

REHABILITATION REPORT

REHABILITATION REPORT FOR PROTEA ROAD (KM 0.00 – KM 8.79) AND RELATED CULVERTS AT KM 1.3112, KM 2.312, Km 4.326, Km 5.102, PAARL, WESTERN CAPE.

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1. INTRODUCTION:

Guillaume Nel Environmental Consultants (GNEC) have been appointed by the Western Cape Government: Department of Transport and Public Works to compile a rehabilitation report for the road reserve of Protea road (Km 0.00 – Km8.79) and related culverts to be upgraded and rehabilitated at Km 1.3112, Km 2.312, Km 4.326, Km 5.102, Paarl, Western Cape.

The Cape Winelands area have recently experienced tremendous growth; with an influx of more permanent residents being the result. This has automatically resulted in an increase in the number of vehicles utilising the public roads in the area. Consequently, road maintenance and road upgrades are important activities required in order to ensure the safety of the public roads are maintained.

Protea Road forms part of Divisional Road 1098. Protea Road (km 0.00 – 8.779) runs parallel with the N1 and extends from the intersection with the R44 West to the intersection with the R304. Protea Road is located predominantly within the Drakenstein municipal area of jurisdiction. The property is surrounded by residential and agricultural practices.

Protea Road is an existing gravel road, with numerous existing stormwater structures also being present in order to accommodate surface runoff.

Protea Road carries between 289 and 728 vehicles per day.

It is proposed that Protea Road (km 0.00 – 8.779) be upgraded; which will result in the road being surfaced. The upgrading is necessitated in order for the road to accommodate the traffic load which is currently experienced. Furthermore, the upgrading of Protea Road will improve the local infrastructure and provide a safer road to the community.

The proposed upgrading of Protea Road also relates to the upgrading of storm water infrastructure's (Culverts).

Only a total of four culverts are located within watercourses at Km1.3112, Km 2.312, Km4.326, and Km 5.102 (while the remainder of the culverts are located within excavated channels which are not categorised as being a watercourse).

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Natural vegetation is present within certain sections of the existing degraded road reserve. Rehabilitation of the road reserve and related storm water infrastructures (culverts) is very important as it will:

- Improve the ecological and biodiversity value of the road reserve and related culverts. .
- Act as natural areas for faunal species.
- Will stabilize bare soil and prevent/minimise erosion of the road reserve and areas at the culverts.
- Will prevent/minimise further invasive vegetation infestation as the disturbed areas will be rehabilitated with endemic species.
- Enhance the visual and aesthetic appearance of the previously disturbed and infested areas.

The following rehabilitation measures to ensure successful rehabilitation will be discussed within this report.

- Alien clearing management plan.
- Management of topsoil.
- Search and rescue of endemic seeds to be collected within construction footprint, and adjacent natural areas.
- Handling of harvested seed.
- The seeding process.
- Search and rescue of endemic geophytes (bulbs) within the construction footprint.
- Search and rescue of endemic species within construction footprint and related environment from which cuttings can be made.
- Culvert rehabilitation.

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2. SITE LOCATION AND STUDY AREA

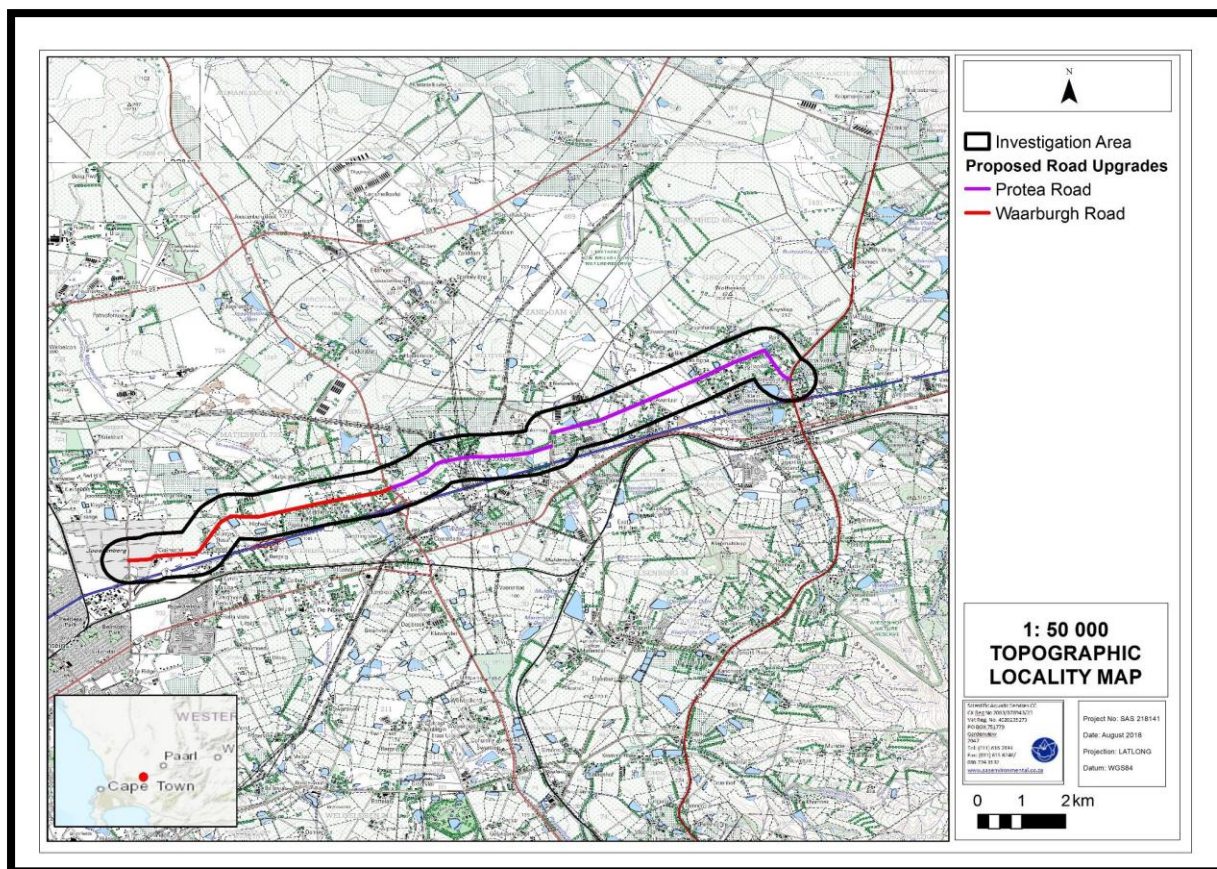
2.1 Locality Image 1:



FIGURE 1: PROTEA ROAD TO BE UPGRADDE (KM 0.00 – KM 8.79), PAARL, WESTERN CAPE.

