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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

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DATE: 26 June 2026

SES REF NO: AMP/MPS/MBM/06/26
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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:	<ul style="list-style-type: none"> • Portion 15 of the Farm Klipheuvél No. 143 • Portion 24 of the Farm Klipheuvél No. 143 • Portion 25 of the Farm Klipheuvél No. 143 	
SG Codes:	Portion 15 of the Farm Klipheuvél No. 143	C0510000000014300015
	Portion 24 of the Farm Klipheuvél No. 143	C0510000000014300024
	Portion 25 of the Farm Klipheuvél No. 143	C0510000000014300025
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	
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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 Klipheuvél 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.

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	SITE DESCRIPTION
4	

Locality and Project Description:

Sharples Environmental Services cc (SES) have been appointed by Lyners Engineers on behalf of the Department of Water and Sanitation 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 Klipheuwel 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.

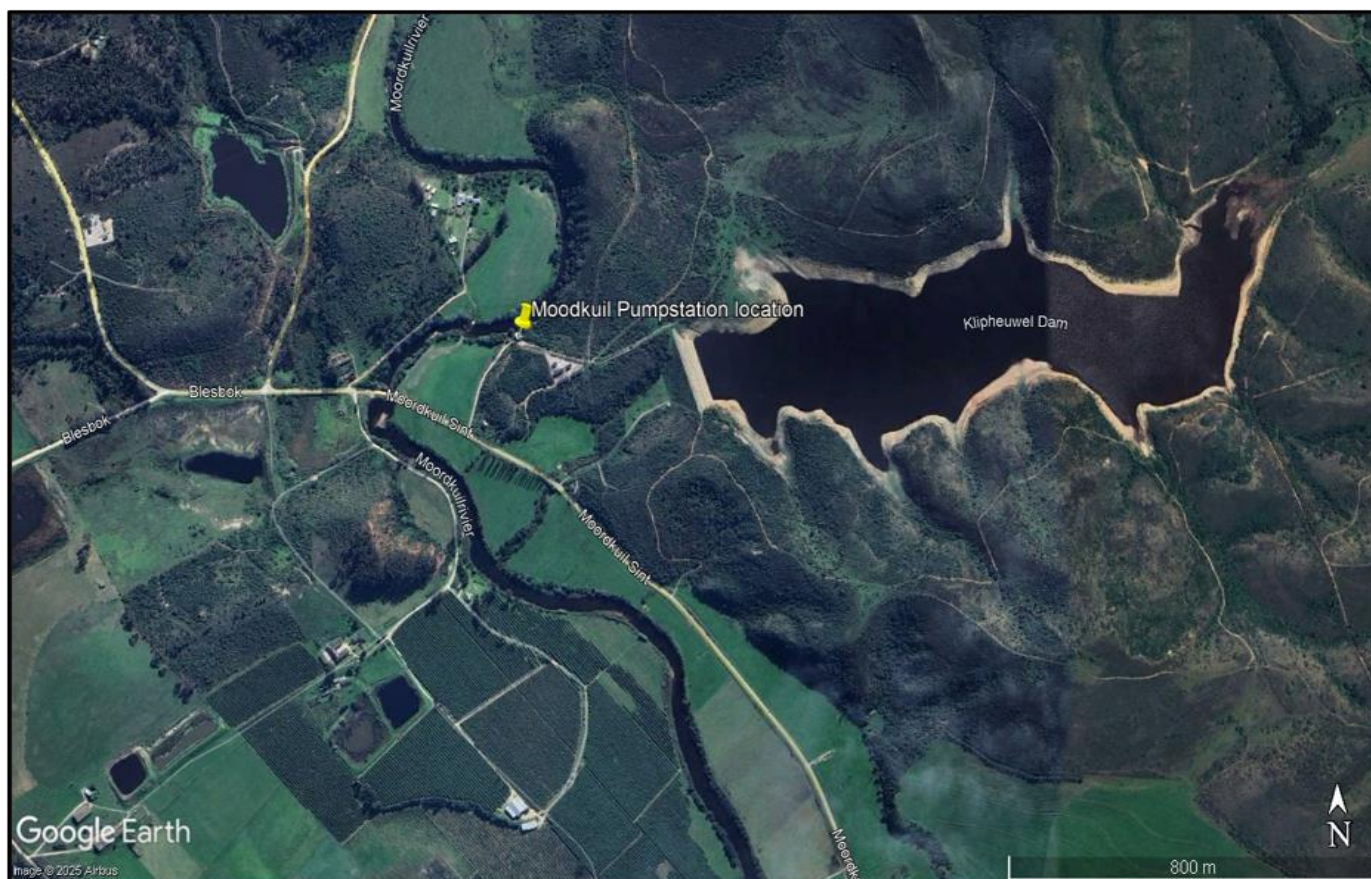


Figure 1: Locality Map of Moordkuil Pump Station.



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.

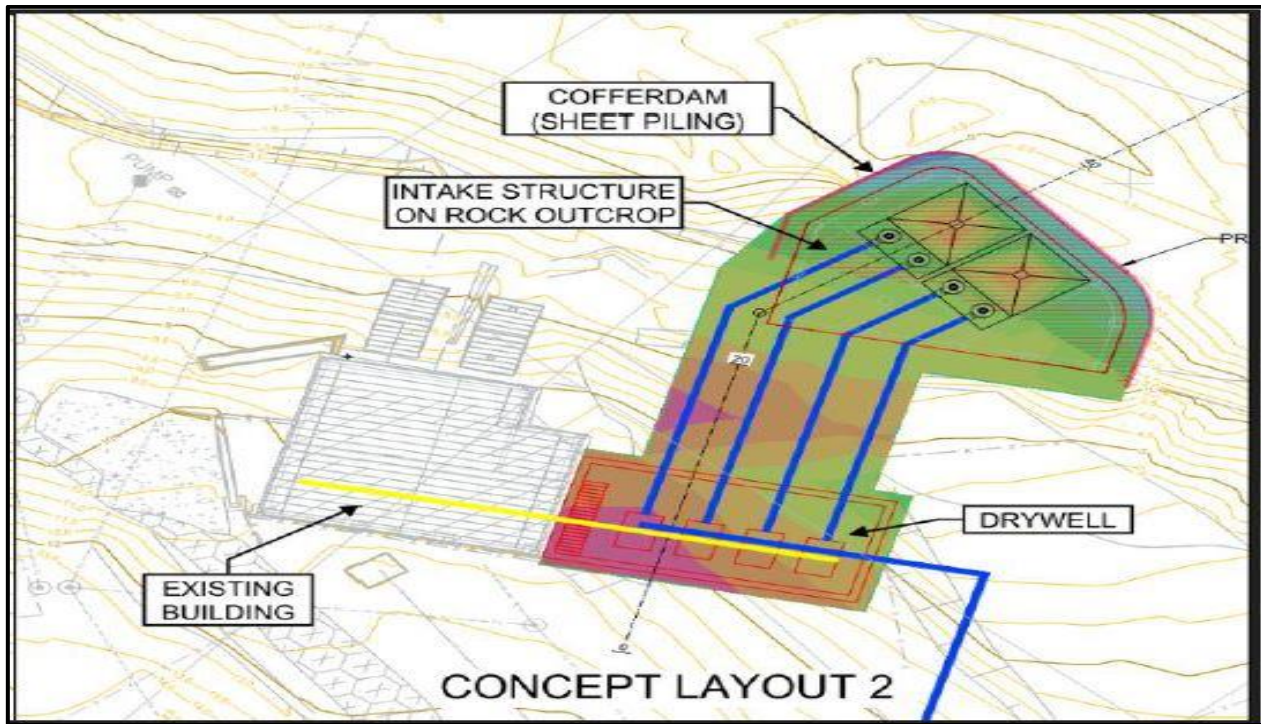


Figure 3: Option 3 – Concept Layout 2.

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 the 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.

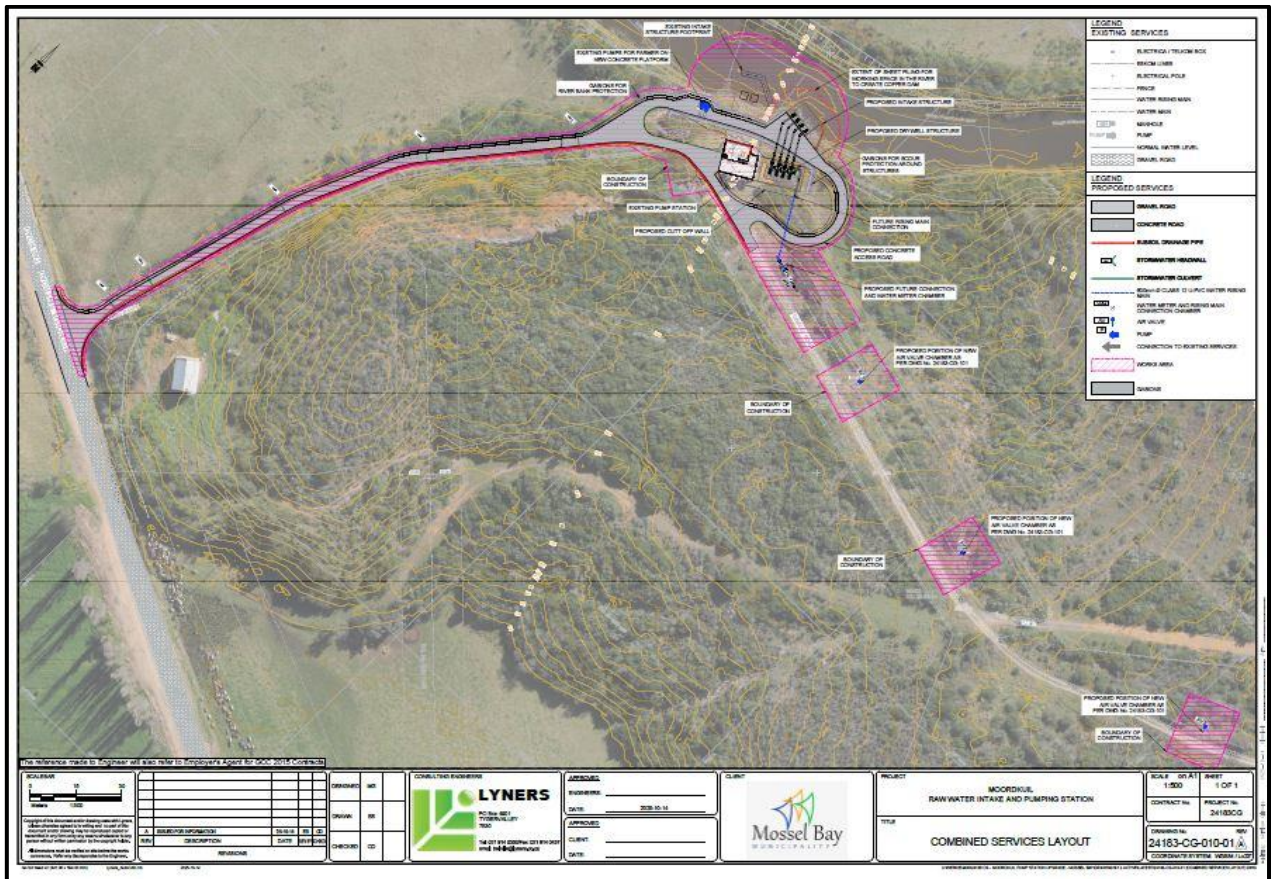


Figure 4: Proposed Services Layout.

