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Decommissioning, Rehabilitation and Mine Closure Plan for Buffalo Coal: Aviemore

Report

Version - Final

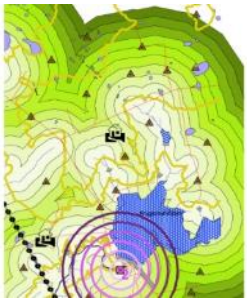
29 March 2019

Buffalo Coal (Pty) Ltd

GCS Project Number: 19-0058

Client Reference: 2018 Closure Costs Update: Aviemore

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EXECUTIVE SUMMARY

Financial Provisioning for Mine Closure is covered under the NEMA Regulations Pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production Operations (GN R.1147). The regulations aim to ensure that operating mines have a clearer understanding of what their operations will look like at the LOM and the risks associated with this. The overall goal is to ensure that there is adequate financial provision for rehabilitation if the mine undergoes sudden closure or once mining activities cease. The closure vision, closure actions, post-closure monitoring and associated costs for Buffalo Coal are covered in this final rehabilitation plan.

Aviemore is an existing coal mine located in the KwaZulu-Natal (KZN) Province of South Africa, approximately 8 kilometres (km) north-northwest of the town of Dundee and approximately 325 km east-northeast of the City of Durban. Mining at Aviemore Colliery began in October 2000 under Mining Licence KZN341/2002. This licence was replaced by a "New order" Mining Right (MR) KZN 174 MR. Subsequent to the granting of this right, MR 301 was granted in June 2013 for what is referred to as Phase 1 of Aviemore's extension.

The existing mining area has an approved Environmental Impact Assessment/Environmental Management Plan (EIA/EMP) and is operating under MR174 and MR301 respectively. Buffalo Coal have recently converted their prospecting right (PR), 258PR, into a MR (MR10083). The existing mining rights are summarised in Table 1-1 – Existing Mining and Prospecting Rights at Aviemore . The coal reserve is situated between the R621 and P272 provincial roads, on the eastern, northern and western slopes of the Impati Mountain, with the Gus Seam being the target coal seam for the extraction of high-grade anthracite coal. The existing Aviemore Coal Mine is currently being mined on the extreme north-eastern flank of the Impati Mountain adjacent to the Morgenstond remaining reserves. The existing underground workings are accessed on the eastern side of the reserve, via a three portal adit.

Mining at Aviemore takes place underground, utilising conventional bord and pillar mining to work the Gus seam at a depth of 120 metres (m). The surface area disturbed by mining operations is relatively small. An adit (box cut) exists in the hillside and forms the entrance for the Gus seam mining operation. The existing coal processing site and rail facility for the Aviemore operation is located at Coalfields, in Dundee. The coal product is transported by rail, 280 km to the Richards Bay Coal Terminal (RBCT) for export and is also delivered to domestic customers by road transport (Provincial P272). There is no discard dump at Aviemore and the discard disposal facility at Magdalena Colliery is used. ROM material is washed in Dundee at Coalfields where there are pollution control measures such as berms and pollution control dams (PCDs) in place, and the separation of waste areas from storm water drains on site is practised. Aviemore is an underground mine with a small surface footprint, refer to Figure 4-1. Surface infrastructure comprising of:

- A fuel storage facility;
- Workshop;
- Haul and Access Roads;
- Change house and ablutions;
- Adit / Box Cut;
- Magazine;
- Topsoil stockpiles;
- Septic tanks;
- Hard parking areas; and
- Site offices.

The monitoring network at Aviemore consists of biannual biomonitoring, with annual reports submitted to the Department of Water and Sanitation (DWS). Monitoring also includes the undertaking of quarterly ground and surface water monitoring with the submission of annual reports to the DWS. Generally, the following can be derived from the water monitoring data:

- Typical indicator elements/parameters for coal mine environments are pH (measuring acidity when acid mine drainage occur), TDS/EC (measuring total dissolved salts), Sulfate (SO4 measuring saline drainage from coal mines), Iron (Fe occur in oxidized environments or where Acid Mine Drainage occur).
- It should be noted that naturally high salt concentrations are typical of this area, both of the groundwater and surface water environment. Therefore, elevated EC, TDS, sodium and chloride values are anticipated.
- Stable and neutral pH occur for the Aviemore water samples and the groundwater hydrochemistry data for most of the monitoring boreholes at Aviemore Colliery indicate overall good water quality.
- The hydrochemistry data collected in 2018 for almost all boreholes showed no significant impact from the mine. Low concentrations of mine indicator parameters, specifically sulphate and metals with neutral pH values, were observed at these sites

The Buffalo Coal closure vision aims to return the disturbed areas to a stable, non-polluting and safe state that represents, as close as possible, the pre mining conditions. Buffalo Coal wishes to leave a positive legacy in the area once the mining operations cease. Building on the closure vision, the objectives of the final rehabilitation plan are to:

- Ensure all areas are closed in a manner that ensures they are geotechnically stable and safe;
- Prevent erosion through sloping of all disturbed areas to appropriate gradients;
- Ensure that all areas are free-draining and non-polluting;
- Establish vegetation cover returning the area to its pre-mining condition;
- Establish a low maintenance system;
- Ensure the final landform blends into the surrounding topography; and
- Ensure water discharged from the area into the natural drainage system is done safely and the quality will be in accordance with the qualities required by the DWS.

The closure vision is underpinned by the more specific closure objectives listed in this section. These objectives are stated qualitatively and would become more specific as the actual closure measures are devised, implemented and their performance determined:

- **Physical stability:** To remove and/or stabilise surface infrastructure that is present on the mine to facilitate the implementation of the planned final land use;
- **Environmental quality:** To ensure that local environmental quality is not adversely affected by possible physical effects and chemical contamination arising from the mine site, as well as to sustain catchment yield as far as possible after closure;
- **Health and safety:** To limit the possible health and safety threats to humans and animals using the rehabilitated mine site as it becomes available;
- **Land capability/land use:** To re-instate suitable land capabilities over the various portions of the mine site to facilitate the progressive implementation of the planned final land use;
- **Aesthetic quality:** To leave behind a rehabilitated mine site that, in general, is not only neat and tidy, giving an acceptable overall aesthetic appearance, but which in terms of this attribute is also aligned to the planned final land use;
- **Biodiversity:** To encourage, where appropriate, the re-establishment of indigenous vegetation on the rehabilitated mine sites such that the terrestrial and aquatic biodiversity is largely re-instated over time; and

- **Social:** To ensure that the infrastructure transfers, if applicable, measures and/or contributions made by the mine towards the long-term socio-economic benefit of the local communities are lasting and sustainable.

This closure plan, devised in line with the surrounding land uses, is aligned to the EMPr which states that the mining areas will be appropriately rehabilitated to a grazing land use. The Aviemore closure vision aims to return the disturbed areas to a stable, non-polluting and safe state as close as possible to the pre-mining conditions. As detailed in the Land use Section (section 4.4.7), the area was used for grazing of cattle and wilderness prior to mining. Current land use surrounding the Aviemore area is comprised of agriculture which is, at this stage, limited to livestock (grazing). The vision thus aims to encourage the surrounding Grassland and Thornveld vegetation to re-establish on disturbed areas on site in order to return the land to that of the surrounding area, which is farmland. The area will be suitable for low-scale grazing activities. The area falls within the bio-resource group VC 16 (Moist Tall Grassveld) and has a bushed grassland bushland vegetation pattern. The recommended stocking rate for the area is normally 2.6 hectares per large stock unit (ha/LSU), however due to the bushed nature, *Lantana camara* (an alien invader plant) and a large increase (approximately 12 - 15%) of increaser grass species (*Sporobolus africana, Aristida congesta,* and *Setaria flabellata*) this site could be downgraded to a 3.5 ha/LSU. Buffalo Coal will strive to ensure that any latent or residual impacts on site will be mitigated as far as possible.

The following assumptions were made when determining the costs if Buffalo Coal were to undergo sudden or LOM closure:

- Decommissioning and rehabilitation activities will follow directly on the cessation of mining;
- All infrastructure where agreements have not been put in place for transfer to the landowner, local community, Government or other third party at the time of mine decommissioning, will be dismantled/demolished as part of mine closure;
- As there are currently no agreements in place for the handover of infrastructure to a third party, it was assumed and subsequently costed for that all infrastructure would be demolished and footprints rehabilitated;
- A post closure land capability of agriculture (grazing) will be established over the rehabilitated footprint area;

- Costs for post-closure water treatment have been excluded based on the findings of updated specialist studies for the Aviemore underground workings and the 2018 ground and surface water monitoring results. The potential for AMD to occur at Aviemore will be continually investigated through updated specialist studies and monitoring;
- Should decant become a problem at site then water treatment options should be considered. However, this option should be reviewed during the annual closure updates (based on the latest available information) to determine the necessity of treatment;
- Stakeholder consultation will be undertaken by Buffalo Coal during operations to obtain stakeholder views and opinions that these could be incorporated/considered in future versions of the closure plan;
- The closure costs are aligned to the principles reflected in the Department of Mineral Resources (DMR) Guideline Document for the Evaluation of the Quantum of Closure Related Financial Provision Provided by a Mine (January 2005);
- Third party contractor rates were used to calculate the costs;
- 4.5% CPIX (StatsSA) was added to all 2017 unit and nominal rates in order to align them with 2018 rates;
- In accordance with the DMR guideline no cost off-sets due to possible salvage values were considered and gross rehabilitation costs are reported;
- Fixed ratios for contingencies as per the DMR guideline have been applied;
- Buffalo Coal has indicated that the mine will perform the rehabilitation work using its own resources, as a result the additional 12% Preliminary and Generals (P and Gs) are deemed unnecessary;
- Any additional costs will be covered by the 10% contingency;
- Closure costs have been determined for both the LOM and Sudden closure situations. LOM closure takes place at a planned date and/or time horizon in accordance with overall mine planning. Sudden closure entails immediate closure of a site, representing decommissioning and rehabilitation of the site in its present state;
- LOM and Sudden Closure costs are the same as there will be no expansion or addition to the surface infrastructure at Aviemore for the LOM;
- All surface infrastructure would be demolished and removed to a depth of 500 mm. Any infrastructure below 500 mm will be sealed, made safe and left in situ;

- The incline shaft opening to the surface will be suitably plugged and backfilled with all the available waste rock at mine closure and the respective box-cut in-filled and rehabilitated utilising the subsoil and topsoil stockpiles;
- The conveyor is mobile and therefore it is assumed that it will not be demolished, and will be removed from the Aviemore site and relocated;
- Costs for the importation of topsoil is calculated based on rates obtained by Buffalo Coal from their contractor;
- Costs were included for groundwater and surface water monitoring for a 5-year period after the closure and rehabilitation efforts cease, thereafter the monitoring network will need to be amended and updated based on monitoring results;
- Quarterly monitoring costs were calculated at a GCS cost estimate of R 2 500.00 per sample and based on the current monitoring network;
- Sampling sites applicable to the current mining works area were included, all consistently dry or inaccessible water sampling sites were excluded;
- Three surface water and four ground water monitoring points were costed for;
- The disturbed area will be returned to its pre-mining agricultural (grazing land) state;
- Costs for care and maintenance of the site as well as water management for a period of five years were included;
- Closure planning will be a progressive/ ongoing process whereby information as it becomes available will be assimilated, refined and incorporated in the closure planning to achieve an appropriate and up-to-date closure plan at the time of actual mine closure. This is especially key for the measurement and monitoring activities as the required knowledge base must be established for which to “launch” eventual mine closure;
- A 10% contingency was added to subtotal 1 to account for any unforeseen shortfalls.

The calculated closure cost if Aviemore were to undergo Sudden Closure as well as the costs for LOM closure are summarised in **Table 1,** which shows that the sudden and LOM closure costs calculated for Aviemore, using third party contractor rates and inclusive of VAT is **R3 330 327.15.**

Table 1 Summary of 2018 Closure Costs for Aviemore.

	Aviemore Coal Mine Closure Costs 2018	LOM Closure Cost	Sudden Closure Cost
1	**Surface Infrastructure**	**R1 271 837.44**	**R1 271 837.44**
1.1	Buildings & Structures	R983 894.88	R983 894.88
1.2	Parking	R57 168.40	R57 168.40
1.3	Tanks/pump stations/boreholes	R59 496.70	R59 496.70
1.4	Magazine Site	R6 936.38	R6 936.38
1.5	Power Lines	R52 022.83	R52 022.83
1.6	Fencing	R40 252.01	R40 252.01
1.7	Concrete	R72 066.25	R72 066.25
2	**Mining Areas & Waste Sites**	**R644 532.68**	**R644 532.68**
2.1	Adit Void	R644 532.68	R644 532.68
3	**General Areas**	**R122 652.34**	**R122 652.34**
3.1	Site Offices, Workshop, Change and Wash rooms (and associated infrastructure footprint)	R31 003.50	R31 003.50
32	Storage/Salvage Yard	R7 086.51	R7 086.51
3.3	Parking Area, Security Hut, Access and Haul Roads	R57 577.93	R57 577.93
3.4	Magazine Site	R5 445.10	R5 445.10
3.5	Water Tanks and Adit Substation Footprint	R321.51	R321.51
3.6	Topsoil shortfall	R21 217.78	R21 217.78
5	**Aftercare & Maintenance**	**R593 647.23**	**R593 647.23**
5.1	Monitoring	R350 000.00	R350 000.00
5.2	Maintenance	R243 647.23	R243 647.23
	Sub Total 1	**R2 632 669.69**	**R2 632 669.69**
	12% Preliminary and General	NA	NA
	10% Contingency	R263 266.97	R263 266.97
	Sub Total 2 (excluding VAT)	**R2 895 936.65**	**R2 895 936.65**
	Grand Total (including VAT)	**R3 330 327.15**	**R3 330 327.15**

The previous closure costs compiled by GCS, dated March 2018, have been utilised as a reference document for the compilation of this updated closure report. Amendments to the previous closure update include:

- Updated monitoring results for the 2018 period have been included, recommendations based on these results have been incorporated into the closure plan;

- Number of groundwater monitoring points have been updated and increased to include all applicable monitoring points in the Aviemore monitoring network that are able to be frequently monitored;
- Number of surface water monitoring points have been updated and increased to include all applicable monitoring points in the Aviemore monitoring network that are able to be frequently monitored (i.e. not dry);
- Monitoring points not applicable to the current Aviemore workings (i.e. sampling sites based on future areas) have been excluded from the monitoring plan;
- Cost of undertaking water monitoring has been updated, based on an anticipated GCS rate of R2500 per sample (this includes all professional fees and disbursements);
- Addition of new shaded walkway from the entrance gate to the office area;
- Addition of new workshop located on the north-east corner of the existing office and workshop area concrete slab;
- 2017 third party contractor rates have been updated and adjusted to account for inflation; and
- Amendment (correction) of the rate for backfilling of the final void.

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LIST OF ABBREVIATIONS

BA	Basic Assessment
°C	Degrees Celsius
Ca	Calcium
Cl	Chloride
CV	Curriculum Vitae
DEA	Department of Environmental Affairs
DMR	Department of Mineral Resources
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
F	Fluoride
Fe	Iron
GCS	GCS Water and Environment (Pty) Ltd
Ha	Hectare
HDI	Human Development Index
HDPE	High-density polyethylene
I&APs	Interested and Affected Parties
IDP	Integrated Development Plan
K	Potassium
KM	Kilometre
KZN	KwaZulu-Natal
LOM	Life Of Mine
LSU	Large Stock Unit
MAE	Mean Annual Evaporation
MAR	Mean Annual Run Off

MAMSL	Metres Above Mean Sea Level
MAP	Mean Annual Precipitation
Mg	Magnesium
MHSA	Mine Health and Safety Act, 1996 (Act No. 29 of 1996)
Mn	Manganese
MR	Mining Right
MM	Millimetres
Mt	Million Tons
MPRDA	Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)
m^3	Cubic Metres
Na	Sodium
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NO_3	Nitrates
NWA	National Water Act, 1998 (Act No. 36 of 1998)
PCD	Pollution Control Dam
PR	Prospecting Right
RBCT	Richards Bay Coal Terminal
ROM	Run of Mine
SMME	Small, Medium and Micro-Sized Enterpises
SO_4	Sulphates
T	Tons
TDS	Total Dissolved Solids
VAT	Value Added Tax
WMA	Water Management Area
WUL	Water Use Licence

1 INTRODUCTION

Financial Provisioning for Mine Closure is covered under the National Environmental Management Act's (Act No. 107 of 1998) (NEMA) Regulations Pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production Operations (GN R.1147) which was promulgated in November 2015. The regulations require a mine to conduct an annual review of the following:

- A final rehabilitation plan;
- An annual rehabilitation plan; and
- An environmental risk assessment.

The regulations aim to ensure that operating mines have a clearer understanding of what their operations will look like at the Life of Mine (LOM) and the risks associated with this. The overall goal is to ensure that there is adequate financial provision for rehabilitation if the mine undergoes sudden closure or once mining activities cease at the LOM. The closure vision, closure actions, post-closure monitoring and associated costs should be covered by the final rehabilitation plan. The NEMA regulations also place greater emphasis on the need for concurrent rehabilitation as required by the annual rehabilitation plan. The annual rehabilitation plan needs to contain a review of the previous 12 months rehabilitation activities, the proposed rehabilitation for the next 12 months of rehabilitation and the expected costs for conducting this. The annual rehabilitation plan needs to speak to the final rehabilitation plan as the two should work hand in hand. Mines are also required to compile and review an environmental risk assessment report. This report must highlight all possible and expected residual and latent and environmental risks which might take place after the cessation of mining.

Buffalo Coal (Pty) Ltd/Zinoju Coal (Pty) Ltd, hereafter referred to as Buffalo Coal, has appointed GCS Water and Environment (Pty) Ltd (GCS) to compile the required plans and reports for Aviemore Colliery (Aviemore) for the 2018 financial year. The following document contains the information required in terms of GN R.1147 for Aviemore. The costing model presented in this report aligns with these latest regulatory requirements. In addition, the key fundamental principles as per the guideline of the Department of Mineral Resources (DMR, 2005), as well as international good practice to ensure closure cost quanta are country and site-specific as well as market-related were also applied as appropriate.

Aviemore is an existing coal mine located in the KwaZulu-Natal (KZN) Province of South Africa, approximately 8 kilometres (km) north-northwest of the town of Dundee and approximately 325 km east-northeast of the City of Durban. Mining at Aviemore Colliery began in October 2000 under Mining Licence KZN341/2002. This licence was replaced by a "New order" Mining Right (MR) KZN 174 MR. Subsequent to the granting of this right, MR 301 was granted in June 2013 for what is referred to as Phase 1 of Aviemore's extension.

The existing mining area has an approved Environmental Impact Assessment/Environmental Management Plan (EIA/EMP) and is operating under MR174 and MR301 respectively. Buffalo Coal have recently converted their prospecting right (PR), 258PR, into a MR (MR10083). The existing mining rights are summarised in Table 1-1 – Existing Mining and Prospecting Rights at Aviemore . The coal reserve is situated between the R621 and P272 provincial roads, on the eastern, northern and western slopes of the Impati Mountain, with the Gus Seam being the target coal seam for the extraction of high-grade anthracite coal. The existing Aviemore Coal Mine is currently being mined on the extreme north-eastern flank of the Impati Mountain adjacent to the Morgenstond remaining reserves. The existing underground workings are accessed on the eastern side of the reserve, via a three portal adit.

Table 1-1 Existing Mining and Prospecting Rights at Aviemore Colliery

Reference Number	Area (ha)
174 MR	697.2268
301 MR	3162.685
10083 MR	1732.55

The underground workings in MR 174 have been mined out and mining started in MR 301 in 2015. The underground workings for the proposed MR 10083 will be an extension to the underground workings in MR 301. The proposed new Aviemore North Adit project will be located within MR 301 on farm Morgenstond 3347, to the north-west of the existing adit location. It is anticipated that mining will cease at the current Aviemore site in 2022, with operations and surface infrastructure relocated to the Aviemore North Adit site. The location of Aviemore is displayed in Figure 1-1.

A one (1) day site visit was undertaken at Buffalo Coal by Brendan Smith (GCS) on 20 February 2019, accompanied by Buffalo Coal's environmental coordinator Dineo Nyambose. The purpose of the site visit was to source information regarding the nature and extent of the operations and related activities on site. This assisted in identifying key closure related risks and gaining an understanding of the current status quo of the site, including rehabilitated areas and changes since the previous closure cost updated undertaken by GCS in 2018. This closure cost estimate has been compiled based on previous GCS closure reports and calculations, monitoring reports for the 2018 period, existing knowledge of Buffalo Coal's operations and observations from the site visit. This report reflects the outcomes of this dedicated site visit, approach, assumptions as well the computed closure costs, applying independent third party (contractor) unit rates for the cost determination.

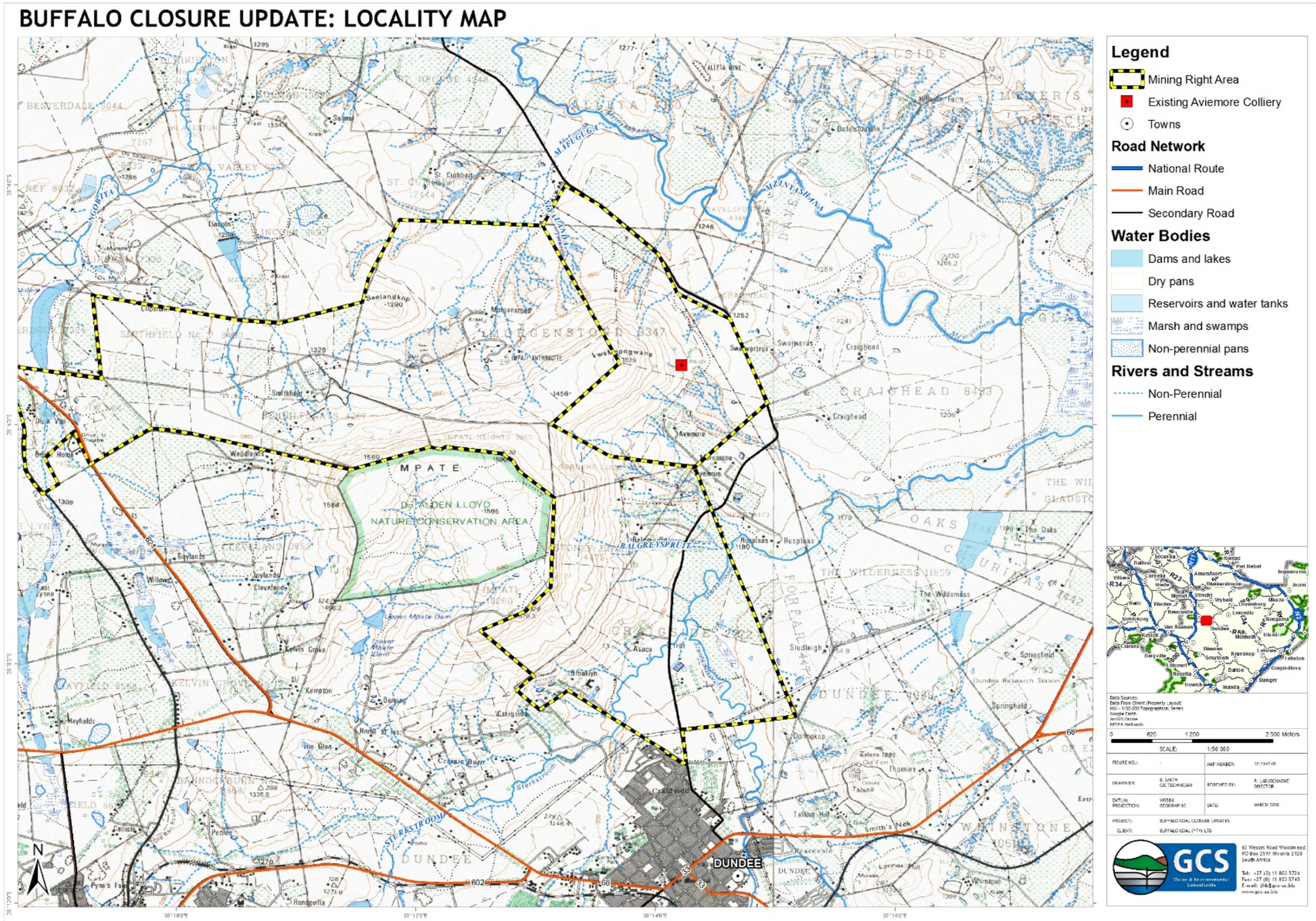


Figure 1-1 Aviemore Regional Locality

1.1 Existing Rehabilitation Plan

Aviemore currently has a rehabilitation plan which formed part of the approved Environmental Management Plan (EMP). Upon completion of the mining activities all disturbed areas will be rehabilitated to an agricultural land use (specifically grazing land), in line with the existing land use of surrounding properties. A re-vegetation programme will be implemented until the vegetation of the area becomes self-sustaining and a closure certificate is granted. This will be done in accordance with the relevant legislation and with approval from the relevant agencies. All excavations and voids will be backfilled and reshaped to a natural gradient (1:3), with all surface infrastructure removed and footprints rehabilitated.

1.2 Details of the Specialist

The details of the specialists responsible for preparing this report are contained in **Table 1-2**. The *curriculum vitae* (CVs) of the specialists are presented in **Appendix A**.

Table 1-2 Details of Specialist.

Name	Title	Professional Registrations	Years of Experience
Jacques Harris	Environmental Group Manager	Pri.Sci.Nat (No: 400363/13)	21
Brendan Smith	Environmental Consultant	-	8

2 SCOPE OF WORK AND APPROACH

The scope of work to develop a final rehabilitation, decommissioning and mine closure plan that is measurable, auditable and identifies a post-mining land use that is feasible, was achieved through:

- Introduction and Background of the mine;
- Legal context on new legislation;
- State of the current environment;
- Description of current infrastructure on the mine;
- An overview of the rehabilitated areas and required rehabilitation work to be undertaken;
- Undertaking a risk assessment;
- Providing the vision, objectives, targets and criteria for final rehabilitation, decommissioning and closure of the project;
- Outlining the design principles for closure;

- Detailing the closure actions that clearly indicate the measures that will be taken to mitigate and/or manage identified risks and describes the nature of residual risks that will need to be monitored and managed post closure;
- Committing to a schedule, budget, roles and responsibilities for final rehabilitation, decommissioning and closure of each relevant activity or item of infrastructure;
- Identifying knowledge gaps and how these will be addressed and actioned;
- Understanding of the relinquishing criteria of closure aspects; and
- Detailing the full closure costs for the life of project at increasing levels of accuracy as the project develops and approaches closure in line with the final land use proposed.

The project approach of GCS in undertaking the scope of works is detailed below:

- Conducting a site visit together with a representative of Buffalo Coal for the following purposes:
    - Source information regarding the current operations and activities on site;
    - Identifying key closure related risks;
    - Gather and collate information such as layout drawings to inform updates to the previous closure costing; and
    - Gaining an understanding of the current status quo of the rehabilitated areas and success thereof.
- Review available information and previous closure reports to create a knowledge base to inform the closure planning process;
- Devising a closure vision and associated closure measures to guide the closure planning as well as the operational activity to, as far as possible, seamlessly translate into the desired closure situation;
- Update unit rates for infrastructure dismantling, demolition and rehabilitation of disturbed areas;
- Update the bill of quantities based on observations during the site visit;
- Apply the above unit rates and associated quantities to update the previous closure costings based on the onsite observations; and
- Compiling the closure plan report.

3 LEGAL CONTEXT

The General Notification (GN R1147) under NEMA according to the new legislation now requires an applicant or holder of a right or permit to compile and annually review the following three reports:

1. A final rehabilitation plan;
2. An annual rehabilitation plan; and
3. An environmental risk assessment.

A full set of legal requirements for closure and rehabilitation is found in Appendix C of this documentation.

4 PROJECT CONTEXT

The current status of the various mining-related activities, rehabilitated area and the state of the surrounding environment, as described in the sections that follow, was used as the basis for the closure cost determination reflected in this report. This was also informed by a site visited conducted during February 2019. It is necessary to understand this context in order to determine an appropriate closure and land use vision for rehabilitation once mining activities at Aviemore cease. The environmental context of the project determines what rehabilitation activities can and can't be achieved once mining activities cease.

4.1 Current Mining Operations

Mining at Aviemore takes place underground, utilising conventional bord and pillar mining to work the Gus seam at a depth of 120 metres (m). The surface area disturbed by mining operations is relatively small. An adit (box cut) exists in the hillside and forms the entrance for the Gus seam mining operation. The existing coal processing site and rail facility for the Aviemore operation is located at Coalfields Processing Plant (Coalfields), in Dundee. The coal product is transported by rail, 280 km to the Richards Bay Coal Terminal (RBCT) for export and is also delivered to domestic customers by road transport (Provincial P272). There is no discard dump at Aviemore and the discard disposal facility at Magdalena Colliery is used. Run of Mine (ROM) material is washed in Dundee at Coalfields where there are pollution control measures such as berms and pollution control dams (PCDs) in place, and the separation of waste areas from storm water drains on site is practised.

The Aviemore underground mine has an estimated mineable measured and indicated coal resource of 35.35 million tons (Mt) of in situ coal with an estimated volume of 23.57 million cubic meters (m^3), and a production capacity of 45,500 tons (t) of anthracite coal per month. All mining is conducted underground, with an expected remaining LOM of 21 years (i.e. until 2037). The current mining method comprises of underground mining using drill and blast and traditional board and pillar techniques. Despite expansion to the underground mining area, no addition to or expansion of surface infrastructure is anticipated. However, a new North Adit and surface infrastructure will replace the current Aviemore site, which will be decommissioned and rehabilitated soon. The presence of a geological upthrow or coal seam displacement prevents mining continuity from the existing Aviemore adit access to the northern and western reserves and serves as the primary motivation for the new Aviemore North Adit location. At Aviemore's current ROM production of approximately 0.528 million tonnes per annum (Mtpa), access from the eastern side of the reserve will reach the end of its life by mid-2020.

4.2 Infrastructure

Aviemore is an underground mine site with a small surface footprint. Surface infrastructure comprising of:

- A fuel storage facility;
- Workshop;
- Haul and Access Roads;
- Change house and ablutions;
- Adit / Box Cut;
- Magazine;
- Topsoil stockpiles;
- Septic tanks;
- Hard parking areas; and
- Site offices.

A steel framed, galvanized clad workshop exists in the adit area and containerised offices are situated on the levelled spoil heaps that were created from the material excavated from the

original box cut. Brick and mortar ablutions, incorporating a septic tank and French drains, are situated alongside the offices. All mined material is transported to Coalfields for processing and all waste is transferred for disposal at the Magdalena discard dump.

The layout of Aviemore is shown in Figure 4-1.

Figure 4-1 Aviemore Site Layout

4.3 Mining Works Schedule

Mining at Aviemore began in October 2000 under Mining Licence KZN341/2002. Current mining operations extract approximately 40,000 ROM tons per month. As previously mentioned, there are no surface mining operations as all mining is conducted underground. Access to the underground operations is through a single adit. Despite expansion to the underground operations, there has been little addition to or expansion of the surface infrastructure at Aviemore. Material is only temporarily stored at Aviemore, before being transported to Coalfields for processing. All ROM material will be processed at Coalfields and the discard generated will be transported to the Magdalena discard facility. Mining will continue as an underground mining operation until the anticipated end of LOM (2037), with the closure of mining operations from the existing Aviemore Adit and commissioning of the Aviemore North Adit expected in mid-2020. It is anticipated that the current Aviemore site will be decommissioned, as much surface infrastructure as possible will be transferred to the new North Adit site and the development footprint rehabilitated.

Figure 4-2 shows the underground mining schedule until the end of mining operations (2037).