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2.2 Locality Image 2:



**FIGURE 2: PROTEA ROAD TO BE UPGRADED (KM 0.00 – KM 8.79), PAARL, WESTERN CAPE.
(REFER TO PURPLE SECTION ONLY)**

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2.3 Locality Image 3:

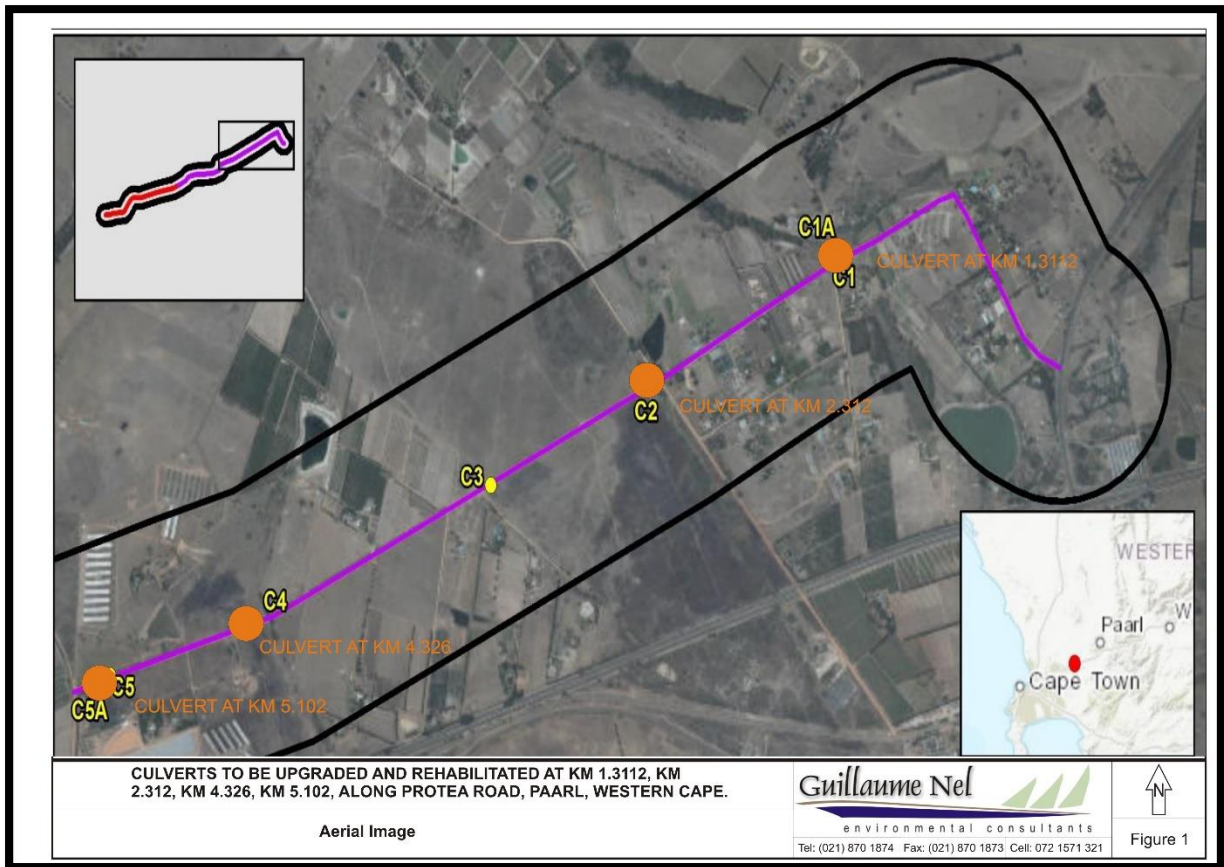


FIGURE 3: LOCATION OF THE CUVLERTS TO BE UPGRADED AND REHABILTIATED. (ORANGE DOTS)

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2.4 Critical Biodiversity Areas.

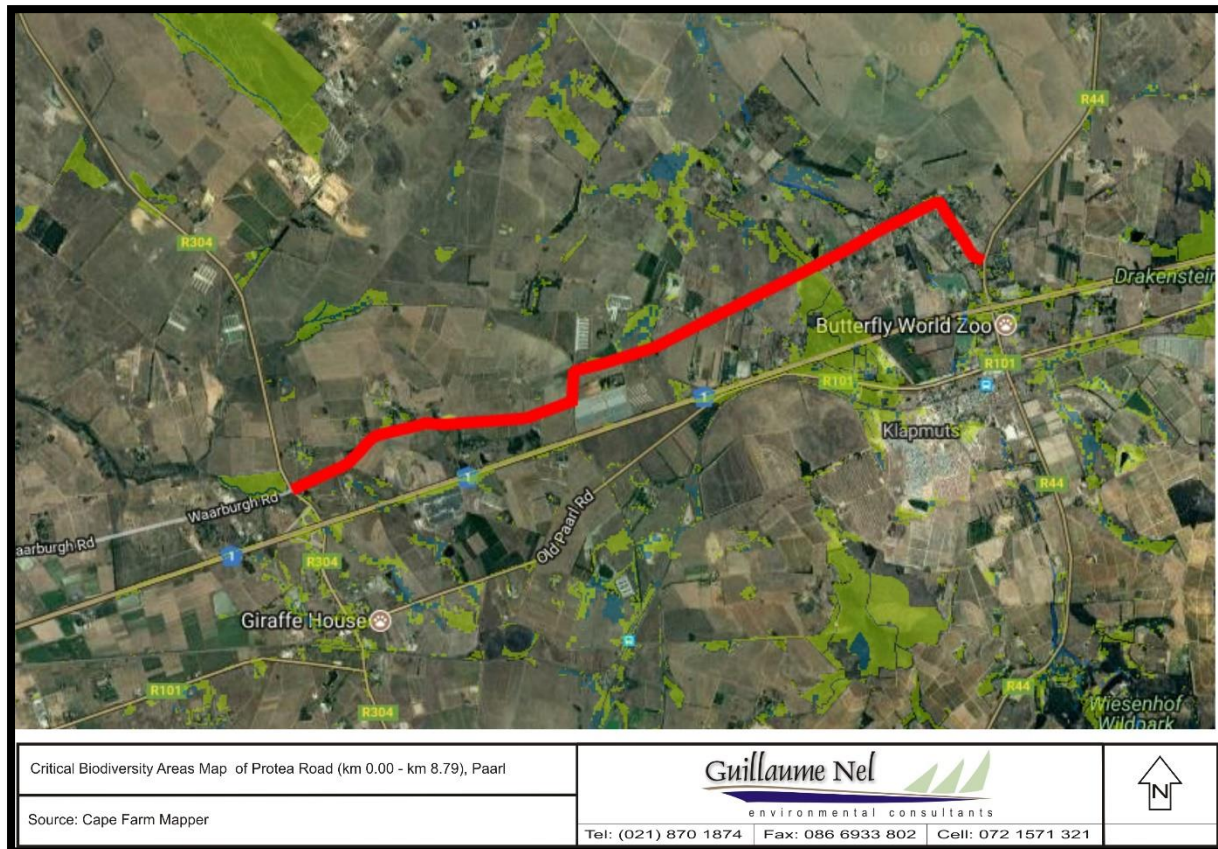
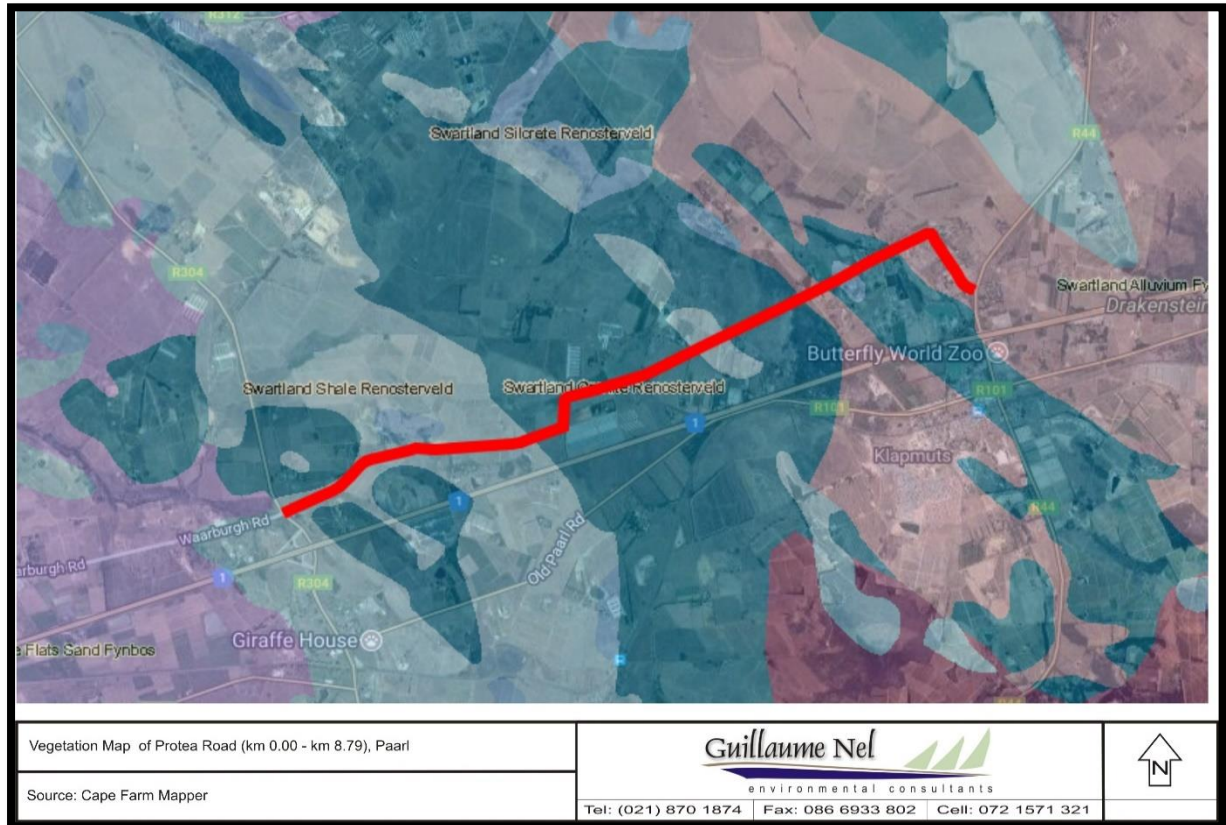