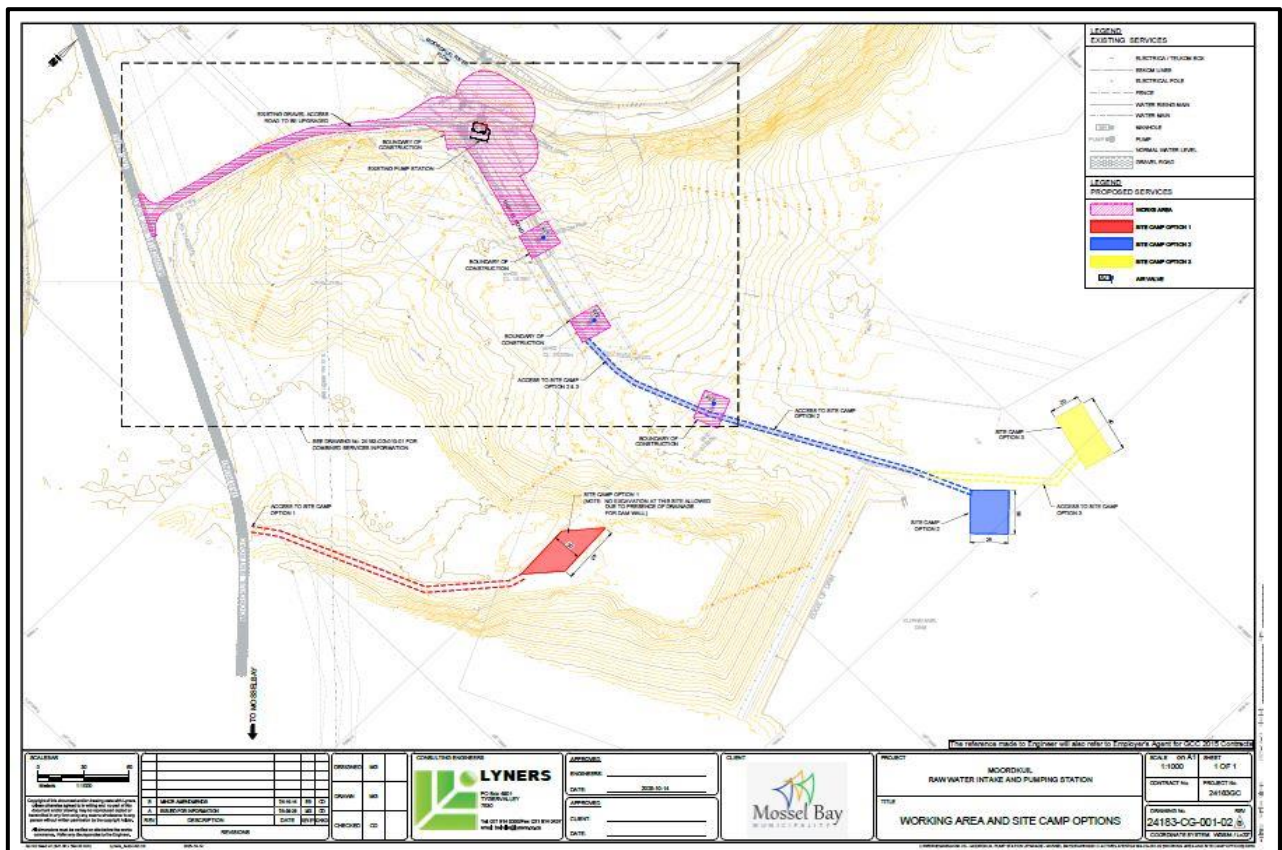


Figure 5: Working Area and Site Camp Locations Layout.

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 tetraacantha*. 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 *Dicrothamnus 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.

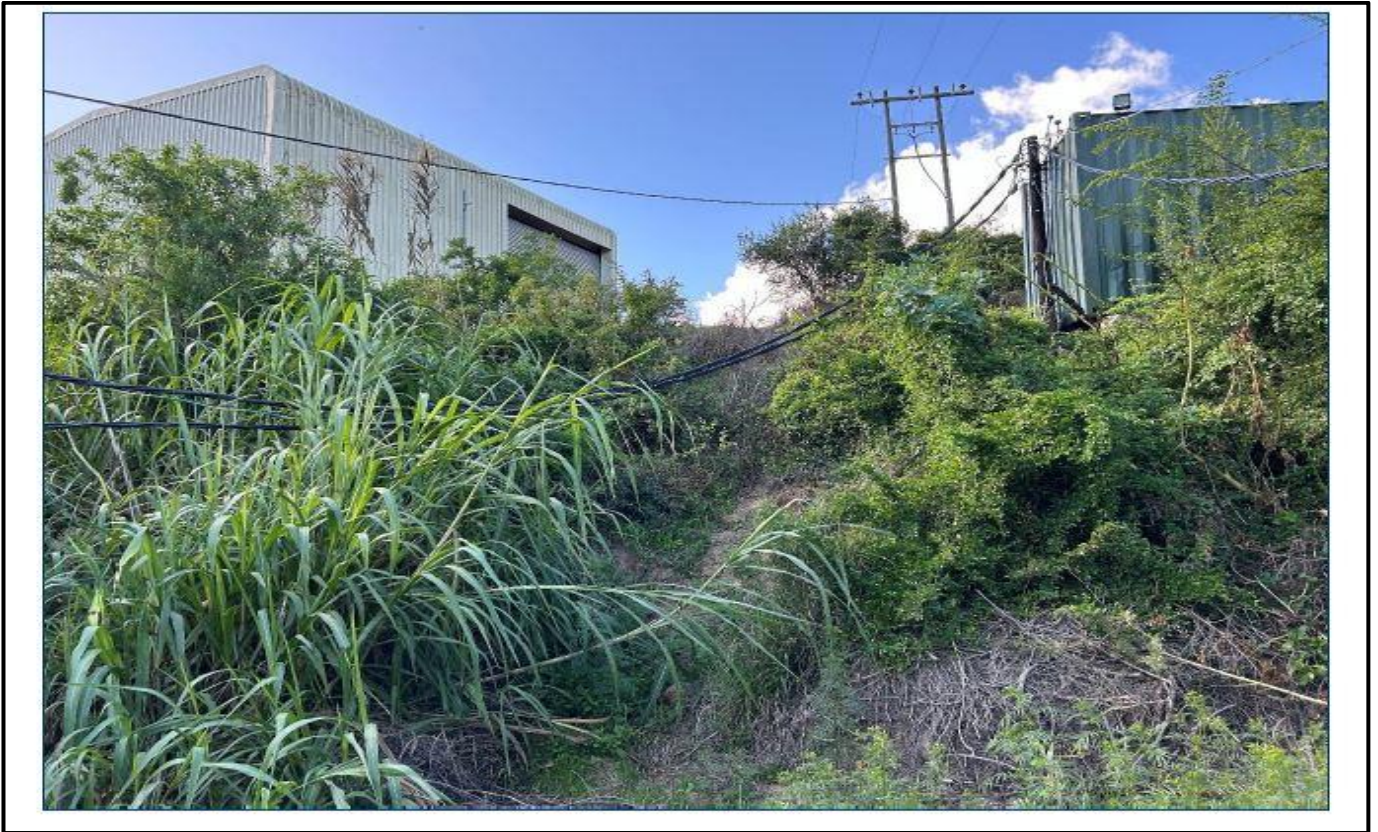


Figure 7: Embankment on western side of pump station, covered by pioneer shrubs and reeds.



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).

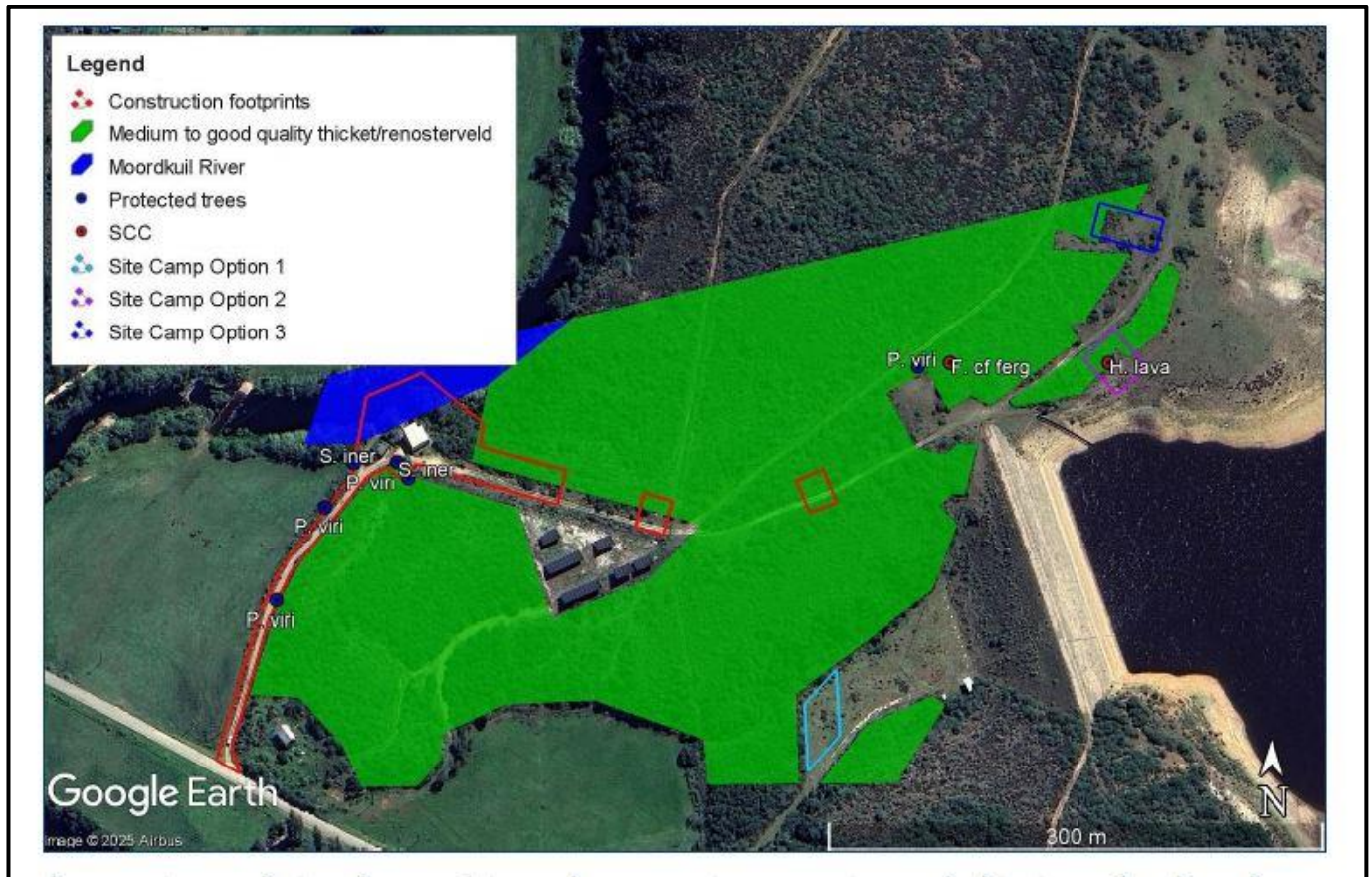


Figure 15: Botanical attributes of the project area. The untuned areas inside the project footprint are transformed or highly degraded.

