**ACA1**

I: So, could you please tell me a little bit about yourself. What your role is and how water relates to you?

R: Okay, I’m an agricultural economist. For my PhD I’m studying the development of qualitative tools for agricultural water management in South Africa. So I had a session with stakeholders across the country. So, my research interest right now is centred around understanding the sustainability of water resource management to ensure that we produce enough food for future generations. I am very interested in this, I am a water management strategist.

I: That’s interesting, we are both researching similar topics.

R: Yes.

I: This is a broad question to start with, could you describe the severity of water scarcity in South Africa?

R: Well, water is a problem in South Africa. Basically, South Africa is a semi-arid country. Which is, I think, South Africa has been classified as a water scarce country at the moment. The water issues actually have different dimensions to it. You can look at the larger aspect of it, where you can look at climate change and how its affecting fresh water availability. You can look at the social factor of it, how water is reused by households, the agricultural sector. You can look at it in terms of the water infrastructure. What are the water infrastructures that are there and how are they being managed? So, there are different aspects, different drivers that are influencing water scarcity in South Africa at the moment. But if you look at it from the perspective of fresh water availability, agriculture uses 65% of the fresh water available in the country, but produces less than 4% to the GDP of the country. So basically what that says is that the agricultural sector right now, with the technology and the infrastructure that it has, they are not managing water affectively. You also have to look at the aspect of water resources being mismanaged by state officials. You have the issues of corruption, you have the issue of water being used as a political tool. So yeah water is in an issue in South Africa, but you look at it in terms of policy that have been put in place to ensure that water is used affectively, those policy are not affective and you can attribute them to mismanagement, you can attribute them to lack of consultation, you can attribute them to climate change.

I: Yes, like that NWA 1998 is renowned worldwide for being a very scientific piece of policy but when it comes to implementation it’s poor.

R: That is the problem.

I: That seems to be a common theme in South Africa.

R: Of course, those policies look great on paper. Amazing on paper. But, when it comes to implementation because those policies were developed by people sitting on a desktop. Without taking into consideration what is actually going on, on the ground. What you always have is, either you have policy resistance or the inability of those policies to be affectively implemented. So now we are calling out for more bottom-up approaches. Where you go down from the grass-roots, understand from the people who are directly affected.

I: Who have first hand experience.

R: Yes, exactly. That way you are developing a piece of policy where you can easily implement.

I: Yes, that’s good. Are you familiar then with public participation?

R: Yeah, we are calling now for the inclusion of all relevant stakeholders in policy development.

I: Yes, because with my studies, my lead supervisor is an environmental lawyer and something that he is very passionate about is public participation. Through public participation you are empowering these vulnerable communities that aren’t often represented in decision making. So public participation is a useful tool for getting those who are often ignored involved in policymaking and thereby you are benefiting from local knowledge and that would influence policy as well.

R: Yes, sure. When you look at, we are now advocating for indigenous knowledge systems in to policymaking. What are the indigenous knowledge systems that these people are using to cope? With the problems they are facing in their communities. Because when you speak to them, they tell you first hand what the problem is. Because they live it, it’s a lived experience. So you ask them, what they think in their perspective that the solution can be. Then, it doesn’t mean that you always have to develop those solutions but you can create solutions around it. So public participation is definitely recommended as one of the tools to solve the water issues that we have in our communities. Yes.

I: Yes, that’s great, thank you. Also, these policies are difficult for implementation by water managers. Do you think the managers of water, especially in agriculture, do you think they need to be involved in policy as well?

R: Of course, anybody, every stakeholder that has a role in water management, in all of the sectors. Especially in agriculture that is seen as the largest water user. All of them are important and they should be included in the discussion around water management. If you don’t include them, we say, you always have policy resistance. Like right now, the commercial farmers are taking the government to court over water right. So if they were included in the policy making in the first place they would not be at a point where they were taking the government to court.

I: Exactly. So going back to agriculture, you said that it only contributes to 4% of GDP?

R: That is agricultural, without talking about down the value chain, where you include the processing and everything else, it contributes to 12-15% across the value chain. But agriculture itself contributes to less than 4% to the GDP of South Africa. That is the latest stats from stats SA.

I: Okay, thank you. So do you know how much of agricultural production is exported?

R: It depends on the crop, in South Africa there are different provinces that are really good with producing a particular prop. In the western cape the fruits and wine really grow well, such as grapes and apples. In the eastern cape, you have maize and other things like that. So, each province is really good at producing a particular thing and they export a lot of stuff. So I actually do not have the stats in my head right now for those specific crops.

I: Yes, that would be impressive! So my next question is about pipeworks, a big issue in South Africa is the maintenance of these pipelines and the distribution of water. That must be a big problem for agriculture as well.

R: Yes, the problem basically has been that these pipelines are not affectively managed. So, they leak quite a lot of water before getting to their destination. So a lot of water is lost as a result of aging infrastructure, or inaffective infrastructure and technology. So, right now we are calling for better techniques, better infrastructure, for transporting water from one area to another. Especially from the stream to the farm.

I: And obviously, rainfall in South Africa is inconsistent.

R: It is, very very inconsistent and it has become a big issue, because farmers, there are dryland farmers who do not irrigate so they depend on rainfall for production and when rain becomes inconsistent it affects their productivity. So yeah, rainfall is really a problem.

I: Yes, so what solutions would help with that? Because obviously, rainwater harvesting is a great solution for benefiting from rainfall, but if there is no rainfall it is not a very good solution. Do you think groundwater is a better idea?

R: Well, I think, boreholes are just a temporary solution. Because what is, when you start drawing water from boreholes, temporarily you are solving a problem now, but long term you are going to see that you either have contaminated groundwater or you have depleted groundwater. So what we are calling for now is for countries to invest in wastewater recycling and desalination where you remove salt from seawater. Because somebody actually has this argument, that water is not scarce, water is in abundance. Only if we are able to remove the salt and recycle waste water. So the solution to that problem will be water recycling and water reuse.

I: So, water desalination is a very energy intensive process. So then does that now shift it from a water issue to an energy supply issue?

R: I think the problem is that it is quite capital intensive, but it is a worthwhile investment. So that is something that we are calling for the government to look in to. Rainwater harvesting is not much of a solution because the rain is not consistent.

I: Yes.

R: But we are also calling for that as an alternative.

I: It may help to bridge the gap.

R: Yes. So, what they are calling for is we should manage our groundwater resources extremely well, so that we don’t deplete them. We can only go to groundwater resources as a last option.

I: Yes, you don’t want to exceed the rate that the aquifers recharge at. Otherwise, they would be exhausted.

R: Exactly.

I: So it is about maintaining pipeworks in good conditions, so that you are not wasting this water.

R: Exactly, how do we minimise water wastage? How do we encourage efficient use. Ensuring that every drop counts. By household, by industry, by agriculture. Every drop counts. Therefore, we ensure that we increase water productivity. By encouraging a minimum use with maximum yield.

I: So, this is a difficult question, but how do you think we can encourage that philosophy in households in vulnerable communities?

R: Okay, so, I think, in 2018, I’m not sure if you are aware. The western cape was in a distressed state.

I: Yes.

R: They were talking about water resources in the province were going to be completely depleted. So measures were put in place where each households was entitled to 50L of water a day. No matter how big the household was. So this amount, it encouraged people to be creative with their use of water. So there are ways, there are systems and techniques that you can implement that will encourage households to use water more effectively and ensure that they get the best out of their water use. So households were now being creative, people came out with solutions and technologies where like, you flush the toilet and it seems like a lot but now it uses less water. So I think if appropriate measures can be put in place to ensure that households use water more effectively. Especially in vulnerable communities where water is already a problem. You know, they are already struggling with issues of water. Therefore we can come up with that thing of saying, you only have this much to use every day. So no matter what you use, you can only use 50L every day. So if you can impose a cap on water use I’m sure it’s going to encourage people to use water more effectively. Because you know, if you finish the 50L before the end of the day then you go for the rest of the day without water.

I: Do you think that would be difficult to monitor or policy? Because how would you know how much each household has bene using?

R: When that happened, households were encouraged to use public taps.

I: Yes.

R: Yes public water systems. Or, if you are actually sending water to households, you can measure if somebody uses all of their allocated water and it will automatically go off.

I: Okay, that makes sense.

R: So, that could work.

I: That’s a good point, because public taps have been criticised because while it’s great to provide communities with free water, if they are not paying for it, they are not incentivised to use it in a sustainable manner so they might use more than they need. Whereas, where you are proposing a cap then they are going to be encouraged to use it sustainably.

R: Yes, so, that is, I think that cap can work, where we say you are only allowed to use this much water in a day and we will put in a system in place to ensure that when you reach that quantity the water stops automatically. So it will push people to be creative with the way they use water. Because most people use water the way they do, because they see it, but if they know that they will not have a lot of it, they will develop strategies to conserve what they have.

I: And then, the last thing I’d like to talk about really is water quality in South Africa. That is also quite an issue, there’s acid mine drainage as a contribution and then you have waste contamination so that must be a big issue for agriculture as well as for households.

R: Yes, water quality is a huge issue. Agriculture also contributes to that, the mining industry contributes to that a lot, households contributes a lot, especially in poor areas where they have poor sanitation. So, I think a system has been put in place now to find industries that pollute water. Agriculture, they are trying to get them to stop water leaching, where they basically pump fertiliser in to the water. Most often it runs back in to the water system and pollutes the system. But, water quality issues is a real issue and one that needs more attention and more strict measures.

I: Definitely. Are there any local case studies in South Africa where you think they are exhibiting great water management and you think that is a good case study for the rest of the country?

R: I think that the western cape now, after the crisis that it had in 2018 now they have developed systems for effective water management. The western cape is developing systems for affective water management, I think they can become the model for states or provinces in the next 5 years, for how you can be in trouble and get yourself out of it and then manage the resources very well.

I: That’s interesting how the region that was mostly strongly impacted by water scarcity can hit a threshold where it was so serious that now it has lead to systems being put in place that make it an example for good water management.

R: Yes, when you knock it down you cannot stay down. You stand up and fight.

I: Yes, that’s great. Okay, thank you. That’s everything I wanted to ask you. Thank you very much, I really appreciate your time.

R: No problems, if you have any more questions just drop them and then I will respond.

**ACA2**

I: So the first question is a very broad one, could you briefly describe the state of water scarcity in South Africa and the main factors?

R: The term water scarcity was first used in the book that was published in about 1850 minus around about 10, maybe a little bit before, if you drop me an email I’ll send it to you.

I: Thank you.

R: That book was published by a Brit in fact and he was writing on the cape colony and the book was titled something like “the aridity of the cape colony and the reasons there of” and so the very very first book ever written that we can track on water in South Africa spoke about aridity and scarcity and that book was read very deeply by a young road engineer called Thomas Bain and Thomas Bain, his father was a Scot who settled in South Africa during the Xhosa wars, so he settled in a place in the border area between the British settles and the warring Xhosa people and this young man, he was a road builder, a road engineer and many famous passes are named after him. Young, Thomas Bain read this book from this guy called J.C Brown, the original book was by J.C Brown and being a road builder he was interested in what this guy said about water and he was travelling over the whole cape colony at the time and he saw a settlement at a place called Uppington and he saw that these people had taken water from the river and had created a very prosperous settlement in the desert and he wrote a book based on that and his book was called “water finding, damn building” that was published in about 1860. That became the second book on water that was written in South Africa and they both talked about this enormous riverine scarcity. But the significance about Bain was that because he was a road builder he understood contour lines and he understood maps, he could make maps. Because he was touring that area extensively he started mapping the area and he came to the conclusion that it’s possible to take water out of the Orange river to take water out of there and deliver it eventually to Port Elizabeth on the coast and he actually drew plans and I’ve actually published work on his original drawing. That was all good and well, he became the first director of the department or irrigation. The first water department was called the department of irrigation. It was a British colonial office and he became the director of irrigation. At that stage they didn’t have the technology to dig these trenches over vast distances and tunnels etc… so a century later in 1960 after the Sharpeville Massacre, that caused South Africa to leave the British commonwealth and caused a problem with the investor confidence in the country, the national party government went back to the book by Thomas in 1860 so they look at what he wrote 100 years before and they then brought that project to light, that project was then called the Orange fish transfer scheme and that still exists to this day. That became the birth of the aggressive phase of hydrologic engineering in South Africa. From that moment onwards South Africa became very aggressive at linking every river to every other river. In the management of water scarcity. So the point is we’ve always been water scarce, always water constrained and that nothing has changed.

I: Thank you for that, thank you for painting the picture there. So river systems are very important in South Africa aren’t they? There’s not many big lakes and reservoirs.

R: Well there are big reservoirs because one of the biggest reservoirs was built at the time in 1960 on the Orange river, in fact we now have two massive dams built on the Orange river and we can store almost three times the annual average flow of the Orange river. So reservoirs have become very much part of South Africa’s hydraulic mission. It is a very important part of what we have done. That of course then is associated with the legacy of apartheid, because that happened from 1961 until 1994 that that was the dam building era and from 1994 the dam building era came to an end and therefore all of the skills that we need to maintain that has also been purged out of the system and we now look at the skills needed to maintain the water infrastructure in South Africa, so the water infrastructure today is very much falling apart. It is in a state of accelerated collapse.

I: That leads me on to my next question, it is about the condition of pipeworks in South Africa.

R: Well, you must appreciate that in South Africa every river of significance has been connected to every other river of significance, now you don’t just divert a river over a mountain. It is not a trivial thing. It is a serious piece of engineering. It was predicated on the need to enable the South Africa energy grid, so water and energy has always been closely linked. Under apartheid South Africa, South Africa went through a phase of accelerated industrialisation and that accelerated industrialisation required water and energy to be stable so it required both of those things to be stable. These pipelines, these massive pipelines, when I say pipelines the pipeline is 3.8 to up to 5.8 metres in diameter, you could drive a truck through the pipeline. This is a tunnel more than a pipeline, okay. This is going for more than 80km to a 100km through a mountain range, so that is not an insignificant amount of engineering and those in general are still in fairly good condition. But the energy needed to pump the water over the mountain that energy comes from surplus energy from the national grid and we have got no more surplus energy. We’ve had no surplus energy for the last decade. For the last decade we have been an energy strained economy, so we don’t have surplus energy. Really the energy constraint that is not enabling us to pump water over the mountains.

I: Yes and South Africa is still very reliant on fossil fuel energy isn’t it?

R: Yes, under apartheid because of the isolation and the sanctions imposed against South Africa, South Africa had a huge amount of coal but no oil. So they pioneered the whole notion of oil from coal. So oil from coal technology is a South African and that created a company called “SASOL” which are a global company and at the same time the whole ESKOM energy thing was all about burning fossil fuel and there the question was do you take the coal to where the water is or do you take the water to where the coal is. Because you had to move bulk stuff in one direction, it was found to be cheaper at the time to pump the water to where the coal is rather than take the coal to where the water is and that’s why the Mpumalanga coal fields are a place of engineered manufactured water integration but they also highly highly destroyed the environment, with very acidic water.

I: Yes, I saw you [presented on AMD].

R: Yes.

I: That’s a very big issue in South Africa.

R: It’s also a big issue in England.

I: Yes, true.

R: In the Newcastle area, it’s a big issue.

I: Yes, there were lots of mines in the north of England. Ok thank you, so, waste water recycling, how affective do you think South Africa is at recycling waste water?

R: Very bad, under current conditions. We’ve got about 824 wastewater works in the country of those 60% are dysfunctional. So we currently discharge around about 5Billion litres of untreated sewage into our rivers every day and that has destroyed what is left of our water resources, so the waste waterworks is a major crisis in South Africa and is probably one of the biggest single crises in the country.

I: There must be little monitoring of the conditions of rivers as well.

R: Well effectively, we are dealing with a failed state scenario, South Africa is a failing state and here I have a very specific definition of state failure. I record state failure, firstly I record state as not being a monolithic structure, a state consists of a number of subunits, the government departments are subunits so I define state failure as what happens when a unit of government is unable to interpret signals coming from its operational environment and then convert those signals to an action that needs to be implemented and properly resourced. We see that in the department of water affairs they effectively are a failed department, because take the waste water problem alone, they are simply unable to interpret those signals and convert that into a viable strategy to mitigate the risks. So one of the most significant elements of that failure has been the failure of the water sector, the failure of the department of water and sanitation and that is in part because they have tried to undo all of the apartheid era technical achievements and the people needed to keep those things going, they have simply purged them all out of the system, is in a nutshell what has happened.

I: The issue really is implementation because the national water act 1998 was renowned as a very scientific piece of policy but in terms of implementation, very little has happened.

R: Yes very little has happened and also the science at the time, the science was very new and wasn’t fully tested, it wasn’t really robust enough. So I was at that point in time in the development of the national water act, I had become part of the intelligence service, I was an intelligence officer before that and I was involved in the creation of the negotiated transition and because I was deeply involved in that negotiated transition I then also got deeply involved with Kader Asmal who was the minister of water affairs at the time and at that point in time the water sector was being broadened from just the technical management of water by engineers, it was now being broadened to include other scientists, including aquatic scientists. I was involved with Asmal at the time and in reality the science that was embraced in the national water act is really not robust enough, you know, to calculate things like the ecological reserve, these are not really robust enough methodologies, at best they are indicators they are not really capable of resulting in a finite definition. There is always a sort of range of options. That is one of the problems of the national water act, it is not being implemented in any way, and in part because of the failed state scenario and also because of the purging of the skills and also in part because the science of which it is based is not robust enough it simply cannot stand up under interrogation.

I: Yes. So with a clear lack of skills and funding, what are the potential drivers of change in South Africa? especially with a failed state.

R: Well the driver of change is going to be ultimately the collapsing the state. It’s inability to deliver services. The services that are critical for the state to survive are water, energy, food. Those are the big ones. Of course job creation, the ability to convert, water energy and food in to a stable economy capable of employing people, I mean we’ve probably got one of the highest unemployment rates in the world right now, you’ve got formal numbers and informal numbers. On the informal side we’ve probably got in excess of 40-50% of our population is unemployed, in some places even as high as 60%, your formal numbers don’t measure the people that have given up hope and given up trying, so that says something like 35-40%. So we’ve just got an exceptionally high unemployment rate. Part of that is because the national water act was driven to a large extent by ideology and also by emerging science that hadn’t yet matured. Those two things kind of created a lethal combination.

I: Do you think public participation could be a powerful tool in involving communities that are directly there, on the ground, directly affected by water scarcity?

R: The short answer there is no. I’ll tell you why, the NWA is very strong in public participation but what public participation is really about is the illusion of inclusion, it is simply an illusion of inclusion. The reason why I say that is because water is such a technically complex issue. How can you expect a person that is unemployed, unable to feed their family today and they are going to sit down and without making an informed decision about complex issues, about how to get water over a mountain, you know, about how to make a tradeoff about are we going to put water in to agriculture or in to industry, are we going to this with water or that. The opportunity costs. It is such an enormously complex field that I’m afraid this whole thing about public participation is a gross exaggeration of reality. There is no way that public participation can do anything to change the trajectory. At best it can legitimise things and make people feel, as I say the illusion of inclusion, but as I say there is no way that the public actually has the ability to make a meaningful input on matters of such enormous technicality.

I: That is an interesting point.

R: How about water managers, how about water managers and the people that are directly involved in management decisions?

I: Well you see, to answer that question you have to look at the official policy of the ruling party. Because they form the ruling government of the day, the African National Congress, so the ANC has created the government. The ANC has implemented a number of policies, one of the policies is a policy of cada employment. They only employ cadas. They only employ members of their political party into any position of political authority. At no point in time does technical competence play a role in the selection of the person to be deployed. So this is the first issue, the typical cada that is deployed. Is not technically competent and that is one of the reasons why we have a failing state because we are managing very complex systems with incompetent people. The second part of it is that the legal system of south Africa, having gone through this revolutionary change in 1994, the entire legal system of the country changed and the one part was in the national water act where they separated land ownership from water ownership and that created in that process now a bureaucratic burden that they’ve never been able to fill. Because every single user of water now needs a water use license and the ability to measure that and manage that and monitor that is such an administrative overload that it has never been achieved. And in fact, it has become a disincentive to investment because major investors are saying why must we spent a billion dollars in that country when we can’t have a guarantee that the water we need for our factory is going to be available 5 years down the line. They might cut our license or cut back our right to water. The other thing that has made South Africa the way it is today is the fact that with the revolutionary further than what happened in 1994, the entire legal system was turned on its head and we saw a separation of rights and obligations. So from the constitution now to every piece of law, rights and obligations are no longer the same thing. So for example if you look at the labour act, all workers have got rights, major, major big rights but no obligations. There is no obligation that a worker has to meet a target or to be productive in a certain way or whatever, but they’ve got all the rights and on the other hand because the struggle was all about an ecological struggle against, labour and capital owners, the capitalists, your investors or your owners of companies were seen as the enemy and they had no more rights but lots of obligations. So the owners had no rights whatsoever, they just don’t have any rights. If a worker decides not to come to work you can’t fire them because whatever thousand reasons why you can’t fire them. The whole thing about rights and obligations has made the South African economy so difficult to manage and impossible to grow jobs in. On top of that you have this cada employment policy and on top of that you have this other issue of black economic empowerment. The BEE legislation which is now mandated, all procurement by the state has to come through companies that are BEE compliant and very often these companies have no technical skills at all and you just get a situation of frantic. All that has done, it’s not built skills in the country, all that’s done is build a level of corruption in to the procurement process. It’s become so institutionalised now that the costs of procurement have just become extremely high and of course in this whole mix, with the separation of duties and obligations, duties and rights, your cadas because they are political deployees they know that they are protected and there has never ever been any legal comeback to any cada, so a cada can go steal. Take for example the president of the company Jacob Zuma, who effectively stole a quarter of the GDP of the country, still to this day he is still waiting for any criminal prosecution. So in other words, that’s the problem, the problem is being the actual cada, the cadas are protected by the party and therefore you can’t have a rule of law. So we’ve migrated away from the rule of law and without the rule of law you can’t hold your, if they screw it up, so what, what are you going to do? They simply just deploy them somewhere else and they carry on stealing and breaking things.

I: I never knew it was so complicated.

R: Oh it’s very complicated, if you get a foreigner coming in here and they look at all these things, I always look with some amusement when they try and look at these things like all you need is more public participation or all you need is more gender equity, all of those things have actually been part of the failure.

I: So, what solutions are there then?

R: Well South Africa is currently in a crisis situation and we are going to, we are really at a binary moment in our history now, one of two things is going to happen, we are either going to continue this collapse, the state failure scenario, in which case we are simply going to become another failed state in Africa, another Zimbabwe another Somalia, you name any one of those countries, OK. The world doesn’t really care about South Africa anymore, you know, we don’t produce anything of economic value, we don’t produce any mineral that the world needs anymore, there is some platinum but that is the only thing that we could simply produce, we don’t produce technology anymore, we’ve deindustrialised, they’ve reinverted the apartheid trend, but in so doing they’ve destroyed the engine of industrialisation, so the world doesn’t really care about us, we’re just going to become another Zimbabwe, another failed state. With hyperinflation and an outward migration of people. That is one option. The other option is a full blown revolution, where we will now become something like Venezuela. A full on revolutionary change, where everything is nationalised, the bank is nationalised, everything is nationalised, of course then we go the typical route that Venezuela followed. We could consider a democratic transition. We will know that very soon, before you finish your PhD you will know that because we have an election in 2 weeks time and you will get an indication at least if there’s going to be a change in support for the African National Congress. Because there is a ground swell opinion that is now turning against the ANC. You’re starting to get a situation where the ANC members that visit rural areas are now being stoned. They are no longer welcome in these rural areas. These are changes in the support based from the past but we don’t know if that’s going to happen at a big enough scale to make a difference.

I: Ok, that’s interesting thank you. So, obviously there is a gross incompetence in government, do you think NGOs can have a significant role to play in water management?

R: Well, NGOs really can’t do much for the simple reason that the management of water and other critical services is defined by law, it’s a statutory definition and you must appreciate that the power that comes from the allocation of funds is what has driven the patronage model that has held the ANC together. So I cannot see the ANC easily giving up the authority to NGOs. In fact there is an example of an NGO that has been around for a long time now. The Mvula trust. The Mvula trust NGO has been around since 1994, so the question is has it managed to fill the vacuum filled by the failing state? Yes or no? You can go and do some political research on the Mvula trust to see if it has, from my perspective I have not seen the Mvula trust fill any gaps at all. In fact I have not seen any NGO capable of filling any of the gaps at all. So, I am not optimistic about the role of NGOs in filling the void.

I: Ok, thank you. My last question is are there any water management case studies that you think have been a success in South Africa?

R: There are some very successful water management cases in South Africa and for some reason they tend to have gone unnoticed. I don’t know why that is, so I will draw your attention to a few now.

I: Thank you.

R: So I think the first real success story in South Africa, actually on ANC watch, it was an ANC initiative was the Durban South Waste Water Treatment Works. At a place called Amazimtoti. They became the first waste water treatment works in the country where they started treating the effluent up to industrial grade water rather than discharging it in to the ocean. That became a huge success story because there’s an oil refinery called SAPREF the South African Petroleum Refinery, SAPREF, they get all their process water from that waste water works, and there is a paper company that makes paper for computer printers, this is actually all made with recycled waste water. So, that is a hugely successful enterprise that for some reason has no received any attention. I don’t know why. The second thing also comes from Durban, the Durban area. Right now, as in the last 6 months, there has been a trial going being run by a company by Hitachi. Hitachi, a Japanese company. Hitachi has been running a trial on membrane technologies for sea water desalination and what they have done is, the model is called the remix. What they have done is they have demonstrated proof of concept where if you take the waste water from a waste water works, the recovered effluent. Now, you know there is the treated effluent and if you put that in to sea water you reduce the salinity of the sea water and therefore you bring the cost of desalination down to almost on a par with the same cost for service water provision. So that is a huge technological breakthrough. You are not seeing that anywhere in any sort of way. There is a third very big story that is about AMD. Acid mine water recovery, there are two example of it which are world leaders, world class technologies. One is a place called Emalahleni, used to be called Witbank. There were two big mining companies Anglo-American and BHP billiton. They had this AMD problem and they worked together about a decade ago and they built the first ever desalination plant of acid mine water. World class, world class and that supplies all of the water to Witbank now, drinking water. Subsequent to that, the technology has been driven at another plant Turffontein. It is a mining area, in the middle of the coal fields, in a tiny place called Oekhies and the Turffontein plant, I’ve been working at that plant so I know about it, they have set a new standard for 98% recovery of water, they only put 2% discharge of waste. That has set a global standard and that is also not being spoken about anywhere. That is amazing technology. So those are some examples that I would say have not made the headlines but are really good examples of success.

I: Yes, definitely. Thank you, I will definitely search those. That concludes my questions, thank you so much for your participation.

R: Ok, good luck with your studies.

I: Thank you very much.

R: Excellent, bye.

**ACA3**

I: To what extent is South Africa a water scarce nation?

R: It depends how you are measuring water scarcity, but yes per capita water availability is limited in South Africa. South Africa has a fair amount of water infrastructure that has improved the situation but yes, a limit on the amount of water available, pretty low on the scale.

I: Thank you, do you think there is an inequality of the distribution of water?

R: Yes.

I: Okay, good, thank you. Who do you think benefits more than other?

R: I think, the middle class predominantly still unfortunately the white population, but those who have access to services and those who have access to the water resources for productive purposes and those who are disadvantaged and mainly the working class and the unemployed.

I: Thank you. What do you think are the main strengths of the NWA 1998?

R: It sets out a process for the involvement of people in the management of water resources. It recognises the inequality in South Africa and the need to address that. It recognises the need to put environmental sustainability in the management of water resources. It takes catchment based approach which I think is useful but it has its challenges in implementation.

I: Why do you think implementation has been so difficult?

R: Well, for a number of reasons. There have been a number of challenges around the complexity of the legislation. Capacity in the country. Capacity in the face of having to change the staffing of the department in order to meet demographics. There has also been more recently massive challenges around corruption. There has been a serious problem around failure of leadership with a number of DGs and ministers which the department has had over the past 15 years.

I: Thank you. The water act of 1956 was a very unequal act, but was there anything that it did better than the NWA 1998?

R: I don’t think the 56 act was in anyway better than the 98 act I think the implementation of the 56 act was probably better than the implementation of the 98 act. But implementation of the 56 act was done by a bunch of technocrats with a limited view serving the minority of the population. So it was a lot easier to implement. If you just exclude 80% of the population it makes life much easier.

I: That’s true. Thank you? Do you think the policies could benefit from public participation?

R: The policy that is in place at the moment, the white paper which dates for 1997 was developed in an extremely participatory manner and so I think that was well informed by people’s experiences on the ground. By a range of different stakeholders etc… Yes I think that policy should be developed in a participatory way. You get a whole range of experiences to the table.

I: What potential do you think household rainwater harvesting might have to contribute to water security in South Africa?

R: It may have some benefits it depends on the area, one would have to look at, it depends whether it is self suppliant or whether you are looking at a government programme, if it’s a government programme would that replace reticulation and if so why? Yes, there is potential for RWH but one needs to look at various things. Whether its seen as a replacement for actually decent services or whether its seen as an odd on, something that can help in the interim for communities that are particularly unlikely to be served by the grid. Then how one manages the issues of water quality.

I: What do you think of saltwater desalination?

R: There’s already desal in South Africa. It’s relatively small, but yes. If you look at the planning done by the DWS you will see that desal is already on there. But it’s not the first option because it is still a very expensive option and with very high energy demands and you know what energy is like in South Africa there are massive outages, yeah so, desal is being considered in various places its on the dams for Cape Town but it’s on various people’s plans, but it’s very expensive and it requires massive energy.

I: Thank you, my final question is do you know any projects in SA that you are particularly proud of how they managed water?

R: I think the way that Durban went about trying to ensure that Durban went, trying to ensure that poor households and households in informal settlements got access to water was very innovative and very interesting, rural water supply no I can’t think of anything off the top of my head of anything particularly fantastic.

**ACA4**

I: Do you think the distribution of water in South Africa is unfair currently? Are particular stakeholders losing out?

R: Yes, so unfair is a bit of maybe not the right term.

I: Unequal?

R: Maybe unequal. We have a constitution in South Africa that really does support access to water services through our free basic services policy and through our ability to make sure that most people have access. Having said that, while most urban dwellers have access to water services of some form, generally better in terms of water supply than sanitation, I would say virtually 1005 of urban dwellers do have access to water, it might not be in their homes but it would be in the minimum prescribed distance a communal tap stand or that sort of thing. But, within urban areas, the lower income and the informal settlement spaces are subject to more breakdowns and more interruptions to their water supply services. There’s no two ways about it. They definitely do not have equal access, compared to fully serviced houses and that’s for a number of reasons, it could be breakdowns in the reticulation system. It could be, generally, that’s the problem actually. Lower grade plumbing, fixtures not operating they are, they are not maintained the way that should be, so that people, often there are breakages in those systems that mean that lower income people are more subject to the interruptions. So people that can afford to put in rainwater tanks or groundwater systems, those sort of things are able to provide their own level of resiliance to watershedding or water problems. So yeah, in affect it is unequal because of the way in which the system works.

I: Thank you. What do you think might be the best mechanisms to try and bridge that gap, to make it more equal?

R: It is difficult, these are very huge intertwined wicked problems, around things funding availability, capacity, infrastructure deficits, corruption is a huge problem in this country, we now have the added problem of loadshedding, we have an energy crisis. So there are all sorts of intertwined that make the delivery of water services quite complicated, how they would be better? Well I guess you have to address all of those different issues and ultimately insure that the services that are provided even in low-income areas are at the same standard as they are throughout cities as a whole.