FIGURE 4: CRITICAL BIODIVERSITY MAP, PROTEA ROAD (KM 0.00 – KM 8.79), PAARL, WESTERN CAPE.

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3. THE VEGETATION:

3.1 Vegetation of area under study:



**FIGURE 5: PORTION OF THE VEGETATION OF SOUTHERN AFRICA SHOWING THE LOCATION OF
THE AREA UNDER STUDY. VEGETATION OF THE STUDY AREA: NORTH SWARTBERG
SANDSTONE FYNBOS FFS23.**

The study area, owing to its linear form, traverses several vegetation types. Based on The Vegetation of South Africa, Lesotho and Swaziland (Rebelo et al. 2006 in Mucina & Rutherford, 2006) four vegetation types occur within the study area.

They are:

- (1) Swartland Granite Renosterveld
- (2) Swartland Alluvium Fynbos
- (3) Swartland Shale Renosterveld
- (4) Swartland Silcrete Renosterveld

All these vegetation types are classified as Critical Endangered.

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3.2 Existing conditions of vegetation within road reserve:

Most of the original vegetation has either been transformed or is highly degraded. A few short sections of the road reserve harbour semi-intact and intact vegetation whereas the culverts are highly degraded.

Although loss of the degraded, semi-intact and intact vegetation is strongly discouraged (these affected habitats are an important refuge of the original vegetation type, associated animal life and ecological processes) the proposed upgrades would not be achievable without disturbing these areas. The construction footprint includes the entire road reserve and edge of the road.

All existing vegetation would be removed within the construction footprint. Since the roadside vegetation cannot be (a) avoided or (b) loss of vegetation minimized, mitigation would have to be aimed at rehabilitation. Although it would not be possible to demarcate and avoid the sensitive areas highlighted as per Botanical Specialist Report, active rehabilitation would need to be conducted.

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Key areas within the road reserve that should be rehabilitated and included in the rehabilitation plan include:

1. Intact vegetation on both sides of Protea Road located between waypoint 020 and 021.



FIGURE 6: AERIAL IMAGE SHOWING THE SURVEY WAYPOINTS.

LHS/RHS: Intact natural vegetation dominated by wild olive trees at waypoint 020 (33°48'33.61"S; 18°48'55.61"E).

The habitat contains higher numbers of wild olive and *Cliffortia ruscifolia*.

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2. Intact vegetation located on the RHS of Protea Road between waypoint 023 and 025.

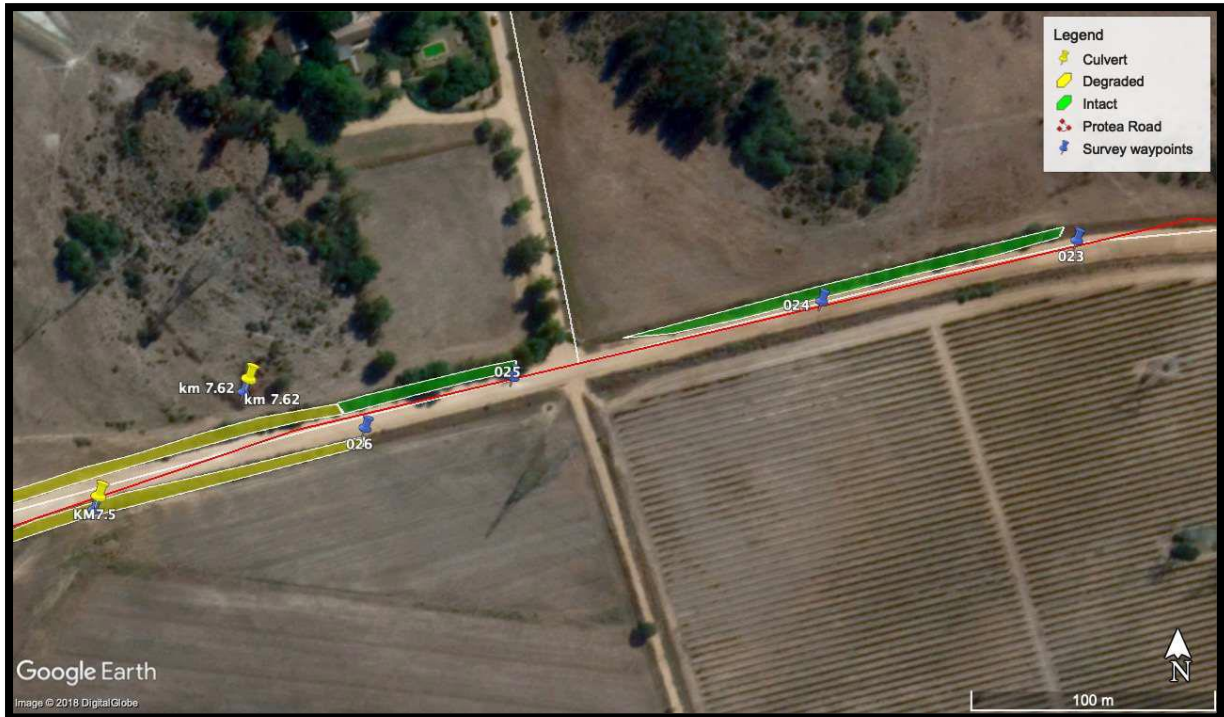


FIGURE 7: AERIAL IMAGE SHOWING THE SURVEY WAYPOINTS.