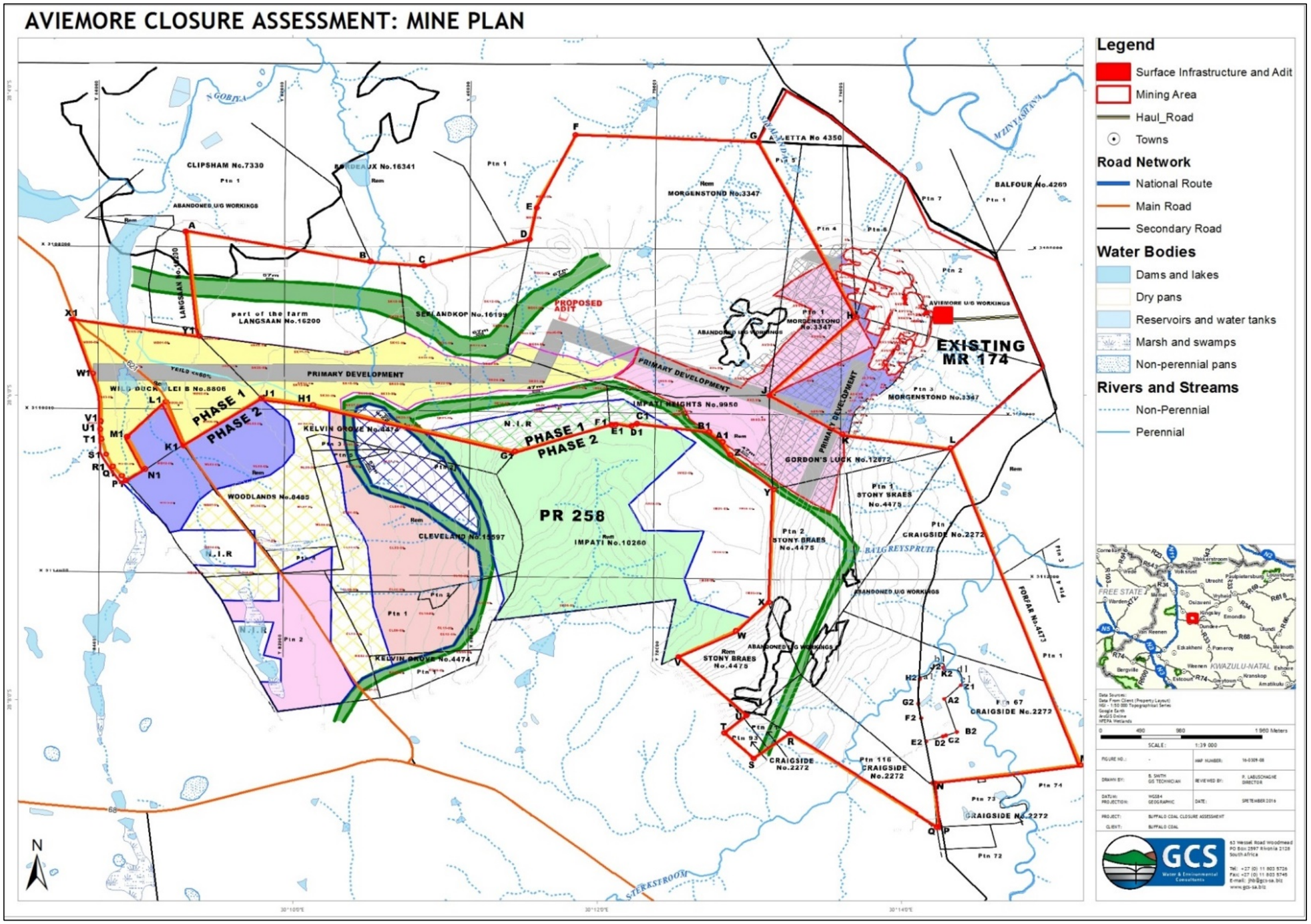


Figure 4-2 Aviemore Mine Plan

4.4 State of the Environment

The social, environmental and economic context within which Aviemore is located is described in the sections that follow. It is necessary to understand this context in order to determine an appropriate closure and land use vision for rehabilitation at Aviemore. The environmental context of the project determines what rehabilitation activities can and can't be achieved once mining activities cease. An overview of the conditions at Aviemore are thus outlined in the sections that follow. The environmental components which could influence closure planning have been included. These include pre-mining land use and land capability studies, topography, geology and soils, vegetation, local hydrology and geohydrology.

4.4.1 Climate

Climatic conditions influence the potential and extent for environmental impacts, as well as considerations for mine and infrastructure design. Specific issues in this regard include:

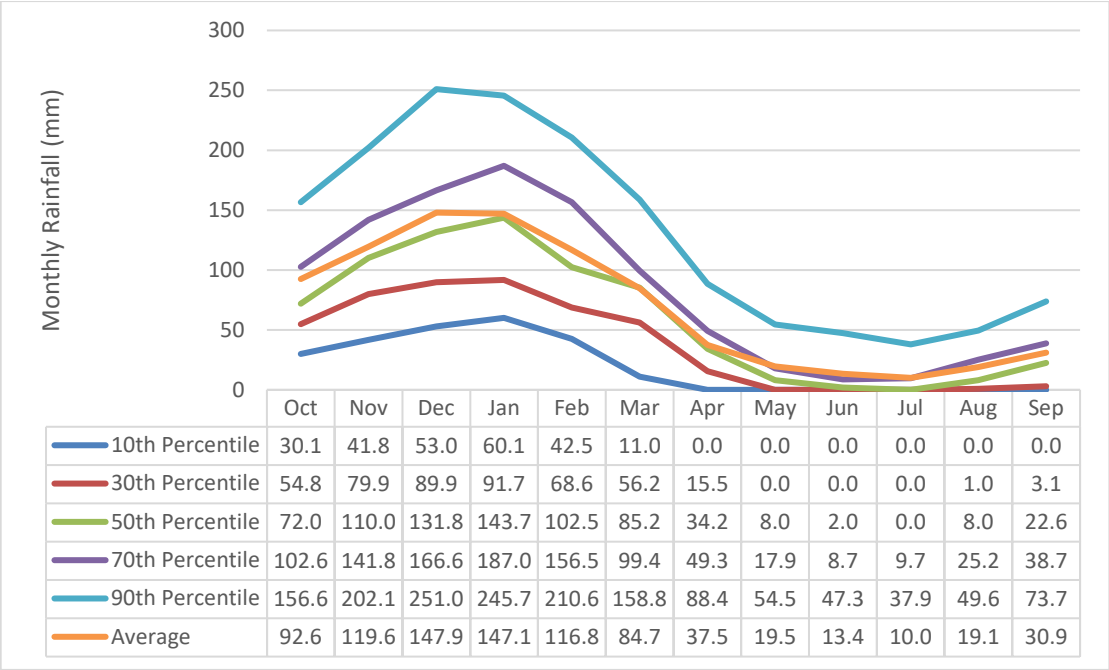
- Temperature influences vegetation growth and evaporation which could influence dust management and rehabilitation planning, and is linked to atmospheric stability thus influencing air dispersion;
- Rainfall influences surface water management planning, erosion, vegetation growth, rehabilitation planning, dust suppression and evaporation;
- Wind influences erosion, the dispersion of potential atmospheric pollutants, and rehabilitation planning.

Aviemore is located approximately 7.5 km North of Dundee and has an altitude of 1,300 - 1,519 meters above mean sea level (mamsl). The climate at Aviemore is warm and temperate with a Koppen-Geiger climate classification of *Cwb* (warm temperate, winter and hot summer) (Conradie, 2012). Summers are warm to hot, with the winters being cold to mild. The monthly distribution of average daily maximum temperatures (in degrees Celsius (°C)) shows that the average midday temperatures for Dundee range from 18.6°C in June to 25.9°C in January. The region is the coldest during July when the mercury drops to 2.7°C on average during the night. Frost occurs during the months between May and September.

4.4.1.1 Rainfall

Rainfall for the site is based on 81 years of record obtained from the Water Resources of South Africa Report 2012 (WR2012) (WRC, 2015). The WR2012 records indicate a long term average of approximately 839 mm per annum (Figure 4-3). The month with the highest average values is that of January (240mm), with the lowest month being July (38mm).

In addition, a daily rainfall data record in the vicinity of the mine was used from the South African Weather Service (SAWS) (Glencoe, 0335250_W) to verify average rainfall. This station had a historical record of 81 years and indicated a long term average of approximately 832 mm per annum, which confirmed the WR2012 record for the Aviemore site area.



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
10th Percentile	30.1	41.8	53.0	60.1	42.5	11.0	0.0	0.0	0.0	0.0	0.0	0.0
30th Percentile	54.8	79.9	89.9	91.7	68.6	56.2	15.5	0.0	0.0	0.0	1.0	3.1
50th Percentile	72.0	110.0	131.8	143.7	102.5	85.2	34.2	8.0	2.0	0.0	8.0	22.6
70th Percentile	102.6	141.8	166.6	187.0	156.5	99.4	49.3	17.9	8.7	9.7	25.2	38.7
90th Percentile	156.6	202.1	251.0	245.7	210.6	158.8	88.4	54.5	47.3	37.9	49.6	73.7
Average	92.6	119.6	147.9	147.1	116.8	84.7	37.5	19.5	13.4	10.0	19.1	30.9

Figure 4-3 Monthly rainfall distribution at the Aviemore Adit

4.4.1.2 Evaporation

Mean Annual Evaporation (MAE) data used for this site is based on the 1 494 mm/year Symons Pan (S-Pan) evaporation and Evaporation Zone 21A (WRC, 2015). Evaporation is likely to be distributed as presented in Figure 4-4.

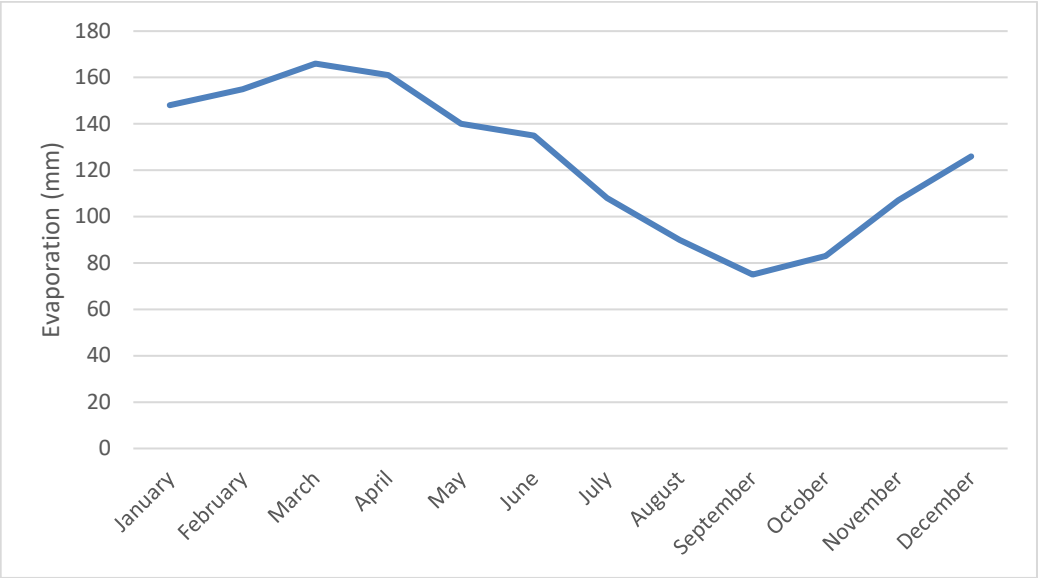


Figure 4-4 S-Pan Evaporation for Aviemore Adit (WRC, 2005)

4.4.2 Topography

Aviemore falls within the V32E catchment and is within the uThukela Water Management Area (WMA). The surrounding river systems are the Sterkstroom, Mzinyashana and Ngobiya Rivers. The Ngobiya River is connected to three (3) large dams in the area. The adit and associated surface infrastructure (offices, workshops, haul road etc.) for Aviemore is located on Portion 2 of Farm No. 3347, Morgenstond. This property has several non-perennial water sources in its northern section, draining north into the Mzinyashana River. Additional non-perennial water sources occurring within the southern section of the mining area drain south-southeast into the Sterkstroom River. A channeled valley-bottom wetland body exists in this southern portion.

The Aviemore area is characterised by a mountainous landscape, located on the northern and eastern slopes of the Mpate Mountain approximately 7.5 km north-northwest of the town of Dundee. This is a mountainous area with the side slopes varying from 15 - 35%. The box cut, forming the entrance to the mine, is in the 15 - 20% slope region along the mountainside (refer to Figure 4-5). Surface infrastructure is located on the gentler slopes (between 2.5 - 5.0%) at the foothill of the Mpate Mountain, which rises steeply to the West of the mine site to a height of approximately 1,590 metres above mean sea level (mamsl). The site offices are located at approximately 1,308 mamsl. Eastwards of this mine adit and offices, the slopes become gentler ranging from 1,308 mamsl at the site offices, to 1,260 mamsl at the end of the haul road (approximately 890 m away), where it meets the P272 road.

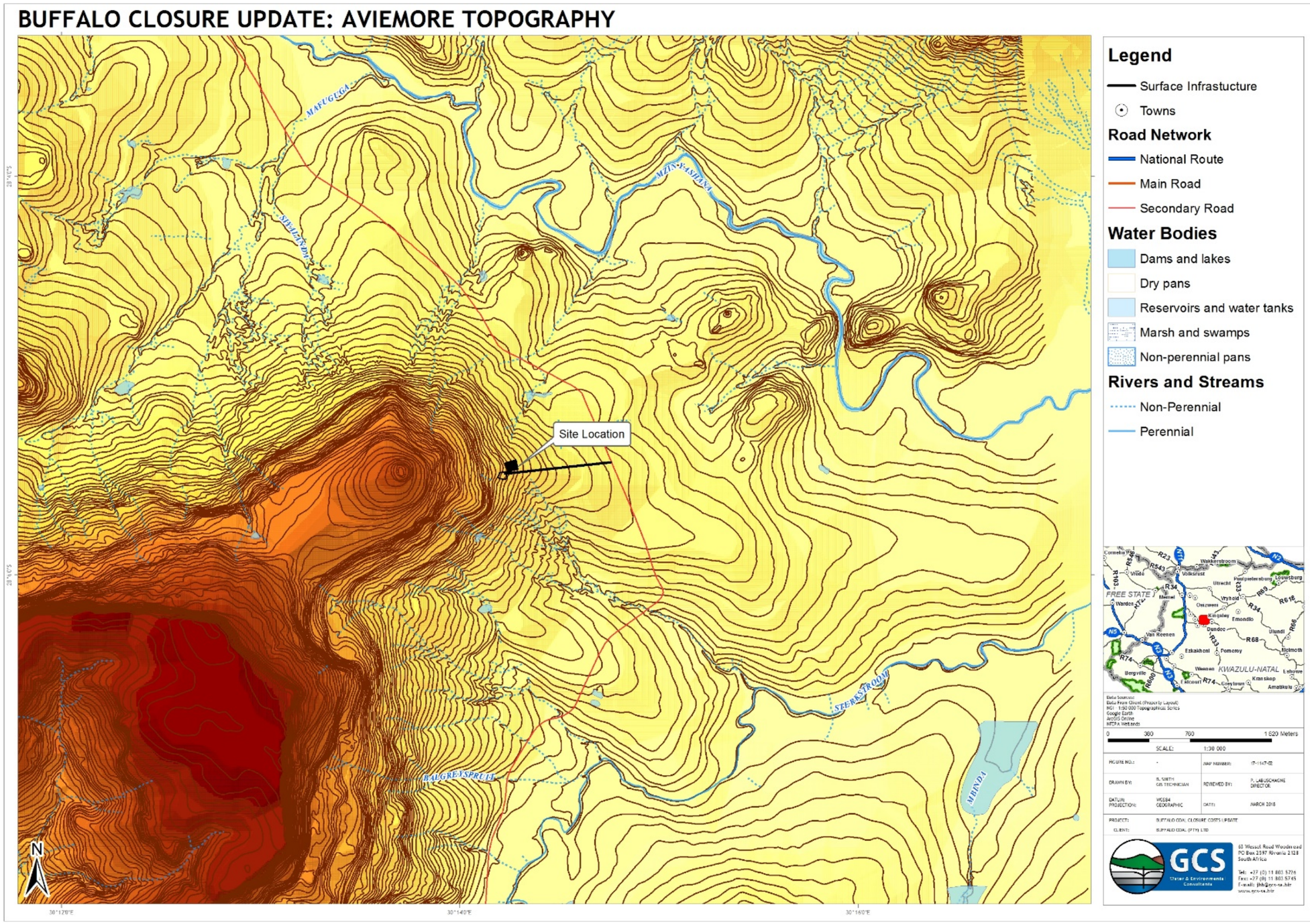


Figure 4-5 Aviemore Topographical Map

4.4.3 Geology and Soils

The Aviemore reserve is situated on the eastern side of the northern most part of the Mpate Mountain. The coal horizon is situated in the Middle Ecca Series (Vryheid Formation) which consists of sandstones, shales, silty mudstones and various coal horizons (Figure 4-6). There is an overlying dolerite sill, the base of which is approximately 85 m above the coal seam. The coal horizon is situated in the Middle Ecca Series (Vryheid formation) of the Karoo System. This formation comprises sandstone, shale, silty mudstone and other silty interbeds.

An upper dolerite sill of approximately 40 m thickness caps the higher reaches of the Impati Mountain in the south. A second major sill at a lower elevation and varying in thickness between 50 - 70 m in the south-west, overlies the coal measures. The base of this sill is at approximately 1,380 mamsl and, on average is 80 m above the Gus coal seam. Towards the north-eastern section of the reserve the sill parts. The lower intrusion of approximately 40m thickness occupies an elevation range of between 1,325 – 1,365 mamsl.

Soils in the general area are shallow and are derived from shales and mudstones of the Ecca Group of the Karoo Sequence. The predominant soils are Glenrosa, Mispa, Clovelly and Cartref (Figure 4-7). The average clay percentage of these soils ranges from 20 - 30%. The soils are situated on a southeast slope (12 - 15%) that is conducive to a high erosion potential if not protected. They have no arable significance and are therefore regarded as rangeland/grazing land soils. .

The land capability of the Aviemore environment is primarily grazing but the encroachment of *Lantana Camara* has diminished the grazing value of the land over time. Land use at the site is currently restricted to mining and grazing. Due to the combination of poor soils and encroachment of alien invasive species, the nature of agriculture should be limited to small scale grazing.

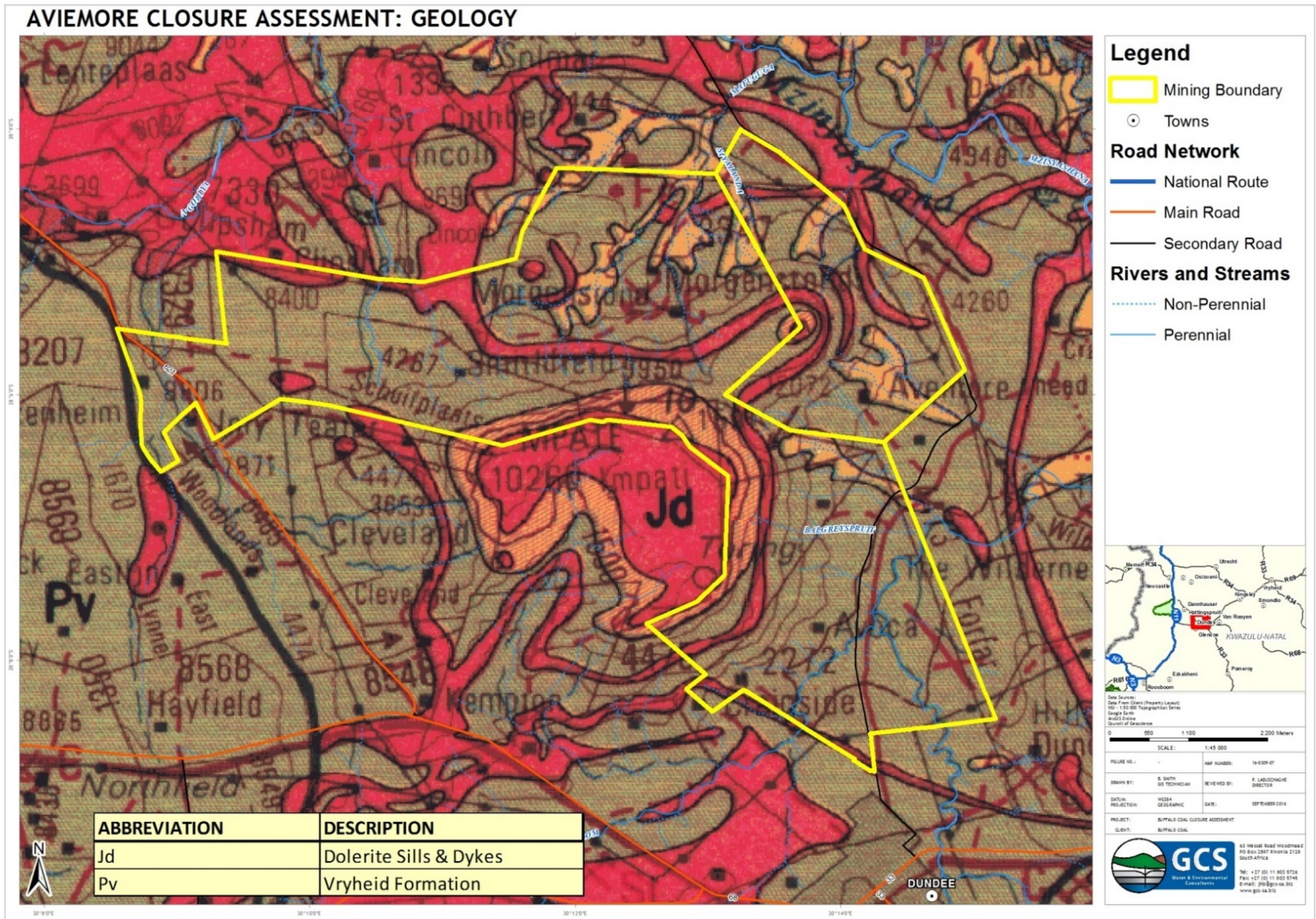


Figure 4-6 **Geology of the Surrounding Area**

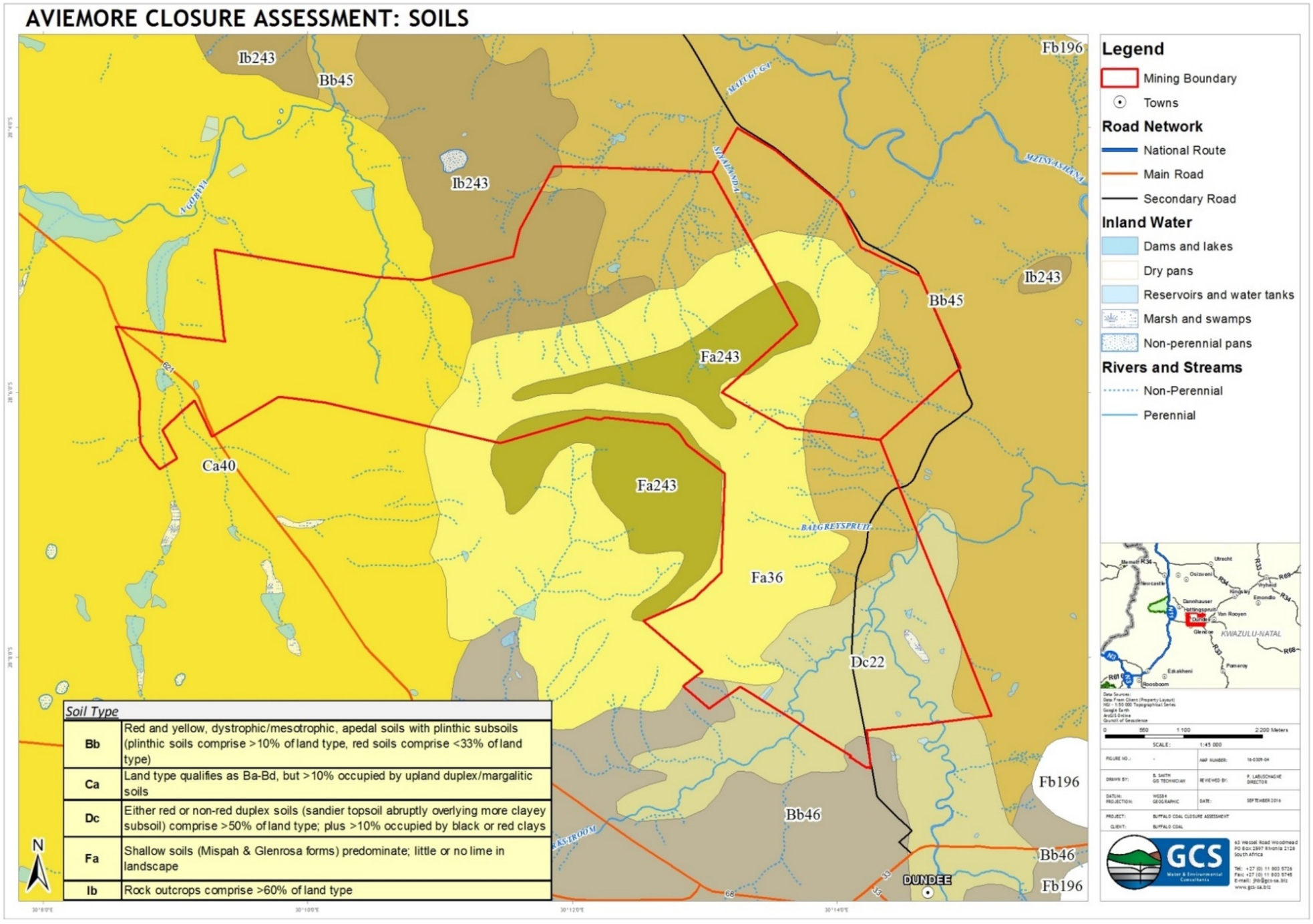


Figure 4-7 Soil Types across the Site

4.4.4 Biodiversity

The area falls within the moist tall grassveld, bushland area of the Northern Natal Midlands. Much of the mining area remains covered in natural vegetation, which is in fair condition, although degraded to some extent by cattle in parts. The project area falls within the Grassland Biome, and includes vegetation types, as defined by Mucina & Rutherford (2006), national (South African National Biodiversity Institute 2012) and provincial vegetation (Scott-Shaw & Escott 2011). The predominant vegetation in the Aviemore Colliery area includes Northern KwaZulu-Natal Moist Grassland and Thukela Thornveld. Low Escarpment Moist Grassland occurs over small parts of the project area (**Figure 4-6**).

Northern KwaZulu-Natal Moist Grassland Distribution is situated almost entirely within the catchment of the Thukela River. The most extensive areas are in the vicinity of Winterton, Bergville, Fort Mistake, Dannhauser, Dundee, north of Ladysmith and west of Newcastle. The conservation status is Vulnerable, with little statutorily conserved. Alien Acacia dealbata, Rubus, Eucalyptus and Populus are invasive in places. Bush encroachment is common (Mucina & Rutherford 2006). Income Sandy Grassland is found in a large triangle between Newcastle, Vryheid and Dundee. The landscape comprises very flat extensive areas with generally shallow, poorly drained, sandy soils supporting low, tussock-dominated sourveld forming a mosaic with wooded grasslands and on well-drained sites with sparse woodlands. The conservation status is vulnerable and none is statutorily conserved. No biogeographically important or endemic species are listed for this type (Mucina & Rutherford 2006).

The land capability of the Aviemore Colliery environment is primarily grazing but the encroachment of *Lantana Camara* has diminished the grazing value of the land over time. Land use at the site is currently restricted to mining and grazing.

4.4.5 Mammals

Approximately seventy-three species of mammal are known to occur or likely to occur within the region (Friedmann & Daly 2004, Skinner & Chimimba 2005, Monadjem et al. 2010), and a fair proportion of these are expected to be present on the property. The community is expected to consist primarily of a small number of rodents, shrews and small carnivores, some species of bats, and small number of antelope species.

4.4.5.1 Rare and Threatened Species

Eight species of conservation importance are known to occur in the broader region (Child *et al*. 2016 2004; Monadjem *et al*. 2010), (Table 4-1). Most are expected to be rare or absent from the study area, given the lack of appropriate habitat, however, a few may occur in small numbers.

Table 4-1 Rare and threatened mammals occurring or likely to occur.

Common Name	Scientific Name	Conservation Status	Comment	Occurrence within the study area
African Marsh Rat	*Dasymys imcomtus*	RD – NT	Confined to rank vegetation in and adjacent to wetlands in grassland.	If present, will be very localised and patchily distributed within limited suitable habitat along the main drainage line.
African Striped Weasel	*Poecilogale albinucha*	RD - NT	Occurs primarily in good quality grassland	Could occur in small numbers in the northern and western grassland portions of the property
Brown Hyena	*Parahyena brunnea*	RD – NT	Occurs widely at low densities in a variety of natural habitats	If present, would occur infrequently or at very low densities
Serval	*Leptailurus serval*	RD – NT	Requires dense, reasonable quality grassland, primarily in proximity to wetlands.	Habitat is sub-optimal on site, but may occur rarely in grassland areas, primarily close to the main drainage line
Cape Clawless Otter	*Aonyx capensis*	RD - NT	Occurs in perennial waterbodies	Likely to be rare or absent, given limited, suboptimal aquatic habitats present.
White-tailed Mouse	*Mystromys albicaudatus*	RD – VU	Occurs patchily and at low densities in reasonable quality grassland.	May be present in grassland patches north of the main drainage line.
Oribi	*Ourebia ourebi*	RD – EN	Occurs in good quality grassland, where a mosaic of short and taller grass is present.	May occur patchily and at low densities In reasonable quality grassland in the northern portion of the property
Mountain Reedbuck	*Redunca fulvorufula*	RD - EN	Occurs in mountainous grassland.	Unlikely to be present – habitat unsuitable.

(EN = Endangered, VU = Vulnerable, NT = Near Threatened, DD = Data Deficient)

4.4.6 Birds

The project area falls within a broader area that supports a moderate diversity of species, with 280 species recorded in the Quarter Degree Cell (QDC) and around 155 species for the well-surveyed pentad (ca 9 x 9km square) that incorporate the study site (Harrison *et al*. 1996, SABAP2 2014, Harvey, 2017), and it is likely that the site regularly supports most of the species recorded for the pentad. The composition reflects the habitats available, with woodland and generalist species dominant, and some grassland species in the open grassy areas. Species reliant on aquatic habitats will be moderately represented, given the lack of extent and quality of this sort of habitat on site.

Important Bird and Biodiversity Areas (IBAs) are sites of global significance for bird conservation, identified nationally through multi-stakeholder processes using globally standardised, quantitative and scientifically agreed criteria (Marnewick *et al*. 2015). The criteria for the identification of IBAs are based on the presence of:

1) Threatened species;
2) Assemblages of restricted-range and biome-restricted species; and
3) Large concentrations of congregatory species, referred to collectively as IBA 'trigger' species.

Currently, there are 98 global and 14 subregional IBAs recognised in South Africa (Marnewick *et al*. 2015). Comparison with South Africa's network of IBAs shows that the study site does not fall within or close to any IBAs; the closest IBA is Chelmsford Dam, located approximately 25km north-west of the study site.

4.4.6.1 Rare and Threatened Species

Several rare and threatened bird species have been recorded within the (Harrison *et al*. 1996, SABAP2 2014, Taylor *et al*. 2015) (Table 4-2). The majority of these are expected to be rare or absent from the study site however, given the absence of appropriate habitats. A small number may occur occasionally in the open grassland areas, while some predatory birds may forage widely across the less wooded areas of the site.

Table 4-2 Rare and threatened birds occurring or likely to occur

Common Name	Scientific Name	Conservation Status	Comment	Occurrence within the study area
Denham's Bustard	*Neotis denhami*	RD- VU	Open grassland specialist, restricted to areas of good quality grassland	May occur rarely in open grassland areas in the north
Blue Crane	*Anthropoides paradiseus*	RD - NT	A grassland specialist, restricted to areas of good quality grassland	May occasionally feed in open grassland areas in the north
Grey Crowned Crane	*Balearica regulorum*	RD - EN	Open, grassy wetlands.	Suitable habitat is not present within the study area. Will be rare or absent.
Martial Eagle	*Polemaetus bellicosus*	RD - EN	Occurs widely but at low densities in woodland and wooded grassland.	May forage occasionally over the study area
Verreaux's Eagle	*Aquila verreauxii*	RD - VU	Associated with mountainous areas where it nests, foraging in adjacent natural vegetation. Seemingly rare in the area.	Likely to be rare or absent over the study area.

Lanner Falcon	*Falco biarmicus*	RD - VU	Breeds in mountainous areas or tall trees, utilizes surrounding natural habitats.	May breed in adjacent mountainous areas, and forage over the study area
Greater Flamingo	*Phoenicopterus roseus*	RD - NT	Shallow, open water habitats	Habitat is not present within the study area. Will not occur.
African Marsh Harrier	*Circus ranivorus*	RD - EN	Open grassland, particularly in the vicinity of wetlands.	Habitat is not present within the study area. Will not occur.
Southern Bald Ibis	*Geronticus calvus*	RD - VU	Breeds in mountainous areas. Forages in adjacent open habitats, particularly grassland, occasionally agricultural land.	May occasionally utilize open grassland areas.
White-bellied Korhaan	*Eupodotis senegalensis*	RD - VU	Restricted to upland grassland	May occasionally utilize open grassland areas north of the main drainageline and possibly in the Northern Adit area; however, habitat is suboptimal.
African Grass Owl	*Tyto capensis*	RD - VU	Restricted to rank, grassy vegetation, in and adjacent to wetlands. Rare in the area.	Suitable habitat is largely absent, and it is expected to be rare or absent from the study site
Secretarybird	*Sagittarius serpentarius*	RD - VU	Occurs in grassland and open woodland. Regularly recorded in the area.	May forage within the more open areas of the study area.
Black Stork	*Ciconia nigra*	RD - VU	Breeds in mountainous areas. Forages in adjacent open habitats, particularly along rivers.	May breed on adjacent mountain, and occasionally forage on site in the vicinity of the main drainageline.
Half-collared Kingfisher	*Alcedo semitorquata*		Perennial streams and coastal lakes in good condition	Habitat is not present within the study area. Will not occur.

(EN = Endangered, VU = Vulnerable, NT = Near Threatened, DD = Data Deficient)

4.4.7 Land Use and Land Capability

Besides mining, commercial agriculture is the main land use activity occurring within and surrounding the proposed mining area, particularly grazing. The proposed mining right area is surrounded by farms used predominantly as grazing land for cattle.

The land capability of the Aviemore environment is primarily suited for grazing. The area in the immediate surrounds of the box cut site is steep with shallow rocky soils suited only to grazing. The encroachment of Acacia species and *Lantana camara* have diminished the grazing value considerably over the years. The majority of the project area comprises of vacant/unspecified land use, with cultivated land extending from the western border and encompassing small regions of land within this south eastern and northern border of the mine area. A small portion on each of the farms within the Phase 2 project area (Craigside, Seelandkop, Morgenstond, Langstaan and Wild Duck Vlei B [entire farm]) are designated as arable land. A small portion of Seelandkop, Morgenstond, Langstaan are also designated to Wilderness. It is important to note that the proposed mining and its associated activities will not affect the surface environment, existing land uses or land capability of the proposed area as there will be no surface disturbance and the existing land uses will continue. Land use at the project site is currently restricted to the following classes: underground mining and commercial agriculture (primarily grazing). The pre-mining land use has been that of agriculture, primarily grazing.

