THE ETHICS OF ADAPTIVE COLLABORATIVE WATER GOVERNANCE ON THE CAPE FLATS AQUIFER:

A case study in the Philippi Horticultural Area

Report to the
Water Research Commission

by

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This is the final report of WRC project no. C2019/2020-000097.

EXECUTIVE SUMMARY

BACKGROUND

This research project set out to pilot an adaptive collaborative approach through series of workshops aimed at bridging the gap between government's management of water resources in the Philippi Horticultural Area (PHA) and communities' needs, expectations and actions around the same water resource. Focusing on the core principles of ecological integrity, social cohesion and economic viability that were identified by the community in the previous WRC research project (Seeliger, 2020), this action research project started cleaning the canals in the PHA, one of the main sources of water pollution in the area.

The project also fortuitously ran congruently with two other sister projects funded by the Worldwide Fund for Nature (WWF) Nedbank Green Trust entitled Restoring the Waterways of the PHA and another project funded by Western Cape Department of Agriculture that supported the WWF project by paying for the labour on the project through the ecological infrastructure project. These projects provided equipment and labour to carry out the work of the envisaged water management/monitoring plan the WRC project was researching by doing.

While the WRC methodology was simple, working with the community and government departments was not. The community were divided among themselves and local government did not function as a cohesive whole with different departments not sharing the same vision. The Western Cape Department of Agriculture had a very specific set of objectives and targets that they funded in the project and saw this as independent from the deliverables of any other sphere of government. The National Department of Water and Sanitation found themselves hampered by a lack of resources and bureaucracy.

The timing of the research (just before and after a municipal election and a pandemic) and the intensity of working in an area where violence and intimidation are common, made the research process unpredictable. It also forced the Stellenbosch University Water Institute to examine the role of research in communities of conflict and the unintended consequences of doing action research and hiring co-researchers in communities where unemployment was high.

The project yielded many outputs: this final report, a policy brief, a water governance ethics training course for government officials wanting assistance with how to deal with competing values and priorities in communities and finally a research paper that will be written to discuss the importance of including value-driven adaptive collaborative water practices in water governance processes between government and communities.

AIMS

The following were the stated aims of the project:

1. Pilot an adaptive collaborative management approach to water governance in the Philippi Horticultural Area.

2. Build trust through workshops between government and civil society on matters of water governance.
3. Evaluate the success of the adaptive collaborative management approach through a questionnaire.

METHODOLOGY

The research methodology was a combination of three distinct but overlapping schools of research:

- Participatory action research
- Collaborative water governance
- Adaptive management
- Value-based ethical analysis

DATA COLLECTION METHODS

- A pilot questionnaire to 15 key stakeholders to ascertain community needs and government concerns
- An adjusted second questionnaire to 62 key stakeholders to obtain the final data
- Workshops

A total of six large stakeholder workshops were planned as the primary data collection method throughout the project cycle but it often proved more effective to have more frequent smaller groups. A total of 16 workshops were held.

PHASES

- Year one (1 April 2020 to 31 March 2021) was planned as the information and design phase but also included the start of implementation with the canal cleaning programme that started in January 2021 that was funded by both the Western Cape (WC) Department of Agriculture (DoA) and the WWF Nedbank Trust.
- The second year (1 April 2021 to 31 March 2022) was planned as the implementation phase. Water management and monitoring plans that involved the cleaning of the canals and the clearing of the wetlands were implemented but stopped from July to November due to, among other reasons, unrest on the project caused by allegations of misconduct against the project manager and the municipal elections.
- The third year (1 April 2022 to 31 March 2023): The water management and monitoring implementation plans continued until June 2022, after which the team started working towards financial sustainability and another period of unrest resulted that caused the University to withdraw their equipment and staff from the premises. The project returned to the site on 20 January 2023.

FINDINGS

FINDINGS OF THE PARTICIPATORY ACTION RESEARCH PROCESS IN THE PHA

1. While community members can become co-researchers, they cannot ultimately own the research project or be the guardians of the principles of engagement for Participatory Action Research (PAR).

2. PAR, if it involves jobs and assets, is risky research when it takes place in poor communities where resources are few and jobs scarce. Legitimate community structures that include the diversity of stakeholders in a community need to be engaged or set up before the hiring of community researchers takes place.

3. PAR is time consuming and cannot be hurried because it involves working with community co-researchers who need to understand the principles of research. Ensure that research projects involving PAR are for three years and longer.

4. The process of developing a draft questionnaire is a worthwhile exercise for PAR. It allows stakeholders to participate in setting the research agenda. This allows for less conflict going forward.

FINDINGS OF ADAPTIVE MANAGEMENT IN THE PHA

1. Learning by doing means making mistakes and being open to correction and changing direction. The experiential learning that is integral to adaptive management and multi-stakeholder collaboration might show that what was originally envisaged won't work or is no longer valid.

2. It is because adaptive management requires learning by doing and making mistakes that a strict compliance and rule-bound approach followed by government does not assist. While following rules are important when this is too strictly enforced communities are not able to problem solve and learn by doing.

FINDINGS OF MUTLI-STAKEHOLDER COLLABORATION IN THE PHA

1. Facilitators in multi-stakeholder collaboration need to constantly check that not one party is dominating the process.

2. The PHA lacks legitimate multi-stakeholder community platforms that promote social cohesion and economic upliftment. This was evidenced in the research project by the failure of the PHA Forum, that emerged from the previous research project (Seeliger, 2020), but could not be sustained in this new research project that followed.

3. Multi-stakeholder business structures like cooperatives, have the potential to promote collaboration and socio-economic transformation in communities where there is high unemployment, a

lack of job opportunities, great disparities in wealth as well as a lack of social cohesion between groups. Other structures that facilitate the same outcomes should also be researched.

FINDINGS OF VALUE-BASED ETHICAL ANALYSIS

1. Sustainable, long term community transformation cannot happen without shared values.

2. The shared values that are necessary to bring about long-standing change in communities require considerable time and common purpose, i.e. tangible action on the ground, to emerge.

3. Conflict is an inevitable and useful part of value-driven transformation and needs to be constantly anticipated and managed throughout the process.

4. Unpacking deep-seated conflict requires an understanding of value pluralism – the theory that purports that multiple truth claims can be valid in a context simultaneously.

5. Providing workable solutions in circumstances where there are multiple truth claims can be solved through employing an environmental pragmatist approach (a form of value pluralism) that chooses the most appropriate solution within a given context at a point in time.

FINDINGS SPECIFIC TO THE PHA COMMUNITY

1. Water governance in the PHA is a complex management issue because the canals run on both private and public municipal land.

2. The PHA is a deeply divided community.

3. Being subjected to intimidation, violence and criminal activity is a normal part of life in the PHA.

FINDINGS REGARDING THE CITY OF CAPE TOWN (CoCT) & DEPARTMENT OF WATER SANITATION (DWS)

1. Officials in the CoCT are often reluctant to engage deeply and sometimes directly with communities in conflict. They prefer to work through service providers closer to the ground to limit liability.

2. Officials in the CoCT and the DWS often struggle to adopt an adaptive management approach because they fear making mistakes. This rule-bound orientation (due to fear of being labelled corrupt or incompetent and losing their jobs) limits the ability of government to bring about meaningful change.

3. Value-driven approaches to community development like ethical adaptive collaborative water governance or ethics-based adaptive management, are not fully understood by officials in the CoCT and the DWS because of their largely technical orientation and training. Understanding value-driven conflict and how to resolve it is important as it emphasizes the need for a problem-solving approach rather than a determination to prove one is right.

4. The CoCT has struggled to manage stormwater in the PHA because the community in the PHA is so divided.

5. The CoCT, because of its large area of jurisdiction and multitude of departments, runs like a large corporation focused on achieving its own management targets rather than responding to the water management needs of communities on the ground.

6. Conflict between departments within the CoCT can act as a barrier to transforming the way in which the CoCT interacts with communities.

7. The CoCT and the National Department of Agriculture and DWS in the Western Cape don't engage optimally with each other in the PHA. This lack of effective engagement means that communities don't receive optimal service delivery.

FINDINGS REGARDING THE WESTERN CAPE DEPARTMENT OF AGRICULTURE INVOVLEMENT

1. The Western Cape Department of Agriculture saw their role in the project strictly in terms of the funding agreement with Stellenbosch University Water Institute and therefore did not agree that they did not engage effectively with communities or with other departments.

2. The Western Cape Department of Agriculture said they were deliberately not involved in any community meetings or any stakeholder meetings because they said it would have been unlawful and subject to Auditor-General findings if they did not keep an arm's length between their department and University of Stellenbosch – the entity supported to complete the work.

FINDINGS OF THE QUESTIONNAIRE ON COMMUNITY PERCEPTIONS OF WATER GOVERNANCE IN THE PHA

1. Both flooding and water shortages occurred at different times of the year in the PHA.
2. Blocked canals was one of the major causes of flooding.
3. Illegal dumping and authorized land use were some of the main causes of blocked canals.
4. A lack of effective communication between government departments and community members on water governance issues was commonplace in the PHA.

FINDINGS OF THE WATER MONITORING MAP & APP

1. The CoCT did not have a recent updated plan of the canals.
2. Physical water monitoring by citizens on the Kobo app that monitors the smell, colour and waste found in canals could assist the City of Cape Town in tracking pollution incidents.
3. It takes a long time for the CoCT to respond to incidents of pollution reported in the canals.
4. Illegal dumping continued despite the efforts of the project team to remove the debris from the canals.
5. General municipal waste was also found in the canals.

DISCUSSION ON FINDINGS

The research demonstrated how an ethics-based approach to adaptive collaborative water governance can create a path for government and communities to improve their engagement on water governance issues. For this to take place, the following issues need to be addressed:

- Communities need to form legitimate legal and cohesive structures to negotiate with government about water resources;
- Government departments need to adopt an attitude of problem-solving when engaging with communities on water governance issues;
- Both communities and government department need to engage more deeply around how to transform the way in which water resources are governed;
- This deeper engagement should be evidence-based using citizen science data that was gathered by the community and shared to government departments who engage with the data to inform their planning and implementation.
- Government departments need to develop an understanding of how to engage with value pluralism in communities to develop workable solutions. This requires officials to understand what the core values of communities and how to handle deep-seated conflicts that are often the result of values clashing.
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THE FIVE CORE PRACTICES OF VALUE-DRIVEN ADAPTIVE COLLABORATIVE WATER GOVERNANCE

The five core practices of value-driven adaptive collaborative water governance include:

1. Regular collaboration between government and communities on multi-stakeholder platforms;
2. Meaningful engagement on these platforms that translates into value-driven action;
3. Government facilitation of multistakeholder collaboration;
4. Community cohesion and accountability through organised, inclusive community structures like cooperatives;
5. Evidence-based experimentalism that allows for learning through experience and mistakes.

THE THREE MAIN STRUCTURES OF ADAPTIVE COLLABORATIVE WATER GOVERNANCE

The structures that are necessary for adaptive collaborative water governance to work include:

1. Multi-stakeholder management bodies that include both different levels of government and inclusive community structures;
2. Cooperatives or other intermediary inclusive non-governmental communities structures that bridge the gap between communities and government;
3. Electronic platforms that allow interactive citizen science data gathering and sharing between communities and government.

