



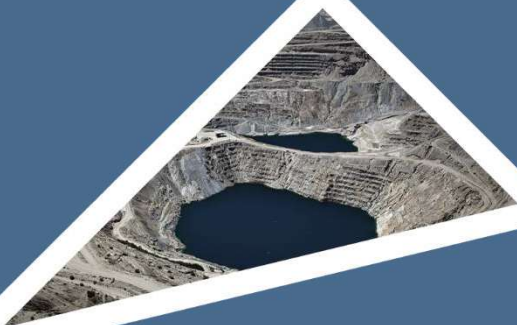
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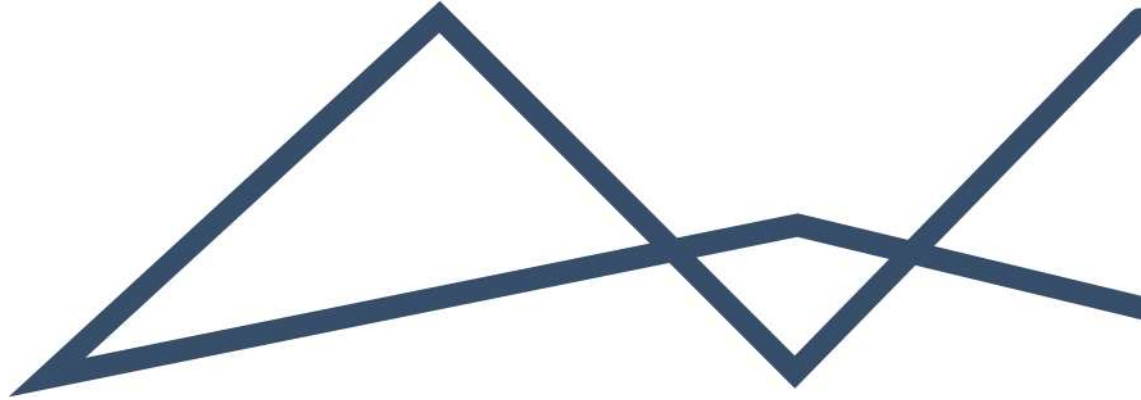
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FINAL REHABILITATION, DECOMMISSIONING AND CLOSURE PLAN

D3 ENERGY SOUTH AFRICA (PTY) LTD PRODUCTION RIGHT
APPLICATION

PASA REF: PR 12/4/016





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EXECUTIVE SUMMARY

This Financial Provision report has been prepared in terms of the National Environmental Management Act, 1998 (NEMA) and the Financial Provisioning Regulations, 2015 (GN R1147). It sets out, and provides the funding estimate for, the rehabilitation, decommissioning, closure and post-closure obligations of the operation.

D3 Energy South Africa (Pty) Ltd (D3 Energy, previously Motuoane Energy (Pty) Ltd) holds Exploration Right ER315 for hydrocarbons in the Free State Province and has applied to the Petroleum Agency South Africa (PASA) for a Production Right (PR 12/4/016) under Section 83 of the MPRDA over a ~14 440 ha portion of ER315, south-east of Welkom and Virginia within the Matjhabeng and Masilonyana Local Municipalities.

The financial provision covers the full proposed production development set out in the Development Plan for the Production Right application (Motuoane Energy, August 2025) and assessed in the EIAR, including up to 48 exploration wells, of which up to 43 may be production wells in total (the three existing wells and 13 new wells on the Virginia fault, and 27 wells on the Ventersburg fault), ~28.8 km of buried HDPE gas gathering pipelines, a helium recovery and gas processing (CNG and/or LNG) plant of ~0.97 ha with a 25 m × 25 m lined evaporation pond, an office and maintenance workshop, and associated access roads. The production right has an expected life of at least 30 years. Seismic and audio-magnetotelluric (AMT) surveys are not applicable to this provision and are not costed.

The total closure quantum (excl. VAT) is R 42 914 338.48 for scheduled closure and R 43 132 569.04 for unscheduled closure (see the summary table below and Appendix 3). This is the first financial provision determination for the Production Right, so there is no prior-year figure or movement to report; from the first annual update, the movement against the previous assessment will be shown here. Well closure (R 15.9 million) and post-closure monitoring (R 11.6 million) are the largest components. Pipeline purging and capping, reinstatement of the pipeline servitude, the closure contamination assessment, ARP rehabilitation of pipeline trenches and the plant construction area, and the plant/pond and pipeline-trench latent risks have not yet been costed; they will be added once rates are obtained (Section 4.12).

According to the Financial Provisioning Regulations, financial provision must be made for annual rehabilitation, final rehabilitation, decommissioning and closure at the end of operations; and remediation and management of latent or residual environmental impacts that may become known in future. The holder must further, on an annual basis, assess its environmental liability, adjust the financial provision to the satisfaction of the Minister responsible for mineral resources, and submit an independent auditor's report on the adequacy of the provision.

To meet these requirements this report comprises three parts required by the regulations:

- Section A - Final Rehabilitation, Decommissioning and Closure Plan (FRDCP), per Appendix 4;
- Section B - Annual Rehabilitation Plan (ARP), per Appendix 3; and
- Section C - Environmental Risk Assessment (ERA), per Appendix 5.

The closure vision is to rehabilitate, decommission and close the operation so that the landscape is left safe, stable and non-polluting over the long term, with a post-closure land use that aligns with the surrounding land uses and/or an agreed end use and does not compromise the sustained use of the land.

Table 1: Summarised financial provision (2026)

Cost Component	Scheduled Closure (excl. VAT)	Unscheduled Closure (excl. VAT)
Final decommissioning and closure – well closure (plugging and abandonment)	R 15 906 491.31	R 15 906 491.31
Final decommissioning and closure – general surface	R 6 569 341.76	R 6 569 341.76



Cost Component	Scheduled Closure (excl. VAT)	Unscheduled Closure (excl. VAT)
rehabilitation (plant, pipelines, pond, roads, well sites)		
Annual rehabilitation (ARP, forthcoming 12 months)	R 0.00	R 181 858.80
Post-closure monitoring	R 11 606 015.59	R 11 606 015.59
Latent and residual risk provision	R 1 547 568.92	R 1 547 568.92
Preliminary and general (P&Gs)	R 3 702 127.16	R 3 720 313.04
Contingencies	R 3 582 793.74	R 3 600 979.62
Total quantum of financial provision (excl. VAT)	R 42 914 338.48	R 43 132 569.04



1 INTRODUCTION

D3 Energy South Africa (Pty) Ltd (previously Motuoane Energy (Pty) Ltd; the holder-name amendment to the EA was granted on 24 July 2026) holds Exploration Right ER315 for hydrocarbons, granted under Section 80 of the Mineral and Petroleum Resources Development Act, 2002 (MPRDA), with the associated Environmental Authorisation (EA ref. 12/3/315) issued by the then Department of Mineral Resources and Energy (now the Department of Mineral and Petroleum Resources, DMPR). The ER originally covered ~149 377 ha near Welkom, Virginia, Hennenman, Theunissen and Kroonstad and was reduced to ~95 483 ha on relinquishment at its second renewal. A Part 2 EA amendment (ten additional exploration wells, ~30 km of seismic transects and an amended EMPr) was granted on 31 October 2024.

D3 Energy has applied to PASA (August 2025) for a Production Right (PR 12/4/016) under Section 83 of the MPRDA over ~14 440 ha of ER315, targeting helium and methane gas. Because the project triggers activities in NEMA Listing Notices 1, 2 and 3, a full Scoping and EIA process is being undertaken by EIMS (EIMS ref. 1709); the Scoping Report was accepted by PASA on 20 April 2026 and the Draft EIAR and EMPr are out for public review. The project history, listed activities and alternatives are set out in the EIAR and are not repeated here.

In accordance with the Financial Provisioning Regulations, financial provision must be made for annual rehabilitation; final rehabilitation, decommissioning and closure; and remediation of latent or residual impacts. To address these requirements this report includes an annual rehabilitation plan, a final rehabilitation, decommissioning and closure plan, and an environmental risk assessment report.

The specific requirements of each of the three plans (GNR1147 Appendices 3, 4 and 5) and the section of this report where each is addressed are set out in Report Structure below.

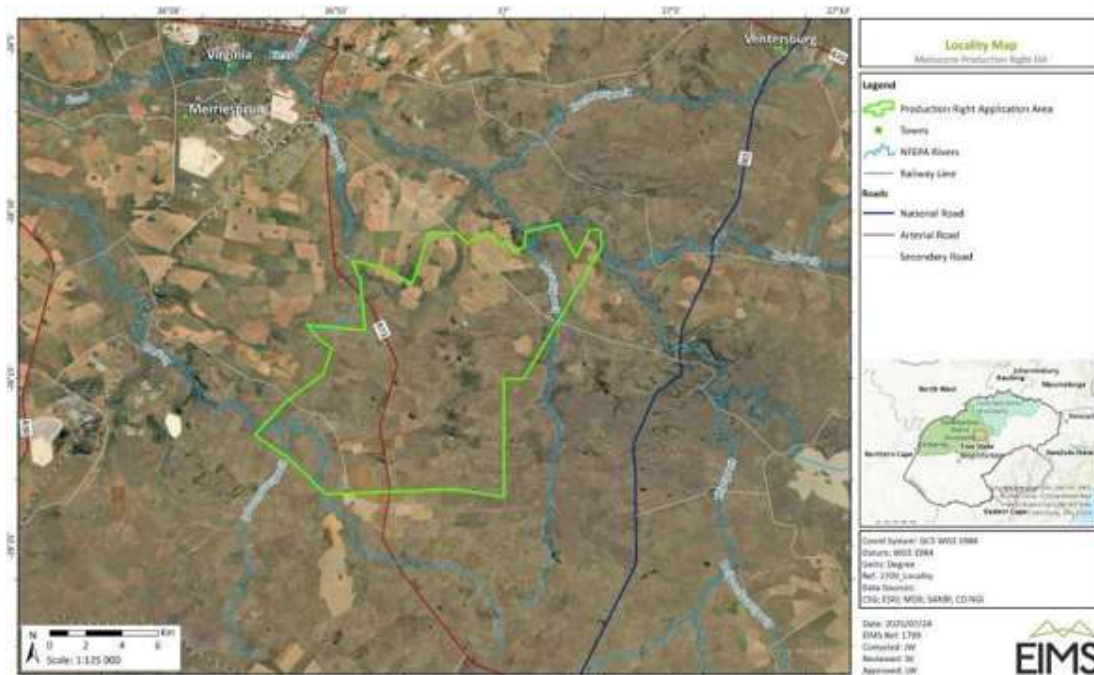


Figure 1: Locality of the proposed D3 Energy Production Right application area.



2 REPORT STRUCTURE

This report is structured in the three parts required by GNR1147. Each part below lists the regulated content requirement and the section of this report in which it is addressed. The requirement-to-section tables are the compliance backbone of the report; keep them and update only the section cross-references (highlighted) each year.

2.1 SECTION A: FINAL REHABILITATION, DECOMMISSIONING AND CLOSURE PLAN (FRDCP) CONTENT REQUIREMENTS

The FRDCP must be measurable and auditable, must take account of the proposed post-closure land use, and must define the closure vision, objectives, design and relinquishment criteria — identifying the infrastructure and activities to be decommissioned, closed, removed and remediated, the risk drivers determining the closure actions, how those actions achieve the relinquishment criteria, and the monitoring, auditing and reporting requirements. Its content requirements and where each is addressed are listed below.

Table 2: FRDCP (GN R 1147 - Appendix 4) content requirements.

No.	Requirement	Section
3(a)	Details of- (i). the person or persons that prepared the plan; (ii). the professional registrations and experience of the preparers;	Section 3
3(b)	The context of the project, including- (i). material information and issues that have guided the development of the plan; (ii). an overview of- (aa) the environmental context, including but not limited to air quality, quantity and quality of surface and groundwater, land, soils and biodiversity; and (bb) the social context that may influence closure activities and post-mining land use or be influenced by closure activities and post-mining land use; (iii). stakeholder issues and comments that have informed the plan; (iv). the mine plan and schedule for the full approved operations, and must include- (aa) appropriate description of the mine plan; (bb) drawings and figures to indicate how the mine develops; (cc) what areas are disturbed; and (dd) how infrastructure and structures (including ponds, residue stockpiles etc.) develop during operations;	Sections 4.1 to 4.3
3(c)	Findings of an environmental risk assessment leading to the most appropriate closure strategy, including- (i). a description of the risk assessment methodology including risk identification and quantification, to be undertaken for all areas of infrastructure or activity or aspects for which a holder of a right or permit has a responsibility to mitigate an impact or risk at closure;	Section 4.4



No.	Requirement	Section
	(ii). an identification of indicators that are most sensitive to potential risks and the monitoring of such risks with a view to informing rehabilitation and remediation activities; (iii). an identification of conceptual closure strategies to avoid, manage and mitigate the impacts and risks; (iv). a reassessment of the risks to determine whether, after the implementation of the closure strategy, the residual risk has been avoided and / or how it has resulted in avoidance, rehabilitation and management of impacts and whether this is acceptable to the mining operation and stakeholders; and (v). an explanation of changes to the risk assessment results, as applicable in annual updates to the plan;	
3(d)	Design principles, including- (i). the legal and governance framework and interpretation of these requirements for the closure design principles; (ii). closure vision, objectives and targets, which objectives and targets must reflect the local environmental and socio-economic context and reflect regulatory and corporate requirements and stakeholder expectations; (iii). a description and evaluation of alternative closure and post closure options where these exist that are practicable within the socioeconomic and environmental opportunities and constraints in which the operation is located; (iv). a motivation for the preferred closure action within the context of the risks and impacts that are being mitigated; (v). a definition and motivation of the closure and post closure period, taking cognisance of the probable need to implement post closure monitoring and maintenance for a period sufficient to demonstrate that relinquishment criteria have been achieved; (vi). details associated with any on-going research on closure options; (vii). a detailed description of the assumptions made to develop closure actions in the absence of detailed knowledge on site conditions, potential impacts, material availability, stakeholder requirements and other factors for which information is lacking;	Section 4.5
3(e)	A proposed final post-mining land use which is appropriate, feasible and possible of implementation, including- (i). descriptions of appropriate and feasible final post-mining land use for the overall project and per infrastructure or activity and a description of the methodology used to identify final post-mining land use, including the requirements of the operations stakeholders; (ii). a map of the proposed final post-mining land use;	Section 4.6
3(f)	closure actions, including- (i). the development and documenting of a description of specific technical solutions related to infrastructure and facilities for the preferred closure option or options, which must include all areas, infrastructure, activities and aspects both within the mine lease area and off of the mine lease area associated with mining for which the mine has the responsibility to implement closure actions;	Section 4.7



No.	Requirement	Section
	(ii). the development and maintenance of a list and assessment of threats and opportunities and any uncertainties associated with the preferred closure option, which list will be used to identify and define any additional work that is needed to reduce the level of uncertainty;	
3(g)	A schedule of actions for final rehabilitation, decommissioning and closure which will ensure avoidance, rehabilitation, management of impacts including pumping and treatment of extraneous water - (i). linked to the mine works programme, if greenfields, or to the current mine plan, if brownfields; (ii). including assumptions and schedule drivers; and (iii). including a spatial map or schedule, showing planned spatial progression throughout operations;	Section 4.8
3(h)	An indication of the organisational capacity that will be put in place to implement the plan, including- (i). organisational structure as it pertains to the plan; (ii). responsibilities; (iii). training and capacity building that may be required to build closure competence;	Section 4.9
3(i)	An indication of gaps in the plan, including an auditable action plan and schedule to address the gaps;	Section 4.10
3(j)	Relinquishment criteria for each activity or infrastructure in relation to environmental aspects with auditable indicators;	Section 4.11
3(k)	Closure cost estimation procedure, which ensures that identified rehabilitation, decommissioning, closure and post-closure costs, whether on-going or once-off, are realistically estimated and incorporated into the estimate, on condition that- (i). cost estimates for operations, or components of operations that are more than 30 years from closure will be prepared as conceptual estimates with an accuracy of ± 50 per cent. Cost estimates will have an accuracy of ± 70 per cent for operations, or components of operations, 30 or less years (but more than ten years) from closure and ± 80 per cent for operations, or components of operations ten or less years (but more than five years) from closure. Operations with 5 or less years will have an accuracy of ± 90 per cent. Motivation must be provided to indicate the accuracy in the reported number and as accuracy improves, what actions resulted in an improvement in accuracy; (ii). the closure cost estimation must include- (aa) an explanation of the closure cost methodology; (bb) auditable calculations of costs per activity or infrastructure; (cc) cost assumptions; (iii). the closure cost estimate must be updated annually during the operation's life to reflect known developments, including changes from the annual review of the closure strategy assumptions and inputs, scope changes, the effect of a further year's inflation, new regulatory requirements and any other material developments; and	Section 4.12



No.	Requirement	Section
3(l)	Monitoring, auditing and reporting requirements which relate to the risk assessment, legal requirements and knowledge gaps as a minimum and must include- (i). a schedule outlining internal, external and legislated audits of the plan for the year, including- (aa) the person responsible for undertaking the audit(s); (bb) the planned date of audit and frequency of audit; (cc) an explanation of the approach that will be taken to address and close out audit results and schedule; (ii). a schedule of reporting requirements providing an outline of internal and external reporting, including disclosure of updates of the plan to stakeholders; (iii). a monitoring plan which outlines- (aa) parameters to be monitored, frequency of monitoring and period of monitoring; (bb) an explanation of the approach that will be taken to analyse monitoring results and how these results will be used to inform adaptive or corrective management and/or risk reduction activities; and	Section 4.13
3(m)	motivations for any amendments made to the final rehabilitation, decommissioning and mine closure plan, given the monitoring results in the previous auditing period and the identification of gaps as per 2(i)	Section 4.14



2.2 SECTION B: ANNUAL REHABILITATION PLAN (ARP) CONTENT REQUIREMENTS

The ARP is relevant for one year and is updated annually to reflect progress in the preceding 12 months and to set out the plan, schedule and budget for the next 12 months. It defines concurrent rehabilitation and remediation activities and how they relate to the closure vision in the FRDCP, indicates which closure objectives and criteria are being achieved, and must be measurable and auditable. Its content requirements (Appendix 3) are listed below.

Table 3: ARP (GN R 1147 - Appendix 3) content requirements.

No.	Requirements	Section/s
3(a)	Details of the – (i) person or persons that prepared the plan; (ii) professional registrations and experience of the person or persons; and (iii) timeframes of implementation of the current, and review of the previous rehabilitation activities.	Sections 3, 5.4 and 5.5
3(b)	The pertinent environmental and project context relating directly to the planned annual rehabilitation and remediation activity.	Section 5.1
3(c)	Results of monitoring of risks identified in the final rehabilitation, decommissioning and mine closure plan with a view to informing rehabilitation and remediation activities.	Section 5.2
3(d)	An identification of shortcomings experienced in the preceding 12 months.	Section 5.3
3(e)	Details of the planned annual rehabilitation and remediation activities or measures for the forthcoming 12 months, including those which will address the shortcomings contemplated in 3(d) above or which were identified from monitoring in the preceding 12 months, and including - (i) if no areas are available for annual rehabilitation and remediation concurrent with mining, an indication to that effect and motivation why no annual rehabilitation or remediation can be undertaken; (ii) where areas are available for annual rehabilitation and remediation concurrent with mining, annual rehabilitation and remediation activities related to previous disturbance or expected planned impacts and disturbance, as per the mine works programme, in the period under consideration, which should be tabulated and must indicate, but not necessarily be limited to. - (aa) nature or type of activity and associated infrastructure; (bb) planned remaining life of the activity under consideration; (cc) area already disturbed or planned to be disturbed in the period of review; (dd) percentage of the already disturbed or planned to be disturbed area available for concurrent rehabilitation and remediation activities; (ee) percentage of the already disturbed or planned to be disturbed area available as per (dd) and on which concurrent rehabilitation and remediation can be undertaken; (ff) notes to indicate why total available or planned to be available area differs from area already disturbed or planned to be disturbed;	Section 5.4



No.	Requirements	Section/s
	(gg) notes to indicate why concurrent rehabilitation will not be undertaken on the full available or planned to be available area; (hh) details of rehabilitation activity planned on this area for the period of review; (ii) the pertinent closure objectives and performance targets that will be addressed in the forthcoming year, which objectives and targets are aligned to the final rehabilitation, decommissioning and mine closure plan; (jj) description of the relevant closure design criteria adopted in the annual rehabilitation and remediation activities and the expected final land use once all rehabilitation and remediation activities are complete for the activity or aspect; and (iii) a site plan indicating at least the total area disturbed, area available for rehabilitation and remediation and the area to be rehabilitated or remediated per aspect or activity.	
3(f)	A review of the previous year's annual rehabilitation and remediation activities, indicating a comparison between activities planned in the previous year's annual rehabilitation and remediation plan and actual rehabilitation and remediation implemented, which should be tabulated and as a minimum contain- (aa) area planned to be rehabilitated and remediated during the plan under review; (bb) actual area rehabilitation or remediated; and (cc) if the variance between planned and actual exceeds 15%, motivation indicating reasons for the inability to rehabilitate or remediate the full area.	Section 5.5
3(g)	Costing, including- (i) an explanation of the closure cost methodology; (ii) auditable calculations of costs per activity or infrastructure; (iii) cost assumptions; and (iv) monitoring and maintenance costs likely to be incurred both during the period of the annual rehabilitation plan and those that will extend past the period of the final rehabilitation, decommissioning and mine closure plan, on condition that the monitoring and maintenance costs included in previous annual rehabilitation plans must be accumulated into subsequent versions of the annual rehabilitation plan until such time as the monitoring and maintenance obligation is discharged.	Sections 4.12 and 5.6



2.3 SECTION C: ENVIRONMENTAL RISK ASSESSMENT (ERA) CONTENT REQUIREMENTS

The ERA determines the potential financial liability associated with managing latent and residual environmental impacts after closure, once the initial relinquishment criteria have been achieved, with reference to the proposed post-closure land use. Its content requirements (Appendix 5) are listed below.

Table 4: ERA (GN R 1147 - Appendix 5) content requirements.

No.	Requirements	Section
3(a)	Details of- (i). the person or persons that prepared the plan; (ii). the professional registrations and experience of the preparers;	Section 3
3(b)	details of the assessment process used to identify and quantify the latent risks, including- (i). a description of the risk assessment methodology inclusive of risk identification and quantification; (ii). substantiation why each risk is latent, including why the risk was not or could not be mitigated during concurrent rehabilitation and remediation or during the implementation of the final rehabilitation, decommission and closure plan; (iii). a detailed description of the drivers that could result in the manifestation of the risks, to be presented within the context of closure actions already having been implemented during the execution of concurrent rehabilitation or during the implementation of the final rehabilitation, decommission and closure plan; (iv). a description of the expected timeframe in which the risk is likely to manifest, typically as expected years after closure, and the duration of the impact, including motivation to support these timeframes; (v). a detailed description of the triggers which can be used to identify that the risk is imminent or has manifested, how this will be measured and any cost implications thereof; (vi). results and findings of the risk assessment; (vii). an explanation of changes to the risk assessment results as applicable in annual updates to the plan;	Section 6.1
3(c)	management activities, including- (i). monitoring of results and findings, which informs adaptive or corrective management and/or risk reduction activities; (ii). an assessment of alternatives to mitigate or manage the impacts once the risk has become manifested, which must be focussed on practicality as well as cost of the implementation; (iii). motivation why the selected alternative is the appropriate approach to mitigate the impact; (iv). a detailed description of how the alternative will be implemented;	Section 6.2
3(d)	costing, calculated using the current value of money and no discounting or net present value calculations included in the determination of the quantum of the liability, including- (i). a cost estimation, which must include-	Section 6.3



No.	Requirements	Section
	(aa) an explanation of the closure cost methodology; (bb) an auditable calculations of costs per activity or infrastructure; (cc) cost assumptions; (dd) monitoring costs post closure to determine whether the risk is imminent or has manifest are to be included in the assessment as are monitoring costs likely to be incurred during the implementation of the strategy to manage or mitigate the impacts once the risk has become manifest; (ii). where appropriate, a differentiation between capital, operating, replacement and maintenance costs; (iii). cost estimates for operations, or components of operations that are more than 30 years from closure prepared as conceptual estimates within an accuracy of ± 50 per cent. Cost estimates will have an accuracy of ± 70 per cent for operations, or components of operations, 30 or less years (but more than ten years) from closure and ± 80 per cent for operations, or components of operations ten or less years (but more than five years) from closure. Operations with 5 or less years will have an accuracy of ± 90 per cent. Motivation must be provided to indicate the accuracy in the reported number and as accuracy improves, what actions resulted in an improvement in accuracy; and	
3(e)	Monitoring, auditing and reporting requirements, which must include requirements prior to the manifestation of the risk and impacts as well as those once the impacts resulting from the manifestation of the risk are realised, inclusive of the approach that will be taken to analyse monitoring results and how these results will be used to inform adaptive or corrective management and/or risk reduction activities.	Section 6.4



3 DETAILS OF SPECIALIST

This report was prepared by Environmental Impact Management Services (Pty) Ltd (EIMS) on behalf of D3 Energy South Africa (Pty) Ltd. The professionals who contributed are listed below; detailed CVs are attached in Appendix 1.

Table 5: Details of Specialists.

Name	Liam Whitlow	Jessica Jordaan	Douglas Richards
Role	Principal Environmental Consultant	Senior Environmental Consultant	Environmental Engineer
Qualifications & experience	BSc Hons Environmental Management. ~30 years environmental consulting experience.	BSc in Geology and BSc Hons in Soil Science. ~5 years in soil science and environmental consulting experience	BEng Tech Civil Engineering ~13 years environmental engineering experience
Professional registration	South African Council for Natural Scientific Professions - Registered Professional Natural Scientist (Environmental Science, 400148/08). Registered Environmental Assessment Practitioner (2019/222). Member of Land Rehabilitation Society of Southern Africa.	South African Council for Natural Scientific Professions - Registered Candidate Natural Scientist (Soil Science, 124758). Registered Candidate Environmental Assessment Practitioner (2023/7087). Member of Land Rehabilitation Society of Southern Africa.	Member of South African Institution of Civil Engineering (SAICE) Member of Land Rehabilitation Society of Southern Africa.
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3.1 AFFIRMATION REGARDING CORRECTNESS OF INFORMATION

I, Jessica Jordaan, in my capacity as Environmental Assessment Practitioner and report author of Environmental Impact Management Services (Pty) Ltd (EIMS), do hereby affirm and declare that:

- I compiled / directed the compilation of the above Financial Provision report, comprising the Final Rehabilitation, Decommissioning and Closure Plan, the Annual Rehabilitation Plan and the Environmental Risk Assessment, on behalf of the Holder;*
- the report was prepared in accordance with the requirements of the National Environmental Management Act, 1998 (Act 107 of 1998) and the Financial Provisioning Regulations, 2015 (GN R1147);*
- the information contained in the report is, to the best of my knowledge and belief, true and correct, and I have not knowingly omitted, misrepresented or withheld any material information;*
- I acted as an independent specialist and have no business, financial, personal or other interest in the activity, right or application in respect of which I was appointed, other than fair remuneration for the*



work performed, and I have performed the work objectively even if this results in views and findings that are not favourable to the Holder;

- I have the necessary qualifications, professional registration and expertise to prepare the report, as reflected in the specialist details recorded therein;*
- the closure cost estimate presented in the report represents an estimate of the anticipated rehabilitation, decommissioning, closure and post-closure costs, based on the information available at the date of the report and the assumptions, limitations and accuracy stated therein;*
- where information was provided by the Holder or by third parties (including contractor rates and specialist studies), such information was accepted in good faith and, where relevant, its source is identified in the report; and*
- I undertake to disclose to the Holder and the competent authority any material information that has or may have the potential to influence the report or the financial provision determined therein.*

I make this declaration in the honest belief that the contents are true and correct.