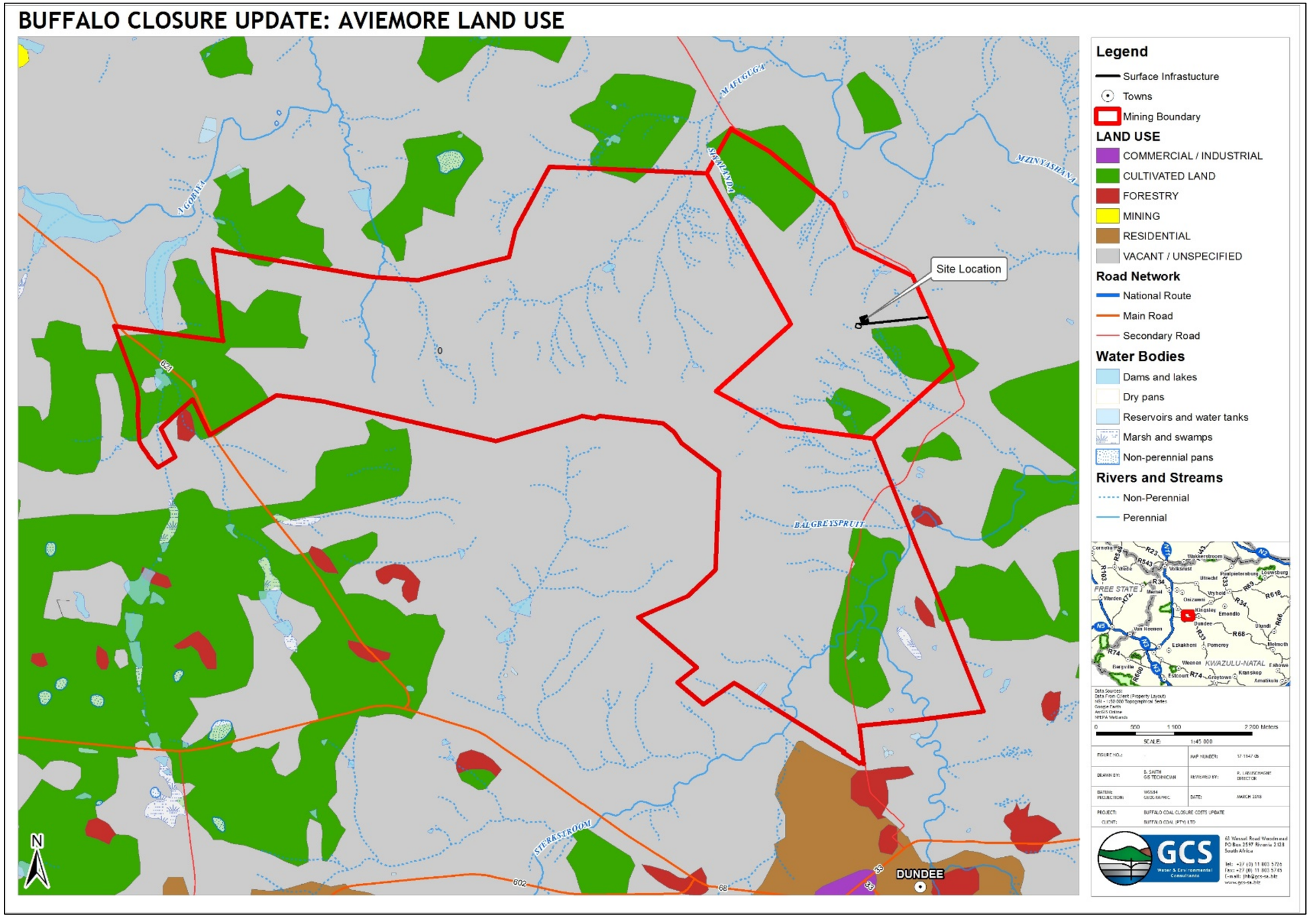


Figure 4-8 **Land cover Map of the Aviemore Area**

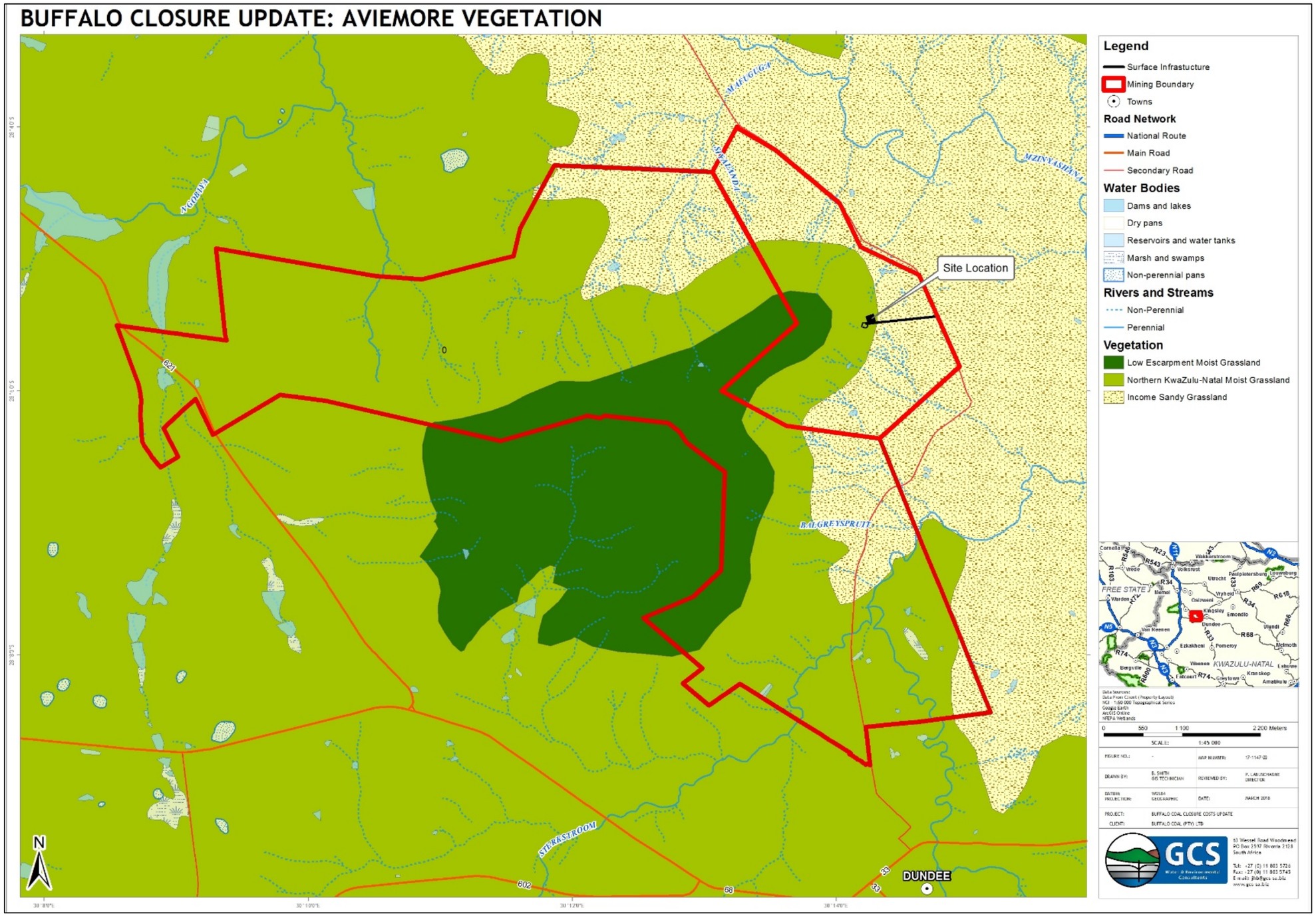


Figure 4-9 Vegetation Map of the Aviemore Area

4.4.8 Socio-Economic

The economic development of Dundee can be attributed to the coal mining operations in the area. The first commercial coal mine in the district was opened in Dundee in the 1970s. As the world demand for coal increased dramatically this resulted in an increased export of the commodity, and the mines in the region gained a relatively large share of the export market. The sector, however, experienced a decline in the late 1980s and early 1990s. The sector faced challenges due to the reduced price of coal due to over-supply and the low grade of coal found in the area, compared with suppliers from other parts of the country. This resulted in the closure of several mines in the area. The coal mining industry is currently undergoing a restructuring process. According to the Umzinyathi District Municipality Integrated Development Plan (IDP) Review (2015/2016, there is a decline in corporate interest in the industry, however there is interest in the small-scale regeneration of the coal belt for Small, Medium and Micro-sized Enterprises (SMME) development.

The town of Dundee falls within the Endumeni Local Municipality. Most of the district population resides within rural areas and the municipal population spread unevenly among the six (6) municipal wards with the average total population ranging from 7,335 in Ward 1 to 9,336 in Ward 4. Wards 4 and 5 (area located just outside of Dundee) contains the highest population and Wards 2 and 6 are the least populated. Dundee town forms part of Ward 6 which makes up a large part of the municipal area. Endumeni is one of the key employment areas within the district. Residents of the municipal area rely on the larger urban centres of Dundee and Newcastle for employment opportunities and higher order goods and services. The mining sector also provides employment, which is another contributing factor in terms of the economic and district growth as well.

An assessment of poverty in KwaZulu-Natal Province undertaken using the Human Development Index (HDI) approach revealed that the Umzinyathi District Municipality has the second lowest HDI within the province. Notwithstanding this, the standard of living in Endumeni is better than the other parts of the district. It has the least number (46.6%) of households with real income below R 6,000 per month and 46% unemployment as opposed to 56% at a district level. It has the least number of people living in poverty. The education profile of the Endumeni Local Municipality population has improved from the situation in 2001.

With specific reference to the contribution that Aviemore has to the socio-economic environment, the current production rate at Aviemore is approximately 40,000 ROM tons per month. The expansion of the current mining activities will increase production to approximately 59,000 ROM tons per month, thus creating additional employment opportunities and extending the current LOM (and subsequent employment).

4.5 Stakeholder Issues and Comments

Stakeholder issues and comments related to closure and rehabilitation are provided in **Table 4.5**. These comments were raised by Interested and Affected Parties (I&APs) during the environmental assessment process for phase one of mining operations at Aviemore, conducted by GCS (2011). The comments provided by the Environmental Assessment Practitioner (EAP) during this process are also provided in **Table 4.5**. These comments and responses have been incorporated into the closure and rehabilitation measures contained within this plan. The additional environmental assessment processes undertaken for Phase 2 and the Aviemore North Adit received limited public interest.

Table 4.3 Stakeholder Issues.

Issue/Comment	EAPs Response
Contamination of main water supply to Dundee as Wild Duck Vlei falls within the main catchment.	The groundwater model provides insight on possible contamination plumes.
Collapses/Exclusion zone around buildings.	The mine is conducting investigations regarding the mining method and depth specifications so that no impact on surface infrastructure will occur.
Location of shafts, washing plant and storage of coal.	There will be no additional surface infrastructure constructed on site. The existing adit will be used and there is no washing plant at Aviemore Colliery. The mined-out material will be transported to the Coalfields Plant for washing and processing.
Grazing and farming activities.	There is no surface disturbance expected at proposed Phase 1 mining areas. Furthermore, cattle where found grazing along the adit access road. This re-iterates that proposed mining activities may not impact current land use and capability of proposed mining extension areas.
Water sourced from the fountains out of the mountain.	The mining company will need to provide the best possible solution for any impact for which it is responsible should it be water or land usage.
Surface and groundwater quality and quantity (current and future).	On-going monitoring will be conducted and annual water monitoring reports will be sent to the Department of Water and Sanitation (DWS) and I&APs who request it.
Fauna and flora study should be conducted.	KwaZulu-Natal (KZN) Wildlife have been contacted and data provided by them regarding predominant vegetation in the area. A detailed site survey is not necessarily due to the underground nature of the mining operation.
Which roads will be used to haul coal?	The existing haul road and transport rout will be used.
Consultation with landowners is required before surface usage of the property.	The mine management have agreed that consultation with landowners is necessary before surface usage of property.

Issue/Comment	EAPs Response
Dust.	Management have issued the instruction that the trucks carrying coal fines must have sails over the load bins to stop coal particles leaving the truck. Management have instructed all operators transporting slurry to ensure that the rear door seals properly when transporting this product. Transgression of theses instructions is unacceptable and members of the public are asked to report any misdemeanour in this regard.
Washing down of the backfill used to make a terrace at the adit, the soil washes down to the kraal.	The Manager of the Mine, Mr Dave Steward has agreed to rectify the matter (washing down of backfill). This will be monitored regularly.
Will rehabilitation of the mine be addressed in the EMP.	Mine rehabilitation has already been dealt with in the existing EMP and will be revised and brought into line with the latest regulations, in the compilation of the latest EMP, if necessary.

4.6 Monitoring Network

The monitoring network at Aviemore consists of biannual biomonitoring, with annual reports submitted to the Department of Water and Sanitation (DWS). Monitoring also includes the undertaking of quarterly ground and surface water monitoring with the submission of annual reports to the DWS. It should be noted that elevated salt concentrations are typical of this area, both groundwater and surface water environment. Therefore, elevated EC, TDS, sodium and chloride values are anticipated. Additionally, elevated calcium and magnesium is associated with the geological conditions in the area. Focus will be allocated to typical mine water indicator elements, specifically pH, sulphate and metals. However, increasing concentrations of these indicator elements will also result in an increased salt load.

4.6.1 Water Monitoring Network

The monitoring network at Aviemore consists of nine boreholes, refer to Table 4-4; four boreholes were part of the original monitoring program (specifically AV2, AV4, AV6 and AV8), two boreholes were added to the monitoring program in 2016 (specifically Swart Dam BH and JBBH2) and three new boreholes were added in the Third Quarter of 2018 for the proposed North Adit (specifically NADITBH1, NABH1 and NABH2). Boreholes AVBH1, BH4 and IH4 were removed from the monitoring network during the Third Quarter due to limited access to the sites and water levels deeper than 100 m. Additionally, borehole POT BH1 was sampled in the Fourth Quarter. Ten groundwater sites were sampled during the Fourth Quarter monitoring event.

The location of the surface water monitoring points are located at the mining right boundary, in order to monitor the surface water quality of streams exiting the mining right area. There are currently twenty surface water monitoring points, these are summarized in Table 4-5. Emslies Spring, Balgrey Channel and Balgrey PCD were added to the monitoring network in the Fourth Quarter. Most of the surface water sites are typically dry. Five surface water sites were sampled during the Fourth Quarter monitoring event. The locations of the monitoring points around Aviemore are shown in Figure 4-10.

Table 4-4 Groundwater monitoring points at Aviemore

Sample ID	Description	Latitude	Longitude	Status			
				Mar 2018	Jun 2018	Sep 2018	Dec 2018
AV2	Borehole 300m down gradient, north east of underground workings.	-28.0870	30.2377	●	●	●	●
AV4	Borehole next to entrance road to site.	-28.0909	30.2421	●	●	●	●
AV6	Borehole 185m down gradient, south east of underground workings.	-28.0967	30.2364	●	●	●	●
AV8	Borehole 790m down gradient, north east of underground workings.	-28.0870	30.2403	●	●	●	●
Swart Dam BH	New monitoring point. Farm borehole, located in future designated mining area.	-28.1016	30.1940		●	●	●
JBBH2	New monitoring point. Borehole located in Farmer's yard.	-28.0998	30.1864	●	Limited Space for Bailer		
NADITBH1	New borehole adjacent to new North Adit, near farm dam used for livestock watering.	-28.0926	30.1930			Limited Access	●
NABH1	New abstraction borehole for the new North Adit, near a dammed stream.	-28.0894	30.1955			Limited Access	●
NABH2	New abstraction borehole for the new North Adit, near a dammed stream.	-28.0894	30.1956			Limited Access	●
POT BH1	Borehole at Balgray farm owned by Mr Potgieter for private use.	-28.14120	30.21369				●

● Sampled

Table 4-5 Surface water monitoring points at Aviemore

Sample ID	Description	Latitude	Longitude	Status			
				March 2018	June 2018	Sep 2018	Dec 2018
AS1	Non- perennial stream flowing north of the mine.	-28.0732	30.2141	●	●	Dry	Dry
AS2	Non- perennial stream flowing north of the mine.	-28.0735	30.2158	Dry	●	Dry	Dry
AS3	Dam downstream, north east, of site.	-28.0847	30.2408	●	●	●	●

Sample ID	Description	Latitude	Longitude	Status			
				March 2018	June 2018	Sep 2018	Dec 2018
AS4	Non- perennial stream flowing north east of the mine.	-28.0819	30.2383	Dry	Dry	Dry	Dry
AS5	Non- perennial stream flowing north east of the mine.	-28.0756	30.2332	Dry	Dry	Dry	Dry
AS6	Non- perennial stream flowing east of the mine.	-28.1016	30.2451	●	●	●	Dry
AS7	Non- perennial stream flowing east of the mine.	-28.1104	30.2400	●	●	Dry	Dry
AS8	Non- perennial stream flowing south east of the mine.	-28.1173	30.2428	●	Dry	Dry	Dry
AV Spring	Spring water collected by farmer for bottling. Sample is taken from animal trough.	-28.0981	30.2350	●	●	●	●
SCH Spring	Farm spring.	-28.0992	30.2062	Limited Access			
JB Font 1	Farm spring, close to Swartdam.	-28.1024	30.1881	●	●	●	●
Emslies Spring	New monitoring point. Farm spring, Langsaan.	-28.0851	30.1798				●
Balgrey Channel	New monitoring point. Water from the old Balgrey Mine.	-28.13542	30.21864				●
Balgrey PCD	PCD at the old Balgrey Mine	-28.13802	30.22383				●
GK Spring 1	Spring collected at farmhouse.	-28.1035	30.2230	●	●	●	Dry
GK Spring 2	Non-perennial spring south east of Aviemore.	-28.1131	30.2292	●	●	Limited Access	
GK Spring 6	Non-perennial spring south east of Aviemore.	-28.1088	30.2335	Dry	Dry	Dry	Dry
GK Spring 7	Non-perennial spring south east of Aviemore.	-28.1098	30.2211	Dry	Dry	Dry	Dry
GK Spring 8	Non-perennial spring south east of Aviemore.	-28.1089	30.2236	Dry	Dry	Dry	Dry
GK Spring 10	Non-perennial spring south east of Aviemore.	-28.1116	30.2233	Dry	Dry	Dry	Dry

● Sampled

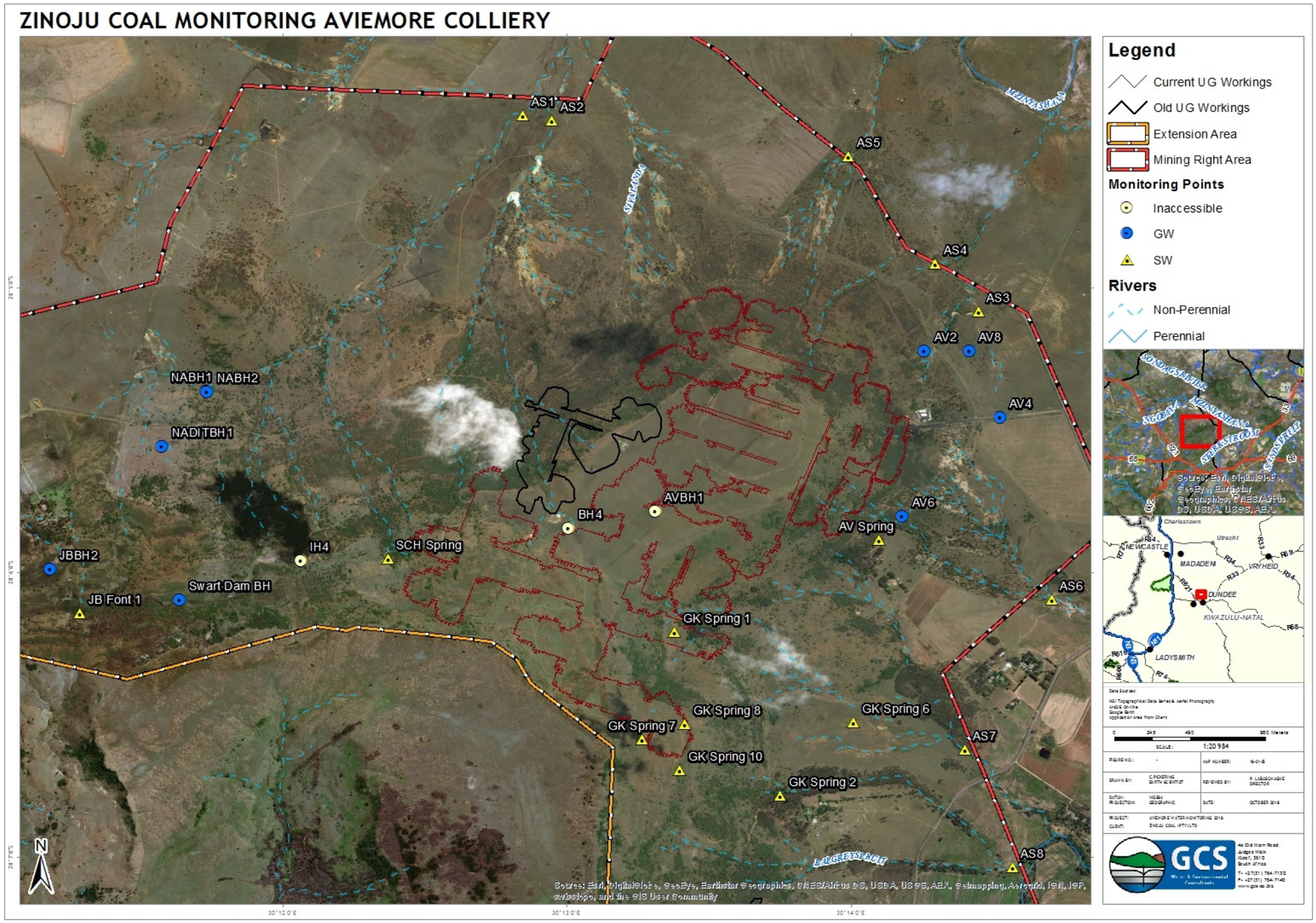


Figure 4-10 Aviemore Monitoring Network

4.6.2 Biomonitoring

The aim of the aquatic assessment is to ascertain, by means of rapid biomonitoring methodology, the ecological state of the perennial surface water (river) resources affected by mining activities of Aviemore. The objectives of the aquatic assessment, as per the project Scope of Work are to:

- Discern potential sampling sites by means of a desktop analysis;
- Measure water quality variables *in situ* at the time of sampling;
- Assess the integrity of the aquatic habitat using the Integrated Habitat Assessment System (IHAS), Index of Habitat Integrity (IHI) and visual assessment of impacts; and
- Assess the health of the watercourse(s) according to the aquatic macroinvertebrates presenting using the South African Scoring System vers. 5 (SASS5) Protocol (Dickens & Graham, 2002).

An initial desktop study was undertaken to gather background information regarding the study area and surrounding region. This information was used to gain an understanding as to the condition of the greater catchment and macro-features (e.g. major river systems) in order to establish the pressures influencing the present ecological condition of the watercourse(s) under investigation and how the aquatic ecology has been impacted. The desktop study entailed the interrogation of GIS databases (SANBI BGIS), information from the REMP and any relevant available reports.

The desktop study also included an assessment of sites potentially suitable for aquatic sampling. Preliminary site selection was influenced by location in respect to the coal mine, nature of flow (perennial vs non-perennial), site accessibility, proximity to existing water quality monitoring points and suitable habitat conditions for SASS5 application.

4.6.2.1 Habitat Assessment

Habitat integrity is a critical component of river ecology as it governs the suitability of a river for inhabitation by aquatic organisms. Knowledge of the existing habitats and their quality is therefore important in evaluations of riverine health. Habitat integrity can be assessed in terms of ecosystem impacts and habitat conditions at each site and is useful for the interpretation of the biological community data collected.

The Index of Habitat Integrity (IHI) assessment considers the impacts on the riparian and the instream habitats and describes their Present Ecological State (PES). The severity of each impact is ranked using a six-point scale with 25 (no impact), 21 to 24 (small impact), 16 to 20 (moderate impact), 11 to 15 (large impact), 6 to 10 (serious impact) and 0 to 5 (critical impact). The estimated impact of each criterion is calculated as follows:

Rating for the criterion/maximum value (25) x weight (percent)

The estimated impacts of all criteria calculated in this way are summed, expressed as a percentage and subtracted from 100 to arrive at an assessment of habitat integrity for the instream and riparian components respectively. The method classifies habitat integrity into one of six classes, ranging from unmodified/natural (Class A), to critically modified (Class F) (Table 4-6).

Table 4-6 Habitat Integrity categories for instream and riparian zone habitats

Ecological Category	Description	Score (% of total)
A	Unmodified, natural.	90 - 100
B	Largely natural with few modifications. The flow regime has been only slightly modified and pollution is limited to sediment. A small change in natural habitats may have taken place. However, the ecosystem functions are essentially unchanged.	80 - 89
C	Moderately modified. Loss and change of natural habitat and biota have occurred. Community composition is therefore lower. Basic ecosystem functions are still predominantly unchanged	60 - 79
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40 - 59
E	Seriously modified. . The loss of natural habitat, biota and basic ecosystem functions is extensive.	20 - 39
F	Critically/Extremely modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat and biota. Changes are likely to be irreversible.	0 - 19

(Source: Kleynhans et al., 2009)

The Integrated Habitat Assessment System (IHAS v2) was used to assess the specific habitat suitability for the survival of aquatic macro-invertebrates and aid in the interpretation of the SASS5 results. The diversity and quality of the three habitat biotypes (Stone, Vegetation, and (GSM) was recorded, assessed and calculated for each site.

The IHAS v2 score is presented as a percentage, where 100% represents pristine habitat quality and diversity. A score of above 65% represents a section of river that has adequate representation of all the major biotopes and therefore good habitat quality. A score of between 55 and 65% is indicative of a river reach that lacks adequate (average) representation of certain biotopes or biotopes of poor quality. A score of less than 55% is indicative of the complete lack of certain biotopes or biotopes that have been critically modified. This infers poor habitat quality, which in turn will impact negatively on aquatic invertebrate community composition.

The IHAS v2 was developed specifically for use with the SASS5 protocol in South Africa (McMillan, 1998). Scores for the IHAS v2 index were interpreted according to the guidelines in Table 4-7 below.

Table 4-7 Interpretation guidelines for the IHAS index

IHAS Score	Description
>75%	Habitat diversity and structure is highly suited for supporting a diverse aquatic macro-invertebrate community
65% - 75%	Habitat diversity and structure is adequate for supporting a diverse aquatic macro-invertebrate community
<65%	Habitat diversity and structure is inadequate for supporting a diverse aquatic macro-invertebrate community

4.6.2.2 Water Quality

Water quality refers to the general appearance, physical, chemical, and biological characteristics of a water resource and serves as an essential descriptor of river health and habitat integrity (DWAF, 1996b). In situ measurements taken at the time of biological sampling reflect the prevailing aquatic 'living' conditions and thus correlate with type of organisms captured. Water quality data therefore provides valuable information for the interpretation of community assessment data.

The *in-situ* water quality was measured at all of the aquatic biomonitoring sites using a Hanna HI 9811-5 EC/TDS/pH meter and a HI 9147 Dissolved Oxygen and Temperature Meter for Aquaculture. The following parameters were recorded: temperature (°C), pH, electro-conductivity (EC) (mS/m), total dissolved solids (TDS), dissolved oxygen (% saturation) and oxygen content (mg/l).

The recorded values were compared against the Target Water Quality Ranges (TWQRs) in terms of the South African Water Quality Guidelines for Aquatic Ecosystems (SAWQGs) (DWAF, 1996b) to ascertain whether any of the measured parameters were beyond the prescribed limits for healthy river ecosystems and therefore detrimental to aquatic organisms. Where available, previous data from the REMP/RHP were used for comparative purposes.

Although these measurements are only a "snapshot" of the conditions present at the time of sampling, they do provide valuable insight into the physico-chemical characteristics of the aquatic resource at a specific spatial location. This is important to note as the water quality findings aid in the interpretation of the response components measured i.e. the macro-invertebrate community biomonitoring data.

The pH of natural waters is determined by both geological and atmospheric influences, as well as by biological activities. Most fresh water resources are usually relatively well buffered with a pH range from 6 to 8 (Davies and Day, 1998) and are slightly alkaline due to the presence of bicarbonates of the alkali and alkaline earth metals (DWAF, 1996b). The pH target for fish health should range between 6.5 and 9.0, as most species will tolerate and reproduce successfully within this pH range (Alabaster and Lloyd, 1982). A pH value of > 9.0 usually indicates eutrophic conditions (nutrient enrichment) (Davies and Day, 1998). The nutrient loads that cause eutrophication are usually a consequence of human activities and may result from runoff from farms, and industrial, urban and animal waste.

According to the SAWQG, pH values should not vary from the range of the background pH values for a specific site and time of day (spatial variation) by more than 0.5 of a pH unit, or by more than 5%, and should be assessed by whichever estimate is the more conservative. However, in all cases, local background conditions should be determined (including diel and seasonal variability where appropriate) when establishing water quality objectives for a aquatic ecosystem (DWAF, 1996b).

Water temperature plays an important role in aquatic ecosystems by affecting the rates of chemical reactions and therefore also the metabolic rates of organisms (Davies and Day, 1998). Temperature affects the rate of development, reproductive periods and emergence time of organisms (Davies and Day, 1998). Temperature varies with season and the life cycles of many aquatic macro-invertebrates are cued to temperature (Davies and Day, 1998).

Aquatic organisms have upper and lower thermal tolerance limits, an optimal temperature for growth, a preferred temperature range in thermal gradients, and temperature limitations for migration, spawning and egg incubation. Therefore, rapid changes in temperature may severely affect aquatic organisms and lead to mass mortality. Less severe temperature changes in water bodies may have sub-lethal effects or lead to an alteration in the existing aquatic community.

Electrical conductivity (EC) is a measure of the ability of water to conduct an electrical current (DWAF, 1996b). This ability is a result of the presence in water of ions such as carbonate, bicarbonate, chloride, sulphate, nitrate, sodium, potassium, calcium and magnesium, all of which carry an electrical charge (DWAF, 1996b). Many organic compounds dissolve in water but do not dissociate into ions (ionise), and consequently they do not affect the EC (DWAF, 1996b). Electrical Conductivity is a rapid and useful surrogate measure of the TDS concentration of waters with a low organic content (DWAF, 1996b).

According to Davies & Day (1998), freshwater organisms usually occur where TDS values are less than 3000 mg/l. According to the TWQRs for Aquatic Ecosystems, TDS concentrations should not vary by more than 15% from the normal cycles of the water body under un-impacted conditions at any time of the year (DWAF, 1996b). However, in all cases, local background conditions should be determined (including diel and seasonal variability where appropriate) when establishing water quality objectives for an aquatic ecosystem (DWAF, 1996b). Dallas and Day (2004) report on the TDS values for polluted and unpolluted streams around Natal coalfields. Unpolluted rivers (including the Mzinyashana River) have relatively low TDS values between 95 and 232 mg/l, mining areas have very high levels ranging from 2110 - 4365 mg/l accompanied by low pH levels, and polluted streams have high TDS values between 1037 and 3105 mg/l with moderate pH levels.

Limit unimpacted measurements are available (Dallas and Day, 2004), however, historical water quality data were available for selected sites as part of the Aviemore Colliery surface water quality monitoring programme (See Appendix 2). The laboratory and fourth quarter 2018 field data were interrogated to assess the range of conditions contributing to the water quality at the sites in the current study.

The maintenance of adequate Dissolved Oxygen (DO) is critical for the survival and functioning of aquatic biota as it is required for the respiration of all aerobic organisms. Therefore, the DO concentration provides a useful measure of the health of an ecosystem (DWAF, 1996b). The median guideline for DO for the protection of aquatic biota is more than 5 mg/l (Kempster *et al.*, 1980). In addition, the percentage oxygen saturation level was also determined using the United States Environmental Protection Agency (USEPA, 1992) data. According to DWAF (1996b), the TWQR for aquatic ecosystems states that dissolved oxygen concentrations should be between 80% and 120% of saturation.

4.6.2.3 Biological Sampling

Aquatic biomonitoring of river benthic invertebrates was undertaken according to the DWA-endorsed SASS v.5 sampling protocol (Dickens & Graham, 2002), where suitable habitat conditions and safe accessibility prevailed. The method utilises a semi-quantitative sampling approach, were the relative abundances of stipulated aquatic invertebrate taxa are recorded within a specific time limit.

All sampling was undertaken by an accredited SASS5 practitioner. All three biotypes (GSM, Stones and Vegetation) were sampled at each site. Samples were cleaned/cleared of as much unnecessary material as possible prior to invertebrate identification. The SASS score and Average Score Per Taxon (ASPT) (SASS Score divided by the number of taxa) were calculated for each site and were used to plot the PES, according to the ecological state model for the North Eastern Uplands ecoregion (lower zone) (Dallas, 2007). The SASS5 and ASPT limits used to categorise the ecological state are graphically presented in Figure 4-11 and summarised in Table 4-8.

Dallas (2007) suggest that biological data collected in this region should be interpreted with caution as there was limited data available at the time to generate the biological bands or ecological categories that are used to interpret the data. SASS5 data is available for the REMP/RHP Reference site V3MZIN-COTSW (Dallas, 2005).

