

**UNIVERSITY OF CAPE TOWN**

**Institute of Marine and Environmental Law**

**A Survey of the Legal Framework Governing the Water Impacts of Proposed  
Shale Gas Extraction in the Karoo**

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fulfilment of the MPhil degree in Environmental Law

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### **Abstract**

It is estimated that South Africa has the eighth largest resources of shale gas reserves in the world. It is reported that shale gas extraction can have important benefits which include economic growth, poverty alleviation, carbon emission reduction and most significantly alleviate the current energy shortage. However the proposed extraction of shale gas using hydraulic fracturing requires large amounts of water and many hazardous chemicals which also risks water resource pollution. This can add to water stress and conflict because the Karoo is a semi-arid, water-deficient and drought prone region.

Since the extraction thereof is a relatively new technology in South Africa there is a need to determine if the current regulatory and institutional framework in South Africa will be adequate to meet the demands posed by this potentially game-changing enterprise. This minor dissertation outlines the regulatory framework regarding both the water quality and quantity in the shale gas extraction process. It recommends that while there are some regulatory building blocks in place, many gaps exist. It will recommend that an inter-departmental co-operative steering committee is established to address the many overlapping responsibilities and at times contradicting requirements.

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## LIST OF ACRONYMS

CMA	Catchment Management Agency
BPEO	Best Practicable Environmental Option
DEA	Department of Environmental Affairs
DMR	Department of Minerals and Resources
DWA	Department of Environmental Affairs
EIA	Environmental Impact Assessment
EMI	Environmental Management Inspector
EMP	Environmental Management Programme
EPA	Environmental Protection Agency
GA	General Authorisation
IRP	Integrated Resource Plan
MPRDA	Minerals and Petroleum Resources Developmental Act, 28 of 2002
NEMA	National Environmental Management Act, 107 of 1998
NEMWA	National Environmental Management Waste Act, 59 of 2008
NGS	National Ground Water Strategy
NNRA	National Nuclear Regulator Act, 47 of 1999
NWA	National Water Act, 36 of 1998 as amended
NWRS	National Water Resources Strategy
PAIA	Promotion of Access to Information Act, 2 of 2000
PAJA	Promotion of Administrative Justice Act, 3 of 2000
PASA	Petroleum Agency of South Africa
tcf	trillion cubic feet
US	United States

## CHAPTER ONE

### INTRODUCTION

#### 1.1 Introduction

During February 2014, the President of South Africa declared shale gas extraction as a ‘game-changer for the Karoo region and the South African economy’.<sup>1</sup>

It is estimated that South Africa has the eighth-largest shale-gas reserves in the world, following China, Argentina, Algeria, US, Canada, Mexico and Australia.<sup>2</sup>

Energy in South Africa is very coal dependent with 94% of electricity being generated from coal and this also results in high carbon emissions.<sup>3</sup> Energy from shale gas is reported to be significantly less carbon emissions per unit energy compared to coal if the methane emissions are controlled.<sup>4</sup>

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<sup>1</sup> JG Zuma ‘State of the Nation Address By His Excellency Jacob G Zuma, President of the Republic of South Africa on the occasion of the Joint Sitting of Parliament’ *State of the Nation Address*, 13 February 2014, available on <http://www.gov.za/speeches/view.php?sid=43620> accessed on 20 February 2014.

<sup>2</sup> United States Energy Information Administration ‘Technically Recoverable Shale Oil and Shale Gas Resources: An Assessment of 137 Shale Formations in 41 Countries Outside the United States’ Independent Statistics and Analysis, 13 June 2013 available at <http://www.eia.gov/analysis/studies/worldshalegas/pdf/overview.pdf> accessed on 21 February 2014 at 6

<sup>3</sup> Econometrix ‘Special Report on Economic Considerations Surrounding Potential Shale Gas Resources in the Southern Karoo of South Africa’ available at <http://cer.org.za/wp-content/uploads/2012/06/Econometrix-KSG-Report-February-2012.pdf>, accessed on 02 October 2012 at 21

<sup>4</sup> A Burnham et al ‘Life-Cycle Greenhouse Gas Emissions of Shale Gas, Natural Gas, Coal, and Petroleum’ (2011) 46 *Environ. Sci. Technol.* 625.



South Africa is experiencing an energy crisis due to an energy shortage. While new capacity is under construction more will be needed as South Africa's energy needs may double by 2030.<sup>5</sup>

It seems therefore that shale gas can play an important role in reducing South Africa's carbon footprint and also assist in reducing the energy gap. Furthermore, shale gas can improve energy security as South Africa is a net importer of gas and oil based products.<sup>6</sup> South Africa needs a stable energy supply for continued economic growth, given that the energy demand in South Africa is projected to grow faster than the average global demand.<sup>7</sup> Oil is the single largest products imported into South Africa with considerable balance of payment implications should the price of oil increase. Shale gas can be a useful alternative to oil imports. Not least of the potential benefits of shale gas extraction is the potential job creation and poverty alleviation.<sup>8</sup> Although these factors make shale gas a very attractive resource to some proponents many landowners, environmentalists, lawyers are not convinced.<sup>9</sup>

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<sup>5</sup> Department of Energy 'Integrated Resource Plan for Electricity 2010 – 2013' 2013 Update Report, available at [www.sapvia.co.za/integrated-resource-plan-for-electricity-irp-2010-2030-update-report-2013-2/](http://www.sapvia.co.za/integrated-resource-plan-for-electricity-irp-2010-2030-update-report-2013-2/) accessed on 30 September 2014 at 15.

<sup>6</sup> Department of Mineral Resources 'Report on Investigation of Hydraulic Fracturing in the Karoo Basin of South Africa' available at [http://fracking.cedha.net/wp-content/uploads/2013/08/the\\_full\\_report\\_on\\_investigation\\_of\\_hydraulic\\_fracturing\\_in\\_the\\_karoo\\_basin\\_of\\_south\\_africa.pdf](http://fracking.cedha.net/wp-content/uploads/2013/08/the_full_report_on_investigation_of_hydraulic_fracturing_in_the_karoo_basin_of_south_africa.pdf), accessed on 1 October 2012 at 40.

<sup>7</sup> Department of Energy op. cit. (n5) 11.

<sup>8</sup> MJ de Wit 'The great shale debate in the Karoo' (2011) 107(7/8) S Afr J Sci. 791.

<sup>9</sup> L Havemann, J Glazewski and S Brownlie 'A critical review of the application for a Karoo exploration right by Shell Exploration B.V.' available from: <http://havemanninc.com/wp-content/uploads/2011/04/KarooPolicyObjection-5-April-0903-FINAL.pdf> accessed on 21 February 2014 at 103.

## 1.2 Shale gas technology

The extraction of shale gas in the Karoo will be made possible using horizontal drilling and hydraulic fracturing. In order to access the shale gas a vertical well is first drilled and then horizontal drilling is used to expand the area fractured for gas extraction.

The vertical hydraulic fracturing technique is not new however the development and expansion of the use of horizontal fracturing is only a recent phenomenon.<sup>10</sup> However this technology is controversial due to air emissions, potential water contamination, significant amount of water usage, the large land footprint of drilling pads and seismic induced events.<sup>11</sup>

As will be elaborated on in Chapter Two, one of the key issues to be debated is the need to protect water resources. This is a concern also because of the scarcity of water in the Karoo and because most of the Karoo is dependent on groundwater.<sup>12</sup>

Arguably the most significant environmental risk that shale gas extraction poses to South African water resources is water pollution because the fluid used to hydraulic fracture contains hazardous chemicals.<sup>13</sup> Some of the fracturing fluid makes its way back to the surface after drilling which is combination of fracturing fluid and also salts, metals and naturally occurring radioactive substances found very deep underground. This water is called “produced water” when the water returns to the ground after drilling or “flowback” when the water returns when gas is extracted.

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<sup>10</sup> D Rahm ‘Regulating hydraulic fracturing in shale gas plays: The case for Texas’ *Journal of Energy Policy* 39 (2011) 2974.

<sup>11</sup> Rahm *op. cit.* (n10) 2975.

<sup>12</sup> G Steyl and GJ van Tonder ‘Hydrochemical and Hydrological Impact of Hydraulic Fracturing in the Karoo, South Africa’ accessed at <http://dx.doi.org/10.5772/56310> on 21 February 2014 at 213.

<sup>13</sup> Rahm *op. cit.* (n10) 2976.

This produced or flowback water is a pollution threat to deep underground water, near surface water and surface water. Thus above ground spills or leaks of produced or flowback water can contaminate surface and groundwater if not properly managed.

The second issue is that the Karoo has a unique and complex geological structure with little knowledge of the underground formations.<sup>14</sup> This introduces the risk of contaminated fluid migrating upwards into fresh water aquifers through fractures which may therefore require specific studies and protection measures unique to the Karoo region.<sup>15</sup>

The disposal of produced water is also subject to some controversy since conventional waste water treatment works may be unsuitable for the treatment of this effluent.<sup>16</sup> One of the options for disposal is the re-injection of effluent underground however this has been known to cause seismically induced events<sup>17</sup> and may cause contamination of receiving water.<sup>18</sup> A growing trend has been to recycling this water and treated at specialised treatment facilities prior to discharge.<sup>19</sup>

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<sup>14</sup> Ibid.

<sup>15</sup> Ibid.

<sup>16</sup> Ferrar et. al. 'Assessment of Effluent Contaminants from Three Facilities Discharging Marcellus Shale Wastewater to Surface Waters in Pennsylvania' (2013) 47 *Sci. Technol.* 3472.

<sup>17</sup> R Davies et al, 'Induced seismicity and hydraulic fracturing for the recovery of Hydrocarbons' (2003) 45 *Marine and Petroleum Geology* 171.

<sup>18</sup> Ferrar op. cit. (n16) 3473.

<sup>19</sup> Ibid.

South Africa is a water scarce country with an average rainfall of 450mm/y compared to an international average of 800mm/y.<sup>20</sup> The Karoo is even drier with an average between 200mm/y and 400mm/y.<sup>21</sup> As a result, there are competing demands for water resources especially since South Africa's water demand will exceed its supply by 2025.<sup>22</sup> In addition there are also issues of declining water quality.<sup>23</sup> The decline in water quality is because of a number of factors including industry and mining waste, agricultural drainage, waste disposal and increased urbanization.<sup>24</sup> Security of a clean water supply has become a key strategic issue as well as a driver for continued and sustained economic growth and service delivery to the people of South Africa.<sup>25</sup> Issues of water scarcity and declining quality as a result of pollution are likely to cause conflict.<sup>26</sup> The challenge is to ensure that there are enough clean water supplies to satisfy the demands for water from various sectors whilst simultaneously attempting to address widespread poverty, inequality and environmental degradation.<sup>27</sup>

Any water impacts would need to be assessed locally and regionally and by various authorities. International experience shows that water pollution is a risk from hydraulic fracturing. Similar mistakes cannot be made with shale gas extraction as

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<sup>20</sup> F Cessford and J Burke 'Background Research Paper: Inland Water, South Africa Environment Outlook available at [http://soer.deat.gov.za/dm\\_documents/Inland\\_Water\\_-\\_Background\\_Paper\\_cSIIdS.pdf](http://soer.deat.gov.za/dm_documents/Inland_Water_-_Background_Paper_cSIIdS.pdf), accessed 2 October 2013 at 5.

<sup>21</sup> PD Vermeulen 'A South African perspective on Shale Gas Hydraulic Fracturing, International Mine Water association, Annual Conference 2012 available at [http://www.imwa.info/docs/imwa\\_2012/IMWA2012\\_Vermeulen\\_149.pdf](http://www.imwa.info/docs/imwa_2012/IMWA2012_Vermeulen_149.pdf) accessed on 10 October 2014 at 151.

<sup>22</sup> Cessford op. cit. (n20) 25.

<sup>23</sup> Department of Environmental Affairs 'State of the environment. Water quality' available at <http://soer.deat.gov.za/50.html> , accessed 17 April 2010.

<sup>24</sup> Cessford op. cit. (n20) 25.

<sup>25</sup> Council of Scientific and Industrial Research 'Acid Mine Drainage in South Africa, Briefing Note 2009/02.' Available at [http://www.csir.co.za/nre/docs/BriefingNote2009\\_2\\_AMD\\_draft.pdf](http://www.csir.co.za/nre/docs/BriefingNote2009_2_AMD_draft.pdf) , accessed 17 April 2013.

<sup>26</sup> M Kidd 'Poisoning the Right to Water in South Africa: What the Law Can Do?' available at [www.cer.org.za/wp-content/UNE-Paper-Kidd-Final-20110408](http://www.cer.org.za/wp-content/UNE-Paper-Kidd-Final-20110408), accessed on 10 October 2012 at 1

<sup>27</sup> J Glazewski *Environmental Law in South Africa* 2 ed (2005) 617.

was made with coal extraction in South Africa which resulted in many serious water pollution issues amongst them Acid Mine Drainage.

### **1.3 Key research question**

Against the above backdrop the central question addressed in this dissertation is whether the current regulatory and institutional framework in South Africa will be adequate to meet the demands posed by this potentially game-changing enterprise. As will be emphasised in the chapters below both the possible water contamination issues and water usage issue highlights the need for an effective governance framework to be in place. This minor dissertation will outline the regulatory framework regarding both the water quality and quantity in the shale gas extraction process. It will conclude that while there are some regulatory building blocks in place, many gaps exist. It will recommend that an inter-departmental co-operative steering committee is established to address the many overlapping responsibilities and at times contradicting requirements.

### **1.4 Theoretical underpinnings underlying the minor dissertation**

Shale gas extraction may impact a number of rights found in the Constitution which includes the environmental right,<sup>28</sup> the right to access to sufficient food and water,<sup>29</sup> the right to access to information,<sup>30</sup> just administrative action<sup>31</sup> and the right to property.<sup>32</sup> The impacts on each right and will be outlined and the associated statutes such as the Promotion of Access to Information Act, 2 of 2000 which gives

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<sup>28</sup> Section 24 of the Constitution Act 108 of 1996.

<sup>29</sup> Section 27 of the Constitution Act 108 of 1996.

<sup>30</sup> Section 32 of the Constitution Act 108 of 1996.

<sup>31</sup> Section 33 of the Constitution Act 108 of 1996.

<sup>32</sup> Section 25 of the Constitution Act 108 of 1996.

effect to the protection and fulfilment of these rights in the context of water quantity and water quality. The dissertation will give an overview of the statutory laws that are relevant to the water impacts of shale gas extraction and assess the more relevant laws in some detail.

The South African legal policies and statutes address the management of water allocation and pollution. In spite of these however, there have been many issues related to the Shell Exploration Company's and other applications to perform exploratory fracturing in the Karoo.<sup>33</sup> Furthermore, many questions have been raised over the effectiveness of the regulatory system in place.<sup>34</sup> In light of this the relevant aspects of extraction, environmental and water law to this subject these laws will be discussed.

## **1.5 Research methodology**

The work is a desktop study entailing the identification and analysis of relevant literature and legal materials.

## **1.6 Structure of the dissertation**

This study is divided into eight chapters. **Chapter two** sets the scene by outlining firstly the geo-physical context related to the water scarcity and the unique and complex geo-hydrological characteristics of the Karoo. Secondly the chapter describes the shale gas extraction process and explores the environmental issues

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<sup>33</sup> Havemann op. cit. (n9) 14.

<sup>34</sup> Bekker, Fritz 'Review of the Draft EMP in Support of an Application for Gas Exploration in the Western Karoo (Central Precinct) by Shell Exploration Company' 1 April 2010 accessed on 2 February 2013 on <http://cer.org.za/wp-content/uploads/2011/04/Final-Report-Shell-EMP-Review-1-April-2011-3-Bekker.pdf> 43.

associated with the process focusing in particular on the water related aspects and the associated potential impacts.

**Chapter three** of gives an overview of the legal and regulatory aspects that are relevant to shale gas extraction. Shale gas extraction may impact a number of rights found in the Constitution. The impacts on each right and will be discussed and the associated legal framework which exists to give effect to these rights. The chapter will give an overview of the statutory laws that are relevant to shale gas extraction.

**Chapter four** will elaborate on the constitutional aspects outlined in the previous chapter by outlining the statutory framework relevant to the water issues described in Chapter 2. This chapter will canvass the not only the various authorisations and related provisions of the National Water regulation relating to water scarcity and water quality but will also outline the relevant environmental and related laws. The governance of ground water is discussed in this chapter and the lack of knowledge of the impacts of the unique geology in the Karoo on the potential water pollution is raised as an issue.

Apart from discussing the water related regulatory gaps proposals will be made regarding regulatory options and considerations for the various authorities to improve decision making. In so doing, the NWRS and other national and regional policies will be assessed to determine how the complex issue of shale gas extraction can be governed.

**Chapter five** discusses petroleum law related to shale gas extraction. There are limitations of the existing approach and this is discussed. For example, a review of recent shale gas extraction applications has shown many regulatory gaps, poorly managed applications and a lack of clarity on how the industry will be managed.

The extraction related environmental impact assessment process is fragmented and there are a number of important changes that are being proposed by the authorities.

The extraction authorities have issued proposed Technical Regulations related to shale gas extraction. A review of these regulations is made.

This section concludes that the fragmentation of the extraction related law regards environmental impact assessments is need for resolution and the Technical Regulations do not adequately take into account the unique geological structures of the Karoo and disposal and treatment of wastewater.

**Chapter six** will assess the specific aspects of environmental law related to shale gas extraction. The administration of environmental law related to extraction related aspects is in transition. The overlap between the extraction law and environmental law is discussed. The lack of a requirement to perform Strategic Environmental Assessments for a new extraction process on a large scale poses some challenges as the broader environmental impacts are not always considered in project specific environmental impact assessments.