Jessica Jordaan

I, Liam Whitlow, in my capacity as Principal Environmental Consultant and reviewer of Environmental Impact Management Services (Pty) Ltd (EIMS), do hereby affirm and declare that:

- I compiled / directed the compilation of the above Financial Provision report, comprising the Final Rehabilitation, Decommissioning and Closure Plan, the Annual Rehabilitation Plan and the Environmental Risk Assessment, on behalf of the Holder;*
- the report was prepared in accordance with the requirements of the National Environmental Management Act, 1998 (Act 107 of 1998) and the Financial Provisioning Regulations, 2015 (GN R1147);*
- the information contained in the report is, to the best of my knowledge and belief, true and correct, and I have not knowingly omitted, misrepresented or withheld any material information;*
- I acted as an independent specialist and have no business, financial, personal or other interest in the activity, right or application in respect of which I was appointed, other than fair remuneration for the work performed, and I have performed the work objectively even if this results in views and findings that are not favourable to the Holder;*
- I have the necessary qualifications, professional registration and expertise to prepare the report, as reflected in the specialist details recorded therein;*
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- where information was provided by the Holder or by third parties (including contractor rates and specialist studies), such information was accepted in good faith and, where relevant, its source is identified in the report; and*
- I undertake to disclose to the Holder and the competent authority any material information that has or may have the potential to influence the report or the financial provision determined therein.*

I make this declaration in the honest belief that the contents are true and correct.



Liam Whitlow



4 SECTION A: FINAL REHABILITATION, DECOMMISSIONING AND CLOSURE PLAN

This section addresses the GNR1147 Appendix 4 objectives (Section 2(a)–(h)) and requirements (Section 3(a)–(m)): it sets the closure vision, objectives and targets; details the closure actions and the resources (cost, time and personnel) needed to implement, monitor, measure and audit them; and identifies knowledge gaps and how they will be addressed to improve cost accuracy.

4.1 PROJECT CONTEXT

This section focuses on the material information and issues that guide the FRDCP. Further detail on the project and its environment is contained in the EIA Report (EIAR) (EIMS, 2026), the EMPr and the specialist studies, which are referenced rather than repeated.

This FRDCP relies on the Draft EIAR for the D3 Energy Production Right (EIMS ref. 1709; PASA ref. 12/4/016, August 2026), its specialist studies, the Site Sensitivity Verification Report and the EMPr. No pre-commencement survey has yet been undertaken for the PR. The site description reflects the pre-construction baseline as at August 2026. Because no production infrastructure exists yet, the battery limits for this estimate are the full proposed layout assessed in the EIAR rather than infrastructure existing at the report date. Authorisation status:

- Exploration Right ER315 and EA 12/3/315 (as amended on 31 October 2024 and 24 July 2026) remain in force for ongoing exploration within and outside the PR area.
- Production Right PR 12/4/016 (Section 83 of the MPRDA) was applied for in August 2025 and has not yet been granted. If granted, a production right is valid for the period specified in the right, which may not exceed 30 years; the project has an expected life of at least 30 years.
- The EA application (Scoping and EIA) covers GNR 983 Activity 21C and GNR 984 Activity 20 (activities requiring an exploration and a production right), with GNR 983 Activities 12, 19, 24, 27, 28, 56 and 67, GNR 984 Activities 5 and 7, and GNR 985 Activities 4, 12, 14 and 18. National Water Act Section 21(c), (i) and (g) water uses (including the evaporation pond) are being applied for in a parallel application.

4.1.1 PROJECT LOCATION

The PR application area (~14 440 ha) lies in the Free State Province, within the Matjhabeng Local Municipality (Wards 1, 3 and 4) and Masilonyana Local Municipality (Ward 6) of the Lejweleputswa District Municipality. Its boundary is ~15 km south-east of Virginia, ~28 km south-east of Welkom, ~13 km south-west of Ventersburg and ~21 km north-east of Theunissen; the approximate centre is at 28°14'38.37"S, 26°57'54.97"E. The R73 and N1 pass through and east of the area respectively. Affected farms and portions are listed in Appendix 2.

No production wells have yet been drilled under the PR. Three existing wells on the Virginia fault (drilled under ER315) will be incorporated into the production development; all other well, pipeline and plant positions are proposed within 500 m wide development corridors along the Virginia and Ventersburg faults. The proposed layout is shown below.

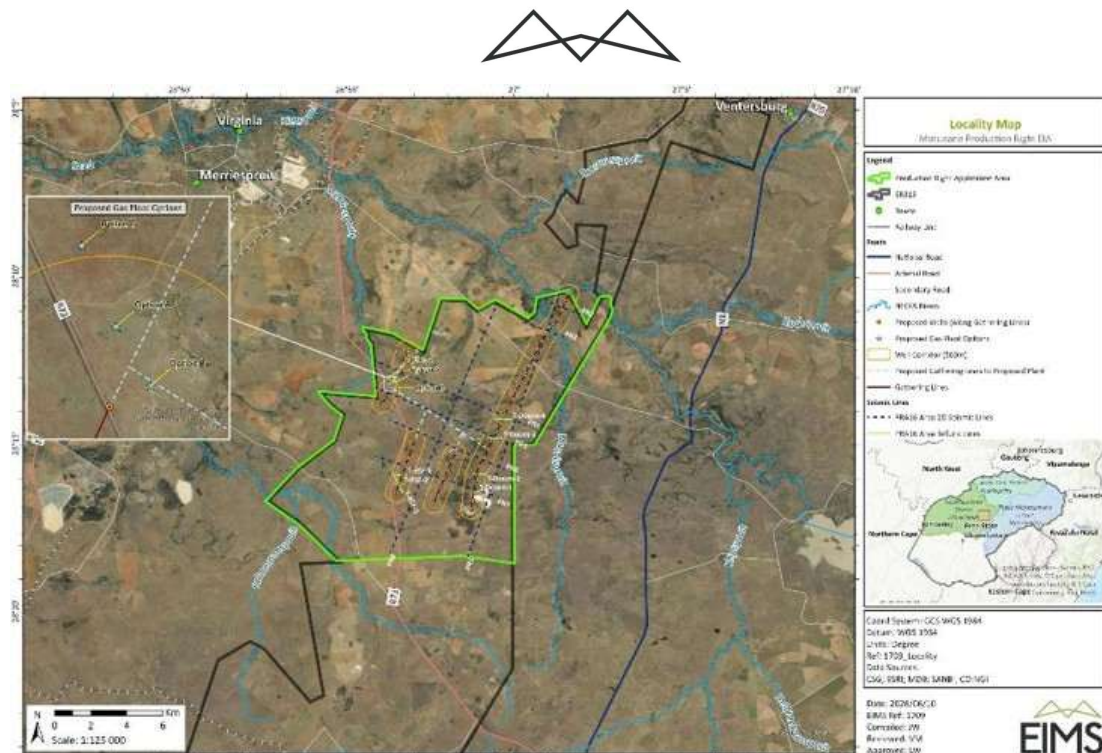


Figure 2: Proposed layout: well corridors, gathering pipelines, gas plant options and seismic/AMT lines.

4.1.2 PROJECT DESCRIPTION

The infrastructure and operations considered as the battery limits for the cost estimate are the existing on-site infrastructure at the report date and all wells/activities (regardless of status) at that date.

The production development comprises well drilling and completion, a buried low-pressure gas gathering network, a single helium recovery and gas processing plant near the Virginia fault, and support infrastructure. Pre-drilling seismic/AMT surveys may be used to optimise well positions (lines shown in Figure 2); they are not applicable to this provision and are not costed. The Development Plan for the Production Right application (Motuoane Energy, August 2025) provides for 43 production well locations: the initial development of 13 new wells and the 3 existing wells on the Virginia fault, and 27 further locations on the Ventersburg fault drilled as required to maintain sales volumes. All wells are drilled as exploration wells: up to 48 are provided for (including the 3 existing wells), of which up to 43 become production wells and the remainder are plugged and the sites rehabilitated. The Development Plan phases the 13 new wells as ~7 in late 2026 and 6 in 2027; the EIAr programme, which allows for authorisation, starts drilling in 2027, with the plant ready to accept gas by early 2028. The well count may increase if drilling moves the assumed gas–water contact or the seismic/AMT surveys identify additional faults; any additional wells will be added to the provision at the annual update.

The PR has not been granted, so no production infrastructure exists yet. This provision covers the full proposed layout (worst case). Where wells would conflict with approved solar PV developments, relocation within the PR is provided for by layout alternative L2 (EIAr Section 6); the well count provided for does not change. The D3 Energy field office in Virginia (existing commercial premises) is excluded.

Table 6: Summary of the proposed activities and infrastructure provided for (battery limits).

Activity / feature	Description	Extent / quantity
Production wells	Vertical wells at ~500 m spacing, drilled to ~500–600 m and completed open-hole in the Witwatersrand reservoir; production casing cemented from	Up to 43 of the 48 exploration wells: 3 existing and 13 new on the Virginia fault; 27 on the



Activity / feature	Description	Extent / quantity
	surface to the base of the Karoo. Simple wellhead (gas metering and pressure monitoring, battery-powered); no tubing, pumps or water tanks at the wellhead.	Ventersburg fault (Development Plan)
Exploration wells	Cased and cemented wells, evaluated for flow, pressure and composition, then converted to production wells or plugged and rehabilitated.	Up to 48 in total, including the 3 existing wells; up to 43 become production wells and the rest are plugged and the sites rehabilitated
Drill pads and sumps	Temporary pad for rig, rods, waste storage, chemical toilets and site office; lined drill sump per well; each pad rehabilitated before moving to the next site.	≤50 m × 50 m (≤0.25 ha) per well; sump ≤4 m × 4 m × 1.5 m
Wellsite (operational)	Fenced wellhead retained for the production life; wellhead may be placed in a below-ground chamber where land use requires (above-ground preferred).	~2 m × 2 m surface infrastructure per well
Gas gathering pipelines	Low-pressure HDPE lines (110–315 mm) buried at 750 mm (grazing land) to 1 000 mm (cultivated land); 10 m servitude kept free of woody plants; above-ground concrete route markers; low-point drains (possibly in below-ground pits); field nodal compression only if required.	~28.8 km (110 mm: 9 500 m; 200 mm: 6 250 m; 250 mm: 7 650 m; 315 mm: 5 400 m)
Helium recovery and gas processing plant	Fenced industrial site with inlet separation, compressors, membrane/PSA helium recovery unit (3.0 MMscfd), cryogenic (helium/LNG) units, CNG/LNG and helium loading bays, flare stack with safety exclusion zone, control room, pipe racks, electrical, instrument air, fire protection and site drainage. Gas-powered.	~128 m × 76 m (~0.97 ha) fenced; ~1.5 ha vegetation clearance (EIAR Table 9)
Produced water management	Two produced-water tanks and an HDPE-lined evaporation pond receiving process water and condensate.	Pond ~25 m × 25 m (625 m ²)
Office and maintenance workshop	Multipurpose office, stores, warehouse and workshop beside the plant.	150 m ² double-storey brick footprint, 200 m ² of canopies/light steel, a 343 m ² prefab building (2



Activity / feature	Description	Extent / quantity
		offices), and a medium-plant/structure allowance.
Access roads and tracks	Existing roads used where possible; new tracks ~3.5 m wide where no access exists; road base or surfacing only where upgrades are needed; borrow pits for road material only if required (none identified yet).	150m length assumed that will not be transferred to post-closure landowners. Well-site tracks: 100 m per well (4 800 m in total; Section 4.5.5).
Temporary and support facilities	Hazardous and general waste storage on impervious surfaces, chemical toilets, generators on impermeable surfaces (construction), laydown areas; workers housed in local towns.	Per drill site / construction area

4.1.2.1 PROJECT ACTIVITIES

Well design (EIAr Section 3.1.3 and Figure 9, typical development well) consists of:

- 8" Sch 40 conductor to ~80 m;
- 5½" production casing to ~400 m (base of the Karoo), cemented to surface;
- open-hole section to total depth (~500 m in the typical design; 500–600 m stated in the text) in the gas-bearing Witwatersrand fractures; and
- 5½" wellhead packoff with a 2" outlet; no tubing in the hole.

A cement bond log is run after the casing is set, and the open hole is logged at total depth. No hydraulic fracturing is proposed. Drilling takes one to two weeks per well using a truck- or skid-mounted rig, TLB, service truck and light vehicles, with up to 70 000 L of water per production well. Air drilling is proposed. Drill fluids and cuttings are contained in lined sumps ($\leq 4 \text{ m} \times 4 \text{ m} \times 1.5 \text{ m}$), with above-ground tanks with secondary containment for emergencies; drilling waste is removed to a licensed facility within 90 days. Wells may be tested by venting or flaring, and existing gas-emitting wells may undergo workover or intervention.

Progressive rehabilitation includes, but is not limited to, rehabilitation of each drill pad before drilling continues to the next site, and disturbed areas are to be rehabilitated within six months of drilling (EMPr). At a successful well only the fenced wellsite will remain, and unsuccessful wells should be plugged and the sites rehabilitated during the operational phase. Pipeline trenches are backfilled and reinstated after installation.

4.1.2.2 SUPPORTING AND SURFACE INFRASTRUCTURE

The nature and extent of supporting infrastructure depends on the scale and type of activity. This production project combines permanent infrastructure (the helium recovery and gas processing plant, evaporation pond, workshop, buried gathering pipelines and production well sites) with temporary drilling infrastructure (drill pads, sumps, mobile offices and chemical ablutions). On completion, infrastructure that is not required for post-closure monitoring is decommissioned and, where applicable, demolished, equipment and structures removed, sumps/ponds emptied and waste disposed of at a licensed facility, sub-soil and topsoil reinstated, compacted areas ripped, and areas re-vegetated (naturally, or actively if natural succession fails).

The infrastructure provided for is summarised in Table 6. Items relevant to closure and costing are:



- helium recovery and gas processing plant (~0.97 ha fenced), including the flare, produced-water tanks, 25 m × 25 m HDPE-lined evaporation pond, loading bays, control room, internal roads, security fencing and site drainage;
- office and maintenance workshop beside the plant;
- ~28.8 km of buried HDPE gathering pipelines with route markers, low-point drains and any nodal compression;
- up to 48 exploration wells with their drill pads and sumps and up to 43 production well sites from the exploration wells (fenced wellheads);
- access roads and tracks, fencing and firebreaks; and
- temporary hazardous and general waste storage, generators, mobile offices and chemical toilets.

None of the production infrastructure has been constructed. The plant site will be selected from three options near the Virginia fault (Options A, B and C); the plant layout is shown below.

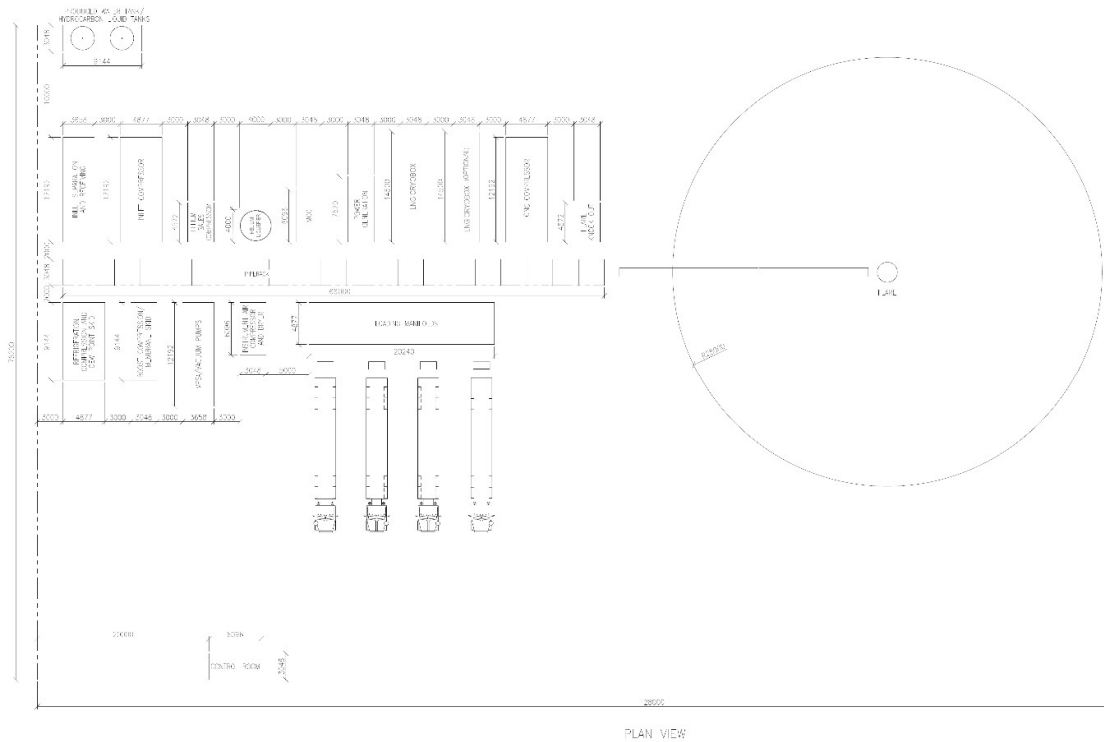


Figure 3: Conceptual layout of the helium recovery and gas processing plant, showing the evaporation pond, produced-water tanks, process units, loading bays and flare exclusion zone.



4.2 ENVIRONMENTAL AND SOCIAL CONTEXT

The pre-closure environmental and social baseline is summarised below from the specialist studies undertaken for the project. Only the aspects that materially influence closure, rehabilitation and the end land use are carried into this report; full detail remains in the referenced specialist reports and EIA. The baseline below is drawn from the EIAR and the specialist studies listed below:

- Air quality
- Archaeological and cultural heritage
- Aquatics and wetlands
- Climate change
- Financial provision (this report)
- Hydrology / floodlines
- Geohydrology
- Noise
- Palaeontology
- Quantitative risk assessment
- Social
- Soils and agricultural potential
- Terrestrial biodiversity

4.2.1 ARCHAEOLOGICAL AND CULTURAL HERITAGE

Heritage resources are protected under the National Heritage Resources Act, 1999 (Act 25 of 1999). Any graves or burial grounds are retained and buffered (at least 30 m per SAHRA guidance; 50 m is recommended for graves on this project) or, only if unavoidable, relocated through the full Section 36 process.

The HIA recorded 18 heritage features (MPR001–MPR018) in or near the project footprint: five burial grounds or grave sites (MPR003, MPR004, MPR006, MPR012 and MPR014; Grade IIIA), three stone-built foundations (MPR013, MPR017 and MPR018; Grade IIIA), four historical farmsteads and structures (MPR001, MPR008, MPR009 and MPR010; Grade IIIC), two middens (MPR002, IIIC; MPR015, IIIA), two potential historical settlements (MPR005, IIIC; MPR011, still to be verified), a kraal (MPR007, not conservation-worthy) and a possible grinding stone (MPR016, IIIC). The Relative Heritage Theme Sensitivity was verified as Medium.

Closure constraints: final well, pipeline and plant positions are not yet fixed, so distances to wells cannot be stated. Closure earthworks (pipeline and plant decommissioning, pad reinstatement, access-road rehabilitation) must observe the same buffers as construction – 30 m around heritage structures and 50 m around graves per the EIAR – and structures older than 60 years may not be altered without a permit (NHRA Section 34). Graves may only be relocated through the full Section 36 process. The Chance Find Procedure applies to all closure excavations.

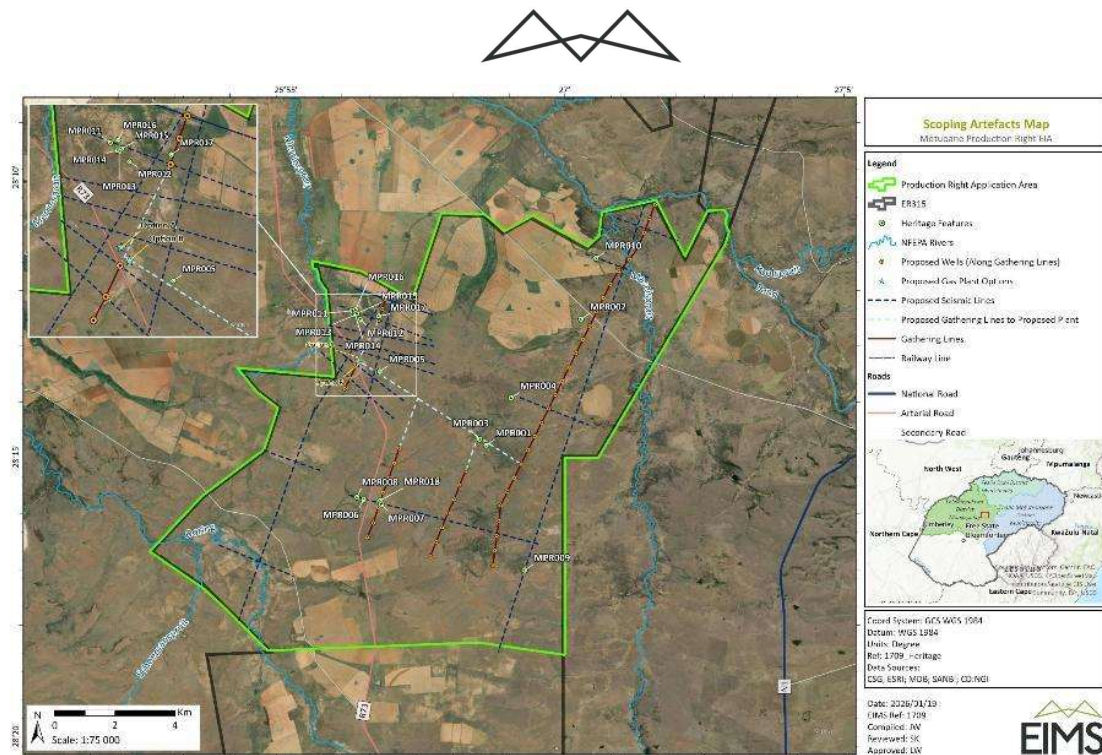


Figure 4: Potential heritage features across the PR area.

4.2.2 SOCIO-ECONOMIC

The socio-economic baseline describes the district and local municipal context and the communities that may be affected by, or benefit from, the project — informing closure objectives, end land use and stakeholder expectations.

The project lies in the Lejweleputswa District Municipality, whose economy has relied heavily on gold mining in the Matjhabeng and Masilonyana municipalities; mining is in decline and agriculture dominates land use elsewhere. The closure-relevant socio-economic context is summarised below.

Table 7: Socio-economic context of the affected local municipalities.

Parameter	Matjhabeng LM	Masilonyana LM
Affected wards	Wards 1, 3 and 4	Ward 6
Main towns	Welkom, Odendaalsrus, Virginia, Hennenman, Allanridge, Ventersburg	Theunissen, Brandfort, Winburg, Verkeerdevlei, Soutpan
Population (2022) and density	439 034; 77.2 persons/km ²	63 800; 9.6 persons/km ²
Population growth 2011–2022	7.9%	6.5%
SAMPI poverty score (2016)	0.018 (improved since 2011)	0.027 (worsened since 2011)
Economy	Gold mining (declining), with manufacturing, agriculture, tourism, logistics and retail	Mining 40.2% of GVA (2022) but ~8% of employment; agriculture the dominant land use
Home languages	Mainly Sesotho; Afrikaans notable in Ward 3; English	Mainly Sesotho; Afrikaans; English



Parameter	Matjhabeng LM	Masilonyana LM
Closure relevance	~16% of Ward 3 households rely on boreholes, so groundwater protection after closure is a direct livelihood issue. Loss of project employment at closure is rated low negative in the EIAR. Stakeholder fatigue is evident in the area.	Semi-rural, agriculture-dependent communities; end land use must support grazing and cropping.

4.2.3 GEOLOGY AND PALAEONTOLOGY

The regional geology and palaeontological sensitivity are summarised only to the extent they affect drilling, plugging and closure risk.

Surface geology comprises Quaternary aeolian sand, alluvium and calcrete over mudstone and sandstone of the Adelaide Subgroup (Beaufort Group, Karoo Supergroup), extensively intruded by Karoo dolerite dykes and sills, with post-Karoo kimberlites (Council for Geoscience sheet 2826 Winburg). The gas target lies in fractures of the Witwatersrand formation beneath the Karoo, along the regional Virginia and Ventersburg faults; a further east–west fault zone is inferred in the central PR area. Faults and dyke contacts are potential preferential pathways for groundwater and gas and must be considered in well-specific barrier design.

Palaeontological sensitivity is Very High for the Adelaide Subgroup, Moderate for Quaternary deposits and zero for dolerite (SAHRIS PalaeoMap; SSVR verified High). No fossiliferous outcrops are expected and an overall medium significance is anticipated (Banzai, 2025). A palaeontologist is to monitor drilling samples, a SAHRA permit is needed before any fossils are collected, and the Chance Find Protocol applies to closure excavations as well as construction.

4.2.4 CLIMATE

Climate parameters (temperature, rainfall, wind, evaporation) are relevant to erosion, vegetation growth and rehabilitation planning, and to the dispersion of any emissions.

The climate is cold semi-arid (Köppen BSk) with warm summers and cold, dry winters with frequent frost. Mean monthly temperatures range from ~11.5 °C (July) to ~24.4 °C (January); mean annual temperature ~18.8 °C, rising from 16.7 °C (1979) to 18.1 °C (2024). Mean annual precipitation is ~536 mm (WR2012; 1:20-year dry and wet years ~353 mm and ~774 mm), ~80% of it falling from October to March as intense thunderstorms, with June to August very dry. Mean annual evaporation (Symons pan) is 1 560–1 600 mm (zone 19C).

