FRESHWATER OPINION REPORT FOR THE CONSTRUCTION OF A ROAD AND ASSOCIATED INFRASTRUCTURE ON PORTION 1 OF FARM BLOUBANK NO. 52, TULBAGH

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EXECUTIVE SUMMARY

To facilitate the movement of larger vehicles within this servitude, owners of Portions 1 and 2 of Farm Bloubank No. 52 in the Tulbagh Valley upgraded the road crossing over a small unnamed stream on the property. The crossing was constructed in a tributary of Klein Berg River (G10E quaternary catchment) in the Berg River System. This freshwater opinion report is intended to provide information on the ecological condition and importance of the watercourse and assess the impacts of the recently constructed road upon it as well as provide rehabilitation measures to mitigate any impacts of the activity.

The tributary has been mapped as a South West Shale Fynbos Channelled Valley Bottom wetland in the Freshwater Ecosystem Priority Areas wetland mapping. The wetland area mapped occurs upstream of the site and incorporates the farm dam on the northern bank of the stream. No wetland area was evident within the immediate area of the stream crossing. The area mapped as valley bottom wetland area comprises largely of a relatively steep stream bank. The small wider stream corridor upstream of the site is also mapped as an aquatic Critical Biodiversity Area buffer due to the largely natural vegetation that still occurs along the steep river bank a short distance upstream of the site.

The ecological condition of the stream at the site is considered to be in a moderately modified within the channel and seriously modified along the riparian areas due largely to the surrounding agricultural activities. The ecological importance and sensitivity of the stream is moderate. Aerial images taken within the past 50 years show that there has been very little alteration to the channel course or the surrounding land cover for this period. The small farm dam on the northern bank of the stream was constructed after 1966 but before 1980. An informal crossing has been used from time to time through the stream at the site.

The works associated with the culvert structure that has been constructed at the road crossing has largely only resulted in limited change to the bed and banks of the unnamed stream at the site. Considering the history of modification of the river channel as a result of the surrounding agricultural activities and the existing ecological state of the stream, this impact is of a low significance. The structure has sufficient capacity that it is unlikely that it will result in any impedance or diversion of flow in the stream.

The main impacts of the works undertaken are thus a modification/loss of aquatic habitat. With some rehabilitation of the site, this impact could be reduced to being of a very low significance with the potential for a positive impact on the existing ecological condition of the watercourse at the site. Recommendations are provided in the report for the rehabilitation as well as the longer term maintenance and management measures for the site.

The Department of Water and Sanitation risk rating was also determined to be low. It is thus recommended that, if DWS requires that the activity be authorised as a water use, it be authorised under the General Authorisations for Section 21 (c) and (i) of the National Water Act.

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1. BACKGROUND

Portions 1 and 2 of Farm Bloubank No. 52 in the Tulbagh Valley (Figure 1) are owned by the Bloubank Boerdery Trust and the F C Orffer Trust respectively. The owners have agreed to register a servitude over Portion 1 of Farm No.52 Tulbagh at the location of an existing road. To facilitate the movement of larger vehicles within this servitude, the road crossing over a small unnamed stream was upgraded. The stream is a tributary of the Klein Berg River in the Berg River System. This freshwater opinion report is intended to provide information on the ecological condition and importance of the watercourse and assess the impacts of the recently constructed road upon it as well as provide rehabilitation measures to mitigate any impacts of the activity.

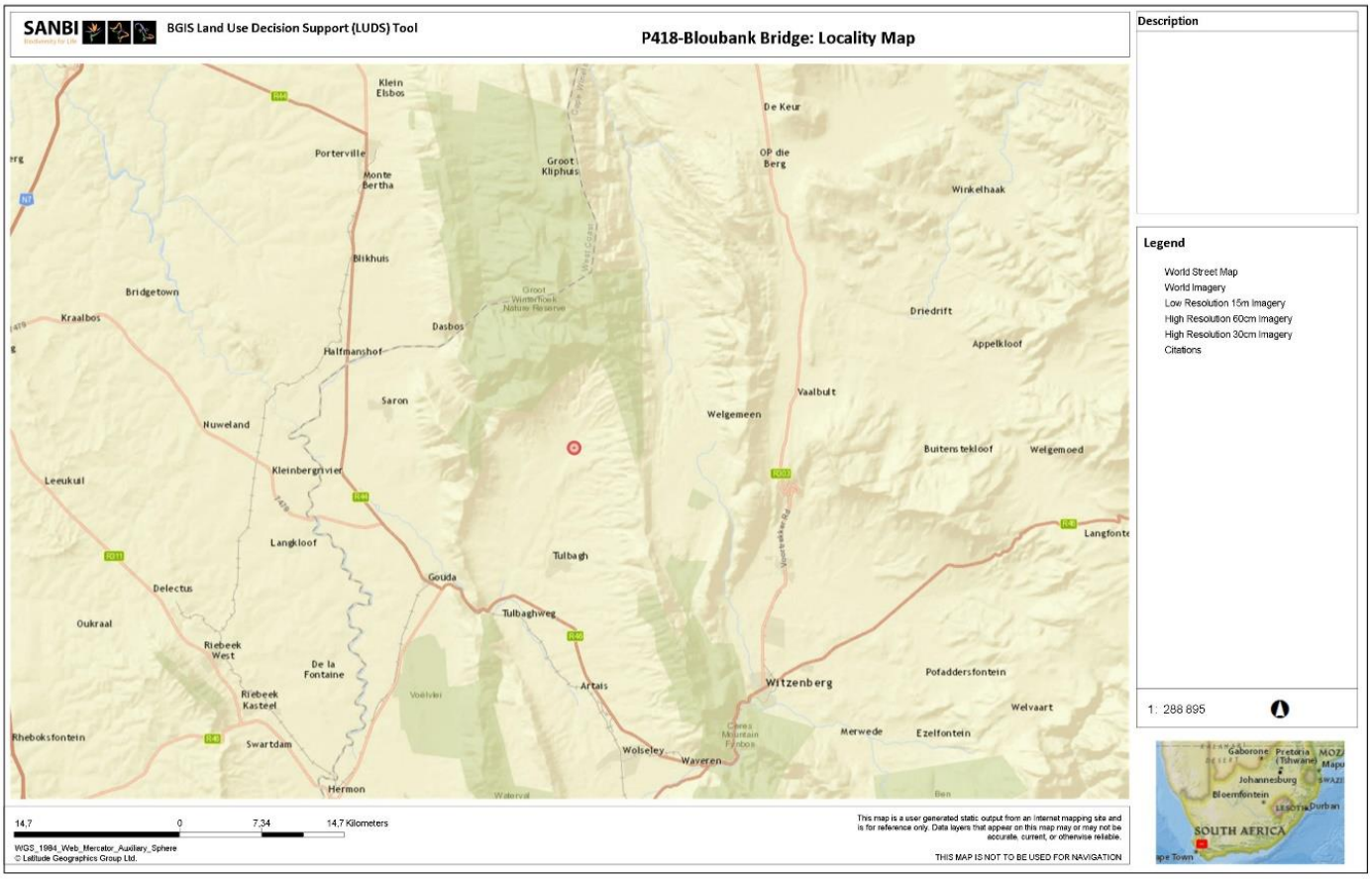

Figure 1. Locality map of Bloubank Farm (red circle) (SANBI Biodiversity GIS, 2017)

Table 1: Key water resources information

Descriptor	Name / Details	Notes
Water Management Area	Berg Olifants WMA	
Catchment Area	Klein Berg River in the middle reaches of the Berg River System	A small tributary of the Klein Berg
Quaternary Catchment	G10E	
Present Ecological State	C (Moderately modified)	Klein Berg (Dept Water Affairs, 2012)
Ecological Importance and Sensitivity	Ecological Importance: High Ecological Sensitivity: Very High	
Water resource component potentially impacted	Unnamed stream	
Latitude	33°12'34"S	Location of the road crossing
Longitude	19°09'32"E	

2. TERMS OF REFERENCE

The suggested and agreed upon scope of works for this freshwater assessment is as follows:

Task 1: Freshwater impact assessment

1. Literature survey and initialisation
2. Site assessment and field work
3. Freshwater ecosystem impact opinion
4. Rehabilitation plan
5. Risk assessment matrix of the Department of Water and Sanitation (DWS)
6. Review and liaison

3. ASSUMPTIONS AND LIMITATIONS OF THE STUDY

Input into this report was informed by a combination of desktop assessments of existing freshwater ecosystem information for the study area and catchment, as well as by a more detailed assessment of the freshwater features at the site. The site was visited in December 2016 in the dry summer season. There was however still flow in the stream and indicator riparian vegetation was present to enable an adequate freshwater assessment.

During the field visit, the characterisation and integrity assessments of the freshwater features were undertaken. Mapping of the freshwater features was undertaken using PlanetGIS and Google Earth Professional. The SANBI Biodiversity GIS website was also consulted to identify any constraints in terms of fine-scale biodiversity conservation mapping as well as possible freshwater features mapped in the Freshwater Ecosystem Priority Areas maps. This information/data was used to inform the resource protection related recommendations.

Limitations and uncertainties often exist within the various techniques adopted to assess the condition of ecosystems. The following techniques and methodologies were utilized to undertake this study:

- Analysis of the freshwater ecosystems was undertaken at a rapid level and did not involve detailed habitat and biota assessments;
- The river health assessment was carried out using South African Department of Water and Sanitation developed methodologies. River Health assessments were carried out to provide information on the ecological condition and ecological importance and sensitivity of the river systems impacted;
- Lists of plants, both alien and indigenous are for the purpose of describing the general and dominant habitat conditions and not comprehensive. A comprehensive botanical survey was not conducted as part of this freshwater assessment; and
- Invasive alien categories refer to the National Environmental Management Biodiversity Act (NEMBA) where:

- Category 1a: Species which must be combatted or eradicated;
- Category 1b: Species which must be controlled;
- Category 2: Species which require a permit to carry out a restricted activity within an area specified in the notice or an area specified in the permit. Outside of the specified area is considered a Category 1b; and
- Category 3: A species which is subject to exemptions or prohibitions but if occurring in riparian areas is considered a Category 1b.

The level of aquatic assessment undertaken was considered to be adequate for this study.

4. USE OF THE REPORT

This report reflects the professional judgment of its authors. The full and unedited content of this should be presented to the client. Any summary of these findings should only be produced in consultation with the authors.

5. OVERVIEW OF THE STUDY AREA AND PROJECT PROPOSALS

5.1. REVIEW OF STUDY AREA

The study area lies within the Tulbagh Valley in the Witzenberg Municipal Area and is surrounded by the Groot Winterhoek Mountains. The farm is approximately nine kilometres due north of the village of Tulbagh and is accessed via the Winterhoek Road and the DR1474 Divisional Road (Figure 3). The farm lies on lower western facing slopes and drainage across the site occurs in an east to west direction. The surrounding land use is dominated by agriculture. The site of the road crossing over the stream lies adjacent to the farm homestead and farm buildings as well as a farm dam to the north and the divisional road to the south (Figure 2). Much of the cover vegetation has been transformed by the farming activities taking place at the site. Approximately 175m downstream of the crossing, the Winterhoek Road crosses the stream. The banks of the stream have been infilled and the channel modified. Much of the riparian vegetation has been removed.

