic life with long lasting effects)								

					H412 (harmful to aquatic life with long lasting effects)								
	Combinations	Group 4: Synthetic auxins	Pyridine compounds such as Fluroxypyr + Pyridine compounds such as Triclopyr as Pyridyloxy compound (Impala)	2	Acute toxicity to mammals and birds GHS07 WARNING  H302 (Harmful if swallowed) H317 (May cause an allergic reaction) H319 (causes serious eye irritation) H373 (May cause damage to organs – heart, liver, kidneys)	1.Chemically resistant nitrile gloves 2.Type 3 and Type 4 protective clothing  3.Safety boots 4.Face & Eye protection 5.Half-face respirators 6.Particulate air filters for respirators 7.Apron/ Knapjack 8. Long-sleeved shirt	     	EN 374:2016 EN 14605:2005 EN 345: 1993 EN ISO 20345 EN 166:2001 EN 140, EN149, EN 143:200 R95, R99, R100		5cc fresh urine sample refrigerated. Tested using ELIZA dipstick test		1.All workers need to be tested before they start working. 2.If the worker sprays 8 hours per day for 5 days per week, an additional test is needed every 2 years. 3. All workers need to be tested once they leave they programme	

				5	Developmental and Reproductive toxicity GHS08 DANGER  H360 (May damage fertility or the unborn child)	1.Chemically resistant nitrile gloves 2.Type 3 and Type 4 protective clothing  Type 5 protective clothing  3.Safety boots 4.Face & Eye protection 5.Half-face respirators 6.Particulate air filters for respirators 7.Apron/ Knapjack 8. Long-sleeved shirts	     	EN ISO 20345 EN 166:2001 EN140 EN 149 EN 143:2000 R95, R99, R100	20cc fresh blood sample. AChE tests done with Test-Mate model 400 device		1.All workers need to be tested before they start working. 2.If the worker sprays 8 hours per day for 5 days per week, an additional test needs to be done every 5 years.. 3. All workers need to be tested once they leave the programme		

				8	Persistence in soil/water and soil absorption potential & bio magnification & bioaccumulation GHS09 WARNING  H411 (Toxic to aquatic life with long lasting effects)								
	Combinations	Group 4: Synthetic auxins	Quinoline carboxylic acid such as Picloram + Pyridine compound such Triclopyr as trimethylamine salt (Kaput gel)	2	Acute toxicity to mammals and birds GHS07 WARNING  H302 (harmful if swallowed) H312 (harmful in contact with skin) H315 (causes skin irritation) H317(May cause allergic skin reaction) H319 (Causes serious eye irritation) H332 (harmful if inhaled) H335 (May cause respiratory irritation)	1.Chemically resistant nitrile gloves 2.Type 3 and Type 4 protective clothing  3.Safety boots 4.Face & Eye protection 5.Half-face respirators 6.Particulate air	    	EN 374:2016 EN 14605:2005 EN 345: 1993 EN ISO 20345 EN 166:2001 EN 140, EN149, EN 143:200					

					H336 (may cause drowsiness or dizziness)	filters for respirators 7.Apron/ Knapjack		R95, R99, R100					
				3	Carcinogenicity GHS07 WARNING  H335 (May cause respiratory irritation)	1.Chemically resistant nitrile gloves 2.Type 3 and Type 4 protective clothing  3.Safety boots 4.Face & Eye protection 5.Half-face respirators 6.Particulate air filters for respirators 7.Apron/ Knapjack	     	EN 374:2016 EN 14605:2005 EN 345: 1993 EN ISO 20345 EN 166:2001 EN 140, EN149, EN 143:200 R95, R99, R100	20cc fresh blood sample. AChE tests done with Test-Mate model 400 device		1.All workers need to be tested before they start working. 2.If the worker sprays 8 hours per day for 5 days per week, an additional test needs to be done every 2 years.. 3. All workers need to be tested once they leave the programme		

				5	Developmental and Reproductive toxicity GHS08 DANGER  H360 (May damage fertility or the unborn child)	1.Chemically resistant nitrile gloves 2.Type 3 and Type 4 protective clothing   Type 5 protective clothing  3.Safety boots 4.Face & Eye protection 5.Half-face respirators 6.Particulate air filters for respirators 7.Apron/ Knapjack 8. Long-sleeved shirts	     	EN ISO 20345 EN 166:2001 EN140 EN 149 EN 143:2000 R95, R99, R100	20cc fresh blood sample. AChE tests done with Test-Mate model 400 device		1.All workers need to be tested before they start working. 2.If the worker sprays 8 hours per day for 5 days per week, an additional test needs to be done every 5 years.. 3. All workers need to be tested once they leave the programme		