I: Yeah, how about public participation? Ways for members of urban dwellings to be educated about the problem and then to leverage their involvement so that they are collaborating with stakeholders.

R: Yeah, that’s the million dollar question actually. These are the real issues that the cities government, the water authorities, the utilities are grappling with at the moment, in fact, just yesterday I was at an innovation, a summit launching platform for innovation, that the city of Cape Town is launching to try and engage with local residents around innovations on the provision of water services, particuarly around water quality. What they are saying is that those innovations are not just tick, how do we engage, how do we develop community platforms, how do we put in place the ways that people can build knowledge and awareness about water issues? But also involve themselves through community groups, through NGOs, through neighbourhood groups, all of those sorts of things. To actually get involved with the types of activities that would start protecting their water assets. Those are not only the ones you could think of in terms of protecting reticulation networks, or, you know, insuring that they are not wasting water, but also things like not flushing the wrong things down toilets, that then cause blockages and that then result in overflows of sewers and contributing to water supply systems and all of those sort of things. It is really about raising levels of consciousness. Getting people to understand the really aspects around water management and how they can contribute in their own ways. The city is really grappling with it and they are doing it through a number of different programmes around water awareness around, as I say, bringing in these innovations and trying to get people to engage more broadly.

I: That’s great to hear. Is that coming mostly from government? Or NGOs?

R: Mostly from government. There is some NGO action, there is sort of activism, particularly around service delivery in low-income areas. Where there are sort of ground up activities that are starting to push local government in terms of service delivery but the broader water consciousness engagement activities are actually coming form the local authorities.

I: That is encouraging to here. Do you think that the SDGs, SDG6, has that provided a good framework for forums and collaboration?

R: I think that the SDGs, SDG6 have given us a good framework. It is something that particularly the national government can set its sights towards and start speeding into the different development agendas that are happening here in Africa and in South Africa as a country. I think it has been helpful and South Africa generally, is sort of on target to meet the SDG around water supply, that is not really our problem. Even though we are a water scarce country we are still mainly managing to ensure that people have access to the resource and that they have access generally to a good quality resource. The issues around wastewater treatment and sanitation are quite different. We are not as good in that regard. The problem with that is that is now having knock-on impacts on water supply systems, so there is a huge initiative from national level down to local authority level to really look at issues of sanitation and the linkages to water quality.

I: That’s good thank you. One of your papers came up in my literature review, 2013 measure of sustainability in context of urban water management. It’s a good paper. Do you think there is enough monitoring of sustainability and the right use of indicators? Is that something that needs to improve in South Africa?

R: Yeah, I mean, I have to say that there isn’t enough monitoring and use of indicator systems, because that’s why I did that research. But, I must say, whether an indicator system would actually difference, I think that what I found as part of that research is that we can’t just look at things like, at that stage it was the MDGs, now it is the SDGs, we couldn’t just look at numbers of toilets numbers of taps, whether people had access, because the reality on the ground is so different, when you, a city can say 95% have access to a toilet, for example and you know jolly well they don’t, because the toilets are broken or locked, something has happened that ensures that people do not have access. We have to start looking beyond the indicators that just look at monitoring numbers and percentages and access to those start considering the environment as a whole, so my current research is much more around water sensitive cities. How do we get to a place across a number of indicator spaces and to integrate them in to a matrix of conditions that you have to meet and those conditions are as diverse as access but also levels of water consciousness how the environment is responding, what policies are available, all of that sort of thing, developing a much bigger picture of how we are meeting development targets. So, yeah, I don’t think we use that enough, we’ve applied the water sensitive cities index that Monash university created for the centre of cooperation research centre for water sensitive cities and we’ve applied that to Cape Town and Johanessburg and they were very helpful for trying to raise the real issues around water security and around how the cities were managing their water resources, but it’s a new way of thinking generally in South Africa and it hasn’t been taken up at a much broader scale. We are hoping that it will do.

I: I suppose another challenge it is quite localised as well so depending on the different cities so different indicators may be more relevant than others.

R: Exactly, yeah, which is why you need to do this sort of composite, more holistic, identification of the issues and strengths and weaknesses, so you can actually start addressing those context specific ones.

I: Yeah and then it comes down to the implementation, how do we act based on those indicators?

R: Exactly.

I: I was going to ask you about the National Water Act as well because what I am noticing from my research is that the policies in South Africa are brilliant, but where the fall down is the implementation. Why is that? Is it political will? Or funding?

R: Yeah, I think again, it is a number of issues. Post apartheid when we became a democratic country there was an enormous work done on the development of policies and the development of a constitution that became a shining light actually around the world and the water act was sort of associated with that constitution, it became a really aspirational water act for other countries to really show that this is the way that we should be considering equitable access and considering the rights of the environment and all of that sort of thing which had not really been done in other water acts. The problems of implementation, regulation, enforcement, all of those things come down to, I don’t know if it is political will alll those it probably does play out as political will. There are a number of issues around capacity at national level the national department of water affairs was really sort of run down very with many years of corruption, poor leadership, low levels of capacity, the people were not employed into roles with the right qualifications, they lost large numbers of engineers for example, so, going from a very well capacitated ministry within national government from something that really struggled to control what was happening in terms of water resource management, so, that’s part of it. There is very sort of complicated political stuff, that happens in a country, a new democracy where co-operative governance is seen as really important and national ministries do not want to come down hard on local governments or to raise legal issues against other ministries there are real, I guess they are just trying to work out how to work together in these new democracies, so very few legal challenges were raised in terms of the ways in which water was being managed and particularly, sewage was bein managed across the country. Which has meant that we have a terrible situation where less than 30% of all sewage works in the country actually function in the way that they are supposed to. So, nobody is taken to task for this. So I think that the sort of ways in which we are managing and regulating and enforcing that wonderful national water act needs to be reconsidered.

I: Thank you, that’s a great answers. My second to last question is, what do you think of IWRM? Do you think that is something that has potential?

R: I actually think SA is one of the first people to talk about IWRM and we had some really good progress around the country as a whole. From my perspective, I don’t really deal a lot with transboundary water and the sort of issues around the broader bulk water management that usually comes up in the IWRM conversation, but of course SA is well known for that and we do a lot of transboundary water management, through the big schemes coming from countries external to South Africa, so I think it’s done relatively well, what I’d like to see is that it gets transferred more in to the urban space so that we have that integrated urban water management much more across the different departments that manage water in local government, so that we have a system where water is considered as one. Because often in cities, this is a worldwide problem, you will have a department that deals with water supply, you’ll have one that deals with stormwater often linked to roads, so it’s got nothing to do with stormwater, it treats stormwater just as a waste. Then you’ll have another one dealing with sanitation and another one dealing with solid waste and another one dealing with energy, so that all of that things are kept in their own silos they often have ring fenced budgets and they don’t start considering all the various overlaps amongst all of them. That’s where the whole idea of IWRM becomes so important, that we start, all water is a resource, there is no such thing as a waste, there is no such as wastewater that needs to be treated, it is actually a resource that we can use for other purposes, that sort of thing. Once you start embedding the concepts of IWRM in to intercity water management it becomes much easier to manage that whole water cycle.

I: That sounds great, that sounds similar, to I think it’s Singapore, where they have the one drop policy. It is all integrated and interdisciplinary. My final question, what example or case study that you’ve come across in water management in SA would you say you’re really proud and you’d love to see spread across South Africa as an example of good water management?

R: There are probably lots! The focus of our research is around water sensitive that we are doing at the moment that I am extremely proud of actually, is a project that is funded through the Danish ministry of education, we are working with colleges at the University of Copenhagen and it is looking at how we can make cities in South Africa more water resilient and we are doing it through the use of storm water harvesting so this whole idea of turning cities in to catchments, so the Singapore example, how do we do that in a context that is quite different to Singapore and how do we start engaging with the right government processes, the people on the ground and the environment. To try and make sure that what we are doing is fitting the bill. So we are looking at stormwater detention ponds, there are about 1,000 of them across Cape Town metro, trying to look at opportunities to retrofit those ponds with green infrastructure approaches, to enhance the infiltration of rain into the groundwater system and to improve the quality of the stormwater which is generally quite poor in our urban areas. So that it is then abstractable through managed aquifer recharge. The nice thing about that is that the water supply thing and this grew out of our drought that we had in 2018, when we were scrabbling around looking for all sorts of water supply options, but what has been taught to us through the process of this project is it has become far less about water supply but also about creating multifunctional infrastructure within cities that enhance liveability, that create amenity, that give us more biodiversity, through the sort of added water in those pond spaces, that actually create urban heat island mitigation, just move towards creating this sort of water sensitive city space that we are wanting to do and we are doing that in collaboration with local people, so you know being lead by local people, actually doing things, embedding that within their local spaces. So, the whole thing becomes a virtuous cycle if you like. Of trying to embed this process. So, I think that is what I would love to see scaled out across South Africa.

I: That sounds really great. Thank you so much for your time.

**ACA5**

I: I'm interested in is multiple stakeholder cooperation so how can these all these different stakeholders with different wants and needs and uses of water how can they come together? So, I was just wondering as an academic how well do you think that the other stakeholders are taking on board your research, do you find that it's well listen to and implemented into policy and practice?

R: The freedom of researchers is that we can facilitate people coming together and slowly sharing ideas, sharing new ideas. New, not that new, because they are definitely, we pick them up in South Africa itself, but we also compare it internationally and in general you know the big, big promises of course in the 1998 national Water Act, yeah it's just really enshrining inequalities from the past in general that of course was very difficult to realise and then the question is in South Africa, how to still go ahead in this sense. Yeah, so I don't know whether you had read about the constitutional case as an example?

I: No, I haven’t.

R: So, so then the big inequalities, gini coefficients etc.. completely ignoring, as we found 70,000 hectares of informal irrigation in Limpopo province informal homelands. So completely ignoring all water users that are not the formal white minority, now the black middleclass as well, so then, to redress that somehow to get more justice the white farmers are very strongly defending what they had already in 1998, in terms of water entitlement and they are event claiming that they can trade the entitlement, so not the infrastructure but entitlements to water. They can trade it with each other, there is one section in the national water act, sector 25.2, that has gone through the courts, because I think quite alert, the department of water and sanitation realised that you have this trade and there was no sharing of water. They said very interestingly, you use or you lose it. So if you trade, it means you don’t need it, so you lose the entitlement, because you don’t need it, you want to trade it. That was then, the organised white farmers, they kept challenging that up to the constitutional court and the constitutional court had to agree that the spirit of the law was fantastic, but they couldn’t help this section. So, basically that was one of the loopholes that was found. this of course there are problems of getting municipalities the new municipalities, new government, to really deliver services. Just the basic domestic needs. Huge problem as well there and pollution, I think the pollution is horrible and then when we see the way of participation, especially in the catchment management forums there has always been this momentum to get more engagement in catchment management forums, then it is mainly the right concerns, again the white, but this concerns environmentalists who I think rightfully then say hey mines, hey please, get your water pollution avoided. Yeah.

I: Yeah, it’s very complex. You actually answered two questions of mine already because the next thing I was going to ask was about how do we facilitate multi stakeholder cooperation and how do we ensure that everyone is listened to and I was going to ask you about catchment management forums do you think that the they are an appropriate and successful mechanism for making sure that everybody is listening to or does it tend to benefit some groups more than others still?

R: The historically advantage individuals or the technically I think top class, the white minority has top class hydrological expertise, that’s clear, they are the still the ones that I think dominate in a sense, in catchment management forums, and, especially in of course there most important moment in in water management is the moment that investments are made in the infrastructure, the way now that in which the Chinese especially are just getting the water in Limpopo, the top North of the country, the companies just come in and they grab the water and the large scale tomato farmers too, they just build dams and get the water and there is no assessment beforehand of what it means for the people who share the same Limpopo river. It’s terrible, nothing has changed, it’s very sad to see.

I: Yeah that is very sad and like you say the white people tend to have the expertise in water management, how can we redress that imbalance? Because the local people lack opportunities for education and the opportunity to be experts.

R: Yeah, so there is a level of specialisation always and now one good thing is the government has really put a lot of black people, historically disadvantaged individuals, the middle class is now taking over and unfortunately then you always get, with Zuma, you just get worse state capture. Elite. The minister of water, huge amount of money, for example the Lesotho highlands project. Huge amounts of money and contracts that is grabbed by France. So in that sense it is not that, it is more of a class issue than a race issue. But the expertise is still biased. At the same time, we are doing a lot of work now. Of course, people know about water it is self-supplying, community based water tenure is there and that has been completely ignored as well. Nobody has looked at what is happening in informal homelands, 70,000 hectares of informal irrigation. You need some expertise to get your pipes, your gravity systems installed. So, there is an issue for the specialist high tech knowledge, but it is also monopolised I would say. It’s ironic, because they became their own consultancy firms. This whole liberal notion that the government should be small and thin and then they should outsource the important work, then you don’t built the capacity within the government, that would be number one and people in government, officials there, for example, who have been in the department from the beginning, they all say, if we did it again we should do much more about the training of more people than just the consultants that we do now. So there are issues, but at the same time there is a lot of local knowledge that should be acknowledged as well.

I: Exactly, taking advantage of the local indigenous knowledge as well. Opportunities for public participation, do you think that is happening? Like the small-scale local communities are there opportunities for people concerned about the water scarcity, the management of water, are there opportunities for them to interact with the government and be listened to properly?

R: Depends a bit on the topic. I think that the biggest problem is that investors can just go ahead and get a license without considering the impact of the new dams for example, without considering the downstream people, or upstream people. So in that sense, the licensing it prescribes two processes, you should really submit plans to government, governors should go to the people who can be impacted and they should have the opportunity to object and then government has to do something and that process is not implemented properly at all. Sometimes, the environmentalists, they are much more active in using that instrument, I think. Water quality, there is definitely momentum, but water quantity is, people are completely overruled. Another important thing that other community, water and sanitation forums, that’s for the really basic water supply in the peri urban area, also everywhere in South Africa, a lot has happened, constructions are there, but they don’t function. Then the big problem is that the people they tell the municipalities because municipalities are responsible for the basic water supplies and then the municipalities don’t respond and the people get tired. Then the government has tried to create, this community water and sanitation forum, specifically for domestic water users. Sometimes it works. If there is a nice collaboration between the forum and the municipality. Because, very often the municipality says “bye, bye, what is your problem?”. The problem in the department of water is really at national level. While the municipalities are at district level, at local level, it is very difficult for the department to get through that clay layer of district level governance. So then the people are excluded because of this, is it municipality or is it department of water and sanitation?

I: So there’s a disconnect between those two sectors of government.

R: Yes, even in the design and the mandate, in this regard. Which makes it even more complex. So at district level things don’t function, at this capacity, definitely, there is also, it is not easy to create, suddenly a local government. Because South Africa is only 25 years old, the local government now. So this is a challenge. So if the government is at national level and the department of the municipalities, they have the mandate for water services to all the villages. So, the department says “Oops, let’s go a bit”, side lining the municipalities to get those forums. But then yeah, then really it is difficult to do this corporative governance. I think it is very structural issues, it is not easy to, in the analysis of participation, more and more we have to look at the silos within the government and the different tiers to really understand. The third one would be the forums that we discussed already, they are an opportunity. At the moment I think the department is really quite active. The manager of the forums is quite active, it’s interesting.

I: That’s good that there is that opportunity for communication. So, from a municipality standpoint do you think that there is challenges of having too much to do in a sense?

R: Oh yeah, absolutely.

I: From the policy, they are overloaded with what they are trying to address from the legacy of the apartheid?

R: That and the fact that they are new, municipalities are still finding their feet as well. Then of course the whole Eskom story. The electricity problems now. That affects the pumps and the infrastructure also as well.

I: So water is interdisciplinary area.

R: Water is a connector definitely, one of the big problems with silos in government, because at the highest level, it makes sense. If I am the department of finances and the treasury for the same thing to all these different people. So I have to get silos, you do this, you do that and this is the money you get. But then, on the ground, it’s a different story. It’s not easy to resolve either.

I: No, so, what hope is there? Perhaps, hopefully, if we change this then we might be able to have more success?

R: Who is we?

I: South Africa as a nation, holistically, we.

R: Then I think the civil society becomes more and more vocal. So, the problem is how to hear the unheard. Organisations like end water poverty, social and environmental resource of rights institutes, they are very clear on getting the voices of everybody documented and then heard. To really amplify the voices of the have nots. The people who still don’t have water. Of course, yeah. That will then inform a lot of changes, depending on the issues.

I: Is it then another stumbling block with political will. If there is not the political will and the facility to implement changes?

R: Yeah, historically, it is easy to say political will. But myself, if I were in that position, my goodness! I see people who are trying for the first time and they don’t have the training I would still say. I also see people who are really good administrators and governors but it is then very complex to get things done. With limited resources, limited technical capacity, huge problems moving from a white minority of 10% of the population, to suddenly everybody, the challenges are huge. But at this moment, state capture, corruption, yeah, that is very sad.

I: Yeah, very sad. We touched upon it a little bit, but with all of these challenges in different sectors, it’s going to take huge amounts of finance. Do you think it will need foreign investment in order to fund this? Does that introduce even more challenges?

R: Yeah, exactly. Absolutely. The grabbing of the minerals, especially and then also the water. Even the lands, the white farmers, you see them encroaching on informal homelands to drill the boreholes there and that’s really sad.

I: And then even if there were projects that funded solar and these kinds of things, they might use their own staff, like Chinese, rather than employing locally.

R: Well at least the Chinese, they bring expertise. At least, nowadays. Pluralistic, how do we call it nowadays? Plural senses of power. They bring expertise, solar now, more and more it is being developed too late. Because the coal was too cheap, so it was always cheaper to burn coal rather than solar. But solar is going up as well. So, even, I think, that’s why it’s so important to analyse the dynamics of government. Because if you plan based on if you get money based on the plan. If you don’t implement the plan within the timeline, usually the end of the fiscal year, you have to return the money. Then sometime returning money is seen as the biggest sin! In any government nowadays, so it is not necessarily just the money that is lacking. But also the expertise, the capacity to spend it as wisely as possibly. But definitely, more money. Good news in that regard is that the South African Revenue Service, the taxation, they were also almost hijacked, but they now seem to get their act together. At least the treasury. That is one of the more positive things, I think.

I: Yeah, so as well as the infrastructure and energy, there is still reliance on coal. I suppose because there is infrastructure there already and it doesn’t take the investment. The same with water, the infrastructure isn’t in a great state generally, there is a lot of wastage, does that again come down to a lack of expertise and education trained personnel that can maintain infrastructure, as well as investments.

R: Yeah, the tendency, still to design new infrastructure rather than really look at the maintenance of infrastructure. Because the contractors and the consultants, they earn more from a new system that from maintaining. So, there is a bias. The rule is the guys do the capital costs, the investment, but after that, for the operation and small repair maintenance, you have to do, but nobody does that. That remains. 8% of the money should go to operation. Maintenance cost and that’s a problem. So there is still a preferred bias towards new infrastructure rather than maintenance.

I: Yeah, so again, another factor that overcomplicates things, when it could be kept more simple.

R: I don’t how to get more simple, because there is the green drop and the blue drop initiatives. That tried to address this as well, to get this culture for higher performance. Then, you can raid local municipalities based on very standards and criteria. But, yeah.

I: Thank you for your time, my final question is about monitoring now, so do you think there is enough monitoring of water use efficiency and are they using the right indicators in general to make sure they are keeping on top of things?

R: Yeah, the blue drop and the green drop is an example that they tried to do it. Yeah, the biggest decisions is where you keep having high impact users taking the last water that is still available in a sense. Those decisions are taken even before any construction. Because then they plan it there and you know already that is already too late in a sense. So, if I would have to choose between monitoring or money for corporate participatory planning of infrastructure investment, I think the infrastructure investment, it can prevent a lot of problems.

I: Yeah, by using precaution to foresee the challenges?

R: Yeah, exactly.

I: That could also translate into pollution as well and large corporations.

R: Absolutely. Pollution issues are huge.

I: There is still the legacy of the acid mine drainage with the mining companies.

R: Horrible, yeah.

I: Do you think that is starting to change now? Mining companies are taking more responsibility after clean up?

R: I would be happily surprised. This is a field I don’t know about very well. I do hear in the catchment management forums. I do hear that pollution remains a huge issue and me, I would say probably the control and enforcement of pollution measures is weak. It’s weaker than what it was in the past. I don’t know, but it is still absolutely not sufficient.

I: Yeah, impacting the water quality which makes it not potable, or fit for purpose.

R: Yeah, so in that sense the quantities and qualities are very relatable.

I: Yeah, if you lose quality you lose quantity of what is usable.

**AGR1**

I: How depleted are water resources in South Africa?

R: The level of water resources depletion in South Africa vary from region to region, this happens due to the ongoing drought period that the country is currently experiencing since the year 2015.

I: What are the main management causes of water scarcity?

Well, aging infrastructure and a lack of adequate water supply infrastructure in some areas, especially in the remote rural areas

I: Do you think water is distributed equally amongst communities? Who loses out? Who wins?

R: No, water is not equally distributed, although it is a constitutional right for water to be distributed equally as part of service delivery for the citizens of South Africa, this result from the fact that South Africa is still faced with the effects of inequality within the political and regional boundaries, where areas that had better service delivery are in a better state of access to water to date, compared to the areas that were underdeveloped during the pre-apartheid regime. The areas that win are the areas that were well developed before the democratic ruling and the areas that are mostly affected are the areas that still require massive infrastructure for the distribution of water

I: Is there an equal share of the environmental benefits and burdens?

R: No, there is never equal share of environmental benefits, because some areas are not environmentally oriented when compared to other areas that include issues of environmental awareness in their daily activities.

I: How easy is compliance with legislation?

R: It’s never easy to comply with the legislation given the state of the economic, the bioregional issues such as population growth, emigration-immigration issues, and lack of by-laws especially in informal settlement areas

I: How important is the quantity and quality of river water for irrigation?

R: Very critical, as both water quality and quantity are crucial in the economy of the country and also in supporting biodiversity

I: How can agricultural companies reduce the amount of water they use?

R: By adopting the strategies that they can use for reducing the amount of water used for irrigation, such as the use of micro-jet and drip irrigation systems, where less amount of water is lost due to evapotranspiration. By programming the irrigation systems, by irrigating only when then crops need water, by irrigating only at night, by using the drought tolerant crops that require less water for growth from the stages of growth to the full stage of maturity.

I: How can local communities become more involved in water management?

R: When the local communities are being placed as the main role players and stakeholders in the activities of the community, their role in water management tend to be more effective than when they are being excluded in the planning for water management. When communities are involved in water management, vandalization of water infrastructure become less to null as the community become the custodian of the water management initiatives.

I: Are you familiar with the National Water Act 1998 (NWA 1998), what are its strengths and weaknesses?

Yes, South Africa as a developing country faced by issues of population growth, it’s also faced by issues of under capacitated government departments, where there is a shortage of expertise to implement the NWA is areas that require attention. As a result of this, the NWA appears to have many loopholes and not even close to become effective in other areas. E.g., in remote rural areas where there are wetlands, communities tend to develop of farm on wetlands and temper with the sensitive ecosystems, due to the unavailability of expertise required to make the communities aware of the importance of protecting the wetlands, and as a result when such developments are undertaken on the sensitive environments, the strength of the NWA is less seen. As indicated that its effectiveness is highly visible when there is enough expertise to implement and pass some knowledge to the communities regarding the importance of maintaining the natural water resources.

I: How much does AMD affect water security in South Africa?

R: Highly impacting the water security and lot of work has been doe but seems not to be obtaining a solution toward the AMD problem, only in those small areas where phytoremediation is being used as a solution to decontaminate the AMD sites

I: Do you think that public participation has the potential to benefit water security in South Africa?

R: Yes, it allows anyone to freely express their needs and concerns regarding the water management issues

I: How can local communities become more involved in water management?

R: By being considered as the central people towards solving the water management issues, this can also apply to other issues, when the community can come up with ideas, those ideas will eventually become long term than having ideas imposed on them

I: Do you think that rainwater harvesting has the potential to benefit water security in South Africa?

R: Yes, it has in many areas resulted in the shifting of the mindset and attitude towards water saving and some positive stories have been told on the rainwater harvesting especially in strengthening the food security of most family backyard gardens

I: Do you think that saltwater desalination has the potential to benefit water security in South Africa? Any others?

R: Yes, but it’s a costly task that could increase the burden on the government given the state of the energy crisis that the country is currently facing

I: Overall, do you think the government is doing enough to address water scarcity in South Africa?

R: The government alone cannot address the issue of water scarcity, NGOs should also play the role.

I: What role can NGOs play in water security?

R: Research is one crucial component that can be played by the NGOs by bringing together the relevant stakeholders together, as most of the involved stakeholders work in silos, and this affect service delivery

I: Ultimately – What needs to happen to improve access to water in South Africa?

R: The provision of water to the communities and community engagement on water management strategies, as well as saving water and use of rain water harvesting tanks

I: Do you know of any examples of good water management practices in South Africa?

R: The Working for water, the working for wetlands, rainwater harvesting, water use efficiency by the fruit farmers, the more crop per drop, the fixing of leaking pipes, the wetress are among some of the successful entities that have resulted in the fruitful water management practices that have been implemented to conserve water.

**AGR2**

I: Water management in local communities, to what extent do you think education is helping to build capacity in local communities? And helping them manage their water more effectively?

R: Yeah I mean, we like to think we are making a difference and we certainly, that’s certainly our aim. I think the one thing that we always say is, that water in particular and it’s true for other things as well, that are these common resources and the management of the commons, is one, there’s no silver bullet and two, there’s no technological fix for it either. So that’s what we kind of say with ours. On the surface it sort of presents itself as a bit of a tech solution right? Like there’s a gadget and you know, so forth. Data that it provides and things, but actually the tech is really just the gateway to the learning journey for those communities, for the individual farmers and for the communities that they are involved in collectively. It’s a way, the tech is a way for that learning to happen. Particularly on a social level. Most of those communities, the management of water is a very social exercise. They are often sharing water sources, they are on shared infrastructure schemes. They might be in a co-op and collectively growing food to sell to a supplier or something like that. So it’s always interactive, it’s always community based. It’s always social. You know really I think the biggest missing link to solving some of the water management issues in places like South Africa and other places is how to provide people with the information and the way to learn a new way of doing things. You know, learn a new way of how to use their water more sustainably. That’s kind of what we are trying to do.

I: That’s brilliant, thank you. That builds into public participation and giving local communities the opportunities the water themselves and had their voices heard. From my findings, a lot of perhaps the negative side, or some scholars may say that for public participation to be successful, the local communities need to have a complex understand and technical know how, do you think that’s true? And how can we overcome that hurdle?

R: I’ve got to say no, I don’t think that’s true, the way that my organisation has been built and the way that the technology and the learning is been built is really around simplicity and minimisation of participation particularly. There was a lot of research done in the early days, what’s the minimum amount of information that a farmer needs to change the irrigation practice? To irrigate more sustainably. And it was really that question of what’s actually the smallest piece? What’s the one or two critical pieces of information that they need? And forget, you don’t need everything else. Everything else is kind of just superfluous to that. That’s really, what we are built around. Both at a farmer level and then when they join in community, is, how do you provide them with the simplest piece of information that they can apply in to their own context and into their own experience and use that to change the way that they are doing things? And so yeah, we definitely run a little bit counter to what a lot of the industry and everything is kind of going. Particularly when you look at first world agriculture. The precision agriculture and big data and all these things, it’s just massive amounts of data. Which is fine, when you’ve got a computer sitting there and you’ve got a robot going and you’ve got automatic pumps and all sorts of things. In a first world setting in Australia and the UK and the United States, wherever it is, those solutions are fine and they work. But yeah, we find that when you get to these low income, base of the pyramid situations, those solutions aren’t practical, they’re not viable. Particularly from a cost point of view. Yeah, so you have to have a completely different approach to it.

I: That’s great, that’s encouraging to hear. Thank you. So when you speak about the basic the knowledge, the one or two important things, could you expand on what is the core knowledge that the local communities do need to know?

R: I mean really, the core pieces of information that we focus on are and obviously this is agricultural and irrigated crops is, what is the crop actually experiencing? So our tools tell a farmer and they provide a colour output to the farmer about what the crop is actually experiencing in terms of their level of access to water. So it is not actually a moisture content it’s actually a tension reading. How hard does a plant have to work? To extract water from the soil. So that’s one thing and that’s a piece of information that you know, most rural farmers in countries like South Africa, in the vast majority of the world, even in the first world, don’t ever know. They have their own ways and their own experience and observation of things of how they would determine that or infer what that might be. But in terms of accurate scientific reading for that, it’s extremely rare and to do that in a cost affordable manner is extremely rare. So the first thing is what is the plant experiencing in it’s need for water. Then the two things that we then focus on that are the really simple ones to get the message of and the primary one is, how much fertiliser and its nitrate, in the terms of agriculture and crop growing. How much fertiliser, how much nitrate is available to my plant right now? And the relationship between application of water and what happens to the fertiliser in the soil. That’s all around how do you minimise the amount of leaching in the soil. Really, what it comes down to is when you tie those two things together, farmers very quickly work out that over irrigation, applying too much water, washes the fertiliser out of their soil, washes the nitrate out of their soil. Past the roots of their plants and into the groundwater and they very quickly change the way that they irrigate. Based on those two very simple pieces of information. That’s mostly to do with the fertiliser because the fertiliser is the expensive part. For a smallholder farmer, most of the farmers in these community settings are paying either nothing or paying very minimal amounts for their access to water. Purely trying to encourage them to save water for sustainability sake or the person downstream or whatever else, you know that’s a very tough message to get across to a smallholder farmer who is struggling to survive in a lot of cases. But then, if you can link that to actually, by over watering you are wasting fertiliser and that’s costing so many hundred dollars, you know, hundreds of dollars per season, then it’s yeah that makes sense and yeah I’ll change now. You go that way.

I: Yeah, that’s a good way of incentivising it for them. Yeah that’s interesting, thanks. Do you find much variation depending on each specific local community you work with and the challenges they face? And the solutions they face, do you have to adapt much? Is it generally the way you are describing identifying the problems with the plants, does that work across all spectrums, or does it need some adaption?

R: Yeah, that’s a funny one actually, because the principals are universal. Right you know, plants grow the same and they have the same requirements whichever condition they’re growing in. The really interesting thing we find is that, it’s more, it’s around the mentality of farmers. And farmers don’t, they want to see something work in their own context. They want to see something work in their own local, doesn’t have to be their immediate community but at least in their local area. Somewhere, regionally close to them, somebody who is growing the same crop in the same type of soil that speaks the same language as them, and these sorts of things. So what we find that is really interesting is, you should be able to transplant the learning and the methology across, particularly, in shared irrigation schemes, which obviously, particularly, in South Africa they are all fairly similar in that sense. But, in theory, it should be translatable and should be able to be moved across, but in practical it doesn’t work like that, you have to be able to go in, establish a new relationship, prove your case again. Yes this works, this is why it works and then people pick it up and go oh yeah okay, that’s fine. I believe that now and then go off. You can’t walk in with a research paper or a story or anything else from outside and come in and expect farmers to actually adopt that sort of technology or those changes. Our experience would say that it doesn’t happen.

I: Yeah, so it’s about making them feel that you are understanding their specific needs?

R: Yes. I don’t know, it’s obviously a risk adversion in the mind of a farmer, in terms of that and going, wanting to see it with their own eyes and wanting to experience it themselves before they really dive in and adopt. I’d say that’s probably true for most, any sort of change, whether that’s a new seed variety or whatever. A family would be in the same boat. Particularly in these basic pyramid type farmers. A lot of them are in South Africa. When you are so reliant and you are running so close to the line in terms of income and poverty and food security. Take a risk and try something new is, a, I can’t relate to it in that sense, but it would be a very scary thing to do right? How do you help them to overcome that and actually see it in action and working before they go on and take it for themselves.

