

## RIVER MAINTENANCE MANAGEMENT PLAN

**PROPOSED REPAIR AND UPGRADE OF THE EXISTING DEGRADED  
STORM WATER INFRASTRUCTURES ALONG MAIN ROAD 269, KM 4.95  
AND KM 5.67 AND DIVISIONAL ROAD 1257, KM 1.47, HEMEL & AARDE  
VALLEY, BETWEEN SANDBAAI AND CALEDON, WESTERN CAPE.**

**(DEA&DP REF: 16/3/3/1/E4/1007/16)**

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**ABBREVIATIONS**

|        |                                                              |
|--------|--------------------------------------------------------------|
| CBA    | Critical Biodiversity Area                                   |
| DEA&DP | Department of Environmental Affairs and Development Planning |
| DWS    | Department of Water and Sanitation                           |
| ESA    | Ecological Support Area                                      |
| GA     | General Authorisation                                        |
| NEMA   | National Environmental Management Act                        |
| NWA    | National Water Act                                           |
| RMMP   | River Maintenance Management Plan                            |
| TOR    | Terms of Reference                                           |
| WULA   | Water User License Application                               |
| RE     | Resident Engineer                                            |
| ECO    | Environmental Control Officer                                |
| HDPE   | High Density Polyethylene                                    |

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**RIVER MAINTENANCE MANAGEMENT PLAN**DEA&DP REF NR: **16/3/3/1/E4/5/1007/16****1. Introduction****Important Note:**

**The RMMP and Freshwater Assessment Report must be used in conjunction with the EMP. The applicant and ECO must use the above mentioned documents during and after construction for Construction, Rehabilitation and Maintenance. This should also be a condition in the Environmental Authorisation.**

Guillaume Nel Environmental Consultants (GNEC) was appointed on behalf of the Department of Transport and Public Works as Environmental Assessment Practitioner for the application of the proposed repair and upgrade of the existing degraded storm water infrastructures along Main Road 269, Km 4.95 and Km 5.67 and Divisional Road 1257, KM 1.47, Hemel & Aarde Valley, Between Sandbaai and Caledon, Western Cape.

The River Maintenance Management Plan (RMMP) submitted herewith is broad and general in terms of its objectives and expected outcomes, and is intended to include the requirements as received from the Department of Environmental Affairs and Development Planning (DEA&DP) and the Department of Water and Sanitation (DWS).

The expertise of the person who prepared this report follows:

*MSc & Man (PUK), B(Hons) & Man (US), B Geography (US), Certificate-Environmental Law (PUK), Certificate – EIA (PUK), Certificate– EMS 14000 (PUK), Certificate– Air Quality Management (PUK), Certificate– Environmental Auditing (SABS). Guillaume Nel has thirteen years relevant experience as an Environmental Assessment Practitioner.*

The objectives of this RMMP are divided into five sections to ensure the sensitive planning, maintenance and ongoing maintenance of the maintenance site, once maintenance activities have been completed. Each of the five sections is divided into **Mitigation Measure, Management Objectives, Measurable Targets, Responsible Party, and Frequency of Action, both before and during maintenance as well as possible future maintenance.**

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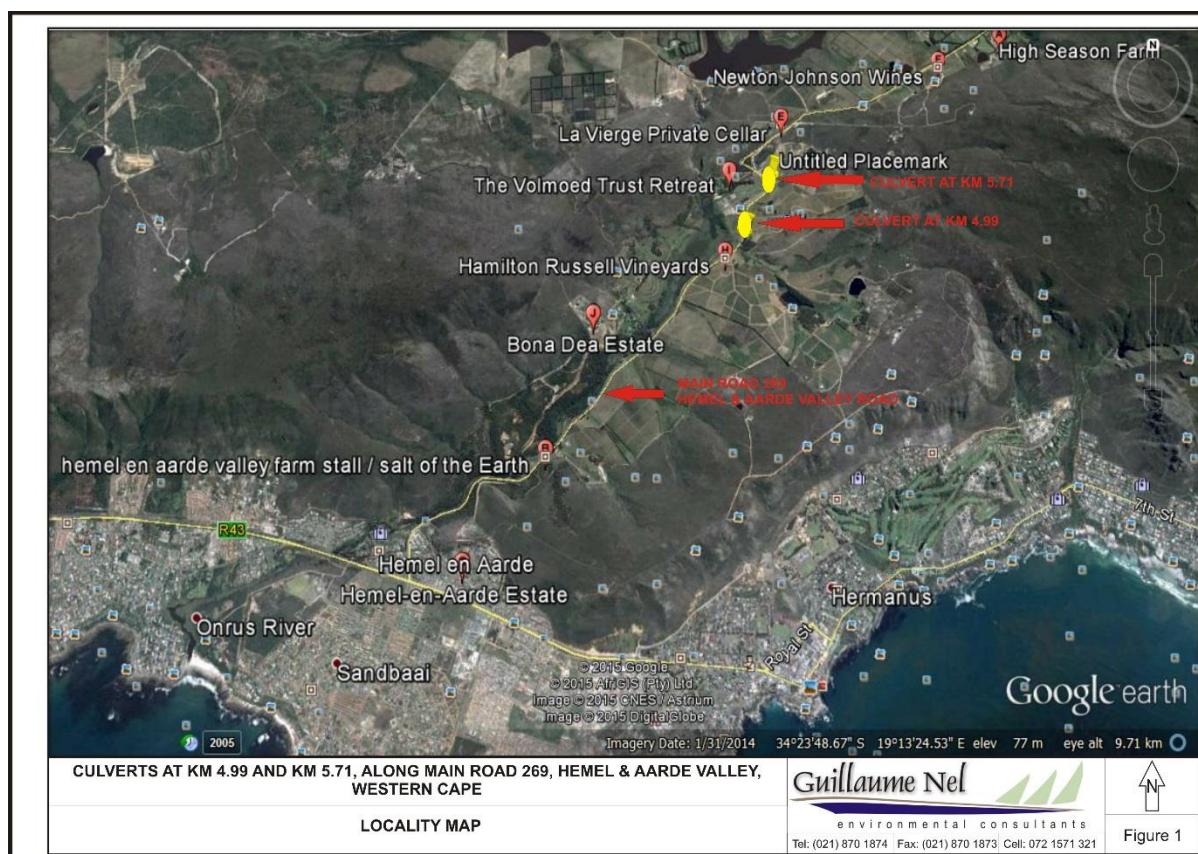
## 2. Relevant Legislation and Policies

The RIVER MAINTENANCE MANGEMENT PLAN includes the following listed activities:

| GN 983 Item | Provide the relevant <b>Basic Assessment Listed Activity(ies)</b> as set out in <b>Listing Notice 1</b> (GN No. R. 983)                                                                                                                                                                                                                                                                                                                                                                                                      | Describe the portion of the development as per the project description that relates to the applicable listed activity. |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|
| 19          | <p>The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from:</p> <p>(i) watercourse</p>                                                                                                                                                                                                                                                                              | Repair and upgrade of the existing degraded culverts.                                                                  |
| GN 985 Item | Provide the relevant <b>Basic Assessment Listed Activity(ies)</b> as set out in <b>Listing Notice 3</b> (GN No. R. 985)                                                                                                                                                                                                                                                                                                                                                                                                      | Describe the portion of the development as per the project description that relates to the applicable listed activity. |
| 23          | <p>The expansion;</p> <p>(vi) bulk storm water outlet structures where the structure is expanded by 10 square or more in size</p> <p>(xii) infrastructure or structures where the physical footprint is expanded by 10 squares metres or more;</p> <p>Where such development occur;</p> <p>(a) within a watercourse</p> <p>(g) In Western Cape:</p> <p>(i) Outside urban areas, in:</p> <p>(ff) service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;</p> | Repair and upgrade of the existing degraded culverts.                                                                  |

### 3. Site location

#### Activity Location:



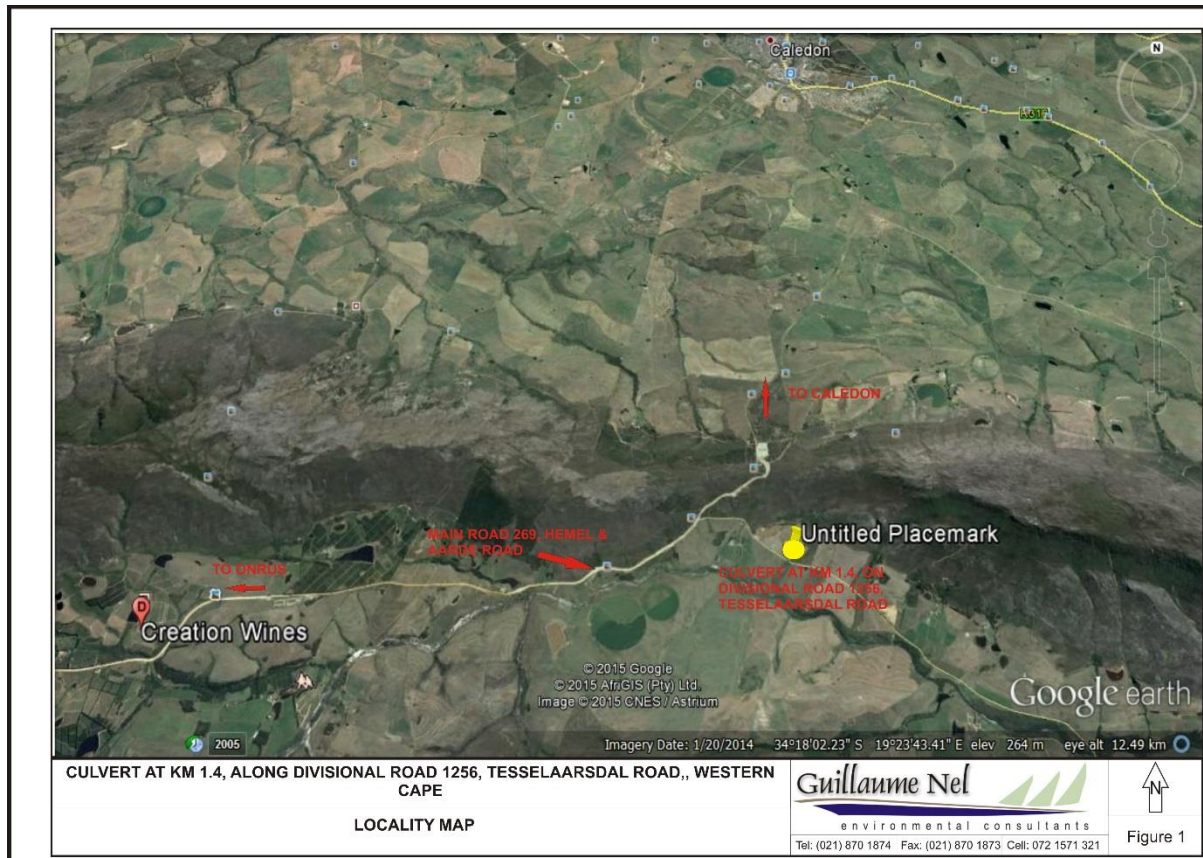
**Locality Map: Culvert at Km 4.95 and 5.67 along MR269**