GENERAL

Two of the aims of the research process were achieved:

1) The piloting of a value driven adaptive collaborative management approach to water governance in the PHA;
2) The building of trust through workshops between government and civil society on matters of water governance.

The third aim of evaluating the success of the adaptive collaborative research process on water governance with a questionnaire was not completed due to delays caused by hearings on alleged misconduct, intimidation and threats of criminal activity on the project. However, the continuing existence of the multi-stakeholder agricultural cooperative and their current work on the Groote Post Farm in Philippi where they are building a tunnel and shade-net farm to grow micro vegetables attest to the success of the project, as does the plan of the same cooperative to tender at the CoCT for citizen science water monitoring services using Kobo in the PHA. A tourism cooperative has also been registered.

CONCLUSIONS

A value driven adaptive collaborative water governance process, if continued between the PHA community and the CoCT, Western Cape DoA and the National Department of Agriculture, Rural Development and Land Reform (DALRRD) and the National DWS after the research process ends, could:

- Play a significant role in improving water quality and quantity on the Cape Flats Aquifer in the PHA
- Bring about great social cohesion in the PHA
- Make farming in the area potentially more economically viable and environmentally sustainable
- Address poverty and job creation through other water related activities like ecotourism

RECOMMENDATIONS

FOR THE PHA COMMUNITY

- Develop the two registered multi-stakeholder primary cooperatives, incorporating more members from the PHA and surrounding areas on the Cape Flats Aquifer.
- Establish a Secondary Community Development Cooperative representing these two cooperatives so that they can receive further support from DALRRD.
- The two cooperatives could tender their services to the CoCT, especially in Citizen Science Water Monitoring in the PHA
- The Tourism Cooperative could make the PHA an agri-ecotourism destination following the success of their first tour last year with a conference at the University of the Western Cape.
- When the Secondary Community Development Cooperative is formed, it could meet regularly with the Municipal Area Coordinating Team (ACT) and the Cape Flats Aquifer Monitoring Committee as well as the about to be formed Catchment Management Forum to update them on water governance issues in the PHA.

FOR GOVERNMENT DEPARTMENTS

- To engage more deeply with communities on water governance by using value-driven processes, i.e. value-driven multi-stakeholder adaptive collaboration
- To train technical staff to engage with communities on water governance using value-driven processes

FOR RESEARCH ORGANISATIONS

- To invest time and resources in value-driven research on issues of water governance by doing longer-term research that results in sustainable transformation of communities
- To make it financially possible for students to engage in long-term research
- To engage with government departments around the training of civil servants in value-driven transformation process in water governance

A PERSONAL REFLECTION ON THE ACTION RESEARCH PROCESS

Participating action research requires the researcher to both embed themselves in the values and mindsets of the community/government departments being researched and simultaneously maintain a slight distance from stakeholders (i.e. both government departments and community participants) so as to enable reflection to take place. If the researcher becomes too embedded and begins to take sides with any one stakeholder, they cannot create the platform for analysis that is needed to allow for growth and learning.

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ACRONYMS & ABBREVIATIONS

CoCT	City of Cape Town
DALRRD	National Department of Agriculture Land Reform and Rural Development
DoA	Western Cape Department of Agriculture
DWS	Department of Water and Sanitation
EPWP	Expanded Public Works Programme
FAPRO	Future Agro-processing Cooperative
PAR	Participatory Action Research
PHA	Philippi Horticultural Area
WRC	Water Research Commission
WWF	World Wildlife Fund

GLOSSARY

Term A. Values

Values are what is important to an individual or a group. Values influence how an individual perceives what is wrong and right.

Term B. Ethics

Ethics are a set of moral principles that are used to inform a group or individuals' conduct in a context like water governance.

Term C. Principles

Principles are moral rules that assist individuals or groups in deciding what is wrong or right. They are influenced by the values of an individual or a group.

Term D. Citizen Science.
Citizen science is scientific research conducted with participation from the public.

Term E. Kobo Toolbox.

Kobo Toolbox is a suite of open-source free-to-use data collection tools for use in challenging research environments. It was first developed by the Harvard University Humanitarian Initiative team and then adopted by the United Nations and its affiliated agencies like the UNDP as a field collection tool

CHAPTER 1: BACKGROUND

1.1 INTRODUCTION

This research project was conducted during a time in South Africa's history when corruption was being uncovered in the state. Stories of institutionalised "state capture" were flooding the media, leading understandably to an emphasis on mandate compliance in state departments. While the intention behind this emphasis on accountability was necessary, it did not address the widening gap between communities and government around issues of water governance that was highlighted in a previous research project by the WRC in the PHA.

The research, entitled *Water Issues in Ethical Perspective: A case study in the Philippi Horticultural Area (PHA)* (Seeliger, 2020), had highlighted a lack of trust between governments and communities on issues of water governance in the PHA. It further suggested that an ethics-based methodology could create a potential platform for more meaningful engagement that would rebuild a community's confidence in government if it was included in a meaningful way in government engagement processes.

The aim of this research project, following on the previous one by the WRC was to do just that, to test how an ethics-based methodology could be put in action through a value-based adaptive collaborative approach to water governance in the PHA. The research methodology was simple, ask the community and government officials what their needs and concerns were through a questionnaire devised through a workshop process, use that questionnaire to identify the core issues and the location of those issues, workshop the results with the community and the government officials and jointly devise interventions and adaptive collaborative water governance processes to address the issues. The project was linked to ecological infrastructure and the removal of invasive alien plants and the restoration of wetlands.

The WRC project also fortuitously ran congruently with two other sister projects funded by the Worldwide Fund for Nature (WWF) Nedbank Green Trust entitled Restoring the Waterways of the PHA and another funded by the provincial Department of Agriculture that supported the WWF project by paying for the labour through the ecological infrastructure project. The fact that the 31 temporary jobs were created in the PHA by these two sister projects meant that the WRC project had a high profile in the PHA community and was closely watched by farmers, residents and informal settlement dwellers as well as DA and ANC politicians living here.

While the project methodology was simple, working with the community and government departments was not. The community were divided among themselves. The farmers did not represent a cohesive group with the emerging farmers concerns not being addressed by the commercial farmers, and the commercial farmers themselves, though part of an association, were not always in agreement. The residents of the PHA were often at loggerheads: informal settlement residents and formal residents having different needs and interests. The former being blamed for the pollution and both groups sometimes clashing with the farmers for different reasons.

Similarly, local government did not function as a cohesive whole with different departments with different heads not sharing the same vision, resulting in some departments engaging in the workshops of the research project and others actively avoiding involvement. Working with the Western Cape Department of Agriculture was limited to them providing funding with clear objectives and targets, which were independent from the deliverables of any other sphere of government. The DoA officials were only involved in the monitoring and evaluation of the project.

Three other issues further complicated matters: the Covid pandemic, the 2021 municipal elections and gangsterism on the Cape Flats. The Covid pandemic limited the face-to-face interaction, and resulted in several of the workshops being virtual and minimised the social interaction that was necessary for the workshops to be optimally effective. The 2021 municipal elections were contested in the PHA with the Democratic Alliance and the African National Congress both having representatives seeking to be the ward councillor of the area. One of the supervisors on the sister project decided to stand for election and this led to attempted political interference in the research project.

Physical intimidation also occurred on the project with workers who were hired to clear the canals being involved in gangster activity over weekends, and then continuing these fights during the week at work. Towards the end of 2022, the university had to withdraw its manger and equipment from the Groote Post project site, following threats from a former supervisor on the project who lived in the PHA. The manager only returned to site on 20 January 2023 when the university moved the equipment back to the Groote Post farm to start the tunnel-based agriculture.

The learning that was achieved out of this project was significant. The questionnaire helped us to understand what the nature of the gap of was between government and communities and the workshops demonstrated how value pluralism could assist with integrating the different priorities of government (i.e. sticking to legal mandates) and communities (problem-solving on the ground). The outputs of the project will include this final report that will be published by the Water Research Commission, a policy brief that will also be published and a training course that, upon the request of several of the officials involved in the

project, will be offered to local, provincial and national government. Finally, an academic paper on value-based adaptive collaborative water governance in the PHA will be written and submitted for publication.

1.2 PROJECT AIMS

The following were the aims of the project:

1. Pilot an adaptive collaborative management approach to water governance in the Philippi Horticultural Area.
2. Build trust through workshops between government and civil society on matters of water governance
3. Evaluate the success of adaptive collaborative management approach through a questionnaire

1.3 SCOPE AND LIMITATIONS

The two main aims of the research process were achieved:

1) the piloting of a value driven adaptive collaborative management approach to water governance in the PHA
2) the building of trust through workshops between government and civil society on matters of water governance.

The third aim of evaluating the success of the adaptive collaborative research process by the PHA community and the officials with a questionnaire was not completed due to delays caused by intimidation and threats of criminal activity on the project.

There were two significant delays of this kind on the project. This first delay occurred between July 2021 and November 2021, when the election occurred and the project was the target of electioneering. During this time the University held several hearings with workers on the project following a supervisor on the project claiming that the first project manager had treated workers unfairly. The project manager was found not guilty of treating workers unfairly but he was disciplined for inappropriate drinking after hours in the office.

The second delay occurred at the end of July 2022, when the second project manager received threats from one of the supervisors on the recently finished Western Cape DoA ecological infrastructure funding programme. The University decided to withdraw its equipment and staff and work off site, until the situation improved. Since then the University has been training the staff in Stellenbosch in secondary cooperative management and aquaponics. Several meetings have been held at Groote Post and the WWF Nedbank Trust

part of the project returned to Groote Post in January 2023, when the tunnels will be rebuilt and vegetables planted.

It is the opinion of the researchers that the continuing existence of the multi-stakeholder agricultural and tourism cooperative and their plans to currently construct a pilot aquaponics farm on the Groote Post Farm in Philippi attest to the success of the project, as does the plan of the agricultural cooperative to tender at the City of Cape Town for citizen science water monitoring services using Kobo in the PHA. If aquaponic farming is successful in the PHA it will alleviate the need to buy expensive fertilizer because the fish in the pond provide the nutrients for the medium in which the plants are grown. Moreover, this will reduce the contamination of the Cape Flats Aquifer below. The cost effectiveness of aquaponic farming will need to be piloted to see if it would have a significant impact on costs as well as water contamination on the Cape Flats Aquifer.

It should be noted that aim of the questionnaire conducted in the research was to gauge the viewpoints and observations of the research participants rather than make scientific claims about the state of water quality and quantity in the PHA. Similarly, the water monitoring results were qualitative surface water observations aimed at acting as an early warning system to the CoCT. It was not trying to replace the need for chemical water samples.

CHAPTER 2: METHODOLOGY

2.1 INTRODUCTION

The research methodology was a form of participatory action research. Action research is research that involves three repetitive stages inquiry, action and reflection. Through the iteration of these stages continual improvement is facilitated. Action research becomes participatory when those being researched become active participants in the activities (Mackenzie et al., 2012). This research project was strongly participatory in that the participants (residents, farmers and government officials) were asked to help identify the water governance issues, assist with finding the solutions and then evaluate and change their implementation. Their involvement was continuous throughout the project and not confined to only the planning stage.