I: Yeah, that’s interesting to hear. It focuses on building trust. How much cooperation from other stakeholders and support from government, do the farming communities have? Is it more like NGOs are bridging the gaps that government are failing to do?

R: It’s, my experience would say in South Africa that it’s fairly cooperative. It may be that the NGOs and things are sort of plugging the gaps that the government system is not. But there is definitely activity through the government sector. The government is trying to work with particularly, smallholder farmers and improve irrigation for agriculture and these sort of things through the public sector and it’s definitely happening through the not for profit, donor NGO sector as well. So yeah, I don’t know how much those two sectors talk to eachother to coordinate their activities but they are definitely both active and we work with both quite regularly.

I: That’s good, do you think that the local activities know that the government are there? And they can talk to them if they have a problem?

R: Yeah definitely, I think it may depend on which area they are in and which provincial government. But certain areas, where we are working and we are obviously working with the ones that are more active. The ones around Gauteng. The ones around Pretoria and Johannesburg we're working with the local departments for agriculture there and they have extension workers that are going out and working with farmers on a regular basis to help with these sorts of things. We’ve implemented training and so forth through that as well, I know that’s happened in other districts as well. So I would assume that it runs across the country.

I: That’s good to hear. How about, like you mentioned just now, about local farmers together knowledge sharing. Is that something is increasing and having success?

R: That’s a tricky one, I think yes that in general people want to happens. Because most of these ones are community based. These people are tied together by language and culture and these sorts of things. So when an intervention comes in, generally speaking people want the best for their community and their people. So everybody bands together to do that, shares knowledge, shares learning and those sorts of things. So yeah, I’d say, in most of those settings that would be true.

I: That’s great. Do you come across much policy in your work?

R: Yeah a little bit, we’ve obviously done a little bit, we’ve obviously worked with the public sector so you kind of always run in to a little bits of policy and bureaucracy in the middle of that, yes.

I: How do you find that? Do you find it hard to interpret and comply with?

R: Not so much on our side. I guess, working in agriculture and the way that we do, we don’t really have to kind of work your way around too many of those policies. With the technology and the solutions that we have in that one. I’d say it’s more understanding the way that the system works in terms of, from our side, the way that the national department of agriculture and the provincials work together and are interreliant on each other and how you go about actually getting something done. That’s the kind of thing you have to work through, rather than a policy getting in your way.

I: That makes sense, a lot of the struggles in SA are the policies are really good but they fall down in their implementation. Perhaps that’s because they may be overly scientific or there’s a lack of facilitation to actually make these policies work in reality.

R: I agree with that. There’s lots of really good policies written and scientific studies done. Obviously, universities and water research commission in South Africa. There’s a lot of understanding there and generally that then gets in to policy and people are trying to do the right thing. I think it’s not just in agriculture and water. I think the struggle in South Africa is the functioning of government in general and so that, best of intentions and people trying their best in the midst of it sometimes, the system just doesn’t work for you and that can be frustrating. But that’s the environment you’ve got to work in.

I: And in the same sense, do the SDGs come in to play much in your work?

R: In our work they do, when you start working towards zero hunger and poverty alleviation. Sustainability of water resources and so forth. That all plays in to it and I think that’s part of, you know, even through the public sector, you know, they are trying to do these things as well. So that’s always encouraging. People want to improve and want to help make a difference in these areas. It’s just sometimes the system is frustrating but you know, the intention is there.

I: Yeah, it provides a good framework. Is there much monitoring and working with indicators to see progress within local communities. Bringing that to them so that they can see the impact they’re having? Does that happen?

R: I don’t know how much of that filters down, back down to local communities. But certainly at national level and things. Those indicators, people are tracking them and looking at improvements and changes over time and things like that. The higher levels, definitely that exists. I don’t know how well that, or if it filters down to get back to communities.

I: Do you think that would be a good thing for the local communities to be able to put a quanitification on how much water they are using? And how much they are saving? Or perhaps, economic indicators too?

R: At a local community level, ultimately I think, yeah to be able to say, to a small farmer in South Africa, because you adopted these practices you were able so many thousands litres of water this year and somebody else has been able to use it. It’s kind of like a feel good story, but ultimately, that’s the struggle with water in general. The saving of water doesn’t necessarily, on it’s own, doesn’t benefit the individual farmer or the community of farmers, but them saving water and keeping water in a river system or a dam, for somebody else to use or for somebody else to use in future years. It’s kind of a little bit of an abstract concept. It's kind of a bit irrelevant. It feels good, but doesn’t actually have a meaning to them. I think the ones that do have a meaning to them is, by adopting these practices you were able to save X amount of dollars this year, whether it was through pumping costs or fertiliser savings or whatever. You were able to get this yield or this return on it and therefore you were X percent more profitable than previous years. I think individual farmers, than as communities, that’s the bit that actually translates through. Given that most of these people are basic pyramid, they’re very low income earners. Would fall below the poverty line in most settings. So I think that’s from the individual level, that’s the real messaging that probably has a lot more standing for them than a sustainable water use message.

I: That makes sense. Are there initiatives to help the communities economically for them to grow food that gets sold to markets or retail? That kind of thing?

R: Yes, both public and through the NGO sector, yeah, there’s all those sort of things. Agricultural co-operatives and you know, collective bargaining so to speak. How do you get everyone together to be doing the same thing? Or be interacting in such a way that everybody benefits out of it? Whether that’s market access or inputs or any of those sort of things. Yeah, definitely both public and private that exists.

I: That’s great and is that having success in your experience?

R: Yeah, in terms of some of the ones that I am aware of, yeah, they have been successful and work quite well. I’m sure there’s others that haven’t. In terms of, particularly, the cooperative style system, seems to be quite effective.

I: That’s good to hear, my final question is about water conservation measures, do you ever work with rainwater harvesting and that kind of thing?

R: We tend to come in and compliment something like rainwater harvesting. Yeah so people come in and set up rainwater harvesting to harvest rainwater through the wet season and then obviously they have a resource that they need to manage through the dry season through irrigation. So we would come and say, in these settings. We can help you to manage this resource. You’ve got a way of capturing it now, let’s help you manage it so you get the best out of it. It’s the same thing as providing someone with a solar pump or somebody who puts in canal irrigation infrastructure. Whatever that is, for us, there’s always this thing about providing access to the resource is great and is definitely necessary and needs to be done in whatever setting that is. Pumps, whatever, but teaching somebody how to use that resource is actually quite often the bit that gets forgotten but is actually so crucial to, particularly, getting a return on investment. If somebody is going to put in so many thousands of dollars of investment to build a rainwater harvesting system or you know, to buy a pump or to put canals in or whatever it is, the only way you can get a return out of that generally speaking, is to manage it really well, so that it sees out its full life span. That area of land that you bought could have been productive under it. Or the theoretical maximum amount of productivity in terms of, crop hectares grown and that’s all, how did you have a management information and a learning system behind that to actually see that through. So we don’t do the rainwater harvesting or all the other infrastructure bits ourselves but we come alongside the people that are providing that and then it’s, how do we jointly work together on this so that you build it you get the return that you are expecting and everybody gets a better outcome by working together. That’s kind of the way that we approach it.

**AGR3**

I: In your experience working with farmers, to what extent do they need to conserve water? How has awareness changed? Are they aware of the approaches that they can use to conserve water?

R: Okay, I’d say they are aware and the adoption rates. So the awareness is rising compared to the previous years. Because now they use more of the irrigation scheduling also the use your weather forecast platforms more often to check as to whether is there any chances of rain so that actually helps them in the decision making at to whether they get told to irrigate and a particular day or they and also like a few of the medium scale and large scale places are now using the the moisture probes on the farm to check the moisture in the soil. So that also helps them in the decision making as to whether they need to irrigate or not.

I: That’s great to hear, with the weather forecasting is it difficult in rural areas where they might not have connexion to the Internet or that kind of thing?

R: yeah it's quite difficult for the small scale grower because firstly 90% of them are illiterate. Most of them don't have smartphones they only rely on one source of weather forecast which is the which is the television. They use bulletin and they actually find it very difficult to, actually, they don't have, I'll say that they don’t have more platforms as compared to the medium and the large as well as the literate ones. So yeah, I’d say they are disadvantage they are deprived as compared.

I: So it is supported by the government and other stakeholders like NGOs

R: Yeah they need advisors, coming from the national Department of Agriculture as well as other relevant stakeholders in the farming sector.

I: And I what state do you think that's in right now do you think that's working well?

R: It is working because they are getting into the habitat now. For example, the growers that I work with in the rural areas, they are getting in to a habit of asking me first before they harvest their sugar cane. Particularly because we are in the harvesting season. So they actually via me mostly they depend on me mostly pertaining their harvesting decisions as to how is the Weather looking like in the next seven days. Is it safe for me to burn? and stuff like that.

I: OK that's great. So speaking about public participation. How can we support communities to be involved in decision making within water management? What are your thoughts about that? Do you think it’s successful at the moment.

R: OK I said earlier on that there is the adoption rate, water management has been improving from the previous years when I when I had joined the sugar cane agriculture sector. As I was saying earlier, that I see sugar cane growers slowly adapting into the usage of weather stations and other weather forecast platforms that are in place in South Africa as well as the usage of moisture probes on the field now. assist them in making decisions as to whether they need to irrigate or the moisture is sufficient for crop growth for that particular time.

I: That’s good. How about interactions with government do you think that they are well supported by the government and if they want to talk to them about a problem are there systems in place for that to happen?

R: OK with this plan I don't think we are at the stage where we can say it’s successful. We don't see much government involvement in terms of that.

I: Why do you think that is?

R: I wouldn’t really know as to what is the main reason. The reason I'm saying we are not seeing much of the government in the systems in place, is because of a recent incident that we had in in the area that I'm working in. We had a lot of floods and there were no systems in place into water management or into water conservation. They didn’t have anyone to report to or to actually intervene in preventing this from happening again.

I: Yeah, so the work you are doing to build capacity and knowledge within those communities is important.

R: Yes.

I: And how about the infrastructure in place is it mainly groundwater that's used?

R: It’s the rivers and dams mainly.

I: OK and then in terms of the load shedding that South Africa is experiencing at the moment is that influencing the pumps for irrigation?

R: Definitely, it is influencing. What normally helps particularly the large scale growers is that they do have solar panels and your backup generators. But for someone who doesn't have then they are definitely being affected by loadshedding.

I: Yeah, that's really bad how about the sustainable development goals does that ever come into your work and does that provide any framework at all for you?

R: With the SDGs, I would say there's zero hunger most that is the SDG that drives the work that we do.

I: That's good, how does it support your work?

R: Right with the work that we do, we aim and strive to, one, help growers become sustainable, so they can always, one, generate ways of income. Two, the food security, to make sure that they are secured when it comes to food.

I: That’s great. From your work, what projects are you most proud of and that you think is a great example for water conservation in South Africa?

R: With the projects that I have done, one of them was the sugar scheme where we introduced the sugar cane varieties that were able to survive under rainfed conditions. Because mainly people depend on irrigation. Then there were varieties that we introduced and for me, was to drive the project and make and promote that variety to our small scale growers. To say hey, this is the variety you can try on and there’s no need for water. Especially now that, not that it doesn’t need water, but it doesn’t need, it can be survive under rainfed conditions. It does well even if there is no supplementary irrigation.

I: Yeah, that’s great, so there’s more resilience to climate change.

R: Yes, definitely.

I: A kind of adaptiveness that we need. That’s really interesting. So, with the different communities that you have do you have to adapt your plan to the different climate that they are working in?

R: Okay, I’ll say yeah, because all the farmer groups that I am working with practice agriculture under different conditions. For example, some of them, strictly, mainly dependent on rain. Not irrigating at all and the other group sort of 50% rainfed and 50% supplementary irrigation. So obviously the way you treat them and the recommendations that one would make, would have not been the same across the groups. So obviously, in all the recommendations that you make, you have to take it in to consideration as to how are they farming and also the climatic patterns of different regions.

**AGR4**

I: From your experience and the people that you've worked with or come across in your work in agriculture do you think that the awareness for water conservation is increasing and growing?

R: Yes definitely, if I think about 10 years ago, not necessarily, but, seeing the landscaping here and talking to a lot of key clients, for instance one of our key clients was vodacom, which is a cellular network in South Africa, a big company and they have a big Rose Garden, it’s full of thousands of roses and slowly but surely we started educating those key clients of the water scarcity that we will face in 2020, as predicted by the South African government. Slowly but surely changed over the entire landscape from a formal English Rose Garden to an indigenous waterwise garden with South African plant scaping. So yes, now it's a lot more prevalent but a few years ago, no.

I: that's interesting I did not think of Vodacom having rose gardens.

R: Yes, exactly.

I: So you mentioned native species, is the removal of invasive species quite a key part of your work?

R: Yes. There are strict rules and regulations regarding that, it’s also something that is now being more spoken of creating more awareness. Historically speaking, not at all but they've implemented bylaws that when you sell your property and there’s invaders on it either they do deduct from your selling price and that’s agricultural as well as metropolitan areas. Or you have to remove it by law before selling it to somebody. So it’s a lot more focussed on that.

I: OK, that's interesting and is the policy well implemented and enforced?

R: It is enforced by the government to a certain point and they're called the green scorpions. They h I think I doave a hotline where you can contact them, where you can log any claims. They do go around and just stop and visit many times more your development areas where there is a property being developed there's a lot of cash maybe in the background. Then they hit those property developers with fines so there is fines implemented. But it is there and then the government also have out a lot of tenders towards invasive control. Which is great.

I: That’s good to hear. I have found in my research that policy in South Africa tends to be really good. But where it often falls down is it’s implementation.

R: Yeah, it’s the policing of it that’s not really practical.

I: So maybe the fact that they can generate fines is a factor for funding that project.

R: Yes, they can get money.

I: From a participation perspective, the local communities there, are they disadvantage access to information and education?

R: Definitely, however, I have to say I think a lot of the tenders go out besides governmental properties will also be in those areas for invader control. more so than within private properties a general lack of information flowing through to the more local populations.

I: So I suppose, is it about building capacity within communities so that they are capable themselves to manage and make decisions?

R: I think it’s within our South African government we've got a EPWP programme, EPWP, so the empowerment of the local communities by employing them in a formal sector and then they do litter picking, invader control etc… what we also have, just for interested, I reside within a big 5 game reserve in Gauteng it's the only one within a metropole in the world that function with free roaming big 5 animals. So, we have a lot of invaders dominant in that grassland area. What the government started using is they’ve got a lake to control the fires, if there’s any fires, fire water and fire, what I can do is I can make a note and I can send you the formal name. So what they do is in the seasons, where they do not do any block burning to prevent any fires from running wild in the game reserve they are focussed on invader control so they will do block by block invader control within and that is funded by the government making use of local employment with the surrounding communities around the game reserve. So there is initiatives like that.

I: Yeah that's one of the focuses of my research, multi stakeholder cooperation, are there mechanisms in place to support different stakeholders coming together and listening to the different needs of each other?

R: Yes. That’s been going on now within the game reserve probably for the last five years. working very well.

I: That’s good to hear. Aside from that do you think that big corporations like you said Vodacom are they well supported in terms of how they should conserve water and biodiversity? Are they well supported by government and NGOs that kind of thing?

R: I don't necessarily think by government. I think, more by the new drive that they call ESG. You’ll probably be familiar with ESG and there's a lot more focus where they try and implement it but not necessarily, knowing how to do it so we in the company that I function we do have a landscape environmental scientist principal, that’s what he does for a living. So what I did is when I got your invite I immediately sent it off to them and they said oh they are also interested.

I: Oh that’s good!

R: If you need some more advice they can obviously give you far more scientific feedback. We've been supporting big corporate companies with regards to their ESG reporting structure. Because it's very new, it’s new to me and to them they do try and do the right thing with social responsibility and environmental. But from a government side, I don’t think they are getting any support.

I: OK. So then in terms of that it's about monitoring and using the right indicators to measure success I suppose?

R: yeah

I:So what kind of indicators might they used to make sure that they are conserving water in the right way?

R: There I don’t really have any insight because that’s not really my speciality. But, I do have the scientist that I can ask him, he can maybe send you some information because they support them with establishing the indicators and drafting it up, then measuring according for the reporting. So that’s in a high overview that I know about that.

I: That’s okay no worries. It’s quite a scientific aspect. Do you work with any water conservation measures such as rainwater harvesting or that kind of thing?

R: We do work with it on various levels on various of our sites, rainwater harvesting is one of them, the other one is rain sensors within our irrigation systems. That can be shut down because of, for instance in the middle of Gauteng we've got a lot of dolomite so it’s prone to a lot of sinkholes. So in those areas we do have a lot stricter form of reporting on any leaks. Detection, we will immediately pick up on a leak within a day because it's and we can actually say it's 40 litres that went missing and where did it go? We also have other sites where we make use of water from out of the very dirty Yukskai river. That runs through a main artery in Johannesburg. We allow certain quotas to use per day so those water are also measured and reported on a daily basis. Also in our landscape, we make use of material as mulch to cover the ground so we have less evaporation suppression of weeds and everything else and so we do a lot of education through our clients to implement it. We also make use of, I don’t know if you've heard of hydrozoning.

I: I haven’t.

R: That’s actually very interesting. If you want, it’s free for the public to use I can e-mail you that hydrozone. Together with the various stakeholders within our landscaping industry as well as the plant growers, to zone down, because we've got different biodiversities, to zone down, plant groupings from trees to ground covers that will function well within a zone to preserve water to use your water better, so that is going to gain some traction. It is currently free and available within our industry and we have been handing that information out to our clients. Especially the residential estates finding a lot of info regarding that, very knowledgeable they enjoy that. It is actually starting to filter into our tender processes when we tender for a project. That is forming part of it.

I: That's great, that's good to hear.

R: That reminds me, in our South African landscape institution, nationally, we’ve got an award system whereby our members, it’s a nonprofit organisation, enrol a project and every project, no matter which category, be it environmental, rehabilitation or design, it is compulsory in waterwise involvement. That has been going now for several years. We've got actually a trophy out of the nine trophies that’s handed out annually we've got one trophy that's called secretary waterwise.

I: OK that's great that's a good incentive.

R: Yes.

I: and Speaking of incentives, what tends to be the main motivation for clients approaching you? is it water conservation and wanting to protect the environment or is it finding ways to conserve water for a financial perspective?

R: It's a bit of both so it's functional, the functional landscape to maintain and look after it. And obviously the water polls because obviously many of them are on municipal water. There’s also the effect of load shedding. On our water reservoirs and pump stations, there is a huge effect even within the landscape industry as well, never mind household. Because they can’t get to pump the reservoirs full. So it's a bit of both, but I think the biggest driver is probably financial.

I: Yes, which in a way it's good that they have an incentive other than protecting water especially, in rural communities if they're not paying for water then they might not be incentivised to use it effectively.

R: No definitely.

I: Perhaps from a corporate perspective it may be more viable for them because they have the finances to pay those initial start up costs because in rural areas it may be too expensive compared to their, income whereas large corporations have more space as well.

R: We found that the big property portfolios, like the growth point, growth point is the biggest one within the South African hemisphere. and like the needed funds they had an initiative 2 or 3 years ago that they've launched. It is all to do with waterwise and sustainability and implementing and spending many many millions, if not billions of rands, having water reservoirs, catching the rain and they also are pumping that back into their buildings for sustainability, when there is load shedding and when there is no water, at least there is that water.

I: And that that also brings in the water energy food Nexus I don't know if you are familiar? Yes. There is an interdisciplinary aspect to it where approaches that can conserve water also can conserve energy and vice versa.

R: I think that for the general public with Cape Town city a few years ago that almost went into days with no water that created a lot more awareness, even with the taps that they have installed in public bathrooms. Even at the airports much that came because it affected everybody. Even if we went to visit on business there it affected you. So obviously it created a lot more awareness. I think it was now two years ago, two or three years ago.

I: Yeah, it is almost as if there’s a threshold where at a certain level of scarcity that raises attention and now once that they've had that amount of water scarcity they've implemented a lot more. Do you ever come across the sustainable development goals in your work, does this ever provide any framework?

R: for the company that I work for, we are basically an environmental company but we operate within In the landscaping sphere, or where I operate in. I think that is a differentiator for us from other companies within the country because we see ourself as environmental, so, we do try and basically with the guy that I told you, that’s our principal scientist, he’s actually got a whole list of sites to go and visit with me. Where we can start basically formulating all of that. So in general, it’s just the general talk and trying to implement it at all the sites, but yeah, from a scientific point of view, there is work being done within the company to support our clients with that.

I: That’s good to hear, it's providing an initial framework.

R: Yes, it’s to provide a framework suitable to look our clients. A lot of them do have the environmental impact studies in place but the effective thereof, I think it’s there lying on a shelf or on a laptop, haven’t looked at it in nine years and that’s where we try and support our clients to implement that in the correct way and manner.

I: Yeah, what do you think the reason for that is? What's the difference between it being on the shelf and being implemented?

R: Well for interests sake, I think, if I had the opportunity to look at the game reserve where I stay. In that environmental impact study which is obviously couple of hundred pages long. I think it's too complex for the general person out there to understand especially, if you are specialising in that industry and maybe an overview with a few with a few pointers and tasks set out almost like a little master plan will help the individual that’s say an estate manager or a building manager, or the landscape specialist on that side to understand it better, I think it's too scientific for the general public out there.

I: That’s understandable.

R: It’s almost, you've got it there, but give me a handbook on how to make it work.

I: Yeah that would be good. In terms of environmental impact do you work much with consulting around pollution, like acid mine drainage or fertiliser runoff or that kind of thing?

R: I am aware of it, our principal scientists, they work more with it. We also partner with one or two other credible environmental companies to specialise within that so we do offer it as a service to our client. but in general for us we only will deal with it within our compost plant. Which is the government lead in controlling, policing and auditing and getting you your licence. They will carry out site visits and then we will control that run off because we are close to the Jukskei river, so obviously there is rules and regulations that you have to abide to with that.

I: Okay. My last question for you is what project that you've worked with in water conservation would you say you're most proud of and that you think is a good example for the rest of the country?

R: That’s an interesting one. Hmm, probably the vodacom one because that we started engaging with the clients around 2009, 2010, they even had a rose garden, that we plucked out and we had to give them scientific information how much water, how much water each rose plant will use. The fertiliser it will use, the manual labour that will go in to pruning it, all of that, that took a few years before we had them plant their very first indigenous flower bed. They didn’t have a lot of money to spend so we were only able to do two large flower beds and out of that, we had to create mother stock to turn over an entire Vodacom campus so that was probably one of the very first and biggest ones that stood out for me. With regards to waterwise and rehabilitation currently it would be the Kyalami estate it’s the very first private residential estate in South Africa with 1000 houses and we looks after all the dams, houses and river streams in there. And over the years they have just dumped concrete everywhere to try and create the solution for stormwater and etcetera, etcetera, we have managed over three years now to turn that into a natural, lush space. There’s only a small stretch left. But yeah I think that was one of the one of rehabilitation project in crafting water and restoring wetlands so that it is as pristine that it can be.

I: That's really nice to hear do you think with those case studies and with the data you now have it can work as a case study to transfer to more corporations and to more projects?

R: Yeah it definitely has, Kyalami estate, whenever we started speaking about it, it has won us many tenders within other estates that have seen what we have done there and with rehabilitation because there's obviously a lot more awareness to look after nature than previously so, because the space is getting you know smaller and smaller so that has probably won several contracts for us. The Vodacom one I often refer to, to the big corporations, that it is possible to change over in time.

I: That’s brilliant. Thank you.

**AGR5**

I: What do you think about the awareness within agriculture to conserve water do you think people are becoming more aware of the importance in South Africa?

R: I think for South Africa, the issue is you have a dual system when it comes to agriculture, well developed commercial agriculture, irrigation and all that and then you not well developed agricultural sector where it is like mainly small scale farmers. There are other people in that pool also, who farm for subsistence farming, who also sell some produce maybe for a small amount. So my answer be in that being twofold maybe if people with technology at that level at commercial level they maybe have the systems in place they have already been exposed to technology. That helps them to conserve water and just from my experience I went to a big agribusiness company in Limpopo, the Northern side of South Africa, in Limpopo. They produce avocado and also other commodities like tomatoes and blueberries. The system that they were using, they were having sensors, probes, that measure the soil moisture and also they it will sense when there is a shortage of water in the soil. Then that's when they will they will irrigate. Also the system that they were using, they were using the drip system. Which is designed for efficiency. So, at that level they were using the drip system, they also had this commercial system that would tell them when to irrigate. They were also putting certain probes that tell them when they are reaching a certain level of water availability in the soil. So at the commercial, but at the small-scale farmer levels, also there is just an issue of before we even talk about water conservation, there is short access to that water. Some of them don’t have access to that water. It also forces them to look at, when you look at their production system, they hardly produce in winter when there's no rain. So there production system is in summer, where they depend on rainfed agriculture. Many people don’t have access, before you speak about efficiency and all that. But they are already involved in other practices, conservation agriculture. By design small scale farmers, they’ve been doing those practices, mainly on a small scale. In their own world they are already involved, like using the mulch system. They produce the matching where you put the cover on the soil, they are already using those production systems. In their own ways, they may not be aware in details but they know it helps them during the dry season, they know that. So yeah, I think if you separate it as a dual system. Because of the history of apartheid and commercial sector, you have well advanced, world class. Then you have another system which is still finding itself.

I: Yeah, so for the local communities, where do they learn this approach? Have they learned this themselves?

R: Yeah, it’s the indigenous knowledge system. It’s transferred from generation to generation. It’s well known. They know when it is the dry season, I remember, even when there is wind, they know when it is windy, you have to put the mulch. So that you prevent the evaporation. Because the wind is hitting the soil surface, you lose a lot of water. So they know all of those techniques. What level you have to mulch, what level you don’t have to mulch, because maybe the soil will be saturated, they know all those techniques. It is not because some professors are helping them.

I: Yeah, they are adapted.

R: Yeah they have adapted and they have developed these techniques over years of experiences. It forces them to innovate in their own ways, in their own scale. Because innovation, is not always with technologies.

I: So, when we speak about water use efficiency, the main wastage from commercial farming.

R: Yes, I am not familiar. Because anyway, I worked with a food production company, food production, in it’s nature uses other forms of irrigation systems that maybe you need water coming on top. The nature of food production, you have to use that drip system. Maybe for other crops, but not the company I worked for. Maybe other crops like Maize, where they use big irrigation systems. There may be issue there. I can tell you, in the commercial sector there are a lot of out-dated technology or conventional skills, because they have worked for them. They are making money, money is coming in. So for them, it works. Why do you have to change? I’m just talking about the food industry. I don’t know other crops, they have leakages and all that.

I: Yeah, that’s true as well. Do you think that the main source of water is groundwater?

R: It depends, yes, remember, from my project, in Limpopo. We had a small scale farm. Maize was still boreholes. In those boreholes, it is expensive. And then commercial farmers, some of them they do use groundwater. The one that I was working for, were relying a lot on groundwater. That was the main condition, there was a lot of rumbling around that. That was the main issue, they were draining a lot of water from the ground and the water table. Environmental NGOs were worried about that, they were flagging them. They were relying on those. Most of the avocado orchard on the mountain, uphill, where there is no water source, so they mainly drill from the ground and then take it to their reservoir for irrigation. You can read about that.

I: So, were they monitoring the water quality so that they know how much they’re taking from the aquifer?

R: I have no idea. They had engineers. I know they had the personnel. Theirs is a large scale and they put it in those big reservoirs. It’s not something small. So I am sure, depending, environmental affairs is involved. I don’t know. I don’t know if you’ve seen the Department Of Environmental Affairs.

I: In terms of when there is disputes between water use like that, do you know if there is communication between stakeholders, like agriculture, government, communities, do they come together to discuss this.

R: Yes, what I know, you have to get a license from the department of water affairs. Because there is another level. Where you have irrigation schemes, you have a lot of irrigation schemes in South Africa, where they use, from the open water source. From dams. But I know that one. I don’t know about the groundwater one. But on that one, open dams, we have a lot of licenses, we have developed water user’s associations. There are disparities in terms of, big guys, getting a big chunk. Also the small scale water user’s associations. I was exposing that in the Eastern cape. I was working in there. In Limpopo, it’s different, they don’t have big dams, they mainly rely on groundwater but in the Eastern cape they have irrigation schemes that are in existence already. The main issue with small scale farmers is how much they can grow on that. So, the infrastructure on that, there was a lot of issues about water user’s associations. Who can use what? And connect. Yeah, I was exposing that. They have a big local irrigation scheme, the water comes from the dam, then it comes to the irrigation scheme. So there are a lot of small scale water users there. You also have commercial farmers on that. There are also disparities in terms of the infrastructure from the damn that comes to small scale farmers. They have done a lot of research on that. I use to read a lot of PhD thesises, mainly on water usage around those irrigation schemes. There is another one, there are a lot of issues around that, in terms of water licensing. Based on, commercial around small-scale farmers. I know recently there was a court case. The government of water affairs and the commercial water users, where commercial farmers were happy, if I have a license I have a right to decide, my water, I can give it to the next person. The argument was around that. If I have a water license as a commercial farmer, I have a right to give it to third party without getting permission from the department. I think the farmers won that case but the department are appealing. Because the department is trying to intervene so that even small scale water users can gain benefit. The big ones, they were just holding these licenses and then give those they know, then they just keep it in a small circle. The interesting court case, you can look at that. I saw it on the news. The department of water affairs are appealing that case. I can share you the link.

I: Please do, thank you. That’s interesting, is there enough accountability within the large-scale commercial farmers, do the government take them accountable when they breach the licensing? The policies in South Africa seem very good, but quite poorly implemented.

R: Yeah, that’s interesting. The interesting thing is the court judgement, how did the judge reach that conclusion? But it was a high court judgement. So they are planning to appeal to the higher court, court of appeal and all that. I’d say the issue of water governance, who owns what? Who’s happy to get what? At what level?

I: Yes, do you think there is enough public participation opportunities in South Africa? Small scale farmers for example, do they have opportunities to be involved with their own water sources?

R: Yeah, I think the issue is, are they organised? Do they have a platform where they can come in numbers or as a force. I did a lot of, my last research, my masters was on participation. But it was on climate change. So I was looking at a concept where farmers are coming in large numbers, where there is a centre, they have more chances of being resilient, they have more power to negotiate. I did a lot of interviews based on that. But it was mainly on just intervention and adaptation. So the concept is, when the farmers are organised or they have an organisation that is helping them. They are speaking in one voice. They stand a better chance to stand their case and also negotiate for their resilience and adaptation. In any case, I think on water issues, it can also be the case. But currently, the small-scale farmers are not organised. There are some commercial farmers organisations, but what you find is those emerging are those who want to be commercial. The really small-scale farmers, you can find those organisations, who are negotiating to sit at the main table where others are sitting. So you find out, they don’t serve the interest of small scale farmers. That’s the gap I saw. There are a lot of black farmers, but when you look closer, you think they represent all these farmers, but when you look closer, for them it’s mainly now, what they want to do, they just want to develop they want to sit at the main table. They don’t want to speak on behalf of these farmers, who’s story is different, their struggles and what they are aiming to do in terms of their production. So that’s what I have seen, disparities in terms of farmers organisations. The voice, representation. When they speak in one voice, it becomes more impactful.

