DEPARTMENT OF FORESTRY, FISHERIES AND THE ENVIRONMENT

NO. 6811 **7 November 2025**

NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998
(ACT NO. 107 OF 1998)

CONSULTATION ON THE INTENTION TO PRESCRIBE MINIMUM INFORMATION REQUIREMENTS FOR BASELINE MONITORING FOR ONSHORE EXPLORATION OPERATIONS

I, Dion Travers George, Minister of Forestry, Fisheries and the Environment, hereby consult on the intention to prescribe Minimum Information Requirements for Baseline Monitoring for Onshore Exploration Operations, Revision 1, October 2025 in terms of section 24(5)(h) of the National Environmental Management Act, 1998 (Act No. 107 of 1998). These draft Minimum Information Requirements are published simultaneously with, and are intended to support, the proposed Regulations for the Exploration and Production of Onshore Petroleum Resources Requiring Fracturing Technology, 2025.

This Notice contains a revised version of the draft Minimum Requirements for the Submission of Applications for an Authorisation, Right, Permit or License for the Onshore Exploration of Oil or Gas Intending to Utilise Hydraulic Fracturing, Revision 0 May 2022 contained in Government Notice No. 2265 published on 8 July 2022 in Government *Gazette* No. 46688 for public comment and reflects the incorporation of amendments made based on the first call for public comment.

Members of the public are invited to submit written comments or input, within 30 days from the date of the publication of this notice in the Government *Gazette*, or a notification in a newspaper, whichever occurs last, to any of the following addresses:

By post to: Department of Forestry, Fisheries and the Environment
The Director-General
Attention: Mr Simon Moganetsi
Private Bag X447
PRETORIA
0001

By hand at: Reception, Environment House, 473 Steve Biko Road, Arcadia, Pretoria.
By e-mail: Smoganetsi@dffe.gov.za.
Any enquiries in connection with the notice can be directed to Mr Simon Moganetsi at 012 399 9309 or by mail at Smoganetsi@dffe.gov.za.
A hard copy of any notice or document associated with this Government *Gazette* can be requested from Ms M Masondo at email: mmasondo@dffe.gov.za or collected at the Department's physical address as indicated above. The documents can be downloaded from the Department's website at https://www.dffe.gov.za/projectprogrammes/environmental_management_instruments and the

Government Notice can be downloaded from the Department's website at https://www.dffe.gov.za/legislation/gazetted_notices.

Comments or input received after the closing date may be disregarded.

The Department of Forestry, Fisheries and the Environment complies with the Protection of Personal Information Act, 2013 (Act No. 4 of 2013). Comments received and responses thereto are collated into a comments and response report which will be made available to the public as part of the consultation process. If a commenting party has any objection to his or her name, or the name of the represented company/ organisation, being made publicly available in the comments and responses report, such objection should be highlighted in bold as part of the comments submitted in response to this Government Notice.

DR DION TRAVERS GEORGE
MINISTER OF FORESTRY, FISHERIES AND THE ENVIRONMENT

SCHEDULE

1. The Department of Forestry, Fisheries and the Environment has, through an inter-governmental drafting process, developed the draft Minimum Information Requirements for Baseline Monitoring for Onshore Exploration Operations, Revision 1 October 2025 (MIRs for Baseline Monitoring) which supports the proposed Regulations for the Exploration and Production of Onshore Petroleum Resources Using Fracturing Technology.

2. The MIRs for Baseline Monitoring focusses on the onshore exploration of petroleum intending to utilise fracturing technology and has been developed with the following objectives, namely to-
   2.1. collect baseline monitoring data for the identified environmental themes;
   2.2. identify and consolidate the assessment and reporting requirements of all relevant decision-making authorities into one document;
   2.3. facilitate the combination of the information prepared in line with these MIRs for Baseline Monitoring into one consolidated assessment report and baseline monitoring plan to inform decision-making by all relevant decision-making authorities;
   2.4. facilitate consultation with stakeholders on the consolidated assessment report and baseline monitoring plan through one integrated public particiaption process;
   2.5. facilitate the submission of the consolidated assessment report, baseline monitoring plan and environmental management programme to all decision-making authorities for decision making.

3. The MIRs for Baseline Monitoring can be accessed at https://www.dffe.gov.za/projectprogrammes/environmental_management_instruments and the Government Gazette Notice can be downloaded from the Department's website at https://www.dffe.gov.za/legislation/gazetted_notices

forestry, fisheries & the environment

Department:
Forestry, Fisheries and the Environment
REPUBLIC OF SOUTH AFRICA

October 2025, Revision 1

Minimum Information Requirements for Baseline Monitoring for Onshore Exploration Operations

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Definitions

"animal" means a particular kind of living organism, one that can move voluntarily and can find and digest food and includes birds and insects;

"consolidated assessment report" means the report contemplated in regulation 8(2)(a) of the draft NEMA Fracturing Regulations;

"cumulative impact" means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities;

"designated agency" means the agency designated in terms of section 70 of the Mineral and Petroleum Resources Development Act, 2002;

"Environmental Impact Assessment Regulations" means the regulations published in terms of sections 24(5) and 44 of the Act;

"environmental permissions" means the relevant rights, permits, authorisations and licences that must be obtained by the developer prior to the exercising of an exploration right to which these minimum information requirements relate and include:

(a) an exploration right issued in terms of sections 80 of the Mineral and Petroleum Resources Development Act, 2002;
(b) a heritage permit issued in terms of Chapter 2 of the National Heritage Resources Act, 1999, or a written approval issued in terms of Chapters 8 and 9 of the Kwa-Zulu Natal Amafa and Research Institute Act 2018 (Act No. 5 of 2018) where relevant;
(c) an environmental authorisation issued for activity 21C of Listing Notice 1 of the Environmental Impact Assessment Regulations, 2014;
(d) a water use licence issued in terms of the National Water Act, 1998 (Act No. 36 of 1998); and
(e) approval from the Minister responsible for Mineral Resources of the plans, reports, templates, spreadsheet and the determination of financial provision as contemplated in the Financial Provisioning Regulations;

"exploration" means any activity which includes onshore 2-D and 3-D seismic investigations and which could include the drilling of exploration wells, with the intention of locating a petroleum reserve;

"exploration well" means a stratigraphic well drilled for the purpose of obtaining specific geological and geophysical information to prove, define and assess the existence and commerciality of a petroleum reserve;

"Financial Provisioning Regulations" means the Financial Provisioning Regulations published in terms of section 44(1)(aE), (aF), (aG), (aH) read with sections 24(5)(b)(ix), 24(5)(d), 24N, 24P, 24PA and 24R of the Act;

"flow back" means fracturing additives and other fluids that return to the surface after fracturing has been completed;

“fracturing” means an intervention performed on a well to increase production by improving the flow of petroleum including coal bed methane from the drainage area into the well bore and includes re-fracturing;

"fracturing fluid" means the mixture of the base fluid and the fracturing additives used to stimulate the free flow of a petroleum reserve;

“**incidental activity**” includes all operations and activities reasonably necessary for undertaking an exploration and production activity;

“Minimum Information Requirements for Baseline Monitoring for Onshore Exploration Operations” means the minimum information requirements for the baseline monitoring that is to be undertaken prior to fracturing operations being undertaken in an onshore exploration operation published in terms of section 24(5)(h) of the Act;

“Minimum Information Requirements for the Exploration and Production of Onshore Petroleum Using Fracturing Technology” means the minimum information requirements for the impact assessment for onshore exploration and production using fracturing technology published in terms of section 24(5)(h) of the Act;

“petroleum” has the meaning assigned to it in the Mineral and Petroleum Resources Development Act, 2002;

“production operation” means any operation, activity or matter that relates to the onshore exploration, appraisal, development and production of petroleum;

“screening report” means the report prepared by the national web based environmental screening tool accessible at https://screening.environment.gov.za;

“national web based environmental screening tool” means the online spatial application contemplated in the Environmental Impact Assessment Regulations available at https://screening.environment.gov.za/screeningtool;

"seismic monitoring" means the monitoring of seismic activity using a network of calibrated seismological equipment in order to produce readings on magnitude, depth, location, error and time of each seismic event;

“site” means the area within which the exploration activity will be undertaken; and

“study area” means the site as well as the area beyond the site where the operations could impact the environment and which must be determined by the relevant specialist for each environmental theme with a focus on areas to be considered for fracturing and production operations.

Abbreviations

2-D	two dimensional
3-D	three dimensional
CA	competent authority
CH_4	Methane
CO	Cobalt
CV	curriculum vitae
C_6H_6	Benzene
DA	designated agency
DMPR	Department of Mineral and Petroleum Resources
DWS	Department of Water and Sanitation
EAP	environmental assessment practitioner
EIA	environmental impact assessment
EIA Regulations	Environmental Impact Assessment Regulations
EMPr	environmental management programme
EWT	Endangered Wildlife Trust
H_2S	Hydrogen sulphide
HIA	heritage impact assessment
I&APs	interested and affected parties
MIR	Minimum Information Requirement
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NEM:BA	National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
NGO	non-governmental organisation
NHRA	National Heritage Resources Act, 1999 (Act No. 48 of 1999)
NO_2	Nitrogen dioxide
NOx	Nitrogen oxides
NWA	National Water Act, 1998 (Act No. 36 of 1998)
O_3	Ozone
PAHs	Polycyclic aromatic hydrocarbons
PASA	Petroleum Agency SA
Pb	Lead
PM_{10}	Particulate matter includes particles less than 10 µm in diameter
$PM_{2.5}$	Particulate matter includes particles less than 2.5 µm in diameter
SAHRA	South African Heritage Resources Agency
SEA	strategic environmental assessment
SO_2	Sulfur dioxide
SVOCs	Semi-volatile organic compounds
VOCs	Volatile organic compounds
WGS84	a reference system used by the satellite navigation systems like GPS and used in various mapping applications

i) Preamble

Petroleum exploration and production is a complex, capital intensive process which can have a significant impact on the environment should the necessary environmental precautionary and management measures not be in place. In line with the complexity of the process, several government authorities are involved with the management of the associated environmental impacts through the various licence, permit and authorisation requirements, jointly referred to as environmental permissions, of the respective decision-making departments.

Due to the number of environmental permissions required and the lengthy and complicated process to obtain such permissions, Cabinet, through the *National Development Plan* and Parliament, through the *Report of the High Level Panel on the Assessment of Key Legislation and the Acceleration of Fundamental Change*, called for a coordinated and synchronised approach to the issuing of the various environmental permissions to avoid overlaps and unnecessary duplication which leads to time delays and excessive costs for developers. The issuing of environmental authorisations[1], water use licences[2], heritage permits[3] and exploration and production rights[4] were specifically identified as needing a coordinated effort.