Secondly, the methodology was collaborative in its approach. Collaborative water governance is multi-actor in nature, it is neither market-based, nor government controlled nor community driven but instead a negotiation between a multitude of networked actors that includes business, government and communities. (Harrington et al., 2017). The workshops that formed the backbone of the research methodology always ensured that a diversity of actors was involved. This multi-stakeholder activity occurred in the formulation of the questionnaire, the identification of the water governance issues and the proposed interventions. Government as well as small and large farmers, formal and informal residents were included.

Thirdly, the research methodology was a form of adaptive management. Adaptive management is a well-understood systematic approach for improving resource management in the face of increasing environmental uncertainty by learning from management outcomes (Allen and Garmestani, 2015; Kochskämper et al., 2021). Core to the approach is the idea of learning from experience and modifying subsequent behaviour based on that experience. This formed a central theme in the research, with the opinions and actions of the stakeholders shifting the activities that were completed and the outcomes that were pursued.

While most adaptive management is used to empower scientific managers, in this research project it was used to empower communities and government. Community members in the PHA working on the project collected water quality data with the Kobo app and shared it with government authorities in two forums responsible for managing the water in the Cape Flats Aquifer. One such example was the use of the Kobo app to assist government to adapt their management interventions on the Cape Flats Aquifer with the data gathered by the community. This activity, particularly in the latter workshops,

improved community interaction and trust between community and government officials, leading to government considering whether they could employ community members to monitor pollution hotspots in the PHA.

Fourthly, the methodology was value-based. It took seriously the values identified by the community, government and business in the previous ethics research project, i.e. unity, ecological integrity and economic upliftment. It sought to embed these values in the water management practices that were under discussion between the community and the government departments. By placing ethics at the core of water governance and emphasising the role of collectively held values around water, the project was able to improve trust between government officials and residents and some farmers.

2.2 DATA COLLECTION METHODS

2.2.1 Questionnaires

A pilot questionnaire was developed following three individual virtual workshops with different stakeholders. The pilot questionnaire was conducted as an interview with 15 key stakeholders living and working in or in relation to the PHA between 2 and 12 November 2020. Two researchers conducted fifteen interviews with these stakeholders during this time. Some were completed electronically over the phone, or using video-conferencing software, and others were conducted face-to-face with the appropriate COVID-19 mitigation measures in place.

The overall aim of the questionnaire was to ultimately 'map' the social and ecological issues in the PHA to develop a water management plan in the area that involved the participation of a range of stakeholders who live and work in and around the PHA. Respondents included small and large business employees, residents, ward councillors, landowners, representatives from the greater Cape Town, small and large-scale farmers, and informal settlement dwellers. The questionnaire was split into two sections, a general section and then those focused on more specific governance-related questions. A second questionnaire was developed that improved on the first questionnaire.

A team of two researchers conducted the interviews with the 27 informal settlement dwellers and 3 supervisors who made up the three ground teams working on the WWF Nedbank Green Trust-funded 'Restoring the Waterways' project. Ensuring COVID-19 compliance, these interviews were conducted face-to-face so that the teams could be familiarised with the questionnaire / survey software (KoBo Toolbox) being used. All other respondents were emailed an invitation to participate in the research. Some respondents were interviewed telephonically, by WRC intern Mr Meluxolo Mbali, with him later inputting the

responses into Kobo. Farmers were interviewed face-to-face because they would not have responded to the questionnaire otherwise. The data obtained through the structured interview was used to inform a proposed joint water management and governance plan for the PHA as well as the canal clearing programme underway.

The software selected for administering the questionnaire was Kobo Toolbox. Kobo Toolbox is a suite of open-source free-to-use data collection tools for use in challenging research environments. It was first developed by the Harvard University Humanitarian Initiative team and then adopted by the United Nations and its affiliated agencies like the UNDP as a field collection tool. Researchers decided that a free open-source data collection tool would be useful in assisting a marginalised rural area such as the PHA, particularly because it has the capacity to function as a bottom-up source of information for the relevant departments.

Importantly, the software can be used offline so does not require a stable data connection to operate. Possible overlaps with other software programmes could enable the City of Cape Town and other government departments to integrate with Kobo. The tool has a professional, user-friendly interface. It is very reliable with secure, free, fast and stable servers. Kobo Toolbox proved a robust means of data collection for the survey and served as a simple, easy to use platform for people who were not experienced with this type of software.

However, the drawback was KoBo Toolbox's limitations on design and customisation, such as limited question types. The researchers also discovered that the tool had very limited GIS capabilities in GPS capturing, analysis, and display. For example, it only uses Well Known Text (WKT) format, which needs to be configured for extraction in GIS software. When researchers walked the canals to map the routes, the app did not easily convert that action into kilometres, meaning that it is not an efficient tool for digital mapping. Other programmes such as PowerBI, Microsoft Excel and QGIS plugins had to be used for the ETL (Extract, Transform, Load) process of the captured data. This led to a delay in producing the digital map of the restored canals (see Appendix A below).

Moreover, the Kobo app did not easily collate different versions of the questionnaire. After conducting the first 15 interviews, the pilot questionnaire was adjusted. Questions were trimmed and grouped into themes to reduce the length of the questionnaire. KoBo Toolbox also does not have an auto-numbering function making it a challenge to keep track of the progress and reduce mistakes and repetition. After completing all 77 interviews, it also became clear that merging the two versions would take considerable manual editing. Given that the merging of two questionnaires involves essentially changing the database 'backend', it was a time-consuming task. The collated analysis of the merged questionnaires did not happen because the student took a job and stopped the Masters' programme.

In terms of data analysis, KoBo Toolbox also offered limited data analytics capabilities and no dashboard tools. The original questionnaire was too long and not sufficiently focused on specific target audiences. It also took too long to get into the actual questionnaire. Water Monitoring workshop participants who were going to use Kobo to record qualitative water monitoring data requested that it should be more user-friendly so that users could immediately access the site and select their geographical option. It was suggested that it be considerably shortened and that three user groups be identified: citizen scientists; project workers and PHA residents. The geographical options for monitoring were wetlands, canals and pollution sites. It was suggested that the shortened questionnaire be used for six months to collect data on a weekly and monthly basis and then that these findings workshopped with multiple stakeholders including the City of Cape Town. This however, did not happen because the DoA project ended.

2.2.2 Workshops

A total of six large stakeholder workshops were planned as the primary method of data collection throughout the project cycle but it proved more effective at times to have more frequent smaller groups or virtual meetings. A total of 16 workshops were held. The first workshop that aimed at mapping and identifying water governance issues to be monitored in the PHA could not be held due to Covid so was divided into three virtual workshops: one with the Interim Peoples Forum for the PHA – a body that emerged out of the previous research project in the PHA and then later disbanded, the second with the team of transdisciplinary researchers assisting on the project and the third with the officials who were working on issues of water governance in the PHA. These three online workshops helped identify the questions that needed to be included in the questionnaire through identifying the core issues around water governance.

The second and third workshops that were planned in the research proposal took place on the 11 November 2020 and 26 May 2021 respectively. Both these workshops involved discussions of the data gathered firstly from the initial 15 people involved in the pilot of the questionnaire and secondly from the data gathered from the 62 respondents involved in the second questionnaire. The core water governance issues in the PHA were identified as: variations in water quantity and water quality, blocked canals, illegal dumping, biodiversity, unauthorised land use, communication between government and communities and intergovernmental communication.

The fourth workshop was meant to focus on the interventions required to address the issues that were identified by the multi-stakeholders in the second and third workshops. However, instead what followed were four smaller workshops (21 October (virtual), 8 November, the 18 November and the 23 November 2021(all face-to-face) that focused largely on the issues raised by the informal settlements who boycotted two of the meetings. In the last workshop it was suggested that a multi-stakeholder

cooperative be formed that included farmers, residents and informal settlement dwellers to take over the running of the project when the research was complete. Furthermore, it was suggested that the Kobo cell phone app be used to assist the community and the CoCT monitor water pollution in the PHA. The last of these workshops on November 23, 2021 marked a turning point in the project with the decision not to allow any one stakeholder group to dominate the research project. The farmers and the residents said the research had focused too much on the needs of informal settlements and that the residents and farmers needed to be included more.

The fifth workshop was once again divided into a series of smaller workshops, five of which were training workshops (15, 22, 29 January and 5, February) focused on developing a multi-stakeholder cooperative and the sixth on Constitution making on the 12 February. In between four of which was a water monitoring workshop held on the 11 February 2022. The water monitoring workshop identified environmental education, improved law enforcement, increased refuse collection and improved monitoring as some of the core issues needed to address water governance in the PHA. A total of 13 monitoring sites were identified to monitor levels of pollution in the PHA. A draft map of the canals and pollution hotspots in the PHA was done by Umvoto Africa (see Appendix A and Appendix B) and stakeholders suggested modification to the Kobo app to make it easier for the community workers to use.

The sixth and final workshop involved a discussion around the viability of the project going forward. This follows the Department of Agriculture indicating they were not satisfied with the amount of kilometres of canals that had been covered by the project. They asked that excavators be hired to do the bulk of the canal clearing work, with the employed workers focusing only on that manual work that could not be executed by the excavators. Handwork was too slow. Furthermore, the water monitoring results following monitoring that occurred in March and May at the same sites were released and discussed.

Stakeholders acknowledged that water monitoring and clearing of the canals were not perceived as being vehicles that could create permanent jobs. Since there were no obvious income creation opportunities, it would always need to be funded externally. The research project had been funded by WWF, the WRC and the DoA. However, all these funding sources would end by mid-2023. Everyone agreed a commercial activity was needed that would assist with subsidising the water monitoring and clearing of the canals that were important for improved water quality in the PHA and the CFA below. The commercial activity, however, could not be business as usual but required a shift to agroecology. Moreover, the cooperative model was seen as a way of including more role-players, like informal settlement residents many of whom were unemployed into the local economy. There was agreement that such income- and employment-creating commercial activities needed to be identified and their implementation be supported. By the end of the project two primary cooperatives had been formed one focusing on socially and ecologically sensitive

agriculture and other on ecotourism. A secondary cooperative that would act as a development arm was being formed as the project drew to a close.

2.3 RESEARCH PHASES

Year one (1 April 2020 to 31 March 2021) was planned as the information and design phase. Researchers persisted despite the Covid pandemic. Face to face interviews were done at a distance with masks and the taking of temperatures using the Kobo app. In some instances, interviews were done long distance via cell phones using the Kobo application. The questions did not only ask for biophysical data but also included contextual and cultural data as well as local narratives that were important to identify the causes of water management issues, such as pollution.

In year one implementation also began because the DoA funding materialised and work on the canals started. Geographical information systems technology was used to map the pollution sources and illegal dumping sites in canals and other water-related hazardous issues. The approach was grounded in the notion of 'citizen science' wherein members of the public are involved in scientific research in order to solve tangible, often environmental, ecological, or development-related issues and as a means of furthering community education and outreach (Wiggins and Crowston, 2011).