I: That’s interesting what you say. When they speak in one voice they may have more impact. But then the farmers organisations that get formed, they might not truly be independent, there might be political factors and economic factors that influence.

R: Exactly, that’s what you also find in NGOs, especially the agricultural sector, when you find out that in the participation level, yes, they want representation. There was NGO A, B and C, but when you look closer, even those NGOs are they independent? When they move in that space. What other agendas are they pushing? So the issue is representation and what they call it, elite, capture of the whole system. It’s very important, it’s my area of interest. The participation, at what level? What do you mean about participation? Who is participating? What is the voice? What do they represent?

I: So, could you argue that it would be better if it wasn’t one voice? Any individual can put forward their views?

R: Yes, anybody can put forward their voice at some level. It’s when you move to a certain level, you find that the interest of these farmers, as you go up. I don’t know, there are many forms, there are many theories from participation. What you can find, what form of participation is more local? Others talk about co-creation of solutions, who will co-create with, who do we engage?

I: Yeah, because once you start to engage different stakeholders, it will change the process.

R: It does change, you get swaying along. You get swayed along and you missed and get this.

I: It’s difficult, because if you are a small-scale farmer and you want to suggest a change, who do you go to where they are unbiased and will listen to you and help you to make that change happen? If you suggest a change, it might impact another stakeholder and they want that change, so then it gets difficult.

R: Exactly and also speaking down on them, the talk down approach, where you think you know what they need. You know based on what you have read somewhere. But for them, they live this experience on a daily basis, so circumstances change and they are the ones who are up to date.

I: Yeah, they have the lived experience of what has impacted their production. So they are the experts in their specific situation. They are not listened to.

R: And yeah, it may not fall through, it may not fall in the framework that you have created. That’s their reality. So any response should be based on that.

I: It’s really important, how do you facilitate that? How do you make sure that they are listened to without being swayed? Should there be an independent body that helps to facilitate these kinds of things?

R: But also, how independent is it? They are all human beings with interests who sit in those seats.

I: They can be influenced. It is difficult. Do you think that the sustainable development goals have given any framework?

R: They have given, I have a lot of comment on that. The sustainable development goals, yes, they have, I think they have, if you look deeper in their goals. They have given us, a blueprint. They have in that sense. I think the SDGs are much better compared to the previous ones.

I: The MDGs.

R: Yeah, what I love about the SDGs is there are a lot of synergies that overlap. When they overlap, that’s where opportunities for action and intervention, that’s where you really find it. When you do this, you are not only addressing one goal, but a lot of them. So, the problem lies in action and taking action going forward. I think, they may not be perfect, but I think they are covering a lot of ground.

I: By setting targets.

R: Yes, targets and goals. But the problem is, who monitors that and at what level?

I: Yes, again it’s an implementation problem.

R: Yeah.

I: You can have all the ambition to achieve these targets, but who is insuring that it actually happens?

R: Yeah, that’s a main problem and who does what? Are they obliged? Is it mandatory to do that? Who does what? The government, private sector. In fact, my job here, with the SDGs, is what role you can play also in the private sector. It becomes so clouded that there is progress but then on the overside we have a long way to go. Yeah, in fact, it feels like there is no progress.

I: Do you think that there is a lack of political will to make progression?

R: Yes, a lot of political and also lack of co-ordination. A lot of co-ordination. But everything, it won’t be implemented by government. There are a lot of stakeholders that also play a huge role. The private sector, where their business is involved they have an impact on water. They can get involved, creating a community based water project. What does that look like?

I: But do they actually care?

R: Nobody cares! What you find is a lot of blame game. The private sector saying there is no structure in government for them to bring money. Then government on the other side is saying you are holding back, a lot of de-investment, keeping their money to themselves. I find a lot of it is blame game. At an elite level, even at government level, it is elite. This elite group. At government level, an elite group at business level. I find that nobody wants to commit.

I: The same with pollution. You have acid mine drainage or fertiliser run-off.

R: Oh yes, I forgot about that, also to share with that. We have a national business initiative in South Africa, where the business sector is trying to get involved in different sector. They also have a water hub, where businesses are trying to get involved in a lot of water issues. So, your topic is beyond agriculture, maybe you can also look at water, just for household use. So please look at that.

I: So again, about responsibility, the mining companies, they come in and take the resources and they leave the pollutants, is it their responsibility to clean it up or is it left with the government?

R: Yeah, exactly. Especially within the Gauteng province. Where there was a lot of intensive mining of gold. We have a lot of contamination. We have a lot of that issue there in Gauteng. The mining companies and the current issues there. The current environmental crisis in that area. A lot of issues. After pollution, there is no rehabilitation process in place, there is none. Maybe also on the government side, I don’t know what is happening there because they should be enforcing it. That is the main issue in Gauteng province. The contamination of water resources. So the past exploitation, of gold, there is a lot of history in that. Yeah, it’s a big issue in Gauteng, I don’t know about other provinces, because there are a lot of other provinces involved in mining in the north west, Limpopo.

I: Yeah, so the mining companies come along and profit from exploitation and then they don’t contribute to rehabilitation.

R: Yes, there are a lot of problems there. Contamination of water resources is a main issue. Nobody, I have never heard of any law suit. Especially from civil society. On water contamination. I think there was also an outbreak of diseases, I don’t remember, based on that, contamination. It used to be a big thing, I don’t know if it has died down now, it used to be a big thing in the last 10 years. The issue of that, communities.

I: Yeah, I think the government are moving to try and responsibility on the mining companies after mine closure to clean it up. The final question I want to ask you, is about electricity and currently there is all the loadshedding going on. How does that build in to water? You have the WEF nexus, there is no electricity to pump the water.

R: Yes, even at the municipality, where I am living in Durban, the loadshedding, electricity is turned off for a couple of days. They also have run in to trouble in terms of running pumps, the water reserves, they get depleted because of that. And when you ask them why when there is loadshedding, then in the next few days you have water problems, the water pressure in our taps, it’s because they use the energy to pump the water in the system. So it is interconnected even at a municipality level. I am sure at farmers levels, the special, commercial guys that use the system to pump water, they will be using generators, that’s another problem. We have to include another cost. That influences food prices and then what do you call it, they transfer the costs to consumers, or they transfer the cost to us as retailers and then as retailers you also have to pass the cost to consumers. So it becomes, that chain is not just a water issue. Also, if you have intervention, you buy diesel, that what is happening. We rely a lot on diesel to make sure that operations continue and that means a lot of cost. That costs billions of rands.

I: Yeah, do you ever come across gravity fed irrigation?

R: What is that?

I: Where they use gravity, where the water travels along itself rather than being pumped by electricity?

R: Okay, I see that a lot, especially small-scale farmers where they created trenches and the water moves. It’s very big, especially small-scale farmers, when there is a water source around they use that a lot. I forgot the name, they open trenches, I’ve seen a lot. I forgot the name of it. There is a term we use. Yes, it happens especially, a lot of small-scale farmers.

I: At least they are not relying on electricity there.

R: Yeah, but at a commercial scale. We have to pump water to different parts of the farm. Large quantities. That’s why they have to store that in large reservoirs. Pumping them to reservoirs and then it goes to farms.

I: Yes, especially the way South Africa is built. Being built, like Johannesburg was built around the mines rather than the water resources. They have miles and miles of pipes to pump the water so that is extremely energy intensive.

R: Yeah, it’s very energy intensive, so yeah, it’s impossible. So they rely on diesel, I know for sure. It is also linked to climate change. Because if you are using diesel you are not reducing your emissions. Even though they may be lower, there were a lot of discussions about whether diesel emissions is lower than the coal. But now we are using it a large scale, almost everyone is using it. So now we have to quantify it, also the emissions from diesel. How well can we quantify them. So it is an interesting time we are living in.

I: For sure, so why aren’t they looking at renewable energy and solar energy?

R: It’s that, another problem. The government has started actually, to bring in independent power producers. I think there are a few that are already connected in the grid. But they are only small megawatts. So there is also a move in that in South Africa, a lot of discussion, a lot of technology is coming in. It’s like you are building a plane whilst you are flying it. It is just a mess, people are finding these technologies, is it the cost? Is it suitable for this condition and so on? So it is a big thing, the renewable energies, it is going to be, in South Africa we have to reduce our reliance on coal, because South Africa, when it comes to emissions we are there with the most industrialised countries, but we are not that industrialised. So we have that unique South African problem, when you look at our emissions we are competing with the big players who already use their emissions to develop their countries. Because, heavy reliance on Eskom. Because over the years we are relying on one source. A monopoly, people were comfortable because it was owned by government, because people were saying it was not a monopoly that was owned, but when you look at it, it was a monopoly, so everybody was relying on it. Then the crisis came and everybody is like trying to. It will take years and for us to reduce our emissions, we can never rely on that, on coal. Because when you decarbonise the energy sector it helps other sectors to decarbonise. Because they also rely on energy, you have the agriculture sector, the transport sector, by the use of new technology. We talk about electric cars, if you have an electric car that is plugged on an energy source that is produced from coal. So that is why if we can deal with energy, we can move forward. There are a lot of issues, in terms of who will be accessible, who will pay for it, those with money will be able to pay it, those with money, the discussion now it seems, those with money can easily move away from loadshedding. Then it becomes another segregation, those with money, will withstand loadshedding, but hopefully those with money will move away from the national grid. Maybe they will release some pressure. So we have a lot of issues in terms of inequality. So every topic in South Africa you look at it in terms of inequality, who benefits? Who does what? I talk about Agriculture as a dual system. In fact, every level, South Africa has these disparities where you have people who have everything and those who haven’t.

I: Yeah it is always the poorest who gets the worst impact.

R: The debate changes, once you put those lenses, the debate changes, it becomes even more fascinating. As a researcher, it is fascinating.

I: Yeah, but, in order for change to happen, a lot needs to change in a lot of different sectors.

R: Yeah, there are people who agree on policy, also on policy implementation. The climate on policy itself is not enough. A lot of people being agile and just moving in the space and doing what they can do.

**GOV1**

I: So my first question is quite a broad question, but, how depleted are the water resources in South Africa, just on a general scale?

R: So, I suppose, there’s two ways to answer that question, the first way which is if you look at, I think it’s the national water resource strategy from 2013, there’s a map there and a chart which shows that water resources are 98% allocated across the whole country.

I: Yes.

R: If you dive down into individual water management areas. Some are actually over allocated. So some of the demand actually exceeds the supply. But this figure that generally gets trotted out when people ask that question is that 98% of the country’s water resources are already allocated. However, if you, drill down into that what you find is that the data to support that statement is quite unreliable. So, the data around demand is derived from a database that everyone knows is quite problematic. So, I think we don’t actually, so the second answer to the question is we don’t actually know, the true situation is that the data around water use or demand is out of date and unreliable and as a result, very very difficult to give an accurate at national scale of the demand in relation to supply.

I: Yes, thank you and what are the main reasons for water scarcity in South Africa?

R: Well, we’re a semi-arid country, again, you know we have a rainfall gradient that goes to quite wet along the eastern parts of the country to very arid, you know less than 50mml of rain a year on the west, so the problem we have is that rainfall is unevenly distributed, both in space and in time. Because, much of our rainfall is seasonal, so we have wet seasons and dry seasons. So, there’s both variability within years in terms of wet and dry seasons but there’s a large variability between years, so we live in a region that is prone to cycles of drought. I think we are fortunate that we are currently in a wetter cycle. But, we know that the droughts are going to return. There are always parts of the country that are in drought. I am sure you know about the captain experience a few years back.

I: Yes.

R: There’s another major city, the nelson mandela bay area, port Elizabeth, that is really struggling at the moment with issues around drought. So, I think our average rainfall as a country is less than half of the global average. That is a good way to look at it as well. But, our ability to translate rainfall into streamflow is quite limited and our ability to capture all of that streamflow is also quite limited in terms of infrastructure. So, especially if you look at a situation like Johannesburg which is not situated on any major river. Yet, it’s the largest urban centre in the country it’s located quite far from it’s water sources, which creates a lot of issues around water security and water supply, especially looking at some future demand, in fact we are reliant on transfers of water from another country, from Lesotho to meet the demand in the largest urban centre. So there’s a lot of drivers in that, you know it’s not just climatic issues. There are governance issues as well. There are issues around the location of where the water is in relation to where the water is needed and those two are overlapping issues of the infrastructure. There’s many ways you could answer that questions.

I: Yes, thank you. You lead on to my next question actually, which was about infrastructure the quality of the facilities. Such as waste water treatment, a lot of those are in poor condition. So that’s leading to a large problem isn’t it?

R: It is, I mean infrastructure is quite broad. So it depends what infrastructure you are interested in. Because we typically add a kind of first level, we divide in to what we call water resource infrastructure. Which is large dams and the transfer schemes between catchments, sort of for example the Lesotho highlands scheme that brings water in to South Africa. But then we also have water service infrastructure which is what brings the water in to our taps. Equally, as you were talking about what happens when we flush the toilet, where does the waste water go. So are you more interested in that kind of water service infrastructure rather than the bulk infrastructure?

I: Both, really. It’s all very important. It’s about getting as much value out of the water that is available. They all come in to play, don’t they? What are the reasons for the lack of maintenance?

R: I don’t know if you are aware of the green drop report that was recently report?

I: I have heard of it.

R: Okay, that’s this years’ version of the green drop report.

I: Okay, I haven’t checked that yet.

R: There was a large gap up until this year the green drop hadn’t been published since 2013, because it was just politically too embarrassing. So, with the new minister coming in they have now published about a month or two ago, a new report which shows that the situation is even worse than it was in 2013. The green drop looks at the state of waste water treatment across the country. So if you want a really detailed snapshot of the state of that is the place to go, that’s got it all. I think it does start to tackle some of the driving forces, that’s also a good place to look. But certainly investment in maintenance is a problem and because most of the responsibility for these wastewater treatment works is with local government. There’s a whole set of issues around financing in local government, that then come in to play when you are looking at waste water treatment. It does feel like, politically often, waste water treatment is fairly low down on the priority list, within municipalities. It is one of those less visible, less attractive, you know, not as many ribbon cutting opportunities, what has been determined is that there are very few, if any, municipalities the minimum requirement for maintenance on their water and sanitation infrastructure. I think there is a benchmark of, I forget if it’s about 8% or something like that, which they should be spending, the green drop shows that there is about only 1 or 2 if any municipalities in the country that are actually spending that minimum amount. There’s certainly issues about skills and capacity as well. There are many municipalities, especially smaller and more rural municipalities that don’t have any professional engineering capacity, in the municipality, so there has definitely been a loss of skills to be able to run these systems the way they should be. That’s something that I think is well known. Again, there are a whole set of reasons behind that. I think, yeah, there are also governance failures as well around a lack of support being provided to municipalities to the system in performing these functions adequately, where they are consistently failing to, there are provisions for intervention, but provincial and national government, typically what we’ve found is that where provincial and national government does intervene the situation is stabilised over the short term, but as soon as, the intervention ends and the system is handed back, it tends to revert to what it was before.

I: Yes.

R: So what this suggests is that these issues are actually systemic and it is not an isolated thing, you know, in one or two municipalities, there’s something that suggests that they are systemic issues, be it with financing at local government, be it in terms of how the responsibilities are allocated, which actually needs to be addressed. I think that’s what has really come out so strongly in this new green drop report where, we know now that we are actually in a worse situation than we were in 2013 even then, it was bad back then and now it’s worse, so I think we have got to a point where we can no longer ignore this.

I: That’s a great answer thank you. So moving to the NWA now, that had a lot of praise as being a great piece of scientific policy, but the issues have been in implementation, why do you think the implementation hasn’t been as successful?

R: I’ll share with you some work that some colleagues and I have written on this because it’s a burning subject. Typically there are two schools of thought that emerge, so the first school of thought is that, the act is good, the act remains relevant and contains the tools and enablers that are necessary, but the failure has been one of implementation, it’s been one of political will and capacity within the department, perhaps underestimating the magnitude of some of the challenges that needed to be overcome to move from the 1956 act to the 1998 act. The other school of though, it’s interesting because we see the same kind of arguments happening at the level of the constitution is that it’s the law that is actually flawed. So the reason why we haven’t been able to do what we needed to do is because the law is flawed. I am less sympathetic to that argument, I mean there is no doubt there are changes that are needed to the law, but when you look at it, all of the key enablers are there, I think the problem has been largely one of implementation. There has been reluctance within the department itself to make some of the changes that were required. I think that’s largely individual resistance by managers who perceive that they stand to lose from some of the institutional reforms that are required, for example the setting up of catchment management agencies, some managers perceive that they would be losing power and influence and authority by having certain functions and budgets removed from the department and delegated to these new institutions, so there’s been a lot of resistance and sabotage actually that’s going on, there’s been a lot written about that that I can share with you if you are interested.

I: Thank you.

R: You know, things like the water allocation reform, conversion of old water institutions that still continue to serve historical interests rather than interests of a wider range of stakeholders. Yeah, you know, you look at that and we really haven’t moved. It’s a difficult one to figure out because politically you know these are very sensitive issues these are issues around black people who previously were were excluded from access to water, yeah but it's true through the apartheid policies and through water rights being linked to land ownership and we know the racial dynamics of land ownership under apartheid but those that don’t we just simply haven't made progress you know yeah and it's I think they the department has struggled to know how to actually go about this that the magnitude of the task has been great often when they have tried to move they've been challenged legally because they you know they just haven't kind of moved in step with the law often and they also haven't tested you know certain aspects of these things in the courts you know there's big debates still about whether water rights can be considered property, the way property is defined under section 25 of the constitution because they you know what that section 25 is what they call a sunset clause or grandfather clause it was basically a compromise that was struck in the constitutional negotiations to allow people who own property and it's my property not just land but you know property rights mistranslate a number of things to have some security that those rights would be respected in the in the post 94 South Africa so it was really just to to to kind of to assure white people you know that that there would be some form of respect for existing property rights and there's still a lot of debates about where the water rights fall under that or not and you know this has never been tested in court you know and and and and ultimately that was what was needed and I'm not sure why that is you know whether the apartment just never had the courage or didn't want to test that so we we we continue to struggle on with some some Gray areas and around that So what I can do there's there's two there's two there's a conference paper and a book chapter that I can share with you that I’ve written.

I: Yes, definitely, thank you.

R: That definitely unpack these issues in a lot more detail

I: that would be great thank you and thank you

R: let me just make a note otherwise I forget about what to send you

I: thank you

R: no there's actually a nice paper by someone called Barbara schreiner

I: Yes, I’ve read that one.

R: She was an official in the department a few years back, she's now heading up yeah bought it tegrity at work where she asked precisely that question that you asked me yeah I think I've read that paper OK so yeah I think it goes back like 2013 and 14 somewhere

I: Yes, it’s 2013.

R: Okay, great, so you’ve got that.

I: Brilliant. Ok, so maybe not only in the water perspective but or in general do you think the law in South Africa is slow to adapt with the times and the needs of the people?

R: that's a tough question it feels like we have a very active program of law reform I mean South Africa as a country has been through a huge strong position you know since 1994 so incredibly active program of of law reform for you know to to to bed down because the constitution doesn't it's not self actualized that relies on legislation to give effect to the principles and and the the intent but what I what I have noticed is that that initial that initial kind of ten year phase after 94 it's very different to the situation that we see now then yes I think a lot of the momentum has slowed there's a lot more caution and reluctance on the part of government to make any radical changes so we're not seeing the kind of see changes that we saw in the in the first 5-10 years after democracy in the period when the Water Act was written so many of the kind of Seminole pieces of legislation had a whole new suite of environmental legislation came into effect in the 97,98 so I think what we're seeing now is just more kind of tinkering around the edges you know there's big debates about amendments of the constitution which is actually didn't didn't go through in parliament and that's about the section 25 about to meaning that that was actually killed in parliament to achieve their required majority so certainly you know there there continues to be an ongoing program of law reform but I think it's far less substantial and I suppose like to argue that the big changes were made of early days yeah and and what we're doing now is kind of just fine tuning and and learning as we're going we can't we can't keep making changes of that magnitude all the time you know it's just not it's just not practical but there is decline in trust in governments governments responsiveness to the needs of the people but also you know the question can equally be asked whetherme you know there is a sense of a of a the problems that we see now are problems problems of implementation and not just around water but you know responding to scope your question across the board.

I: so the the main issue really is implementing those laws do you think then national WATER maybe two scientific and some setbacks schreiner touched upon that for the actual managers working to implement that active it may be overcomplicated well there you know the actors is a framework it doesn't it doesn't get into a fine level of detail it it it leaves that level of detail to be elaborated elsewhere you know in in regulations it's strategies in programs I think for example if you if you look at logical reserve which is often the one that the finger gets pointed at around being overly complex to implement because it requires you know these ecological water requirements to be determined and implemented you know I I think the department just approached it badly you know I think I think instead of starting out with a kind of desktop low confidence set of reserve determinations across the country and then progressively refining them they they started out by you know just doing this high confidence very expensive very time-consuming reserve determinations but been very localized areas and then other there is there was nothing so you know I think it was a it was a strategy choice that was poor there were ways they could have done it that that that didn't have to hold up you know all kinds of other processes that were reliant on that so I think you know there may have been areas where that the act was very ambitious in terms of what could be achieved parts that I I think you know they they they they could have been better decisions that were made and I think the question of political will comes into it as well you know just to driving some of these these things through one example would be the catchment management agencies. If there was sufficient political will it could have been done years ago. someone who just said this is the decision that's been made I need my officials to get on and do it and and to hold them accountable for that so yeah I'm I'm I don't know im a bit ambivalent about that argument about you know that scientific complexity because I think there are ways that it could have been done that that that that could have accommodated that you know just like the constitution requires a progressive realization that accepts that you can't do everything overnight I want to see is that one foot in front of the other you know progressively incrementally we are starting to realize these things and and I yeah I think I think better decisions could have been made

I: Yep I agree thank you. do you think there's an equitable share of water in the way that it is distributed amongst stakeholders

R: By, stakeholders do you mean sectors?

I: Yeah, like industry sectors, and to local communities do they have an unfair distribution of the benefits and burdens associated with water?

R: I think I have partly answered that question in my previous responses, what we know is that there is a huge racial disparity in access to water, it's quite important to be specific because you can talk about access to water in different ways. You can talk about access to water in terms of who has access for domestic purposes, you know, who has taps. In their homes, or close to their homes, so what we do know there is that people who continue to lack access are overwhelmingly black. and there are lots of stats you know we report through the SDG process send and others you know, access to water for domestic purposes you know that's that's, so those figures are available. There’s also access to water for productive purposes so that that’s people who are issued with entitlements to use water through a licensing process. and that's typically for things like agriculture but also so for industrial purposes and some recent work that we've done there that I can share with you I just want to make a note of it

I: yeah thank you

R: Shows that water is still overwhelmingly in the hands of white people. purposes so the economic benefits that are being derived from the use of water, are still disproportionately accruing to white people. Yeah the figures are actually worse than we thought you know this recent research has really been quite an eye opener, they looked at all of the water allocated to individuals so not to companies, individuals through the licensing process and they looked at the the volumes of water that were allocated and of those 98% of the volume of water that's allocated to individuals through licensing this is is to white individuals.

I: Wow!

R: I mean it's it's it's outrageous you know like 28 years after democracy and however many years after the Water Act that we still sit with that situation. so I would say no, you know, to answer your question.

I: Yeah

R: massive inequalities whether it's the make benefits derived from water whether it's water form basic human needs yeah I think I think that the the burden is born quite disproportionately.

I: This isn’t an easy answer but how do we remedy that? what solutions do you think have the best potential? is it a matter of policy or public participation, or a mix?

R: it's not a matter of policy, We I think we're drowning in policy and I think I think we have the most incredibly, comprehensive pro poor policy in place, I think the problem is is is is how it manifests how it gets implemented so you know, I think again you know it's it's a very broad question because you know it depends whether you're looking in terms of access to water for economic purposes whether you are looking around the water service side you know around universal access for basic human needs, it's you know there's many PHD's you know either of those yeah so I think it's important to to to to focus because otherwise it's just a very very broad question yeah so I'm not sure where where your particular interest lies but, I think I think we know what the solutions are it's just a question of getting on and doing it.

I: That’s true. So do you think public participation has been fully utilized in South Africa?

R: and there's some nice work that's being done looking now at some public participation at local scale in in in water services planning because we have the local government legislation requires that each municipality develops an integrated development plan (IDP). It updates that plan, I think it's every five years or something, and then as a component of that there's something called a water services development plan which is supposed to spell out you know the municipalities intentions around making sure that everyone has access to water you know those are seen as the vehicles here it falls in the in the in the in the in determining people’s involvement you know how know to meet their needs. So in fact when we report against the SDGs, there’s an SDG6, around public participation. So what were you reports against that is the IDP's but what we are realizing is that you know these IDP's are often tick box exercises, the meaningful level of participation is often not there, so there's a project that that's busy finalizing now I have in My Portfolio that's looking at this this very issue so I'll see what I can share from there but there's certainly a lot more room for improvement, and we see now is this the emergence of these water and sanitation forums as a as a way of complementing that, so this project also looks at these water and sanitation forums. The interesting thing is that they are supported at national level by national government with the responsibility for providing these services actually at local and municipal level, yeah so, it's an interesting one, but, no I mean that the public workstation thing you could look at it you know in any number of levels whether it's that kind of IDP level people being involved in the decisions being made around how best to deliver services to them and there's also public public participation in things like the issuing of water use licenses and whether it's so that's also worth looking at yeah as well because there are requirements around that you know there are even public participation requirements around policymaking you know so any any regulations or any legal stuff any policy stuff needs to be you know the the the act as mechanisms that requiteyou know public participation to be done. to be worth looking at how effectively participation actually is.

I: Yeah, definitely. Thank you I think this is going to be my last question so thank you, thank you how valuable do you think the SDG framework is for bringing access to water for communities to focus being a useful framework>

R: that's an important question because I think it has added value I think I don't think it's changed the agenda in any way because I think everything that's in there SDGs, is is things that we were supposed to be doing anyway, yeah especially around universal access you know we we have the human right to water embedded in our constitution so all of that stuff we we should have been doing anyway doesn't matter which of the SDGS you know at 'm talking specifically around water. I think where it has been useful is as an organizing framework so it's it's actually interesting to watch how within the water sector how it's it's it's provided a kind of common language and especially for reporting purposes for coordination for harmonizing I think it's proven very useful there rather changing the agenda it's almost been a kind of common language. you know for bringing people and and and and functions together and that's where I think it's been of the most use.

I: Yeah. Do you think there is a lack of appropriate indicators to measure the effectiveness of progress towards the SDG's

R: I do! and in fact that has been recognized already and we've we've just started a project with the department to actually review something that's actually to develop new indicators we we recognized that you know 'cause there's provision to domesticate indicators so they're the kind of global indicators, and then you can develop new indicators that better respond to your your national needs so we are, busy development new indicators around 6.3 which is yes focused on water quality 6.6 which focuses on ecosystem and six point B which focuses on community involvement

I: yeah that's great that's brilliant, thank you so much for your participation.

R: Thank you. Bye!

**GOV2**

I: So, the first question is a broad one, can you describe the extent of water scarcity in South Africa?

R: Okay, the water scarcity is quite severe. It’s motivated by quite a lot of factors. Firstly we are a dry country, the 30th driest in the world. I think that is well documented across the globe. Secondly, our water resource distribution is not, most of the areas are distributed far from the waterlogged areas . For example you’ve got some of the areas that have to have long pipes in order to take water from one place to another. Some of the catchments are more drier that the other ones. So that really makes this challenge quite a big issue. Thirdly, obviously the impact of climate change, because we’ve got frequent drought and floods that are happening quite often now and obviously the high temperatures as well makes the rate of evaporation quite high and that really aggravates the scale of water scarcity that we have now. Mostly the rural areas have no access to water and lastly to tap in to the groundwater resources is quite an expensive exercise and also, the water users, we’ve got more water users than what you have, we’ve got more water users competition for water resources we’ve got agriculture, industry, municipalities or residential competing for the water resources that we have. This is quite an extensive problem that we have at the moment.

I: That’s a good answer thank you. Obviously, working with Eskom, South Africa is quite reliant on fossil fuels, isn’t it? That’s going to be a concern with climate change, do you think that there is potential to move to more renewable energies?

R: I’m going to give you an honest answer. Yes, there is a need for us to move towards renewable energy. But, my perspective is that if you look at South Africa’s background with oil, we’ve only been having access, most residents have only been given access in the past 20 years or so and it’s left most of the people not having access to this electricity and also the rate of overreliance on fossil fuel, that has not been so reliable recently. Because of the operational issues and most importantly, now the issue of climate change that also impacts on water shortages and that is one of the key inputs in to the fossil fuel energy generation. That really pushes us to move, not only to renewable, but we need to have an energy mix that can be able to sustain us as a country. When I talk about energy mix I am also referring ways to look at incorporating more nuclear reactors in to the system and also having your solar systems and your wind systems in to the energy grid so that we can be able to sustain the current energy challenges that we have in the country. The fossil fuel has not been so reliable recently because of the operational issues and also climate change, the greenhouse gases, the need to move away from carbon dioxide generation and more towards sustainable energy generation which is low carbon.

I: Yes, to diversify the energy mix and give more reliance.

R: Yes.

I: Thank you for that answer. My next question is about the national water act 1998, how familiar are you with that?

R: I’ve been quite fortunate, to work at the department of water, that was my first job when I graduated from University. So one of the tasks that was given to me was that I need to familiarise myself with the national water act. So I am quite familiar with most of the sections in the act and one of my key responsibilities, then and now, is to implement some of the requirements of that particular act.

I: Okay, that’s good then. The NWA 1998 is quite famous worldwide for being so scientifically thorough.

R: Yes, on paper the NWA is regarded as one of the best laws in terms of water management, but it’s the implementation that is quite challenging you know. At the moment, we’ve got people that are interpreting it differently and that brings a lot of challenges in terms of implementing that particular act.

I: Do you think the challenge comes from the policy being made by people that don’t have first hand experience in the implementation.

R: That is one of the issues but the other issue, it is also coming from people that have to comply with the act. For example, the industries. If they have to comply with some of the conditions of the national water act it’s quite difficult because some of these industries have been in existence for quite long periods and they might need a lot of funding to retrofit their systems in a way that can accommodate the requirements of this act.

I: That is a good point. So, do you think public participation would be a useful tool so that you are including multiple stakeholders in policy making?

R: Public participation is one of those contemporary systems that can be used to enhance compliance to the national water act or any other act that attempts to address water related issues. The problem is the political wheel to allow the multiple stakeholders to participate in these implementations. For example, if you are developing a project that has got potential to impact on water resources. There is already a political motive for that project to go ahead despite its impact on the water resources and that is one of the challenges. In most cases in South Africa, the stakeholders and in particular the marginalised ones, are always excluded from these project plannings. They only come in when the decision has been made.

I: Exactly. So public participation could give them better representation.

R: Yes.

I: So, there is obviously still inequalities in the distribution of water.

R: Definitely.

I: Even though one of the main purposes of the national water act was for equal distribution. That still hasn’t been addressed fully.

R: Yes.

I: How do you think this could change?

R: I honestly doesn’t see it changing that much. Unless, there is a political wheel to drive the involvement of marginalises communities into decision making. At the moment it is lacking. One other thing that really aggravates the challenge is the silent approach that we have in the country in terms of addressing challenges such as water shortages or climate change impacts, or energy issues, or land and agricultural issues. Remember agriculture is one of the biggest consumers of water in South Africa because it requires water for food production. If you find many of the projects that are happening, you’ll find there is no representation for agriculture. That silent approach especially coming from government, that top layer that is coming down, with different departments sitting individually and addressing their own issues or their own policies without considering the requirements of other departments, so until we break those barriers.

