ENGAGING A COMPLEX PROBLEM THROUGH A COMMUNITY OF PRACTICE APPROACH: Improvement of Dysfunctional Wastewater Treatment Works Through a Multi-Stakeholder Green Drop Support Campaign

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by

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EXECUTIVE SUMMARY

1. Introduction

Pollution from South Africa's Wastewater Treatment Works (WWTW) has been a national priority concern for some years now. Dysfunctional WWTW threaten the provision of drinking water, the safety of people living downstream from WWTW and using water directly, as well as aquatic ecosystems. To date, most interventions have focused on training and capacity building, emergency interventions and inspections. They have NOT not addressed the political questions that constitute the dynamic of dysfunctional WWTW. This research project approached the problem of dysfunctional WWTW via a combination of political ecology, action research, social learning and complexity approaches, with the following research question: "Can dialogue, social learning in a community of practice formed from diverse stakeholders, practical co-operation and a better understanding of the position of WWTW frontline staff as well as the responsible municipalities, lead to improvement in Green Drop scores and performance?"

The project consolidated lessons learnt in 2014 and 2015, when seven dialogues took place in the form of the "Crocodile (East) Catchment Green Drop Support Campaign" between stakeholders in the Crocodile catchment, located in the Inkomati-Usuthu Water Management Area. The dialogues comprised industry, local municipalities, water quality regulators and members of civil society. The support campaign was aimed at improving the performance of the WWTW of the four municipalities in the Crocodile (East) River catchment, through a collaborative engagement and development of a community of practice. The dialogues were followed up by interviews with municipalities, officials in national government departments, and campaign participants. Separate research tested the applicability of the Community of Practice (CoP) concept to this intervention.

The research tested a theory of change, namely that in a Green Drop support campaign:

- WWTWs will achieve a higher profile locally, in public and with the municipality (councillors and officials). This will prevent the current practice of reallocating WWTW budgets to other priorities midyear, and inappropriate and inadequate procurement practices.
- Civil society will adopt a supportive attitude towards WWTW, on the basis of an in depth understanding of their context and functioning. Staff responsible for WWTWs will not be under general attack by civil society and other catchment stakeholders; instead efforts will be focused on identifying the bottle necks in achieving a better green drop score, within the Green Drop programme.

- While there is clear support from national and regional DWS, and a focus by the IUCMA, the working group with broad stakeholder support needs to receive and orient the support into productive channels.

The first CGDSC dialogue took place in January 2014, with the seventh in February 2015. The campaign met roughly every two months. Attendance grew with each meeting. It involved most relevant stakeholders: TSB Sugar, White River Irrigation Board, Manganese mines and industries, Mbombela frontline staff, IUCMA water quality team and Green Drop staff, Crocodile Forum chair, DWS, South Cape farmers Association, Rhodes and Wits researchers, and some staff from all 4 municipalities, with senior managers from 2 out of 4. We used the Chatham House Rule, which creates a safe space by protecting the confidentiality of participants' contributions.

2. Conclusions

1. The main problem is a disconnect between the WWTWs, their frontline staff and local government's top triangle: municipal manager, technical manager, finance manager.

2. National departments (DWS, COGTA and Treasury) feel bound by the constitutional autonomy of local government, which as an equal sphere of government with the right to earn income from providing water and electricity services, which it defends jealously.

3. A Community of Practice was formed, but due to the disparate range of backgrounds, people, professions, cultures and paradigms, this was not the best conceptual framework, and exploring a collective action, social learning or a strategic adaptive management approach is recommended.

4. There is great concern about the dysfunctional WWTW, nationally and locally, in civil society but also in various arms of government (particularly on national level), and this energy can be harnessed towards solutions and improvements.

5. Civil society and local government WWTW staff have the ability to develop (much better) working relationships and social trust, in order to work together in a Community of Approach or social learning setting. This can contribute to the development of active citizenship in a participatory democracy, and the strengthening of participation in catchment management.

6. Action or generative research can support the development and testing of strategic options.

7. The Green Drop issue should be conceptualised more broadly to include sewer systems and unserviced areas, such as informal settlements.

3. Research recommendations

Raising visibility of the issue by making the consequences clear is the core of a research strategy that would:

1. Investigate direct links, in specific places, between diarrhoea as a leading cause of child death between the ages of 1 and 5, and contaminated drinking water as a result of dysfunctional WWTW.

2. Spell out the impact of eutrophication on ecosystems, such as repeated oxygen depletion events which, for example, lead to impoverishment of ecosystem function and integrity (including the ability of river to clean itself), in specific places.

3. Spell out clearly the economic impacts dysfunctional WWTW on health (costs to the public purse and to suffering families), to livelihoods, and threats to products marketed nationally and internationally.

4. Indicate the best ways of communicating these results to those institutions who may be in a position to engage with these challenges. Such a communication strategy would clarify, among constituents, councillors, officials and the broad public, the threats of poor water quality: for health, economy, and ecosystems. It should clarify the exact mandates of different departments and tiers of government. It should include participatory research on affected rivers and communities surrounding them, which would raise awareness and understanding how water quality issues are experienced by communities on the ground.

5. Research how CMF working groups can best function, in terms of how they should be conceptualised, facilitated and supported. After exploring the concept of Communities of Practice, social learning and collective action frameworks may be more appropriate.

6. Research the implementation of the Green Drop incentive scheme, to explore responses within the water sector, national departments (DWS. COGTA and others), the local government sector, consultants working in the programme, civil society, the public and other stakeholders. Such research must pay attention to intra-municipal decision making.

ACRONYMS

AWARD	Association for Water and Rural Development
CGDSC	Crocodile River Catchment Green Drop Support Campaign
CHAT	Cultural Historical Activity Theory
CMA	Catchment Management Agency
CMF	Catchment Management Forum
COP	Community of Practice
GDSC	Green Drop Support Campaign
IUCMA	Inkomati Usuthu Catchment Management Agency
IWQMP	Integrated Water Quality Management Process
ML/day	Megalitre per day
MISA	Municipal Infrastructure Support Agent
MuSSA	Municipal Services Strategic Assessment
SALGA	South African Local Government Association
THRIP	Technology and Human Resources for Industry Programme
TPNP	Towards Practising a New Paradigm
VEJA	Vaal Environmental Justice Alliance
WESSA	Wildlife and Environment Society of South Africa
WISA	Water Institute of Southern Africa
WWTW	Wastewater Treatment Works

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Chapter 1: THE CROCODILE GREEN DROP SUPPORT CAMPAIGN

1.1 Introduction

Pollution from South Africa's Wastewater Treatment Works (WWTW) has been a national priority concern for some years now (Snyman et al., 2006) as pointed out in *A Strategy for the Improvement of Wastewater Collection and Treatment in South Africa* (DWAF 2008), which formulated the basis of the Green Drop incentive scheme. Dysfunctional WWTW threaten the provision of drinking water, the safety of people living downstream from WWTW and using water directly, as well as the health of aquatic ecosystems.

To date, most interventions have focused on training and capacity building, emergency interventions and inspections. They have NOT addressed the political questions that constitute the dynamic of dysfunctional WWTW. However, as this report will argue, the political questions are crucial both to engaging with this problem, and to frame future research, including scientific research, on this question. This report approaches the problem of dysfunctional WWTW via a combination of political ecology, action research, social learning and complexity approaches. The research question is: "Can dialogue, social learning in a community of practice formed from diverse stakeholders, practical co-operation and a better understanding of the position of WWTWs frontline staff as well as the responsible municipalities, lead to improvement in Green Drop scores and performance?"

The project consolidates lessons learnt in 2014 and 2015, when seven dialogues took place in the form of the "Crocodile (East) Catchment Green Drop Support Campaign" between stakeholders in the Crocodile catchment, located in the Inkomati-Usuthu Water Management Area. The dialogues comprised industry, local municipalities, water quality regulators and members of civil society. The support campaign was aimed at improving the performance of the WWTW of the four municipalities in the Crocodile (East) River catchment, through a collaborative engagement and development of a community of practice. The dialogues were followed up by interviews with municipalities, and officials in national government departments, as well as campaign participants. Separate research was undertaken to test the applicability of the Community of Practice (COP) concept to this intervention.

A severe limitation was the repeated delay of the Green Drop inspections in the area, combined with the non-release of the previous round of Green Drop inspections, the results having only been released individually, and directly, to the local authorities.

However, the research was able to learn about:

1. the nature of the WWTW problem, at municipal, national and local stakeholder levels;
2. the role of a catchment forum working group tackling the issue from civil society perspective;
3. the social dynamics as revealed in the dialogues and follow-up interviews;
4. the Green Drop process itself;
5. considerations for replication this approach in different contexts;
6. the importance of the IUCMA as a partner in this approaches;
7. the need for facilitation in a community of practice style;
8. what further research would be practically useful in solving the WWTW issue.

The research methods used to construct this report comprised desktop studies of a variety of reports, document analysis of selected meeting minutes, telephonic interviews of select individuals who work in and for WWTW, as well as five interviews (comprising 15 individuals) who were national level officials in Treasury, COGTA, DWS, MISA, Public Works as well as an interview with a South African Local Government Association (SALGA) official. This allowed the research team to triangulate information and analysis. The minutes of the seven dialogues, in which frank discussions between participants explained the nature of the problems, were also used.

1.2 Background

Pollution from WWTW has remained a top priority nationally (Dr Marlene van der Merwe Botha, personal communication, October 2013), as well as for stakeholders in the catchment (Palmer et al., 2013). It has retained a high profile in the media (Kings, 2015) which included reports of the death of five babies and the dismissal of an ANC mayor in Bloemhof (see Tempelhoff et al., in process). It is an important focus area for the Integrated Water Quality Management Process (IWQMP), in terms of both eutrophication and microbial pollution, and for the Water Research Commission (WRC) project Towards Practising a New Paradigm for Water Quality in South Africa (WRC project K5/2248).

However, there is a clear disconnect between this view of the national importance of dysfunctional WWTW and the lack of importance ascribed, in practice, to these issues by especially local government politicians and officials, as this report will show. At the heart of the issue, therefore, is the tension between the constitutional imperative of local government to provide and earn income from water services, including WWTW, and the impact that dysfunctional WWTW have on the broader environment, as these water resources belong to

all who live in South Africa. This tension also poses a regulatory challenge that was explored in this project.

Pollution from WWTW is also an ongoing site of concern in the Crocodile River catchment specifically. The IUCMA report (2014) concluded that the effective functioning of WWTW "is not a high priority for municipalities, the Department of Public Works (national and provincial) and the private owners of these facilities" (IUCMA, 2014: 130). The report shows that the majority of the WWTW located within the four local municipalities – Mbombela, Umjindi, Nkomazi and Emakhazeni – had made little to no progress with regards to Municipal Services Strategic Assessment regarding the treatment of effluent, with the exception of outsourced WWTW in Mbombela (to the multinational Sembcorp). In many cases, this cannot, in the first place, be attributed to the WWTW workers themselves, but rather to the ill-equipping of these workers in terms of institutional support, institutional bureaucracy, financial provision, politicking, ignorance, and load-shedding practices.

1.3 The Green Drop Certification Programme

This research was specifically framed in terms of the Green Drop incentive scheme which originated in 2008 (DWAF, 2008). Some of the research team members had gained experience of this approach in the Rietspruit Catchment Forum, in the Upper Vaal catchment, in 2011 when a working group of the Rietspruit forum engaged with the Department of Water Affairs (DWA) and staff of the three Emfuleni WWTW (Munnik, 2010). We found that the Green Drop approach provided space for collaboration and developing trust between catchment forum members, the department, and WWTW staff, when its public accountability component was elaborated into a seven step "Green Drop Support Campaign".

The Green Drop Certification programme seeks to identify and develop the core competencies required for the sector that, if strengthened, will gradually and sustainably improve the level of Wastewater management in South Africa. (DWA, 2013). It is a form of regulation that intends to synergise the available goodwill exhibited by Water Services Institutions and existing government support programmes, to give the focus, commitment, planning and resources needed to achieve excellence in Wastewater management.

The Green Water Services Audit is a tool for incentive- and risk-based regulation. The Green Drop process measures and compares the results of the performance of Water Service Institutions, and subsequently rewards (or penalises) the institution upon evidence of their

excellence (or failures) according to the minimum standards or requirements that has been defined. WWTW that get less than 30% for the Green Drop score are put under surveillance by DWS.

Whilst the Green Drop assessment focuses on the entire value chain (reticulation, pumping, treatment, discharge) of the Wastewater business within the municipal (or other) Wastewater services business, the Cumulative Risk assessment focuses on the Wastewater treatment function specifically. The latter approach allows the Regulator to have insight into the treatment component of the municipal business, which is one of the high-risk components within the Wastewater value chain. Risk-based regulation allows the municipality to identify and prioritise the critical risk areas within its Wastewater treatment process and to take corrective measures to abate these.

The two main outputs from the Green Drop assessment are:

- A weighted Green Drop score for each municipal system; and
- A Cumulative Risk Rating for each municipal Wastewater treatment works.

1.4 The Crocodile River Forum Green Drop Support Campaign

In early 2014, the Crocodile (East) Catchment Management Forum agreed to form the Green Drop Support Campaign as a working group, in response to a proposal by one of the authors (Dr Munnik) emanating from information gathered in interviews with stakeholders in the Rhodes/AWARD/THRIP/IUCMA Crocodile (East) River Water Quality Project in November 2013. Based on these interviews, a theory of change was developed to tackle the problem of dysfunctional WWTW, namely that as a result of a Green Drop support campaign:

1. WWTW will achieve a higher profile locally, in public and with the municipality (councillors and officials). This will prevent the current practice of reallocating WWTW budget to other priorities midyear, and inappropriate and inadequate procurement practices.

2. Civil society will adopt a supportive attitude towards WWTW, on the basis of an in depth understanding of their context and functioning. Staff responsible for WWTW will not be under general attack by civil society and other catchment stakeholders; instead efforts will be focused on identifying the bottle necks in achieving a better green drop score, within the Green Drop programme.

3. While there is clear support from national and regional DWS, and a focus by the IUCMA, the working group with broad stakeholder support needs to receive and orient the support into productive channels.

The Green Drop dialogues were developed in response to priorities identified in prior research in the Crocodile River catchment. It drew participation and support from national and regional offices of the DWS, frontline staff of the four municipalities, industry and civil society representatives, as well as the IUCMA.

Through these dialogues, as well as a series of interviews with municipal officials, officials in national government departments, as well as campaign participants, these hypotheses were challenged, and expanded to include considerations at a national level, including the constitutional allocation of powers. Such analysis, presented in the final part of this report, will show that the challenges are indeed part of a broader constellation of challenges.

The four municipalities involved were Mbombela, Umjindi, Nkomazi and Emakhazeni. They form part of two district municipalities, Ehlanzeni and Nkangala. The CGDSC itself is discussed in more detail in chapter IV, and considered in terms of a COP approach in Chapter 5.
Specific methodology for each chapter is given in each chapter, and in the final chapter the overall theoretical/methodological approach is considered for learning and further research design purposes.

1.5 Chapter sequence and content

Chapter 2 sketches the project area background by providing a geographic context to the WWTW in the area, and an overview of some water quality research on the area. Chapter 3 describes the WWTW in the four local municipalities of Mbombela, Nkomazi, Umjindi and Emakhazeni, using insights from WWTW employees, triangulated with responses and opinions of observers, colleagues and regulators. Chapter 4 describes the seven dialogues and their results. Chapter 5 considers the dialogues and working group from the perspective of a Community of Practice.
Chapter 6 considers conclusions, including the wider replicability of the Green Drop campaign.
Chapter 7 presents recommendations for further research in this area.