Implementation, enforcement and institutional capacity will be assessed in **chapter seven**. The relevant institutions will be discussed in terms of their respective mandates and how they need to work together. In line with the promulgation of the National Water Act<sup>35</sup> (the Water Act) in 1998, the Minister of Water Affairs became the public trustee of all water resources and as such is seen as one of the main players in the regulation of shale gas extraction<sup>36</sup>. Other departments that

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<sup>35</sup> Act 36 of 1998.

<sup>36</sup> Section 3 of the National Water Act 36 of 1998.



need to be involved include the Department of Mineral Resources, Department of Environmental Affairs and the Department of Energy. Provincial and Local government will also have an important role to play in the governance of the industry. Co-operative governance will be assessed and how the various organs of state are and should collaborate in this regard.

One of the key enforcement agents is the Petroleum Agency of South Africa (PASA). Chapter seven will assess if PASA has sufficient capacity to provide the necessary industrial oversight.

**Chapter eight** concludes by arguing that while the water regulatory frameworks are in place to govern shale gas extraction impacts institutional capacity and enforcement are in need for further development.

## **1.7 Terminology**

Hydraulic fracturing and well-field development is commonly grouped together in popular literature. This is incorrect, since hydraulic fracturing is the process of fracturing the underground rock strata in order to release gas<sup>37</sup>. The term shale gas extraction is used in this dissertation as it encompasses the entire operation from well drilling to hydraulic fracturing, well completion, gas production and post-closure. Any waste water that is transported and processed in a separate waste facility is included in the scope of shale gas extraction.

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<sup>37</sup> Steyl op. cit. (n12) 221.

## CHAPTER TWO

### THE GEOPHYSICAL AND ENERGY CONTEXT OF SHALE GAS EXTRACTION

#### 2.1 Energy context in South Africa

Fossil fuels are the dominant source of energy in South Africa with coal the largest source.<sup>38</sup> As a result South Africa has a very carbon intensive economy, high levels of air pollution and water pollution from coal extraction.<sup>39</sup> South Africa has the largest coal based economy in the world which results in significant carbon emissions.<sup>40</sup> Apart from alleviating South Africa's energy shortage a move to natural gas can reduce the carbon intensity of the economy, with gas having only approximately half of the carbon release per unit of energy compared to coal.<sup>41</sup> The electricity Integrated Resource Plan (IRP-2010) showed an increase in the use of gas in the energy mix by only 4%,<sup>42</sup> whereas this was increased to 28% of new installed capacity by 2030 in the revised IRP of 2013 in the 'big gas' scenario.<sup>43</sup> This shows the shift to gas in the energy planning arena. Thus shale gas could become an important resource in the future energy planning.

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<sup>38</sup> A Ruffini 'South Africa's carbon intensity dilemma – the gap between ambitions and reality' available at <http://www.esi-africa.com/node/14935> accessed on 3 October 2012 1

<sup>39</sup> Ibid.

<sup>40</sup> Ibid.

<sup>41</sup> Burnham op. cit. (n4) 625.

<sup>42</sup> Department of Energy 'Integrated Resource Plan for Electricity 2010 – 2013' Rev 2 (2010) available at [http://www.energy.gov.za/IRP/irp%20files/IRP2010\\_2030\\_Final\\_Report\\_20110325.pdf](http://www.energy.gov.za/IRP/irp%20files/IRP2010_2030_Final_Report_20110325.pdf) accessed on 5 October 2012 at 25.

<sup>43</sup> Department of Energy op. cit. (n5) 36.

## 2.2 Shale gas reserves and location in South Africa

Shale gas is found in the shale formations of the Ecca group in the Karoo basin between about 2500 and 4000m below ground.<sup>44</sup> The Karoo basin is geologically far greater than the area identified by the arid landscape. The basin of interest is approximately 90 000 square kilometres and includes the Whitehill, Prince Albert and Collingham geological formations.<sup>45</sup> This covers a large part of the country extending from Sutherland in the Western Cape until Pretoria in the North. There are currently five exploration right applications being considered amounting to a vast area inside five provinces with a combined area equal to the whole of the Eastern Cape.<sup>46</sup> Within these areas however only a limited part can be exploited when one removes natural protected areas, towns, astronomy facilities, topographical features.<sup>47</sup> It is estimated that this leaves 28% of the Karoo and typically only some of this will be exploited, perhaps only 5% to 10% of the area will become viable.<sup>48</sup>

What is unique about the Karoo compared to many other regions where shale gas is extracted is that the Karoo is a water scarce region also has unique geological features. These features include the intrusion of dolerite sills and dykes which are not found in any other shale gas region in the world.<sup>49</sup> There have been little

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<sup>44</sup> Vermeulen op. cit. (n21) 149.

<sup>45</sup> L Kotzé and C Goosen ‘’n Ontleding van die Suid-Afrikaanse regsraamwerk met betrekking tot die omgewingsaspekte van breking in die Karoo=An analysis of the South African legal framework relating to the environmental aspects of fracking in the Karoo’ (2014) 11 *LitNet Akademies* 150

<sup>46</sup> Econometrix op. cit. (n3) 18.

<sup>47</sup> Vermeulen op. cit. (n21) 150.

<sup>48</sup> Ibid.

<sup>49</sup> Vermeulen op. cit. (n21) 149.

studies on the importance of these intrusions however the concern are that the dykes could be conduits for polluted water into aquifers higher up.<sup>50</sup>

It is estimated that reserves of 390 trillion cubic feet (tcf) of shale gas exists in the Karoo which makes the Karoo the eighth biggest reserve in the world.<sup>51</sup> PASA on the other hand has estimated that the reserve which is only 40 tcf and well below the Shell's feasible level of 50 tcf.<sup>52</sup>

Shale gas extraction and associated industry could contribute significantly to economic growth and employment however there is much uncertainty over the extent. According to a study performed by the industry if 50 tcf is exploited over a 25 year period economic contribution and employment estimations amount to 208% of South African GDP (2010) and 700 000 jobs respectively.<sup>53</sup> A comparison between the Karoo forecast and the experience at the Barnett shale plays in Texas shows that 55 386 jobs created in 2006 and US\$ 5.2b was spent in the economy.<sup>54</sup> This gas field has reserves estimated at 30 tcf compared to the South African study which assumed 50 tcf.

### **2.3 Shale gas extraction technology**

Traditionally, natural gas is extracted using conventional drilling methods using vertical wells in single gas reservoirs close to the surface. However drilling for gas

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<sup>50</sup> Vermeulen op. cit. (n21) 154.

<sup>51</sup> United States Energy Information Agency op. cit. (n2) 6.

<sup>52</sup> P Vecchiato 'SA petroleum agency's Karoo shale-gas estimate "far lower"' Business Day live accessed on 27 February 2015, available at <http://www.bdlive.co.za/business/energy/2014/02/21/sa-petroleum-agencys-karoo-shale-gas-estimate-far-lower> accessed on 12 February 2014 at para 1.

<sup>53</sup> Econometrix op. cit. (n3) 11

<sup>54</sup> Perryman Group 'Barnett Shale 2008 Economic Impact Report' available at [http://www.northtexansformaturalgas.com/new\\_economic\\_study\\_from\\_the\\_perryman\\_group\\_proves\\_barnett\\_shale\\_is\\_thriving](http://www.northtexansformaturalgas.com/new_economic_study_from_the_perryman_group_proves_barnett_shale_is_thriving) accessed on 4 October 2012 at para 2.

in shale rock was not economical mainly due to the lack of permeability to allow the gas to be extracted.

Unconventional extraction methods however allow for economic shale gas extraction. This technique involves the use of water to drill wells a few thousand meters deep and then using horizontal drilling once the required depth has been reached. This method allows the drilling of fewer wells and is a well suited drilling technique for the Karoo, given that the gas resource is relatively deep. After the wells are drilled large volumes of water containing hydraulic fracturing fluids are pumped under high pressure into the shale in order to release the natural gas. This process is commonly known as ‘hydraulic fracturing’ or ‘fracking’.

Once the shale has been fractured some of the well water which contains the fracturing fluids and some salt, metals and radioactive substances found below ground make their way to the surface via the well. In addition when gas is extracted some more water will flow to the surface over time. The management of this water will be discussed in Section 2.7.

#### **2.4 South African water context**

South Africa is a water scarce country.<sup>55</sup> It is estimated that the water supply will remain relatively constant with a 2025 baseline of 14681 million m<sup>3</sup>.<sup>56</sup> Demand however is expected to increase to between 14 486 for the low growth scenario and 17 248 million m<sup>3</sup> for the high growth scenario.<sup>57</sup> This result in a change from a

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<sup>55</sup> M Vawda, N King and M Muller ‘Pricing of Water for Cost Recovery, Economic Efficiency and Social Equity’ (2011) 2 *Global Issues in Water Recovery* at 181.

<sup>56</sup> Ibid.

<sup>57</sup> Ibid.

surplus of 186 million m<sup>3</sup>/y in 2000<sup>58</sup> to a deficit of 1788 million m<sup>3</sup>/y.<sup>59</sup> It would seem therefore that additional water needs of shale gas extraction needs to be carefully managed to avoid conflict with other users.

Groundwater is part of the natural hydrological cycle and is therefore not seen as an additional or separate water resource. The source of groundwater is surface water that drains into the soil and replenishes the groundwater over time. The ground water naturally overflows feeding surface wetlands and rivers. If groundwater is over-utilised or the surface run-off is overly reduced then the dependent ecosystems are negatively impacted.<sup>60</sup>

Irrigation in South Africa dominates water use at about 62% of all water used. Domestic and urban use follows with 27% and extraction, large industries and power generation 8%.<sup>61</sup>

It is not clear at this stage exactly where the water needed for shale gas extraction will come from. For example, one of the exploration applicants, Shell has not yet indicated where the water will come from but is considering using ground water, recycled water or brackish water.<sup>62</sup> Apart from fresh water or brackish water sea water can also be used. However it can be safely assumed that the majority of the water will come from groundwater sources given that many parts of the Karoo are arid and have little surface water at hand or the distances for water transport from

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<sup>58</sup> Department of Water Affairs 'National Water Resources Strategy' available at <http://www.dwaf.gov.za/nwrs/NWRS2012.aspx>, accessed on 2 October 2012 at 182

<sup>59</sup> Ibid.

<sup>60</sup> K Knüppe 'The challenges facing sustainable and adaptive groundwater management in South Africa' available at <http://www.ajol.info/index.php/wsa/article/view/64110/51907> accessed on 2 October 2012 at 69

<sup>61</sup> DEA op. cit. (n23) 25.

<sup>62</sup> Shell 'Protecting Water Resources' accessed on 27 January 2015, available at <http://s04.static-shell.com/content/dam/shell-new/local/country/zaf/downloads/pdf/karoo basin/Water.pdf>

surface water supplies could be extensive. Apart from groundwater, water can also be supplied by water supply authorities such as municipalities, stored surface water or rivers. Rivers are however in many cases over utilised as excess water in the Orange River has already been allocated to previously disadvantaged farmers.<sup>63</sup>

Given the high water needs of shale gas extraction water can be stored initially in small portable containers of about 80m<sup>3</sup> each however in the US water is also stored in reservoirs up to 500 000 m<sup>3</sup>.

Groundwater is the only water source for over 300 towns and 65% of the population in South Africa.<sup>64</sup> Groundwater use was estimated at 1770 Mm<sup>3</sup>/a with 64% being used for agriculture. In many cases it has been established that groundwater is being under-utilised with an estimated resource of 19 000 Mm<sup>3</sup>/y. However only some of this is potentially exploitable is usable at 10 350 Mm<sup>3</sup>/y.<sup>65</sup> Given this backdrop further exploitation of ground water needs to be carefully managed as there are few aquifers with most of the water being trapped in fractured rock with associated low yields.

The majority of water management areas in the 2025 base-case scenario have a water deficit.<sup>66</sup> Some of the areas in deficit include parts of the Karoo.

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<sup>63</sup> Vermeulen op. cit. (n21) 152.

<sup>64</sup> A Woodford et. al. 'How Much Water Does South Africa Have?' available at [http://www.anthonyturton.com/admin/my\\_documents/my\\_files/SRK\\_Woodford\\_How\\_much\\_Groundwater\\_does\\_SA\\_have.pdf](http://www.anthonyturton.com/admin/my_documents/my_files/SRK_Woodford_How_much_Groundwater_does_SA_have.pdf) and accessed on 10 October 2012 at para 2.

<sup>65</sup> Ibid.

<sup>66</sup> Department of Water Affairs 'National Ground Water Strategy' available at [http://www.dwa.gov.za/Groundwater/Documents/GSDocument%20Final%202010\\_MedRes.pdf](http://www.dwa.gov.za/Groundwater/Documents/GSDocument%20Final%202010_MedRes.pdf), accessed on 12 October 2012 at 24.

Since hydraulic fracturing can use saline water this could be a more desirable choice taking water scarcity into account. However the environmental impacts will need to be assessed.

To illustrate the possible aquifer impacts of hydraulic fracturing requires about 5,9 million m<sup>3</sup> in an area of 250 km<sup>2</sup>. A review of groundwater studies in the Oudtshoorn region show that the level in the aquifer could drop by 5m and given a recharge rate of 0,36 million m<sup>3</sup> the aquifer will only recover between 100 and 10 000 years depending on rainfall.<sup>67</sup> The rate of extraction is thus far higher than recharge which is perhaps one of the most important considerations for the water authorities and hence the reason why the authorities may require water re-injection into the aquifer.

There are clear advantages of using sea water as this is not a scarce resource, however this would require long distance transport making it potentially an unattractive option. Brackish water found underground could become a good alternative as it will have less competing users, however this does come with more complex waste water treatment, hydraulic fluid additives will need to be adjusted, and increased negative environmental impacts should spills or leaks occur.

It is expected that as a greater understanding of the location, feasibility and extent of the gas reserves becomes available will the water supply choices be made. In the interim however the availability of water supply is a strategic issue of importance.

Groundwater would be an important source of water for hydraulic fracturing.

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<sup>67</sup> K Riemann and D Blake 'Groundwater Reserve Determination for Current and Potential Well field Development of TMG Aquifers' available at <http://www.wrc.org.za/Document%20Thumbnails/Research%20Reports/KV%20Reports/KV%20236-10%20Groundwater.pdf> accessed on 2 October 2012 at 23.



## 2.5 Shale gas water needs

The water required for hydraulic fracturing is estimated to be about 20 000 m<sup>3</sup> per well which includes the water needed for drilling as well as for hydraulic fracturing.<sup>68,69</sup> This should be a once-off need, however it is not uncommon to hydraulically fracture a well a number of times during its productive lifetime and thus the water use could be four times that. The water required to frack a well is used within a week's period and not over a long period. This sudden high usage could have a high local impact on the local water resource. A small town like Beaufort West uses an average water 8500 m<sup>3</sup>/d.<sup>70</sup> Thus in comparison the drilling and fracturing of a well is the same as 10 days of water use for a small town. This might not appear to be significant however a large number of wells could be drilled and fractured in the same region in the same year and thus the cumulative impact is needs to be considered.

It is difficult to estimate how many wells will be drilled and fracked in any given year as this is yet unknown. However the Barnett shale gas found in Texas is a good reference point. The Barnett field has estimated reserves of 30 tcf (about 10% of the Karoo reserves) covering an area of about 13 000 km<sup>2</sup> compared to the Karoo region of interest of 80 000 km<sup>2</sup>.<sup>71</sup> The Barnett field hydraulic fracturing water use in 2006 was 1665 million m<sup>3</sup> which is equivalent to the usage of 530 small Karoo

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<sup>68</sup>JP Nicot and B Scanlon 'Water Use for Shale-Gas Production in Texas, U.S.' (2012) 46 *Environ. Sci. Technol.* 3582.

<sup>69</sup>Chesapeake Energy 'Water Use in Barnett Deep Shale Gas Exploration' available at [http://isites.harvard.edu/fs/docs/icb.topic1061062.files/Barnett\\_Water\\_Use\\_Fact\\_Sheet.pdf](http://isites.harvard.edu/fs/docs/icb.topic1061062.files/Barnett_Water_Use_Fact_Sheet.pdf) accessed on 29 September 2012 at 1.

<sup>70</sup>Vermeulen op. cit. (n21) 152.

<sup>71</sup>DWA op. cit. 1 at 18.

towns.<sup>72</sup> This water need requires comparison against the available surplus in the affected catchment management areas discussed below.

The legal framework around water use is elaborated on in chapter four.

## **2.6 Shale gas extraction fracturing fluids**

Hydraulic fracturing fluid consists mostly of water however a small fraction (about 1%) consists of sand and chemical additives some of which are hazardous. Sand acts as a proppant to keep the fractures open after hydraulic fracturing. The chemical additives include acids, bactericides, breakers, corrosion inhibitors, cross-linkers, emulsifiers, flocculants, foaming agents, scale inhibitors and surfactants. Examples include potassium chloride, guar gum, ethylene glycol, sodium carbonate, potassium carbonate, sodium chloride, borate salts, citric acid glutaraldehyde, acid, petroleum distillate and isopropanol.<sup>73</sup>

Between 2005 and 2009, chemical additives were used in the industry in the US containing twenty nine chemicals that are known or possible carcinogens or a risk to human health.<sup>74</sup> These toxic chemicals include diesel fuel, kerosene, benzene, toluene, xylene and formaldehyde.<sup>75</sup>

The fluid once injected will also contain cuttings (rock, soil and metal shavings excavated by the drill bit).