I: Do you think the current government are showing potential to do this?

R: I honestly don’t think so.

I: I have read that you are involved in integrated water resource management.

R: Yes, I am.

I: Do you think that has potential to increase water security in South Africa?

R: It has the potential, because we will be able to view management of some of the key sectors of the economy holistically and in an integrated manner. For example, if we apply the nexus thinking or apply some of the principles of IWRM with water as the underlying factor in South Africa, we can be able to view this energy, food, climate change, health systems holistically. So I’m passionate about this nexus thinking approach.

I: That’s good and it recognises the interrelatedness of all these different factors. They all influence each other.

R: Yes.

I: So do you think there is a chance that could be implemented in government? Or again, do you think that they are not showing willingness.

R: Throughout this process that we have undertaken so far. There is quite a lot of interest from institutes like the water research commission, ESKOM is coming in to the picture. So we are trying but there is a lot of effort coming from different stakeholders to try and break this barrier. We have got hope that once we start collaborating and working together we can be able to convince government to start working together in terms of policy development and work so there can be security for water, energy, food and resilient systems towards climate change impacts.

I: Yes and now is really about the implementation of the policies.

R: Yes.

I: So do you think that the integrated resource management approach is the best solution for water security?

R: It is naturally the best solution, but looking at how it was implemented and how it was able to delineate water management into catchments it makes things quite easy. So the reason I am of the opinion that IWRM can be able to be used in other sectors, for example I am from the school of thought that says even the energy distribution or transmission or generation has to be broken down in to catchments. For example, an area for example in your case you have Bournemouth, you have to have a system whereby Bournemouth has got their own generation and distribution capacity so that when there is a challenge in that region it doesn’t affect the whole country. That is how IWRM encourages the breakdown of approaches in to catchments. Even the energy systems, even the food production, you can break it down in to catchments. Different catchments have different dynamics.

I: That’s interesting. There is also rainwater harvesting, do you think that has any potential?

R: It does have a lot of potential but remember one of the challenges that has is shared river basins. We share our 4 main river basins with 4 different countries across the south of Africa. For example we share the Limpopo river basin with Botswana, Zimbabwe and Mozambique. We share the Orange river basin with Lesotho and Namibia if I’m not mistaken. So we already have got the river basins that are shared, so we cannot harvest everything that falls on to our land. We have got to let the water flow in to different countries.

I: That’s a good point.

R: So in a small scale, rainwater harvesting can be done. But in a larger scale, it is quite difficult to capture a lot of water because of the shared river basins.

I: That’s true, also rainfall is not consistent.

R: Yes.

I: So do you think perhaps, the use of groundwater would be more beneficial?

R: That is another issue that can be explored, but remember at the moment in terms of South Africa’s policy, ground water is reserved for emergency purposes and not being used for larger scale water needs. For example I can have a borehole in my own yard just for my own domestic use but there needs to be a licensing process that has to be applied for bigger industrial or agricultural processes. Also we need to preserve our groundwater at all costs so that when there is an emergency we can be able to tap in to them. The other thing that is emerging now is the pollution in to groundwater systems. That is quite difficult to purify in to usable water.

I: Yes, through acid mine drainage and agricultural run off for example.

R: Acid mine drainage being one of them, yes.

I: Rivers must be of utmost importance then.

R: Yes, South Africa’s water is mostly from rivers. Remember we are also tapping in to water from other countries. For example, the Lesotho highlands project. We get water from Lesotho because they don’t have much water issues like us. So we get a lot of our water from them and also the other catchments that are more linked to Swaziland we also get water from those catchments, into our rivers and into our dams.

I: Okay, that’s good. Do you think there is a particular case study that would showcase good water management in South Africa and one that you think the rest of South Africa could follow?

R: At the moment I won’t really say yes. There are different dynamics for every catchment. One thing that I notice right now is that South Africa is going through the establishment of the catchment management agencies in order to try and manage its water resources sustainably. So there has been a document for the past 27 years but there have been 2 so far, I think that process needs to be sped up in order to see how effective can this water catchment management agency approach be. Also, we need to invest more into technology, water treatment technology, we need to invest more into that. Also, we must remember to upgrade our infrastructure. Because some of the challenges that we come across now are because of the infrastructures that we have. We have not been able to maintain our infrastructure in a way that can give us good water resource management.

I: Yes, there is also a huge lack of funding and a lack of skilled workers.

R: You are right, true.

I: That makes it very difficult. Last question, do you think the use of salt water desalination has potential in South Africa? Or is it too energy intensive?

R: It is too energy intensive and now that is why the water energy, climate change, food paradigm comes in. Now you need to have more water, you need to purify, it was supposed to be the case in Cape Town where they wanted to do a desalination process, it was quite energy intensive and in that moment South Africa was faced with energy challenges, so the question was where will you get energy to purify that water if you have unreliable systems? So desalination could be quite good. Another process that needs to be explored going forward is how best can we augment our water resource challenges through the desalination process, but also you must remember that the majority of South Africa is inland. So that also plays a part.

I: That is a good point. So it comes back to the need for the maintenance of pipeworks.

R: Yes.

I: So that is another problem that needs solving.

R: Yes.

I: Okay, that is everything I wanted to ask you. Thank you very much.

R: Thank you.

**GOV3**

I: That’s great thank you. So my first question is a very broad one, could you describe the extent of water scarcity in South Africa and the different contributors?

R: Sure. Just so I can manage my time, how many questions do you have?

I: Approximately 10.

R: 10, Okay. I’ll keep them fairly short. At the moment South Africa is a very water scarce country. We do have surface, we have groundwater which is being used more and more, in terms of SDG6. If we do nothing now, by 2030 we’ll have a shortfall of about 30% of water. So we need to act now in terms of addressing the water use efficiency, the water service authorities for example they are currently on average losing about 41% non revenue water. That goes up to 60 or even 70% in some municipalities which is water that has been extracted, treated and distributed to the consumers but along the way they are losing on average 41% of the water back in to the ground or unaccounted for. So first of all we need to fix the leaks and make sure there are affective revenue management systems in place to try and use the little water that we’ve got more efficiently, as at the end of the day the population is growing and there is no more water coming from the sky, so we have to use what we’ve got more effectively. But yeah, in terms of the volumes and the cubic metres I haven’t got those with me.

I: That is okay.

R: We are going to have a shortfall of water by 2030 if we don’t do anything.

I: Thank you. You said that you’ve been working in community projects to train people, do you think that there is a significant lack of skills in that sector for maintaining pipe works? Are there any initiatives to grow the numbers of engineers?

R: You know, if you look at the fall value chain of the water business from the extraction to the tap and then back to the rivers again. A lot of different skills are required, engineers, technicians, social scientists, etc… There is a shortfall of different disciplines within the different areas. Yes, there is a shortfall of engineers and there are processes in place to try and address that to get more engineers on board and to appoint them in the right places as well. But the challenges are that sometimes the municipalities are in very remote areas and it can be difficult sometimes to get a qualified individual to go and move to a little town in the bush when they really want to be in the city where everything is happening. So, you know, there are challenges in terms of getting skills to the right places. But when it comes to the implementation of water and sanitation projects, the involvement of the community is so important and is something I very much value, particularly during my time at Mvula. Even though the community are not always engineers of social scientists, a lot of them have a great deal of common sense and with the application of training and giving them capacity to run the water and sanitation projects. They often have the ability and the skills to do so. It doesn’t need an engineer to repair a pipe, it just needs someone to know how to fix the leaks, where to get the fittings, how to take the old fittings out and how to put the new fittings in. So that the water can flow again, the same at the pump stations. You need to know someone who can change the oil, change the oil filter, put in diesel and if it breaks down, know how to take the motor out and get it fixed. So community involvement and community managed approaches is so important and the Mvula trust, if you look at them, they had the right approach 20 years ago, you can read up about their community managed approach. Government is also adopting that more and more and right now they are developing the rural water and sanitation strategy. Apart of which will try to maximise the involvement of the community and develop relationships and agreements with the water service authorities so they play a more formal role in the whole process.

I: That’s great thank you. You answered two questions there really because I was going to ask you about public participation and empowering communities. Giving them a voice and a say in the matter that are affecting them.

R: Maybe if I have answered it, just to add on to that. Within the SDG6 programme, SDG6b focusses on community involvement as well. So through the SDG6 programme we were given an indicator by the UN in terms of community participation. But the indicator they gave to use only measures whether there are systems in place to encourage their participation, what SDG6 doesn’t do is to measure the performance of their involvement. So South Africa is currently creating a new domestic indicator, which then considers the performance of communities involvement from the conception right through to the design, the implementation and the operators are making this right throughout the whole life cycle of a project. I think that’s another great initiative we are pursuing.

I: Thank you, that’s great. The next question is, what are your thoughts on the national water act of 1998 and it’s implementation?

R: You know, the national water act focuses on the water resources side of the business and then you have the water services act which focuses on the water services side of the business. The national water act focuses on from abstraction, from the rivers and the dams, up to and through the treatment of the water by the water boards. The water board sell the water to the water service authorities and there’s 144 of them. Which is then where the water services act kicks in. Both acts are very good. I think we have very good legislation, but they are old. But they are supported by other documents. The national water act is supported by the national water resource strategy and we are now going on to our third strategy since the birth of democracy twenty five years ago. So the national water resource strategy unpacks the water act in terms of the current status and informs the sector how to apply the activities related to the strategy and put it in line within law of the act. Similar with the water services as well, but the water services act has a particular framework for water services which guides the sector in that regard. But in terms of your question, the act is very good. There was an initiative a short while ago to combine the water act and the water services act in to one. I think with the new minister in place I don’t know whether that is going to happen or not. I think the previous minister wanted it to be combined but we are waiting for the new minister to give direction for that initiative. But without the strategies in and the policies in place, to drive the issues of the act, then the act wouldn’t be as affective. So those policies and strategies are updated on a regular basis.

I: That’s good.

R: So I encourage you to have a read of the national water resource strategy. I can send the document to you.

I: Thank you, that would be great. So, how do you think it’s going in terms of implementation in terms of both of those acts?

R: Well, I think that implementation is not as good as the acts themselves. There’s some very good legislation, the implementation is a lot more difficult. I can speak more on the water services side because that is the area that I am in. In terms of the constitution, the local government is responsibility for the delivery of water services and for that we’ve got 44 water services authorities to drive water services issues, but again they are quite often under capacitated, under funded when they do have funding often they use it for other priorities. So in terms of water services, things like infrastructure asset management is a major problem. Because maintenance generally is not carried out on a routine basis like it is supposed to be. It is very much reactive to drowns and crises and that is a major problem. You know the rural communities in particular, they have very little revenue coming in so they rely on what they call equitable share which is based on the number of indigenous people that are in the area. Rural areas can be very diverse and spread out. Based on the number of people that are there, the amount of budget that they get in terms of equitable share might be quite relatively small. But then, you need more to be able to run water treatments etc… So there are things in place, for example. We have the regional bulk infrastructure grant whereby water service authorities can apply for additional funding above and beyond their equitable share to help to implement water and sanitation bulk infrastructure that is a process that the department of water helps to fund. But then through every project that is funded we only pay for the social component which is basically the domestic water and sanitation supply any economic components such as farming or industry must be paid for by the water service authority. That can be a challenge in itself. In that area there might be a lot of farming for example, but very few inhabitants in comparison or you might have a 300 million rand project but 50% of it is economic and the municipality has to pay 150 million towards it which they just don’t have. Then, there are other opportunities where they can apply to national treasury for exemptions of their contribution and these things take a long time and I think that’s also one of the challenges, some of the projects which have been in planning have been there for 10 years and some haven’t moved on and by the time they do move on you find the situation changes. The agriculture changes from crops to live stock which increases the demand on water. It may be a new mine has been opened, so water demand is greater. So sometimes the planning process takes so long that by the time it’s ready for implementation, the initial needs have changed.

I: Exactly.

R: But on the water act again. You know there is still a process, the act is good, the application of the act is okay. But I think there is a lot of room for improvement for the water use by the different sectors. The department of water is initiating catchment management agencies within the various catchments to help manage the resource and to allocate water accordingly. If a company applies for a water use license, it use to take 3 years for that license to be approved, now we’ve made improvements and they can turn it over in approximately 6 months but again decision is a long process unfortunately. You know, I think, coming from the UK in a democratic society whereby yes, we get the free choice to make decisions, I know my bosses as southern trent water were saying this is the way you were going to do it so do it. But in South Africa, democracy is so new and there are a lot of people who are nervous to make decisions and there is too many people involved to make that decision in my opinion. There are two many different layers to make a simple decision by which time it takes so much longer for the decision to be made and the moment could be lost.

I: It sounds over complicated.

R: Well, there is an old joke that says the difference between an American soldier and a South African soldier, is that an American soldier will pick up his gone and then shoot and then aim whereas a South African soldier will pick up his gone, aim and then have a meeting to decide whether they are pointing in right direction or not.

I: Haha!

R: So, too many meetings and too many non-decisions made.

I: Yes, my next question is about waste water treatment, it’s a very big and important issue over there and a lot of waste water treatment facilities are dysfunctional, why do you think that is?

R: Well the key one is, lack of infrastructure asset management. Which is a legal requirement by the public finance management act. It is just not competed by the water service authorities and because of that there is no maintenance done, or little maintenance done. Again, it is reactive rather than planned. So, something that is designed for a 10 year life cycle only lasts for 4 years. They break and then they haven’t got the spares to go and replace. Also lack of skills. There’s quite often, the technologies that are installed are not appropriate in my view. There is a lot of status issues in South Africa. If a ponding system will work for waste water treatment and they have the land to incorporate ponding systems then that is the most appropriate way to go. Instead they will go for a surface activated sludge plant, which requires high skills, high costs, in terms of the capital investment, but then, the consultants try and convince the water service authorities to go this technical way, because then they get a bigger professional fee towards it. They want the most expensive option not the cheapest option. But with a surface activated sludge plant for example, if it breaks today then that same day you have water going into the rivers. With a ponding system, if it breaks today it can still operate for about 3 or 4 weeks and maintain the same quality of effluent going in to the river without any involvement at all. So the workmen can pack up their bags and go home and go on strike and the works will still work. But with the surface activated sludge plant you need constant intervention, maintenance, operating activities to ensure it works. So, quite often we are not using appropriate technologies. If you go around the UK you get lots of biofilters and primary settlement tanks, secondary settlement tanks, you know and you don’t get as many here, you do get them but they’ll go for other spec tank technologies. Which work if they are implemented affectively, but when it comes to management as well, if the money is not applied to issues of operation and maintenance and gets used for other things. Sometimes, it is allocated for operation and maintenance but it gets used for housing and building roads instead because, like now it is close to the election time and the councils want people to see the things that people can see like roads and houses and they forget about what is happening underground and the kind of routine maintenance requirements. So yeah, just over 50% over the waste water treatment plants were effective, the rest are not and if you look at the private sector we have got this blue drop green drop award system, which you may of heard of.

I: Yes.

R: You look at the private sector waste water treatment plans, they have all got green drop certification because they have all got the money and the skills and the application to run those plants effectively. But the rural municipality who has high tec technology, doesn’t have the same level of skills, money or the application process to make it sustainable. So yeah that’s the long and short of it.

I: Thank you. So, most of the waste water treatment facilities are government owned aren’t they?

R: Yes, the majority are government owned. Run by the water service authorities.

I: Thank you, my next question is about water quality. Do you think that quantity is looked at over quality. Do you think water quality is often over looked in terms of supply?

R: Well, I don’t think it’s overlooked. But I think it’s not complied with. The department of water has a very major focus on water quality. Obviously SDG6.3 and 6.6 in terms of the environment, have a major focus in terms of water quality. The standards are there, the levels of effluent that are allowed in to the rivers is there. But you find that there is a lot of illegal dumping where people will go and dispose of other effluents and chemicals back in to the river without authority because they don’t want to pay the money to a waste water treatment plant to treat that effluent. You know the Hartbeespoort Dam which is close to Johannesburg is a big example of that. There is a lot of waste going in to that Dam. It starts upstream. There are lots of proposals to clean the dam, but unless you address the cause. You are just going to be pumping money in to cleaning the dam, well people are still dumping illegal stuff upstream. So again, you’ve got in the department of water we have the compliance, monitoring and enforcement sector which is like the water and sanitation police to curb those that don’t comply with the law and the regulations and try and bypass the system. They can go to court for that. But also, again, the waste water treatment plants only working to 50% of their capacity that once again you get effluent that is not in the right quantity going in to the rivers. So we also have to make sure that the 53% of effective waste water treatment plants in the country become 100% for that you need to make sure that the money and skills are available. That the technology is appropriate. So that if there is downtime then the rivers don’t get polluted. Like I mentioned before, people have to comply. There needs to be enforcement of law to make sure that people that don’t comply are met with the full arm of the law. Such as closing down businesses or whatever. Again, the comparison with the UK is that yes the laws are here but they are often not quite adhered to in the same way. When you look at people that drink and drive in the UK you get caught drinking and driving you lose your license for a year.

I: Yes, that’s true.

R: That is a good incentive not to. In South Africa yeah, you can get a slap on the wrist and then go out to the pub again the next day! The incentive is not there, the same with illegal disposing of waste. So that’s an area we need to improve on.

I: Yes, thank you. Going with that, do you think there is enough monitoring of rivers and water quality?

R: Personally, I think we can do a lot better in the monitoring and evaluation area. Within the urban areas and the periurban areas, the water quality side, the drinking water is monitored very well and we have very good drinking quality standards. We are one of 21 countries where you can drink from the tap. You know, the water quality is very good! It’s not monitored as it is supposed to be. That’s where SDG6 has highlighted the gap that we are busy trying to address now. The rural water temptations strategy that we are developing now will go a long way to address that. So, the drinking water quality is very good. In the rural areas, in some areas it is not so great and it is not monitored affectively. But what I must say is that what we are doing is we are doing a very good job in terms of provision of drinking water. We know where the gaps are, there are areas which are not good like anywhere around the world. We are aware of those shortfalls. But then we are only, there’s a lot of stakeholders involved and the water service authorities had to raise their game and do their job and be compliant. We can wave a big stick and we can developed the laws and the processes and the policies, but it needs compliance by the sector.

I: Thank you for that.

R: My next question is about solutions. So what do you think of the potential for rainwater harvesting? Obviously rainfall in South Africa is very inconsistent.

I: Personally, I think it has got great potential. It is something I am seeing more and more of around the place. But when we talk about the lack of water that we had in South Africa, we had to use every opportunity to save water. In the cities, I see rainwater harvesting, I haven’t got a tank myself yet. I want to, it’s on my bucket list. The neighbours have one, they irrigate their garden, they fill up their pools with that. In the rural communities, similarly it can be used for crops, it can be used for washing, for irrigation of some kind or whatever. We only get rain for 6 months of the year, but for those 6 months we can use rainwater harvesting and okay you have a hybrid system where you connect the main supply if there is a main supply to the same tank. When rainwater is there then we use the rainwater, when it isn’t there you use alternatives. Well we have to maximise the use of alternative supplies, you do some research on Singapore. How they recycled every drop of water. There’s no such thing as waste water, we should be using every drop of water. Recycling it, recycling it, recycling it, using the minimum. In South Africa we are using 273L per capita per day. Compared to the world average of 173L per capita per day. Yet, we are a water scarce country. But when Cape Town had their drought a few years ago they managed to bring that consumption level down to below 100L per capita per day. I think it was like 60 or 70L per capita per day, now the drought is over, some people have built that water saving mindset in to their day to day lives. Now, you know it has not gone up to what is was before. So we have to look at rainwater harvesting, you have to look at maximising groundwater, we have to fix our leaks. We can’t afford to lose 41% of our water that we are producing and paying for. We need to look at water reuse, taking water straight from the waste water treatment plants and recycling it for drinking water like again we do in the UK. But there’s a change of mindset that is required in that regard as well, I could tell you some funny stories if we had more time. But we need to learn those lessons from Singapore, we should not be talking about waste water. But then South Africa is also surrounded by sea and when desalination becomes more affordable. You know, which it will. Then, ultimately as population grows, you know in 100 years time they may have a third more people or two thirds more people in Africa but the same amount of rainfall in South Africa, so we have to look at desalination as a solution in the future.

I: That’s funny, have you got my notes or something? Because my next question is about desalination?

R: Maybe I should do a PhD like you, but I don’t think I’m clever enough.

I: No, you should! I was going to ask you about desalination, it’s very energy intensive and South Africa is still very reliant on fossil fuels. South Africa must diversify it’s energy mix too.

R: Absolutely, desalination is essential in the future water mix, even now, the power supply is not sustainable. Like, it’s going off for me in about 15 minutes.

I: Yes, that’s a good example!

R: So we are starting to use solar more and more and wind power. But there are a lot of other alternatives as well. I remember when I worked for Welsh water they have wave power, they use the waves to generate electricity. We need to invest more and more in that as a country and get a way from fossil fuels. But desalination does take up a lot of power, it is expensive, in terms of the rand economy you are looking at around 6 rand per cubic meter to treat water the conventional way. You are looking at 25 to 30 rand to treat water through desalination but that price is coming down and in 20 years it will be far more affordable. If we can save on power consumption by using solar and wind and wave power and all sorts of other alternatives then we can reduce the costs of desalination even further. It’s the only way we can manage our water supply in the future as the demand increase and the supply remains the same.

I: Yes, thank you. My last question now, what are you most proud of? What case study do you think best reflects South Africa in terms of water management.

R: I know I am always very biased towards Mvula trust. Which was my previous employer from a long time ago. But I use to really love the community management approach. If you went in to the rural areas and you saw a government scheme, the government would go in build and get out and leave it for the water service authorities to manage and 2 years down the line it would be dysfunctional. Using the community, I built projects 20 years ago, I could take you to communities in the rural area now where they are still running, they are still pumping and delivery water because the community knows every nut and bolt, every pipe and valve and how to fix it. To be honest the community will pay maybe 5 rand per house to keep that system running, if they hand it over to municipality they will pay 30 rand.

\*Electricity cuts out\*

**GOV4**

I: So in terms of the water services, the infrastructure and the way that water as a resource is managed in South Africa. What are some of the reasons that water is reduced in availability?

R: I think first, that’s quite a broad question. I think the water sector is broken in to two parts. You have the water services part and you have the hydrological services or climate services part. Obviously, to understand water availability in South Africa, I think, from a quantity perspective one will have to first start looking at the hydrological aspects, in terms of South Africa being a highly variable climate. Look, there isn’t a lot of water going around, so South Africa really has to be extremely good at managing the available water resource in this region. That said, I am not saying South Africa doesn’t have water service challenges, but we have to be as a country extremely good at managing what is available so from a hydrologic perspective, in the case you know, our mean annual precipitation in South Africa is much lower than you know internationally like Europe being a much better part. So from, from a hydrological you know from hydrological science perspective there has to be a lot of sort of management of hydrology continuous updating to determine what their main ability is, and as well as looking at the bigger picture in terms of where the climate change is playing our own in terms of us getting more water less water, that has to be a dynamic process it has to be ongoing so that's just from that point of view from the climate services point of view. From a water services point of view I'm gonna come out and say that I'm not an expert in water services I don't really know exactly what the nitty gritties are around the management of the infrastructure in South Africa. in fact you have a local government that deals with municipal level and then provincial and national government international level you know that's overall planning for the country in terms of water services, a lot of the management of the services happens at a local government level. In South Africa we have what is called water utilities for example randwater, umgeni water, is a utility, they deal with bulk water supply to communities. They basically supply through the municipalities, so yeah, they deal with a lot of the challenges on the ground. I think a lot of the challenges we face is at a ground level where, I think if you look at some of the water research papers on the water services side, I think you would find that South Africa is losing something 7billion rand annually due to leaking infrastructure, that’s just infrastructure that needs to be continuously maintained. So there are areas where those are challenges within different municipalities and look different, South Africa as a country, different areas are managed by different municipalities, that’s how it is across the country. So you may find one area is perhaps doing a better job than the other and there are reasons for those that must be investigated and they must determine what is the sole cause, is it just a financial thing, is it just poor management at a government level or not. Is national governmental doing enough oversight on provincial and local scales of government? To ensure that the mandates that are given to those particular functions are dealt with. But yes, we do face a lot of challenges and I don’t think you can say it’s just a financial problem.

I: That’s a great answer thank you. Very detailed and complex. I’m interested in, like you say, how is the communication in the trickling down of policies, such as the national water act, a great policies, are there difficulties that come up in transferring that to municipalities and communities as well?

R: In my opinion, I don’t think it’s a case of policies, I think we have some of the best policies in the world in terms of water. I think it comes down to implementation of the policy and interpretation of the policy as well. I guess it just comes down to doing the basics right. I think if South Africa can do the basics right, I think they will deal with a lot of their water challenges, but not withstanding that there is a highly variable climate. So one can’t just say, that a particular municipality is failing, if you don’t understand the broader context of water in South Africa, it is easy for media houses to just point fingers at particular authorities and you know, they have a particular role to play in doing that, in keeping government accountable. But I think you need to dig deeper into, what are the real reasons for service delivery, for lack of water? You may find, in the South African setting, based on our history, you may find an area that just formed out of nowhere and you may find a protest where now they say there is no water, but, there was never ever a plan to implement water in that particular community. But now, this government is responsible to bring in that infrastructure. So, the perspective can be skewed. In an internationla market, if you just look at you know, perhaps, news articles here and there without really giving context to the problems that the country faces. Yeah, if you find if you do dig deeper in to really what the problem are, you may realise it is not really a governance issue per say, there could be a whole lot of other things. In my personal opinion, I don’t think the policies are failing. I think it’s just implementation of the policies.

I: Like you say, it’s very situation dependent.

R: Yes, it’s site specific. That’s true.

I: I see, that you’ve done some great work with water quality, do you think that is quite an underlooked or ignored area?

R: I think there’s room for expansion of monitoring networks within the water quality environment, perhaps pickup issues of pollution. I think generally, we do have an idea of what the status of what the water resource is in South Africa. But, with expanded monitoring networks, comes expanded costing. With a developing country you’ve got to look broaded in terms of where’s the investment in terms of water resources, because as a country we are dealing with other challenges. So perhaps maybe not enough money is being allocated to do water quality analysis. Water quality is quite expensive. To run a chemical laboratory at every single location would cost billions of rands so government has to grapple with what available resources they have, to get the best idea of what the water status of what the water quality is in South Africa. There are a number of divisions within the department of water and sanitation in South Africa that looks at the state of water resources in the country, so they do analyse the status of water, but you will get cases where you’d have a particular factory polluting and that’s a separate ball game all together, to trace that kind of pollution it’s not just looking at the general quality of the rivers and so forth. A lot of the contamination I think, recently is as a result of the need to upgrade some of the infrastructure, like wastewater treatment plants. You may get cases of wastewater treatment plants needing to be upgraded to deal with the growing population in South Africa. Also, very much so understanding the history of the country, in terms of the lay out where people live, from when SA became a democracy in 1994, there’s been a massive migration of people most rural settings in to urban settings to seek employment. So, the current infrastructure was never developed to handle the amount of migration that you have, 50 years in to democracy, if you look at Guateng province, it’s the smallest province in South Africa but it is sitting at 13 million people, that’s quite a big chunk of South Africa’s population sitting in the smallest province, because of the gold rush that occurred in Guateng and the big industry that is huddled around a single province in order to deal with some of the water challenges perhaps the country will need to actually change that paradigm where everyone thinks that a job is only available in Guateng and develop the industry in the broader part of South Africa and that perhaps will reduce the pressure on these areas, relying on a few rivers to sustain itself. If you look at the water resource planning side of South Africa’s water resources, if you are looking at Guateng, if you really look at the network in terms of how they are able to access water from other provincial boundaries, we’ve got inter-basin transfer schemes, we’ve got a lot happening. Just to be able to supply the demand that sits in one province. Because it’s so linked to our economic development, this province is so important, that, governments and the country didn’t really have a choice but they had to mobilise the resource. The demand is constantly growing, so, if we are going to now look at, like I say, this water thing is so multidisciplinary, you never get an expert, I can tell you, I’m a hydrological scientist, I focus a lot on hydrological monitoring networks for flow, but, if you look at the multidisciplinary nature of water, you never get one person who is an expert across the board. You know that’s just another thing, so I think when you are doing your studies it is also good to cut across from hydrological to climate services, to local government, not just national government to really try and dig deep and in fact go to community level in fact to try and understand the story from bottom up, top down, that’s just the way I see it from my perspective.

I: Yeah, you make a lot of very good points. Thank you for that. Do you think integrated water resource management has potential to bring in all these interdisciplinary factors together?

R: I think the concept of IWRM has been around for a very long time, from what is it Rio conference, Dublin, Rio Dublin principles, I mean that’s quite a long time ago, you know I think there’s been a lot of time around implementing IWRM, but I don’t think it’s at the scale that it should have been implemented at in practice. So while we may have people who understand the concepts of IWRM, I think it’s still challenging to get all the stakeholders around in one room and make good decisions. I think it’s bigger than that. I think it comes down to the fact that there are so many players in this industry. To co-ordinate that is a huge challenge and I don’t think it’s been done effectively, I think there is moves towards, if you look at the water sector as a whole, you will see, South Africa has a national government of water, it has a provincial government which is separate from the department of water and sanitation, it is basically corporate government and traditional affairs, they are separate departments that deal with municipalities, so what has happened is, since the concepts of integrated water resource management came about, South Africa moved towards developing catchment management agencies, which focussed more towards specifically to those areas, to try and deal with those areas, closer to communities. So it is not to say that there hasn’t been an implementation of integrated water resource management principles, but whether it’s been completely effective is something that needs to be assessed. I know there is a whole lot of entities that have developed around the concepts to deal with water resources. Because I mean, a person sitting at national government may not necessarily interact with a community member, but that community member’s point of view is quite important that it reaches the highest decision that must say that there is going to be a new dam built in that area. So I don’t think there is a proper mechanism that links the different players together. I think there is maybe, I am too young, maybe in the past, in South Africa’s water history, maybe, it worked better than it does today but there is sort of a breakdown in that communication lines, in terms of how it is communicated. I think maybe the water sector needs to be reorganised. To perhaps, be more effective in implementation of policy. We’ve got academia producing reams and reams of research, in water business, in the water sector, but how much of that filters through to a policy level where a director general of a department is aware of that? I think you know, there is a block in terms of, the flow of information getting to whichever stakeholder needs it. I think if you do an analysis of the water sector you may found duplication where national government and a catchment management agency is trying to implement the same, trying to find the same answers, I think that is the case here, I think you will find a lot of duplication, because of the lack of co-ordination, maybe if the principle of IWRM is better implemented maybe you will minimise the impacts of people doing the same and not even knowing about it. But it definitely does happen that way.

I: It’s challenging because different levels of understanding, for examples, communities, even me in my own home, if there was a lack of water, I wouldn’t know who to go to about it or how to fix it directly. So, though they have very important lived information, indigenous knowledge, that’s really important to find ways to leverage that information and communicate it through to the top management. Like you say.