Implications for rehabilitation: seeding and planting should follow the first spring rains (October to December); the high-intensity summer storms drive erosion risk on freshly reinstated soils, so erosion control must be in place before the rainy season; soil handling is best done in the dry winter months; and the evaporation surplus supports passive evaporation of produced water but also limits natural re-establishment of vegetation in dry years.

4.2.5 SOILS AND AGRICULTURAL LAND POTENTIAL

Soil types and agricultural potential inform topsoil handling, re-vegetation and the achievable end land use. The PR is covered by land types Dc 12 (dominant; Mispah, Mayo, Swartland and Rensburg soil forms), Bd 20 (Clovelly, Avalon, Hutton and Valsrivier) and Dc 8 (Arcadia, Valsrivier, Rensburg, Oakleaf and Fernwood). Land capability sensitivity is split evenly between "Moderate to High" and "Low to Moderate", with isolated "Very Low to Low" areas. The DFFE Screening Tool rates agricultural sensitivity Very High; the SSVR verified it as Medium, noting limited cultivation mainly in the northern and southern PR.

Implications for rehabilitation: the shallow lithic soils (Mispah, Mayo) have little topsoil to salvage and are easily lost, while the vertic and duplex soils (Arcadia, Rensburg, Valsrivier, Swartland) are prone to compaction and erosion when disturbed wet. Topsoil must be stripped, stockpiled and replaced by soil form, and cultivated land



must be returned to its pre-disturbance land capability. Whether crop fields in the footprint are active is still to be confirmed and determines the residual agricultural impact.

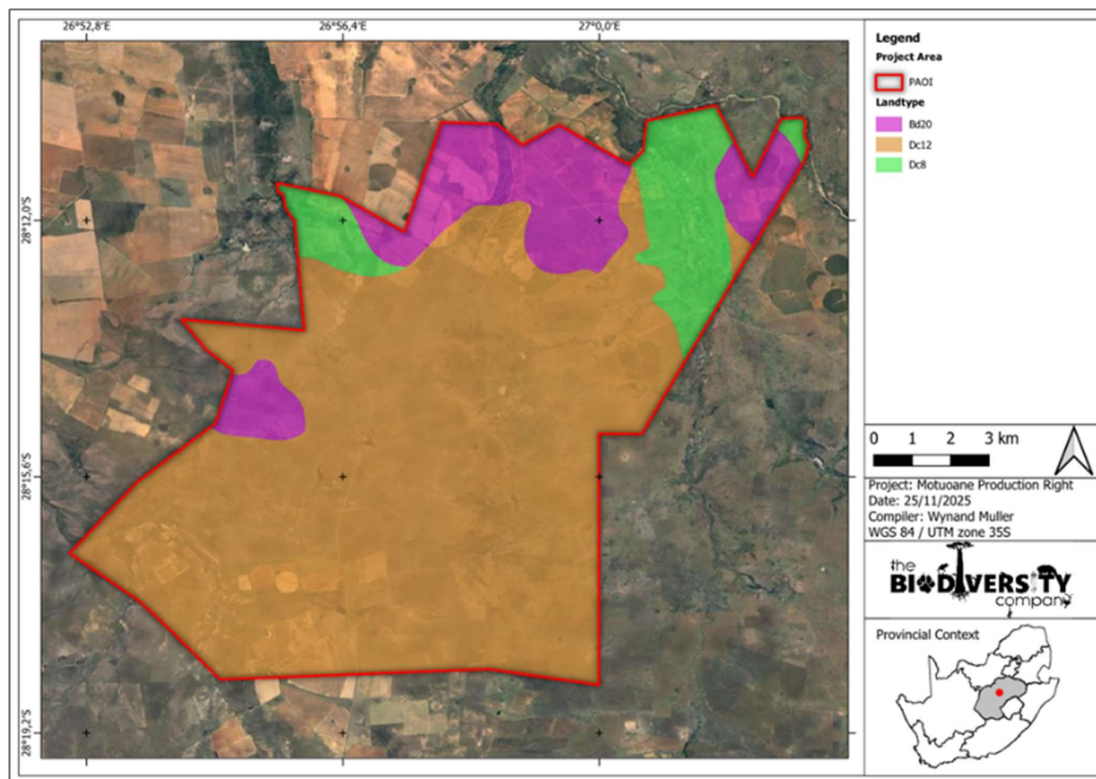


Figure 5: Land types of the PR area

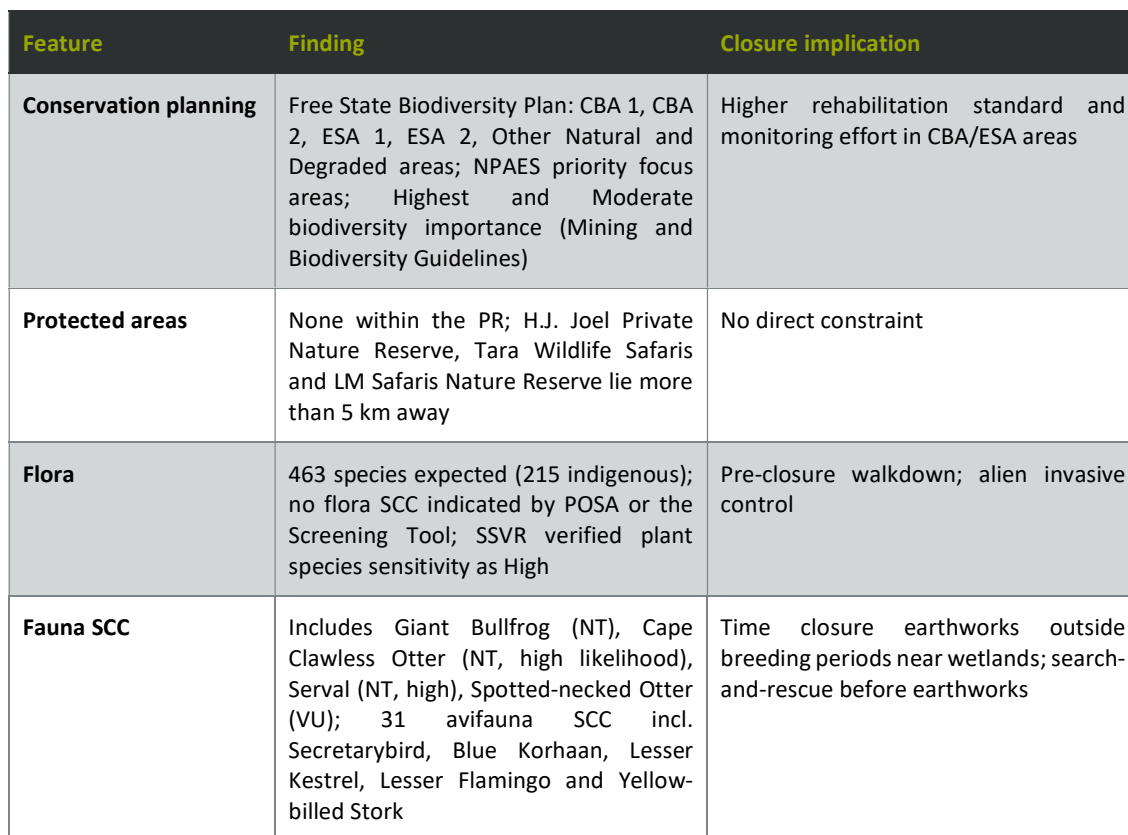
4.2.6 TERRESTRIAL BIODIVERSITY

The terrestrial biodiversity baseline (vegetation type and condition, CBA/ESA status, ecosystem threat and protection levels, and species of conservation concern) informs re-vegetation targets and no-go constraints at closure.

The closure-relevant terrestrial biodiversity findings are summarised in the table below. Revegetation must use locally indigenous grasses of the affected vegetation type, and areas of High sensitivity outside the footprint remain no-go areas during closure.

Table 8: Summary of terrestrial biodiversity features relevant to closure.

Feature	Finding	Closure implication
Vegetation types	Grassland Biome: Vaal-Vet Sandy Grassland (Endangered), Central Free State Grassland (Vulnerable), Highveld Alluvial Vegetation (not threatened) and karroid shrubland on dolerite ridges (least threatened)	Revegetation targets and seed mixes per vegetation type, <i>Themeda triandra</i> -dominated grassland as reference where natural
Threat and protection status	Overlaps Endangered and Least Concern ecosystems; Not, Poorly and Moderately Protected ecosystems	Rehabilitate to functional grassland, not just cover





4.2.7 WETLANDS AND AQUATICS

Wetlands, watercourses and their buffers are a primary closure constraint: rehabilitation must maintain or improve their present ecological state and respect the recommended buffers, and any water-use authorisation required is obtained before commencement.

The PR lies in the Vaal Water Management Area (WMA 5), quaternary catchments C42G, C42H and C42K. The Merriespruit, Steenbokspruit and Maselspruit drain the northern PR towards the Sand River, and the Doringspruit and Schoemanspruit drain the south; Allemanskraal Dam is ~13 km east. The national inventory shows numerous Least Concern depression wetlands, one Critically Endangered seep and Critically Endangered river reaches, and the area overlaps NFEPA rivers and non-priority wetlands. Aquatic sensitivity was verified as High.

Closure constraints: no drilling or seismic activity is permitted within wetlands or watercourses, with a 32 m buffer before mitigation and 15 m after mitigation (EIAr Table 42). Pipeline crossings and any works in the regulated area of a watercourse (100 m or the 1:100-year floodline; 500 m from wetlands) require NWA authorisation, including at decommissioning. Plant Option C lies within 32 m of a wetland and the 1:100-year floodline.

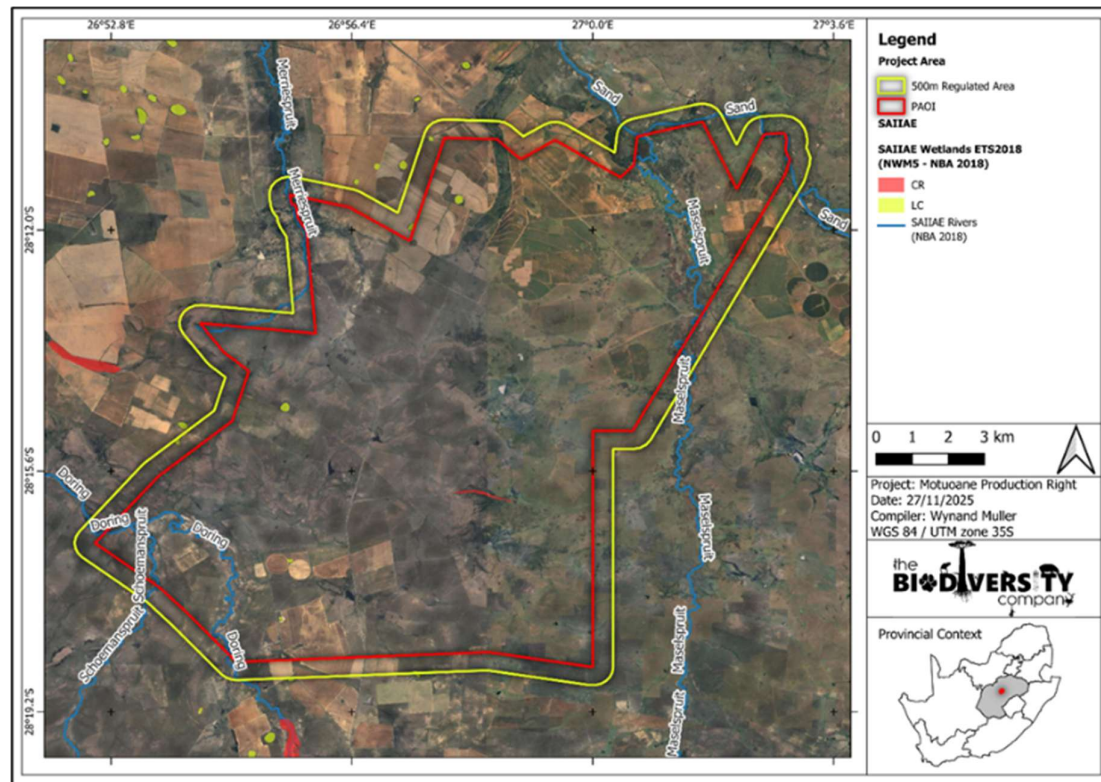


Figure 7: Ecosystem threat status of rivers and wetlands in the study area.

4.2.8 GROUNDWATER

Groundwater is the key receptor for well-integrity risk and the focus of post-closure monitoring. A Class d2 intergranular and fractured aquifer (median yields 0.1–0.5 L/s, exceeding 5 L/s along dyke contacts and faults), in Vegter Region 30, has been assessed and includes three units, namely:

- a perched/unconfined Quaternary alluvial aquifer along drainage lines,
- a shallow weathered and fractured Beaufort–dolerite aquifer (~20–30 m thick, unconfined), and
- a deeper semi-confined to confined fractured aquifer.



Depth to groundwater is ~30 m to more than 55 m, average transmissivity ~17.5 m²/d and recharge ~17.5 mm/a (3.3% of MAP). The aquifer is classified as a minor aquifer of Moderate vulnerability and Medium susceptibility and has a Groundwater Quality Management Index 4, requiring medium-level protection. Groundwater and surface water are well connected (gaining streams).

In terms of closure, the key risks are migration of saline water or fugitive gas from the deep fractured aquifer into the shallow potable aquifers through inadequately sealed wells, and seepage from the plant, evaporation pond and waste areas. Receptors are the shallow aquifers, riparian aquifers and baseflow, and private boreholes (about 16% of Ward 3 households use boreholes).

4.2.9 AIR QUALITY

Operational emissions (gas-engine combustion at the plant, intermittent flaring and venting during well testing, maintenance or upsets, dust and vehicle exhaust) stop at decommissioning, the long-term air risks include fugitive gas at decommissioned wells, which are addressed under post-closure monitoring.

No public ambient monitoring data exist near the project; the baseline is shaped by agriculture, mining, domestic fuel burning, biomass burning and unpaved roads. Winds at the Welkom SAWS station (2019–2021) are mainly from the north-east. Sensitive receptors include farmsteads, Virginia (Meloding and Calabria) and mine residential areas (Beatrix and Harmony Joel). Gases that may be encountered while drilling or producing include methane and other hydrocarbon gases, carbon dioxide and helium. At the current design no Atmospheric Emission Licence is required. The EIAR rates closure-phase air quality and greenhouse-gas impacts low negative after mitigation; the residual long-term issue is fugitive methane from abandoned wells, addressed through post-closure monitoring (Section 4.5.4) and the latent-risk provision (Section 6).

4.2.10 CURRENT LAND USE

The current and surrounding land use sets the reference for the post-closure end land use. Where the exact locations of future activities are not yet known, a site-specific assessment and landowner consultation precede closure of each site.

Land use in and around the PR is predominantly agricultural such as livestock grazing on natural and degraded grassland, with maize and other crop fields mainly in the northern and southern parts, together with gold mining to the south-west, scattered farmsteads and rural residences, the adjacent Tetra4 gas production right, and approved and proposed solar PV developments (Quagga and Corona Solar Parks, Red Rocket Virginia 1–4 and further PV application areas). Existing gas-emitting boreholes ("blowers") occur in the area.

For costing, the post-closure land use is assumed to be natural grassland used for livestock grazing, with cultivated land returned to cropping where it was cultivated before disturbance (Section 4.6).

4.2.11 NOISE

The ambient noise environment is generally rural; noise is a short-term operational rather than closure issue.

A Noise Impact Assessment was completed (Enviro-Acoustic Research) under SANS 10103:2008 and the Noise Control Regulations. The area is rural with low ambient noise; noise from drilling, plant operation and decommissioning is rated low negative after mitigation, and there are no residual noise impacts after closure.

4.3 STAKEHOLDER ISSUES AND COMMENTS

A public participation process was undertaken through the Scoping and EIA process. The comments relevant to rehabilitation, decommissioning and closure have informed this plan, the full record can be found in the Scoping and EIA Issues and Responses Report (IRR). The Public Participation Process commenced in November 2025 (notification in English, Afrikaans and Sesotho; site notices at 50 locations; Vista newspaper and Government Gazette notices). The Scoping Report was available for comment from 23 January to 23 February 2026 and a public meeting was held in Virginia on 18 February 2026. Comments relating to decommissioning, rehabilitation and closure on the EIAR will be added to this plan in the final submission. No grievances have been recorded under the PR because no activities have started, grievance-register entries on rehabilitation and closure will be listed here from the first annual update.





The closure-relevant comments are summarised below. The comments relevant to this report relate mainly to groundwater contamination, farming, livestock and farm security, wetlands and biodiversity, compatibility with solar PV developments and cumulative impacts, climate change and employment.

Table 9: Stakeholder issues and comments summary.

Name	Date	Method	Issues	Response	Aspect
Paul Lado (CER, for MACUA, MEJCON-SA, groundWork, FSEJN and Natural Justice)	Scoping review (23 Jan–23 Feb 2026)	Written submission (IRR)	Groundwater contamination, wetlands, biodiversity, food security, heritage and social impacts; air-quality, climate change (Scope 1–3) and hydrogeological baselines insufficient	Detailed air quality, climate change, hydrogeological (incl. groundwater modelling), social, agricultural, heritage and biodiversity studies undertaken in the EIA phase; cumulative impacts assessed	Groundwater; wetlands; biodiversity; land use
Gert Oosthuizen (Optavit Trust)	Scoping review (23 Jan–23 Feb 2026)	Written submission (IRR)	Impacts on cattle farming, food security, farm security and disease transmission; groundwater contamination; no Access Protocol or Emergency Response Plan	Agricultural and livestock impacts, biosecurity, groundwater, access protocol and emergency response to be assessed and included in the EMPr	Land use (agriculture); groundwater; safety
Celine Oates (Red Rocket SA)	Scoping review (23 Jan–23 Feb 2026)	Written submission (IRR)	Conflict between gas infrastructure and approved solar PV facilities; cumulative impacts on renewable energy; freshwater, biodiversity and agricultural assessments	Co-existence being pursued; land-use compatibility and alternatives (proposed and alternative pipeline layouts; alternative L2) assessed in the EIA phase	Post-closure land use (pipeline servitudes); cumulative



Name	Date	Method	Issues	Response	Aspect
Phumla Ngesi	Scoping review (23 Jan–23 Feb 2026)	Written submission (IRR)	Water Use Licence and AEL requirements; wastewater management	AEL not required at current design; WUL applications (S21 c, i and g) submitted where applicable	Water (produced water, evaporation pond)
Kahmani Gounden (Sibanye Gold)	Scoping review (23 Jan–23 Feb 2026)	Email (IRR)	Overlap with Sibanye mining rights and infrastructure	KMZ files, locality maps and preliminary layouts provided	Land use (mining)
Taole Mavious Mokhele (Goldfields Community Forum)	Scoping review (23 Jan–23 Feb 2026)	Written / public meeting (IRR)	Support for the project for employment and skills; accessibility of participation	Support recorded; additional hard-copy locations arranged	Socio-economic (employment at closure)



4.4 ENVIRONMENTAL RISK ASSESSMENT FINDINGS

The full environmental impact/risk assessment and findings are contained in the EIAr and the impact assessment methodology is attached as Appendix 4. The impacts relevant to final rehabilitation, decommissioning and closure, with the conceptual closure strategy and the post-mitigation risk, are summarised in the table below. Impacts that remain high-risk after mitigation are treated as latent/residual and are provided for in Section C. This assessment is revised annually.

4.4.1 WELL-SPECIFIC RISK DRIVERS

The abandonment design must, as a minimum, explicitly address the three residual risks posed by wells:

- Loss of hydrocarbon containment from formations previously not in communication with the surface environment;
- Cross-flow — transfer of fluids between formations causing unnatural pressurisation or contamination, including of fresh-water aquifers; and
- Surface hazard — wellheads or structures obstructing or endangering other users of the land.

4.4.2 CONCEPTUAL CLOSURE STRATEGY

The strategy for every zone with flow potential is to reinstate the cap rock by placing verified permanent barriers across the wellbore, with a surface environmental plug and full site reinstatement. Zone-specific strategy for the typical production well:

- Witwatersrand reservoir (open-hole gas-producing interval, ~400–500/600 m): treated as a hydrocarbon-bearing zone – two permanent barriers from surface or one combination barrier, set in the 5½" casing above the casing shoe (at least 30 m into the cased hole) and pressure-tested.
- Karoo sequence and deeper fractured aquifer (behind the cemented 5½" casing to ~400 m): isolate the saline deeper aquifer from the shallow aquifers with at least one permanent barrier, relying on verified annular cement (cement bond log) plus an internal cement plug; remediate any intervals logged as poor or no bond.
- Shallow fresh-water aquifers (~20–30 m thick; water table at ~30–55 m) and the 80 m conductor: at least one permanent barrier across the base of the fresh-water zone, plus an environmental plug at surface after the wellhead and casing are cut 1.5–5 m below ground level.
- Faults and dyke contacts (Virginia and Ventersburg faults; inferred east–west fault): assess well-specifically as potential flow and cross-flow pathways when positioning barriers.

4.4.3 RESIDUAL RISK REASSESSMENT AND REGISTER

Reassess risk after the strategy is applied and record the outcome (Appendix 4(c)(iv)). Maintain a risk register:

Table 10: Residual risk assessment.

Well / zone	Hazard	Cause / driver	Likelihood	Impact	Residual category	Mitigation / further action
Production and exploration wells – reservoir zone	Loss of containment (gas to surface or shallow aquifers)	Barrier failure: cement channelling, shrinkage or debonding; casing corrosion over the ≥30-year life	L	H	Uncertain (insignificant once the barriers are verified at P&A)	Verified two-barrier design; post-abandonment gas surveys; latent-risk



Well / zone	Hazard	Cause / driver	Likelihood	Impact	Residual category	Mitigation / further action
						provision (Section 6)
Karoo section / deeper fractured aquifer	Cross-flow of saline water into shallow aquifers	Poor annular cement behind the 5½" casing; faults and dyke contacts as pathways	L	H	Uncertain	Cement bond log before P&A; remedial cementing; groundwater monitoring for 5 years after closure
Shallow aquifers (all wells)	Aquifer contamination (salinity, dissolved methane)	Failed surface or base-of-freshwater barrier; legacy blowers in the area	L	M	Uncertain (insignificant once the base-of-fresh-water barrier is verified and monitoring shows no change)	Baseline hydrocensus before drilling; monitoring boreholes per well cluster
Existing wells (3 on the Virginia fault) and legacy blowers	Loss of containment / cross-flow	Unknown construction and cement records; older wells	M	H	Uncertain until records are verified	Compile well records and run integrity logging before incorporation into the PR
Well sites (surface)	Surface hazard to land users	Casing stubs or wellhead left above plough depth	L	L	Insignificant	Cut 1.5–5 m below surface, marker plate and buried marker tape, position recorded on title deed / SG diagram or placement of a marker

Residual categories follow the Onshore Well Decommissioning Guidelines (GN 6807, Appendix E). Insignificant: low residual impact and likelihood; the well can be regarded as suitably abandoned without further work. Uncertain: moderate residual risk; more data or evidence of barrier effectiveness (for example cement bond logs, pressure tests and post-abandonment gas and groundwater surveys) is needed, and intervention may be required. Significant: high residual risk; further risk reduction, such as well intervention, is needed before the well can be accepted as abandoned. The uncertain risks are carried into the Environmental Risk Assessment (Section 6).

Changes to the risk assessment (Appendix 4(c)(v)) are not applicable at this stage since this is the first FRDCP for the PR. Changes will be recorded here for each annual update.





Table 11: Environmental risk assessment summary.

Aspect	Impact	Pre-mitigation risk	Mitigation / closure strategy	Post-mitigation risk	Closure option
Land use	Interference with existing land uses (farming, mining, solar PV)	Medium-low (–)	Formal landowner agreements; rehabilitate to pre-disturbance use; record retained infrastructure	Low (–)	Rehabilitate; retain only by written agreement
Soils and agriculture	Loss of soil and agricultural potential	Medium-low (–)	Topsoil replacement by soil form; deep ripping; rehabilitate within 6 months	Low (–)	Return to pre-disturbance land capability
Soils	Erosion and sedimentation	Medium-low (–)	Free-draining landform; contour banks; stay out of 32 m / 15 m watercourse buffers	Low (–)	Reshape and revegetate
Social	Landownership and displacement of landowners and livestock	Medium-low (–)	Access protocol; fence work areas; compensation	Low (–)	Landowner consultation before closure
Air quality	Dust, emissions and fugitive methane	Medium-low (–)	Dust suppression; verified well barriers; gas surveys	Low (–)	Cut and cap; verified barriers (full-length plug costed)
Health and safety	Community safety and security	Medium-low (–)	Access control; emergency response plan; plug wells to prevent gas release	Low (–)	Complete removal of surface infrastructure
Noise and sense of place	Nuisance, noise and visual impact	Medium-low (–)	Daylight working hours; rehabilitate promptly	Low (–)	Complete removal
Groundwater	Contamination of groundwater quality and quantity	Medium-low (–)	Barrier design and verification; remove pond and waste sources; monitoring	Low (–)	Verified barriers (full-length plug costed); cut and cap
Surface water	Contamination of surface water	Medium-low (–)	Spill control; clean and dirty water separation; buffers	Low (–)	Remove sources; reshape to natural drainage
Biodiversity	Natural habitat, vegetation, fauna and microorganisms	Medium-low (–)	Minimise disturbance; indigenous revegetation; alien invasive control	Low (–)	Hybrid revegetation



Aspect	Impact	Pre-mitigation risk	Mitigation / closure strategy	Post-mitigation risk	Closure option
Heritage	Disturbance of heritage features	Medium-high (–)	Buffers (30 m structures, 50 m graves); ECO; Chance Find Procedure	Medium-low (–)	Avoid; no-go areas
Palaeontology	Disturbance of fossils	Medium-high (–)	Chance Find Protocol; palaeontologist on call	Medium-low (–)	Avoid; record and permit
Traffic	Traffic and road damage	Medium-low (–)	Roadworthy vehicles; repair damage	Low (–)	n/a
Socio-economic	Loss of employment at closure; stakeholder fatigue	Low (–)	Targeted engagement; social and economic change management	Low (–)	Closure consultation



4.5 DESIGN PRINCIPLES

4.5.1 LEGISLATIVE AND GOVERNANCE FRAMEWORK

The requirement for final rehabilitation, decommissioning and closure stems primarily from the legislative requirements of the MPRDA and the NEMA. The relevant extracts from each of these are presented in this section. Please also refer to the EIA Reports for an overview of other enviro-legal requirements which may influence closure planning.