Plant species:

The following indigenous tree and shrub species were recorded on site, namely *Athanasia trifurcata*, *Dicrothamnus 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*, *Mystroxyton aethiopicum*, *Scolopia zeyheri*, *Buddleja saligna*, *Euclea undulata*, *Pittosporum viridiflorum*, *Olea europaea*, *Azima tetraacantha*, *Ruschia tenella*, *Lampranthus emarginatoides*, *Delosperma neethlingiae*, *Drosanthemum parvifolium*, *D. floribundum*, *Carpobrotus deliciosus*, *Cotyledon orbiculata*, *Crassula perforata*, *C. nudicaulis*, *C. subulata*, *C. muscosa*, *Sideroxyton 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*, *Phyllica cf axillaris*, *Cynanchum ellipticum*, *C. viminale*, *Gomphocarpus physocarpus*, *Rhoicissus digitata*, *Acalypha capensis*, *Pavonia columella*, *Hypoestes forskoolii* 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 *Dicrothamnus 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).

Alien Invasive Species:

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).

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

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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Prioritise removal before seed set. Avoid clearing during heavy rainfall periods to prevent soil erosion.
4. Disposal	<p>All plant material must be:</p> <ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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:	<ul style="list-style-type: none"> 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:	<ul style="list-style-type: none"> Immediate application of systemic herbicide to cut surfaces. Ensure no untreated stumps remain.
3. Seed Bank Management	<ul style="list-style-type: none"> Disturbed soil areas must be stabilised quickly. Avoid unnecessary soil disturbance.

4.	Record Keeping:	<ul style="list-style-type: none"> • 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:	<ul style="list-style-type: none"> • Clearly demarcate approved development footprint. • No clearing outside approved areas.
2.	Vehicle & Equipment Hygiene:	<ul style="list-style-type: none"> • Construction vehicles must arrive free of soil and plant material. • No storage of contaminated soil near natural vegetation
3.	Stockpile Management:	<ul style="list-style-type: none"> • No stockpiling within 10–20 m of watercourses or buffers. • Prevent wind or water dispersal of seeds.
4.	Stormwater Control	<ul style="list-style-type: none"> • Install erosion control measures. • Prevent runoff transporting invasive seeds.
5.	Immediate Removal	<ul style="list-style-type: none"> • 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:	<ul style="list-style-type: none"> • Strip and stockpile topsoil separately. • Replace topsoil during rehabilitation phase.
2.	Revegetation:	<ul style="list-style-type: none"> • Encourage natural regeneration where feasible. • Supplement with locally indigenous species if required. • Avoid planting invasive or ornamental species.
3.	Erosion Control:	<ul style="list-style-type: none"> • Use brush packing where appropriate. • Install silt fencing and berms where necessary.
4.	Rehabilitation Monitoring:	<ul style="list-style-type: none"> • Assess vegetation cover percentage. • Ensure no new alien dominance.
5.	Success Criteria:	<ul style="list-style-type: none"> • 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:	<ul style="list-style-type: none"> • This Alien Management Plan forms part of the approved EMPr. • Binding on the Applicant and all contractors.
2.	ECO Monitoring:	<ul style="list-style-type: none"> • Monthly monitoring during construction. • Post-construction monitoring every 6 months for 3 years (recommended).
3.	Reporting:	<ul style="list-style-type: none"> • Alien clearing activities to be included in ECO reports. • Non-compliance to be recorded and corrective action implemented immediately.

4. Training:	<ul style="list-style-type: none"> • Contractors and workers must receive environmental induction. • Awareness of listed invasive species and legal obligations.
5. Legal Compliance:	<ul style="list-style-type: none"> • Compliance with: <ul style="list-style-type: none"> ○ NEMBA (Act 10 of 2004) ○ Alien & Invasive Species Regulations ○ NEMA Duty of Care (Section 28)
6. Responsibility:	<ul style="list-style-type: none"> • The Applicant remains legally responsible for ongoing control of invasive species.

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.

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.

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 EMP, 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 EMP;
- 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 Municipality
- 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, Kleinbrak 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 Clinkscapes 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 Environmental 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 filling 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 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** Knysna 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 Rheeboek

- 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** Knysna 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** Knysna 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 Quantity 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



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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Highest Qualification	PhD in Botany
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.

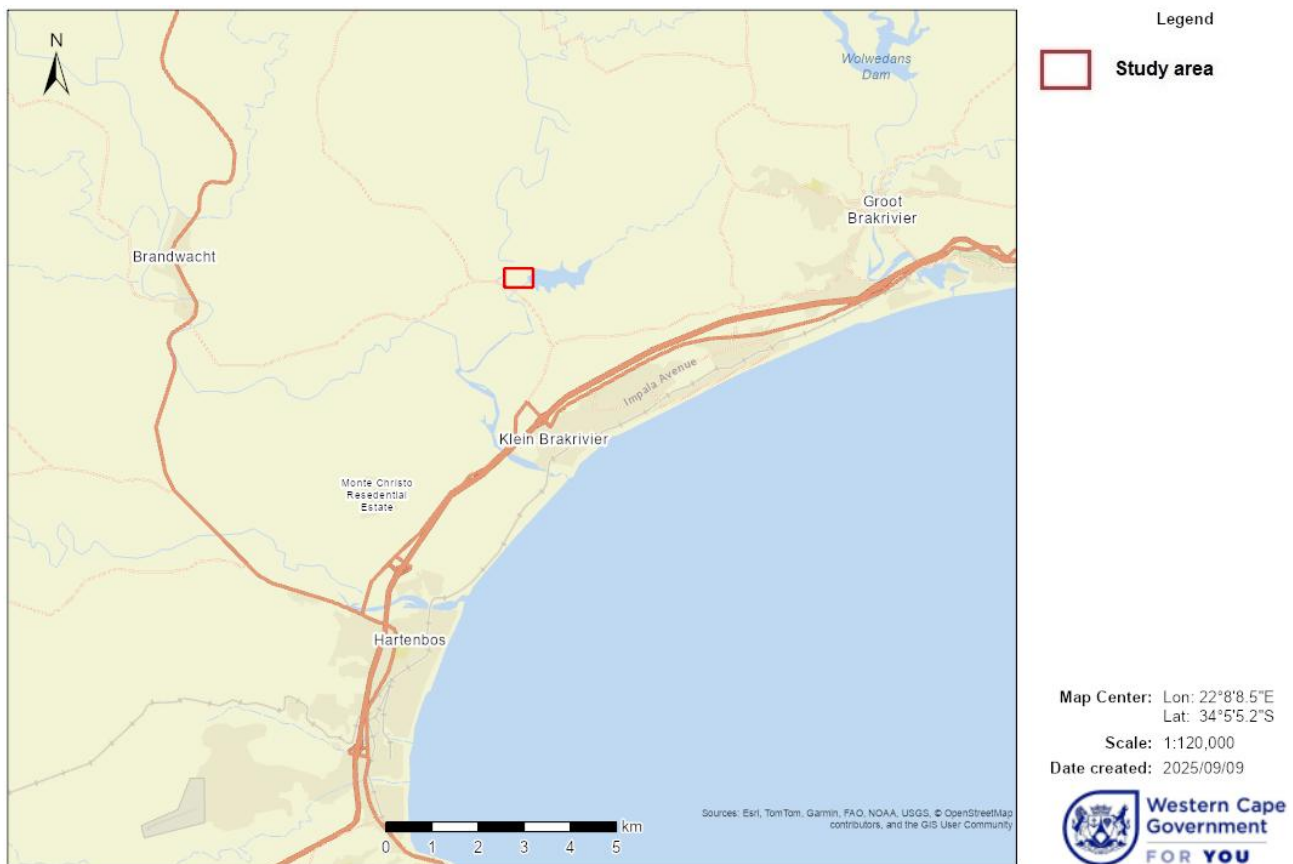


Figure 1-1: Satellite photo showing the location of the site (outlined in red) north of Klein Brak River in the Mossel Bay area.

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 Klipheuvel 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 database¹ 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.

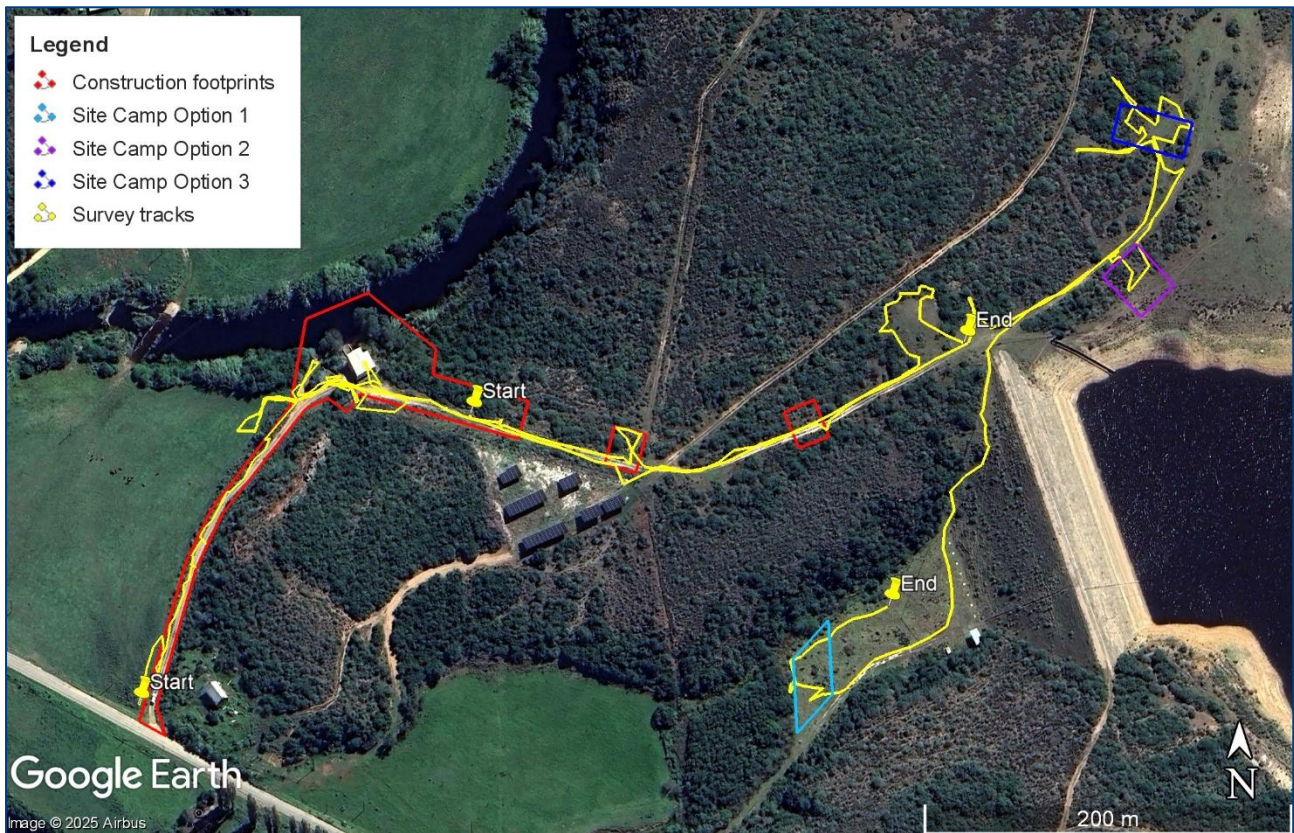


Figure 3-1: Satellite photo showing the survey tracks on site.

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*, *Mystroxydon 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.