R: Yeah, so you kind of need to have your organisations working together in a much better way, but yeah you’ve got to obviously understand the environment for that to happen. Everybody has different roles to play at the same time, if you look at a water utility, their responsibility is to make sure that they purify the water that they abstract and that they distribute it to the people. From a hydrological perspective, it’s just to look at the general trends in terms of whether there is quality and whether the quantity is of reasonable standard. So it’s different scales. You know when people talk about water from a lay man’s perspective, it’s very important to understand, because public servants in general have to understand that they serve the public. So yeah, a lay man doesn’t know about planning in government. He just needs to open a tap, to have a shower. He should be able to have access to clean water. He is not concerned with the different dynamics that are going on, in the water sector value chain. But, if you are looking for the problems, you have to understand the full value chain. From source to the time its purified, that kind of thing. It is complex, water in SA, managing water resources in South Africa, it’s a complex process. It’s not easy, it’s not an easy to do. Especially where you are sitting with not as much of an available resource. So, your concern is definitely there. If there is a water quality issue, because you’ve got too little to go around. To actually take too much risk around, you know, your waste water treatment plants discharging in to a river for example. You certainly can’t take those risks, you’ve got to deal with them decisively, whether budget, allows for that is a completely different ball game. I don’t think you can ignore the political side of it as well. Everything has a play these days. On political level, international government level, the dynamics that are at player are bigger than just the policy, because if you are just to implement a policy without understanding the dynamics in the country around the different players, yeah it would be easy. The national water act insures that every citizen gets access to clean water, that’s basic. But yeah, implementation of that, not so straightforward.

I: Thank you. Do you think the SDGs have given any support in water management and perhaps in community engagement? Such as in forums.

R: So SDG, I think it is 6.

I: Yes.

R: SDG13, I think that also sort of deals with water if I am not mistaken or climate action. I think, the SDGs have done a lot to create awareness around, the value of water and why we should insure that we are taking care of those goals. Because South Africa has what we call a national development plan. Which is 2030, I think the national development plan is aligned with the SDGs, it considers those thing. SA also has what is called the national water and sanitation master plan. I think it would be a good document for you to go through. Because it covers all of the goals in line with the SDGs. The government has aligned to meet the SDGs, whether we are going to do it by 2030, is subject, you know, lots of things. I am not sure whether we are going to completely reach the target. But the fact that a goal was set means that the country must push in that direction, so if we never set goals initially, I don’t think we would have come thus far in any case. To insure people get water and meet the targets and access to clean sanitation and such, is sometimes, as a lay man, if you have access to sanitation, you think this is something basic and perhaps a bit, there are still people out there that need proper access to this kind of thing, I think South Africa, in relation to the rest of Africa is doing quite well, in terms of meeting those goals. I still think there is an area of work that needs to be done. I don’t think it’s purely financial. I think again, it’s implementation of the goals. It’s driven by various factors, policy, political will, political will is so important, having that aligned and public servants working and accountability in government and in private sector because you do get corruption in private sector and government. So dealing with those kind of challenges will go a long way to insure that we are not falling short on meeting the SDGs. I think the world, I don’t think it is just South Africa, I think we are dealing with a lot of global economics and challenges around the economy and whether we have enough money and you know, like I said, it is not only a long way, I think good management can go a long way as well, to implement the SDGs. To do more with the less that we have. You know, it’s going to take a lot, it’s not just money, it’s going to be resources, people and innovation. Good ideas, you know decision makers listening to the intellectual capital of the country. You know, I know internationally, the technical are very well respected and their opinions matter. I think in South Africa, there’s a lot of good intellectual capital that we have. I think it is important that government and the political environment listen to the expertise and do what is supposed to be done and have ethics when you are running a country. I think that’s basically, things every country in the world needs to have in line, not just South Africa. I think all countries are dealing with their own problems, but for South Africa, I like to remain optimistic that we will deal with the water issue. I know it was an SDG question, so ha, we hear about SDGs all the time, it’s already incorporated in to the plans, you just look at the national water and sanitation master plan, of the department of water and sanitation, I think it will be a good document for you to read. I think it falls between the national water act and it is basically to implement that. The goals outlined there cover the SDGs, if I am not mistaken there is probably a chapter on SDGs in there. But yeah, you also need to understand, from a climate action point of view, South Africa’s department of water and sanitation is separate from the department of environmental affairs. But because water has become such a big thing from a climate point of view, you kind of need to work together to address some of the problems. But not just the department of environmental affairs, across the value chain here in South Africa, yeah, understanding the relationships between the different layers is not straightforward. If you look at the landscape, you will come to find it’s quite complex.

I: Very much, it will take a lot of collaboration and different approaches, all mixed together and location specific too.

R: Yeah, If you look at South Africa, the rainfall varies in the country. If you look at, you know, you’ve got the wetter part along the coastlines. As you go inland the rainfall decreases. The Western cape, is also winter rainfall, part of the western cape is a winter rainfall region and the rest of the country a summer rainfall region. We’ve got a mix of climates here, so you kind of have to apply different ways of managing water in different parts of this place, you don’t have that homogenous rainfall across the country. So, we’ve got desert areas where people are more reliant on groundwater, things like that. The different types of ways in which we supplement our water supply varies. I mean across the landscape, I know if you may have heard of the cape town droughts of 2018, most of those dams were empty. What had happened there was the communities were then restricted. The city of Cape Town had severe water restrictions. It required a number of stakeholders from the local govenrment provincial to national, to be able to come out with the plans to deal with that situation. But, locally now they’ve got water again. That again comes back to the climate in this place. You can have 3 or 4 years of drought and then lots of flood events after that, it is like that. Managing water here is an art more than a science.

I: Thank you for that, my last quick question, is do you have a case study for water management that you are most proud of in South Africa?

R: Well I think South Africa has some very impressive water engineering and that comes down to the fact that South Africa has got I think in excess of 4,000 reservoirs, ranging from small farm dams to bigger infrastructure. So a lot of the dam engineering happened from the 1950s to the 2000s. South Africa was at one point a leader in dam engineering in the world. A lot of the techniques applied here are probably ahead of countries like America and Europe even at some point. So this country had a lot of expertise in dam engineering. We do have the tugella-vaal interbasin transfer scheme. It’s one of the, I call it a marvel in engineering, where you take water from a completely different basin and pump it in to the Guateng basin here. So that you can supply where the economy needs it. I think that is something as a case study where the country can be proud of. The way in which it is still managed to this day. It was impressive work that was done in the earlier years, today, South Africa is not building so much more dams because I think the mindset around water management has changed, so the paradigm has shifted from hard infrastructure to be able to deal with what you have. So better manage what you have, than to build hard infrastructure. Rather fix leaks, because you are building 7 billion rand annually, to water leaks than to invest that money in hard infrastructure. Not saying you shouldn’t build dams where you need them, but, I think that you need to be sensible around how you choose to solve water problems and the scale that you want to solve it at. So yeah.

I: That’s a great answer thank you.

**GOV5**

I: We will start with a broad question. Perhaps you can answer this holistically. What do you think of the main causes of water scarcity. Perhaps, from a management perspective?

R: Okay, the issues can vary. From a management perspective, I think, historically, surface water has been seen as the reliable resource. There are a lot of dams that were built and all that. We also have groundwater resources which are a huge resource there that have not been tapped that much. So the west part, even though we have these big infrastructures, the dams, they are not very well managed in different municipalities and those local authorities and therefore, you find, in the end, you don’t really the exact volumes that you were anticipating. Because of the problems with the dam. The sedimentation, those kind of things. But also, if you also mean that the people are not getting the water at their houses. That’s mostly because of local governance of water in this country. There’s many problems there in those municipalities.

I: Thank you. Do you think that the local communities are the stakeholder type that perhaps suffer the most as a result of this?

R: Absolutely, that’s the truth. In rural areas, because the urban ones, even though there is supply, there are also local governance issues which relate to the management, the maintenance, government, the financing of these infrastructures. But in the rural areas it is even worse because they actually don’t have these bulk water systems. I would say that maybe there would be a dam in the area. But the pipes are not going to them, they are passing. Going to some sub urban areas. Or richer areas. So the rural areas have more problems.

I: This is a difficult question, but what do you think are the kind of approaches that may help increase water availability in these rural areas?

R: Okay the first one would be to tap more underground water, because in the rural areas, the homesteads are very far apart from each other. So at least if you tap the groundwater there you don’t need big infrastructure that would need long pipelines and stuff like that. But also to teach the people in how they can contribute in terms of accessing and managing the water, how they can contribute to letting the governance know, there’s no access to water, the influence that they have towards the government. Because this is their government. They should be hearing from the people. Another thing, rainwater harvesting in rural areas. There has been a lot of talks on that. The government will support the communities but it does not really happen. At the extent that it should be happening. The government will talk but does not do. That tends to be the problem.

I: Yeah that tends to be the key theme. There are a lot of ideas, but no implementation and then in the end little happens.

R: Yes.

I: Speaking of rainwater harvesting, do you think with the initial costs, if you think of that as a fraction of their monthly income, it’s quite a lot, so for that to happen, it would need to be subsidised.

R: Absolutely. Which the government promises. Because they say we will buy tanks for you, in which the rainwater will fall in to. But that does not happen. They really need subsidisation. Because also in the rural areas, you will find the young ones who are working will not stay there. So the older one who are already on pension, they cannot use that stipend to start these rainwater harvesting schemes.

I: Yeah, so like you’ve been saying, public participation is really important and educating communities and giving them opportunities to get involved with water management. How do you think that can be improved? Is it about government communicating more with communities?

R: Yeah, I think now this should be a national thing. I think it should come from the national government as the custodian of the water resources in the country. Then they can filter it down to the local government, some sort of directive that tells local authorities that this is what we want you to do. I know that the national department has some programmes about creating awareness and teaching communities what to do. But also, it is not widespread, they will select maybe once in a year or 4 times in a year they will go to different communities. But still, I think this should be directed to the people who are managing the resource at local level. Then, they can take it to their communities. Their might be examples, maybe I am not aware of maybe, but there could be examples they can use, successful examples, to taylor make for other areas, other communities. So yeah, public participation, if the community knows that we came up with this kind of management plan for this resource, they would own it, they would make sure it is protected. It’s managed sustainably.

I: That sounds like a great idea. They would have a good understanding and they know that they need to protect the water themselves. It builds capacity.

R: And probably the local schools and the schools in the area could be involved in this. They also have some management they should do of water in the area. So yeah, that would be helpful.

I: Yeah, speaking of schools, it would be good to have initiatives that educate the children and create staff for industry that is needed for water management. Such as, the maintenance of infrastructure.

R: Absolutely, it would be better if they come up with those kinds of things.

I: What condition overall do you think the water infrastructure is?

R: Let me not say it’s getting worse. But it is not good either. I think, the main thing is, they, we have drought at some point. Then it was clear that the infrastructure that we have is not really big enough to hold the volume that we require now as a country. They would build, a long time ago, for specific groups of people. So now they have to extend, to raise the walls of the dam, to do all kinds of extensions of those infrastructures. So it is not a matter of they are dilapidated but they are small. They can no longer, the capacity is no longer enough for the communities that are now joined in to the bulk water systems. So those are the kinds of things.

I: So moving on now to the sustainable development goals, do you think that’s given a good framework in South Africa?

R: Yes! Absolutely, I think we have, South African champion of that, I think it’s the department of statistical agency of SA, stats agency and the reports that the reports that they submit they come back with positive responses from the UN. I think there is a very good structure here to report on SDGs. Because, departments are leading their sectors. The water department, they are leading SDG6, then there are task leaders and they are champions for different resources. There are champions for groundwater, champions for quality. Champions for ecosystems, champions for all these indicators. Whenever they ask for those reports and the data collection, I have seen, sometimes they say, now is a data collection period, so we all jump in to that. Now is reporting time, we have to jump in to that. I know that they did a lot of methodologies initially, in order to report, so I think that one is handled very well currently, from the country’s perspective.

I: That’s great, do you think there’s been enough monitoring to keep up with that?

R: Yeah, I don’t think so. Maybe I will know more about SDG6, I wouldn’t talk much about the other indicators, but it’s a general concern in the country that the monitoring stations are dwindling, they are going down instead of offering more. But the SDG reporting gives us a chance to say, where are the gaps? And then those included in the national water master plan. Which is implementing the national water strategy. The strategy takes about 5 and then it’s updated. So the water master is trying to implement the strategy. So those gaps that we have identified currently are going to the master plan and then they are addressed there. But monitoring is our biggest problem. I would say, no we are not. Maybe I can say, we can report using what we have, but it is not enough. Also, some distribution is skewed to certain parts of the country, some parts you don’t have, some parts you have a lot more and so that also should be addressed.

I: I understand, do you think that’s limited by the staff available and the funding available.

R: It’s mainly the funding, because we used to have lots of monitoring sites and then with the country’s financial restrictions, the budgets keep getting cut and getting cut. Almost every year. Then, you will find we don’t have enough. You can say the funding also effects the human resource because the departments are also allocated some funds from the treasury. So if the treasury is not giving enough you cannot hire enough human resources. However, we do try, because there are consulting companies, there are also entities of government, like water research commission, you have scientific research institutes, they also do some monitoring, just for example. So now we try to also get their monitoring stations in to our databases also. So that, we can use where we discuss monitoring sites. So that one is a problem but we are trying to address it. Hopefully, in the near future funds will be available. Also, now I think we are looking at using, there is something about digitisation, like the recent technology, which is also dependent on finances. So it will be better to use the technology where we cannot have human, physical monitoring there.

I: That sounds resourceful. Finding innovative approaches to save money and still produce valuable data. Those kinds of things important.

R: Yes, there is another project now which is monitoring using drones for surface water bodies. They are piloting it somewhere.

I: That’s clever. We are living in the future now.

R: Absolutely.

I: Thank you, my last quesiton is about solutions. We can talk about lots of different solutions. What do you think has to happen overall on a management perspective to improve water availability?

R: Overall, let’s hope that it rains. Because we are one of those semi-arid areas. Then of course there’s management of the infrastructure. Maintenance. In other areas there is more work that needs to be done to adhere to those rules. We do have, the biggest problem is the local government. Everybody knows this. Municipalities, they have structures. In some of them you don’t even have budget for operational maintenance. So you wonder. Then also the skills, that is required to do those kinds of jobs are not there at all. So, one is the capacitation by human resource, the skills of that human resource, needs to be improved drastically. And of course, the finances that should be directed to the right activities, if I say operational maintenance, yes. And, bringing the stakeholders close to you, if you want to manage your resources sustainably. Otherwise, if you don’t include them, even the community can also be a problem, they can waste, they vandalise infrastructure, there is a lot of vandalism actually. If it is theirs, if they own it, at least there can be some kind of protecting the infrastructure, but if they think ah that’s just for government, they just vandalise, I think bringing them in and teaching them these kinds of things, creating awareness that will be very useful.

I: That’s a great answer thank you. My last quesiton then would be, what case study are you most proud of?

R: Well, I wouldn’t say, I know personally. But in the country, we have programmes, called blue drop. They are, different authorities are audited sort of, in the infrastructure, in how they manage the water. For the past many years, I think the city of Cape Town and the city of eThikwini in Durban, those ones have been doing very well. There might be some small local municipalities in far-flung areas that I am not aware of, I’m not really involved in this process, I just read reports when they come out. I think those 2 will always be up there, the systems are working.

I: That’s great thank you.

**GOV6**

I: What are the main causes of water scarcity in South Africa?

R: South Africa is a semi-arid country, which means there’s less available water in rivers and dams. When it comes to the available water, the water is not distributed equally which makes it a scarce resource. I have picked up that agriculture consumes above 50% of available freshwater in South Africa.

I: What groups or stakeholders lose out most in the distribution of water? Who gains the most?

R: Agriculture gains more water in South Africa, while people get less especially in rural areas, there is no water.

I: How well do you think water resources are being managed to prevent water scarcity in South Africa?

R: It is managed well, and some different laws and regulations are applied to water management in South Africa. The big problem of water challenges in the country is water pollution. Most companies are discharging untreated effluent into the rivers and dams which makes it hard to treat such water. Then most of our resources are polluted.

I: How efficient are the water service infrastructures and what are the causes for this?

R: We are also battling with old infrastructure in the water sector, due to a lack of investments, a lack of qualified personnel in the water sector, and poor maintenance. This has a huge effect on the water services and infrastructure, where now old water treatment plants are still used without being serviced or building new ones.

I: What condition are wastewater treatment works in on a national scale? What are the causes for this?

R: Wastewater treatment works are deteriorating, most are old, and few new ones are building. With the old ones existing, there's no personnel to operate such machines and you find that at night, there's a breakdown and spill. This results in effluent discharged to be not in a good standard. There are a lot of reasons why it is happening, with political interferences and the national crisis of load shedding (sharing of electricity) being the top reasons.

I: Have the SDGs given a good framework to work on reaching water security in South Africa?

R: Yes, there's little progress in that sense because the country is facing political and electricity uphill which is making everyone forget about other objectives and problems. SDG 6 will be achieved even though it's at a snail's pace. We find political interference in service delivery so making a whole thing a mess.

I: Are you familiar with the National Water Act 1998 (NWA 1998), what are its strengths and weaknesses?

R: Yes, it's our drive in the Department of Water and Sanitation. The strength in the regulation, implementation part, and management of resources using the NWA, 1998. You still find dams being managed by department and there's application to anyone who uses water. I think that’s great up to so far. However, the gap is on polluter pay principles. We find companies can pay a hefty fine for polluting the environment, but the amount is not equivalent to the damage it has caused. Also, in the financial management part of it, a lot of funds are mismanaged which are means for rehab, citation of environment, and water sector especially in the Acid mine drainage.

I: Are mining companies doing enough to address their impact on water security?

R: Mining companies are not doing enough, there's a lot of acid mine drainage in the country and there are few experts in that section. Water discharged from mines ends up polluting rivers, and underground aquifers without anything happening to the mines and companies. Polluter principles it's not covering everyone or money doesn’t solve environmental issues.

I: Are you a part of any forums to discuss water scarcity in South Africa with other stakeholders?

R: Yeah.. am part of the Youth Parliament for Water in South Africa, it's an organization that’s involved in the water sector. It's more of education, awareness, emulating ideas, and trying to solve the water crisis in the country. Benefits, yes, my colleagues went to New York as part of delegations to represent South African youth in the water sector. Opportunities are there but they are also scarce. You need to keep looking and sometimes, get a hook-up from someone to get the opportunity.

I: Do you think there is enough public participation in water management?

R: I think it's 50/50 based that there are a lot of NGOs who are doing public participation and are involved in the water sector in Urban areas while there's most people in rural areas don't have the background and know much about water quality and water distribution. The government is also involved in public participation, but, I think, it will never be enough as there's a lack of education and a lack of career choices in the water sector.

I: Ultimately – What needs to happen to improve access to water in South Africa?

R: I think we need stability in terms of politics and electricity problems. Then from there, we go back to appoint relevant people in water departments and sections. From there, educate existing staff and update them on SDG6 and what needs to be achieved. From there, follow up on mining industries on what are they doing to remedy Acid mine drainage and air pollution which has an impact on water quality and people. From there, we can do boreholes for people who don’t have water and fix existing infrastructure, especially waste to be able to transport and treat wastewater to reach an acceptable level.

**MIN1**

I: Thank you. So my first question is, could you please give an overview of the severity of water scarcity in South Africa and what are the factors going in to it?

R: So we operate in two different provinces of South Africa, the one happens to be a very water rich area, we pump probably in excess of 250 million litres a day in great depths probably 3 to 3.5km below the surface, that does cost us a lot of money from an electricity perspective to pump. Some of that we do treat before we discharge that in to the environment. But just to paint the context that’s a very water rich area. Then in the other province that we operate in with our platinum operation, we are very water scarce. In fact, there is hardly any water there is continuous reductions from the rand water which is the local regulated water service utility. It regulates potable water in to the towns and communities and in to the mining operations itself. Because water is so scarce we’ve often had to restrict or curtail our use of that water. Through the different contexts that we’ve got within South Africa, the water rich area with the gold and the water scarce in platinum. We’ve got 2 different strategies the one is water independence in the gold operations to become independent of potable water systems to actually utilise our water that we’ve got and pump and treat for our own use and become less reliant on rand water so that there will be more potable water for other communities, whereas in Rustenberg we’ve got a not a water independent strategy but a water security strategy. That’s where we focus on rainwater harvesting accessing the groundwater table sustainably, that’s where we talk about desilting of pits, opening up the pits, creating reservoirs for water, taking out alien invasive species that consumes a lot of water, so that there is more water available for production. Within that as well, I guess across both properties there is very clear technologies that support understanding which water flows where. How we consume our water at various pieces of infrastructure, putting benchmarks in place to reduce our water consumption and to benchmark across each of the operations so that there is a competition around, not so much a competition, there is healthy competition, but more so the understanding of every L is used relative to what is available. So we drive water intensity targets, we’ve got very clear metrics and objectives as a group to drive down our water consumption so that we can be responsible in terms of the way we do manage our water.

I: That’s great thank you. You answered a lot of my questions already there! So thank you for that. What policies influence your business? Such as the national water act and how difficult is it to comply with those acts and implement them?

R: You know before we get to acts and frameworks and structures and policies and procedures, there is first and foremost the thinking about what is the right thing to do and that comes outside of any legislation, the fundamental understanding of what is ethical and what is the right thing to do. What is the wrong thing to do is pumping and discharging polluted and impacted water. What is the wrong thing to do is wasting water, what is the wrong thing to do is taking water away from doorstep communities just to support safe productive operations. What is the wrong thing to do is let water discharge uncontrollably off tailings facilities or not manage the levels in our return water dams and so there is leaks. What is also the wrong thing to do is to let illegal mining activity for example sabotage pipelines which carry water so that they break the water our for their illegal mining activities. What is the wrong thing to do is not fix infrastructure that is broken. The wrong thing to do is not fix leaking taps. So fundamentally, before you’ve got anybody telling you what to do, you almost know what the right thing to do is. If you start off from that principle well then the rest becomes easy. Then you start getting in to policies and procedures which you correctly stated, which outline our objectives, which outline and demonstrate why sustainability is important, why responsible behaviour is important. That really just guides behaviour and is out there for everybody to have a common understanding of what ultimately we want to achieve. Then I guess you also get external regulatory frameworks such as the national water acts and the legislation there. Largely dictated by our water use license which is largely dictated by the quality of water that we discharge, where are we allowed to abstract water from how much are we allowed to abstract, how we audit against those licenses, how we report against that license, how we disclose against that license. Again, that’s just responsible simple behaviour but that’s just a guideline within which we work, we work quite comfortably within that, then I guess there’s external frameworks try and drive a collective global behaviour, like the ICM, the responsible gold mining principles, the United Nations global compact agreements, the SDGs, those all have links to water, how to utilise water, how to disclose the water that you do use, how to understand and report for example the CDP that we disclose. In terms of responsible water use. How we recycle water, how we make water available for local sanitation and those frameworks and how we report those and that just from an ESG perspective aligns and tries to differentiate out those that do and those who don’t. Not to say that those who don’t don’t do it responsibly, they probably just choose not to disclose. It’s quite cumbersome process. But yeah that’s how we work within all those different frameworks but I think first and foremost what we should be guided by is what is responsible, what is the right thing to do.

I: That’s respectable, thank you. Is your organisation involved in service provisions of water to communities?

R: Yes and no, when we start mining you have always got to have the end in mind. We have got large footprints and because of those large footprints because we pour some 80 odd thousands employees, you can appreciate that we’ve got some large lets call it hostels for employees, sort of accommodation and things like that. So we’ve got waste water treatment and sewage works which accommodate all of those. We provide sanitation for our employees and the residencies that they live in. The hostels, the housing, the villages. So yes, in that sense we do. We make provisions for services and reticulation of water and we also, in fact, we treat water and we distribute that to some of our villages that are in and around our operations. Whether you ask whether that is the right thing to do or not is a different story because I think that what that does is create a lazy state. We rely on local government to deliver services. Basic services, like sanitation, like drinking water, like power and electricity and when the mine starts delivering those, there is an expectation for that to continue in perpetuity, the mine is not going to be there forever, when it does leave what will happen to those basic services? And so you create a crippled economy reliant on enterprise or private business as oppose to relying on state and so we must be careful to manage that balance and to not lets call it, get the state off the hook in terms of delivering their basic services. It needs to be done responsibly with the end in mind and with the end in mind it means how can we donate sewage, treatment works, infrastructure, potable water, treatment water facilities and how we can use that in to post mining economies.

I: That’s a good answer thank you. A lot of the water treatment works in South Africa are dysfunctional, the state owned ones. So the private sector is an option, but you make a good point that the mining won’t be there forever.

R: Yes. Let me just tell you this. I’m glad you’ve done your research on the state of some of the waste water treatment facilities. They happen to be also along the integrated Vaal river system, which is probably the economic source of water for probably 40% of the capital of South Africa, the Gauteng province which is the economic hub of South Africa. We rely on that water supply. You can appreciate that we’ve got uncontrolled discharge from those waste water treatment works that are state run and managed in to the integrated Vaal river system. So it polluting the Vaal water resource, it’s compromising our ability to get clean water and it’s compromising industry. So it is actually poisoning the economic hub of what is supporting the local economy. So it’s vicious cycle, so we really need to hold the state accountable. We participate in forums together with the state, together with NGOs, together with industry, not just mining. To collaborate, to understand how we can hold each other accountable to make sure that the catchments in which we operate are held to levels of pristine that we can be proud of and we will hold state accountable and we do. The point is that they just always necessarily respond in the way that we want them to.

I: That’s great, thank you. I have seen that you are in initiatives with public participation to help vulnerable communities, how powerful is that?

R: I’ll be honest with you, it’s in its infancy and immature at this point in time and we want to get better at it. If we want to be successful within the areas in which we operate, we have got to come a lot further than we are currently. But we’ve opened the stakeholder communication channels. It is important for us to create awareness, understanding and educate the local communities. Our doorstep communities, some of which contain our employees. Around the responsible use of water and also talk about closure, the end game, what does closure look like? How do we create sustainability? In the gold space where we have got a lot of water we have created a programme which is really an agri-industrial development programme where we’ve donated between ourselves and another agency, donated 30,000 hectares of land to develop lets call it fine margin agriculture, high intensity in terms of employment, high intensity in terms of margin. So it’s not simply your crops, it’s more like your onions that you can export. It’s high value products. That requires a lot of water so some of the water they we would of typically discharged, we would help them develop water use licenses and utilise some of that water. Like I say we pump 280 million litres of water a day. Pump it to become part of this agri initiative so that when mining does cease there is the local communities that are able to participate in growth economies and sustain themselves post mining. So to come back to your question around public participation those kind of things need to be communicated right up front to get alignment to create that common vision of what the end game looks like, how they will participate in the end game, infrastructure for impact which is water and office space and things like that they could leverage and utilise and once we’ve agreed on that common alignment through communication and public participation we can then execute over the balance of the life of mine that we do have left. So yes, very much of important part of the process.

I: That sounds great. You mentioned that you are involved in rain water harvesting. What potential do you think that and other solutions for access to water, such as desalination may have?

R: Whatever it is, it’s natural water harvesting, so that you can become less reliant on the states water system. That’s our objective, to become independent from that, or less reliant on that in the case of the north west province where we have water scarcity. What we do, as I said we have got large pits where we have had open pit mining and we can leverage those to fill with water and utilise it. We have also integrated a large portion of our footprint and integrated the east which is water rich to water scarce. So where we would typically have excess water, we would connect pipelines between the water scarce and the water rich and we would leverage that water so that we have got a closed loop as part of the water balance is concerned. Bring in grey water. So bring in all that water that we generate from the waste water treatment works, before we would leverage clean potable water systems. Recycling is an important part of that, the way we discharge it, you may not appreciate but as part of both our gold and platinum, we discharge a lot of that water on to tailing facilities as we deposit our waste. That’s just the very nature of it, but if we can manage the densities of it, in which that waste goes to its tailings facilities, we reduce the water on the facility and we reduce evaporation we can then keep more water in the system and reduce our reliance on potable water systems. As I say, managing the levels of our dams, desilting them, making the water that we can store in those dams a lot better, managing the levels so that we do get frequent storms, 1 in a 100 year or 1 in 50 year floods, they are becoming more and more frequent with climate change, be able to harvest that water, take out alien species that eat a lot of that water, clean that out, also education with our employees and communities to become more conservative with water, turn off taps, shorter showers, then, I guess, education and awareness and we have a lot of old infrastructure there’s a lot of subterranean pipes that transport water from A to B and when those become broken or corroded there’s leakage in those pipes that you see only days later and so they are putting measurement points between point A and point B, you can see where the pressure of the system, the volume of water that flows between A and B to that reading from rand water so that you can be proactive around leak management.

I: That’s great thank you. Last question, is there a specific project that you are most proud of that represents good water management?

R: Yes, absolutely. So one of our gold operations they call it the treefontein operations, we consume probably 22million litres of water a day in those operations. Historically those operations used to be reliant on rand water. We are now completely independent of rand water, we have got our treatment plants in place to treat 25 million litres of water a day, so we are completely independent of water there. We are slowly driving independence at our gold operations.

I: That’s great, thank you.

R: Thank you.

**MIN2**

I: Okay we are recording now. So my first question is a broad one but could you describe how depleted you feel the water resources are in South Africa overall?

R: So, uhm, you know as we know water is not a challenge that would be felt across a country, it would be linked to a certain basin or we would call it a catchment. The context around that is really important. While I have a specific interest in the integrated vaal river system, that is where I worked an oil and gas company that is highly reliant on that system and I also do research and have my own interest in that. So, in terms of an answer I think it’s a national debate. But it gets played out a local catchment level. So I am not going to give you a view on nationally, we can tease out some of the issues, whether they are around policy, institutional, as well as scarcity, so you know it is quite clear that South Africa has a water scarcity issue but it’s not to suggest that we are on our last, there are actually places, particularly the vaal river, is a good example where there are quite a lot of planning and management that does take place and there are already large amounts of infrastructure in place to make water available to quite a lot of people. So, probably not a great answer.

I: That is a good answer, thank you. From your experience, of course there are physical and geographical reasons for water scarcity in South Africa, but from your experience, what are the main management causes for water scarcity?

R: So you know, you can have physical scarcity or other forms of scarcity. So economic as well. Because often, there is enough water it just isn’t available where it is needed and at an affordable price as well and quality. Bring me back to your question, what are you specifically asking in this context?

I: No worries, so, from your experience what are the main management causes of water scarcity?

R: Yeah, um, so, I’ll give you a very South African answer. You can run out of water because you run yourself in to a drought cycle, um, you can have infrastructure that is failing. That is intending to move water from where you need it. Where it is available, where it is needed. I think that is in it’s self an infrastructure challenge. Really, um, it manifests itself in aging infrastructure, dealing with pump transfers, physical losses in the like. The other one has been around governance specifically the issue around operating. Just a second. Sorry about that.

I: That’s okay, no worries.

R: Yeah I was talking about operating rules, governance. The key things for us to worry about is unlawful use of water, you know that’s a management and governance issue, putting others at risk. Physical losses, you know we have aging infrastructure and you’ll find a lot of information on that. The growing demand and competition for water and then, the challenge of bringing in new infrastructure, again, the vaal river, linked to the Lesotho highlands project, phase 2. Many many years in delay. That is an issue. But is it a management issue? Governance issue? Just the hard reality of putting infrastructure in to being these days.

I: That’s a great answer. What seems to be a common problem in South Africa is that the policies are good but then it falls down in it’s implementation.

R: Correct, that is a statement you will hear a lot, yeah.

I: So speaking of policies, what are the main policies that influence your organisation?

R: Look, I think it is all cast under the national water act, there is a whole series of water policy, water act, water resource strategy and then supporting regulations, norms and standards. So, it’s quite clear in the case of water. The issue around, you need to apply for a water use. There is no entitlement to water, water is owned by the state. What you need to do is apply for water use, allocations, storage of water, reuse, things like that.

I: Yes.

R: So the whole challenge of applying for water use licenses and the delays in getting those, concluded are I think quite a serious issue. But in the case of my company from an allocation point of view which is still being driven from a national point of view, while you have to go through the hoops of applying for that, it is reasonable predictable what you are doing but there is no certainty in to the future as well. So, yeah I think maybe licenses, delay in applying for licenses, the typical conditions that you need to apply with.