Chapter 2: INKOMATI-USUTHU WATER MANAGEMENT AREA AND ITS WATER QUALITY CONCERNS

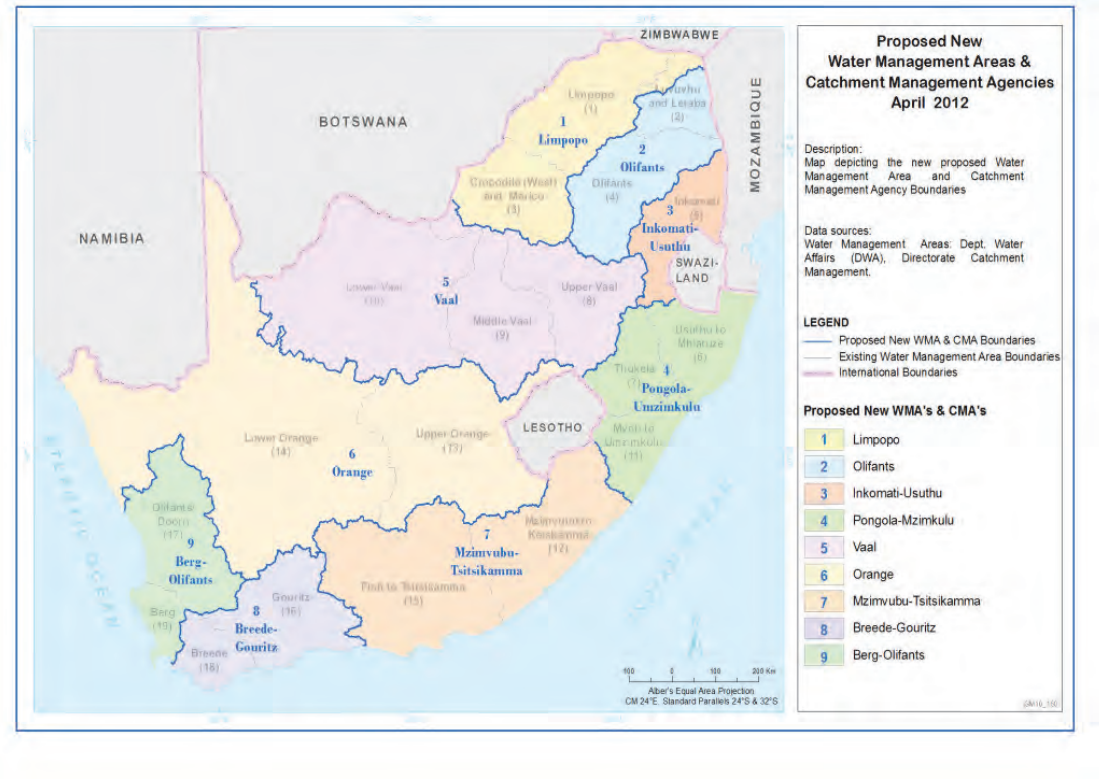
This chapter provides a geographic context to the WWTW in the area, and an overview of some water quality research on the area.

2.1 The Context

The Inkomati-Usuthu Water Management Area (WMA) is situated in the north-eastern part of South Africa and shares borders with Mozambique and Swaziland (see Map 1). It occupies the south eastern corner of the Mpumalanga province, west of Swaziland. Its main rivers include the Sabie-Sand, the Crocodile (East), Komati and Usuthu Rivers. The Komati River first flows into Swaziland and re-enters South Africa before flowing into Mozambique. Three of the four rivers draining the WMA confluence to form the Incomati River in Mozambique, which flows to the Indian Ocean, while the Usuthu joins the Pongola River just before the Mozambican border.

This WMA is one of the first two Catchment Management Agencies in South Africa, and has a strong water quality team. This has enabled it to build up a detailed knowledge of, and engage robustly with, emerging and existing water quality challenges. Members of the IUCMA water quality team have participated in the THRIP project and the Green Drop Support Campaign. They have also produced the exhaustive overview of WWTW in their area (IUCMA 2014).

The Inkomati sub-catchment of the WMA (see Map 2) includes areas with rainfall of around 1 000 mm per annum in the elevated western and southern portion and a much lower rainfall of around 500 mm per annum in the lower lying eastern portion. The Usuthu sub-catchment has rainfall that ranges between 550 mm in its eastern areas to 850 mm on the eastern escarpment of the Drakensberg. The Gross Geographic Product (GGP) of the Inkomati-Usuthu WMA is estimated at around R9 billion per annum and makes up approximately 0.3% of South Africa's Gross Domestic Product (GDP). The manufacturing and mining sector is the biggest contributor with 28.6% – a total of just over R2.5 billion per annum. These sectors are followed by agriculture at 14.9% contribution to GGP.



Map 1. The new water management areas as announced on 19 March 2012 (DWS).

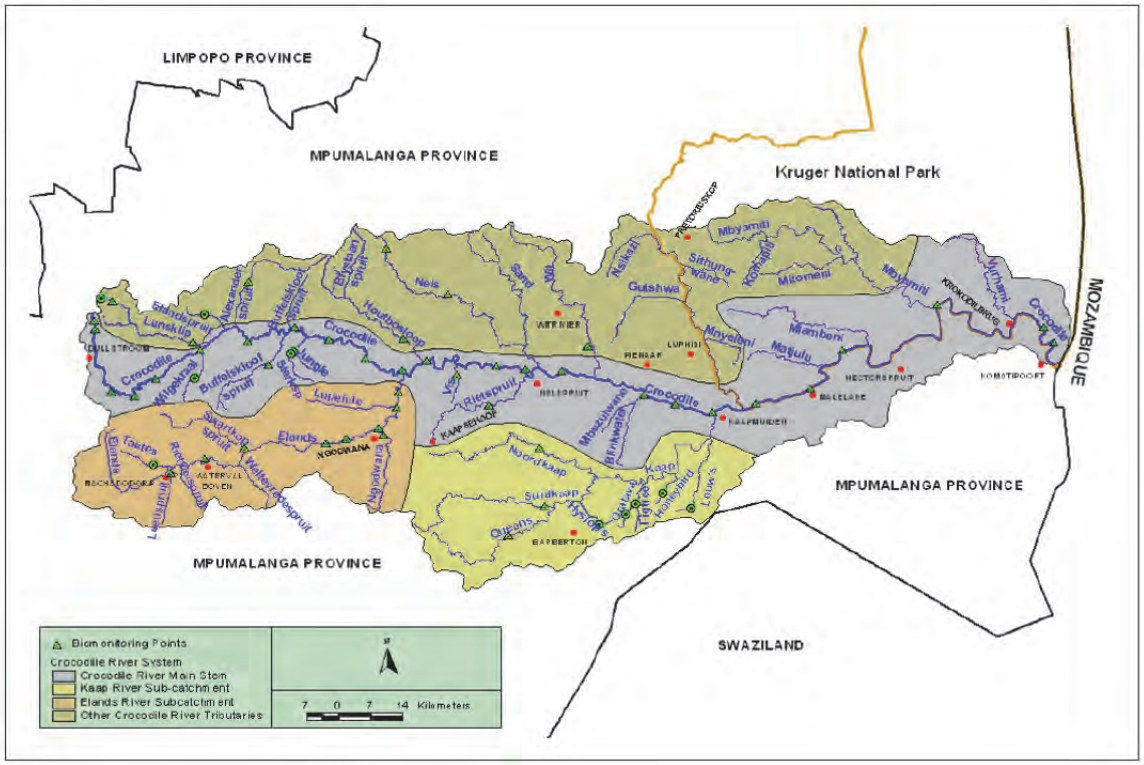
Map 2. The Inkomati Basin (Inkomati Catchment Management Agency, 2013).

2.2 The Inkomati and Crocodile (East) River catchments

The Inkomati River WMA is one of the most important river basins in South Africa because of its industrial and tourism contribution to GDP and because it is an internationally shared water course. The river itself drains between the Limpopo in the north and the Pongola in the south and comprises three sub-basins: the Komati, the Sabie and the Crocodile. The main river begins its journey in the high plateau of Mpumalanga and Swaziland and works its way through the Lowveld region of Mpumalanga, where its water is used significantly for agriculture, before winding through the coastal region of Mozambique and then discharging into the Indian Ocean just north of Maputo, Mozambique. The river basin area is approximately 47 000 km^2 of which 63% is in South Africa, 5% is in Swaziland and the balance is in Mozambique.

According to a 2013 report: *Ecostatus of the Crocodile River catchment, Inkomati River System*, the Crocodile River is also one of the most important rivers in South Africa. This is because a broad spectrum of riverine habitats – from cold Drakensberg streams to meandering temperate waters in the Lowveld – makes it one of the most biologically diverse rivers in the country. The catchment area is approximately 10 500 km^2 (see Map 3) and it rises at an altitude of approximately 2000 m above sea level in the Steenkampsberg near Dullstroom, Mpumalanga. Two large tributaries of the Crocodile are the Kaap and Elands Rivers. Some of the main land-use activities are (DWAF, 1995):

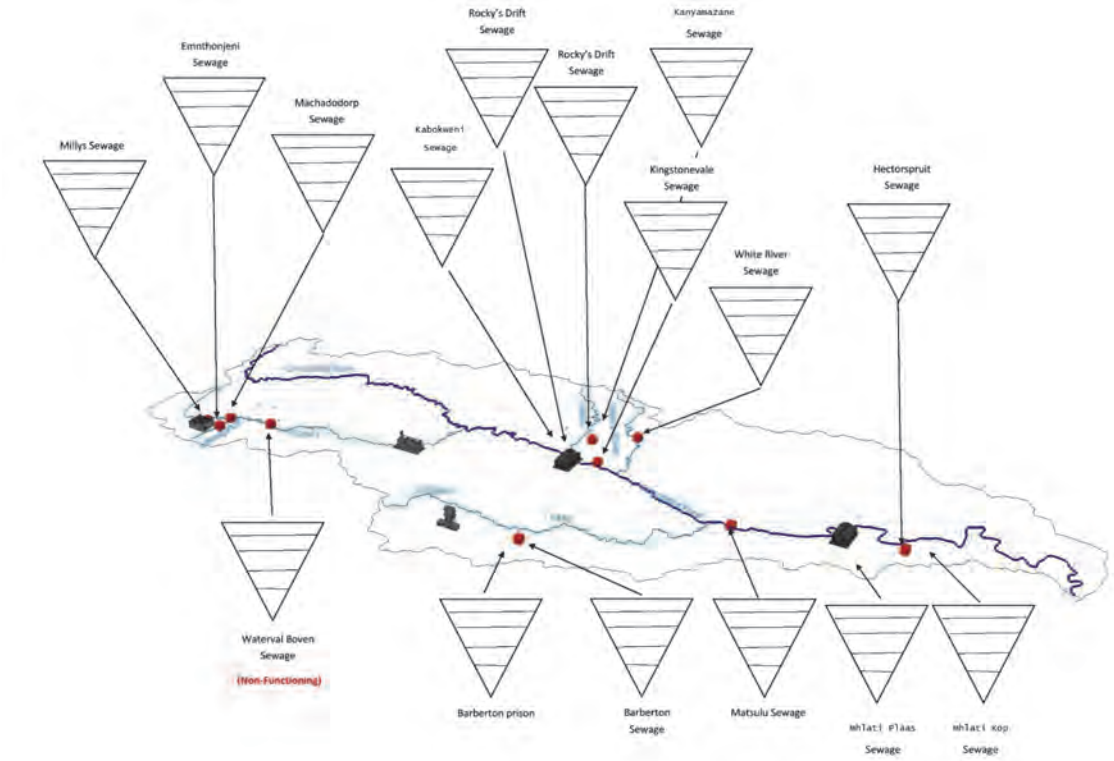
Forestry: approximately 16.5% of the catchment is covered in exotic plantations. This equates to approximately 1 722 km^2 of land area.
Irrigated agriculture: approximately 91 000 ha – including 21 000 ha of sugar cane and 20 000 ha of citrus – are under agriculture. This land use is concentrated in the central and eastern regions.
Dryland agriculture: this type of agriculture consists of maize, subtropical fruits, coffee, nuts, citrus and other vegetables.
Mining and quarrying: most mining activities occur along the Kaap tributary, and to a lesser extent along the central stem of the Crocodile River.
Nature Conservation: mainly represented by the southern portion of the Kruger National Park, with some smaller reserves.
Domestic and industrial land use: besides the large paper mill located alongside the Elands River, the large towns of Nelspruit and White River host major domestic and industrial agglomerations.



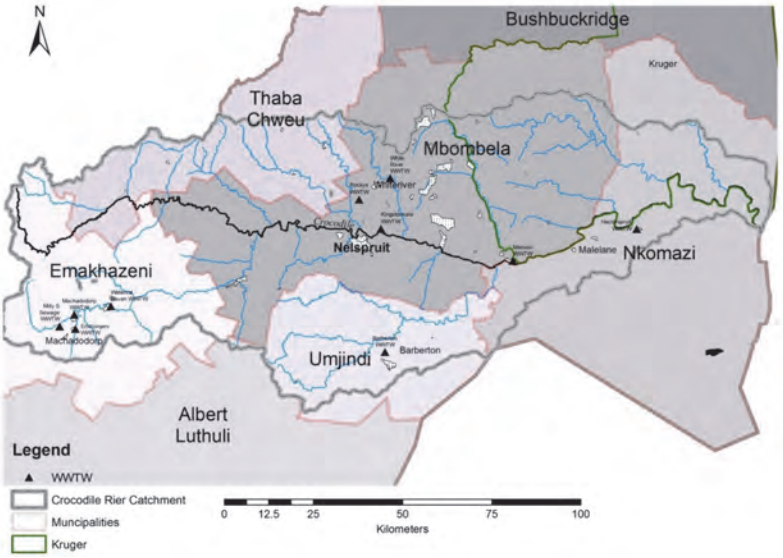
Map 3. The Crocodile River catchment (Inkomati Catchment Management Agency, 2013).

This study focused on the local municipalities of Mbombela, Umjindi, Nkomazi and Emakhazeni (see Map 4). They form part of two district municipalities, Ehlanzeni and Nkangala. The first district municipality is Ehlanzeni District Municipality (EDM). The EDM is bordered by Mozambique and Swaziland in the east, Gert Sibande District in the South, Mopani and Sekhukhune Districts of Limpopo in the North and Nkangala District in the west. It is comprised of five local municipalities of Mbombela, Umjindi, Bushbuckridge, Nkomazi and Thaba Chweu. Of these five, Bushbuckridge and Thaba Chweu do not front on the Crocodile River.

The Nkangala District Municipality – to the west of Mbombela – comprises six local municipalities; one of which is Emakhazeni Local Municipality, which fronts on the Crocodile River and is included in this study, while the other five are not.



Map 4. The WWTW positions in relation to the Crocodile (East) River (with thanks to Hugo Retief, Croc THRIP project).



Map 5. Local municipalities and their WWTW in the Crocodile (East) River catchment

2.3. Water quality in the Crocodile (East) River

The Crocodile River is central to growth and development in this economically active hub of Mpumalanga. This means that many water users – mining, agriculture, domestic and industry – use it and because of this use there are threats to its health (Soko, 2014). These uses of water have long been studied and proven to cause modification to water resource quality, and the Crocodile is no exception. Water pollution problems are identified through the identification, sampling and analysis of the following key parameters: turbidity, total suspended solids (TSS), phosphorous, pH, pesticides, nitrate, heavy metals, total dissolved solids (TDS), dissolved oxygen (DO), biochemical oxygen demand and ammonia (Soko, 2014). Soko (2014) concludes that the Crocodile and its tributaries have poor ecological and water quality status.

Using these parameters, Kleynhans (1999) studied different reaches of the Crocodile and found that the lower reaches are of generally poor quality, while the upper reaches have good water quality but are more susceptible to eutrophication due to agricultural and trout fishing activities. Heath and Claassen (1999) found that the stretch of river from Nelspruit to the confluence with the Kaap River is associated with domestic runoff, littering, and an increase in nutrient loads caused by both industrial plants and Wastewater treatment works. Downstream from the Kaap, water quality is negatively affected by pesticides, increase in trace elements, and nutrients, which are all associated with agricultural runoff. Mining in the Kaap catchment also impacts on water quality in this section of the river's reach.

In an important Inkomati-Usuthu Catchment Agency report titled, *Annual Water Quality Status Report for the Inkomati Water Management Area (IUCMA 2014)*, it is noted that, viewed against the Interim Water Quality Objectives (IWQO), microbiological quality is serious cause for concern in the Crocodile catchment. It has also been noted that even though the numbers of *E. coli* counts were averaged, the counts were still "extremely high" (IUCMA, 2014: iv).

This observation influenced the IUCMA's decision to profile all Wastewater treatment works in the water management area to "determine their status in respect of authorization, design and operational capacities, classification of controllers, and so on" (IUCMA, 2014: iv). In addition, Palmer et al. (2013), in a Water Research Commission paper, that describes water quality problems in the area, came up with a list of eight water quality issues – first on the list was Wastewater treatment works effluent. The others were: "paper and pulping effluent irrigation; nitrate and phosphate pollution owing to commercial agriculture; elevated

sediment loads owing to soil erosion processes; and elevated levels of manganese and iron in water.” (Palmer et al., 2013: 8).

So, from an aquatic science and regulator perspective, as well as in the view of a large number of stakeholders, there is no doubt that the poor condition of WWTWs along the Crocodile River is cause for concern. In these circumstances, the Green Drop incentive programme of DWS, launched in 2008 is a logical framework to turn to in an attempt to deal with this issue.

Chapter 3: THE EXTENT OF THE CHALLENGE OF DYSFUNCTIONAL WWTW: THE STATUS OF WASTEWATERTREATMENT WORKS IN MPUMALANGA

This chapter describes the WWTW in the four municipalities, and provides a broad understanding of their challenges. It gives a picture of the WWTW preparedness in the area, using insights from WWTW employees, triangulated with responses and opinions of observers, colleagues and regulators. Some of the descriptions were enriched by discussions during the CGDSC dialogues. Results from the 2012/13 Green Drop report had unfortunately not yet been made publicly available by DWS at the time of writing this final report, and as a result, this chapter relies on earlier data.