The integration of environmental permissions is provided for in the National Water Act, 1998[5] (NWA), the National Environmental Management Act, 1998[6] (NEMA), the Mineral and Petroleum Resources Development Act, 2002[7] (MPRDA), the National Heritage Resources Act 1999 (NHRA)[8] and the KwaZulu-Natal Amafa and Research Institute Act, 2018 (Act No. 5 of 2018) (KZNARI Act). Section 22(4) of the NWA anticipates and promotes cooperative governance and arrangements with other organs of state to combine respective licencing requirements into a single licence requirement. In addition, section 41(5) of the NWA, requires the Minister responsible for water affairs to align and integrate the process for considering applications for water use licences with those of the environmental authorisations applied for in terms of the NEMA and licences, permits and rights for amongst others, exploration and production in terms of the MPRDA. NEMA similarly envisages an integrated process. In terms of section 24C(12), applications required under NEMA or a specific environmental management Act (SEMA) must be submitted simultaneously to all relevant departments after the acceptance of the application submitted in terms of the MPRDA by the Department of Mineral and Petroleum Resources (DMPR)/ designated agency. In this regard it should be noted that the NWA is a SEMA. In addition, section 50A(2)(d) of NEMA requires that the Ministers responsible for mineral resources, water affairs and the environment, agree to synchronise timeframes for consideration and issuing of authorisations in terms of their respective legislation.

Section 41(7) of the Environmental Impact Assessment Regulations, 2014 (EIA Regulations) indicates that where an environmental authorisation is required and an authorisation, permit or licence is

[1] Issued in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998).
[2] issued in terms of the National Water Act, 1998 (Act No. 36 of 1998).
[3] issued in terms of the National Heritage Resources Act, 1999 (Act No. 25 of 1999).
[4] issued in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).
[5] The National Water Act, 1998 (Act No. 36 of 1998).
[6] The National Environmental Management Act, 1998 (Act No. 107 of 1998).
[7] The Mineral and Petroleum Rescources Development Act, 2002 (Act No. 28 of 2002).
[8] National Heritage Resouces Act, 1999 (Act No. 25 of 1998).

required in terms of a SEMA, the public participation processes may be combined on condition that all relevant authorities agree to such combination of processes.

The MPRDA similarly promotes coordination. Sections 79(4)(a) and 83(4)(a) promote the coordination of consultation requirements. Section 79 of the MPRDA requires that, if the designated agency accepted the MPRDA application for an exploration right the designated agency must, within 14 days of the receipt of the application notify the applicant in writing to consult in the prescribed manner with interested and affected parties on the application and to include result of the consultation in the NEMA Chapter 5 environmental reports, which were subjected to a 30 day public comment period. Integration is also anticipated under the NHRA. Section 38(8) of the NHRA and section 41(8) of the KZNARI Act provide for the heritage impact assessment required under section 38(2)(a) of the NHRA and section 41(1) of the KZNARI Act to be provided through the environmental authorisation (EA) application process in terms of the EIA Regulations,[9] where an EA is required.

Over and above Cabinet's request for an integrated authorisation process, when lifting the moratorium on the exploration of shale gas in August 2012, a stepwise approach was agreed to with only normal exploration being allowed as a first phase and fracturing being allowed only after a number of additional steps had been achieved.

In line with and in order to facilitate the stepwise authorisation approach envisaged, amendments were made to the EIA Regulations Listing Notices in June 2021, which split the authorisation process for exploration and production of petroleum resources into three distinct phases, which are:

- Exploration which anticipates the use of fracturing technology (seismic surveys);
- Exploration which includes the use of fracturing technology; and
- Production of petroleum resources which uses fracturing technology.

The three phased authorisation process is intended to facilitate the collection of environmental information at each stage of the process and to assess and consider the cumulative environmental impacts to promote environmental protection and informed decision-making.

To respond to Parliament's request for a more coordinated approach to considering environmental permissions, the relevant decision-making authorities have agreed to develop a series of Minimum Information Requirements (MIRs) to achieve the objectives indicated below related to onshore exploration and production of petroleum intending to and utilising fracturing technology:

The objectives of the MIRs are to:

- Identify and consolidate the assessment and reporting requirements of all decision-making authorities for all phases of onshore petroleum exploration and production into two minimum information requirements documents;
- Combine the information prepared for the exploration of petroleum anticipating fracturing into one consolidated assessment report, baseline monitoring plan and environmental management programme which conforms to the first MIR in the series;

[9] Environmental Impact Assessment Regulations, 2014 as amended.

- Combine the information prepared for the phase of exploration utilising fracturing technology or for the production phase into a consolidated assessment report, operational monitoring plan and environmental management programme which conform to the second MIR in the series;
- Facilitate consultation with stakeholders on the consolidated assessment report, operational plan and programmes for each phase of exploration and production, through one integrated public participation process; and
- Facilitate the submission of the consolidated assessment reports, monitoring plans and programmes for each phase of exploration and production which incorporates the information required by all decision-making authorities to the relevant authorities for consideration and decision making where relevant.

ii) The Minimum Information Requirement series

The EIA Regulations include the requirement to apply MIR in instances where a Government Notice, gazetted by the Minister responsible for environmental affairs, provides for the application of such MIR. The respective provisions in the EIA Regulations which deal with the content requirements of an application for environmental authorisation, basic assessment report, specialist report, scoping report and environmental impact assessment report, include the ability of the Minister responsible for the environment to require compliance with a MIR relevant to the application as identified and gazetted by such Minister in a Government Notice.

In addition, the Water Use Licence Application and Appeals Regulations, 2017 (NWA Water Use Licence Regulations) and the draft *Regulations for the Use of Water for Exploration and Production of Onshore Naturally Occurring Hydrocarbons that Require Stimulation Including Hydraulic Fracturing and Underground Coal Gasification to Extract and any Activity Incidental Thereto that may Impact Detrimentally on the Water Resource, 2021* (NWA Regulations for Naturally Occurring Hydrocarbons), both refer to providing information in relation to a MIR.

There are two MIRs in this series. This document constitutes the first MIR and focuses on the pre-fracturing phase and guides the process required by each decision-making authority related to:

- The collection of baseline monitoring data for all required categories and parameters;
- The assessment of impacts related to the pre-fracturing phase prior to the use of fracturing technology; and
- The reporting requirements.

The second MIR is entitled "*The Minimum Information Requirement for the Exploration and Production of Onshore Petroleum using Fracturing Technology*". This MIR focuses on the exploration and production of onshore petroleum that require and utilise fracturing technology. The document guides the process required by each decision-making authority related to the-

- Identification of the environmental sensitivity of the site on which the exploration or production operations are proposed to take place;

- Identification of expected impacts related to the exploration or production operations relative to the environmental sensitivity of the site and the baseline monitoring conditions;
- Identification of the specialist impact assessments and reports that will be required to assess and mitigate potential impacts including the prediction of cumulative impacts;
- Determination of risks, the likelihood, extent and severity of such impacts and risks occurring;
- Consideration of expected severity of impacts after mitigation and the acceptability of the residual impacts and risk;
- Proposed layout of the infrastructure and exploration or production wells in relation to the environmental sensitivity of the site and the principles of impact avoidance, management and mitigation; and
- Identification of ongoing monitoring, reporting and auditing requirements through the exploration or production operations.

The MIRs do not set out or explain the regulatory procedures (i.e., application forms and information required at application), but rather deal with the project specific details, the social, cultural, environmental and technical information as well as the baseline monitoring requirements which are to be consulted on and submitted in support of the applications for various required environmental permissions. For guidance on the regulatory steps and information required to submit applications to the decision-making authorities, the applicant must consult the various statutes or regulations and guidance documents.

Applicants must take note of the need to submit the applications simultaneously to the relevant decision-making authorities as required by section 24C(12) of NEMA after the application for the exploration right in terms of section 79 of the MPRDA or the application for a production right in terms of section 83 of the MPRDA, has been accepted by the DMPR, to allow for an integrated consultation process.

iii) Phasing of petroleum exploration and production operations

The exploration and production of onshore petroleum intending to, or utilising fracturing technology is a process that is realised through several phases taking place over a prolonged period of time. The initial phase of the process is reconnaissance which typically includes desktop studies of existing seismic and geological information and the undertaking of an aerial survey using a fixed aircraft, helicopter or drone technology to explore the earth's magnetic and gravity signals. This phase can include 2-D and 3-D seismic investigation but does not include the drilling of any stratigraphic wells. The reconnaissance phase is not considered in this MIR.

This MIR considers exploration which includes 2-D and 3-D seismic investigation and could include the drilling of exploration wells, but excludes the use of any fracturing technologies. The exploration phase extends over approximately 2 to 3 years but could be extended into the first renewal period if renewal is applied for.

The exploration phase used for the gathering of geophysical data utilises either the shot-point method and/or vibrioses trucks. In this phase of exploration, it is unlikely that any infrastructure incidental to the exploration activities will be needed. The exploration phase may include the drilling of vertical

exploration wells of more than 1 000m deep and possibly horizontal boreholes may be drilled from the base of a vertical well extending up to 2 kms into geological layers. The geological samples from the target formations would be subject to a variety of tests to confirm whether a petroleum resource exists within the formation or not. Based on the information generated the areas of interest would be revised. If the target formation is found and a petroleum resource is detected, the project would continue into the well fracturing phase and depending on the commercial viability, into the production phase. If the target formation cannot be found or no petroleum resources is detected, the next phase of exploration which involves fracturing and testing would not proceed and the exploration wells would be decommissioned. It is during this period of the exploration that the baseline monitoring will be undertaken.

The second phase is intended to assess the existence and commercial viability of the petroleum reserve. This phase of exploration includes the continuation of 2-D and 3-D seismic investigation, the drilling of vertical and horizontal exploration wells, pressure testing, fracturing of the reserve through well fracturing and possibly, the flaring of gases. This phase has a duration of approximately three to five years after which the commercial viability of the reserve will be known and a decision will be taken to commence with production or not.

The third phase is the production phase in which gas will be extracted commercially. This phase will be undertaken until the reserve is depleted and a closure certificate for the production operation is applied for.

Decommissioning of wells is an ongoing activity which is undertaken throughout the exploration and production phases. The final phase of the exploration and production is the final rehabilitation, decommissioning, closure and post closure monitoring phase. The requirements of this phase are covered under the contents of the *financial provisioning spreadsheet and final closure plan template* in the case of exploration without fracturing, or the *final rehabilitation, decommissioning and mine closure plans for operations* and *the environmental risk assessment report for the determination of latent liability for operations* in the case of exploration utilising fracturing or production as required by the Financial Provisioning Regulations, 2015[10] as amended.