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**Locality Map: Culvert at Km 1.47 along DR1257**

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## 4. Photo Pages

|                                                                                                                                                                                             |                                                                                                                                                                                                                                                                     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                            |                                                                                                                                                                                   |
| <p>HIGHLY DEGRADED INLET STRUCTURE OF THE CULVERT. THE SITE HAS BEEN PREVIOUSLY DISTURBED AND HIGHLY INFESTED WITH KIKUYU GRASS</p>                                                         | <p>HIGHLY DEGRADED INLET STRUCTURE OF THE CULVERT. THE SITE HAS BEEN PREVIOUSLY DISTURBED AND HIGHLY INFESTED WITH KIKUYU GRASS</p>                                                                                                                                 |
|                                                                                                           |                                                                                                                                                                                  |
| <p>HIGHLY DEGRADED OUTLET STRUCTURE OF THE CULVERT. THE SITE HAS BEEN PREVIOUSLY DISTURBED AND HIGHLY INFESTED WITH KIKUYU GRASS<br/>CULVERT WILL BE REHABILITATED WITH ENDEMIC SPECIES</p> | <p>HIGHLY DEGRADED OUTLET STRUCTURE OF THE CULVERT. THE SITE HAS BEEN PREVIOUSLY DISTURBED AND HIGHLY INFESTED WITH KIKUYU GRASS<br/>CULVERT WILL BE REHABILITATED WITH ENDEMIC SPECIES</p>                                                                         |
| <p>T.</p>                                                                                                                                                                                   |                                                                                                                                                                                                                                                                     |
| <p>Site Photos</p>                                                                                                                                                                          | <div>  </div> <div>  </div> |
| <p>Mr269, CULVERT AT KM 4.99</p>                                                                                                                                                            | <p>Tel: (021) 870 1874   Fax: (021) 870 1873   Cell: 072 1571 321</p>                                                                                                                                                                                               |

**Figure 1**

### Photo Page: Culvert at Km 4.95 along MR269

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## Photo Page: Culvert at Km 5.67 along MR269

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THE ROAD OVER THE CULVERT IS VERY NARROW AND ONLY ALLOWS FOR ONE WAY TRAFFIC. THE DROP OF THE CULVERT IS VERY HIGH AND POSE A HUGE SAFETY RISK FOR PEOPLE USING THIS ROAD.



THE STRUCTURE OF THE CULVERT HAS BEEN SEVERELY ERODED AND DEGRADED AND URGENTLY NEEDS TO BE UPGRADED. EROSION IS AN ONGOING EVENT.



THE SITE HAS BEEN PREVIOUSLY DISTURBED AND HIGHLY INFESTED WITH KIKUYU GRASS AND OTHER ALIEN VEGETATION. ALL ENDEMIC SPECIES WILL BE REMOVED PRIOR TO CONSTRUCTION, AND AFTER CONSTRUCTION ALL THE DISTURBED AREAS AT THE CULVERT WILL BE REHABILITATED WITH ENDEMIC SPECIES

T.  
•

Site Photos

Dr1256, CULVERT AT KM 1.4

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Figure 1

## Photo Page: Culvert at Km 1.47 along DR1257

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## 5. Activity description:

This Maintenance Management Plan only allows for maintenance activities for the culverts, as there may be a need for repair, upgrade and maintenance work in the future due to flood damages. The Maintenance Management Plan would then eliminate the need for a new environmental authorisation each time this is required.

This Management Plan only allow for maintenance of the following culverts:

- Culvert at KM 4.95 along MR269
- Culvert at KM 5.67 along MR269
- Culvert at KM 1.47 along MR1257

### Access during Maintenance Activities

Access to the culverts needs to be at the least sensitive area identified.

Prior to maintenance activities the smaller plants that can easily be replanted within the access road footprint needs to be removed and planted in identified adjacent bare areas. Larger shrubs that cannot be easily re-planted needs to be brush cut to ensure natural res-sprouting after maintenance activities.

Only one access road needs to be used. The maintenance team needs to strictly stay on this access road. Adjacent natural areas needs to be clearly cordoned off and seen as no go areas.

## 6. The current status of the streams/rivers as of April 2015:

### Present Ecological State

The freshwater ecosystem sites for the three culverts can be classified as ('C') moderately modified as, loss and change of natural habitat and biota have taken place but the basic ecosystem functions are still predominantly unchanged. Alien species invading the natural vegetation has also been identified at all three culverts.

### Reference Condition

**Vegetation type:** MR269, Culverts at Km 4.95 and Km 5.67

According to the national vegetation map (Mucina *et al.* 2005, Mucina & Rutherford 2006) the vegetation that would previously have occurred on site would be FFf1 Elim Ferricrete Fynbos.

Conservation: Endangered. Target 30%.

Distribution: Western Cape Province: Extensive areas between the Bot River Valley, **Hemel en Aarde** Valley, Stanford environs, Salmonsdam and baardskeerderbos, with the most extensive parts around Elim on the Agulhas Plain spanning the area from Soetmuisberg in the north to Buffeljags and the Soetanytsberg in the South.

#### Vegetation & Landscape Features:

Undulating hills and plans covered with open to closed dwarf shrub land with occasional scattered tall shrubs. It is a diverse unit, with all structural fynbos types present, but with extensive areas of asteraceous fynbos dominated by low proteoid elements.

Conditions of site: It is evident that the areas at the culverts have been previously disturbed during the construction of the old road and culverts, and due to agricultural activities. These culverts is surrounded by agricultural pastures consisting of Kikuyu grass. The Kikuyu grass has infested these culverts. Erosion at these culverts is an ongoing event due to the severe degraded conditions of the culverts. Further upstream and downstream of the proposed culverts to be upgraded, more endemic vegetation is found. These species falls outside the construction footprint.



**Vegetation type:** DR1257, Culvert at Km 1.47

According to the national vegetation map (Mucina *et al.* 2005, Mucina & Rutherford 2006) the vegetation that would previously have occurred on site would be FRs11; Western Ruens Shale Renosterveld

Conservation: Critically endangered. Target 27%. None of the area is conserved statutorily and only a small portion enjoys protection in the Witdraai Private Nature Reserve. Some 86% has already been transformed, mostly by cultivation. Only the steepest slopes carry remnants of the natural vegetation. Erosion very low and low.

Distribution: Western Cape Province: Western parts of the Ruens region (Overberg) – from Bot River and Villierdorp eastwards, surrounding the Caledon Swartberg, and approximately to a line between Napier and Genadendal.

Vegetation & Landscape Features: Moderately undulating plains, today mostly stripped of natural vegetation and where preserved, supporting an open to medium dense, cupressoid and small – leaved, low to moderately tall grassy shrub land dominated by renosterbos.

Conditions on site: It is evident that the area at this degraded culvert has been severely eroded. Erosion is an ongoing event due to the condition of the degraded culvert. The culvert is surrounded by agricultural pastures consisting of Kikuyu grass. Although this culvert has more endemic vegetation still present, Kikuyu grass is also infesting this culvert. Further upstream and downstream of the proposed culvert to be upgraded, more endemic vegetation is found



## 7. Rehabilitation Plan:

In addition to proposed mitigation measures rehabilitation may be necessary to prevent deterioration of the present ecological state and maintain overall riparian functionality. Integrity of the riverine profile (longitudinal as well as cross sectional) and maintenance of vegetation cover are the two most critical factors for achieving overall ecological resilience and functionality. Rehabilitation activities will therefore generally comprise reconstruction of the profile and substrate layers and revegetation of denuded or disturbed areas.

The natural (current) profile of the bank and bed should be noted before the commencement of the maintenance phase. This will provide a localised template for rehabilitation of the maintenance activities once maintenance have been completed.

Alteration of the river, bed and embankments profile may occur due to erosion or deposition that would happen naturally in the system. Examples of situations that may result in rehabilitation being required include (but are not limited to), downstream (and subsequent upstream) deposition against protruding gabions or headwalls, erosion around gabion or headwall sides, substrate deposition in the downstream due to increased turbidity or bank destabilisation, or bed or bank erosion during rainfall or flooding events due to short term vulnerability.