3.1 Introduction

According to the *2010/11 Green Drop Certification Programme Report*, Wastewater services treatment was undertaken by eighteen Water Services Authorities in Mpumalanga via 76 Wastewater collector and treatment systems. The province had an average Green Drop score of 56% in 2010/11, in a system in which 90% is the threshold for awarding a Green Drop certificate. In 2010/11, the design capacity of the total number of Wastewater treatment works had a surplus of 51% to meet future demand capacity. This was on the premise that the Wastewater Treatment Works had qualified and experienced plant management and scientific services. The picture as of 2014 (see Section 1.6.4) is somewhat different, particularly with regards to facilities in the Sabie Sand, Crocodile and Komati catchments.

When comparing 2010/11 Green Drop results with 2009, the following trends were observed:

- Twenty-six more systems were assessed in 2010 (76) compared to 2009 (50);
- One system achieved Green Drop Certification, indicating that one system was considered ‘excellent’ (>90%). This marks a reduction from the two excellent systems that were achieved in 2009;
- Twenty-four percent ‘average systems’ in 2009 improved to 30% in 2010/11;
- Sixty-eight percent of systems were in ‘critical state’ in 2009, compared to 38% in 2010/11;
- However, systems previously in ‘critical’ (2009) moved into ‘very poor’ (2010), resulting in an increase in ‘very poor’ systems.

Overall, the Cumulative Risk Rating (CRR) trend in 2010/11 was one where more works were in higher risk positions compared to 2009.The primary objective for Mpumalanga, the

Report cautioned, would be to arrest this decline, and apply the necessary means to reverse this trend. Fifty-eight percent of all municipal plants in Mpumalanga were in a **high- to critical risk** zone in 2010/11. This was a direct indicator of the inadequacies pertaining to plant capacity, effluent quality and technical skills. Experience teaches that the costs of specialist resources are much higher to address a critical risk scenario, when compared to earlier interventions signalled by early warning signals of a plant moving into distress.

According to the Inkomati-Usuthu Catchment Agency report titled, *Annual Water Quality Status Report for the Inkomati Water Management Area (2014)*, chemical water quality monitoring was initially performed on strategic monitoring points around three major catchments: the Sabie Sand, the Crocodile and the Komati catchments. These points included the headwaters, the exit point of the catchment, the discharge points of the tributaries in the main stem and the strategic points in the main stem.

Three indicator variables were used: pH, electrical conductivity and *E*. *coli.* The final results show that the chemical water quality is fairly good in all catchments except for a few instances in the Komati Catchment. However, the microbiological quality was a “serious cause for concern” (IUCMA, 2014: iv) in all three catchments. This finding prompted the profiling of all the Wastewater treatment works in the WMA.

In total, fifty Wastewater Treatment Works were profiled. Only seventeen of those fifty were authorised to operate; and only eight of those had water use licences while the balance had possession of a general authorization.

There are also only three WWTW that comply with the set standards or authorizations. Two of these are oxidation pond systems and they comply because these systems are not designed to release effluent; while the third is irrigating with its effluent (despite the fact that it does not analyse the quality of its effluent irrigation). Other oxidation pond systems are overflowing or discharging illegally.

Only four of the fifty WWTW are known to operate within their design capacity. The design capacities of other WWTW are unknown because there are no measuring devices to use to quantify these capacities. However, what is clear is that most WWTW are overloaded and so, in some instances, overflow. Only six of the fifty have emergency dams, and so, when there are breakdowns to the system, raw, untreated sewage flows directly into the streams. Regardless of this poor state of affairs, there are only six WWTW that are currently under refurbishment or being upgraded. Only a “few” WWTW are classified and only a few have

classified process controllers, if at all.

The authors of the Report concluded that the effective functioning of WWTW “is not a high priority for municipalities, the Department of Public Works (national and provincial) and the private owners of these facilities” (IUCMA, 2014: 130).

Against this general background for the Inkomati Usuthu Water Management Area, the report now turns to a description of the current status of the WWTWs in the four local municipalities that front on the Crocodile River.

3.2 Status of Wastewater Treatment Works in the Emakhazeni, Mbombela, Nkomazi and Umjindi Local Municipalities

3.2.1 *Emakhazeni Local Municipality*

Municipal Context

Emakhazeni Local Municipality is situated in the heart of Mpumalanga Province. It is bordered by Mbombela Local Municipality to the East and Middelburg Local Municipality to the West. The area is characterized by farming and coal mining. The area is also South Africa's premier fly fishing area, hosts some of the sub-continent's rarest birds, offers the best rock climbing, and most spectacular wild flower displays, within two or three hours from the metropolitan centres of Gauteng and Maputo, Mozambique. According to the municipality’s recent Integrated Development Plan (2015/16), mining contributes 24.4% of GDP, trade contributes 18.9% and agriculture 10.7%.

Emakhazeni Local Municipality is home to the following towns: Emakhazeni (Belfast), Entokozweni (Machadodorp), Emgwenya (Waterval Boven), and Dullstroom.

The municipality is dealing with massive maintenance and infrastructure backlogs dating back to when the four transitional local councils of Belfast, Machadodorp, Waterval Boven and Dullstroom were integrated. Community frustration with regards to this backlog came to the fore in late 2014 when a municipal strike halted services in the municipality. The South African Municipal Workers’ Union (SAMWU) demanded the dismissal of senior municipal managers, whom they accused of incompetence and of victimising workers (SABC, 2015).

Municipal Wastewater Treatment Works

There are four WWTW in the municipality. There is one WWTW in each town: Emakhazeni (Belfast), Entokozweni (Machadodorp), Emgwenya (Waterval Boven) and Dullstroom. As can be seen in Maps 4 and 5, two of the WWTW – **Emthonjeni (Machadodorp) and Emgwenya (Waterval Boven) –** are situated at the top of the catchment alongside both the Leeuspruit and Elands Rivers, which are tributaries of the Crocodile (East) River.

The *Annual Water Quality Status Report for the Inkomati Water Management Area (2014)* reports the following:

Emgwenya (Waterval Boven) Wastewater Treatment Works

It uses an activated sludge and bio-filter system and has a design capacity of 2.4 ML/day. The WWTW does not have flow measuring devices and so does not have an average daily flow capacity. This WWTW is authorized to discharge treated effluent and all process controllers are classified. Mechanical failure and general operational disrepair are rife. At the time of the aforementioned report, disinfection was not occurring and so the potential release of either untreated, or partially treated effluent into the Elands River is significant.

Emthonjeni (Machadodorp) Wastewater Treatment Works

The works uses an activated sludge and oxidation ponds system and has a design capacity of 1.5 ML/day. The WWTW does not know its average daily flow capacity because it does not have flow measuring devices. This WWTW is authorized to discharge treated effluent and all process controllers are classified. At the time of the IUCMA report, disinfection was not occurring and so the potential release of either untreated, or partially treated effluent into the Leeuspruit is significant. The last public Green Drop report in 2010/11, found the following:

1. All four WWTW do not monitor incoming flow.
2. None of the four plants comply with effluent discharge limits, thereby posing a risk to the receiving environment and public health.
3. Crucial to future success is planning of the collector and treatment capacity and appropriateness of technologies to achieve the objectives of the municipality. Any planning should be done in close consultation with the affordability of the services and the municipal capabilities regarding operation. In 2010/11, Emakhazeni achieved a Green Drop score of 70.2%.

3.2.2 *Mbombela Local Municipality*

Municipal Context

Mbombela, the Siswati word for "a lot of people together in a small space" aptly describes some of the areas of the Mbombela Local Municipality's area of jurisdiction in the Mpumalanga Province, South Africa. The municipality was born out of the amalgamation of previous local councils in December 2000: Nelspruit, White River, Hazyview and the Greater Nelspruit Area, now known as Mbombela City, the capital city of the Mpumalanga province and the gateway to the Lowveld. It is a vibrant, sub-tropical city that combines a rich history with scores of wildlife and nature activities and attractions. Mbombela City is also the entry point to Big Five country and the centre of a huge farming community specializing in sub-tropical fruit. The municipal Integrated Development Plan (IDP) of 2015/16 notes that in 2010, the mining sector, the trade sector and the transport sector all contributed considerably to the local economy; while in 2012 there was an increase in the contribution made by the agricultural sector as well as the utilities sector. The city hosts a number of industrial works including processing manganese and paper board.

The Mbombela Local Municipality has been plagued over the last three years with performance irregularities of Municipal Managers. In 2012, the municipality hired a Municipal Manager three years after the former manager was fired for tender corruption; in 2013, the position became vacant once more as the then Municipal Manager was accused of maladministration and corruption. Then in 2014, another person was appointed but was later taken to court in 2015 for alleged fraud and corruption (IOL News, 2015; News24, 2015; SABC, 2015).

Municipal Wastewater Treatment Works

There are seven WWTW in this municipality. Three of the seven are managed by a Singaporean company called Sembcorp Industries, a multinational water, energy and marine group operating across six continents worldwide (Sembcorp, 2015). Sembcorp-Silulumanzi, as the local concession is known, operates and manages the following WWTW:

1. Kingstonevale
2. Matsulu
3. Kanyamazane

The local municipality operates and manages the remainder of the WWTW.

The following description is based on information collected from the Inkomati-Usuthu Catchment Agency report titled, *Annual Water Quality Status Report for the Inkomati Water Management Area (2014)* and minutes of the February 2015 Green Drop Support Campaign meeting:

Kingstonevale Wastewater Treatment Works

Situated 5 km North of Mbombela City, the WWTW uses a bio-filter and activated sludge system. The design capacity is 26 ML/day. The design capacity of the bio-filter system is 15 ML/day and the activated sludge system can manage 11 ML/day. The WWTW is classified as Class B and all process controllers who work there are classified accordingly. The WWTW has a water use authorization. For most of the duration of the IUCMA Water Quality study, the WWTW did not comply with the effluent discharge standards.

Matsulu Wastewater Treatment Works

This WWTW, situated approximately 30 km East of Mbombela City, uses an activated sludge process and has a design capacity of 6 ML/day. The governance of the WWTW is good with it holding a Class C classification and an authorization to discharge effluent into the river. This WWTW complies, for most of the time, with the effluent discharge standards.

Kanyamazane Wastewater Treatment Works

The technology used in this WWTW is a parallel PETRO pond system with design capacity of 12 ML/day. The WWTW is situated approximately 30 km East of Mbombela City. All process controllers are classified and the plant itself is classified as a Class D. Although the WWTW is authorized to discharge effluent, it did not comply with the discharge standards for most of the duration of the study.

Kabokweni Wastewater Treatment Works

The WWTW has a capacity of 3.4 ML/day and uses an activated sludge system. The WWTW is situated approximately 25 km East of White River. The process controllers are classified and the WWTW is a Class E but it does not have a water use authorization. For the duration of the study, the WWTW did not comply with the effluent discharge standards.

Hazyview Wastewater Treatment Works

Located within the Central Business District (CBD) of Hazyview, the WWTW has a design capacity of 0.7 ML/day and uses activated sludge technology. It does not measure its average daily flow rate because it does not have monitoring devices. The WWTW has a Class C classification and all process controllers are authorized. The WWTW is authorized

to discharge effluent into the Sabie River. For the duration of the study, only Ortho-Phosphates and E.*coli* did not comply with the effluent discharge standards.

White River Wastewater Treatment Works

The type of process technology used by the WWTW is activated sludge. The WWTW has a design capacity of 6 ML/day and is located 3 km North of White River. The WWTW is not in possession of measuring devices and so the average daily flow capacity is unknown. The WWTW has been classified as a Class B, the process controllers are classified and the WWTW is authorized to discharge effluent. However, the WWTW did not comply with the effluent discharge standards for the duration of the study.

Rocky's Drift Wastewater Treatment Works

The WWTW is located 3 km West of Rockys Drift. It uses an activated sludge system that has a design capacity of 2 ML/day. The average daily flow capacity is unknown because the WWTW does not have flow measuring devices. The WWTW is classified as Class C, it has a water use authorization and the process controllers are classified. The WWTW discharges effluent into the Sand River and for most of the study time, this effluent complied with the effluent discharge standards.

The following points, from the minutes of the February 2015 Green Drop Support Campaign meeting, were used to highlight “high risk areas”:

- There are capacity constraints as the hydrological and organic load increase as sewer outfalls increase due to burgeoning development
- There is a lack of suitably qualified staff, particularly artisans
- The ageing infrastructure exacerbates the struggle to get spares
- Lack of maintenance
- Manhole spills are prevalent due to lack of capacity and thus poor maintenance
- Procurement is a laborious process
- Absence of funding: Cost of generators (and running them) is huge
- Theft and vandalism
- Load shedding
- Lack of commitment of work team who are making money on overtime hours

The last public Green Drop report in 2010/11, found the following:

1. Two out of seven WWTW do not monitor their operational flows, and thereby compromise

future planning and efficiency monitoring;
2. None of the seven systems had captured its data on the Green Drop System (GDS);
3. Three of the seven systems are faring poorly in terms of effluent quality compliance;
4. Four of the seven systems do not have incident response management in place;
5. Four of the seven systems do not have adequate bye-laws or implementation thereof in place;
6. Four of the seven systems need to improve on the credibility of their data, and process control (technical) practice must improve;
7. The shortcomings on asset management principles and systems, especially unit costing against ring-fenced expenditure records, will hamper improved Green Drop scores in future.

In 2010/11, Mbombela achieved a Green Drop score of 86.3%.

3.2.3 *Nkomazi Local Municipality*

Municipal Context

The Nkomazi Local Municipality is located in the eastern part of the Ehlanzeni District Municipality of the Mpumalanga Province. The municipality is strategically placed between Swaziland (North of Swaziland) and Mozambique (West of Mozambique). It is linked with Swaziland by two provincial roads and with Mozambique by a railway line and the main national road (N4), which forms the (final stretch of the) Maputo Corridor. According to the municipal Integrated Development Plan, the municipality has identified different types of agriculture (like biodiesel production), mining (like coal mining) and tourism as key opportunities in the near future.

The main urban centres are Louw's Creek, Kaapmuiden, Malelane, Hectorspruit, Marloth Park, Komatipoort, KaMhlushwa, Tonga and KaMaqhekeza.

In recent community protests, 1000 residents of Mzinti took to the streets and faced off against police in protest against a lack of clean drinking water.

Municipal Wastewater Treatment Works

There are five WWTW in this municipality, situated in the towns of Komatipoort, Hectorspruit, Malelane and Tonga village. All the WWTW are operated and managed by the municipality.

The following description is based on the Inkomati-Usuthu Catchment Agency report titled, *Annual Water Quality Status Report for the Inkomati Water Management Area (2014)* and

minutes of the February 2015 Green Drop Support Campaign dialogue.

Komatipoort Wastewater Treatment Works

This works uses an oxidation pond system and has a design capacity of 1.2 ML/day. The WWTW does not measure its daily flow capacity because it does not have measuring devices. The WWTW is not authorized to discharge treated effluent into the Crocodile. The WWTW is not classified and, at the time of research, there were no process controllers on site. In general, the operations and maintenance of the WWTW is in a state of disrepair and derelict. For most of the period studied, the WWTW did not comply with most of the effluent discharge standards.

Hectorspruit Wastewater Treatment Works

This WWTW uses an oxidation pond system that has a design capacity of 0.265 ML/day. The average daily flow is not measured because the WWTW does not have a measuring device. The class of this WWTW is unknown and at the time of study did not have a water use authorization for discharge of effluent into the Crocodile River. The certificates of the process controllers could not be verified because they were not available at the WWTW. Some water quality indicators were not complied with in terms of effluent discharge standards.

Mhlathi Plaas Wastewater Treatment Works

An oxidation pond system is used in this WWTW. It has a design capacity of 0.75 ML/day but the average daily operational flow is unknown because the WWTW does not have a measuring device. The WWTW does not have a water use authorization for the discharge of effluent into the Crocodile and for the majority of the study period did not comply with most of the effluent discharge standards. Copies of the process controllers' and supervisors' certificates could not be verified.

Mhlathi Kop Wastewater Treatment Works

This WWTW uses an activated sludge system with a design capacity of 1 ML/day. Like the other WWTW, its average daily operational flow is unknown because it does not have a measuring device. The WWTW is not classified and does not have a water use licence. The process controllers' and supervisors' certificates could not be verified and so governance is an issue at this WWTW. As a result five out of the seven water quality variables monitored did not comply with the effluent discharge standards for almost the entire duration of the reporting period.

Tonga Ponds Wastewater Treatment Works

It has a design capacity of 1.25 ML/day and operates with an oxidation pond system. The average daily flow capacity is also unknown. The WWTW is classified as a Class D and the process controller on site is a class V. The WWTW does not have a water use authorization for the discharge of effluent into the Komati River. During the study period, five out of the seven water quality indicators monitored did not comply with the effluent discharge standards.