As identified in the preamble, in order to ensure that there is sufficient information available to support informed decision-making at each phase of the exploration and production operations, the exploration and production activities have been separated into three distinct phases, which are separately listed in terms of the EIA Regulations Listing Notice 1 and 2:

- The first phase of exploration is listed as activity 21C of Listing Notice 1, and is defined *as any activity including the operation of that activity associated with an onshore seismic survey which requires an exploration right in terms of section 79 of the MPRDA as well as any other applicable activity as contained in this Listing Notice or in Listing Notice 3 of 2014, required to exercise the exploration right, excluding any desktop study, any aerial survey and an activity which requires the use of fracturing technology;*

[10]Published under Government Notice 1147 published in Government *Gazette* No. 39425 on the 20 Novermber 2015.

- The second phase of exploration involves fracturing which is listed as activity 20A of Listing Notice 2, and is defined as an *exploration operation which requires the use of fracturing technology as well as any other applicable activity as contained in this Listing Notice, in Listing Notice 1 of 2014 or Listing Notice 3 of 2014, required for such fracturing*; and
- The third phase relates to production and is listed as activity 20 of Listing Notice 2 and is defined *as any activity including the operation of that activity which requires a production right in terms of section 83 of the MPRDA as well as any other applicable activity as contained in this Listing Notice, in Listing Notice 1 of 2014 or Listing Notice 3 of 2014, required to exercise the production right.*

In terms of the NEMA Fracking Regulations and the NWA Regulations for Naturally Occurring Hydrocarbons, for phase one the Department of Water and Sanitation (DWS) will be required to grant concurrence for the approval of the baseline monitoring plan. For phases two and three a Water Use License is required as stimulation, which includes fracturing, has been identified as a controlled activity in terms of section 38(1) of the NWA[11].

The phasing of the operations, facilitating a step-wise authorisation procedure, has several advantages which include among others:

- Rationalising the ever-increasing amount of environmental data and reserve determination information being generated to inform the next phase of exploration or production which allows for informed decision-making;
- Facilitating public participation on the baseline monitoring plan before decision-making;
- The execution of the baseline monitoring plan for a minimum of 24 months prior to any fracturing operations being implemented, should all the necessary authorisations be granted;
- The approval of the integrated operational monitoring plans prior to implementation; and
- The ability to consider cumulative impacts in a more realistic manner as ongoing monitoring data collected through the operations can be assessed against the pre-fracturing baseline conditions.

iv) Introduction to minimum information requirements for baseline monitoring for onshore exploration operations

This MIR contains the prescribed assessment and report content for the technical documents required for environmental permissions relevant to the onshore exploration of petroleum intending to utilise fracturing technology. The assessment and report content for all relevant environmental permissions must comply with this MIR and failure to do so will result in the reports not being accepted by the relevant decision-making authority. The report requirements of this MIR meet, among others, the requirements of Appendix 1 of the EIA Regulations, the technical requirements of the NWA Water Use Licence Regulations, the requirements of section 38(3) of the National Heritage Resources Act 1999 (NHRA)[12] and section 41(3) of the KZNARI Act.

[11] Published under Government Notice 999 published in Government *Gazette* No. 39299 on the 16 October 2015.
[12] National Heritage Resouces Act, 1999 (Act No. 25 of 1999).

The MIR has been developed through the findings of the Strategic Environmental Assessment of Shale Gas Development in the Central Karoo, June 2017[13]; internal literature reviews; the requirements of the EIA Regulations and NWA Water Use Licence Regulations; the knowledge of officials represented on the interdepartmental committee for the development of this MIR, the draft NEMA Fracturing Regulations, the MPRDA Regulations for Petroleum Exploration and Production of 3 June 2015, which were set aside by the Supreme Court of Appeal and stakeholders who contributed through the consultation process.

This MIR must be read with the draft NEMA Fracturing Regulations, the draft NWA Regulations for Naturally Occurring Hydrocarbons, section 38(1), (3) and (8) of the NHRA, sections 41(1), (3) and (8) of the KZNARI Act where relevant and the EIA Regulations.

The experience, understanding and capability of the environmental assessment practitioner (EAP) and specialists to follow the requirements and to reach the intended outcomes of the MIR are crucial and must be demonstrated in the section on qualifications and experience in undertaking similar work as identified in Chapter 1 of Part 1 of this MIR.

iv) Structure of the Minimum Information Requirement

In order to capture the required information and produce one combined assessment and baseline monitoring plan which complies with the assessment requirements of all decision-making authorities, the MIR has been drafted in two parts.

Part 1 deals with general requirements as well as baseline monitoring and reporting requirements.

Part 2 deals with the impact that will result from the activities to be undertaken on the site through the 2-D and 3-D seismic investigations which could include the drilling of exploration wells. These impacts and the severity thereof are to be determined by specialists through analytical methods where relevant. This section also deals with mitigation measures to be implemented through an environmental management programme.

[13] The Strategic Environmental Assessment of Shale Gas Development in the Central Karoo, June 2017 can be accessed at https://seasgd.csir.co.za.

CONTENT OF THE CONSOLIDATED ASSESSMENT REPORT AND BASELINE MONITORING PLAN FOR EXPLORATION ANTICIPATING THE USE OF FRACTURING TECHNOLOGY

PART 1 – GENERAL REQUIREMENTS AND BASELINE MONITORING

1. Chapter 1

1.1 General project description, EAP and specialist details

This section of the draft combined assessment and baseline monitoring plan document is to be compiled by the EAP based on information provided by the applicant and specialists. This section provides the introductory information and the details of the applicant, the EAP and the specialists working on the project. This section is to include the supporting documentation, including the declarations of independence, the experience and academic qualification of the EAP, and specialists as well as copies of their professional registration, their CV and company profile where relevant. Once provided, this information must not be repeated in any of the other specialist or general reports. Information will therefore be available in the consolidated assessment report, to all who need it without the need for duplication. The consolidation of introductory information into one section is intended to provide a more efficient process for document preparation and review which saves document preparation and review time and facilitates cost savings.

When preparing this information, consideration must be given to the aims of the section and the documents provided should not contain unnecessary information. For example, the company profile and CVs should be concise and relevant to the project under consideration.

In terms of this section, the following information must be provided:

1.1.1 General location and contact information:

- The name of the project;
- A short description of the project, including the scope and anticipated duration of the operations;
- The location of the project,[14] including the farm names, relevant portion number or numbers and the relevant surveyor general's twenty-one-digit codes. The relevant catchment in which the project is to be undertaken, an annotated location map, the land use context surrounding the proposed project, 1:100-year flood line, major roads, towns, major topographical features, buildings and railroads where relevant; the proximity of the proposed activity, including any exploration wells or monitoring boreholes to a prohibited or restricted area as identified in the NEMA Fracturing Regulations and the NWA Regulations for Naturally Occurring Hydrocarbons;
- The name and contact details of the applicant. The contact details should include relevant telephone and cell phone numbers, the business street and postal address;

[14] The farm names and SG codes are available from the screening report produced by the screening tool.

- The name and contact details for the appointed EAP, which must include business contact details as well as a personal cell phone number;
- The company details for the EAP including telephone numbers, and physical and postal address;
- The name and contact details of all the specialists who have contributed to the reports, assessments and plans related to the project. The contact details are to include a street address as well as a postal address for the specialist and where relevant the specialists company. The telephone and cell phone details for the specialist as well as the specialist's company must also be included;
- The years of experience of the EAP and specialist; and
- The professional registration status and details of the EAP and the relevant specialist.

1.1.2 Project information:

- Need and desirability of the project;[15]
- The legislative and policy context including any strategies or plans within which the project is located and the manner in which the project responds to this context;
- A description (scope) of the project, to be undertaken as well as any associated structures or infrastructure to be erected;
- The identified activity that will be triggered in relation to the EIA Regulations Listing Notices;[16]
- The water uses being applied for in terms of the NWA Water Use Licence Regulations, issued in terms of the NWA if relevant;
- Confirmation of engagement with the relevant heritage authority as required in terms of section 38(1) of the NHRA and section 41(1) of the KZNARI Act and the response of the relevant heritage authority as required in terms of section 38(2) of the NHRA and section 41(2) of the KZNARI Act;
- The right being applied for in terms of the MPRDA;
- Technology alternative considered and a motivation for the technology to be applied; and
- Licenses, authorisations or rights which exist for the land within the site.

1.1.3 Supporting information:

The following supporting information must be included under this heading:

- The applicant's company environmental policy;
- A short profile of the EAP and the EAP's company, where relevant;
- A short profile of the relevant specialists and specialists' company who provided input to the assessment and baseline monitoring report;
- An abbreviated CV of each EAP and specialist who provided input to the document identifying the expertise and qualifications of the EAP and specialist;
- Company BBBEEE certification;
- Power of attorney;

[15] This information must be provided in accordance with DFFE's *Guideline on Need and Desirability, 2017*
[16] For a mining activity the associated activities are incuded in the main mining activity and the associated activities are not to be seperatly identified.

- A short profile of similar work undertaken by the EAP and each specialist;
- Copy of the professional registration for the EAP and each specialist; and
- A signed declaration of independence from the EAP and specialists.

1.2 Summary for decision-makers

A summary for decision-makers is to be provided in the consolidated assessment report. The consolidated assessment report must include a summary of the findings of each of the specialist impact assessments undertaken related to site sensitivity including the sensitivity to water resources and cultural heritage, expected environmental impact, possible mitigation measures and the overall outcome of the impact assessment as prepared by the EAP as well as from each specialist under the relevant sub-paragraphs, and how findings informed the baseline monitoring plan. This section must include a substantiated statement on the acceptability or not of the project related to the specific environmental theme from each specialist. In addition to the written summary, all the information must be overlaid onto a base map which is to be included in a hard copy in the report and also provided as a shape file.

The section must include a summary of the baseline monitoring that is to be implemented, providing the scope of the activities to be undertaken, the objectives of the plan, general timeframes and monitoring frequency, among others.

2. Chapter 2

2.1 Screening and specialist assessments

As of 4 October 2019, it is required that a screening report produced by the national web based environmental screening tool (screening tool) accompany all applications for environmental authorisation submitted to the competent authority, which would include an application for an exploration right in terms of section 79 of the MPRDA. The requirement for screening is to ensure that sites with high environmental sensitivity, including the location of water resources are identified and avoided where possible. In instances where the preferred site has high environmental sensitivity and considering an alternative site may not be possible, screening to reduce impacts as far as possible, is possible by avoiding the placement of infrastructure in areas identified as being sensitive. In this way, the screening assists in site selection and facilitates the implementation of the impact mitigation hierarchy and the location of infrastructure.

