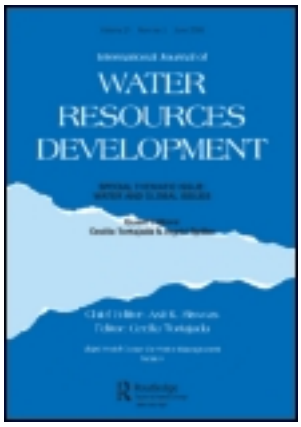

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Weaknesses in Environmental Action in South Africa: A Historical Glance on the West Rand (Gauteng Province)

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Weaknesses in Environmental Action in South Africa: A Historical Glance on the West Rand (Gauteng Province)

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ABSTRACT *In essence, this paper aims to provide a historical overview of some weaknesses in the taking of actions (such as environmental management), and/or the lack of achieving progress after having taken action. The process of environmental conservation in the West Rand, with specific reference to the Merafong municipal area is discussed. Merafong is situated in the Gauteng Province. Decades ago the area featured a number of natural springs of which the Wonderfontein Spruit (WFS) is one. WFS is close to several gold mines in the Merafong, Mogale City and Randfontein areas. It is also regarded as one of the most complex catchments in South Africa. Since the start of goldmine production (1930s) uranium (and thus the daughter product radium)—as part of the mining process—has settled in the sediment of the WFS. Although voices of concern have featured prominently since the 1960s, no extraordinary environmental management action is recorded in history. Bibliographic sources of the WFS currently amount to over 5000 entries. Despite this impressive production especially resulting from research, reports and whistle blowing, in the past 50 years the area was exposed to limited and insufficient actions of environmental management. As a consequence a process of pollution and radiation exposure continued in ignorance of the facing dangers. Pollution poses a considerable hazard to human health and calls for urgent action to be taken. This paper explores the history since the early 20th century of the absence of, or weak and ineffective, environmental monitoring and management. It is suggested that the reason for this can be found in the priority given to the contribution of gold mining to economic growth, at the expense of the environment and people's well being. At present the challenge for government and environmental experts/activists is to seriously find solutions together in order to at least support ideas that will contribute towards stabilizing the WFS environment. More funds for research on the health status of WFS inhabitants should also be considered to assure proactive environmental management control, and to provide some form of support to at least the economically active injured population.*

Introduction

According to recorded history human activities in the Wonderfonteinspruit (WFS) area—currently known as part of the Merafong Municipal region—resulted in the civilized settlement of a variety of cultures over decades (Van Eeden, 1998, 2007). Controversial historical moments in the process of utilizing the Wonderfontein springs for agriculture as well as for towns like Johannesburg were recorded since the late 19th century.

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In the process the WFS environment was transformed to accommodate mining activities in particular (Van Eeden, 1992).

Active mining accelerated from the early 1930s in the areas east from the WFS (the Venterspost Mine as example) and in the Merafong area from 1934 (Van Eeden, 2001). The establishment of three gold mines, Blyvooruitzicht (1937), West-Driefontein (1945) and Doornfontein in 1947 (Macnab, 1987), raised entrepreneurial expectations. Several towns were founded in the area: they were West Wits (1937), Oberholzer (1939), Bank (1940), Welverdiend (1942), Blybank (1947) and Carletonville (1948) (Unie Van Suid-Afrika, Department van Handel en Nywerheid, 1950, 1953). It was within this setting that the economic development of the Carletonville area (as part of the Oberholzer district) in the former Far West Rand (currently the Merafong area as part of the Gauteng Province) took place (Van Eeden, 1997). After Carletonville's municipal independence in July 1959, the mining sector gradually featured as the dominant role-player, land owner and exploiter of the WFS environment.

After the 1950s, the WFS environmental issues snowballed as a hot topic of debate between various groups as stakeholders. Government and the gold mining companies were accused of being the polluters, with poor management and regulation that harmed the area. The area is known for its water-bearing dolomitic compartments and natural springs as a result of these features underground. Other peculiarities related to these features are the cavernous and some huge and smaller ancient sinkhole spots that have made this area a unique environment in its own right.