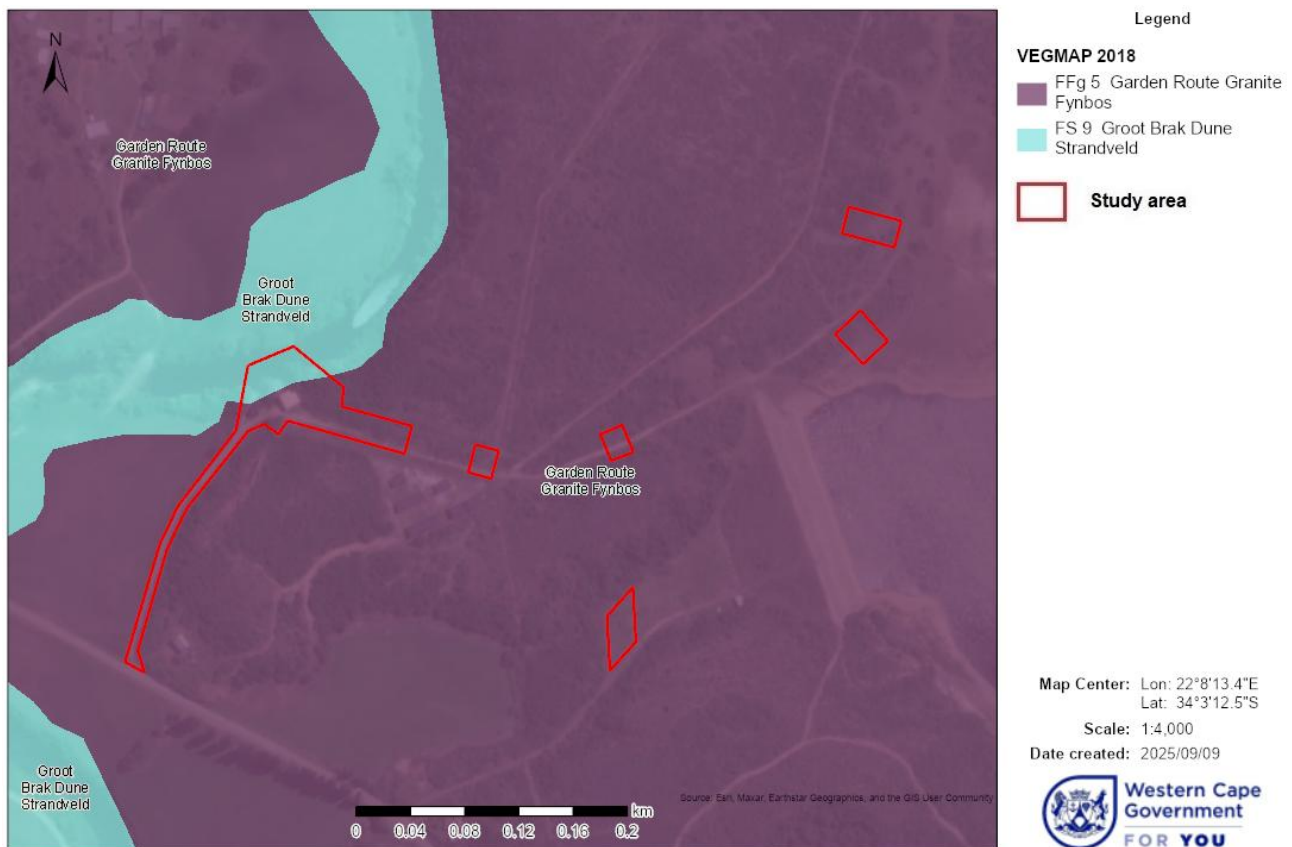


Figure 4-4: Extract of the 2018 SA Vegetation map.

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 protected². 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 collapse³.



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 *Dicerotheramnus 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 Klipheuvel Dam wall (34° 03' 17" S; 22° 08' 17" E).



Figure 5-8: Site camp option 2, above Klipheuvel 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).

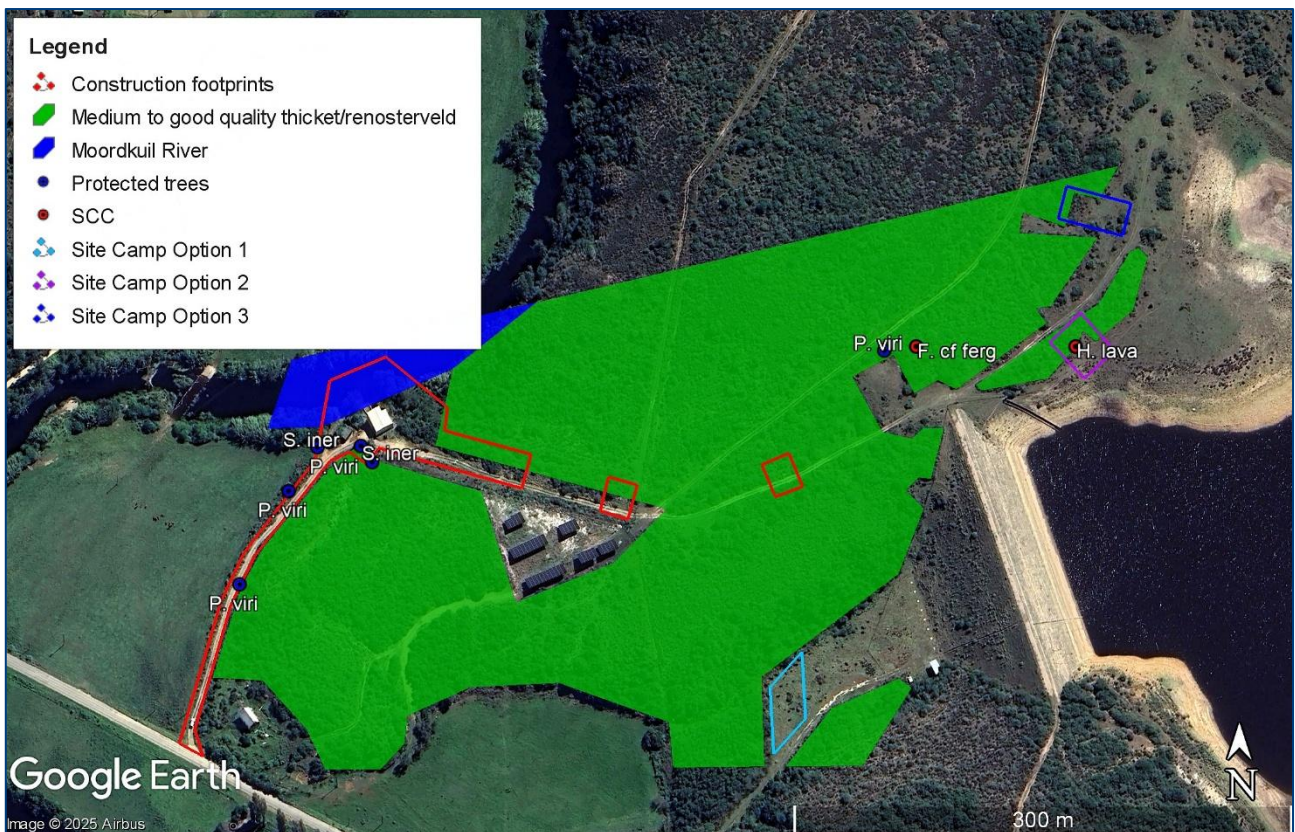


Figure 5-10: Botanical attributes of the project area. The untuned areas inside the project footprint are transformed or highly degraded.

Plant species

The following indigenous tree and shrub species were recorded on site, namely *Athanasia trifurcata*, *Dicerotheramnus 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*, *Mystroxyton 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*, *Sideroxyton 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*, *Phyllica cf axillaris*, *Cynanchum ellipticum*, *C. viminale*, *Gomphocarpus physocarpus*, *Rhoicissus digitata*, *Acalypha capensis*, *Pavonia columella*, *Hypoestes forskalii* 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 *Dicerotheramnus 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 *Sideroxyton 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**.

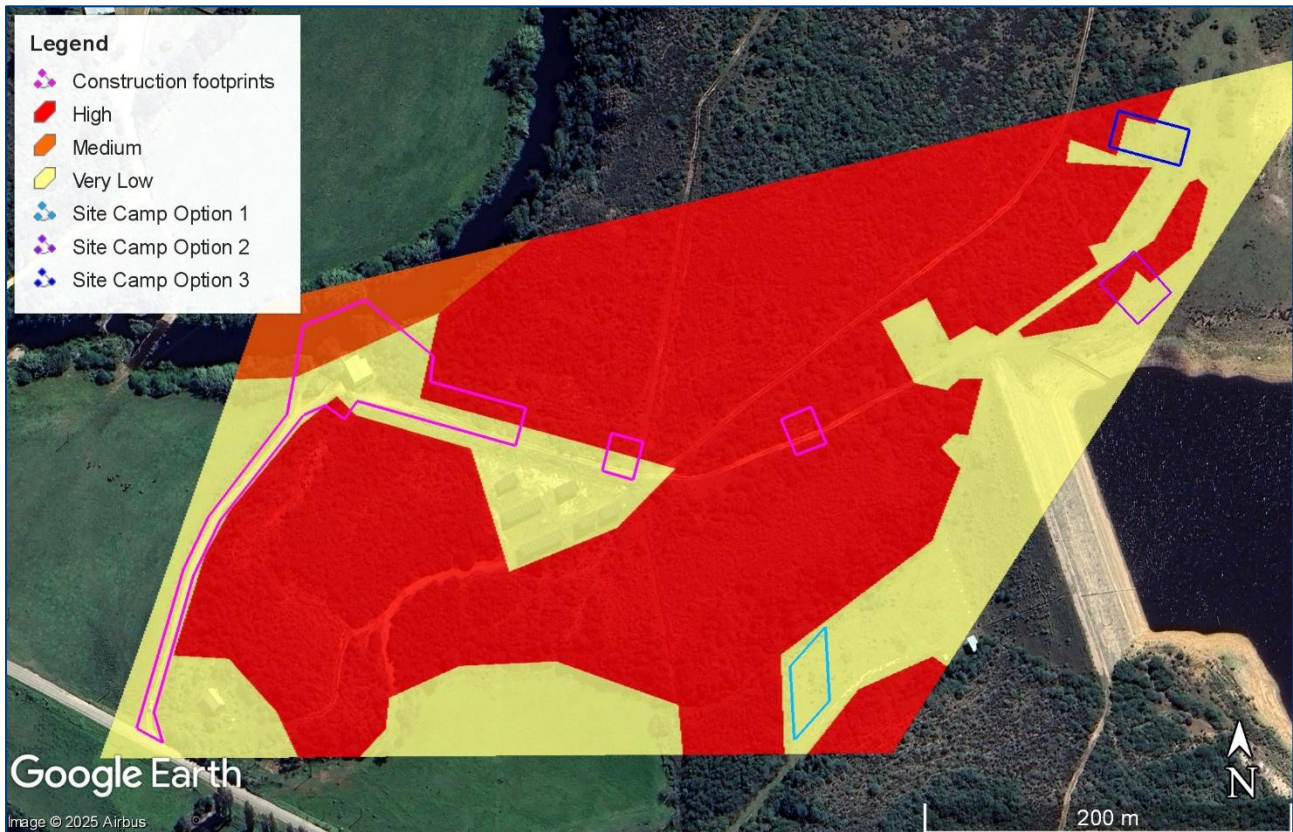


Figure 5-13: Site ecological importance (SEI) map of the project area.

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, *Dicerotheramnus 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)	<ul style="list-style-type: none"> - Clearing of mostly degraded thicket/renosterveld. - Temporary impact on the functionality of biodiversity network. - Increased opportunity for alien infestation. - Pollution of aquatic systems. 	<ul style="list-style-type: none"> - 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 Klipheувel 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.