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<sup>72</sup>Chesapeake Energy op. cit. (n69) 1.

<sup>73</sup>United States House of Representatives Committee on Energy and Commerce ‘Chemicals used in Hydraulic Fracturing’ available at <http://democrats.energycommerce.house.gov/sites/default/files/documents/Hydraulic-Fracturing-Chemicals-2011-4-18.pdf>, accessed on 30 September 2013 1

<sup>74</sup> United States House of Representatives Committee on Energy and Commerce op. cit. (n73) 2

<sup>75</sup> Rahm op. cit. (n10) 2971.

## 2.7 International evidence of water contamination

Many studies have been performed which link ground water contamination to shale gas extraction. One of the main reasons for this is that compared to conventional methods, unconventional gas extraction requires more chemicals, water, infrastructure and less is understood of the extraction process impacts.<sup>76</sup> There have been 243 confirmed cases of contamination linked to shale gas extraction from 2010 until 2013 in Pennsylvania.<sup>77</sup> Studies on the water contamination impacts of shale gas extraction in many cases have differing results and causes. However, an investigation into the causes of water contamination events in Texas, Pennsylvania, Ohio, and West Virginia clearly linked water contamination events to shale gas exploration.<sup>78</sup> There are also clearly identified pathways of exposure to hazardous chemicals.<sup>79</sup>

The many contamination events have led to numerous health related complaints,<sup>80</sup> and a higher than normal reported health issues per person.<sup>81</sup> These health complaints and health issues cannot be ignored.

Data collected in the period 2008 until 2011 in Pennsylvania, 1144 notices of violation were issued from 3533 wells.<sup>82</sup> Of these violations 30.2% lead to surface

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<sup>76</sup> J Hays et. al, 'Considerations for the development of shale gas in the United Kingdom' (2015) 37 *Science of the Total Environment* 512.

<sup>77</sup> L Legere 'DEP releases updated details on water contamination near drilling sites Pittsburg Post-Gazette' 9 September 2014, available at <http://powersource.post-gazette.com/powersource/policy-powersource/2014/09/09/DEP-releases-details-on-water-contamination/stories/201409090010> accessed on 12 January 2015.

<sup>78</sup> K Begos (2014) 'Some states confirm water pollution from drilling' available at <http://bigstory.ap.org/article/some-states-confirm-water-pollution-drilling> accessed 12 October 2014

<sup>79</sup> DJ Rozell, 'Water Pollution Risk Associated with Natural Gas Extraction from the Marcellus Shale' (2012) 32 *Risk Analysis* 1384.

<sup>80</sup> P Saberi 'Navigation Medical Issues in Shale Territory' (2013) 23 *New Solutions* 214.

<sup>81</sup> PM Rabinowitz et. al. 'Proximity to Natural Gas Wells and Reported Health Status: Results of a Household Survey in Washington County, Pennsylvania' (2015) 123 *Environmental Health Perspectives* 21.

water contamination, 20.6% linked to minor spills, 4% linked to major spills and 9,8% linked to well integrity incidents. Each of these pathways and factors will be discussed in more detail below.

## 2.8 Surface water pollution

A large portion of the injected fluid (between 0 and 75%) will return to the surface when the gas is extracted.<sup>83</sup> This is either known as ‘backflow’ or ‘produced water’ the former occurring suddenly after hydraulic fracturing and the latter more slowly during the productive lifespan of the well.<sup>84</sup> This backflow water not only contains fracturing fluid but also contains substances found deep underground such as naturally occurring radioactive material, naturally occurring metals and salts.<sup>85</sup>

This water is hazardous and therefore needs careful management.<sup>86</sup> The salt content of the flowback or produced water can range from 5000 mg/l to more than 200 000 mg/l which is between 2 and 5 times higher than sea water.<sup>87</sup> The high levels of naturally occurring radioactive material waste water can be expected between 185 and 592 Bq/l of Radium isotopes.<sup>88</sup> Radioactive isotopes can accumulate in sediment as high 8759 Bq/kg even after waste treatment a more than 90%

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<sup>82</sup> TJ Considine et. Al. ‘The Economic Opportunities of Shale Energy Development’ Energy Policy and The Environment Report available at [http://www.manhattan-institute.org/3BB3F97F-886F-4636-890E-DDAAABFBCD4D/FinalDownload/DownloadId-AAB23C0B7DD9E55E63B599DC0E733A80/3BB3F97F-886F-4636-890E-DDAAABFBCD4D/pdf/eper\\_09.pdf](http://www.manhattan-institute.org/3BB3F97F-886F-4636-890E-DDAAABFBCD4D/FinalDownload/DownloadId-AAB23C0B7DD9E55E63B599DC0E733A80/3BB3F97F-886F-4636-890E-DDAAABFBCD4D/pdf/eper_09.pdf) accessed on 12 January 2015 8.

<sup>83</sup> European Commission of the Environment ‘Support to the identification of potential risks for the environment and human health arising from hydrocarbons operations involving hydraulic fracturing in Europe’ available at [http://ec.europa.eu/environment/integration/energy/pdf/hydraulic\\_fracturing%20study.pdf](http://ec.europa.eu/environment/integration/energy/pdf/hydraulic_fracturing%20study.pdf) accessed on 3 October 2012.

<sup>84</sup> Ibid.

<sup>85</sup> N Warner ‘Impacts of Shale Gas Waste Water on Water Quality in Western Pennsylvania’ (2013) 47 *Environ. Sci. Technol.* 11849.

<sup>86</sup> Ibid.

<sup>87</sup> Ibid.

<sup>88</sup> Ibid

reduction.<sup>89</sup> The levels in sediment are more than the threshold for radioactive waste disposal in the US of 1850 Bq/kg.

The radioactive reference criterion in South Africa is 200 Bq/kg, which refers to the threshold for the exclusion criteria for the National Nuclear Regulator Act.<sup>90</sup> This will be discussed in more detail in Chapter 6.

There are three main waste water management options which include (a) recycling, (b) on-site treatment followed by solids disposal at an off-site licensed facility, (c) discharge into a water resource after treatment or finally, (d) disposal by re-injection underground.

The most common practise in Marcellus Shale region in 2008 was the treatment at municipal domestic waste treatment facilities.<sup>91</sup> However since domestic waste water treatment facilities are not able to treat the highly saline flowback water this has resulted in one of the main sources of water pollution.<sup>92</sup> As a result, this practise is being discontinued to a large extent.<sup>93</sup>

Since 2008, the Marcellus Shale region has increased the amount of waste recycled, re-injected underground for disposal and treatment at municipal industrial waste water treatment facilities.<sup>94</sup>

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<sup>89</sup> Ibid.

<sup>90</sup> P Wade et. al. 'Tier 1 Risk Assessment of Selected Radionuclides in Sediment of the Mooi River Catchment' WRC Report No: 1095/1/02, 2002 available at <http://www.wrc.org.za/Knowledge%20Hub%20Documents/Research%20Reports/1095-1-02.pdf> accessed on 12 January 2014 page vii

<sup>91</sup> BD Lutz et al 'Generation, transport, and disposal of wastewater associated with Marcellus Shale gas development' (2013) 49 *Water Resources Research* 465.

<sup>92</sup> Ibid.

<sup>93</sup> Ibid.

<sup>94</sup> Ibid.

In spite of recycling being potentially the most expensive option, this was the most common practise in the region in 2011 at 58% of total water managed followed by re-injection (13%), Industrial waste facility (3%) and domestic waste facilities (less than 1%).<sup>95</sup>

Apart from recycling or above ground disposal after treatment, another common option is the practise of disposal by re-injection into the ground through boreholes for this purpose.<sup>96</sup> The re-injection however has led to many seismic induced events due to the increased pressure from the injected fluid on geological faults.<sup>97</sup> Also re-injection can lead to further ground water contamination should the re-injected effluent migrate to ground water nearby.

Recycling of shale gas extraction wastewater not only reduces the need for fresh water but also resolves some of the disposal issues experienced internationally. Thus recycling will become of the key issues discussed in the remaining chapters in the context of the regulatory framework.

## **2.9 Groundwater pollution**

The main sources of underground pollution come from the migration upwards of gases and wastewater through fractures and the failure of well casings.<sup>98</sup> The risk of upward migration from the shale is a function of local geohydrological conditions and as such any the unique and complex geology of the Karoo will need

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<sup>95</sup> Ibid.

<sup>96</sup> MPRDA *Proposed Technical Regulations for Petroleum Exploration and Exploitation* GN 1032 GG 36938 of 15 October 2013.

<sup>97</sup> Davies op. cit. (n17) 171.

<sup>98</sup> A Vengosh et. al. 'A critical review of the risks to water resources from unconventional shale gas development and hydraulic fracturing in the United States' (2014) 48 *Environmental science & technology* 8337.

to be taken into account.<sup>99</sup> The reason for this unique and complex geology is the presence of dolerite sills and dykes in much of the Karoo can act as a conduit for contaminated groundwater.<sup>100</sup> It has been argued by some that this risk is low given the barrier that is found between the shale gas zone and aquifers due to low permeability of the sub structures.<sup>101</sup> There is however much uncertainty of this risk due to the lack of knowledge and thus these areas should be avoided.<sup>102</sup> Migration of pollution through fractures is however a long term phenomena and it is unclear if the indication of methane which migrates more easily is a precursor to a longer term migration of contaminated liquid wastes.<sup>103</sup>

Apart from the possible migration of contaminated water upwards there is a risk of well casing failure.<sup>104</sup> One of the main causes of water contamination is a loss of well integrity. An example of a loss of well integrity incident includes a blowout at a well in Clearfield Pennsylvania which discharged 12600 litres of fracking fluid into a state forest.<sup>105</sup> There are many other incidents where drinking water was contaminated, wildlife and farming stock deaths.<sup>106</sup>

According to industry data about 5% of wells fail almost immediately and up to 50% over a thirty year period.<sup>107</sup> This has led some experts to believe that ‘the greatest threat to groundwater is gas leakage from wells from which even existing

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<sup>99</sup> Steyl op. cit. (n12) 231.

<sup>100</sup> Vermeulen op. cit. (n21) 154.

<sup>101</sup> Vermeulen op. cit. (n21) 152.

<sup>102</sup> Vermeulen op. cit. (n21) 154.

<sup>103</sup> Vengosh et. al. op cit. (n98) 8348.

<sup>104</sup> Vermeulen op. cit. (n21) 152.

<sup>105</sup> Rahm op. cit. (n10) 2975.

<sup>106</sup> Ibid.

<sup>107</sup> C Brufatto et. al. ‘From Mud to Cement - Building Gas Wells’ (2003) 15 *Oilfield Review* 62

best practices cannot assure long-term prevention'.<sup>108</sup> Apart from the impact on water contamination this also can lead to intensive release of green-house gases.<sup>109</sup>

Wells are constructed to insulate the well from groundwater. However one of the most common problems is a faulty seal which prevents methane leaking into shallow groundwater.<sup>110</sup> This is somewhat controversial since it is no always easy to prove if the methane is from natural causes or from shale gas operations.

## **2.10 Conclusion**

Water management is one of the key environmental issues related to shale gas extraction activities. This includes a robust regulatory framework which includes enforcement. The legal framework around water use including water pollution is elaborated on in chapter four while the next chapter sets the legal context by providing an overview of the legal framework.

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<sup>108</sup> Council of Canadian Academies 'Environmental Impacts of Shale Gas Extraction in Canada: the Expert Panel on Harnessing Science and Technology to Understand the Environmental Impacts of Shale Gas Extraction' available at <http://bit.ly/1nNicuf>, accessed on 14 March 2013

<sup>109</sup> Ibid.

<sup>110</sup> R Vidic et. al. 'Impact of Shale Gas Development on Regional Water Quality' (2013) 340 *Science* 826.



## CHAPTER THREE

### OVERVIEW OF THE CONSTITUTION AND OVERALL REGULATORY FRAMEWORK

#### 3.1 Introduction

South Africa is a constitutional democracy and as such the Constitution is the supreme law of the land. The main laws that give effect to the Constitution that are relevant to the water related regulatory framework and which are outlined in subsequent chapters include the National Water Act, 36 of 1998 (the Water Act), the Minerals and Petroleum Resources Development Act, 28 of 2002 (the MPRDA), the National Environmental Management Act, 107 of 1998 (NEMA), the Promotion of Access to Information Act, 2 of 2000 (PAIA) and the Promotion of Administrative Justice Act, 3 of 2000 (PAJA).

The MPRDA governs the extraction of petroleum productions during exploration and production. Petroleum extraction activities require either an exploration right or a production right.<sup>111</sup> Both of these require the approval of associated environmental impact assessment and environmental management programmes.<sup>112</sup> In terms of water law, a water use license is required for the approval of the water management of the associated environmental aspects.<sup>113</sup>

The main laws that give effect to the Constitution relevant to water and shale gas extraction will be discussed in more detail below.

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<sup>111</sup> Van Wyk, J Van Wyk ‘Fracking in the Karoo: approvals required?’ (2014) 25.1 *Stellenbosch Law Review*=*Stellenbosch Regstydskrif* 40

<sup>112</sup> Ibid.

<sup>113</sup> Ibid.

## 3.2 Constitution of South Africa: Bill of Rights

The Constitution of South Africa, 1996 includes the Bill of Rights<sup>114</sup> which has a number of rights that are relevant to shale gas extraction such as an environmental right<sup>115</sup>, a right to water<sup>116</sup>, a right to property<sup>117</sup>, a right to access to information<sup>118</sup>, a right to just administrative action<sup>119</sup>. The state is also required in the Constitution<sup>120</sup> to take reasonable measures, within its available resources, to achieve the progressive realisation of each of the rights which includes to water and the environment'.<sup>121</sup> Each of these rights will be discussed in turn below.

### 3.2.1 Environmental right

The Constitution, section 24 states that:

Everyone has the right:

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

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<sup>114</sup> Chapter 2 of the Constitution.

<sup>115</sup> Section 24 of the Constitution.

<sup>116</sup> Section 27 of the Constitution.

<sup>117</sup> Section 25 of the Constitution.

<sup>118</sup> Section 32 of the Constitution.

<sup>119</sup> Section 33 of the Constitution.

<sup>120</sup> Section 41 of the Constitution.

<sup>121</sup> Section 184(3) of the Constitution.

Since the definition of the environment includes water resources,<sup>122</sup> the water and petroleum law does make provision for this right as both aim at protecting the water resources from pollution and inappropriate use. This right is fleshed out in NEMA and will be discussed in more detail in chapters 4, 5 and 6 respectively.

### **3.2.2 Right to water**

Section 27 of the Constitution states that:

- (1) Everyone has the right to have access to ... (b) sufficient food and water
- (2) The state must take reasonable legislative and other measures, within its available resources to achieve the progressive realisation of each of these rights.

Any inappropriate water use or pollution could compromise this human right and as such is taken into account in the water and petroleum law. This right is given effect to by both the Water Act and the Water Services Act, 19 of 1997. The former law is relevant to SG extraction and will be elaborated on in Chapter Four.

### **3.2.3 Right to property**

Section 25 of the Constitution states that:

- (1) No one may be deprived of property except in terms of law of general application, and no law may permit arbitrary deprivation of property.
- (2) Property may be expropriated only in terms of law of general application-
  - (a) for a public purpose or in the public interest; and

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<sup>122</sup> ‘environment’ is defined as ‘the surroundings within which humans exist and that are made up of (i) the land, water and atmosphere of the earth; (ii) micro-organisms, plant and animal life; (iii) any part or combination of (i) and (ii) and the interrelationships among and between them; and (iv) the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and wellbeing;’

- (b) subject to compensation, the amount of which and the time and manner of payment of which have either been agreed to by those affected or decided or approved by a court.

It has been argued that an exploration or production company may claim the right to property in order to explore, prospect or mine however this right will need to be ‘tempered according to legal norms’.<sup>123</sup> In contrast however the rights of other property right holders that may be adversely affected by hydraulic fracturing who also need to be considered. Given that the property right includes compensation if the loss of land use by the land owner is experienced, as a result of hydraulic fracturing to the extent that it affects the property owner’s rights, then compensation can be sought. The right to property is not central to the protection of water since the petroleum products are the property of the state and the land owner has no claim to these products. The land owner however has the right to the use of his or her property and thus it could be affected when shale gas extraction enterprises claim the right to his / her land for this purpose. This will be discussed briefly in Chapter Six.

### **3.2.4 Right to access to information**

Section 32 of the Constitution states that:

- (1) Everyone has the right of access to
  - (a) any information held by the state; and
  - (b) any information that is held by another person and that is required for the exercise or protection of any rights.
- (2) National legislation must be enacted to give effect to this right, and may provide for reasonable measures to alleviate the administrative and financial burden on the state.

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<sup>123</sup> Havemann op. cit. (n9) 6.

The Promotion of Access to Information Act, 2 of 2000 gives effect to this right and will be discussed in more detail in Chapters 4 and 5 respectively where water and petroleum legislation is outlined in this context.

### **3.2.5 Right to just administrative action**

Section 33 of the Constitution states that:

- (1) Everyone has the right to administrative action that is lawful, reasonable and procedurally fair.
- (2) Everyone whose rights have been adversely affected by administrative action has the right to be given written reasons.
- (3) National legislation must be enacted to give effect to these rights, and must
  - a. provide for the review of administrative action by a court or, where appropriate, an independent and impartial tribunal;
  - b. impose a duty on the state to give effect to the rights in subsections (1) and (2); and
  - c. promote an efficient administration

The water and petroleum law does make provision for this right in their respective statutes. This will be discussed in general terms in Chapters 4 and 5 but in Chapter 7 specifically.