Figure 2. View of the northern bank of the site, looking downstream of the crossing

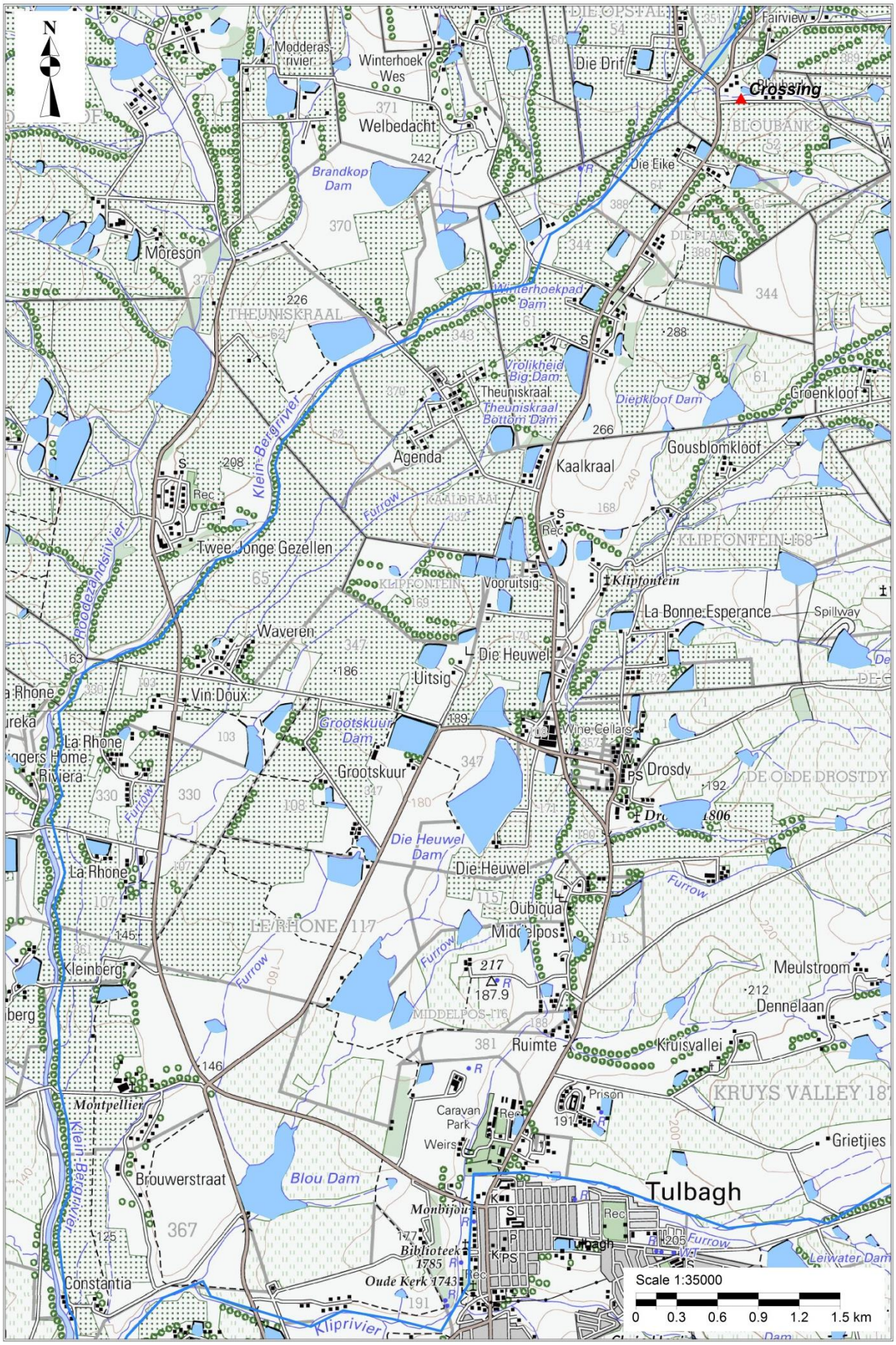

Figure 3. Topographical map of the study site and the surrounding area

5.2. ACTIVITY DESCRIPTION

A gravel road has been constructed from Divisional Road R1474 to the farm buildings on Portion 2 of Farm Bloubank No. 52, Tulbagh. The road is six meters wide and has a length of 22m (Figure 4). The road crosses a small stream along its route. The crossing consists of box culverts and the bridge has a surface area of 9.6m^2. The box culverts, with a dimension of approximately 2.4m wide by 2.1m high has been placed across the stream channel in order to allow water to flow unobstructed beneath the crossing. In order to construct the road it was necessary to raise the level of the surface with infilling on either side of the culvert. Brick wing walls have been constructed to prevent erosion at the culvert structure.

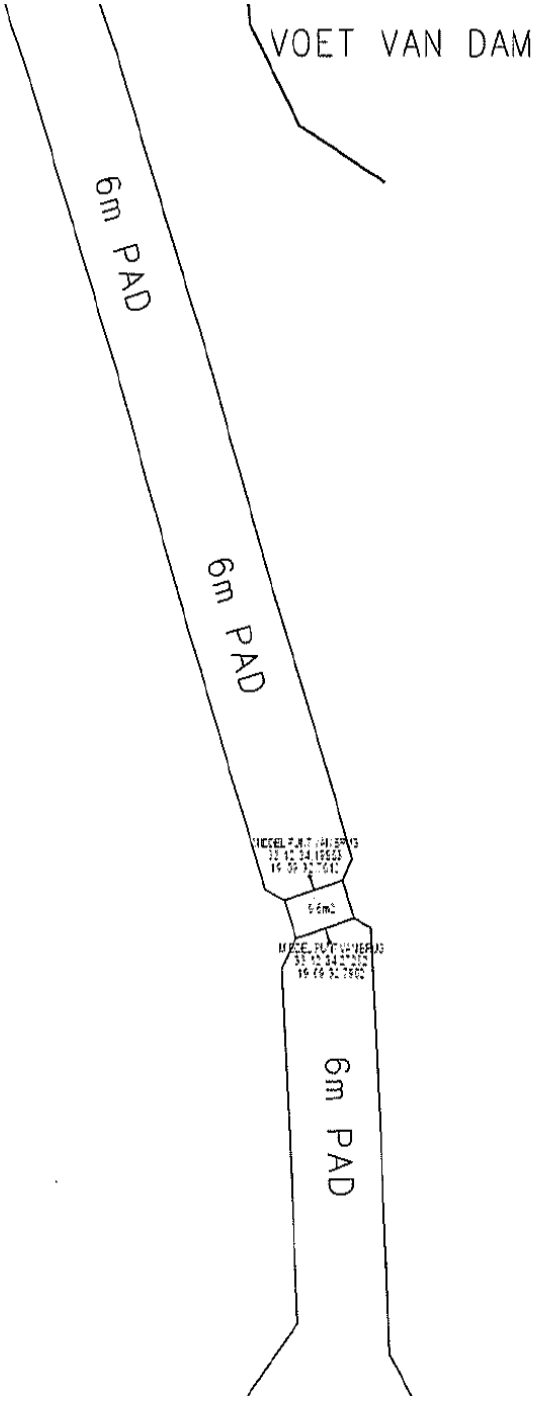

Figure 4. Schematic diagram of the road and stream crossing

6. LEGISLATIVE AND CONSERVATION PLANNING REQUIREMENTS

The proposed activity needs to take cognizance of the legislative requirements, policies, strategies, guidelines and principals of the relevant regulatory documents of the Witzenberg Municipality, such as the Biodiversity Network Framework (Figure 14), as well as the National Water Act (NWA) and the National Environmental Management Act (NEMA).

6.1. NEMA AND ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REGULATIONS

NEMA is the overarching piece of legislation for environmental management in South Africa and includes provisions that must be considered in order to give effect to the general objectives of integrated environmental management. These provisions are contained in Section 24 (4)(a)(b) of the Act, and will be considered during the EIA process. Activities listed in terms of Chapter 5 of NEMA in Government Notice No. R. 983, 984 and 985, dated 4 December 2014, as amended, trigger a mandatory Basic Assessment, or even a full scoping EIA process, prior to development. Many of the listed activities relate to activities within or adjacent to aquatic ecosystems. The activities assessed within this report are being assessed to determine whether any listed activities for which an environmental authorisation is required under the 2014 EIA Regulations apply.

6.2. NATIONAL WATER ACT, 1998 (ACT NO. 36 OF 1998)

The purpose of the National Water Act, 1998 (NWA) is to provide a framework for the equitable allocation and sustainable management of water resources. Both surface and groundwater sources are redefined by the Act as national resources which cannot be owned by any individual, and rights to which are not automatically coupled to land rights, but for which prospective users must apply for authorisation and register as users. The NWA also provides for measures to prevent, control and remedy the pollution of surface and groundwater sources.

The Act aims to regulate the use of water and activities (as defined in Part 4, Section 21 of the NWA), which may impact on water resources through the categorisation of 'listed water uses' encompassing water abstraction and flow attenuation within catchments as well as the potential contamination of water resources, where the DWS is the administering body in this regard. Defined water use activities require the approval of DWS in the form of a General Authorisation or Water Use Licence authorisation. There are restrictions on the extent and scale of listed activities for which General Authorisations apply. Those water use activities that may apply for this assessment are as follows:

- Section 21 (c) – Impeding or diverting flow in a watercourse; and/or
- Section 21 (i) – Changing the bed, banks or characteristics of a watercourse.

Section 22(3) of the National Water Act allows for a responsible authority (DWS) to dispense with the requirement for a Water Use Licence if it is satisfied that the purpose of the Act will be met by the grant of a licence, permit or authorisation under any other law.

GENERAL AUTHORISATION IN TERMS OF SECTION. 39 OF THE NWA

According to the preamble to Part 6 of the NWA, "*This Part established a procedure to enable a responsible authority, after public consultation, to permit the use of water by publishing general authorisations in the Gazette…*" *"The use of water under a general authorisation does not require a licence until the general authorisation is revoked, in which case licensing will be necessary…"*

The General Authorisations for Section 21 (c) and (i) water uses (impeding or diverting flow or changing the bed, banks or characteristics of a watercourse) as defined under the NWA have recently been revised (Government Notice R509 of 2016). The proposed works within or adjacent to the streams have the potential to change the characteristics of the associated freshwater ecosystems and may therefore require authorization. Determining if a water use licence is required for these water uses is now associated with the risk of degrading the ecological status of a watercourse. A low risk of impact could be authorised in terms of a General Authorisations (GA). A risk assessment for the activity is included in this report.