The screening report also identifies an initial list of specialist studies to be undertaken based on the known impacts of the activity. This list is to be finalised based on the outcome of the site sensitivity verification, which is to be undertaken as per the "site sensitivity verification and minimum report content requirement" as gazetted,[17] the pre-application meeting and site visit held with representatives of the DWS, and the engagement with the relevant Heritage Resources Agency (HRA). Once the environmental sensitivity of the site is confirmed or revised in relation to the sensitivity

[17] Published under Government Notice 320 in Government *Gazette* No. 43110 on 20 March 2020 and Government Notice No. 1150 in Government *Gazette* No. 43855 on 30 October 2020, as amended.

rating provided by the screening tool for each environmental theme under consideration and the interactions with the DWS and the NHA or PHA, the list of specialist assessments/compliance statements to be undertaken should be confirmed through discussion with the relevant decision-making authority before embarking on the assessments. Where the site sensitivity verification has identified that a specific specialist impact assessment identified in the screening report is not necessary, the EAP or relevant specialist must motivate this to the relevant decision-making authority and include the motivation in the assessment report under the relevant heading, including the supporting evidence. Only specialist assessment or compliance statements for aspects as agreed to by the relevant decision-making authority are required to be undertaken.

The EIA Regulations require the screening report to be attached to the application for an environmental authorisation. This MIR, however, provides guidance that is relevant to the requirements of all decision-making authorities. Therefore, with regards to screening, the following information is to be included in the *consolidated assessment report*:

- A screening report which reflects the entire site under consideration drawn from the screening tool;[18]
- A site sensitivity verification report which meets the requirements of the "*site sensitivity verification requirements where a specialist assessment is required but no specific assessment protocol has been prescribed*" or the specific site sensitivity verification requirements as identified in the prescribed protocol for the specific environmental theme;[19]
- The outcome of the pre-application meeting and site visit held and undertaken with the representatives from DWS and the competent authority as relevant;
- The outcome of interactions with the NHA or PHA;
- A list of studies identified by the screening report which in the view of the EAP are not necessary as well as the motivation for not including them and the relevant evidence to support the motivation; and
- A list of specialist impact assessments to be undertaken which reflects the sensitivity of the site as confirmed by the site sensitivity verification and agreed to in the discussion with the decision-making authority which would include the DWS, the competent authority and the relevant heritage authority.

2.2 Public participation and report content

Providing the public with adequate opportunity to engage with the project and to provide inputs is a crucial component of any project. It is widely acknowledged that the exploration of petroleum as well as the use of fracturing technology are highly complex and controversial topics. It is therefore vital for the applicant to carefully consider the extent and methods to be used in the public participation process.

As indicated in the Preamble, one of the objectives of the introduction of MIRs is to combine the information prepared to apply for environmental permissions for projects which anticipates and then

[18] The national web based environmental screening tool is accessed at: https://screening.environment.gov.za/screeningtool.
[19] Published in Government Notice No. 320 published in Government *Gazette* No. 43110 on 20 March 2020.

utilises a fracturing technology into one consolidated assessment document to, among others, allow for one integrated public participation process. This will provide for an efficient and cost-effective public participation process and reduce stakeholder fatigue.

When communicating information on complex or controversial projects, applicants should consider extending their efforts beyond the use of company stakeholder databases, commercial media, email communication, providing information on websites, site notices and single language background information documents. The approaches to stakeholder communication should be context specific to adequately inform stakeholders of the proposed project, and specific attention must be placed on reaching stakeholders in rural areas, which would include communities that may be affected and farmers, as petroleum exploration and production activities could be located in remote areas.

The applicant's approach to public participation (to disseminate information and register stakeholders) through more accessible means could include among others:

- Community and commercial radio stations;
- Notifying local ward councillors and traditional leaders;
- Notifying national and local non-governmental organisations, community-based organisations, and farmers associations located within the study area;
- Providing background information;
- Placing these background information documents in strategic places frequented by stakeholders which could include community halls, churches, taverns, and notice boards in malls/shopping centres;
- Affixing notice boards on the boundary fence of the site;
- Physically or in the form of registered delivery, inform adjoining and adjacent landowners of the project; and
- Using local and community news media.

Registration should then take place using accessible means which could include:

- Social media apps for example Facebook and WhatsApp;
- Email;
- Prepaid SMS; and
- Dedicated information desks set up at malls, filling stations, farmers cooperations or shopping complexes in the affected community.

When registering stakeholders, the applicant must consider the protection of privacy of the stakeholders. No personal details may be used for purposes other than the project under consideration in terms of the Protection of Personal Information Act, 2013.[20] Once interested and affected parties have registered, innovative ways of distributing further information about the project which must be subjected to a public participation process must be considered which could include among others;

[20] The Protection of Personal Information Act, 2013 (Act No. 4 of 2013).

- Free download SMS;
- Providing access to pre-paid or free download apps;
- Email;
- Locating documents in libraries, municipal offices and offices of community-based organisations or non-governmental organisations; and
- At the offices of the relevant national and provincial Departments or a municipal office.

In person meetings with affected community members could be held. Such meetings should be organised at accessible venues such as community halls or municipal offices, also catering for people with disabilities. The EAP must provide accessible information to allow stakeholders who have no experience with fracturing technologies and the impacts thereof to follow the discussions and for knowledge to be transferred.

Virtual meetings can be an effective means of communication for a selected audience who have access to internet but virtual meetings cannot be the only method of stakeholder consultation. The timing of meetings is important. Stakeholders must be able to conveniently attend meetings, so planning meetings outside of work time is suggested.

Consideration should be given to the appropriate use of language. Background information documents should include, but not be limited to, versions in the predominant language of the area. Technical documents should include an executive summary in the predominant language of the area, and slide presentations should also be translated. Allowing for interpreters at public meetings is important to allow stakeholders to express themselves without a language barrier. Where appropriate, recorded verbal inputs from illiterate stakeholders must be catered for.

The preparation for the public participation process can begin at any time and the consultation process can proceed as soon as a draft consolidated assessment report and the baseline monitoring plan has been prepared. The outcome of the public participation process is to be detailed in a public participation report which must be included in the *consolidated assessment report*. The report must, as a minimum, include the following information:

- Objectives of the public participation process;
- Identified areas of the project impact, including the rationale for their inclusion;
- Identify the assumptions made and gaps in knowledge;
- An outline of the public participation process followed, indicating what actions were undertaken, the venue, dates and times of interactions;
- The audience reached in relation to the identified area of the project impact;
- The participants at any meeting, including attendance registers;
- Minutes of meeting or interactions including recorded inputs;
- Objectives and outcomes of any information sessions held where relevant;
- Consultation undertaken with the local municipality, the site owners and site occupiers as well as adjacent site owners or occupiers;
- Which documents were subjected to public participation and how were the documents distributed and located;
- How persons without internet access and transport were accommodated;

- How issues of language were considered;
- Copies or photographs of all correspondence, documents, notices etc. distributed or erected;
- Copies of all supporting documentation and stakeholder databases; and
- A summary of the issues raised by interested and affected parties and an indication of the manner in which the issues were incorporated or reasons for not including them, in the form of a comments and responses document.

3. Chapter 3 – Preparation and content of a Baseline Monitoring Plan

Although exploration without fracturing is not anticipated to have significant environmental impacts, an outcome of this exploration phase could be the further investigation of the deposit by means of fracturing technology. The exploration phase considered under this MIR must therefore anticipate the use of fracturing technology and facilitate baseline monitoring.

Baseline monitoring involves determining the reference conditions of key environmental attributes against which changes to the reference condition of these attributes, can be measured over time. It is important to undertake baseline monitoring where projects have various phases and the impacts will increase over time due to the incremental expansion of the wells, structures and infrastructure and the changing nature of the activities. An assessment of monitoring results during the fracturing and production phases against the baseline conditions will provide an understanding of the cumulative impacts of the operations and allow for the ongoing determination of the limits of acceptable change, i.e., the acceptability of impacts at the various phases. At each phase the impacts must remain acceptable with or without mitigation. South Africa is in a fortunate position that baseline monitoring will be able to be undertaken prior to any fracturing commencing.

The step wise authorisation process for petroleum exploration and production utilising fracturing allows for the baseline monitoring plan to be developed, consulted on and approved as part of the assessment processes for exploration. This step wise approach also allows for the baseline monitoring plan to be implemented and for data to be collected for 24 months prior to the consideration of the EA application for activities involving fracturing.

The site is the area within which the exploration activities will take place, however, for baseline monitoring to be effective, it must be conducted in the wider area that could be influenced by the exploration or production activities (e.g., migration of groundwater extends beyond the boundaries of the site). This wider area of influence is referred to as the study area and must be determined by the specialists for the various environmental themes.

The baseline monitoring plan must be prepared by an independent team of appropriately qualified and registered specialists,[21] which will include but not be limited to specialists for the following themes: surface water and aquatic biodiversity; groundwater; air quality; cultural and paleontological heritage; terrestrial biodiversity and seismicity. Socio economic factors, tourism, light and noise are also themes that need monitoring but impacts are expected to be marginal during the first phase of exploration. All themes must be monitored for a reasonable period to be determined by the relevant

[21] Where required, specialists must be registered with the relevant professional body related to their area of expertise.

specialists and identified in the baseline monitoring plan. The plan must detail the nature of monitoring to be undertaken and the methods for data collection. The baseline monitoring plan which includes the monitoring requirements and reporting content for each theme must be signed off by all relevant specialists and the EAP and must accompany the *consolidated assessment report.* Baseline monitoring requirements are required for the following themes:

3.1 Surface water and aquatic biodiversity

Exploration operations which utilise fracturing technology can impact on surface water and aquatic biodiversity through the abstraction of water or the release of polluted water into the natural water system. Some surface water resources can be associated with cultural practices. The pre-fracturing baseline on the quality of surface water and aquatic biodiversity must be determined for the study area that will be impacted, by providing the general overview information and identifying the monitoring plan which must include monitoring methodologies, parameters, monitoring intervals and monitoring locations among others for this theme.

3.1.1 General

General information to be provided on the aquatic environment is listed below. This general information is only to be included once to avoid duplication, and is more appropriately placed in the impact assessment chapter. However, the information is included here to give an overall idea of the level of information required under the surface water and aquatic biodiversity theme. The following general information is required:

- General overview of the aquatic environment within the study area;
- The regional daily precipitation and evaporation;
- The local daily precipitation and evaporation;
- Mean annual run-off;
- Regional water use, accessibility, volumes and stresses in the study area;
- The location of surface water features within the study area or where continuity of a surface water feature is identified, the study area. Features with GPS coordinates as appropriate (i.e., a centre point for a pan or linear points along a river) are to be located on a surface water annotated map;
- Resource class and river health, receiving water quality objectives and reserves as determined by the DWS;
- A description of the ecological importance and sensitivity of the surface water feature, including the ecosystem processes in operation on the site and the study area for example movement of surface and subsurface water, recharge, discharge, sediment transportation etc.; and
- A description of the vegetation and animals within the study area and its reliance on water availability.