4.5.1.1 MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002 (ACT 28 OF 2002)

The following extracts relate to the principle of closure for any right issued under the Mineral and Petroleum Resources Development Act (MPRDA):

- *Section 43(1): 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.*
- *Section 43(4): An application for a closure certificate must be made to the Regional Manager in whose region the land in question is situated within 180 days of the occurrence of the lapsing, abandonment, cancellation, cessation, relinquishment or completion contemplated in subsection (3) and must be accompanied by the required information, programmes, plans and reports prescribed in terms of this Act and the National Environmental Management Act, 1998.*
- *Section 43 (5): No closure certificate may be issued unless the Chief Inspector and each government department charged with the administration of any law which relates to any matter affecting the environment have confirmed in writing that the provisions pertaining to health and safety and management pollution to water resources, the pumping and treatment of extraneous water and compliance to the conditions of the environmental authorisation have been addressed.*
- *Section 43 (7): 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, or the person contemplated in subsection (2), as the case may be, must plan for, manage and implement such procedures and such requirements on mine closure as may be prescribed.*
- *Section 43 (8): Procedures and requirements on mine closure as it relates to the compliance of the conditions of an environmental authorisation, are prescribed in terms of the National Environmental Management Act, 1998*

4.5.1.2 NEMA - FINANCIAL PROVISIONING REGULATIONS, 2015 (GN R1147)

On 20th November 2015 the Minister promulgated the Financial Provisioning Regulations under the NEMA (GN R 1147, 2015). The regulations aim to regulate the determination and making of financial provision as contemplated in the NEMA for the costs associated with the undertaking of management, rehabilitation and remediation of environmental impacts from prospecting, exploration, mining or production operations through the lifespan of such operations and latent or residual environmental impacts that may become known in the future. These regulations provide for, inter alia:

- **Determination of financial provision:** An applicant or holder of a right or permit must 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, as contemplated in the Act and to the satisfaction of the Minister responsible for mineral resources.



- Scope of the financial provision: Rehabilitation and remediation; decommissioning and closure activities at the end of operations; and remediation and management of latent or residual impacts.
- Regulation 6: Method for determining financial provision – An applicant must determine the financial provision through a detailed itemisation of all activities and costs, calculated based on the actual costs of implementation of the measures required for:
 - Annual rehabilitation – annual rehabilitation plan
 - Final rehabilitation, decommission and closure at end of life of operations – rehabilitation, decommissioning and closure plan; and
 - Remediation of latent defects and residual impacts – environmental risk assessment report.
- Regulation 10: An applicant must-
 - ensure that a determination is made of the financial provision and the plans contemplated in regulation 6 are submitted as part of the information submitted for consideration by the Minister responsible for mineral resources of an application for environmental authorisation, the associated environmental management programme and the associated right or permit in terms of the Mineral and Petroleum Resources Development Act, 2002; and
 - Provide proof of payment or arrangements to provide the financial provision prior to commencing with any prospecting, exploration, mining or production operations.
- Regulation 11: Requires annual review, assessment and adjustment of the financial provision. The review of the adequacy of the financial provision including the proof of payment must be independently audited (annually) and included in the audit of the EMPR as required by the EIA regulations.

Appendix 4 of the Financial Provisioning Regulations provides the minimum content of a final rehabilitation, decommissioning and closure plan. This FRDCP has been prepared to align with these requirements. Appendices 3 and 5 of the Financial Provisioning Regulations provide content requirements for the Annual Rehabilitation Plan and Environmental Risk Assessment Report respectively.

4.5.1.3 **ONSHORE WELL DECOMMISSIONING GUIDELINES (GN 6807) PREPARED BY THE PETROLEUM AGENCY SA**

The Petroleum Agency of South Africa has been developing the Onshore Well Decommissioning Guidelines (the P&A Guidelines), which set minimum technical requirements for decommissioning all onshore wells drilled under the MPRDA, whether for exploration, appraisal, production or injection (GN 6807, Section 3), and therefore apply to the wells provided for in this plan.

As at the date of this plan, the Onshore Well Decommissioning Guidelines have not been promulgated and have no final operational commencement date. They are understood to be undergoing post-consultation regulatory consolidation following the close of public comment.

Status: not yet promulgated

The Onshore Well Decommissioning Guidelines are **not yet a final, operational instrument and have no confirmed commencement date**. This plan nonetheless applies them in full, as the current statement of good practice for well P&A design, consistent with their status as guidance rather than binding regulation, and will review this plan against the final, promulgated version once it is issued.



4.5.1.4 OTHER GUIDELINES

The following additional guidelines which relate to financial provisioning and closure have been published in the South African context:

- Best Practice Guideline G5: Water Management Aspects for Mine Closure: This guideline was prepared by the DWS and aims to provide a logical and clear process that can be applied by mines and the competent authorities to enable proper mine closure planning that meets the requirements of the relevant authorities. This guideline is aimed primarily at larger scale mines and does not specifically address closure issues related to closure of exploration activities, however certain principles related to closure and water management are relevant. The following technical factors which should be considered during closure, and those which are likely to relate to exploration activities, have been considered:
 - Land use plan: directly interlinked with water management issues insofar as water is required to support the intended land use- in this regard the surrounding communities and the land uses implemented rely on available ground and surface water to be sustained. Management of water quality and quantity has been identified as an aspect to be covered in this FRDCP.
 - Public participation and consultation: consultation is fundamental to closure and there is a need for full involvement of stakeholders in the development of the final closure plans, and in the agreement of closure objectives, in this regard this FRDCP has been made available through the EIA public participation process for comment by relevant stakeholders.
- Guideline for the Evaluation of the Quantum of Closure Related Financial Provision Provided by a Mine: The objectives of the guideline include the need to improve the understanding of the financial and legal aspects pertaining to the costing of remediation measures as a result of mining activities. Whilst this guideline predates the recent NEMA Financial Provisioning Regulations, it does contain certain principles and concepts that remain valid and have been considered in this FRDCP.

4.5.2 CLOSURE VISION, OBJECTIVES AND TARGETS

The vision, and consequent objective and targets for rehabilitation, decommissioning and closure, aim to reflect the local environmental and socio-economic context of the project, and to represent both the corporate requirements and the stakeholder expectations.

The receiving environment within which the production and exploration activities will be undertaken include the following key land-uses:

- Agriculture – cultivated fields (mainly maize);
- Natural and Degraded Veld primarily utilised for livestock grazing;
- Gold mining areas to the south-west and the adjacent Tetra4 gas production right;
- Approved and proposed solar PV developments; and
- Low-density rural residential (farmsteads).

With reference to Section 4.3, the stakeholders consulted during the public participation process for the Scoping and EIA process (EIMS, 2026) raised concerns regarding, amongst others, the following:

- Groundwater and surface water contamination (water quality);
- impacts on farming, livestock, food security and farm security;
- wetlands and biodiversity;
- compatibility with solar PV developments and cumulative impacts with existing mining and energy projects; and



- climate change (greenhouse gas and methane emissions).

With reference to both the environmental context of the project and the feedback from the consultation process the vision for closure is to:

Ensure that the post closure land use aligns with the surrounding land-use and does not affect the sustained utilisation of the land

In practice the post-closure land use will depend on the pre-production land use at each site. Final well, pipeline and plant positions will only be fixed within the 500 m development corridors once landowner agreements and pre-construction surveys are complete, so this plan must be refined site by site as positions are confirmed. It does, however, set the closure objectives that will apply to all production and exploration activities.

- Driven by the closure vision and with due consideration of the project context the following closure objectives are presented:
- Set the course for eventual ecosystem restoration, including the restoration of the natural vegetation community, hydrology, and wildlife habitats.
- Prevent future environmental issues related to fluid or gas leakage or lateral movement through the well.
- Protection of water resources.
- Ensure that land is usable, in alignment with surrounding land uses.
- Make the area safe for people and animals – plug and seal wells and refill excavations.
- Recreate a free-draining landform as close as possible to the original topography.
- Revegetate disturbed areas by reseeding or natural succession, as the site requires.
- Manage stormwater and control erosion during and after rehabilitation.
- Verify rehabilitation success through monitoring.

These objectives are aligned with the rehabilitation plan in the EMPr. The targets for each objective are set out in the monitoring, auditing and reporting table in Section 4.13.

The proposed rehabilitation framework also integrates continuous, adaptive environmental management throughout the project lifecycle to ensure a safe, sustainable, and socio-economically valuable post-closure landscape, by applying the key principles below (after the LARRSA surface-rehabilitation guideline), adapted to the scale of gas exploration and production activities.

Table 12: Surface rehabilitation principles.

Component	Rehabilitation principle
Regulatory compliance	• Achieving legal compliance is a minimum for appropriate rehabilitation planning. • Rehabilitation objectives and associated actions will not conflict with local legislation and will aim to complement and possibly go beyond legal compliance, where possible.



Component	Rehabilitation principle
Concurrent implementation	• Concurrent, progressive rehabilitation will be undertaken throughout the operational stage of mining¹. • A risk-based approach will be applied to ensure concurrently implemented rehabilitation actions will achieve the desired post-mining landscape and land capability aligned with end land use targets.
Stakeholder engagement and custodianship	• Relevant mining-affected stakeholders will be identified and involved in rehabilitation planning throughout the mining lifecycle, as required. • Rehabilitation planning will leverage from local stakeholder views, experiences, cultures and/or customs, on possible uses and needs of the rehabilitated landscape, to foster a land stewardship culture from potential next land users.
Landform Management	• Rehabilitation will be undertaken and aligned to a site-specific surface landform design that will be compiled during the planning stage of an operation. • The site-specific landform design will incorporate the surface profiling needs of the target post-mining land capability and land use/s, to optimize material movement throughout the operational and decommissioning periods, and to ensure the long-term sustainability of the rehabilitated landscape. • A 'management-of-change review process' will be incorporated into the mine planning process, to ensure that changes to the mine plan do not compromise either the proposed final landform or its potential use.
Land capability	• Post-mining land capability will, as far as is practically possible, be constructed to resemble the pre-mining land capability of the disturbed area. • Attention will be given to rehabilitating the site to specified land capabilities that can support a suite of mixed land uses. • Soil physical and chemical properties will be aligned to the productivity needs of the post-mining land use/s, and to support these in the long-term.
Land use	• Post-mining land use planning will consider the needs of changing regional development and planning, over time. • The site will be left in an environmentally physically safe, stable, and non-polluting condition for the defined post-mining land uses. • The defined post-mining land use/s will provide socio-economic value to next land users, as agreed with these land users (once exact post-mining land uses can be defined).
Climate uncertainty	• Predictive modelling will form the basis for longer-term environmental impact identification and risk management.
Monitoring	• Monitoring will be initiated as soon as the first ground has been moved (at construction). • Monitoring will be continued progressively throughout the project lifecycle, in parallel with concurrent rehabilitation activities. • Data obtained through ongoing monitoring will be frequently assessed for trends that could demonstrate rehabilitation success, and where corrective action may be required. • The monitoring process must be linked to a corrective action process.
Adaptive land management	• An adaptive land management approach will be adopted on-site, allowing for implementation of alternative and improved rehabilitation strategies and corrective action, where required.

¹ Where reference is made to mining in these guidelines it can be extended to relevant and similar activities associated with exploration and production activities.



4.5.3 ALTERNATIVE CLOSURE AND POST-CLOSURE OPTIONS

Alternatives are assessed against their ability to meet the closure vision and objectives, their practicality and viability, and their fit with the local environmental and socio-economic context. The evaluated options for well abandonment and site closure, and the preferred option, are set out in Table 13.

There are various alternative closure and post closure options available. The identification and consideration of the most suitable alternatives are driven by, inter alia the following considerations:

- The ability of the selected alternative to adequately meet the specified closure vision and objectives.
- The efficiency, viability, and practicality of the selected alternative.
- The alignment with the local environmental and socio-economic context and associated opportunities and constraints.

Table 13 presents some available options and alternatives related to the process of abandoning and closure of a well site/production plant. The options in the table below in **green text** and that are marked with an “

Table 13: Alternative closure and post-closure options.

Exploration/Production Activity	Aspect	Options	Preferred Option	Comment
Wells (all 48, plugging and abandonment)	Casing	Retain		The full retention of the casing is strongly dependant on the nature of the geological strata and location of groundwater aquifer and other permeable zone. The presence of thief zones may also be a hindrance to the removal of a casing string.
		Remove		Casing is often removed in an attempt to recover and salvage the steel. Depending on the nature of the well corrosion of the casing over time may affect the integrity of the plug.
		Partial removal — cut and cap (environmental plug)		Removal of the wellhead and casing strings to a shallow depth (typically 1.5–5 m below ground level) and placement of a surface cement plug across the casing stubs, leaving the deeper cemented barriers undisturbed. This is the default approach in the Onshore Well Decommissioning Guidelines (GN 6807,



Exploration/Production Activity	Aspect	Options	Preferred Option	Comment
				section 3.7), which this report aligns with.
	Plugging extent	Complete	☑	The well bore is to be cemented for the full length and diameter of the wellbore to surface.
		Partial/ intermittent		Due to the cost of complete cementing, there may be instances where intermittent casing could be used. This is dependent on the nature of the well and the geological strata.
		Risk-based barrier placement (targeted zones)		Permanent barriers are placed only at zones with flow potential (hydrocarbon-bearing, water-bearing, over-pressured or fresh-water zones) plus an environmental plug at surface, sized and positioned per a documented risk assessment. It is the design approach the well engineer or P&A specialist applies in each well-specific programme; for costing, complete (full-length) plugging is conservatively assumed until those designs exist.
	Plugging Material	API Standard	☑	The cement to be used must comply with the requirements of the MPRDA Regulations and the relevant API standards, as set out in the EMPr. Please refer to Sections 4.7.2.2 and 4.7.2.5.1.
		Alternative / engineered materials (resin, bismuth, thermite, etc.)		GN 6807 (s.3.4.6) recognises non-cement barrier materials as acceptable where performance is demonstrated to match or



Exploration/Production Activity	Aspect	Options	Preferred Option	Comment
				exceed API cement, subject to certification and field trials. Currently more relevant as a remedial option (e.g. where primary cementing has failed — s.D.12 of the guideline) than as the primary plugging material. Not assumed in the costing: the default and costed plugging material is API-class cement.
	Plugging techniques	Dump Bailer		Outdated. This technique has the potential to allow for contamination of the well plug and therefore may affect the plug integrity.
		Squeeze	☑	The displacement method minimises the contamination of the cement by being able to displace fluid within the well. Allows for a more stable well plug.
		Balanced plug (displacement method)		A measured cement volume is spotted across the target interval via drillpipe or tubing and left to set in a balanced (equal hydrostatic head) column — the standard method for straightforward open-hole plugs (GN 6807 s.3.4.10). Simpler and cheaper than a squeeze where there is no need to force cement into the annulus or perforations. An acceptable alternative for the open-hole section where the well engineer or P&A specialist specifies it; the costing assumes the squeeze technique.
	Surface Infrastructure	Complete removal	☑	The surface area of a decommissioning well must be clear of



Exploration/Production Activity	Aspect	Options	Preferred Option	Comment
				obstructions and equipment. In order to allow unhindered land use of the well area, it is suggested that all surface infrastructure be removed.
		Retain		Surface infrastructure would typically include the well, cap, flange, and /or collar.
		Repurpose for an approved alternative use (e.g. groundwater monitoring), by agreement		Where a well is not required for production and a genuine beneficial use exists, most commonly conversion to a groundwater monitoring point, the wellhead and surface completion may be retained and repurposed rather than removed, subject to a documented asset register entry, a condition/safety assessment, and a formal handover agreement with the land user and regulator. Not planned or costed: full removal is the standard assumption, and repurposing would be considered only if a specific beneficial use and a formal agreement exist at closure.
Drill site	Surface Infrastructure	Complete removal	☑	The surface area of a decommissioning well site must be clear of obstructions and equipment. In order to allow unhindered land use of the well area, it is suggested that all surface infrastructure be removed.
		Retain		Surface infrastructure of the drill site would typically include containers, temporary offices,



Exploration/Production Activity	Aspect	Options	Preferred Option	Comment
				ablutions, vehicles, waste bins/skips and the drill rig.
		Repurpose specific structures for an agreed alternative use, by formal agreement		As above for exploration wells, applies here to drill-site infrastructure such as hardstanding or containers rather than the wellbore itself, on the same case-by-case, formally-agreed basis. Not planned or costed; full removal is the standard assumption.
	Sump	Emptied and backfilled	☑	Sumps will be emptied and content thereof disposed at a suitably licenced facility. It has been suggested to replace sumps with mobile containers above ground to minimise the impacts.
		Retain		The sumps were emptied by evaporating the liquids and removing the drill muds but are not backfilled.
		Above-ground lined tank sump with secondary containment, rather than an excavated pit		Circulation fluid is contained in mobile steel or plastic tanks with secondary containment above ground, rather than an excavated, lined earthen sump — removing the excavation/backfill/soil-contamination pathway entirely. Retained as an option to investigate only. At P&A the returns are mainly displaced well fluid and excess cement, so the plan and the costing assume a conventional lined sump that is emptied and backfilled.
	Access roads	Rehabilitate	☑	The intention is to rehabilitate the area, including the access route, to the pre-disturbance condition.



Exploration/Production Activity	Aspect	Options	Preferred Option	Comment
		Retain		In certain instances, the landowner may request the retention of the access route.
		Partial retention, minimum access retained for post-closure monitoring, remainder rehabilitated		A defined minimum route is left trafficable (not fully rehabilitated) specifically to allow the post-decommissioning site visits this report already commits to elsewhere, while the balance of the access route is rehabilitated to pre-disturbance condition. Not assumed in the costing, which prices rehabilitation of all well-site tracks; a minimum route is kept only by written landowner agreement, and the saving is recognised at the annual update.
	Revegetation	Proactive revegetation		Actively reestablish natural indigenous vegetation via hydroseeding.
		Passive revegetation		Allow for natural reestablishment of indigenous vegetation and implement an Alien Invasive Management programme and monitoring of vegetation growth.
		Hybrid / risk-based revegetation — active intervention on high-disturbance areas, passive recovery elsewhere	☑	Hydroseeding or equivalent active planting is targeted at the drill pad and other heavily compacted or cut areas where natural recruitment is least likely to succeed, while lower-disturbance areas (e.g. access road verges) are left to regenerate passively with alien-invasive control and monitoring — matching the revegetation method to site condition rather than applying one method



Exploration/Production Activity	Aspect	Options	Preferred Option	Comment
				across the whole disturbed footprint. Passive recovery is monitored, and active revegetation is triggered wherever it is not succeeding; the costing conservatively prices active revegetation of all well sites.
Production wells (production-specific aspects)	Completion string and downhole equipment	Full retrieval before plugging	☑	The completion string, packers, control lines and any gauge or ESP cables are pulled before permanent barriers are set, so that each barrier can be placed across the full cross-section of the well including all annuli. This is the most direct route to a barrier meeting the Onshore Well Decommissioning Guidelines' definition of a Permanent Barrier, and it removes the leak paths dealt with below. Not applicable to the current well design, which has no tubing or downhole completion equipment (Development Plan Section 5.3.2); retained in case completions change.
		Through-tubing abandonment		Permanent barriers are installed within and around the completion tubulars, and potentially below the completion string, without pulling it (GN 6807 s.3.4.11). Faster and cheaper where the completion cannot be recovered, but the guideline requires that reliable procedures and appropriate techniques for placing barriers in that configuration be



Exploration/Production Activity	Aspect	Options	Preferred Option	Comment
				established first, and verification is more difficult.
		Partial retrieval to packer		Tubing is recovered to the uppermost packer and the remainder left in hole. A middle option where the lower completion is stuck or the well is highly deviated; the retained sections must still be shown not to compromise barrier continuity.
	Wellhead and Christmas tree	Remove; cut to 1.5–5 m BGL	☒	The standard end state under GN 6807 s.3.7: wellhead equipment and all casing strings are retrieved to 1.5–5 m below ground level, a surface (environmental) cement plug is placed across the casing stubs, and a marker plate recording well name, date drilled, date abandoned and total depth in mBGL is tack-welded to the casing stub. Fluids sitting above the uppermost barrier that cannot lawfully be discharged are removed or contained before the wellhead comes off. A buried marker (warning) tape is laid above the capped stub before backfilling, to warn anyone excavating at the site later.
		Retain for monitoring access		The wellhead is left in place and fenced to allow pressure monitoring or future re-entry. It retains a visible obstruction and an ongoing maintenance and security liability on the landowner's property, and is defensible only for a defined monitoring period



Exploration/Production Activity	Aspect	Options	Preferred Option	Comment
				with an agreed removal date.
	Producing interval (open hole below the 5½" casing shoe)	Cement the open hole and casing shoe (squeeze)	☑	The wells have no perforations: they are completed open-hole below the 5½" casing shoe at ~400 m (Development Plan Section 5.3 and Figure 4). Cement is pumped down the well and squeezed into the open hole and casing shoe, so that it fills the open hole and the fractures immediately around it, seals the producing zone and restores the natural seal (cap rock) above it (GN 6807 s.3.4.13). This is the costed approach. The design must allow for cement lost into the fractured Witwatersrand reservoir, contamination or slumping of the cement, and the small volumes involved.
		Mechanical plug at the casing shoe, cement on top		A bridge plug or cement retainer is set in the casing just above the shoe and at least 30 m of cement is placed on top (Table 16), leaving the open hole below uncemented. Simpler and cheaper, and the fallback where heavy losses into the fractured reservoir make cementing the open hole impractical; it holds only where the casing-shoe cement and the cap rock are shown to isolate the reservoir on their own.
	NORM and mercury in tubing, vessels and pipework	Survey, then decontaminate or dispose	☑	Radium-226 and radium-228 co-precipitate with barium, strontium and calcium salts and concentrate as scale inside tubing and wellhead



Exploration/Production Activity	Aspect	Options	Preferred Option	Comment
				equipment, and as sludge in separators, dehydration vessels, scrubbers, compressors and tank bottoms; pigging debris is a further source. Equipment is dose-rate surveyed and sampled before release. Items below the exemption level and free of visible scale can be decontaminated by high-pressure water jetting, chemical or mechanical cleaning and released for re-use, repair or sale as scrap; the balance goes to a facility authorised to receive it.
		Dispose all as radioactive waste		Avoids the survey cost but forecloses any salvage or recycling of steel and is likely to be disproportionate, since most equipment will fall below exemption levels. It also does not remove the obligation to characterise the waste before it is transported and accepted at a disposal site.
		Assume none present		Not defensible for a gas field without a screening survey. GN 6807 s.F.11 presupposes that the presence or absence of NORM has been established rather than assumed.
Gas gathering system — flowlines and pipelines	Decommissioning extent	Abandon in situ — cleaned and filled	☒	The line is left buried but rendered permanently safe: divided into sections and capped so it cannot act as a conduit carrying water or contamination along the route, and filled with grout or foamed concrete at major road, rail and watercourse crossings and anywhere future collapse



Exploration/Production Activity	Aspect	Options	Preferred Option	Comment
				could cause subsidence. Filling also displaces or isolates residual hydrocarbon, which reduces the long-term liability.
		Full lift and removal		The line is excavated and removed in full. It gives the cleanest end state and the clearest return of the land to the landowner, but costs at least an order of magnitude more than filling in place, and the excavation re-disturbs the entire servitude — soils, vegetation and every watercourse crossing — which can be a worse environmental outcome than leaving a clean, filled line undisturbed.
		Abandon in situ — capped only		The minimum end state, with no fill. Acceptable for smaller-diameter lines in flat terrain where collapse and water-conduit risk are low, but it leaves both the void and any residual contamination in place.
	Pre-abandonment cleaning	Depressurise, purge and cap (pig only where liquids have collected)	☑	Drawn from good-practice guidance for pipeline decommissioning (UKOPA GPG038), not from South African regulations. For these low-pressure, dry-gas HDPE lines (110–315 mm) a proportionate approach applies: each line is depressurised, purged of residual gas with nitrogen (or air once it is gas-free) and capped. Pigging is used only where condensate or water has collected at low points, and arisings from the low-point drains are sampled before disposal.



Exploration/Production Activity	Aspect	Options	Preferred Option	Comment
		Flush with inhibited water		An alternative to inert gas, more usual for liquid lines. It generates a substantial volume of contaminated water requiring treatment and licensed disposal, which has to be provided for in the cost estimate.
		Depressurise only		Leaves hydrocarbon residue in the line. That residue can become a liability long after abandonment, by which time identifying the responsible party is difficult — which is why the guidance treats cleaning as a precursor to abandonment rather than as one of the options.
	Servitude records and marking	Mark, record and lodge as-left plan	☑	Sections left in place are marked and records kept for the full route, and a plan showing the size, depth and location of the abandoned line is prepared and shared with landowners and occupiers. Although the pipe itself typically becomes the landowner's property on abandonment, liability for contamination arising from it (residual condensate, produced-water residues or scale left in the line) can remain with the final owner or operator indefinitely, so what is recorded at closure determines who carries that risk.
		Remove markers		Leaves no surface record of a buried line. This creates a real risk of third-party strike during later excavation or cultivation, and in any event does not extinguish the operator's



Exploration/Production Activity	Aspect	Options	Preferred Option	Comment
				residual contamination liability.
Pigging, valve and block stations	Above-ground pigging station (launcher / receiver)	Complete removal and reinstatement	☑	Above-ground installations associated with an abandoned line are removed in full: all above-ground pipe and equipment taken out, associated buried pipework removed to a depth of at least 900 mm, the ground decontaminated where required, fencing removed and the land reinstated. Pig traps hold the accumulated debris from the line, so characterisation and decontamination of the arisings is not optional here.
		Retain by formal agreement		Only where a real downstream use exists and a formal handover agreement, condition assessment and engineering sign-off are in place — the same test applied to surface infrastructure elsewhere in this table.
	Below-ground valve chambers and voids	Fill voids and reinstate	☑	Below-ground valve chambers are expressly identified as voids to be filled where a line is abandoned in place. Filling prevents later collapse and removes a confined-space and access hazard on land returning to agricultural use.
		Break out and remove		The cleanest end state where the chamber is shallow and accessible; cost rises sharply with depth and with any reinforced-concrete structure.