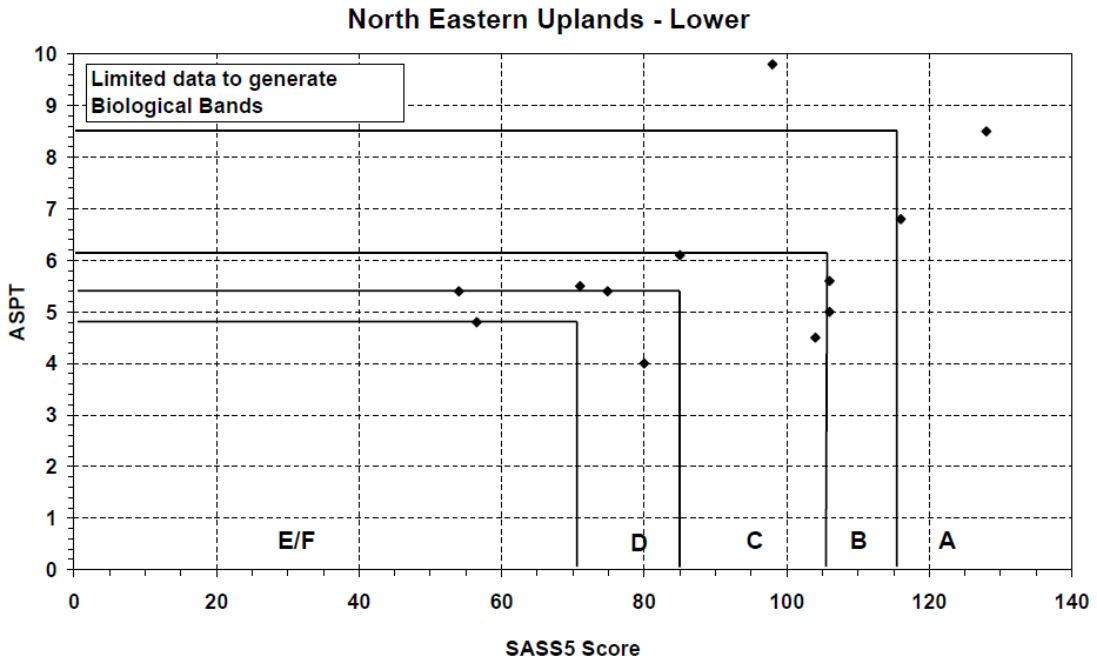


Figure 4-11 Present Ecological State (PES) Categories for the Lower Region of the North Eastern Uplands ecoregion

Table 4-8 Modelled Reference Conditions for the North Eastern Uplands ecoregion (lower zone) based on SASS5 and ASPT scores

SASS5 Score	ASPT	Ecological Category	Category Name	Description
> 116	> 8.5	**A**	**Natural**	*Unmodified, natural.* Natural habitats, ecosystem functions, and biota are at an optimum and comparable to the best possible condition.
106 - 116	6.1 - 8.5	**B**	**Good**	*Largely natural with few modifications.* A small change in natural habitats and biota may have taken place, but Ecosystem functions are essentially unchanged
85 - 106	5.4 - 6.1	**C**	**Fair**	*Moderately modified.* Loss and change of natural habitat and biota have occurred. Community composition is therefore lower. Basic ecosystem functions are still predominantly unchanged
71 - 85	4.8 - 5.4	**D**	**Poor**	*Largely modified.* A large loss of natural habitat, biota and basic ecosystem functions has occurred. Community composition is markedly reduced.
< 71	< 4.8	**E/F**	**Seriously modified**	*Seriously modified.* The loss of natural habitat, biota and basic ecosystem functions is extensive. Very few taxa are present due to loss of most of the sensitive species.

(Source: Dallas, 2007)

Sampling sites were selected at the time of the summer survey (January 2018) based on the following criteria:

- Location relative to the coal mine;
- Nature of flow (perennial vs non-perennial);
- Accessibility;
- Suitable habitat conditions for SASS5 application; and
- Proximity to existing water quality monitoring points.

The sites are located within the Mzinyashana and Sterkstroom perennial rivers. The location of the aquatic sampling points is summarised in Table 4-9 and presented in Figure 4-12.

Table 4-9 Aviemore Colliery aquatic sampling sites

Site	Description	Co-ordinates		WINTER 2018 STATUS
		Latitude	Longitude	
AS_Ref	Reference site located on the Mtotwane R. above the Ngobiya R. confluence to the Mzinyashana R.	-28.042742°	30.158677°	Stagnant pools of water, Not sampled
AS_05	Water quality monitoring site in the Mzinyashana R., below three drainage lines draining the northern area of the Aviemore Coal Mine.	-28.070358°	30.246201°	Flowing water, Sampled
AS_10	On the Sterkstroom River below the weir.	-28.105818°	30.278155°	Flowing water, Sampled
AS_12	Tributary of Sterkstroom R. draining the area to the south of the Aviemore Coal Mine, upstream of water quality monitoring site AS_10.	-28.103134°	30.249062°	Stagnant pools of water, Not sampled

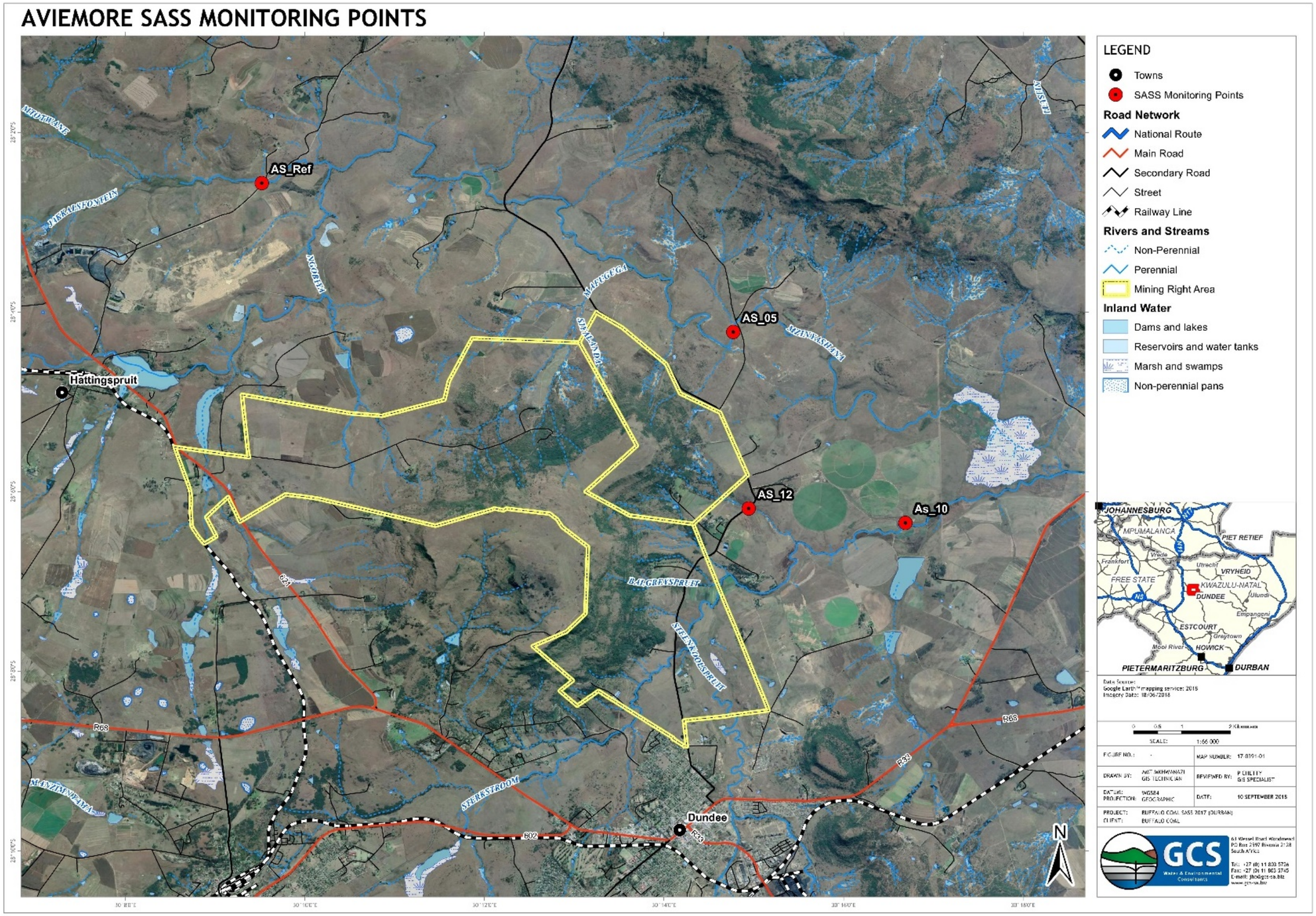


Figure 4-12 Aviemore Biomonitoring Network

5 RISK ASSESSMENT

GN R1147 under NEMA requires an applicant or holder of a right or permit to undertake an environmental risk assessment annually in order to identify possible risks associated with rehabilitation and closure which might be encountered during the closure and post closure phases. All the risks identified during this process are incorporated into the final rehabilitation, decommissioning and mine closure plan. A risk assessment has been undertaken for Aviemore in order to:

- Ensure timeous risk reduction through appropriate interventions;
- Identify and quantify the potential residual and latent environmental risks related to post closure;
- Detail the approach to managing the risks;
- Quantify the potential liabilities associated with the management of the risks; and
- Outline monitoring, auditing and reporting requirements.

GCS used the risks assessment process detailed in Appendix D to identify the possible residual and latent risks associated with Aviemore.

5.1 Predicted Risks and impacts

5.1.1 Key Success Factors and stakeholder identification

The key success factors and stakeholders identified for Aviemore with regards to the risks are listed below:

- Key success factors:
    - Obtaining approval for the Closure and Rehabilitation Process;
    - Reduce and remove any environmental degradation;
    - Reduce and remove any possible health and safety risks post closure;
    - Reduce and remove any possible water pollution;
    - Obtain the final land use requirements;
    - Have sufficient financial provision to ensure closure and rehabilitation; and
    - Follow all legislative requirements to ensure avoidance of time and cost delays.
- Stakeholders:
    - Buffalo Coal Management;
    - Buffalo Coal Board;
    - Consultants;
    - Contractors;
    - Surrounding communities and landowners;

- Farmers of surrounding properties;
- Interested and Affected Parties (I&APs) and organisations;
- NGO's; and
- National, Provincial, and municipal government departments.

5.1.2 Risk Categories

The standardised risk categories that were used in the analysis of the risks are shown in Table 5-1.

Table 5-1 Standardised risk categories

Risk Category	Risk Categories
1	Staff
2	Surface Water
3	Ground Water
4	Topography
5	Soils
6	Flora
7	Fauna
8	Air Quality
9	Noise
10	Sensitive Landscapes
11	Visual
12	Land Use and Capabilities
13	Erosion
14	Traffic
15	Social Impact
16	Safety
17	Health
18	Economic

5.1.3 Project Risks, Existing Controls and Treatment Plan

The possible risks, the existing controls and the risk treatment plan to mitigate the latent and residual risks that were identified are shown in Table 5-2.

Colour code:

- ***Extreme risk - Red***
- ***High risk - Purple***
- ***Moderate risk - Yellow***
- ***Low risk - Green***

Table 5-2 Risks and existing controls

Number	Rank	Risk Description (Event and Consequence OR Cause)	Category	Existing Controls and Measures
1	1	Effect of future closure on the employees and their future income have social and economic implications	Staff	Social and Labour Plan
20	2	Changes in future legislation making the closure requirements more stringent with a higher cost implication	Economic	Annual updates to the closure costing
21	3	Loss of revenue to surrounding communities and industries as a result of the closure and rehabilitation of the mining operation	Social Impact	Social and Labour Plan
4	21	Potential decant after mine closure at Aviemore underground mine as a result of water levels rebounding when mining ceases	Surface Water	Dewatering and reticulation, monitoring, gradient of workings
5	4	Pollution of surrounding aquifers by shallow aquifer decant and seepage impacting communities and surrounding environment negatively	Ground Water	Dewatering and reticulation, SWMP, monitoring, gradient of workings
23	5	Unions organise themselves against the closure of the mine which will have social and economic implications	Social Impact	Social and Labour Plan, consultative forums with unions and communities
24	6	Adits not properly sealed and area not safely rehabilitated could pose a safety risk to trespassers	Safety	Safety signs, access control, Mine Health and Safety Plan
25	7	Features on site that cause injury which will have a reputational and economic implication	Safety	Safety signs, access control, Mine Health and Safety Plan
26	8	Acid Mine drainage could pose a health risk to surrounding communities	Health	Dewatering, reticulation, gradient of workings, seam profile, monitoring
12	9	Further impact and reduction of flora due to rehabilitation activities	Flora	EMP
27	10	Shortfalls of cover material to achieve successful rehabilitation of disturbed areas.	Economic	Annual closure cost assessments
17	11	Visual impact of unrehabilitated development footprint	Visual	EMP
18	12	The soil potential decreasing grazing capacity as a result of contaminated soils from the mining activities	Land Use and Capabilities	EMP
19	13	Insufficient profiling of the topography of the mining area during rehabilitation may lead to erosion	Erosion	EMP, SWMP
22	14	Dissatisfaction of communities with future land use from	Social Impact	Social and Labour Plan, EMP, Closure Plan

		rehabilitation can have social and economic implications		
2	15	Runoff over unrehabilitated areas will increase sediment flow into surface water resources	Surface Water	EMP, SWMP and continuous monitoring
3	16	Dirty water runoff into the surrounding environment having a detrimental effect on the surrounding water resources	Surface Water	EMP, SWMP and continuous monitoring
9	17	Polluted soil in the infrastructure areas as a result of mining activities	Soils	Concrete areas, oil traps, EMP, SWMP, spill-kits, monitoring
10	18	Degradation of soils post-closure leading to decreased land capability	Soils	Concrete areas, oil traps, EMP, SWMP, spill-kits, monitoring
11	19	Possible growth of alien invasive species during rehabilitation process of disturbed areas	Flora	EMP, alien invasive removal plan, monitoring
16	20	Noise pollution created during decommissioning	Noise	EMP, noise monitoring, open communication with surrounding landowners
6	22	Potential of subsidence from underground mining could pose a residual risk	Topography	Visual Inspections and monitoring, engineering inspections, mine planning and surveying
7	23	Failure to create a landform profile to suit the surface water run-off during rehabilitation	Topography	EMP, SWMP, annual rehabilitation and closure costs updates
13	24	Flora fails to re-establish post-rehabilitation	Flora	EMP, alien invasive removal plan
14	25	Reducing the potential of fauna returning to the mining area	Fauna	EMP
15	26	Dust pollution influencing surrounding landowners	Air Quality	EMP, dust suppression, dust monitoring

Refer to Appendix D for the full Risk Register and Action Plan.

5.1.4 Project Risk Assessment Results

Risks were identified and analysed in terms of the likelihood of occurrence and the consequence or impact they could have. Figure 5-1 illustrates the level of impact the identified risks could have on the project before mitigation.

Risk Map Before Treatment			Consequence				
			Insignificant 1	Minor 2	Moderate 3	Major 4	Catastrophic 5
Likelihood	A	Almost Certain				1 20 21	
	B	Likely		2 3 9 10 11 16	12 27		
	C	Moderate			17 18 19 22		
	D	Unlikely		15	4 6 7 13 14	5 23 24 25 26	
	E	Rare					

Low	Moderate	High	Extreme
1	5	17	3

Figure 5-1 Project Risk Map Before treatment

From Figure 5-1 several major risks are recorded for Aviemore in its current state. Several high risks are evident, but most were mitigated in the following section. Figure 5-2 indicates the ability to influence these risks.

Risk / Influence Matrix		Ability to Influence		
		Low / None	Moderate	High
Risk	Extreme		20 5 16 6	1 23 24 25 12 17 2 9 10 11 7 13 15
	High	21 26	4	27 18 19 22 3 14
	Moderate			
	Low			

Figure 5-2 Risk Influence Matrix

5.1.5 Risk Mitigation

Figure 5-2 illustrates the level of impact the identified risks could have on the project after mitigation.

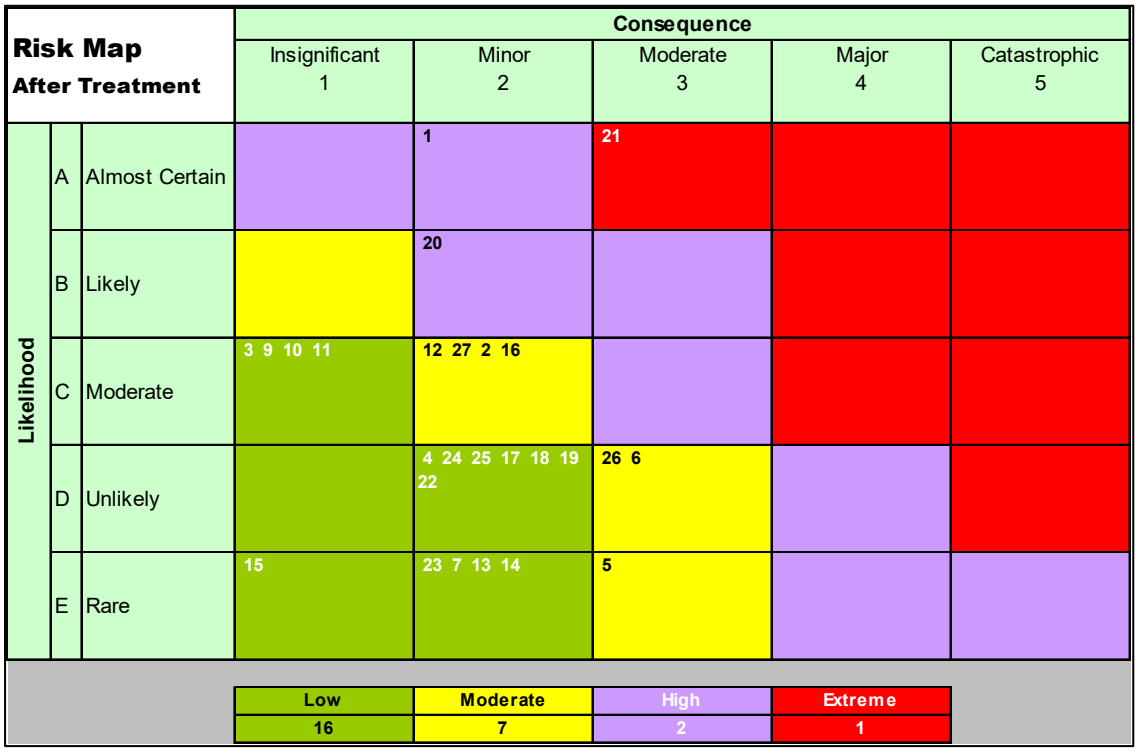


Figure 5-3 Project risk map after treatment

The main risks that requires further mitigation to reduce the impact of the mine are as follows:

- The effect of future closure on the employees and their future income have social and economic implications;
- Changes in future legislation making the closure requirements more stringent with a higher cost implication; and
- Loss of revenue to surrounding communities and industries as a result of the closure and rehabilitation of the mining operation.

5.1.6 Risk Summary

Table 5-3 represents the effect of risk mitigation on identified risks. Please refer to Appendix D for the full risk register.

Table 5-3 Summary of risks

Risk Summary					
Risk	Rank	Description	Mitigation		
			Before		After
1	1	Effect of future closure on the employees and their future income have social and economic implications	Extreme		High
2	20	Changes in future legislation making the closure requirements more stringent with a higher cost implication	Extreme		High
3	21	Loss of revenue to surrounding communities and industries as a result of the closure and rehabilitation of the mining operation	Extreme		Extreme
21	4	Potential decant after mine closure at Aviemore underground mine as a result of water levels rebounding when mining ceases	Moderate		Low
4	5	Pollution of surrounding aquifers by shallow aquifer decant and seepage impacting communities and surrounding environment negatively	High		Moderate
5	23	Unions organise themselves against the closure of the mine which will have social and economic implications	High		Low
6	24	Adits not properly sealed and area not safely rehabilitated could pose a safety risk to trespassers	High		Low
7	25	Features on site that cause injury which will have a reputational and economic implication	High		Low
8	26	Acid Mine drainage could pose a health risk to surrounding communities	High		Moderate
9	12	Further impact and reduction of flora due to rehabilitation activities	High		Moderate
10	27	Shortfalls of cover material to achieve successful rehabilitation of disturbed areas.	High		Moderate
11	17	Visual impact of unrehabilitated development footprint	High		Low
12	18	The soil potential decreasing grazing capacity as a result of contaminated soils from the mining activities	High		Low
13	19	Insufficient profiling of the topography of the mining area during rehabilitation may lead to erosion	High		Low
14	22	Dissatisfaction of communities with future land use from rehabilitation can have social and economic implications	High		Low
15	2	Runoff over unrehabilitated areas will increase sediment flow into surface water resources	High		Moderate
16	3	Dirty water runoff into the surrounding environment having a detrimental effect on the surrounding water resources	High		Low
17	9	Polluted soil in the infrastructure areas as a result of mining activities	High		Low
18	10	Degradation of soils post-closure leading to decreased land capability	High		Low
19	11	Possible growth of alien invasive species during rehabilitation process of disturbed areas	High		Low
20	16	Noise pollution created during decommissioning	High		Moderate
22	6	Potential of subsidence from underground mining could pose a residual risk	Moderate		Moderate
23	7	Failure to create a landform profile to suit the surface water run-off during rehabilitation	Moderate		Low
24	13	Flora fails to re-establish post-rehabilitation	Moderate		Low
25	14	Reducing the potential of fauna returning to the mining area	Moderate		Low
26	15	Dust pollution influencing surrounding landowners	Low		Low

5.1.7 Opportunities

The opportunities identified during the risk assessment are included in Table 5.4.

Table 5.4 Process Opportunities

Risk Description (Event and Consequence OR Cause)	Category
Mine infrastructure (Buildings and Utilities) which will be demolished according to current closure criteria, could be utilised by the farmer and might add value to post-closure land use. There might be a risk of expectation of continuing involvement.	Closure

5.1.8 Latent and Residual Risks

According to the Mineral and Petroleum Resources Development Regulations, 2004 (Published under Government Notice R527 in Government Gazette 26275 of 23 April 2004) (GN R527) latent and residual impacts are defined as follows:

> **"latent environmental impact means any environmental impact that may result from natural events or disasters after a closure certificate has been issued" (own emphasis);**

and

> **"residual environmental impact means the environmental impact remaining after a closure certificate has been issued" (own emphasis).**

Latent and residual risks are specifically related to post mining impacts that occur at the site once rehabilitation has been completed.

The residual impacts identified for Aviemore as required by NEMA General Notification (GN R1147) are described as follows:

- Loss of employment and loss of revenue for the surrounding communities and industry has a socio-economic impact on the region;
- Adits not properly sealed and area not safely rehabilitated could pose a safety risk to trespassers; and
- Features on site that cause injury which will have a reputational and economic implication.

The latent impacts identified for Aviemore as required by NEMA General Notification (GN R1147) are described as follows:

- Potential decant after mine closure at Aviemore underground mine as a result of water levels rebounding when mining ceases;

- Pollution of surrounding aquifers by shallow aquifer decant and seepage impacting communities and surrounding environment negatively;
- Acid Mine drainage could pose a health risk to surrounding communities;
- The possibility of subsidence that could occur in future related to the underground mining operations.

5.2 Changes from Previous Risk Assessment Reports

No major changes from the Environmental Risk Report undertaken in 2018 are noted.

6 CONCURRENT REHABILITATION

GN R1147 requires that mines annually review and update their annual rehabilitation, as reflected in an annual rehabilitation plan as per Appendix 3 of GN R1147. The NEMA regulations place greater emphasis on the need for concurrent rehabilitation. The annual rehabilitation plan needs to contain a review of the previous 12 months rehabilitation activities, the proposed rehabilitation for the next 12 months of rehabilitation and the expected costs for conducting this rehabilitation. The annual rehabilitation plan needs to speak to the final rehabilitation plan as the two should work hand in hand.

The objective of the annual rehabilitation plan is to:

- Review concurrent rehabilitation and remediation activities already implemented;
- Establish rehabilitation and remediation goals and outcomes for the forthcoming 12 months, which contribute to the gradual achievement of the post-mining land use, closure vision and objectives identified in the holder's final rehabilitation, decommissioning and mine closure plan;
- Establish a plan, schedule and budget for rehabilitation for the forthcoming 12 months;
- Identify and address shortcomings experienced in the preceding 12 months of rehabilitation; and
- Evaluate and update the cost of rehabilitation for the 12-month period and for closure, for purposes of supplementing the financial provision guarantee or other financial provision instrument.

6.1 Review of 2017/2018 Annual Rehabilitation Activities

The annual rehabilitation plan requires a review of the previous year’s annual rehabilitation and remediation activities as well as a comparison between activities planned in the previous

year's annual rehabilitation plan and the actual rehabilitation and remediation implemented. This section provides a review of the rehabilitation goals from the previous 12 months.

Apart from monitoring, no annual rehabilitation activities were conducted at Aviemore as there are no areas available for remediation and rehabilitation concurrent with the mining activities. This is due to several reasons, mainly:

- Surface activities and infrastructure are limited and therefore annual rehabilitation measures are not required until the cessation of mining activities;
- There are no waste deposits or stockpiles at Aviemore;
- All waste is transported to another facility;
- ROM is not stored, washed or processed at Aviemore, all ROM is transported to Coalfields Processing Plant;
- There are no open cast mining areas;
- All mining activity is conducted underground;
- There are no pollution control dams; and
- Rehabilitation can only be conducted to disturbed areas once mining activities cease the surface infrastructure are removed.

Current measures undertaken at Aviemore include quarterly surface and groundwater monitoring, storm water management, biomonitoring and general housekeeping.

6.1.1 Monitoring Results

Current monitoring relates specifically to surface and groundwater sampling. Ad-hoc monitoring of erosion to the storm water control measures (berms and furrows) is conducted. Buffalo Coal has assigned specialists to conduct quarterly monitoring of the groundwater and surface water quality at Aviemore.

The current water quality at most of the boreholes is relatively good with no significant impact from the mine. The water quality at borehole AV6 has shown an overall improvement since 2015; however, the concentrations still predominantly exceed the WUL Limits. The data indicates the presence of a Zone of Influence created by the Aviemore mine workings. However, as the mine water indicator elements are not significantly high and appear to be localized at AV6, the impact of the mine is moderately low.

The water level data indicates stable trends at most boreholes. However, borehole AV8 has historically shown large fluctuations in water levels over time as well as during the 2018 monitoring period. The data indicates localized groundwater abstraction. GCS are not aware of any abstraction boreholes in this area.

Most of the surface water monitoring points, that form part of the approved monitoring program, were dry throughout 2018 and therefore intermittent monitoring data has been collected for these sites. The hydrochemistry results for all routine surface water sites exhibited low sulphate concentrations and neutral pH conditions. This indicates no significant impact from the mine workings as a result of contaminated storm water runoff or as baseflow seepage.

Additional surface water samples were collected from the old Balgray mine, close to Aviemore. The combination of mine indicator elements at both Balgrey PCD and Balgrey Channel is indicative of acid mine drainage conditions within the vicinity of the surface water monitoring point. The poor water quality at Balgrey Channel is most likely a result of decant from the old Balgrey Mine. As these sites are not associated with Aviemore, further monitoring of these points is considered unnecessary. This data should serve as reference only.

6.1.2 Biomonitoring Results

Biomonitoring was undertaken in the summer (January) and winter (August) months of 2018. The results of this monitoring are provided in the sections that follow.

6.1.2.1 2018 Summer Sampling Results

A major rainfall/thunderstorm event struck the Glencoe/Dundee/Newcastle/Ladysmith area in the week preceding the aquatic assessment (25 January 2018), reportedly the “worst storm in 40 years”[1], resulting in loss of life, considerable structural damage to buildings and infrastructure, and significant localized flooding in and around these towns. The Sterkstroom and Buffels rivers burst their banks. Light rainfall continued for several days after the main event.

All water courses, including the non-perennial donga systems, around the Aviemore Colliery were subject to significant scour and were still exhibiting flood conditions (high volumes and flow velocities) at the time of the site visit; conditions which are not conducive to the application of the SASS5 biomonitoring protocol. The National Aquatic Ecosystem Biomonitoring Programme (Mangold, 2001) provides for 6-8 weeks for the recovery from a major environmental event, such as a chemical spillage (the impact of which would be like a major flood event) before sampling can commence.

[1] https://northernnatalcourier.co.za/79457/storm-wreaks-havoc-destruction-like-not-seen/

Consequently, the results of the summer aquatic assessment are not a true reflection of the 'normal' aquatic habitats, the associated aquatic invertebrates or the persistent impacts of mining activities, as all of these aspects would have been affected by flushing of the river systems, and the presence of too much water, in the case of the perennial river systems, or the mere presence of water in systems that are dry for much of the year, in the case of the donga systems. In the donga systems, suitable aquatic habitat is generally lacking due to the prolonged dry conditions, and thus the application of the SASS5 protocol in these areas is generally not appropriate. In both river types, diverse invertebrate communities are unlikely to have re-established in the short time following the flood event. Four sites were surveyed during the summer assessment, including a control or reference site (AS_Ref).

The results of the assessment of the aquatic invertebrate assemblages indicated the moderately to seriously impaired ecological state of the riverine ecosystems in the vicinity of Aviemore, with an extensive loss of ecosystem functions having occurred at two of the four sites. The effect of the Dundee flood event was evident at all sites, manifested in high flow velocities and water levels, erosion of river banks and sediment deposition. Based on the magnitude of the flood event and the findings of this assessment, it was concluded that the results of this summer survey mainly reflected the impacts of this large natural environmental disturbance, compounded by reduced habitat diversity and other notable modifications to the water courses (e.g. weir construction, effluent discharges), and not the impact(s) of Aviemore on the integrity of these systems. That is, the diminished communities were likely still recovering from the flood event or generally poor due to the impacted state of the water courses.

While the impacts, if any, of mining activities were not clearly discernible, it must be borne in mind that cumulative anthropogenic impacts (e.g. urban development impacts, land transformation, agricultural practices and mining impacts) generally lower the resilience of ecosystems to disturbance, which would thus recover more slowly or to an increasingly altered state after major flood events.

6.1.2.2 2018 Winter Sampling Results

The winter sampling event was undertaken on 6 August 2018. Four sites were surveyed, of which only two (AS-10 and AS-05) had flowing water and were suitable to conduct an aquatic assessment in accordance with the SASS5 protocol.

The results of the assessment of the aquatic invertebrate assemblages indicated the largely to seriously impaired ecological state of the riverine ecosystems in the vicinity of the Aviemore Colliery.

The results for Site AS_05 indicated that the Mzinyashana River has been largely modified. Changes to the basic ecosystem were detected, which were mostly like due to water quality impacting on the species composition of the community as habitat diversity and integrity were rated adequate. High values of TDS and EC were measured at this site, which has limited the occurrence of pollution sensitive aquatic species.

It can be concluded that this site is revealing mining impacts on the Mzinyashana River. However, there are many other mining activities and old discard dumps located upstream to this site and therefor it cannot be ascertained that the impact is from Aviemore mining operations.

Site AS_10 is located on the Sterkstroom River was rated to be seriously impaired as a result ofthe extensive loss of basic ecosystem function. The surrounding land uses consisted of agriculture and the discharge of effluent by a WWTW located upstream from the sampling point. The habitat integrity indicated that the river system is largely modified by anthropogenic activities and these impacts are reflected by the poor results obtained for the aquatic assemblages. It can be concluded that main impacts on this river are from the various land uses and the impacts of mining activities were indiscernible.

It must be noted that there are numerous ephemeral drainage lines in the study area that persist as prominent donga systems and are generally only wet following prolonged seasonal rainfall or extreme rainfall events. The absence of water flow will be the norm during the winter season and may even persists during the summer season if not enough rain fall takes place. The interpretation of biomonitoring results of ephemeral riverine systems therefore must be done with caution, because the SASS5 method has not been adequately tested in ephemeral systems where there are extensive dry periods that interrupts the establishment of a diverse aquatic invertebrate community and interferes with the indicative power to adequately reflect anthropogenic impacts.

6.2 Planned Concurrent Rehabilitation

As described in Section 6.1, currently there is no planned concurrent rehabilitation to be conducted at Aviemore as there are no areas available for remediation and rehabilitation concurrent with the mining activities. Concurrent rehabilitation measures for 2018 will are detailed in the sections that follow.

6.2.1 Ground and Surface Water Monitoring

Buffalo Coal will appoint a suitable specialist for the undertaking of the groundwater and surface water monitoring at Aviemore for the 2019 year. Surface and groundwater sampling will be conducted on a quarterly basis. All field work will be conducted based on the protocols, specifications and code of practice contained in the SABS ISO 5667:1-15. These standards address all aspects of the programme design, sampling methods as well as sample preservation. For quality purposes, sampling will be undertaken in accordance with the following publications:

- ISO 5667–1: 2008 Part 1: Guidance on the design of sampling programs and sampling techniques;
- ISO 5667-3: 2012 Part 3: Guidance on preservation and handling of samples;
- ISO 5667-6: 2014 Part 6: Guidance on sampling of rivers and streams;
- SABS ISO 5667: 2009 Part 11: Guidance on sampling of groundwater; and
- DWAF Best Practice Guidelines Series G3: General Guidelines for Water Monitoring Systems.

Groundwater samples will be collected from boreholes as per the scope of work, with the use of a PVC/polyethylene bailer. Prior to groundwater sampling, a borehole inspection will be conducted after which the borehole is carefully opened, and the static groundwater levels recorded using a dip meter.

Surface water samples will be collected from just below the surface, avoiding any surface scum and debris. When taking the sample directly into the sample bottle, the sampler faces upstream and collects the sample without disturbing the bottom sediments. When the sample point cannot be accessed, the sample is taken using a bailer or a bucket attached to a long rope.

Both groundwater and surface water samples will be collected and stored in a one litre plastic bottle. In situ field measurements will be taken for each sample using a multi-parameter meter; these include pH, Electrical Conductivity (EC), Total Dissolved Salts (TDS) and temperature. One member of the field sampling team takes all notes and photographs, fills out all tags, etc., while the other members collect the samples. Samples are kept below 4ºC in a dark container and are submitted to a South African National Accreditation System (SANAS)-accredited laboratory for analysis as soon as possible, preferably within 48 hours of sampling.