References

- Bromilow, C. 2010. Problem Plants and Alien Weeds of South Africa. Briza Publications, Pretoria.
- DEA 2022. Revised National List of Ecosystems that are threatened and in need of protection. Government Gazette No. 47526. Government Printer, Pretoria.
- Manning, J. & Goldblatt, P. 2012. Plants of the Greater Cape Floristic Region 1: the Core Cape flora, *Strelitzia* 29. SANBI, Pretoria.
- Mucina, L. & Rutherford, M.C. 2006. The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.
- Pool-Stanvliet, R., Duffell-Canham, A., Pence, G. & Smart, R. 2017. The Western Cape Biodiversity Spatial Plan Handbook. CapeNature, Stellenbosch.
- SANBI 2020. Species Environmental Assessment Guideliene. Guidelines for the implementation of the Terrestrial Fauna and Terrestrial Flora Species Protocols for environmental impact assessments in South Africa. South African National Biodiversity Institute, Pretoria. Version 3.1. 2022.
- Viljoen, J.H.A. & Malan, J.A. 1993. Die geologie van die gebiede 3421 BB Mosselbaai en 3422 AA Herbertsdale. Geologiese Opname, Departement van Minerale- en Energiesake, Pretoria.

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	<i>Polygala pubiflora</i>	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 project will 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:
Name/Section:	Directorate: National Southern & Western Programmes	Dr Christo Marais	Ms Nonhlanhla Mkhize	Ms Nomfundo Tshabalala
Designation	D: N, S&WP	CD: NRM	DDG: EP	DG
Signature:				
Date:				

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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 of 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 Lifecycle 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 handling or storage of 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 such risks posed by said 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)

Occupational 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 Practice for the Safe Handling of Pesticides)

SANS 10228:2010 (The Code of Practice 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 convention¹, Rotterdam convention², Basel convention³ and Bamako⁴ 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 Management⁵ 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 of this

policy, the life cycle includes procurement, distribution, storage, transport, use and final disposal of the pesticide product and/or its container⁵.

The Service Provider is responsible for the procuring pesticides and may make use of the RT12 (Transversal Contract by national Treasury) to procure pesticides at 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 protocols⁶ for pesticides in hazard groups 1-6 and 9 & 10 (Annexure 1), Regulations for Hazardous Chemicals Agents⁷ and Guidelines for Personal Protection when handling and Applying Pesticides⁸.
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 8⁶ (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 protection⁶. 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 volatilizing pesticides due to human health inhalation risk being too high to mitigate⁹, 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 contamination⁵⁻⁹.

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 to⁶, as well and the PPE guidelines¹⁴.
 - 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.

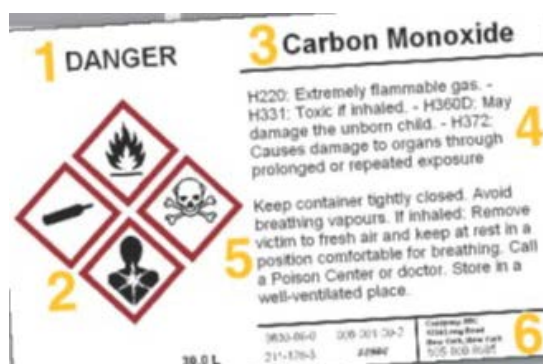
3.2.1 All measures must be taken to ensure the safety of the operators^{6,8} and where choices exist preference should be given to the safest product. Check the label colour band.

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 Hazard¹⁰:

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 follows⁹:

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 legislation⁶⁻¹⁰.

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 Programme¹¹.
- 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. Hygiene⁵⁻⁹.
- 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 requirements⁶⁻¹⁰.
- 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 Africa¹¹, Regulations for Hazardous Chemical Agents 2021⁷, Occupational Health and Safety Act 85 of 1993, FAO Pesticide Storage and Stock Control Manual¹² 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 Countries¹³. 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 stored¹². 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 in¹². Another option is smooth screeded concrete, however sealed, steel container floors are also acceptable. The doorway should be banded 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 cleaning¹². 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 fire 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 if 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 volatilise) and barred or burglar bars installed to prevent unauthorised entry¹².

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 fittings¹². 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 is 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 cause 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 vapours¹².

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 1m³sump /10m²floor 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 In the field the following must be observed:
- 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 Transportation^{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 Disposal^{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 out¹².

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 nozzles¹².

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 contaminated⁶⁻⁹.

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
<i>Cylindrobasidium leave*</i>	Stumpout	None	Only registered for <i>A. Cyclops</i> , <i>A. mearnsii</i> , <i>A. dealbata</i> , <i>A. decurrans</i> , <i>A. melanoxylon</i> , <i>A. pycnantha</i>	None
<i>Colletrotrichum acutatum*</i>	Hakea gummosis	Grahamstown hakea resistant to pathogen	Only used on <i>Hakea sericea</i> , <i>H. drupacea</i> and <i>H. sericifolia</i> Effective on all growth stages	None
<i>Puccinia eupatori*</i>	Leaf pathogen		Only for <i>C. macrocephalum</i>	None
<i>Uromycladium tepperianum*</i>	Rust fungus		Only for <i>A. saligna</i>	None
<i>Cercospora rodmannii*</i>			Only for <i>E. crassipes</i>	None
<i>Mycovellociella lantanae*</i>	Leaf pathogen		Only for <i>L. camara</i>	None
<i>Pasalora agaritinae*</i>	Leaf pathogen		Only for <i>A. adenophora</i>	None
<i>Entyloma ageratinae*</i>	Leaf pathogen		Only for <i>A. riparia</i>	None
<i>Puccinia abrupt*</i>	Leaf pathogen		Only for <i>P. hysterothorus</i>	None
<i>Puccinia xanthii*</i>	Leaf pathogen		Only for <i>P. hysterothorus</i>	None







Active ingredients	Trade names	Restrictions	Comments	Hazard criteria
<i>Prospodium transformans*</i>	Leaf pathogen		Only for <i>T. sans</i>	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 Voloxypr	Exclusion period	Limited species on Starane and Voloxypr 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
				<p>3 - Carcinogenicity GHS07 WARNING </p> <p>6 – Endocrine Disrupting Chemicals (EDC) GHS08 DANGER </p> <p>7 – Acute toxicity to aquatic organisms GHS09 WARNING </p> <p>8 – Persistence in soil/water and soil absorption potential & bio magnification & bioaccumulation GHS09 WARNING </p>
<p>Picloram (as potassium salt) 54g/L + Triclopyr (as triethylamine salt) 46g/L</p>	<p>Kaput gel</p>	<p>Limited species registered currently</p>	<p>No mixing necessary</p>	<p>2- acute toxicity to mammals and birds GHS 07 WARNING </p> <p>3 - Carcinogenicity GHS07 WARNING </p>







Active ingredients	Trade names	Restrictions	Comments	Hazard criteria
				<p>5 – Developmental and reproductive toxicity</p> <p>GHS08 DANGER</p>  <p>6 – Endocrine Disrupting Chemicals (EDC)</p> <p>GHS08 DANGER</p>  <p>7 – Acute toxicity to aquatic organisms</p> <p>GHS09 WARNING</p>  <p>8 – Persistence in soil/water and soil absorption potential & bio magnification & bioaccumulation</p> <p>GHS09 WARNING</p> 
<p>2-4D (as dimethyl amine salt) 480g/L</p>	<p>2,4D 2,4D Amine</p>	<p>Limited registrations, herbaceous species</p>	<p>Weedy species such as <i>D. ferox</i></p>	<p>2- acute toxicity to mammals and birds</p> <p>GHS 07 WARNING</p>  <p>3 - Carcinogenicity</p> <p>GHS07 WARNING</p>






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 isopropylamine 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
				<p>GHS08 DANGER</p>  <p>7 – Acute toxicity to aquatic organisms</p> <p>GHS09 WARNING</p>  <p>8 – Persistence in soil/water and soil absorption potential & bio magnification & bioaccumulation</p> <p>GHS09 WARNING</p> 
Tebuthiuron 200g/kg	Molopo	<p>Bush encroachment only</p> <p>Consult the technical unit PRIOR to application</p>	<p>Extremely residual in soil, acutely toxic</p>	<p>2- acute toxicity to mammals and birds</p> <p>GHS 07 WARNING</p>  <p>7 – Acute toxicity to aquatic organisms</p> <p>GHS09 WARNING</p>  <p>8 – Persistence in soil/water and soil absorption potential & bio magnification & bioaccumulation</p> <p>GHS09 WARNING</p>

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
				<p>7 – Acute toxicity to aquatic organisms</p> <p>GHS09 WARNING</p>  <p>8 – Persistence in soil/water and soil absorption potential & bio magnification & bioaccumulation</p> <p>GHS09 WARNING</p> 
<p>Triclopyr (as thiethyl ammonium) 120g/L + Aminopyralid (as triisopropanol) 12g/L</p>	<p>Confront super</p>	<p>Eye irritant, skin irritant</p> <p>Don't use in aquatic environments</p>	<p>Limited registrations</p>	<p>2- acute toxicity to mammals and birds</p> <p>GHS 07 WARNING</p>  <p>5 – Developmental and reproductive toxicity</p> <p>GHS08 DANGER</p>  <p>7 – Acute toxicity to aquatic organisms</p> <p>GHS09 WARNING</p>  <p>8 – Persistence in soil/water and soil absorption potential & bio</p>






Active ingredients	Trade names	Restrictions	Comments	Hazard criteria
				magnification & bioaccumulation GHS09 WARNING 
Bromacil 250g/L + Tebuthionon 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-trichloroethylidene	Alphachloralose	<p>To not use near water bodies. Toxic if swallowed.</p> <p>Inhalation risk</p> <p>CNS depressant</p>	<p>Used as a sedative in invasive bird control such as Mallard control programmes</p>	<p>2- acute toxicity to mammals and birds</p> <p>GHS06 – DANGER</p>  <p>GHS 07 WARNING</p>  <p>7 – Acute toxicity to aquatic organisms</p> <p>GHS09 WARNING</p>  <p>8 – Persistence in soil/water and soil absorption potential & bio magnification & bioaccumulation</p> <p>GHS09 WARNING</p> 
3-chloro-p-toluidine hydrochloride	DRC-1336/Starlicide	<p>Toxic if swallowed</p> <p>Toxic in contact with skin</p> <p>Skin irritation, eye irritation</p> <p>Inhalation risk</p> <p>Toxic to aquatic environments 4</p>	<p>Avicide powder to mix into bait to control corvids</p>	<p>2- acute toxicity to mammals and birds</p> <p>GHS06 – DANGER</p>  <p>GHS 07 WARNING</p>  <p>7 – Acute toxicity to aquatic organisms</p> <p>GHS09 WARNING</p>  <p>8 – Persistence in soil/water and soil</p>

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 permanganate 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 

References:








1. UNEP, 2019. Stockholm Convention on Persistent organic Pollutants (POPs). United Nations Environment Programme, Secretariat of the Stockholm Convention, September 2020. Available from <https://www.chm.pops.int>
2. UNEP, 2020. Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade. United Nations Environment Programme and Food and Agriculture Organization, Secretariat of the Rotterdam Convention, August 2020.