Exploration/Production Activity	Aspect	Options	Preferred Option	Comment
		Retain		Leaves an accessible void on farmland. Ownership, long-term structural integrity and public safety must then be assigned to someone, which is difficult to sustain after relinquishment.
Gas processing plant and compressor station	Plant structures and foundations	Complete removal; foundations broken out	☑	All structures, machinery and services are removed, waste is disposed of at suitably licensed facilities, and foundations, plinths and bunds are broken out to a defined depth so the area can be ripped, re-soiled and returned to the agreed post-closure land use.
		Demolish to ground level		Cheaper, and sometimes appropriate where the agreed end use is industrial. It leaves a buried concrete raft that obstructs root development and drainage, so it is not compatible with a grazing or cultivated end use.
		Retain for agreed alternative use		Requires an identified user, a formal handover agreement and engineering sign-off on structural stability. The current cost estimate deliberately makes no allowance for beneficial re-use and assumes total demolition, so selecting this option changes the basis of the quantum and must be motivated.
	Process vessels, piping and salvage	Decontaminate, cut and recycle	☑	Vessels, scrubbers, separators, dehydration units and associated pipework are drained, purged and cleaned on site, surveyed for NORM and mercury, and released for recycling where they



Exploration/Production Activity	Aspect	Options	Preferred Option	Comment
				clear the exemption criteria. Sludge and scale removed in the process are handled as a separate, characterised waste stream.
		Remove intact for re-use		Preserves more value where the equipment has a ready second-hand market, but transport of uncleaned vessels is constrained and the receiving party must accept the residual contamination, which in practice means characterisation still has to happen first.
		Remove without decontamination		Not available as a route for equipment that may hold NORM or mercury residues; disposal sites require characterisation and prior acceptance before a shipment is received.
	Flare and vent stack	Purge, dismantle and remove	☑	The stack, knock-out drum and associated pipework are purged and removed once the last well is isolated. The flare is normally among the last items decommissioned because it manages residual gas through the rest of the shutdown, so its removal has to be sequenced accordingly in the closure schedule.
		Retain temporarily, then remove		Holds the flare through the decommissioning campaign under a defined retention period and removal date, rather than leaving that timing implicit in the schedule.
	Residual soil and groundwater	Risk-based assessment and	☑	Areas where infrastructure stood are assessed on a risk basis against the



Exploration/Production Activity	Aspect	Options	Preferred Option	Comment
	contamination beneath the plant	targeted remediation		agreed post-closure land use, and only material that fails is excavated and disposed of. This is the approach Table 19 already commits to for demolished areas, applied here to the much larger plant footprint.
		Excavate and dispose all		Removes the judgement call but is generally disproportionate. It generates large volumes for landfill and can cost more than the value of the risk it removes.
		Leave in place with monitoring		Defensible only where the risk assessment shows no unacceptable pathway to receptors. It converts a one-off closure cost into a latent liability, which must then be carried in the environmental risk assessment and the post-closure provision rather than in the closure cost.
Produced water and dirty-water infrastructure	Produced water handling at closure	Treat and dispose under licence	☑	Remaining produced water is treated to the standard required by the applicable water use authorisation and disposed of or discharged, after which tanks, separators and pipework are cleaned and removed. This requires the water use authorisation to remain in force through closure, which is a scheduling dependency worth stating in Table 20.
		Re-inject to authorised zone		Avoids surface treatment but is a separately authorised activity in its own right, requiring its own authorisation and its own well decommissioning at the end — in effect adding



Exploration/Production Activity	Aspect	Options	Preferred Option	Comment
				a well to the closure inventory rather than removing a cost from it.
		Evaporate and dispose of residue		Reduces volume but concentrates salts and any NORM into a residue that is then a hazardous waste stream, and the evaporation area itself becomes a closure item — see the next aspect.
	Pollution control dams and evaporation ponds	Remove residue and liner; backfill	☑	Silt and residue are characterised and disposed of, the lining system is lifted, and the void is backfilled, profiled free-draining and revegetated. This is consistent with the schedule driver already recorded in this report — that PCDs and sumps are decommissioned once dirty-water areas and the need for them end, that is, once the pollution source terms are removed.
		Retain as clean water storage		Only where residue and liner have been removed, the facility is demonstrated to be clean, the structure carries engineering sign-off, and a formal handover agreement transfers maintenance and dam-safety obligations. Otherwise the operator retains a dam-safety liability after relinquishment.
		Cap residue in place		Leaves the contamination source in position beneath an engineered cover. It requires long-term cover integrity and seepage monitoring, so it belongs in the environmental risk assessment as a latent risk rather than being recorded



Exploration/Production Activity	Aspect	Options	Preferred Option	Comment
				as a completed closure action.
Site services and shared infrastructure	Power lines and electrical reticulation	Remove all lines and structures	☑	The default position already stated in Table 19, all power lines are removed unless there is written agreement to retain them for a beneficial end use. Included here so that production-phase reticulation, which is considerably more extensive than the exploration-phase supply, falls explicitly within the closure inventory.
		Retain by written agreement		Requires the written agreement Table 19 already calls for, together with transfer of the servitude and of maintenance responsibility to the receiving party.
	Access roads, hardstanding and laydown areas	As for the drill sites — see above	☑	The options and the reasoning are the same as for the drill sites and are not repeated here. The difference is scale: production access roads are engineered to a higher standard and carry heavier traffic, so there is more surfacing, sub-base and compaction to remove and rip. The argument for retaining a minimum route is also stronger, given the fifty-year methane monitoring commitment this report already carries.

The final closure and decommissioning of an exploration and/or production well must be pre-empted by a site-specific assessment and where applicable the implementation of the most appropriate rehabilitation and closure strategy. Furthermore, the annual review of this FRDCP must, where applicable, include an assessment and adjustment of the closure strategy to reflect the most recent technical development and industry best practice, as well as any lessons learnt from the implementation of closure on this project. The options selected in Table 13 are the default and costed basis. Depending on the actual well condition and geology (for example, severe losses into the fractured reservoir), the well engineer or P&A specialist may justify an alternative in the well-specific programme, provided it meets the barrier requirements in Section 4.7.2 and is approved by PASA.



4.5.3.1 PREFERRED CLOSURE ACTION

The preferred and costed closure option, as selected in Table 13, is to retain the cemented casing downhole and remove only the wellhead and the top 1.5–5 m of casing (partial removal: cut and cap); to plug the full length of the well (cased and open hole) with API-class cement placed by the squeeze technique, in accordance with the Onshore Well Decommissioning Guidelines and the petroleum design basis; to remove all surface infrastructure; to empty and backfill drill sumps; to rehabilitate access tracks unless a landowner asks in writing to keep them; and to revegetate by the hybrid approach. Effective abandonment depends on knowledge of the well construction, geology and hydrogeology.

Before closure of any well, a suitably qualified well engineer or P&A specialist prepares a site-specific decommissioning plan, informed by well-integrity testing, drilling/cement records, and the barrier-placement factors listed below, and submits it to the regulator for approval, together with the landowner consultation outcome.

With reference to Table 13 (Section 4.5.3) and the cost assumptions in Section 4.5.5, the preferred closure option is as follows:

- Retain the cemented casing (informed by a pre-closure casing-integrity inspection), place permanent barriers across the Witwatersrand reservoir, the Karoo section and the base of the fresh-water aquifers per Section 4.7.2, verified by tagging and pressure testing. For costing, the full cased and open-hole length is conservatively assumed to be cemented until well-specific designs exist. The barriers must meet the minimum requirements of the guidelines, but their number, position and length depend on each well's condition and on the well engineer's or P&A specialist's design, so the full-length assumption is a cautious upper bound for costing.
- Remove the wellhead and cut all casing strings 1.5–5 m below ground level (below plough depth on cultivated land), set a surface cement plug across the stubs and weld on a marker plate and lay a buried marker tape above the stub; record the position on the title deed or SG diagram.
- Rehabilitate access tracks (as costed), unless a landowner asks in writing that they be kept; a minimum route to an abandoned well may be kept for post-closure monitoring only by landowner agreement.
- Purge and cap gathering pipelines (pigging only where liquids have collected); remove all above-ground components (markers, low-point drain pits, valves, any nodal compressors); leave the buried HDPE in situ at 0.75–1.0 m unless a landowner or solar developer requires removal (removal is not costed).
- Decommission, dismantle and remove all structures and foundations of the plant, workshop and evaporation pond, remove pond contents, residues and liner to a licensed facility; assess and remediate soil contamination; reshape and revegetate.
- Empty drill sumps and dispose of contents at a licensed facility and backfill.
- Active revegetation on pads, the plant footprint and other compacted or cut areas if regrowth is insufficient during rehabilitation; passive recovery with alien invasive control elsewhere.
- It is anticipated that the closure option presented above, together with monitoring of the post closure period, will achieve the required closure objective. This closure option is in line with industry best practice and the requirements of the MPRDA Regulations and the Onshore Well Decommissioning Guidelines.
- Effective abandonment depends on knowledge of the well construction, geology, and the hydrogeology. In this regard it is recommended that prior to commencement of closure and decommissioning of any specific well the following must be undertaken
- A detailed site-specific decommissioning plan must be prepared by a qualified well engineer or P&A specialist, supported by other specialists as needed. This plan must take into consideration the following site-specific factors:



- Current condition and design of the well (informed by suitable well integrity testing);
- Records of the drilling results (geological logs), cement used and testing results for the life of each well, including the cement bond log tests immediately after grouting and prior to decommissioning as well as any periodic maintenance checks during the operational life;
- Height of cement in annulus outside casing;
- Considerations for the composition and placement of the plug or barriers should include:
 - Location of potential flow zones and pore pressures.
 - Location of useable water sources.
 - Formation fracture pressure of natural seals.
 - Crossflow potentials; direction and resultant equalised pressures.
 - Future field plans.
 - Compaction, subsidence, and recharged formations.
 - Corrosion risks.
 - Locations of natural faults and their ability to transmit fluids and/or pressure.
 - Ability to be able to verify the barrier.
 - Operating environment (temperature, pressures, chemical characteristics).
- Cement casing overlaps;
- The need for abandonment plugs to cover the full diameter of the hole;
- The type of fluid in annuli above cement;
- The chemical composition of the prevailing groundwater;
- The following considerations apply to determining the composition of the barrier material/s:
 - Inability for wellbore fluids to bypass in either direction.
 - No degradation of sealing capacity over time.
 - The specific host rock thermal and effective stress characteristic which may affect permanent plug integrity.
 - Avoidance of movement.
 - Appropriate for the environment (e.g. Temperature, pressure, chemical exposure) and application.²
- Potential difficulties of injecting cement into the annulus;
- Future monitoring of the integrity of the well plug; and
- The depth below surface at which casing must be cut.

² The development of an applicable well bore stress model would assist in planning the final specific barrier characteristics.



- The applicable landowner must be consulted and input obtained regarding the current and planned land-uses applicable to the area and the need to retain surface infrastructure, well accessibility and/or access tracks.

4.5.4 CLOSURE AND POST-CLOSURE PERIOD AND REQUIREMENTS

The closure period is defined as the period between the cessation (decommissioning) of exploration, production, and the completion of active rehabilitation actions on the applicable site. It may become necessary to decommission and plug unsuccessful or dry wells during the operational phase (should a Production Right be obtained). In these instances, it is suggested that closure on these specific wells is initiated as soon as possible.

Following the successful completion of the active closure actions, it is suggested that a further post-closure period be assigned to allow for rehabilitation, monitoring of the success of closure. This closure and post-closure monitoring will involve the following actions and durations:

- Surface and groundwater monitoring- as informed by the water monitoring plan bi-annually for five (5) years after decommissioning or until a long-term trend can be determined and verified by an independent groundwater specialist;
- Fugitive gas emissions using either soil vapour probes, effluxes, Flir Methane Cameras, or surface methanometers, every five years for a period of 50 years post-closure (i.e. 10 sampling events);
- Well plugging and abandonment verification (rehabilitation monitoring) to confirm that there is proper and effective vertical isolation (this could include: bond log tests, cementing tests, communication tests, hydraulic pressure tests, applied weight test); and
- Biodiversity assessments mid-wet season (i.e. annual) should be undertaken by a qualified ecologist/botanist or EAP to monitor the rehabilitation progress with regards to flora for a period of 3 years after rehabilitation.

Certain residual and latent impacts may manifest in the post-closure phase. These relate primarily to the risk of well plug integrity and associated long-term management of vertical migration of gas and/or fluids to the shallow water resources or the surface. The management and monitoring associated with these residual and latent risks are addressed in Section 6.

4.5.5 ASSUMPTIONS AND LIMITATIONS

The closure cost is built on stated assumptions and limitations. The standing assumptions, which apply every year, are:

- an outside contractor establishes on site to carry out the closure work;
- all infrastructure is fully dismantled, with no credit for beneficial re-use;
- no salvage value is offset against the cost;
- preliminaries and general and contingencies are applied at fixed percentages;
- costs are in present-day money, with no discounting; and
- costs are estimated for both scheduled and unscheduled closure.

The project-specific assumptions below (well count, plug volumes, access-track length, failure rates and monitoring boreholes) must be updated each year.

The following assumptions and limitations apply to this FRDCP:

- Final positions of wells, pipelines and the plant (one of Options A, B and C) are not yet fixed within the 500 m development corridors, so end land use is known only in general terms. The estimate and, where necessary, the plan will be updated annually as positions are confirmed.



- Due to the uncertainty of the exact site-specific conditions applicable to aspects of the planned development, the following assumptions have been made and used as the basis for the financial provision calculations:
 - Post closure land use: natural grassland associated with livestock grazing (cropland where cultivated before disturbance).
 - Distance of access track (requiring rehabilitation): 100 m per well site (4 800 m for 48 well sites). The Development Plan (Section 5.2) sites wells close to existing fence lines and tracks where practical, so this is expected to be conservative; the length will be measured from the final layout. At the rate used, each additional 100 m per well adds about R 41 700.
 - 2 groundwater boreholes and 1 surface water point within the zone of influence of a well site to be utilised for water monitoring.
 - New access tracks (~3.5 m wide) will be rehabilitated during closure unless retained by written landowner agreement. Existing roads will be used as far as possible. No borrow pits have been identified; if any are opened for road material, their rehabilitation will be costed at the annual update.
 - No permanent construction or accommodation camps will be built; workers will be housed in local towns.
 - Mobile site offices will be used at drill sites; the permanent office and workshop beside the plant is demolished at closure unless retained by agreement.
 - Chemical toilet facilities will be supplied at all drill sites and established work areas. The closure actions and associated period will commence as soon as a well is abandoned.
 - For costing, it is conservatively assumed that the entire cased and open-hole length of each well (~500–600 m) is cemented, pending well-specific barrier designs.
- It is assumed that the management and mitigation measures suggested in the EIA and EMPr Report relating to ongoing environmental management are complied with. This includes post drilling clean-up and rehabilitation.
- It is assumed that the drilling, including casing and grouting, is carried out in accordance with industry best practice and that permeable zones are adequately isolated (including the usable ground water aquifers).
- It is assumed that once a decision is made to initiate closure on a well that a suitably qualified well engineer or P&A specialist is appointed to undertake an assessment and consult with the landowner and prepare a site-specific decommissioning plan for submission to PASA for review and approval.

Closure cost estimations were determined using the general and site-specific assumptions and qualifications listed below

- Wells provided for: up to 48 wells, all drilled as exploration wells (including the 3 existing Virginia-fault wells), of which up to 43 become production wells per the Development Plan for the Production Right application (Motuoane Energy, August 2025): the 3 existing and 13 new wells on the Virginia fault and 27 wells on the Ventersburg fault. The remaining 5 wells are not converted to production and are plugged and rehabilitated during the operational phase; their positions are to be confirmed. As a worst case, all 48 wells are provided for as requiring plugging and abandonment in both the scheduled and unscheduled scenarios.
- Plug volume basis: 5½" production casing to ~400 m and open hole to ~500–600 m (EIAR Figure 9; Development Plan Figure 4), with the excess allowance applied in the P&A cost model (Section 4.12.2).



- Surface footprints: drill pads $\leq 50 \text{ m} \times 50 \text{ m}$ (rehabilitated concurrently after drilling); fenced wellsites retained until closure; plant $\sim 0.97 \text{ ha}$ fenced ($\sim 1.5 \text{ ha}$ cleared); evaporation pond $25 \text{ m} \times 25 \text{ m}$; pipelines $\sim 28.8 \text{ km}$ in a 10 m servitude.
- Pipelines are decommissioned in situ (purged, cleaned, capped and above-ground components removed); removal is not costed; if a landowner or solar developer requires removal, it will be costed at the annual update once confirmed.
- Water monitoring: 2 groundwater boreholes and 1 surface-water point per well cluster, plus boreholes up- and down-gradient of the plant and evaporation pond per the geohydrological monitoring network.
- Well-integrity failure rate for the latent-risk provision: 3.4% (as used in the ER315 FRDCP), giving ~ 1.6 wells on 48 wells, rounded up to 2 wells (Section 6).
- Cement bond logging (CBL/USIT) is run on every well during P&A planning, as all production wells will have produced for more than 10 years by closure. It is also costed for the 5 exploration wells that are not converted to production (worst case).
- No allowance is yet made for annulus top-up or remedial cementing of wells whose cement bond logs show poor or no bond. The well construction records and CBL results will be reviewed each year (Table 15) to estimate how many wells may need it, and an allowance will be added to the provision as the data accrue.
- The July 2026 fugitive-gas monitoring quote and the well-site revegetation quote were scoped for nine wells. Until PR-specific quotes are obtained, each is applied per round of nine wells, i.e. 6 rounds per event for 48 wells. The water monitoring rate (R 663 760.96 per sampling event) and the rehabilitation monitoring rate (R 75 995.00 per annual event) cover all 48 wells.
- ARP for the forthcoming 12 months: ~ 13 drill pads (the 13 new Virginia-fault wells of the initial development) of $50 \text{ m} \times 50 \text{ m}$ (sump backfill, ripping and revegetation of the pad outside the fenced wellsite). Seismic/AMT surveys are not applicable and are not costed.
- Plant and infrastructure quantities and rates are from the contractor costing (July 2026 rates), based on the conceptual plant layout.
- Preliminaries and general and contingencies: 10% each on the well, well-site, ARP, monitoring and latent-risk items; 13% and 11% on the plant and infrastructure demolition and rehabilitation items.



The main risks to the accuracy of the closure cost estimate, and how each is verified and mitigated, are set out in Table 14.

Table 14: Risks to the accuracy of the closure cost estimate, and their verification.

Risk Item	Primary Source	Risk Description	Verification / Mitigation
Completeness and accuracy of the well register	Annual well information sheet provided by D3 Energy (client-managed; updated internally)	- The well register (used to determine plugging quantities and cost) may be incomplete, contain outdated status classifications, or include wells that have since been physically altered or abandoned without formal record update. - Wells may be misclassified (e.g., a suspended well recorded as operational, or a newly drilled well not yet captured), leading to incorrect plug-and-abandon (P&A) quantities and associated cost variances.	- Annual on-site physical verification on a sample basis of wells against the register, conducted by or in the presence of the Environmental Control Officer (ECO). - Cross-referencing the well register against ECO inspection reports, drilling completion reports, and PASA submissions. - Flag discrepancies between the register and field conditions for resolution prior to each annual cost update.
Assumed well depth and volume for cement plug calculation	Specialists' reports; well completion records; Torque Exploration Solutions (Pty) Ltd	The Plugging and abandonment cost is reliant on assumed well depth (562 m average, the mean of the three existing wells) and cement volume (8.76 m³ per well, including a 25% excess allowance). If actual well depths or casing configurations deviate materially from these assumptions, the cost per well could increase significantly.	- Verify actual well depths and casing strings from well completion/logging reports for each well prior to closure. - Use actual logged depth data rather than planned depth where records are available. - Apply average well depth for casing depth estimation where actual records are unavailable. - Use actual internal well diameter measurements to verify cement volume calculations.
Annulus cement condition and remedial cementing	Cement bond logs run after the casing is set; drilling and cementing records	Wells with poor or no annular cement bond need annulus top-up or remedial cementing before plugging. This is not yet costed.	Review the well construction records and CBL results annually, estimate the number of wells needing annulus top-up or remedial cementing at closure, and add an allowance to the provision where needed.



Risk Item	Primary Source	Risk Description	Verification / Mitigation
Accuracy of surface infrastructure footprint and as-built extents	Approved engineering designs; aerial photography (February 2024)	- Quantities for demolition and surface rehabilitation are calculated from approved design drawings. If actual as-built infrastructure footprints differ from approved designs (e.g., expanded hard-stand areas, additional structures, or unrecorded modifications), the quantities and costs used in the estimate will be inaccurate. - This risk is particularly relevant to the LNG/Helium Plant complex, where phased construction and operational modifications may not always be reflected in the as-built records used for costing.	- Conduct a physical site inspection and compare to approved designs prior to each annual cost update. - Use the most recent aerial imagery (updated at minimum every two years or when additional infrastructure is constructed) to check infrastructure extents.
Accuracy and currency of contractor rates for well closure operations	Torque Exploration Solutions (Pty) Ltd rate schedule; CPI escalation (5% applied in 2026 to rates not re-quoted in July 2026)	- All well closure unit rates are based on third-party contractor rates provided by Torque Exploration Solutions. If the actual market rates at the time of closure have increased beyond CPI-equivalent escalation (e.g., due to high demand for P&A services, fuel cost increases, or specialist equipment shortages), the cost estimate will understate actual expenditure. - The petroleum services sector is subject to cyclical rate fluctuations driven by commodity prices, rig availability, and demand for specialised P&A services.	- Obtain updated rate confirmation from Torque Exploration Solutions at minimum every three years (or more frequently if market conditions change significantly). - Apply CPI escalation annually between formal rate updates. - Consider obtaining competitive quotations from a secondary P&A contractor to benchmark rates.



4.6 FINAL POST-CLOSURE LAND USE

The aim of closure is to return the land to a state similar to its pre-activity condition, consistent with the surrounding land use and land capability. The final land use for each site is confirmed by the pre-closure site assessment and landowner consultation (Section 4.7); for costing, a reasonable end land use is assumed.

The post-closure land use for costing is natural grassland for livestock grazing, with cultivated land returned to cropping where it was cultivated before disturbance. The post-closure land use per activity is set out below. It was identified from the pre-disturbance land use and land capability, the closure objectives in the EMPr, and stakeholder input – notably landowners' farming concerns and the solar PV developers' request that gas infrastructure not constrain renewable energy land use (Section 4.3). It will be confirmed with each landowner before closure.

Table 15: Proposed post-closure land use per activity or infrastructure.

Activity / infrastructure	Pre-disturbance land use	Proposed post-closure land use
Production and exploration wellsites, drill pads and sumps	Grazing or cropland	Same as pre-disturbance; abandoned wells marked and recorded on title deeds
Gas gathering pipelines and servitudes	Grazing, cropland or solar PV land	Unrestricted grazing or cropping over pipe left in situ at 0.75–1.0 m; servitude released
Helium recovery and gas processing plant, evaporation pond and workshop	Grazing	Grazing; buildings retained only by written landowner agreement
Access roads and tracks	Grazing or cropland (existing farm roads retained)	Rehabilitated to grazing or cropland, or retained as farm roads by agreement

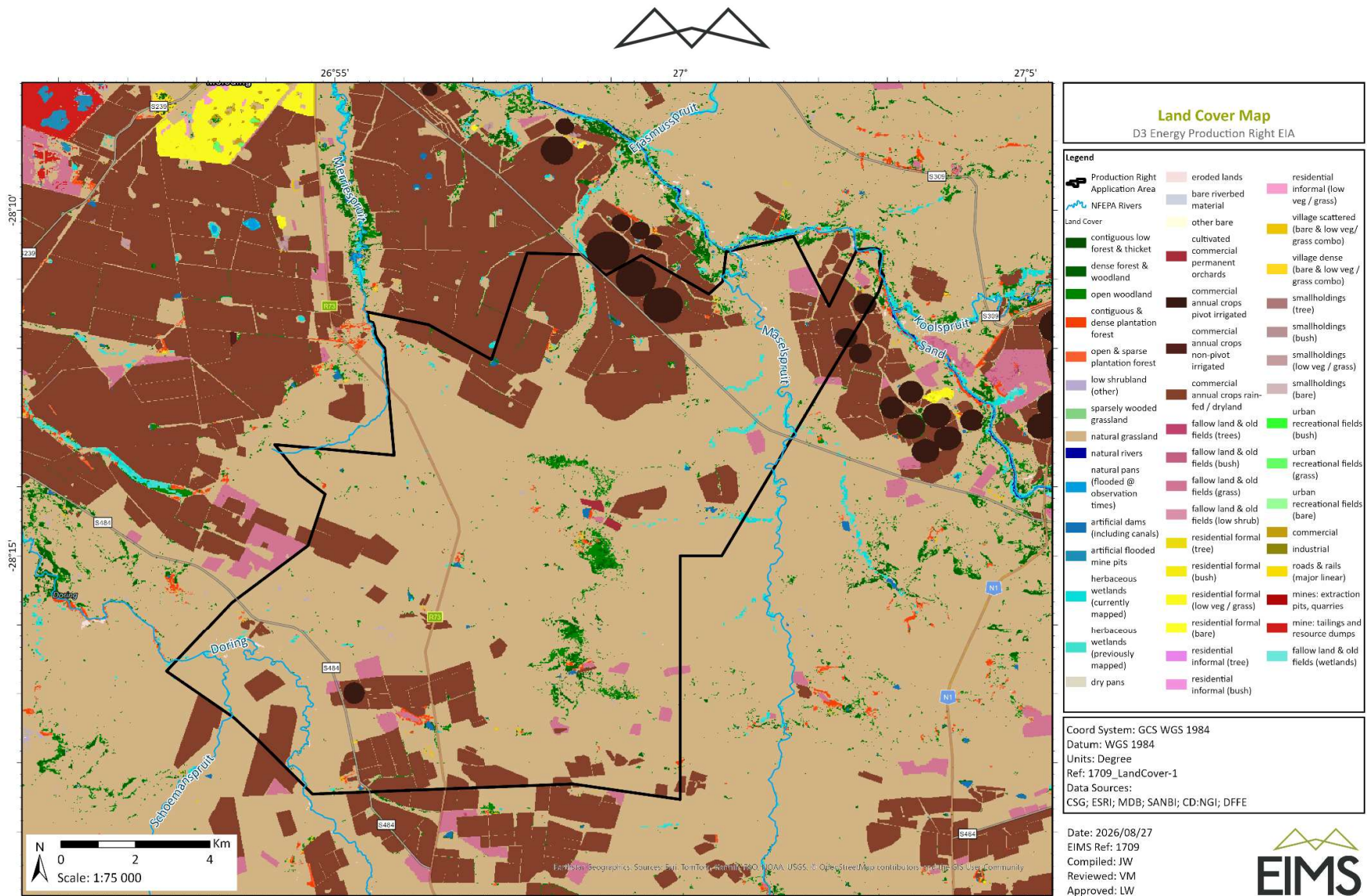


Figure 8: Land cover map.



4.7 CLOSURE ACTIONS

The closure actions apply to all infrastructure, activities and aspects for which the holder is responsible, and are grouped into the following phases:

- **Phase 1:** Preparation for Closure;
- **Phase 2:** Well Decommissioning, Plugging and Abandonment
- **Phase 3:** Rehabilitation;
- **Phase 4:** Monitoring, Maintenance and Relinquishment.

4.7.1 PHASE 1: PREPARATION FOR CLOSURE

Before decommissioning a well, a suitably qualified professional confirms pre-closure site conditions, undertakes a site-specific closure risk assessment and consults the affected landowner; a well engineer or P&A specialist assesses the specific well (condition, casing and grouting integrity, and informed by the operational-phase cement-bond logs, the plugging method) and prepares the technical decommissioning plan. A consolidated site-specific closure and decommissioning plan is submitted to the regulator for approval before closure begins.