At the centre of this kind of engagement is the understanding that citizen scientists can be deployed to cover large-scale areas (such as the PHA) and collect data from areas otherwise inaccessible to a small research team or government department, and specifically inaccessible to geographic and community 'outsiders' who are not familiar with the area and its context (Dickinson, Zuckerberg, and Bonter, 2010).

The second year (1 April 2021 to 31 March 2022) was when the water management plans and indicators to keep government accountable were discussed in workshops. However, year two was also the run up to the municipal elections and the research was plagued by political and community interference. The first project manager was accused of mistreating the workers in the Department of Agriculture funded EPWP team. Moreover, the University was accused of mismanaging the funds for the WWF project. Neither of these incidents had any direct impact on the WRC research work but it slowed down the implementation and forced the researchers to rethink the relationships with some of the informal settlement leaders who had reverted to intimidation in an attempt to take over the project and its assets.

With regards to the local government departments, year two was also when the stormwater infrastructure in the PHA, that previously been the responsibility of the Department of Water and Sanitation’s planning department was handed over to the Roads and Infrastructure Management (RIM) Department. While the

previous department had been willing to take over the interventions planned by the research project and had actively participated in the development of them, RIM were initially reluctant to engage with the project, despite several attempts by researchers to do this.

In the third year of the project (1 April 2022 to 31 March 2023) the focus shifted towards the financial sustainability of the project so that it could begin to stand on its own apart from the research project. This followed concerns that once the University project team finished the project, the social cohesion created and the closer working relationship with government departments and the water monitoring of the canals in the PHA would end. In the third year, the development of the cooperatives and the start of a secondary cooperative as well as a comprehensive map of the cleared canals and the finalisation of the water monitoring cell phone application became priority. However, towards the middle of year three, the workers failed to reach the performance target of 45 metres per two people required for clearing of canals and the DoA decided not to fund another project.

CHAPTER 3: FINDINGS

3.1 INTRODUCTION

The research yielded a multitude of findings on many different levels. This was because it was both an academic project as well as a practical project that involved water monitoring, the mapping of canals using Geographical Information Systems, the hiring of workers and the clearing of canals. The project had a high profile in the community because through the funding of the Western Cape Department of Agriculture it hired 31 workers from the informal settlements in the PHA. During an election year this made the research a political ball to be kicked or run with if you were a politician. The project also drew the attention of the farmers especially when it hired an excavator to unblock canals on farms to prevent flooding. Moreover, the residents, both formal and informal were drawn in when blockages in the canals running through their properties were addressed. To capture the complexity of the research and its impact, the findings have been divided up into research process findings (Participatory Action Research, collaborative water governance, adaptive management, value-driven ethical analysis) as well as findings for the PHA community, government officials and research institutions themselves.

3.2 FINDINGS OF THE PARTICIPATORY ACTION RESEARCH PROCESS

While community members can become co-researchers they cannot ultimately own the research project. An action research project, despite the multitude of community benefits that result from it, remains a research project and therefore the University and not the community should give ultimate direction. Their direction, however, should be not so much in terms of content but in terms of ensuring that the principles of debate where respect of other opinions and no threat of intimidation or violence towards others are maintained.

This is because though participatory action research invites stakeholders to become co-researchers and partners in the research, there still needs to be a party that ensures that the principles of multi-stakeholder engagement are upheld. This is because not all stakeholders are always interested in debate or research. There are role-players who have set agendas that are often motivated by self-gain. When these agendas run contrary to matter at hand, they can and sometimes will lie, cheat and bully others to achieve their aims.

In this research project, the informal settlement leadership when they could not control the outcome of the investigation, threatened intimidation and protest to achieve their ends. By doing this, they violated the principles of mutual respect that are critical for multi-stakeholder engagement and without which no reasoning or intimidation free research can take place.

Academic institutions because they are not business interests, or in theory, interested and affected parties, are supposedly the most likely custodians of the ethical principles of engagement, in contested water governance issues. However, for the university to be effective as an ombudsman of the principles of engagement it needs to leave the ivory tower of Academia and step into the chaos of community activism and politics. Moreover, the research team involved needs to be willing to both understand and describe the sentiments and values of the community but also to simultaneously to remain an analytical outsider in the context. While social scientists acknowledge that no truly neutral position exists, no researcher should ever lose their role as facilitator of the research process that entails respect for different viewpoints or debate without intimidation.

Participatory action research when it involves assets and temporary jobs for community members in poor communities poses many legal risks.. The University of Stellenbosch as an institution and as individual researchers were exposed to significant amount of risk because at first the University hired the workers who participated in the canal clearing and who were doing the water monitoring for the WRC research process. This was because no other institution or company was willing to do this. No one wanted to take on the liability of hiring workers from informal settlements. Only later was the Future Agroprocessing Cooperative (Fapro), with Mr Joe Barend acting as a project manager, willing to do this. During his tenure, he had to endure gangsterism on site, alcohol and drug abuse and frequent visits from a councillor wanting to exploit the project for their own ends. At the end of July 2022, when he received a direct threat from a former supervisor, the University decided it was better to withdraw staff and assets from the Groote Post Farm in Philippi.

Participatory action research cannot be hurried because it takes time for community co-researchers, many of whom have no tertiary education and some of whom haven't finished school, to learn to apply the principles of research. It also takes time for them to reflect on their situations and form new ideas and common values with other community members, many of whom they have never had the opportunity to engage with due to social or economic barriers.

Finally, the decision to initially develop a draft questionnaire was a worthwhile exercise. It allowed stakeholders to participate in setting the research agenda up front. Usually in research projects participants are not privy to this part of the process. The questions are asked of them, they are mostly not involved in tabling the questions that will drive the data collection. This radical move meant that community members and government officials were from the start invested in the research process and not token participants.

3.3 FINDINGS OF THE ADAPTIVE MANAGEMENT

Experiential learning is a core component of adaptive management. Part of learning from experience is making mistakes. This is humbling and it is not something that researchers, politicians and community members and government officials easily admit to. Moreover, government officials could get into a lot of trouble, even lose their jobs, for making mistakes. However, an adaptive management research project welcomes mistakes because it creates opportunities to improve and in some cases change direction. A technocratic and/or compliance orientated approach to water governance can leave little room for experimentation, innovation and ultimately transformation within a community.

3.4 FINDINGS OF MULTI-STAKEHOLDER COLLABORATION

Multi-stakeholder collaboration requires facilitation that is sensitive to the domination of any one party in the process. During the research process, there were several stakeholders who wished to own the process and take control of the project. First the informal settlement leaders sought to control the debate, even threatening violence if their demands were not met. Later some of the farmers wanted to put a stop to the project because they felt it benefitted mostly the informal settlement dwellers with jobs and added no real value to addressing water quality. Multi-stakeholder collaboration requires participants to be sensitive to the views of others, focused on understanding their point of view and open to negotiation regarding one's own position. This is a skill that is sorely lacking within the community of the PHA, where intimidation is commonplace.

What is missing in the PHA is legitimate multi-stakeholder structures that represent most people in a community are financially sustainable and promote social cohesion, ecological sensitivity and economic upliftment of the poor. Community groups without a business orientation or way of creating jobs and income often turn into talk shops or rely on constant protest action to maintain popularity. Viable businesses that promote community transformation are few and far between. In communities, like the PHA, where there is high unemployment, a lack of skills and great disparities in wealth as well as a lack of social cohesion between groups, multi-stakeholder business structures like cooperatives, have the potential to bring about socio-economic transformation. This is because they are legal structures that can trade, litigate and tender. They, however, also have powers to make their members accountable because they can discipline members who fail to uphold the values outlined in their Constitutions.

3.5 FINDINGS OF VALUE-BASED ETHICAL ANALYSIS

Shared communal values are what makes a community work towards common goals. In the PHA, and in many other parts of South Africa, people are polarised in their various cultural, religious and racial groupings and often fail to move toward or negotiate common values. However, without these shared values that are respected, practiced and protected, a community is unable to act as a cohesive whole over time.

Creating shared values where hatred formerly existed does not occur automatically, it requires sincere engagement, trust over time and often tangible actions to emerge. Conflict is also an inevitable part of creating these shared values as opinions and cultural practices clash and mistakes are made. Change makers or champions in communities who are willing to make the effort or risk engagement across divides do exist and are integral to making a community effective at working together.

Value pluralism is the theory that there can be conflicting moral views in a situation, both of which are equally worthy of consideration (Seeliger, 2009). This contrasts with moral monism which is the theory that there can only be one correct moral viewpoint in a situation and the point of deliberation is to establish this. Environmental pragmatism, as a form of value pluralism, makes the point that arriving at the best possible decision when there are conflicting moral views, is best achieved by taking the context seriously and deliberating what works best for those stakeholders in that geographical context at that point in time.

Environmental pragmatism asserts that moral viewpoints are “snapshots in time” and are always open to review and change as the context and stakeholders’ change (Seeliger, 2009). This means that certain moral values might have higher priority in one context with a certain set of stakeholders, and lower value for another set of stakeholders at a different time. It all depends on the location, time and the scale at which the decision is being made.

Environmental pragmatism differs from moral relativism because it is not saying that all moral viewpoints are equally valid in every context (Seeliger, 2009). Some are more appropriate than others in a particular situation. By adopting this approach to decision-making in adaptive collaborative water governance, stakeholders open themselves up to deliberation and sense-making as a collective, rather than sinking into moral relativism where anything goes or moral monism where participants, often those in charge, are bent on proving their list of values as the only right ones.

3.6 FINDINGS SPECIFIC TO THE PHA COMMUNITY

Water governance in the PHA is a complex management issue because the canals run on both private and public municipal land. The private land could be either farmland or residential houses or informal settlements. The municipal land is mostly road infrastructure. The canal restoration project was not supposed to work on municipal land but inevitably had to clear areas here because some of the blockages or dumped tyres occurred on municipal turf. Meanwhile, the municipality was not allowed to work on private land and were keen for the project to assist with clearing areas on farms. Farmers, however, were reluctant to allow other workers, besides those they personally employed on their farms.

The PHA is a diverse but deeply divided community. German settlers who were farmers settled in the area and turned dunes into farms. There are about 10 of these commercial farmers left, many of whom are still of German heritage. KhoiSan who also lived in the area, tended their cattle and roamed the area. There is also a large Muslim population, some of whom are emerging farmers. The Xhosa population who migrated to the area, more recently in search of jobs are a growing group. There are more than 20 smaller informal settlements within the PHA and the area is also surrounded by much large informal settlements. Within each of the main stakeholder groupings: i.e. formal residents, informal settlement dwellers, commercial farmers and emerging farmers there are further groupings, many of whom are in conflict.

The PHA though primarily a farming area has begun to experience the infiltration of Cape Flats gangs in the informal settlements. With high levels of unemployment, poverty and lack of skills to acquire jobs outside the area, violence, intimidation and criminal activity are a normal part of life in the PHA informal settlements. During the course of the project, when things did serve the interests of some informal settlement leaders, the project leaders would receive WhatsApp threats of action that would result from not following their instruction. Some of the action was blatantly defamatory in nature and was publicised in the media.