6.2.2 Biomonitoring

As per the conditions of the IWUL, biannual biomonitoring must be undertaken at Aviemore, including summer and one winter monitoring event. Even though all sites proved to have had adequate biotopes to fulfil the SASS5 sampling requirements water flow was a limiting factor for sampling during the winter survey. Therefore, it is recommended that:

- Continued biannual sampling to be undertaken at Sites AS_Ref and AS_12.
- Remove Site AS_10 (Sterkstroom River) and AS_05 (Mzinyashana River) from the biomonitoring program as the impacts observed in the river are not indicative of Aviemore mining activities but rather of the dominant surrounding land uses, namely historical mining activities, agriculture and urban inputs (treated wastewater).
- Site AV-09, which lies north of Aviemore colliery at the confluence for three drainage lines, to be added to the biomonitoring program in place of Site AS_10.
- Site AV Spring, which lies south east of Aviemore colliery to be added to the biomonitoring program.
- These data must be investigated considering water quality monitoring data obtained near the coal mine, including the donga systems. Water quality monitoring must continue to include chemical analyses.

6.2.3 Financial Provision

The financial provision anticipated for undertaking the annual rehabilitation measures is outlined in Table 6-1, this figure relates solely to the anticipated annual rehabilitation measures and is not included in the final closure costings (refer to Chapter 14).

Table 6-1 Annual Rehabilitation Costs

Studies to determine Latent and Residual Risks	Cost
Biomonitoring Assessment	R 35 015.00
Ongoing ground and surface water monitoring	R 99 679.00
Total	**R 134 694.00**

7 CLOSURE VISION

7.1 Final Land Use

The fundamental objective of post-mining land use planning is to establish a landscape that is self-sustaining and value-generating to the communities that will inherit it. A final land use plan is to be developed to determine the likely end land use options for the Aviemore site towards achieving the following outcomes and objectives:

- To facilitate the progressive re-instatement of disturbed areas as these become available for rehabilitation, not only to be safe and non-polluting, but also to be amenable for integration/alignment to the surrounding/nearby bio-physical situation;
- To ensure that the devised end land use is acceptable to stakeholders, through transparent and appropriate consultation and engagement; and
- To maximize socio-economic opportunities that will endure beyond mining that should preferably be initiated and largely be realised during operations.

Land use options are to be further explored through dedicated land use planning while ensuring that the land use plan is discussed with effected stakeholders. Buffalo Coal will strive to ensure that any latent or residual impacts on site will be mitigated as far as possible and that water management will be adopted according to best practice principles, including GN704, to ensure no adverse impacts emanate from the rehabilitation action.

This closure plan, devised in line with the surrounding land uses, is aligned to the EMPr which states that the mining areas will be appropriately rehabilitated to a grazing land use. The Aviemore closure vision aims to return the disturbed areas to a stable, non-polluting and safe state as close as possible to the pre-mining conditions. As detailed in the Land use Section (section 4.4.7), the area was used for grazing of cattle and wilderness prior to mining. Current land use surrounding the Aviemore area is comprised of agriculture which is, at this stage, limited to livestock (grazing). The vision thus aims to encourage the surrounding Grassland and Thornveld vegetation to re-establish on disturbed areas on site in order to return the land to that of the surrounding area, which is farmland. The area will be suitable for low-scale grazing activities. The area falls within the bio-resource group VC 16 (Moist Tall Grassveld) and has a bushed grassland bushland vegetation pattern. The recommended stocking rate for the area is normally 2.6 hectares per large stock unit (ha/LSU), however due to the bushed nature, *Lantana camara* (an alien invader plant) and a large increase (approximately 12 - 15%) of increaser grass species (*Sporobolus africana, Aristida congesta,* and *Setaria flabellata*) it is suggested that this site could be downgraded to a 3.5 ha/LSU. Buffalo Coal will strive to ensure that any latent or residual impacts on site will be mitigated as far as possible.

7.2 Closure Vision

The Buffalo Coal closure vision aims to return the disturbed areas to a stable, non-polluting and safe state that represents, as close as possible, the pre mining conditions. Buffalo Coal wishes to leave a positive legacy in the area once the mining operations cease. Building on the closure vision, the objectives of the final rehabilitation plan are to:

- Ensure all areas are closed in a manner that ensures they are geotechnically stable and safe;
- Prevent erosion through sloping of all disturbed areas to appropriate gradients;
- Ensure that all areas are free-draining and non-polluting;
- Establish vegetation cover returning the area to its pre-mining condition;
- Establish a low maintenance system;
- Ensure the final landform blends into the surrounding topography; and
- Ensure water discharged from the area into the natural drainage system is done safely and the quality will be in accordance with the qualities required by the DWS.

7.3 Possible Closure Alternatives

There are two possible closure alternatives which are detailed in the sections that follow.

7.3.1 Alternative 1

Closure Alternative 1 would be a complete demolition and removal of all mine related infrastructure. In this case all infrastructure would be demolished, removed and where possible sold for scrap. All mining areas would be closed and rehabilitated. The site would be rehabilitated to a point as close as possible to the pre mining conditions. This would include backfilling of all voids and adits and include the demolition of all buildings, roads and other infrastructure. If this alternative is selected, no infrastructure would be handed over to the landowner or surrounding community.

7.3.2 Alternative 2

Closure Alternative 2 would see all mining areas and waste sites closed and rehabilitated. However, where possible, infrastructure that can be handed over to the surrounding community will be considered. In order to identify what infrastructure is to be handed over, a stakeholder engagement process will be run. This process will be the responsibility of Buffalo Coal. For the infrastructure to be handed over, a legal agreement will need to be in place, which removes the mines liability from this infrastructure. Infrastructure for which no legal agreement is in place for the handover will be demolished and removed.

7.3.3 Preferred Alternative

On closure it is planned that all infrastructure that will not be handed over to a third party will be demolished, and the site will be rehabilitated to an agricultural land use, particularly

small scale grazing due to the combination of poor soils and encroachment of alien invasive species. Due to the surrounding land-use being limited to agriculture and mining, possible closure alternatives are limited. Surrounding communities are limited however consultation will be undertaken by Buffalo Coal with the landowner with regards to the handover of any infrastructure.

7.4 Closure Goals

The closure vision is underpinned by the more specific closure objectives listed in this section. These objectives are stated qualitatively and would become more specific as the actual closure measures are devised, implemented and their performance determined:

- **Physical stability:** To remove and/or stabilise surface infrastructure that is present on the mine to facilitate the implementation of the planned final land use;
- **Environmental quality:** To ensure that local environmental quality is not adversely affected by possible physical effects and chemical contamination arising from the mine site, as well as to sustain catchment yield as far as possible after closure;
- **Health and safety:** To limit the possible health and safety threats to humans and animals using the rehabilitated mine site as it becomes available;
- **Land capability/land use:** To re-instate suitable land capabilities over the various portions of the mine site to facilitate the progressive implementation of the planned final land use;
- **Aesthetic quality:** To leave behind a rehabilitated mine site that, in general, is not only neat and tidy, giving an acceptable overall aesthetic appearance, but which in terms of this attribute is also aligned to the planned final land use;
- **Biodiversity:** To encourage, where appropriate, the re-establishment of indigenous vegetation on the rehabilitated mine sites such that the terrestrial and aquatic biodiversity is largely re-instated over time; and
- **Social:** To ensure that the infrastructure transfers, if applicable, measures and/or contributions made by the mine towards the long-term socio-economic benefit of the local communities are lasting and sustainable.

8 CLOSURE ACTIONS

The following closure actions will be undertaken once the mining activities at Aviemore have ceased. Returning this land to its pre-mining condition will involve the demolishing of all

infrastructure that will not be handed over to a third party, and the rehabilitation of all disturbed areas. Figure 8-1 depicts the areas requiring rehabilitation measures. The area in the immediate surrounds of the box cut site is steep with shallow rocky soils whose use is only suited to grazing. The encroachment of *Acacia* species and *Lantana camara* has diminished the grazing value considerably over the years. It is the intention of Buffalo Coal to rehabilitate the area so that it will not be prone to erosion by employing soil erosion controls, such as contour furrows/berms and the establishment of suitable vegetation. Water management according to best practice principles, including GN704, will be done to ensure no adverse impacts emanate from the rehabilitation actions. Water discharged from the area into the natural drainage system will be done so safely and the quality will be in accordance with the qualities required by the DWS. The grazing capacity will be of equal standing to the surrounding area. The re-vegetated area will be maintained until it is self-supportive. Landscaping of the area will be done to an acceptable design, so as to imitate the pre-mining relief, which will make the area easily accessible and manageable for post mining usage. The following closure actions will be undertaken once the mining activities at Aviemore have ceased. These closure actions have been adapted from the approved EMP for Aviemore Colliery.

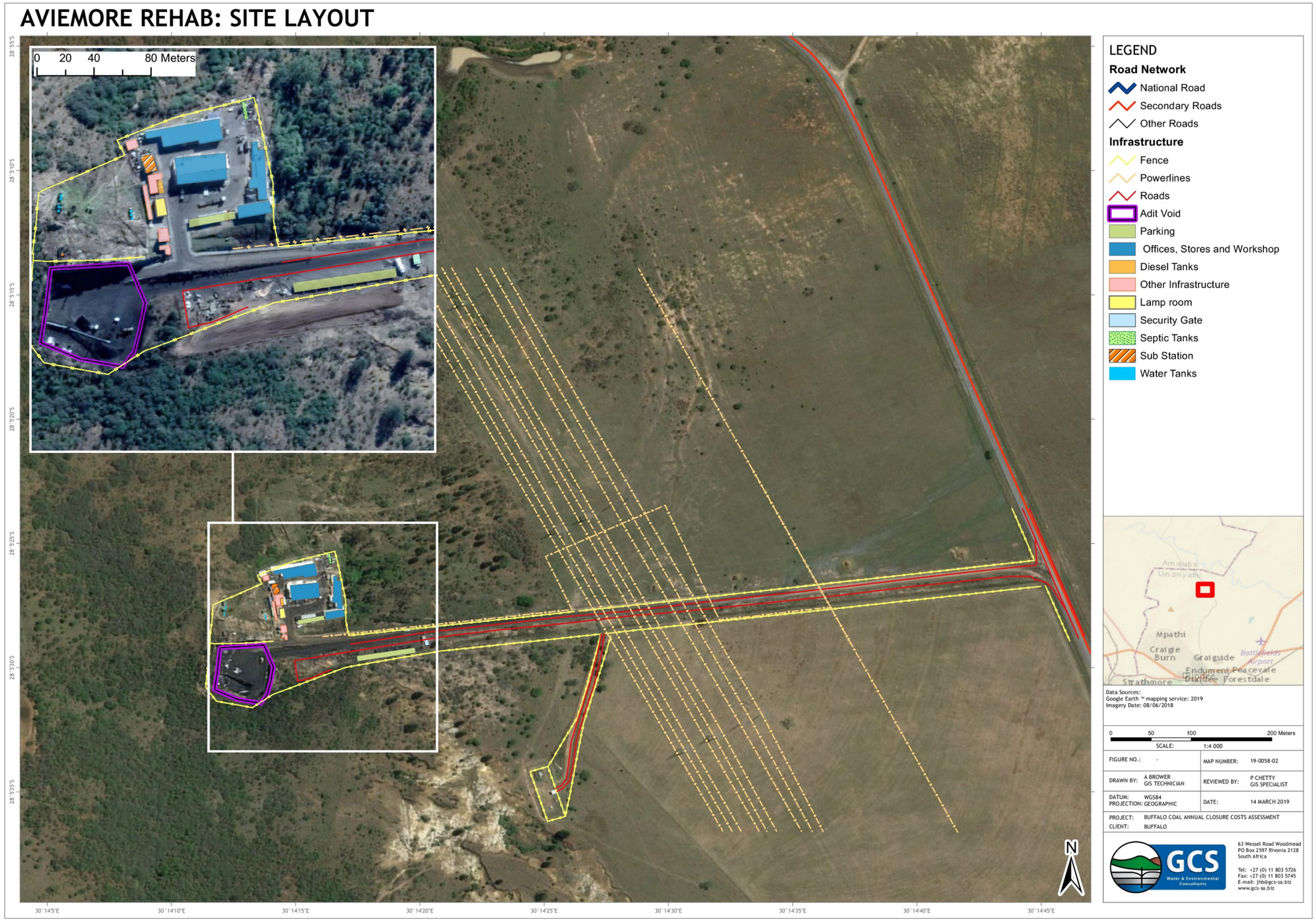


Figure 8-1 Areas Requiring Rehabilitation

8.1 Preparation Prior to Rehabilitation

The following aspects relate to site preparation prior to rehabilitation being initiated:

- The rehabilitation plan must be followed unless further studies are required;
- The final rehabilitation programme and plan will be submitted to all interested and affected parties (I&APs) for comment;
- Concerns from the I&APs during the Public Consultation Process are to be considered by the mine and the rehabilitation specialist;
- Final approval (following a basic assessment environmental authorisation process) will be required to start rehabilitation activities at Aviemore;
- A rehabilitation team must be appointed to oversee and give guidance during the rehabilitation process;
- The rehabilitation team must draw up a final risk assessment to deal with the rehabilitation processes required for the site;
- A health and safety and environmental officer will guide contractors during the process;
- Rehabilitation should preferably be undertaken before the first rains start in order to prevent erosion;
- The slopes of steep areas are to be graded to a slope of approximately 1:3 (or unless otherwise stated) in order to prevent excessive erosion, to allow vegetation to establish enough root growth and in line with health and safety requirements for closure;
- Prior to the utilisation of stockpiled topsoil, a representative sample will be analysed at a reputable laboratory to determine the soil fertility status. If the fertility status is found to be diminished, agricultural fertilisers will be added to supplement the soil;
- Care should be taken to ensure that the topsoil does not contain any large rocks or remnants of alien invasive species. This can be accomplished by screening the topsoil before application;
- Ensure that demolition and rehabilitation contractors restrict their activities to the areas that need to be rehabilitated; and
- Continuous management and monitoring are required to ensure contractors keep to the final rehabilitation plan and schedule.

8.2 Landform Redesign and Final Topography

Landform redesign is required to include a final topography that coincides with all the surface drainage areas of the site. The aim of the final landform is to ensure that the topography blends into the surrounding landscape. Some of the key aspects that require management include:

- The drainage topography for the overall site must be planned as part of the overall landscaping. Drainage areas of adjacent land areas will provide a guide to site requirements;
- Where stable slope profiles are limited, benches will be required to reduce the velocity of run-off. The position of the benches is critical when long slopes and intense rainfall is experienced. In these cases, several benches may be required;
- The volume and velocity of the runoff water must be controlled entering the watercourses in surrounding areas. An increase of water could result in erosion in downstream areas of the catchment;
- Care should be taken to ensure that the topsoil does not contain any large rocks or remnants of alien invasive species. This can be accomplished by screening the topsoil before application; and
- Side slopes of the rehabilitation area are to be covered by topsoil sourced from the topsoil stockpiles which were created during the clearing of specific areas. The layer of topsoil on the side slopes and other areas should be at least 300 mm thick (after compaction) to aid plant growth and assist in re-generation of indigenous plants;

Drainage and Erosion Control is normally the key aspects to consider when redesigning for post closure. The rehabilitation procedures described above will be planned and carried out to ensure surface runoff patterns. A key objective of the rehabilitation and closure activities will be to ensure good soil displacement does not occur and that re-vegetation is effective and contribute to the reduction in financial liability of the process. Key rehabilitated processes required include:

- Grading and contouring the disturbed surface area as necessary to reduce erosion potential from surface runoff;
- Appling a soil cover where it is considered necessary for vegetation growth;
- Establishing low maintenance erosion control devices in areas where erosion is a potential concern from the contoured surfaces; and
- Establishing vegetation cover on reclaimed surfaces that is of a similar density and diversity as that which exists in surrounding areas.

Elements such as drainage paths and contour drains, will be shaped, as much as practical, to keep with natural landforms of the surrounding environment. Contour and catch drains are designed to collect surface runoff from revegetation or disturbed areas. A vegetation cover is the best long-term means of protecting against wind erosion. While a vegetation cover is being established, there are three basic methods of controlling wind erosion on disturbed soils. All aim to reduce the wind velocity near the soil surface. They are:

- Protection of the soil surface by natural or manufactured materials or mulch. In most cases, the use of these materials may form an integral part of the revegetation program, the aim of which is to establish a permanent protective cover;
- Maintenance of the soil surface in an erosion resistant condition. This usually means leaving the surface in a coarse condition. Keeping the soil surface damp using sprays or water tankers will increase the aggregation of particles and their resistance to wind erosion; and
- Reduction of wind velocity across the disturbed areas by establishing windbreaks. Windbreaks may be rows of trees or shrubs retained or planted at right angles to the direction of the erosive

Erosion by water is caused mostly by surface runoff from intense rainfall events. Even in arid and semi-arid areas, high intensity low frequency rainfall events can cause rapid runoff and extensive soil erosion. The important factors influencing runoff include:

- Clearing of vegetation should be limited to that necessary for the safe operation of the mine. Minimising the area cleared will reduce costs both for clearing and site rehabilitation.
- Construction of diversion channels or holding structures such as banks, drains or dams will effectively limit the entry of water on to the site.
- Where dams are constructed for water storage and/or as a measure to limit entry of water to site, ensure the dam is adequately sized and provision is made for safe discharge.
- This is often, but not always, most effectively achieved by ripping the disturbed area parallel to the contours.

8.3 Underground Operations

Aspects to consider with regards to underground mining voids include:

- All underground infrastructure will be removed if recyclable, or left in situ;
- All power cables and water pipelines will be cut before mine is closed; and

- All surface openings (mineshafts, air vents and portals) will be sealed with a concrete cover linked to the existing concrete shaft. These seals will be engineered to fit in the hole and keep all deterrents away from site.

Removal of all unwanted infrastructure and rendering this safe are basic legal requirements for mine closure. Where underground mining has been done, a key issue is the sealing and making safe of mine shafts, adits, ventilation tunnels and any other access routes to the underground workings. In all cases, the access routes must be sealed.

Sinkholes may be triggered during the operational phase but are likely to continue for many years following closure of the mine as sinkholes are a completely natural occurrence. Renewed sinkhole formation and subsidence may occur following recharge of the groundwater level but this is subject to investigation. The following measures must be implemented to ensure that the mine understands the full extent of the risk:

- Management of ground movement;
- Identify potential sinkhole area;
- Monitor seismic event;
- Investigate areas of movement; and
- Implement remedial action.

Remediation measures include:

- Controlled access to the vicinity of possible sinkhole areas using fencing;
- Erection of signs warning of possible sinkhole developments and presence;
- Filling and doming of sinkholes where necessary. Depending on the size and shape of the cavity, large boulders are inserted into the hole to block the most bottom throat of the hole. The subsequent boulder sizes are reduced and the cavity is filled to the top. The top section is compacted and domed to reduce the ingress of water down the cavity. In some instances, the hole is cemented over the more stable slopes of the cavity ensuring a more stable landform. In such cases the cement is covered by soil, domed and vegetated to reduce the ingress of water in the vicinity of the cement blocks;
- Reshaping landform to minimise water ponding; and
- Minimise and/or control water discharges thereby minimising the potential of seepage that might trigger a sinkhole.

Plastered brick walls prior to the void being backfilled will seal off the underground entrance. The box cut/adit site will be rehabilitated to resemble the pre-mining surface and, once rehabilitated, the vegetation will be maintained by using normal agricultural practice. Monitoring will be carried out to check for erosion, poor germination etc. This will continue until a closure certificate has been received. Stormwater runoff entering the adit area must be avoided with an effective diversion berm. This will minimise any impact on the groundwater by restricting the ingress of surface runoff water into the mining voids. Due to the steepness of the rehabilitated surface of the adit site, the stormwater diversion berm will be maintained until the quality of the rehabilitated vegetation can once again accept the mean annual runoff. Free draining contour canals and diversions will be built and maintained as an on-going process in order to protect the establishing vegetation and to keep erosion of soil and gullying to a minimum. Any areas of subsidence will be refilled, compacted and grassed.

8.4 Buildings and Infrastructure

All structures will be removed, unless requested otherwise by the land owner, and the area rehabilitated back to grazing standards. Infrastructure serving as offices can be put to beneficial use upon closure of the mine and thus should not be removed if there is an adequate use for these buildings post-closure (preferred alternative). This adequate use should be determined before final closure and rehabilitation measures are formally implemented. In the period leading up to decommissioning of project facilities and mine closure, the mine operator will evaluate options to identify the potential for recycling and the reuse of materials. Where such potential exists, the final Rehabilitation and Closure Plan will be modified to include:

- Details of materials and demolition wastes which are to be salvaged;
- Locations where such materials are present on site;
- Any conditions which render the materials unsuitable for salvage and reuse, such as structural damage, wetting, or contamination;
- Methods for salvaging the materials to ensure they meet required conditions for reuse;
- Any requirements for cleaning or otherwise rendering the materials safe for use; and
- Locations for stockpiling salvaged materials separate from other demolition wastes.

If any agreement is reached with the landowner and/or any other organization to take over the ownership of any infrastructure, then a formal agreement to that extent needs to be entered and signed by all parties concerned. The DMR also needs to be alerted to this fact and adequate legal arrangements need to be made in this regard. If various parties cannot reach agreement on the adequate use for these buildings, then these buildings should be demolished. All temporary buildings (pre-fabricated buildings), containers and infrastructure should be

removed and their footprints rehabilitated. The following rehabilitation objectives pertaining to buildings and infrastructure apply:

- Dismantle mine related infrastructure;
- Demolish all concrete, brick and/or gravel foundations, slabs, pavements and roadways;
- Dismantle all fencing for recycling or metal scrapping;
- Remove all fuel storage facilities (tanks, reticulation, etc.) by an accredited fuel handling company; and
- The foundations of all buildings that will be removed should be removed to a depth of 0.5 m. Anything deeper than this can be sealed, buried and left *in situ*.

8.4.1 Buildings and Infrastructure

8.4.1.1 Demolish all Steel, Mechanical, Electrical, Concrete and Brick Structures

All steel, mechanical, electrical, concrete and brick structures and infrastructure associated with the mine area are to be demolished and removed. No signs of brick, steel, wood or cement are to be left on the site. Any steel, mechanical and/or electrical apparatus that can be recycled, scrapped or reused should be done in accordance with a recycling/ reuse plan as defined before post-closure rehabilitation can commence. Closure actions include:

- Identify infrastructure items that may be of use to the future land users in association with those users and the authorities, define what could be left, how it would be used and how sustainable that use would be:
    - Compile an inventory of infrastructure and equipment to potentially remain at mine closure to support and underpin the desired final land use;
    - Obtain legal authorisations for infrastructure to remain and to be transferred to third parties and finalise agreements with third parties, along with the transfer schedule and responsibilities;
    - Ensure remaining infrastructure is robust and sustainable if correctly maintained by third parties; and
    - Build capacity amongst the third party to ensure that the infrastructure and equipment will be maintained and correctly managed.
- The remaining infrastructure should be assessed for its suitability for re-use/recycling;
- The re-usable items should be removed from the site;
- Mining infrastructure that will be left on site must be rendered safe;
- Hazardous material locations and deposits require specialised assessment and analysis to determine how these materials should be decontaminated and to ensure that all

residual power and water services to be disconnected and certified as safe prior to commencement of any demolition works;

- All remaining inert equipment and demolition debris will be placed in the base of the declines or failing this into the nearest general waste disposal facility;
- Salvageable equipment will be removed and transported offsite prior to the commencement of demolition;
- All fittings, fixtures and equipment within buildings will be dismantled and removed to designated temporary disposal yards;
- All tanks, pipes and sumps containing hydrocarbons to be flushed or emptied prior to removal to ensure no hydrocarbon/chemical residue remains;
- All above ground electrical, water and other service infrastructure and equipment to be removed and placed in declines or the designated temporary salvage yards;
- Electrical, water and other services that are more than 500mm below ground surface will remain;
- Non-hazardous concrete slabs and footings will be broken. This concrete (and metal) will be broken up and disposed of in the declines;
- All concrete below 500mm depth will remain underground with the invert of all structures broken/sealed to prevent possible ingress and ponding of water;
- Soils beneath the plant, storage tanks and chemical storage areas will be sampled. Any contaminated soils found will be removed for disposal; and
- All excavations resulting from demolition of plant, buildings, roads, conveyor platforms, etc. and earth structures will be left in a safe manner.

The yard areas (e.g. platforms created for buildings, laydown areas, salvage yards, and other disturbed areas) will be closed and re-graded to control storm water runoff and erosion. Once the structures and foundations are demolished, removed, or buried, the yard areas will be inspected for any areas of hydrocarbon contamination.

8.4.1.2 Contaminated Infrastructure and Equipment

All contaminated infrastructure and equipment will need to be washed before removal to appropriate landfill sites. Rehabilitation of the facility and surrounding areas include:

- Storing tanks and vessels, equipment, pipes, concrete buildings and floors;
- Drain all tanks and vessels in appropriate containers and remove from site to off-site storage facilities or disposal thereof at authorised landfill facilities;
- Establish polluted water routes to sumps prior to the washing of the equipment, tanks, and concrete buildings and floors;

- Determine the criteria and set procedures for water that requires to be captured in containers and water run-off to sumps;
- Include possible treatment of contamination within the criteria and procedures;
- Wash all areas and monitor water content continuously;
- Remove all high content hazardous containers and dispose thereof at authorised landfill facilities;
- Once tanks are deemed safe, dismantle and safely dispose in terms of scrap metal protocol; and
- Demolish concrete and identify suitability for possible beneficial re-use (restricted re-sale).

8.4.1.3 Underground Mine and Vent Shaft Areas

The underground workings will be decommissioned through the implementation of the following actions:

- All salvageable equipment and plant is to be removed as the miners retreat on closure of mining operations;
- All tanks, pipes and sumps containing hydrocarbons or any other fluids to be flushed or emptied prior to removal or abandonment once underground mine is sealed off;
- All power and water services to be disconnected and certified as safe. Where practicable cabling containing copper is to be brought to surface; and
- Surface openings (air vents, shafts, portals, etc.) will be sealed with a steel or concrete cover that attaches to the existing concrete collar. The entrance area immediately behind access portals to be backfilled with rock as a further deterrent.
- The seal to the decline will be engineered to withstand potential pressure exerted on the seal from water as the workings fill during groundwater rebound.

8.4.1.4 Fuel Storage and Dispensing

Although this will be the responsibility of the supplier, closure of these facilities will focus on physical closure and investigation of potential subsurface contamination from petroleum products. Closure of these facilities will include:

- Removing remaining fuel inventory;
- Decontaminating equipment including tanks, piping, and dispensing equipment, as needed;
- Removing equipment;
- Demolishing all storage tanks and buildings;
- Removing any appurtenances including piping and electrical;

- Breaking walls and foundations to grade;
- Hauling non-hazardous demolition debris to the adit area for backfilling;
- Sampling soils beneath and surrounding the facility;
- Classifying and removing any contaminated soils identified and treating them on site to acceptable standards or to a licensed facility if hazardous; and
- Grading the footprints in line with adjacent yard footprints.

8.4.1.5 Transport Rubble and Dispose in Pit

All inert rubble that is created by the demolition of the plant area can be, on approval, disposed of down the shaft. If this is not possible then the material must be transported to an appropriate waste site. The transport of the rubble and discard materials should be done in a cost-effective manner.

8.4.2 Structural and Infrastructural Development Footprints

Following demolition of infrastructure and the ripping of road surfaces, the remaining footprints will be returned to a land use as far as reasonably and practically possible like that which existed prior to construction. This will be achieved by implementing the following closure actions:

- Regraded to a topography consistent with the surrounds to control storm water runoff and erosion;
- Deep ripping with at least 500mm will be undertaken in areas where there is no potential of damaging any pipes or cables which may be required. Where space allows, cross ripping to be undertaken, with the final rip to be parallel to contours. Where pipes or cables are present below the footprint, these will be demarcated to ensure that they are avoided. If necessary, a shallower tine will be used in these areas;
- Placement of soil stockpiled ahead of construction. The soils depths to be placed are dependent on the final land use, with the following be the minimum utilisable soil depth – utilisable soils depth includes underlying substrate and does not necessary specify placed growth medium thickness.
- Soil ameliorants will be added dependent on soil fertility analyses after placement;
- Footprints to be ploughed parallel to the contours after soils and ameliorants placed to mitigate compaction which may have occurred during soil placement; and
- Natural vegetation to be established.

8.4.2.1 Buildings and Paved Footprint Areas

The entire area where the mine administration buildings, workshops, change houses and any other area where a building once stood should be ripped to loosen the soil. Ripping will aid the germination of indigenous seeds and encourage new plants to take root in these previously compacted areas. Any areas that have been compacted which were not direct building footprints should also be ripped. These areas include gravel car parking areas, gravel workshop yards and lay-down areas which have been compacted.

8.4.2.2 Topsoil and Vegetate Footprint

The entire footprint area from old buildings is to be laid with topsoil after it has been ripped. Once topsoil is laid to the appropriate depth and specifications of at least 300mm thick (after compaction), the area must be re-vegetated using grasses, shrubs and trees that are indigenous to the thatched grass ecoregion.

8.4.3 Fencing and Walling

Due to the maintenance costs associated with retaining the fence, the fence will be removed as the areas are reclaimed. Should infrastructure that is handed over to a third party require security fencing, this will then be retained. Closure actions therefore include:

- Remove all fencing that will no longer be required post closure;
- Demolish all concrete foundations/supports to 0.5 m below ground level; and
- Rip tracks along the fence and allow for natural re-vegetation.

8.5 Waste

8.5.1 Solid Waste Disposal

The operations daily waste stream at the site will likely have consisted of plastics, wood, shipping and packaging materials and paper products that cannot be further recycled in the offices and laboratories. Also included in this waste stream will be a very small amount of employee generated waste from packaging of meals. This material will be handled by the domestic waste collection system during operations and will not be on site at the time of closure.

8.5.2 Process Waste

A certain amount of industrial waste will also be generated over the operating period of the mine. This material will include mostly scrap metal, used conveyor belts, abandoned vehicles, and machine parts. It is expected that these materials will be disposed of off-site with a certified waste collector during mine operations as part of the Waste Management Plan. Materials remaining upon closure will be removed and disposed of with the general demolition waste or recycled, where possible.

8.5.3 Hazardous Materials

Portions of the site may be identified at the time of closure as having the potential to contain hazardous materials either in storage or in the ground as a result of normal activities and/or accidental spills. In the case of stored materials such as fuel, oils, lubricants, explosives, hazardous chemicals, and other hazardous materials, these will be removed from site and handled either by disposal, resale or restocking in accordance with the transportation and safety procedures outlined in the appropriate Material Safety Data Handling Sheet (MSDS). All such materials will be identified and inventoried on the surface and underground and will be removed from the site prior to the commencement of closure activities.

8.6 Haul and Access Roads

The following rehabilitation objectives pertaining to haul roads and access roads apply:

- Demolish all haul and access roads;
- Rip and scarify all roads that have been compacted; and
- Encourage plant growth and natural seeding in order to revegetate disturbed areas.

Access roads on the mining property have been substantially compacted over the years of mining. Road areas need to be ripped in order to loosen the soil and shaped according to the topography of the area. During the shaping process, drainage lines should be considered before revegetation takes place. Once access roads have been ripped, these areas need to be laid with topsoil and revegetated.

The rehabilitation of the mines haul and access roads should be done as the last rehabilitation item. This will allow the rehabilitation contractors to make use of these roads during all other rehabilitation activities. Once all other activities have been completed, the haul and access

roads should be ripped and rehabilitated from the furthest point from the point of exit to the mine.

8.7 Material Balances

Rehabilitation measures require the infilling of the adit/box cut area and top soiling of all disturbed areas. In order to determine that enough material is available for the required rehabilitation measures; a survey of available subsoil and topsoil stockpiles was undertaken by Buffalo Coal. These estimates provided a rough indication of the material balance at Aviemore and whether additional material will be required for successful rehabilitation. Based on Buffalo Coal's survey department calculations, currently the existing subsoil stockpiles was estimated at 495 000m³. This will be enough for the infilling activities required during final rehabilitation. The topsoil stockpile is estimated at 5 000m³. The total area of disturbed land (development footprint), requiring a minimum of 300mm of topsoil, is approximately 25 900m². Aviemore, therefore, requires a minimum of 7 770m³ of topsoil to ensure successful rehabilitation. This presents a shortfall of approximately 2 770m³ of topsoil material that will have to be imported to site during rehabilitation. The cost of this shortfall has been included in the closure costing, with rates (price of topsoil per m²) obtained from Buffalo Coal's contractor.

8.8 Top Soil Stockpiles

Topsoil provides a good microenvironment for seed germination and generally contains seeds, nutrients and microorganisms that are necessary for plant growth. If these are lost, then the system will generally take a longer time to re-establish. During the operational activities on the mine, soil stockpiling becomes a requirement that would ultimately be required during the annual and final rehabilitation processes on the mine. Aspects that requires consideration include:

- Where practical, strip and place soils when dry, and not when wet;
- Locating topsoil stockpiles to minimise the final handling and reducing the final cost of rehabilitation;
- Ensure proper drainage at stockpile to reduce erosion and removing the fertility of the soil;
- Reducing the compaction of the stockpiles and ensure that soil is treated;
- Vegetate the stockpile if soil will only be used during final rehabilitation processes; and
- Manage the stockpiles so that it is used for its intended purpose.

8.8.1 Soil Stripping and Stockpiling

Soil recovery and the use thereof becomes a very important aspect of rehabilitation. A top soil management plan can be considered as a critical component during the operational phase of a mine.