REGULATIONS REQUIRING THAT A WATER USER BE REGISTERED, GN R.1352 (1999)

Regulations requiring the registration of water users were promulgated by the Minister of DWA in terms of provision made in section 26(1)(c), read together with section 69 of the National Water Act, 1998. Section 26(1)(c) of the Act allows for registration of all water uses including existing lawful water use in terms of section 34(2). Section 29(1)(b)(vi) also states that in the case of a general authorisation, the responsible authority may attach a condition requiring the registration of such water use. The Regulations (Art. 3) oblige any water user as defined under section 21 of the Act to register such use with the responsible authority and effectively to apply for a Registration Certificate as contemplated under Art.7(1) of the Regulations.

7. PHYSICAL CHARACTERISTICS OF THE STUDY SITE

7.1. VISUAL CHARACTERISTICS

The site is located at the foot of the Witzenberg Mountains that are located along the eastern side of the Tulbagh Valley. The stream over which the road crosses originates in these mountains and drains the relatively steep slopes, to join a larger tributary of the Klein Berg River approximately 400m downstream of the site. The steep mountain slopes are still covered with largely natural mountain fynbos vegetation, however as the slope flattens most of this vegetation has been removed for agricultural activities. The riparian vegetation along the stream has similarly been removed by the surrounding farming activities.

The stream drops from its source at approximately 1190m above mean sea level (amsl) to a height of about 265m amsl where it joins the tributary of the Klein Berg River. The length of the stream is

approximately 5.4km and has an average slope of 17%. The height of the site is about 285m with a much reduced average slope of 3.5%.

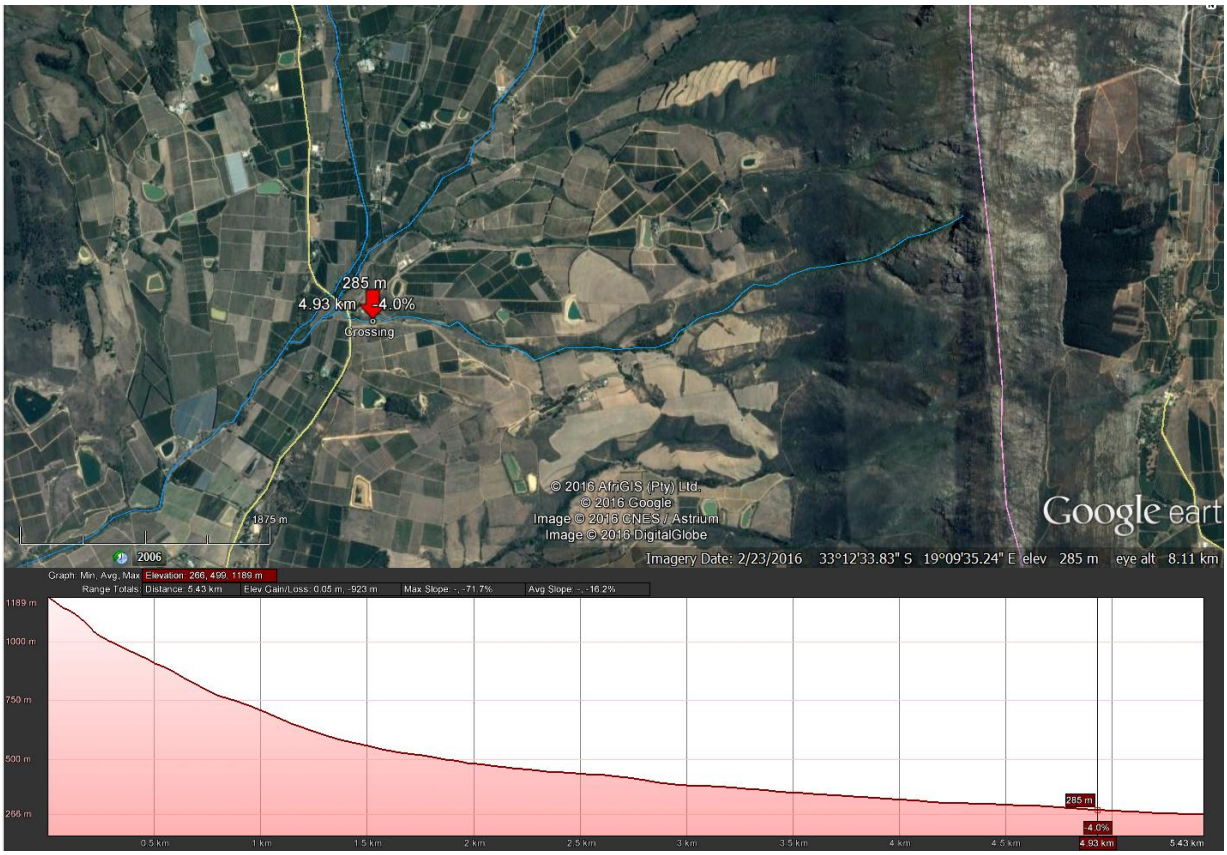

Figure 5. Elevation profile for the stream over which the road crosses, shown in Google Earth

7.2 CLIMATE AND HYDROLOGY

The study area experiences a Mediterranean climate with winters (June – August) being typically colder with a higher rainfall than in summer (December – February) (Figure 6). The mean annual rainfall for the farm is 669mm with the highest rainfall on average occurring in June (135mm) and the lowest in February (11mm). Run-off is therefore much higher in winter than summer.

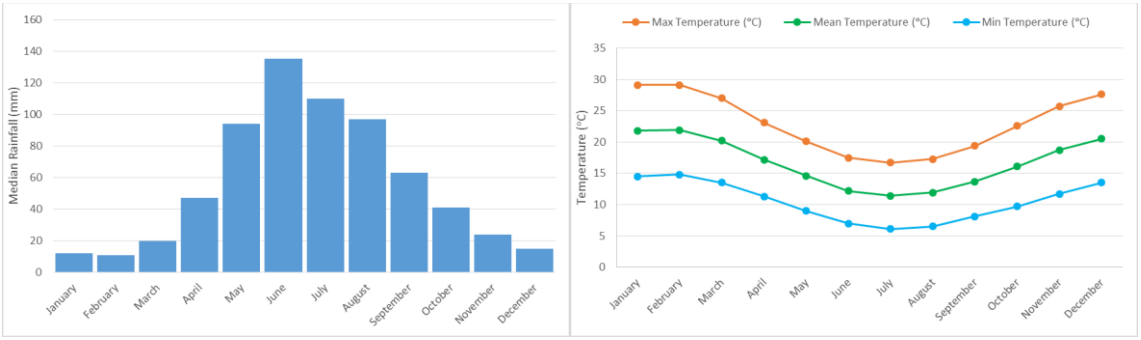

Figure 6. Average monthly rainfall (left) and temperatures (right) for Bloubank Farm (Schulze, 2009)

The catchment area for the stream upstream of the site is approximately 5.35km^2 which results in a mean annual runoff (MAR) at the site of about 1.1 million cubic meters. Most of the runoff occurs in August towards the end of winter. Due to the steepness of the catchment, one can expect that the flow in the river tends to occur largely for a short duration immediately following rainfall events with a short peak flow. The low flow occurs throughout the year and is fed by groundwater.

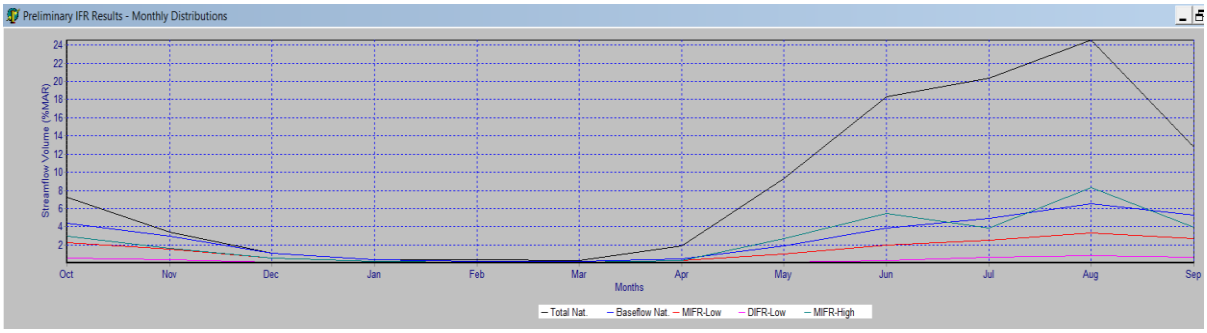

Figure 7. Flow distribution curves for the stream (Reserve Decision Support System, Version 2), where the black line indicates natural flow volumes as a percentage of the mean annual runoff and the blue line indicates the base flow in the stream that is largely fed by groundwater

7.3 GEOLOGY AND SOIL

The underlying geology of the area is dominated by phyllite shale, schist and greywacke of the Porterville Formation, Malmesbury Group with a partial covering of talus gravel (CapeFarmMapper, 2017)

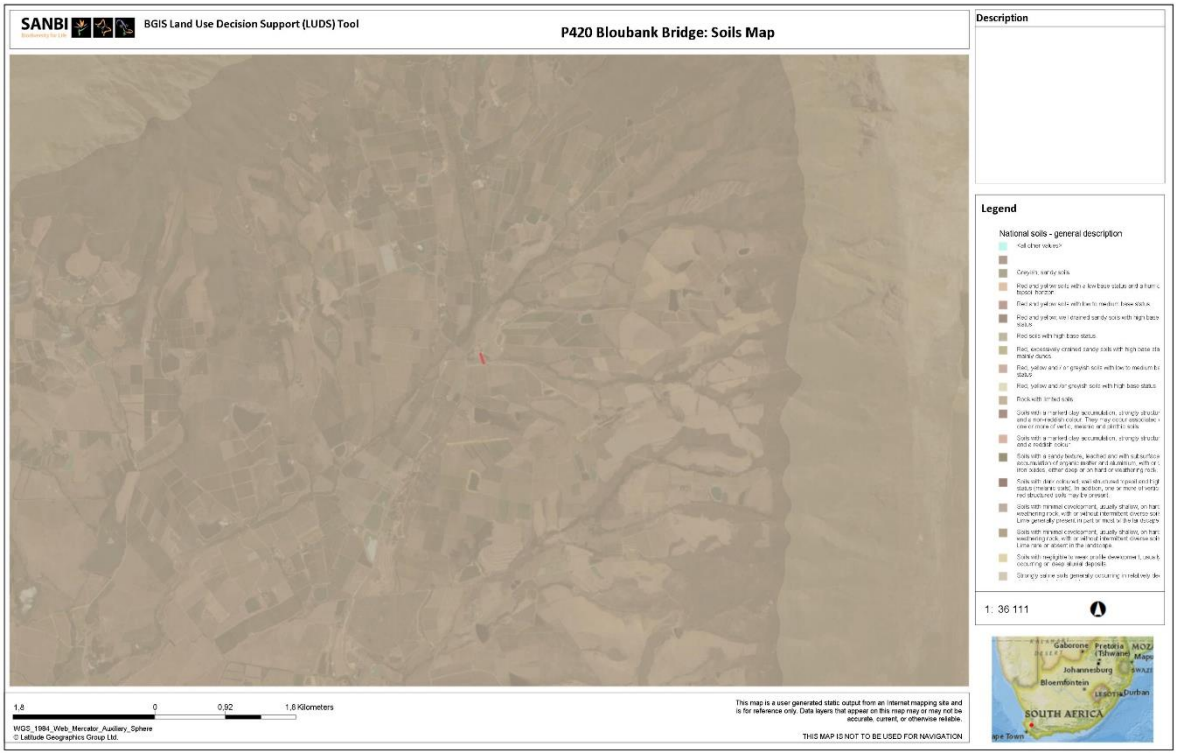

Figure 8. The Soils Map for the site of the newly constructed road (Red line) (SANBI BiodiversityGIS, 2017)

The soils show minimal development and are usually shallow on hard or weathering rock (brown area in Figure 8). Typically Glenrosa and Mispah forms are dominant. The soils are highly erodible.