				6	Endocrine Disrupting Chemicals (EDC) GHS08 DANGER  H370 (causes damage to organs – lungs)	1.Chemically resistant nitrile gloves 2.Type 3 and Type 4 protective clothing  Type 5 protective clothing  3.Safety boots 4.Face & Eye protection 5.Half-face respirators 6.Particulate air filters for respirators 7.Apron/ Knapjack 8. Long-sleeved shirts	     	EN ISO 20345 EN 166:2001 EN140 EN 149 EN 143:2000 R95, R99, R100	20cc fresh blood sample. AChE tests done with Test-Mate model 400 device		1.All workers need to be tested before they start working. 2.If the worker sprays 8 hours per day for 5 days per week, an additional test needs to be done every 2 years.. 3. All workers need to be tested once they leave the programme		

				7	Acute toxicity to aquatic organisms GHS09 WARNING  H400 (Very toxic to aquatic life)								
				8	Persistence in soil/water and soil absorption potential & bio magnification & bioaccumulation GHS09 WARNING  H410 (Very toxic to aquatic life with long lasting effects) H411 (Toxic to aquatic life with long lasting effects) H412 (harmful to aquatic life with long lasting effects)								
	Combinations	Group 4: Synthetic auxins	Pyridine compounds such Triclopyr as amine salt + Pyridine compounds such as	2	Acute toxicity to mammals and birds GHS07 WARNING 	1.Chemically resistant nitrile gloves 2.Type 3 and Type 4		EN 374:2016 EN 14605:2005		5cc fresh urine sample refrigerated. Tested using ELIZA		1.All workers need to be tested before they start working. 2.If the worker sprays 8 hours per	

			Clopyralid (Confront, Astra)		H302 (Harmful if swallowed) H315 (Causes skin irritation) H317 (May cause an allergic reaction) H318 (causes serious eye damage) H319 (causes serious eye irritation) H335 (May cause respiratory irritation) H373 (May cause damage to organs – heart, liver, kidneys)	protective clothing  3.Safety boots 4.Face & Eye protection 5.Half-face respirators 6.Particulate air filters for respirators 7.Apron/ Knapjack		EN 345: 1993 EN ISO 20345 EN 166:2001 EN 140, EN149, EN 143:200 R95, R99, R100		dipstick test		day for 5 days per week, an additional test is needed every 2 years. 3. All workers need to be tested once they leave they programme	
				5	Developmental and Reproductive toxicity GHS08 DANGER  H360 (May damage fertility or the unborn child)	1.Chemically resistant nitrile gloves 2.Type 3 and Type 4 protective clothing  Type 5 protective clothing		EN ISO 20345 EN 166:2001 EN140 EN 149	20cc fresh blood sample. AChE tests done with Test-Mate model 400 device		1.All workers need to be tested before they start working. 2.If the worker sprays 8 hours per day for 5 days per week, an additional test needs		

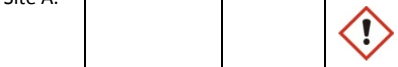
						 3.Safety boots 4.Face & Eye protection 5.Half-face respirators 6.Particulate air filters for respirators 7.Apron/ Knapjack 8. Long-sleeved shirts		EN 143:2000 R95, R99, R100			to be done every 5 years.. 3. All workers need to be tested once they leave the programme		
				8	Persistence in soil/water and soil absorption potential & bio magnification & bioaccumulation GHS09 WARNING  H411 (Toxic to aquatic life with								

					long lasting effects)								
	Combinations	Group 4: Synthetic auxins	Pyridine compounds such as Triclopyr as triethyl ammonium + Aminopyralid (Confront super)	2	Acute toxicity to mammals and birds GHS07 WARNING  H317 (May cause an allergic skin reaction) H318 (Causes serious eye damage) H319 (Causes serious eye irritation) H315 (Causes skin irritation) H335 (may cause respiratory irritation) H336 (may cause drowsiness or dizziness)	1.Chemically resistant nitrile gloves  2.Type 3 and Type 4 protective clothing 3.Safety boots 4.Face & Eye protection 5.Half-face respirators 6.Particulate air filters for respirators 7.Apron/ Knapjack	     	EN 374:2016 EN 14605:2005 EN 345: 1993 EN ISO 20345 EN 166:2001 EN 140, EN149, EN 143:200 R95, R99, R100		5cc fresh urine sample refrigerated. Tested using ELIZA dipstick test		1.All workers need to be tested before they start working. 2.If the worker sprays 8 hours per day for 5 days per week, an additional test is needed every 2 years. 3. All workers need to be tested once they leave they programme	
				5	Developmental and Reproductive toxicity GHS08 DANGER	1.Chemically resistant nitrile gloves		EN ISO 20345	20cc fresh blood sample. AChE tests		1.All workers need to be tested before		