Intact natural vegetation occurs along the roadside between waypoint 023 and 026. The vegetation is dominated by wild olive trees and includes additional species such as *Elytropappus rhinocerotis*, *Searsia laevigata*, *Helichrysum pandurifolium*, *Lobelia* sp., *Aspalathus hispida* and *Struthiola* sp.

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3. Degraded vegetation located on both sides of Protea Road between waypoint 026 and 027.



FIGURE 8: AERIAL IMAGE SHOWING THE SURVEY WAYPOINTS.

LHS/RHS: degraded natural vegetation occurs along this section, with dominant species including *Elytropappus rhinocerotis*, *Cliffortia ruscifolia*, *Passerina corymbosa*, *Olea europaea* subsp. *africana* and *Searsia laevigata*.

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4. Degraded and intact vegetation on both sides of Protea Road from the intersection at KM2.31 to waypoint 010. The intact vegetation is located at waypoint 006.

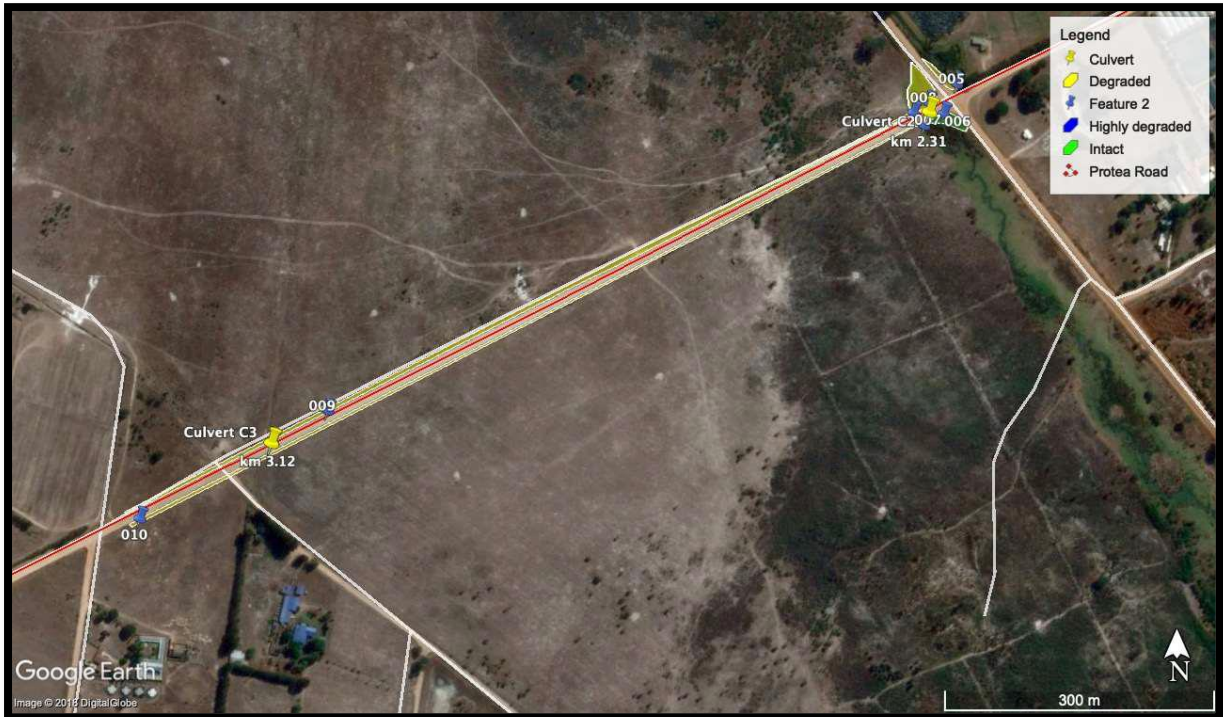


FIGURE 9: AERIAL IMAGE SHOWING THE SURVEY WAYPOINTS.

The road section supports degraded natural vegetation within the road reserve at about 25% cover. Dominant species include *Athanasia trifurcata*, *Cliffortia juniperina*, *Ehrharta calycina*, *Passerina corymbosa* and *Stoebe plumosa*

RHS and LHS: Culvert C3 does not support any natural vegetation (Figures 8.11 and 8.12). The area is highly modified and dominated by alien grasses. The only indigenous species that were found are weedy in nature, including *Athanasia trifurcata* (LHS) and *Stoebe plumosa* (RHS)

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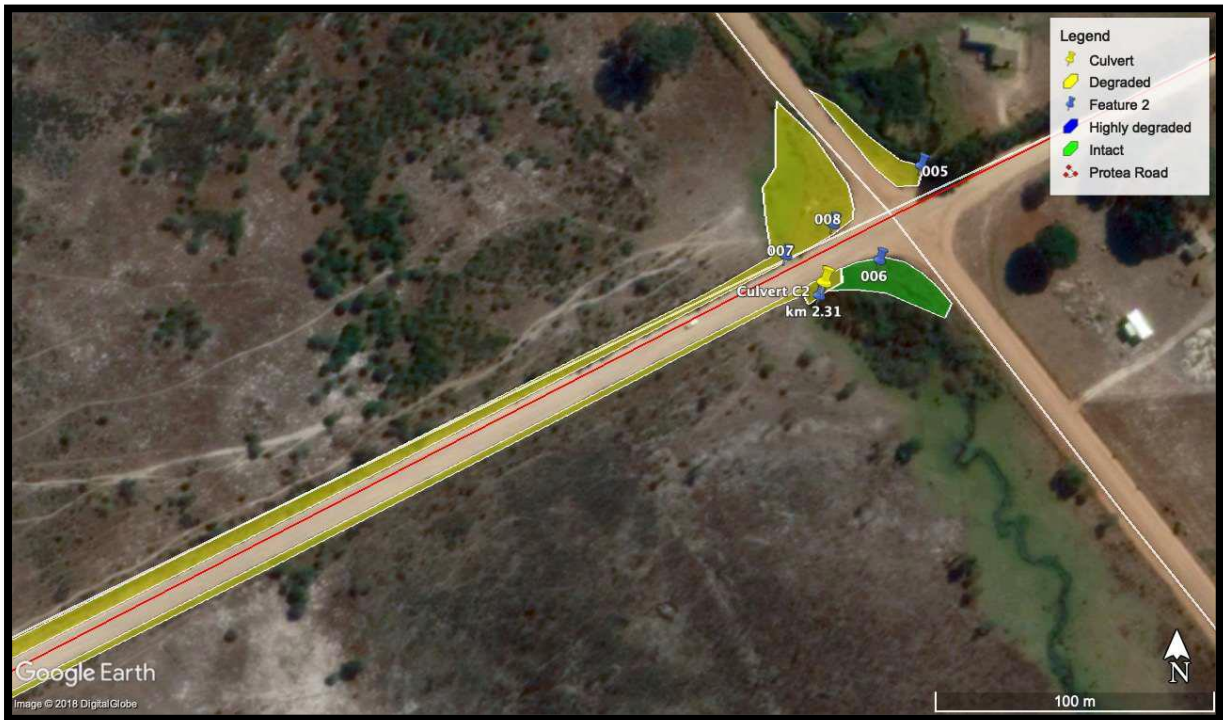


FIGURE 10: AERIAL IMAGE SHOWING THE SURVEY WAYPOINTS.

Intact vegetation occurs on the corner on the road reserve in the vicinity of waypoint 006 (33°47'40.44"S; 18°51'0.81"E). The area is dominated by dense patch of *Watsonia meriana*.