7.4. FLORA

The naturally occurring vegetation type at the site is mapped as Breede Shale Fynbos (Pink area in Figure 9). The vegetation is typically moderately tall and dense shrubland. It occurs on the upper slopes down to the valley plains. Approximately 30% of its original extent has been transformed, mostly by agricultural development. It is considered to be a vulnerable vegetation type.

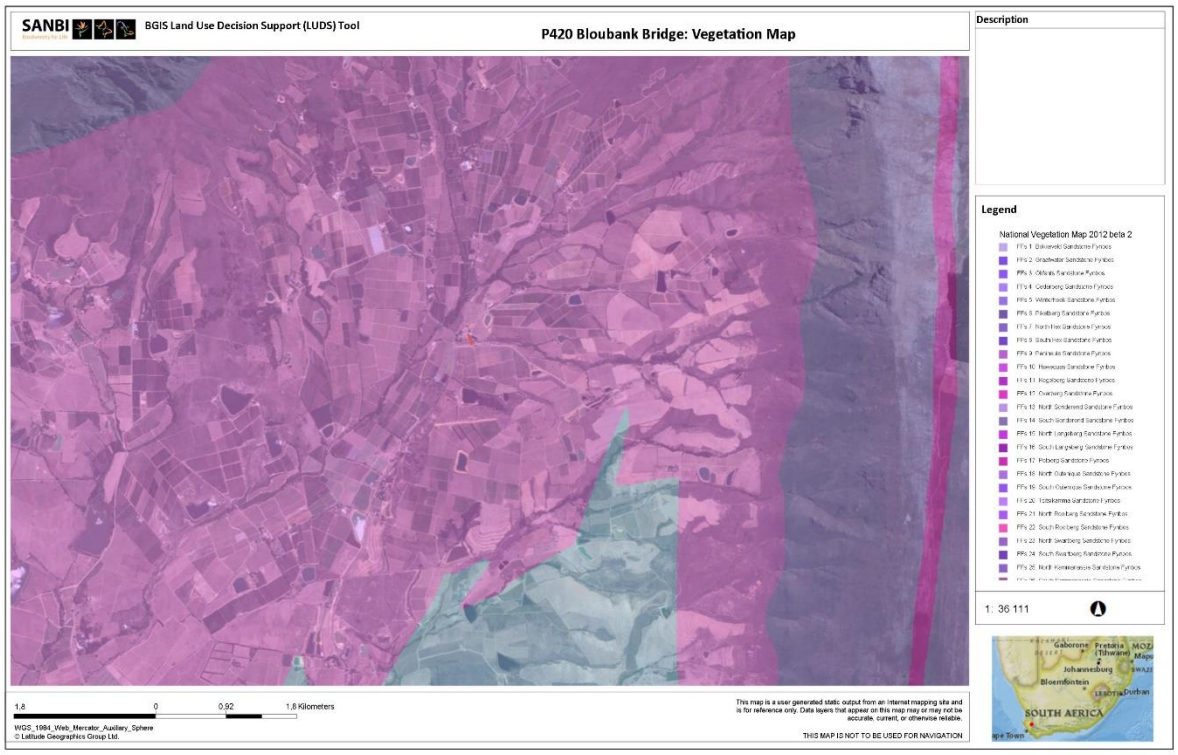

Figure 9. Vegetation map, updated from Mucina and Rutherford (2006), for the vicinity of the study site (Red line) (SANBI BiodiversityGIS, 2017)

The natural vegetation adjacent to and within the stream has largely been removed with open areas and exotic grasses occurring within the area currently. Within the stream channel upstream of the road crossing alien nasturtiums (*Tropaeolum majus*) occur together with weedy shrubs and exotic grasses and some arum lilies (*Zantedeschia aethiopica*). Downstream of the crossing, a mix of indigenous and exotic vegetation occurs. Indigenous vegetation consists of wild olive trees (*Olea europaea* subsp *africana*), arum lilies, kruidjie-roer-my-nie (*Melianthus major*), fountain bush (*Cliffortia strobilifera*), water sedge (*Isolepis prolifera*), cut grass (*Bolboschoenus glaucus*), spiny rush (*Juncus acutus*), cobra lilies (*Chasmanthes aethiopica*) and bulrushes (*Typha capensis*). Exotic plants include English oak trees (*Quercus robur*), black wattle (*Acacia mearnsii*), red sesbania (*Sesbania punicea*), weeping willows (*Salix babylonica*), swamp cypress (*Taxodium distichum*), cocklebur (*Xanthium strumarium*), Zimbabwe creeper (*Podranea brycei*) and dock (*Rumex crispus*).

7.5. AQUATIC FEATURES

The new road has been constructed in G10E quaternary catchment (Figure 11), which is drained by the Klein Berg River, a tributary of the Berg River. The road crosses a small stream which is an unnamed tributary of the Klein Berg River. The tributary has been mapped as a South West Shale Fynbos Channelled Valley Bottom wetland in the Freshwater Ecosystem Priority Areas wetland mapping. The wetland area mapped occurs upstream of the site and incorporates the farm dam on the northern bank of the stream (Figure 10). No wetland area was evident within the immediate area of the stream crossing. The area mapped as valley bottom wetland area comprises largely of a relatively steep stream bank.

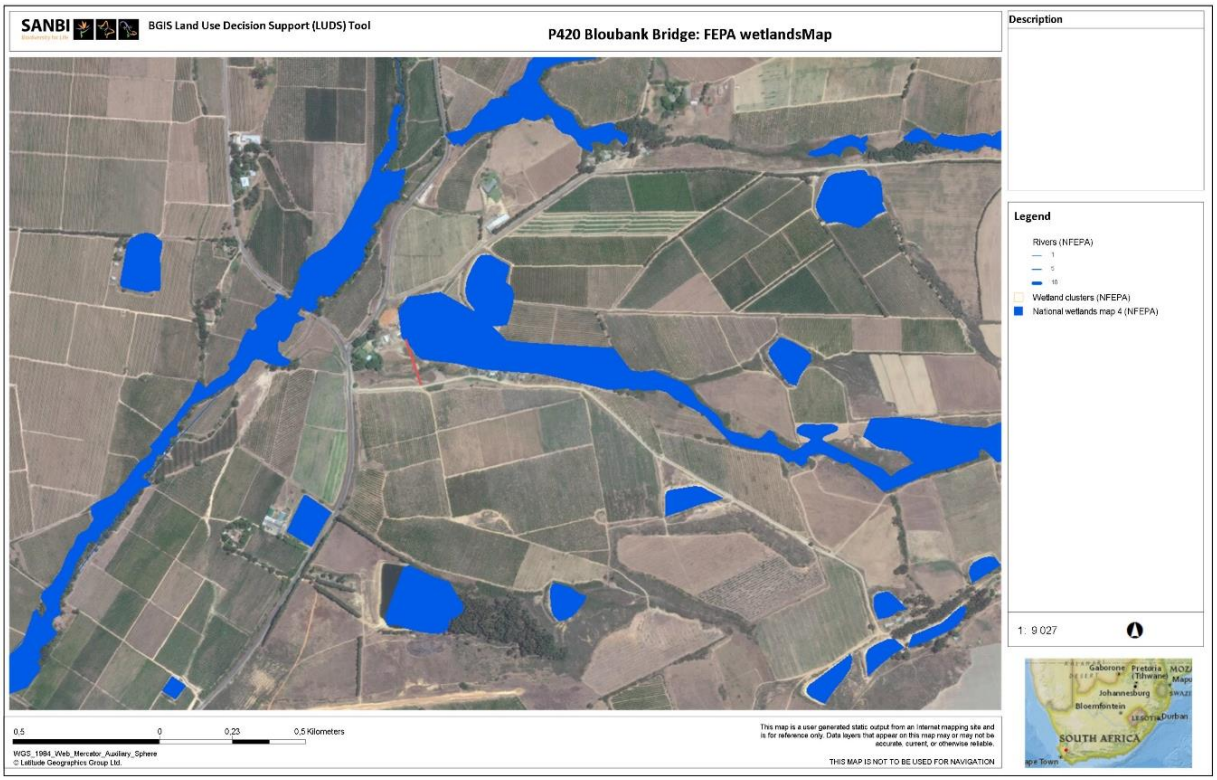

Figure 10. FEPA wetlands and rivers at the study site (SANBI BiodiversityGIS, 2017)

The stream is in a highly modified condition as a result of the surrounding agricultural activities. A more detailed assessment of the freshwater features at the site is included in the following section.