In this paper the condition of being weak or showing some or other weakness with regard to action taking in environmental management and conservation in South Africa (with the WFS area in Gauteng as an example), could imply the following from an onlooker's perspective:

- Government fails in implementing its widely praised and acknowledged Constitution, filled with Acts and Amendments to Acts that aim to preserve the environment to secure healthy communities in the process.
- Departments in the government are not sufficiently organized and/or strict enough, or/and even not informed enough to implement environmentally related acts in a balanced way all over the country.
- Local governments do not always have the money or a mandate to address local environmental concerns in a correct manner.
- Industries, as creators of income and employment, do not always act responsibly or do not feel responsible for environmental issues/concerns they might have stirred in the name of economic growth. Amongst others, their negligence of seriously monitoring the acid mine drainage (AMD) pollution.
- The voice of field experts in a variety of disciplines related to the environment and social dynamics is either not heard or simply ignored.
- Non-profit Organizations or Non-governmental Organizations are not sufficiently organized, funded and motivated to put continuous pressure on the polluters or the regulators.
- The majority of the public in general are ignorant about the problems; and if they are aware of them, they are not proactive in finding or even thinking of solutions.

The scope of this paper is mainly focused on the government's actions in environmental management in Merafong. The ethical actions of other actors such as the gold mining

industry, experts and activists are currently extensively researched for publication elsewhere and will be only broadly described.

Government and Environmental Management

Environmental awareness and conservation in the WFS catchment area since the 1950s appear to have had a slow beginning, with users of the area being genuinely 'aware', but still not necessarily driven by 'responsibility'. Although it is accepted that physical landscape manipulations are inevitable in the process of meeting human needs, these alterations will produce (and have done so in the past) biological consequences, of which some are unavoidable. Over the decades, the key challenge was that of controlling the side-effects of 'something wanted by society' (Turton *et al.*, 2007). Unfortunately, the weaknesses of past generations have always become fully visible only in the lifetime of next generations. The controversial Merafong area is no exception but should not be regarded as the rule either. Rather, its irreversible environmental destruction reflects a shameful reality.

Since the early 1930s until the beginning of the 21st century, the upper part of the lower WFS in the former Far West Rand was thought to be the richest of all seven active goldfields of the Witwatersrand basin. The mines were also an important asset to the government in the form of tax income in gold and uranium (Water Research Commission (WRC), 2006; Van Eeden, 2006). As a manager and an initiator of the formulation of laws and Acts on environment in government departments, divisions, commissions, boards, associations, committees and forums since at least 1912, the national government indeed acted, or could have acted, as a powerful actor in the WFS area.

A Dependence on Minerals

South Africa's dependence on its mineral wealth since the 19th century forever changed the landscape and the environment in many places into an economic machinery. After becoming a union in 1910, the consolidation of environmental management through laws only gained momentum after 1967 with the Physical Planning Act, later renamed the Environmental Planning Act (Davenport, 1991). Indeed, shortly before and after 1910, the government even financially supported research by experts in disciplines such as geology and geography in order to gain a grasp of the potential richness of the country for mining exploration purposes (see Bunkell, 1902; DM, 1939). From a 21st century environmental awareness perspective, this action by government is marred by weaknesses, because the motive was economically motivated first and foremost.

Financially strong gold mining groups from the USA and Britain further steered the exploitation of South Africa's mineral resources to their benefit in the early 20th century (with the prominent General J. C. Smuts absolutely in favour of this approach because it complemented his holistic thinking). The South African government eagerly seized the opportunity. Furthermore, the need at the time for government to pull the country out of stages of severe poverty and to allow for the creation of employment opportunities after the South African War (1899–1902), followed by two world wars and a process of rapid urbanization, which resulted in stages that required a fast forward way of thinking, could not be ignored (Davenport, 1991; Liebenberg & Spies, 1993; Giliomee & Mbenga, 2007).

Departments and Environmental Regulation

As far as some departments in government are concerned, the Department of Minerals and Industries (DMI), earlier called the Department of Mines (DM), focused more on the management of the mining industry and the safety of its workforce (DM, 1935, pp. 43, 66–70) than on the well-being of the workforce as representatives of a broader community and the environment in which communities had to make a living. As such, this one-sided and narrow-minded approach could be argued to be a weakness on the side of government and its various departments.