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5. Semi-intact vegetation at the intersection along Protea Road at waypoint 004.



FIGURE 11: AERIAL IMAGE SHOWING THE SURVEY WAYPOINTS.

LHS: At waypoint 004, renosterveld vegetation, dominated by renosterbos (*Elytropappus rhinocerotis*), occurs within 1m of the road edge. The roadside vegetation between waypoint 004 and waypoint 005 (33°47'39.35"S; 18°51'1.39"E) consists of alien grasses and high numbers of *Athanasia trifurcata*, an indigenous species indicative of heavy disturbance. Additional species include *Senecio polyanthemoides* and *Stoebe plumosa*.

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6. Wild olive trees (*Olea europaea* subsp. *africana*) close to Culvert C1 at waypoint 001.



FIGURE 12: AERIAL IMAGE SHOWING THE SURVEY WAYPOINTS.

Three mature wild olive trees (*Olea europaea* subsp. *africana*) occur at waypoint 001 (33°47'24.89"S; 18°51'33.10"E)

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3.3 Existing conditions of vegetation at the culverts:

The proposed culverts to be upgraded would not impact on any sensitive vegetation since the affected habitat is already highly modified, disturbed and degraded. The vegetation cover is likely to return to the same weedy component after construction.

Proposed culvert to be upgraded and rehabilitated are situated at:

Km1.3112



Km 2.312



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Km4.326



Km 5.102



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4. REHABILITATION MEASURES:

Natural vegetation is present within certain sections of the road reserve as mentioned above.

Rehabilitation of the road reserve and related storm water infrastructures (culverts) is very important as it will:

- Improve the ecological and biodiversity value of the road reserve and related culverts. .
- Act as natural areas for faunal species.
- Will stabilize bare soil and prevent/minimise erosion of the road reserve and areas at the culverts.
- Will prevent/minimise further invasive vegetation infestation as the disturbed areas will be rehabilitated with endemic species.
- Enhance the visual and aesthetic appearance of the previously disturbed and infested areas.

The following rehabilitation measures will be discussed within the rehabilitation section:

- Alien clearing management plan.
- Management of topsoil.
- Search and rescue of endemic seeds to be collected within construction footprint, and adjacent natural areas.
- Handling of harvested seed.
- The seeding process.
- Search and rescue of endemic geophytes (bulbs) within the construction footprint.
- Search and rescue of endemic species within construction footprint and related environment from which cuttings can be made.
- Culvert rehabilitation.
- No Go Areas
- Timing of rehabilitation.

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4.1 Alien Clearing Management Plan

Invasive vegetation has been identified within the previously disturbed and degraded road reserve and related culverts of Protea Road.

It is recommended that the following alien clearing practises be conducted before construction commences to prevent/minimise the re-growth of invasive vegetation after construction has been completed.

This alien clearing management plan can be used for future alien clearing within the road reserve of Protea Road.

Alien clearing practices to follow:

4.1.1 Ring barking of larger species:

Ring barking is a technique that involves removing a ring of bark around a tree trunk. Ring barking interferes with the circulation of the tree and results in it slowly dying. Remove a 30 to 40 cm strip of bark around the base of the tree trunk to ground level. Ring-barking removes the cambium/phloem, a layer just beneath the bark, which carries food from the leaves down to the roots. The roots will eventually die thereby killing the tree. The ring barked area can then be painted with a systemic poison.



FIGURE 13: EXAMPLE OF RING BARKING OF LARGER INVASIVE SPECIES. .

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4.1.2 Cutting and painting of medium size individuals:

Invasive trees needs to be cut leaving a stem of 10cm. The remaining stem needs to be painted using a brush with a systemic herbicide. The systemic herbicide needs to be coloured to ensure that all the cut stems be treated. Care should be taken not to spill systemic poison when painting the stems. The systemic poison will infiltrate the stem killing the roots, and prevent the invasive tree from re-sprouting again. Cut down invasive trees needs to be removed from site to the nearest licensed landfill site to prevent the spread of seeds.



FIGURE 14: EXAMPLE OF A CUT DOWN STEM TREATED WITH COLOURED SYSTEMIC HERBICIDE.

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4.1.3 Hand Pulling:

Hand pulling can be done when invasive vegetation is still small and easy to remove. This is the most environmental friendly method to use for smaller individuals. .

Spot spraying of smaller individuals is not recommended as the drift of poison can negatively impact upon the remaining vegetation within the road reserve.



FIGURE 15 EXAMPLE OF SMALLER SPECIES IDEAL FOR HAND PULLING.

4.1.4 Protective gear:

Working in a dangerous environment, operators need to have the necessary protective gear:

- Safety boots, steel cap.
- Safety gloves.
- Face mask to prevent herbicide inhalation.
- Safety glasses for eye protection.
- Protective clothes for chainsaw operators.
- Reflector vests to ensure visibility.
- Necessary chainsaw operating certificate and training.

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4.2 Management of Topsoil.

Topsoil is a crucial element for rehabilitation as it contains the seedbank of the indigenous species.

Topsoil need to be stripped to a depth of 200mm and windrowed within the road reserve of Protea road to be upgraded.

Topsoil need to be demarcated, and clearly seen as no go areas. .

Windrow of topsoil is the preferred method for the following reasons:

This will:

- Limit the handling of the topsoil.
- Prevent the damage and loss of topsoil.
- Prevent the contamination of topsoil with invasive vegetation.
- Will ensure that the topsoil of different vegetation types be place back in the exact same location. (Prevent mixing of topsoil from different vegetation types)
- Prevent the mixing of dryland and wetland topsoil.

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FIGURE 16: EXAMPLE OF WINDROWED TOPSOIL



FIGURE 17: EXAMPLE OF WINDROWED TOPSOIL

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4.3 Search and rescue for endemic seeds within construction footprint and adjacent natural areas. (Road Reserve)

Seed collection of endemic species need to be done within the road reserve. Seeing that the road reserve is highly disturbed and degraded with a very few indigenous species remaining, adjacent natural areas with the same vegetation type can also be used for seed collection. Seed collection need to be done under the supervision of a qualified Horticulturist, Retaliation Specialist, or Botanist.

It is important to note that the road reserve of Protea road comprises of four vegetation types:

- (1) Swartland Granite Renosterveld
- (2) Swartland Alluvium Fynbos
- (3) Swartland Shale Renosterveld
- (4) Swartland Sicrete Renosterveld

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**4.3.1 Seed to be collected within the Swartland Granite Renosterveld
Vegetation:**

Seeds of the following species can be collected:

Olea europaea subs. *Africana*



Searsia laevigata



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Diospyros glabra



Dodonaea viscosa var. *angustifolia*



Searsia angustifolia



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Searsia tomentosa



Athanasia trifurcata



Helichrysum cymosum



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Helichrysum crispum



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4.3.2 Seed to be collected within the Swartland Alluvium Fynbos
Vegetation:

Diospyros glabra



Olea europaea subsp *Africana*



Searsia angustifolia



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Dodonaea viscosa var. *angustifolia*



Metalasia densa



Protea repens



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Leucadendron salignum



Athanasia tricurcata



Stoebe plumosa



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4.3.3 Seed to be collected within the Swartland Shale Renosterveld
Vegetation:

Olea europaea subsp *Africana*



Searsia angustifolia



Helichrysum cymosum



**REHABILITATION REPORT FOR PROTEA ROAD (KM 0.00 – KM 8.79) AND RELATED
CULVERTS AT KM 1.3112,
KM 2.312, Km 4.326, Km 5.102, PAARL, WESTERN CAPE**