The following points were extracted from minutes of the February 2015 Green Drop Support Campaign meeting and used to highlight “high risk areas”:

- There seems to be a lack of skilled process controller staff *and a shortage* of process controller staff to meet the requirements. 2834/17. In addition, there is no supervisor for WWTW
- The absence of security guards at all WWTWS, has meant that vandalism and theft of major components is rife
- There are no flow meters, and the installation of these flow meters is stalled. This means that there is no historical trend to advise if an upgrade is required
- The budget for maintenance of WWTW infrastructure is insufficient. It is also not ring-fenced and so the money can be moved around line items
- Current maintenance is reactive only (therefore, there is a lack of preventative maintenance). This leads to spillages
- Lack of Operational and Maintenance plans, which includes no risk assessment done
- No water use authorisation for the discharge of Wastewater effluent
- Absence of by-laws enforcement
- Ageing infrastructure and overloading of collector capacity and WWTW
- Delays in the procurement process results in the non-implementation of the W_2RAP, which is generic. The W_2RAP is not submitted to the DWS for review, nor does the municipality approve it
- No standby pumps
- Poor, or no, monitoring of effluent done and so WWTWs cannot adjust treatment accordingly
- Damage is done to the reticulation system seemingly because of political agendas

According to the *2010/11 Green Drop Certification report*, general conditions were:

1. Five out of five WWTW do not have adequate monitoring in place, especially with regard to process and catchment monitoring.

2. Four of the five WWTW do not monitor inflow or effluent volumes, whilst the design capacity of the Tonga plant is unknown.
3. None of the plants have achieved scores for data submission.
4. Five of the five systems do not have adequate failure response management or bylaws in place, or implementation thereof.
5. Planning aspects of the sewer collection systems and treatment plant are not adequate and will hamper decision-making and resource allocation in order to rectify deficiencies.
6. Asset management is not sufficiently institutionalised and ring-fencing of cost centres remain outstanding to determine the cost of services in order to inform appropriate tariff structures.

In 2010/11, Nkomazi achieved a Green Drop score of 42.8%.

3.2.4 *Umjindi Local Municipality*

Municipal Context

The municipality is one of five local municipalities within Ehlanzeni District Municipality, situated in the Southern Lowveld of Mpumalanga and is predominantly a Swazi area. Umjindi is a historical gold-mining area about 45 km by road from Mbombela-Nelspruit. Umjindi's economy today centres around gold mining, forestry, agriculture and tourism, where large initiatives, such as the tentative listing of the Barberton-Makhonjwa Mountain land as a World Heritage Site have been identified. The major urban centre is Barberton.

Community protest began in March 2015 due to a February proposal by the Provincial Executive Council to amalgamate Mbombela and Umjindi Local Municipalities. Apparently the proposal was made to ensure financial sustainability (Lowvelder, 2015). More recently, council workers staged a sit-in to demand their labour-forum recognition and so caused service delivery to grind to a halt in Umjindi (Barberton Times, 2015).

Umjindi Municipal Wastewater Treatment Works

There is only one WWTW in this municipality and it uses an activated sludge system with a design capacity of 8.4 ML/day.

Using the Inkomati-Usuthu Catchment Agency's *Annual Water Quality Status Report for the Inkomati Water Management Area (2014)* and minutes of the February 2015 Green Drop Support Campaign meeting, the status of the WWTW can be described as follows:
It does not have an average daily flow capacity because the WWTW does not have flow

measuring devices. With regards to governance, the WWTW is authorized to discharge treated effluent and it seems that all process controllers are classified. The classification of the WWTW is Class B. Although the WWTW is not compliant with effluent discharge standards, it is in the process of refurbishment. As of 2014, it was releasing partially treated effluent into the environment.

Moreover, the following points were extracted from the minutes of the February 2015 Green Drop Support Campaign meeting and were used to highlight “high risk areas”:

1. There are manhole blockages;
2. Aerators breakdown;
3. No skilled process controllers;
4. By-laws have not been gazetted so they cannot enforce them. Therefore they cannot issue a directive;
5. Environmental Health Practitioners are not employed because by-laws are not in place;
6. The W_2RAP[1] has been completed but is awaiting approval from the municipality;
7. Phosphates are a risk because the WWTW is not complying, i.e. it does not have a phosphate removal filter;
8. Sometimes transport is not available to take samples to the laboratory in Mbombela City;
9. There have been payment defaults to the laboratory prompting delays in sample testing;
10. Budget is reallocated to other areas;
11. Technical staff have limited support from management.

The conclusions from the *2010/11 Green Drop Certification report*, were:

1. The WWTW cannot optimize its process control and impact on the receiving water resources as a result of the inadequate monitoring. This transgression reaches beyond effluent quality monitoring and include volumetric (flow) metering as well.

2. Data submission and data credibility falls short of expectation for the Green Drop requirements.

3. Forty-five percent compliance to legislative requirements regarding authorized operation of the plant and effluent quality discharge

4. ‘No volumetric flow’ also translates to ‘no planning’ for collection and treatment capacity
5. The absence of asset management principles results in an additional burden on the

municipal budget when reactive maintenance and premature replacements will have to be done to ensure an acceptable service level

In 2010/11, Umjindi achieved a Green Drop score of 56.0%.

3.3 General Wastewater Treatment Works issues within the Crocodile (East) catchment

Part of the work of the seven dialogues in the GDSC was to develop a common diagnosis and understanding of the causative mechanisms of WWTW failure. The following issues were recognized as common amongst all WWTW in the aforementioned catchment:

1. Power cuts impact on pump stations, which are often located next to a river. Raw sewage, thus, flows straight into the river;
2. There seem to be issues in co-operation between local municipalities and the DWS;
3. Misallocation and under-spending of funds;
4. Lack of focus on Wastewater Risk Abatement Plan (W_2RAP);
5. Absence of Municipal Managers' support;
6. Lack of Councillor understanding;
7. Gap between finance and technical people;
8. No mechanisms that encourage support (and/or learning) between organisations in the same catchment;
9. Lack of training for process controllers;
10. Limited reporting from municipalities to DWS highlighting key issues;
11. Lack of transparency between WWTW hinders the possibility of sharing resources that could be mutually beneficial;
12. Increased *E*. *coli* and phosphate levels due to mechanical failures on WWTW;
13. Supply chain/procurement delays;
14. Vacancies in WWTW not seen as a priority within municipality;
15. Inexperienced appointees;
16. Reticulation breakdown;
17. Absence of operation and maintenance manuals;
18. Staff capacity.

3.4 Current preparedness of Wastewater Treatment Works in the Crocodile catchment

The data presented in this section was collected by telephonic interviews conducted with

select individuals within the relevant WWTW. The questions (see Appendix 1) were designed to elicit a broad understanding of each WWTW preparedness for the forthcoming Green Drop Assessment, despite the obvious delay in inspections.

In a number of Green Drop dialogues, participants observed that the (then) upcoming Green Drop inspections, scheduled for the first quarter of 2015, would provide an ideal opportunity to (1) see the preparedness of the involved local municipalities for these inspections and (2) provide an opportunity for the campaign to offer assistance (from its technically qualified members) for such preparations. In one of the dialogues, DWS officials gave specific advice on how to prepare.

In the design of this research, the green drop inspections were expected to take place in the first quarter of 2015 (information from GDSC meeting in October 2014).

However, while inspectors were trained on time, the inspections themselves were delayed, apparently by a tender process. At the time of writing, the inspections had not yet started. The research team, however, considered that the report should report the state of preparedness nonetheless, which could be updated for the final report later in 2015.

3.4.1 *Mbombela Local Municipality*

Ideas about the start date of the Assessment varied. The general understanding was that it was meant to begin at the end of January 2015 but has been pushed out several times. As a result, people interviewed thought that it would be either the end of April or July 2015. Two respondents suggested two different reasons for the delay: 1) due to process verification issues and/or assessor training issues but wasn't sure, and 2) because of a shift of location for the Green Drop programme within the DWS.

Respondents from both the municipality and Sembcorp felt that they were ready. Sembcorp’s path to readiness exhibits characteristics of a tried and tested process and structure. Both Sembcorp respondents explained that their process consisted of workshops and full operational expertise that help each other ensure readiness. A sentiment that was expressed by one of the Sembcorp respondents was that, “If one fails, we all fail”. The municipal respondent said that the municipality wanted to participate but that they had to work with Sembcorp to get ready. Though the municipality is approximately 95% ready, they are still awaiting water use licences from the DWS.

There was general agreement by the respondents that the Green Drop programme has “nil” influence on municipalities. Their opinion is that it seems as though people feel that the municipalities do not take it seriously and that if they did take it “to heart”, the outcome would be different. One respondent thinks that the Municipality does not take Green Drop seriously because the DWS takes too long to release the Report (if at all!). This lack of feedback undermines the credibility of the Green Drop programme and thus undermines the importance of the programme. She asked if the DWS takes the Green Drop Certification programme seriously. In contrast, the message from the Sembcorp respondents is that Sembcorp *is* serious about the Green Drop programme. This message was communicated by the respondent’s juxtaposition of Municipal and Sembcorp management understanding of the Programme; and by another respondent’s explanation of Sembcorp’s adherence to their ISO accreditation.

One respondent did feel that the programme was positive. The respondent suggested that the Green Drop programme is good because it helps the WWTW “get a good outcome”, i.e. that effluent is kept within standard [the irony is that this is just not happening, as described in this report]. The respondent likened the Green Drop programme to a Department of Education Inspector who moves around monitoring teaching quality. However, she felt that unlike the Education example, the WWTW should want to do well whether the Green Drop is there or not. But, she added, it is good to have assistance. In a similar vein, another respondent suggested that the audit be used to lead the WWTW and not be used as a stick to punish the WWTW.

3.4.2 *Nkomazi Local Municipality*

In Nkomazi as well, there was uncertainty as to when the Assessment would occur. One respondent thought it may be before the end of May 2015 (which was at odds with information received from DWS in the February 2015 dialogue.) The reason given for the delay was that the DWS needed to have a workshop with the Municipal Manager, interviews with national departments, CFO and Councillors to improve understanding about the Green Drop programme. This was a resolution that emanated from the Green Drop Support Campaign.

One respondent said that the municipality was busy readying the WWTW; that every day they are working to improve things. In fact, it was pointed out that they had improved since the last Assessment. They did receive help from the DWS provincial office in the form of a free Assessment. This was done in January 2015 and it helped to identify any changes or

improvements they need to make. However, some of the areas identified for improvement need more finances, which the municipality does not have in this budget cycle.

A respondent said that the programme increased competition (because of the Awards system) and helped improve practice of WWTW management. A respondent believed that the municipality took the Green Drop programme seriously, or, at the least, her technical service division did. The respondent was also uncertain as to whether other operational support divisions did, like finance, for example. The respondent also suggested that it was important that the political heads of the municipality are educated about the importance of the Green Drop programme.

3.4.3 *Umjindi and Emakhazeni*

For two municipalities it was not possible to reach any conclusions, since staff and councillors did not make themselves available for interviews, despite undertakings to do so. This may indicate that they do not attach importance to it, or that there is no capacity to engage on this terrain.

Chapter 4:THE CROCODILE GREEN DROP SUPPORT CAMPAIGN

4.1 Introduction

The previous chapter presented a picture of neglect, pervasive disrepair, disinterest, and in many cases irresponsibility exercised by senior management of the municipalities in question. While there are notable exceptions, as well as individuals who are committed to improvement of the WWTW, the overall picture is bleak. The majority of the WWTW located within the four municipalities identified as part of this study, had made little to no progress with regards to the treatment of effluent (IUCMA 2015). This, in many cases, cannot in the first place be attributed to the WWTW workers themselves but certainly to the ill-equipping of these workers in terms of institutional support, institutional bureaucracy, financial provision, politicking, ignorance, and load-shedding practices.

However, it must also be noted that amongst the ineptitude that seems to govern these works, there are pockets of excellence comprised of people who are keen to make a difference but who feel stranded in a sea of poor decision-making, especially as it pertains to budgets. It is exactly the intention of the Green Drop Support Campaign (GDSC) to reach out to these pockets of excellence, connect them through dialogue with other actors in the catchment who could be of assistance, and stimulate the growth of solidarity and working together by creating the conditions for social learning, or a community of practice, centred on better Green Drop performance, to emerge.

This chapter looks at the CGDSC as a response to this situation. It refers to the origins of this campaign to similar work undertaken in 2009 and 2010 in the Rietspruit Forum in the Upper Vaal catchment (Munnik 2010a; 2010b). It traces the seven steps of the GDSC as they were followed, up to the present day, in the Crocodile River, via a comparison of the Crocodile River and Rietspruit campaigns. From this comparison it draws conclusions about the general replicability of this approach.

The Crocodile River GDSC process described in this progress report has not been concluded. While the first four steps have been achieved, and some actions in the last three steps have been taken, the campaign is currently busy with step 5. As a result, there are a number of uncertainties in the project, which is to be expected. These developments are discussed in detail in this report, leading to a strategic and tactical consideration of the next steps. A strong influence on this was the delay in the Green Drop assessments by the Department of Water and Sanitation (DWS) from the first quarter of 2015, as originally

planned when this project was conceived, until the first quarter of 2016.

4.2 Methodology

This chapter is based on:

1. Seven dialogues in the period January 2014 to February 2015
2. Interviews with DWS, COGTA, MISA, Public Works and SALGA
3. Discussions at the Kingfisher Project meeting of 2 July 2015
4. Discussions at the 30 July 2015 DWS Green Drop training for Mpumalanga local governments
5. A preview of a report in process on the Bloemhof events in which bad water treatment was associated with the death of a number of infants, and political intervention led to the removal of the mayor.

4.3 Background discussion

At the heart of the GDSC is an attempt to bring the insights and energies of actors outside of local government, into collaboration with local governments to improve their WWTW. This is a response to the current dynamics around WWTW: while segments of civil society, business and various national departments are intensely concerned about the risks of dysfunctional WWTW, the local governments responsible for them seem to be resolutely out of step. However, the risk to the health of citizens affected by microbial pollution in rivers (aggravated in some instances by deficient drinking water treatment systems) and the ongoing degradation of ecosystems are the concern of actors outside of local government (Le Roux *et al.*, 2012). The contradiction is that local government is guaranteed a strong degree of autonomy in how it takes responsibility for this particular water service. The Green Drop scheme is itself the result of this arrangement – it is an incentive scheme, rather than a compliance regime, although it does not replace the compliance regime. Moreover, this is complicated further by political reluctance to release information about local government performance (see Sipho Kings, *Mail and Guardian* 7 Aug 2015 as an example).

How does one bring the energies of highly concerned, but marginalised actors together? The seven steps of the CGDSC was an attempt to do exactly that.

Box 1: Seven steps of a Green Drop Support Campaign

Step 1: Scoping	Check (with stakeholders/actors) the need for the campaign: Are dysfunctional WWTW an important problem? For whom? Check the institutional feasibility: What elements are present in the context, what types of civil society, water sector, local government and other actors? Specifically, what is the catchment management set-up? Are there forums and possibly a CMA?
Step 2: Establish working group	Establish a mandated, representative (across class, race, geographical spread, interest groups etc.) group. Agree on campaign objectives and working group rules and approach. Build capacity, esp. knowledge of WWTW, the green drop criteria, and a language in which the group (working group) can discuss and understand the issues. (Good materials are available, starting with the WRC publications.)
Step 3: Involve WWTW staff	Involve the operators. Share and understand their challenges. Get to know and understand the specific WWTW at issue. Their flow diagrams.
Step 4: Build understanding	Test current performance against the Green Drop criteria. How is the Green Drop process going, which criteria were met, and which were not met, and why? Understand the WWTW/local government interface: what is the nature of municipal support (or lack of support) for WWTW?
Step 5: Develop solutions	Develop solutions and implement them. Use a wide range of tactics, including close engagement with local government, small circle engagement in problem areas, also publicity and engaging allies and other sources of influence. This is the wrestle phase.
Step 6: Acknowledge success	Acknowledge and publicise success. Analyse the reasons for success. Consider how to make the situation sustainable (e.g. does it need ongoing monitoring from the catchment, or does each WWTW need a citizens' committee – like landfill committees – and regular reporting?). Is there need for a standing green drop support group? Is it possible to fold the work of the working group back into the subcatchment forum?

Step 7: Link, scale up, replicate	Link with and support other subcatchment forums and other institutions dealing with the same issues. For example, neighbouring subcatchment forums in the Upper Vaal, or other active or challenged forums dealing with dysfunctional WWTWs. Feed experiences into broader CMA policy and implementation, and into local government policy. Draw out the lessons for sector collaboration and DWS's role as a regulator, including the role of citizens' monitoring.

Step 1: Scope the felt need and support for the campaign

The first step in a Green Drop Support Campaign is to make sure whether the campaign is needed. Is it enough of a priority for catchment citizens? Is it a priority for local government? What are the contradictions between broader concerns (citizens and national government) and the priority that local governments accord to the Green Drop? Are there enough actors willing to get involved and contribute time, knowledge and other resources? Are there adequate resources available within the catchment to conduct such a campaign? Are there resources that could be brought into the catchment, for example knowledge from the national or provincial DWS office, or within the CMA, on a temporary basis, in the hope of building an autonomous, local structure (or that one emerges or grows out of the project) in order to deal with the issue locally in the future? This last question reveals the underlying vision of an action research or more properly generative research approach which intends to build capacity as it undertakes research.