					 H360 (may damage fertility or the unborn child)	2.Type 3 and Type 4 protective clothing  Type 5 protective clothing  3.Safety boots 4.Face & Eye protection 5.Half-face respirators 6.Particulate air filters for respirators 7.Apron/ Knapjack 8. Long-sleeved shirts	    	EN 166:2001 EN140 EN 149 EN 143:2000 R95, R99, R100	done with Test-Mate model 400 device		they start working. 2.If the worker sprays 8 hours per day for 5 days per week, an additional test needs to be done every 5 years.. 3. All workers need to be tested once they leave the programme		
				7	Acute toxicity to aquatic organisms GHS09 WARNING								

					 H400 (Very toxic to aquatic life)							
				8	Persistence in soil/water and soil absorption potential & bio magnification & bioaccumulation GHS09 WARNING  H410 (Very toxic to aquatic life with long lasting effects) H11 (Toxic to aquatic life with long lasting effects)							
	Combinations	Group 4: Synthetic auxins	Pyridine compounds such as Triclopyr as Butoxy ethyl ester + Aminopyralid (Garlon Max)	2	Acute toxicity to mammals and birds GHS07 WARNING  H302 (Harmful if swallowed) H315 (causes skin irritation) H317 (May cause an allergic reaction) H318 (causes serious eye damage)	1.Chemically resistant nitrile gloves 2.Type 3 and Type 4 protective clothing  3.Safety boots 4.Face & Eye protection	   	EN 374:2016 EN 14605:2005 EN 345: 1993 EN ISO 20345		5cc fresh urine sample refrigerated. Tested using ELIZA dipstick test		1.All workers need to be tested before they start working. 2.If the worker sprays 8 hours per day for 5 days per week, an additional test is needed every 2 years. 3. All workers need to be tested once they leave they programme	

					H319 (causes serious eye irritation) H335 (may cause respiratory irritation) H336 (may cause drowsiness or dizziness) H373 (May cause damage to organs – heart, liver, kidneys)	5.Half-face respirators 6.Particulate air filters for respirators 7.Apron/ Knapjack	 	EN 166:2001 EN 140, EN149, EN 143:200 R95, R99, R100					
				5	Developmental and Reproductive toxicity GHS08 DANGER  H360 (May damage fertility or the unborn child)	1.Chemically resistant nitrile gloves 2.Type 3 and Type 4 protective clothing  Type 5 protective clothing  3.Safety boots 4.Face & Eye protection	    	EN ISO 20345 EN 166:2001 EN140 EN 149 EN 143:2000 R95, R99, R100	20cc fresh blood sample. AChE tests done with Test-Mate model 400 device		1.All workers need to be tested before they start working. 2.If the worker sprays 8 hours per day for 5 days per week, an additional test needs to be done every 5 years.. 3. All workers need to be tested once they leave the programme		

						5.Half-face respirators 6.Particulate air filters for respirators 7.Apron/ Knapjack 8. Long-sleeved shirts							
				8	Persistence in soil/water and soil absorption potential & bio magnification & bioaccumulation GHS09 WARNING  H410 (Very toxic to aquatic life with long lasting effects)								
	Uracils	Group 5: Photosynthetic inhibitors at Photosystem II, Site A.	Bromacil (Bushwacker)	2	Acute toxicity to mammals and birds GHS07 WARNING  H302 (Harmful if swallowed)	1.Chemically resistant nitrile gloves 2.Type 3 and Type 4 protective clothing	 	EN 374:2016 EN 14605:2005		5cc fresh urine sample refrigerated. Tested using ELIZA dipstick test		1.All workers need to be tested before they start working. 2.If the worker sprays 8 hours per day for 5 days per week, an	