Since the Water Act of 1912, there have been various attempts by government to manage dolomitic water in the WFS, for example, through Acts and Amendments to Acts from the mid-1930s (Swart *et al.*, 2003a; Funke *et al.*, 2007). The powers of the Ministry of Water Affairs increased in the 1950s when the new Water Act, No. 54 of 1956, stipulated that a mine was required to have a permit to discharge dolomitic groundwater beyond its boundaries (Van Eeden, 2006). If this regulation was strictly enforced, government would no longer have appeared to be placing an absolute premium on economic prosperity. However, government's attempts to curb exploitation of the environment by actors such as goldmines were poor (Turton *et al.*, 2007).

The Share of the Jordaan Commission in 'Envirobusion'

During this 'effort' to regulate environmental exploitation by means of the 1956 Water Act, the Department of Water Affairs was also busy, together with the support of a group named the Jordaan Commission, to investigate the merits of 'total' dewatering in the Wonderfontein catchment area (DWAF, 1960; Swart *et al.*, 2003a).

From the beginning, the work of the Jordaan Commission, which eventually amounted to more than 10 000 pages, showed several weaknesses. For example, all discussions and findings were confidential and private. This approach was not only typical of the political and economic ideology of the time (Marks & Trapido, 1987; Worden, 1994) but also exposed the sufficient knowledge that the government of the time had on the fragile WFS environment (see also the concise discussion of other weaknesses below). The majority of South Africans had no access to the environmental reports (Stoch, 1960–1970), and this made it easier for the government to 'manage' regulations as it saw fit. The apartheid government of the time used its position and power to work towards 'envirobusing' for the sake of its own economic image.

Clearly, many people were aware of the problem but, as the agricultural representative on the Jordaan Commission stated, "he did not see the problem clearly yet". He certainly was not alone in this: secrecy, together with the results of that secrecy, was the most serious weakness which government displayed in handling this issue. Gold mining activities in the area, for example, were allowed to operate in the WFS area as they wished until the beginning of the 21st century (DWAF, 1960; Macnab, 1987; Swart, 2008).[1]

Regulation: From Bad to Worse

The government's weakness in regulating the WFS environment became more visible in 1963. It is recorded that the Secretary for Water Affairs observed the drastic decrease of the water table in the WFS and surrounding compartments, but that the responsible authorities

were nevertheless indirectly advised that more was to be gained financially by continuing with dewatering than by enforcing attempts to reverse the environmental damage already done (Swart *et al.*, 2003a; Van Eeden, 2006). In December of that year an agreement was reached between the government and the Chamber of Mines on the policy of dewatering and how to approach the resulting damage (Kleywegt & Pike, 1982; Van Eeden, 1992, ch 4).

In 1964 two bodies were formed to deal with the effects, namely the State Co-ordinating Technical Committee on Sinkholes and Subsidences (SCTC) and the Far West Rand Dolomitic Water Association (FWRDWA). The effects were mainly addressed by a process of doing research on the formation of sinkholes and to determine the level of remuneration (to those who financially suffered in certain areas). A process of restoration of areas where sinkholes disturbed economic activity and communication in the 1960s in particular, was also addressed (National Archive of South Africa, 1957; Van Eeden, 1988, 1992, 1994; Adler *et al.*, 2007). This was apparently done according to the discretion of the mining authorities themselves. The use of mine slime as an option to fill up sinkholes created concern among DWAF experts in the 1960s because of the effect it could have on polluting the natural water resources. This was communicated to government officials and the mining authority. Research was then advised, but in the meantime the use of mining slime continued until the closure of activities of the SCTC. By 1998 still no proper research was carried out with regard to the effect mine slimes might have on natural waters if used as a restoration option to fill up sinkholes (SCTC, 1964–1998).

Since the1960s, more individuals suffered than the small number who were eventually remunerated through the channels of the SCTC by the FWRDWA (Stoch, 1960–1970; SCTC Archive, 1964–1998; Van Rooyen, 1966–2000; Van Eeden, 2006). On paper, these efforts by government or through government assignments appeared admirable, but in reality it turned out to be little more than an attempt to secure votes for the next election. In fact, it turned that the gold mining industry's 'injured status' was placed above that of the broader community.