3.1.2 Plan for determining the pre-fracturing surface water and aquatic biodiversity baseline

Having identified, located and mapped the surface water features, the monitoring plan to determine the pre-fracturing quality of the features is to be prepared. The objective of the monitoring plan for surface water is to ensure that the pre-fracturing status of all the relevant surface water features are determined within the study area or where there are interlinked features to the area of influence in relation to water quality, quantity, recharge rates and the ecological status of each feature. As such the surface water baseline monitoring plan must include the following:

- Purpose of the plan;
- The specific surface water features to be monitored;
- Water quality - the parameters of the surface water feature to be monitored to determine the water quality – including but not limited to: hydrochemistry parameters - field pH, electrical conductivity, temperature, dissolved oxygen, total dissolved solids; organics - VOCs, SVOCs and PAHs; radioactive isotopes - uranium, thorium, radium and strontium as well as radioactivity;
- Water quantity - the flow rate where relevant or depth and extent of the feature;
- Groundwater fed surface water features which could be impacted by groundwater contamination;
- Information relating to the sub-surface connectivity of activities to surface water resources and water supply infrastructure;
- Ecological status – species found in the water body including an estimate of the species abundance. Consideration must be given to in-stream, riparian and floodplain habitats. Any species of conservation concern must be identified and discussed in relation to the threat status, the national and provincial priority status; and
- The intervals for the monitoring of each feature.

The features to be monitored must be identified on a surface water annotated map and parameters and frequencies included in an excel spread sheet. Both the map and the excel spreadsheet must be included in the surface water baseline monitoring plan. Surface water must be monitored for a period of not less than 24 months.

All monitoring results must be submitted to the DWS as well as the designated agency which is Petroleum Agency SA (PASA). The monitoring results must at least include a detailed description of the sampling and testing conducted, including duplicate samples, the chain of custody of the samples and the quality control of the testing.

3.2 Groundwater

The primary issues of concern with respect to petroleum developments is the risk of contamination of groundwater resources and the abstraction of groundwater for drilling and fracturing activities. The risk of contamination is associated with the potential hydraulic connectivity between deep and shallow formations, as well as contamination of groundwater from flowback and produced water. This contamination can result from spills, leaks and uncontrolled waste water and the accumulation of toxic or radioactive contaminants in soils and stream sediments from spill or unmanaged waste water.

An additional risk relates to the over-exploitation of water resources to supply drilling and fracturing operations.

The groundwater baseline information must be provided for a study area which must include general information on groundwater as well as specific information on the intended monitoring to be undertaken as part of the hydro-census, including the intended monitoring locations, methodologies and intervals.

3.2.1 General

Much of the general information regarding groundwater will have been included under the impact assessment for groundwater and should not be repeated here. The general information under this heading should focus on more detailed information for specific boreholes to be used for baseline monitoring.

The general section related to the baseline monitoring of groundwater must contain the following information:

- Current monitoring regime in the study area, including monitoring points, monitoring parameters and frequency; and
- Current water uses in the study area, including the quality and quantities of water used, and the purpose of such uses.

3.2.2 Plan for determining the pre-fracturing groundwater status

The objective of the monitoring plan for groundwater is to ensure that the pre-drilling and fracturing status in terms of quantity and quality of groundwater is identified. This baseline will facilitate an understanding of any possible impact on groundwater from fracturing should this activity proceed. The groundwater baseline monitoring will rely on a hydro-census which is to be undertaken in the affected area. The first part of the hydro-census will rely on desktop information and site inspection to identify the existing boreholes in the affected area and to determine their current use and condition. The following information is required at this stage:

- Purpose of the plan;
- The location of all boreholes including the coordinates in WGS84 of each borehole identified within the affected area;
- The use and frequency of use of the borehole;
- The depth of the borehole;
- The water quality;
- The current condition of the borehole; and
- The recorded yield and recharge rate of the borehole.

These boreholes must be identified on a baseline monitoring geohydrological map and must include coordinates as well as the motivation for choosing the specific borehole. Once the general locational and use information is determined, the baseline monitoring plan for groundwater must be prepared and must include as a minimum the following information:

- The boreholes to be monitored to determine the groundwater baseline;
- The parameters for which each borehole is to be monitored including a short motivation for the choice. The following parameters must be monitored as a minimum: hydrochemistry parameters - field pH, electrical conductivity, temperature, dissolved oxygen, total dissolved solids; organics - VOCs, SVOCs and PAHs, radioactive isotopes - uranium, thorium, radium and strontium as well as radioactivity; and
- The planned monitoring frequencies for each parameter per borehole including a motivation for the frequency.

The boreholes to be monitored must be identified on a groundwater annotated map including the coordinates, parameters to be measured and frequencies for monitoring must be included in an excel spread sheet and the locations provided as a shapefile. Both the map and the excel spread sheet must be included in the groundwater baseline monitoring plan. Groundwater must be monitored for a period not less than 24 months. In the case where there is a lack of boreholes, or boreholes that are too shallow to provide any real value, additional deep boreholes are to be proposed to be drilled in the plan, to allow for the collection of information on deep and shallow aquifers pre-fracturing,

Groundwater aspects must be recorded and reported according to the department responsible for water affairs “Standard Descriptors for Geosites”.

3.3 Air quality

Local air quality can be impacted on by exploration activities such as the movement of heavy vehicles, the flaring of gas, gas leaks, diesel fumes and the evaporation of hydrocarbons as examples. It is therefore important to determine the pre-fracturing local air quality. The air quality baseline monitoring must be undertaken within the study area to determine the current ambient air quality of the area prior to any fracturing activities. The study must include general information on existing monitoring stations within the study area, an inventory of possible air pollutants and GHG emissions in the areas as well as specific information on the intended monitoring to be undertaken to determine the baseline ambient air quality.

Generally, air quality monitoring stations are located in areas where there is development or industrial activity. It is unlikely that there would be an air quality monitoring station within the areas where exploration for onshore petroleum would be undertaken. It is also unlikely that an emissions inventory would have been compiled for the area. It will therefore be anticipated that temporary air quality monitoring stations will need to be set up to undertake the baseline emissions monitoring.

The general respiratory health of the resident population will need to be determined for the pre-fracturing conditions. The methodology for determining the pre-fracturing general respiratory health of the population will need to be provided by a medical expert and confirmed through a peer review.

3.3.1 General

The general section related to the baseline monitoring of ambient air quality must contain the following information:

- Air quality monitoring stations located within the study area, including their monitoring parameters;
- An inventory of possible air pollutants in the area including any existing GHG emissions that could impact on local air quality, for example agricultural activities and industries; and
- General respiratory health of the population within the study area.

3.3.2 Plan for determining the pre-fracturing ambient air quality

The objective of the monitoring plan for ambient air quality is to ensure that the pre-fracturing status of ambient air quality is identified. This baseline will facilitate an understanding of any possible impact on air quality from fracturing should this activity proceed. The ambient air quality baseline monitoring will rely on the monitoring of current point sources, the ambient air quality for the study area and determining the general respiratory health of the population within the study area. The baseline air quality monitoring plan must identify the sampling methodology for each parameter and the accredited laboratories to be used for the analysis of samples. When considering the content of the baseline monitoring plan, the applicant must consider international best practices for additional parameters of concern as well as the most up to date monitoring methodologies.

The following information is required as a minimum:

- Purpose of the plan;
- Daily onsite weather conditions including wind direction;
- Sampling methodology to be used including the methodology to be used for determining the pre-fracturing respiratory health of the population;
- Laboratory to be used for analysis;
- An inventory of possible air pollutants and GHG emission in the areas;
- The location of air quality monitoring points;
- The location of air quality monitoring stations;
- The monitoring parameters must as a minimum include: SO_2, NO_x, NO_2, PM_{10}, $PM_{2.5}$, O_3, C_6H_6, Pb, CO, H_2S, CH_4, VOCs; and
- Monitoring intervals.

The air quality monitoring points must be identified on an annotated map and parameters and monitoring frequencies included in an excel spread sheet. Both the map and the excel spread sheet must be included in the ambient air quality baseline monitoring plan. Air quality baseline monitoring must cover all four seasons, and must be undertaken for a period not less than 24 months. A specific section of the air quality report is to be dedicated to a discussion on the methodology to be applied to determining the pre-fracturing general respiratory health of the population and the monitoring to be undertaken throughout the 24-month baseline monitoring period.

3.4 Seismicity

The injection of fluids into the earth at high pressures can cause rocks to fracture and/or faults to slip and may cause a regional increase in seismic events (i.e., induced seismic activities over and above the extent of natural seismic activities). It is the purpose of this investigation to consider the potential risk posed by natural and induced seismicity in the study area, especially as many of the buildings in rural areas where exploration takes place will be home to heritage buildings or stone walled sites, which could be vulnerable to shaking due to their age or building material.

During the exploration phase, historical seismic data is to be reviewed and continuous baseline monitoring is required to be undertaken to determine the current seismicity in the area and to identify any aspects which may be impacted on by an increase in seismic activity which could potentially be caused by fracturing for example dams supplying towns and farms, infrastructure such as pipelines as well as the built environments must be monitored to consider the possible impact of increased seismicity, including buildings, monuments stone walled sites and other structures which may be at risk of cracking or become unstable.

The Strategic Environmental Assessment (SEA) which was undertaken between 2015-2017 to consider the opportunities and constraints with regard to shale gas development in the Karoo in Chapter 15[22] identified and mapped dwellings and structures that could be impacted on by seismic activity within the Karoo area. The SEA information and maps could form the base of the further study to be undertaken should the Karoo be the area of investigation and is available at http//seasgd.csir.co.za.

3.4.1 General

The general section related to the baseline monitoring of seismicity and possible features and structures that could potentially be impacted by induced seismicity, must contain the following information, mapped where relevant, related to the study area:

- Information from existing geological maps;
- Seismic reflection and refraction data, where available;
- Stress data from proximal boreholes where available;
- Current seismicity monitoring locations;
- Historical seismic activity in the area based on available information;
- A requirement to undertake continuous seismic monitoring on the exploration site;
- A general discussion about the historic buildings, other built structures and stone walls;
- The location including the coordinates of historical buildings, other built structures and stone walls;
- A discussion on the structural integrity of the buildings, stone walls and structures, etc.;
- The location of any other infrastructure which could be impacted on by an increase in seismic activity for example pipelines, tailings dams and bridges; and

[22] Maps of known category 1, 2 and 3 heritage resources were provided in the Digital Addenda to the Chapter 15 of the SEA.