3.7 FINDINGS REGARDING THE CITY OF CAPE TOWN AND NATIONAL DEPARTMENT OF WATER AND SANITATION

The CoCT and the DWS and many other government departments, are reluctant to engage deeply and in some cases directly with communities in conflict. They prefer to work through intermediaries closer to the ground to limit liability.

As discussed previously, the experiential learning that is integral to adaptive management sees management as an experiment where mistakes are not only permitted but expected. They represent opportunities to do things differently or better than before. Officials in the CoCT and in many other

government departments like the DWS, often struggle to adopt an adaptive management approach because they fear making mistakes. This rule-bound (understandably because of fear of being labelled corrupt or incompetent and losing their jobs) orientation limits the ability of government to bring about meaningful change.

Value-driven approaches to community development, like ethical adaptive collaborative water governance or ethics-based adaptive management, are not fully understood by officials in the DWS and the CoCT and other government departments because of the officials' largely technical orientation and training in water issues. During the research, it became clear that much of the research work we were doing was not considered technical or scientific enough. A case in point was the comment in a report that the citizen science data on surface water that had been collected was not valuable because it was not a chemical analysis. This missed the point of the data entirely. It was intended as early warning data that could be fed to the City of Cape Town to delve deeper. Moreover, the collection of the data was part of an awareness raising environmental education process.

The CoCT because of its large area of jurisdiction and multitude of departments runs like a large corporation focused on achieving its own management targets rather than responding to the water management needs of communities on the ground. This means that departments are so focused on achieving the aims and objectives of their management system that there is no time to focus on the needs of communities as reported in their help lines. One of the managers on the research project reported a serious pollution incident and was contacted several weeks later in the evening when it was too dark to address the issue.

Moreover, conflicts within departments in the CoCT can act as a barrier to transforming the way in which the CoCT interacts with communities. An official in one department fully supporting our project and wishing to incorporate its insights into their departmental programme was unable to do so because a fellow colleague in another department that was the implementing agency did not wish to take the insights of the project onboard, for reasons largely unknown to the project. Ultimately, this led to the project insights not being fully taken on board by CoCT.

However, not all issues are due to a problem originating in the attitude of government officials. The CoCT has also struggled to manage stormwater in the PHA because of the lack of a cohesive community in the PHA. It is often because the community does not work together that government officials cannot get to the real issue at hand. This means that important water governance issues are not identified early enough or at all.

3.8 FINDINGS REGARDING THE WESTERN CAPE DEPARTMENT OF AGRICULTURE

While all three levels of government, local, provincial and national were involved from the conception of the project, the Western Cape Department of Agriculture were the only government department that put financial resources into the project. Despite several discussions about taking over the project outcomes, no contractual agreement was ever signed between the City of Cape Town and the University of Stellenbosch to financially support the project. The DWS were clear from the start that they did not have funds available.

As a funder, the Western Cape Department of Agriculture saw their role in the project strictly in terms of the funding agreement with Stellenbosch University Water Institute and therefore did not agree that they did not engage effectively with communities or with other departments. The Western Cape Department of Agriculture said they were deliberately not involved in any community meetings or any stakeholder meetings because they said it would have been unlawful and subject to Auditor General findings if they did not keep an arm's length between their department and University of Stellenbosch – the entity supported to complete the work.

3.9 FINDINGS REGARDING THE QUESTIONNAIRE ON PERCEPTIONS OF WATER GOVERNANCE IN THE PHA

It is important to note that the questionnaire was about "perceptions of water governance in the PHA". We did not collect physical data about these perceptions or seek to verify each of them **(See Version 1 of the PHA questionnaire in Appendix A)** Our sample size of 62 respondents were a mix of informal settlements residents, formal residents, government officials and farmers all living or working in the PHA. At the time of the research process, this physical water quality and quantity data was not available. However, water quality and water quantity data in the PHA is now being collected by Umvoto Africa on behalf of the City of Cape Town.

3.9.1 Variations in water quantity and quality throughout the PHA

At places of work, the majority of the water used by participants came from a tap (58%), followed by a groundwater source or well point (23%). When asked if their access to water was sufficient for work purposes, most people (53%) said yes. Of the 6% who only 'sometimes' had enough, they mentioned the drought and the fact that they had to use borehole water because there was not enough tap water for their farms.

Shortages occurred in the hot summer months of Jan, Feb and March and most people experienced it about once or twice a year. The perceived causes of the shortages were drought, climate change and poor infrastructure. Flooding occurred on average at least once a year in the months of June, July and August. The main causes of flooding were perceived to be heavy rainfall, blocked stormwater drains and poor infrastructure.

With regards to the quality of surface and groundwater in the PHA, 35% out of the 52 respondents answered that they were aware of issues. The water quality issues listed included that the water causes illness, is unsuitable for drinking, has poor taste, is discoloured, has poor smell, is polluted, too saline, or murky/cloudy. Under 'other', respondents indicated that there was too much iron and lime in the water, that illegal dumping in the canals was an issue, that the water contains E-coli and phosphorus, and reported experiencing changes in water colour.

Water quality on the farms and at other workplaces was seen as adequate most of the time. Perceived groundwater pollution included heavy metals, high salinity and E.coli. Sources were identified as industrial pollutants, pesticides from farming, septic tanks' runoff and pollution from the rubble. There were also perceived problems with household water quality, i.e. that it tasted salty and was discoloured. The perceived causes of household water pollution were old pipes.

3.9.2 Blocked canals

The source of canal blockages was perceived to be largely because of illegal dumping, followed by maintenance of the system being required, then erosion and finally because of people building over canals **(See Appendix C for a view of the canals mapped)**.

3.9.3 Unauthorised land use

Unauthorised land use continued to be a serious concern in the PHA with as many as 20 participants in the PHA being aware of it continuing. Unauthorised land uses included light industrial, brickworks, composting, rock crushing and a scrapyard being built on canals.

3.9.4 Illegal dumping

Illegal dumping continued to be one of the core issues discussed with as many as 37 respondents to the questionnaire stating they were aware of dumping sites in the PHA.

3.9.5 Biodiversity

Respondents to the questionnaire recognised the unique biodiversity of the area with as many as 37 saying they were aware of the areas of unique biodiversity. Few were aware of alien invasive plant and animal species with 24 recognising it as a problem.

3.9.6 General communication issues

Communication issues were of serious concern in the PHA. There was not sufficient community information incorporated into government planning, and information was not always shared between the community and the government. There were forums like the Cape Flats Aquifer Monitoring Committee and the PHA Food and Farming Campaign, but there was no coordinated effort. The government in turn shared information on water through council meetings, website, community forums, social media and WhatsApp.

Similarly, the manner in which government departments collected water quality information was diverse: through ward councillors, officials of specialist professions, research teams and community groups. The community also received water quality information in a variety of ways including ward councillors, social media, website, and the printed media

3.9.7 Intergovernmental communication issues

There was also a concern about the limited amount of information sharing between government departments. The reason for this was that the government operated in silos. Data was also not readily available on one platform and one had to request data from specific departments if one wanted to analyse it.

3.10 FINDINGS REGARDING THE WATER MONITORING

3.10.1 The City of Cape Town has no updated map

When the project started the City of Cape Town gave the project a map that was supplied to them by some of the original farmers whose family assisted in building the original canals. When the student mapping the canals tried to ground truth the map, several of the canals did not exist or had been altered, with the result that the project had to create its own map to restore the canals in the PHA. This map has now been given

to the City of Cape Town to use **(See Appendix C).** This map will continuously need to be updated as unauthorised land uses in the PHA continue and citizens and businesses fill in and build over the canals.

3.10.2 Physical water monitoring by citizens on the Kobo app

Citizen scientists could use the Kobo app to monitor smells, the colour of the water and the waste found in canals to assist the City of Cape Town to tracking pollution incidents in an early warning system **(See Water Monitoring Points in Appendix B).** Umvoto Africa trained project staff in water monitoring and later also cooperative members how to record this information in Kobo. Umvoto Africa are looking at ways of further training the cooperative members so they can eventually sub-contract these services to whatever service provider of the City is tasked with monitoring water quality in the PHA. This is in principle a very important service that citizens could render. This is because it will cost a scientific firm a great deal of labour hours to find these sites in the community. Moreover, it might not be safe to do so in certain areas in the PHA.

3.10.3 City of Cape Town response times

The research project made frequent use of the City Problem Reporting system but with very limited success and long delays in getting issues addressed. A case in point was the sewerage contamination incident on old Lansdowne Road wetland that took several months to be addressed. It is suggested that if a citizen Kobo app could report regularly to the Cape Flats Aquifer Monitoring Committee on data collected there might be a speedier and more effective response time.

3.10.4 Illegal Dumping in canals

Illegal dumping in canals continued unabated despite the project team removing tyres and debris that were dumped. On one site because the tyres were regularly removed, businesses started using it as a tyre dumping site more frequently. Stricter law enforcement through citizen science monitoring of offenders is a solution that was discussed.

3.10.5 General municipal waste in canals

PHA residents, especially in informal settlements, complained of insufficient waste removal in their areas. Most areas were cleared once a week, however, if an informal settlement was on private farmland they struggled to get their waste cleared. According to residents, general municipal waste was often dumped in the canals by waste pickers who emptied their wheelie bins of non-tradeable waste in them.

3.11 DISCUSSION OF FINDINGS

The research demonstrated how in principle an ethics-based approach to adaptive collaborative water governance can create a path for government and communities to improve their engagement on water governance issues. However, for this to take place there are many issues that need to be addressed.

3.11.1 Inclusive community structures

In the PHA there is a plethora of non-governmental organisations that operate independently from each other and serve particular interests and communities. Many of the individuals in these organisations, though well meaning, often claim they speak for the greater whole but without any legitimacy. These organisations need to become part of bigger legitimate structures to make it easier for government departments and other institutions to work in the area. It is too much to expect government and other outsiders to the PHA to work for the multitude of different interest groups on an individual basis. Where there are disagreements between these organisations, these should be dealt with at a community level. Without this social cohesion on an organisational level it is very unlikely that the sustainable transformation of water governance can take place in the PHA.

3.11.2 Less superficial engagement

While handing out pamphlets and doing awareness raising campaigns serve an important purpose they are exploratory interactions that require follow up engagement if real change in communities around water governance is to be actioned. Government officials need to know what the real priorities are in communities and what is preventing them from being realised. If waste pickers for example are clogging up canals with wheelie bin waste perhaps they need to be partially employed and certified to turn them into waste policeman rather than sources of the problem. The solutions are endless and innovative when communities feel their issues are being taken seriously rather than noted in participation exercises.

3.11.3 More evidence-based

A deeper engagement with communities would mean regularly exchanging information about flooding, water quality and quantity issues and pollution incidents through actual evidence of this. This would mean that citizens would need to share photographs or reports of incidents of pollution or flooding with government departments and receive feedback on possible interventions. While the City of Cape Town has a C3 problem notification system it is not effective at promoting communication between the residents and citizens because feedback can take a long time. The project reported several incidents, many of which were

not followed up and some of which took 6 months to respond. The system is not designed for continuous engagement but rather once-off incident reporting.