Well-integrity regime: a cement bond log is run on each well once the 5½" production casing is set, and the open hole is logged at total depth. As every production well will have produced for more than 10 years by closure, cement logging (CBL/USIT) is repeated during P&A planning, together with clean-out, calliper logging and pressure testing. The three existing wells need their construction and cement records verified before they are brought into the PR. The latent-risk provision assumes a 3.4% barrier-failure and re-intervention rate.

4.7.2 PHASE 2: DECOMMISSIONING, PLUGGING AND ABANDONMENT

Guided by the approved decommissioning plan, wells are plugged and made safe, surface infrastructure is dismantled and removed, sumps are emptied and waste disposed at licensed facilities, and disturbed areas are re-profiled to the original landform, ripped, topsoiled and re-vegetated. The typical closure actions per component are set out in Table 19. This section integrates the Onshore Well Decommissioning Guidelines so that the cost estimate is built on a defined barrier scope for each well.

4.7.2.1 DECOMMISSIONING OBJECTIVES

Permanent abandonment provides permanent isolation of every formation with flow potential penetrated by the well, preventing outflow of fluids/hydrocarbons and contamination of any fresh-water aquifer, and leaves the location safe for other users.

Temporary abandonment (suspension) provides a combination of permanent and temporary barriers to prevent migration between formations while facilitating future re-entry or subsequent permanent abandonment.

4.7.2.2 DESIGN BASIS AND PLANNING

- Detailed P&A planning should commence at least five years ahead of the operation, to gather well-status data and define scope.
- Typical design inputs: well configuration, stratigraphy of each wellbore, cement logs and cementing records, formations with suitable barrier properties, and specific well conditions.
- For wells produced for more than 10 years, or that have undergone remedial cement jobs, cement logging must be undertaken as part of design planning to verify casing cement quality.
- Well plugging material must meet recognised international standards (e.g. API Spec 10A). Before operations, appropriate drilling/completion fluids are pumped to provide hydrostatic control and wellbore stabilisation.



4.7.2.3 ZONES WITH FLOW POTENTIAL

The operator undertakes a detailed engineering appraisal of the flow potential (including cross-flow) of every formation the well passes through, considering all scenarios: reservoir re-charge, zones charged during the well's life, post-decommissioning fluid movement and potential future re-development. An ALARP approach addresses the consequences of flow potential, and the appraisal is documented in the agency submission.

4.7.2.4 BARRIER PHILOSOPHY

- Water-bearing zone: a minimum of one permanent barrier from surface.
- Hydrocarbon-bearing zone (or water-bearing and significantly over-pressured): two permanent barriers from surface, or a single combination barrier of equivalent reliability.
- Between zones with unacceptable cross-flow risk: at least one permanent barrier isolating the zones from each other.
- All wells: in addition, an environmental (surface) plug to disconnect the open annuli from the environment — this is not a competent barrier.

4.7.2.5 PERMANENT BARRIER REQUIREMENTS

4.7.2.5.1 MATERIAL REQUIREMENTS

Barrier materials (cement or a demonstrably equivalent material) must be:

- Compatible with adjacent formations;
- resistant to downhole fluids (CO₂, H₂S, hydrocarbons, brine) at anticipated pressure/temperature;
- immovable;
- impermeable (gas release rate < 1 m³/year);
- of adequate load capacity;
- permanently durable (non-shrinking, resisting cracking/de-bonding); and
- provide an interface seal against casing and rock.

4.7.2.5.2 BARRIER LENGTH AND PLACEMENT REQUIREMENTS

The minimum length and placement of each permanent barrier depend on where it is set in the well. The requirements of the Onshore Well Decommissioning Guidelines for each scenario are summarised in Table 16; the well engineer or P&A specialist applies them in each well-specific programme.

Table 16: Barrier length and placement requirements.

Scenario	Minimum requirement (Good Cement, MD)
Open-hole plug above a zone	30 m of Good Cement above: hydrocarbon-bearing strata; zones with flow potential; abnormally geo-pressured strata (set across a competent formation); and the top of all fresh-water zones. Extend/set a barrier in the cased hole (min. 30 m into cased hole) to fully isolate the open hole and allow a pressure test.
Segregate cased / uncased (casing shoe)	One of: continuous plug from 30 m below to 30 m above the shoe; or a mechanical bridge plug 15–150 m above the shoe with ≥30 m cement on



Scenario		Minimum requirement (Good Cement, MD)
		top; or top-down squeeze via a retainer 15–150 m above the shoe (cement to 30 m below shoe) capped with ≥15 m cement.
Cased-hole perforations (isolated below)		One of: bridge plug ≤30 m above perforations + ≥30 m cement; retainer squeeze 15–30 m above perforations capped with ≥15 m; displacement/bull-head plug ≥30 m long, base ≤30 m above perforations; through-tubing basket plug ≤30 m above perforations + ≥30 m cement; or ≥30 m cement above the uppermost packer with ≥30 m in the annulus.
Casing / tubing stubs		One of: plug from 30 m below to 30 m above the stub; down-squeeze retainer ≤15 m above stub; bridge plug ≤15 m above (cemented stub annulus) + ≥30 m cap; or displacement plug ≥30 m, base ≤15 m above stub end.
Combination barrier (replacing two)		≥60 m of Good Cement; 60 m above the zone with flow potential; internal plug overlapping the annular Good Cement over a cumulative 60 m.
Where Good Cement is NOT verified		Increase isolation lengths from 30 m to up to 150 m for the internal plug and/or adjacent annuli. Placement allowance: up to 150 m pumped to achieve ~30 m Good Cement; up to 240 m to achieve 60 m.
Zones < 30 m apart		Place the maximum practical column of Good Cement between the zones.

4.7.2.5.3 POSITION REQUIREMENTS

- **General** - a permanent barrier is set above the zone across a suitable cap rock, extends across the full cross-section of the well (including all annuli), and has formation fracture pressure at its base exceeding the maximum anticipated pressure from the isolated zone.
- **Open hole** - set (or extend) the barrier in the cased hole; zones of different pressure regimes are separated by a permanent barrier unless cross-flow is acceptable; where pressure may exceed fracture pressure in the open hole, isolate with two barriers or a combination barrier.
- **Cased hole** - cemented casing alone is not a permanent barrier to lateral flow; a full lateral barrier requires an internal cement plug (or equivalent) plus overlapping good annular cement, whether the casing is perforated or not.

4.7.2.5.4 PLACEMENT TECHNIQUES

Address, per well: general placement (fundament to prevent slumping — noting mechanical plugs and viscous pills are not competent Barrier Elements); through-tubing placement; penetrations (control/instrument/power cables must not pass through a permanent barrier unless leak-paths are appraised and plugged); bull-heading (subject to cap-rock restoration); and high-angle/horizontal wells (coverage and verification are harder; treat plug length as true vertical height above ~65°

4.7.2.5.5 REMEDIAL CEMENTATION (WHERE CEMENT QUALITY IS INADEQUATE)

Table 17: Remedial cementation methods.

Method		Advantage	Disadvantage
Casing milling	section	Clear rock-to-rock barrier placement.	Operationally risky (esp. un-cemented casing); swarf handling; time-consuming and costly.



Method	Advantage	Disadvantage
Cut & pull casing, plug across stump	Unequivocal full-wellbore barrier; can be pressure-tested and tagged.	Pulling can be difficult/infeasible (barite fallout, residual cement, corrosion); heavy pipe-handling and laydown; costly for multiple strings.
Perforate & squeeze below a retainer	Relatively swift and inexpensive.	Squeezed volumes highly uncertain; poor verification; annulus can only be tested/logged if the internal plug is drilled out.
Perforate, wash & cement (proprietary)	Demonstrates circulation and larger annular cement volumes.	Uncertain annulus cleanliness and barrier length; verification limited; less certain with multiple annuli.
Inject cement into annulus from surface	Relatively swift and inexpensive.	Relies on injectivity below the shoe; barrier quality uncertain; TOC hard to verify (annulus pressure test possible).

4.7.2.6 SEALING FORMATIONS AND EXISTING ANNULAR MATERIALS

An impermeable formation of sufficient, durable strength (e.g. some shales or salts) may replace good annular cement where it can be demonstrated that the cumulative seal length prevents flow at maximum anticipated pressures. Existing annular materials may likewise qualify if non-corrosive to the casing. Verification is addressed in Section 4.7.2.7.

4.7.2.7 BARRIER VERIFICATION

Appendix 4(f) requires verifiable closure actions. Each Barrier Element is verified by an appropriate combination of methods — no single method is relied on exclusively:

Table 18: Barrier verification methods.

Element	Verification
Internal (wellbore) cement plug	Documented installation (density, pump rate, volumes, returns, spacers); confirmed slurry strength development (pre-job testing at simulated downhole conditions); position by tagging (drill-pipe ~10–15 klbs; or wireline/CT/stinger) or by pumped-volume/pressure calculation; pressure test ≥ 500 psi above the leak-off below the barrier, not exceeding casing strength minus wear; and/or inflow test to the maximum differential.
Annular cement	Pressure/inflow testing; cementing records (density, volumes, returns, differential, losses, centralisation); CBL/USIT logs; annulus pressure history; shoe leak-off test; modelling. Where TOC is inferred from volumes only, a ~305 m column may be considered adequate for two barriers / a combination barrier, adjusted for confidence.
Sealing formation	Evidence of adequate fracture strength; adequate seal length by differential testing; bond-log interpretation by a qualified specialist; plus (per App. F.12) a leak test between perforations at 30 m spacing and two independent bond logs.
Through-tubing bull-headed /	Combination of tagging inside tubing, QC of the job, pressure responses during pumping, injection characteristics and TOC accuracy — no single method relied upon.



Element	Verification
Liner lap	Not part of a permanent barrier unless verified (pressure/inflow test and/or logging); otherwise place a verifiable barrier above and/or below the lap.

4.7.2.8 ENVIRONMENTAL PLUG AND SURFACE REINSTATEMENT

- Fluids above the uppermost barrier that cannot be legally discharged are removed or contained before wellhead removal.
- Wellhead equipment and all casing strings are retrieved to 1.5–5 m below ground level, and a surface cement (environmental) plug is placed across the casing stubs.
- A well marker plate is tack-welded to the casing stub recording well name, date drilled, date abandoned and total depth (mBGL); a buried marker tape is laid above the capped stub before backfilling.
- The well site, access and surface infrastructure are decommissioned, reshaped, soil-reinstated and revegetated to the agreed final land use (costed in Section 4.12).

4.7.2.9 TEMPORARY ABANDONMENT (SUSPENSION)

The same minimum number of barriers as for permanent abandonment applies, but the secondary barrier may be a verified mechanical device (e.g. pressure-tested bridge plug, wellhead seal, suspension cap). Kill-weight fluid is a barrier element only where it can be monitored and maintained. For suspension exceeding 90 days a risk assessment is undertaken and approved by the regulator, and the design facilitates both re-entry and future permanent abandonment.

4.7.2.10 SPECIAL CONSIDERATIONS

Each of the following, where present, is the subject of a specific risk assessment and may change barrier design and cost, partial abandonment for sidetracking; radioactive sources; hole angle; multi-lateral wells; multiple reservoirs; cemented casing liner; control/ESP/gauge cables; HPHT wells; and wells containing H₂S, CO₂, NORM and/or mercury (waste-management and materials-selection implications).

4.7.2.11 DEVIATIONS AND MANAGEMENT OF CHANGE

All proposed deviations from the guidelines are risk-assessed, approved by the Operator's Competent Person/Technical Authority and accepted by the regulator during design; during operations a management-of-change process governs any change affecting the final abandonment status.

4.7.2.12 PER-WELL DECOMMISSIONING PROGRAMME

For each well, the abandonment programme and schematic (barrier locations, capacities, lengths and cement volumes) form part of the site-specific decommissioning plan prepared in Phase 1. In summary, for the typical production well, two permanent barriers (or one combination barrier) above the open-hole reservoir, one permanent barrier at the base of the fresh-water aquifers and an environmental plug, each verified by tagging and pressure testing, with remedial cementing wherever the pre-P&A bond log shows poor annular cement (Section 4.4.2). Well-specific programmes are prepared in Phase 1.

Table 19: Typical closure actions per component.

Component	Closure Action
Dismantling and removal of any on-site infrastructure (including processing plant and compressor stations).	- Pre-emptive planning for post closure land use including development of surface infrastructure inventory and the identification of infrastructure which is available for reuse and repurposing post closure.



Component	Closure Action
	- Removal of all services, structures, machinery, and infrastructure unless these are specifically required for post-exploration land use, post-exploration projects or have been requested by the landowner. - Establish formal agreements for any infrastructure handed over for third party use, and management. - All identified infrastructure, including foundations, plinths and bunds, is removed so the area can be ripped, re-soiled and revegetated (Table 13). All waste materials to be disposed of at suitably licenced disposal facilities. - Remove all power lines unless agreed in writing to retain for beneficial end use. - Dismantle and dispose of all fences that do not form part of post-closure property boundaries. - Areas where infrastructure was demolished should be assessed through a risk-based system to determine if there is any residual contamination or risk and appropriate remediation measures implemented. Where contaminated material is detected, this should be removed and disposed of. - Profile the area to be free draining. - Remove and rehabilitate all Stormwater management infrastructure not required in the final closure plan. - Assess available topsoil stockpiles in respect of quantity and quality- the topsoil's to be placed for rehabilitation must be suitable for revegetation. - Revegetate disturbed areas with suitable local grass mix in areas where natural regrowth is not successful or anticipated. - A waste and infrastructure hierarchical principal should be applied to all decommissioned infrastructure or wastes, as follows: Reduce, re-use, recycle, dispose. - Monitor and manage dust generated from decommissioning activities to relevant standards. - Removal and safe disposal of any remnant processing waste deposits, including PCD's and evaporation ponds/ dams. - Pump and treat or dispose (at licenced facility) remnant polluted water from PCD's. - Remove liners and residue and dispose at suitably licenced facility. - Ongoing monitoring to ensure no erosion, ponding, and adequate revegetation.
Helium recovery and gas processing plant (incl. flare, loading bays, produced-water tanks and evaporation pond)	- Depressurise, isolate and purge all process equipment, vessels and piping with inert gas before dismantling. - Drain and recover refrigerants (propane, ethylene and mixed refrigerant), lubricants, glycol and chemicals for recycling or licensed disposal.



Component	Closure Action
	- Remove helium, CNG and LNG storage and loading equipment, membrane and PSA units, compressors, cryogenic units, the flare stack and the control room; salvage or recycle where possible. - Sample produced water, pond residues and scale (including for naturally occurring radioactive material) and dispose of them at a suitably licensed facility. - Remove the HDPE pond liner, test the underlying soil and remediate contamination; backfill and shape to the surrounding landform. - Undertake a contamination assessment of the whole plant footprint before relinquishment.
Rehabilitation of access roads	- Develop transport layout plan to utilise existing access routes where possible and minimise unnecessary access roads. - Restrict vehicular movements to designated access and routes to avoid unnecessary soil compaction. - Conclude final closure layout plan defining access roads required for ongoing monitoring, management, and maintenance. - Retained access roads to be designed in accordance with relevant engineering standards and specifications- including specific management of stormwater. - Closure, decommissioning, and rehabilitation of all access roads (incl. associated structures, signage, culverts, etc) unless these are specifically required for post-closure land use, post-closure projects, or have been requested by the landowner. - Remove any contaminated soil from roads, dispose at suitably licenced facilities. - Deep rip all compacted areas prior to rehabilitation. - Topsoil rehabilitation and amelioration as is necessary. - Revegetation. - Apply dust suppression (e.g. water sprays) where necessary.
Gas gathering pipelines and inline infrastructure	- Depressurise the pipelines and purge them with nitrogen (or air once gas-free), pigging only where liquids have collected; drain condensate from low-point drains and dispose of it at a licensed facility. - Disconnect from wellheads and the plant; cut, cap and seal pipe ends. - Remove above-ground route markers, low-point drain pits, valves and any nodal compression to below plough depth; leave buried HDPE in situ at 0.75–1.0 m unless removal is required by the landowner or a solar developer. - Reinstate and revegetate any disturbed servitude; repair trench subsidence. - Lodge an as-left pipeline route plan with the landowners, the regulator and the Surveyor-General.
Well site	- The well must be cleared of obstructions prior to abandonment. This includes associated surface infrastructure.



Component	Closure Action
	- Remove any waste materials from the well sites and dispose at a suitably licenced waste disposal facility. - Prior to placing plugs- the state and effectiveness of the applicable annular barrier must be evaluated and verified (method may include cement bond logs, calliper logging, or communication tests). Where necessary this may require remediation of this annular barrier prior to plugging. - A qualified well engineer or P&A specialist to design the most suitable and appropriate closure strategy to ensure no vertical gas or fluid movements and that all potential hydrocarbon / water bearing formations by utilizing placed cement plugs. This must include determination of plug length/ location and plug material specifications. - The cement plugs are stacked along the entire length of the wellbore (both in the open hole as well as the upper casing) to ensure efficient redundancy. The extent of plugging to be confirmed during the Preparation phase. - All plugs are tagged to ensure successful placement. - Cementation technique to follow the squeeze displacement technique (or alternative as directed by the well engineer). Wiper plugs must be utilised where applicable. - Conduct cement top-ups along the annulus, and existing cemented sections showing “no bond” or “poor bond” from logging results. - The integrity and effectiveness of the plug must be evaluated and verified once completed. There are many evaluation and verification methods which can be used subject to a specific well circumstance (e.g. physical or mechanical tests, or hydraulic/ pressure tests). The most suitable verification method to be determined by a suitably qualified well engineer. - A surface / shallow cement plug (+/-50 m below ground level) is set, and the well is cut and capped 1.5–5 m below ground level (below plough depth) remove the wellhead and all casing above this point. - The collar is then collapsed and the surface reinstated and the site rehabilitated. - Rehabilitation must reflect the local environment -ecosystem rehabilitation of impacted areas, including natural fauna and flora, hydrology and hydrogeology. - Ensure that the final landscape is safe, stable and non-polluting over the long term, and that post closure land use does not affect the sustained utilization. - Placement of a “surface tag” in order to ensure monitoring can continue once the casing is cut and the area revegetated. The well location can be recorded on the Title/SG Diagram if a physical surface is not possible. A buried marker tape is laid above the capped stub. - Groundwater and surface water monitoring.
General Rehabilitation	Surface - Develop and implement an alien vegetation eradication control and management plan (AVECMP).



Component	Closure Action
	- The removal and/or disturbance of previously unaffected topsoil's must be avoided as far as possible and limited to the existing areas of disturbance. - Develop and implement a revegetation plan. If required, seeding and planting to be done at, or immediately after, the first rains in spring, and into freshly prepared, fine-tilled seedbeds (where soils are not prone to crusting). - Alien Invasive management. - Annual monitoring of the status of rehabilitation and revegetation. - No driving will be permissible on any rehabilitated areas- only on pre-defined designated routes for monitoring. - Implement soil amelioration as is necessary. - Any contamination of the topsoil on surrounding areas must be avoided by ensuring machinery is well maintained and leak free. If contamination has occurred, the area must be remediated and ameliorated immediately. - Monitoring, including review and assessment of soil balances, soil surveys (stripped, stockpiles, and placed). - Implement defoliation on established grasses and vegetation under direction of rehabilitation specialist- to allow for reintroduction of organic matter. - Ongoing rehabilitation monitoring (including soil surveys) and maintenance until relinquishment. - Ongoing rehabilitation of eroded areas through a root cause investigation and rectification approach. - Shape all channels and drains (where applicable) to smooth slopes and integrate into the natural drainage pattern. - Construct contour banks and energy dissipating structures as necessary to protect disturbed areas from erosion prior to stabilisation. - Implement controlled livestock grazing once vegetation is established. Restrict access of livestock newly rehabilitated unless specifically required for defoliation as instructed by a suitably qualified rehabilitation specialist. - Ongoing rehabilitation monitoring and maintenance until relinquishment. Including but not limited to: Alien invasive monitoring and management, erosion control and remediation, vegetation growth and supplementation).
Social and economic change management.	- Public review and comment on rehabilitation, decommissioning, and closure planning. - Regular consultation with I&APs on closure planning and rehabilitation progress, and any intrusive activities. - Develop final land management and maintenance plan with relevant landowners. - Implement land management and maintenance plan.



4.7.3 PHASE 3: REHABILITATION

Phase 3 restores the disturbed areas to the agreed land use once wells are plugged and infrastructure is removed. The component actions are in the closure-actions table above (general surface rehabilitation). Project-specific requirements are:

- Landform: shape all disturbed areas to be free-draining and consistent with the gently undulating surroundings (slopes about –2.5% to +3.5%); remove hardstanding, road base and foundations.
- Soils: replace stockpiled subsoil and topsoil by soil form; rip compacted pads, the plant footprint and tracks; handle vertic and duplex soils only when dry; ameliorate where soil tests show deficiencies.
- Revegetation: seed with a locally indigenous grass mix suited to Vaal-Vet Sandy and Central Free State Grassland after the first spring rains (October to December); actively revegetate pads, the plant and pond footprint; allow natural recovery on lightly disturbed verges, with alien invasive control.
- Erosion control: install contour banks or energy dissipaters before the summer thunderstorm season; keep rehabilitation outside the 32 m / 15 m watercourse and wetland buffers unless authorised under the NWA.
- Heritage and palaeontology: maintain the 30 m and 50 m heritage buffers during closure earthworks and apply the Chance Find Procedure.
- Livestock: exclude livestock from newly rehabilitated areas until vegetation is established, unless controlled grazing is prescribed by the rehabilitation specialist.

4.7.4 PHASE 4: MONITORING, MAINTENANCE AND RELINQUISHMENT

Post-closure monitoring confirms that objectives are met, on the durations defined in Section 4.5.4 (Closure period). Post-decommissioning environmental reports must be submitted to the regulator and stakeholders at intervals dictated by the monitoring frequency. Specifically, submissions will occur annually for the first five years, and every five years thereafter (unless otherwise agreed). All reports must include comparative before-and-after photographic records and will continue until the relinquishment criteria outlined in Section 4.11 are successfully achieved. The following actions, to be adjusted based on the completion of the pre-closure site assessment as well as the Onshore Well Decommissioning Guidelines prepared by PASA, are proposed:

- **Groundwater and surface water monitoring (production and exploration wells):** The post-closure monitoring should take place bi-annually for five (5) years, in line with the closure costing, or until a long-term acceptable trend can be determined. The extent of the monitoring is to be determined in the site-specific closure and decommission plan (provision has been made for bi-annual monitoring for five years). This monitoring aims to confirm that abandoned wells are safe and do not result in a pollution or contamination hazard.
- **Rehabilitation monitoring:** Monitoring to be undertaken by a qualified Ecologist or EAP annually as required in the EMPr. The purpose of a Rehabilitation Monitoring Program is to ensure that the management measures, rehabilitation and decommissioning objectives for the management of various environmental aspects, are met and that the rehabilitation process is followed. The frequency of monitoring must be adequate to identify potential gaps in the effectiveness of the management plans. A rehabilitation programme must be implemented during the construction, operational and decommissioning phases. The following aspects require monitoring during these phases:
 - Erosion and sedimentation status of disturbed areas;
 - Surface drainage and surface water quality;
 - Groundwater quality;
 - Successful re-vegetation and basal cover proportions;



- Rehabilitation effectiveness;
- Fauna and flora re-colonization; and
- Control of alien and invasive vegetation species.

To achieve the primary objective, management infrastructure must be designed and operated with the following objectives in mind (DWAF, 2008):

- Visual impacts of disturbed areas should be minimized by restoring the landform to a condition suited to the surrounding landscape;
 - Management of invasive/alien vegetation;
 - Restoration of native vegetation covers and ecology;
 - Minimize the area of vegetation clearing for drilling and construction;
 - Ensure that water management measures take into account and fit into the broader regional water management context;
 - Ensure that water of different quality (clean and dirty water) is kept separate and managed separately if possible. This implies minimizing the contact between water of different qualities to minimise potential deterioration of water quality;
 - Address water pollution issues at source; and
 - The need for long-term monitoring must be reduced.
- **Gas emissions (production and exploration wells):** The well site must be monitored for the release of gas from the decommissioned well site. This can be undertaken through appropriate sampling techniques, either soil vapour probes, efluxes, Flir Methane Cameras, or surface methanometers. Methane/natural gas monitoring to be conducted every 5 years for 50 years, or until a long-term acceptable trend can be determined, during the post closure period.

The monitoring reports shall include a list of any remedial action necessary to ensure that infrastructure that has not been removed remains safe and pollution-free and that rehabilitation of project sites is in a stable, weed-free condition. Electronic/digital photographs will be taken before and after rehabilitation. Please refer to Section 4.13 for further detail on the required auditing and monitoring requirements.