The Government and the Opposition

Complaints by the official opposition, the United Party (UP), about the water pollution at the time were not sufficiently addressed by Cas Greyling, Carletonville's Member of Parliament (MP). Indeed, there appears to have been a rather nonchalant approach at the time towards environmental destruction (at this stage dewatering, sinkholes and water pollution) and its socio-economic consequences (Greyling, 1950–1988; Van Eeden, 2003). UP member HJ van Eck queried the WFS status in 1972 (Greyling, ca 1950–1988):

> ... Then I want to discuss the pollution in the mining industry, and point out that approximately 368 mining dumps exist between in Witwatersrand between the Nigel and Randfontein area of which 95 are sand-heaps and 237 silt dams ... We also know that they [the mining companies] had to artificially fertilize the sterile steep slopes ... the rain still lye salts, acids and other chemicals from these mining dumps; they pollute our rivers ... [Freely translated from Afrikaans to English]

Although nothing came from this query, the government at least took notice of the worldwide focus on environmental heritage in 1971 as well as the United Nation's Stockholm conference on environmental protection and heritage (National Archive of

South Africa, 1970, 1972). However, global awareness did not significantly change the government's perspective on the WFS environmental scenario in the 1970s and 1980s.

A New Democratically Elected Government and the Environment

Long-standing connections between the mining industry and government were somewhat weakened by the turnover of government personnel in the new dispensation after the 1994 elections. In Rand value, government still benefits from the profits of the gold mines, and as far as the production of some mines are concerned it even benefits more than in earlier decades (results of the Chamber of Mines, 2006). However, newly adopted Acts (such as the Water Act of 1998, which is rated as one of the best in the world) and a new constitution set the table for more stakeholder participation.

By 1998, the National Ministries, represented by the Department of Environment and Tourism (DEAT), the Department of Water Affairs and Forestry (DWAF) and the Department of Minerals and Energy (DME) as key actors in the process of environmental sustainability, could and should have been more proactive in the remedial process for the WFS area. Initiating stakeholder participation and avoiding possible abuses of their managerial power by adopting the role of a neutral facilitator could have done this.

The successes and failures of institutions such as the DWAF Institute for Water Quality Studies (IWQS) and the DWAF Loopspruit Forum still need to be described. Other actors in forums such as the Parliamentary Portfolio Committee/Parliamentary Monitoring Group, the DEAT Portfolio Committee and the DME National Nuclear Regulator also still have to earn credibility. Some critics argue that there is reason to believe that the information at the disposal of these forums is not sufficiently distributed. Once again, the reference to insufficient environmental reporting (ER) was a point of debate (with the findings of Mitchell & Quinn, 2005 in Tempelhoff, 2007).

21st Century Actions and Weaknesses in Government Structures

A growing need for proper environmental regulation resulted in the forming of the Enforcement Directorate (also known as the Green Scorpions), which was eventually placed under the management of the DEAT (the DEAT website). Their assignment, among others, covered a regulation of the environmental responsibility by local governments with regard to environmental issues related to water and air pollution (Liefferink, 1988–2007). Another recent environmentally focused watchdog is the National Nuclear Regulator (NNR). Despite four large departments and their respective divisions responsible for various aspects of the environment, the government's aim of developing a strong regulatory arm is still not fully realized due to a lack of sufficient coordination. As a result, there are still unfortunate incidents in which the inability of the government to properly regulate the larger industries as polluters (some with a formidable history of environmental trespassing) is very clear (an example is in Merafong in the next section as well as Van Eeden, 2007).

In August 2007, the investigation programme Carte Blanché on MNet featured the WFS and its water pollution with various heavy metals. It was pointed out that this pollution could potentially destroy this fragile environment, leading to an ecological catastrophe. This would also have far-reaching consequences for the health of people as well as animals in the area (Van Eeden, 2006). In this programme, the representative of DWAF remarked that the penalty of R40 000 to R50 000 for pollution (such as the gold mines) is not really

effective, and by implication not strictly imposed either. Although communities are expected to understand the complexities government has to deal with such as a lack of capacity and sometimes memory when experts/officials resigns (Swart, 2008), there are proactive ways to address the problem, even if it means that the State Treasury will suffer because of a mine's payment of a penalty or even its closure (Liefferink, 1988–2007).