It is recommended that where excavations take place that as much of the in situ material be replaced as possible, and that levelling be done according to the original slopes as far as possible. In addition, should the in situ material display distinct layering when excavated, different substrata should be stockpiled separately and replaced according the original layering and compaction.

After construction the disturbed sections needs to be ripped, levelled, shaped and stabilized in such a way that it blends in with the natural contour of the site and surrounding area.

Since some of the slopes might be steep, erosion control, along with preservation of the topsoil would be very important for rehabilitation. Stabilization should be done by ensuring that the velocity of surface runoff is reduced through naturally aligned terracing. Terracing can be done by using hand labor to create natural terraces, as done at the Spookfontein wetland (Figure 6.2 and 6.3 Freshwater Specialist Report) on the same road (MR269) (Consult the ECO and Rehabilitation Specialist in this regard)

The topsoil then needs to be evenly spread over the naturally looking prepared slopes.

Rehabilitation needs to be done with the following endemic species:

Submergent/Emergent

- *Isoliper prolifera*
- *Juncus lomatophyllus*
- *Carpha glomerata*

Emergent:

- *Restio suberviticillatus*
- *Wachendorfia thyrsiflora*
- *Cliffortia* sp
- *Pelargonium cucculatum*
- *Psolralea pinnata*
- *Halleria lucida*
- *Zantedeschia aethiopica*
- *Searsia rehmanniana*

Terrestrial:

- *Chrysanthemoides monilifera*
- *Leonotus leonurus*
- *Pelargonium cucculatum*
- *Athanasia trifurcate*
- *Passerina* sp.
- *Leucadendron strictum*
- *Searsia angustifolia*

Rehabilitated areas needs to be water as the need arises for the first 3 months until the plants have successfully established.



Example of horizontal terracing prior to planting to minimise vertical erosion



Picture of rehabilitated and established embankments along the same road; MR269; Done by GNEC

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Picture of rehabilitated and established embankments along the same road; MR269; Done by GNEC



Picture of rehabilitated and established embankments along the same road; MR269; Done by GNEC

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## 8. Description of maintenance activities

Relevant maintenance activities which will influence the wetland and riparian environment include the following:

- 1) Driving of machinery on rivers banks to access areas where maintenance is required. Although hand labour is highly recommended far as possible, maintenance might require the use of machinery, especially during major maintenance activities after severe flood events.
- 2) Repairs on degraded/damaged infrastructure such as Gabions, Headwalls, inlet and outlet structures of the culverts. Although hand labour is highly recommended far as possible, maintenance might require the use of machinery, especially during major maintenance activities after severe flood events.
- 3) Removal of build-up sediment at inlet and outlet structure, especially after severe flooding event.
- 4) Stabilization and re-vegetation of eroded embankments after severe flooding events
- 5) Removal of alien species establishing on River Embankments. Hand Labour recommended

Due to the fact that the existing degraded culverts with inadequate capacity will be repaired and upgraded, erosion to these structures will be better managed. These structures will require less maintenance than is currently required, seeing that the upgraded culverts will be less prone to flood damage and erosion.

**The maintenance activities are to be conducted during the summer months (dry season), if possible, when stream flow and expectancy of rain is lowest**



## 9. Impact assessment

### METHODS

Potential impacts for future maintenance were assessed for the proposed study site and mitigation measures for potential impact provided. The criteria for assessing type, spatial extent, duration, magnitude (the severity or size of the impact), probability (the likelihood of the impact actually occurring) and significance (dependent on ratings for extent, duration and magnitude as a function of probability of occurring) of potential impacts are shown in Table 1.

**Table 1: The criteria for spatial extent, duration, magnitude, probability and significance of an impact, and confidence in the assessment.**

| Criteria              | Categories    | Explanation                                                                                                 |
|-----------------------|---------------|-------------------------------------------------------------------------------------------------------------|
| <b>Type</b>           | Negative      | Overall will represent a negative impact                                                                    |
|                       | Positive      | Overall will represent a positive impact                                                                    |
| <b>Spatial Extent</b> | Site          | Immediate area of activity                                                                                  |
|                       | Local         | Area within 10km of the river site                                                                          |
|                       | Regional      | Entire drainage basin, municipal area, landscape etc.                                                       |
|                       | National      | South Africa                                                                                                |
|                       | International | International                                                                                               |
| <b>Duration</b>       | Short-term    | 0-1 year (or construction period)                                                                           |
|                       | Medium Term   | - 1-5 years (initial operation)                                                                             |
|                       | Long-term     | 5-20 years                                                                                                  |
|                       | Permanent     | Permanent change                                                                                            |
| <b>Significance</b>   | Very High     | Likely to lead to irreversible loss in ecosystem integrity / functionality at the spatial extent identified |

|                    |                 |                                                                                                       |
|--------------------|-----------------|-------------------------------------------------------------------------------------------------------|
|                    | High            | Likely to lead to major loss of ecosystem functionality and significant deterioration in PES category |
|                    | Moderate        | Likely to lead to moderate loss of ecosystem functionality and moderate deterioration in PES category |
|                    | Low             | Possible loss of ecosystem integrity, but no deterioration in PES category                            |
|                    | Negligible      | Unlikely to have a measurable effect                                                                  |
| <b>Probability</b> | Unlikely        | Less than 20% chance of impact occurring                                                              |
|                    | Possible        | 20-40% chance of impact occurring                                                                     |
|                    | Probable        | 40-60% chance of impact occurring                                                                     |
|                    | Highly Probable | 60-80% chance of impact occurring                                                                     |
|                    | Definite        | >80% chance of impact occurring                                                                       |
| <b>Magnitude</b>   | None            |                                                                                                       |
|                    | Minor           |                                                                                                       |
|                    | Low             |                                                                                                       |
|                    | Moderate        |                                                                                                       |
|                    | High            |                                                                                                       |
|                    | Very High       |                                                                                                       |

The significance rating provided is that significance WITH mitigation and WITHOUT mitigation. Mitigation potential describes the ability to manage or mitigate an impact given the necessary resources. Some impacts, by their very nature are extremely difficult to mitigate, while others may be managed to an acceptable level with the implementation of a sound environmental management plan. It should be noted that a LOW mitigation potential does not necessarily imply that the impact is highly significant. An impact with a low significance rating may be extremely difficult to mitigate, while a highly significant impact may be relatively simple to mitigate with the implementation of the correct management measures.

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**The criteria for spatial extent, duration, magnitude, probability and significance of an impact, and confidence in the assessment.**

| Mitigation Potential | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Example                                                                                                                                                                                    |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| HIGH:                | <p>The impact is relatively easy and cheap to manage. Specialised expertise or equipment is generally not required.</p> <p>The nature of the impact is understood and may be mitigated through the implementation of a management plan, with regular monitoring undertaken to ensure that any negative consequences remain within acceptable limits.</p> <p>The significance of the impact after mitigation is likely to be LOW to Non-Significant.</p> <p>These impacts are normally mitigated by “good housekeeping”.</p>                                                                                                                                                                                      | <p>Litter impact</p> <p>Clearing and nursing of protected plant species</p> <p>Bank stabilisation with planting (Bioengineering approach)</p> <p>Substrate continuity beneath crossing</p> |
| MEDIUM:              | <p>Management of this impact requires a higher level of expertise and resources in order to maintain within acceptable levels</p> <p>The significance of the impact after mitigation is likely to be LOW to MEDIUM depending on the level of management applied.</p> <p>May not be possible to mitigate the impact entirely – may result in a residual impact (e.g. topographical change)</p> <p>Despite mitigation being entirely possible, if complex, the experience of the assessor/s suggests that this /these mitigation measures are seldom managed successfully, and they are thus assessed as MEDIUM or LOW. This is for a number of reasons, including a lack of understanding by the developer or</p> | <p>Visual Impacts</p> <p>Changes to instream habitat</p>                                                                                                                                   |

|      |                                                                                                                                                                                                                                                                                                                 |                                                                                                                       |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
|      | contractor of the severity of the consequences of not mitigating adequately; a lack of disciplined auditing by the Environmental Control Officer; and inadequate planning for seasonal flow events (e.g. floods).                                                                                               |                                                                                                                       |
| LOW: | <p>Will not be possible to mitigate this impact entirely regardless of the expertise and resources applied.</p> <p>The potential to manage the impact may be beyond the scope of the Project.</p> <p>Management of this impact is not likely to result in a measurable change in the level of significance.</p> | Alteration in local flow velocity due to channel constraint (acceleration of flow in restricted areas, e.g. culverts) |



## POTENTIAL IMPACTS FOR MAINTENANCE ACTIVITIES

### Access to culvert structure

Although hand labour is recommended as far as possible, it might be necessary to access the structure with machinery should great damaged to the infrastructure occurred. An access road needs to be created, and the machinery might have to drive on the river bank and in river section of the inlet and outlet structure where maintenance is required.

#### IMPACT ASSESSMENT

|                                  |                     |
|----------------------------------|---------------------|
| TYPE:                            | Positive (Long Run) |
| SPATIAL SCALE:                   | Site                |
| DURATION:                        | Short term          |
| MAGNITUDE:                       | Low                 |
| PROBABILITY:                     | Probable            |
| SIGNIFICANCE WITH MITIGATION:    | Low                 |
| SIGNIFICANCE WITHOUT MITIGATION: | High                |
| MITIGATION POTENTIAL:            | High                |

#### MITIGATION

Access to the culverts needs to be at the least sensitive area identified.