- A discussion on the structural integrity of infrastructure including pipelines, tailings dams and bridges.

3.4.2 Plan for determining the pre-fracturing seismicity

The objective of the baseline monitoring plan for seismic activity is to ensure that the pre-fracturing seismicity for the study area is known, through the review of historical seismic activity in the area, the results of seismic activity based on continuous seismic monitoring for the twenty four months base line monitoring period, as well as the structural integrity of buildings, built structures and stone walls. This baseline will facilitate an understanding of any possible change in seismic activity and any impact on buildings built structures and stone walls within the study area that could occur as a result of such a change. As a minimum the baseline monitoring plan must identify the locations for monitoring or observation and the monitoring methods for each location. The following information is required as a minimum:

- Purpose of the plan;
- The locations for monitoring or observation;
- The necessary monitoring equipment; and
- The monitoring parameters and methods.

The monitoring and observation points must be identified on an annotated map and parameters and frequencies included in an excel spread sheet. Both the map and the excel spread sheet must be included in the seismicity baseline monitoring plan. The Council for Geoscience must be engaged for any inputs that may be relevant and not covered in these requirements as well as the potential impact on identified buildings and structures.

3.5 Cultural Heritage and paleontological resources

Heritage resources are distributed in variable densities throughout the country. In undeveloped area where exploration and fracturing activities would potentially take place the survey coverage is generally low, and the actual distribution of resources is poorly known. Fracturing and other petroleum related activities could uncover buried artefacts or fossils, could lead to a loss of medicinal plants associated with rituals or cultural practises and could affect heritage resources to varying degrees.

The heritage baseline study overlaps to some degree with the seismicity baseline study in relation to the built environment as the data gathered on structures that may potentially be impacted by any increase in seismic activity, are relevant to this theme. In addition, although some proactive work can be undertaken to identify areas in which it would be anticipated to find heritage, cultural[23] or paleontological resources, the actual unearthing of these resources would occur in most cases once the exploration or production operations are being implemented.

[23] Cultural resources include medicinal plants used for cultural or ritual practices.

As indicated under the seismicity theme, Chapter 15 of the SEA on Shale Gas Development in the Karoo contained a specialist study on the impacts of shale gas exploration on heritage resources in the Karoo. This information could assist as a point of departure for the heritage baseline monitoring plan should the potential site overlap with that of the SEA. The SEA specialist study and supporting maps are available at http//seasgd.csir.co.za.

3.5.1 General

The general section of the heritage baseline monitoring plan must identify the possibility of finding or unearthing of heritage, cultural or paleontological resources or damaging medicinal plants associated with rituals based on: desktop studies, professional knowledge, discussion with the provincial/national Heritage Resources Agencies and local municipalities. Where relevant, interviews with local residents should be held, to gather information. The aspects of heritage architecture are dealt with under the seismicity baseline monitoring requirements.

3.5.2 Plan for determining the pre-fracturing status of cultural heritage and paleontological resources

The objective of the baseline monitoring plan for heritage resources is to identify any areas in which heritage, cultural or palaeontological resources may be found. The baseline monitoring must be undertaken within the study area. The plan must provide a methodology and areas for further investigation prior to exploration activities being undertaken. The following information is required as a minimum:

- Purpose of the plan;
- The identification and mapping of the locations of known heritage, cultural or paleontological resources within the study area;
- Areas for further investigation through the implementation phase of the exploration operations;
- Condition of the heritage, cultural or paleontological resources and assessment of the significance of such resources; and
- The investigation methodology to be used when undertaking the additional site work including the scoping of residence where relevant and the methodology for recording the findings.

The location of current heritage and archaeological resources as well as the areas/sites for further investigation must be mapped on an annotated heritage map which must include coordinates. The parameters and frequencies for monitoring must be included in an excel spread sheet. Both the map and the excel spread sheet must be included in the cultural heritage and paleontological resources baseline monitoring plan. The baseline monitoring must be undertaken for a period not less than 24 months.

3.6 Terrestrial Biodiversity and species

The terrestrial biodiversity and species baseline information must be provided for the study area identified by the terrestrial biodiversity and species specialists. The study must include information on

terrestrial biodiversity and species including vegetation, habitats, groundwater dependant ecosystems as well as plant and animal species.

3.6.1 General

The general section of the terrestrial biodiversity and species baseline monitoring plan must describe the current biodiversity features as well as aspects which influence the terrestrial biodiversity and species within the study area. The following information must be included as a minimum:

- Biomes and vegetation types including fine-scale vegetation types and groundwater dependant ecosystems where relevant;
- A desktop analysis of biodiversity, plant and animal species expected to be found within the study area, including a list of species and their conservation status;
- A desktop analysis of the existing habitats which could be of importance to plant or animal species e.g., breeding habitat, foraging habitat, movement corridors;
- Any areas of anomaly which would be of specific importance to biodiversity both plants and animals (e.g., rocky outcrop);
- Any habitats which provide movement corridors;
- Any expected species migration routes; and
- A desktop analysis of biodiversity, plant or animal species, expected to be found within the affected area, including a list of expected species, their conservation status and level of endemism.

The features and expected species locations identified must be mapped on an annotated terrestrial biodiversity map and the corresponding shapefile provided.

3.6.2 Plan for determining the pre-fracturing status of terrestrial biodiversity

The objective of the baseline monitoring for terrestrial biodiversity is to identify the abundance and diversity of animal and plant species in the affected area and to identify any specific features or areas which should be avoided during any subsequent phase of exploration and production due to its terrestrial biodiversity sensitivity or resource properties. The baseline monitoring plan for terrestrial biodiversity must identify the species and habitats to be monitored. The plan must propose monitoring frequency and methodologies to be used to determine any possible impact on abundance and diversity of plant and animal species as well as the current vegetation and habitat status in the study area. The following information is required as a minimum:

- Purpose of the plan;
- The priority plant and animal species to be identified (confirmed presence or absence) including species of conservation concern, keystone species and indicator species;
- The methodology to be used to identify or confirm the presence of the priority plant and animal species;
- The habitats and vegetation types to be monitored;
- The methodology for monitoring each species and their habitats e.g., presence, distribution, abundance, habitat condition/degree of modification;

- The location for monitoring; and
- The monitoring frequency and duration per species and vegetation type.

The monitoring and observation points must be identified on an annotated map and parameters and frequencies included in an excel spread sheet. Both the map and the excel spread sheet must be included in the biodiversity baseline monitoring plan. The baseline monitoring must be undertaken for a period not less than 24 months.

3.7 Waste

The management of waste and waste water has been identified as one of the main issues confronting the use of fracturing technology. Baseline information on waste management facilities available in the study area must be gathered to determine the ability of these facilities to deal with the waste that would be generated from well drilling and fracturing activities.

It must be noted that the draft NEMA Fracturing Regulations, prohibits, among others, the discharge or disposal of fracturing fluids, process water or any other component of process water into a water resource, a government waste water treatment works or underground disposal including the use of re-injection wells. The Regulations also prohibit the disposal of sludge to landfill with a water content of >40% or that liberates moisture under pressure in landfill conditions and which has not been stabilised by treatment.

3.7.1 General

The general section of the waste baseline information must describe the current waste water and waste treatment, recycling and waste disposal facilities available in the broader study area. The following information must be included as a minimum:

- Waste water and waste treatment facilities including the types and volumes of waste water and waste that the facility is permitted to treat;
- Waste water and waste recycling facilities and the types and volumes of waste water and waste which the facility has been permitted to recycle; and
- Waste disposal facilities including the types and volumes of waste for which the facility has been permitted;
- Desktop analysis of the possibilities available in the study area or the broader area to treat, dispose of or recycle the waste which will be generated from the exploration, fracturing and production operations. The analysis is to identify any treatment, disposal or recycling facility gaps and make recommendations as to the interventions required to ensure the safe management of all wastes to be generated through the exploration, fracturing and production operations.

3.7.2 Report on waste management options

The objective of the baseline monitoring for waste is to determine the availability of waste water and waste treatment, recycling and disposal facilities within the study area. Gaps in treatment facilities and waste water and waste management options will be identified for consideration in the

environmental impact assessment process for exploration, fracturing and production. A report on the findings of the investigation must be prepared which identifies and discusses as a minimum the following:

- the locations of suitable facilities for sound waste management, including disposal sites, treatment and recycling facilities. These facilities must be located on an annotated waste management map;
- a discussion on the disposal, treatment and recycling facilities including the facilities capacities, the types of waste or waste water for which the facilities are licenced, the current conditions including the licencing status and the ability of the facility to receive the waste from the exploration, fracturing or production operations;
- any waste water and waste treatment, recycling and disposal gaps identified; and
- recommendations for waste and waste water treatment, recycling or disposal options to be used for the recycling, treatment or disposal of the anticipated waste to be generated from the fracturing and production operations.

3.8 Traffic study

The traffic study must be undertaken on all national and provincial routes which provide access to the site as well as any secondary roads. The study must be undertaken for a period of at least six months and must consider a twenty-four-hour period for seven days of the week. The study must consider the route from the main departure points to the proposed study area. There must also be a consideration of rail infrastructure, the suitability of the infrastructure to transport materials and wastes to and from the site and the rail schedules to the nearest rail siding in the proposed study area.

3.8.1 General

The general section of the traffic baseline monitoring plan must describe the current traffic situation along the national, provincial and secondary roads to allow for the understanding of the current flow of traffic, peak traffic times and traffic risk, etc. and the possibility of utilising and upgrading the current rail infrastructure, noting that traffic impacts have been identified as a major concern by residents in the area due to increased traffic volumes, spills, noise, accidents and a general degradation of the sense of place of the Karoo.

3.8.2 Traffic Management Report

The following information must be included as a minimum on an annotated map:

- National, provincial and secondary roads;
- Weighbridges;
- Low bridges, or narrow road sections;
- Toll points;
- High traffic accident zones/spots;
- Areas which would be regarded as being sensitive to environmental pollution in the case of a spill, for example rivers, streams wetlands etc.

- Tourist venues;
- Scenic features;
- Settlements and towns that could be affected by an increase in traffic volumes; and
- Truck stops and filling stations.