					H315 (Causes skin irritation) H319 (Causes serious eye irritation) H335 (may cause respiratory irritation)	 3.Safety boots 4.Face & Eye protection 5.Half-face respirators 6.Particulate air filters for respirators 7.Apron/ Knapjack		EN 345: 1993 EN ISO 20345 EN 166:2001 EN 140, EN149, EN 143:200 R95, R99, R100				additional test is needed every 2 years. 3. All workers need to be tested once they leave they programme	
				7	Acute toxicity to aquatic organisms GHS09 WARNING  H400 (Very toxic to aquatic life)								
				8	Persistence in soil/water and soil absorption potential & bio magnification & bioaccumulation GHS09 WARNING								

					 H410 (Very toxic to aquatic life with long lasting effects)								
	Ureas	Group 7: Photosynthetic inhibitors at Photosystem II, Site B.	Tebuthiuron (Limpopo, Molopo)	2	Acute toxicity to mammals and birds GHS07 WARNING  H302 (Harmful if swallowed)	1.Chemically resistant nitrile gloves 2.Type 3 and Type 4 protective clothing  3.Safety boots 4.Face & Eye protection 5.Half-face respirators 6.Particulate air filters for respirators 7.Apron/ Knapjack	     	EN 374:2016 EN 14605:2005 EN 345: 1993 EN ISO 20345 EN 166:2001 EN 140, EN149, EN 143:200 R95, R99, R100		5cc fresh urine sample refrigerated. Tested using ELIZA dipstick test		1.All workers need to be tested before they start working. 2.If the worker sprays 8 hours per day for 5 days per week, an additional test is needed every 2 years. 3. All workers need to be tested once they leave they programme	

				7	Acute toxicity to aquatic organisms GHS09 WARNING  H400 (Very toxic to aquatic life)								
				8	Persistence in soil/water and soil absorption potential & bio magnification & bioaccumulation GHS09 WARNING  H410 (Very toxic to aquatic life with long lasting effects)								
	Combinations	Group 5 (Uracil) + Group 7 (urea)	Bromacil + Tebuthiuron (Bundu)	2	Acute toxicity to mammals and birds GHS07 WARNING  H302 (Harmful if swallowed) H315 (Causes skin irritation) H319 (Causes serious eye irritation) H335 (may cause respiratory irritation)	1.Chemically resistant nitrile gloves  2.Type 3 and Type 4 protective clothing 3.Safety boots  4.Face & Eye protection 	 	EN 374:2016 EN 14605:2005 EN 345: 1993 EN ISO 20345		5cc fresh urine sample refrigerated. Tested using ELIZA dipstick test		1.All workers need to be tested before they start working. 2.If the worker sprays 8 hours per day for 5 days per week, an additional test is needed every 2 years. 3. All workers need to be tested once they leave they programme	

						5.Half-face respirators 6.Particulate air filters for respirators 7.Apron/ Knapjack	 	EN 166:2001 EN 140, EN149, EN 143:200 R95, R99, R100					
				7	Acute toxicity to aquatic organisms GHS09 WARNING  H400 (Very toxic to aquatic life)								
				8	Persistence in soil/water and soil absorption potential & bio magnification & bioaccumulation GHS09 WARNING  H410 (Very toxic to aquatic life with long lasting effects)								

	Glycines	Group 9: Inhibitors of EPSP synthesis.	Phosphono glycines such as Glyphosate isopropylam ine salts (Seismic, tumplewee d) POE-T free	2	Acute toxicity to mammals and birds GHS07 WARNING  H318 (Causes serious eye damage)	1.Chemical ly resistant nitrile gloves 2.Type 3 and Type 4 protective clothing  3.Safety boots 4.Face & Eye protection 5.Half-face respirators 6.Particula te air filters for respirators 7.Apron/ Knapjack	     	EN 374:2016 EN 14605:2005 EN 345: 1993 EN ISO 20345 EN 166:2001 EN 140, EN149, EN 143:200 R95, R99, R100		5cc fresh urine sample refrigerat ed. Tested using ELIZA dipstick test		1.All workers need to be tested before they start working. 2.If the worker sprays 8 hours per day for 5 days per week, an additional test is needed every 2 years. 3. All workers need to be tested once they leave they programme	
	Glycines	Group 9: Inhibitors of EPSP synthesis.	Phosphonog lycines such as Glyphosate sodium salts (Kilo max)	2	Acute toxicity to mammals and birds GHS07 WARNING	1.Chemical ly resistant nitrile gloves 2.Type 3 and Type 4 protective clothing	 	EN 374:2016 EN 14605:2005		5cc fresh urine sample refrigerat ed. Tested using ELIZA dipstick test		1.All workers need to be tested before they start working. 2.If the worker sprays 8 hours per day for 5 days per week, an	