Athanasia frifurcata



Stoebe plumosa



REHABILITATION REPORT FOR PROTEA ROAD (KM 0.00 – KM 8.79) AND RELATED
CULVERTS AT KM 1.3112,
KM 2.312, Km 4.326, Km 5.102, PAARL, WESTERN CAPE

4.3.4 Seed to be collected within Swartland Secrite Renosterveld
Vegetation:

Athanasia frifurcata



Stoebe plumose



**REHABILITATION REPORT FOR PROTEA ROAD (KM 0.00 – KM 8.79) AND RELATED
CULVERTS AT KM 1.3112,
KM 2.312, Km 4.326, Km 5.102, PAARL, WESTERN CAPE**

4.3.5 Handling of harvested seeds:

- Collected seed from different vegetation types need to be stored separately.
- Collected seed need to be cleaned and dried under the supervision of a Horticulturist, Rehabilitation Specialist, or Botanist and stored within an enclosed pest free environment.
- Prior to seeding for rehabilitation purposes, the prepared seeds need to be treated with a smoke water solution to enhance germination. (Rehabilitation specialist to be consulted in this regard).

4.3.6 Seeding process:

- Seeding can done by hydro-seeding or hand sowing. (Hydro-seeding highly recommended as this is more effective).
- Prior to seeding the areas need to be ripped and levelled in such a way that it blends in with the natural contour of the site to ensure effective infiltration of sown seed into the soil.
- Seeding need to be done immediately after the area has been ripped to ensure effective infiltration of the seed into the soil.
- Seeding need to be done just before winter to ensure that the sown seed receive enough precipitation for germination and successful growth.

**REHABILITATION REPORT FOR PROTEA ROAD (KM 0.00 – KM 8.79) AND RELATED
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4.4 Search and rescue for endemic Geophytes (Bulbs) within the construction footprint. (Road Reserve)

Geophytes (Bulbs) can easily be removed within the construction footprint of the road reserved. These bulbs need to be taken to the GNEC rehabilitation nursery, where these bulbs will be bagged and grown for rehabilitation purposes.

4.4.1 Geophytes (Bulbs) to be collected within the Swartland Granite Renosterveld Vegetation:

Watsoni borbonica



Watsonia meriana



REHABILITATION REPORT FOR PROTEA ROAD (KM 0.00 – KM 8.79) AND RELATED
CULVERTS AT KM 1.3112,
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**4.4.2 Geophytes (Bulbs) to be collected within the Swartland Alluvium
Fynbos Vegetation:**

Zantedeschia aethiopica



REHABILITATION REPORT FOR PROTEA ROAD (KM 0.00 – KM 8.79) AND RELATED
CULVERTS AT KM 1.3112,
KM 2.312, Km 4.326, Km 5.102, PAARL, WESTERN CAPE

**4.4.3 Geophytes (Bulbs) to be collected within the Swartland Shale
Renosterveld Vegetation:**

Aristea Africana



Watsonia marginata



**REHABILITATION REPORT FOR PROTEA ROAD (KM 0.00 – KM 8.79) AND RELATED
CULVERTS AT KM 1.3112,
KM 2.312, Km 4.326, Km 5.102, PAARL, WESTERN CAPE**

4.5 Search and rescue of endemic from which cutting can be made.

Endemic species have been identified from which cuttings can be made for rehabilitation purposes. Seeing that the road reserve is highly disturbed and degraded with a very few indigenous species remaining, adjacent natural areas with the same vegetation type can also be used for taking cuttings.

Handling of Cuttings:

- Cuttings need to be done early in the morning or late afternoon when temperatures are still low.
- Cuttings need to be done under the supervision of a qualified Horticulturist, Rehabilitation Specialist, or Botanist.
- The cuttings can be taken to the GNEC rehabilitation nursery, where these cuttings can be propagated, bagged and grown for rehabilitation purposes within a controlled environment.

The following endemic species have been identified for cuttings:

REHABILITATION REPORT FOR PROTEA ROAD (KM 0.00 – KM 8.79) AND RELATED
CULVERTS AT KM 1.3112,
KM 2.312, Km 4.326, Km 5.102, PAARL, WESTERN CAPE

**4.5.1 Cuttings to be collected within the Swartland Granite Renosterveld
Vegetation:**

Crysanthemoides monilifera



Ruschia sp.



Carpobrotus edulis



REHABILITATION REPORT FOR PROTEA ROAD (KM 0.00 – KM 8.79) AND RELATED
CULVERTS AT KM 1.3112,
KM 2.312, Km 4.326, Km 5.102, PAARL, WESTERN CAPE

**4.5.2 Cuttings to be collected within the Swartland Alluvium Fynbos
Vegetation:**

N/A

**4.5.3 Cuttings to be collected within the Swartland Shale Renostervled
Vegetation:**

Ruschia sp.



Chrysantemoides monilifera



**REHABILITATION REPORT FOR PROTEA ROAD (KM 0.00 – KM 8.79) AND RELATED
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KM 2.312, Km 4.326, Km 5.102, PAARL, WESTERN CAPE**

Lampranthus elegans.



REHABILITATION REPORT FOR PROTEA ROAD (KM 0.00 – KM 8.79) AND RELATED
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KM 2.312, Km 4.326, Km 5.102, PAARL, WESTERN CAPE

**4.5.4 Cuttings to be collected within the Swartland Secrite Renosterveld
Vegetation:**

Ruschia sp.



Lampranthus filicaulis



Carpobrotus edulis



**REHABILITATION REPORT FOR PROTEA ROAD (KM 0.00 – KM 8.79) AND RELATED
CULVERTS AT KM 1.3112,
KM 2.312, Km 4.326, Km 5.102, PAARL, WESTERN CAPE**

4.6 Culvert Rehabilitation.

The proposed culverts to be rehabilitated are situated at Km 1.3112, Km 2.312, Km 4.326 and Km 5.102.

The culverts area highly disturbed and degraded with almost no natural vegetation remaining.

The proposed rehabilitation of the culvert will ensure:

- Improve the ecological and biodiversity value and functioning of the culvert and related river system. .
- Act as natural area for faunal species.
- Will stabilize bare soil and embankments and prevent further erosion.
- Will prevent siltation of the culvert and related river system.
- Will prevent/minimise invasive vegetation infestation.
- Enhance the visual and aesthetic appearance of the previously disturbed and degraded culverts.

REHABILITATION REPORT FOR PROTEA ROAD (KM 0.00 – KM 8.79) AND RELATED
CULVERTS AT KM 1.3112,
KM 2.312, Km 4.326, Km 5.102, PAARL, WESTERN CAPE

4.6.1 Planting zones and planting list for culvert rehabilitation:

(Please refer to the culvert rehabilitation plan below).