### **3.3 The Constitution of South Africa: Cooperative government**

The Constitution also sets the obligations in respect to these rights of national, provincial and local spheres of government also with regards to the legislative, executive and judicial functions of government. The three spheres of government are distinctive, interdependent and interrelated.<sup>124</sup> The Constitution also requires that the concept of co-operative government is implemented and in accordance with

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<sup>124</sup> Section 40 of the Constitution.

the principles of cooperative governance such as the cooperation with one another in mutual trust and good faith.<sup>125</sup>

### **3.4 Statutory context**

#### **3.4.1 Water law overview**

The main statute that regulates water resources is the Water Act. The Minister of Water Affairs and Sanitation is the public trustee of all water which includes groundwater and surface water. Furthermore, the Water Act requires that the administration must ensure that water is protected, used developed, conserved, managed and controlled, taking into account, inter alia, the basic human needs of present and future generations, equitable access to water, social and economic development, the public interest, the growing demand for water, ecosystems and biological diversity and international obligations.<sup>126</sup> As a result all reasonable measures must be taken to prevent pollution from occurring.<sup>127</sup>

The Water Act allows the minister to regulate activities that have a detrimental impact on water by declaring the water uses as controlled activities.<sup>128</sup> Any such controlled activity requires an authorisation in terms of the Act and this process requires public participation. The minister declared her intent to declare the production of unconventional gas as a controlled activity.<sup>129</sup>

The Constitution has allocated exclusive legislative competence and executive authority over fresh water. This rests with the national government unlike

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<sup>125</sup> Section 41 of the Constitution.

<sup>126</sup> Section 3 of the National Water Act 36 of 1998.

<sup>127</sup> Section 19 and s20 of the National Water Act 36 of 1998.

<sup>128</sup> Section 37 and s38 of the National Water Act 36 of 1998.

<sup>129</sup> Minister of Water Affairs, GN 863 GG 36760 of 23 August 2013.

environmental matters are both a national and provincial competence. This reflects the importance of water.

### **3.4.2 Petroleum law overview**

The MPRDA is the principal legislation that governs the environmental impacts of the exploration and exploitation of petroleum resources in South Africa. It defines the objectives of the regulatory system and the institutions, processes and norms related to the management of environmental impacts, public participation and enforcement.

The MPRDA has entrenched the custodianship of all mineral and petroleum resources with the state and has acknowledged the section 24 Constitutional requirements to develop petroleum resources in an ecologically sustainable manner.

Mining activities require a mining permit which includes an Environmental Management Programme (EMPR).

Chapter 5 discusses shale gas extraction law in more detail.

### **3.4.3 Environmental law overview**

NEMA is the main law that regulates significant impacts to the environment. Given the environmental impacts associated with shale gas extraction it will be relevant. The Minister of Environmental Affairs is charged with the responsibility for the oversight and control over environmental matters as such has developed regulations that apply to the shale gas extraction activities. The environmental authorisations however issued in terms of NEMA are issued by the Minister of Mineral Resources.

The relevance and overlap of NEMA and MPRDA will be discussed in more detail in Chapter 6 while the next chapter focusses on water law.



## CHAPTER FOUR

### WATER LAW AND SHALE GAS EXTRACTION

#### 4.0 National Water Act, 36 of 1998 (the Water Act)

#### 4.1 Introduction

As discussed in Chapter Two, shale gas extraction requires large amounts of water to hydraulically fracture shale and also has important potential pollution impacts on surface and groundwater. This chapter is accordingly concerned with both water quantity and water quality in the water stressed Karroo region and as such is concerned with the law concerning both conserving and protecting water resources.<sup>130</sup>

The central legislation in this regard is the National Water Act, 36 of 1998 (the Water Act) which sets out the purpose of the Act as <sup>131</sup> “...to ensure that the nation’s water resources are protected, used, conserved, managed and controlled in ways which take into account amongst other factors...”. There follow a number of factors and of particular relevance to shale gas extraction are firstly, the equitable access to water, secondly the sustainable and beneficial use of water in the public interest and thirdly, reducing and preventing pollution and degradation of water resources.<sup>132</sup>

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<sup>130</sup> Water Resource includes water bodies such as rivers, streams, wetlands, estuaries and groundwater.

<sup>131</sup> Section 2 of the Water Act.

<sup>132</sup> Factors (b), (d) and (h) of Section 2 of the Water Act respectively.

The Water Act describes the regulatory framework to give effect to the protection of a number of rights which includes the right to access to food and water and to a healthy environment. More specifically Chapter 3 titled “Protection of Water Resources” and Chapter 4 titled “Use of water” are particularly relevant to this shale gas extraction and the relevant provisions are elaborated on below. Given the scarcity of water in South Africa and in the Karoo in particular this makes this task vital to the sustainability of South Africa’s water resource.

The Minister of Water Affairs and Sanitation acts on behalf of the national government as the custodian of the water resources.<sup>133</sup> To give effect to the Constitution the Minister needs to ensure equitable allocation of water and ensures that water use is beneficial, in the public interest and for promoting values which include sustainability.<sup>134</sup> In doing so the Minister applies and enforces the principles and conditions as set out by the Water Act such as pollution prevention, regulating water use, licensing and authorising water use, determining the quantity of water which may be allocated, elaborated on below.

The Water Act regulates the use of water by allowing certain water use types without an authorisation and other water use types requires authorisation.<sup>135</sup> For example Schedule I users such as reasonable water use for domestic and small scale farming will not require an authorisation.<sup>136</sup> For larger scale water use General Authorisations may be issued with predetermined water use requirements.

However given the scale of water use of shale gas extraction the limits of General

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<sup>133</sup> Ibid.

<sup>134</sup> Ibid.

<sup>135</sup> Section 4 of the Water Act.

<sup>136</sup> Schedule I of the Water Act.

authorisations will most probably be exceeded and thus a water use license will be required.<sup>137</sup>

Any water right granted by any other law such as the use of water and to affect the quality of water is replaced by the water right granted by the Water Act<sup>138</sup>. As such the Water Act will be the most important law regulating water use by shale gas extraction activities.

#### **4.2 Water resource strategy**

The Water Act requires that a National Water Resource Strategy (NWRS) is developed<sup>139</sup>. The NWRS is an important document as the Water Act requires that the water authorities give effect to the strategy when exercising any power or performing any duty<sup>140</sup>. The NWRS will thus shape the outcomes of any shale gas extraction water use submission and authorisation conditions.

The NWRS includes the establishment of catchment management areas, management of the water demand and water quality objectives,<sup>141</sup> and establishing the Reserve.<sup>142</sup> The Reserve is established to determine water use attributed to basic human and ecological needs.<sup>143</sup> The determination of the Reserve is a prerequisite for the issuing of any water authorisations.<sup>144</sup> The determination of the Reserve for groundwater is a highly technical process and may be required before

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<sup>137</sup> J Van Wyk op. cit. (n111) 48.

<sup>138</sup> Section 4(4) of the Water Act.

<sup>139</sup> Preamble to Part 1 of Chapter 2 and Section 5; the latest version (NWRS 2nd edition) was launched on 3 July 2013.

<sup>140</sup> Section 7 of the Water Act.

<sup>141</sup> Section 13 of the Water Act.

<sup>142</sup> The Reserve would include basic human needs and ecological needs.

<sup>143</sup> Chapter 3 part 3; the Reserve is defined as the quantity and quality needed for basic human and ecological needs.

<sup>144</sup> Section 17 of the Water Act.

shale gas extraction is licensed should the Reserve not be in place at the time. To date progress has been made in establishing the Reserve however this has focussed on surface water use. The Reserve has in most cases not been established for groundwater albeit an important resource<sup>145</sup>. The development of the Reserve and Water Quality Objectives as required by the Water Act require extensive financial resources.<sup>146</sup> In addition to the establishment of the Reserve and Water Quality Objectives, water resources also protected by the development of a resource classification system can include the identification of which activities need to be regulated to protect water resources.<sup>147</sup> Therefore the Department of Water Affairs and Sanitation could introduce additional requirements in various catchments that may require specific protection against shale gas extraction activities.

On a more localised level, Catchment Management Agencies (CMAs) can be established which can develop their own strategies and be more detailed than the national strategy however it must be consistent with national standards.<sup>148</sup> The Minister may develop guidelines for establishing catchment strategies which includes cooperation and engagement with public and other institutions.<sup>149</sup> To date, of the nine water management areas, there are only two which have operational CMAs and only one of these is in the Karoo.<sup>150</sup>

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<sup>145</sup> Department of Water Affairs and Forestry ‘National Ground Water Strategy’ available at [http://www.dwa.gov.za/Groundwater/Documents/GSDocument%20FINAL%202010\\_MedRes.pdf](http://www.dwa.gov.za/Groundwater/Documents/GSDocument%20FINAL%202010_MedRes.pdf), accessed on 12 October 2012 5.

<sup>146</sup> Estimated at R 340 million in K Pietersen et. al. ‘Groundwater Governance in South Africa: A Status Assessment’ (2012) 38 *Water SA* at 454 and Jacobs op. cit. (n306) 455.

<sup>147</sup> Chapter 3 parts 1 and 2 of the Water Act.

<sup>148</sup> Section 9(b) of the Water Act.

<sup>149</sup> Section 10 of the Water Act.

<sup>150</sup> Department of Water Affairs ‘Annual Report 2013/14’ available at [http://pmg-assets.s3-website-eu-west-1.amazonaws.com/dwa\\_annual\\_report\\_2013-14.pdf](http://pmg-assets.s3-website-eu-west-1.amazonaws.com/dwa_annual_report_2013-14.pdf) accessed on 10 January 2015 at 17

### 4.3 Water supply and access

As stated in Chapter Two, the most likely water resource that will be used for hydraulic fracturing is saline groundwater given that alternative water resources are of short supply. However if scarce surface water or fresh groundwater is utilised a more complex regulatory approach will need to be taken that takes the NWRS into account.

The NWRS has stated that water demand in South Africa seriously challenges the available water supply.<sup>151</sup> The strategy indicates that this is resolved through the better utilisation of water groundwater in particular and the more efficient use and less wastage.<sup>152</sup> The NWRS strategy is relevant to hydraulic fracturing due to the large water needs of shale gas extraction. The authorities when determining the appropriate strategy for water supply for shale gas extraction will need to also consider other water users and may require that all water users use water more efficiently and thereby increasing the water supply by reducing water demand. However the implementation of efficiency measures could be time-consuming and complex. For example farmers currently do not have water meters installed so are unable to determine their losses.<sup>153</sup> Water licensing of farming could thus take time and the hydraulic fracturing companies may wish to consider alternatives.

One of the ways that hydraulic fracturing companies can obtain water rights is to purchase them through a water market (from farmers). The value of water in the

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<sup>151</sup> NWRS 27.

<sup>152</sup> Ibid.

<sup>153</sup> Ibid.

mining sector is far greater than in the agricultural sector.<sup>154</sup> This will allow the hydraulic fracturing companies to offer high prices for the transfer of water rights from farming activities. The Water Act allows for the transfer of licences from users to another for a ‘different purpose’ if approved by the water management institution.<sup>155</sup> This in theory paves the way for a water market. The agricultural sector could however create an imbalance as all of the agricultural rights being transferred.<sup>156</sup> This could lead to decreased agricultural production and further rural poverty. Alternative water allocation methods are also available such as the re-allocation of water rights.

Apart from water markets, the DWA can re-allocate water rights by taking some allocated rights away from some water users and allocate to others for example from farmers to mining. This however could result in compensation claims. Any person who applied for a license for an existing lawful use and obtained a lesser amount than applied for and this resulted in severe prejudice to the economic viability of the enterprise may claim compensation.<sup>157</sup> The NWRS does not address re-allocation of water rights nor the transfer of water rights since the NWRS indicates that water efficiency improvements would make sufficient water available. Given the large volumes of water required for hydraulic fracturing it is recommended that the DWA reviews its position to determine if sufficient water is available through water efficiency and the use of groundwater to determine if re-allocation or water license transfers are viable and if so desirable.

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<sup>154</sup> S Farolfi and S Perret ‘Inter-sectoral competition for water allocation in rural South Africa:Analysing a case study through standard environmental economics approach’ available at <http://ageconsearch.umn.edu/bitstream/18026/1/wp020012.pdf>, accessed on 2 October 2012 11.

<sup>155</sup> Subsection 25(1) of the Water Act.

<sup>156</sup> Farolfi op. cit. (n 151) at 11.

<sup>157</sup> Section 22(6) of the NWRS.

One of the ways to make water use more efficient in the Karoo which could increase the water available is the pricing of water<sup>158</sup>. The higher the price the higher the efficient use of water. Given the high value of water for hydraulic fracturing it is unlikely that water costs will be a relatively high input costs and thus higher water pricing may not result in higher water efficient use. We recommend that the DWA investigates instead as a license condition the need to recycle any waste water used.

#### **4.4 Water pollution prevention**

The Act has endorsed the principle of pollution<sup>159</sup> prevention and requires any owner of the land, any person in control of the land or any occupier of the land which may or does cause pollution to either prevent or remedy pollution.<sup>160</sup> Thus any organisation that undertakes shale gas exploration or production will be required to adhere with this principle by taking reasonable measures even if the land is not owned by the organisation. The CMA may direct any person or organisation to take reasonable measures for either pollution prevention or remediation<sup>161</sup>.

Section 19 of the Water Act is similar to NEMA Section 28 in that it prescribes the requirements for prevention and remediation of any pollution. This requirement applies to the land owner or occupier of the land and requires reasonable measures

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<sup>158</sup> NWRS 29 para 3.

<sup>159</sup> Pollution is defined as ‘the direct or indirect alteration of the physical, chemical or biological properties of a water resource so as to make it –

(a) less fit for any beneficial purpose for which it may reasonably be expected to be used; or

(b) harmful or potentially harmful –

(aa) to the welfare, health or safety of human beings;

(bb) to any aquatic or non-aquatic organisms;

(cc) to the resource quality; or

(dd) to property.

<sup>160</sup> Section 19 of the Water Act.

<sup>161</sup> Section 19(3) of the Water Act.

to prevent, mitigate or remedy pollution. This requirement can be retrospectively applied to past occurrences or re-occurrences.

#### **4.5 Water licensing and General Authorisations**

Chapter 4 of the Water Act establishes the need for the minister of Water Affairs and Sanitation to ensure equitable access to water, pollution prevention and the need for regulation. Section 21 lists the applicable activities that require a water use authorisation:

- (a) taking water from a water resource;
- (b) storing water;
- (c) impeding or diverting the flow of water in a watercourse;
- (d) engaging in a stream flow reduction activity contemplated in section 36;
- (e) engaging in a controlled activity identified as such in section 37(1) or declared under section 38(1);
- (f) discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;
- (g) disposing of waste in a manner which may detrimentally impact on a water resource;
- (h) disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process;
- (i) altering the bed, banks, course or characteristics of a watercourse;
- (j) removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and
- (k) using water for recreational purposes.

Water authorisations will either be specific water use licenses or can be performed under a General Authorisation (GA).<sup>162</sup> The licensing or General Authorisations related to each will be discussed in Sections 4.5.1 to 4.5.3 below.

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<sup>162</sup> Section 22(1) of the Water Act.



#### 4.5.1 Water abstraction and storage

While it is still unclear where the water used for shale gas extraction will come from, but the most likely source will be from a saline aquifer. Saline water is still considered a water resource in terms of the Water Act as an aquifer is regarded as a water resource irrespective of quality. As such an authorisation in terms of 21(a) will be required. In the unlikely case where water would be obtained directly from a water supply authority or should sea water be used then it an authorisation in terms of 21(a) would not be required.

Shale gas extraction will most likely need to store water on site for the purposes of hydraulic fracturing and thus will also require an authorisation in terms of section 21(b). There are currently no general authorisations for 21 (a) or (b) water use as such a water license will be required.<sup>163</sup>

#### 4.5.2 Controlled activity

A further instrument which is particularly pertinent to shale gas extraction is the Minister of Mineral Resources' power to declare her intent to declare shale gas extraction activities as a section 21(e) controlled activity<sup>164</sup>. Should this intent become reality then an authorisation in terms of section 21 (e) will also be required. Should the Minister declare shale gas extraction as a controlled activity, not only will a license be required, but the authorities may attach conditions related specifically to the equipment to be installed for waste treatment, pollution control

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<sup>163</sup> The current *General Authorization in Terms of Section 39 of the National Water Act* GN 665 GG 36820 of 6 September 2013 does not include section 21 (a) and (b) use as was found in the expired General Authorisation GN 1191 GG 20526 of 8 October 1999.

<sup>164</sup> Department of Water Affairs *Proposed Declaration of the Exploration for or Production of Onshore Unconventional Oil or Gas Resources and any Activities Incidental Thereto Including but not Limited to Hydraulic Fracturing as a Controlled Activity* GN 863 GG 36760 of 23 August 2013.

and monitoring in addition to the management practices needed as discussed in Section 4.1.4.2 below.<sup>165</sup>

### 4.5.3 Effluent discharge and disposal

Any discharging and disposal of waste or water containing waste into a water resource will require an authorisation in terms of section 21(f), 21(g) and 21(h). At this stage it is not clear where the waste will be treated and disposed of and if such a facility will be an integral part of the well pad, however a license or GA will be required for this purpose. The GA address section 21 (f) water use however is not applicable to shale gas extraction wastewater since these wastes are regarded as ‘complex industrial wastewater’ because there is no wastewater limit specified and it may also be considered harmful to a water resource.<sup>166</sup>

The GA that relates to Section 21 (g) water use may be relevant to shale gas extraction. The GA however does allow the disposal of mine water into mine residue deposits provided the mine meets the wastewater standards prescribed in GN704<sup>167</sup> and the storage dams and disposal sites are located specified distances away from water resources. The GA also requires the removal of suspended solids, monitoring, and adequate management such as provision for failures and water resource contamination.<sup>168</sup> Should shale gas extraction meet these requirements then a water license will not be required in terms of 21 (g) water use.