The environmental governance embedded in the Constitution of the Republic of South Africa since 1996 is based on the Bill of Rights, Act No. 108, Section 24, which states that people have environmental rights. These rights include entitlement to an environment that is not harmful to the health or well-being of people as well as a claim to environmental protection for the benefit of present and future generations. Therefore, the government is obliged to protect, promote and uphold the rights of people in terms of the environment. These rights are contained in laws that bind the legislature, the executive, the judiciary and all the associated organs of state. They are, amongst others, that government:

- must use its constitutional authority to take decisions and carry out actions;
- is accountable to the people, especially to vulnerable and previously disadvantaged communities;
- must create public awareness among affected communities of the hazards and/or risks pertaining to the contamination such as the Wonderfonteinspruit catchment area (Council for Geoscience (GI), 2005);
- must monitor and regulate the actions of the gold mining industry; and
- it must enforce environmental regulation.

However, the general public, NGOs, civil society and industry still feel that there are serious weaknesses in enforcing the regulations and that government has therefore failed in this respect, and also specifically with reference to the Wonderfonteinspruit catchment area (Liefferink, 1988–2007; Van Eeden, 2006).

For government to fulfil its obligations in terms of responsible environmental management, it must coordinate all the organs of state at all levels to ensure responsible environmental stewardship. Regrettably, the South African government's environmental management of the Wonderfonteinspruit is perceived as being fragmented, diverse, uncoordinated and administered by under-resourced and different government departments (Turton, 2007).[2]

Other Weaknesses in Environmental Management

As mentioned earlier, there are a number of actors—from a spectator's perspective—whose past actions should be looked at more closely in future discussions regarding the wider WFS environmental debate.

The Gold Mining Industry

An ironic feature of mineral exploitation in a country such as South Africa is that it was local and international professional consultants, as well as scientifically trained employees in service of the gold mining industry who have determined the outcome of environmental exploitation. This weakness lies in the economic eagerness to exploit, and as a result short-term solutions were created or imported without considering long-term consequences for generations.

Gold has been mined in parts of the West Rand and further west from the early 20th century, mainly for economic progress. Examples of how the environment was managed to live up to expectations of mineral exploitation are numerous and already widely covered in research (Van Eeden, 1992). Some of the major environmental interferences in the mining management process from the early 20th century until 2007 were:

- the process of cementation that was introduced by the goldmines in the dolomitic areas of South Africa (thus also in the WFS Catchment) to safeguard the underground mineworkers and to explore the rich gold ores to benefit the economy (Pelletier, 1937; Walker, 1960; Macnab, 1987);
- to pump out the surplus water. This gradually destroyed the local water resources. In essence, this approach only enabled the mineworkers to work without difficulties, and did not explicitly safeguard them in every aspect of their personal life (that includes health. See WRC, 2006);
- to manage accusations of water pollution in the WFS (Tempelhoff, 2007; Avril, 2007); and
- to invest and embark on future strategic plans with the assistance of expertise acquired since early days of environmental destruction. The transformation of the WFS into a possible game reserve (an idea of the early 1970s) comes to mind (RSA, Government Gazette, 1973; Potgieter, 1978; Jacobs, 2007; Stoch, 2007).[3]

To ensure stakeholder inclusiveness in environmental concerns in the WFS in the post-1994 democratic years in South Africa, the mines developed a number of stakeholder forums (Bigenafrica, 2006–2007). Some stakeholders (including environmental activists/individuals from a spectrum of professions) are sceptical of this approach, because after 50 years of raising concerns and pointing out that the mines are the primary polluters (who are responsible to remunerate as well as remediate), no real action has been taken. In addition, requests for environmental reports from the local mines in the WFS were perceived as being silenced. Trust in this possibly well-meant initiative by the mines (who possess the funds implement it and who are urged to remediate) will not come overnight. In the past decade, the government expected industries such as the gold mines to be more environmentally responsible by ensuring that their environmental plans and remediation funds are in order. In theory this was the case, but in reality not enough was done to ensure progress towards stakeholder participation in these forums, or the combining of expertise ideas in any process of aspiring for a constructive plan or vision for efficient remediation (Van Eeden, 2006, 2007; Swart, 2008).