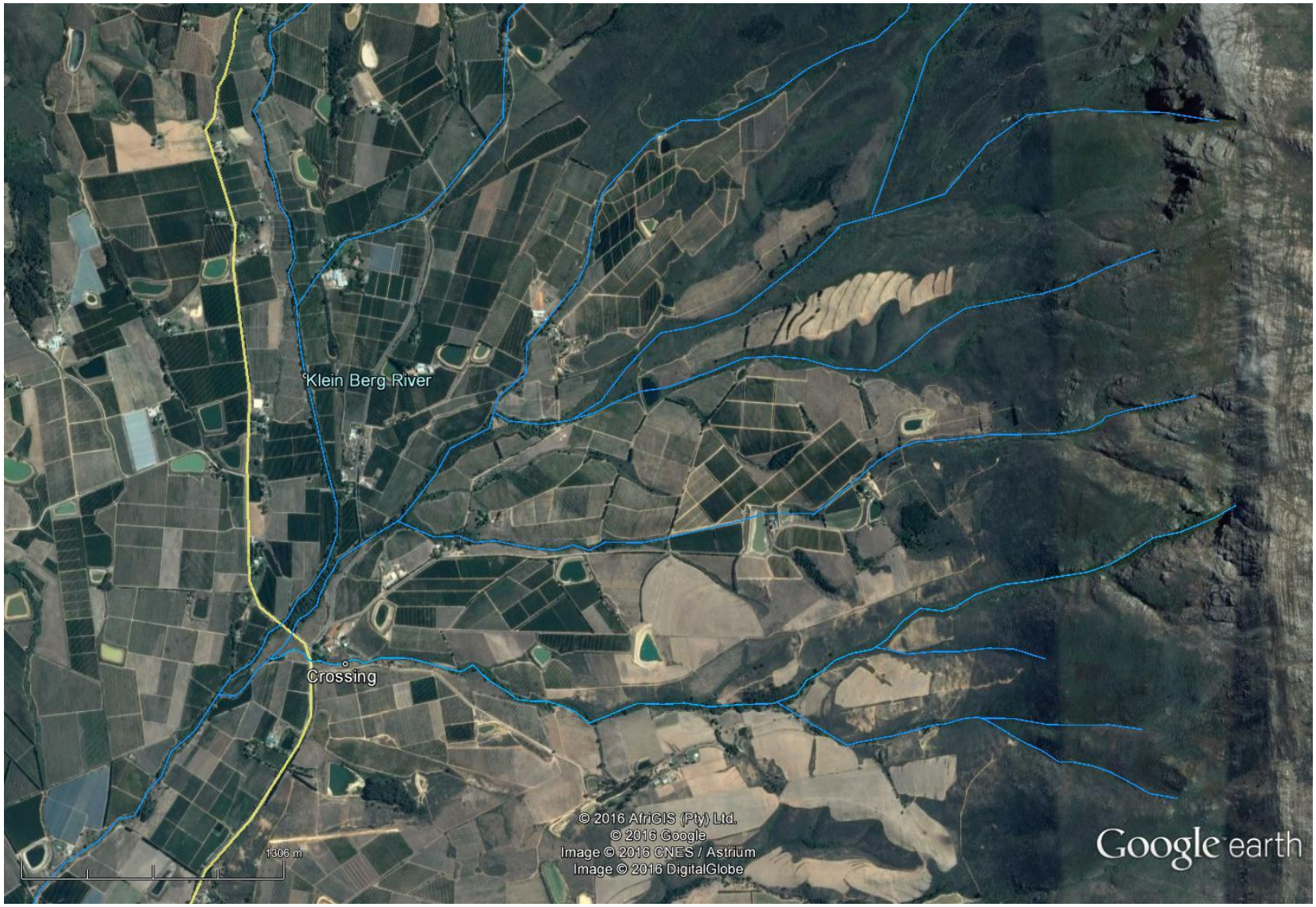

Figure 11. Google Earth image showing the tributaries of Klein Berg River in the upper G10E quaternary catchment, with the location of the crossing indicated

7.6 LAND USE

Fine scale land cover mapping in 2014 identified that most of the area has been cultivated (pink areas in Figure 12). The stream corridor has been mapped as a combination of dense shrub (dark green in Figure 12) and wetlands (light blue in Figure 12). The upper reaches of the stream lie within the Winterhoek Mountain Catchment Area and Groot-Winterhoek Wilderness Area protected areas.

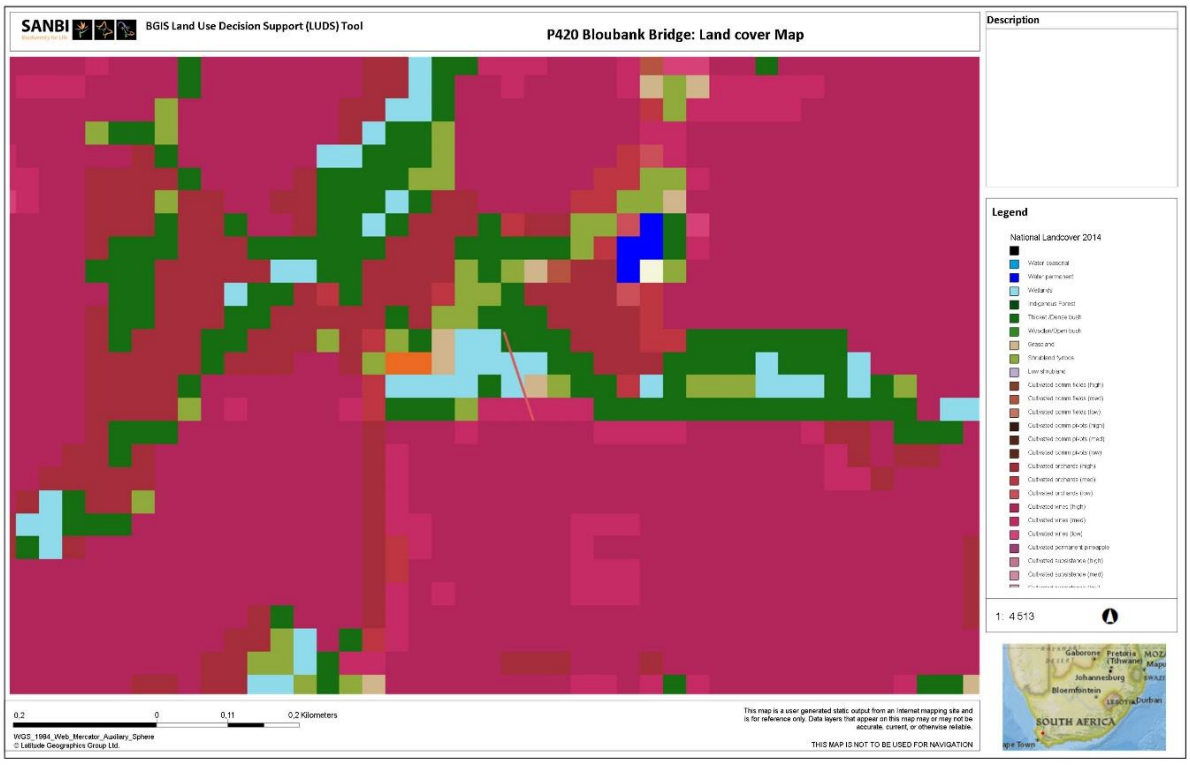

Figure 12. National Landcover (2014) for the study area (SANBI BiodiversityGIS, 2017)

7.7 BIODIVERSITY CONSERVATION VALUE

There are two freshwater biodiversity conservation mapping initiatives of relevance to the study area, the national Freshwater Ecosystem Priority Areas (FEPAs) and the Witzenberg Municipality Critical Biodiversity Areas (CBA) mapping. FEPAs are intended to provide strategic spatial priorities for conserving South Africa's freshwater ecosystems and supporting sustainable use of water resources. FEPAs were determined through a process of systematic biodiversity planning and were identified using a range of criteria for serving ecosystems and associated biodiversity of rivers, wetlands and estuaries. The G10E catchment is not mapped as a river FEPA (Figure 13).

The catchments of the adjacent Leeu River and the Olifants River to the north are mapped as FEPA rivers. These rivers still support populations of indigenous fish species such as Berg River redfin (*Pseudobarbus bergii*) in the Leeu River and Clanwilliam yellowfish (*Labeobarbus capensis*) in the Olifants River. The more widely spread Cape galaxias (*Galaxias zebratus*) and Cape kurper (*Sandelia capensis*) do however occur within the larger Klein Berg River System. The Cape Ghost Frog (*Heleophryne purcelli*) is endemic to the Western Cape Province and occurs in clear, swift flowing and perennial mountain streams such as in the Upper Klein Berg River System.

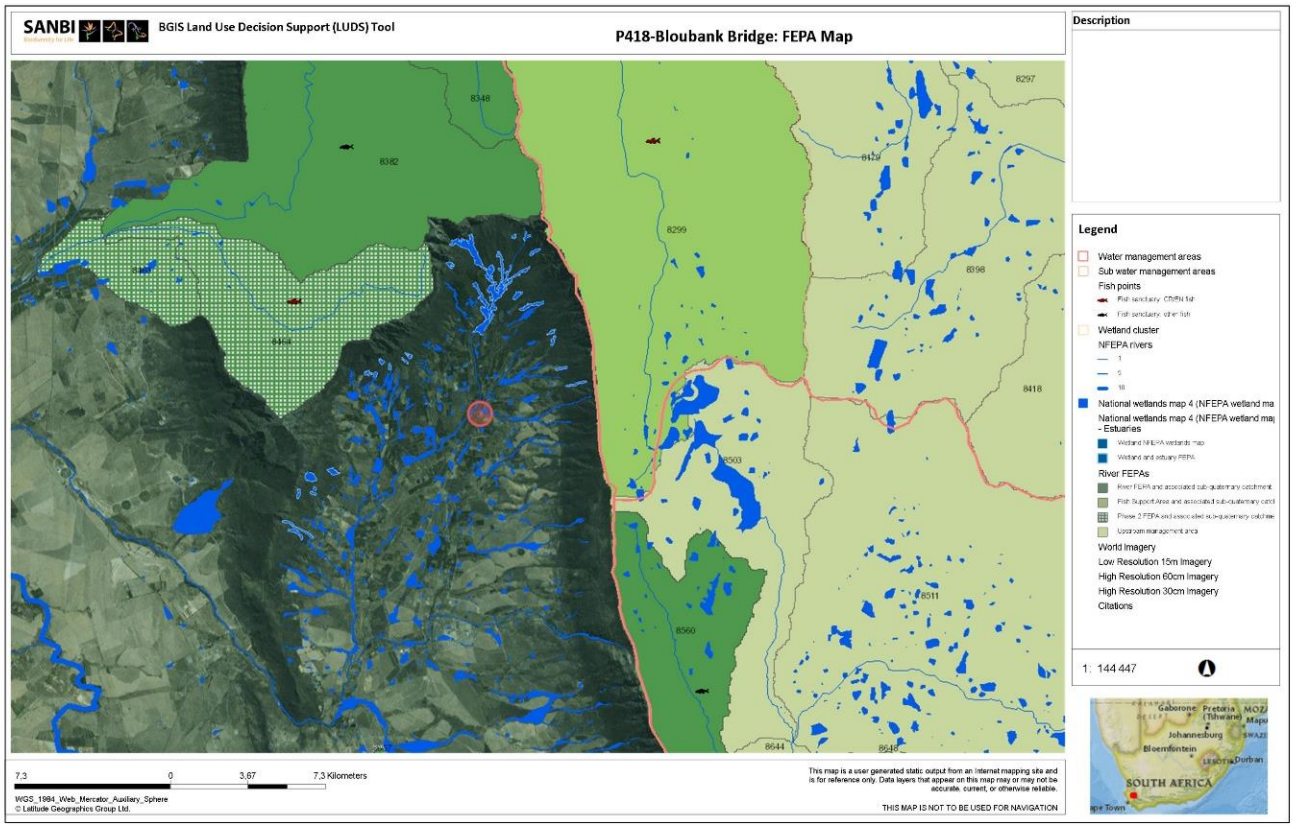

Figure 13. FEPA sub-catchments in the vicinity of the study area (red circle) (SANBI BiodiversityGIS, 2017)