					H318 (Causes serious eye damage)	 3.Safety boots 4.Face & Eye protection 5.Half-face respirators 6.Particulate air filters for respirators 7.Apron/ Knapjack		EN 345: 1993 EN ISO 20345 EN 166:2001 EN 140, EN149, EN 143:200 R95, R99, R100				additional test is needed every 2 years. 3. All workers need to be tested once they leave they programme	
	Glycines	Group 9: Inhibitors of EPSP synthesis.	Phosphonoglycines such as glyphosate (all GBH's containing POE-T such as Roundup etc)	2	Acute toxicity to mammals and birds GHS07 WARNING  H318 (Causes serious eye damage)	1.Chemically resistant nitrile gloves 2.Type 3 and Type 4 protective clothing  3.Safety boots		EN 374:2016 EN 14605:2005 EN 345: 1993 EN ISO 20345		5cc fresh urine sample refrigerated. Tested using ELIZA dipstick test		1.All workers need to be tested before they start working. 2.If the worker sprays 8 hours per day for 5 days per week, an additional test is needed every 2 years. 3. All workers need to be tested once they leave	

						4.Face & Eye protection 5.Half-face respirators 6.Particulate air filters for respirators 7.Apron/ Knapjack	  	EN 166:2001 EN 140, EN149, EN 143:200 R95, R99, R100				they programme	
				3	Carcinogenicity GHS07 WARNING  H335 (May cause respiratory irritation) H336 (may cause drowsiness or dizziness) H315 (Causes skin irritation) H319 (causes serious eye irritation)	1.Chemically resistant nitrile gloves 2.Type 3 and Type 4 protective clothing  3.Safety boots 4.Face & Eye protection 5.Half-face respirators 6.Particulate air	    	EN 374:2016 EN 14605:2005 EN 345: 1993 EN ISO 20345 EN 166:2001 EN 140, EN149, EN 143:200	20cc fresh blood sample. AChE tests done with Test-Mate model 400 device		1.All workers need to be tested before they start working. 2.If the worker sprays 8 hours per day for 5 days per week, an additional test needs to be done every 2 years.. 3. All workers need to be tested once they leave the		

						filters for respirators 7.Apron/ Knapjack		R95, R99, R100			programme		
				8	Persistence in soil/water and soil absorption potential & bio magnification & bioaccumulation GHS09 WARNING  H411 (Toxic to aquatic life with long lasting effects)								
	Organoarsenicals	Group 17: Unknown	Monosodium methylarsonate (MSMA)	2	Acute toxicity to mammals and birds GHS07 WARNING  H302 (Harmful if swallowed) H315 (causes skin irritation) H319 (Causes serious eye irritation) H332 (Harmful if inhaled)	1.Chemically resistant nitrile gloves 2.Type 3 and Type 4 protective clothing  3.Safety boots	  	EN 374:2016 EN 14605:2005 EN 345: 1993 EN ISO 20345		5cc fresh urine sample refrigerated. Tested using ELIZA dipstick test		1.All workers need to be tested before they start working. 2.If the worker sprays 8 hours per day for 5 days per week, an additional test is needed every 2 years. 3. All workers need to be tested once they leave	

						4.Face & Eye protection 5.Half-face respirators 6.Particulate air filters for respirators 7.Apron/ Knapjack	  	EN 166:2001 EN 140, EN149, EN 143:200 R95, R99, R100				they programme	
				3	Carcinogenicity GHS07 WARNING  H335 (May cause respiratory irritation) H336 (May cause drowsiness or dizziness)	1.Chemically resistant nitrile gloves 2.Type 3 and Type 4 protective clothing  3.Safety boots 4.Face & Eye protection 5.Half-face respirators 6.Particulate air	    	EN 374:2016 EN 14605:2005 EN 345: 1993 EN ISO 20345 EN 166:2001 EN 140, EN149, EN 143:200	20cc fresh blood sample. AChE tests done with Test-Mate model 400 device		1.All workers need to be tested before they start working. 2.If the worker sprays 8 hours per day for 5 days per week, an additional test needs to be done every 2 years.. 3. All workers need to be tested once they leave the programme		