Prior to maintenance activities the smaller plants that can easily be replanted within the access road footprint needs to be removed and planted in identified adjacent bare areas. Larger shrubs that cannot be easily re-planted needs to be brush cut to ensure natural resprouting after maintenance activities.

Only one access road needs to be used. The maintenance team needs to strictly stay on this access road. Adjacent natural areas needs to be clearly cordoned off and seen as no go areas.

The watercourse needs to be clearly seen as no go areas. Machinery will not be allowed to drive in the watercourse.

After maintenance activities the disturbed areas needs to be ripped, levelled and shaped and stabilized in such a way that if follow the natural slope and contour of the site.

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The disturbed section needs to be re-planted with plants from the list provided in this report as soon as possible. Consult a qualified Horticulturist and Rehabilitation Specialist in this regard.

### Removal and disturbance of vegetation within access road and construction footprint

In order to conduct the necessary upgrade according to outlined methodology, it might be necessary to re-locate, disturb and brush-cut vegetation in localised areas, both along the access road and at the inlet and outlet structures. .

#### IMPACT ASSESSMENT

|                                  |                      |
|----------------------------------|----------------------|
| TYPE:                            | Temporary Negative   |
| SPATIAL SCALE:                   | Site                 |
| DURATION:                        | Short term/Temporary |
| MAGNITUDE:                       | Low                  |
| PROBABILITY:                     | Definite             |
| SIGNIFICANCE WITH MITIGATION:    | Low                  |
| SIGNIFICANCE WITHOUT MITIGATION: | High                 |
| MITIGATION POTENTIAL:            | High                 |

#### MITIGATION

Access to the culverts needs to be at the least sensitive area identified.

Prior to maintenance activities the smaller plants that can easily be replanted within the access road footprint needs to be removed and planted in identified adjacent bare areas. Larger shrubs that cannot be easily re-planted needs to be brush cut to ensure natural resprouting after maintenance activities.

Only one access road needs to be used. The maintenance team needs to strictly stay on this access road. Adjacent natural areas needs to be clearly cordoned off and seen as no go areas.

The watercourse needs to be clearly seen as no go areas. Machinery will not be allowed to drive in the watercourse

After maintenance activities the disturbed areas needs to be ripped, levelled, shaped and stabilized in such a way that if follow the natural slope and contour of the site.

The disturbed section needs to be re-planted with plants from the list provided in this report as soon as possible. Consult a qualified Horticulturist in this regard

## Removal of build-up sediment at inlet and outlet structure of the culverts

During storm events it might happen that the inlet structures of the culvert get obstructed with debris and sediment leading to erosion and damage of the culverts itself and associated embankments. Although hand labour is strongly recommended, it might happen in a severe event that machinery needs to be used to help with the clearing of the build-up debris. Allowing sediments and debris to enter the river should be avoided at all costs. This has the potential to drastically modify instream habitats with resultant deterioration of the ecological condition.

### IMPACT ASSESSMENT

|                                  |                     |
|----------------------------------|---------------------|
| TYPE:                            | Positive (Long Run) |
| SPATIAL SCALE:                   | Site                |
| DURATION:                        | Short term          |
| MAGNITUDE:                       | Low                 |
| PROBABILITY:                     | Possible            |
| SIGNIFICANCE WITH MITIGATION:    | Low                 |
| SIGNIFICANCE WITHOUT MITIGATION: | High                |
| MITIGATION POTENTIAL:            | High                |

### MITIGATION

Only one access road to be used to access structure as mentioned in this report.

Removal of build-up sediment to be done when river flow is at its absolute lowest.

Silt traps needs to be installed downstream to filter some of the sediment during the maintenance activities.

Removed debris should not be dumped within watercourse or associated river embankments. Removed debris needs to be removed from site and properly disposed to the nearest licensed landfill site.

## Alien species Management

At all three the culverts alien species have been identified, which needs be removed prior to the proposed upgrades.

Seeing that the culvert is situated in an area where alien species is present in the surrounding area, alien clearing will have to be conducted at yearly intervals or as the need arises. (Yearly intervals suggested)

If left unchecked, alien infestation will gradually take place, negatively impacting on the endemic diversity and ecological functioning of the site. .

### IMPACT ASSESSMENT

|                                  |                     |
|----------------------------------|---------------------|
| TYPE:                            | Positive (long Run) |
| SPATIAL SCALE:                   | Site                |
| DURATION:                        | Long Run            |
| MAGNITUDE:                       | Moderate            |
| PROBABILITY:                     | Probable            |
| SIGNIFICANCE WITH MITIGATION:    | Low                 |
| SIGNIFICANCE WITHOUT MITIGATION: | Medium              |
| MITIGATION POTENTIAL:            | High                |

### MITIGATION

Alien clearing needs to be conducted with hand labour.

Alien removal team needs to take good care that endemic species are not damaged and trampled upon. Surrounding natural vegetation needs to be clearly seen as no go areas. Disturbance on site needs to be kept to an absolute minimum. Small aliens can be hand pulled/removed. Lager alien species needs to be cut down and the remaining stems immediately treated with a systemic poison to prevent re-sprouting of the alien vegetation. (A professional poison company needs to be consulted for a systemic poison in this regard) Cut down alien vegetation needs to be removed from site and dispose at the nearest licensed landfill site, to prevent seed from dispersing and germinating on site. No alien material to be left on site.



## Contamination of the watercourse and associated embankments from concrete, oil or diesel spills etc

Concrete will have to be mixed off site away from watercourses, but the possibility of contamination of channel water and substrates still exists when pouring wet concrete at maintenance areas. Similarly, plant using oil and diesel have the potential to leak and contaminate water and embankment vegetation.

### IMPACT ASSESSMENT

|                                  |                   |
|----------------------------------|-------------------|
| TYPE:                            | Negative          |
| SPATIAL SCALE:                   | Site              |
| DURATION:                        | Short term        |
| MAGNITUDE:                       | Minor to Low      |
| PROBABILITY:                     | Possible          |
| SIGNIFICANCE WITH MITIGATION:    | Low to Negligible |
| SIGNIFICANCE WITHOUT MITIGATION: | Medium            |
| MITIGATION POTENTIAL:            | High              |

### MITIGATION

Concrete and cement needs to be mixed off from site on the necessary mortar board and plastic sheeting to prevent cement run-off from infiltrating and contaminating the area. It is also suggested that ready mix cement and concrete be used. Cement and concrete spills during maintenance activities needs to be immediately removed from the area. Prior to maintenance activities all machinery needs to be inspected for any hydrocarbon leaks and rectified if necessary. Parked vehicles transporting hydrocarbons needs to be supplied with a drip tray at all times.

## Watercourse channel and embankment erosion during floods or heavy rainfall events

Even though the disturbed area will be rehabilitated with endemic vegetation after construction activities, the river bank and bed remain vulnerable to erosion during severe flooding or rainfall events. Erosion control might need to be conducted after severe erosion events. In severe cases, erosion control will have to be done by shaping and securing the eroded areas with horizontal terracing and replanting the disturbed areas with endemic vegetation from the list provided in this report. (Consult a Horticulturist and rehabilitation specialist in this regard)

### IMPACT ASSESSMENT

|                                  |                     |
|----------------------------------|---------------------|
| TYPE:                            | Positive (Long Run) |
| SPATIAL SCALE:                   | Site                |
| DURATION:                        | Medium term         |
| MAGNITUDE:                       | Low to Moderate     |
| PROBABILITY:                     | Possible            |
| SIGNIFICANCE WITH MITIGATION:    | Low                 |
| SIGNIFICANCE WITHOUT MITIGATION: | Moderate            |
| MITIGATION POTENTIAL:            | High                |

### MITIGATION

Regular monitoring of the site should be conducted, but site checks following major flooding events should additionally be conducted in order to assess the possibility of this impact. Should erosion be occurring, an onsite assessment would be required to determine the appropriate actions. A qualified Horticulturist and Rehabilitation specialist needs to be consulted in cases of severe erosion to demonstrate embankment stabilization by horizontal terracing and endemic planting.

## Maintenance, on degraded/damaged storm water infrastructure

During event of high storm water it might happen that the storm water infrastructure such as the inlet structure, outlet structure, headwalls and gabions get damaged and needs urgent repairs. Although hand labour is strongly recommended, it might happen in a severe event that machinery needs to be used during the repair/maintenance process.

### IMPACT ASSESSMENT

|                                  |                     |
|----------------------------------|---------------------|
| TYPE:                            | Positive (Long Run) |
| SPATIAL SCALE:                   | Site                |
| DURATION:                        | Short term          |
| MAGNITUDE:                       | Low                 |
| PROBABILITY:                     | Possible            |
| SIGNIFICANCE WITH MITIGATION:    | Low                 |
| SIGNIFICANCE WITHOUT MITIGATION: | High                |
| MITIGATION POTENTIAL:            | High                |

### MITIGATION

Damaged infrastructure needs to be removed from watercourse. No material may be left within the watercourse. Before repair/maintenance activities silt traps needs to be installed to prevent sediment from washing away downstream. Should hand labour not be feasible it might be necessary to use machinery.

Access to the damaged storm water infrastructures needs to be at the least sensitive area. Prior to maintenance activities the plants within the access footprint needs to be removed and planted in identified adjacent bare areas. Only one access road needs to be used. The maintenance team needs to strictly stay on this access road. Adjacent natural areas needs to be clearly cordoned off and seen as no go areas. After maintenance activities the disturbed areas needs to be ripped, levelled, shaped and stabilised in such a way that it follow the natural slope and contour of the site. The disturbed section needs to be re-planted with plants from the list provided in this report as soon as possible.