I: Okay, that’s great thank you. That’s really good. My next question is, from your experience do you think that there is a fair share of the environmental benefits and burdens associated with water?

R: So, again, intrenched in law and in the NWA, call it the balancing act between water use and water resource protection. So you know, water has this dual thing about it, it’s quite clear you need to use it and there are a lot of competing interests in using it, then, you also need to protect it. So from picking water hierarchy of allocation to basic humans needs, which is really not a big problem. We overplay it because it is a small amount in relation to what is going on. As well as the environment, as those with a right to water in quite clearly intrenched. How it is then translated in practice, I think is still quite a big challenge to see, but I think there are good examples where there are particularly, environmental flows, particularly when you are building new infrastructure and considering those there are a lot of good consideration going in that, informed by the commission on dams. So is it totally in practice? Probably not. Because we sit with a lot of legacy stuff. A lot of our systems were really designed at the turn of the century and to really turn those things around and really consider using a bit of a clean sheet, the ecological flows, or the environmental reserves, I think is still a challenge. Yeah.

I: That’s good thank you. The next question is do you think public participation in water management has potential to benefit water scarcity in South Africa?

R: Definitely. I do, I definitely see that as an important requirement and public participation is also intrenched in our application processes and in our EIAs etc.. So yes, I think the answer is very clearly yes. However, in practice, it’s been intrenched particularly in, call it what you like, we still have large users, intrenched users, I guess with competing interests. So in that sense, again, whatever you want to call it, sustainable water management, integrated water resource management, in my language I am sort of advocating around water stewardship. I think, you really are going to find yourself at a juncture where you have to look at the interests of the whole to serve your interests. You are going to do that through active alignment on expectations and engaging stakeholders and really important, disclosure, that’s what you have to do. So yes.

I: That’s a really good answer, thank you. Are you a part of any forums to discuss water scarcity amongst different stakeholders?

R: So in South Africa we actively participate in different forums that are focussed on managing the integrated Vaal river system. So there is a whole series of sessions that I held on an annual basis where the whole planning and performance monitoring of the vaal river system is discussed where the allocations are confirmed and through quite a sophisticated planning model which was developed in the 80s, the systems operational performance is confirmed and projects made as to whether there is enough water in the system for the following hydrological year. In that sense any decisions made around restrictions or changes to the allocations etc… So there is a whole process there. As far as scarcity is concerned I guess we are also involved in an initiative called the strategic water partners network which is a multistakeholder platform. Created through the 2030 water resources group. But, largely now an independent, sort of anonymous initiative here. We are also in the initiatives of the global contracts water mandate so that, not driving water security per se, but it’s driving practices in water stewardship and they have a further initiative called the water resilience coalition that we are trying to get involved in. I am a board member of the international alliance water stewardship but that is in itself a whole standard setting certification process for claims around water stewardship. So I don’t know, there’s always odd things that come up here and there. We try and participate.

I: That’s great, you sound busy!

R: Haha!

I: So my questions now move towards mining. So, do you know of any innovative technologies involved in AMD that may be beneficial for water scarcity?

R: Yeah, so AMD is quite a loaded question, I’ll say that from the start. We’ll have to unpack it in a few ways.

I: Sure.

R: Yeah, my employer also has an extensive mining complex and water is dealt with in a hierarchical approach around avoidance, reuse, recycling, disposal, very simply in the 90s they experienced surplus water that they needed to treat and they actually went for quite an expensive electrodialysis reversal process, but in the end discovered after several years that they no longer needed this facility in the way that they were able to balance the positive water balances on the complex and that acid was then transferred over to the processing facility which is supported by the mine. There are pockets of this. I don’t know what you define as innovative, but you know, membrane technology, desalination, things like that are occurring. Where I have an interest in this question is particularly around legacy. AMD from the gold mines, is quite an input in to the way that we think about the integrated Vaal river system. So, you know, Johannesburg was brought up as a very intense gold mining town. You know, they mined tonnes and tonnes of gold here and as they did that they also went deeper and needed to pump water out. The pumped water became quite contaminated and to this day still a lot of this water is then released in to the Vaal river by different tributaries. Now the challenge with this is actually, I think, in simple terms, it is that we are, I’m not of the view that desalination is the solution. I think, we are going to have to figure out something which is more affordable and also, you know, something that is a bit more sustainable, there is in that sense initiatives like looking at mine water irrigation or alternative sources of water, basically post closure. There is an old mine water coordinating who’s driving initiatives in this area, so, I would still think that is, I am not now saying everything can be irrigated, I do have a background in that. But irrigating lyme treated well balanced waters, even though they are not really considered suitable for irrigation, can be a great thing to drive, post closure enterprise developers around creating opportunities, livelihoods, whether it is food or other things you can grow. I’ll hang on that one. I think that is an interesting one and I could also point out, there was some work carried out by the water research commission, who also drove some programme to look at innovations around mining. That’s got a lot of really good work that came out of that as well. But yeah, I would say mine irrigation and also thinking about mining and mine water in a bit more of a different way. If you don’t get fixed on the future of an unaffordable and frankly, unsustainable approach to just desalination contaminated water, there must be better things we can do.

I: That’s very good thank you. So then, moving away from mining. But also looking at solutions for water scarcity, you mentioned desalination for mining, but in general what do you think of salt water desalination? Do you think that it is probably too expensive as a solution?

I: Well I think one has to start rethinking one’s view. Yeah, probably five years ago I probably would of said I’m not a big fan of desalination, but it’s becoming increasingly prominent and particularly along the coastline is going to be quite expected that we are going to see more developments, more growth in coastal cities and in the reality that you can see desalination fitting in but currently I still think from an energy intensity perspective you are, I’m not sure, but again it is going to be very site specific and I think, yeah desalination of effluent, recycling of water, those sort of things on industrial complexes, effluent system absolutely. But in the inland for now. I still have the view that we still have sufficient surface water. If we manage that responsibly, I think we should be okay for now. Although, these systems are becoming bigger and bigger. Just take the vaal river or the orange river. I mean the orange river supplies water all the way down to Port Elizabeth you know it’s incredibly, we have very big, if you move water for forever and a day, I think that in itself is very, I don’t think that’s the greatest of ideas. To me, that’s what’s happened. But in those big systems I think we need to be more mindful and attuned to what we can do on the smaller front and really be much more disciplined about how we think about water.

I: Thank you. So, on a local scale do you think perhaps rainwater harvesting has potential.

R: So, again, I’ll give you a skew answer. I mean, what is rainwater harvesting? In terms of catching water from roofs and putting it in to tanks. That sort of, we are not really big in to groundwater recharge, certainly not what I am familiar with. When we do go down the road of doing that, we just have to keep in mind that a lot of waters are in any case down the road going to be reused. So we talk about return flow. In Johannesburg where I stay we bring in a lot of water from the Vaal river. A lot of that, effectively half of that goes down the drain, from the baths and the showers, your laundry etc.. that water gets treated and that water gets upgraded in your waste water treatment works. Then by law the treated effluent needs to be put back in to the river, so, you know, these are very large amounts, you know, I can unpack it for you, but essentially when we do go down the road of rainwater harvesting we must also not forget that what we are putting down the drain already has a future life somewhere downstream of our development. So, in the case of the Vaal river. Yes, so I think more rainwater harvesting needs to be advocated but taking it in to the context that return flows are also very important water resources down the road.

I: That’s a good point, so waste water treatment is very important but a lot of the facilities are in quite poor condition aren’t they?

R: Absolutely and there you can look at the recent green drop report, have you seen that?

I: Yes, there’s also a good website that shows you a map of all of the facilities and most of them are red for being in poor condition.

R: Yes, well we were quite fortunate and you are absolutely right, so don’t underplay, those are the you know, again, I put them in one hand unlawful irrigation, large physical losses, poorly maintained infrastructure including waste water, delays in new infrastructure and the optimum reuse of the returns flows is really important. I don’t want to get distracted now but my employer has a very good story to tell because we were the best private sector, we also run plants that are old and they also treat the town sewage and on the green drop report now the recent report we came out as the best private sector facility meaning we were green drop certified for the one plant and the other one fell short by 1%. That’s just on the side and something that I think we should be proud of. It doesn’t take away from the fact, this is my other work, I’ve been working 10/15 years in local government failures and a lot of, don’t start me off, if you want any of that stuff I can point you in that direction.

I: That’s great thanks. A lot of the government facilities are in poor condition, there’s a lack of action, a lack of funding and a lack of staff, do you think that perhaps privatisation is the answer for the water treatment facilities?

R: As much as I am pro privatisation and one has to unpack it a little bit what we mean by privatisation, it’s a very difficult topic in South Africa particularly where you have a strong labour union force. I tend to not find it that easy a discussion of privatising a water sector. But to do private sector arrangements or partnerships in that water sector is totally fine. A very friend of mine always reminds me, we are so anti this privatisation but you already a sector that has 2 trade journals, your water sewage and effluent, there is a lot of private sector stuff happening in the water sector but we don’t kinda wanna call it that because it would really trigger the politicians as well as the unions. So if I could extend one point around this and you are quite right in your analysis around the poorly maintained, there’s not enough money going in to it and how you eloquently put it, but I think fundamentally to this problem is a question around who is holding whom to account. Within government, they are finding it very difficult to hold each other to account. So a lot of the failures are at local government level, so municipalities. The municipalities as well, that would be my second point, it’s really just not financially viable, so how do you against the backdrop of poorly maintained infrastructure, lets be honest, corruption and all related financial mismanagement and just the way things are set up, also underpinned by a lack of revenue generation. These are compounding challenges that add up, to create where we find ourselves here. But fundamentally I think it could be reclarified in law, if somebody does mess up, so if a local government does fail to deliver water and sanitation services, how are they held to account. That is, if you want to go down that route I can also point you to some work in that area, but that’s my honest answer. I think we are always going to criticise, we are always going to find faults, but we also have to stand back a little bit and say well what is going to make these things sustainable and it’s not just beating and criticising, not that that’s what I’m hearing from you, so don’t get me wrong here. Accountability and government. I’m all for privatisation but, you know there are different forms of privatisation so it needs a little bit of unpacking.

I: That’s great, thank you. My final question now is that do you have a project that you are particularly proud of and think that is a great example of how things could be in South Africa?

R: The green drop certification is a good one. Look on our website there is in the media section a nice write up. Maybe this is bias, because this is my study on the Vaal river system, it’s difficult to pin down what really would I be proud of. I think it is an extraordinary system that has been shaped over time and creates just a wonderful for supporting the inland region of South Africa, with all its challenges, we do recognise that, I think it is a remarkable piece of just fancy engineering, good thinking and pioneering spirit which is still holding us well today. On a more on the ground stuff I think we have also driven our own water conservation partnerships I think that is the thing that the private sector should be proud of is how they’ve also been able to get in there and shape and by doing create multistakeholder partnerships that can drive, our thinking here is, we have a big footprint, we are still in to coal and so on but, water use is really fixed in our inherent design and we have the view that in addition to dealing with our footprint on our own operations has lead us to drive collective action in the area in which we operate so in the same basin, driving partnerships to save water. So there have been good examples, I feel quite proud of that. But on the whole, lets also not say that we are a thickle bunch in the water sector. There is a lot of feeling that we are not doing that great, but the research sector has been great, we have fantastic research output but we tend to scratch our heads when we look at what’s happening on the ground. Again, I’m saying this with all respect and understanding that you know there’s not, I’m still positive about South Africa, I think that the water sector really needs to underpin that, but until we move away, we deal with you know, just the basics, you know again without repeating myself dealing with the basics around governance, unlawful irrigation, dealing with physical losses, dealing with infrastructure and really solvable issues, delays in infrastructure and then dealing with the competing interests I think we are always going to forever and a day be finding ourselves on the backfoot.

I: That’s great. Thank you, you’ve been very helpful.

R: Thank you.

**MIN3**

I: How much co-operation do mining organisations have with other stakeholders?

R: So, co-operation varies between stakeholder, dependent on the maturity of the relationship , the capacity and values of the stakeholders. Typically, cooperation is viewed as low, but considering the success of large mining companies it is more likely to be the exception than the rule that disagreements occur. Many are also trying to align with the principle of FPIC.

I: What opportunities can mining provide to local communities to build capacity?

R: Several, Education, training, awareness, on site learnerships, bursaries, job training, these kinds of things.

I: In general, how well do you think water is being managed in SA? What state is the water infrastructure in?

R: It is in a dismal state, despite excellent laws we have terrible implementation as is clearly evident from the state of our water infrastructure, large water losses and continued threat for water shortages.

I: What responsibilities do mining companies have after mine closure? How can they limit their impact on the environment?

R: Mines must plan for a closure end state that is pre-agreed with all relevant stakeholders and considers latent and residual impacts. This will ensure communities and governments are prepared for the end state and to continue with sustainable post-mining uses. The key issue is the lack of closure guidance and support from government resulting in significant costs being waste on keeping assets that no longer serve a function and that could be better used for alternative purposes.

I: As well as limiting impact, what can mining companies do to support sustainable development?

R: The key requirements is to implement avoidance of critical natural resources, form both a biodiversity and human use perspective, from the start, as no critical resources can be rehabilitated or compensated. If ecosystems and ecosystem services are well managed from the commencement of mining through to the post-mining environment then the backbone for sustainable development will be guaranteed.

I: Are you aware of the National Water Act 1998? How does it influence your work? How do you find interpreting it and implementing it?

R: The National Water Act is excellent, but the implementation is very poor. Further scientific and factual studies to support the implementation of the act are infrequent, stooped in assumptions and generally quite outdated. Thus in the most cases the pre-determined and scientifically inaccurate licences and legal requirements that have abounded form the act are more of an impediment than support in trying to get water users to do the right thing. Why would any water user want to listen to the law, when there is no scientific or practical background to the requirements.

I: How is load shedding influence sustainable water management and mining operations? Should SA diversify it's energy mix away from a reliance on coal?

R: Yes to diversification though it is recognised that the entire supply cannot be attained from renewable alone. Load shedding has a significatn impact as it influences pumping regimes that result in threats to safety, deteriorated water quality, increased cost for storage, treatment and pumping; lack of treatment or failure in treatment processes during loadshedding, potential health impacts for potable water management systems, environmental incidents when capacity constraints cannot be managed due to lack of pumping and processing as a result of load shedding.

**MIN4**

I: How much co-operation do mining organisations have with other stakeholders

R: Cooperation is mostly with the government departments that govern water use activities. The relationship is mostly based on governance and compliance.

I: What opportunities can mining provide to local communities to build capacity?

R: Mining companies largely give preference to local communities in provision job and business opportunities. Mine water treatment plants also consider nearby communities as off takers of treated mine water

I: In general, how well do you think water is being managed in SA? What state is the water infrastructure in?

R: The state of water infrastructure differs between different municipalities. Municipalities in poor areas generally don't have financial and technical capacity to maintain their water infrastructure and this results in them being in a bad state.

I: What responsibilities do mining companies have after mine closure? How can they limit their impact on the environment?

R: The responsibility to reinstate the environment to pre-mining is the core responsibility by mining companies. The post mining land use is currently the drivers of mine closure plans and these are done in cooperation with surrounding communities.

I: As well as limiting impact, what can mining companies do to support sustainable development?

R: Continue to operate the mines with sustainable closure in mind. Sustainable economic activities beyond mine closure need to be at the driver of all activities towards closure.

I: Are you aware of the National Water Act 1998? How does it influence your work? How do you find interpreting it and implementing it?

R: Yes. It governs the use and protection of water resources in South Africa. My role is to ensure that mining activities are aligned to the prescripts of the Act and to ensure continuous alignment with government wherever there might be challenges relating to compliance to the Act.

I: How is load shedding influence sustainable water management and mining operations? Should SA diversify it's energy mix away from a reliance on coal?

R: Load shedding negatively affects the performance of water management infrastructure due to unplanned stoppages. South Africa should indeed diversify but this should be done at a pace that doesn't negatively influence coal mining as the industry is a massive contributor to the economy in job creation and to secondary and tertiary economies.

**MIN5**

I: How much co-operation do mining organisations have with other stakeholders?

R: There is cooperation, although it sometimes depends on the issue at hand.

I: Yes. What opportunities can mining provide to local communities to build capacity?

R: There areas where collaboration with government is necessary, in such avenues, mining houses can partner with communities, train them on sustainable water practices.

I: In general, how well do you think water is being managed in SA? What state is the water infrastructure in?

R: In the area where I am, water infrastructure doesn’t seem to be improving. Although dams are often full, communities do not have clean water. This then leads to community uprisings.

I: What responsibilities do mining companies have after mine closure? How can they limit their impact on the environment?

R: Closure Plans should embed extensively the element of water monitoring. Water licenses must also be kept active, although some uses can be scrapped.

I: As well as limiting impact, what can mining companies do to support sustainable development?

R: Invest in SLP projects that aim at providing water sustainably

I: Are you aware of the National Water Act 1998? How does it influence your work? How do you find interpreting it and implementing it?

R: Guided by our licenses, we always ensure that compliance is adhered to. Working with Government

I: How is load shedding influence sustainable water management and mining operations? Should SA diversify its energy mix away from a reliance on coal?

R: Many areas are unable to fill dams due to loadshedding. This leaves many communities without water. A good energy mix can help reduce the impact of loadshedding. Any transition that happens on the energy front should be just.

**NGO1**

I: That’s brilliant. Thank you. So, my first question is a broad one, to what extent do you think, overall, in South Africa, do you think water resources are depleted in South Africa?

R: This is something that I don’t have direct knowledge on. It’s very difficult.

I: That’s okay.

R: Yeah, I don’t monitor the mass water availability in the country. If anything I’ve been looking at it more on a local level. But, I don’t go in to that level of analysis of water availability. I know from our public reports and so on, they are constantly saying that we are going to run out of water. Especially in Gauteng. Water in the next 10 years will be very scarce based on the drought and rainfall records that we have from the past. So we know we have patterns of availability and patterns of non-availability, whether we, South Africa is a water scarce country so we already do not have enough to start with. The reason we had enough water was because we built so many dams. We had the forethought to that so water availability in South Africa is purely because the dams were constructed. We really in some areas would have run out of water long ago or never have populations develop there etc… if we did not have this massive infrastructure of water supply and transfer and control and so on. So very well designed and developed systems that were done long before I was even considered on this Earth. You know, 1950s, 40s, etc.. so done and dusted. Building more dams, South Africa hasn’t really achieved that well in the last 20 years. You know, I think they’ve constructed maybe one or two more major dams, since probably the 1980s or so, well, since the Lesotho highlands project basically, one of the last big dam projects. So we didn’t really have a lot of planning that went in to providing water and there wasn’t a lot of money that was properly allocated to ensuring that we secure water security. They continued to develop, so we continued to expand, the cities continued to get bigger and yet the dam capacity never changed you know we still have these drought periods that are well known in South Africa. We have the La Nina and the El Nino so when we are going through the La Nina we are having problems and it can persist and with the amount of people, the population growth in South Africa, the usage, the demand of water you know logically you would say there is no way that we are going to survive unless we A, built tonnes more dams or B we start desalinating water and distributing to the higher regions of the country, from the coastline, that would be in my mind the ultimate approach that we would have to take. Because, we are not going to stop the population from expanding, we are not going to stop those things.

I: So do you think dams have one of the best potentials to meet the water needs of South Africa?

R: Not really. I don’t think dams are a good thing, I think dams have got their downfalls, they change ecosystems. They change, they have plenty of negative impacts, they create safety issues downstream, they become pollution catchment dams, because that is all they are now in South Africa, is they become pollution catchment dams of what comes in in the catchments. So no, I think dams are a terrible idea. I think we would rather desalinate water and pump it up to you know, just bring it up to perhaps fill the Vaal with it, or whatever, find a way to distribute water and not just rely on rainwater and catchment water continuously.

I: Yes, OK. Thank you.

R: So dams no, but it’s done, it’s done and dusted and it saved us.

I: That’s true. Do you think there are particular groups that are more aversely affected than some others in South Africa?

R: Probably, but, especially in townships possibly. But that would be more to do with infrastructure. As opposed to lack of water. Some areas really struggle with water because of capacity. Because the municipality has run out of chemicals. So, not so much no access to water. But there are areas, very remote areas in South Africa, like the Transkei, that still does not have access to drinking water sources from a municipal level which is a constitutional requirement. We must supply drinking water to everybody. But in some of the very very remote areas that messaging didn’t get through. Then in other areas like KZN, they really invested a lot in supplying water to people. Just because I have first hand knowledge of seeing that happen, but they eventually started worrying that they were going to run out of water. Because now they were tapping in to all of the available resources supplying water to everybody. Now suddenly, the resources and the ground water tables were dropping drastically. So there was, you know, the plus factor of supplying water to people, but then the negative of the fact that they might not even have any water anymore because it might all run out as well. Depending on seasons, you know how much rain we get so, in that case it didn’t go up a lot this year. So, we have enough water right now. People have, I think the country tried very hard to supply water. There were definitely areas that were neglected though.

I: Do you think that is worsened by a lack of skills to maintain the infrastructure and a lack of finances too?

R: Of course, it is worsened by corruption too. That’s it. We have the skills, we have those things, we’ve got people that can be trained. It’s the mismanagement of the funds and resources that’s the problem.

I: The implementation?

R: Yes, a lack of.

I: Speaking of, that brings me to the national water act. You said you were familiar with it. That seems like it’s a really good piece of policy but where it falls down is it it’s implementation in practice.

R: Yeah, that’s interesting, that is a lot in the national water act that is yeah, not practice basically so tonnes of sections that are just not being properly implemented, guided, we are not updating waste water regulations and keeping up to date with emerging pollutants. But yeah, a relatively good document. I mean, I don’t love the national water act, I think that it is a bit boring and extended on issues that are more governance issues. So they could have actually split the governance side of issues like the water use associations, the irrigation boards and all that nonsense out of the act and kept the act about catchment management, about pollution and about managing water resources in the way it does. But it is also very complicated, parts of it might not ever be implemented because of the complication, people just didn’t know how to practically do these things sometimes.

I: Yeah.

R: It’s not an amazing piece of legislation, it’s okay. It’s very long to read and I don’t think anyone has really read it from beginning to end because it is so boring. There’s lots of stuff in there that you could miss I think. So we stick to the important parts which is the pollution section, section 19 and the water use license section, section 21 and 43 I think is linked back to that. Then offenses and penalties, section 151. Those are the ones we really focus on and then the regulations which there are many as well. Like all the water use license regulations. Those basically.

I: So, do you think that they are over complicated and hard for people that perhaps don’t have expertise in this area, it’s hard for them to understand what is required?

R: Somewhat, yeah. It’s a complex. Yes, we over complicate things all the time and it does not need to be so complicated. I think we had a lot of incredibly intelligent people in South Africa in the 90s, the 80s and the 90s and those people really were like way above the level of the average person in South Africa and yeah, they started utilizing legal companies to write policy which just made it so high level. All the legal companies want to prove that they know how to write a policy, you know. So yes, it is so convoluted and can be so complex, it’s really yeah. Haha! Over done and over complicated in a sense, definitely without a doubt, yeah.

I: Thank you. Do you think there’s a lack of the adoption of public participation in South Africa and within the NWA?

R: It definitely could now, now that we the public are so interested in the water sector. Because there was no interest in the public until the water got polluted. We just, everyone assumed the government was doing their job. We didn’t need to know about those things necessarily, but now that we need to try and figure out who is doing what wrong, why is the water, how did we get here, what caused this, so you go through the laws and you analysis everything, so it is, what is the question again? Repeat it.

I: Is there enough adoption of public participation?

R: Oh that’s right. So, now that we are more aware we definitely partake more. We are invited now by the minister himself. The new minister has sort of, what’s the word? Turned a new leaf, turned a whole corner for the department of water affairs. He is trying to do what is right and the messaging coming through is strong on that you know. He has been very honest and open you know, that they have messed up, that they need to correct their wrongs and that there is all this pollution happening and that it needs to stop. So definitely public participation at the moment is high. Look, I don’t know, it depends on what they want to change. So, public participation is always important, it’s incredibly important. But it depends on who you are asking and what they are trying to achieve and so on. We don’t have enough professionals that publicly want to participate, no. We don’t have enough people who actually know what to look for. We don’t have enough specialists to read that law and understand the unintended consequences of that legislation. The public can’t do that, they are not equipped for that. All of us anyway, you have a job, you have a life. You are not an engineer or a specialist in those fields. So yes, commentary is great but will it add value if the person who is commenting doesn’t under the core of the problems. Doesn’t see the unintended problems of this new policy or this new development and doesn’t have time to actually comment on it in time. Because you only get 30 days most of the time which is just ludicrous, so if anything the commentary period is just too short, that would be a comment on that. Yeah, whether you get valuable commenting because people don’t know what they are looking for is the problem.

I: That’s true. So perhaps it’s more beneficial from a feedback perspective.

R: Well it needs to go through water bodies and water forums. Proper established, engineering bodies, they need to be handed the document for comment and they must be forced to comment. If you have no comments you write there, we as the engineering society of South Africa have no comments, you know. Like, get all the major role players that actually know about water to comment on the act and make sure that they comment. If they choose to not to read it, they can say, we choose not to comment on this and you move on. Actually get the valuable insight from the specialists that should be looking at it.

I: Yes.

R: It doesn’t help if you just throw it out to the 50 million people and half of them don’t even have access to a computer, nevermind would understand the level of what they are talking about.

I: Yes, that’s true. Thank you. So, to what extent do you think household waste is contributing to water scarcity?

R: Ooh, water scarcity. Household waste pollution contributing to water scarcity?

I: In terms of how it is polluting water quality.

R: It contributes to clean water scarcity but it doesn’t cause water not to be supplied. It might, I can’t imagine an instance where you can’t get water because of a waste issue. Those two don’t relate to me, especially because we get our water from the Vaal. For instance, in Gauteng the Vaal is like 100km away and it’s a very rural area so there are no waste issues necessarily that contribute to how we get our water. Maybe the quality of the water is good enough based on waste issues is relevant. So the leaching of plastics in to our water resources, do we actually test for those when we treat our water supply for the whole of Gauteng. Even mine waste, so you’ve got tailings waste. In South Africa we often refer to tailings or dumps as often a waste. But it’s not household obviously. Household domestic waste affecting water scarcity, I can’t see how they would relate. I’m not sure if I can think of an example of that relationship.

I: So for example in England, what is happening quite a lot is a lot of effluent water is pumped in to our water sources or plastic pollution.

R: Effluent is waste for you guys hey? We don’t consider water a waste in South Africa. Because it’s so complicated our waste laws. So we’ve taken out of the definition of waste. So waste water affecting availability, or causing water scarcity, water doing that. Look, it pollutes the water it causes the water quality to deteriorate. Recently in Bronkhorstspruit there was a pollution incident of the river and the water treatment works got contaminated and they sent contaminated water down the line. So definitely, it contaminates the system. But, whether, look, they had to switch it off they had to flush it. So that caused three or four hours, maybe more, sometimes days of no water availability, yes. When they must maintain, there is a scarcity of water. Often the townships get it the worst because just the geography like Bronkhorstspruit for instance, it’s not necessarily the case everywhere and it’s not designed like that. But it is just the instance where just because they are so far away, their reservoir takes the longest to fill up, so they get the water last and they feel like they are being mistreated because everyone else has water and they still don’t have water. So yeah, it’s complex. It depends on things. But lack of maintenance definitely can cause water scarcity or a water supply problem. You know when pipes start bursting, now they are busy replacing asbestos pipes which will cause a lack of supply for those days or weeks or whatever it might be, who knows. So yeah. Often community will fight with the contracts who come and fix stuff.

I: Oh!

R: Because what happens, generally you get poor service delivery in the townships, okay. That’s just a known fact. The reason is often because say they don’t pay very high rates for taxes so there is not a load of money allocated to that area. They are not bringing in any revenue. They are actually an expense to the municipality so the municipality services them the least basically. Then, when something goes wrong like they don’t have water for 3 or 4 days they get upset. Eventually, the municipality will send the contractor or whatever. Then the contractors will get chased away because they aren’t local people for instance. Now we can’t fix the water supply because the contractor keeps on getting chased and harassed because he is not part of the local forum or something. So it becomes so complicated. Then they might burn down the water treatment works because they keep on getting water. So to them the solution is to protest and burn down the water treatment works. Then, they don’t have water as well because they burnt their water treatment works down or they burnt the substation down or the transformer that feeds the system, you know. That is also stemmed by poor service delivery to start with, often, or a political issue on labour and labour unrest. So it’s very complicated.

I: Yes, definitely. Further complicating it would be AMD, do you think there is enough responsibility on mining companies to clean up after themselves after mine closure?

R: I do, but that is a 2 part question because the first part is that the minimum, petroleum, development and resources act was only inacted in 2002. So prior to that there was no onus on you to rehabilitate back to an acceptable form. There was no trust for that sort of thing. So when a company finished mining, they would just go insolvent and they would close down and they would leave. There were no strict measures to prevent that from happening. After 2002, that was the case. But before 2002, there was no measure in place, so any mine that closed before 2002 becomes the responsibility of the government to either claim funds back from those people to do the rehab or rehab with our own tax money. Because it is the government’s responsibility to uphold the constitution which means that they have to rehabilitate those mines ultimately. So it becomes the burden of the taxpayer. Everyone before 2002 is the taxpayer’s burden. The government is not taking on that burden for us, necessarily. They are not spending the money to do the rehab. So yeah, anything after 2002 there should be a solid rehab plan in place. There should be a trust fund, all those things. So that should happen in the future. We still don’t have examples, a lot of working examples of rehabilitation happening successfully in South Africa because either the mine was abandoned before 2002, or those companies are still mining. So they haven’t had the opportunity to close out yet. So we really don’t have a lot in practice to say yeah rehab works in South Africa. The acid mine drainage was created before 2002. However, some mines actually take responsibility for pumping of that acid mine drainage because they are down the line. So if they don’t pump, the works will get flooded. So it is a matter of business continuity for them to pump the acid mine drainage out on behalf of a government person. So like, fluitfruit mine used to do that but then it was taken over by politicians and they stopped pumping. They mined everything and just stopped pumping. So, it’s a mess. They tried to fix it, so there was the east, the west and the central basin, the issues, they tried to fix the east, the central and the west, but now the pumps apparently are breaking down. Because they are from Germany and we can’t get the parts in fast enough etc… so we are, they say by December this year, the acid mine drainage it’s not being pumped in some of the areas and it will start rising to the surface by the end of the year if we do not start pumping today! So acid mine drainage is a problem.

I: Another problem!

R: Major. Some people, this one guy, he reckons that because the government has not tried to claim anything for that. Now, why can’t they? Why can’t they go to the trust funds of the original gold miners who came to South Africa in the 1800s or even before that, it’s in the history, the mining rights of who mined where, what, how. It’s all in the history, we have those archives. Those people still have trust funds in their countries. Which are massive! Some of them will still have humungous wealth from what they generated in Africa and mining of South Africa’s gold. Why does the government not go after them? And go after that money on behalf of us? And use that money to fix the problems. Well, what worries is they won’t use it to do the right things. So they will get all of this money and waste it you know. But, in an ideal world, if they were good people then they could actually you know, recoup that money, or recoup some of it. Now the taxpayers, the taxpayer’s burden again. We must pay for it. They are not looking out for our best interests, financially speaking and mismanaging the project. I mean, how do you get pumps and not secure supplies etc.. for such an important project? It is always somebody else’s fault. Or it was the contractor. It is always the contractors fault. But, yeah, it can’t be only the contractor’s fault.