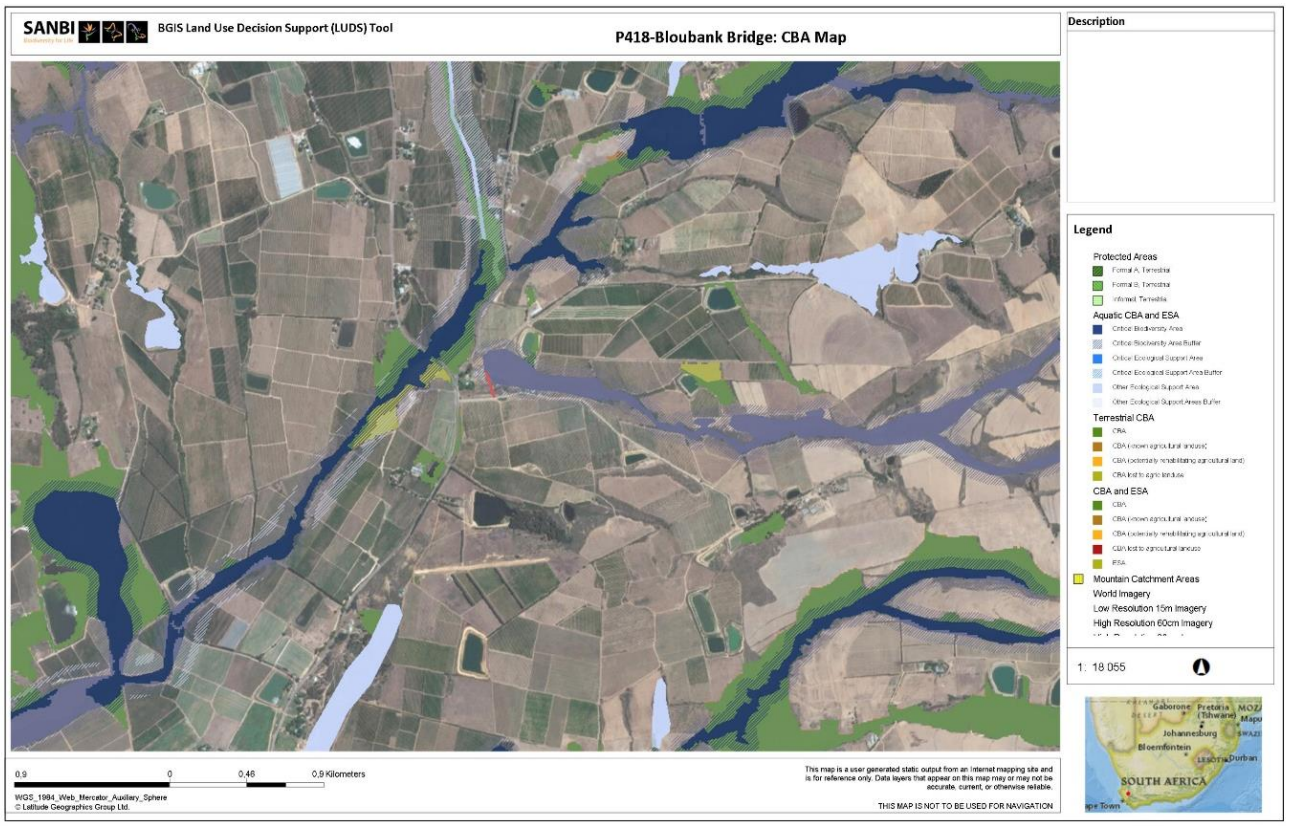

Figure 14. The Witzenberg Municipality's CBA mapping in the vicinity of the new road (red line) (SANBI BiodiversityGIS, 2017)

The CBA map for the Witzenberg Municipality aims to guide sustainable development by providing a synthesis of biodiversity information to decision makers. The map indicates areas of land as well as aquatic features which must be safeguarded in their natural state if biodiversity is to persist and ecosystems are to continue functioning. The small stream which is crossed by the new road is mapped as an aquatic CBA buffer along the wider stream corridor (grey-blue in Figure 14) upstream of the site. The management objective of CBA's is that they should be maintained in a natural state and where degraded, they should be rehabilitated. Retaining the ecological services of the stream is important.

8. ASSESSMENT OF FRESHWATER FEATURES AND THEIR SIGNIFICANCE

8.1. HISTORICAL MODIFICATION OF THE FRESHWATER FEATURES WITHIN THE SITE

The following aerial images were examined to assess the modification to the stream that has taken place in the past 50 years: December 1966 (Figure 15); March 1980 (Figure 16); December 2002 (Figure 17) and February 2016 (Figure 18). All of these images show that there has been very little alteration to the channel course or the surrounding land cover for this period. The small farm dam on the northern bank of the stream was constructed after 1966 but before 1980. An informal crossing has been used from time to time through the stream at the site that is visible in some of the Google Earth images.

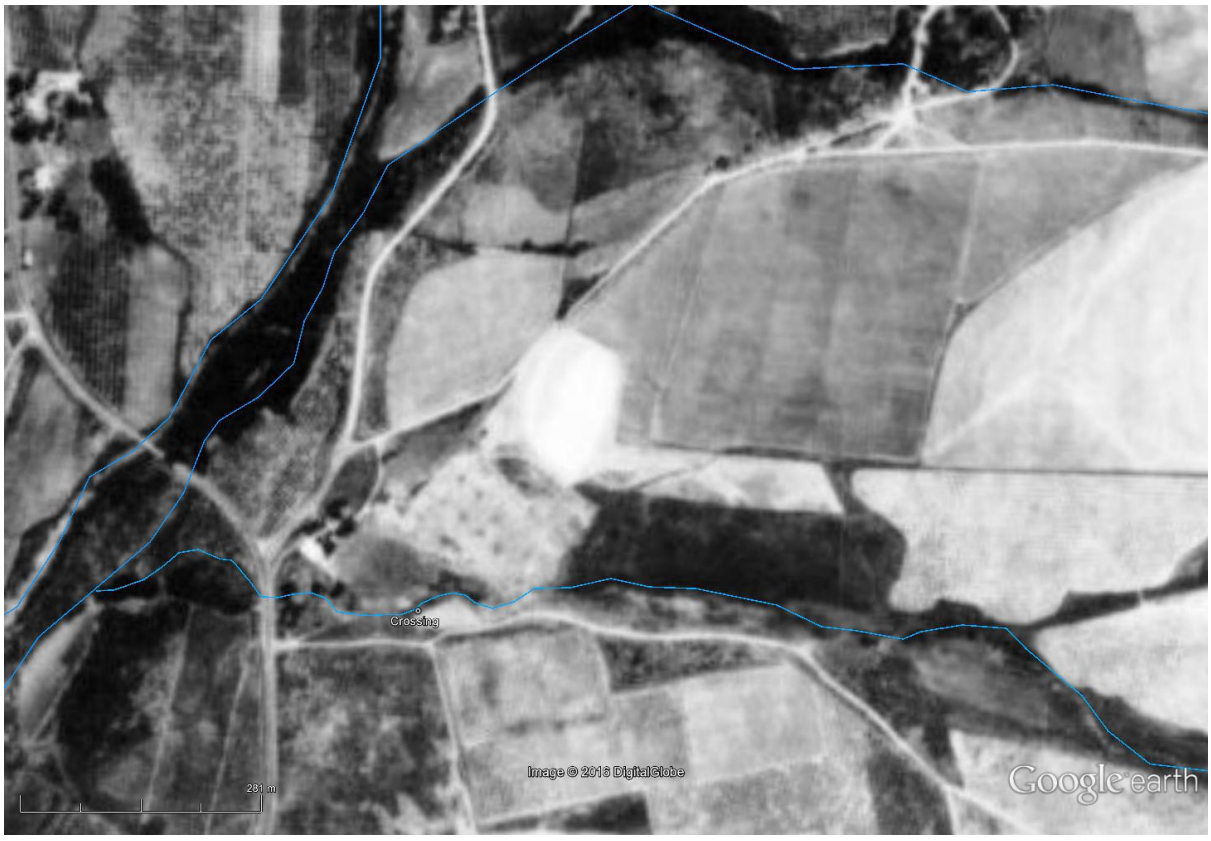

Figure 15. Aerial image taken in 1966/7 of the area

Figure 16. Aerial image taken in 1980 of the area

Figure 17. Google Earth image taken in 2002 of the area

Figure 18. Google Earth image taken in February 2016 of the area

8.2. DESCRIPTION OF FRESHWATER FEATURES

The stream at the site flows within a relatively deep channel upstream of the crossing that becomes shallower downstream of the structure. The stream is a lower foothill cobble bed stream that flows naturally throughout the year. The active channel is approximately 2.5m with an 8 to 10m wide macro channel. The southern bank upstream of the crossing is relatively low but downstream of the crossing is steep and approximately 4m high (Figure 19). The bank has been stabilised with boulders. The northern bank on the other hand, is steep upstream of the structure but downstream of the crossing is about 1m in height. All the indigenous riparian vegetation has been removed and the disturbed area now consists of exotic and invasive alien plants. The only remaining riparian vegetation occurs just upstream of the Witzenberg Road crossing over the stream. The banks at the culvert structure have been stabilised with bricks and the brick wing walls.

Figure 19. View of the culvert structure (top), stream upstream of the structure (middle) and downstream of the structure (bottom)

8.3. ASSESSMENT OF THE UNNAMED STREAM

The present ecological status of the stream was determined using a Habitat Integrity (HI) Assessment and Site Characterisation. The ecological importance and sensitivity of the stream was also assessed.

8.3.1. RIVER CLASSIFICATION

In order to assess the condition and ecological importance and sensitivity of the stream, it is necessary to understand how the stream might have appeared under unimpacted conditions. This is achieved through classifying the watercourses according to their ecological characteristics, in order that they can be compared to ecologically similar rivers.

River typing or classification involves the hierarchical grouping of rivers into ecologically similar units so that inter- and intra-river variation in factors that influence water chemistry, channel type, substratum composition and hydrology are best accounted for. Any comparative assessment of river or stream condition should only be done between rivers/streams that share similar physical and biological characteristics under natural conditions. Thus, the classification of rivers provides the basis for assessing river/stream condition to allow comparison between similar river/stream types. The primary classification of rivers is a division into Ecoregions. Rivers within an ecoregion are further divided into sub-regions.

Ecoregions: groups of rivers within South Africa, which share similar physiography, climate, geology, soils and potential natural vegetation. For the purposes of this study, the ecoregional classification presented in DWAF (1999), which divides the country's rivers into ecoregions, was used. The stream lies within the Western Folded Mountains Ecoregion (Table 2).