Some Negative Effects of Silence by Experts on the WFS Environment: A New Debate

The previous section mentioned negative effects of silences by experts on environments, such as the WFS, where they should have spoken out against the gold mining industry and government. The same applies to research (past and present) or academic institutions not in service of the mines (Dovers *et al.*, 2003; Van Eeden, 2008). These silences not only discredited the sciences but also opened a new debate on ethical responsibility that in the past could (and in the present should) have made a difference. This is to say if the definition of ethical responsibility were widened to allow researchers to make their findings public and not only favour the party, responsible for sponsoring the research (Van Eeden, 2008), to bury results in secrecy.

The stakeholder status of academic professionals/experts in tertiary education, or of employees in the private and public sector, is extensive and complex. They may also differ in their approach to standard, accepted ethical commitments to report on and to publish controversial findings and observations, depending on who is paying their salary. Therefore, it will always be a controversial debate to decide what should or could have been said and done in cases such as those in the WFS area. A few notes will suffice to accentuate the weakness of a situation where the polluter (or the one in power to regulate the polluter) is also the employer or provider of funds for any specific research.

Academics from tertiary educational institutions, the Water Research Commission as from the 1970s, the Council for Geo-Science, the Council for Scientific & Industrial Research (CSIR) as well as private research consultants (even since the early days of the gold mining industry) were, among others, actively involved in research and reporting on the WFS area (the first dissertation by Schnetler, 1935). Mitchell & Quinn (2005) regard environmental consultants as key players in the environmental reporting process. They not only serve business but also act as intermediaries between business and governments. Not all consultative reports and reports from research projects in the past were open to the public, and some consultants have only recently produced whistle-blowing reports or articles (Funke *et al.*, 2007). In the past, they simply kept the silence on critical issues (Van Eeden, 2007; Van Eeden & Brink, 2007), which in turn raised doubts about the ethical approach of professionals and research institutions toward environmental issues of a broader concern.

However, there also were some early research reports that reflected the destructive possibilities of mining in dolomitic areas (Draper, 1894; Bunkell, 1902; Anderson & Stanley, 1909; Harger, 1922; DM, 1939; Jennings *et al.*, 1965). Examples of environmental destruction in other areas in South Africa could also serve as a baseline for some of the concerns in the WFS, but these reports were never sufficiently implemented (National Archive of South Africa, 1956a, 1956b).

Another reality at the time was that the water quality in mining areas in earlier days was tested from time to time mainly for the Ph balance and the electrical resistance. No extraordinary peculiarities were mentioned about these results, although concerns on some results were raised more often from the mid-1960s (SCTC, 1964–1998).

What natural scientists (some of whom were in service of gold mining companies) also knew about the environment (even before gold mining actively commenced in the WFS area), was that:

- Dolomite contains metals of considerable value and importance in several areas. Dolomite is also a well-known home of lead and silver lead ores as well as zinc and bodies of manganese and iron. Pigments are formed from their oxides (Krahmann, 1936; Pelletier, 1937; Crawhall, 1953).
- Mine slimes are metalliferous and could be harmful if exposed to natural waters in underground dolomitic compartments, waters that humans eventually consume (SCTC, 1964–1998).
- A rewatering of the WFS area was considered already between 1964–1966. Between experts, the mining houses and government it was decided that it was dangerous and too late to reverse a decision making in this regard (SCTC, 1964–1998; Swart *et al.*, 2003b).

Other consequences include heavy metal exposure on the surface and in the air as a result of decades of underground destruction and mining activities, which can affect the health of those living in the surrounding mining areas (Matic & Mrost, 1964; Swart *et al.*, 2003a; Barthel & Funke, 2007; Barthel *et al*., 2007).