Zones to be planted consist of:

Dry bed planting, Zone 1:

Olea europaea subs. *Africana*



Chrysanthemoides monnifera



**REHABILITATION REPORT FOR PROTEA ROAD (KM 0.00 – KM 8.79) AND RELATED
CULVERTS AT KM 1.3112,
KM 2.312, Km 4.326, Km 5.102, PAARL, WESTERN CAPE**

Dodonaea viscosa var *angustifolia*



Eriocephalus africanus var *africanus*



Helichrysum cymosum



REHABILITATION REPORT FOR PROTEA ROAD (KM 0.00 – KM 8.79) AND RELATED
CULVERTS AT KM 1.3112,
KM 2.312, Km 4.326, Km 5.102, PAARL, WESTERN CAPE

Watsonia marginata/meriana



Ruschia sp



Salvia lanceolate



**REHABILITATION REPORT FOR PROTEA ROAD (KM 0.00 – KM 8.79) AND RELATED
CULVERTS AT KM 1.3112,
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Metalasia densa



Elegia tectorum



**REHABILITATION REPORT FOR PROTEA ROAD (KM 0.00 – KM 8.79) AND RELATED
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Seasonal Wet Bed Planting, Zone 2

Ischyrolepis capensis



Thamnochortus fruticosus



**REHABILITATION REPORT FOR PROTEA ROAD (KM 0.00 – KM 8.79) AND RELATED
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Water bed planting, Zone 3:

Zantedeschia aethiopica “Arum lily”



Cyperus textilis



Elegia capensis



**REHABILITATION REPORT FOR PROTEA ROAD (KM 0.00 – KM 8.79) AND RELATED
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KM 2.312, Km 4.326, Km 5.102, PAARL, WESTERN CAPE**

Wachendorfia thyrsiflora



Juncus capensis



REHABILITATION REPORT FOR PROTEA ROAD (KM 0.00 – KM 8.79) AND RELATED CULVERTS AT KM 1.3112, KM 2.312, Km 4.326, Km 5.102, PAARL, WESTERN CAPE.

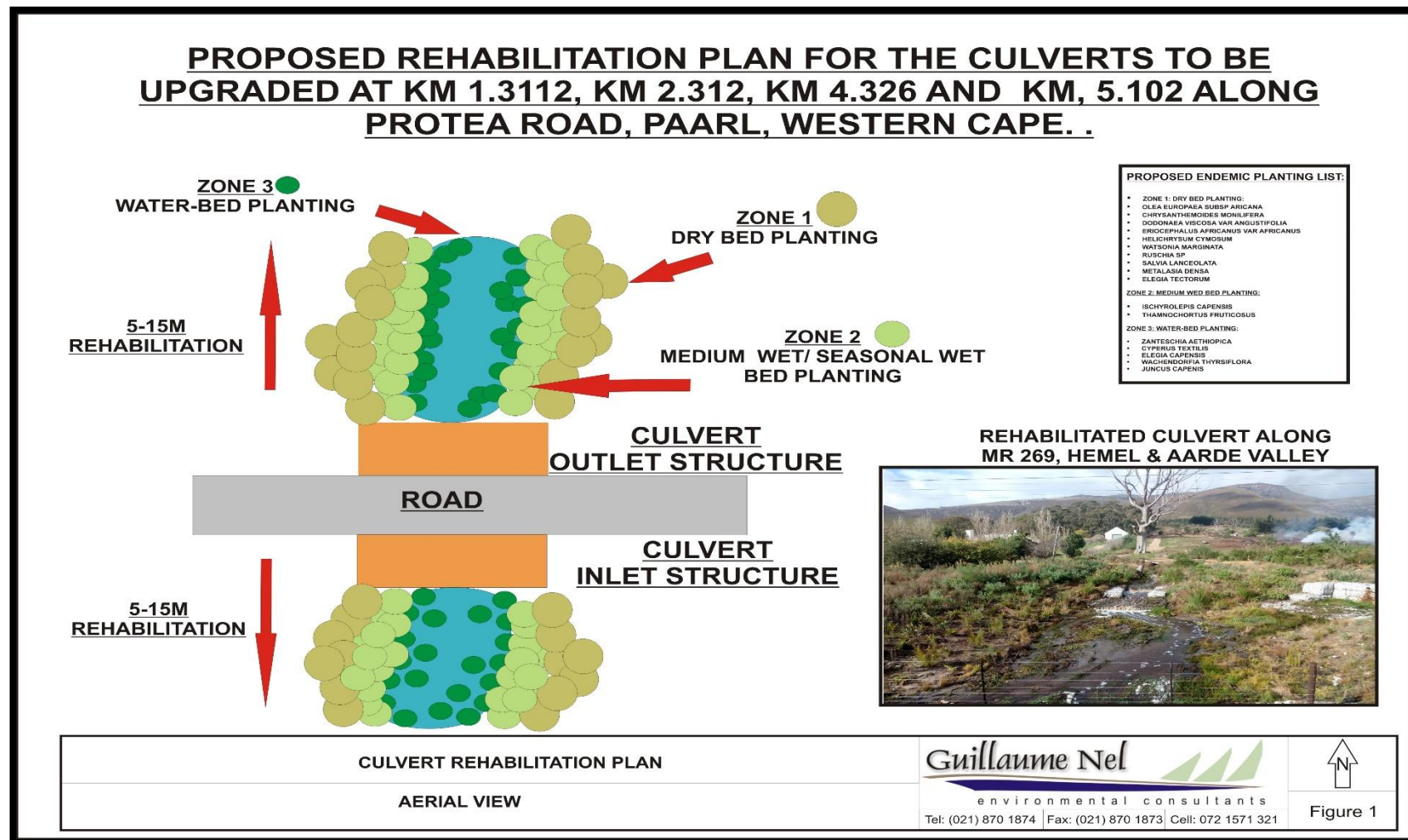


FIGURE 18: CULVERT REHABILITATION PLAN.

**REHABILITATION REPORT FOR PROTEA ROAD (KM 0.00 – KM 8.79) AND RELATED
CULVERTS AT KM 1.3112,
KM 2.312, Km 4.326, Km 5.102, PAARL, WESTERN CAPE.**

4.7 No go areas:

After rehabilitation the sown and planted areas need to be clearly as no go areas. Trampling of these areas will inhibit the germination of seed and growth of planted species. Access to the rehabilitated road reserve and culverts need to be limited.

4.8 Timing of Rehabilitation

Due to the fact that there will be no irrigation to help the plants to settle and strengthen, the best time for sowing and planting will be at the beginning of the rainy season. This will help the seed and plants to settle and strengthen, preparing them for the summer. All plants (even water wise plants) need water in the establishment phase. Should planting be done in the summer (which is not advised), the area will need to be watered at least two times a week.

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5. Rehabilitation nursery

GNEC have a rehabilitation nursery where several endemic species are being propagated, multiplied and grown for rehabilitation projects.



FIGURE 19: EXAMPLE OF THE SHADE NET/HARDENING OFF AREA WITHIN THE GNEC REHABILITATION NURSERY.



FIGURE 20: EXAMPLE OF THE GNEC REHABILITATION NURSERY.

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**FIGURE 21: EXAMPLE OF MAN MADE WETLAND PONDS IN THE GNEC REHABILITATION
NURESERY WERE WETLANDS PLANTS ARE GROWN AND MULTIPLIED**

The following mitigation needs to be in place at a rehabilitation nursery for successful propagation, multiplication and growth of search and rescued plants:

- Well trained staff with nursery and propagation experience.
- Well sanitized propagation tools and equipment.
- Well drained growing medium. 1 Part compost, 2 part sand.
- Well sanitized growing medium to prevent the spread of invasive species.
- Growing hormones 1 and 2 for root stimulation.
- 4 Litre planting bags in which plants can grow. 4 litre bags are easily manageable especially during rehabilitation.
- Shade net area for the hardening off of plants before moving to the full sun section.
- Controlled irrigation as needed.
- Water free of pathogens.
- Pest and disease free area.
- Weed free area to prevent the spread of invasive species.
- Genus, species and quantity labelling system.

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**6. PREVIOUS ROAD VERGE AND CULVERTS REHABILITATION DONE BY
GNEC.**

Hemel & Aarde Valley Wetlands, Hermanus, Western Cape.