## 10. Scope and Terms of Reference

The principles contained within this document apply to all PRE-MAINTENANCE, MAINTENANCE, POST-MAINTENANCE and FUTURE MAINTENANCE activities.

Principles of this RMMP

This RMMP is compiled using the following concepts and implementation requirements so that the higher principles of sustainable development are realised:

- **Continuous improvement.** The project Applicant (or implementing organisation) must be committed to review and to continually improve environmental management, with the objective of improving overall environmental performance.
- **Broad level of commitment.** A broad level of commitment will be required from all levels of management as well as the workforce in order for the development and implementation of this RMMP to be successful and effective.
- **Flexible and responsive.** The implementation of the RMMP must be responsive to new and changing circumstances, i.e. rapid short-term responses to problems or incidents. The RMMP is a dynamic “living” document and thus regular planned review and revision of the RMMP must be carried out.
- **Integration across operations.** This RMMP is integrated across existing line functions and operational units such as health, safety and environmental departments in a company/project. This is done to change the redundant mind set of seeing environmental management as a single domain unit.

## **11. Applicant's environmental management policy and commitments**

The Applicant understands the importance of conserving the environment, and will endeavour to apply all necessary mitigation measures to conserve and maintain sensitive areas and prevent environmental damage.

The implementation of this RMMP is not an additional or “add on” requirement. The RMMP is legally binding through the National Environmental Management Act. This RMMP is to be used during future maintenance activities of the three culverts



## 12. Future Maintenance Activities

The person in control of the land must appoint, on their own cost, a suitably qualified Environmental Control Officer (ECO) who will oversee the compliance of the Maintenance Management Plan during maintenance activities.

The DEA&DP must be informed of the appointment of the ECO prior to maintenance activities. Please note that the responsibility of the particular ECO may end at the end of the maintenance period.

**The independent ECO is responsible for audits** on compliance to relevant environmental legislation and conditions of the RMMP for the project.

Before any maintenance activities commence, the ECO must compile, for the approval by the DEA&DP, an audit checklist based on the contents of this RMMP. The ECO shall at the request of the DEA&DP forward audit reports to the Department at a frequency determined by the DEA&DP which shall be stipulated in their authorisation.

Evidence of the following as **Key Performance Indicators**, must be included in the audit reports:

- Complaints received by landowners and actions taken.
- Environmental incidents, such as oil spills, concrete spills, etc. and actions taken (litigation excluded).
- Incidents leading to litigation and legal contraventions.
- Environmental damage that needs rehabilitation measured to be taken.

A copy of all ECO monitoring reports, contractor method statements and pro forma documentation must be held on site and be made available to the DEA&DP and/or the ECO upon request.

| Phase of development                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | PRE-MAINTENANCE (PLANNING)                                                                                                                                                                                                                                                                                                                                                 |                                                                                                            |                   |                                                                                                                        |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|-------------------|------------------------------------------------------------------------------------------------------------------------|
| Impact / issue                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Watercourse Maintenance                                                                                                                                                                                                                                                                                                                                                    |                                                                                                            |                   |                                                                                                                        |
| MITIGATION MEASURE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | MANAGEMENT OBJECTIVES                                                                                                                                                                                                                                                                                                                                                      | MEASURABLE TARGETS                                                                                         | RESPONSIBLE PARTY | FREQUENCY OF ACTION                                                                                                    |
| <p><b><u>Watercourse Maintenance Guidelines:</u></b></p> <ul style="list-style-type: none"> <li>• Proper authorisation should be obtained from the relevant environmental authority <b>(DWS) (BOCMA)</b> and <b>(DEA&amp;DP)</b> if required.</li> <li>• <b>Ensure that the Environmental Control Officer (ECO) appointed is suitably qualified.</b></li> <li>• Ensure that all guidelines/terms of this RMMP are agreed upon by the entire project team.</li> <li>• Proper information to and training of machine operators and site personnel. Including induction training and toolbox talks prior to and during maintenance activities.</li> <li>• Plan the demarcation of sensitive/No-Go areas to ensure access is restricted/controlled. This needs to be done in accordance with the appointed Environmental control Officer.</li> <li>• The watercourse outside the maintenance footprint must be clearly cordoned off as a “no go” area.</li> <li>• Prior to maintenance activities silt traps needs to be installed downstream to filter out sediment. These silt traps needs to be inspected daily and replaced as required.</li> </ul> | <ul style="list-style-type: none"> <li>• No pollution of the environment and especially the river</li> <li>• No litigation due to transgression of pollution control acts</li> <li>• No complaints from I &amp; AP's</li> <li>• To ensure that sensitive natural areas are adequately managed and conserved in accordance with the maintenance management plan.</li> </ul> | <ul style="list-style-type: none"> <li>• Contract records</li> </ul> <p>Signed declaration pro forma's</p> | Project team      | <p>Pre-maintenance phase</p> <p><b>ECO to conduct induction training prior to start of maintenance activities.</b></p> |

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| Phase of development                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | PRE-MAINTENANCE (PLANNING) |                    |                   |                     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|--------------------|-------------------|---------------------|
| Impact / issue                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Watercourse Maintenance    |                    |                   |                     |
| MITIGATION MEASURE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | MANAGEMENT OBJECTIVES      | MEASURABLE TARGETS | RESPONSIBLE PARTY | FREQUENCY OF ACTION |
| <ul style="list-style-type: none"> <li>Rehabilitation of disturbed areas after maintenance will form part of the contract (within available budget agreed upon)</li> <li>Maintenance activities to be conducted during the <b>summer months (dry season)</b>, when streamflow and expectancy of rain is lowest.</li> <li>The disturbed areas <b>must be rehabilitated</b> in accordance with the attached Rehabilitation Plan. A suitably qualified Botanist/Horticulturist is to be appointed by the Applicant to facilitate the rehabilitation.</li> </ul> |                            |                    |                   |                     |

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| Phase development of                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | PRE-MAINTENANCE (PLANNING)                                                                                                                          |                    |                     |                                 |  |
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| Impact / issue                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Emergencies / Non-Compliance / Communication                                                                                                        |                    |                     |                                 |  |
| MITIGATION MEASURE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | MANAGEMENT OBJECTIVES                                                                                                                               | MEASURABLE TARGETS | RESPONSIBLE PARTY   | FREQUENCY OF ACTION             |  |
| <p><b><u>Emergencies, non-compliance and communication:</u></b></p> <p>The applicant/implementing authority must as far as it's feasibly possible appoint and utilize the services of a single Environmental Control Officer.</p> <p>The contractor must provide method statements on the protocols to be followed, and contingencies to be put in place for the following, before maintenance may begin:</p> <ul style="list-style-type: none"> <li>• Emergency spills procedures for the contamination of soils from spills and fire</li> <li>• Handling &amp; storage of oils and chemicals</li> <li>• Cement and concrete batching, which includes the storage, washing &amp; disposal of cement, packaging, tools and plant.</li> <li>• Diesel tanks and refuelling procedures</li> <li>• Crew camps and maintenance lay down areas</li> <li>• The work to be conducted inside the river</li> </ul> <p>No fires shall be allowed on the maintenance site</p> | <ul style="list-style-type: none"> <li>• Contingencies for minimising negative impacts anticipated to occur during the maintenance phase</li> </ul> | Method statements  | Contractor/Engineer | Prior to maintenance activities |  |

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| Phase development of                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | PRE-MAINTENANCE (PLANNING)                                                                                                                                                                                                                              |                                                                                                                                                                                                         |                   |                      |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|----------------------|
| Impact / issue                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Emergencies / Non-Compliance / Communication                                                                                                                                                                                                            |                                                                                                                                                                                                         |                   |                      |
| MITIGATION MEASURE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | MANAGEMENT OBJECTIVES                                                                                                                                                                                                                                   | MEASURABLE TARGETS                                                                                                                                                                                      | RESPONSIBLE PARTY | FREQUENCY OF ACTION  |
| <p>or surroundings.</p> <p>The appointed ECO shall be on site daily once maintenance activities take place.</p> <p><b><u>Future maintenance:</u></b></p> <p>The streams must be maintained by the applicant or responsible authority. Authorisation for any additional repair works for future maintenance is also included in this RMMP</p> <p>The RMMP authorises the following activities that need to be conducted during maintenance intervals:</p> <ul style="list-style-type: none"> <li>• <b>Clearing and cleaning of built-up debris and sediment</b></li> </ul> <p><b><u>Emergency Flooding Procedure:</u></b></p> <p>This RMMP authorises the following activities that needs to be conducted in and after the event of flooding:</p> <ul style="list-style-type: none"> <li>• <b>Clearing of flood related debris</b></li> <li>• <b>Sediment removal</b></li> <li>• <b>Small scale repair work to structures</b></li> </ul> | <ul style="list-style-type: none"> <li>• To ensure that sensitive natural areas are adequately managed and conserved in accordance with the maintenance management plan.</li> <li>• No pollution of the environment and especially the river</li> </ul> | <ul style="list-style-type: none"> <li>• Minimise scarring of the soil surface and land features</li> <li>• Minimise disturbance and loss of soil</li> <li>• No complaints from I &amp; AP's</li> </ul> | Applicant         | As and when required |



| Phase development of                                                                  | PRE-MAINTENANCE (PLANNING)                                                                                                                                                                                                                          |                                                                                                                                                                                                                 |                         |                                                                                                                                                                    |
|---------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Impact / issue                                                                        | Emergencies / Non-Compliance / Communication                                                                                                                                                                                                        |                                                                                                                                                                                                                 |                         |                                                                                                                                                                    |
| MITIGATION MEASURE                                                                    | MANAGEMENT OBJECTIVES                                                                                                                                                                                                                               | MEASURABLE TARGETS                                                                                                                                                                                              | RESPONSIBLE PARTY       | FREQUENCY OF ACTION                                                                                                                                                |
| <ul style="list-style-type: none"> <li>Stabilisation of eroded embankments</li> </ul> | <ul style="list-style-type: none"> <li>To ensure that sensitive natural areas are adequately managed and conserved in accordance with the maintenance management plan.</li> <li>No pollution of the environment and especially the river</li> </ul> | <ul style="list-style-type: none"> <li>Minimise scarring of the soil surface and land features</li> <li>Minimise disturbance and loss of soil</li> <li>Minimise contamination of storm water run-off</li> </ul> | Contractor/<br>Engineer | <p>During and after flooding events</p> <p><b>ECO to keep pre-flooding records i.e. Photographic.</b></p> <p>ECO to conduct audit report after flooding event.</p> |