In the Rietspruit, the (2009/10) working group had been almost indistinguishable from the Forum itself. It also met in the Sebokeng WWTW, where all the forum meetings took place. There was broad participation from the forum. Rand Water already played a crucial role in the forum, by providing water quality monitoring data in addition to that of DWS and the municipality. Staff in the municipality (strictly speaking Metsi a Lekoa), from DWS national and provincial provided technical support. The Mvula Trust and WESSA provided process facilitation support. Technical and training inputs were made by consultants on a volunteer basis, namely Dr Marlene van der Merwe-Botha, and Dr Pieter van Eeden (a member of a number of Upper Vaal CMFs).

In the Crocodile River catchment, an important new actor was available, namely the Inkomati Usuthu Catchment Management Agency (IUCMA) with a well capacitated, active and dedicated water quality team. The IUCMA provided information and a meeting space. Its information provision included the publication of an overview of all the WWTW in its jurisdiction (IUCMA 2014). The Crocodile Forum gave its support to the project. An

institutional base, and human resources for secretarial and logistical, as well as also facilitation support was available within the Crocodile River THRIP project, carried by industry stakeholders, and housed in the IUCMA water quality team and run by Rhodes University. The current WRC project provided resources to conduct further interviews, attend crucial meetings, and compile research reports.

The IUCMA (previously ICMA), is one of only 2 operational CMAs in the country, with a lively and professional water quality team. The IUCMA was – and still is – acutely aware of the problem of dysfunctional WWTWs and spent much of its time on this issue. The IUCMA played an important role in the campaign. For replicability therefore one will have to ask whether a CMA, proto-CMA exists, and what the arrangements and effectiveness of their water quality staff is. But note that in the Rietspruit (Upper Vaal), there was no CMA, although institutional capacity was available – and did participate – in the form of Rand Water (and its history of taking responsibility for catchment management) and the regional DWS office, which was actively supporting the Rietspruit forum.

The IUCMA area is also well researched in terms of water quality (see chapter 2). Research done by Palmer et al. (2013) produced a list, based on industry and other participants' inputs, on the top water quality concerns for the Crocodile River. Top of the list was the issue of dysfunctional WWTW. The list was:

- the performance of wastewater treatment works (WWTW);
- disposal by irrigation of pulp and paper effluent;
- nutrient enrichment (agriculture and WWTW);
- accelerated sediment production (forestry),
- dissolved Manganese and Iron (mining),
- to identify and integrate diverse monitoring programmes and data;
- to harmonise various water quality standards used by diverse industries;
- to identify accredited analytical laboratories and to develop protocols for reliability and accuracy of water quality data.

In addition, early research into the situation as part of the Rhodes THRIP project, consisting of individual and group interviews in November 2013, and following the Cultural Historical Activity Theory (CHAT) approach, pointed to a range of problems. The research had the effect that issues were clearly defined and that stakeholders were well aware of them. The analysis led the research team to develop a theory of change:

1. WWTW will achieve a higher profile locally, in public and with the municipality (councillors and officials). This will prevent the current practice of reallocating WWTW budget to other priorities midyear, and inappropriate and inadequate procurement practices.
2. Civil society will adopt a supportive attitude towards WWTW, on the basis of an in-depth understanding of their context and functioning. Staff responsible for WWTW will not be under general attack by civil society and other catchment stakeholders; instead efforts will be focused on identifying the bottle necks in achieving a better Green Drop score, within the Green Drop programme.
3. While there is clear support from national and regional DWS, and a focus by the IUCMA, the working group with broad stakeholder support needs to receive and orient the support into productive channels, to avoid perverse incentives.

These points could be seen as hypotheses that action research could explore. At the same time, they amounted to an agenda for change.

In conclusion, in both the Rietspruit and the Crocodile GDSC, there was ample institutional capacity to support the working group: from Rand Water, the IUCMA, and as a result of active participation by DWS regional and national offices responsible for the Green Drop. The main impact of the GDSC was to bring these resources together in one place with a focused goal and mandate.

Step 2: Establish a mandated, inclusive working group and build capacity in Green Drop frame

Step 2 aims at establishing a mandated, representative group (representative across class, race, geographical spread, and interest groups), by agreeing on campaign objectives and working group rules and approach. Working groups are an accepted and familiar way for Catchment Management Forums to deal with issues with a technical component, where more time than is available in the two-monthly forum meetings is needed, and where a smaller, focused group can be more effective.
Once established, this group's capacity needs to be built, especially knowledge of WWTW, the Green Drop criteria, and a language in which the group (working group) can discuss and understand the issues.

The Rietspruit working group had a strong presence of nearby communities, many of them members of the Vaal Environmental Justice Alliance. They were involved in a broader process of capacity building on water quality issues already, and the WWTW issues were added to these. Good materials for training were discovered, namely Dr Pieter van Eeden's

training pack “Introduction to Environmental Water Quality Management” (not dated), and Boyd and Mbelu’s (2009) “Guideline for the Inspection of Wastewater Treatment Works. Water Research Commission Report no TT 375/08”. In the Rietspruit, civil society representatives insisted on learning “the proper terms” and not the “baby language” as they felt it affected their ability to interact authoritatively with other forum members. This is an important lesson for other engagements.

In the Crocodile catchment, the theory of change (the three hypotheses referred to above) and evidence from the Rietspruit experience in 2009/2010 were put forward at the Crocodile Forum (29 November 2013). The Crocodile Forum, after debate about whether the forum was prepared to replace its then confrontational approach with local government, agreed to experiment with this approach in the form of a working group, called the Crocodile River Green Drop Support Campaign. There have been a number of presentations and report backs at Crocodile Forum.

The first CGDSC dialogue took place in January 2014, with the seventh in February 2015. The campaign met approximately every two months (sometimes more often, other times less). Attendance grew with each meeting. It involved most relevant stakeholders: TSB Sugar, the White River Irrigation Board, manganese mines and industries, Mbombela frontline staff, IUCMA water quality team, DWS Green Drop staff (national and regional), the South Cape farmers Association, Rhodes and Wits University researchers, and all four municipalities, with senior managers from two out of four. The initiative was strongly supported by the Crocodile Forum chairperson, Mr Theo Dormehl. An exception was the Mpumalanga Water Caucus, a civil society formation, which did not regularly attend because they considered the Blue Drop more interesting to the communities where many people still don’t have clean drinking water (December Ndlovu, informal communication May 2014). This was in contrast with the Upper Vaal experience, and points to the relative importance that communities ascribe to wastewater vs. drinking water quality.

The municipalities own the WWTW and play a crucial role. The specific approach the campaign followed was to work from the ground up, by first inviting the frontline staff. The theory (developed in Rietspruit in 2009/10) was that the frontline staff (1) were interested in their jobs and could do them well under different circumstances (2) needed help from the broader community including national structures and (3) good relationships between frontline staff, civil society and other water users would lead to solutions, instead of the current hostility.

In the first meeting the group responded by agreeing on the following approach or principles, after broad discussions:

- Understand each individual WWTW and its challenges. Understand Green Drop requirements in relation to the individual works (GDIP and W_2RAP);
- Know and support the frontline staff;
- Collective empowerment at process controllers' level so that they can support each other;
- Develop healthy challenges between municipalities;
- Understand the dynamics in the municipalities and get ward councillors on board;
- Work with the willing, attract the unwilling, look for sticks for the unwilling – in Berg River, farmers were affected economically and made a strong lobby group. Patience with local government may run out. Media can be used as a stick (Name and Shame).
- Use tools from regulations, and pressure from central government;
- Approach rapid response unit for financial needs;
- Encourage industry and civil society to adopt a neighbouring Wastewater treatment works.

In both the Rietspruit and Crocodile cases, participants were driven by the urgency of the problem. Skilled facilitation to steer away from confrontation towards building understanding was important. Agreeing on principles consolidated the shift from a confrontational to a co-operative approach. Both the facilitation and the agreement on rules should be taken into account in replication of this approach.

Step 3: Get to know WWTW and operators' challenges

The intention of step 3 is to develop an on the ground (as opposed to on paper) working knowledge of the WWTW and their challenges – as well as to create an atmosphere of trust in which the operators of the WWTW would feel safe enough to share their problems and frustrations. In the Rietspruit, the first part was easy because only three WWTW were involved, at relatively close proximity to each other. Site visits were combined with working group meetings. In the Crocodile, there were 17 WWTW, and they were widely spread out (see map 4). However, the CGDSC participants had wide knowledge of the works, including the IUCMA who carry out regular inspections in the area, and compiled a comprehensive report on WWTW (IUCMA 2014).

Creating a safe space in which to discuss the real obstacles to Green Drop improvements was gradually achieved as more municipal staff joined in the discussion, and became more

frank and open about their experiences. Guided by the Chatham House Rule, which creates a safe space by protecting the confidentiality of participants' contributions, the minutes were kept without references to participants' names. Initially there was certain nervousness from municipal employees, but this disappeared over time as the group identity grew stronger.

Some WWTW were visited, e.g. the nearby White River works, a topic of much discussion; as well as works in Nkomazi. The lessons from this are that (1) there may be varying levels of technical knowledge as well as familiarity with the WWTW, and (2) the logistical feasibility of visiting various WWTW must be taken into account. The campaign eventually decided to create a subcommittee for each of the four WWTW, which could also assist in meeting this challenge (as the WWTW would now be divided into four areas). It is not clear, at the time of writing, whether these subcommittees were successful.

The IUCMA compiled a detailed report on all the WWTW in the IUCMA, which created an authoritative reference and basis for future action (IUCMA 2014). That type of support from the CMA is a replicable element in the constellation around the Green Drop. It was possible for IUCMA to prepare the report because of its active involvement in regulation of the WWTW. In the Rietspruit, Upper Vaal case, Rand Water had played a similar strong role (albeit without having the mandate of the IUCMA), guaranteeing the continuous flow and integrity of water quality information, undertaking capacity building in meetings, for example, explaining water quality monitoring data in an understandable way and answering questions to encourage participation. This researcher has observed similar functions carried out by IUCMA staff in Upper Komati and Lower Komati forums. This type of support is crucial.

The CGDSC dialogues soon arrived at the main problem: a disconnect between the WWTW and frontline staff, and local government's top triangle: municipal manager, technical manager and finance manager. Staff would be held responsible for Green Drop performance, then not get budget or support, then do badly, then be held responsible by top management. This was very frustrating and not working.

Again, this mirrored the experience in the Upper Vaal, where the core finding was that the municipality did not take proper care of their WWTW and their staff. The group proposed two approaches:

1. To involve national departments, with regulatory, fiduciary or other responsibilities that may enable or entitle them to intervene in the situation, "from the top", and
2. To create four local teams to interact with each of the four local municipalities.

The group thus naturally progressed to Step 4. We can also draw the conclusion that the first

steps are logical and replicable in other places.

Step 4: Use Green Drop inspection process for analysis. Bring in national support. This step is focused on testing current performance against the Green Drop criteria. How is the Green Drop process going, which criteria were met, and which were not met, and why? In the process, it starts a process of building a detailed understanding of the WWTW/local government interface: what is the nature of municipal support (or lack of support) for WWTW?

A core assumption of the GDSC is that the regular Green Drop assessments create a situation in which pressure is brought to bear on local government to do well, and as a result municipalities would welcome support at this particular time.

Step 4 therefore starts with exploring the readiness of municipal WWTW for assessment or inspection. It can gauge the situation from previous reports. This was a valid assumption in the Rietspruit in 2010. Moreover, the staff from the three WWTW in the Rietspruit was perfectly prepared to share their information with the working group, identify challenges and look for solutions together.

However, in the Crocodile the situation for Step 4 was complicated by the fact that the DWS had decided not to release the overall Green Drop results, but to only give each municipality their own results. It was therefore the prerogative of the municipalities to share their results or not. Moreover, local government elections were due in 2016, and it may be that political leaderships wanted to avoid any possible embarrassment about less than adequate performance.

In these circumstances, the CGDSC has at times been at a loss at how to proceed. The one factor was the difficulty to engage local government managers (municipal, finance and technical managers) in the process. When one of them did attend a GDSC meeting, there was heated debate following his assertion that the Green Drop simply is not a priority, since there are many other more important and urgent things for municipalities to do, since high level managers are typically overwhelmed by the demands on them, and that, in the final analysis, politicians (the councilors) will always invest in improvements that are visible to their constituents, like roads, clinics, schools and streetlights … and not in WWTW.

The other factor was the delay in starting the Green Drop assessments, from the first quarter of 2015 to the first quarter of 2016, in other words by a full year. Adding to this the fact that

the previous Green Drop reports have still not been released to the public, this created uncertainty about the seriousness with which DWS views the Green Drop itself. A leading figure in the DWS Green Drop unit also resigned, creating further uncertainty. Her successor later explained (informal communication, Acting Director, DWS 30 July 2015) that the delay was the result of a redesign of the terms of reference for the assessments to include not only the Green and Blue Drops, but also the new No Drop, a measure of success of water conservation and demand management.

Assessments meant for the first quarter of 2015 were pushed out to what now looks like the first quarter of 2016. A 30 July meeting in Mbombela, organised by Green Drop unit in DWS national, with support from DWS province, provided a vision of a 10 year horizon for the Green Drop, and information about criteria and assessments. It is only logical, but it needs to be pointed out that the GDSC is crucially dependent on the integrity of, and departmental support for, the Green Drop assessments, and the public release of the results. This is clearly a factor that needs to be kept in mind in considering replication.

Step 5: Co-develop solutions. Use a variety of tactics

While Step 4 is strongly diagnostic, which is enabled by the Green Drop framework, Step 5 is where change is actually brought about and/or theories of change are tested. In this phase, participants co-develop solutions within the principles laid down (by themselves) at the outset, and see how they can be developed. A wide range of tactics can be used, including close engagement with local government, small circle engagement in problem areas (for example focusing on a single WWTW or municipality). It could include publicity, although this may run the risk of threatening the trust that has been built up. An interesting option is to “borrow the power” of other actors, in particular the relevant national government departments.

Step 5 was not fully explored in the Rietspruit case, as the WWTW were handed over into the care of Rand Water. This effectively suspended the campaign. If followed to its logical conclusion, this option would remove WWTW from local government and hand them over to water boards, and in the process also remove the option of constituent pressure on local government. It is not clear to the researchers whether this is constitutional, but SALGA warned in an interview that pursuing this option would be met with stiff resistance from organized local government (William Moraka, SALGA, interview 31 March 2015).

Responding to the option to engage with national departments to “borrow their power”, and create a local interface, the research team undertook a series of interviews with AWARD,

Treasury, DWS, COGTA, MISA and Public Works. An important aspect was to understand what power these departments could exercise over local governments in terms of the Green Drop issues, and under what circumstances they would wield such power. In co-operation with a well-established research and development NGO, AWARD (Association for Water and Rural Development), the Rhodes team undertook a number of interviews with national government departments which revealed the following institutional and political landscape:

- Treasury is reluctant to intervene. Since its focus is on money flows, the quality of the effluent and other technical parameters are not visible to these officials. However, they have taken a keen interest in Green Drop developments, from a “value for money” perspective. It may be possible to involve them more immediately.
- The Department of Co-operative Governance and Traditional Authorities (COGTA) has undertaken a “Back to Basics” programme, which holds the promise to motivate better performance of WWTW. However, it was noticeable in interviews with Municipal Infrastructure Support Agency (MISA), a supporting agency within COGTA that interventions in municipalities can only happen when welcomed by the municipalities.
- DWS arguably has the most responsibility and opportunity to intervene. In theory, the Green Drop scheme does not replace the day-to-day compliance monitoring, and could itself trigger pre-directives, and court action (against poorest non-performing municipalities). In practice, this is limited by the number of officials on the ground, and the fact that the Green Drop programme competes with other tasks on their agenda. DWS officials pointed out that a number of directives have been issued against municipalities, and have produced results. In addition, DWS has embarked on a Municipal Services Strategic Assessment (MuSSA) programme, in which municipalities self-report in a number of risk areas, including Wastewater treatment.

The picture that emerged from interviews is that all the national departments are bound by the constitutional autonomy of local government, which (1) is an equal sphere of government and (2) has the right (or is designed) to earn income from providing water and electricity services, which it defends jealously.

In the Crocodile, this is where the campaign is currently:

1. Pursuing direct improvements in Green Drop scores, through workshops, training and direct help.
2. Doing this in a way that builds local capacity and connectedness so that it becomes sustainable, and that there is a healthy relationship between civil society and local government.
3. Bringing in national attention and expertise to deal with bigger issues such as ring-

fencing, corruption, municipal priorities, the contradiction between municipal disregard and the national importance of water resources. Here the role of organisations such as SALGA is important, and there are dedicated programmes in national departments to deal with the (array of) local government challenges. In its implementation plan for the National Water Resources Strategy 2, SALGA has prioritised the Green, Blue and No Drop programmes.

Step 6: Publicise and acknowledge. Sustainability

Step 6 is predicated on success in improving municipalities' Green Drop scores, which the campaign has not yet achieved. It contains the idea that municipalities and others that produce such success should be acknowledged as a way of also inspiring others, bringing visibility to WWTW and earning the Green Drop a place among municipal priorities.
At this stage it would be important to analyse the reasons for such success as may be achieved, and to ensure sustainability, while folding the work of the working group back into the sub-catchment forum.