						filters for respirators 7.Apron/ Knapjack		R95, R99, R100					
				6	Endocrine Disrupting Chemicals (EDC) GHS08 DANGER  H371 (may cause damage to organs (kidneys and liver) H372 (causes damage to organs through prolonged effect (liver and kidneys)	1.Chemically resistant nitrile gloves 2.Type 3 and Type 4 protective clothing  Type 5 protective clothing  3.Safety boots 4.Face & Eye protection 5.Half-face respirators 6.Particulate air filters for respirators	     	EN ISO 20345 EN 166:2001 EN140 EN 149 EN 143:2000 R95, R99, R100	20cc fresh blood sample. AChE tests done with Test-Mate model 400 device		1.All workers need to be tested before they start working. 2.If the worker sprays 8 hours per day for 5 days per week, an additional test needs to be done every 2 years.. 3. All workers need to be tested once they leave the programme		

						7.Apron/ Knapjack 8. Long-sleeved shirts							
	Bipyridyliums	Group 22: Cell membrane disruptors	Diquat dibromide (Scuba, Midstream) & Paraquat (Gramoxone)	2	Acute toxicity to mammals and birds GHS06 DANGER  H301(Toxic if swallowed) H311(Toxic in contact with skin) H330(Fatal if inhaled) GHS07 WARNING  H315(Causes skin irritation) H319(causes serious eye irritation) H335(May cause respiratory irritation) H372(Causes damage to organs)	1.Chemically resistant nitrile gloves 2.Type 3 and Type 4 protective clothing  3.Safety boots 4.Face & Eye protection 5.Half-face respirators 6.Particulate air filters for respirators 7.Apron/ Knapjack		EN 374:2016 EN 14605:2005 EN 345: 1993 EN ISO 20345 EN 166:2001 EN 140, EN149, EN 143:200 R95, R99, R100		5cc fresh urine sample refrigerated. Tested using ELIZA dipstick test		1.All workers need to be tested before they start working. 2.If the worker sprays 8 hours per day for 5 days per week, an additional test is needed every 2 years. 3. All workers need to be tested once they leave they programme	

				7	Acute toxicity to aquatic organisms  H400 (Very toxic to aquatic life)								
				8	Persistence in soil/water and soil absorption potential & bio magnification & bioaccumulation GHS09 WARNING  H411 (Toxic to aquatic life with long lasting effects)								

PESTICIDES FOR NON-PLANT INVASIVES CONTROL

						PPE			**Medical Biomonitoring**		**Frequency and Duration**		
	Chemical group	**MOA**	**Examples**	**Hazard Group**	**Hazard Criterion**	**Type**	**Pictogram**	**Classification**	**Blood**	**Urine**	**Blood**	**Urine**	**Environmental monitoring**
1	Rodenticides	Inhibits vitamin K, anti-coagulant	Difenacoum, Brodifacoum Coumatetralyl	2	Acute Toxicity to mammals and birds GHS06 DANGER 	1.Chemically resistant nitrile gloves		EN ISO 20345 EN 166:2001	20cc fresh blood sample. AChE tests		1.All workers need to be tested before they		

					H300 (Fatal if swallowed) H310 (Fatal in contact with skin) GHS07 WARNING  H373 (Causes damage to organs through prolonged or repeated exposure – blood)	2.Type 3 and Type 4 protective clothing  Type 5 protective clothing  3.Safety boots 4.Face & Eye protection 5.Half-face respirators 6.Particulate air filters for respirators 7.Apron/ Knapjack 8. Long-sleeved shirts	    	EN140 EN 149 EN 143:2000 R95, R99, R100	done with Test-Mate model 400 device		start working. 2.If the worker sprays 8 hours per day for 5 days per week, an additional test needs to be done every 2 years.. 3. All workers need to be tested once they leave the programme		
				5	Developmental and Reproductive toxicity GHS08 DANGER 	1.Chemically resistant nitrile gloves 2.Type 3 and Type 4		EN ISO 20345 EN 166:2001	20cc fresh blood sample. AChE tests done		1.All workers need to be tested before they start working.		