# RIVER MAINTENANCE MANAGEMENT PLAN

| Phase development of                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | PRE-MAINTENANCE (PLANNING)                                                                                                                                                                      |                                                                                                                                                                                                                           |                                                                                   |                              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------|
| Impact / issue                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Maintenance Timing                                                                                                                                                                              |                                                                                                                                                                                                                           |                                                                                   |                              |
| MITIGATION MEASURE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | MANAGEMENT OBJECTIVES                                                                                                                                                                           | MEASURABLE TARGETS                                                                                                                                                                                                        | RESPONSIBLE PARTY                                                                 | FREQUENCY OF ACTION          |
| <p><b><u>Maintenance Timing:</u></b></p> <p><b>Maintenance to commence during Summer (dry months) when the stream-flow and expectancy of rain are low.</b></p> <p>Rivers (including their riparian zones) should be treated as “no-go” areas and appropriately demarcated as such. No vehicles, machinery, personnel, maintenance material, fuel, oil, bitumen or waste should be allowed into these areas without the express permission of and supervision by the Environmental Control Officer (ECO).</p> | <ul style="list-style-type: none"> <li>To avoid altering the stream or influencing the current flood lines during restoration work no infilling shall be allowed in the flood plain.</li> </ul> | <ul style="list-style-type: none"> <li>No pollution of the environment and especially the river</li> <li>No litigation due to transgression of pollution control acts</li> <li>No complaints from I &amp; AP's</li> </ul> | <p>Project team</p> <p>ECO to keep pre-maintenance records i.e. Photographic.</p> | <p>Pre-Maintenance phase</p> |

| Phase development of                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | PRE-MAINTENANCE (PLANNING)                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                   |                       |                                                                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|----------------------------------------------------------------------------------|
| Impact / issue                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Hydrology / Erosion / Topsoil                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                   |                       |                                                                                  |
| MITIGATION MEASURE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | MANAGEMENT OBJECTIVES                                                                                                                                                                                                                                                                                                              | MEASURABLE TARGETS                                                                                                                                                                                                                                                                                                                                                                                                                | RESPONSIBLE PARTY     | FREQUENCY OF ACTION                                                              |
| <p><b>Topsoil:</b></p> <p>During general and minor maintenance, topsoil will not be removed prior to maintenance as this will lead to more disturbance of rehabilitated and established areas.</p> <p>Access to the culverts needs to be at the least sensitive area identified.</p> <p>Prior to maintenance activities the smaller plants that can easily be replanted within the access road footprint, needs to be removed and planted in identified adjacent bare areas. Larger shrubs that cannot be easily re-planted needs to be brush cut to ensure natural res-sprouting after maintenance activities.</p> <p>Only one access road needs to be used. The maintenance team needs to strictly stay on this access road. Adjacent natural areas needs to be clearly cordoned off and seen as no go areas.</p> <p>If required that a larger section needs to be cleared during larger maintenance activities, 300mm of the topsoil needs to be stripped and stockpiled in a protected area for later use during rehabilitation. Topsoil to be stockpiled no higher than 2 metres.</p> | <ul style="list-style-type: none"> <li>• To ensure rehabilitation of the stream banks</li> <li>• Minimise the potential for the spread of the maintenance footprint</li> <li>• Reduce loss of fauna and flora habitat</li> <li>• Minimise the potential for loss of protected and or endangered fauna and flora species</li> </ul> | <ul style="list-style-type: none"> <li>• Minimise scarring of the soil surface and land features</li> <li>• Minimise disturbance and loss of soil</li> <li>• Minimise maintenance footprint</li> <li>• Maintain the integrity of topsoil's for landscaping and rehabilitation</li> <li>• Containment of invasive plant growth by means of topsoil monitoring.</li> <li>• Minimise contamination of storm water run-off</li> </ul> | RE / Contractor / ECO | <p>Monitor daily – Contractor</p> <p><b>ECO audit reports once per week.</b></p> |

|                                                                    |    |                               |                    |                   |                     |
|--------------------------------------------------------------------|----|-------------------------------|--------------------|-------------------|---------------------|
| Phase development                                                  | of | PRE-MAINTENANCE (PLANNING)    |                    |                   |                     |
| Impact / issue                                                     |    | Hydrology / Erosion / Topsoil |                    |                   |                     |
| MITIGATION MEASURE                                                 |    | MANAGEMENT OBJECTIVES         | MEASURABLE TARGETS | RESPONSIBLE PARTY | FREQUENCY OF ACTION |
| Stockpiles need to be clearly cordoned off and seen as No-Go Areas |    |                               |                    |                   |                     |

| Phase development of                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | PRE-MAINTENANCE (PLANNING)                                                                                                                            |                                                                                                                                                                              |                             |                                                                                 |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|---------------------------------------------------------------------------------|--|
| Impact / issue                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Erosion Control                                                                                                                                       |                                                                                                                                                                              |                             |                                                                                 |  |
| MITIGATION MEASURE                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | MANAGEMENT OBJECTIVES                                                                                                                                 | MEASURABLE TARGETS                                                                                                                                                           | RESPONSIBLE PARTY           | FREQUENCY OF ACTION                                                             |  |
| <p><b><u>Erosion Control:</u></b></p> <p>Keep disturbance of the channel bottom, sides, adjacent land and surrounding natural landscape to a minimum during maintenance activities</p> <p>The contractor shall take cognisance of weather forecasts and prepare / maintain the maintenance area ahead of possible flooding events</p> <p>After maintenance activities all disturbed areas will be rehabilitation with endemic species. (To be discussed in the rehabilitation section)</p> | <ul style="list-style-type: none"> <li>• Appropriate engineering for stream banks</li> <li>• To ensure improved conditions of stream banks</li> </ul> | <ul style="list-style-type: none"> <li>• No pollution of water resources</li> <li>• Erosion control of stream banks</li> <li>• ECO inspections and record keeping</li> </ul> | Engineer / Contractor / ECO | <p>Prior to maintenance activities</p> <p>Prior to possible flooding events</p> |  |

| Phase development of                                                                                                                                                                                                                                                                                                                                           | PRE-MAINTENANCE (PLANNING)                                                                                          |                                                                                                      |                   |                                                                             |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|-------------------|-----------------------------------------------------------------------------|
| Impact / issue                                                                                                                                                                                                                                                                                                                                                 | Induction Training                                                                                                  |                                                                                                      |                   |                                                                             |
| MITIGATION MEASURE                                                                                                                                                                                                                                                                                                                                             | MANAGEMENT OBJECTIVES                                                                                               | MEASURABLE TARGETS                                                                                   | RESPONSIBLE PARTY | FREQUENCY OF ACTION                                                         |
| <b><u>Environmental Induction:</u></b><br><br>The ECO is responsible in ensuring everyone on site is given an environmental awareness induction session which not only clearly defines what the environment is and specifics detailing the local environment but outlines the requirements of the EMP and MMP as a management tool to protect the environment. | <ul style="list-style-type: none"> <li>To ensure maintenances' crew understanding of the aquatic habitat</li> </ul> | <ul style="list-style-type: none"> <li>Environmental induction training and toolbox talks</li> </ul> | Contractor / ECO  | ECO to conduct induction training prior to start of maintenance activities. |



| Phase development of                                                                                                                                                                                                                                                                                                                               | PRE-MAINTENANCE (PLANNING)                                                                                                                                                    |                                                                                                                                                                                      |                                            |                                                                                             |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|---------------------------------------------------------------------------------------------|
| Impact / issue                                                                                                                                                                                                                                                                                                                                     | Alien Vegetation Removal                                                                                                                                                      |                                                                                                                                                                                      |                                            |                                                                                             |
| MITIGATION MEASURE                                                                                                                                                                                                                                                                                                                                 | MANAGEMENT OBJECTIVES                                                                                                                                                         | MEASURABLE TARGETS                                                                                                                                                                   | RESPONSIBLE PARTY                          | FREQUENCY OF ACTION                                                                         |
| <p><b><u>Alien Vegetation Removal:</u></b></p> <p><b>Alien vegetation needs to be removed as part of the maintenance process.</b> Small alien species need to be removed by hand. Larger alien species needs to be cut down and remaining stems be treated with a systemic poison (Professional Poison company to be consulted in this regard)</p> | <ul style="list-style-type: none"> <li>• To ensure removal of alien invasive plants</li> <li>• No alien invasive plant species growth after maintenance activities</li> </ul> | <ul style="list-style-type: none"> <li>• Map areas of alien infestation</li> <li>• Plan to provide guidelines to monitor re-growth areas and follow-up as and when needed</li> </ul> | <p>Contractor / ECO</p> <p>ECO - Audit</p> | <p>Prior to maintenance activities</p> <p><b>ECO to keep records i.e. Photographic.</b></p> |