3.11.4 More focused on value change

Lasting change in communities needs to happen at a more fundamental level to be sustainable. This means that interactions with government should not be only about reporting problems but also about developing shared values, working through conflicting values in communities and discussing how to work towards the realisation of goals that embody those values. This deep level of engagement requires an understanding of how to engage with value pluralism in communities and develop workable solutions. This goes beyond focusing on enforcement of a set of rules and asks of government and communities to problem solve together and co-develop solutions. This requires officials to understand what the core values of communities and how to handle deep-seated conflicts that are often the result of values clashing.

3.12 POTENTIAL PRACTICAL OUTCOMES OF THE FINDINGS

3.12.1 Five core practices of value-driven adaptive collaborative water governance

If value pluralism (many different truth claims in a context) is taken as a given in water governance then it would be helpful to have some practices that could assist water governance practitioners to navigate the conflict that comes about when there is more than one understanding of how water should be managed in a context. The research project through its process of engagement was able to identify five key practices of value-driven adaptive collaborative water governance.

Firstly, the practice of “regular collaboration” was important. The understanding that water cannot be managed by any one institution or authority effectively but always requires communities, government and business concerns to engage with one another on a regular basis. This means that catchment management plans or water strategies cannot be completed without all three these parties being involved in the conception, the planning and the roll-out and even to a degree on the enforcement.

The second practice of “meaningful engagement” flows from the first. The engagement between government and the other partners in water governance needs to be based on value-driven interaction, rather than mere compliance. Communities should not be used to rubber stamp government actions that have been conceived in isolation from their values and resulting needs. This because the community values are a necessary part of the value-driven choices that need to take place before action is embarked on.

Thirdly, the practice of “government facilitation” pertains to government to go beyond legal compliance. It should treat communities and business as partners and play a facilitating role in the identification of joint values and projects, as well as the already defined regulatory role.

The fourth practice of “community cohesion” follows from the third and is the responsibility of the community. If communities and business are partners then they need to organise themselves into structured, cohesive entities that represent the interests of the diversity of stakeholders in their areas. Only when they have these cohesive structures that embody the diversity of opinions in their contexts will government be able to interact with them meaningfully as partners. Government cannot be expected to develop community structures.

The fifth practice of “evidence-based experimentalism” speaks to how government and business must interact with water governance issues. The dynamic nature of community and business interaction requires an experimental approach to solving the problems of water governance that makes use of measurable targets and outcomes that are subject to change**.** It accepts that solutions are time-bound and unlikely to stay the same forever but always open to revision as contexts, stakeholders and values change.

3.12.2 Three main structures of value-driven adaptive collaborative water governance

The five practices of regular collaboration, meaningful engagement, government facilitation, community cohesion and evidence-based experimentalism are likely to give rise or adapt existing community/government interaction structures. These new structures should include bodies that are multi-stakeholder and include different levels of government and diverse community bodies; they should include cooperatives or other intermediary non-governmental structures that bridge the gap between communities and government; and they should include electronic platforms that allow interactive citizen science data gathering and sharing between communities and government.

Multi-stakeholder bodies like catchment management forums, area coordinating teams and aquifer management bodies would enable meaningful, regular interaction between government, business and communities. Two of these structures were regularly engaged with during the PHA case study. Researchers and stakeholders joined the PHA Area Coordinating Team that included all government officials working in the PHA and community organisations that wanted to discuss issues that had arisen. The interaction was managed by the ward councillor who ensured that all parties had a chance to discuss the issues that had arisen on the communities’ agenda. Water governance was one of the top priorities regularly discussed. It was organised as a Skype meeting.

The Cape Flats Aquifer Monitoring Committee that was managed by the City of Cape Town's Department of Water and Sanitation was another such multi-stakeholder body that included key officials from other City of Cape Town departments who were critical for the management of the Cape Flats Aquifer as well as outside community stakeholders who had an interest in water management. It created a platform for discussion around threats to the aquifer and also the City of Cape Town's managed aquifer recharge plans.

There is also a need for intermediary community structures that can bridge the gap between the individual citizen on the street and the government department managing water. These intermediary structures are necessary because government cannot be expected to meaningfully engage with every individual or grouping in a community. There are numerous non-governmental intermediary structures like community trusts that could be researched. However, the research project found cooperatives to be the preferred structure because it was able to embody business principles and potentially interact with government tenders and hereby facilitate job creation in communities. Moreover, because of its focus on acting in the interests of community business rather than individual business, it proved a useful bridge between communities and individual business interests. Finally, cooperatives are registered legal entities that can sue, tender for contracts and litigate, giving them the power to act as equal partners in collaborative partnerships with government structures.

Finally, there is a need to include community actors in the monitoring of water resources through the creation of citizen science monitoring processes. Communities can get to places in neighbourhoods at times that government officials cannot. They are the eyes and ears of government and can assist with early detection of pollution before it becomes too late to contain the situation. However, to achieve this, they need to be able to report issues to the correct department timeously and on a regular basis. Trust needs to be built up between the community water monitors and the government experts receiving the information. The information needs to be verifiable. The research project used Kobo Toolbox to record incidents of pollution at regular sites. Unfortunately, this was not fed directly into government departments but was rather reported at workshops where government officials were present. At the last workshop with the City of Cape Town, the community members on the project were encouraged to approach Umvoto Afrika, the groundwater consultants working on the research project with the University of Stellenbosch and to approach them with a proposal to assist them with their contractual obligations with the City of Cape Town to monitor water quality and quantity in the PHA. The Agricultural Cooperative is in the process of doing this.

CHAPTER 4: CONCLUSIONS AND RECOMMENDATIONS

4.1 CONCLUSIONS

Water governance in the PHA cannot be done by any one stakeholder or government department operating in the PHA. The farming area is surrounded by informal settlements, industrial areas and formal residential areas, all of which impact on the water quality in the Cape Flats Aquifer. If the City of Cape Town wishes to minimise the impact of pollution on the Cape Flats Aquifer as part of its drought strategy, a more collaborative form of management is necessary through the setting up of more multi-stakeholder collaborative management structures to engage with communities.

Enforcement on its own will not be able to transform values in the long term because there are not enough law enforcement staff on the beat to practically protect the surface or groundwater. A transformation of local values is the slow but only way to work. These new ecologically friendly and socially sensitive values would need to be nurtured by the community through the setting up inclusive intermediary structures that bring together diverse cultures and viewpoints on water governance.

The intermediary community structures and the multi-stakeholder government platforms need to discuss pollution and flooding data monitored by the community and sent to the relevant government departments via electronic platforms They also need to identify key values that are shared by the community and government departments and work on achieving the goals that embody these values.

A value-driven adaptive collaborative water governance process, if continued post the research project between the PHA community cooperative and the City of Cape Town, Western Cape Department of Agriculture and the National Department of Agriculture, Rural Development and Land Reform and the National Department of Water and Sanitation, could:

- improve water quality and quantity
- bring about greater social cohesion in the PHA
- make farming in the area potentially more economically viable and environmentally sustainable
- address poverty and job creation through other water related businesses like eco-tourism

4.2 RECOMMENDATIONS

4.2.1 For the PHA Community

The project has suggestions for the PHA community, some of which are already in operation and others of which would take more time to develop. These include:

- Developing the two registered multi-stakeholder primary cooperatives, incorporating more members from the PHA and surrounding areas on the Cape Flats Aquifer.
- Establishing a Secondary Community Development Cooperative representing these two cooperatives so that they can receive further support from the Department of Agriculture, Land Reform and Rural Development to form a Farmer Production Support Unit.
- The two cooperatives could also tender their services to the City of Cape Town, especially in Citizen Science Water Monitoring in the PHA and also by offering alien vegetation removal and ecological canal restoration to the surrounding farmers as a paid service.
- The Tourism Cooperative could make the PHA an ecotourism destination and bring to life the KhoiSan history of the area. This follows the success of the Tourism Cooperative's first tour last year with a conference group from the University of the Western Cape. The visitors were shown the Lutheran Church and Museum, the Canals, the Edith Stephens' Nature Reserve and KhoiSan village off Weltevreden Road.
- When the Secondary Community Development Cooperative is formed it could meet regularly with the Municipal Area Coordinating Team (ACT) and the Cape Flats Aquifer Monitoring Committee as well as the soon to be formed Catchment Management Forum to update them with data on water governance issues in the PHA.
- The above data gathering and sharing process could be managed on a weekly basis with the use of a Kobo-based water monitoring app for the PHA, that would collect citizen science data as well as slightly more sophisticated data from trained cooperative members who could take water samples and analyse them for the presence of certain toxic chemicals.

4.2.2 For government departments

One of the core findings of the research was the need to change how government perceived their role in communities. While government must remain in charge of regulation and ensure legal compliance, they also have a role to play in the facilitation of multi-stakeholder bodies like the Cape Flats Aquifer Monitoring Committee on which the intermediaries like cooperatives that have been created by communities can sit to partner with government to better manage water resources.

These intermediary bodies can interact on these multistakeholder bodies and assist government to engage more deeply with communities on water governance by using value-driven processes to drive their interaction. This would go way beyond just receiving City of Cape Town problem notification numbers when incidents are reported by members of the public. It would also go beyond handing out awareness pamphlets and instead focus on employing local citizens to supply community data on the canals and wetlands in their area using online cell phone applications like Kobo that was piloted in the research.

Government departments should also train technical staff who engage with communities on water governance to understand and use value-driven processes in their interaction with communities. This would mean sending officials, especially those who have professional qualifications and can earn Continuous Professional Development points, on environmental ethics courses that explains what value pluralism is all about at how an environmentally pragmatist approach can assist them to approach communities on contested water governance issues in a more meaningful way.

4.2.3 For research organisations

This project forced the researchers on the project to reflect on how to go about engaging community members as co-researchers on water governance research projects that occurred in communities in conflict. It became clear that in communities where resources were scarce and unemployment high, special care needs to be taken to:

- invest extra time and resources and do longer-term research that could support sustainable transformation of communities. This implies avoiding one-year or even two -year research projects that don't allow the time required to engage meaningfully with communities.
- To make it financially possible for students to engage in longer term research. This could possibly mean Masters' students could take 3 years to finish their degrees and spend an extra year doing community service in the communities they had been researching.
- To engage with government departments around the training of civil servants in value-driven transformation process in water governance by writing up manuals and offering courses that provide them Continuous Professional Development points.

CHAPTER 5: PERSONAL REFLECTION ON THE ACTION RESEARCH JOURNEY

Action research is an intense experience. It requires the researcher to embed themselves in the values of all the key stakeholders in the research to accurately reflect and write up their understanding of the context in which they find themselves. However, simultaneously as a researcher you need to maintain a healthy distance from all stakeholders and remain as unpartisan as possible. This professional distance is necessary to be able to reflect and create a space for analysis and deliberation.

Conducting research on the Cape Flats Aquifer in the Philippi Horticultural Area is especially intense because of the levels of poverty and unemployment that exist here. While the research funding for the project was modest, in the eyes of the community it was vast sums of money, which many felt should have been given directly to them. They did not always see why the research work was important or necessary. This mistrust of the motives of the research from the community and the levels of violence and intimidation were at times beyond the levels I could tolerate.

My name was brandished on placards and photographed by the media insinuating I had misappropriated funds when the project had only been briefly stopped to process another application for funding. I was called to meetings in the informal settlement at night to answer to their leaders and received many intimidating WhatsApp messages demanding that I implement their demands.