The GDSC idea, while still in progress, has been shared with the water sector at a number of presentations including WISA, Integrated Water Quality Management Strategy, WAT-Indaba, The New Paradigm & other WRC reference groups, working with IUCMA, Crocodile Forum and the Kingfisher project. It is one of a number of attempts to deal with this “wicked” problem (Rittel and Webber 1973).

However, it has not been taken to the broader public through the media. The tactical decision would be to either succeed and then broadcast the success, or turn to the media when no other measures are working. Instead, the media is monitored for attention to Green Drop related incidents and how they are covered.

Step 7: Ensure sustainability and replicate more broadly

The final step would be to move to a replication. There are discussions about using this approach elsewhere, e.g. in the Olifants and in Upper Komati.

Chapter 5: THE CROCODILE GREEN DROP SUPPORT CAMPAIGN AS A COMMUNITY OF PRACTICE

The core of this chapter seeks to understand the internal dynamics of the GDSC by applying the concept of a Community of Practice to the seven dialogues held between Jan 2014 and Feb 2015, the impacts on the participants and the actions that flowed from there.

5.1 Introduction to communities of practice

A community of practice is an old concept but the term itself is relatively recent. It has come to provide a worthwhile perspective on knowing and learning. Jean Lave and Etienne Wenger used it to understand how learning occurs as situated co-participation that is more about a social process than a cognitive one (Lindley, 2014). One of Wenger's earlier definitions of communities of practice speaks of this social nature or "structure" where people, who are of the same interest of topic or activity, interact with one another frequently around this topic or activity, to improve knowledge and skills (Wenger, 2006). A later definition proposes that communities of practice are "formed by people who engage in a process of collective learning in a shared domain of human endeavour" (Wenger, 2006). In their book *Cultivating Communities of Practice*, Wenger, McDermott and Snyder (2002) describe these communities as being made up of people who meet on a regular basis because they value the collaborative sharing of ideas, challenges, and attempting to find solutions. In the process they develop new knowledge that is both tacit and explicit, new ways of doing things, new tools, and stronger relations between themselves.

According to Wenger, there are some characteristics that are critical for a community of practice to form. One of the critical characteristics is that there must be a shared **domain** of interest. A community of practice is not merely a social gathering of friends or even a shared network between people. There is a commitment to and a shared competence with regards to the domain. This may mean that the expertise in the domain will not necessarily be recognised outside of the domain.

A sense of **community** is the second characteristic. Members of this community share information, help each other, build relationships and learn from each other as a result of the strength of these networks. However, it is a point to note that members may not necessarily work together, or be in the same geographic area.

It is instructive that it is called a community of **practice** and not merely interest. And so, the

third characteristic is that members of this community are practitioners. They develop shared resources like experiences, tools, stories and the like, which can be construed as a shared practice. This, however, takes time and sustained interaction.

Lastly, as the community's members are developing competence and defining a domain of interest, they are forming an **identity**. This constant interaction and learning supports the growth of an individual's identity of who they are, including their relationship to that community (Lindley, 2014).

It is important to remember that another of the characteristics of communities of practice is that learning can be a reason to come together or it could be an unintended consequence of the community's interaction.

Communities of practice have been around for as long as people have learned together and so we know them intuitively as learning networks, clubs or a variety of groups. They are labelled differently depending on the need. Wenger describes that they are "everywhere"; a familiar phenomenon. However, when they are identified they can become powerful tools that help us understand our world better.

5.2 Research questions and objectives

Can dialogue, social learning in a community of practice formed from diverse stakeholders, practical co-operation and a better understanding of the position of WWTWs frontline staff as well as the responsible municipalities lead to improvement in Green Drop scores and performance?

The research was aimed at answering this crucial question by consolidating the lessons learnt in 2014 and early 2015, when seven dialogues took place in the form of the "Crocodile (East) Catchment Green Drop Support Campaign", between stakeholders in the Crocodile catchment, in the Inkomati Usuthu Water Management Area, comprising industry, local municipalities, water quality regulators and members of civil society. The support campaign is aimed at improving the performance of the WWTWs of the four municipalities in the Crocodile catchment, through a collaborative engagement and development of a community of practice.

However, as a result of the delay of the 2015 Green Drop Assessment, the aforementioned, fundamental question could not be answered. This chapter focuses on the following question: *Can we claim that the GDSC, via the dialogues (and possibly other activities) functioned as a Community of Practice?*

5.3 Methodology

This chapter is based on nine telephonic interviews were conducted with people who participated in the Green Drop Support Campaign, over a period of approximately three months, as well as minutes of the February 2015 Green Drop Support Campaign meeting, and the 2014 minutes of six Green Drop Support Campaign meetings. The research team then met for an analytic consideration of the material, before final writing up.

5.4 Presenting the key concepts of communities of practice

This section presents the data based on the analytical process. Each of the key concepts of communities of practice as described in section 5.1 is presented with the aid of sub-categories that were used to analyse the data. The presentation of this data uses the method of thick description to create the narrative that is used below.

a. Domain:

i) *Expected outcome:*

The expectations of outcomes of the GDSC largely coincided amongst respondents. The following sentiments were specifically recorded to help illuminate particular respondents' thinking. The expected outcomes were:

- "Success in terms of attendance, urgency to improve the Green Drop performance and to raise awareness about the importance of the entire Green Drop programme."
- "No one expected all the problems to be solved and there was no expectation that there would be a vastly improved Green Drop score. However, there was expectation that there would be fact-finding and a declaration that there was a problem which needed solving."
- "To raise awareness with top management like the CFO. The GDSC needed the full support from top management because much of the issues pertaining to the WWTWs are budgetary in nature."
- "To improve the Green Drop score of the municipality through support and help with regards to the Green Drop criteria. They looked at how to improve that Green Drop score for municipalities."
- "That all plants meet all requirements as per the DWS and so are accountable to all standards set." The respondent also expects that staff is happy.
- "To understand the challenges of WWTWs of the municipalities as well as assist with any capacity constraints that they may have."

- “A commitment from role players, especially of the municipalities.” The respondent suggested, in no uncertain terms that, there was no point in pursuing the Green Drop if there was no commitment from Water Service Authorities. In her opinion, there was one goal: improvement of water resources.
- “Improved municipalities with regards to Green Drop. It was to ensure that municipalities were ready for the assessment and to support the municipalities in this regard.”
- “More (better) support from the GDSC.” The respondent expected that the GDSC was going to help her to achieve a better Green Drop score and thus enable the WWTWs to meet DWS requirements
- “To obtain support of the Campaign and high level municipal authorities; and to see improvements after the GDSC was completed.”

ii) *Frequency of meetings*

Frequency of meetings, as an indicator of a strong domain, was a key component of this concept to analyse. It seems, according to the data collected, that respondents are divided about the frequency of meetings.

One respondent described the frequency of meetings as “fine”. The respondent said that more meetings would not have been more effective. Another respondent said that the frequency of the group meetings should be dependent on what needs to be done and how it is done, i.e. if the meetings are productive, then once per month is sufficient. However, she did qualify this by saying that, “If the GDSC rehashes the agenda then one meeting in 10 years is too many”. All in all, the respondent was not unhappy with the frequency. Reflecting a similar sentiment, another respondent said that the frequency of meetings is ok. This is because she felt that “you don't want to meet unless there is feedback.” Also, it is the respondent’s view that municipalities do not deliver on tasks given to them anyway. The respondent does not want a “talk show”.

One respondent had an alternative view and so felt that there should be more meetings otherwise there is a sense of losing momentum. And if the meetings are too far apart, then, the meeting spends a lot of time revising and reminding its participants of the last meeting.

Then, a couple of respondents linked meetings with a factor of time or availability of others:

- The respondent said that the frequency of meetings was fine. It was aligned to the availability of others.

- The frequency, which was once in two months, was ok considering the commitments of those involved. She felt that the GDSC could not meet monthly because of these commitments.
- The frequency of group meetings, according to the respondent, is not enough. She did mention that people are busy though. It would be good to have more so that people had more time to work through problems in a simpler manner. She also suggested that site meetings would've been invaluable. These are practical, and if you can see what the problem is, issues become "more powerful" and "more effective".

One respondent felt that meeting frequency was good and so no more was needed. While another could not recall the frequency of meetings but said that the group was committed.

iii) *Common interest*

Closely aligned with section i, this section seeks to establish links into the domain. Despite the professional diversity within the group, it seems as though a common interest was shared, which means that a domain was established. The sentiments revolved around resource protection and quality management. The following are some of the common interests expressed by respondents:

- Sharing problems
- Highlight the pollution
- To ensure that everyone is on-board to work together to protect the environment; that they are aware of problems and then come up with solutions, because our water resources are stressed
- Water resource protection
- Get a good sCOPe of the Mpumalanga municipalities. Everyone wanted to improve, get a good score and have a plant that meets DWS standards
- To improve the current situation which is water quality
- Achievement of Green Drop
- To see change

iv) *Perspectives*

Wenger et al. (2002), share seven principles that are at the heart of cultivating a successful COP. One of these is the encouragement of open dialogue between outside and inside perspectives. The following data was collected to get a sense of the nature of this interaction. However, it must be noted that the interview questions did not probe for the interaction of outside perspectives.

According to a respondent, people were generally tolerant of others' perspectives. Hearing the grass-roots perspectives helped facilitate understanding. It helped "open people's eyes; see a new point of view." Another respondent felt that everyone's opinion was valued; all were respected and everyone was open to new ideas. Then, another respondent said that the group was committed and open to others' suggestions. The group were not "pulling to the right or to the left" but everyone was engaged and integrated so that the group could come up with solutions.

Then, two respondents suggested slightly contrary perspectives. One respondent felt intimidated by fellow participants at first – she "couldn't deal with big, educated people" – but then, over time, came to see that her opinion was valued. The other respondent felt that there was no immediate agreement and that in some instances there was agreement to disagree.

b. Community:

i) Relationships – before and after

Members of a COP build relationships that enable them to learn from each other. The relationships between the GDSC participants were explored as well as an understanding if learning was enabled as a result these strengthen relationships. The researcher deemed it prudent to understand the change in relationships, if at all, because of the GDSC interaction.

The data reveals that the majority of respondents have better relationships after the GDSC interaction than before. There were a couple, however, who experienced little or no change. Some of these insights are highlighted in the thick description described below:

The respondent now has good relations with people. They recognize each other and now these plant workers even call to ask for help as there is no municipal management support. The respondent suggested that the municipality should also get to know their staff better in a similar informal, one-on-one manner. The respondent described the relationship with group members before the GDSC was formed as respectful. This was because she had interaction with them in different forums in other circumstances. The relationships were good but the respondent was also interested in meeting new players.

After the formation of the GDSC, the respondent's knowledge of new role players expanded and included them. The respondent was already working with GDSC participants either through the Crocodile River Catchment Forum working group or historically as a DWS official

working with Green and Blue Drop programmes. So, these people were not unfamiliar to her. Therefore the relationships stayed the same as they were already there.

Relationships are now on a friendship level. People exchange cell numbers as friends. She also explained how before the GDSC meetings, the IUCMA were perceived as “police” but because of the opportunity to interact with them on a more lighter note, she understood that they were just doing their job.

The respondent felt that it was easy for people to judge if they don't know you. But the GDSC platform provided a place for engagement, which then allowed people to realize who she was.
Relationships strengthened after people began to meet as the GDSC. There was more understanding and people believed in and trusted one another. Now, after the GDSC, her relationships have improved. She feels as though she is part of a family where her problem is another’s’ problem, i.e. there is a shared burden. And there is a greater understanding.

Before meeting in the GDSC she had good relationships with the Crocodile Catchment Forum and so the GDSC meetings did not help her improve on those relationships.

Lastly, the following excerpt is a delightful account of how this community seemed to strengthen people’s relationships:

The respondent described one relationship that helped highlight her answer to the question. She spoke of a senior government official as an old school friend she had known some time ago, who she then reconnected with at a past Green Drop Assessment session. During this Assessment, the respondent felt “reserved” because she perceived the government official to be this “big DWS person” now. It was only during the GDSC meetings that the respondent was able to see the government official as she really was: the same person she had known at school! This made a big impact on the respondent.

ii) *Did these relationships enable this learning?*
Despite the evidence that proves that learning did occur, questions do arise, including: what kind of learning took place and will this learning enable practice that helps the practitioners move closer to their goal of water resource protection and quality management? Some of this learning is captured in the narrative below.

The respondent learnt that the plant workers know more than he expected they would know.

He realized that some of them are good artisans. He learnt that whatever energy there was is now lost and so must be reactivated and guided properly. He learnt that there is a lack of interest and motivation of municipal management.

The respondent admitted that while there seemed to be more talking than getting things done, there was now greater knowledge about what the problems are. There also seems to be a greater commitment and empowering of members to do something. The respondent committed to continuing to address issues.

The respondent is applying this new learning in the following manner: the respondent learned despite the White River WWTW being “10x worse” than all other WWTWs the Irrigation Board continued with a strategy of constructive engagement, never resorting to militancy. However, they now realize that they need to engage with more senior members of the municipality to get results.
The respondent learnt that if they work together, they will be able to share ideas and come to solutions that will benefit everyone. Different stakeholders helped open eyes because the information that they shared helped people realise that they were sharing common problems.

The respondent began by saying that “in a group of different people with different backgrounds, you are bound to learn something.” She then went on to say that as a regulator you are often seen to be harsh with the front-line people. However, she has learnt that these people know what to do but just don't have the support needed to do their jobs. For example, they may know that chemicals are needed for the plant but they don't have those chemicals nor the money to buy them so the water is released, untreated, into the rivers. These things are beyond their control. She summed her point up by saying that, “they know what needs to be done but the enabling conditions are not there.”

The respondent did learn. She learnt that one should not judge people before you know them. She illustrated this by explaining how when she first met Dr Victor Munnik, she was reserved; intimidated by his title. However, she soon realized that he was down-to-earth and valued her opinion. The respondent learnt who the responsible people were and thus who to connect with if a problem needed to be solved.

The respondent did learn. She learned that you need to be a good listener. You need to understand each person’s situations or stories to understand what they are going through
The respondent learnt a lot from others. She learnt not to judge people. She also learnt how

others analyse problems and how to apply solutions. She mentioned that there was a transfer of learning and experience from specialists.

c. Practice:

i) *Problems*

A community of practice is not merely a community of interest. Members of a community of practice are practitioners. They develop a shared repertoire of resources: experiences, stories, tools, and ways of addressing recurring problems— in short, a shared practice.

The problems that occur in the GDSC seem to be repetitive and complex. They coalesce around the following themes:

- Budget/finance
    - There is not enough budget, or the budget is not ring-fenced, so it is shifted without consultation or communication
- Equipment
    - There is no equipment or it does not function correctly; there are no chemicals to treat the water sufficiently; old plants that cannot handle current capacity
- Support
    - There is a lack of support from both local municipalities' senior management and from the DWS. This is highlighted in the following explanations from respondents: hidden agendas of municipal management; feeling of fear that plant workers feel about their municipal bosses; "how do you have a support campaign if you don't know when the assessment is happening?"; the integrity of the Programme has been comprised by the DWS by not releasing the reports on time; lack of attendance at the GDSC by municipal authorities
- Qualified staff
    - Staff is poorly recruited or there are no qualified staff to perform appropriate functions.

ii) Solutions

Much like the problems, the solutions offered were coalesced around a few major themes:

- Ring-fence the budget;
- Stimulate Municipal attendance through targeted lobbying and/or pressure;
- Involve COGTA and SALGA
- Share good practice: between WWTWs and between WWTWs and private sector

- Educate Councillors, Municipal Managers and the CFO about the Green Drop Programme.
- On site education sessions with Municipal Managers so that they have a “finger on the pulse” of the WWTW.

Apart from these ideas, the following suggestions were also presented by a couple of respondents:

One respondent suggested the following to the group as a solution to some of the challenges: the group should form separate groups to assist the different municipalities. Whereas the group only wanted to support one or two municipalities, the respondent felt that looking at the entire catchment – by quaternary catchment – one could get a better sense of all the WWTWs in the catchment. She suggested that the group involve SALGA and COGTA and DWS (provincial). Then, each group, together with the partners, would go to each municipality to present the challenges and to show them ways to improve. But, it would be important to talk to the decision makers and then compile a proposal to assist them with their work.

Another respondent suggested that because the right connections were made with the right people, solutions to problems were found in a quicker manner.

One respondent said that in terms of moving the baseline, nothing much has happened there at all, and so one could say that the GDSC failed. If the process controllers have skills, experience and resources and support, then things will change.

The respondent made a suggestion: use specialized task teams to liaise with the DWS in order to facilitate getting things done.