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<sup>165</sup> Section 29(1)(d) of the Water Act.

<sup>166</sup> Section 2.7 of *General Authorization in Terms of Section 39 of the National Water Act* GN 665 GG 36820 of 6 September 2013 GN 665 GG 36820 of 6 September 2013.

<sup>167</sup> Department of Water Affairs ‘*Regulations on Water Use of Water for Mining and Related Activities Aimed at the Protected of Water Resources*’ R704 GG 20119 of 4 June 1999.

<sup>168</sup> Sections 3.16 and 3.15 of the *General Authorization in Terms of Section 39 of the National Water Act* GN 665 GG 36820 of 6 September 2013 GN 665 GG 36820 of 6 September 2013.

A section 21(j) would not be applicable to shale gas extraction since this water use is aligned to water that seepage or runoff into mine workings which is not relevant to shale gas extraction.<sup>169</sup>

#### **4.5.4 License conditions**

The authorisation discussed above will require conditions as the authorities have this right to impose any conditions on the water user<sup>170</sup>. Typically this includes compliance to waste standards for water disposal containing waste and the water may not be wasted. As such management practices will be specified related to water recycling, monitoring and containment to ensure that spills and leaks are sufficiently addressed and water extraction and storage.<sup>171</sup>

The Water Act also stipulates requirements that may affect the re-injection of flowback and produced water. The Water Act requires that water be returned to its original source after use, unless the relevant authorisation decides not to allow this.<sup>172</sup> In any event the authorities may prescribe which water resource the water shall be returned to and in what manner.<sup>173</sup>

The authorities may request financial security if it is deemed necessary to protect a water resource.<sup>174</sup> In effect the authorities will assess the risks of degradation and the possible need for additional costs and sanctions that may be required.

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<sup>169</sup> Section 4.6 defines ‘water found underground’ as ‘water that enters mine workings, basements, tunnels or other construction that seeps or runoff and does not refer to water from an aquifer’.

<sup>170</sup> Section 22 of the Water Act.

<sup>171</sup> Sections 29(1)(c) and (e) of the Water Act.

<sup>172</sup> Section 22(2)(e) of the Water Act.

<sup>173</sup> Section 29(1)(c) of the Water Act.

<sup>174</sup> Section 30 of the Water Act.

Compliance to any license condition is mandatory and non-compliance would constitute an offense.<sup>175</sup>

#### **4.5.5 Water licensing considerations**

Water Act describes the considerations for issue of licences which require the authorities to take into account.<sup>176</sup>

- (a) existing lawful water uses;
- (b) the need to redress the results of past racial and gender discrimination;
- (c) efficient and beneficial use of water in the public interest;
- (d) the socio-economic impact –
  - (i) of the water use or uses if authorised; or
  - (ii) of the failure to authorise the water use or uses;
- (e) any catchment management strategy applicable to the relevant water resource;
- (f) the likely effect of the water use to be authorised on the water resource and on other water users;
- (g) the class and the resource quality objectives of the water resource;
- (h) investments already made and to be made by the water user in respect of the water use in question;
- (i) the strategic importance of the water use to be authorised;
- (j) the quality of water in the water resource which may be required for the Reserve and for meeting international obligations; and
- (k) the probable duration of any undertaking for which a water use is to be authorised.

These factors will become relevant when the competing needs for water are assessed in the areas where hydraulic fracturing may occur.

The Minister of Water Affairs and Sanitation when determining the quantity of water for a license will need to take into account the NWRS.<sup>177</sup> The Minister may

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<sup>175</sup> Section 155(1)(c) of the Water Act.

<sup>176</sup> Section 27 of the Water Act.

also allow the use of water from land that is not owned by the water user either if the owner consents or for good reason.<sup>178</sup> Furthermore, the authorisation for water used for irrigation can be transferred to another party for a different purpose.<sup>179</sup> Thus shale gas companies could obtain water from farmers in the Karoo that have water rights provided the Minister allows this practise.<sup>180</sup>

The Water Act does not indicate any priorities when taking the factors (a) to (k) above into account in section 27 however the National Water Resource Strategy<sup>181</sup> which is required to be developed by the Water Act has indicated priorities. The strategy emphasis 4 priorities in the following order: the Reserve, international commitments, social upliftment (poverty eradication, ending marginalisation and gender and racial equity) and economic development. Therefore the water use authorities cannot issue a water use license if the Reserve, international commitments or social upliftment is unduly compromised.

The water authorities will have to carefully manage the allocation of water users in water scare areas to avoid conflict. However in spite of the fact that shale gas extraction is expected to create many jobs and uplift many communities it is the Reserve that can trump the water use of shale gas extraction should this conflict occur. The Reserve includes water for ecological purposes and for social needs. Thus the local impacts will also need to be taken into account such the impact on local communities.

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<sup>177</sup> Section 23(1) of the Water Act.

<sup>178</sup> Section 24 of the Water Act.

<sup>179</sup> Section 25 of the Water Act.

<sup>180</sup> Section 23 of the Water Act.

<sup>181</sup> The NWRS was updated in July 2012 after initially being issued in 2004.

In terms of the strategy, the authorities may determine that the needs of shale gas extraction outweigh the needs of farming communities in the Karoo. If water supplies cannot fulfil all the water commitments and needs then it may be necessary to curtail the use of water of many individuals for the greater good. This curtailment, if significant could be determined to be a form of expropriation. The state however to date has not yet expropriated water for public purposes.<sup>182</sup>

Shale gas extraction could occur in five of the nine provinces and in many of the nineteen catchment management areas. It is also expected that many water licenses will be issued as the industry develops. Also, some of the catchment management areas are or will be in surplus where others could be in deficit. The sources of water will also vary as discussed above. Nevertheless we expect that the water use authorities will need to take these aspects into account.

There are many areas of the Karoo where groundwater is over-extracted and increased extraction could cause many more areas becoming over extracted.<sup>183</sup> This is an example of impacts on other users which is a factor that needs assessment. Studies will need to be performed to determine the risk of over extraction. Shale gas extraction not only uses extensive amounts of water but the withdrawals can occur over a very short period of time which can lead to localised issues. For example, local water users may need to sink deeper boreholes and additional

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<sup>182</sup> *Harksen v Lane 1997 SA 11 (CC)*.

<sup>183</sup> Unknown 'Northern Cape groundwater under mining pressure' which states 'the result is that some farms close to the mines have been left virtually waterless since the boreholes ran dry' Farmers Weekly 09 March 2012 available at <http://www.farmersweekly.co.za/article.aspx?id=15708&h=Northern-Cape-groundwater-under-mining-pressure> accessed on 5 October 2012.

boreholes to compensate. The water authorities will need to consider the impact on other water users identified<sup>184</sup> and will need to ensure that the Reserve<sup>185</sup> is met.

The DWA developed a Groundwater Strategy (NGS) in 2010<sup>186</sup>, in accordance with the requirements of Water Act section 5 and the National Groundwater Strategy.

The intension was to address deficiencies with the NWRS.

Section 27(1) (d) requires that a socio-economic aspect of granting or not granting a water license is taken into account. Should there be conflict between water users this will need to be addressed. This is likely in light of the above scenarios.

An application for a water license will be submitted to the Minister of Water affairs and Sanitation or to a CMA if assigned. The authorities may request the applicant to perform an assessment report by a suitably qualified specialist and the authorities may also request an independent review of such a report.<sup>187</sup> The application may be subject to review by the public and/or commenting authorities and the authorities may also perform their own assessment or a Basic Assessment or full EIA in terms of NEMA.<sup>188</sup>

Given the large uncertainties over the geology and geohydrology the authorities are likely to take into account any studies performed in the EIA process given that shale gas extraction will require an EIA as discussed in Chapter Six of this minor dissertation. Likewise the authorities are also likely to require specialist studies and potentially an independent review.

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<sup>184</sup> Section 27(1)(a) of the Water Act.

<sup>185</sup> Section 27(1)(j) of the Water Act.

<sup>186</sup> DWA 'National Groundwater Strategy' 2010 available at [http://www.dwa.gov.za/Groundwater/Documents/GSDocument%20FINAL%202010\\_MedRes.pdf](http://www.dwa.gov.za/Groundwater/Documents/GSDocument%20FINAL%202010_MedRes.pdf) accessed on 1 October 2012.

<sup>187</sup> Section 41(2) of the Water Act.

<sup>188</sup> Ibid.

#### 4.6 Integrated approach to authorisations

In line with the one environmental management system the application for a water license will need to occur at the same time as an exploration or production right.<sup>189</sup>

While the similar information is provided regards water use and pollution in the mining or exploration right EMPR or NEMA EIA, generally the information required for a water license is of much great detail.<sup>190</sup> For example the authorities require detailed geotechnical and hydrological assessments, detailed waste characterisation, detailed design information of water management infrastructure, detailed predictions of post-closure conditions.<sup>191</sup>

Given that interests to explore gas in six of the nine province shale gas extraction is clearly an issue of not only local or regional interest but also a national one.<sup>192</sup> One would expect that given the anticipated large demand for water for shale gas extraction, the NGS is updated to address shale gas extraction. The National Water Resource Strategy (NWMS) governs all water use in the country whereas at a more local level we have the Catchment Management Strategy which should also be updated. Given that shale gas extraction could have an impact on farming and the water for towns in the Karoo, agricultural plans and strategies and the Integrated Development Plans (IDPs) respectively could also be affected.

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<sup>189</sup> Section 41(5) requires integration and in particular with the MPRDA.

<sup>190</sup> Cessford, Fiona, 'New Mining Regulations: What they Mean for Water Management' available at: [www.ewisa.co.za/literature/files/060.pdf](http://www.ewisa.co.za/literature/files/060.pdf), accessed on 30 September 2014.

<sup>191</sup> Ibid.

<sup>192</sup> Vermeulen op. cit. (n21); Shale gas applications have been received for exploration rights in six of the nine provinces namely the Northern Cape (Anglo, Sasol and Shell), Western Cape (Shell and Falcon), Eastern Cape (Shell, Bundu, Sasol and Falcon), Free State (Sasol and Anglo), Kwazulu Natal (Sasol), North West Province (Anglo). The Karoo basin also stretches into the Gauteng, Mpumalanga provinces however no exploration rights have been received for these regions.



Job creation related to water as an enabler in this regard is discussed in the strategy. The strategy acknowledges that job creation linked to water does not necessarily only mean direct jobs such as more water allocation to farming but also to mining and industry which in turn will create jobs. However the value of water to industry and mining is likely to be far greater than that of farming. Also the number of jobs that can be created per volume of water is far greater in mining than in agriculture. This will create some tension between the needs of farmers and the needs of mining in the Karoo.

Some catchment areas are either in deficit or are predicted to become in deficit without a change in water management practices. The introduction of the need for water for shale gas extraction needs to be incorporated into the national debate and national strategies to minimise the potential for water conflict.

Water albeit a resource that belongs to no-one but everyone, the state as custodian needs to ensure that the rights of affected parties are not infringed.

There are some areas that have been identified for shale gas extraction such as the southern KZN region where the current proportion of the population that has access to water is very low.<sup>193</sup> The NWRS has placed the needs of the poor as a higher priority need than that of economic interest. The lack of water access in this region is however more due to a lack of infrastructure than rainfall however it is clear that any infrastructural development will have complex needs.

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<sup>193</sup> Council of Scientific and Industrial Research 'Perspectives on Water 2010' available at [http://www.csir.co.za/nre/docs/CSIR%20Perspective%20on%20Water\\_2010.pdf](http://www.csir.co.za/nre/docs/CSIR%20Perspective%20on%20Water_2010.pdf), accessed on 10 October 2012.

The strategy however recognises that most if not all economic sectors require water for development. Job creation within these economic sectors may vary and a water market would enable better efficiency and the water would be allocated to the highest water valued customer.<sup>194</sup> However markets will not meet all of the objectives of the Water Act and that of equity and upliftment of the poor. Thus water markets cannot be used to solve the water shortages that may occur in the Karoo.

The development of infrastructure however will cost money and this in turn can result in an increase in the cost and the price of water. The pricing of water is of importance because if the price is too high then this will result in poorer people from access to water or also result in farmers not being able to farm due to the high costs of farming in water stressed areas and water being a significant relative input cost. It may be necessary therefore to price the water separate to the cost of providing the service.

Given the scarcity of water and given the limited capacity of the water institutions in South Africa, the ability of the state to effectively manage water resources could be problematic.<sup>195</sup> Water use license backlogs and delays in establishing functioning catchment management authorities is evidence of this.

#### **4.7 Water regulations**

The Water Act makes provision for the development of regulations which include the monitoring of water taken from of a water resource; controls to protect water

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<sup>194</sup> G Pienaar and E Van der Schyff 'The Public Management of Water Resources in South Africa' 2008 Forum on Public Policy: A Journal of the Oxford Round Table, available at

<sup>195</sup> Malzbender, Daniel 'Africa Water Laws' available at [www.nri.org/projects/waterlaw/Malzbender.pdf](http://www.nri.org/projects/waterlaw/Malzbender.pdf), accessed on 27 September 2012.

resources; and to prescribe an outcome that must be achieved through water management practices such as treatment.<sup>196</sup> Regulations were gazetted in 1999 to protect water resources from mining.<sup>197</sup> These regulations do not define the terms ‘mine’ or ‘mining’ but since the MPRDA was not in place in 1999 we need to refer to the old Minerals Act, 51 of 1991 for the definition of ‘mine’ and ‘mining’<sup>198</sup>. The definitions in the old Minerals Act does not exclude petroleum from the defined term ‘mineral’ and the term ‘mining’ also does not exclude petroleum products. Also there is no defined term for petroleum products. Thus these regulations would seem to be applicable to shale gas extraction.<sup>199</sup> These regulations require reporting and notification to DWA for any change in mine status;<sup>200</sup> restrictions on the location of a mine such as away from flood plains,<sup>201</sup> setback lines from water courses, wells, estuaries and boreholes;<sup>202</sup> and the prohibition of the disposal of any substance that is likely to cause pollution.<sup>203</sup> Given that shale gas extraction needs to drill through existing aquifers it may not be possible to adhere to the setbacks from aquifers. The regulations also require separation of dirty and clean water,<sup>204</sup> and also require that the design ensures that contamination of clean water can only occur once in 50 years. It is not clear if this requirement will apply to each well or to a well field as this could be challenging for shale gas operations should this be applied to a well field given that the incident rate in the US. The regulations also require pollution prevention measures such as

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<sup>196</sup> Section 26(1) of the Water Act.

<sup>197</sup> Department of Water Affairs *Regulations on Water Use of Water for Mining and Related Activities Aimed at the Protected of Water Resources* R704 GG 20119 of 4 June 1999.

<sup>198</sup> Act 50 of 1991.

<sup>199</sup> The MPRDA changed the term mining to exclude petroleum products.

<sup>200</sup> Regulation 2 of R704.

<sup>201</sup> Regulation 4 of R704.

<sup>202</sup> Regulation 4(a) of R704.

<sup>203</sup> Regulation 4(c) of R704.

<sup>204</sup> Regulation 6 of R704.

containment systems and the recycling of wastewater as far as practicable.<sup>205</sup>

Finally, regards treatment, no disposal of water is allowed unless it meets the Basic Standards<sup>206</sup> for effluent disposal.<sup>207</sup> These standards set limits for many effluent constituents at the end-of-pipe for parameters such as suspended solids which are relevant to shale gas mining. However the standard specified does not address many other important constituents such as radioactivity and many other hazardous substances unique to shale gas mining.<sup>208</sup>

#### **4.8 Enforcement**

Enforcement is a critical matter given that South Africa is a water scarce country and given the need to ensure that the rights prescribed in the Constitution is protected including the right to sufficient water and the environmental right. The Water Act makes it a contravention of the Act to fail to comply with several activities and which includes compliance with a water use license or general authorisation conditions or not applying for a water authorisation as required.<sup>209</sup> The maximum sanction for an offence is five years for the first offence and ten years for a subsequent offense. The question of enforcement is revisited in Chapter Seven below where the need for a cooperative governance approach is argued for.

Water Act addresses the need for remediation of polluted water should this occur. The Water Act also makes the provision for financial security where relevant.<sup>210</sup>

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<sup>205</sup> Regulation 7 of R704.

<sup>206</sup> Department of Water Affairs and Forestry Water Act, (Act 54 of 1956) *Requirements for the Purification of Wastewater or Effluent* R991 GG 9225 dated 26 May 1984 as amended.

<sup>207</sup> Regulation 10(2)(a) of R704.

<sup>208</sup> Regulation 3 of R991 of Water Act, 54 of 1956.

<sup>209</sup> Section 151 of the Water Act.

<sup>210</sup> Section 30 of the Water Act.

#### **4.9 Conclusion**

The Water Act is the main legislation regulating the allocation of water and the discharge of waste water that may pollute the water resource of South Africa. The Minister of Water Affairs and Sanitation as the custodian of water in the country will need to carefully consider the water impacts given the scarcity of water in the Karoo and the high depend of communities on groundwater and liaise with the Minister of Mineral Resources who ultimately issues the shale gas extraction licences. This should be in accordance with the spirit if not the letter of Chapter 3 of the Constitution on Cooperative Government.

Shale gas extraction may not commence until the various water use licenses are obtained from the water authorities for water abstraction, storage, and waste water disposal and associated treatment. These licenses will need to take into account other water users and the potential impacts of shale gas extraction.