The lack of communication among experts is a serious shortcoming. In the past, many issues that involved experts from the gold mining industry, the government and the academia, were addressed by these individuals in relative or complete isolation of each other. Neither was there any effort to find solutions together or to consolidate ideas. Indeed, the process to find an acceptable means to accommodate ideas from different sectors to find and implement solutions for the WFS environment still appears to be chaotic and politically manipulated.

Weaknesess in the Approach by Non-governmental Organizations

A few individuals from some non-governmental organizations (NGOs) have been fairly active in the Wonderfonteinspruit area in recent years (Van Eeden, 2007). Although the various NGO groupings formally progressed towards the initiating of an umbrella federation in November 2007 (Federation for a Sustainable Environment), funds to operate are still a luxury (and ears that listen to their complaints are still limited). Not even government departments like DEAT claim to have money for so-called green environmentalist groups (Liefferink, 2007). Within these serious weaknesses NGO efficiency in the WFS area can be assessed as a mixture of success and failure.

Conclusion

This paper explored the history since the early 20th century of the absence of, or weak and ineffective, environmental monitoring and management in the WFS catchment in the former West Rand. South Africa's environment is not typical of the rest of Africa because it has a very strong commercial and industrial sector. With only approximately 12% of the country being arable, South Africa is agriculturally poor and this sector contributes very little to the overall GDP. South Africa's natural attributes are equally complex. Its ecological richness is unparalleled and despite its small area (1 219 912 km^2) it is the third most biodiverse country on earth, a 'world in one country' (World Conservation Monitoring Centre, Development of a National Biodiversity Index, 1992). However, in terms of local environmental awareness of the preservation of this environmental richness, it might also be one of the countries most ignorant of the ecological consequences of exploiting minerals.

With specific reference to the WFS area and actors involved in that area, this paper mentioned norms and values that are determined by how the government of any given period manages the environment. In the case of the WFS, an environment policy analysis will reflect the classic choice between environmental protection and economic development. The gold mining riches in the WFS area in 1988 peaked at a contribution of 18% of the total gold mine production in South Africa (Van Eeden, 1992). This even progressed in the years that followed (Van Eeden, 2007). Many authorities under government supervision for years operated in the area under a legal mandate with the environment only as an 'object' to be explored and not to be approached in reasonable ethical ways.

An ethical approach to decide what should be preserved, and how, is called a policy analysis. An analysis includes a quantification and comparison of many different values over time to estimate amenable the cost, benefits and quantification over time. This helps in determining whether the environmental protection in question is more or less valuable than the economic development (Gutmann & Thompson, 2006). Sources such as Gutman & Thompson often refer to this method or approach as part of conservation ethics because of the environment's worth in terms of its utility or usefulness (also known as shallow ecology and not deep ecology).

It may be concluded that a government's definition of cooperation within a specific political system and ideology in the past and present in many ways determines the historical status of environmental controversies such as that experienced in the WFS catchment area. Although government leaders in South Africa can emphasize some features in past decision making that relate to democracy, the present and past government systems to manage water and pollution appear to have been 'fledgling-like' democracies rather than 'mature' democracies (Turton *et al.*, 2007). This simply means that the past and the present governments, as indicated, were and still are acting insufficiently on certain crucial environmental issues such as a proper regulation and management under the available environmental acts.

Furthermore, the perception that South Africay depends on its gold mines for economic growth has led to autocratic and often secretive actions for the sake of economic benefits. Ineffective governance and untrustworthy government practices in environmental issues do not encourage representative stakeholder participation in any forum.

The weaknesses of experts on the WFS highlighted the way in which authorities and institutions with power influence the validity and the availability of findings. Although the authorities were unable to remedy certain past actions, in other cases (especially after 1981) research findings were available but were often ignored. The government deliberately gave priority to the contribution of gold mining to economic growth at the expense of the environment and people's well-being. The challenge at present for government and environmental experts/activists is to find serious solutions together in order to at least support ideas that will contribute towards stabilizing the WFS environment. Furthermore, funds for research on the health status of WFS inhabitants should be considered to assure a proactive environmental management control, and to provide some form of support to at least the economically active injured population.

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