					H360D (May damage the unborn child)	protective clothing  Type 5 protective clothing  3.Safety boots 4.Face & Eye protection 5.Half-face respirators 6.Particulate air filters for respirators 7.Apron/ Knapjack 8. Long-sleeved shirts	    	EN140 EN 149 EN 143:2000 R95, R99, R100	with Test-Mate model 400 device		2.If the worker sprays 8 hours per day for 5 days per week, an additional test needs to be done every 2 years.. 3. All workers need to be tested once they leave the programme		
				6	Endocrine Disrupting Chemicals (EDC) GHS08 DANGER  H372 (Causes damage to organs through	1.Chemically resistant nitrile gloves 2.Type 3 and Type 4 protective clothing		EN ISO 20345 EN 166:2001	20cc fresh blood sample. AChE tests done with Test-		1.All workers need to be tested before they start working. 2.If the worker		

					prolonged or repeated exposure – blood)	 Type 5 protective clothing  3.Safety boots 4.Face & Eye protection 5.Half-face respirators 6.Particulate air filters for respirators 7.Apron/ Knapjack 8. Long-sleeved shirts	    	EN140 EN 149 EN 143:2000 R95, R99, R100	Mate model 400 device		sprays 8 hours per day for 5 days per week, an additional test needs to be done every 2 years.. 3. All workers need to be tested once they leave the programme		
				7	Acute toxicity to aquatic organisms  H400 (Very toxic to aquatic life)								Ensure environmental monitoring is complied with such as ESRA protocols
				8	Persistence in soil/water and soil absorption								Ensure environmental monitoring is

					potential & bio magnification & bioaccumulation GHS09 WARNING  H410 (Very toxic to aquatic life with long lasting effects)								complied with such as ESRA protocols
			Cholecalciferol	2	Acute Toxicity to mammals and birds GHS06 DANGER  H301 (Toxic is swallowed) H311 (Toxic in contact with skin) H330 (fatal if inhaled)	1.Chemically resistant nitrile gloves 2.Type 3 and Type 4 protective clothing  Type 5 protective clothing  3.Safety boots 4.Face & Eye protection 5.Half-face respirators 6.Particulate air filters for respirators 7.Apron/ Knapjack	     	EN ISO 20345 EN 166:2001 EN140 EN 149 EN 143:2000 R95, R99, R100	20cc fresh blood sample. AChE tests done with Test-Mate model 400 device		1.All workers need to be tested before they start working. 2.If the worker sprays 8 hours per day for 5 days per week, an additional test needs to be done every 2 years.. 3. All workers need to be tested once they leave the programme		

						8. Long-sleeved shirts							
				6	Endocrine Disrupting Chemicals (EDC) GHS08 DANGER  H372 (Causes damage to organs through prolonged or repeated exposure	1.Chemically resistant nitrile gloves 2.Type 3 and Type 4 protective clothing  Type 5 protective clothing  3.Safety boots 4.Face & Eye protection 5.Half-face respirators 6.Particulate air filters for respirators 7.Apron/ Knapjack	    	EN ISO 20345 EN 166:2001 EN140 EN 149 EN 143:2000 R95, R99, R100	20cc fresh blood sample. AChE tests done with Test-Mate model 400 device		1.All workers need to be tested before they start working. 2.If the worker sprays 8 hours per day for 5 days per week, an additional test needs to be done every 2 years.. 3. All workers need to be tested once they leave the programme		

						8. Long-sleeved shirts						
2	Avicides	Sedative powder	alphachloralose	2	Acute Toxicity to mammals and birds GHS06 DANGER  H301 (Toxic if swallowed) GHS07 WARNING  H332 (Harmful if inhaled) H336 (may cause drowsiness or dizziness)	1.Chemically resistant nitrile gloves 2.Type 3 and Type 4 protective clothing  Type 5 protective clothing  3.Safety boots 4.Face & Eye protection 5.Half-face respirators 6.Particulate air filters for respirators 7.Apron/ Knapjack	     	EN ISO 20345 EN 166:2001 EN140 EN 149 EN 143:2000 R95, R99, R100	20cc fresh blood sample. AChE tests done with Test-Mate model 400 device		1.All workers need to be tested before they start working. 2.If the worker sprays 8 hours per day for 5 days per week, an additional test needs to be done every 2 years.. 3. All workers need to be tested once they leave the programme		