If it were not for the support of my colleagues, especially Mr Joe Barends, Mr Mawethu Nyakatya and Mr Tyrel Flugel and the two students Mr Thabo Nhlapo and Ms Katherine Morris as well as the WRC intern Mr Meluxolo Mbali, I would not have been able to complete this project. Moreover, the support of the funders especially Mr John Dini who continued to encourage me in the emergency meetings that were called to address the issues at hand.

While it was not an experience I would like to repeat, it has been one of the most formative research experiences I have embarked on in my career. It has taught me perseverance, the value of learning from mistakes (a core adaptive management principle) and the importance of not taking things personally. It also reminded me why I chose a career in research in the first place to be given the opportunity to assist in the transformation of communities and their impact on the environment.

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APPENDIX A: STAKEHOLDER QUESTIONNAIRE VERSION 1

Philippi Horticultural Area (PHA) Water Governance Mapping Questionnaire

SECTION 1: RESPONDENT MAPPING

How do you experience the PHA

1. Do you live in the PHA or on the immediate edge?

Yes
No

2. Please provide suburb / ward name where you live

3. Do you work within the PHA

Yes
3.1 Please provide a short description of your work and proceed
3.2 Please provide location you work in
No

4. How would you describe your travel within the PHA during the week and on the weekend?

a. Week i. Mainly travel across/through it
ii. Mostly within
iii. Blended

b. Weekend i. Mainly travel across/through it
ii. Mostly within
iii. Blended

5. What best describes your mode of travel? a. Your own: i. Car / bakkie
ii. Motorbike
iii. Bicycle

b. Someone else's vehicle (non-public)
c. Bus
d. Mini-bus
e. On foot
f. Other

6. Do you experience your travel as safe and secure?

SECTION 2: RESPONDENT WATER MAPPING

7. When in the PHA how do you use water?

a. Personal use and sanitation (drinking, washing hands, etc.)

b. For work on a small scale (food preparation, cleaning work surfaces, etc.)

c. For work on a large scale (car wash, irrigation, building, etc.)

8. Do you know the source of the water you use?

Yes – please proceed to question 9
No

9. The source of the water I use is a. From a tap
b. From surface water (canals, streams)
c. From groundwater (well points, boreholes)
d. Unsure

10. Do you consider your access to water at work adequate to meet your needs?
Yes
No

11. Do you consider the water you use as clean?
Yes
No

12. How do you access water when at home?
a. Tap inside dwelling
b. Share a tap with nearby neighbour
c. Standpoint / community tap
d. Other: please specify

13. At home do you consider your access to water adequate to meet your needs?
Yes
No

14. Have you experienced flooding in the last five (5) years?
Yes – please proceed to question 13
No – please proceed to question 17

15. Where do you experience flooding?
a. At home
b. At my place of work
c. At my place of recreation / spiritual worship / learning
d. During my travel

16. When did/do you experience flooding? If possible, please provide the month(s) and year(s)

17. During periods of flooding, how often do you experience it?
a. Daily
b. Weekly
c. Monthly
d. Less the five (5) times a year

18. What do you think was/is the cause of the flooding?

19. Have you experienced a shortage of water in the last five (5) years?

20. Where do you experience this shortage?

a. At home

b. At my place of work

c. At my place of recreation / spiritual worship / learning

d. During my travel

21. When did/do you experience this water shortage? If possible, please provide the month(s) and year(s)

22. During periods of water shortage, how often do you experience it?

a. Daily

b. Weekly

c. Monthly

d. Less the five (5) times a year

23. What do you think was/is the cause of the shortage?

24. Please indicate all of the following statements with which you agree:

a. There has been more rainfall this year than last year

b. There was more rainfall in 2019 than 2018

c. There was more rainfall in 2018 than 2017

d. There was more rainfall in 2017 than 2016

SECTION 3: POLLUTION MAPPING

25. Are you aware of any water quality issues (surface or ground) in the PHA? a. What are the water quality issues in the PHA?

b. Where are the water quality issues?

26. Are you aware of any water quantity issues (surface or ground) in the PHA? a. What are the water quantity issues in the PHA?

b. Where (landmark, GPS coordinates, street address) are the water quantity issues in the PHA?

27. Are you aware of any blocked channels in the PHA? a. Where are these issues? Please provide details:

28. Are you aware of any unauthorised land use (e.g. building without permission, alterations to heritage sites, land occupation in the PHA? a. Can you provide a location (GPS coordinates, street address, or landmark) of this site/these sites? Please provide details:

29. Are you aware of any water or sand extractions (e.g. water or sand) in the PHA? a. Can you provide a location (GPS coordinates, street address, or landmark) of this site/these sites? Please provide details:

30. Are you aware of any umping sites (e.g. depositing, discharging, spilling or releasing of any kind of waste in or on any public space including waste that is loose or in boxes, barrels or bags) in the PHA? a. Can you provide a location (GPS coordinates, street address, or landmark) of this site/these sites? Please provide details:

Yes (if YES, proceed to question 30a)
No
No

31. Are you aware of any water/drainage channels that have been built on or obstructed in the PHA? a. Can you provide a location (GPS coordinates, street address, or landmark) of this site/these sites? Please provide details:
a. Can you provide a location (GPS coordinates, street address, or landmark) of this site/these sites? Please provide details:

Yes (if YES, proceed to question 31a)
No

32. Are you aware of any artificial channelling of waterways in the PHA?

Yes (if YES, proceed to question 19.1)

33. Are you aware of channels that are critical for the restoration of the waterways in the PHA? a. Can you provide a location (GPS coordinates, street address, or landmark) of this site/these sites? Please provide details:

Yes (if YES, proceed to question 33a)
No

34. Are you aware of any other sources of pollution affecting water quality in the PHA?

Yes (if YES, proceed to question 35)
No

35. Can you provide a location (GPS coordinates, street address, or landmark) of this site/these sites? Please provide details

36. How important are the resolving of water quality, water quantity, channel clearing and water access issues to you?

SECTION 4: SOCIAL MAPPING

37. Are you aware of any educational, historical, sporting, recreation, cultural, market or commercial sites (past, present, or desired) that exist in the PHA?

38. Can you provide a location (GPS coordinates, street address, or landmark) of this site/these sites? Please provide details:

Item	Site Type (educational, sporting, recreation, cultural, market/commercial)	Site Name	Site Location (GPS coordinates, street address, landmark)
1			
2			
3			
4			
5…			

SECTION 5: ECOLOGICAL MAPPING

39. Are you aware of any areas of unique biodiversity (fauna and/or flora that exist in the PHA?

Yes (if YES, proceed to question 40)
No

40. Can you provide a location (GPS coordinates, street address, or landmark) of this site/these sites? Please provide details:

41. Are you aware of any areas of unwanted flora or fauna in the PHA?

Yes (if YES, proceed to question 42)

42. Can you provide a location (GPS coordinates, street address, or landmark) of this site/these sites? Please provide details:

43. Are you aware of any areas of soil erosion in the PHA?

Yes (if YES, proceed to question 44)
No

44. Can you provide a location (GPS coordinates, street address, or landmark) of this site/these sites? Please provide details

45. Are you aware of any water management techniques that farmers employ in the PHA to alleviate shortages?

46. Are you aware of any agroecological approaches that are used that might impact on the water cycle in the PHA?

SECTION 6: WATER GOVERNANCE IN THE PHA

47. What are the primary sources of information for water management related planning by the City of Cape Town?

48. Is community information about, for example, pollution sources, land use, and dumping used for water management planning in the PHA?

49. Are you aware of any ways in which the community and the government share information on the water quality in the PHA?

Yes (if YES, proceed to question 50)
No

50. Please provide details of the ways in which government currently receives water quality information from the PHA: (e.g. official channels, research teams, ward councillors, community members/groups):

51. Please provide details of the ways in which the community currently receives water quality information in the PHA: (e.g. official websites, community groups/forums/WhatsApp groups/social media, government employees, ward councillors):

52. Are you aware of any ways in which the community and the government share information on the water quantity in the PHA?

Yes (if YES, proceed to question 53)
No

53. Please provide details of the ways in which government currently receives water quantity information from the PHA: (e.g. official channels, research teams, ward councillors, community members/groups):

54. Please provide details of the ways in which the community currently receives water quantity information in the PHA: (e.g. official websites, community groups/forums/WhatsApp groups/social media, government employees, ward councillors):

55. Do government officials consult the community about water issues in the PHA?

Yes (if YES, proceed to question 56)
No

56. If yes, how does this happen?

57. Who speaks on behalf of the government?

58. Do the government officials consult the community about possible solutions to water management issues in the PHA?

59. If yes, please provide details about when and how this consultation happens.

60. Who speaks on behalf of the government

61. Do community representatives talk to the community about managing water resources?
Yes (if YES, proceed to question 62)
No

62. If yes, how does this happen?

63. Who speaks on behalf of the community?

64. Do the government representatives provide feedback to the community on whether water concerns have been addressed?
Yes (if YES, proceed to question 65)
No

65. If yes, please provide more details on how this has happened in the past.

66. Do you have recommendations for how the community and the government could share information on the water quality

67. and water quantity in the PHA?

68. Do you have any recommendations for how the community and government could share information on the water quality and water quantity in the PHA?

SECTION 7: INTERGOVERNMENTAL COOPERATION AND TECHNOLOGICAL INNOVATION

69. Do national provincial and local government share water data in the PHA? If yes, please provide details on how this sharing happens. If no, then please proceed to question 70

70. Do you think that the current means of sharing water data between departments is effective?

Please provide details

71. Do you think that the current means of data sharing/uptake between departments can be improved?

Please provide details

72. How can Intergovernmental information sharing improve water monitoring and management in the PHA?

Please provide details

73. How do government departments currently access community information on water in the PHA?

Please provide details

74. Can community water information sharing/uptake be made more effective?

Please provide details

75. How can community information sharing improve water monitoring and management in the PHA?

Please provide details

76. What platforms or methods (e.g. official website, council meetings, community forum, social media, WhatsApp) are currently used by government to share water data with the community in the PHA?