Table 2. Characteristics of the Western Folded Mountains Ecoregion

Main Attributes	Characteristics
Terrain Morphology:	Limited Plains; Moderate / Low Relief; Lowlands; Hills and Mountains; Moderate and High relief; **Closed Hills; Mountains; Moderate and High Relief;** Table-Lands: Moderate and High Relief
Vegetation types	**Mountain Fynbos;** Central Mountain Renosterveld; West Coast Renosterveld (very limited); Little Succulent Karoo; Upland Succulent Karoo (very limited); Strandveld Succulent Karoo (very limited)
Altitude (m a.m.s.l)	300-1700, 1900-2100 (limited)
MAP (mm)	200 - 1500
Rainfall seasonality	Winter
Mean annual temp. (°C)	10 to 20
Median annual simulated runoff (mm)	5 to >250 for quaternary catchment

Sub-regions: sub-regions (or geomorphological zones) are groups of rivers/streams, or segments of rivers/streams, within an ecoregion, which share similar geomorphological features, of which gradient is the most important. The use of geomorphological features is based on the assumption that these are a major factor in the determination of the distribution of the biota. Table 3 provides the geomorphological features of the stream.

8.3.2. SITE CHARACTERISATION

From the Site Characterisation assessment, the geomorphological and physical characteristics of the streams can be classified as follows:

Table 3. Geomorphological and Physical features

Geomorphological Zone	Lower foothill
Lateral mobility	Confined
Channel form	Simple
Channel pattern	Single channel, moderate to low sinuosity
Channel substrate	Cobble, sandy bed
Channel modification	Channel has been moderately modified by removal of riparian vegetation and agricultural activities
Hydrological type	Perennial
Ecoregion	Western Folded Mountains
DWA catchment	G10E
Vegetation type	Breede Shale Fynbos
Rainfall region	Winter

8.3.3. HABITAT INTEGRITY

The evaluation of Habitat Integrity provides a measure of the degree to which a river or stream has been modified from its natural state. The methodology (DWAF, 1999) involves a qualitative assessment of the number and severity of anthropogenic perturbations on a river/stream and the damage they potentially inflict upon the system. These disturbances include both abiotic and biotic factors, which are regarded as the primary causes of degradation of a river or stream. The severity of each impact is ranked using a six-point scale with 0 (no impact) to 25 (critical impact).

The Habitat Integrity Assessment is based on assessment of the impacts of two components of the river, the riparian zone and the instream habitat. Assessments are made separately for both components, but data for the riparian zone are interpreted primarily in terms of the potential impact on the instream component. The total scores for the instream and riparian zone components are then used to place the habitat integrity of both in a specific habitat category (Table 5).

Table 4. Results for the Habitat Integrity assessment for the stream

Instream Habitat Criteria	Weighting	Unnamed Stream	Riparian Habitat Criteria	Weighting	Unnamed Stream
Water Abstraction	14	14	Vegetation Removal	13	21
Flow Modification	13	8	Exotic Vegetation	11	14
Bed Modification	13	12	Bank Erosion	12	8
Channel Modification	13	9	Channel Modification	13	9
Water Quality	14	7	Water Abstraction	13	14
Inundation	10	4	Inundation	12	4
Exotic Macrophytes	9	9	Flow Modification	14	8
Exotic Fauna	8	4	Water Quality	12	8
Rubbish Dumping	6	8			
Instream Integrity Category		**C/D**	**Riparian Integrity Category**		**E**

Table 5. Habitat Integrity categories (From DWAF, 1999)

CATEGORY	DESCRIPTION	SCORE (% OF TOTAL)
A	Unmodified, natural.	90-100
B	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.	80-90
C	Moderately modified. A loss and change of natural habitat and biota have occurred but the basic ecosystem functions are still predominantly unchanged.	60-79
D	Largely modified. Large loss of natural habitat, biota and basic ecosystem functions has occurred.	40-59
E	The loss of natural habitat, biota and basic ecosystem functions is extensive.	20-39
F	Modifications have reached a critical level and the lotic system has been modified completely with an almost complete loss of natural habitat and biota. In worst instances, basic ecosystem functions have been destroyed and changes are irreversible.	0

The unnamed stream is considered to be moderately to largely modified in terms of its instream habitat with its riparian habitat seriously modified by the surrounding agricultural activities.

8.3.4. ECOLOGICAL IMPORTANCE AND SENSITIVITY (EIS)

The EIS assessment considers a number of biotic and habitat determinants surmised to indicate either importance or either importance or sensitivity. The determinants are rated according to a four-point scale (Table 6). The median of the resultant score is calculated to derive the EIS category (

Table 7). The results of the EIS assessment are shown in Table 8.

Table 6. Scale used to assess biotic and habitat determinants that indicate either importance or sensitivity

Scale	Definition
1	One species/taxon judged as rare or endangered at a local scale.
2	More than one species/taxon judged to be rare or endangered on a local scale.
3	One or more species/taxon judged to be rare or endangered on a Provincial/regional scale.
4	One or more species/taxon judged as rare or endangered on a National scale

Table 7. Ecological importance and sensitivity categories (DWAF, 1999)

EISC	General description	Range of median
Very high	Quaternaries/delineations that are considered to be unique on a national and international level based on unique biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) are usually very sensitive to flow modifications and have no or only a small capacity for use.	>3-4
High	Quaternaries/delineations that are considered to be unique on a national scale based on their biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) may be sensitive to flow modifications but in some cases may have substantial capacity for use.	>2-≤3
Moderate	Quaternaries/delineations that are considered to be unique on a provincial or local scale due to biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) are not usually very sensitive to flow modifications and often have substantial capacity for use.	>1-≤2
Low/ marginal	Quaternaries/delineations that are not unique on any scale. These rivers (in terms of biota and habitat) are generally not very sensitive to flow modifications and usually have substantial capacity for use.	≤1

Table 8. Results of the EIS assessment for the unnamed stream

Biotic Determinants	Score
Rare and endangered biota	1
Unique biota	1.5
Intolerant biota	2
Species/taxon richness	1
Aquatic Habitat Determinants	
Diversity of aquatic habitat types or features	2
Refuge value of habitat type	1.5
Sensitivity of habitat to flow changes	1.5
Sensitivity of flow related water quality changes	1.5
Migration route/corridor for instream & riparian biota	2
National parks, wilderness areas, Nature Reserves, Natural Heritage sites, Natural areas, PNEs	2
EIS CATEGORY	**Moderate**

The unnamed stream is considered to be of moderate ecological importance and sensitivity.

9. ASSESSMENT OF THE RIVER CROSSING STRUCTURE

The works associated with the culvert structure that has been constructed at the road crossing has largely only resulted in limited change to the bed and banks of the unnamed stream at the site. Considering the history of modification of the river channel as a result of the surrounding agricultural activities and the existing ecological state of the stream, this impact is of a low significance. The structure has sufficient capacity that it is unlikely that it will result in any impedance or diversion of flow in the stream.

The main impacts of the works undertaken are thus a modification/loss of aquatic habitat. With some rehabilitation of the site, this impact could be reduced to being of a very low significance with the potential for a positive impact on the existing ecological condition of the watercourse at the site. Recommendations are provided for the rehabilitation as well as the longer term maintenance and management measures for the site.

9.1. REHABILITATION MEASURES

The following recommendations are provided for the rehabilitation of the site:

- Rubble and debris from construction activities that have been undertaken at the crossing should be removed.
- The stream banks should be cleared of exotic and in particular invasive alien plants. The invasive alien kikuyu grass in particular should be kept out of the riparian zone as it destabilises the river banks. It should be replaced by indigenous grasses such as kweek (*Cynodon dactylon*). This should be undertaken during the dry season but following rainfall events when the soil is moist. Weedy shrubs and small invasive alien saplings occurring along the stream banks within the disturbed area at the crossing should be hand pulled. Should this not be possible for some of the large plants, the plants should be sprayed with a

foliar herbicide. Regular follow-up uprooting of new seedlings or follow-up herbicide spraying of coppicing stumps should be undertaken.

- Immediately following the clearing of exotic and invasive alien plants, the banks should be revegetated with local indigenous riparian vegetation such as wild olive trees (*Olea europaea* subsp *africana*), Cape willows (*Salix mucronata*), wild almond (*Brabejum stellatifolium*), waterwitels (*Brachylaena neriifolia*), willow karee (*Searsia augustifolia*), lance-leaved myrtle (*Metrosideros angustifolia*), kruidjie-roer-my-nie (*Melianthus major*), fountain bush (*Cliffortia strobilifera*), water sedge (*Isolepis prolifera*), spiny rush (*Juncus acutus*), cobra lilies (*Chasmanthes aethiopica*), arum lilies and palmiet (*Prionium serratum*).

- Storm water discharge from along the road should not be discharged into the stream at the structures as it is likely to result in erosion at the bridge. The road should shaped ensure that the concentration/intensity of runoff along the road is reduced to dissipate the energy and erosion potential of the flow from the road into the stream at the crossing.

- Clean topsoil (not containing invasive alien plant seed or rubble/waste) should be placed over the dumped bricks at the crossing and vegetated to cover the stabilised area adjacent to the crossing. A ground cover such as hottentot-fig (*Carpobrotus edulis*) or indigenous grass such as kweek could be planted in this area.

9.2. MAINTENANCE AND MANAGEMENT MEASURES

Below are guidelines for the longer term maintenance and management of the site:

- Ongoing monitoring and management of the disturbed areas within the stream channel and riparian zone should be undertaken to ensure that the area stays clear of eroded areas and invasive alien plant growth.

- The stream channel upstream of the crossing should be kept clear of sediment, cobbles and woody debris that could impede flow through the structure during low and higher flow events.

- The longer term rehabilitation and management of the stream channel at the crossing should be managed by means of the approved Management Maintenance Plan (MMP) for the site. The MMP should include method statements for the removal of sediment and debris upstream of the crossing, revegetation of indigenous plants and control of alien invasive plants as well as erosion control measures should they be required.

- Control of alien invasive plant species should be undertaken with a specific focus on the invasive plants such *Acacia mearnsii, Sesbania punicea* and *Pennisetum clandestinum*. These species are known to do well in riparian and wet habitats. They should be controlled by manual removal or the application of appropriate herbicides. Manual removal should not be carried out by any machinery larger than a chainsaw. For additional information on alien vegetation clearing management visit the Working for Water website (http://www.dwaf.gov.za/wfw/Control/)

- Areas of soil that are disturbed by the maintenance activity should be revegetated with appropriate indigenous vegetation such as the species listed in this report. Re-vegetation should take place immediately after construction. As mentioned in the previous mitigation measures, method statements for alien vegetation clearing and revegetation with indigenous plants should be addressed in an MMP for the site.