3. UNEP, 2019. Basel Convention on the Control of Trans boundary Movements of Hazardous Wastes and their Disposal. United Nations Environment Programme, Secretariat of the Basel Convention, April, 2020.
4. UNEP, 1991. Bamako Convention on the Ban of the Import into Africa and the Control of Trans boundary Movement and management of Hazardous Wastes within Africa. United Nations Environment Programme, Secretariat of the Bamako Convention, April 1991.
5. FAO & WHO, 2014. The International Code of Conduct on Pesticide Management. Food and Agriculture Organization of the United Nations & World Health Organization, Rome, 2014. Available from www.fao.org/publications
6. Muir.D & Taliep.M, 2021. EP Biomonitoring protocols for pesticide management. Internal document available from D. Muir.
7. DOEL, 2021. Regulations for Hazardous Chemical Agents. Occupational health and Safety Act, 1993. Notice No. 44348, published Government Gazette, 29 March 2021. Available from: <https://www.pgwonline.co.za>
8. FAO & WHO, 2020. International Code of Conduct on Pesticide Management: Guidelines for Personal Protection when Handling and Applying Pesticides. Food and Agriculture Organization of the United Nations & World Health Organization, Rome, 2020. Available from: <https://www.fao.org/publications>
9. UN, 2011. Globally Harmonised System of Classification and Labelling of Chemicals (GHS). 4th Revised Edition. United Nations, New York and Geneva, 2011. Available from: http://www.unece.org/trans/danger/publi/ghs/implementation_e.html
10. WHO, 2009. The WHO Recommended Classification of Pesticides by Hazard and Guidelines to Classification. International Programme on Chemical safety (IPCS). Inter-Organization Programme for Sound Management of Chemicals (IOMC), World Health Organization, Stuttgart, 2010. Available from: http://www.unece.org/trans/danger/publi/ghs/ghs_rev03/03files_e.html.
11. Croplife SA, 2018. Waste Management Programme: Guidelines for the Responsible Disposal of the Triple Rinsed Empty Plastic Pesticide Containers. December 2018 Edition. Available from Croplife SA.
12. FAO, 1996. Pesticide storage and stock control manual. FAO Pesticide Disposal Series 3. Food and Agriculture Organization of the United Nations, Rome, 1996. Available from: <https://www.fao.org/publications/>
13. FAO, 1988. Guidelines for Retail Distribution of Pesticides with Particular reference to Storage and Handling at the Point of Supply to Users in Developing Countries. Food and Agriculture Organization of the United Nations, Rome. October 1988. Available from: <https://www.fao.org/publications/>
14. Muir, D. & Taliep, M. 2020. EP Job category PPE Spreadsheet 2020. Internal document. Available from: D. Muir
15. FAO & WHO, 2008. International Code of Conduct on the Distribution and Use of Pesticides: Guidelines on Management Options for Empty Pesticide Containers. Food and Agriculture Organization of the United Nations & World Health Organization. Rome, May 2008. Available from: <https://www.fao.org/publications/>







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




	Chemical group	MOA	Examples	Hazard Group	Hazard Criterion	PPE			Medical Biomonitoring		Frequency and Duration		Environmental monitoring
						Type	Pictogram	Classification	Blood	Urine	Blood	Urine	
1	Imidazolinones	Group 2: ALS: AHAS inhibitors	Imazapyr (Chopper, Hatchet, Arsenal)	2	<p>Acute toxicity to mammals and birds GHS07 WARNING</p>  <p>H319 (causes serious eye irritation) H335 (Respiratory irritant) H315 (causes skin irritation)</p>	<p>1.Chemically resistant nitrile gloves</p> <p>2.Type 3 and Type 4 protective clothing</p> <p>3.Safety boots</p> <p>4.Face & Eye protection</p> <p>5.Half-face respirators</p> <p>6.Particulate air filters for respirators</p> <p>7.Apron/ Knapjack</p> <p>8. Long-sleeved shirts</p>	     	<p>EN 374:2016</p> <p>EN 14605:2005</p> <p>EN 345: 1993</p> <p>EN ISO 20345</p> <p>EN 166:2001 EN 140, EN149, EN 143:200</p> <p>R95, R99, R100</p>	N/A	5cc fresh urine sample refrigerated. Tested using ELIZA dipstick test	N/A	<p>1.All workers need to be tested before they start working.</p> <p>2.If the worker sprays 8 hours per day for 5 days per week, an additional test is needed every 2 years.</p> <p>3. All workers need to be tested once they leave they programme</p>	











STRATEGY: ENVIRONMENTAL PROGRAMMES PESTICIDE POLICY, 2021

				8	<p>Persistence in soil/water and soil absorption potential & bio magnification & bioaccumulation</p> <p>GHS09 WARNING</p>  <p>H412 (harmful to aquatic life with long lasting effects)</p>								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	<p>Acute toxicity to aquatic organisms</p> <p>GHS09 WARNING</p>  <p>H400 (Very toxic to aquatic life)</p>								
				2	<p>Acute toxicity to mammals and birds</p> <p>GHS07 WARNING</p>  <p>H315 (causes skin irritation) H335 (Respiratory tract irritant) H319 (Causes serious eye irritation)</p>	<p>1. Chemically resistant nitrile gloves</p>  <p>2. Type 3 and Type 4 protective clothing</p>  	<p>EN 374:2016</p> <p>EN 14605:2005</p> <p>EN 345:1993</p>	N/A	<p>5cc fresh urine sample refrigerated. Tested using ELIZA dipstick test</p>	N/A	<p>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</p>		




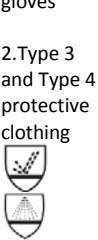


STRATEGY: ENVIRONMENTAL PROGRAMMES PESTICIDE POLICY, 2021

						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		










						<p>5. Half-face respirators</p> <p>6. Particulate air filters for respirators</p> <p>7. Apron/ Knapjack</p> <p>8. Long-sleeved shirts</p>	 	<p>EN 166:2001 EN 140, EN149, EN 143:200</p> <p>R95, R99, R100</p>				
				3	<p>Carcinogenicity GHS07 WARNING</p>  <p>H335 (May cause respiratory irritation)</p>	Same as above	Same as above	Same as above	20cc fresh blood sample. AChE tests done with Test-Mate model 400 device	<p>1. All workers need to be tested before they start working.</p> <p>2. If the worker sprays 8 hours per day for 5 days per week, an additional test needs to be done every 2 years..</p> <p>3. All workers need to be tested once they leave the programme</p>		

					6	<p>Endocrine Disrupting Chemicals (EDC) GHS08 DANGER</p>  <p>H370 (causes damage to organs – lungs)</p>	<p>1.Chemically resistant nitrile gloves</p> <p>2.Type 3 and Type 4 protective clothing</p>   <p>Type 5 protective clothing</p>  <p>3.Safety boots</p> <p>4.Face & Eye protection</p> <p>5.Half-face respirators</p> <p>6.Particulate air filters for respirators</p> <p>7.Apron/ Knapjack</p> <p>8. Long-sleeved shirts</p>	     	<p>EN ISO 20345</p> <p>EN 166:2001</p> <p>EN140 EN 149</p> <p>EN 143:2000</p> <p>R95, R99, R100</p>	<p>20cc fresh blood sample. AChE tests done with Test-Mate model 400 device</p>	<p>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</p>
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STRATEGY: ENVIRONMENTAL PROGRAMMES PESTICIDE POLICY, 2021

				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.	











STRATEGY: ENVIRONMENTAL PROGRAMMES PESTICIDE POLICY, 2021

					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	






STRATEGY: ENVIRONMENTAL PROGRAMMES PESTICIDE POLICY, 2021

						6.Particulate air filters for respirators 	EN 140, EN149, EN 143:200			once they leave the programme	
						7.Apron/ Knapjack 	R95, R99, R100				
			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		









STRATEGY: ENVIRONMENTAL PROGRAMMES PESTICIDE POLICY, 2021

					<p>H319 (causes serious eye irritation) H373 (May cause damage to organs – heart, liver, kidneys)</p>	<p>3.Safety boots 4.Face & Eye protection 5.Half-face respirators 6.Particulate air filters for respirators 7.Apron/ Knapjack</p>	  	<p>EN ISO 20345 EN 166:2001 EN 140, EN149, EN 143:200 R95, R99, R100</p>			<p>tested once they leave they programme</p>
				5	<p>Developmental and Reproductive toxicity GHS08 DANGER  H360 (May damage fertility or the unborn child)</p>	<p>1.Chemically resistant nitrile gloves 2.Type 3 and Type 4 protective clothing  Type 5 protective clothing  3.Safety boots</p>	   	<p>EN ISO 20345 EN 166:2001 EN140 EN 149 EN 143:2000 R95, R99, R100</p>	<p>20cc fresh blood sample. AChE tests done with Test-Mate model 400 device</p>	<p>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</p>	








STRATEGY: ENVIRONMENTAL PROGRAMMES PESTICIDE POLICY, 2021

						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	







STRATEGY: ENVIRONMENTAL PROGRAMMES PESTICIDE POLICY, 2021

					<p>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)</p>	<p>protective clothing    3.Safety boots  4.Face & Eye protection  5.Half-face respirators  6.Particulate air filters for respirators  7.Apron/ Knapjack</p>	<p>EN 345: 1993 EN ISO 20345 EN 166:2001 EN 140, EN149, EN 143:200 R95, R99, R100</p>	<p>ELIZA dipstick test</p>	<p>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</p>
			8	<p>Persistence in soil/water and soil absorption potential & bio magnification & bioaccumulation GHS09 WARNING  H411 (Toxic to aquatic life with</p>					













STRATEGY: ENVIRONMENTAL PROGRAMMES PESTICIDE POLICY, 2021

					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		












STRATEGY: ENVIRONMENTAL PROGRAMMES PESTICIDE POLICY, 2021

					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		





STRATEGY: ENVIRONMENTAL PROGRAMMES PESTICIDE POLICY, 2021

			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








STRATEGY: ENVIRONMENTAL PROGRAMMES PESTICIDE POLICY, 2021

						<p>4.Face & Eye protection </p> <p>5.Half-face respirators </p> <p>6.Particulate air filters for respirators </p> <p>7.Apron/ Knapjack </p>	<p>EN 166:2001 EN 140, EN149, EN 143:200</p> <p>R95, R99, R100</p>			<p>every 2 years.. 3. All workers need to be tested once they leave the programme</p>	
				6	<p>Endocrine Disrupting Chemicals (EDC) GHS08 DANGER  H370 (causes damage to organs – lungs)</p>	<p>1.Chemically resistant nitrile gloves </p> <p>2.Type 3 and Type 4 protective clothing  </p> <p>Type 5 protective clothing </p> <p>3.Safety boots </p> <p>4.Face & Eye protection </p>	<p>EN ISO 20345</p> <p>EN 166:2001</p> <p>EN140 EN 149</p> <p>EN 143:2000</p> <p>R95, R99, R100</p>	<p>20cc fresh blood sample. AChE tests done with Test-Mate model 400 device</p>	<p>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</p>		








STRATEGY: ENVIRONMENTAL PROGRAMMES PESTICIDE POLICY, 2021

						<p>5. Half-face respirators</p> <p>6. Particulate air filters for respirators</p> <p>7. Apron/ Knapjack</p> <p>8. Long-sleeved shirts</p>	 				programme		
			7	<p>Acute toxicity to aquatic organisms</p> <p>GHS09</p> <p>WARNING</p>  <p>H400 (Very toxic to aquatic life)</p>									
			8	<p>Persistence in soil/water and soil absorption potential & bio magnification & bioaccumulation</p> <p>GHS09</p> <p>WARNING</p>  <p>H410 (Very toxic to aquatic life with long lasting effects)</p>									