Proper topsoil (the first 0.3m) should be stored separately from subsoil because it contains more nutrients and microbes than subsoil. These stockpiles should be restricted to heights less than 1.5 m to ensure that aeration is not compromised which in turn assists microbial activity and therefore soil quality. The downside to the practice is that this might not be practical as space on site may be limited. Allowing subsoil to contaminate topsoil dilutes the nutrient and organic matter content causing soil infertility. Infertility imbalances then must be reclaimed and optimised by using costly fertilizers. It is recommended that the subsoil stockpiles should be limited in height (4-5m). Soil should not be stripped or redistributed if the top or subsoil is too wet. The soils should be stockpiled on the parent soils and as close to the originally stripped and final rehabilitation areas as possible. The top and sub soils are to be stockpiled in a berm like manner within the project area.

Post mining soil reclamation is very difficult or near impossible if the stockpiled topsoil materials are of inferior quality due to mismanagement during storage. Good quantity and quality topsoil are an essential ingredient in the process of soil reclamation.

8.8.2 Compaction Avoidance

To avoid compaction to take place, soils must be stored and kept as loose as possible. This could include adding mulch to the soil at a very early stage of storage. Movement of vehicles at the site must be limited and trucks must dump soil in a single movement.

8.8.3 Topsoil Stockpile Vegetation.

These topsoil dumps will potentially be in place for the full life cycle of the mine or until concurrent rehabilitation takes place. These dumps will require vegetation to reduce the possibility of erosion and an alien invasive management plan to assure the quality of the topsoil. Care of the dumps is required to ensure quality and integrity of soils.

8.8.4 Topsoil and Subsoils Stockpile Maintenance and Monitoring

Once established, stockpiles should be managed to ensure that losses from the stockpiles are minimized and that additional damage to the physical, chemical or biotic component of the topsoil is minimised. It must be ensured that the stockpiled soil is only used for its intended purpose. The topsoil stockpiles must be clearly demarcated as "No Go" zones and monitored frequently.

8.8.5 Soil Amelioration

Before replacing the soils, both physical and chemical amelioration is required. The actions that should be taken during the amelioration of soils are as follows:

- The topsoil stockpile must be ripped to reduced compaction which occurred throughout the lifecycle of storage;
- During the ripping process mulch and immobile fertilisers are added to restore soil fertility; and
- Fertilisers are added until the soil fertility cycle has been restored.

8.8.6 Soil replacement

When replacing the soils, the sub-soil layer will be replaced first and lastly the 300mm topsoil in which the seeds will germinate. The risk of replacing soil in this fashion is that it enhances the compaction of the soil, which is one of the critical areas of hard setting. Typical actions of soil replacement include:

- Not all soil must be replaced and a reserve of soil is required to repair areas that failed during the rehabilitation process;
- Compaction by heavy equipment must be minimised as far as possible;
- Compaction can be limited when soils are dry. Wet soil adds to the compaction;
- When soils are replaced, it must be ripped to full rooting depth; and
- In places where revegetation is difficult the vegetation can be tiled.

8.9 Soils

8.9.1 Long term soil stability

The preferred closure actions pertaining to soil stability are as follows:

- Erosion control structures and rehabilitated surfaces will be maintained until the surface is stable and self-supportive.

8.9.2 Final rehabilitation in respect of erosion and dust control

The preferred closure actions pertaining to erosion and dust control are as follows:

- Disturbed areas will be kept to a minimum;
- Exposed surfaces must be re-vegetated as soon as possible;
- A re-vegetation programme will be implemented and maintained until the area becomes self-supportive and a closure certificate is granted;
- Where disturbed areas cannot be re-vegetated, appropriate measures will be taken to control erosion. These may include grading of surfaces to prevent rapid run-off of storm water and energy dissipaters if necessary;
- The area will be rehabilitated to be free draining and fit into the surrounding landscapes;
- Dust suppression will continue during the decommissioning phase; and
- All the above will be in accordance with the regulations and approval of by the relevant agencies.

8.10 Re-vegetation

The following aspects relate to hydro-seeding/re-vegetation:

- A suitably qualified hydro-seeding specialist should be contracted to perform the seeding process;
- A grass mixture utilising endemic grasses should be utilised in the seeding process;
- The seed mixture should be incorporated into mulch which includes fertiliser and germination acceleration agents;
- The seed mulch should then be used to fill the Hessian socks;
- The seeded areas should then be irrigated according to the recommendation of the hydro-seeding specialist;
- Weekly monitoring should take place in order to ascertain the efficacy of the hydro-seeding and to repair any areas where gullies or rills are forming; and
- Note that hydro-seeding is primarily for grasses and smaller shrubs. Larger shrubs and trees will need to be hand-planted.

The overall objectives for the re-vegetation of reshaped and top-soiled land are to:

- Prevent erosion;

- Restore the land to the agreed land capability;
- Re-establish eco-system processes to ensure that a sustainable land use can be established without requiring fertilizer additions; and
- Restore the biodiversity of the area as far as possible.

A suitably qualified hydro-seeding specialist should be contracted to perform the seeding process;

- A grass mixture utilising endemic grasses should be utilised in the seeding process;
- Analysis of the soils on the site returned deficiencies of nitrogen, phosphorus and potassium. Depending on the outcome of the soil tests, a standard 3:2:1 (25) ratio N:P:K fertilizer should be added to the soil in a slow release granular form at a rate of approximately 200 kg/ha before re-vegetation (These results must be verified prior to rehabilitation commencing). It will be necessary to re-evaluate the soil conditions of the site at regular intervals to determine if additional fertiliser applications are required;
- The seed mixture should be incorporated into mulch which includes fertiliser and germination acceleration agents;
- The seed mulch should then be used to fill the Hessian socks;
- The seeded areas should then be irrigated according to the recommendation of the hydro-seeding specialist;
- Weekly monitoring should take place in order to ascertain the efficacy of the hydro-seeding and to repair any areas where gullies or rills are forming; and
- Note that hydro-seeding is primarily for grasses and smaller shrubs. Larger shrubs and trees will need to be hand-planted.

The following aspects related to the establishment of grass on rehabilitated areas applies:

- Once enough basal cover has been established, the introduction of species representative of the grass vegetation type may commence;
- Introduction of these species should commence through the stages of natural succession, i.e. Pioneer species (grasses, herbaceous species), Secondary species (grasses, small shrubs, and small trees) and Climax state (larger shrubs, large trees);
- This process will also occur naturally as seeds from the neighbouring thatching grass areas are introduced and germinate;
- Certain tree species can be selectively introduced; however, consideration will need to be given to rooting depths and soil stability as well as the ability of the trees to establish on the subject area;

- A test area should be designated to test possible tree species to be introduced for their ability to grow in different substrates. This should commence immediately in order to allow informed decision-making once rehabilitation commences; and
- The primary goal is to achieve a stable, climax state, representative of the thatching grass and vegetation type where the ecological function of the plant community is tolerant of most environmental conditions it encounters.

The soil factors most likely to affect the success of rehabilitation are:

- Compaction or the presence of hard layers that restrict root penetration;
- Surface crushing or hard-setting;
- Acidity, alkalinity, salinity or sodicity;
- Presence of excess Manganese, Aluminium or heavy metals;
- Low availability of nutrients (especially nitrogen and phosphorous but can also include other major and minor plant nutrients); and
- Water repellence.

8.11 Alien Invasive Species

The following is relevant:

- Controlling the introduction and spread of alien invasive species is an important consideration in rehabilitation. Alien species infestations on rehabilitated areas can be very difficult to control and the emphasis should be on prevention rather than cure;
- Alien invasive vegetation is often vigorous, persistent and good colonisers. Consequently, they may rapidly invade sites being rehabilitated;
- Alien invasive vegetation in areas adjacent to those disturbed by mining should be controlled to reduce the potential seed load. Be sure the mine site does not become a source of alien invasive species for possible infestation of adjacent properties;
- Care must be taken to ensure that alien invasive species are not introduced to the area in topsoil, hay, mulch or manure or as contaminants in seed of the desirable species;
- Clean equipment coming on to site from other areas to remove seed or plant pathogens;
- Early detection of alien invasive species before they are well established can simplify their control;
- Apply one or a combination of the following basic methods of control, according to species of concern:
    - Physical (mechanical) consisting of –

- Uprooting (hand pulling);
- Cutting back;
- Hand pulling, chopping, slashing and felling;
- Ring-barking (girdling);

- Chemical by means of herbicides as follows:
  - Foliar application;
  - Stem notching and application;
  - Stump treatment;
  - Soil treatment;

According to legislation any category 1 invader must be eradicated. This will reduce the competition between species and improve chances for desired vegetation establishment.

8.12 Surface and Groundwater

8.12.1 Surface Water

In order to prevent contamination of surface water, surface water containment or diversion structures be constructed and maintained. This has been undertaken at Aviemore in the form of the diversion berms and silt traps to which surface water is directed. As with groundwater, Buffalo Coal is cognizant of the surface management issues and is continually assessing and implementing corrective actions to improve the mine's surface water management. The preferred closure actions pertaining to surface water are as follows:

- The designs implemented will ensure compliance with GN704;
- Regular monitoring of boreholes and trench systems will continue with an action plan to address surface water contamination where it does occur;
- Additional monitoring boreholes shall be constructed as and when they may be needed. This will be determined by the yearly audits done on the mine;
- The operational surface water monitoring programme will be adapted in order to be relevant for the mine decommissioning and post closure period;
- In areas of shallow ponding where the topography allows for mitigatory action, the land will be reshaped and rehabilitated to enable free drainage to occur;
- Free draining contour canals and diversions will be built and maintained as an ongoing process, in order to protect the establishing vegetation and to keep erosion of soil and gullying to a minimum;

- Due to the steepness of the rehabilitated surface of the adit site, the stormwater diversion berm will be maintained until the quality of the rehabilitated vegetation can once again accept the Mean Annual Runoff (MAR);
- Re-instate local drainage lines of the areas shaped and levelled under general surface reclamation, particularly in areas where subsidence has occurred; and
- Any areas of subsidence will be refilled, compacted and grassed.

8.12.2 Groundwater

On closure of the mine, any decant water must be managed appropriately as surrounding farmers may wish to utilise this resource. Abstraction can lower water levels, thus causing oxidation to recommence. Uncontrolled abstraction can lead to repeated wetting and drying, acidification and neutralisation. This process uses up the existing calcite in the pillar structures, which can cause instability and collapse of the coal pillars. These unstable conditions may generate lines of weakness to the surface in the form of fissures and fractures thereby inducing infiltration from the surface and exposure to an oxidising environment. The preferred closure actions pertaining to groundwater are as follows:

- The designs implemented will ensure compliance with GN704;
- Regular monitoring of boreholes and trench systems will continue with an action plan to address groundwater contamination where it does occur;
- Additional monitoring boreholes shall be constructed as and when they may be needed. This will be determined by the yearly audits done on the mine;
- The operational surface water monitoring programme will be adapted in order to be relevant for the mine decommissioning and post closure period;
- Seal all old vent shafts and adits;
- Multiple-level monitoring wells must be constructed to monitor base-flow quality within the identified sensitive zones and to monitor groundwater level behaviour in the underground workings. The results of the monitoring programme will be used to confirm/validate the predicted impacts on groundwater availability and quality after closure;
- Update existing predictive tools to verify long-term impacts on groundwater, if required;
- Present the results to DWS on an annual basis to determine compliance with the closure objectives;

- PCDs could be used to intercept polluted seepage water. This should be considered if it is found that surrounding surface water resources are indeed negatively affected by pollution. Regular sampling of these surface water resources is essential;
- All mined areas should be flooded as soon as possible to prevent oxygen from reacting with remaining pyrite;
- Identify decant points and decant elevations during the operational period so that measures can be implemented during the operational period to limit possible risks (i.e. evaporation facility and a seepage capture system);
- Audit the monitoring network annually;
- Backfilled areas will be compacted. This will reduce the permeability of the rehabilitated area;
- Monitor the water quality in the recharging compartments against the required receiving water quality objectives;
- Review the long-term water management strategy if the water quality proves to be of an unacceptable quality.
- Caution will be taken to prevent cavities between large pieces of rock that are backfilled so as to minimize oxygen intrusion; and
- An alternative source of water must be supplied to groundwater users in the unlikely event of any negative impact on their boreholes due to their mining activities.

8.12.3 Ongoing seepage and control of rain water

The preferred closure actions pertaining to seepage and rain water control are as follows:

- Pollution control structures and storm water management measures will be maintained until closure has been obtained. This will ensure the maintenance of the fresh water and polluted water catchments;
- Avoid all storm water runoff entering the adit area with effective diversion berm. This will minimise any impact on the ground water by restricting the ingress of surface runoff water into the mining voids; and
- Suitable mining centres and safety factors will be implemented to ensure ground stability. This prevents surface subsidence and the creation of fissures/cracks to surface.

8.13 Groundwater and Acid Mine Drainage Management Plan

Best Practice Guideline - A6: Water Management for Underground Mines (DWAF, 2008b) states the following:

> Plan, design, operate and close the underground mining operations in a manner that reduces the ingress of clean water into the mine, minimizes the volume of water used in mining operations, maximizes water reuse, minimizes the water quality deterioration within the mine and minimizes the impacts on the water resource.

To restrict the local groundwater and surface water impact during mine maintenance and closure; and to reduce likely AMD, the actions listed in Table 8-1 are proposed.

Table 8-1 AMD prevention methods based on a control objective (adapted from Kuyucak, 2012)

Objective of Control	Control / Prevention Method
Water mitigation	Capping & seeding, diversion ditches, grout curtains, slurry walls, impermeable geomembranes.
Reduction of water inflow	Encapsulation, capping and sealing.
Exclusion of oxygen	Water covers (flooding), blending with finer material to reduce pore space, and sub-aqueous deposition.
pH Control	Waste segregation and blending, with the addition of alkaline / lime.
Sulphide removal and isolation	Conditioning tailings, discard dump and waste rock.
Control of bacterial action	Bactericides.

8.13.1 General management

The following general management strategies must be considered to manage any long-term AMD:

- Plan for closure about understanding where water enters the mine and would normally accumulate, how it flows, how it should preferably flow in order to minimize water quality deterioration.
- Seal all boreholes, old ventilation shafts, old rescue bays and mine portals/adits. These holes need to be plugged from the bottom where they intersect the workings and then grouted through to surface. It would be advantageous if the board can be backfilled (e.g. with ash) to give further support to the roof to reduce the risk of board failure which could destroy the plug and grouting thus allowing water to ingress into the workings.
- Shafts can be major sources of surface and groundwater ingress if not properly lined. Two typical shaft types are illustrated which are used on underground coal mines.

  - Vertical shafts for men, materials and ventilation.
  - Incline shafts for men, materials, coal conveying and ventilation.
- Enough pillars must be left underground, as part of sound mine planning, to avoid subsidence of the roof to surface along the shallower areas (where underground mining is less than 40m from surface).
  - This will ensure that the rate of recharge to the underground workings remain at natural rates and will minimise decant from the workings post-closure.

8.13.2 Site specific

The focus areas for AMD management should be:

- To reduce oxygen ingress into the old mine workings.
- To reduce excessive rainfall recharge/inflows into the underground workings after flooding.

8.13.3 Monitoring

The focus of monitoring should be:

1. Operational:
   a. Multiple-level monitoring wells must be constructed to monitor base-flow quality within the identified sensitive zones (Figure 5 1) and to monitor groundwater level behaviour in the underground workings.
2. At and After Closure:
   a. Deep underground boreholes will only be required towards mine closure.
3. Use the results of the monitoring programme to confirm/validate the predicted impacts on groundwater availability and quality after closure.
4. Update existing predictive tools to verify long-term impacts on groundwater, if required.

8.14 Water Treatment Options

In terms of decant, a review of the coal floor elevations shows that decant is unlikely. The mine workings in higher elevated areas will therefore most likely stay dry over time. The potential for decant at Aviemore is therefore considered to be low. Additionally, the adit will be sealed post closure.

Following a worst-case scenario approach, all mine decant and dewatered mine water will need to be treated before it is discharged into the receiving environment. Based on available data, two (2) treatment systems are considered:

1. Active water treatment system; and
2. Semi-passive water treatment system.

The treatment systems and preliminary cost estimates for implementation are discussed in the sub-sections below. In selecting a suitable water treatment system, the following should be considered:

- Composition of the inlet water;
- Specific cations of product water;
- Infrastructure and space available;
- Capital expenditure (CAPEX);
- Operational expenditure (OPEX); and
- Waste generation.

8.14.1 Active water treatment

Active water treatment is highly effective at treating AMD, however, comes with high long-term operational costs. Based on available chemistry data (low pH, high TDS, high Fe, Al and Mn) the following treatment options were considered:

1. Reverse osmosis process:
    - The concept of this type of process is that very high purity water is recovered by reverse osmosis, and the salts in solution are concentrated and kept in solution using anti-scaling technology. The supersaturated solutions are then treated in precipitation reactors thereby removing sparing soluble salts from solution. The reactors can be designed and operated for the removal of specific salts or for the generation of a mixed salt. In some cases, lime may be added, and the reactors then operated for "cold lime softening" and the pH elevated.
2. Ion exchange process:
    - Ion exchange processes are provided as an adsorption barrier against the breakthrough of dissolved ions in the water. Cation exchange resins are employed to remove cations followed by anion exchange resins for the removal of anions.
    - Although there are several pilot plants used for the treatment of mine water, there are currently no large installations being operated for the treatment of water before discharge. Ion Exchange has however been used in large installations to produce Demineralised water of power stations.

- Once the salts are adsorbed onto the resins, these need to be selectively removed. Chemical addition and the potential volume of high concentrated wastes then becomes the underlying issue. Although Ion Exchange can ensure acceptable quality the volumes and concentrations of brines needs to be considered. The options for brine disposal include:

    i. Neutralisation is necessary as the chemicals are either acidic or caustic;

    ii. Evaporation is necessary as all the salts report to the regeneration as dissolved;

    iii. Disposal of the concentrated solutions to a waste site; and

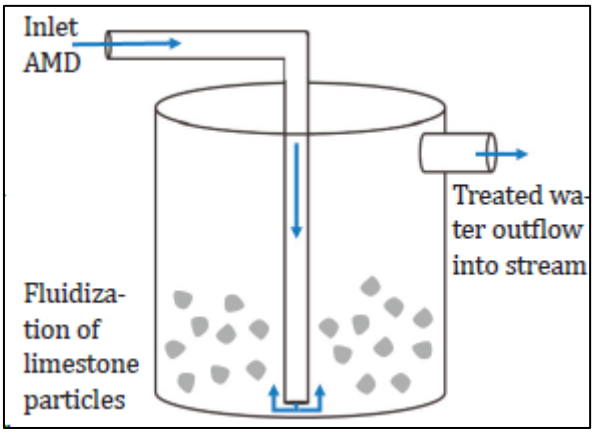
    iv. Production of saleable by-products is possible; however, the quantities probably make this non-viable.

8.14.2 Semi-passive water treatment

Passive treatment of AMD is a favourable method of treating contaminated waters. These systems are low maintenance, low cost and take advantages of naturally occurring processes at the given site (IMWA, 2018). Based on available chemistry data the following treatment options were considered:

1. Limestone diversion wells:

    - Typical well consists of a circular casing, often sunk into the ground at a shallow level alongside a stream. Water is forced into the well by having an elevation difference that creates a hydraulic head. This often involves damming water upstream. The water is flushed into the centre of the well through a pipe and exits the pipe near the bottom of the well. The water then flows upwards, fluidizing the limestone substrate. Calcium carbonate reacts with the contaminated water to raise the pH and increase alkalinity, thus allowing for the removal of metal contaminants. Treated water can then be discharged to a nearby watercourse.



2. Linear Flow Channel Reactor (LFCR)

- The operation of the integrated process relies on the formation of niche environments within the LFCR, partitioning a distinct aerobic zone at the air-liquid interface and an anaerobic zone within the bulk volume of the reactor. The Sulphate Reducing Bacteria (SRB) in the bulk volume reduce sulphate, in the presence of a suitable electron donor, to sulphide. The sulphide is partially re-oxidised by Sulphur Oxidising Bacteria (SOB) under oxygen-limiting conditions at the air-liquid interface, forming a floating sulphur biofilm.

3. Passive underground mine-water purification (PUMPS, Figure 8-2):

- PUMPS is a semi-passive in-situ AMW purification system that uses sulphate reducing bacteria for bioremediation of large volumes of AMD. PUMPS is designed to draw its operational energy from geothermal heat extracted from mines below the mines and to eventually convert the mines into clean water reservoirs.

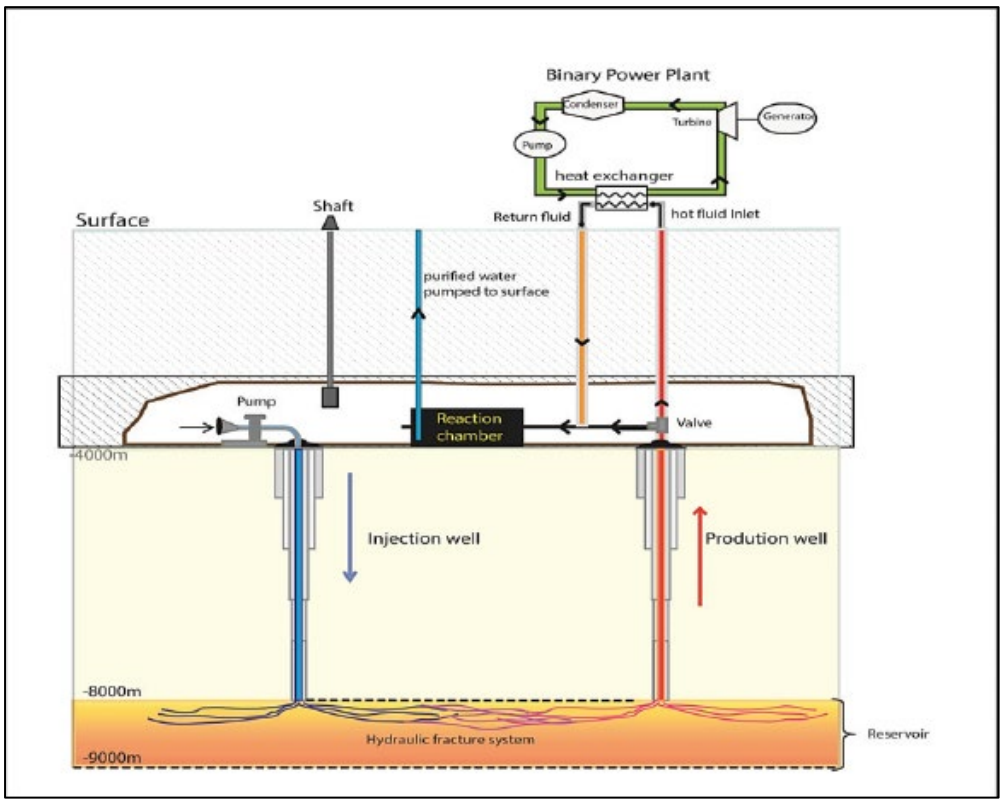


Figure 8-2 PUMPS semi-passive water treatment (retrieved from IMWA, 2018)

8.15 Subsidence

Sinkholes may continue for many years following closure of the mine as sinkholes are a completely natural occurrence. Renewed sinkhole formation and subsidence may occur following recharge of the groundwater level in the underground workings, but this is subject to investigation. The following measures must be implemented to ensure that the mine understands the full extent of the risk:

1. Management of ground movement;
2. Identify potential sinkhole areas;
3. Monitor seismic events;
4. Investigate areas of movement; and
5. Implement agreed remedial action.

Remediation measures include:

- Controlled access to the vicinity of sinkholes using fencing;
- Erection of signs warning of sinkhole developments and presence;
- Filling and doming of sinkholes where necessary. Depending on the size and shape of the cavity, large boulders are inserted into the hole to block the most bottom throat of the hole. The subsequent boulder sizes are reduced and the cavity is filled to the top. The top section is compacted and domed to reduce the ingress of water down the cavity. In some instances, the hole is cemented over the more stable slopes of the cavity ensuring a more stable landform. In such cases the cement is covered by soil, domed and vegetated to reduce the ingress of water in the vicinity of the cement blocks;
- Reshaping landform to minimise water ponding; and
- Minimise and/or control water discharges thereby minimising the potential of seepage that might trigger a sinkhole.

8.16 Maintenance of Rehabilitated Areas

All areas must be maintained for a period of five (5) years after formal rehabilitation ceases. During maintenance, the following should be done:

- Clearing of alien and invasive plants to allow indigenous plants to out-compete invasive and take a strong hold in the area;
- Watering of larger trees that were planted during rehabilitation to allow for these tree to establish adequately;
- Patching/fixing of any areas that have eroded since rehabilitation;

- If hydro-seeding was not effective during the first application, a second application of hydro-seed mixture may have to be applied in certain areas. The application of hydro-seed should be at the discretion of the hydro-seeding specialist;
- Maintain water runoff areas so as to not increase chances of further potential erosion or water ingress into the rehabilitated voids;
- Encourage growth of plants and grasses by cordoning off, fertilising and watering areas that have struggled to take root or re-vegetate;
- Areas of high importance (i.e. slopes or riparian areas) should be more vigorously maintained, fertilized and watered during maintenance;
- Along the crest of steep gradients', a 1 m high Hessian screen should be placed around the facility to assist with the trapping of seeds and to protect the crest from wind erosion;
- Regular application of fertiliser should take place in order to ensure efficient establishment of vegetation cover until such time as sufficient organic matter is being produced by the established grasses to allow for self-sustaining growth;
- The process of unification can be utilised to ensure a constant supply of organic compost (fertiliser). This entails the establishment of a compost heap, where cleared indigenous organic matter is stored and allowed to break down naturally to the point of resembling garden compost;
- Care must be taken to ensure that ONLY indigenous plant matter is utilised for this process, as the presence of alien invaders may cause the establishment of invader plant communities in the rehabilitated areas: and
- With the re-establishment on natural ecological processes, Herpetofauna fauna and flora will slowly return to normal on the mining areas.

8.17 Health and Safety Hazards

The potential to create safety hazards because of rehabilitation should be considered. Potential health and safety hazards may include:

- The closure health and safety hazards are likely to be like those encountered during operations. Typical hazards associated with operations such as vehicle traffic, electrical, chemical, air quality and water hazards may also exist during the closure and post-closure periods because many of the same activities will continue after operations. The operational health and safety program may require modification to identify these hazards and train closure site staff accordingly;
- All hazards that could endanger the safety of any person or animal must be identified and eliminated where practical;

- All residual safety and health hazards must be identified and controlled in accordance with regulatory requirements and consideration of industry guidance; and
- They must conform to DMP guidelines for structural stability, with no significant slumping or failure of accessible constructed slopes or berms. No unacceptable hazards to humans or wildlife should be developed thorough erosion, subsidence, AMD or otherwise.

8.18 Social Programs and Strategies

8.18.1 Closure Planning

This final rehabilitation, decommissioning and mine closure plan considers the optimal use of mine land and infrastructure during the closure phase of the mining life cycle. Buffalo Coal is geared towards mitigating the impact of mine-closure on surrounding communities and specific planning is required regarding the post-mining use of the physical assets of the mine for potential community development purposes. These physical assets for Aviemore include:

- Offices
- Workshop;
- Powerlines; and
- Roads.

All infrastructure and mine management programmes on projects will be conceived and implemented within the context of accepted standards of sustainable development.

8.18.2 Transfer of ownership of and responsibility for some infrastructure and services

Possibilities include the transfer of infrastructure to local, provincial or national authorities for local authority management. This infrastructure includes:

- Offices;
- Workshop;
- Powerlines; and
- Roads.

8.18.3 Post-closure uses of mine infrastructure

Once the possibilities for concurrent use of mine infrastructure have been exhausted, the future of the remaining land and infrastructure belonging to or managed by the mine will be considered. It is not always possible to find alternative uses for mine-specific infrastructure or land-use. However, the mine will examine each component of its land and infrastructure and assess the extent to which post-mining use is possible. These options will include the following:

- Transfer of land and associated infrastructure to the landowner or surrounding communities for conversion and use in local economic development, skills development and training programmes to build capacity in several vocational or technical areas; and
- Rehabilitation of the land or demolition and removal of the infrastructure.

9 SCHEDULE OF ACTIONS

9.1 Phase: Operation

During the operations phase the following actions will take place:

- **Employee training:** Employee training will take place during the operational phase to ensure that when Aviemore closes, employees have enough transferable skills to find employment elsewhere;
- **Ongoing Consultation:** Ongoing consultation with effected stakeholders is imperative, in order to manage expectations due to the loss of employment opportunities, SLP projects and community upliftment projects.
- **Concurrent rehabilitation:** As per the Annual Rehabilitation Plan, Buffalo Coal aims to ensure that concurrent rehabilitation takes place. This, however, is limited to monitoring activities;
- **Closure and rehabilitation:** Areas that are no longer in use will be closed and rehabilitated; and
- **Update of the required plans as per GN R1147:** The annual rehabilitation plan, final rehabilitation, decommissioning and mine closure plan, and the Environmental Risk Report will be updated on an annual basis to ensure Buffalo Coal continues to work towards its closure vision.

9.2 Phase: Decommissioning and Closure

During the decommissioning and closure phase which is expected to last for the one to two years after the cessation of mining the following actions will take place:

- **Demolition of infrastructure:** All infrastructure remaining on site, that will not be handed over to the surrounding community, will be demolished and removed; and
- **Sealing of Adits:** All adits will be sealed to ensure that they are safe and cannot be easily accessed.

9.3 Phase: Rehabilitation

During the rehabilitation phase the following actions will take place:

- **Transfer of facilities (possibly the access road or infrastructure):** Facilities are required to be transferred to new landowners;
- **Cleaning up of contaminated areas:** All areas that have been contaminated will be remediated;
- **Shaping:** Areas requiring shaping will be shaped;
- **Vegetating:** Buffalo Coal will allow the natural vegetation to be established on all denuded areas and where natural vegetation is not developing, will ensure vegetation growth through seeding processes as quickly as possible;
- **Monitoring:** The site will be monitored to ensure the stability of landforms, that vegetation establishes and to monitor for possible latent risks. Once the studies prove the site is non-polluting and has reached equilibrium with the surrounding environment an application can be made to the relevant government department for the cessation of these activities;
- **Aftercare and maintenance:** The monitoring programmes will be used to identify areas that require aftercare and maintenance. The length of this activity is therefore dependant on the continuation of the monitoring programmes; and
- **Ground and surface water quality and levels:** This process of monitoring has to continue up to the point of establishing water levels of the pre-mining environment and water quality of acceptable standards.

10 REHABILITATION TEAM

Table 10.1 and Table 10.2 details the actions, objectives and responsible party for all rehabilitation activities to be undertaken at Aviemore.

Table 10.1 Actions, objectives and responsible party for rehabilitation activities

Responsibility	Duties
Mine Manager	Owning and Overseeing the overall rehabilitation
Rehabilitation Specialist (contractor)	Implementation of rehabilitation measures
Environmental Manager	Monitoring of the Rehabilitation progress
Environmental Engineer	Responsible for landform redesign
Hydro-seeding/revegetation specialist (Contractor)	Seeding where applicable
Closure Contractors	Any further decommissioning and closure

Table 10.2 Actions, objectives and responsible party for rehabilitation activities.

Rehabilitation Area/s	Actions	Objectives	Responsible party/ies
Landform redesign	Design the final landform and develop a change management process to inform final landform design.	• Design the final landform to determine topography in conjunction with surrounding areas	• Mine management • Environmental engineer
Natural surface water and ground water	Return all-natural surface water and ground water back to pre-mining	• Natural surface water drainage line as part of the final land form design • Groundwater recharge will require a full management plan to identify possible surface stability issues and final decant to the surface water bodies • Wetland system returned to original flow	• Hydrogeologist • Hydrologist • Wetland specialist • Mine management
Acid Mine Drainage (AMD)	Develop a management plan to mitigate AMD on mine site	• Identify and manage all current areas of Acid mine drainage on site • Predict possible areas of decant after water has rebound in mine sites • Create appropriate mitigation for future post mine decant (surface water) or plumes (underground water)	• Hydrogeologist • Rehabilitation specialist • Water treatment engineers • Mine management
Buildings and infrastructure – Plant area, mine area and surrounds (excluding	Demolish all steel, mechanical, electrical,	• Dismantle mine related infrastructure • Demolish all concrete, brick and/or gravel	• Rehabilitation contractor • Mine Manager • Closure contractor

Rehabilitation Area/s	Actions	Objectives	Responsible party/ies
infrastructure to be handed over to a third party)	concrete and brick structures	foundations, slabs, pavements, roadways • Dismantle all fencing for recycling or metal scrapping • Remove all fuel storage facilities (tanks, reticulation etc.) and have them removed by an accredited fuel handling company • The foundations of all buildings that will be removed should be removed to a depth of 0.5 m	
	Transport rubble and dispose in pit	• All building rubble should be adequately disposed of in the open pits	• Rehabilitation contractor • Mine Manager • Closure contractor
Buildings and infrastructure – Footprints	Rip and Scarify plant area and all other building and paved footprint areas	• Loosen soil • Aid germination of seeds and encourage roots to take hold	• Rehabilitation contractor • Mine Manager
	Topsoil and allow natural revegetation of the footprints	• Topsoil to a minimum depth of 300 mm • Re-vegetate using flora indigenous to the area.	• Rehabilitation contractor • Hydro-seeding specialist (contractor) • Mine Manager Environmental Manager
Haul and access roads	Rip and Scarify	• Demolish all haul and access roads (rip and scarify to loosen soil) • Encourage plant growth and natural seeding (encourage roots to take hold) • Aid germination of seeds	• Rehabilitation contractor • Mine Manager
	Topsoil and allow natural revegetation	• Return areas back to natural vegetation state (restore land for potential grazing purposes) • Only plant and re-vegetate with indigenous flora	• Rehabilitation contractor • Hydro-seeding specialist (contractor) • Mine Manager • Environmental Manager

11 RELINQUISHMENT CRITERIA

The relinquishment criteria for each of the closure actions identified in Section 8 are listed Table 11-1. It is recommended that these closure criteria be updated as Buffalo Coal nears the end of mining operations.