| Phase development of                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | PRE-MAINTENANCE (PLANNING)                                                                                                         |                                                                                                                                                  |                   |                                                                                             |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|---------------------------------------------------------------------------------------------|
| Impact / issue                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Fauna and Flora                                                                                                                    |                                                                                                                                                  |                   |                                                                                             |
| MITIGATION MEASURE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | MANAGEMENT OBJECTIVES                                                                                                              | MEASURABLE TARGETS                                                                                                                               | RESPONSIBLE PARTY | FREQUENCY OF ACTION                                                                         |
| <p><b><u>Fauna and Flora:</u></b></p> <p>All possible sensitive endemic faunal species within the maintenance footprint must be rescued and relocated to the surrounding natural area of the culverts.</p> <p>Adjacent natural areas need to be clearly cordoned off and seen as no go areas. This needs to be done in accordance with the ECO before any maintenance activities may commence.</p> <p>Prior to maintenance activities the smaller plants that can easily be replanted within the access road footprint needs to be removed and planted in identified adjacent bare areas. Larger shrubs that cannot be easily re-planted needs to be brush cut to ensure natural res-sprouting after maintenance activities.</p> <p>Only one access road needs to be used. The maintenance team needs to strictly stay on this access road. Adjacent natural areas needs to be clearly cordoned off and seen as no go areas</p> <p>The disturbance footprint should be as narrow as possible</p> | <ul style="list-style-type: none"> <li>To protect possible fauna and flora species on the site from being exterminated.</li> </ul> | <ul style="list-style-type: none"> <li>Should sensitive species be present on the site, the correct re-establishment of these species</li> </ul> | ECO Contractor /  | <p>Prior to maintenance activities</p> <p><b>ECO to keep records i.e. Photographic.</b></p> |

### OBJECTIVES FOR MAINTENANCE PHASE:

[illegible]

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| Phase development of                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | MAINTENANCE             |                                                                                                                 |                                      |                                                                                            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----------------------------------------------------------------------------------------------------------------|--------------------------------------|--------------------------------------------------------------------------------------------|
| Impact / issue                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Watercourse Maintenance |                                                                                                                 |                                      |                                                                                            |
| MITIGATION MEASURE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | MANAGEMENT OBJECTIVES   | MEASURABLE TARGETS                                                                                              | RESPONSIBLE PARTY                    | FREQUENCY OF ACTION                                                                        |
| <p>(uncured),</p> <ul style="list-style-type: none"> <li>Any chemicals for the control of alien vegetation,</li> <li>Sanitation structures and refuse disposal sites and</li> <li>Soaps and any other chemicals and</li> <li>Fertilisers.</li> </ul> <p>5) No spoil material should be placed in close proximity to the watercourse, dumped on riparian or bank habitats, spread out around trees, used to fill hollows and other irregularities in the floodplain, or be used for erosion control, but must be removed to approved dumping sites.</p> <p>6) Rivers/streams/wetland areas (including their riparian zones) should be treated as “<b>no-go</b>” areas and appropriately demarcated as such. No vehicles, machinery, personnel, maintenance material, fuel, oil, bitumen or waste should be allowed into these areas without the express permission of and supervision by the Environmental Control Officer (ECO).</p> |                         | <ul style="list-style-type: none"> <li>No spoil material</li> <li>ECO inspections and record keeping</li> </ul> | <p>Contractor</p> <p>ECO - Audit</p> | <p>Monitor daily – Contractor</p> <p><b>ECO to conduct audit reports once per week</b></p> |

| Phase of development                                                                                                                                                                                       | of MAINTENANCE          |                       |                    |                   |                     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----------------------|--------------------|-------------------|---------------------|
| Impact / issue                                                                                                                                                                                             | Watercourse Maintenance |                       |                    |                   |                     |
| MITIGATION MEASURE                                                                                                                                                                                         |                         | MANAGEMENT OBJECTIVES | MEASURABLE TARGETS | RESPONSIBLE PARTY | FREQUENCY OF ACTION |
| <u>Repair work</u> <ul style="list-style-type: none"> <li>Debris (concrete, steel, asphalt, etc.), from maintenance work and/or other sources, may not enter the river or riparian environment.</li> </ul> |                         |                       |                    |                   |                     |

| Phase of development                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | of | MAINTENANCE                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                        |                                         |                                                                                                                           |
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| Impact / issue                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |    | Hydrology / Erosion / Topsoil                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                        |                                         |                                                                                                                           |
| MITIGATION MEASURE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |    | MANAGEMENT OBJECTIVES                                                                                                                                                                                                                                                                                                      | MEASURABLE TARGETS                                                                                                                                                                                                                                                                                     | RESPONSIBLE PARTY                       | FREQUENCY OF ACTION                                                                                                       |
| <p><b>Topsoil:</b></p> <p>During general and minor maintenance, topsoil will not be removed prior to maintenance as this will lead to more disturbance of rehabilitate and established areas.</p> <p>Access to the culverts needs to be at the least sensitive area identified.</p> <p>Prior to maintenance activities the smaller plants that can easily be replanted within the access road footprint, needs to be removed and planted in identified adjacent bare areas. Larger shrubs that</p> |    | <ul style="list-style-type: none"> <li>To ensure rehabilitation of the stream banks</li> <li>Minimise the potential for the spread of the maintenance footprint</li> <li>Reduce loss of fauna and flora habitat</li> <li>Minimise the potential for loss of protected and or endangered fauna and flora species</li> </ul> | <ul style="list-style-type: none"> <li>In flowing streams, install sandbags or other appropriate measures to inhibit flow and create a temporary coffer dam.</li> <li>Use a pump to convey water around the excavation/work site and discharge water onto a stable outlet to prevent scour.</li> </ul> | <p>RE/ Contractor</p> <p>Contractor</p> | <p>Maintenance dependant</p> <p>Monitor daily Contractor</p> <p>Maintenance dependant</p> <p>Monitor daily Contractor</p> |

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| Phase development of                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  | MAINTENANCE                   |                                                                                                          |                                       |                                                                            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-------------------------------|----------------------------------------------------------------------------------------------------------|---------------------------------------|----------------------------------------------------------------------------|
| Impact / issue                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  | Hydrology / Erosion / Topsoil |                                                                                                          |                                       |                                                                            |
| MITIGATION MEASURE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |  | MANAGEMENT OBJECTIVES         | MEASURABLE TARGETS                                                                                       | RESPONSIBLE PARTY                     | FREQUENCY OF ACTION                                                        |
| <p>applicable) with appropriate stabilizing measures/structures whilst future maintenance activities are undertaken. (To be discussed in rehabilitation section of this report)</p> <p>2) Silt traps needs to be installed downstream to filter sediment during maintenance activities. Silt traps needs to be inspected on a daily basis and cleaned as the need arises.</p> <p>3) The contractor shall ensure that excessive quantities of sand, silt and silt-laden water do not enter any watercourse.</p> <p>4) The contractor shall take cognisance of weather forecasts and prepare / maintain the maintenance area ahead of possible flooding events</p> |  | conditions of stream banks    | <p>stream banks</p> <ul style="list-style-type: none"> <li>ECO inspections and record keeping</li> </ul> | <p>/Contractor</p> <p>ECO - Audit</p> | <p>Contractor</p> <p><b>ECO to conduct audit reports once per week</b></p> |

| Phase development of                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | MAINTENANCE                                                                                                                                                     |                                                                                                                                                                              |                                                        |                                                                                                                               |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| Impact / issue                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Pollution Control - Machinery                                                                                                                                   |                                                                                                                                                                              |                                                        |                                                                                                                               |
| MITIGATION MEASURE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | MANAGEMENT OBJECTIVES                                                                                                                                           | MEASURABLE TARGETS                                                                                                                                                           | RESPONSIBLE PARTY                                      | FREQUENCY OF ACTION                                                                                                           |
| <p><b><u>Pollution Control – Machinery:</u></b></p> <p>All stationary plant shall <b>employ drip trays to capture all spilt oil and fuel</b>. These shall be maintained to prevent overtopping during rainfall events. Stationary or mobile plant with significant leaks must be <b>repaired immediately or removed from the maintenance area</b>. Machinery and plant shall be inspected daily and repaired / maintained in a sound working state with no leaks. Excess grease around bearings should be wiped off before plant works in or near the watercourse.</p> <p><b>No damage or pollution to the environment outside of the maintenance area whatsoever.</b></p> | <ul style="list-style-type: none"> <li>• To ensure improved conditions of stream banks</li> <li>• To ensure water quality is maintained and improved</li> </ul> | <ul style="list-style-type: none"> <li>• No pollution of water resources</li> <li>• Erosion control of stream banks</li> <li>• ECO inspections and record keeping</li> </ul> | <p>Contractor</p> <p>Contractor</p> <p>ECO - Audit</p> | <p>Monitor daily – Contractor</p> <p>Monitor daily – Contractor</p> <p><b>ECO reports per week</b>      <b>audit once</b></p> |