Closure and Post-Closure Phasing Schedule

Well decommissioning (plugging & abandonment) programme, GN R1147 Appendix 4: 3(d)(v) & 3(g)

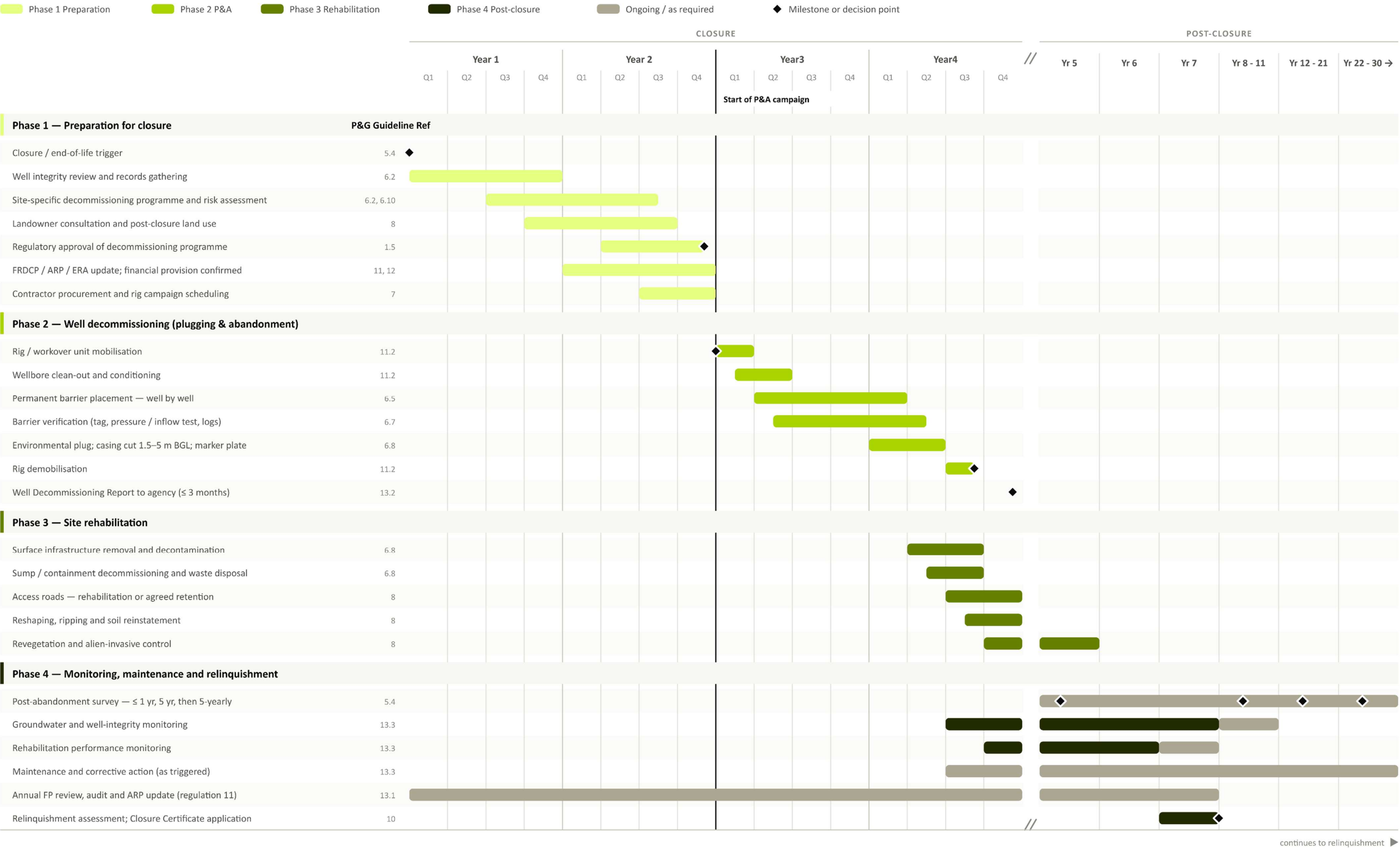


Figure 9: General Closure and Post-Closure schedule and requirements.



4.8 FINAL REHABILITATION, DECOMMISSIONING AND CLOSURE SCHEDULE

The key rehabilitation and closure components, their actions and schedule drivers are set out below. Permits and licences that may be required before closure (e.g. water-use licences, environmental authorisations) should be initiated early, as lead times are long. The schedule is linked to D3 Energy's development programme (greenfields):

- 2027–2028: drilling of the 13 new wells on the Virginia fault (phased as ~7 in late 2026 and 6 in 2027 in the Development Plan), construction of the initial gathering pipelines to these and the 3 existing wells, and commissioning of the plant by early 2028. Drill pads are rehabilitated within six months of drilling and exploration wells not converted to production are plugged as they occur (ARP, Section 5).
- Operational phase (at least 30 years): the 27 wells on the Ventersburg fault drilled as needed to sustain sales volumes; wells and pipeline sections decommissioned progressively as they stop producing.
- Final decommissioning (after cessation of production, not before ~2058 on the stated life): plugging and abandonment of the remaining wells, followed by pipeline, plant, pond and road closure, then rehabilitation and post-closure monitoring until relinquishment.

Spatial progression is from the Virginia-fault corridors near the plant to the Ventersburg-fault corridors. Schedule drivers are gas deliverability per well, landowner and solar-developer agreements, and the time needed for regulator approval of well-specific P&A programmes.

Table 20: FRDCP schedule.

Activity	Closure schedule driver
Ongoing activities.	Ongoing decommissioning and closure of abandoned exploration and production wells. The timing of this will depend on when a decision is made to abandon a specific well.
Planning and preparation for Closure.	Updated FRDCP and compliance with the Financial Provision Regulations. Obtain relevant closure related environmental authorisations, licences, and permissions (if applicable).
Dismantling and removal of any on-site infrastructure.	Progressively as infrastructure is no longer required. Final dismantling of all infrastructure not to be retained at cessation of production and/or exploration activities.
Rehabilitation of access roads.	Cessation of production activities and where relevant rehabilitation activities- if possible, rehabilitation of access roads should be done progressively as these roads are no longer required.
Decommissioning and closure of well sites.	Well decommissioning and plugging will be initiated once a well site is no longer yielding viable gas volumes or lapsing of the approved suspension period. The closure will commence on completion and approval of the site-specific decommissioning plan.
Removal and safe disposal of processing waste deposits, including PCD's and evaporation ponds/dams.	PCDs/Sumps to be decommissioned once dirty water areas and need for PCDs ends (i.e. once pollution source terms are removed)- most likely at the end of decommissioning and rehabilitation.



Activity	Closure schedule driver
General surface rehabilitation (incl. drill pads, plant and pond footprint, compacted areas, etc).	Completion of decommissioning. Seeding and planting is most successful when done at or immediately after the first rains in spring, and into freshly prepared, fine-tilled seedbeds (where soils are not prone to crusting). Natural re-establishment of indigenous vegetation, with alien invasive control, is preferred; active revegetation is applied wherever natural recovery is not succeeding.
Rehabilitation Monitoring.	Ongoing throughout rehabilitation activities and into the closure and post closure periods.
Social and economic change management.	Ongoing throughout rehabilitation activities and into the closure period.
Ground and surface water monitoring	Ongoing throughout rehabilitation activities and into the closure and post closure periods.
Fugitive gas emissions monitoring	Ongoing throughout rehabilitation activities and into the closure and post closure periods.
Decommissioning of gas gathering pipelines	Each section is decommissioned when the wells it serves are abandoned; the trunklines at the end of production, after the last wells are plugged.
Decommissioning of the helium recovery and gas processing plant and workshop	Cessation of production; follows well and pipeline decommissioning and precedes final surface rehabilitation of the plant footprint.



4.9 ORGANISATIONAL CAPACITY

It is critical that roles and responsibilities for the effective planning, implementation, monitoring, and revision of the closure process are clearly defined and provided for. The Holder of the Production Right is ultimately responsible for ensuring compliance with all the provisions of the Right and associated plans, as well as other relevant legal requirements. The Holder must ensure knowledge and understanding of the applicable legislation, guidelines, and industry best practices.

Capacity in the following key roles and responsibilities must be provided for:

- Internal Closure champion: a suitably qualified person(s) who will be accountable for the following:
 - Driving the ongoing development, refinement and implementation of the closure plan;
 - Resourcing and implementing the plan;
 - Ongoing management and monitoring requirements to support the closure plan;
 - To ensure the integration of the rehabilitation and closure activities with general operational activities; and
 - Ensure legal compliance and deliver on commitments.
- Internal Social champion: a suitably qualified person(s) who will be accountable for the following:
 - Develop and implement training strategies for internal training;
 - Develop and implement effective communication with all stakeholders;
 - Develop and implement a stakeholder forum to promote information and idea sharing regarding closure related aspects and/or ensuring meaningful contributions to existing forums; and
 - Continually develop the relationship with I&APs, to promote the social licence to operate and close and decommission.
- Independent Environmental Assessment Practitioner: This individual will be appointed to ensure compliance with the requirements of the FRDCP and specifically to undertake the following tasks:
 - Undertake the required pre-closure environmental site assessment, risk assessment, and if required landowner consultations.
 - Prepare a site-specific final closure and decommissioning plan.
 - Undertake the required periodic compliance monitoring and reporting during the closure period.

Well engineer or P&A specialist: This individual must be a suitably qualified professional who must have relevant experience in petroleum exploration and production. Key attributes must include experience and qualifications related to the technologies applicable to production well closure and abandonment, as well as a thorough understanding of internationally accepted well closure and abandonment standard and guidelines. This specialist will be responsible for ensuring that the closure plan is implemented to ensure that the risks to the environment and surrounding communities are prevented or limited.

Further education, training and capacity building is critical to ensure that the production activities align with evolving internationally accepted best practice and research. In this regard the Holder must ensure that regular review of international best practice is undertaken and where applicable implemented throughout the project programme. It needs to be recognised that closure planning needs to start early within the project lifecycle and continued as an integral component of the operations.

The positions responsible for this plan are listed below. D3 Energy's named incumbents are still to be confirmed.



Table 21: Organisational capacity for implementing the FRDCP.

Role	Person / position	Key responsibilities and training needs
Holder (accountable)	D3 Energy South Africa (Pty) Ltd	Overall accountability for closure and financial provision; funds the annual update and independent audit
Closure champion	D3 Energy South Africa (Pty) Ltd and an independent EAP	Implements and updates the FRDCP and ARP; integrates closure with drilling and operations; closure competence training on the Onshore Well Decommissioning Guidelines
Social champion	D3 Energy South Africa (Pty) Ltd – stakeholder/community liaison	Grievance mechanism, landowner access protocol and closure consultation; stakeholder fatigue management
Independent EAP	To be appointed	Annual FRDCP, ARP and ERA updates; pre-closure site assessments; site-specific closure plans; closure certificate application support
Environmental Control Officer	To be appointed before construction, per the EMPr	Compliance monitoring, pre-construction walkdowns, rehabilitation monitoring; heritage and palaeontology chance-find recognition
Well engineer / P&A specialist	To be appointed	Well-specific P&A design and barrier verification; submissions to PASA; well register and integrity data
Specialists	Hydrogeologist, ecologist or rehabilitation specialist, soil scientist, palaeontologist and archaeologist, as required	Groundwater monitoring network, revegetation and soil amelioration, chance-find response

4.10 IDENTIFICATION OF CLOSURE GAPS

The scope of the plan depends on the environmental context of the activities, which is not fully known until the exact locations of future activities are scoped. The closure liability estimate will need to be updated (and where necessary the closure plan amended) once the exact locations of future drilling campaigns have been formally scoped.

The following actions have been proposed to address these gaps:

- A site-specific environmental assessment will be undertaken once the specific locations of all drilling and other invasive activities have been defined. This will be done prior to the commencement of any invasive activities and will include relevant specialist input as and where necessary.
- A detailed drilling log will be prepared and maintained for each of the wells to ensure that the specific geological stratigraphy and sub-surface conditions are considering and inform the final site-specific closure and decommissioning plan.
- A site-specific closure and decommissioning plan will be prepared for each invasive activity and will where applicable be informed by a specialist environmental site assessment, and risk assessment, as well as a specialist assessment and plan for well plugging and abandonment.



Further the financial provisioning regulations requires that the FRDCP be revisited, assessed, and revised on an annual basis. This annual review must aim to ensure that the gaps identified above are addressed, as applicable, and the relevant financial provisioning updated.

4.11 RELINQUISHMENT CRITERIA

Relinquishment can be defined as the formal approval by the relevant regulating authority indicating that the completion criteria for the production activity have been met to the satisfaction of the authority. In this regard the relinquishment criteria are driven by the objectives of closure and consequently the indicators applicable to each impact associated with the closure and decommissioning. Reference is made to Table 27 which presents each identified environmental impact, the associated indicators and proposed closure targets. In summary the proposed relinquishment criteria include:

- **Groundwater:** the quality and quantity of the groundwater levels must be consistent with the pre-production condition - or adjusted depending on external inputs and drivers.
- **Air quality:** Evidence must be provided there are no gas emissions from the well sites.
- **Biodiversity:** The vegetation cover of the affected areas must be consistent with surrounding vegetative cover. There must be ecosystem functionality which is consistent with the surroundings.
- **Social:** There must be no unattended complaints.
- **Waste:** There must be no waste materials remaining on-site.
- **Land use:** The area must be available for ongoing land uses. The location of all abandoned wells must be demarcated and where appropriate reflected on the relevant property title information.
- **Wells:** all wells plugged and abandoned with verified barriers, cut and capped 1.5–5 m below surface, marker plates installed and positions recorded; no sustained gas emissions in the post-abandonment surveys. A buried marker tape lies above each capped stub.
- **Infrastructure:** plant, pond, workshop and above-ground pipeline components removed; buried pipelines purged, capped and recorded on an as-left plan.
- **Soils:** land capability restored to the pre-disturbance class; no residual contamination at the plant and pond footprint above the soil screening values of the Norms and Standards for the Remediation of Contaminated Land (GN R331 of 2014).
- **Heritage:** no damage to recorded heritage features and all chance finds reported to the heritage authority.

4.12 CLOSURE COST AND FINANCIAL PROVISION

The closure cost is determined per GNR1147 and represents a realistic estimate of the cost of decommissioning, rehabilitation, closure and the management of residual/latent impacts, using third-party contractor rates.

4.12.1 APPROACH TO CLOSURE COST DETERMINATION

Financial provision must at any time equal the sum of the costs of implementing the plans and reports for a period of at least the next 10 years (Regulation 7 of the Financial Provisioning Regulations, 2015). The regulations set a required cost-estimate accuracy that improves as the operation approaches closure (Table 22).

Table 22: Cost methodology and accuracy summary.

Time to closure	Required accuracy
More than 30 years	± 50 % (conceptual)



Time to closure	Required accuracy
More than 10 up to 30 years	± 70 %
More than 5 up to 10 years	± 80 %
5 years or less	± 90 %

The reported accuracy, and the actions that improved it, are stated with the estimate. The cost is built by defining the closure battery limits; verifying third-party unit rates for dismantling, demolition and rehabilitation; measuring quantities from layout plans and site verification as far as possible, and applying the rates to the quantities. The assumptions and limitations stated in Section 4.5.5, also underpin the basis of this closure cost determination. The closure cost has been calculated through the following steps:

- Review of available information to inform the closure battery limits for the D3 Energy operation;
- Verify unit rates for infrastructure dismantling and demolition as well as associated rehabilitation of disturbed areas, taking into account the latest demolition equipment available;
- Develop layout plans indicating existing and proposed infrastructure to be included in the rehabilitation and closure cost estimation;
- Unit rates were sourced from available precedents, inputs from specialists in the field, and experience;
- Rates are based on third-party contractor rates and not mining rates; and
- Apply the verified unit rates and associated quantities measured from the layout plans in spreadsheets to determine the closure costs.
- Methane/natural gas monitoring to be conducted at five-yearly intervals for a period of 50 years during the post closure period.
- Vegetation monitoring to be undertaken once per year for three (3) years during post-closure phase as part of the rehabilitation monitoring.

The battery limits for this closure provision assessment are limited to:



- Access roads;
- Well heads;
- Operational, abandoned and suspension wells;
- Fencing and firebreak;
- Temporary Hazardous waste storage;
- Temporary General waste storage;
- Mobile offices and ablution facilities;

Production-specific infrastructure includes gas gathering pipelines and inline infrastructure; the helium recovery and gas processing plant (incl. flare, loading bays, produced-water tanks and evaporation pond); the office and maintenance workshop; and drill pads and sumps.

Reported accuracy: the production facilities have an expected life of at least 30 years, so their closure costs are conceptual estimates ($\pm 50\%$). Components expected to close within five years, such as exploration wells not converted to production and drill pads rehabilitated under the ARP, fall in the $\pm 90\%$ band. The accuracy will improve as final layouts, well records and contractor quotes for production infrastructure become available.

Unit rates that were applied during the closure determination were obtained from third-party quotes. The rates are recorded in a database, which is updated in consultation with the civil contractors. The post-closure unit rates that are included in the applied rates are summarised in the subsections below. The unit rates used in the costing models were calculated based on experience and rates obtained from contractors. The site-specific unit rates and assumptions are summarised in Tables 23 to 25 below.

4.12.2 P&A COST MODEL

The following section presents a detailed cost breakdown, encompassing specific unit rates and cost components, for the plugging and abandonment of one well. Applied to 48 wells, well closure (preparation for closure, and plugging and abandonment) costs R 15 906 491.31 before P&Gs and contingencies (Table 1).

Table 23: P&A costing summary.

Cost element	Rates and assumptions	Notes
Rig mobilisation and demobilisation and site setup.	- Establishment of rig, TLB, cementing equipment & accessories is a once-off cost @ R 102 600.00 - Setup of site per well @ R 32 917.50 - Setup of drill machine @ R 3 600.00 per hour, 6 hours per well - Water supply for contractors is a once-off cost @ R 31 500.00 - Movement of rig and equipment @ R 1 950.00 per hour, 4 hours per move Total rate <i>per well</i> is initially (once off costs incl. for first well) R 196 417.50, and R 62 317.50 thereafter.	Rig and site setup and mobilisation and demobilisation includes the following: • Establishment of Rig, TLB, Cementing equipment & accessories • Setup of Site • Setup of Drill Machine • Water Supply for contractors • Inter-hole move of Rig and equipment
Well control / kill & completion fluids	Not costed separately.	Hydrostatic control before operations.
Well clean-out & testing	- Clean out string @ R3 600.00 per hour, 8 hours per well	Well cleaning and testing includes the following: • Clean out string to identify and investigate potential



Cost element	Rates and assumptions	Notes
	- Calliper logging (tagging of well) @ R 3 600.00 per hour, 10 hours per well - Calliper logging (lowering camera) @ R 1 800.00 per hour, 5 hours per well - Cement bond logging per well @ R 53 000.00 Total rate per well is R 126 800.00.	blockages/cavities within the well. • Conduct Calliper logging to identify and investigate potential blockages/cavities within well - Step 1 • Conduct Calliper logging to identify and investigate potential blockages/cavities within well - Step 2 • Cement Bond Logging to investigate the current integrity of the casing and grouting.
Well plugging	- Cementing of open well @ R 6 500.00 per cubic meter, 8.76m³ per well (incl. 25% excess) - Preparing equipment @ R 3 600.00 per hour, 4.5 hours per well - Cementing of well @ R 3 600.00, 1 hour per well - Cleaning of equipment @ R 3 600.00 per hour, 1.5 hours per well Total rate <i>per well</i> is R 82 140.00	Plugging of wells includes the following: • Supply and install cement plug within well via squeezing technique.³ • Prepping cementing equipment • Cementing of well • Cleaning of cementing equipment
Cementation integrity testing	- Cementation integrity testing @ R 3 600.00 per hour, 4 hours per well Total rate <i>per well</i> is R 14 400.00	Integrity of the plugs must be confirmed by setting weight down on the upper most plug (using the drill string) as well as a differential pressure test.
Wireline / CBL / USIT logging	- Cement bond logging per well @ R 53 000.00 Included in well clean-out & testing above (not additional).	Mandatory for wells >10 yrs production or with remedial cement history. All production wells will have produced for more than 10 years by closure, so CBL is costed for every well (48 wells: R 2 544 000.00).
Cut & pull wellhead + casing to 1.5–5 m BGL	- Dismantle of wellhead @ R 3 600.00 per hour, 2 hours per well - Excavation and cutting of the top section of the well (demolition hammer) @ R 3 600.00 per hour, 5 hours per well Total rate per well is R 25 200.00.	Removal and cutting of wellhead to a depth of ~1.5 – 5m includes the following: • Dismantle of wellhead • Excavation of material and demolition hammer and casing

³ Develop cement formulation for cementing the entire well annulus. Develop cement formulation to top-up “no bond” or “poor bond” cemented sections between casing and formation walls – ensure cement seals and does not disperse into porous formations. Cement formulations and volumetric calculations to be approved by well engineer/cement specialist.



Cost element	Rates and assumptions	Notes
Environmental (surface) plug	Included in well plugging (cement to surface). Surface tag per well @ R 3 500.00.	Always present; not credited as a barrier.
Redrilling of failed wells	- Excavation of material above plug per well @ R 16 206.37 - Removal and redrill of plug per well @ R306 739.29 - Excavation of material and demolition hammer and casing per hour R3 600.00, 5 hours per well Total rate per well is R 340 945.66. Full re-entry and re-plugging of a failed well (establishment, logging, cementing, waste and site rehabilitation): R 773 784.46 per well; 2 wells: R 1 547 568.92.	In the event of a failed well, the following are included: • Excavation of material to access plug • Removal of plug and redrill • Excavation of material and demolition hammer and casing
Waste management	- Transport of demolition waste @ R 484.83 per cubic meter, 8.76 m³ per well - Disposal of demolition waste @ R 485.88 per cubic meter, 8.76 m³ per well Total rate per well is R 8 503.37 (failed wells; latent and residual provision)	Waste management consists of the transport of demolition waste (including, in the case of a failed well, any drilled plugging material)

4.12.3 GENERAL SURFACE REHABILITATION COST MODEL

The cost items and unit rates for surface infrastructure and site rehabilitation are presented in Table 24. These costs predominantly encompass infrastructure dismantling, sump backfilling, and general surface rehabilitation activities. Well-site items are costed in the EIMS wells costing and plant and infrastructure items in the contractor costing (Appendix 3). Removal of well-site surface infrastructure (first row) is reported under well closure in Table 1.

Table 24: General surface rehabilitation costing summary.

Cost element	Rates	Notes
Removal of surface infrastructure, hardstanding and foundations	Removal of infrastructure @ R 3600.00 per hour, 4 hours per well site. Total rate per well is R 14 400.00; 48 well sites: R 691 200.00	Removal of all storage facilities, mobile offices and ablutions, equipment, vehicles, fences, etc.
Deep ripping / compaction alleviation	Compacted soil deep ripping @ R 600.00 per hour; 34 m of ripping per 10 m × 10 m well site at 500 m/h (~0.07 hour) Total rate per well site is R 40.80; 48 well sites (1 632 m): R 1 958.40	The following assumptions are made: • Deep ripping (more than 1m) and extreme compaction, • estimated speed of ripping - 500m per hour ripped - worst case/risk averse.



Cost element	Rates	Notes
		- assuming the ripping equipment is 3m wide - Assume 10x10 for well sites post drilling (area of fenced off well head) and depth of 1m
Revegetation	Revegetation and AIP control @ R 93 172.00 per event. The quote covers 9 well sites per event; 48 well sites = 6 events: R 559 032.00	While passive regrowth of indigenous plants and grazing grass is preferred, subject to landowner agreement, active revegetation will be required in areas where natural recovery is unsuccessful. This active intervention will consist of the following: - Seedbed preparation - Procurement of seed and plant material - Sowing and planting
Alien and Invasive Species Eradication		To ensure the successful eradication of alien and invasive species, the designated Alien Invasive Management Plan must be adhered to. Concurrent with revegetation efforts, targeted control of alien and invasive plant species will be implemented.
Plant demolition and removal	R 2 400 338.30 (process units, control room, flare, loading manifolds, pipe racks, stormwater channels, culverts, weighbridge, fire break and perimeter fence)	Plant footprint ~0.97 ha (128 m × 76 m); structures, foundations, flare, loading bays, control room; quantities from the final plant design
Evaporation pond and produced-water system closure	R 162 593.01 (produced-water tanks; pond dewatering, liner removal, excavation, shaping and silt trap)	625 m ² HDPE-lined pond and two produced-water tanks: residue and liner removal, classification and licensed disposal, soil testing, backfill and shaping
Gas gathering pipeline decommissioning	R 162 910.84 (low-point drains and pipe markers; pigging stations currently nil). Purging and capping and servitude reinstatement not yet costed	~28.8 km: purge and cap (pig only where liquids have collected); remove above-ground markers, low-point drains and valves; reinstate servitude; in-situ abandonment of buried HDPE
Office and maintenance workshop demolition	R 544 721.96 (guardhouse, mobile offices, offices and workshops)	Footprint to be confirmed from the final layout
Access road and track rehabilitation	R 64 041.58: plant access road and parking areas R 22 360.78 (contractor); well-site tracks 48 × 100 m × R 8.68 per m = R 41 680.80	~3.5 m wide tracks; length from the final layout (100 m per well site assumed, Section 4.5.5); rip, topsoil and revegetate



Cost element	Rates	Notes
Contamination assessment and remediation	Not yet costed – specialist quote required	Plant and pond footprint and waste storage areas; assessment against GN R331 (2014) before relinquishment
Demolition waste transport and disposal	R 2 049 389.99 (crushing and transport of concrete; transport of steel and general waste; disposal of general and hazardous waste)	General demolition waste to the Welkom general landfill site; hazardous waste assumed at 2% of general waste (contractor costing)
Infrastructure footprint rehabilitation	R 624 355.67 (rip, level and shape, import 0.15 m of topsoil and revegetate ~0.84 ha)	Plant, office, pond and road footprints after demolition (contractor costing)

4.12.4 MONITORING COST MODEL

Post-closure monitoring costs are accounted for in the Latent and Residual section. This section details the specific unit rates for these required monitoring activities.

Table 25: Monitoring costing summary.

Cost element	Rates	Notes
Surface water monitoring	Groundwater and surface water monitoring @ R 663 760.96 per sampling event, covering all 48 wells; 10 events (bi-annual for 5 years): R 6 637 609.60. Plant and evaporation-pond surface water (contractor): R 47 154.01 per year for 5 years = R 235 770.07.	Allowance has been made to conduct the surface water and groundwater monitoring (total of three samples per well cluster). It is assumed that it would take at least one man-day of an independent specialist (including the preparation of the sampling equipment) to conduct the sampling at these points. It has been assumed that surface water monitoring should continue at a bi-annual frequency for five (5) years post-closure.
Groundwater monitoring		It has been assumed that 2 groundwater monitoring boreholes would be required to reflect post-closure groundwater quality. Water Quality Monitoring is assumed to include sampling of 2 boreholes and 1 surface water site per well cluster. It has been assumed that groundwater monitoring should continue for five (5) years post-closure at a bi-annual frequency, in line with the closure costing.
Rehabilitation monitoring	Rehabilitation monitoring @ R 75 995.00 per event; 3 events (annual for 3 years): R 227 985.00 (well sites). Plant and infrastructure areas (contractor): rehabilitation monitoring R 23 069.97 and care and maintenance R 31 055.73 per year for 3 years: R 162 377.13.	Rehabilitation monitoring to be undertaken by an ecologist or EAP, annually for the first 3 years post-closure.



Cost element	Rates	Notes
Fugitive gas emissions monitoring	Fugitive gas emissions monitoring @ R 72 371.23 per monitoring event; the quote covers 9 wells, so 48 wells = 6 rounds per event × 10 events (every 5 years for 50 years): R 4 342 273.80.	The surface methane gas monitoring is undertaken for a period of 50 years at a frequency of 5 years for each well. All 48 abandoned wellsites are surveyed at each event (GN 6807 item F.13). This can be undertaken through appropriate sampling techniques, either soil vapour probes or surface methanometers. It is assumed that one man-day would be required to conduct a monitoring event (including preparation, site establishment, equipment hire ex.).

4.12.5 FINANCIAL PROVISION QUANTUM SUMMARY

Table 26: Financial provision quantum summary.