A report which is to identify and discuss as a minimum:

- Current condition of the roads;
- Road upgrade and/or maintenance frequency;
- The number of vehicles utilising the national, provincial and secondary roads within the study area;
- The peak times;
- Types of vehicles;
- Common loads transported;
- High accident zones and the reasons for these zones;
- Accident rate as well as the times of accidents;
- Existing rail transport and the possibility of upgrading and utilising rail infrastructure; and
- The number of hazardous trucks utilising the route and the preferred travel times.

A report on the rail opportunities to the site, and its implications on the above-mentions aspects.

3.9 Socio-economic resources

Exploration activities would most likely be undertaken in rural areas which would generally be un-developed areas and have low population densities. A major influx of construction and exploration activity into such areas could provide development opportunities but could also disrupt the current social and economic fabric which could have negative social consequences. The negative impacts could include, among others, the change of economic activity, an increase in cost of living, deterioration in services, increases in crime, illness, shortage of housing, reduced tourism, increased traffic and traffic accidents, greater social inequality, unrest and conflict.

In order to be able to assess the possible impact of exploration, fracturing and production activities on the social fabric on a small rural agricultural community, baseline monitoring considering the pre-exploration, fracturing and production environment must be undertaken. The baseline monitoring will take the form of statistics gathering rather than specific monitoring.

3.9.1 General

The general section of the socio-economic baseline monitoring plan must determine the current socio-economic situation on the site and the study area. This baseline monitoring results will be used in the environmental impact assessment for the following phases of exploration, fracturing and production to determine possible changes in the baseline and to determine the acceptability of these changes.

3.9.2 Socio-economic Report

The socio-economic report must be comprehensive and provide an overall impression of the socio-economic fabric of the area which must address, with data and evidence, the following aspects as a minimum:

- Local and regional demographics;
- Employment and unemployment figures, types of employment available and average remuneration;
- Economic activities and the contribution of the activity to the economics of the area;
- Availability of schools and secondary educational institutions, numbers of scholars and teacher student ratio;
- Religious and cultural services available in the area;
- General health of the community, number of hospitals or medical centres including beds available, admittance numbers, number of doctors including their areas of specialisation and costs of medical services;
- Vulnerable socio-economic groupings;
- Geographical areas that are vulnerable to socio-economic change;
- Cost of living in the municipality and region including the cost of food, rates and taxes, electricity etc. housing prices, rentals;
- Housing stock, including caravan parks, hotel accommodation, bed and breakfast facilities, guest houses including prices, available beds and general annual occupancy rates;
- Availability and costs of office and commercial rental space, as well as occupancy rates;
- The security situation including the number of police stations servicing the municipal area and the region, the number of crimes reported, the nature of the crimes, response times and resolution statistics;
- Levels of municipal services provided, including, roads construction and maintenance, waste and waste water treatment and disposal performance, water allocation and access to electricity;
- Disaster management services, including ambulance availability and response times, availability of firefighting services, flood control and evacuation potential; and
- Tourist facilities and attractions in the area, including numbers of tourists visiting and areas of special attraction.

3.10 Noise and light

As previously noted, exploration activities would most likely be undertaken in rural areas which would generally have low noise and light levels which contributes to the areas' sense of place. The increase of vehicular traffic and development activity in the area will increase the both local noise and light levels. In order to assess the increase in noise and light from the activities related to exploration or production, the baseline noise and light levels must be determined.

3.10.1 General

The baseline noise and light monitoring will need to be undertaken for a sufficient period to monitor the noise and light levels through various situations, the time period will be determined by the noise specialist based on his/her professional experience as well as general good practice. It must be noted that the draft NEMA Fracturing Regulations prohibit the consideration of exploration, fracturing and production activities within the Karoo Central Astronomy Advantage Area 3 as identified in the Regulations on the Protection of the Karoo Central Astronomy Advantage Areas in Terms of the Astronomy Geographic Advantage Act, 2007, as published in Government Notice 1411 in Government *Gazette* No. 41321 of 15 December 2017, and restricts these activities in Area 2 and 1. The consideration of exploration, fracturing and production activities are also prohibited in the Sutherland Central Astronomy Advantage Area identified in figure 1 of Government Notice No. 199 published in Government *Gazette* No. 37434 on 12 March 2014.

3.10.2 Plan for determining the pre-fracturing status of noise and light report

The objective of the baseline monitoring for noise and light is to determine the current ambient noise and light levels which occur in the local area through a number of different situations. In the case of noise, night time and daytime levels and weekdays and weekends levels must be considered, and in the case of light, full moon or new moon situations must be considered. In addition, any topographical features which could influence the passage of noise or light must be considered and reported on with an explanation as to how these features could affect the transmission of noise and light. Meteorological effects which could affect noise and light levels such as temperature inversions must also be discussed. A plan for the monitoring of these aspects is to be drawn up for the study area which must include the following aspects as a minimum information:

- Purpose of the plan;
- Major noise and light emitters in the area, including the location of these emitters on an annotated plan;
- Possible receptors of noise and light, for example, houses, schools, nursing homes, hospitals, places of worship etc. These receptors must be located on an annotated plan;
- Topographical features which could influence the transmission of noise and light located on an annotated plan;
- The methodology for monitoring, including the monitoring equipment to be utilised; and
- Monitoring points, the duration and time intervals of such monitoring. The monitoring points are to be identified on an annotated plan and the duration and time intervals captured into an excel spreadsheet.

PART 2 – ENVIRONMENTAL IMPACT ASSESSMENT

1. Chapter 1

1.1 Agriculture

Exploration for petroleum generally takes place in undeveloped areas which would have an agricultural zoning. A major concern from an agricultural perspective with any development is the possible loss of high potential agricultural land and the curtailment of agricultural activities.

Agriculture was not a theme specifically identified for baseline monitoring as the current status will be considered under the general section of this heading and through exploration no monitoring of agricultural land will be required, if agricultural land is to be lost, that loss is regarded as an impact and will be identified under this heading.

1.1.1 General

The aspects to be covered under this heading relate to the current status of the agricultural land which has been included in the "protocol for the specialist assessment and minimum report content requirements for environmental impacts on agricultural resources" and therefore are not repeated.

1.1.2 Content of the agricultural agro-ecosystem impact assessment report

The impacts on agricultural land must be assessed and reported on in line with the "protocol for the specialist assessment and minimum report content requirements for environmental impacts on agricultural resources".

The findings of the agricultural agro-ecosystem impact assessment must contain –

- A reasoned opinion, based on the findings of the impact assessment, regarding the acceptability or not, of the development related to agricultural land and any conditions to be included in the environmental authorisation should the project be approved, if relevant; and
- A discussion on the application of the impact mitigation hierarchy and where areas of high agricultural potential cannot be avoided, the mitigation measures which must be implemented to mitigate the impacts of the exploration activities on agriculture. These mitigation measures must be transferred by the EAP into a draft environmental management programme to be included at the end of Part 2.

1.2 Surface water and aquatic biodiversity

The geographical characteristics such as topography, soils, and land use as well as the surface geohydrology, affects the development and character of surface water systems such as rivers, springs, pans and wetlands. By altering these geographical characteristics through the 2-D and 3-D seismic surveys and the drilling of exploration wells associated with the exploration of petroleum reserves, impacts on surface water resources can occur. This disturbance arises from physical disturbance of

watercourses during exploration activities as a result of traversing numerous watercourses. Compaction and surface disturbance both within watercourses and their catchments could potentially affect infiltration rates and increase runoff rates across disturbed compacted surfaces. The movement of heavy vehicles over large areas could also disturb aquatic biodiversity for example frogs, dragonflies, etc.

In order to understand these impacts a surface water and aquatic biodiversity impact assessment must be undertaken to determine any changes in the character of surface water features, variabilities in water quality, water flow or aquatic biodiversity resulting from the seismic survey activities.

The surface water and aquatic biodiversity impact assessment must consider the site and the study area where continuity of features is identified, for example rivers or interlinked wetlands and pans. The surface water and aquatic biodiversity impact assessment must include general information on the aquatic environment, weather and precipitation.

The following aspects must be included in the surface water impact assessment report as a minimum:

1.2.1 General

The aspects to be covered under this heading related to the aquatic biodiversity have been included in the “Biodiversity protocol for the specialist assessment and minimum report content requirements for environmental impacts on aquatic biodiversity” and therefore are not repeated.

The general section related to the surface water must contain the following information:

- Purpose of the assessment;
- General overview of the surface water attributes within the study area;
- The regional daily precipitation and evaporation;
- The local daily precipitation and evaporation;
- Water availability and accessibility within the study area;
- Mean annual runoff;
- Regional water uses and accessibility and stresses;
- The location of surface water features within the study area or where continuity of a surface water feature is identified, in the study area. The feature with GPS coordinates as appropriate (i.e., a centre point for a pan or linear points along a river) is to be located on a surface water annotated map;
- The resource class and river health receiving water quality objectives and reserves as determined by the DWS;
- A description of the ecological importance and sensitivity of the surface water feature including the ecosystem processes in operation in the study area, for example movement of surface and subsurface water, recharge, discharge, sediment transportation etc.;
- Wetland classification should wetlands occur in the study area;
- Wetland delineations taken from a wetland study;
- A description of the vegetation within the study area and its reliance on water availability; and

- Water users in the study area.

1.2.2 Content of the surface water and aquatic biodiversity impact assessment report

The impacts on aquatic biodiversity must be assessed and reported on in line with the "Biodiversity protocol for the specialist assessment and minimum report content requirements for environmental impacts on aquatic biodiversity".

In addition, the impact assessment report for surface water must contain among others the following:

- Potential pollution sources;
- Potential polluting activities;
- Potential disturbances to surface water features (this task could include the modelling of surface water changes);
- The report on the impacts on animal species prepared in line with the "Protocol for the specialist assessment and minimum report content requirements for environmental impacts on animal species";
- The report on the impacts on plant species prepared in line with the "Protocol for the specialist assessment and minimum report content requirements for environmental impacts on plant species";
- The report on the impacts on aquatic biodiversity prepared in line with the "Biodiversity protocol for the specialist assessment and minimum report content requirements for environmental impacts on aquatic biodiversity"; and
- The findings of the surface water and aquatic biodiversity impact assessment which must contain a reasoned opinion, based on the findings of the specialist assessment, regarding the acceptability or not, of the development related to the surface water and aquatic biodiversity and any conditions to be included in the environmental authorisation should the project be approved, if relevant;
- The mitigation measures which must be implemented to avoid, manage or mitigate the impacts from the exploration activities on surface water and aquatic biodiversity; and
- The mitigation measures must be transferred by the EAP into a draft environmental management programme to be included at the end of Part 2.