| Phase development of                                                                                                                                                                                                                                                                                                            | MAINTENANCE                                                                                                                                                     |                                                                                                                                                                              |                                                        |                                                                                                                                   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| Impact / issue                                                                                                                                                                                                                                                                                                                  | Pollution Control – Building Material                                                                                                                           |                                                                                                                                                                              |                                                        |                                                                                                                                   |
| MITIGATION MEASURE                                                                                                                                                                                                                                                                                                              | MANAGEMENT OBJECTIVES                                                                                                                                           | MEASURABLE TARGETS                                                                                                                                                           | RESPONSIBLE PARTY                                      | FREQUENCY OF ACTION                                                                                                               |
| <p><b><u>Pollution Control – Building Materials:</u></b></p> <p>No inert building materials (sand, aggregate, topsoil, precast building materials, gabion baskets, etc) shall be stockpiled in the watercourse channel.</p> <p><b>No damage or pollution to the environment outside of the maintenance area whatsoever.</b></p> | <ul style="list-style-type: none"> <li>• To ensure improved conditions of stream banks</li> <li>• To ensure water quality is maintained and improved</li> </ul> | <ul style="list-style-type: none"> <li>• No pollution of water resources</li> <li>• Erosion control of stream banks</li> <li>• ECO inspections and record keeping</li> </ul> | <p>Contractor</p> <p>Contractor</p> <p>ECO - Audit</p> | <p>Monitor daily – Contractor</p> <p>Monitor daily – Contractor</p> <p><b>ECO inspections and audit reports once per week</b></p> |

| Phase development of                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | MAINTENANCE                                                                                                                                                     |                                                                                                                                                                              |                                                        |                                                                                                                                    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| Impact / issue                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Pollution Control – Distance to watercourse                                                                                                                     |                                                                                                                                                                              |                                                        |                                                                                                                                    |
| MITIGATION MEASURE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | MANAGEMENT OBJECTIVES                                                                                                                                           | MEASURABLE TARGETS                                                                                                                                                           | RESPONSIBLE PARTY                                      | FREQUENCY OF ACTION                                                                                                                |
| <p><b><u>Pollution Control – Distance to watercourse:</u></b></p> <p>Any hazardous materials, temporary toilets, fuel storage tanks, lubricants, paints, cement, cement additives, <b>must be kept at least 100m from the river/stream bank and must be properly secured.</b> Any spilt hazardous materials within the maintenance area shall be recovered immediately and disposed of appropriately.</p> <p><b>No damage or pollution to the environment outside of the maintenance area whatsoever.</b></p> | <ul style="list-style-type: none"> <li>• To ensure improved conditions of stream banks</li> <li>• To ensure water quality is maintained and improved</li> </ul> | <ul style="list-style-type: none"> <li>• No pollution of water resources</li> <li>• Erosion control of stream banks</li> <li>• ECO inspections and record keeping</li> </ul> | <p>Contractor</p> <p>Contractor</p> <p>ECO - Audit</p> | <p>Monitor daily – Contractor</p> <p>Monitor daily – Contractor</p> <p><b>ECO inspections and audit reports once per week.</b></p> |

| Phase development of                                                                                                                                                                                                                                                                                                                                                                                      | MAINTENANCE                                                                                                                                                     |                                                                                                                                                                              |                                                        |                                                                                                                                   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| Impact / issue                                                                                                                                                                                                                                                                                                                                                                                            | Pollution Control – Rubbish Bins                                                                                                                                |                                                                                                                                                                              |                                                        |                                                                                                                                   |
| MITIGATION MEASURE                                                                                                                                                                                                                                                                                                                                                                                        | MANAGEMENT OBJECTIVES                                                                                                                                           | MEASURABLE TARGETS                                                                                                                                                           | RESPONSIBLE PARTY                                      | FREQUENCY OF ACTION                                                                                                               |
| <p><b><u>Pollution Control – Rubbish Bins:</u></b></p> <p>A sufficient number of rubbish bins shall be provided to avoid the build-up of litter and fine maintenance debris. <b>A litter collection parade shall be conducted daily</b> or as required to prevent the build-up of litter on site.</p> <p><b>No damage or pollution to the environment outside of the maintenance area whatsoever.</b></p> | <ul style="list-style-type: none"> <li>• To ensure improved conditions of stream banks</li> <li>• To ensure water quality is maintained and improved</li> </ul> | <ul style="list-style-type: none"> <li>• No pollution of water resources</li> <li>• Erosion control of stream banks</li> <li>• ECO inspections and record keeping</li> </ul> | <p>Contractor</p> <p>Contractor</p> <p>ECO - Audit</p> | <p>Monitor daily - Contractor</p> <p>Monitor daily - Contractor</p> <p><b>ECO inspections and audit reports once per week</b></p> |

| Phase development of                                                                                                                                                                                                                                                               | MAINTENANCE                                                                                                                                                                   |                                                                                                                                                                                                                                      |                                                                                                                                       |                                                                                                                                      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| Impact / issue                                                                                                                                                                                                                                                                     | Alien Vegetation Removal                                                                                                                                                      |                                                                                                                                                                                                                                      |                                                                                                                                       |                                                                                                                                      |
| MITIGATION MEASURE                                                                                                                                                                                                                                                                 | MANAGEMENT OBJECTIVES                                                                                                                                                         | MEASURABLE TARGETS                                                                                                                                                                                                                   | RESPONSIBLE PARTY                                                                                                                     | FREQUENCY OF ACTION                                                                                                                  |
| <p><b><u>Alien Vegetation Removal:</u></b></p> <p><b>All alien vegetation within the maintenance footprint needs to be removed as part of the rehabilitation process.</b></p> <p>The removal of the alien vegetation needs to commence under supervision of the appointed ECO.</p> | <ul style="list-style-type: none"> <li>• To ensure removal of alien invasive plants</li> <li>• No alien invasive plant species growth after maintenance activities</li> </ul> | <ul style="list-style-type: none"> <li>• Map areas of alien infestation</li> <li>• Plan to provide guidelines to monitor re-growth areas and follow-up as and when needed</li> <li>• Removal of alien invasive vegetation</li> </ul> | <p>Contractor with input from ECO</p> <p>Contractor with input from ECO</p> <p>Contractor with input from ECO (method statements)</p> | <p>Before maintenance commences (ECO to supervise removal)</p> <p><b>ECO inspections and audit reports as and when required.</b></p> |

# **OBJECTIVES FOR POST-MAINTENANCE PHASE:**

| Phase development of                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | POST MAINTENANCE                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                            |                                                                                                       |                                                                               |  |
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| Impact / issue                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Rehabilitation and Future Maintenance                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                            |                                                                                                       |                                                                               |  |
| MITIGATION MEASURE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | MANAGEMENT OBJECTIVES                                                                                                                                                                                                                                                                                                              | MEASURABLE TARGETS                                                                                                                                                                                                                                                                                                                                         | RESPONSIBLE PARTY                                                                                     | FREQUENCY OF ACTION                                                           |  |
| <p><b>Rehabilitation:</b></p> <p>After construction the disturbed sections needs to be ripped, levelled, shaped and stabilized in such a way that it blends in with the natural contour of the site and surrounding area.</p> <p>Since some of the slopes might be steep, erosion control, along with preservation of the topsoil would be very important for rehabilitation. Stabilization should be done by ensuring that the velocity of surface runoff is reduced through naturally aligned terracing. Terracing can be done by using hand labor to create natural terraces, as done at the Spookfontein wetland (Figure 6.2 and 6.3 Freshwater Specialist Report) on the same road (MR269) (Consult the ECO and Rehabilitation Specialist in this regard)</p> <p>The topsoil then needs to be spread over the naturally looking prepared slopes.</p> <p><u>Rehabilitation needs to be done with the following endemic species:</u></p> <p><u>Submergent/Emergent</u></p> <ul style="list-style-type: none"> <li>Isoliper prolifera</li> <li>Juncus lomatophyllus</li> </ul> | <ul style="list-style-type: none"> <li>Unnecessary visually visible impacts are avoided</li> <li>To ensure rehabilitation of the watercourse area</li> <li>To ensure water quality is maintained and improved</li> <li>To ensure erosion is kept to a minimum</li> <li>To encourage avifauna and aqua-fauna to the area</li> </ul> | <ul style="list-style-type: none"> <li>Placing back the windrowed topsoil over disturbed areas</li> <li>Compacted area needs to be ripped after maintenance</li> <li>Mulch and re-vegetate with the suitable, indigenous species all disturbed areas after maintenance, as described and illustrated in the attached <b>Rehabilitation Plan</b></li> </ul> | <p>Contractor with input from ECO</p> <p>Contractor</p> <p>Botanist/Horticulturist with ECO input</p> | <p>Post Maintenance –</p> <p>Post Maintenance -</p> <p>Post Maintenance -</p> |  |

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| Phase development of                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | POST MAINTENANCE                      |                    |                   |                     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|--------------------|-------------------|---------------------|
| Impact / issue                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Rehabilitation and Future Maintenance |                    |                   |                     |
| MITIGATION MEASURE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | MANAGEMENT OBJECTIVES                 | MEASURABLE TARGETS | RESPONSIBLE PARTY | FREQUENCY OF ACTION |
| <ul style="list-style-type: none"> <li>Carpha glomerata</li> </ul> <p><u>Emergent:</u></p> <ul style="list-style-type: none"> <li>Restio suberveticillatus</li> <li>Wachendorfia thyrsiflora</li> <li>Cliffortia sp</li> <li>Pelargonium cucculatum</li> <li>Psolrlea pinnata</li> <li>Halleria lucida</li> <li>Zantedeschia aethiopica</li> <li>Searsia rehmanniana</li> </ul> <p><u>Terrestrial:</u></p> <ul style="list-style-type: none"> <li>Chrysanthemoides monilifera</li> <li>Leonotus leonurus</li> <li>Pelargonium cucculatum</li> <li>Athanasia trifurcate</li> <li>Passerina sp.</li> <li>Leucadendron strictum</li> <li>Searsia angustifolia</li> </ul> <p>Rehabilitated areas needs to be watered as the need arises for the first 3 months until the plants have successfully established.</p> |                                       |                    |                   |                     |

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