There are no water regulations that have been developed specifically for shale gas extraction however the regulations developed for water use for mining are applicable. These regulations require careful management of extraction water use activities which include setbacks from existing water users and aquifers, confinement principles and waste treatment. The next chapter turns to examining the relevant shale gas extraction law.

## CHAPTER FIVE

### PETROLEUM LAW AND SHALE GAS EXTRACTION

#### 5.0 Minerals and Petroleum Resources Development Act, 28 of 2002

##### 5.1 Introduction

The Minerals and Petroleum Resources Development Act, 28 of 2002 (the MPRDA) governs the environmental impacts of mineral and petroleum resources extraction activities which includes the exploration and exploitation of petroleum resources in chapter 6 of the Act.<sup>211</sup>

The MPRDA has entrenched the custodianship of all mineral and petroleum resources with the state and has acknowledged the section 24 Constitutional requirements to develop petroleum resources in an ecologically sustainable manner.<sup>212</sup>

While the MPRDA governs both the exploitation of minerals and petroleum resources the definition of ‘minerals’ excludes petroleum since ‘mineral’ is defined as ‘any substance, whether in solid, liquid or gaseous form, occurring naturally in or on the earth ... but excludes ... (b) petroleum ...’,<sup>213</sup>

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<sup>211</sup> Section 2 of the MPRDA.

<sup>212</sup> Sections 2 and 3 of the MPRDA.

<sup>213</sup> Definition in Chapter 1 of the MPRDA.

Since the term ‘mine’ is defined as the verb for extracting minerals and since petroleum is excluded from the term ‘mineral’ it stands to reason that the term ‘mining’ would also exclude shale gas extraction.<sup>214</sup>

## **5.2 Applications for permits and rights**

The MPRDA allows for a designated agency to be appointed to process various applications such as technical cooperation and reconnaissance permits, or exploration and production rights.<sup>215</sup> Currently the designated agency is the Petroleum Agency of South Africa (PASA). The mandate of the designated agency however not only includes the processing and assessments of permits which includes the assessment of environmental impacts and of shale gas extraction but also the agency also has the function of promoting the shale gas extraction industry.<sup>216</sup> This poses a conflict of interest.<sup>217</sup> The proposed MPRDA Amendment Bill however aims at changing this from PASA to an appointed Regional Manager of the DMR.<sup>218</sup>

One of the first regulated activities is a reconnaissance permit which will allow field surveys but this does not include exploration operations and is valid for one year.<sup>219</sup>

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<sup>214</sup> ‘mine’ as defined by the MPRDA is ‘when used as a verb, means any operation or activity for the purposes of winning any mineral on, in or under the earth, water or any residue deposit, whether by underground or open working or otherwise and includes any operation or activity incidental thereto;’

<sup>215</sup> Section 70 of the MPRDA.

<sup>216</sup> Ibid.

<sup>217</sup> Van Wyk op. cit. (n111) 41.

<sup>218</sup> MPRDA Amendment Bill 15 of 2013 GG 36523 of 31 May 2013.

<sup>219</sup> Section 75 of the MPRDA; ‘reconnaissance’ is the searching for a petroleum by geological, geophysical and photogeological surveys and includes any remote sensing techniques.

The reconnaissance permit does not grant any exclusive rights for exploration or production of the land surveyed.<sup>220</sup>

Apart from the reconnaissance permit, the MPRDA also regulates activities related to a technical co-operation permit.<sup>221</sup> This will allow an applicant to one year to conduct desk-top studies on the feasibility of gas extraction.<sup>222</sup> This permit will allow an exclusive exploration right.<sup>223</sup> Should the applicant wish to perform more intrusive investigations and start underground drilling and perhaps even hydraulic fracturing to determine the extent of any resource, an exploration right can be applied for. An exploration right will allow exclusive shale gas extraction rights for exploration purposes for a period of three years renewable for another six years.<sup>224</sup> If the applicant believes that extraction of the reserves is feasible an exclusive production right can be applied for and if successful shale gas extraction can be performed for up to 30 years which is also renewable.<sup>225</sup>

The drilling and hydraulic fracturing and shale gas extraction will require from the Minister of Mineral Resources either an exploration right or production right.<sup>226</sup>

The exploration right and production right prior to commencement of the activity requires the development and approval of an environmental management programme which is also subject to public participation.<sup>227</sup> The production right on the other hand also requires an EIA. The EMPR and EIA would manage the

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<sup>220</sup> Section 75 of the MPRDA.

<sup>221</sup> Section 76 of the MPRDA.

<sup>222</sup> Section 77 of the MPRDA.

<sup>223</sup> Sections 79 and 78 of the MPRDA.

<sup>224</sup> Section 80 of the MPRDA.

<sup>225</sup> Sections 83 and 84 of the MPRDA.

<sup>226</sup> Sections 79 and 83 of the MPRDA for exploration and production right respectively.

<sup>227</sup> Sections 79(4) and 83(4) of the MPRDA for exploration and production right respectively.



environmental impacts of the exploration or production activities.<sup>228</sup> The EMPR must contain baseline information of the affected environment in order to develop appropriate protection measures and environmental management objectives.<sup>229</sup> The EMPR also includes the assessment of environmental and socio-economic aspects and associated management controls such as for resource and pollution protection.<sup>230</sup>

The approval of the EMPR rests with the Minister of Mineral Resources however only after the Petroleum Agency of South Africa (PASA) has reviewed and recommendations are made to the Minister.

### **5.3 Integration with other legislation**

NEMA, MPRDA and the Water Act have their own process and information requirements and also there is currently a lack of integration which is being addressed. The DEA and DMR in order to address this issue agreed in 2008 to amend the MPRDA and NEMA with a view to integrating the processing, permitting timelines and decision making of the water, environmental, petroleum and waste authorisations.<sup>231</sup>

The main changes would result in:

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<sup>228</sup> Section 39 of the MPRDA.

<sup>229</sup> Section 39(3) of the MPRDA.

<sup>230</sup> Ibid.

<sup>231</sup> Department of Mineral Resources et al, 'NEMA / MPRDA AND Water Act Amendments: Joint Presentation on Mine Environmental Management, 10 September 2013' [http://www.google.co.za/url?url=http://cer.org.za/wp-content/uploads/2013/09/2-2013-09-09-Joint-IPIC-Presentation-ver-4.pptx&rct=j&frm=1&q=&esrc=s&sa=U&ei=rsnYVN\\_VFIOvU961grgD&ved=0CBwQFjAB&usg=AFQjCNHskbviMx4SFvM7yr1KcUHPwIp6hQ](http://www.google.co.za/url?url=http://cer.org.za/wp-content/uploads/2013/09/2-2013-09-09-Joint-IPIC-Presentation-ver-4.pptx&rct=j&frm=1&q=&esrc=s&sa=U&ei=rsnYVN_VFIOvU961grgD&ved=0CBwQFjAB&usg=AFQjCNHskbviMx4SFvM7yr1KcUHPwIp6hQ)

- repealing all environmental requirements through the MPRDA Amendment Act;
- the transfer of all environmental requirements to NEMA; and
- A transitional period of 18 months for the implementation of the requirements in NEMA and the final transfer of the competent authority for all environmental authorisation to the Minister of Environmental Affairs within 3 years.

The Minister of Environmental Affairs and the Minister of Mineral Resources met in 2011 and considered a change to the proposed direction agreed to in 2008.<sup>232</sup>

Three options were considered which included the transfer to the Minister of Environmental Affairs, to keep the environmental function with the Minister of Mineral Resources or leave the system as is. The following was decided:<sup>233</sup>

- The 2008 agreement without the final transfer of the function to Environmental Affairs. Thus Mineral Resources would issue environmental authorisations in terms of NEMA for a listed activity related to prospecting, exploration or petroleum operations and the Minister of Environmental Affairs will be the appeal authority. The Minister of Mineral Resources could appoint environmental inspectors for enforcement within the mineral and petroleum sector;
- Different authorisation processes resulting from the agreement must be preferably integrated, if not possible, aligned. This included

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<sup>232</sup> DMR op.cit. (n227) slide 10.

<sup>233</sup> Ibid.

alignment/integration of the NMA in terms of water license. An exploration right or production right would trigger the water license and the EIA processes; and

- A last addition was to pay specific attention to mining in ecologically sensitive areas.

In effect what this means is that the Minister of Minerals and Resources would retain the competent authority for the implementation of environmental management systems related to mining however the Minister of Environmental Affairs would be the repeal authority in order to exercise his/her mandate as the custodian of the environment.

The statutory amendments that gave effect to this included the National Environmental Management Laws Amendment Act<sup>234</sup> which came into effect on 1 May 2009, the Minerals and Petroleum Resources Development Amendment Act<sup>235</sup> that came into effect on 7 June 2013 and the EIA Regulations came into effect on 18 June 2010 and on 8 December 2014. There were no amendments necessary to the Water Act in terms of licensing however amendments will be required in terms of the appeal process. The subordinate EIA regulations were amended prior to 8 December 2014 which avoided the commencement date of the 2011 amendments.

Both the MPRDA and the Water Act addresses the need for remediation of polluted water should this occur. The MPRDA requires the exploration or production right to remedy any negative impact on the environment.<sup>236</sup> The MPRDA also requires

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<sup>234</sup> Act 25 of 2014.

<sup>235</sup> Act 49 of 2008.

<sup>236</sup> Section 38 of the MPRDA.

financial provision to be set aside for such a liability.<sup>237</sup> The Water Act also makes the provision for financial security where relevant.<sup>238</sup>

#### **5.4 Status of current applications**

Since December 2010, PASA has received applications in terms of the MPRDA for exploration right for shale gas extraction in the Karoo from Shell International, Falcon Oil and Gas, Bundu (also known as Sunset Energy), Anglo Coal and Sasol/Chesapeake/Statoil JV.<sup>239</sup>

However due to much public outcry<sup>240</sup> and the gaps highlighted in the applicant submissions,<sup>241</sup> the Minister of Minerals and Resources issued a moratorium on new applications related to shale gas exploration and production in the Karoo in February 2011. Later in April 2011 the Minister of Minerals and Resources issued a suspension of all processing of existing applications for exploration and production for shale gas in the Karoo until a feasibility study was performed.<sup>242</sup>

Once the feasibility study was completed, the Minister lifted the suspension decision of April 2012 and allowed the processing of exploration applications to continue. Any exploration however would be supervised by a monitoring committee which would need to be established and would need to comply with

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<sup>237</sup> Section 41 of the MPRDA.

<sup>238</sup> Section 30 of the MPRDA.

<sup>239</sup> Econometrix op. cit. (n3) 17 and 18.

<sup>240</sup> For example: News24, 'TKAG slams fracking task team' available at <http://www.news24.com/SciTech/More/TKAG-slams-fracking-task-team-20110727-2> accessed on 30 September 2013.

<sup>241</sup> Havemann op. cit. (n9) and F Bekker op.cit. (n34).

<sup>242</sup> Minister of Environmental Affairs issued the statement via a press briefing on 27 April 2011 which was never officially gazette and hence the legality of the decision is questionable.

appropriate regulations and controls which also required to be established.<sup>243</sup> As a result proposed regulations were issued in 2013<sup>244</sup> (the Technical Regulations) which is discussed below in Section 5.5.

## **5.5 Proposed Technical Regulations**

The Technical Regulations were developed and issued for public comment in October 2013.<sup>245</sup> The objectives of the Technical Regulations are to augment gaps identified in the regulatory framework for shale gas extraction.

The objectives of the Technical Regulations are set out in Chapter 1 of the regulations. It is clear that the Technical Regulations apply to all on-site and below ground activities not only related to hydraulic fracturing but also the associated above ground activities of waste storage and handling. There is no mention however of the broader activities that may occur off-site such as the withdrawal or collection of raw water for fracturing purposes nor the probable off-site waste treatment and/or disposal. It could be argued that the water supply and storage will be addressed by the NWA authorisations and not by the Technical Regulations however given that quality of the water supply is a technical issue we recommend that the Technical Regulations addresses this. For example, if saline groundwater is

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<sup>243</sup> Bowman and Gilfillan 'Regulatory guidelines around fracking' available at <http://www.bowman.co.za/News-Blog/Blog/Regulatory-Guidelines-Around-Fracking> access on 30 September 2014.

<sup>244</sup> Department of Mineral Resources *Proposed technical Regulations for Petroleum Exploration and Exploitation* GN 1032 GG 36938 of 15 October 2013 known as the 'Technical Regulations' in this dissertation.

<sup>245</sup> Ibid.

used the drilling and fracturing processes would need to be adapted to accommodate this.<sup>246</sup>

Chapter 2 of the regulations establishes the site assessment, selection and preparation aspects. This includes the need and scope for an environmental impact assessment.<sup>247</sup> The scope of the environmental impacts assessment described however does not include the off-site activities of water withdrawal or waste disposal or treatment. Even if water was abstracted on site this is omitted. The environmental impact assessment is augmented with below ground assessments which includes the geological characteristics and a water resource (above and below ground) assessment.

The water resource assessment includes a hydrocensus<sup>248</sup> and an independent water ground water baseline monitoring prior to and after shale gas activities.<sup>249</sup>

Monitoring while not stated in the regulations will address:

- environmental enforcement (ensure compliance to permit conditions and also document any non-compliances);
- environmental control (determine if the effectiveness of control measures and need for improvement);
- environmental remediation (proof of liability and ensure remediation); and

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<sup>246</sup> Vengosh op. cit. (n98) 8347

<sup>247</sup> Regulation 3 of the Technical Regulations.

<sup>248</sup> Regulation 5 of the Technical Regulations.

<sup>249</sup> Ibid.

- environmental knowledge (promote better understanding of environmental system dynamics);

The base-line monitoring requires baseline monitoring 1 km from the vertical projection of the planned well bore to surface.<sup>250</sup> While the Technical Regulations does not exclude monitoring beyond 1 km it also does not specifically require:

- an expansion of monitoring based on any assessment of local geological conditions. It is general accepted amongst geo-hydrologists that a 1km range is too marginal<sup>251</sup>. Furthermore there is no timeframe in terms of the baseline monitoring e.g. two years before site establishment;
- the regional monitoring of drinking water boreholes for pollution based on the precautionary principle given so little is known about the geohydrology of the Karoo;

An important part of the site preparation activities includes a requirement for site containment in order to prevent soil and groundwater contamination.<sup>252</sup> Site Containment is regarded as best practise,<sup>253</sup> however the regulations only address this in the context of spills. There is no mention of the containment of leaks and storm water which will also need to be contained but is it assumed that this will be considered.

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<sup>250</sup> Regulation 5(2) of the Technical Regulations.

<sup>251</sup> K Eshleman and A Elmore 'Recommended Best Management Practices for Marcellus Shale Gas Development in Maryland' available at <https://www.yumpu.com/en/document/view/11194285/memorandum/109>, accessed on 21 September 2014.

<sup>252</sup> Regulation 8 of the Technical Regulations.

<sup>253</sup> Ibid.

Chapter 3 of the regulations establishes the requirements for well design, construction, testing and closure to prevent pollution and also to rehabilitate the site after closure.<sup>254</sup> The regulations refer to the American Petroleum Institute (API) standards in this regard. Adequate well design, construction, testing and closure are very important regulated activities since this is one of the reported causes of pollution as discussed in Chapter 2 of this dissertation. Given the high number of well integrity failures reported in the US since 2010 it is questionable if the current standards of well integrity are adequate.

Chapter 4 of the regulations addresses operations and management aspects of the extraction process. This covers the need for competent persons to manage the activities,<sup>255</sup> management of vertical drilling fluids,<sup>256</sup> and general operational management aspects. One of the more important requirements relates to the disclosure of drilling fluids<sup>257</sup> which is one of the more important points raised in Chapter 4 of this dissertation as it is one of the rights for public to have access to information. Chapter 4 also requires an extraction fluids management plan and waste management plan to ensure that the hazards to water are appropriately managed in terms of the Water Act and NEMWA.<sup>258</sup> NEMWA will be discussed in Chapter 6 of this dissertation.

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<sup>254</sup> Regulation 11 to 23 of the Technical Regulations.

<sup>255</sup> Regulation 24 of the Technical Regulations.

<sup>256</sup> Regulation 25 of the Technical Regulations.

<sup>257</sup> Regulation 29 of the Technical Regulations.

<sup>258</sup> Regulation 26 of the Technical Regulations.



The Technical Regulations however have a number of gaps to best practise:

- The regulations require setbacks and states that no fracturing may occur within 1 km of existing wells or a developed water resource.<sup>259</sup> This requirement is based on international recommendations<sup>260</sup> however this may not have taken into account local geo-hydrological aspects which are unique to the Karoo. As such a setback should also be considered based on established geo-hydrological risks.<sup>261</sup> The migration of fracking fluid and brine upwards will depend on the nature of the geology of the local area and as such need to be informed by further study and analysis. Furthermore, the regulations only seem to take into account developed water resources and existing wells. Undeveloped water resources should also be protected. Finally, apart from setbacks from water resources setbacks to potential migration pathways should also be considered;
- The Regulations state that the holder must consider re-using fracturing fluids and produced water and also prohibits re-injection of produced water underground.<sup>262</sup> This is in line with best practise however the regulations do not discuss best management practices such as closed loop drilling system and zero effluent discharge, nor the consideration of technologies such as desalination.<sup>263</sup> Typically these processes would require on-site treatment for immediate re-use which reduces waste and fresh water used. Also the

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<sup>259</sup> Ibid, Regulation 38(2) of the Technical Regulations.

<sup>260</sup> Vengosh op. cit. (n98) 8344.