1.3 Groundwater

The groundwater information must be provided for the site and must include general information on groundwater as well as specific information on the expected impacts on groundwater from the 2-D and 3-D seismic investigation and exploration well drilling to be undertaken. Although the activities of the seismic survey are not expected to have a major impact on the groundwater situation within the study area, the impacts of potential pollution to groundwater and the drilling of exploration wells, if this is an activity that will be undertaken through the exploration operations must be determined.

1.3.1 General

The general section related to groundwater impacts from the seismic investigation and the exploration well drilling must contain the following information:

- Purpose of the assessment;
- General overview of the geological information;
- Aquafer classification;
- General overview of the regional groundwater aquatic environment;
- Discussion on the frequency and intensity of precipitation, temperature, humidity, evaporation and aquifer recharge within the affected area;
- Groundwater model; and
- The regional reliance on groundwater with specific focus on the study area.

1.3.2 Content of the groundwater impact assessment report

The impact assessment report must contain among others the following:

- The purpose of the impact assessment;
- Potential pollution sources;
- Potential polluting activities;
- Potential for the drilling of exploration wells and the impact that this could have within the study area;
- Potential disturbances to groundwater features where relevant;
- The extent to which the impacts may cause irreplaceable loss of resources;
- The degree to which the identified impacts can be avoided, managed or mitigated;
- The findings of the groundwater impact assessment which must contain a reasoned opinion, based on the findings of the specialist assessment, regarding the acceptability or not, of the development related to groundwater and any conditions to be included in the environmental authorisation should the project be approved, if relevant;
- The measures which must be implemented to mitigate the impacts from the exploration activities on groundwater; and
- These mitigation measures must be transferred by the EAP into a draft environmental management programme to be included at the end of Part 2.

1.4 Air quality

Local air quality can be impacted on by activities related to exploration of petroleum such as the movement of heavy vehicles and diesel fumes. It is therefore important to identify potential impacts on the local air quality, to assess the significance of these impacts, and to determine if avoidance, management or mitigation of these impacts is possible. The study must include information on the general ambient air quality in the area as well as factors which affect ambient air quality within the study area.

1.4.1 General

The general section related to air quality impacts from the seismic activity must contain the following information:

- General overview of the ambient air quality in the study area;
- Discussion on the weather patterns in the area including wind direction and velocity, temperature, cloudiness, frequency and intensity of precipitation, and humidity among others; and
- Current agricultural, industrial or mining operations which could result in air pollution including their locations.

1.4.2 Content of the air quality impact assessment report

The impact assessment report must contain among others the following:

- Potential pollution sources;
- Potential polluting activities;
- Potential changes to ambient air quality;
- The extent to which the impacts may cause harm to the environment or human health;
- The degree to which the identified impacts can be avoided, managed or mitigated;
- The findings of the air quality impact assessment which must contain a reasoned opinion, based on the findings of the specialist assessment, regarding the acceptability or not, of the development related to air quality and any conditions to be included in the environmental authorisation should the project be approved, if relevant;
- The measures which must be implemented to mitigate the impacts from the exploration activities on air quality; and
- These mitigation measures must be transferred by the EAP into a draft environmental management programme to be included at the end of Part 2.

1.5 Seismicity

The impact of seismicity from the exploration activity is expected to be low, however, any impact from increased seismic activity on heritage buildings must be determined.

1.5.1 General

The general section related to impacts from the seismic activity must contain the following information:

- General overview of the geomorphology and geology;
- The historical and current available seismic data;
- Seismic reflection and refraction data;
- Desktop studies of existing geological maps;

- Desktop studies of existing regional probabilistic seismic hazard assessments for the area;
- Any identified stressed faults or fault scarps;
- Stress data from proximal boreholes where available; and
- Geophysical data such as gravity.

1.5.2 Content of the seismic impact assessment report

The impact assessment report must contain among others the following:

- Purpose of the assessment which will be to consider the possible impact on heritage buildings or structures;
- Potential activities which could increase seismicity in the study area through the exploration operations which could impact on heritage buildings or structures;
- Potential changes to the current seismic environment from the exploration operations including the extent of these changes;
- The extent to which the change in seismicity may increase risks to heritage buildings or structures;
- The degree to which the identified impacts can be avoided, managed or mitigated;
- The findings of the seismicity impact assessment which must contain a reasoned opinion, based on the findings of the specialist assessment, regarding the acceptability or not, of the exploration related to the additional risks to heritage buildings or structures as well as any conditions to be included in the environmental authorisation, should the project be approved, if relevant;
- Any monitoring that must be undertaken through the exploration operations;
- The measures to be implemented to mitigate the impacts from the exploration operations related to seismicity; and
- These mitigation measures must be transferred by the EAP into a draft environmental management programme to be included at the end of Part 2.

1.6 Cultural heritage and paleontological resources

Heritage resources are distributed in variable densities throughout the country, but because of a generally low survey coverage, the actual distribution of resources is poorly known, specifically in rural areas. Small pockets of high coverage indicate that important heritage resources of all types can occur anywhere in the landscape but river valleys and the undulating uplands tend to be more sensitive than the open plains for some categories of heritage, largely because of access to water. Although it will not be possible to choose the area to be explored and/or developed based on heritage resources, micro-siting of the infrastructure and the implementation of management and mitigation measures during all phases of exploration and production will help to reduce the significance of the impacts that would be experienced.

1.6.1 General

The general section related to impacts on cultural heritage and paleontological resources must contain the following information:

- Areas in which cultural and paleontological resources are likely to be found within the study area based on past activities or specific locations;
- The identification of locations of known artefacts, rock paintings, graves, fossils, conservation buildings, monuments, etc. within the study area; and
- Activities which could impact on cultural and palaeontological resources in the study area.

1.6.2 Content of the cultural and palaeontological resources impact assessment report

The impact assessment report must comply with section 38(3) of the NHRA and must as a minimum contain among others the following:

- Purpose of the assessment;
- The identification of a search methodology for cultural heritage and palaeontological resources;
- Findings of a field study to possible areas in which cultural and palaeontological resources could be found and the significance of these resources;
- Possible areas in which heritage resources could be found and the significance of these resources;
- A “chance find protocol for cultural heritage artefacts and palaeontological resources” must be prepared and included as an appendix to the environmental management programme to be included at the end of Part 2.
- The findings of the seismicity impact assessment must contain a reasoned opinion, based on the findings of the specialist assessment, regarding the acceptability or not, of the exploration related to the possible increased seismicity and any conditions to be included in the environmental authorisation should the project be approved, if relevant;
- Any monitoring that must be undertaken through the exploration operations;
- The measures which must be implemented to protect any cultural heritage artefacts and paleontological resources should these be identified; and
- These mitigation measures must be transferred by the EAP into a draft environmental management programme to be included at the end of Part 2.

The findings of the cultural and palaeontological resources impact assessment must contain a reasoned opinion, based on the findings of the specialist assessment, regarding the acceptability or not, of the activities related to exploration on cultural and palaeontolgoical resouces as well as any conditions to be included in the environmental authorisation should the project be approved, if relevant, and the mitigation measures which must be implemented to mitigate the impacts from the exploration activities on cultural and palaeontolgoical resouces.

1.7 Terrestrial biodiversity and species

The seismic activities related to 2-D and 3-D investigations can impact on flora and fauna through disturbance, displacement, compaction and spillages, among others. The impact on flora and fauna from seismic activities must be determined.

1.7.1 General

The aspects to be covered under this heading related to the current status of terrestrial biodiversity and species have been included in three protocols listed in paragraph 1.7.2 below and are therefore not repeated here.

1.7.2 Content of the biodiversity and species impact assessment report

The impacts on biodiversity and species must be assessed and reported on in line with the following protocols:

- The "Biodiversity protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial biodiversity";
- The "Protocol for the specialist assessment and minimum report content requirements for environmental impacts on plant species"; and
- The "Protocol for the specialist assessment and minimum report content requirements for environmental impacts on animal species".

The findings of the terrestrial biodiversity plan and animal species impact assessment must contain a reasoned opinion, based on the findings of the specialist assessment, regarding the acceptability or not, of the development related to terrestrial biodiversity, animals and plants species as well as any conditions to be included in the environmental authorisation should the project be approved, if relevant, and the mitigation measures which must be implemented to mitigate the impacts from the exploration activities on terrestrial biodiversity, animals and plant species. These mitigation measures must be transferred by the EAP into a draft environmental management programme to be included at the end of Part 2.

1.8 Waste Management

The waste generated from the 2-D and 3-D seismic investigation would not be expected to be excessive, however proper waste management must be undertaken throughout the exploration operations and the impacts of waste on the environment from the seismic investigation must be determined.

1.8.1 General

An assessment of waste to be produced by the exploration operations must be conducted. This assessment must include the possible generation of solid waste, hazardous waste, oil and lubricant waste, construction and demolition waste and sewage etc. Opportunities for avoiding, reducing, reusing and recycling of waste materials must be identified.

1.8.2 Content of the waste impact assessment report

The assessment must determine where the siting of temporary waste facilities will have the least environmental impacts and determine the most suitable waste storage methods, locate the final disposal facilities (licensed landfills) and identify the service providers for the disposal of waste.

The waste management assessment must make special mention of hazardous waste handling, storage and disposal (including oil and lubricant waste), and must propose mitigations for avoidance of the pollution of ground or surface water. In addition, the waste management specialist assessment must determine the emergency procedures to be followed in the event of a hazardous waste spill.

The waste management specialist assessment must make specific mention of the handling, treatment and disposal of sewage, such that this is done in the most environmentally friendly manner taking particular note of surface and groundwater resources, odour nuisance, and accessibility.

The findings of the waste impact assessment which must contain a reasoned opinion, based on the findings of the specialist assessment, regarding the acceptability or not, of the development related to waste management as well as any conditions to be included in the environmental authorisation should the project be approved, if relevant, and the mitigation measures which must be implemented to manage and mitigate the impacts of waste on the study area. These management and mitigation measures must be transferred by the EAP into a draft environmental management programme to be included at the end of Part 2.

2. Chapter 2

2.1 Environmental management programme

An environmental management programme plays a vital role in the implementation of consistent and continued environmental management practices during the life of the exploration and production operations.

A draft environmental management programme must be provided under this heading which satisfies the requirements of section 24N of NEMA and Appendix 4 of the EIA Regulations, which regulate and prescribe the content of any environmental management programme and specify the type of supporting information that must accompany the submission of the report to the authorities. This draft environmental management programme must include the setting up of the seismic survey as well as the execution of the seismic survey.

The implementation of the environmental management programme is not an optional requirement. The environmental management programme is legally binding through NEMA and the environmental authorisation. The applicant must ensure that the environmental management programme forms part of all project tenders and exploration contracts to allow for costs of the mitigation and management measures to be included in the consideration of the viability of the project.