Lastly, one respondent shared this wonderful solution she had picked up and so shared with the group: if you don't get what you want, nag management, i.e. “be a mosquito in their ears!” She told a story that highlighted this point: senior management didn't want to help her buy equipment that was urgently needed for the plant. So she threatened to close the plant down and then give the community the Director’s cell number. Two days later she had the equipment!

d. Identity:

Wenger highlights the development of an identity, as a way of talking about how this learning

supports the growth of an individual's identity of who they are, as well as in relation to that community.

Many respondents felt that they had made some contribution to the GDSC. These perspectives are shared below:

The respondent saw himself as an independent engineer who uses platforms to market himself to get work. But when he is not busy, he uses the platform to help improve the river status.

Another respondent saw herself as a small player with not much to contribute.

A respondent saw herself as a contributor who was glad to be part of the team. She also helped find information that was requested by the group, like an operations manual for a plant.

The respondent saw herself as someone who provided insight in terms of what is needed, e.g. she gave insight into WWTWs risk abatement plans. She also availed herself to help with the whole Green Drop Certification process because that is where her experience lies.

One respondent saw herself as someone who made others aware of the challenges that municipalities face. She related how surprised a local sugar producer representative was when she told the meeting of the municipal finance woes. This, she said, big corporations don't think about as they have the money.

The respondent saw himself as a contributor and an Interested and Affected Party (I&AP).

The respondent saw herself as outspoken. In the group, she felt she was a good influence. She conveyed messages in a way that people understood. She perceives herself to have been "an influencer in making things happen". The respondent also described how, if she gets a no, she accepts it and moves on because she recognizes that everyone is different. The respondent wanted to share her experience, knowledge and skill for people to get a vision.

The respondent felt that she was a support to others and was a contributor of information Another respondent felt that she was a person who contributed; who suggested new ideas and analytical thinking. She also felt that she added assistance in terms of sharing

experience.

e. Change:

This “sub-category” of communities of practice emerged as a way to assess whether the social learning that is communities of practice has learning, in this instance, that is active, in that the “learner is encouraged to investigate the world, find out about it with others, and engage in collaborative reflections and change orientated actions.” (United Nations Environment Programme, 2006, p.28)

One respondent said that “this mutual understanding of each other has not led to change.” This respondent’s explanation of changes is an interesting one that is filled with different thought processes that may or may not relate to her way of practice. It also highlights that in some ways learning has altered her behaviour, and in other ways not. The respondent’s role is compliance monitoring, which means that she exercises “zero tolerance” in circumstances where other colleagues would try to *understand* issues. For example, she says that Mbombela says that she is “over-policing” because they are constantly non-compliant. The person who operates the pump knows what must be done but the municipal supply chain is holding the procurement process up. The respondent maintains, however, that she will not entertain this as a reason not to be compliant. She does admit, however, that she now issues a directive to the municipal manager as head of the responsible municipality and not to the front-line person. So while she intimated that her practice has not changed from being “zero tolerant”, she strongly suggested that her practice has changed in that she takes action against the municipal manager now and not the person on the ground. This is because the municipal manager does not make it possible to empower, for example: not employing a service provider to fix malfunctioning systems in the municipality such as pump stations. The municipal manager is not providing resources to enable people (front-line) to do their job.

The respondent who spoke of being a “mosquito in their ears” is applying the “mosquito” principle on a daily basis. Learning this new practice has changed the way she works. This is because she now feels that it is not enough to simply feel satisfied that she wrote a purchase order even though it later gets thrown away, but now she follows up on that purchase order. To confirm this she reiterated that she is a “mosquito” and so she follows up.

One respondent does not see his practice changed as he didn't expect a change. From his perspective, he was merely helping.

Another respondent exercises learning by engaging with her clients with an attitude of listening and/or paying attention so that she comes out of that engagement with a lot of

knowledge.

A respondent suggested that would like to share her learnings with her community. In fact, she suggested that we share this learning with other forums or conferences to take the learning forward. She said that we need to “light the candle and make it a big fire till the end.” The respondent is trying to apply learning to her current role but there are “hiccups” so she felt that she needed the help of a workshop to help her apply this learning.

Another respondent’s practice has changed in that the way she sees things has changed. She has more of an attitude of, “you can do better”.

One respondent felt that she had come away feeling changed. She feels somehow different. She said that you think about where you come from and you think about working as a team. The respondent isn’t being able to change practice as he is not directly exposed to WWTW on a daily basis.

The Irrigation Board has changed its practice by engaging with the IUCMA and Mbombela to address these issues at more senior level. Moreover, the respondent has advised her Board that more senior members of municipalities must be addressed in future.

The respondent is not applying this learning directly but certainly in an indirect manner as he goes about general Wastewater management and stakeholder engagement.

5.5 Deepening understanding of key concepts in their application to GDSC

In this section the data spanning the interviews will be discussed, thereby addressing the question directly:

- *Can we claim that the GDSC, via the dialogues (and possibly other activities) functioned as a Community of Practice?*

To enable the discussion of data contained within section 5, the data has been condensed into four analytical statements (Bassey, 1999), which synthesize the data to enable a discussion in relation to the research question. In addition to using the data, this section will also draw on contextual and theoretical reviews. This iterative process of analysis and data testing engenders confidence and trustworthiness in the analytical statements (Bassey, 1999), and is congruent with abductive inferences as discussed in section 3.

Analytical statement 1:

The domain is established but the community seems 'fast'

The "expected outcomes" and "common interest" of the respondents highlights the fact that the domain is established in that it has "an identity defined by a shared domain of interest." (Wenger, 2006, p. 1). Generally the meeting frequency was deemed "fine" but was it good enough for a COP to form?

There is an implicit message that people were busy and that meeting more regularly would not be possible. In Roberts (2006), there is a discussion of how the current era of conducting business is driven by an "adoption of acceleration" (p. 632) driven by technology, competition and increased complexity. According to Roberts (2006), this acceleration of conducting business may create "fast communities" which may hinder the ability to establish proper COPs. Roberts (2006) questions how developing trust and mutual understanding – both of which are required for a community of practice – can be achieved in a "fast community", when they are developed over a period of time. This COP is a working group of a CMF, which lends it two characteristics – over the short term, the group may meet and dissolve as short term objectives are achieved (or not), and over the longer term, interaction in the CMF may continue between these "active catchment citizens".

Analytical statement 2:

Relationships are strengthened by the GDSC but do the relationships themselves enable learning?

It is evident that people have changed some behaviour as a result of learning; and it is evident that some relationships have strengthened. However, is there a proportional relationship between the strengthening of the relationships and learning? Have the relationships in this group have been the conduit for this learning, or whether we are witnessing a coming together of previous knowledge? It seems clear that participants have learnt about each other, have a new appreciation for each other's' knowledge and feel that they understand the overall situation.

Analytical statement 3:

People share stories of practice that exhibit problem narrative but are lacking in solutions that exhibit innovation

The 'problems' are a collection of stories, often epitomized by the provision of examples. These 'problems' originate from people's lived experiences and so, from them, the group could craft tools that could enable change. Forming a component of these 'tools' are the solution ideas. However, one can see that either people could not recall varied stories of

solutions or innovative solutions are lacking. This latter point talks to Robert's (2006) idea of how communities of practice may support the accumulation of incremental knowledge but reduce sCOPe for radical innovation (p. 630). So while the *theoretical* purpose of the COP is to catalyse the emergence of better practice, it seems that stories of problems rather than ideas for solutions are more top of mind and so are expressed in reality. However, this argument is based solely on the analysis of the interviews with GDSC participants and **not** on data gathered in the GDSC meetings. The meetings themselves, as remarked in Chapter I, did lead to two strategies: (1) to work directly with the four municipalities in local working group, which seemed difficult to implement, and (2) to "borrow power" from national departments, a process that will be underway until the Green Drop inspections are concluded. These could be argued to present solution oriented thinking. Also, there have been many attempts to deal with dysfunctional WWTW, with very little result, so it may be unfair to expect a radical new solution from this group.

To conclude, one could also argue that the problem narrative is an expression of two particular characteristics of a COP, viz. a shared repertoire and/or a shared discourse reflecting a certain perspective of the world (Roberts, 2006). Therefore, while it may be true that problems, rather than innovation, may be more easily forthcoming, this may be indicative of a COP who shares a similar discourse or repertoire of stories.

Analytical statement 4:

The Participants' identity seems to exhibit individualism which may inhibit the formation of a true community of practice

The data reflects an interesting finding: most of the sentiments expressed are from the perspective of I – an individualistic perspective that may be influenced by the socio-cultural context within which our contemporary society is embedded (Roberts, 2006). Can an individualistic perspective pave the way for a *community* of practice? (Lindley, 2013; Roberts, 2006). The answer may lie in the theory of COP, which seems to suggest that the learning prevalent in a COP supports the growth of an individual's identity of who they are, *as well as in relation to that community.* It seems, however, that learning has just strengthened the individuals' identity and not necessarily in relation to that community. Importantly, it must be noted that the researcher did not probe the formation of a catchment citizen type identity which may very well have begun to form within the sub-conscious of the GDSC participants. Further work may be required in this regard.

5.6 Findings and recommendations

The aim of analysis in this chapter, through examining the thinking about the seven dialogues of the GDSC, was to understand whether the GDSC dialogues constituted a community of practice. Drawing from literature in the field of community of practice, the data was discussed in the form of analytical statements. Each key concept of the COP – domain, community, practice and identity – was analysed in relation to the theory that was used. A narrative summary of the key findings of that data follows.

It seems that a COP was formed but the strength of the COP is in doubt. This is because while the characteristics of a COP were evident, i.e. a domain had formed, relationships seemed to have strengthened, learning did occur and some identity was shaped, there was a lack of substance to these characteristics and in two characteristics – change and practice – there seemed to be little evidence to prove that the COP was established and healthy. It is recommended that trust be evaluated within this COP to understand strength of relationship that would facilitate faster/deeper learning pathways.

The doubt about the strength of the COP could be expressed by the following thoughts:

- Would the GDSC group continue meeting without the intervention of the researchers?
- How have relationships enabled learning?
- Has social change occurred due to this learning?
- How embedded is old and changed practice?
- And if there is new practice, how much of the learning associated with this practice is coming back into the group to enable others' practice?

The weakness of the COP will affect rate and depth of change within the community and thus fail in the achievement of improving Green Drop scores and performance. However, the COPs weakness does not negate the opportunity that now exists: develop another intervention that may help achieve this study's primary aim. This point leads the remainder of this study into key recommendations.

Due to the disparate range of backgrounds, people, professions, cultures and paradigms, perhaps a adopting a COP approach did not provide the study with the optimal conceptual framework. It is recommended that either a collective action approach (Du Toit et al., 2013), or a strategic adaptive management approach (Rogers and Luton, 2010) be followed, rather

than a Community of Practice approach. Both of these approaches allow for diverse groupings, key learnings and change actions.

Chapter 6: CONCLUSIONS, GUIDELINES FOR PURSUING A GREEN DROP SUPPORT CAMPAIGN

6.1 Introduction

This research started with the question: "Can dialogue, social learning in a community of practice formed from diverse stakeholders, practical co-operation and a better understanding of the position of WWTWs frontline staff as well as the responsible municipalities, lead to improvement in Green Drop scores and performance?" Due to the circumstances of the research, namely the delay in Green Drop inspections, the main question cannot be answered within the time frame of the research. However, a number of lessons have been learnt in this research. By way of introduction to this chapter, we consider the fate of some assumptions with which this research started.

1. *There is great concern about the dysfunctional WWTW, nationally and locally, in civil society but also in various spheres of government (particularly on national level), and this energy can be harnessed towards solutions and improvements.*
This assumption held true, as witnessed by the level, reach and quality of participation by stakeholders in the Crocodile River catchment, as well as knowledge gained during interviews with national departments. The question, however, of how to best harness this energy remains open, both in the light of the delayed Green Drop inspections, and the sense that national interventions are not yet effective.

2. *Civil society and local government WWTW staff have the ability to develop (much better) working relationships and social trust, in order to work together in a Community of Practice Approach or social learning setting. This can contribute to the development of active citizenship in a participatory democracy, and the strengthening of participation in catchment management.*
Again, this assumption held through the dialogues, but how much it can contribute to active citizenship and catchment management remains to be tested through further action research. The research also found that the COP framework should be replaced by social learning or adaptive management more appropriate to this setting. It is important is to see the GDSC as a longer term intervention that creates LOCAL capacity to deal with the situation on a sustainable basis.

3. *Action or generative research can support the development and testing of strategic options.*

The action or generative research approach lends itself to the “campaign” format, targeting change in a specific situation, and framing it within a strategic analysis, or a theory of change. If change does not happen as predicted, the change theory has to be rejected or adapted. Due to environmental factors, the theory of change has not been tested, and remains open for future research.

The knowledge creation aspect of the GDSC should not be neglected. The campaign setting (the dialogues) was designed to bring various knowledge sets together: local, provincial, and national perspectives and skills, knowledge in the workplace, knowledge as neighbours of WWTW, technical water sector knowledge, knowledge of corporate environmental managers and of government regulators. This is necessary in order to synthesise an understanding of the situation that is many-sided, inclusive and provides a platform for action. The research can also lead to new insights, for example pointing to areas which are part of the phosphates/microbial contamination problem, but not covered in the Green Drop (see final section of this report).

4. *We can learn from this approach and replicate it in other areas.*
The GDSC design has an explicit intention for replicability, as was pointed out in the description of the original Mvula project carried out in the Rietspruit Forum in the Upper Vaal (Munnik, 2010). The discussion of replicability looks specifically at context. Context in catchment management is much more than surrounding issues and landscape. The constellation of institutions, participants, agendas and issues that form the context of a forum, also generate the activities of the forum itself, both in terms of agendas (what the forum wants to do), and what it is able to do. Some participants, such as regulators (IUCMA, DWS regional, DWS national and other departments), bring information and “teeth” to the forum. Others contribute knowledge – local, technical and political knowledge – while others lend it legitimacy, and hold it accountable. The context is therefore a determining influence on the existence and actions of the forum. This aspect is discussed more fully below.

6.2 Context and replicability

The replicability questions are whether there is need for a GDSC, what the requirements are, and what the advantages would be.

Before starting out, organisers should be convinced that there is a clear need for the campaign, which means enough active concern to drive its activities. In general, observation of the public sphere during this project (that is media and civil society groups) has shown

widespread concern. There is also growing awareness of the politically disruptive potential of the issue, for example the close attention of opposition councillors in Nkomazi opposition, and the Bloemhof case of suspected vandalism with a political motive (Tempelhof and Ginster, personal communication July 2015). Wastewater infrastructure, the works as well as the sewer lines, are vulnerable. There is also growing and unequivocal research on the risks of microbial pollution and phosphate eutrophication, which is a national concern.

Replicability has much to do with context, and the resources available within a specific context or situation. For the campaign to succeed, it seems that a specific combination of research, brought to the campaign by involved organisations, is necessary. The building blocks include:

1. Reliable monitoring information, ideally triangulated by different institutions, e.g. Rand Water, DWS and local municipalities in the Rietspruit brought their own monitoring data to the forum working group, where it could be compared.

2. Existing knowledge, in the form of research so that the issues are clearly defined, e.g. in the Crocodile catchment the impacts on water quality are known and can be substantiated. IUCMA 2014 report was a crucial contribution, in terms of information, authority and indicating seriousness in approach. Knowledge should be used to develop a theory of change, and there needs to be agreement on the principles of the approach in the campaign.

3. Knowledgeable participants, often found in CMA or Water Board, universities and researchers, volunteer consultants and industry's environmental managers.

4. The ability to provide capacity building to civil society participants. The capacity building was specific in the Rietspruit, and dispersed, generalised and ongoing in IUCMA area.

5. Ample knowledge within municipal staff. As the Crocodile experience showed, municipal staff had ample knowledge; they were more frustrated with lack of support from senior managers and access to resources than under capacitated, although it is granted that training of some staff is needed. In the Crocodile, Silulamanzi (Sembcorp) had professional staff on the ground who joined the campaign. In the Rietspruit, there were consultants and environmental managers in industry who were willing to act in the public interest.

6. Organised civil society with legitimacy (with constituencies in the different segments of

society, i.e. white and black). In the Rietspruit case, the Vaal Environmental Justice Alliance (VEJA) was a prominent, if not driving force, and both the Mvula Trust and WESSA participated. The disillusioned Save the Vaal Environment (SAVE), which follows a strongly legal, confrontational strategy, did not agree to participate in the Rietspruit campaign. In the Crocodile, the Mpumalanga Water Caucus had limited participation, because, as one participant explained “the Blue Drop is more interesting to us than the Green Drop because many of our people do not have safe drinking water”. This aspect needs further attention as it indicates that civil society, like the majority of voters at local government level, do not view the water cycle as a whole. VEJA, on the other hand, had as one of its founding issues the water quality concerns from industrial pollution in the Vaal.

7. As a working group of an established CMF, the campaign enjoyed legitimacy and accountability through the need to report back regularly.