<sup>261</sup> T Myers 'Potential Contaminant Pathways from Hydraulically Fractured Shale to Aquifers' (2012) 50 *Groundwater* 872.

<sup>262</sup> Regulation 40(3) of the Technical Regulations.

<sup>263</sup> Vengosh op. cit (n98) 8344 recommends desalination.

regulations do not require the assessment of alternative or environmentally more suitable fracturing fluids;

- While the Technical Regulations does make reference to other legislations that should be considered it does not mention any co-operative agreements or seem to take into account the need for integration or co-operation between the various authorities.
- The regulations do not discuss the use of fresh water needed for hydraulic fracturing and the need to consider non potable water for use which is recommended elsewhere.<sup>264</sup>

## **5.6 Conclusion**

The MPRDA is the main petroleum extraction law legislation regulating petroleum extraction activities. The MPRDA requires an exploration and/or production rights to be approved for any shale gas extraction.

The MPRDA requires an EMPR to be developed and approved for both exploration and production rights while the production right also requires an EIA.

To augment gaps in current legislation the Minister of Mineral Resources has issued proposed Technical Regulations that addresses many of the issues which include water pollution issues experienced internationally. The Technical Regulations do require many of the established best practises identified such as establishing baseline water monitoring, public disclosure of fracturing fluids, water setbacks and

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<sup>264</sup> Vengosh op. cit. (n98) 8344.

well integrity standards.<sup>265</sup> The regulations however does not address many of the water treatment and disposal issues experienced internationally,<sup>266</sup> nor do the Regulations discuss the need to consider more environmentally-friendly fracturing fluids nor the best practise of using saline water or recycled water for fracturing. Presumably this will be left to the Minister of Water Affairs which is not recommended given the integrated approach that should be taken. Finally, unfortunately the Technical Regulations do not seem to take into account the unique nature of the geohydrological structure of the Karoo. For example, there is no indication of any setbacks to the dolerite intrusions.

The designated agency that deals with permits and rights applications is also charged with the promotion of shale gas extraction industry. This potential conflict of interest is being addressed by the proposed MPRDA Amendment Bill of 2013.

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<sup>265</sup> Vengosh op. cit. (n98) 8344.

<sup>266</sup> Ibid.

## CHAPTER SIX

### ENVIRONMENTAL LAW AND SHALE GAS EXTRACTION

#### 6.1 Introduction

The main environmental legislation that regulates the environmental impacts of shale gas extraction is the National Environmental Management Act, 107 of 1998 (NEMA). NEMA is a framework act which sets out the principles, norms and standards and processes for environmental impact assessment and management. In addition to NEMA, a specific environmental legislation is the National Environmental Management: Waste Act, 59 of 2008 (NEMWA) which also addresses waste from mining and petroleum product extraction. These two Acts will be discussed in more detail below.

#### 6.2 National Environmental Management Act, 107 of 1998

NEMA is the overarching legislation regulating activities that result in significant environmental impacts. Important principles included in NEMA include co-operative governance, procedures for co-ordinating functions by organs of state, administration and enforcement of laws.<sup>267</sup> NEMA also sets out to give effect to the environmental right in the Constitution.<sup>268</sup>

NEMA sets out key principles that would be relevant to any project that has a negative impact on the environment and thus may impact or infringe on people's

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<sup>267</sup> Preamble of NEMA.

<sup>268</sup> Section 24 of the Constitution.

rights.<sup>269</sup> Sustainable development<sup>270</sup> requires that negative impacts are avoided or prevented, and where these cannot be prevented, are minimised and remedied. The negative impacts apply not only to those predicted but those that may occur.<sup>271</sup> As such impacts to the environment will need to be identified and assessed. The risk assessment that is required will then determine what appropriate or reasonable actions to take be it prevention, mitigation or remediation.<sup>272</sup>

Public consultation and participation is an important part of the principles of environmental management and any decision making are required to take into account the needs of interested and affected parties.<sup>273</sup>

When it comes to waste,<sup>274</sup> NEMA highlights the following principle in relation to waste management:<sup>275</sup>

‘that waste is avoided, or where it cannot be altogether avoided, minimised and reused or recycled where possible and otherwise disposed of in a responsible manner’

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<sup>269</sup> Section 2 of NEMA.

<sup>270</sup> ‘sustainable development’ is defined in NEMA as ‘means the integration of social, economic and environmental factors into planning, implementation and decision making so as to ensure that development serves present and future generations’.

<sup>271</sup> Section 2 of NEMA.

<sup>272</sup> Section 23(2)(b) of NEMA.

<sup>273</sup> Sections 2(4)(f) and 2(4)(g) of NEMA.

<sup>274</sup> Waste is not defined in NEMA however it is defined in the NEM: Waste Act 59 of 2008 as amended in 2014: ‘ “Waste” means any substance, whether or not that substance can be reduced, re-used, recycled or recovered—

- (a) that is surplus, unwanted, rejected, discarded, abandoned or disposed of;
- (b) which the generator has no further use of for (he purposes of production;
- (c) that must be treated or disposed of; or
- (d) that is identified as a waste by the Minister by notice in the Gazette, and includes waste generated by the mining, medical or other sector, but—
  - (i) a by-product is not considered waste; and
  - (ii) any portion of waste, once re-used, recycled or recovered, ceases to be waste;

<sup>275</sup> Section 2(4)(a)(iv) of NEMA.

One of the factors related to sustainable development under NEMA is the application of the Best Practicable Environmental Option (BPEO).<sup>276</sup> The BPEO principle requires that different options for environmental management are considered and the most appropriate and reasonable approach implemented.<sup>277</sup> Of relevance are the DWA's BPEO guideline for water quality management and the Minimum Requirements document for waste management.<sup>278</sup>

NEMA Section 28 gives effect to the polluter pays principle and provides for a duty of care and for the remediation of environmental damage. Every person who is causing or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring.<sup>279</sup> The Act endorses the polluter pays principle by covering costs of degradation to the environment but it does not specifically address incentive measures to decrease pollution to the environment.<sup>280</sup>

### **6.2.1 Environmental impact assessments**

NEMA Section 5 sets out the objectives for integrated environmental management. The objectives of integrated environmental management include the integration of the environmental principles,<sup>281</sup> into environmental decision making. This process of environmental decision making includes the identification of activities that

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<sup>276</sup> Section 2(4)(b) of NEMA, BPEO is defined as 'means the option that provides the most benefit or causes the least damage to the environment as a whole, at a cost acceptable to society, in the long term as well as in the short term'.

<sup>277</sup> Ibid.

<sup>278</sup> Department of Water Affairs and Forestry, Operational Guideline No. M6.1' Guideline document for the implementation of regulations on the use of water for mining and related activities aimed at the protection of water resources' 2000a

<sup>279</sup> Section 28 of NEMA.

<sup>280</sup> Section 2(4)(a)(p) of NEMA

<sup>281</sup> Chapter 2 of NEMA.

require an authorisation, the process for authorization and some implementation requirements.<sup>282</sup>

The Minister of Environmental Affairs has declared a list of activities that requires an environmental authorisation.<sup>283</sup> These listed activities would require an environmental authorisation prior to proceeding.<sup>284</sup>

The EIA process requirements are prescribed in the EIA Regulations.<sup>285</sup> Distinction is made between activities that requires a full scope EIA or a Basic Assessment. The full scope EIA will require the development of a scoping document which sets out the required methodologies and scope of specialist input for the assessment of the environmental impacts and control measures of the development activities.<sup>286</sup> The Minister may also establish a list of activities that triggers the need for an environmental authorisation taking geographical or location specific aspects into account.<sup>287</sup> This means that where some locations are deemed to be more sensitive to developments such as in proclaimed natural protected areas then this can be considered.

The 2014 EIA regulations have prescribed timelines for the process which are relatively short. For example, the scoping report will need to be submitted within 44 days after acceptance of the application. Also, the assessment report will need to be submitted 106 days after acceptance of the scoping report. These timelines may

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<sup>282</sup> Section 23 of NEMA.

<sup>283</sup> Listed activities are established in terms of Section 24(2) and 24(D) of NEMA

<sup>284</sup> Section 24(F) of NEMA.

<sup>285</sup> Chapter 4 of R.982 Regulation 21 of R.982 *National Environmental Management Act (107/1998): Environmental Impact Assessment Regulations, 2014* R982 GG38282 dated 4 December 2014.

<sup>286</sup> Regulation 21 of R.982 *National Environmental Management Act (107/1998): Environmental Impact Assessment Regulations, 2014* R982 GG38282 dated 4 December 2014

<sup>287</sup> Section 24(2)(b) and (c).

not be achievable for complex and controversial projects if the project team does not have the extensive assessment data on hand. For shale gas extraction projects this would mean that many of the assessment studies would need to be performed prior to the application or scoping document submission.

Once an applicant is ready to perform an EIA and is confident that the timelines can be met, an application is lodged with the authorities. For shale gas exploration activities this would be with PASA however the minister will authorise the activity based on recommendations from PASA.<sup>288</sup> An application for an EIA should only be made after acceptance of the application for an exploration or production right in terms of MPRDA.<sup>289</sup> An application will only be accepted by the authorities if it contains all the necessary information; and the application fees if applicable are paid.<sup>290</sup>

The developer would need to appoint an independent consult to perform the EIA and the consultant will need to compile a scoping report which outlines the assessment scope, methodologies and knowledge gaps related to the development. The scoping report is subject to public participation prior to issuing to the authorities for approval.<sup>291</sup>

The main issue that may emerge during the discussions during the scoping phase is the scope and extent of the huge task of collecting data of the geology and hydrogeology of the area to be affected.

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<sup>288</sup> Section 24(C)(2A) of NEMA.

<sup>289</sup> Regulation 16(2) of R982.

<sup>290</sup> Regulation 16 of R982.

<sup>291</sup> Section 24(I) of NEMA.



Should the scoping report be accepted by the authorities then the assessment phase can commence. The assessment phase would include a risk assessment of the various activities on the consequences of negative and positive aspects of the project on the environment which includes the biophysical, physical and social and economic aspects.<sup>292</sup> The mitigation measures to reduce impacts and the associated alternatives will need to be assessed.<sup>293</sup> Gaps of scientific knowledge and adequacy of methods will need to be described when developing reports.<sup>294</sup> The various aspects would be assessed by specialists in their respective disciplines and a range of specialists who are suitably qualified are appointed to perform the specialist studies.<sup>295</sup> These studies are summarised in an assessment report by the independent environmental assessment consultant. The consultant will also develop an environmental management programme (EMP),<sup>296</sup> which captures some of the key recommendations from the specialists in terms of the environmental controls such as monitoring, mitigation and prevention. The EMP will cover all phases of the development such as pre-construction, construction, operation, rehabilitation, decommissioning and closure.

The assessment report will be subject to not only public scrutiny but also any other commenting authority that have in terms of their respective mandates a decision making role over the activity in question. The comments from various commenting authorities need to be taken into account<sup>297</sup> when the competent authority makes

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<sup>292</sup> Section 24(b).

<sup>293</sup> Ibid.

<sup>294</sup> Ibid.

<sup>295</sup> Section 24(I).

<sup>296</sup> EMP requirements in NEMA 24N and Appendix 4 of the NEMA EIA Regulations.

<sup>297</sup> Section 24(K) of NEMA.

any decisions as well as engagement with the public.<sup>298</sup> Typically this would include the departments from water and environmental authorities such as the CMA and potentially also heritage, agricultural, and the local authorities. It is important in terms of the cooperative governance that the various authorities work together.<sup>299</sup> The DMR has put in place some cooperative agreements but this will be discussed in more detail in Chapter 7 of this dissertation.

Consent from the land owner is not required for developments related to petroleum products extraction.<sup>300</sup> The land owner or occupier can however participate in the public process and object should they believe the rights are being infringed upon.

The authorities will need to attach conditions related to the authorisation to ensure that provision is made for on-going management and monitoring of the environmental impacts for the life cycle of the facility.<sup>301</sup> However prior to issuing an authorisation, should the authorities wish to do so, they will need to take into account the minimum criteria set by NEMA.<sup>302</sup> This includes taking into account the measures that are required to conservative natural resources and minimise pollution, the ability of the developer to implement mitigation measures, relevant alternatives measures, comments from the public and any relevant guidelines developed by the DEA.<sup>303</sup>

The listed activities relevant to shale gas extraction will be discussed in the section below.

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<sup>298</sup> Section 23(d)

<sup>299</sup> Section 24(4)(a)(ii) of NEMA.

<sup>300</sup> Regulation 16 read with Regulation 39(2) of R982.

<sup>301</sup> Section 24(E) of NEMA.

<sup>302</sup> Section 24(O) of NEMA.

<sup>303</sup> Ibid.

## 6.2.2 Listed activities relevant to shale gas extraction

Since natural resource conservation and pollution prevention are part of the environmental principles and given that the environmental impacts of shale gas extraction are deemed to be significant one would expect that shale gas extraction activities would be a listed activity and as such a review of the NEMA 2014 listed activities<sup>304</sup> was performed.

The most important listed activities related to shale gas extraction are the need for an EIA for an exploration or production right. The Regulations require a full scope EIA for any exploration right<sup>305</sup> or any production right.<sup>306</sup> Other listed activities could also be triggered such the construction of facilities or infrastructure for the extraction of gas,<sup>307</sup> and the storage and handling of a dangerous good above certain limits.<sup>308</sup>

List 2 which list less important activities but will still nevertheless require an environmental authorization requires a Basic Assessment.<sup>309</sup> which is a simpler permitting process is required for activities with potentially smaller negative

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<sup>304</sup> NEMA listed activities R984, R985, R983 GG 38282 of 4 December 2014

<sup>305</sup> Activity 18 of NEMA, R 984, EIA list 2: 'Any activity including the operation of that activity which requires an exploration right as contemplated in section 79 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), including associated infrastructure, structures and earthworks'.

<sup>306</sup> Activity 20 of NEMA R 984, EIA list 2: 'Any activity including the operation of that activity which requires a production right as contemplated in section 83 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), including associated infrastructure, structures and earthworks, directly related to the primary processing of a petroleum resource.'

<sup>307</sup> Activity 22 of NEMA R 984, EIA list 2: 'Any activity including the operation of that activity associated with the primary processing of a petroleum resource including winning, extraction, classifying, concentrating, water removal, but excluding the refining of gas, oil or petroleum products in which case activity 5 in this Notice applies'

<sup>308</sup> Activity 4 of NEMA EIA list 2: 'The development of facilities or infrastructure, for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of more than 500 cubic metres'.

<sup>309</sup> R983 Listing notice 1: List of activities and competent authorities identified in terms of sections 24 (2) and 24 D GG 38282 of 4 December 2014.

environmental impacts but which still require authorisation relates to clearing of vegetation,<sup>310</sup> storage of dangerous goods,<sup>311</sup> a closure of the facility,<sup>312</sup> and an effluent treatment facility.<sup>313</sup>

NEMA Regulations also have a list ('list 3') for activities that would trigger a Basic Assessment if the activity is located near or in sensitive vegetation. For example storage of more than 250 m<sup>3</sup> of water in the Eastern Cape in a critical biodiversity area would require a Basic Assessment.<sup>314</sup> The criteria vary between each province and as such will not be elaborated further in this dissertation.

Should a waste water treatment facility be built then this may also trigger an EIA as desalination will be required for this purpose.<sup>315</sup>

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<sup>310</sup> Activity 27 of NEMA R983, List 1: 'The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for-

(i) the undertaking of a linear activity; or

(ii) maintenance purposes undertaken in accordance with a maintenance management plan

<sup>311</sup> Activity 14 of NEMA R983, List 1: The development of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic metres or more but not exceeding 500 cubic metres.

<sup>312</sup> Activity 22 of NEMA R983, List 1: 'The decommissioning of any activity requiring -

(i) a closure certificate in terms of section 43 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002); or

(ii) a prospecting right, mining right, mining permit, production right or exploration right, where the throughput of the activity has reduced by 90% or more over a period of 5 years excluding where the competent authority has in writing agreed that such reduction in throughput does not constitute closure.

<sup>313</sup> Activity 25 of NEMA R983 List 1: The development and related operation of facilities or infrastructure for the treatment of effluent, wastewater or sewage with a daily throughput capacity of more than 2000 cubic metres but less than 15000 cubic metres.

<sup>314</sup> Activity 2 of NEMA R985 List 3: The development of reservoirs for bulk water supply with a capacity of more than 250 cubic metres.

<sup>315</sup> Activity 16 of NEMA, EIA list 2: The development and related operation of facilities for the desalination of water with a design capacity to produce more than 100 cubic metres of treated water per day.

### 6.3 National Environmental Management Waste Act, 59 of 2008

Apart from NEMA which is a framework act for environmental related activities, the Minister of Environmental Affairs has also established the National Environmental Management: Waste Act 59 of 2008 (NEMWA).

The NEMWA was established to prevent pollution and ecological degradation by providing the necessary processes, standards and supporting institutional arrangements.<sup>316</sup> NEMWA defines waste as any substance that is unwanted or disposed of.<sup>317</sup> This definition thus includes solid, liquid and gaseous wastes. The definition of ‘waste’ excludes substances that are recycled however only after an application for recycling has been approved.

Shale gas extraction wastes such as fracturing fluids and flowback would be classified as hazardous waste given their respective properties discussed in Chapter 2 of this dissertation.<sup>318</sup> The recycling of flowback water could be exempted from the definition of waste if recycling is approved.

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<sup>316</sup> Objectives of NEMWA.