Please provide details

77. Can current methods of government sharing of water data in the PHA be improved?

Please provide details

78. Which existing platforms/apps/technologies does the government use to collect water governance-related data?

Please provide details

79. Can these existing technologies be improved to make information gathering and sharing more effective?

Please provide details

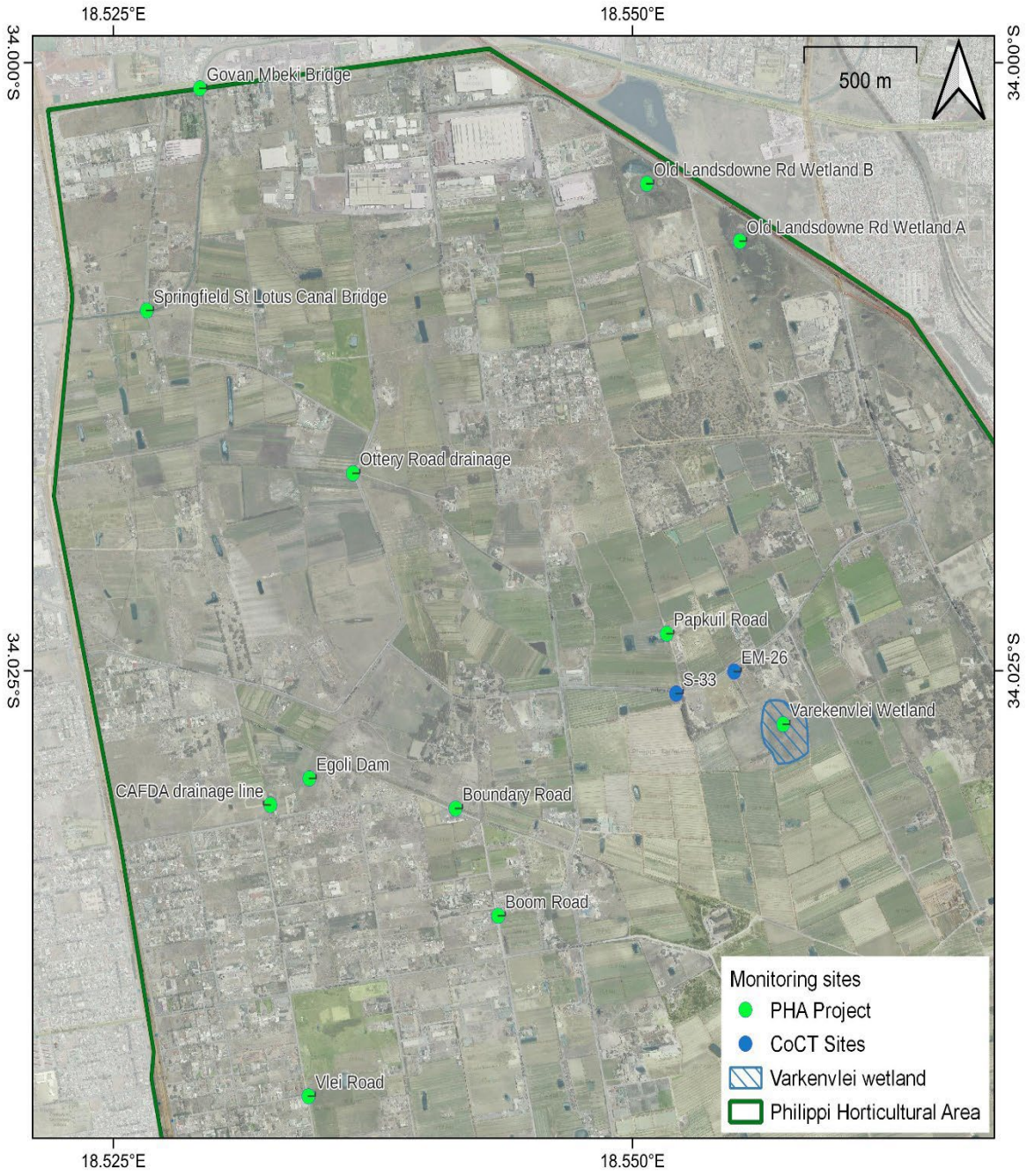
80. Can existing platforms/technologies be adapted to better identify and monitor problem areas (e.g. dumping sites) in an area like the PHA?

Please provide details

81. With some of the questions you were asked, did you feel

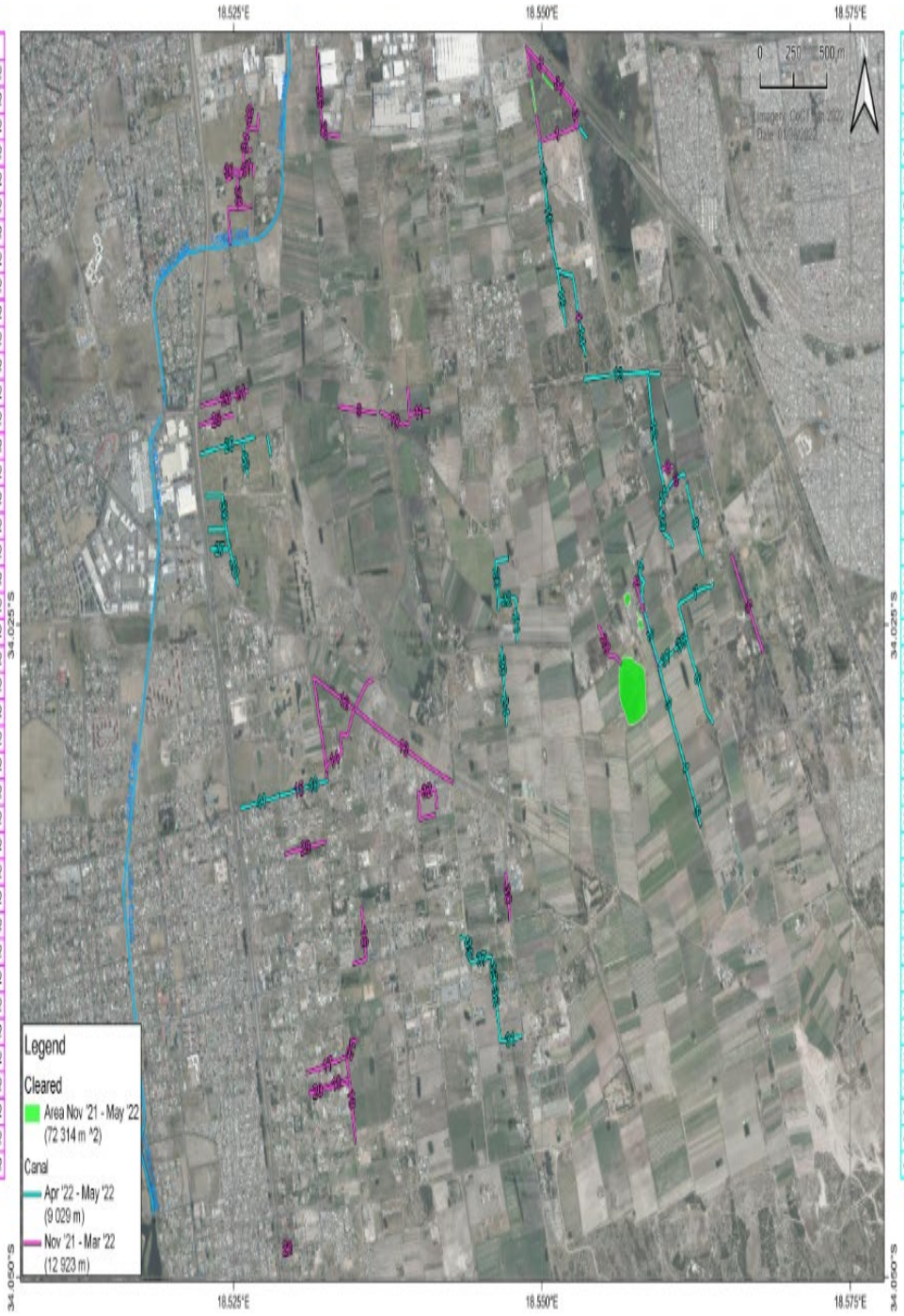
1. Uncomfortable Yes/No Numbers……..
2. Unqualified to answer Yes/No Numbers……..
3. Better to ask this question to someone else Yes/No Number……

APPENDIX B: PHA MONITORING SITES



APPENDIX C: PHA CANAL MAP

ID	Length (m)	Phase
1	1001	Nov 2021 - Mar 2022
2	172	Nov 2021 - Mar 2022
3	99	Nov 2021 - Mar 2022
4	1034	Nov 2021 - Mar 2022
5	475	Nov 2021 - Mar 2022
6	70	Nov 2021 - Mar 2022
7	1157	Nov 2021 - Mar 2022
8	87	Nov 2021 - Mar 2022
9	276	Nov 2021 - Mar 2022
10	369	Nov 2021 - Mar 2022
11	136	Nov 2021 - Mar 2022
12	970	Nov 2021 - Mar 2022
13	784	Nov 2021 - Mar 2022
14	397	Nov 2021 - Mar 2022
15	360	Nov 2021 - Mar 2022
16	315	Nov 2021 - Mar 2022
17	294	Nov 2021 - Mar 2022
18	366	Nov 2021 - Mar 2022
19	290	Nov 2021 - Mar 2022
20	292	Nov 2021 - Mar 2022
21	118	Nov 2021 - Mar 2022
22	55	Nov 2021 - Mar 2022
23	241	Nov 2021 - Mar 2022
24	93	Nov 2021 - Mar 2022
25	250	Nov 2021 - Mar 2022
26	466	Nov 2021 - Mar 2022
27	39	Nov 2021 - Mar 2022
28	240	Nov 2021 - Mar 2022
29	302	Nov 2021 - Mar 2022
30	188	Nov 2021 - Mar 2022
31	240	Nov 2021 - Mar 2022
32	437	Nov 2021 - Mar 2022
33	61	Nov 2021 - Mar 2022
34	267	Nov 2021 - Mar 2022
35	115	Nov 2021 - Mar 2022
36	125	Nov 2021 - Mar 2022
37	103	Nov 2021 - Mar 2022
38	348	Nov 2021 - Mar 2022
39	92	Nov 2021 - Mar 2022
40	40	Nov 2021 - Mar 2022
41	54	Nov 2021 - Mar 2022
42	95	Nov 2021 - Mar 2022



ID	Length (m)	Phase
1	217	Apr 2022 - May 2022
2	233	Apr 2022 - May 2022
3	354	Apr 2022 - May 2022
4	247	Apr 2022 - May 2022
5	117	Apr 2022 - May 2022
6	412	Apr 2022 - May 2022
7	417	Apr 2022 - May 2022
8	323	Apr 2022 - May 2022
9	35	Apr 2022 - May 2022
10	85	Apr 2022 - May 2022
11	97	Apr 2022 - May 2022
12	602	Apr 2022 - May 2022
13	482	Apr 2022 - May 2022
14	142	Apr 2022 - May 2022
15	679	Apr 2022 - May 2022
16	187	Apr 2022 - May 2022
17	67	Apr 2022 - May 2022
18	235	Apr 2022 - May 2022
19	190	Apr 2022 - May 2022
20	266	Apr 2022 - May 2022
21	134	Apr 2022 - May 2022
22	202	Apr 2022 - May 2022
23	163	Apr 2022 - May 2022
24	150	Apr 2022 - May 2022
25	77	Apr 2022 - May 2022
26	405	Apr 2022 - May 2022
27	131	Apr 2022 - May 2022
28	123	Apr 2022 - May 2022
29	157	Apr 2022 - May 2022
30	351	Apr 2022 - May 2022
31	299	Apr 2022 - May 2022
32	94	Apr 2022 - May 2022
33	117	Apr 2022 - May 2022
37	165	Apr 2022 - May 2022
35	88	Apr 2022 - May 2022
36	36	Apr 2022 - May 2022
37	112	Apr 2022 - May 2022
38	96	Apr 2022 - May 2022
39	61	Apr 2022 - May 2022
40	283	Apr 2022 - May 2022
41	280	Apr 2022 - May 2022
42	128	Apr 2022 - May 2022