Before:



**REHABILITATION REPORT FOR PROTEA ROAD (KM 0.00 – KM 8.79) AND RELATED
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After:



**REHABILITATION REPORT FOR PROTEA ROAD (KM 0.00 – KM 8.79) AND RELATED
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Shaw'ss Pass, Hemel & Aarde, Hermanus

Before:



**REHABILITATION REPORT FOR PROTEA ROAD (KM 0.00 – KM 8.79) AND RELATED
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After:



**REHABILITATION REPORT FOR PROTEA ROAD (KM 0.00 – KM 8.79) AND RELATED
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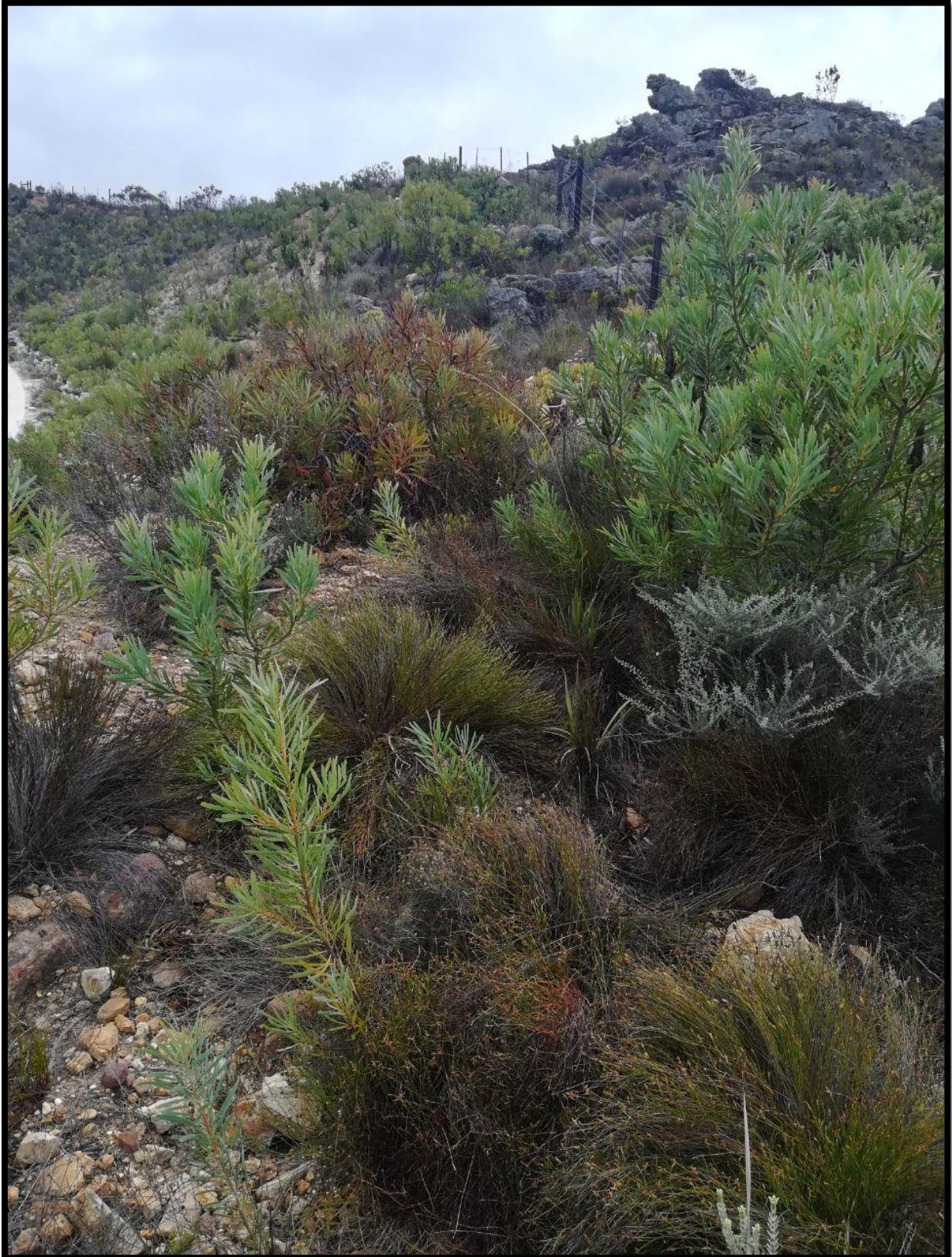
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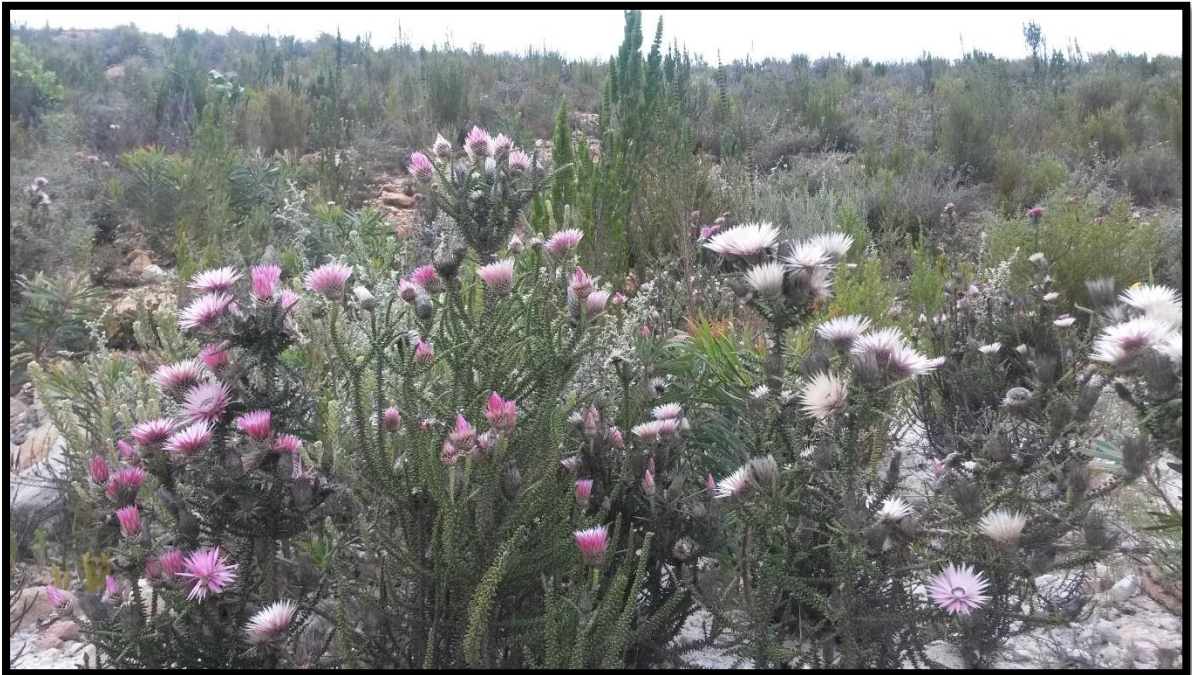
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7 CONCLUSION:

GNEC in our professional capacity as rehabilitation specialist strongly feel that the above mentioned rehabilitation will:

- Improve the ecological and biodiversity value of the road reserve and related culverts.
- Act as natural areas for faunal species.
- Will stabilize bare soil and prevent/minimise erosion of the road reserve and areas at the culverts.
- Will prevent/minimise further invasive vegetation infestation as the disturbed areas will be rehabilitated with endemic species.
- Enhance the visual and aesthetic appearance of the previously disturbed and infested areas.