10. RISK ASSESSMENT

A risk assessment was carried out for the road crossing in the stream (summary in Table 9). The full risk assessment matrix can be seen in full in Appendix C. The risk rating, (where Low (L) risk has a significance score of 1-55 and Moderate risk (M) has a score of 56-169) of the activity is considered to be low, provided the proposed rehabilitation measures are implemented.

Table 9. A summary of the risk assessment for the stream crossing

Phases	Activity	Aspect	Impact	Significance	Risk Rating
Rehabilitation	Rehabilitation works associated with the bridge	Clearing and shaping of stream banks and revegetating with local indigenous vegetation	Loss of aquatic habitat, flow modification, increased sedimentation and decreased water quality and facilitated invasion by alien flora	22.75	L
Operation	Operational activities associated with the bridge	Maintenance of/and ongoing disturbance associated with the bridge		48	L

The DWS should be consulted regarding the need to apply for a water use authorisation for the crossing. The risk rating is considered low; thus it is recommended that, if DWS requires that the activity be authorised as a water use, it be authorised under the General Authorisations for Section 21 (c) and (i) of the National Water Act.

11. CONCLUSION

The new road crossing has been constructed in an unnamed tributary of Klein Berg River (G10E quaternary catchment) in the Berg River System. The tributary has been mapped as a South West Shale Fynbos Channelled Valley Bottom wetland in the Freshwater Ecosystem Priority Areas wetland mapping. The wetland area mapped occurs upstream of the site and incorporates the farm dam on the northern bank of the stream. No wetland area was evident within the immediate area of the stream crossing. The area mapped as valley bottom wetland area comprises largely of a relatively steep stream bank. The small wider stream corridor upstream of the site is also mapped as an aquatic Critical Biodiversity Area buffer due to the largely natural vegetation that still occurs along the steep river bank a short distance upstream of the site.

The ecological condition of the stream at the site is considered to be in a moderately modified within the channel and seriously modified along the riparian areas due largely to the surrounding agricultural activities. The ecological importance and sensitivity of the stream is moderate. Aerial images taken within the past 50 years show that there has been very little alteration to the channel course or the surrounding land cover for this period. The small farm dam on the northern bank of

the stream was constructed after 1966 but before 1980. An informal crossing has been used from time to time through the stream at the site.

The works associated with the culvert structure that has been constructed at the road crossing has largely only resulted in limited change to the bed and banks of the unnamed stream at the site. Considering the history of modification of the river channel as a result of the surrounding agricultural activities and the existing ecological state of the stream, this impact is of a low significance. The structure has sufficient capacity that it is unlikely that it will result in any impedance or diversion of flow in the stream.

The main impacts of the works undertaken are thus a modification/loss of aquatic habitat. With some rehabilitation of the site, this impact could be reduced to being of a very low significance with the potential for a positive impact on the existing ecological condition of the watercourse at the site. Recommendations are provided in the report for the rehabilitation as well as the longer term maintenance and management measures for the site.

The DWS risk rating was also determined to be low. It is thus recommended that, if DWS requires that the activity be authorised as a water use, it be authorised under the General Authorisations for Section 21 (c) and (i) of the National Water Act.

12. REFERENCES

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APPENDIX A: DECLARATION OF INDEPENDENCE

I, Antonia Belcher, as the appointed independent specialist hereby declare that I:

- act/ed as the independent specialist in this application;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2010 and any specific environmental management Act;
- have and will not have no vested interest in the proposed activity proceeding;
- have disclosed, to the applicant, EAP and competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the NEMA, the Environmental Impact Assessment Regulations, 2010 and any specific environmental management Act;
- am fully aware of and meet the responsibilities in terms of NEMA, the Environmental Impact Assessment Regulations, 2010 (specifically in terms of regulation 17 of GN No. R. 543) and any specific environmental management Act, and that failure to comply with these requirements may constitute and result in disqualification;
- have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- have ensured that the names of all interested and affected parties that participated in terms of the specialist input/study were recorded in the register of interested and affected parties who participated in the public participation process;
- have provided the competent authority with access to all information at my disposal regarding the application, whether such information is favorable to the applicant or not; and
- am aware that a false declaration is an offence in terms of regulation 71 of GN No. R. 543.

Signature of the specialist: 

Date: 25 February 2017

APPENDIX B: BACKGROUND AND QUALIFICATIONS OF SPECIALIST CONSULTANT

Contact details: PO Box 455, Somerset Mall, 7137

Name: Antonia Belcher

Profession: Aquatic Scientist (Pr. Nat. Sc. 400040/10)

Fields of Expertise: Specialist in river and wetland monitoring and reporting

Relevant work experience:

Due to my involvement in the development and implementation of the River Health Programme as well as the Resource Directed Measures directorate of the Department of Water Affairs in the Western Cape, I have been a key part of the team that has undertaken six catchment or area wide 'state-of-river' assessments as well as routine monitoring and specialized assessments of rivers and wetlands in all the major catchments for the Western Cape. In the past eight years, I have undertaken numerous freshwater assessments as input into both the environmental authorization and water use authorization process throughout the Western Cape as well as greater Southern Africa.

Papers and Publications:

More than 300 publications, papers and posters relating mostly to water resource quality and river health assessments in South African rivers and their management.

Recent projects that she has been involved in are:

- Classification of Water Resources in the Olifants-Doorn Water Management Areas, Department of Water Affairs;
- Development and piloting of a National Strategy to Improve Gender Representation in Water Management Institutions, where the focus is on improving the capacity to participate in water related decision making, Department of Water Affairs and Forestry;
- Compilation of a background document as well as a framework management plan towards the development of an integrated water resources management plan for the Sandveld;
- Specialist on the City of Cape Town project: Determination of additional resources to manage pollution in storm water and river systems;
- River Health Programme monitoring for the Free State Region, Department of Water Affairs; and
- Framework for Education and Training in Water (FETWATER), Resource Directed Measures Network partner which has undertaken training initiatives on environmental water requirements in the SADC region.

APPENDIX C: PRESENT ECOLOGICAL STATUS AND ECOLOGICAL IMPROTANCE AND SENSITIVITY FOR THE KLEIN BERG RIVER

SELECT SQ REACH	SQR NAME	LENGTH km	STREAM ORDER	PES ASSESSED BY XPERTS? (IF TRUE="Y")	REASONS NOT ASSESSED	PES CATEGORY DESCRIPTION	PES CATEGORY BASED ON MEDIAN OF METRICS
G10E-08457	Klein Berg	20.56	1	Y		MODERATELY MODIFIED	C
MEAN EI CLASS	**MEAN ES CLASS**	**DEFAULT ECOLOGICAL CATEGORY (DEC)**	**RECOMMENDED ECOLOGICAL**				
HIGH	VERY HIGH	A	0.00				

PRESENT ECOLOGICAL STATE		ECOLOGICAL IMPORTANCE				ECOLOGICAL SENSITIVITY	
INSTREAM HABITAT CONTINUITY MOD	SMALL	FISH SPP/SQ	2.00	INVERT TAXA/SQ	41.00	FISH PHYS-CHEM SENS DESCRIPTION	MODERATE
RIP/WETLAND ZONE CONTINUITY	LARGE	FISH: AVERAGE CONFIDENCE	3.00	INVERT AVERAGE CONFIDENCE	5.00	FISH NO-FLOW SENSITIVITY DESCRIPTION	MODERATE
POTENTIAL INSTREAM HABITAT MOD ACT.	SMALL	FISH REPRESENTIVITY PER SECONDARY: CLASS	MODERATE	INVERT REPRESENTIVITY PER SECONDARY,	VERY HIGH	INVERT PHYS-CHEM SENS DESCRIPTION	VERY HIGH
RIPARIAN-WETLAND ZONE MOD	LARGE	FISH REPRESENTIVITY PER SECONDARY: CLASS	MODERATE	INVERT RARITY PER SECONDARY: CLASS	VERY HIGH	INVERTS VELOCITY SENSITIVITY	VERY HIGH
POTENTIAL FLOW MOD ACT.	LARGE	FISH RARITY PER SECONDARY: CLASS	MODERATE	ECOLOGICAL IMPORTANCE: RIPARIAN-WETLAND-INSTREAM VERTEBRATES (EX FISH) RATING	HIGH	RIPARIAN-WETLAND-INSTREAM VERTEBRATES (EX FISH) INTOLERANCE WATER LEVEL/FLOW CHANGES DESCRIPTION	VERY HIGH
POTENTIAL PHYSICO-CHEMICAL MOD ACTIVITIES	SMALL	ECOLOGICAL IMPORTANCE: RIPARIAN-WETLAND-INSTREAM VERTEBRATES (EX FISH) RATING	HIGH	HABITAT DIVERSITY CLASS	HIGH	STREAM SIZE SENSITIVITY TO MODIFIED FLOW/WATER LEVEL CHANGES DESCRIPTION	VERY HIGH
		RIPARIAN-WETLAND NATURAL VEG RATING BASED ON % NATURAL VEG IN 500m (100%=5)	LOW	HABITAT SIZE (LENGTH) CLASS	MODERATE	RIPARIAN-WETLAND VEG INTOLERANCE TO WATER LEVEL CHANGES DESCRIPTION	VERY HIGH
		RIPARIAN-WETLAND NATURAL VEG IMPORTANCE BASED ON EXPERT RATING	VERY HIGH	INSTREAM MIGRATION LINK CLASS	VERY HIGH		
				RIPARIAN-WETLAND ZONE MIGRATION LINK	MODERATE		
				RIPARIAN-WETLAND ZONE HABITAT INTEGRITY	MODERATE		
				INSTREAM HABITAT INTEGRITY CLASS	VERY HIGH		

APPENDIX D: RISK ASSESSMENT

ASPECTS AND IMPACT REGISTER/RISK ASSSESSMENT FOR WATERCOURSES INCLUDING RIVERS, PANS, WETLANDS, SPRINGS,DRAINAGE LINES: Road crossing on Portion 1 of Farm Bloubank No. 52, Tulbagh
COMPILED BY: Toni Belcher, BlueScience (SACNASP No 400040/10)
Date: March 2017

					Severity																
Nr.	Phases	Activity	Aspect	Impact	Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph+ Vegetation)	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Control Measures	Borderline LOW MODERATE Rating	Watercourse PES and EIS
	Rehabilitation	Rehabilitation works associated with the bridge	Clearing and shaping of stream banks and revegetating with local indigenous vegetation	Loss of aquatic habitat, flow modification, increased sedimentation and decreased water quality and facilitated invasion by alien flora	1	1	2	1	1.25	1	1	**3.25**	1	2	1	3	**7**	**22.75**	L	See freshwater assessment		Unnamed tributary of the Klein Berg River: PES: instream C/D riparian E; EIS: Moderate
1	Operation	Operational activities associated with the bridge	Maintenance of/and ongoing disturbance associated with the bridge		1	1	1	1	1	1	4	**6**	2	2	1	3	**8**	**48**	L			