						8. Long-sleeved shirts							
				7	Acute toxicity to aquatic organisms  H400 (Very toxic to aquatic life)								Ensure environmental monitoring is complied with such as ESRA protocols
				8	Persistence in soil/water and soil absorption potential & bio magnification & bioaccumulation GHS09 WARNING  H410 (Very toxic to aquatic life with long lasting effects)								Ensure environmental monitoring is complied with such as ESRA protocols
		Uptake orally resulting in hepatic necrosis and eventual death	DRC 1336/ Starlicide	2	Acute Toxicity to mammals and birds GHS06 DANGER  H301 (Toxic if swallowed) H311 (Toxic in contact with skin) GHS07 WARNING	1.Chemically resistant nitrile gloves 2.Type 3 and Type 4 protective clothing 	 	EN ISO 20345 EN 166:2001 EN140 EN 149	20cc fresh blood sample. AChE tests done with Test-Mate model 400 device		1.All workers need to be tested before they start working. 2.If the worker sprays 8 hours per day for 5 days per week, an additional		

					 H315 (Causes skin irritation) H317 (May cause an allergic skin reaction) H319 (Causes serious eye irritation) H332 (Harmful if inhaled)	Type 5 protective clothing  3.Safety boots 4.Face & Eye protection 5.Half-face respirators 6.Particulate air filters for respirators 7.Apron/ Knapjack 8. Long-sleeved shirts	   	EN 143:2000 R95, R99, R100			test needs to be done every 2 years.. 3. All workers need to be tested once they leave the programme		
				7	Acute toxicity to aquatic organisms  H400 (Very toxic to aquatic life)								Ensure environmental monitoring is complied with such as ESRA protocols
				8	Persistence in soil/water and soil absorption potential & bio magnification & bioaccumulation								Ensure environmental monitoring is complied with such as ESRA protocols

					GHS09 WARNING  H410 (Very toxic to aquatic life with long lasting effects)								
3	Piscicides	Mitochondrial NADH: ubiquinone reductase inhibitor and toxin	Rotenone	2	Acute Toxicity to mammals and birds GHS06 DANGER  H301 (Toxic if swallowed) GHS07 WARNING  H315 (Causes skin irritation) H319 (Causes serious eye irritation) H335 (May cause respiratory irritation)	1.Chemically resistant nitrile gloves 2.Type 3 and Type 4 protective clothing  Type 5 protective clothing  3.Safety boots 4.Face & Eye protection 5.Half-face respirators 6.Particulate air filters for respirators 7.Apron/ Knapjack	     	EN ISO 20345 EN 166:2001 EN140 EN 149 EN 143:2000 R95, R99, R100	20cc fresh blood sample. AChE tests done with Test-Mate model 400 device		1.All workers need to be tested before they start working. 2.If the worker sprays 8 hours per day for 5 days per week, an additional test needs to be done every 2 years.. 3. All workers need to be tested once they leave the programme		

						8. Long-sleeved shirts							
				7	Acute toxicity to aquatic organisms  H400 (Very toxic to aquatic life)								Ensure environmental monitoring is complied with such as ESRA protocols
				8	Persistence in soil/water and soil absorption potential & bio magnification & bioaccumulation GHS09 WARNING  H410 (Very toxic to aquatic life with long lasting effects)								Ensure environmental monitoring is complied with such as ESRA protocols

Appendix H: Fossil Chance Find Protocol

Fossil Chance Find Protocol

Monitoring Programme for Palaeontology – to commence once the excavations / drilling activities begin.

1. The following procedure is only required if fossils are seen on the surface and when drilling/excavations commence.
2. When excavations begin the rocks and discard must be given a cursory inspection by the environmental officer or designated person. Any fossiliferous material (plants, insects, bone or coal) should be put aside in a suitably protected place. This way the project activities will not be interrupted.
3. Photographs of similar fossils can be provided to the developer to assist in recognizing the fossil plants, vertebrates, invertebrates or trace fossils in the shales and mudstones. This information will be built into the EMP's training and awareness plan and procedures.
4. Photographs of the putative fossils can be sent to the palaeontologist for a preliminary assessment.
5. If there is any possible fossil material found by the developer/environmental officer then the qualified palaeontologist sub-contracted for this project, should visit the site to inspect the selected material and check the dumps where feasible.
6. Fossil plants or vertebrates that are considered to be of good quality or scientific interest by the palaeontologist must be removed, catalogued and housed in a suitable institution where they can be made available for further study. Before the fossils are removed from the site a HWC permit must be obtained. Annual reports must be submitted to HWC as required by the relevant permits.
7. If no good fossil material is recovered then no site inspections by the palaeontologist will be necessary. A final report by the palaeontologist must be sent to HWC once the project has been completed and only if there are fossils.
8. If no fossils are found and the excavations have finished then no further monitoring is required.