Table 11-1 Completion criteria for Aviemore

Rehabilitation Action	Completion Objective	Rehabilitation Works	Completion Criteria
Buildings and Infrastructure	Removal of all infrastructure that will not be handed over to a third party	Demolishing and removing all infrastructure that will not be handed over to a third party. Any structures that are deeper than 500 mm can be left in situ once they have been made safe (i.e. sealed).	There should be no evidence of bricks, wood, concrete or steel on site after the demolition of these facilities.
	Establish native vegetation cover	Topsoil placement, ripping and vegetate	Establishment of vegetation on >85% of surface
Adit and Box Cut	Geotechnically stable and safe	Sloping of facility	Slope is of an angle that is deemed safe by an expert. They should not exceed 1:3 (preferably 1:5)
	Establish native vegetation cover	Topsoil placement, ripping and vegetate	Establishment of vegetation on >85% of surface
	Blending of the final landform	Removal of piping and other infrastructure	All piping and infrastructure are removed from the facility and recycled or used for scrap
Underground mined areas	All shafts and ventilation shafts sealed and capped	Cap and seal with concrete and determine stability	Stable concrete caps in place
	Fence and signage all underground installations	Fence and include signage	Fenced and appropriate signage in place
Access road	Rip and Scarify	Demolish all access roads and disturbed areas (rip and scarify to loosen soil) Encourage plant growth and natural seeding (encourage roots to take hold) Aid germination of seeds	Rip and Scarify
	Topsoil and allow natural revegetation	Return areas back to natural vegetation state (restore land for potential grazing purposes) Only plant and re-vegetate with indigenous flora	Topsoil and allow natural revegetation
Waste	Removal and safe disposal of all waste streams	Wastes are separated and removed by a licensed contractor for disposal at a licensed waste facility	All waste removed from site
Pipelines and Powerlines	Reuse or removal of pipelines and powerlines	Reuse and/or recycle salvaged material. Dismantle the remaining equipment and associated water supply pipelines in the same manner as other non-hazardous material. Remove buried pipelines if required, and if not, the pipelines will be fully covered with no exposed open ends.	Pipeline and powerline infrastructure will be retained where possible, infrastructure that will not be retained is removed and footprint rehabilitated

Rehabilitation Action	Completion Objective	Rehabilitation Works	Completion Criteria
Material Balances	Determine the material balance at Aviemore and whether additional material will be required for successful rehabilitation	A survey of available fill material and topsoil stockpiles has been undertaken by Aviemore and has determined that a topsoil deficit exists.	Ensure sufficient cover material is imported to Aviemore for successful rehabilitation.
Soil	Strip soil and stockpile suitably	Topsoil (first 300mm) removed and stockpiled separately from subsoil. Topsoil stockpile heights restricted to below 1.5m and Subsoil stockpiles restricted to 4-5m.	Good quantity and quality topsoil which is an essential ingredient in the process of successful rehabilitation.
	Soil amelioration	Before replacing the soils, both physical and chemical amelioration is required. The topsoil stockpile must be ripped to reduced compaction which occurred throughout the lifecycle of storage. During the ripping process mulch and fertilisers are added to restore soil fertility until the soil fertility cycle has been restored.	
	Erosion and dust control	Disturbed areas will be kept to a minimum and exposed surface will be re-vegetated as soon as possible. A re-vegetation programme will be implemented and maintained until the area becomes self-supportive and a closure certificate is granted. Where disturbed areas cannot be re-vegetated, appropriate measures will be taken to control erosion.	Disturbed areas are kept to a minimum and rehabilitated/revegetated timeously.
Revegetation	Establish native vegetation cover	Re-vegetation should take ideally take place during spring and summer where plant growth is at its maximum; A grass mixture utilising endemic grasses should be utilised in the seeding process; The seed mixture should be incorporated into mulch which includes fertiliser and germination acceleration agents; Topsoil placement, ripping and vegetate; Place cuttings of thorny species such as Acacia around the perimeter of the rehabilitated area to limit access by domestic livestock until vegetation has successfully established.	The primary goal is to achieve a stable, climax state, representative of the vegetation type where the ecological function of the plant community is tolerant of most environmental conditions it encounters. The area must be: Erosion free; Restored to the agreed land capability; Re-established eco-system processes that ensure a sustainable land use can be established without requiring fertilizer additions; and

Rehabilitation Action	Completion Objective	Rehabilitation Works	Completion Criteria
	The introduction of species representative of the grass vegetation type may commence	Introduction of these species should commence through the stages of natural succession, i.e. Pioneer species (grasses, herbaceous species), Secondary species (grasses, small shrubs, and small trees) and Climax state (larger shrubs, large trees); This process will also occur naturally as seeds from the neighbouring thatching grass areas are introduced and germinate; Certain tree species can be selectively introduced; however consideration will need to be given to rooting depths and soil stability as well as the ability of the trees to establish on the subject area;	Biodiversity of the area restored as far as possible.
Natural surface and ground water	Surface water free drainage into large streams	Free flowing areas for surface water	No obstructions or ponding on surface areas
Natural surface and ground water	Return water resources to original flow	Allow flow to return to original flow rate through appropriate sloping	Original wetlands established
	Ground water flow established and decant areas identified	Ground water rebound with possible decant areas	Decant areas identified for possible further treatment facilities
AMD	AMD mitigation measures for plume's developing during the water recharge of the mine and possible decant post mining	Hydrogeology study on the effects water recharge of the underground workings	All mitigation measures must be in place before sign-off on risk
Alien Invasive Species	Control the proliferation of alien invasive vegetation	Physical, chemical or a combination of both alien control methods.	Alien invasive vegetation in MR areas and adjacent to those disturbed by mining are controlled to reduce the potential seed load and the mine site is not a source of alien invasive species for possible infestation of adjacent properties.
Subsidence	Rehabilitate any existing areas of subsidence	Infill erosion gullies using rock material from the surrounding area and cover using available topsoil material.	Rehabilitation of sinkholes
	Reshaping landform	Infill areas of surface subsidence and shape and profile to be free draining.	Minimised water ponding and surface water inflow/groundwater recharge
	Establish native vegetation cover to limit infiltration into the local groundwater and or infilled pit	Topsoil placement, ripping and vegetate	Establishment of vegetation on >85% of surface

Rehabilitation Action	Completion Objective	Rehabilitation Works	Completion Criteria
	Map areas of subsidence	Undertake regular surveys and identifying all areas of subsidence. These should be mapped in order to determine the extent of subsidence	Areas of subsidence are identified and mapped.
	Reduce safety risks	Controlled access to the vicinity of sinkholes by the use of fencing. Erection of signs warning of sinkhole developments and presence	Significance of the potential safety hazards are reduced by awareness and access restriction

11.1 Rehabilitation Assessment Sign Off

When the completion criteria have been achieved, the Buffalo Coal Environmental Coordinator will undertake the following steps:

- Engage suitably qualified and experienced consultants to complete a final rehabilitation assessment and record findings to ensure all objectives have been met;
- Arrange for a meeting with relevant Government agencies to obtain consensus that the necessary requirements have been fulfilled and that no further work is required; and
- Conduct a basic environment assessment as per the EIA regulations and submit this alongside the application for a closure certificate.

12 MONITORING REQUIREMENTS

Monitoring and measurement are required in order to establish and create a closure-related knowledge base, demonstrate compliance to regulatory related stipulated requirements and demonstrate success/performance of the implemented closure measures. Post-closure monitoring is required in order to determine the success of rehabilitation measures that have been implemented, to guide corrective measures and to provide the relevant authorities with enough information to ensure informed decision making.

12.1 Ground and Surface Water Monitoring

The objective of the monitoring plan will be achieved through implementation of long-term water quality monitoring, which will inform proper management of site activities. The successful development and implementation of an appropriate, accurate and reliable monitoring plan requires that a well-defined and structured procedure be followed. The monitoring plan is based on the processes described by the Department of Water Affairs and Forestry Best Practice Guidelines: G3 Monitoring (DWAF, 2007), as illustrated in Figure 12-1.

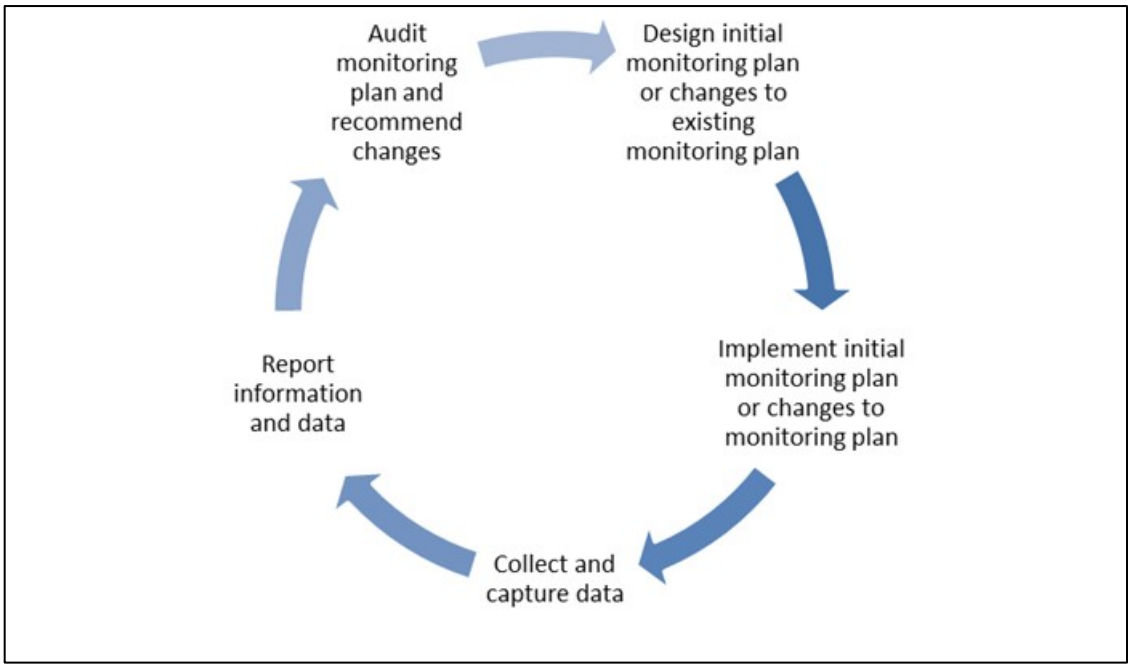


Figure 12-1 Monitoring process

The range of determinants monitored, and the distribution of the monitoring points, is designed to identify potential pollutants and their source as well as quantify any impacts on the surrounding water resources as a result of the activities and potential pollutants generated during the routine operation of Aviemore North Adit.

The following components define the key aspects of the monitoring plan:

- **Monitoring sites** – Water quality monitoring of the systems at defined key sites.
    - Monitor the quality of groundwater at the specified boreholes.
    - Monitor the quality of the surface water within the vicinity of the adit.
    - Monitor the ecological state of the perennial surface water resources.
- **Monitoring frequency** – Monitoring at defined frequencies.
    - Water quality monitoring on a quarterly basis.
    - Biomonitoring on a biannual basis.
- **Determinants for monitoring** – Monitoring of key parameters.
- **Reporting** – Prompt analysis and reporting of results to appropriate management, stakeholders and authorities.

Monitoring of surface and groundwater is currently undertaken at Aviemore, which has allowed for the detection of pollution trends over time. The monitoring points are monitored and reported on a quarterly basis with annual reports produced and submitted to the DWS. Regular monitoring of boreholes is undertaken to ensure that groundwater impacts are monitored and impacts on surrounding land uses are managed as effectively as possible. Appointed specialists are responsible for field sampling and data capture, results are compared to both the 1996 DWS Domestic Use Guidelines as well as the SABS SANS 241-2:2015 Drinking Water Guidelines. The Aviemore monitoring programme has been discussed in Chapter 4.6 of this report. This monitoring programme has been put into place for the mine, extending 5 years after cessation of mining operations.

Surface water samples will be taken monthly whilst groundwater samples will be collected quarterly for chemical analysis by an accredited laboratory. As per the IWWMP, South African Bureau of Standards (SABS) analysis is to be undertaken for samples collected from the monitoring points at the mine site, whilst South African National Standards (SANS) analysis is to be undertaken for samples collected from the monitoring points located at the siding area. In-field surface water measurements are made for pH and EC (as a minimum) when samples are collected – to allow for immediate corrective action. In-stream surface water monitoring, whereby the instream flow is measured, will be undertaken bi-annually. The groundwater level is to be measured at both the siding and mines monitoring points quarterly.

It is recommended that Buffalo Coal continue to monitor the surface and groundwater quality post rehabilitation, however it is deemed unnecessary to continue monitoring at all of the abovementioned monitoring points. It is therefore proposed that an audit of the monitoring program is undertaken. Changes to the monitoring program, such as frequency of monitoring and borehole requirements, need to be investigated. Monitoring will continue for a minimum of five (5) years post closure (or until a closure certificate is issued) with annual reports submitted to the DWS.

12.2 Biomonitoring

Biomonitoring is undertaken in order to monitor the health and ecological integrity of aquatic life in the surrounding river systems, and to track changes over time with the intention of assessing changes in relation to changing water quality and other potential mining impacts. Assessment of the aquatic ecological resources over time is deemed essential to determine any impacts (positive or negative) on a river system and to highlight any significant temporal and spatial trends associated with the aquatic ecosystem.

The SASS 5 bio-monitoring methodology is used to determine the aquatic health and ecological integrity of stream biodiversity. This approach includes an assessment of habitat availability for aquatic macro invertebrates (Integrated Habitat Assessment System – IHAS), Fish Response Assessment Index (FRAI) as well as diatoms as required by Ezemvelo KZN Wildlife. Biomonitoring is a condition of the IWUL, aquatic bio monitoring surveys must be undertaken by Buffalo Coal bi-annually.

The bio- monitoring and sampling network (refer to Figure 4-12 and Table 4-9) includes upstream and downstream sampling sites in streams and drainage lines that could be potentially affected by mining operations will require reviewing and updating. These sampling points should be regularly reviewed, amended and updated. Results and findings will be reported in an aquatic health assessment report delivered after each assessment.

12.3 General Monitoring

All rehabilitated areas will be inspected for signs of erosion, subsidence, alien invasive vegetation proliferation, soil fertility and vegetation establishment. Monitoring will be undertaken in all areas disturbed by mining activities and land reinstated by rehabilitation activities.

12.3.1 Erosion

Rehabilitated areas will be monitored for soil erosion to ensure that a self-sustaining vegetation cover is established that will minimise soil loss through raindrop impact and rainfall runoff erosion. Visual inspections of newly rehabilitated areas will be conducted to determine areas of erosion or potential erosion (noting areas of sheet, rill or gully erosion). All indications of erosion must be rectified within 2 weeks of discovery. Erosion control and maintenance will continue for a period of 5 years or until such time as it can be proved that the area is stable and erosion free – whichever is the longest. Eroded areas will be stabilised by infilling and reshaping, and by establishing vegetation on the repaired areas/ bare patches, as required.

12.3.2 Subsidence

All underground mining was done using the bord and pillar method. No stooping was practiced and therefore subsidence is unlikely to occur. Subsidence monitoring however must be undertaken to ensure that any areas of subsidence are timeously identified, existing areas of subsidence are constantly examined, and rehabilitation measures are monitored.

12.3.3 Alien Invasive Vegetation

Buffalo Coal must eradicate, or control declared Category 1, 2 and 3 invader species on both rehabilitated land to minimise the threat posed by invasive species to reinstated pasture lands, as well as natural ecosystems and habitats, and biodiversity. This will increase the potential for natural systems to deliver improved ecological goods and services.

Buffalo Coal must conduct a visual inspection for invasive species over the site on a regular basis, focusing on areas where invasive species have been previously eradicated, and on rehabilitated areas where placed soils were stripped. Eradication / control measures must be constantly reviewed and modified to improve effectiveness. Findings will be reported in a rehabilitation report after each assessment.

12.3.4 Vegetation Establishment

Regular visual inspections must be made on rehabilitated land to ensure that seed establishment has been successful and any germination or establishment failures (through poor seed quality, seed application, drought etc.). Findings will be reported in a rehabilitation report after each assessment

13 GAPS IDENTIFIED

While the best effort has been made to understand the possible impacts on the surrounding environment, several knowledge gaps have been identified.

1. While the best effort has been made to understand the possible impacts on the surrounding environment, specifically with regards to groundwater, the models cannot predict for unplanned future activities which may impact on the rehabilitation measures suggested by this plan.
2. At this stage it is uncertain if any infrastructure will be transferred to the landowner, this is still to be negotiated.

14 CLOSURE COST

The required closure costs should the mine undergo sudden closure as well as for LOM were calculated using the above closure actions. The methodology, assumptions and costs calculated are detailed as follows.

14.1 Methodology

The NEMA regulations require that the closure costs be calculated according to real rates. GCS sourced these rates from a third-party contractor specialising in demolition and rehabilitation. The following methodology was used to determine both:

1) The Sudden closure cost; and
2) The LOM closure cost.

In order to calculate the closure cost using the third-party contractor rates, each of the closure actions were broken down into specific units (i.e. roads, power lines, railways, buildings, plant equipment etc.).

The latest mine layout drawings were used to determine the quantities for each of these units (e.g. m, square metres (m^2), m^3, ha or t). The bill of quantities that have been previously compiled and reviewed were utilised, these were updated where required based on site observations and the latest layout plans. The sudden closure (assuming the mine were to close tomorrow) and LOM closure costs were based on the most current mine layout and mine planning. The major rehabilitation measures that would need to take place should the mine undergo sudden or LOM closure would include:

- The dismantling of all surface infrastructure;
- The backfilling and shaping of the adit;
- The ripping and re-vegetating of the remaining disturbed areas including haul and access roads; and
- The aftercare and maintenance measure which would include monitoring.

The quantities determined for each of the units were then applied to the third-party contractor rates to determine a closure cost per unit. These costs were then summed together to get Subtotal 1 – the preliminary closure cost. A fixed 12% preliminary and general (P and Gs) is usually added to subtotal 1, as per DMR requirements, however as the mine will undertake all rehabilitation utilising their existing resources, the additional P and Gs is deemed unnecessary and has not be included. A 10% contingency was calculated on Subtotal 1 and added to this to get Subtotal 2 – the closure cost excluding VAT.

14.2 Assumptions

The following assumptions were made when determining the costs if Buffalo Coal were to undergo sudden or LOM closure:

- Decommissioning and rehabilitation activities will follow directly on the cessation of mining;
- All infrastructure where agreements have not been put in place for transfer to the landowner, local community, Government or other third party at the time of mine decommissioning, will be dismantled/demolished as part of mine closure;
- As there are currently no agreements in place for the handover of infrastructure to a third party, it was assumed and subsequently costed for that all infrastructure would be demolished and footprints rehabilitated;
- A post closure land capability of agriculture (grazing) will be established over the rehabilitated footprint area;
- Costs for post-closure water treatment have been excluded based on the findings of updated specialist studies for the Aviemore underground workings and the 2018 ground and surface water monitoring results. The potential for AMD to occur at Aviemore will be continually investigated through updated specialist studies and monitoring;
- Should decant become a problem at site then water treatment options should be considered. However, this option should be reviewed during the annual closure updates (based on the latest available information) to determine the necessity of treatment;
- Stakeholder consultation will be undertaken by Buffalo Coal during operations to obtain stakeholder views and opinions that these could be incorporated/considered in future versions of the closure plan;
- The closure costs are aligned to the principles reflected in the Department of Mineral Resources (DMR) Guideline Document for the Evaluation of the Quantum of Closure Related Financial Provision Provided by a Mine (January 2005);
- Third party contractor rates were used to calculate the costs;
- 4.5% CPIX (StatsSA) was added to all 2017 unit and nominal rates in order to align them with 2018 rates;
- In accordance with the DMR guideline no cost off-sets due to possible salvage values were considered and gross rehabilitation costs are reported;
- Fixed ratios for contingencies as per the DMR guideline have been applied;
- Buffalo Coal has indicated that the mine will perform the rehabilitation work using its own resources, as a result the additional 12% P and Gs are deemed unnecessary;
- Any additional costs will be covered by the 10% contingency;

- Closure costs have been determined for both the LOM and Sudden closure situations. LOM closure takes place at a planned date and/or time horizon in accordance with overall mine planning. Sudden closure entails immediate closure of a site, representing decommissioning and rehabilitation of the site in its present state;
- LOM and Sudden Closure costs are the same as there will be no expansion or addition to the surface infrastructure at Aviemore for the LOM;
- All surface infrastructure would be demolished and removed to a depth of 500 mm. Any infrastructure below 500 mm will be sealed, made safe and left in situ;
- The incline shaft opening to the surface will be suitably plugged and backfilled with all the available waste rock at mine closure and the respective box-cut in-filled and rehabilitated utilising the subsoil and topsoil stockpiles;
- The conveyor is mobile and therefore it is assumed that it will not be demolished, and will be removed from the Aviemore site and relocated;
- Costs for the importation of topsoil is calculated based on rates obtained by Buffalo Coal from their contractor;
- Costs were included for groundwater and surface water monitoring for a 5-year period after the closure and rehabilitation efforts cease, thereafter the monitoring network will need to be amended and updated based on monitoring results;
- Quarterly monitoring costs were calculated at a GCS cost estimate of R 2 500.00 per sample and based on the current monitoring network;
- Sampling sites applicable to the current mining works area were included, all consistently dry surface water sampling sites were excluded.
- Three surface water and four ground water monitoring points were costed for;
- The disturbed area will be returned to its pre-mining agricultural (grazing land) state;
- Costs for care and maintenance of the site as well as water management for a period of five years were included;
- Closure planning will be a progressive/ ongoing process whereby information as it becomes available will be assimilated, refined and incorporated in the closure planning to achieve an appropriate and up-to-date closure plan at the time of actual mine closure. This is especially key for the measurement and monitoring activities as the required knowledge base must be established for which to “launch” eventual mine closure;
- A 10% contingency was added to subtotal 1 to account for any unforeseen shortfalls.

14.3 Closure Cost

The calculated closure cost if Aviemore were to undergo Sudden Closure as well as the costs for LOM closure are summarised in **Table 14-1**. **Table 14-1** shows that the sudden and LOM closure costs calculated for Aviemore, using third party contractor rates and inclusive of VAT is **R3 330 327.15**

The detailed cost calculations are provided in **Appendix B**.

Table 14-1 Summary of 2018 Closure Costs for Aviemore.

	Aviemore Coal Mine Closure Costs 2018	LOM Closure Cost	Sudden Closure Cost
1	**Surface Infrastructure**	**R1 271 837.44**	**R1 271 837.44**
1.1	Buildings & Structures	R983 894.88	R983 894.88
1.2	Parking	R57 168.40	R57 168.40
1.3	Tanks/pump stations/boreholes	R59 496.70	R59 496.70
1.4	Magazine Site	R6 936.38	R6 936.38
1.5	Power Lines	R52 022.83	R52 022.83
1.6	Fencing	R40 252.01	R40 252.01
1.7	Concrete	R72 066.25	R72 066.25
2	**Mining Areas & Waste Sites**	**R644 532.68**	**R644 532.68**
2.1	Adit Void	R644 532.68	R644 532.68
3	**General Areas**	**R122 652.34**	**R122 652.34**
3.1	Site Offices, Workshop, Change and Wash rooms (and associated infrastructure footprint)	R31 003.50	R31 003.50
32	Storage/Salvage Yard	R7 086.51	R7 086.51
3.3	Parking Area, Security Hut, Access and Haul Roads	R57 577.93	R57 577.93
3.4	Magazine Site	R5 445.10	R5 445.10
3.5	Water Tanks and Adit Substation Footprint	R321.51	R321.51
3.6	Topsoil shortfall	R21 217.78	R21 217.78
5	**Aftercare & Maintenance**	**R593 647.23**	**R593 647.23**
5.1	Monitoring	R350 000.00	R350 000.00
5.2	Maintenance	R243 647.23	R243 647.23
	Sub Total 1	**R2 632 669.69**	**R2 632 669.69**
	12% Preliminary and General	NA	NA
	10% Contingency	R263 266.97	R263 266.97
	Sub Total 2 (excluding VAT)	**R2 895 936.65**	**R2 895 936.65**
	Grand Total (including VAT)	**R3 330 327.15**	**R3 330 327.15**

14.4 Amendments to Previous Closure Costs

The previous closure costs compiled by GCS, dated March 2018, have been utilised as a reference document for the compilation of this updated closure report. Amendments to the previous closure update include:

- Updated monitoring results for the 2018 period have been included, recommendations based on these results have been incorporated into the closure plan;
- Number of groundwater monitoring points have been updated to include all applicable monitoring points in the Aviemore monitoring network that are able to be frequently monitored;
- Number of surface water monitoring points have been updated to include all applicable monitoring points in the Aviemore monitoring network that are able to be frequently monitored (i.e. not dry);
- Monitoring points not applicable to the current Aviemore workings (i.e. sampling sites based on future areas) have been excluded from the monitoring plan;
- Cost of undertaking water monitoring has been updated, based on an anticipated GCS rate of R2500 per sample (this includes all professional fees and disbursements);
- Anticipated post-closure water managements aspects have been updated based on the latest available specialist study information for the Aviemore area, undertaken in 2018;
- Addition of new shaded walkway from the entrance gate to the office area;
- Addition of new workshop located on the north-east corner of the existing office and workshop area concrete slab;
- 2017 third party contractor rates have been updated and adjusted to account for inflation (4.5% increase as per StatsSA); and
- Amendment (correction) of the rate for backfilling of the final void.

15 CONCLUSION

Financial Provisioning for Mine Closure is covered under the NEMA Regulations (GN R.1147). The regulations aim to ensure that operating mines have a clearer understanding of what their operations will look like at the LOM and the risks associated with this. The overall goal is to ensure that there is adequate financial provision for rehabilitation if the mine undergoes sudden closure or once mining activities cease. The closure vision, closure actions, post-closure monitoring and associated costs for Aviemore have been covered in this report. Aviemore is an existing coal mine located in the KZN Province of South Africa, approximately 8 km north-northwest of the town of Dundee and approximately 325 km east-northeast of the City of Durban. Mining at Aviemore began in October 2000 under Mining Licence KZN341/2002.

Mining at Aviemore takes place underground, utilising conventional bord and pillar mining to work the Gus seam at a depth of 120 metres (m). The surface area disturbed by mining operations is relatively small. An adit (box cut) exists in the hillside and forms the entrance for the Gus seam mining operation. The existing coal processing site and rail facility for the Aviemore operation is located at Coalfields, in Dundee. The coal product is transported by rail, 280 km to the RBCT for export and is also delivered to domestic customers by road transport (Provincial P272). There is no discard dump at Aviemore and the discard disposal facility at Magdalena Colliery is used. ROM material is washed in Dundee at Coalfields where there are pollution control measures such as berms and PCDs in place, and the separation of waste areas from storm water drains on site is practised. Surface infrastructure comprises of:

- A fuel storage facility;
- Workshop;
- Haul and Access Roads;
- Change house and ablutions;
- Adit; and
- Site offices.

The Buffalo Coal closure vision aims to return the disturbed areas to a stable, non-polluting and safe state that represents, as close as possible, the pre mining conditions. Buffalo Coal wishes to leave a positive legacy in the area once the mining operations cease. Building on the closure vision, the objectives of the final rehabilitation plan are to:

- Ensure all areas are closed in a manner that ensures they are geotechnically stable and safe;
- Prevent erosion through sloping of all disturbed areas to appropriate gradients;
- Ensure that all areas are free-draining and non-polluting;
- Establish vegetation cover returning the area to its pre-mining condition;
- Establish a low maintenance system;
- Ensure the final landform blends into the surrounding topography; and
- Ensure water discharged from the area into the natural drainage system is done safely and the quality will be in accordance with the qualities required by the DWS.

This closure plan, devised in line with the surrounding land uses, is aligned to the EMPr which states that the mining areas will be appropriately rehabilitated to a grazing land use. The Aviemore closure vision aims to return the disturbed areas to a stable, non-polluting and safe state as close as possible to the pre-mining conditions. As detailed in the Land use Section (section 4.4.7), the area was used for grazing of cattle and wilderness prior to mining. Current land use surrounding the Aviemore area is comprised of agriculture which is, at this stage, limited to livestock (grazing). The vision thus aims to encourage the surrounding Grassland and Thornveld vegetation to re-establish on disturbed areas on site in order to return the land to that of the surrounding area, which is farmland. The area will be suitable for low-scale grazing activities. The area falls within the bio-resource group VC 16 (Moist Tall Grassveld) and has a bushed grassland bushland vegetation pattern. The recommended stocking rate for the area is normally 2.6 hectares per large stock unit (ha/LSU), however due to the bushed nature, *Lantana camara* (an alien invader plant) and a large increase (approximately 12 - 15%) of increaser grass species (*Sporobolus africana, Aristida congesta,* and *Setaria flabellata*) it is suggested that this site could be downgraded to a 3.5 ha/LSU. Buffalo Coal will strive to ensure that any latent or residual impacts on site will be mitigated as far as possible.

The following assumptions were made when determining the costs if Buffalo Coal were to undergo sudden or LOM closure:

- Decommissioning and rehabilitation activities will follow directly on the cessation of mining;

- All infrastructure where agreements have not been put in place for transfer to the landowner, local community, Government or other third party at the time of mine decommissioning, will be dismantled/demolished as part of mine closure;
- As there are currently no agreements in place for the handover of infrastructure to a third party, it was assumed and subsequently costed for that all infrastructure would be demolished and footprints rehabilitated;
- A post closure land capability of agriculture (grazing) will be established over the rehabilitated footprint area;
- Costs for post-closure water treatment have been excluded based on the findings of updated specialist studies for the Aviemore underground workings and the 2018 ground and surface water monitoring results. The potential for AMD to occur at Aviemore will be continually investigated through updated specialist studies and monitoring;
- Should decant become a problem at site then water treatment options should be considered. However, this option should be reviewed during the annual closure updates (based on the latest available information) to determine the necessity of treatment;
- Stakeholder consultation will be undertaken by Buffalo Coal during operations to obtain stakeholder views and opinions that these could be incorporated/considered in future versions of the closure plan;
- The closure costs are aligned to the principles reflected in the Department of Mineral Resources (DMR) Guideline Document for the Evaluation of the Quantum of Closure Related Financial Provision Provided by a Mine (January 2005);
- Third party contractor rates were used to calculate the costs;
- 4.5% CPIX (StatsSA) was added to all 2017 unit and nominal rates in order to align them with 2018 rates;
- In accordance with the DMR guideline no cost off-sets due to possible salvage values were considered and gross rehabilitation costs are reported;
- Fixed ratios for contingencies as per the DMR guideline have been applied;
- Buffalo Coal has indicated that the mine will perform the rehabilitation work using its own resources, as a result the additional 12% Preliminary and Generals (P and Gs) are deemed unnecessary;
- Any additional costs will be covered by the 10% contingency;

- Closure costs have been determined for both the LOM and Sudden closure situations. LOM closure takes place at a planned date and/or time horizon in accordance with overall mine planning. Sudden closure entails immediate closure of a site, representing decommissioning and rehabilitation of the site in its present state;
- LOM and Sudden Closure costs are the same as there will be no expansion or addition to the surface infrastructure at Aviemore for the LOM;
- All surface infrastructure would be demolished and removed to a depth of 500 mm. Any infrastructure below 500 mm will be sealed, made safe and left in situ;
- The incline shaft opening to the surface will be suitably plugged and backfilled with all the available waste rock at mine closure and the respective box-cut in-filled and rehabilitated utilising the subsoil and topsoil stockpiles;
- The conveyor is mobile and therefore it is assumed that it will not be demolished, and will be removed from the Aviemore site and relocated;
- Costs for the importation of topsoil is calculated based on rates obtained by Buffalo Coal from their contractor;
- Costs were included for groundwater and surface water monitoring for a 5-year period after the closure and rehabilitation efforts cease, thereafter the monitoring network will need to be amended and updated based on monitoring results;
- Quarterly monitoring costs were calculated at a GCS cost estimate of R 2 500.00 per sample and based on the current monitoring network;
- Sampling sites applicable to the current mining works area were included, all consistently dry surface water sampling sites were excluded.
- Three surface water and four ground water monitoring points were costed for;
- The disturbed area will be returned to its pre-mining agricultural (grazing land) state;
- Costs for care and maintenance of the site as well as water management for a period of five years were included;
- Closure planning will be a progressive/ ongoing process whereby information as it becomes available will be assimilated, refined and incorporated in the closure planning to achieve an appropriate and up-to-date closure plan at the time of actual mine closure. This is especially key for the measurement and monitoring activities as the required knowledge base must be established for which to “launch” eventual mine closure;
- A 10% contingency was added to subtotal 1 to account for any unforeseen shortfalls.

The sudden and LOM closure costs calculated for Aviemore, using third party contractor rates is **R3 330 327.15.**

APPENDIX A. CVS

APPENDIX B. CLOSURE COST SPREADSHEETS

APPENDIX C. LEGAL REQUIREMENTS

Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996)

The Constitution of South Africa is the supreme act to which all other acts must speak to. The Constitution sets out the rights for every citizen of South Africa and aims to address past social injustices. With respect to the environment, Section 24 of the constitution states that:

"Everyone has the right:

a) **To an environment that is not harmful to their health or well-being;**
b) **To have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that:**
   i. **Prevent pollution and ecological degradation;**
   ii. **Promote conservation; and**
   iii. **Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development".**

The constitution also establishes the idea of the polluter pays principal - simply that the party responsible for pollution of the environment remains responsible for financial reparations of the impacts from their activities.

National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA)

The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) provides the framework environmental legislation and establishes an integrated environmental management system for South Africa. It aims to prevent pollution and degradation of South Africa's natural environments while at the same time promoting sustainable economic and social development.