	2025		2026	
	Unscheduled	Scheduled	Unscheduled	Scheduled
Final Decommissioning and Closure Cost	n/a	n/a	R 29 797 125.73	R 29 760 753.97
- Well Closure	n/a	n/a	R 15 906 491.31	R 15 906 491.31
- General Surface Rehabilitation	n/a	n/a	R 6 569 341.76	R 6 569 341.76
- P&Gs and contingencies	n/a	n/a	R 7 321 292.66	R 7 284 920.90
Annual Rehabilitation Cost	n/a	n/a	R 181 858.80	R 0.00
Post closure Phase - Residual and Latent Cost	n/a	n/a	R 13 153 584.51	R 13 153 584.51
- Monitoring	n/a	n/a	R 11 606 015.59	R 11 606 015.59
- Latent and residual risk provision (redrill and plugging of wells)	n/a	n/a	R 1 547 568.92	R 1 547 568.92
Total quantum of Financial Provision (Excl VAT)	n/a	n/a	R 43 132 569.04	R 42 914 338.48



4.13 MONITORING, AUDITING AND REPORTING REQUIREMENTS

The monitoring, auditing and reporting requirements address the risk assessment, legal requirements and knowledge gaps: an audit schedule (responsible person, dates, frequency and close-out approach), a reporting schedule (internal/external, including stakeholder disclosure), and a monitoring plan (parameters, frequency, period, and how results inform corrective management). The environmental indicators, targets and monitoring per impact are tabulated below and inform whether the closure objectives have been met.



Table 27: Monitoring, auditing and reporting requirements summary.

Aspect	Impact	Responsible Party	Frequency	Indicator	Closure target
Groundwater	Contamination by saline water, stray gas or seepage from plant/pond	D3 Energy; independent hydrogeologist	Bi-annually for 5 years after decommissioning, then per trend	EC, TDS, pH, major ions (Cl, Na, SO ₄), dissolved methane and water levels in monitoring and private boreholes	No statistically significant deterioration against the pre-development baseline
Surface water	Contamination and sedimentation	D3 Energy; independent specialist	Bi-annually for 5 years after decommissioning	pH, EC, TSS and hydrocarbons, upstream and downstream	Downstream quality consistent with upstream and baseline
Fugitive gas (air quality)	Methane release from abandoned wells	D3 Energy; gas specialist	Every 5 years for 50 years after abandonment	Surface methane concentration or flux at each abandoned wellsite	No sustained emission attributable to the well above background
Well integrity	Loss of containment / cross-flow	Well engineer	At P&A of each well	Tag and pressure-test results; cement bond logs	All barriers verified per Section 4.7.2
Rehabilitation and biodiversity	Failed revegetation, erosion, alien invasive species	ECO / ecologist	Annually (mid-wet season) for 3 years after rehabilitation	Basal cover, species composition, erosion features, alien invasive cover	Cover and composition consistent with adjacent reference veld; no active erosion; alien invasives controlled
Soils and land capability	Loss of land capability; residual contamination	Soil scientist	Once at closure, then with rehabilitation monitoring	Topsoil depth, compaction, fertility, contaminants	Pre-disturbance land capability restored; below GN R331 screening values
Heritage	Damage to heritage features during closure	ECO	During closure earthworks	Buffer compliance; chance finds	No damage; all finds reported



Waste and infrastructure	Residual waste or structures	ECO	At closure	Waste disposal certificates; site inspection	No waste or unapproved structures on site
Social	Unresolved grievances	Social champion	Ongoing; reported annually	Grievance register	All closure-related grievances closed out

Table 28: Audit schedule for the FRDCP.

Audit	Responsible person	Frequency / planned date	Close-out approach
Internal review of the FRDCP, ARP and ERA	D3 Energy closure champion	Annually, before the FP update (first within 12 months of the PR/EA being granted)	Findings logged in a corrective-action register with owner and due date; verified at the next review
Independent audit of the adequacy of the financial provision (GN R1147 Reg. 11)	Independent auditor appointed by D3 Energy	Annually	Auditor's report submitted with the annual update; any shortfall in the provision corrected
EMPr and EA compliance audit	Independent environmental auditor	At the frequency specified in the EA	Report to the competent authority and made available to I&APs; non-conformances closed out through the corrective-action register
ECO compliance inspections	ECO	Monthly during construction and drilling; quarterly during operation	Issues closed within agreed timeframes and reported in the next ECO report



Audit	Responsible person	Frequency / planned date	Close-out approach
Post-closure inspections	Independent specialist	Annually for 5 years after decommissioning, then every 5 years until relinquishment	Remedial action list in each report, tracked to completion

Table 29: Reporting schedule and stakeholder disclosure.

Report	Recipient	Frequency	Disclosure
Annual FP update (FRDCP, ARP and ERA)	DMPR (via PASA)	Annually	Notice to registered I&APs and landowners; copy on request or on the project website
Independent FP adequacy report	DMPR	Annually, with the FP update	On request
EMPr/EA audit report	Competent authority	Per the EA	Made available to I&APs
ECO reports	D3 Energy management; authority on request	Monthly / quarterly	Internal
Post-decommissioning environmental reports	Regulator and stakeholders	Annually for 5 years, then 5-yearly (Section 4.7.4)	Landowners of affected properties
Closure certificate application (MPRDA Section 43)	DMPR Regional Manager	Within 180 days of cessation	Landowners and I&APs notified



Monitoring results are compared against the baseline and targets above after each event. Any exceedance or adverse trend triggers a root-cause investigation, corrective or adaptive management (e.g. remedial revegetation, erosion repair, well re-entry) and, where relevant, escalation to the latent-risk response in Section 6.

4.14 MOTIVATIONS FOR AMENDMENTS BASED ON MONITORING OUTCOMES AND IDENTIFIED GAPS

This section records the motivation for any amendments to the plan arising from the previous period's monitoring results and the gaps identified (GNR1147 Appendix 4, 3(m)).

This is the first (baseline) FRDCP for the Production Right, prepared for the EIA application, so no amendments arise from previous monitoring or audits. Future updates will record changes in well count and status, final layout, monitoring outcomes, contractor rates and escalation, regulatory changes (including promulgation of the Onshore Well Decommissioning Guidelines) and gap close-out.



5 SECTION B: ANNUAL REHABILITATION PLAN

The Annual Rehabilitation Plan (ARP) aims 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-production 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.

The purpose of an ARP report is to provide a record containing the relevant information regarding concurrent rehabilitation and remediation activities for the site for the forthcoming 12 months and how these relate to the operation's closure vision, as detailed in the final rehabilitation, decommissioning and mine/production closure plan. The ARP also indicates what closure objectives and criteria are being achieved through the implementation of the plan.

5.1 ENVIRONMENTAL AND PROJECT CONTEXT FOR THE ANNUAL ACTIVITIES

The PR and EA have not yet been granted and no PR activities have started, so no rehabilitation has taken place under this ARP; areas disturbed under ER315 remain covered by the ER315 ARP. The environmental and project context is in Sections 4.1 and 4.2. Specific to the forthcoming 12 months, and assuming authorisation within that period:

- Planned activities: the first drilling campaign (the 13 new Virginia-fault wells, from 2027), and the start of pipeline and plant construction.
- Seasonal window: seed after the first spring rains (October to December); handle soils in the dry winter months; have erosion control in place before the summer storms.
- Access constraints: signed landowner access agreements before any disturbance; heritage (30 m / 50 m) and watercourse (32 m / 15 m) buffers; co-existence arrangements with solar PV developers.
- Well status: no PR wells drilled yet; the three existing Virginia-fault wells are to be incorporated once their records are verified.

5.2 MONITORING RESULTS INFORMING REHABILITATION AND REMEDIATION

Appendix 3(c). Summarise monitoring results against the risk register (Section 4.4) and the monitoring plan (Section 4.13) that are relevant to rehabilitation and remediation planning for the forthcoming 12 months:

- Groundwater monitoring: no PR monitoring yet. A hydrocensus within 500 m of each drill site and baseline sampling are to be completed before drilling.
- Surface water monitoring: no PR monitoring yet. Baseline samples upstream and downstream of planned drill sites and pipeline crossings are to be taken before construction.
- Fugitive gas emissions: no PR wells drilled. A baseline gas survey of the three existing wells and nearby legacy blowers is recommended before they are incorporated.
- ECO reports: none under the PR yet; the ECO is to be appointed before construction.
- Rehabilitation progress: none – no PR disturbance to date.



5.3 SHORTCOMINGS IN THE PRECEDING 12 MONTHS

Appendix 3(d). Identify shortcomings against the previous ARP. This is the first ARP for the PR, so there is no preceding 12-month period to review.

5.4 PLANNED ANNUAL REHABILITATION AND REMEDIATION ACTIVITIES

Planned concurrent rehabilitation and remediation for the forthcoming 12 months (subject to authorisation). No shortcomings or monitoring results need to be addressed yet.

- Rehabilitate each drill pad within six months of drilling: remove equipment and waste, empty and backfill the sump, replace topsoil, rip and revegetate; keep only the fenced wellsite at productive wells.
- Plug and rehabilitate any exploration wells not converted to production.
- Reinstall pipeline trenches progressively and revegetate the working width.
- Control alien invasive plants on all disturbed areas.
- Establish the groundwater and surface-water baseline and monitoring network.

5.4.1 AVAILABILITY OF AREAS FOR CONCURRENT REHABILITATION

No areas are currently available for concurrent rehabilitation under the PR because no PR activities have started. Once development begins, areas become available as shown below (indicative, forthcoming 12 months).

Planned disturbance and concurrent rehabilitation, referenced by activity (Ref) across both tables:

Table 30: Planned disturbance and availability for concurrent rehabilitation (forthcoming 12 months).

Ref	Activity / infrastructure	Remaining life	Area disturbed this period	% available for concurrent rehab.	% on which rehab. undertaken	Notes (why totals differ / why not full area)
1	Drill pads and sumps (first campaign, 13 new wells)	Pad: weeks (1–2 weeks drilling per well); wellsite ≥30 years if productive	Up to 3.25 ha (13 × 0.25 ha)	All but the fenced wellsite (>95%)	100% of available	Fenced wellsite retained until closure
3	Gathering pipeline trenches (initial Virginia-fault network)	≥30 years (buried)	TBC	100% of working width after backfill	100%	10 m servitude kept free of woody plants
3	Plant site (construction)	≥30 years	~1.5 ha cleared (0.97 ha fenced)	~35% (cleared area outside the fence)	100% of available	Fenced plant closed at end of life
4	New access tracks	Life of operation	~0.46 ha (13 well sites × 100 m × 3.5 m, assumed)	0%	0%	In use until closure or



Ref	Activity / infrastructure	Remaining life	Area disturbed this period	% available for concurrent rehab.	% on which rehab. undertaken	Notes (why totals differ / why not full area)
			in the costing)			retained by agreement

Table 31: Planned rehabilitation activities, closure objectives and design criteria.

Ref	Rehabilitation activity planned this period	Closure objective / target addressed	Closure design criteria & expected final land use
1	Remove equipment and waste; empty and backfill sump; replace topsoil; rip; revegetate	Land revegetation; protection (Section 4.5.2)	Free-draining pad, topsoil by soil form, indigenous grass cover; grazing or cropland
3	Backfill in soil order; compact to limit subsidence; replace topsoil; revegetate	Land usable; erosion control	Unrestricted grazing or cropping over the pipe
3	Rehabilitate cleared area outside the fence; stormwater control	Erosion control; revegetation	Grazing
4	None this period	–	Rehabilitated at closure or retained by agreement

The areas planned for disturbance are shown on the proposed layout (Figure 2). A site plan of actual disturbed, available and rehabilitated areas per activity will be included from the first ARP after activities start.

5.5 REVIEW OF THE PREVIOUS YEAR'S ANNUAL REHABILITATION AND REMEDIATION ACTIVITIES

Not applicable – this is the first ARP for the PR, so there is no previous year to review.

Table 32: Review of the previous year's rehabilitation.

Activity / area	Planned (ha / m)	Actual (ha / m)	Variance (%)	Motivation if >15%
No previous ARP under the PR	n/a	n/a	n/a	n/a

5.6 ARP COSTING

This section records the ARP-specific figures for the forthcoming 12 months and the cumulative monitoring/maintenance carry-forward.



Table 33: ARP costing.

Activity (ref. Section 20)	Cost this ARP (R)	Cumulative monitoring/ maintenance carried forward (R)	Total this ARP (R)
Drill pad and sump rehabilitation (Ref 1)	R 181 858.80	R 0 (first ARP)	R 181 858.80
Pipeline trench reinstatement (Ref 2)	Not yet costed	R 0	Not yet costed
Plant site – cleared area outside the fence (Ref 3)	Not yet costed	R 0	Not yet costed
Baseline and monitoring (groundwater, surface water, rehabilitation)	Not yet costed	R 0	Not yet costed
	Total ARP cost		R 181 858.80

Monitoring and maintenance costs in this and each subsequent ARP are accumulated until the obligation is discharged (GN R1147 Appendix 3(g)(iv)); none are carried forward in this first ARP. Costs exclude P&Gs and contingencies (10% each), which are included in the P&G and contingency rows of Table 1. Pipeline trench reinstatement, the plant-site cleared area and baseline monitoring have not yet been costed; their quantities depend on the final layout and construction programme.



6 SECTION C: ENVIRONMENTAL RISK ASSESSMENT

The Environmental Risk Assessment (ERA) determines the financial liability associated with managing latent environmental impacts that may only become apparent after relinquishment criteria have been met and a Closure Certificate has been issued. For wells, the latent risk of most consequence is a loss of containment or cross-flow that was not detectable at the point of relinquishment — for example gradual barrier degradation, or an aquifer impact with a long subsurface transport time — as distinct from the pre-closure design risk already addressed and reassessed in Section 4.

The primary objective of Part C is to: identify and quantify potential latent risks; develop risk management strategies for their timely mitigation; quantify the associated financial liability; and establish a monitoring, auditing and reporting framework.

Table 34: ERA (GN R 1147 - Appendix 5) content requirements and where they are addressed.

No.	Requirements	Section
3(a)	Details of- (iii). the person or persons that prepared the plan; (iv). the professional registrations and experience of the preparers;	Section 3
3(b)	details of the assessment process used to identify and quantify the latent risks, including- (viii). a description of the risk assessment methodology inclusive of risk identification and quantification; (ix). substantiation why each risk is latent, including why the risk was not or could not be mitigated during concurrent rehabilitation and remediation or during the implementation of the final rehabilitation, decommission and closure plan; (x). a detailed description of the drivers that could result in the manifestation of the risks, to be presented within the context of closure actions already having been implemented during the execution of concurrent rehabilitation or during the implementation of the final rehabilitation, decommission and closure plan; (xi). a description of the expected timeframe in which the risk is likely to manifest, typically as expected years after closure, and the duration of the impact, including motivation to support these timeframes; (xii). a detailed description of the triggers which can be used to identify that the risk is imminent or has manifested, how this will be measured and any cost implications thereof; (xiii). results and findings of the risk assessment; (xiv). an explanation of changes to the risk assessment results as applicable in annual updates to the plan;	Section 6.1
3(c)	management activities, including- (v). monitoring of results and findings, which informs adaptive or corrective management and/or risk reduction activities; (vi). an assessment of alternatives to mitigate or manage the impacts once the risk has become manifested, which must be focussed on practicality as well as cost of the implementation;	Section 6.2



No.	Requirements	Section
	(vii). motivation why the selected alternative is the appropriate approach to mitigate the impact; (viii). a detailed description of how the alternative will be implemented;	
3(d)	costing, calculated using the current value of money and no discounting or net present value calculations included in the determination of the quantum of the liability, including- (iv). a cost estimation, which must include- (aa) an explanation of the closure cost methodology; (bb) an auditable calculations of costs per activity or infrastructure; (cc) cost assumptions; (dd) monitoring costs post closure to determine whether the risk is imminent or has manifest are to be included in the assessment as are monitoring costs likely to be incurred during the implementation of the strategy to manage or mitigate the impacts once the risk has become manifest; (v). where appropriate, a differentiation between capital, operating, replacement and maintenance costs; (vi). cost estimates for operations, or components of operations that are more than 30 years from closure prepared as conceptual estimates within an accuracy of ± 50 per cent. Cost estimates will have an accuracy of ± 70 per cent for operations, or components of operations, 30 or less years (but more than ten years) from closure and ± 80 per cent for operations, or components of operations ten or less years (but more than five years) from closure. Operations with 5 or less years will have an accuracy of ± 90 per cent. Motivation must be provided to indicate the accuracy in the reported number and as accuracy improves, what actions resulted in an improvement in accuracy; and	Section 6.3
3(e)	Monitoring, auditing and reporting requirements, which must include requirements prior to the manifestation of the risk and impacts as well as those once the impacts resulting from the manifestation of the risk are realised, inclusive of the approach that will be taken to analyse monitoring results and how these results will be used to inform adaptive or corrective management and/or risk reduction activities.	Section 6.4

6.1 IDENTIFICATION AND QUANTIFICATION OF LATENT RISKS

Appendix 5(b). This is the assessment of risk that survives closure and relinquishment — distinct from the pre-closure design-stage risk assessment in Section 4, which this section cross-references rather than repeats.

Methodology (Appendix 5(b)(i)): latent risks were identified by carrying the EIAr impact assessment (EIAr Section 9.1) and the geohydrological source–pathway–receptor model forward to the period after relinquishment, and asking which closure-phase risks cannot be shown to be fully mitigated when the closure certificate is issued. Each risk is quantified as the cost of the monitoring needed to detect it plus the cost of the response if it manifests, multiplied by the expected number of occurrences (for well-barrier failure, 3.4% of wells).

Table 35: Latent risks and why they could not be mitigated at closure.

Latent risk	Why not mitigable during P&A / concurrent rehabilitation	Related well(s)/zone(s)
Gas migration from degraded well barriers	Long-term performance of cement and casing over decades cannot be	All 48 abandoned wells; reservoir and Karoo sections



Latent risk	Why not mitigable during P&A / concurrent rehabilitation	Related well(s)/zone(s)
	proven at abandonment; only monitoring over time can confirm it	
Saline cross-flow into shallow aquifers	Travel times along faults and dyke contacts may exceed the 5-year post-closure water-monitoring period	Wells near the Virginia, Ventersburg and inferred east-west faults
Residual contamination at plant, pond and waste areas	Slow-migrating salts, hydrocarbons or NORM may not be detected in the pre-relinquishment assessment	Plant and evaporation-pond footprint; down-gradient boreholes
Pipeline trench subsidence and residual condensate	Settlement and pipe degradation continue for years after decommissioning	~28.8 km gathering network left in situ

Drivers (Appendix 5(b)(iii)), given the closure actions already implemented: cement shrinkage, cracking or de-bonding and casing corrosion in contact with saline formation water; pressure recharge of the Witwatersrand reservoir after abandonment; seismic events, including mining-related seismicity in the Free State goldfields; drilling or mining near abandoned wells; land-use change such as deep ploughing, solar PV foundations or piling over pipelines and wells; and extreme rainfall (a 1:20-year wet year of ~774 mm) accelerating trench subsidence and erosion

Table 36: Expected timeframe and duration.

Latent risk	Expected timeframe (years after closure)	Duration of impact	Motivation for timeframe
Gas migration from degraded well barriers	5–50	Until re-plugged	Barriers degrade slowly; basis for 5-yearly gas surveys over 50 years
Saline cross-flow into shallow aquifers	5–30	Decades established once	Low recharge (~17.5 mm/a) and fractured-rock flow give long travel times
Residual contamination at plant, pond and waste areas	1–10	Until remediated	Detectable within post-closure monitoring once sources are removed
Pipeline trench subsidence and residual condensate	1–10	Until repaired	Settlement mostly in the first wet seasons; pipe degradation later



Table 37: Risk triggers.

Latent risk	Trigger / threshold	Measurement method	Cost implication if triggered
Gas migration from degraded well barriers	Methane at an abandoned wellsite above background, or gas reported in nearby boreholes	Soil-gas probes, surface methane survey or optical gas imaging	Well re-entry and re-plugging (redrill rates, Section 4.12.2)
Saline cross-flow into shallow aquifers	Statistically significant rise in EC, TDS, chloride or dissolved methane above baseline trigger values in monitoring or private boreholes	Groundwater sampling (bi-annual for 5 years, then per trend)	Investigation boreholes, well re-entry, alternative water supply to affected users
Residual contamination at plant, pond and waste areas	Exceedance of GN R331 soil screening values or baseline groundwater quality down-gradient of the plant or pond	Closure contamination assessment; down-gradient borehole sampling	Excavation and licensed disposal; possible pump-and-treat
Pipeline trench subsidence and residual condensate	Visible subsidence, ponding or erosion along the route; gas at pipe ends	Annual inspections for 5 years after decommissioning	Trench repair, backfill, revegetation; re-sealing

Results and findings (Appendix 5(b)(vi)): the material latent risk is barrier degradation at abandoned wells, leading to gas or saline-water migration into shallow aquifers that local households and farms rely on. The other latent risks are smaller and can be managed within the post-closure monitoring period. Changes (Appendix 5(b)(vii)): not applicable – this is the first ERA for the PR; changes will be recorded here in each annual update.

6.2 MANAGEMENT ACTIVITIES

Appendix 5(c).

6.2.1 MONITORING AND ADAPTIVE MANAGEMENT

Monitoring of results informs adaptive or corrective management and/or risk-reduction activities (Appendix 5(c)(i)) — see the monitoring plan in Section 6.4.

Table 38: Alternatives to mitigate a manifested risk.

Latent risk	Alternative(s) to mitigate/manage once manifest	Practicality	Indicative cost
Gas migration from degraded well barriers	Re-enter and re-plug (drill out the surface plug, remedial cementation); or monitored natural	High (proven method)	R 773 784.46 per well (2 wells: R 1 547 568.92)



Latent risk	Alternative(s) to mitigate/manage once manifest	Practicality	Indicative cost
	attenuation where emission is negligible		
Saline cross-flow into shallow aquifers	Re-enter and remediate the well; alternative water supply to affected users; monitored natural attenuation	Medium	Included in the re-entry cost above; alternative water supply not costed
Residual contamination at plant, pond and waste areas	Excavate and dispose of contaminated soil; pump-and-treat if groundwater is affected	Medium to high	Not yet costed – specialist quote required
Pipeline trench subsidence and residual condensate	Backfill and compact the trench, repair erosion, revegetate; re-seal pipe ends	High	Not yet costed

Motivation (Appendix 5(c)(iii)): re-entry and re-plugging is selected for well-related risks because it removes the pathway and can be verified by pressure testing, whereas monitored natural attenuation leaves the pathway open and alternative water supply is only a short-term measure. For contamination and trench risks, excavation and physical repair are practical and low-cost at the expected scale.

Implementation (Appendix 5(c)(iv)): if a trigger is exceeded, the holder confirms the result by re-sampling within 30 days; an independent specialist investigates the source; the well engineer prepares a re-entry programme for PASA approval, or the rehabilitation specialist a remediation plan; a specialist contractor carries out the work, which is verified by pressure testing or follow-up sampling; and affected landowners and the regulator are informed and the ERA and provision updated

6.3 ERA COSTING

Appendix 5(d). This section is the complete ERA-specific costing record; it follows the cost methodology in Section 4.12. Costs are in current-day rand with no discounting or net present value, using the rates in Section 4.12 and the costing sheet (Appendix 3). Both the monitoring needed to detect whether a risk is imminent (Section 6.4) and the cost of responding once it manifests are included. Assumptions: 3.4% of wells (2 of 48, rounded up) need re-entry; gas surveys every 5 years for 50 years; groundwater monitoring bi-annually for 5 years after closure. The monitoring costs in Tables 39 and 40 are the post-closure monitoring items in Table 1 and are not additional to them; the latent and residual risk provision in Table 1 covers re-entry and re-plugging of 2 wells. The plant/pond contamination and pipeline-trench latent risks have not yet been costed and will be added once rates are obtained.



Table 39: Latent risk cost summary.

Latent risk	Monitoring cost (pre-manifestation, R/yr)	Management cost (if manifested, R)	Basis / assumptions
Gas migration from degraded well barriers	R 86 845.48 (R 4 342 273.80 over 50 years)	R 1 547 568.92	2 wells (3.4% of 48, rounded up) × R 773 784.46 re-entry and re-plugging; gas surveys every 5 years for 50 years (10 events × 6 rounds × R 72 371.23)
Saline cross-flow into shallow aquifers	R 1 327 521.92 (R 6 637 609.60 over 5 years)	Included in risk 1	Bi-annual groundwater sampling for 5 years; response shared with risk 1
Residual contamination at plant, pond and waste areas	R 47 154.01 (plant and pond surface-water monitoring; R 235 770.07 over 5 years)	Not yet costed	One hotspot at the plant/pond footprint (assumed); rate outstanding
Pipeline trench subsidence and residual condensate	Not yet costed	Not yet costed	~1.4 km trench repair (assumed); annual inspection for 5 years; rates outstanding

Table 40: Latent risk cost differentiation.

Latent risk	Capital (R)	Operating (R)	Replacement (R)	Maintenance (R)
Gas migration from degraded well barriers	R 1 547 568.92	R 4 342 273.80	n/a	n/a
Saline cross-flow into shallow aquifers	Included in risk 1	R 6 637 609.60	n/a	n/a
Residual contamination at plant, pond and waste areas	Not yet costed	R 235 770.07	n/a	n/a
Pipeline trench subsidence and residual condensate	n/a	Not yet costed	n/a	Not yet costed

Accuracy (Appendix 5(d)(iii)): the bands in Section 4.12.1 apply. The latent-risk provision relates to the period after closure of an operation with a life of at least 30 years, so it is a conceptual estimate (±50%).



6.4 MONITORING, AUDITING AND REPORTING

Appendix 5(e). Extends the Section 13 audit/reporting cadence and the Section 13.3 post-abandonment survey and aquifer monitoring into the ongoing test of whether each latent risk is imminent or has manifested:

Table 41: ERA monitoring, auditing and reporting.

Latent risk	Parameters monitored	Frequency	Phase	Escalation / analysis approach
Gas migration from degraded well barriers	Surface methane / soil gas at each abandoned wellsite	Every 5 years for 50 years	Before manifestation	Compare with background (Section 6.1); if exceeded, re-survey within 30 days and escalate to re-entry (Section 6.2)
Gas migration from degraded well barriers (after re-plugging)	Gas survey and pressure test	After re-plugging, then annually until three clean results	After manifestation	Confirm success; update the ERA and provision
Saline cross-flow into shallow aquifers	EC, TDS, chloride, dissolved methane and water levels	Bi-annually for 5 years, then per trend	Before manifestation	Trend analysis against baseline; exceedance triggers investigation
Residual contamination at plant, pond and waste areas	Soil and groundwater quality down-gradient of the plant and pond	At closure, then annually for 5 years	Before manifestation	Compare with GN R331 screening values and baseline
Pipeline trench subsidence and residual condensate	Trench condition, erosion and gas at pipe ends	Annually for 5 years	Before manifestation	Repair defects; extend inspections if defects recur



Appendix 1: Specialist CVs

Appendix 2: Farm Names

Appendix 3: Costings

Appendix 4: Impact Assessment Methodology