<sup>317</sup> Waste is defined in NEMWA as:

- (a) any substance, material or object, that is unwanted, rejected, abandoned, discarded or disposed of, or that is intended or required to be discarded or disposed of, by the holder of that substance, material or object, whether or not such substance, material or object can be re-used, recycled or recovered and includes all wastes as defined in Schedule 3 to this Act [NEMWA]; or
- (b) any other substance, material or object that is not included in Schedule 3 that may be defined as a waste by the Minister by notice in the Gazette, but any waste or portion of waste, referred to in paragraphs (a) and (b), ceases to be a waste-
  - (i) once an application for its re-use, recycling or recovery has been approved or, after such approval, once it is, or has been re-used, recycled or recovered;
  - (ii) where approval is not required, once a waste is, or has been re-used, recycled or recovered;
  - (iii) where the Minister has, in terms of section 74, exempted any waste or a portion of waste generated by a particular process from the definition of waste; or
  - (iv) where the Minister has, in the prescribed manner, excluded any waste stream or a portion of a waste stream from the definition of waste.

<sup>318</sup> NEMWA defines ‘hazardous waste’ as ‘means any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment and includes

NEMWA does not apply to radioactive waste that is regulated by other legislation.<sup>319</sup> It is not clear prohibits re-injection of produced water underground if the exclusion is only for the radioactive substances contained in the waste water or if the waste water that contains radioactive substances is excluded from NEMWA. The exclusion limit according to regulations promulgated in terms of the National Nuclear Regulator Act, 46 of 1999 (the NNRA) is 500 Bq/l<sup>320</sup> above which the Act will apply.<sup>321,322</sup> Furthermore, the regulations allow the regulator to exempt waste if that waste exceeds the exclusion limits but does not pose more than a low risk based on radiological dose to public.<sup>323</sup> The radioactivity of shale gas liquid waste as discussed in Chapter 2<sup>324</sup> of this dissertation shows that the typical maximum levels detected in the US can be more than the exclusion levels found in the NNRA regulations. The operator can however request an exemption based on the risks of the activity. Should this not be obtained then the radiological wastes would be excluded from the NEMWA. In any case, regardless of the levels of radioactivity, this will need to be assessed in the EIA required by NEMA regulations.

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hazardous substances, materials or objects within business waste, residue deposits and residue stockpiles...’ .

<sup>319</sup> Section 4(1)(a) excludes substances regulated by the Hazardous Substances Act 15 of 1973, the National Nuclear Regulator Act 47 of 1999 and the National Energy Act 46 of 1999.

<sup>320</sup> Becquerel per litre

<sup>321</sup> Regulation 2.1 of the *Regulation Safety Standards and Regulatory Practises* R388 GG 28755 of 28 April 2006.

<sup>322</sup> Regulation 2.1 of R388 excludes Uranium and Thorium progeny and also Radon. Radium which is the key radionuclide associated with shale gas extraction is however not excluded.

<sup>323</sup> Regulation 2.2 *Regulation Safety Standards and Regulatory Practises* R388 GG 28755 of 28 April 2006

<sup>324</sup> Page 26

The Minister of Water Affairs and Sanitation lists those waste activities that are detrimental to the environment and thus require a waste license.<sup>325</sup> The list is divided into two groups, Group A which is applicable to those activities that requires a Basic Assessment in terms of NEMA and Group B which consists of those activities that require a full scoping and assessment EIA in accordance with NEMA<sup>326</sup>.

The list requires a waste license for the storage,<sup>327</sup> or recycling,<sup>328</sup> or treatment,<sup>329</sup> or disposal<sup>330</sup> of hazardous waste. In the case of storage of hazardous waste, a license is not required for the storage of effluent. Neither the list nor does NEMWA or NEMA distinguish between ‘waste’ and ‘effluent’ as the term ‘effluent’ is not defined. Generally the term effluent would apply to a liquid with a waste dissolved or suspended within it.<sup>331</sup> Thus the term effluent still would fall within the definition of waste (unless recycled). This poses some confusion over the need for a waste license.

NEMWA allows the Minister to determine the amount of recycling that is required for any application.<sup>332</sup> The Minister has the power to require an industry Waste

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<sup>325</sup> Department of Environmental Affairs *List of Waste Management Activities that have, or are likely to have a Detrimental Effect on the Environment* GN 921 GG 37083 of 29 November 2013.

<sup>326</sup> Ibid.

<sup>327</sup> Section 4(1) of GN 921 is applicable to ‘the storage of hazardous waste in lagoons excluding storage of effluent, wastewater or sewage’

<sup>328</sup> Section 4(1) of GN 921: ‘The reuse or recycling of hazardous waste in excess of 1 ton per day, excluding reuse or recycling that takes place as an integral part of an internal manufacturing process within the same premises’.

<sup>329</sup> Section 4(4) of GN 921: ‘The treatment of hazardous waste in excess of 1 ton per day calculated as a monthly average; using any form of treatment excluding the treatment of effluent, wastewater or sewage’ and s4(5) of GN 921: ‘The treatment of hazardous waste in lagoons, excluding the treatment of effluent, wastewater or sewage’.

<sup>330</sup> Section 4(7) of GN 921: ‘The disposal of any quantity of hazardous waste to land’.

<sup>331</sup> Taken from the definition of ‘effluent’ in the National Environmental Management: Integrated Coastal Management Act 24 of 2008.

<sup>332</sup> Section 17(2) of the NEMWA.

Plan which would be used to determine the conditions of granting of a waste permit.<sup>333</sup>

NEMWA does require the Minister to take into account cooperative governance in terms of NEMA and other legislation dealing with waste. There are many cases where overlapping and potentially contradictory requirements. For example, the Water Services Act<sup>334</sup> (WSA) requires approval of the local water services authority for the disposal of industrial effluent,<sup>335</sup> and may establish effluent disposal standards.<sup>336</sup> In addition approval is required in terms of the Water Act and NEMA EIA regulations as discussed above.

#### **6.4 Conclusion**

One of the most important regulatory controls over shale gas extraction activities will be the requirement for an environmental authorisation in terms of the EIA regulations which includes activities that have a significant impact on natural resource conservation and/or environmental pollution. Since shale gas extraction has significant environmental impacts it is not surprising that it triggers the need for a full scope EIA.

The environmental assessment process will require the identification and assessment of risks to the Karoo water resources. The precautionary principle will need to apply where a lack of knowledge exists and thus much will rest on the

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<sup>333</sup> Section 28 of the NEMWA.

<sup>334</sup> Act 19 of 1997, as amended.

<sup>335</sup> Section 7(2) of WSA: also industrial effluent definition includes mining effluent and the term mining while not defined is probably aligned to the definition in the Mines Act which includes petroleum products.

<sup>336</sup> Section 9 of the WSA.



availability or lack of availability of scientific studies on the unique geo-hydrological characteristics of the Karoo.

## CHAPTER SEVEN

### IMPLEMENTATION, ENFORCEMENT AND INSTITUTIONAL CAPACITY

#### 7.1 Introduction

While the environmental laws are generally well developed many gaps remain<sup>337</sup> and the current state of implementation is also often inadequate.<sup>338</sup> In addition a number of weaknesses that have been discussed in previous chapters include enforcement and institutional capacity.<sup>339</sup> The gaps include lack of Technical Regulations (which are yet to be put in place), too low financial guarantees for environmental damage, and confusion over the overlapping and processes and mandates.<sup>340</sup> This will be discussed in broader terms in this chapter.

#### 7.2 Regulatory implementation

The fragmented nature of South African legislation and institutions can lead to an uncoordinated and an un-optimised approach to regulation.<sup>341</sup> While an attempt has been made to integrate licensing of exploration and production activities there is no

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<sup>337</sup> Haveman op. cit. (n9) and S Esterhuyse, M Kemp and N Redelinghuys 'Assessing the existing knowledge base and opinions of decision makers on the regulation and monitoring of unconventional gas mining in South Africa' available at <http://dx.doi.org/10.1080/02508060.2013.818478> accessed on 31 January 2014

<sup>338</sup> IM Jacobs 'Water Governance Framework in the Orange-Senqu River Basin in Southern Africa' (2012) *Int Environ Agreements* 199

<sup>339</sup> K Pietersen et. al. 'Groundwater Governance in South Africa: A Status Assessment' (2012) 38 *Water SA* no.3 at 454 and Jacobs op. cit. (n338) 199.

<sup>340</sup> Jacobs op. cit. (n338) 200 .

<sup>341</sup> A Paterson and L Kotze *Environmental Compliance and Enforcement in South Africa: Legal Perspectives* 2009 at 108.

single legislation in terms of water use for mining / petroleum extraction or the governing institution.

Given that the effects of shale gas extraction are both cumulative and regional, it is recommended that permitting and enforcement is managed at a regional level.<sup>342</sup>

While it is acknowledged that the South African water law is one of the most progressive worldwide, what limits implementation is an overly complex system demanding high skilled resources leading to delays.<sup>343</sup> An example of delays due to capacity constraints is the roll-out of CMAs and only one CMA has implemented in the Karoo basin areas. The regional DWA office would thus need to act as the interim CMA in this regard. Since the impact of hydraulic fracturing may also affect farming and urban water use there may be a need for co-operation between the water, agricultural, mining institutions and municipalities. This could include national DWA if any international agreements are affected however this is unlikely. A groundwater extraction plans will need to be developed and this will need to be a co-ordinated effort between the various institutional bodies. Since access to water is a constitutional right, the regional DWA office and the local authorities will need to ensure that the basic rights of access to water of citizens are not infringed. The institutional frameworks in place are highlighted as a weakness<sup>344</sup> such as inadequate co-ordination between regional, local and national institutions and the lack of implementation of the Groundwater Management Institute of Southern

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<sup>342</sup> Esterhuyse S Esterhuyse 'Towards the Effective Management of Groundwater Resources During Unconventional Gas Mining'  
[http://gwd.org.za/sites/gwd.org.za/files/07\\_S%20Esterhuyse\\_Towards%20the%20effective%20management%20of%20groundwater%20resources%20during%20unconventional%20gas%20mining.pdf](http://gwd.org.za/sites/gwd.org.za/files/07_S%20Esterhuyse_Towards%20the%20effective%20management%20of%20groundwater%20resources%20during%20unconventional%20gas%20mining.pdf)  
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<sup>343</sup> Esterhuyse et al. 'Assessing the existing knowledge base and opinions of decision makers on the regulation and monitoring of unconventional gas mining in South Africa' (2013) 38 *Water International* 693.

<sup>344</sup> Pietersen op. cit. (n144) 454.

Africa. It is recommended that a water strategy that deal exclusively with hydraulic fracturing is developed to ensure that these weaknesses are addressed timeously.<sup>345</sup>

### 7.3 Capacity of institutions

The challenge that regulatory institutions face when implementing new legislation and confronting new technologies is that it requires adequate skills and management systems.<sup>346</sup> This will affect all institutions.

Apart from the numerous capacity issues and delays reported with the issuing of water licences,<sup>347</sup> there have been delays in the roll-out of CMAs and in particular the CMAs that are likely to be involved with the Karoo areas are not yet in place. A number of capacity issues have been highlighted such as a lack of information on groundwater and the lack of capacity of staff within the water sector at all levels. To address this issue one would expect that the industry will perform studies to identify and assess the impacts of the sources of water. The DWA can in terms of the Water Act implement a water use charge to recover any costs that the authorities may accrue. This can be used to develop capacity and develop the required knowledge within the sector. However there needs to be effective co-operation between the institutions to best leverage capacities and knowledge. It is estimated that the financial implications of not implementing the NGS is ten times if not one

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<sup>345</sup> Van Wyk op. cit. (n111) 35.

<sup>346</sup> M Claassen 'Integrated Water Resource Management in South Africa' (2013) 1 *International Journal of Water Governance* 323.

<sup>347</sup> Esterhuyse op. cit. (n343) 693 and H Dagut and S Gore 'Streamlining Water use License Applications into Environmental Mining Regulation' available at <http://www.golegal.co.za/legislation/streamlining-water-use-licence-applications-environmental-mining-regulation> accessed on 31 January 2014.

hundred times the cost of implementing the NGS.<sup>348</sup> It is recommended that all institutions establish capacity and financial needs in their strategic plans to address these issues.

#### **7.4 Transfer from PASA to Regional Managers**

The MPRDA allows according to Section 70 the assignment of a designated agency to process authorisations as the main regulatory agent in terms of the Act. Currently this has been assigned to PASA. However it is proposed in the Amendment Act<sup>349</sup> that the designated agency as prescribed in section 70 of the MPRDA is changed to Regional Managers of the Minerals and Resources in terms of licensing of exploration and production.<sup>350</sup> While this change will resolve the potential conflict of interest highlighted earlier, it is thus important the handover of this function is implemented timeously and effectively to ensure no risk on the regulation and licensing function.

#### **7.5 Scientific knowledge**

The geology of the Karoo is complex and unique and not much is known about the geology. This poses as risk to decision makers not only in terms of issuing authorisations but also in the enforcement of the regulations or permit conditions.

#### **7.5 Compliance and enforcement**

Chapter 16 of the Water Act makes provision for enforcement of the Water Act and describes specific offences as well as stipulating the penalties attributed to non-

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<sup>348</sup> Ibid.

<sup>349</sup> Minerals and Petroleum Resources Development Amendment Act, 17 of 2013

<sup>350</sup> Section 46 of the MPRDA Amendment Bill 13 of 2013.

compliance. It is an offence to use water unlawfully<sup>351</sup> or to comply with the conditions of a water authorisation.<sup>352</sup>

One of the challenges with enforcement of water resources is that the Department of Water Affairs has the mandate to manage an extensive number of water users (legal and illegal). The risk of groundwater over extraction and pollution could also require extensive water level monitoring. Thus control over the operations can stretch resources. One way to resolve this is to ensure an effective co-operative governance framework that can benefit from all spheres of government and institutions. This would need to be coupled with appropriate sanction and penalties for repeat offenders such as the possible withdrawal of rights of illegal users. The use of local government EMIs in monitoring the use of water by hydraulic fracturing companies could be an important aspect.

Given that it is reported that one fifth of wells in Pennsylvania had non administrative notices of violations and given the high number of wells in the region, this gives an indication of the importance of, need for and capacity required to monitor industry practises.<sup>353</sup>

## **7.6 Cooperative government**

It is inevitable that conflict will arise between interested and affect parties related to shale gas extraction permitting processes.<sup>354</sup> This will put pressure on the various authorising agencies to carefully apply their minds to the matter at hand. As

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<sup>351</sup> Section 151(1)(a) of the Water Act.

<sup>352</sup> Section 151(1)(c) of the Water Act.

<sup>353</sup> SL Brantley et al 'Water resource impacts during unconventional shale gas development: The Pennsylvania experience' (2014) 126 *International Journal of Coal Geology* 140.

<sup>354</sup> De Wit, op. cit. (n8) 1.

discussed in the previous chapters there is a lack of capacity and competency at the various regulatory institutions and also a general shortcoming in scientific knowledge. With this as a backdrop, there is a fragmented regulatory system which may threaten the ability of the decision making authorities to make mistakes or lead to delays in decision making. Either of these would potentially lead to the erosion of just administrative action.

One of the main solutions to these challenges lies in improved cooperation and alignment between the various authorities.<sup>355</sup> Greater alignment and cooperation need not necessarily be a change in law as much of this alignment could be voluntary.<sup>356</sup> The next chapter will make specific conclusions and recommendations in this regard.

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<sup>355</sup> E Bray *Environmental Compliance and Enforcement in South Africa: Legal Perspectives* Chapter 7, 155

<sup>356</sup> *Ibid.*

## CHAPTER EIGHT

### CONCLUSION AND RECOMMENDATIONS

An unconventional method to extract shale gas is a new technology in South Africa. Given the large potential shale gas reserves in the Karoo and the important negative environmental impacts on water resources a review was undertaken of the regulatory frameworks in this minor dissertation.

There have been many documented cases of water contamination of water internationally linked to shale gas extraction. While this points to important lessons to be learned from others and the risks involved. Some argue that the risks can be managed through effective regulation which also requires the implementation of best practise. However there are many cases where contamination events have occurred despite regulatory systems which call into question the effectiveness of theoretical best practise with actual practises and experiences.

Given that the Karoo is a water scarce region and in many cases dependent on groundwater the regulatory framework for protecting water is of utmost importance. While much can be learned from international experience shale gas extraction in the Karoo will pose some unique challenges. Some of the main challenges that can affect water resources include the Karoo being a water scarce region and the geology of the Karoo is unique and complex. The presence of dolerite sills and dykes can affect the migration of hazardous fluids used to fracture the shale in addition to any salts, radioactive material and methane into fresh water bodies.



The protection of water resources in South Africa will require an effective regulatory system which is not yet in place. The challenge that regulatory institutions face when implementing new legislation and confronting new technologies is that it requires adequate skills and management systems. The country cannot afford to experience unintended consequences and be left with the legacy of similar failures such as Acid Mine Drainage.

There are many statutory institutions and laws that are applicable to shale gas extraction many of which require overlapping mandates and requirements. As discussed, the various departments have attempted to develop an integrated environmental regulatory system. Apart from an integration of permitting systems, the necessary implementation of the proposed hydraulic fracturing regulations in terms of the MPRDA and the proposed declaration of shale gas extraction as a controlled activity in terms of the Water Act is recommended.

There is a need to develop scientific knowledge and capacity within the various institutions in order to effectively direct, permit and enforce the various laws. It is recommended that an inter-departmental steering committee is formed to ensure that the cooperative approach required by the Constitution is implemented. This committee should not only focus on the permitting system gaps but also on the need to develop scientific knowledge over the unique geohydrology of the Karoo and to develop resources and capacity for enforcement and regulatory oversight.

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