STRATEGY: ENVIRONMENTAL PROGRAMMES PESTICIDE POLICY, 2021









					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	<p>Acute toxicity to mammals and birds GHS07 WARNING</p>  <p>H302 (Harmful if swallowed) H317 (May cause an allergic reaction) H319 (causes serious eye irritation) H373 (May cause damage to organs – heart, liver, kidneys)</p>	<p>1.Chemically resistant nitrile gloves</p> <p>2.Type 3 and Type 4 protective clothing</p> <p>3.Safety boots</p> <p>4.Face & Eye protection</p> <p>5.Half-face respirators</p> <p>6.Particulate air filters for respirators</p> <p>7.Apron/ Knapjack</p> <p>8. Long-sleeved shirt</p>	     	<p>EN 374:2016</p> <p>EN 14605:2005</p> <p>EN 345: 1993</p> <p>EN ISO 20345</p> <p>EN 166:2001 EN 140, EN149, EN 143:200</p> <p>R95, R99, R100</p>	<p>5cc fresh urine sample refrigerated. Tested using ELIZA dipstick test</p>	<p>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</p>				










STRATEGY: ENVIRONMENTAL PROGRAMMES PESTICIDE POLICY, 2021

				8	<p>Persistence in soil/water and soil absorption potential & bio magnification & bioaccumulation</p> <p>GHS09 WARNING</p>  <p>H411 (Toxic to aquatic life with long lasting effects)</p>							
Combinations	Group 4: Synthetic auxins	Quinoline carboxylic acid such as Picloram + Pyridine compound such Triclopyr as trimethylamine salt (Kaput gel)	2	<p>Acute toxicity to mammals and birds</p> <p>GHS07 WARNING</p>  <p>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)</p>	<p>1.Chemically resistant nitrile gloves</p>  <p>2.Type 3 and Type 4 protective clothing</p>  <p>3.Safety boots</p>  <p>4.Face & Eye protection</p>  <p>5.Half-face respirators</p>  <p>6.Particulate air</p>	<p>EN 374:2016</p> <p>EN 14605:2005</p> <p>EN 345: 1993</p> <p>EN ISO 20345</p> <p>EN 166:2001 EN 140, EN149, EN 143:200</p>						





STRATEGY: ENVIRONMENTAL PROGRAMMES PESTICIDE POLICY, 2021

					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	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	<p>Developmental and Reproductive toxicity GHS08 DANGER</p>  <p>H360 (May damage fertility or the unborn child)</p>	<p>1.Chemically resistant nitrile gloves</p> <p>2.Type 3 and Type 4 protective clothing</p> <p>Type 5 protective clothing</p> <p>3.Safety boots</p> <p>4.Face & Eye protection</p> <p>5.Half-face respirators</p> <p>6.Particulate air filters for respirators</p> <p>7.Apron/ Knapjack</p> <p>8. Long-sleeved shirts</p>	      	<p>EN ISO 20345</p> <p>EN 166:2001</p> <p>EN140 EN 149</p> <p>EN 143:2000</p> <p>R95, R99, R100</p>	<p>20cc fresh blood sample. AChE tests done with Test-Mate model 400 device</p>	<p>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</p>			

				6	<p>Endocrine Disrupting Chemicals (EDC) GHS08 DANGER</p>  <p>H370 (causes damage to organs – lungs)</p>	<p>1. Chemically resistant nitrile gloves</p>  <p>2. Type 3 and Type 4 protective clothing</p>  <p>Type 5 protective clothing</p>  <p>3. Safety boots</p>  <p>4. Face & Eye protection</p>  <p>5. Half-face respirators</p>  <p>6. Particulate air filters for respirators</p>  <p>7. Apron/ Knapjack</p>  <p>8. Long-sleeved shirts</p>	<p>EN ISO 20345</p> <p>EN 166:2001</p> <p>EN140 EN 149</p> <p>EN 143:2000</p> <p>R95, R99, R100</p>	<p>20cc fresh blood sample. AChE tests done with Test-Mate model 400 device</p>	<p>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</p>		
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STRATEGY: ENVIRONMENTAL PROGRAMMES PESTICIDE POLICY, 2021

				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	











STRATEGY: ENVIRONMENTAL PROGRAMMES PESTICIDE POLICY, 2021

			Clopyralid (Confront, Astra)		<p>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)</p>	<p>protective clothing </p> <p>3.Safety boots </p> <p>4.Face & Eye protection </p> <p>5.Half-face respirators </p> <p>6.Particulate air filters for respirators </p> <p>7.Apron/ Knapjack</p>	<p>EN 345: 1993</p> <p>EN ISO 20345</p> <p>EN 166:2001 EN 140, EN149, EN 143:200</p> <p>R95, R99, R100</p>		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	<p>Developmental and Reproductive toxicity GHS08 DANGER  H360 (May damage fertility or the unborn child)</p>	<p>1.Chemically resistant nitrile gloves </p> <p>2.Type 3 and Type 4 protective clothing  </p> <p>Type 5 protective clothing </p>	<p>EN ISO 20345</p> <p>EN 166:2001</p> <p>EN140 EN 149</p>	20cc fresh blood sample. AChE tests done with Test-Mate model 400 device		<p>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</p>








STRATEGY: ENVIRONMENTAL PROGRAMMES PESTICIDE POLICY, 2021

						 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							









STRATEGY: ENVIRONMENTAL PROGRAMMES PESTICIDE POLICY, 2021

					long lasting effects)							
Combinations	Group 4: Synthetic auxins	Pyridine compounds such as Triclopyras triethyl ammonium + Aminopyralid (Confront super)	2	<p>Acute toxicity to mammals and birds GHS07 WARNING</p>  <p>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)</p>	<p>1.Chemically resistant nitrile gloves</p> <p>2.Type 3 and Type 4 protective clothing</p>   <p>3.Safety boots</p> <p>4.Face & Eye protection</p> <p>5.Half-face respirators</p> <p>6.Particulate air filters for respirators</p> <p>7.Apron/ Knapjack</p>	     	<p>EN 374:2016</p> <p>EN 14605:2005</p> <p>EN 345: 1993</p> <p>EN ISO 20345</p> <p>EN 166:2001 EN 140, EN149, EN 143:200</p> <p>R95, R99, R100</p>	5cc fresh urine sample refrigerated. Tested using ELIZA dipstick test	<p>1.All workers need to be tested before they start working.</p> <p>2.If the worker sprays 8 hours per day for 5 days per week, an additional test is needed every 2 years.</p> <p>3. All workers need to be tested once they leave they programme</p>			
			5	<p>Developmental and Reproductive toxicity GHS08 DANGER</p>	<p>1.Chemically resistant nitrile gloves</p>		<p>EN ISO 20345</p>	20cc fresh blood sample. AChE tests	1.All workers need to be tested before			









STRATEGY: ENVIRONMENTAL PROGRAMMES PESTICIDE POLICY, 2021

				 <p>H360 (may damage fertility or the unborn child)</p>	<p>2.Type 3 and Type 4 protective clothing</p>  <p>Type 5 protective clothing</p>  <p>3.Safety boots</p>  <p>4.Face & Eye protection</p>  <p>5.Half-face respirators</p>  <p>6.Particulate air filters for respirators</p>  <p>7.Apron/ Knapjack</p> <p>8. Long-sleeved shirts</p>	<p>EN 166:2001</p> <p>EN140 EN 149</p> <p>EN 143:2000</p> <p>R95, R99, R100</p>	<p>done with Test-Mate model 400 device</p>	<p>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</p>		
			7	<p>Acute toxicity to aquatic organisms GHS09 WARNING</p>						






STRATEGY: ENVIRONMENTAL PROGRAMMES PESTICIDE POLICY, 2021

					 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			









STRATEGY: ENVIRONMENTAL PROGRAMMES PESTICIDE POLICY, 2021

					<p>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)</p>	<p>5. Half-face respirators 6. Particulate air filters for respirators 7. Apron/ Knapjack</p>	 	<p>EN 166:2001 EN 140, EN149, EN 143:200</p> <p>R95, R99, R100</p>				
			5	<p>Developmental and Reproductive toxicity GHS08 DANGER</p>  <p>H360 (May damage fertility or the unborn child)</p>	<p>1. Chemically resistant nitrile gloves 2. Type 3 and Type 4 protective clothing 3. Safety boots 4. Face & Eye protection</p>	    	<p>EN ISO 20345</p> <p>EN 166:2001</p> <p>EN140 EN 149</p> <p>EN 143:2000</p> <p>R95, R99, R100</p>	<p>20cc fresh blood sample. AChE tests done with Test-Mate model 400 device</p>	<p>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</p>			









STRATEGY: ENVIRONMENTAL PROGRAMMES PESTICIDE POLICY, 2021

						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		









STRATEGY: ENVIRONMENTAL PROGRAMMES PESTICIDE POLICY, 2021

					<p>H315 (Causes skin irritation) H319 (Causes serious eye irritation) H335 (may cause respiratory irritation)</p>	  	<p>3.Safety boots 4.Face & Eye protection 5.Half-face respirators 6.Particulate air filters for respirators 7.Apron/ Knapjack</p>	   	<p>EN 345: 1993 EN ISO 20345 EN 166:2001 EN 140, EN149, EN 143:200 R95, R99, R100</p>				<p>additional test is needed every 2 years. 3. All workers need to be tested once they leave they programme</p>	
			7	<p>Acute toxicity to aquatic organisms GHS09 WARNING  H400 (Very toxic to aquatic life)</p>										
			8	<p>Persistence in soil/water and soil absorption potential & bio magnification & bioaccumulation GHS09 WARNING</p>										




STRATEGY: ENVIRONMENTAL PROGRAMMES PESTICIDE POLICY, 2021

					 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 the programme			











STRATEGY: ENVIRONMENTAL PROGRAMMES PESTICIDE POLICY, 2021

				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				












STRATEGY: ENVIRONMENTAL PROGRAMMES PESTICIDE POLICY, 2021

					<p>5. Half-face respirators</p> <p>6. Particulate air filters for respirators</p> <p>7. Apron/ Knapjack</p>		<p>EN 166:2001 EN 140, EN149, EN 143:200</p> <p>R95, R99, R100</p>					
			7	<p>Acute toxicity to aquatic organisms</p> <p>GHS09</p> <p>WARNING</p>  <p>H400 (Very toxic to aquatic life)</p>								
			8	<p>Persistence in soil/water and soil absorption potential & bio magnification & bioaccumulation</p> <p>GHS09</p> <p>WARNING</p>  <p>H410 (Very toxic to aquatic life with long lasting effects)</p>								










STRATEGY: ENVIRONMENTAL PROGRAMMES PESTICIDE POLICY, 2021

						<p>1.Chemically resistant nitrile gloves</p> <p>2.Type 3 and Type 4 protective clothing</p> <p>3.Safety boots</p> <p>4.Face & Eye protection</p> <p>5.Half-face respirators</p> <p>6.Particulate air filters for respirators</p> <p>7.Apron/ Knapjack</p>	     	<p>EN 374:2016</p> <p>EN 14605:2005</p> <p>EN 345: 1993</p> <p>EN ISO 20345</p> <p>EN 166:2001 EN 140, EN149, EN 143:200</p> <p>R95, R99, R100</p>	<p>5cc fresh urine sample refrigerated. Tested using ELIZA dipstick test</p>	<p>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 the programme</p>
	Glycines	Group 9: Inhibitors of EPSP synthesis.	Phosphonoglycines such as Glyphosate isopropylamine salts (Seismic, tampleweed) POE-T free	2	<p>Acute toxicity to mammals and birds GHS07 WARNING</p>  <p>H318 (Causes serious eye damage)</p>					
	Glycines	Group 9: Inhibitors of EPSP synthesis.	Phosphonoglycines such as Glyphosate sodium salts (Kilo max)	2	<p>Acute toxicity to mammals and birds GHS07 WARNING</p> 	<p>1.Chemically resistant nitrile gloves</p> <p>2.Type 3 and Type 4 protective clothing</p>	 	<p>EN 374:2016</p> <p>EN 14605:2005</p>	<p>5cc fresh urine sample refrigerated. Tested using ELIZA dipstick test</p>	<p>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</p>