Central to NEMA is the idea of Integrated Environmental Management (IEM). IEM seeks to:

- Promote the integration of the principles of environmental management into the making of all decisions;
- Identify, predict and evaluate the actual and potential impact on the environment, socio-economic conditions and cultural heritage, the risks and consequences and alternatives and options for mitigation of activities, with a view to minimising negative impacts, maximising benefits, and promoting compliance with section 2 principles; and

- Ensure that the effects of activities on the environment receive adequate consideration before actions are taken in connection with them.

NEMA also enforces the idea of the polluter pays principle as established in the Constitution. Section 28(1) of the NEMA states:

"Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment".

This is central to the idea of mine closure whereby the holder of a mining permit remains responsible for ensuring the mined area is rehabilitated to a state acceptable to all parties and that is not harmful to people or the surrounding environment.

Section 24P of the NEMA also sets out the requirements for financial provision for remediation of environmental damage while Section 24R of the NEMA speaks specifically to environmental authorization on mine closure. Section 24P (5) states the following:

"The requirement to maintain and retain the financial provision contemplated in this section remains in force notwithstanding the issuing of a closure certificate by the Minister responsible for mineral resources in terms of the Mineral and Petroleum Resources Development Act, 2002 to the holder or owner concerned and the Minister responsible for mineral resources may retain such portion of the financial provision as may be required to rehabilitate the closed mining or prospecting operation in respect of latent, residual or any other environmental impacts, including the pumping of polluted or extraneous water, for a prescribed period. responsible for mineral resources in terms of the Mineral and Petroleum Resources Development Act, 2002 to the holder or owner concerned and the Minister responsible for mineral resources may retain such portion of the financial provision as may be required to rehabilitate the closed mining or prospecting operation in respect of latent, residual or any other environmental impacts, including the pumping of polluted or extraneous water, for a prescribed period" (own emphasis).

Furthermore, Section 24R (1) of the NEMA states:

"Every holder, holder of an old order right and owner of works remain responsible for any environmental liability, pollution or ecological degradation, the pumping and treatment of polluted or extraneous water, the management and sustainable closure thereof notwithstanding the issuing of a closure certificate by the Minister responsible for mineral resources in terms of the Mineral and Petroleum Resources Development Act, 2002, to the holder or owner concerned" (own emphasis).

Important to note here is that the NEMA specifically states that the liabilities associated with mining do not end with the issuing of a closure certificate. This is at odds with the MPRDA as illustrated before. Furthermore, the NEMA carries heavier penalties than the MPRDA for transgressions.

NEMA 2017 Environmental Impact Assessment (EIA) Regulations GN R326

The Department of Environmental Affairs (DEA) has developed a list of activities which are likely to have an impact on the environment. The list of activities was published in 2014 and were separated into three listing notices (GN R983, GN R984 and GN R985) and were amended by the Department in 2017. The amended list of activities was separated into three listing notices (GN R.324, GN R.325 and GN R327).

Any activity which is listed under these notices requires an environmental assessment to be conducted and approved before the activity can proceed. Activities falling under Listing Notice 1 (GN R327) or Listing Notice 3 (GN R324) require a Basic Assessment (BA) to be conducted while any activity falling under Listing Notice 2 (GN R325) requires a full Scoping and Environmental Impact Assessment (S&EIA) process to be conducted.

With the introduction of the 2014 NEMA EIA Regulations (GN R982), as amended by the 2017 NEMA EIA Regulations (GN R326) on 07 April 2017, mine closure is now a listed activity under GN R983 which requires a BA. The listing notices are detailed in Table .

Table 16-1: Listing Notice GN R327 which triggers a BA.

Activity Number	Activity Description
Activity 22 under GN R324.	The decommissioning of any activity requiring -

	(i) a closure certificate in terms of section 43 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002); or (ii) a prospecting right, mining right, mining permit, production right or exploration right, where the throughput of the activity has reduced by 90% or more over a period of 5 years excluding where the competent authority has in writing agreed that such reduction in throughput does not constitute closure. but excluding the decommissioning of an activity relating to the secondary processing of a – a) mineral resource, including the smelting, beneficiation, reduction, refining, calcining or gasification of the mineral resource; or b) petroleum resource, including the refining of gas, beneficiation, oil or petroleum products; – in which case activity 31 in this Notice applies.

Therefore, any mine that wishes to apply for a closure certificate is now required to conduct a BA and submit this alongside the application for a closure certificate.

NEMA 2015 Regulations Pertaining to Financial Provision

The NEMA regulations pertaining to financial provision were previously regulated under the MPRDA, however they have since been retracted from the MPRDA and have now been gazetted under the NEMA.

The regulations pertaining to financial provision (GN R1147) under the NEMA set out the requirements for an applicant or holder of a right or permit to determine and make financial provision to guarantee the availability of sufficient funds to undertake rehabilitation and remediation of the adverse environmental impacts of prospecting, exploration, mining or production operations.

GN R1147 now requires an applicant or holder of a right or permit to compile and annually review the following three documents:

1. A final rehabilitation plan;
2. An annual rehabilitation plan; and
3. An environmental risk assessment report.

The NEMA regulations require that the financial provision is, at any given time, equal to the sum of the actual costs of implementing the plans and report for a period of at least 10 years forthwith. The calculation of these costs needs to be based on real costs and are no longer calculated according to given rates.

The transitional arrangement under regulation 17(4) states that:

"A financial provision approved in terms of the Mineral and Petroleum Resources Development Regulations, 2004 must be regarded to be the financial provision approved in terms of these Regulations, on condition that a holder that operates in terms of a financial provision approved in terms of the Mineral and Petroleum Resources Development Act, 2002 at the time of the coming into operation of these Regulations, must review and align such approved financial provision with the provisions of these Regulations, after the coming into operation of these Regulations, as set out in sub-regulations (5) to (10), and annually thereafter as set out in regulations 9 and 11, read with the necessary changes" (own emphasis).

Therefore, the previous financial provisions for BUFFALO COAL which were approved as per the Mineral and Petroleum Resources Development Regulations (published under Government Notice R527 in Government Gazette 26275 of 23 April 2004) (GN R527), can be considered to be approved of in terms of GN R1147 so long as Kangra reviews and aligns the previous financial provisions with GN R1147 and continues to do so on an annual basis.

In terms of the time period within which the first review and alignment must take place the transitional arrangement under regulation 17(5) further states that:

"A holder must -

- **(a) within three months of its financial year end following the coming into effect of these Regulations and annually thereafter; or**
- **(b) within 15 months after the coming into effect of these Regulations and annually thereafter;**

ensure that a review, assessment and adjustment of the financial provision is conducted in accordance with regulation 11 of these Regulations, read with the necessary changes, and submit an updated financial provision, including the plans and report contemplated in regulation 11(1), a copy of the independent auditor's reports and proof of payment or arrangements to provide the financial provision for approval by the Minister responsible for mineral resources, which updated financial provision must be included in—

- **i) any audit required in terms of an environmental authorisation issued in terms of the Act; and**
- **ii) any amendment of an environmental management programme to be submitted in terms of the Environmental Impact Assessment Regulations, 2014" (own emphasis).**

This document comprises the final rehabilitation plan for BUFFALO COAL and contains all the required information as per Appendix 4 of the NEMA regulations. This plan should be read in conjunction with the Annual Rehabilitation Plan and the Environmental Risk Assessment Report.

Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA)

The Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA) was enacted in order to make provision for equitable access to and sustainable development of South Africa's mineral and petroleum resources; and to provide for matters connected therewith. The MPRDA recognises that mineral and petroleum resources are non-renewable resources yet are important resources for ensuring the continued economic growth and social upliftment of the people of South Africa. The MPRDA therefore sets out the State's obligation to protect the environment for the benefit of present and future generations, to ensure ecologically sustainable development of mineral and petroleum resources and to promote economic and social development.

As part of the commitments to protect the environment for the benefit of present and future generations and to ensure ecologically sustainable development of mineral and petroleum resources the MPRDA provides that all mining activities need to minimise their impacts on the surrounding environment as much as possible. This includes rehabilitation and mitigation of latent environment impacts of the site post closure of the mine.

Section 43 of the Act enforces the need for every mine to apply for a closure certificate upon completion of the activity. Section 43(1) states that:

"The holder of a prospecting right, mining right, retention permit, mining permit, or previous holder of an old order right or previous owner of works that has ceased to exist, remains responsible for any environmental liability, pollution, ecological degradation, the pumping and treatment of extraneous water, compliance to the conditions of the environmental authorisation and the management and sustainable closure thereof, until the Minister has issued a closure certificate in terms of this Act to the holder or owner concerned" (own emphasis).

Important to note here is that the MPRDA specifically speaks to the holder of a right or permit. Even if the right or permit has ceased to exist the holder remains responsible for any environmental liability associated with their activities until a closure certificate is granted. As mentioned earlier, this is at odds with the NEMA which states that the liabilities associated with mining activities remain with the holders of the rights or permits notwithstanding the issuing of a closure certificate.

MPRDA Regulations (GN R537)

The MPRDA Regulations (GN R537 of 23 April 2004) regulate the procedures and criteria for mining related activities as set out in the MPRDA.

The MPRDA Regulations set out the principles for mine closure in Section 56 as follows:

"In accordance with applicable legislative requirements for mine closure, the holder of a prospecting right, mining right, retention permit or mining permit must ensure that -

a) **The closure of a prospecting or mining operation incorporates a process which must start at the commencement of the operation and continue throughout the life of the operation;**
b) **Risks pertaining to environmental impacts must be quantified and managed pro-actively, which includes the gathering of relevant information throughout the life of a prospecting or mining operation;**
c) **The safety and health requirements in terms of the Mine Health and Safety Act, 1996 (Act No. 29 of 1996) are complied with;**
d) **Residual and possible latent environmental impacts are identified and quantified;**

e) **The land is rehabilitated, as far as is practicable, to its natural state, or to a predetermined and agreed standard or land use which conforms with the concept of sustainable development; and**
f) **Prospecting or mining operations are closed efficiently and cost effectively".**

The Regulations also set out the procedure for applying for a closure certificate in Section 57 when a mine reaches its LoM.

Mine Health and Safety Act, 1996 (Act No. 29 of 1996) (MHSA)

The Mine Health and Safety Act, 1996 (Act No. 29 of 1996) (MHSA) was enacted to provide for the protection of the health and safety of employees and other persons at mines. The Act seeks to promote a culture of safe and healthy work environments in the South African mining sector. The Act further seeks to regulate employers' and employees' duties to identify hazards; to eliminate, control and minimise the risk to health and safety; to entrench the right to refuse to work in dangerous conditions; and to give effect to the public international law obligations of the Republic relating to mining health and safety.

According to Section 2(2) of the act the MHSA applies to the mine until a closure certificate is awarded as per Section 43 of the MPRDA:

"The employer of a mine that is not being worked, but in respect of which a closure certificate in terms of the Minerals and Petroleum Resources and Development Act has not been issued, must take reasonable steps to continuously prevent injuries, ill-health, loss of life or damage of any kind from occurring at or because of the mine".

This section of the act highlights that the employer of a mine remains liable for any injuries, ill-health, loss of life or damage of any kind occurring at or because of the mine until a mine closure certificate has been awarded. Not only are they liable but they must take reasonable steps to continuously prevent any of these incidents from occurring.

National Water Act, 1998 (Act No. 36 of 1998) (NWA)

The National Water Act, 1998 (Act No. 36 of 1998) (NWA) aims to ensure the protection and sustainable use of South Africa's water resources. The three main pillars of the NWA are sustainability, equity and efficiency. The NWA requires that any activity which might impact on water resources apply for a Section 21 Water Use License (WUL).

The NWA also enforces the idea of the polluter pay principle. Section 19(1) of the NWA states that:

"An owner of land, a person in control of land or a person who occupies or uses the land on which –

a) any activity or process is or was performed or undertaken; or

b) any other situation exists,

which causes, has caused or is likely to cause pollution of a water resource, must take all reasonable measures to prevent any such pollution from occurring, continuing or recurring."

GN704 Compliance

In order to ensure compliance to the requirements of Government Notice (GN) 704 of 4 June 1999: Regulation on use of water for mining and related activities aimed at the protection of water resources (hereafter referred to as GN704), the following applicable requirements of the GN 704 regulations have been taken into consideration:

4. Restrictions on locality

No person in control of a mine or activity may-

a. locate or place any residue deposit, dam, reservoir, together with any associated structure or any other facility within the 1:100 year flood-line or within a horizontal distance of 100 metres from any watercourse or estuary, borehole or well, excluding boreholes or wells drilled specifically to monitor the pollution of groundwater, or on water-logged ground, or on ground likely to become water-logged, undermined, unstable or cracked;

b. place or dispose of any residue or substance which causes or is likely to cause pollution of a water resource, in the workings of any underground or opencast mine excavation, prospecting diggings, pit or any other excavation; or

5. Restrictions on use of material

No person in control of a mine or activity may use any residue or substance which causes or is likely to cause pollution of a water resource for the construction of any dam or other impoundment or any embankment, road or railway, or for any other purpose which is likely to cause pollution of a water resource.

6. Capacity requirements of clean and dirty water systems

Every person in control of a mine or activity must-

a. confine any unpolluted water to a clean water system, away from any dirty area;

b. design, construct, maintain and operate any clean water system at the mine or activity so that it is not likely to spill into any dirty water system more than once in 50 years;

c. collect the water arising within any dirty area, including water seeping from mining operations, outcrops or any other activity, into a dirty water system;

d. design, construct, maintain and operate any dirty water system at the mine or activity so that it is not likely to spill into any clean water system more than once in 50 years; and

e. design, construct, maintain and operate any dam or tailings dam that forms part of a dirty water system to have a minimum freeboard of 0.8 metres above full supply level, unless otherwise specified in terms of Chapter 12 of the Act.

f. design, construct and maintain all water systems in such a manner as to guarantee the serviceability of such conveyances for flows up to and including those arising as a result of the maximum flood with an average period of recurrence of once in 50 years.

7. Protection of water resources

Every person in control of a mine or activity must take reasonable measures to-

a. prevent water containing waste or any substance which causes or is likely to cause pollution of a water resource from entering any water resource, either by natural flow or by seepage, and must retain or collect such substance or water containing waste for use, re-use, evaporation or for purification and disposal in terms of the Act;

b. design, modify, locate, construct and maintain all water systems, including residue deposits, in any area so as to prevent the pollution of any water resource through the operation or use thereof and to restrict the possibility of damage to the riparian or in-stream habitat through erosion or sedimentation, or the disturbance of vegetation, or the alteration of flow characteristics;

c. cause effective measures to be taken to minimise the flow of any surface water or floodwater into mine workings, opencast workings, other workings or subterranean caverns, through cracked or fissured formations, subsided ground, sinkholes, outcrop excavations, adits, entrances or any other openings;

d. design, modify, construct, maintain and use any dam or any residue deposit or stockpile used for the disposal or storage of mineral tailings, slimes, ash or other hydraulic transported substances, so that the water or waste therein, or falling therein, will not result in the failure thereof or impair the stability thereof;

e. prevent the erosion or leaching of materials from any residue deposit or stockpile from any area and contain material or substances so eroded or leached in such area by providing suitable barrier dams, evaporation dams or any other effective measures to prevent this material or substance from entering and polluting any water resources;

f. ensure that water used in any process at a mine or activity is recycled as far as practicable, and any facility, sump, pumping installation, catchment dam or other impoundment used for recycling water, is of adequate design and capacity to prevent the spillage, seepage or release of water containing waste at any time;

g. at all times keep any water system free from any matter or obstruction which may affect the efficiency thereof; and

b) cause all domestic waste, including wash-water, which cannot be disposed of in a municipal sewage system, to be disposed of in terms of an authorisation under the Act.

8. Security and additional measures

Every person in control of a mine or activity must-

a. *cause any impoundment or dam containing any poisonous, toxic or injurious substance to be effectively fenced-off so as to restrict access thereto, and must erect warning notice boards at prominent locations so as to warn persons of the hazardous contents thereof;*

b. *ensure access control in any area used for the stockpiling or disposal of any residue or substance which causes, has caused or is likely to cause pollution of a water resource so as to protect any measures taken in terms of these regulations;*

c. *not allow the area contemplated in paragraph (a) and (b) to be used for any other purpose, if such use causes or is likely to cause pollution of a water resource; and*

d. *protect any existing pollution control measures or replace any existing pollution control measures deleteriously affected, damaged or destroyed by the removing or reclaiming of materials from any residue deposit or stockpile, and establish additional measures for the prevention of pollution of a water resource which might occur, is occurring or has occurred as a result of such operations.*

9. Temporary or permanent cessation of mine or activity

1. *Any person in control of a mine or activity must at either temporary or permanent cessation of operations ensure that all pollution control measures have been designed, modified, constructed and maintained so as to comply with these regulations.*
2. *Any person in control of a mine or activity must ensure that the in-stream and riparian habitat of any water resource, which may have been affected or altered by a mine or activity, is remedied so as to comply with these regulations.*
3. *On either temporary or permanent cessation of a mine or activity the Minister may request a copy of any surface or underground plans as required in terms of the Minerals Act, 1991.*

11. Additional regulations for rehabilitation of coal residue deposits

Any person mining or establishing coal residue deposits must rehabilitate such residue deposits so that-

a. all residue deposits are compacted to prevent spontaneous combustion and minimise the infiltration of water; and

b. the rehabilitation of the residue de

c. posits is implemented concurrently with the mining operation.

APPENDIX D. RISK METHODOLOGY

RISK METHODOLOGY

Risk is a measure of future uncertainties in achieving program performance goals and objectives within defined cost, schedule and performance constraints. Risk can be associated with all aspects of a program (e.g. threat, technology, supplier capability, design maturation, performance against plan, etc.). Risk addresses the potential variation in the planned approach and its expected outcome.

A risk assessment process comprises identification of the following three components:

- A future root cause (yet to happen), which, if eliminated or corrected, would prevent a potential consequence from occurring;
- A probability (or likelihood) assessed at the present time of that future root cause occurring; and
- The consequence (or effect) of that future occurrence.

A future root cause is the most basic reason for the presence of a risk. Accordingly, risks should be tied to future root causes and their effects or consequences.

Risk Management Objective

The objective of a well-managed risk management program is to provide a reputable process for balancing cost, schedule, and performance goals within program funding.

Successful risk management depends on the knowledge assessments of all aspects of the program coupled with appropriate mitigations applied to the specific root causes and consequences.

The Risk Management Process

Risk management is a continual process, performed throughout the life cycle of a system or project. It is an organised methodology for continuously identifying and measuring the unknowns; developing mitigation options; selecting, planning, and implementing appropriate risk mitigations; and tracking the implementation to ensure successful risk reduction. Effective risk management depends on risk management planning; early identification and analysis of risks; early implementation of corrective actions; continuous monitoring and reassessment; and communication, documentation, and coordination.

Planning a good risk management program is integral to the overall program management process that ensures risks are handled at the appropriate management level.

The Risk Management Process Model

The risk management process model (Figure 16-1) includes the following key activities, performed on a continuous basis:

- Risk Identification;
- Risk Analysis;
- Risk Mitigation Planning;
- Risk Mitigation Plan Implementation; and
- Risk Tracking.

Effective risk management approaches generally have consistent characteristics and follow common guidelines regardless of program size.

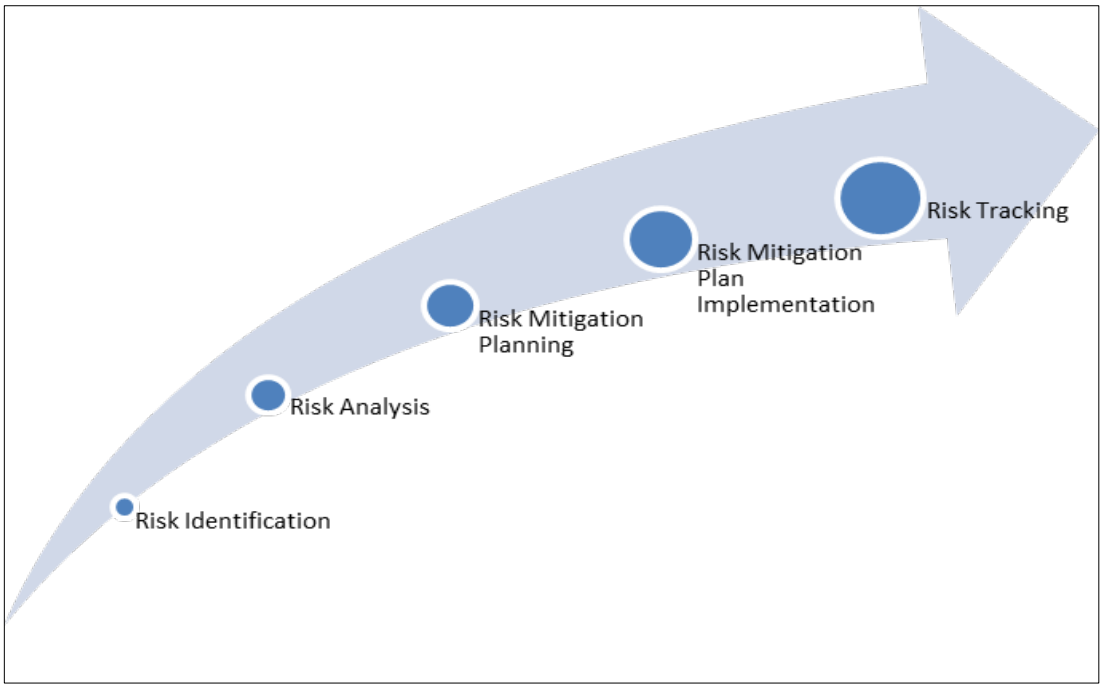


Figure 16-1: Risk Management Process

Risk Identification

The first key activity in the risk management process is Risk Identification. The intent of risk identification is to answer the question "What can go wrong?" by:

- Looking at current and proposed staffing, process, design, supplier, operational employment, resources, dependencies etc.;
- Monitoring test results especially test failures (readiness results and readiness problems for the sustainment phase);
- Reviewing potential shortfalls against expectations; and

- Analysing negative trends.

Risk identification is the activity that examines each element of the program to identify associated root causes, begin their documentation, and set the stage for their successful management. Risk identification begins as early as possible in successful programs and continues throughout the program with regular reviews and analysis.

Identification of Root Causes

The risk manager should examine the programs and identify root causes by reducing program elements to a level of detail that permits an evaluator to understand the significance of any risk and identify its causes. This is a practical way of addressing the large and diverse number of risks associated with a project or program. Root causes are identified by examining each product and process element in terms of the sources or areas of risk. Root causes are those potential events that evaluators determine would adversely affect the program at any time in its life cycle.

An approach for identifying and compiling a list of root causes is to:

- List product or process elements;
- Examine each in terms of risk sources or areas;
- Determine what could go wrong; and
- Ask "why" multiple times until the source(s) is discovered.

Risk Analysis

The intent of risk analysis is to answer the question "How big is the risk?" by:

- Considering the likelihood of the root cause occurrence;
- Identifying the possible consequences in terms of performance, schedule, and cost; and
- Identifying the risk level using the Risk Reporting Matrix shown in the figure below.

Risk analysis is the activity of examining each identified risk to refine the description of the risk, isolate the cause, determine the effects, and aid in setting risk mitigation priorities and strategies. It refines each risk in terms of its likelihood, its consequence, and its relationship to other risk areas or processes. Analysis begins with a detailed study of the risks that have been identified. The objective is to gather enough information about future risks to judge the root causes, the likelihood, and the consequence/s of the risk should it occur. The frequently used term "risk assessment" includes the distinct activities of risk identification and risk analysis.

Risk analysis sequence of tasks includes:

- Develop likelihood and consequence scales;
- Assign a probability of occurrence to each risk appropriate criteria;
- Determine consequence; and
- Document the results in the program risk database.

Risk Reporting Matrix

The Risk Reporting Matrix (Figure 16-2), should be aligned with BUFFALO COAL's risk rating matrix' and is typically used to determine the level of risks identified and associated with a project or within a program. The level of risk for each root cause is reported as low (green), low moderate (yellow), high moderate (purple) or high (red). The purpose of a risk assessment process is to move risks from the top right to the bottom left as reflected in the risk map.

Figure 16-2: Illustrative Risk Map

The level of likelihood of each root cause is established utilising specified criteria (Table 16-2). For example, if the root cause has an estimated five per cent probability of occurring, the corresponding likelihood is Rare (Level E).

Table 16-2: Likelihood Category

Likelihood Category				
E	**D**	**C**	**B**	**A**
Rare	**Unlikely**	**Moderate**	**Likely**	**Almost Certain**
Highly unlikely to occur on this project	Given current practices and procedures, this incident is unlikely to occur on this project	Incident has occurred on a similar project	Incident is likely to occur on this project	Incident is very likely to occur on this project, possibly several times

The level and types of consequences of each risk are established utilising criteria such as those described in Table 16-3. For each type of consequence there is a description that relates to a specific consequence value.

Table 16-3: Levels and Types of Consequences

	Consequences				
	1 - Insignificant	2 - Minor	**3 - Moderate**	**4 - Major**	**5 - Catastrophic**
Safety and Health	First Aid Case	Minor Injury, Medical Treatment Case with/or Restricted Work Case.	Serious Injury or Lost Work Case	Major or Multiple Injuries - permanent injury or disability	Single or Multiple Fatalities
Environment	No impact on baseline environment. Localized to point source. No recovery required	Localized within site boundaries. Recovery measurable within 1 month of impact	Moderate harm with possible wider effect. Recovery in 1 year	Significant harm with local effect. Recovery longer than 1 year.	Significant harm with widespread effect. Recovery longer than 1 year. Limited prospect of full recovery
Reputation	Localised temporary impact	Localised, short term impact	Localised, long term impact but manageable	Localised, long term impact with unmanageable outcomes	Long term regional impact
Business Impact	Impact can be absorbed through normal activity	An adverse event which can be absorbed with some management effort	A serious event which requires additional management effort	A critical event which requires extraordinary management effort	Disaster with potential to lead to collapse of the project

The results for each risk are then plotted in the corresponding single square on the Risk Reporting Matrix. In this example, since the level of likelihood and consequence of risk 36

were both "3 and C", the corresponding schedule risk is reported as "purple" as shown in Figure 16-3.

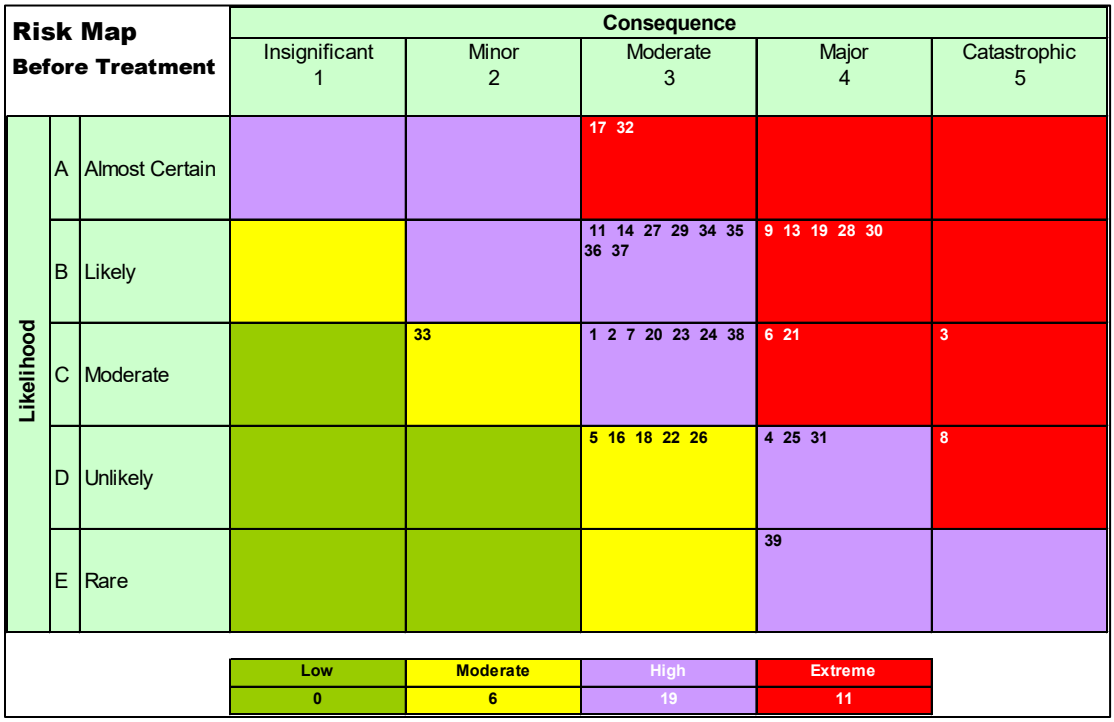


Figure 16-3: Illustrative Risk Map before treatment

Mitigation Identification

The intent of risk mitigation identification is to answer the question "What is the project or program approach for addressing this potential unfavourable consequence?"

Risk mitigation identification is the activity that identifies, evaluates, and selects options to set risk at acceptable levels given program constraints and objectives. Risk mitigation planning is intended to enable program success. It includes the specifics of what should be done, when it should be accomplished, who is responsible, and the funding required to implement the risk mitigation plan. The most appropriate program approach is selected from the mitigation options listed below and documented in a risk mitigation plan. One or more of these mitigation options may apply:

- Avoiding risk by eliminating the root cause and/ or the consequence;
- Controlling the cause or consequence;
- Transferring the risk; and/ or
- Assuming the level of risk and continuing the current program plan.

For each root cause or risk, the type of mitigation must be determined, and the details of the mitigation described.

Mitigation Analysis

The intent of mitigating analysis is to answer the question "How does the mitigation identification affect the risk?" by:

- Considering the likelihood of the root cause after mitigation;
- Identifying the possible consequences after mitigation; and
- Identifying the change in risk level using the Risk Reporting Matrix.

Once alternatives have been analysed, the selected mitigation option should be incorporated into the risk analysis, either into existing program plans or documented separately as a risk mitigation plan (not to be confused with the risk management plan). The tasks are like the Risk Analysis described in section 4 of the Report. By mitigating a risk, the report will illustrate a shift to a lower left level as indicated in Figure 16-4.

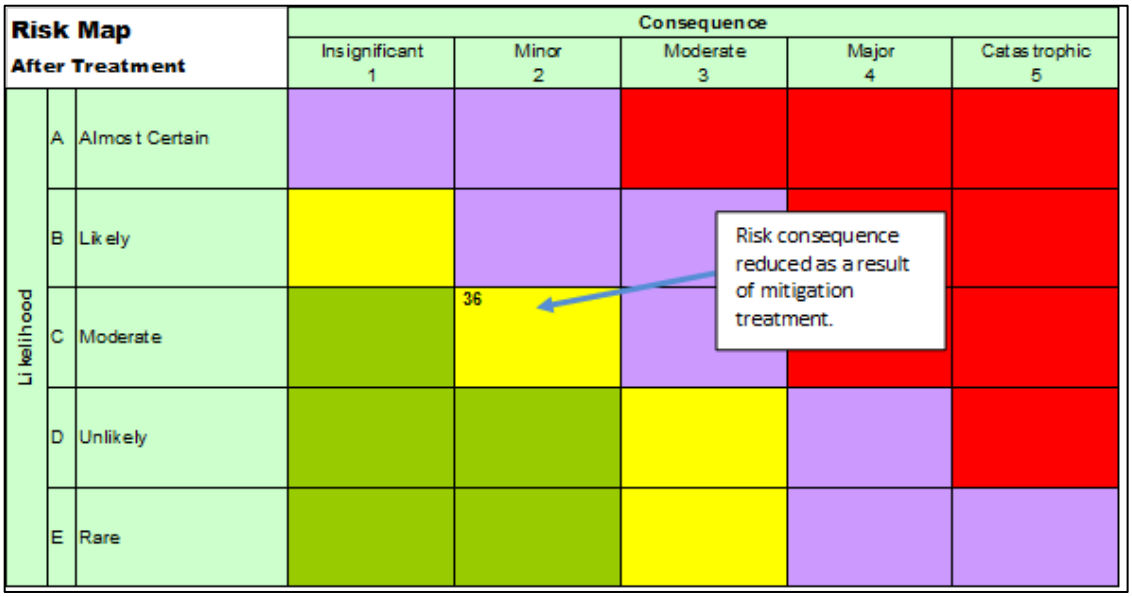


Figure 16-4: Illustrative Risk Mitigation Map after treatment

Mitigation Planning

The intent of risk mitigation (plan) execution is to ensure successful risk mitigation occurs. It answers the question "How can the planned risk mitigation be implemented?" it:

- Determines what planning, budget, requirements and contractual changes are needed;
- Provides a coordination vehicle with management and other stakeholders;
- Directs the teams to execute the defined and approved risk mitigation plans;
- Outlines the risk reporting requirements for on-going monitoring; and

- Documents the change history.

Once alternatives have been analysed, the selected mitigation option should be incorporated into program planning, either into existing program plans or documented separately as a risk mitigation plan (not to be confused with the risk management plan). The risk mitigation plan needs to be realistic, achievable, measurable, and documented and address the following topics:

- A descriptive title for the identified risk;
- The date of the plan;
- The point of contact responsible for controlling the identified root cause;
- A short description of the risk (including a summary of the performance, schedule, and resource impacts, likelihood of occurrence, consequence, whether the risk is within the control of the project or program);
- Why the risk exists (root causes leading to the risk);
- The options for mitigation (possible alternatives to alleviate the risk);
- Definition of events and activities intended to reduce the risk, success criteria for each plan event, and subsequent "risk level if successful" values;
- Risk status (discuss briefly);
- The fall-back approach (describe the approach and expected decision date for considering implementation);
- A management recommendation (whether budget or time is to be allocated, and whether or not the risk mitigation is incorporated in the estimate at completion or in other program plans);
- Appropriate approval levels; and
- Identified resource needs.

APPENDIX E. RISK REGISTER AND ACTION PLAN