8. Some openness from local government to co-operate, interest or enthusiasm from local WWTW staff, and space for them to participate. It was clear that working with local government on these issues was tricky. The campaigns built solidarity from the ground up with willing parties, rather than starting from the top where there could be a lack of interest or defensiveness. However, the aim remains to win over the upper echelons of local government through real assistance, encouragement and acknowledgement of any success. The GDSC is designed to allow local government top structures to achieve, to look good, and is not meant as an attack on them. Interaction between local government staff across different municipalities should be encouraged and supported, and some of this happened in the Green Drop space. It needs to be acknowledged that this interaction also happens in other forums, including with support from DWS, SALGA, WISA and other programmes such as the Kingfisher programme, in which the IUCMA is working with the equivalent of Dutch catchment agencies who faced similar water quality problems, and overcame them. The GDSC would do best to find out what these opportunities are and participate in them, and support them.

9. The facilitation of the campaign is important. Facilitation is needed to deal with lack of trust, fears of professional repercussions (for WWTW staff but also for consultants) within local government power structures, and replacing old patterns of blame and confrontation with new patterns of collaboration, listening, building trust and sharing resources. Facilitation needs to be based on social learning or community of practice principles, which include listening skills, facilitation that involve people, small group work instead of lectures and very importantly the Chatham House rule providing for safe space, and anonymity in reporting in

the minutes that are distributed.

10. Publicity needs to be handled carefully. In neither the Rietspruit nor Crocodile campaigns did the campaign use the media. It is in contradiction with the “safe space” and trust building principles, and premature publicity would threaten these. The consensus within the groups – after discussion – was to hold back until success, or utter failure, is achieved. This was not easy to achieve in the Rietspruit, as it meant civil society had to refrain from using one of its strongest “weapons” (compare point 6, above). At the same time, publicity should not be given to hollow successes, as this will compromise civil society constituencies.

11. Visiting the works physically can raise the profile because a root cause of WWTW neglect is their lack of visibility. In the Crocodile it was learnt that spatial spread in a rural area may pose logistical challenges for this, thus a system of “local committees” was proposed.

12. Explore the possibility of creating local structures – subgroups focused on each municipality – within the working group. This has not been tested in full yet.

13. National help and intervention can be very helpful. This includes financial, information and training, as well as strengthening the profile of the campaign.

14. It remains to be tested whether a GDSC in a more resource scarce environment could succeed through different means. The research team is not prepared to discount that challenge for new CMAs.

15. Finally, the Green Drop scheme – which is a dynamic, evolving one – is crucially important in providing a framework that is both technically sound and politically acceptable to all participants. This cannot be underestimated as providing the basis for the campaign. Therefore the continued investment of national government in the Green Drop scheme is important.

6.3 Limitations of the Green Drop Incentive Scheme

This action research was closely based on the Green Drop programme, and thus a number of useful lessons about the Green Drop programme was learnt in the process. The Green Drop is an evolving programme and it therefore makes sense to look at its current limitations.

- The programme does not deal with all sources of phosphate and microbial pollution – even when only municipal sources are considered. While WWTW are important, the sewer system (as the Bloemhof example shows, together with other evidence) is often a source of raw sewage pollution in residential areas as well as into the river. Another important source is informal settlements.
- The programme does not address technology choices particularly in terms of energy intensity. For example, Advanced Algal Ponding Systems are a better climate change solution. Simpler systems more robust to staff ignorance, electricity interruptions etc.
- Feedback from local government that the Green Drop scheme "is continually moving the goal posts" needs to be considered. Green Drop needs to maintain pressure on local government to achieve, which raises questions about the balance between incentive scheme and compliance enforcement
- The programme does not explicitly involve the public or civil society, whereas this research shows that the involvement can make a difference.

6.4 Green Drop Campaigns can strengthen Catchment Management Forums

Apart from dealing with an immediate problem, the intention was also to experiment with what a working group of a Catchment Management Forum is able to achieve, and how it can do so. This research thus intended to also make a practical contribution to the development of robust and able catchment forums through action research. The revitalisation of Catchment Management Forums are currently part of the roll-out of CMAs country wide (Mahasha, 2014; Munnik et al., 2015), so the understanding of the role of working groups in engaging with complex problems is an important investment in the creation of new instruments to address complex problems.

The GDSC as a working group experience could be widely replicated to build the ability of catchment forums to deal with issues of water quality. This may however depend on the stage of maturity of the forum. The expectation is that new forums and new CMAs will be formed, but they may be caught up in initialising activities, such as devising a catchment management strategy.

The GDSC is replicable as a way of building participation in catchment management, so that participants can experience the CMFs as forums where things can be achieved, but then there must be results. Achieving these results does not depend on the campaigns only.

Such replication is closely bound up with the sustainability question. If the practice of the Green Drop Support Campaigns spread as working groups of forums, these working groups can support each other, and this practice can become a norm, rather than a pioneering effort. An effect of upscaling would be to place catchment citizens in a position where they can form effective alliances for collective action with other actors in catchment management. If this GDSC, catchment citizens' collaborative approach, becomes the norm, it can also be integrated into the thinking of the regulator and the rest of the sector, and the advantages of social learning and communities of practice become available. As Chapter 5 shows, the conceptualisation of a working group as a Community of Practice may not be appropriate. The research therefore recommends that the terminology of collective action (see Du Toit et al., 2013) and expansive social learning (Engestrom, 2000) rather be employed.

Chapter 7: RESEARCH RECOMMENDATIONS

The following research recommendations first present research that is immediately required, and then present important potential knowledge contributions that emerge from this study.

7.1 Health, economic and ecosystem impacts of dysfunctional WWTW

The most immediate area of concern is the impact and cost of bacteriological contamination on people's health, particularly direct river water users, including poor people with no access to treated water, farmers who use raw water for productive uses, fisher folk, children who swim in rivers and traditional healers (who baptise in rivers and use river water for mixing medicines).

Diarrhoea is the third biggest killer in South Africa, and children in particular are vulnerable to it. According to a recent NEPAD report, diarrhoea is a major cause of mortality for children under five years, claiming between 65 and 70 children's lives per 1000 births, per year (NEPAD, 2013:48).

A study by Le Roux et al. (2012) in the Upper Olifants catchment – the neighbouring catchment to the Inkomati – found that "extreme levels of faecal pollution could in most instances be traced back to inadequate Wastewater treatment" (Le Roux et al., 2012: 6587). Research done on microbial water quality risks concluded that:

> "… the data show that an individual consuming 100 ml of untreated water from such a water source [i.e. highly contaminated with faecal pollutants] could expect to have up to a 26% chance of falling ill" (from any of the seven pathogens that were monitored in this study). It further notes "Important water-borne pathogens as they may be, these organisms are but a fraction of the total potential pathogen pool expected to occur in poor quality waters, and the true risk water users face would in fact be much higher. Using E coli as an indicator for pathogens, the risk of infection at some sites was calculated to be in the region of 80% based on a single exposure event…" (2012: 6586).

The authors of the microbial water quality risks report conclude that large gains can be achieved by ensuring the proper functioning of a few WWTW within the Upper Olifants River catchment.

Bacteriological contamination is purified by the workings of healthy aquatic ecosystems. The

irony is that ongoing eutrophication weakens river ecosystems, and their ability to deal with bacteriological contamination. This degradation of ecosystems is the second area of impacts. Eutrophication hammers river ecosystems through algal blooms (and other growth stimulated by an excessive supply of the nutrients phosphate and nitrogen), which often results in de-oxygenation, using up all the oxygen. In these episodes, fish and invertebrates choke to death, and the ecosystem structure is gradually impoverished, affecting its ability to recover. There is less active life that can deal with the bacteriological contamination. International research (Zheng and Paul, 2007:7) points out that:

> "Eutrophication, as one of the main causes of stream impairment in the United States, imposes severe threats to ecosystem structure and function. The direct impact of nutrient enrichment is to increase autotrophic production and change species assemblages including proliferation of filamentous algae. Nutrient enrichment also accelerates litter breakdown rates by bacteria and fungi. The dramatic changes at lower trophic levels may also lead to "trophic cascading".

As nutrient concentrations increase and destabilize the primary producer assemblage and water chemistry, macro-invertebrates and fish may shift from sensitive species to more tolerant, often non-native species. Changes in the food web may also cause changes in ecosystem function and further alter stream physical habitat and water chemistry, e.g. decreasing dissolved oxygen."

Other effects include reduced light penetration, changes in available habitat, long term oxygen depletion, extremely high or low pH levels (increasing toxicity to fish and other organisms), while low pH can make heavy metals in stream sediments available, toxin released by cyanobacteria, and a decrease in macrophyte richness.

Thirdly, there are economic impacts of dysfunctional WWTW. Improvements in the Berg River catchment in the Western Cape resulted from economic threats, namely the rejection of fruit by export markets. But there are other costs as well, including health costs borne by the State and by families exposed to contamination.

The political response by poor and rich South Africans is not far from the surface, as evidenced by events following WWTW failures in Ukhahlamba, Delmas, Biesiesvlei, Sannieshof and Bloemhof.

A next round of Green Drop Dialogues in the Crocodile River catchment will need to take these insights into account, and explore the possibilities offered by these scenarios, while

waiting for the institutional environment to be more practically supportive of initiatives to deal with dysfunctional WWTW and their consequences.

A practical recommendation is therefore to focus on research into relevant river stretches, with popular participation and support from the Green Drop Support Campaign, in order to determine whether it should and could be a municipal priority. This could take the form of delineating, with the help, for example, of the IUCMA Water Quality team, of a river stretch downstream from a WWTW, and determining the impact of its dysfunctionality. This could be supported by a social component, in which the water uses and water interactions are documented. Visibility could then be achieved by the erection of warning signs downstream from dysfunctional WWTW. This could be accompanied by media attention on the dangers of such contaminated water.

The functionality of WWTW is, in the final analysis, not only a local government issue, to be assigned priority amongst competing priorities for local government who, it can be argued, has inherent limitations in according it proper importance. It is also a national issue as it affects people's health, and the health of water resources and ecosystems. It is urgent for the conceptualization of WWTW dysfunctionality to be seen beyond the realm of local government.

7.2 Summary of research recommendations

Raising visibility of the issue by making the consequences clear would rely on expanded research, synthesis of existing research, and communicating the results not only to local and national government, but also to the public at large. The issues are of real concern and provide the reasons why dysfunctional WWTW are in the spotlight in the first place. Issues can be organized in three main areas:

1. Research that investigates direct links, in specific places, between diarrhoea as a leading cause of child death between the ages of 1 and 5, and contaminated drinking water as a result of dysfunctional WWTW.

2. Research that spells out the impact of eutrophication on ecosystems, such as repeated oxygen depletion events, for example, leading to impoverishment of ecosystem function and integrity (also removing the ability of river to clean itself), in specific places.

3. Research that spells out clearly the economic impacts dysfunctional WWTW have on

health (costs to the public purse and to suffering families), on livelihoods, and threats to products that are marketed nationally and internationally.

4. Research that indicates the best ways of communicating these results to those institutions – national, provincial, local, professional, and in civil society – who may be in a position to engage with these challenges. Such a communication strategy would clarify, among constituents, councillors, officials and the broad public, the threats of poor water quality: for health, economy, and ecosystems. This should be supported by research that clarifies the exact mandates, including under which circumstances responsibilities pass from local government, to provincial and national government. This should include undertake participatory research on affected rivers and communities surrounding them, which would have the added benefit of raising awareness and understanding how water quality issues are experienced by communities on the ground.

In addition, useful further research could also look at:

5. How CMF working groups can best function, in terms of how they should be conceptualised, facilitated and supported. This research explored the concept of Communities of Practice, but found that social learning, collective action and Strategic Adaptive Management frameworks may be more appropriate.

6. The replication of a Green Drop Support Campaign in other areas, as action research, is suggested by this research.

7. Research that synthesises and reviews the range of Green Drop interventions to date, focusing on approaches, involvement of players and success and failure factors would be useful. Allied to this, we suggest research into the implementation of the Green Drop incentive scheme itself, to explore responses within the water sector, national departments (DWS. COGTA and others), the local government sector, consultants working in the programme, civil society, the public and other stakeholders. Such research would need to pay attention to intra-municipal decision making processes around WWTW and the Green Drop.

8. Conceptualise the issue more broadly to include sewer systems and unserviced areas. Investigate the vulnerability of WWTW infrastructure, especially sewer systems and pump stations.

9. Natural science researchers, for example dealing with eutrophication, should be in dialogue with political ecology perspectives when designing research.

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Appendix 1: Methodology for Community of Practice research

1. *Methods*

Over a period of approximately three months, nine telephonic interviews (see Table. 1) were conducted with people who participated in the Green Drop Support Campaign. Before each telephonic interview, permission was obtained to record the interview and the respondent's confidentiality and time were respected. Each interview was conducted for a maximum duration of 45 minutes. The probing nature of the questions necessitated reassurance that any question could remain unanswered. Once the interview was transcribed, the full transcribed interview was sent to the respondent for review and comment. This was done to secure credibility and confirmability.

Table. 1: List of different sector respondents interviewed

Date	**Sector respondent**
1 April	Private sector
2 April	Irrigation Board
13 May	Local government
13 May	Private sector
19 May	National government
20 May	Private sector
22 May	Local government
4 June	National government
9 June	Government entity

2. *Analysis*

Huberman and Miles (cited in Denzin & Lincoln, 1994) define data analysis by incorporating three processes, viz. data reduction, data display and drawing conclusions. Data reduction and display comprise the first stage of data analysis while the drawing of conclusions comprises the second stage of the analysis. Freeman and Richards (1996) and Danermark et al. (2002) describe five categories of analysis that enable the answering of the research questions. The categories are as follows:

- Grounded Analysis (categories and analysis that emerge from the data with minimal *a priori* (beforehand) expectation).
- Negotiated Analysis (categories and analysis developed by the researcher with the input of the participants).

- Guided Analysis (categories developed *a priori*: subsequent analysis guided and categories are modified through interaction with the data).
- *A Priori* Analysis (categories determined in advance of the data collection: analysis according to those categories).
- Retroductive Analysis ("from a description and analysis of concrete phenomena, reconstruct the basic conditions for these phenomena to be what they are" (Danermark et al., 2002, p. 80)).

Grounded and negotiated analyses are similar in concept to the Danermark et al. (2002) theory of inductive analyses. Guided and *a priori* analyses are similar in concept to the Danermark et al. (2002) theory of abductive analyses.

The data reduction process engaged with in this project began with *guided analysis*, because a) the key objects of the project: domain, community, practice and identity were clearly integral to the research questions; and b) the framework of communities of practice enabled the identification of core and sub-categories from which the researcher could reduce the data (see Table 2). However, interaction with the data did allow some modification of the categories and any information which emerged from the data not easily captured in the *a priori* categories was placed in new categories. The integration of both types of analyses – guided and *a priori* – enabled both inductive and abductive analysis. Inductive analysis allows the identification of emergent themes as the analysis unfolds, while abductive analysis allows a re-contextualisation or re-interpretation of the data using "wider lenses" provided by theory (Danermark et al., 2002).

3. *Sequence of Data Analysis*

According to Maxwell (2008), a basic principle of qualitative research is to ensure that data analysis is conducted at the same time as data collection. The reality of this study was that collection occurred before analysis.

Step 1: Content analysis and categorising

A table was drawn up describing the core and sub-categories using the key theoretical objects of the study (see Table 2), which reflects the use of abductive analysis. However, as interaction with the data proceeded (the content of the interviews were analysed first), the core and sub-categories were added to (see Table 2), which reflects an inductive approach to analysis. Once the interviews were transcribed, their content was analysed, indexed and coded and they were systematically transferred to corresponding analytical memos that

contained the core and sub-categories described in Table 2.

Table 2. Communities of practice core and sub categories

Category	**Notes**
Domain,	Commitment to; shared competence;
Community,	Engage in joint activities & discussions; help each; form relationships that enable learning
Practice,	Develop a shared repertoire of resources : experiences, stories, tools; takes time and a sustained interaction
Identity	Strengthens self-identity and in relation to group
COP sub-category	
Change	
Problems/challenges	

Step 2: Displaying the data: Abductive and inductive analysis

The display of the data in section 5 shares narratives of communities of practice. This was done by using carefully structured analytical memos compiled from the data collected and by using the method of thick description to create the narrative. Thick description allows for a rich, extensive and detailed description with regard to the issues and cases under study (Merriam, 1995) so that the original "voices", and thus meaning, do not get lost in the data. The information was presented in a way that ensured that readers saw that the data were generated in the real world among people, and so were "not de-contextualised from the spaces where it [was] generated".

Step 3: Interpreting and discussing the data (drawing conclusions): Abductive and retroductive analysis

Guidance for constructing section 5 was taken from Bassey (1999) to ensure that interpretation and explanation was brought to bear on the data so that an "understanding of the way things are" (in terms of data) was provided (Bassey, 1999, p. 71). In section 6, the data is condensed using analytical statements, which are based on the raw data. Through a process of testing these statements against the data and the theory, they are shaped into a form that is trustworthy (Bassey, 1999) and that also reflects the abductive and retroductive analysis processes used. In section 6, major analytical statements are presented with discussion coalescing around abductive and retroductive perspectives on the actual and the real for each of the analytical statements, which are constructed from context, theory and data.