STRATEGY: ENVIRONMENTAL PROGRAMMES PESTICIDE POLICY, 2021

					H318 (Causes serious eye damage)	 	    	<p>EN 345: 1993</p> <p>EN ISO 20345</p> <p>EN 166:2001 EN 140, EN149, EN 143:200</p> <p>R95, R99, R100</p>			additional test is needed every 2 years. 3. All workers need to be tested once they leave the programme
Glycines	Group 9: Inhibitors of EPSP synthesis.	Phosphonoglycines such as glyphosate (all GBH's containing POE-T such as Roundup etc)	2	<p>Acute toxicity to mammals and birds GHS07 WARNING</p>  <p>H318 (Causes serious eye damage)</p>	<p>1.Chemically resistant nitrile gloves</p>  <p>2.Type 3 and Type 4 protective clothing</p>  <p>3.Safety boots</p> 	<p>EN 374:2016</p> <p>EN 14605:2005</p> <p>EN 345: 1993</p> <p>EN ISO 20345</p>	5cc fresh urine sample refrigerated. Tested using ELIZA dipstick test	<p>1.All workers need to be tested before they start working.</p> <p>2.If the worker sprays 8 hours per day for 5 days per week, an additional test is needed every 2 years.</p> <p>3. All workers need to be tested once they leave</p>			










STRATEGY: ENVIRONMENTAL PROGRAMMES PESTICIDE POLICY, 2021











					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	

STRATEGY: ENVIRONMENTAL PROGRAMMES PESTICIDE POLICY, 2021











					filters for respirators 7.Apron/ Knapjack			R95, R99, R100			programm e	
				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 methylarsenate (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	

STRATEGY: ENVIRONMENTAL PROGRAMMES PESTICIDE POLICY, 2021



						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	<p>Endocrine Disrupting Chemicals (EDC) GHS08 DANGER</p>  <p>H371 (may cause damage to organs (kidneys and liver)) H372 (causes damage to organs through prolonged effect (liver and kidneys))</p>	<p>1.Chemically resistant nitrile gloves</p>  <p>2.Type 3 and Type 4 protective clothing</p>  <p>Type 5 protective clothing</p>  <p>3.Safety boots</p>  <p>4.Face & Eye protection</p>  <p>5.Half-face respirators</p>  <p>6.Particulate air filters for respirators</p> 	<p>EN ISO 20345</p> <p>EN 166:2001</p> <p>EN140 EN 149</p> <p>EN 143:2000</p> <p>R95, R99, R100</p>	<p>20cc fresh blood sample. AChE tests done with Test-Mate model 400 device</p>	<p>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</p>				



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						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.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	











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				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

	Chemical group	MOA	Examples	Hazard Group	Hazard Criterion	PPE			Medical Biomonitoring		Frequency and Duration		Environmental monitoring
						Type	Pictogram	Classification	Blood	Urine	Blood	Urine	
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		

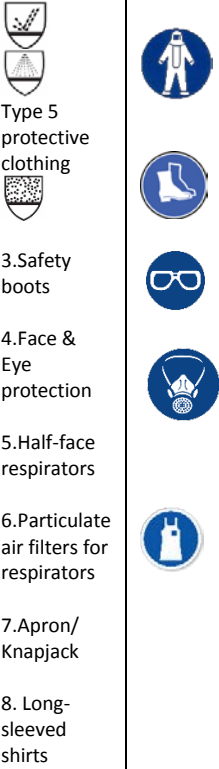

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					<p>H300 (Fatal if swallowed) H310 (Fatal in contact with skin) GHS07 WARNING</p>  <p>H373 (Causes damage to organs through prolonged or repeated exposure – blood)</p>	<p>2.Type 3 and Type 4 protective clothing</p>  <p>Type 5 protective clothing</p>  <p>3.Safety boots</p> <p>4.Face & Eye protection</p> <p>5.Half-face respirators</p> <p>6.Particulate air filters for respirators</p> <p>7.Apron/ Knapjack</p> <p>8. Long-sleeved shirts</p>	    	<p>EN140 EN 149</p> <p>EN 143:2000</p> <p>R95, R99, R100</p>	<p>done with Test-Mate model 400 device</p>	<p>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</p>		
			5	<p>Developmental and Reproductive toxicity GHS08 DANGER</p> 	<p>1.Chemically resistant nitrile gloves</p> <p>2.Type 3 and Type 4</p>		<p>EN ISO 20345</p> <p>EN 166:2001</p>	<p>20cc fresh blood sample. AChE tests done</p>	<p>1.All workers need to be tested before they start working.</p>			












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					<p>H360D (May damage the unborn child)</p> <p>protective clothing</p>  <p>Type 5 protective clothing</p>  <p>3.Safety boots</p>  <p>4.Face & Eye protection</p>  <p>5.Half-face respirators</p>  <p>6.Particulate air filters for respirators</p>  <p>7.Apron/ Knapjack</p>  <p>8. Long-sleeved shirts</p>	<p>EN140 EN 149</p> <p>EN 143:2000</p> <p>R95, R99, R100</p>	<p>with Test-Mate model 400 device</p>	<p>2.If the worker sprays 8 hours per day for 5 days per week, an additional test needs to be done every 2 years..</p> <p>3. All workers need to be tested once they leave the programme</p>		
			6	<p>Endocrine Disrupting Chemicals (EDC) GHS08 DANGER</p>  <p>H372 (Causes damage to organs through</p>	<p>1.Chemically resistant nitrile gloves</p>  <p>2.Type 3 and Type 4 protective clothing</p>	<p>EN ISO 20345</p> <p>EN 166:2001</p>	<p>20cc fresh blood sample. AChE tests done with Test-</p>	<p>1.All workers need to be tested before they start working.</p> <p>2.If the worker</p>		

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					<p>prolonged or repeated exposure – blood)</p>  <p>Type 5 protective clothing</p> <p>3.Safety boots</p> <p>4.Face & Eye protection</p> <p>5.Half-face respirators</p> <p>6.Particulate air filters for respirators</p> <p>7.Apron/ Knapjack</p> <p>8. Long-sleeved shirts</p>	<p>EN140 EN 149</p> <p>EN 143:2000</p> <p>R95, R99, R100</p>	<p>Mate model 400 device</p>	<p>sprays 8 hours per day for 5 days per week, an additional test needs to be done every 2 years..</p> <p>3. All workers need to be tested once they leave the programme</p>			
			7	<p>Acute toxicity to aquatic organisms</p>  <p>H400 (Very toxic to aquatic life)</p>							<p>Ensure environmental monitoring is complied with such as ESRA protocols</p>
			8	<p>Persistence in soil/water and soil absorption</p>							<p>Ensure environmental monitoring is</p>

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				<p>potential & bio magnification & bioaccumulation GHS09 WARNING</p>  <p>H410 (Very toxic to aquatic life with long lasting effects)</p>							<p>complied with such as ESRA protocols</p>
			Cholecalciferol	2	<p>Acute Toxicity to mammals and birds GHS06 DANGER</p>  <p>H301 (Toxic is swallowed) H311 (Toxic in contact with skin) H330 (fatal if inhaled)</p>	<p>1.Chemically resistant nitrile gloves</p>  <p>2.Type 3 and Type 4 protective clothing</p>   <p>Type 5 protective clothing</p>  <p>3.Safety boots</p>  <p>4.Face & Eye protection</p>  <p>5.Half-face respirators</p>  <p>6.Particulate air filters for respirators</p>  <p>7.Apron/ Knapjack</p> 	<p>EN ISO 20345</p> <p>EN 166:2001</p> <p>EN140 EN 149</p> <p>EN 143:2000</p> <p>R95, R99, R100</p>	<p>20cc fresh blood sample. AChE tests done with Test-Mate model 400 device</p>	<p>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</p>		

						8. Long-sleeved shirts						
			6	<p>Endocrine Disrupting Chemicals (EDC) GHS08 DANGER</p>  <p>H372 (Causes damage to organs through prolonged or repeated exposure)</p>	<p>1. Chemically resistant nitrile gloves</p>  <p>2. Type 3 and Type 4 protective clothing</p>  <p>Type 5 protective clothing</p>  <p>3. Safety boots</p>  <p>4. Face & Eye protection</p>  <p>5. Half-face respirators</p> <p>6. Particulate air filters for respirators</p>  <p>7. Apron/ Knapjack</p> 	<p>EN ISO 20345</p> <p>EN 166:2001</p> <p>EN140 EN 149</p> <p>EN 143:2000</p> <p>R95, R99, R100</p>	<p>20cc fresh blood sample. AChE tests done with Test-Mate model 400 device</p>	<p>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</p>				








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						8. Long-sleeved shirts						
2	Avicides	Sedative powder	alphachloralose	2	<p>Acute Toxicity to mammals and birds GHS06 DANGER</p>  <p>H301 (Toxic if swallowed)</p> <p>GHS07 WARNING</p>  <p>H332 (Harmful if inhaled) H336 (may cause drowsiness or dizziness)</p>	<p>1. Chemically resistant nitrile gloves</p>  <p>2. Type 3 and Type 4 protective clothing</p>   <p>Type 5 protective clothing</p>  <p>3. Safety boots</p>  <p>4. Face & Eye protection</p>   <p>5. Half-face respirators</p>  <p>6. Particulate air filters for respirators</p> <p>7. Apron/ Knapjack</p> 	<p>EN ISO 20345</p> <p>EN 166:2001</p> <p>EN140 EN 149</p> <p>EN 143:2000</p> <p>R95, R99, R100</p>	<p>20cc fresh blood sample. AChE tests done with Test-Mate model 400 device</p>	<p>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</p>			













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					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		



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					 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

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					<p>GHS09 WARNING</p>  <p>H410 (Very toxic to aquatic life with long lasting effects)</p>							
3	Piscicides	Mitochondrial NADH: ubiquinone reductase inhibitor and toxin	Rotenone	2	<p>Acute Toxicity to mammals and birds</p> <p>GHS06 DANGER</p>  <p>H301 (Toxic if swallowed)</p> <p>GHS07 WARNING</p>  <p>H315 (Causes skin irritation)</p> <p>H319 (Causes serious eye irritation)</p> <p>H335 (May cause respiratory irritation)</p>	<p>1. Chemically resistant nitrile gloves</p> <p>2. Type 3 and Type 4 protective clothing</p>  <p>Type 5 protective clothing</p>  <p>3. Safety boots</p> <p>4. Face & Eye protection</p> <p>5. Half-face respirators</p> <p>6. Particulate air filters for respirators</p> <p>7. Apron/ Knapjack</p>	      	<p>EN ISO 20345</p> <p>EN 166:2001</p> <p>EN140 EN 149</p> <p>EN 143:2000</p> <p>R95, R99, R100</p>	<p>20cc fresh blood sample. AChE tests done with Test-Mate model 400 device</p>	<p>1. All workers need to be tested before they start working.</p> <p>2. If the worker sprays 8 hours per day for 5 days per week, an additional test needs to be done every 2 years..</p> <p>3. All workers need to be tested once they leave the programme</p>		

STRATEGY: ENVIRONMENTAL PROGRAMMES PESTICIDE POLICY, 2021

						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