I: That’s a very good point, thank you. So moving to solutions now, how much potential do you think rainwater harvesting has in South Africa? Because obviously, rainfall is very inconsistence. But, do you think it does have some potential?

R: Absolutely, but at the same time it is risky. So, the water will get algae very quickly. It is definitely not a drinking water source. It would only be used for gardening and say flushing of toilets. So realistically speaking it does not help massively. I know in the cape when they had their major water droughts and stuff, it helped a lot. But you were only able to flush your toilet once a day in those circumstances, that’s how bad it was. So, everybody would use the toilet and then they would flush, you know once a day is what they were restricting themselves to. Which is crazy! So having a rainwater tank was useful for those instances where you could be more hygienic and if you had a beautiful garden. Then you could keep that beautiful garden alive, like you wouldn’t lose your prized plants or whatever. In those instances a rain harvesting system would be fantastic. But, other than that I don’t see it being a majorly beneficial thing. Unless, you are irrigating gardens and you’ve got say a sports field. It definitely depends on the application. But 90% of the time water is wasted on a garden. You don’t really use it on much else other than flushing toilets and watering gardens. Which, anyway, should not be done. You should actually have a dry toilet and you should only have indigenous plants in your garden that survive mostly on natural processes. So I don’t know if rainwater harvesting has major major potential. The water is going to get contaminated pretty fast. So you are going to have to start treating that water, you are going to have to have a whole system of checking. You get legionella and then you’ve got problems as well, now you’ve given yourself Legionella poisoning. So, it’s risky. So, I am very much on the fence with that one.

I: Okay. So do you think salt water desalination has more potential than rain water harvesting?

R: Yeah, a combination definitely, like, why can’t we get water from the air aswell. We could generate 10L of water per day per household from the air. Everyday, if you had a machine that did that. So you wouldn’t even have to worry about drinking water from the tap and the contaminated water from the tap and putting a filter system on the tap. You could just harness your water from the air. Your drinking water specifically. So every type of water has a purpose, specifically and has a risk.

I: Perhaps one of the main problems with salt water desalination is it’s very energy intensive and at the moment South Africa is quite reliant on fossil fuels.

R: Yeah, I don’t worry about that at all in terms of renewables being the way of the future. So, when you take into account that it would probably end up being driven 100% by renewable energy in the next 20 years, that can’t be an argument. So what would be the other argument, we have got billions and billions of cubic litres of water out there, that we don’t use, I think our biggest concern would now be pollutants that we’ve put in to the ocean. Look, it would go through a combination you would start with desalination then you would go through reverse osmosis. You would have a double process for it to be drinking water, but for it to perhaps be irrigation water it could only go through other more simple processes of cleaning to the classifications.

I: So do you think the answer is a mixture of different approaches?

R: Definitely! Groundwater is always an option as well, it just depends on the reserve. I think that in some areas there is reserve and capacity for that. So, use the groundwater is there is reserve to use. So definitely groundwater should be better investigated and applied and used. That, I think. I support groundwater usage, but obviously, sustainable. So if the area is already not capable of producing then you are not able to abstract, the end. Only when, you are able. But that would require a lot of management on a local level. Which we don’t have those skills and resources, necessarily, currently, on a local level.

I: Yeah.

R: I don’t even think our municipality has a geohydrologist on their books.

I: Yeah, it’s a rare position.

R: It’s something they should invest in you know.

I: Yes. This is my last question now, so thanks for your time. Do you have a project, a water management project or practice in South Africa that you are most proud of, that you think this is a great case study for how we should go ahead?

R: Sure. I think the catchment management forums definitely it’s an integrated multi-stakeholder platform. Which is so important. We don’t have that within our government departments. A multi-stakeholder platform. Where we are all on the same footing or ground. Where we are all equal and we are only there for the benefit of the resource of water and the people. Yeah, the forums without a doubt. To me that’s the best policy, localized, even per city per town and you are able to have every department, the engineering department, the infrastructure department, the water quality department, the health department, the agriculture department, the mining departments, all together in one platform to discuss how to protect the water resource and how to amicably and in terms of best practice and those kind of things, you know, what is acceptable what would the reasonable be doing and we make sure that we implement that and we do that together and change the value system of that. Because, that is the biggest problem, is where it went wrong. Water is not valued as much as we value money. Until we change that no policy on Earth will change this problem. That is my honest hard-cutting truth of this issue, policy is policy, we need to value money as much as we value water. Then, we can make policies to value water and processes to value water But people’s values need to be right to start with and department’s, government’s, everyone’s value system of water needs to be all on the same place, that is the number one thing and we must protect it no matter what. So, if an activity is unsustainable and doesn’t protect the water that activity can’t exist. That is how it should be. This, you know, trying to manage the pollution, thousands and millions suffer, for one industry or one corporation, it’s just unreal, that’s not how the value system is suppose to work. Yeah, so forum is the best policy I think.

I: That’s a brilliant answer, thank you very much.

R: Thank you.

**NGO2**

I: Wow, you are definitely the right person to talk to about water then! That must keep you very busy.

R: It does keep us very busy, but what I shall do is I shall send you, it’s just coincidental but we met on Thursday with our newly appointed minister of water and sanitation and we met virtually on Monday also with the deputy minister of water and sanitation and yesterday again had a meeting with the department of water and sanitation and it’s deputy minister and it’s minister. And I have submitted comments to the minister which I can also share with you. But, perhaps what I can do is, are you aware of the national water and sanitation master plan of South Africa?

I: No, I am not.

R: Okay so, can I just give you some highlights from this master plan?

I: Yes, please.

R: These will perhaps exemplify the challenges that South Africa is experiencing at the moment with water. First of all, and I am quoting directly from the master plan. 56% of our waste water treatment works and 44% of our water treatment works are in a poor or critical condition and 11% are dysfunctional. This of course results in raw sewerage spilling in to the environment and not only the environmental but also in to residential areas. It has also resulted in river systems becoming well, sewerage rivers and inlets. I can just mention to you here, are you doing this research on a social perspective or from a physical science perspective?

I: Both, so social in terms of how it affects vulnerable communities and then an environmental perspective as well.

R: So just to illustrate to you, the quality of our water in some of our tributaries. The regulatory limit of e.coli, e.coli is an indicator of raw sewerage. So, the regulatory limit for instream water quality is 400mg per litre, in some of the tributaries in some of the significant rivers there are 52 million counts per 100ml. This has been ongoing not just for a year or two but for many years. The vaal river systems, which of course is one of major river systems has now been pushed almost to the point of no recovery and one of its tributaries has an e.coli count of 9.5 million counts per 100ml. So this has been on going for many years, the Vaal river system supplies water to approximately 19 million people and it is, as you may know, a resource not just for domestic and commercial use but also for drinking purposes.

I: Yes.

R: Then, more than 50% of South Africa’s wetlands have been lost and of those that remain 53% are in poor ecological condition. Only 5% of agricultural water is being used by black farmers the majority is used by white farmers, so there is an equitable distribution of water for agricultural use. The department of water and sanitation has a R370bn shortfall for the next 10 years. Without funding of course there can be no upgrading of infrastructure, there can be no appointment of skilled technical persons and engineers and there can be no implementation of the actions that have been proposed in the national water and sanitation master plan. Between, 1999 and 2011, the extent of main rivers in South Africa, classified as having a poor ecological condition increased by 500% with some rivers pushed beyond the point of recovery. So this is the current status of South Africa. There is also other challenges, for example non-revenue water is not being accounted for, there are significant water leaks, losses of water and if the demand for water in South Africa continues to grow at current rates the deficit between water supply and demand could be between 2.7 and 3.8 billion cubic meters per annum by 2030, a gap of about 17% of available surface and ground water. There were actions proposed by the national water and sanitation master plan, there were responsibilities that indicated who should do what and also a completion date for the execution date of these actions, regrettably, most of the actions scheduled for completion by 2019, 2020 and 2021 have not been completed. So, that is a matter of serious concern. Then, the national water and sanitation master plan, also called for the desalination and reuse of mine water in order to augment the water supply, this too has been delayed because of fiscus constraints, in other words, because of monetary constraints. Also because of a delay in the implementation of the recalibration of the salinity and hydraulic model of the integrated Vaal river system. Now, this is an overview, but I can also now give you more detailed information if you require. Or would you like first to ask some questions.

I: Yes, could I ask a few more questions please. That was very interesting and very insightful, thank you. So, you are involved with sustainable development goals 6. I would like to ask you, how do you think South Africa is performing in terms of reaching these goals, obviously from the overview you have given it does not sound positive and do you think that these goals are the right approach to security in South Africa?

R: Yes, I can answer that. Perhaps first with background, since I am a member of the water and sanitation sector leadership group, sustainable development goal 6 task team. I was appointed to represent one of the 6 sectors because goal 6 has 6 separate components. The sector that I represent is supporting society organisations in South Africa. Now, the sustainable goal 6 task teams has identified the gaps in the SDG6 and these gaps that have been identified will now translate in to actions in the water and sanitation master plan. But that of course is still to come, it is a follow up to the existing 2018 water and sanitation water and sanitation master plan. I will now give you some of these gaps. In terms of target 6.1 to achieve universal and equitable access to safe and affordable drinking water for all, we have no data on rural water quality, there has been a delay in the reconfiguration of the blue, green and no drop certification programmes. These certification programmes report back to the public, the state of our waste water and the state of our drinking water, but there has been a delay in the publication of the publication of these statistics since 2014. There has been interruptions, with basic water supply, some communities go for weeks without water. 2011, was the last time any meaningful data on reliable water supply was obtained. There is a major gap in receiving information from other national departments and lack of cooperation between these departments. Then, would you like me to also discuss about sanitation?

I: Yes, please.

R: So, 6.2 the target is toa chieve access to adequate and equitable sanitation and hygiene for all and end of open defecation paying special attention to the needs of women and girls and those in vulnerable situations. So, the gaps that have been identified is the lack of processes to accelerate the uptake of alternative and appropriate sanitation technologies for household and associated institutions such as schools. There is a need for the development of faecal sludge management strategy. 2% of the national population practice open defecation. 2.8million households, are without access to improved sanitation services. There is a weak coordination and leadership at all levels, that is now water, health, education, gender and environment. The next target is 6.3 that is the improvement of water quality by reducing pollution, eliminating dumping and minimising the release of hazardous chemicals and materials, halving the proportion of untreated waste water and substantially increasing the recycling and safe use globally. The gaps that we identified is that there is inadequate surface and groundwater data to enable reporting on this target. The compliance to resource quality objectives is not monitored or reported on. There are large data gaps regarding data on quality and quantity of effluent discharge by municipalities. Many municipalities do not have flow monitoring stations or are monitoring the quality of outflows. There are significant gaps in the availability of data of wastewater discharge by authorised non-municipality waste water treatment works. Can I continue? Because there are more targets that I wish to address.

I: Yes, that would be good to hear, thank you.

R: Okay, so 6.4 is the target to substantially increase water use efficiency across all sectors and ensure sustainable withdrawals with a supply of fresh water, to address water scarcity and substantially reduce the number of people suffering from water scarcity. The gaps that we have identified are there are no comprehensive national water balance at catchment level and since the national water resource strategy of 2004, which directly impacts on target 6.4. There is a need for the improvement of the ecological water requirement calculations, as developed by the food and agricultural organisation. There is a lack of consistent and accurate water use and water loss data in all major water sectors that is agriculture, industry and municipalities. There is a lack of integrated approach to efforts, projects that seek to support the achievement of the interrelated SDG6. As you know, water is in fact important in most of the SDG6.

I: Yes.

R: So, the target 6.5 is to implement integrated water resource management at all levels including through transboundary cooperation. So the gaps that were identified, there is no provision for the testing in rivers. The drafting of subsidiary, regulations to support existing legislation is lacking. There is need for the incorporation of a sanity policy in to legislation. The maintenance of water resource reconciliation and development studies are needed. The seven catchment management strategies will still have to be developed there are no operational plans for the international basins. There is a need for integrated management of groundwater resources at river basin level there is limited cooperative governance between organs of state. There is the lack of institutional capacity, there is little transformation of irrigation boards. There is a need for increased participation of vulnerable groups in the integrated water resource management. The department of water and sanitation has a R300bn shortfall over the next 10 years. Without funding, the master plan cannot be implemented. There is no funding for basic commissions. The existing institute operate at oversight level only. Now, one of the last targets is 6.6 which the target is by 2020 to protect and restore water related ecosystems including mountains forests, wetlands, river systems, aquifers and lakes. Gaps that have been identified, is the severe lack of wetland data. 69% of South Africa has low confidence in data on the location and extent of wetlands. Monitoring, of wetland health data, is currently not being undertaken by the department of water and sanitation, with limited wetlands monitored by others. There is lack of coordination, which presents massive gaps and issues with access data There is insufficient estuary monitoring data, only 23 of the 300 are being monitored by the department of water and sanitation. There is insufficient hydrological data for rivers, lakes, dams and estuaries. The groundwater level data is insufficient, 16 geohydrological regions have only one borehole for monitoring and 4 regions have none at all. There is lack of groundwater 18:56 operating rules in high ground water use areas to ensure sustainable use of groundwater. There is a lack of updated national water survey and the number of SDG indicators for ecosystems is not useful in decision making in South Africa. So, I think that is perhaps a summary of the gaps.

I: Yes, thank you.

R: But I also wanted to say to you that we also have a presentation, that was done by the development bank of South Africa. They have commissioned the world bank to do an analysis of whether we can attain the SDG6 goal and that report is available, it basically states that we do not have funding to achieve these goals. But this percentage is given. I don’t know if you want me to talk on that but it is of course it is, for us, a significant concern.

I: Yes, so there is clearly a huge lack of funding and data and a lot of lack of communication amongst government.

R: Yes, so you know, one of the SDG6 targets is also of course, well part of our indicators is to support and strengthen the participation of local communities in improving water and sanitation management, because most of our communities are characterised by widespread poverty. They do not participate in any of these forums or task teams or steering committees and in fact I am the only civil society representative on the SDG task team.

I: Okay, that’s interesting. My supervisor for my PhD is an environmental lawyer and something that he is very interested in, and myself too, is public participation. Empowering individuals, especially those who are vulnerable, to get involved in decision making processes and representing their communities.

R: Yes. Are there any other questions, you know I can just recommend to you what I can report on. I can report on, first of all the South African human rights commission and directives, relating to the impacts of mining on mining affected communities. Both the socioeconomic and environmental challenges. Because I was a member of the advisory committee. I can also report on the South African human rights commission’s report on acid mine drainage and its report on the sewage pollution of the vaal river system, I can report to you on the national mine closure strategy, because when mines close rewatering takes place, so it has an impact, obviously, on water quantity and quality. I can report on acid mine drainage, the current status of acid mine drainage.

I: Yes, that would be good to hear an overview of the current status of acid mine drainage in South Africa please.

R: Okay, so first of all I just want to mention that acid mine water is of course recognised as one of the most costly and socioeconomic risks in South Africa. In South Africa are gold, coal and iron ore. So the iron pirate in combination with water and oxygen produces acid mine drainage. Of course, the acid mine drainage production will continue for many years. After mine closure. Now, with regards to the gold mines, over more than a century in fact 150, the 120 gold mines extracted approximately 43,500 tonnes of gold and approximately 73,000 tonnes of uranium between 1995 and 1953. But it left a legacy of the largest gold and uranium mining basin in the world which is now flooded with acid mine water. It also left us with a legacy of 6Billion tonnes of iron pirate tailings and 600,000 tonnes of uranium. The tailings are stored in tailing storage facilities there are 270 in South Africa. It was recognise more or less in 2011, that there is a need to address acid mine water because acid mine water started to flow on surface from the western basic, within the west rand gold fields of South Africa on surface and left a devastating impact. It started in 2002 and continued in 2012 unbagged. It resulted in radioactive dams, river systems that were completely toxic and for example in the Robinson lake, becoming a declared radioactive lake with uranium levels 40,000 above natural uranium levels in water. So, in 2012, the short term treatment of acid mine drainage was implemented. The short term treatment of acid mine drainage is merely a Ph adjustment. That would mean the Ph would be increased from 2 or 3 to 7, 8, 9, 10, 11 or 12 depending on the metals. At that level, some of the metals will then drop out or precipitate these precipitated metals will then be stored in unlined tailing storage facilities in an open pit and in boreholes, depending on the basin. So, since 2012 and going forward about 180 million litres of acid are being pumped today. The metals of course when the Ph is adjusted do not disappear they merely change in to a different oxidisation state. That is form being soluble to solid. So these metals can then again be mobilised. There is a perhaps acidity, or if the Ph decreases. So this is not a permanent solution. The other challenge with current treatment of AMD is that it remains very high in salinity. The regulatory limit for sulphate in South Africa is 600mg per litre the neutralised AMD contains between 1,000 to 3,000 mg per litre sulphate so that water remains unfit for any purpose. This can also result in the salinity of the vaal river system and that of course would have water scarcity implications because in order to maintain the 600mg per litre regulatory limit, clean water would have to be released from the Lesotho highlands phase 1 in order to make the water fit for use. I also just want to mention here that in terms of the reconciliation strategy for the water within the Vaal river system in order to reconcile the supply with the demand, the Lesotho highlands phase 2 ought to come online in 2020 it’s now been delayed to 2025 or to 2027. In order to address the growing salinity in the Vaal the acid mine water had to be desalinated by 2014 or 2015. It’s now being delayed indefinitely maybe to 2030 or to 2040. So now I shall read to you what was presented to us very recently on the current status of acid mine drainage. The short term treatment of AMD within the eastern and central basins contribute an average total dissolved solid load of 362 tonnes per day to the Vaal barrage catchment, the long-term solution of AMD has been provisionally deferred due to fiscal limitations that is towards 2030 to 2040 and to allow for the recalibration of the salinity and hydrology models of the Vaal. The short term treatment of AMD commenced in the western basin in 2012, the central basin in 2014 and in the Eastern basin in 2016. In terms of the draft mine water management policy of 2017, coal and gold mines are categorised as category A mines because they are acid producing. In terms of the recent information which was presented by Mr. Bashan Govender the director of the department of water and sanitation directive, mine water management treatment, they found that surface and groundwater will continue to find its way in to underground workings in the eastern, center and western rand. Continuous pumping of underground mine drainage is a prerequisite. 180 million litres are pumped per day. If 150 million litres of neutralised AMD are released in to the Vaal barrage, 60 million litres of clean water will have to be released from the Vaal dam to dilute the salinity. The volume in the Vaal dam is insufficient and will have to be augmented by other water sources such as the Lesotho highlands phase 2 which will only be completed 2027 or later. It was previously assumed that in times where poor water quality was separated from the better water quality and will stay deep into the basins, while the water closer to the surface will be of better quality. However, profiling and monitoring has found that this is not the case. It was found that there is no improvement in the raw AMD within the central and eastern basin. These monitoring results therefore confirm that mine water cannot be allowed to flood the mine points and AMD will have significant impact on downstream water users. Pumping and treatment of mine water will therefore have to continue. the disposal of the sludge presents challenges since there is no successful treatment of the sludge for beneficial views in the eastern basin the sludge disposal in boreholes has resulted in the clogging up of boreholes and there was a short presentation on the capex, the capital expenditure and opex, the operation expenditure for the short term and the long term treatment. The total capex cost for the short term treatment was R2.6billion the annual operational cost was R293million rand and then for the long term solution, what is required is R10billion for capex and the opex requires R900million per annum. At the moment there is no apportionment of liability for the payment and the retrospective application of the polluter pays principle. So this is the situation with AMD.

I: Thank you, so obviously mining is such an important part of the South African economy so AMD is always going to be a problem, so what do you think are the potential solutions? Does it lie in policy?

R: The solution lies in the fact that before a mining application is authorized there ought to be sufficient financial provision made, not just to address the current impacts but also the latent and residual impacts including the appropriate treatment of extraneous water. There has not been sufficient provision made. What is also important is that the water must be treated from source, you cannot allow mining companies to discharge water that is unfit for use and that downstream water users must pay for the treatment of. Also, if there is a closure application made, the department of mineral resources and energy and the department of water and sanitation must ensure that the ground and surface water are fit for current and future land uses and obviously the aquatic environment must also be fit for use. So these are perhaps some of the proposals I can make. But I must just mention that South Africa does not have a super fund, which means that the government does not have the money to address this. The result is that even though there are billions of rands in the rehabilitation funds, these rehabilitation funds are not ready money its either in trusts or in bank guarantees and none of these monies have been released to address issues of acid mine drainage with in the coal fields and within the coal mining industry.

I: Ok, that’s interesting thank you. So obviously, the government has a lot of responsibilities, do you feel like they are showing willingness or potential to meet these responsibilities or do you feel like the real differences will be made by other institutions or organisations?

R: The government has significant, besides financial constraints, skills constraints, political interference many of the directors of mining companies are politically connected. There is a lack of skills and I can give you an example. There are a few mining companies that have gone in to liquidation. In the case of mining companies, many of the bigger mining companies like Anglo-American they often divest themselves from South Africa because the resource is not as profitable but obviously the environmental liabilities continue to increase. So what they often do, it’s a very common practice, to avoid their closure commitments, that includes the pumping and treatment of acid mine water. They pass the parcel, that is, they sell their mines close to closure on to less resourced companies. So that they are relieved with the responsibility and liability of dealing with the problems of closure. This has happened with DIT Gold and with an Australian mining company called Mentaus. We are currently in litigation with regards to Mentaus. Mentaus exited its liabilities and left South Africa with a R400million environmental liability. They left us with clusters of open pits, toxic and radioactive dams, unrehabilitated footprints, tailing storage facilities that are unmanaged and partially reclaimed and unmitigated. That of course is a human rights violation. Mentaus followed the loophole of the complex corporate structure of mining companies to avoid mining responsibilities for closure. Listed mining companies currently have the option of existing a liability escalating venture by changing the controlling interest of the corporate entity holding that right. There is no state oversight of this process at present and then the last point I want to mention, is that when a mining company liquidates there is no special obligation to determine whether a company applying for liquidation has applied for a closure certificate. Or to ensure that the transfer of environmental liabilities are being done or actually topped up of the shortfall of rehabilitation funds. Then furthermore, it is unclear. Sorry let me just discuss duties and potential liability of a business rescue practioner and liquidator are unclear, that is whether the liquidator is obliged to apply for a closure certificate. But one of the most serious consequences of liquidation is that the company ceases to exist as a legal person. The environmental obligations specified in our laws is linked to a holder of a mining right, but this in turn is defined within reference to a person. If no person legally exists these obligations by extension cannot be enforced.

I: Thank you. So do you think, obviously there is a shortfall of skills. Do you think the government are showing willingness through initiatives to remedy this issue, through education and through policy?

R: What there are more than abundant of are regulations, acts, policies, frameworks, strategies, plans, regrettably these plans, strategies, policies exist in vain if they are not implemented. It appears that in most cases it is a tick box exercise. So all these plans and policies are excellent, if I may use the example, in South Africa we have world renowned policies and legislation. Our national environmental management act, our national water act are world renowned legislation. So we boast world renowned water policy and legislation. But the implementation remains a serious challenge. This is now, just to give you an example, the national water act was published in 1998, it called for the establishment of catchment management agencies. We are now in 2021, only 2 catchment management agencies are currently operational. There was mention made of 19 catchment management agencies. Due to lack of funds and skills it has now been reduced to 6 and they are further contemplating reducing it to 4. So this shows that we are very weak on implementation. I also just want to mention that AMD was a known phenomenon since 1903, but there was no legislation put in place, it was only in 2012 that the first short term treatment of AMD was implemented.

I: Thank you. So it is obviously abundantly clear that the government aren’t doing enough to implement any action that will improve access to water in South Africa. What do you think could be other potential solutions rather than government action?

R: We have confidence in some of the mining companies. Some of the mining companies are taking over the service provisions of water from municipalities. Most of our municipalities are corrupt and financially lacking, I believe that is common knowledge. So, some mining companies that are now applying for closure have proposed that the water would flow back in to the mining basins, because in order to make mining safe, mining compartments or basins have to be dewatered. So when a mine closes there will be rewatering of these basins and some of the water will be fit for use for drinking purposes. The Sibanye-Stillwater is one of the mining companies that are proposing the closure of their mine, water will then be flowing back in to the dewatered compartments, premining flow patterns and volumes will be restored and that water can then be used not only for agricultural use but also for domestic use. So that is a proposal. Some of the mining companies because of the pressure put on by their international shareholders have become more responsible, more accountable and that is perhaps a positive move. I also just want to mention that there is a reluctance on behalf of government to look at alternative practices, that is innovative technologies, in order to treat acid mine drainage. The South African government has decided on the reverse osmosis exchange and high density sludge technologies and that of course is costly and energy intensive and so another alternative would be that government should also look to the private sector for the implementation of innovative technologies. I have been approached by many persons who have offered these innovative technologies but unfortunately the government has not taken a decision on that and approved it.

I: Thank you. In addition to acid mine drainage, do you think that rainwater harvesting has potential to improve access to water in South Africa?

R: It definitely has, however you must remember that South Africa is a water scarce country. Rainwater harvesting is one option, another option is the desalination of sea water and acid mine water. Another option is of course our groundwater because we have sufficient groundwater sources but it has to be strictly regulated. There can be an increase for example, in water tariffs which will perhaps make available more funds to the department of water and sanitation, it is very essential that water leaks be addressed and non-revenue water be addressed, I can’t give you the figures immediately but I have the figures available. That I can send to you later by email, the losses attributed to water leaks and also non-revenue water. There is also over extraction by what we call water thieves, people that extract water without water use licenses. That is also a major concern. Then, there was another aspect I wanted to address. There is also of course the reuse of sewage. Sewage if it can be appropriately treated can be reused, AMD water and also waste water can be reused but there is slow progress in this regard. In fact, very little progress in that regard.

I: Ok, thank you. That is everything I wanted to ask. I learned a lot thank you.

R: Thank you, I just wanted to say, the last few weeks I have had three meetings with the newly appointed minister of water and sanitation and the deputy minister. Well, we always say new brooms sweep clean, he has made many promises. There was some token engagement with the community groups and civil society. We were only allowed 5 minutes to present so I don’t know if it had any value. We have made written submissions to the minister and I shall perhaps send you later today, some of these written submissions and it may perhaps be useful. I’ll also send you my powerpoint presentation which I attempted to present yesterday at my meeting with the minister, but he was 2 hours late and our 10 minute presentation was reduced to 3 minutes. Thank you very much, it was an honour to speak to you and I wish you very well with your studies.

I: Thank you very much, it was an honour to speak to you too.

**NGO3**

I: Thank you for that explanation and well done for the really good work that you are doing. So my first question is a brief one. How important is the Vaal river to South Africa?

R: Extremely important, it provides water, which is treated for use in industry and households for about 13 million people. That excludes Gauteng which is our biggest province. So if we run out of water here we’ve got major problems. So the Vaal is very important. It also provides irrigation to a lot of agricultural areas. It’s the second largest river in South Africa and it joins up with the Orange river. In the Northern cape and then flows in to the sea from there so it is an extremely important waterway to us. Unlike Britain, our waterways are not used for transport, for commercial purposes. Johannesburg is probably the only major city just about in the world that is not on the river, most cities develop around water but Johannesburg developed because of the gold mining and that is not on the river. But the Vaal river supplies the whole of Gauteng and Johannesburg with water.

I: Thank you, so then, what are the main contributors of pollution to the Vaal?

R: The biggest contributor is sewage from waste water treatment plants, industry and mining, those are the 3 main pollutants to the river.

I: Are there any policies that are supposed to regulate this?

R: Yes the NWA 1998 is a very well written and very good act and similar the environmental acts are extremely well written, but it falls down because there is a lack of implementation of those acts, the acts themselves are excellent. They are not you know, the polluters are not followed up, that’s the big issue.

I: Do you think that is partly down to the policies being created by people who are not working directly with the issue?

R: No, I think it’s just a lack of political will.

I: Yes. Do you think there is also a lack of skills and funding?

R: Yes, very definitely.

I: Okay so, what do you think the pollutions will be?

R: Well I think the problem is, if we just deal with the sewage issue first of all. I think there is a realisation in the whole of South Africa that this is a major problem and I think the government area realising that it has to be addressed. The problem as you say is funding and lack of skills. Certainly in the Vaal they have got plans, but again there is always the financial issue. We do have good engineers in the private sector. Most of the work would be put out on tender by the government, they don’t do the work themselves. If they choose good engineers to run the projects we could some light at the end of the tunnel. But there is an overall lack of skills in the country, particularly at the technical skills level. We’ve got the professional skills but the technical skills are scarce.

I: Yes. So going back to acid mine drainage do you think mining companies are showing any awareness to address these issues?

R: I think they are, a lot of problems in terms of acid mine drainage is historical. A lot of those mining companies have taken all the gold or coal and literally walked away from the mine. The problem has been left with the government because those mines no longer exist, those companies no longer exist. The ones that are in existence, a lot of our mining companies are now international and I think there is a greater awareness of the importance of protecting the environment. They do have environmental departments. The mines do have to report where they are releasing effluent in to a water resource, they are having to report back. They have to get a water license to do this and they have to report back to government. So government is fairly enthusiastic about being vigilant about mining. But less so in terms of other government departments. So there is a greater awareness, but the acid mine problem is ongoing none the less. There is one particular case that I’m dealing with at the moment which is the application for a new mine. This mine is within 3km from the Vaal damn, which is the biggest supplier of raw water to Gauteng, we are fighting this tooth and nail and it has now gone to appeal. We will just have to see what the environmental department have to say about it. But it is a huge problem, the government did build a facility but it is taking a lot of the metals out of the water, I’m not an expert on AMD, but there is still a very high salt content which is leaving the river in a bad state because of the high salt levels.

I: Do you think there are any particular communities that are most badly affected?

R: The communities that live around the mines and the breadth and length of the river. There is obviously a dilution factor as we go down, but none the less I think it’s all communities who draw water from the river and live alongside the river.

I: Vulnerable communities as well?

R: Yes, very much so.

I: Thank you. Do you know how biodiverse the Vaal river is? Are there any important species there?

R: Well, again I am not an expert on this but there are a large variety of fish. There are also organisms that are important to the river. There is a lot of bird life along the river. But as a result of the sewage a lot of it has moved further down the river. There is a lady, I don’t know if you have been in touch with Mariette and Simone Liefferink at all.

I: Mariette, yes.

R: Mariette, well her daughter Simone does a lot of research in to the biodiversity of the river and the impact of organisms.

I: Okay, that’s good to know, thank you. I was wondering, because I have done work in opposing developments myself in the UK and using biologically important species has been powerful, so I thought perhaps it could be the same in the case of the Vaal.

R: Excellent. It certainly does apply to our situation but unfortunately in South Africa there is a much lower level of awareness of biodiversity. It is improving, but there is still not that high level of awareness.

I: Yes. So, what is your confidence in the government to address you?

R: On a scale of 1-10… I would say it depends on, the particular piece of the river. The pressure we are creating I do believe we are eventually going to be successful, I think we are slowly getting the message across. But, countrywide I would say we have a long way to go. I would say my confidence level in government on a scale of 1-10 to met would be about 3.

I: Okay. So with your social media campaigns. Have you found a particular audience that engages more with you, such as younger communities?

R: Not really, we find that the people that follow us are largely environmentalists. Particularly we have a very good media following. The media are very supportive of us. Which is good because that gets the awareness out there. That includes across the whole spectrum, you know, the main media. Our social media campaign has fallen a little bit apart just recently. We had a very good person handling social media who gave up and then we got another person who didn’t do such a great job. We are just starting now with a new person who is on our committee so we hope to get back to where we were. Our main areas are twitter and Instagram, we use for photographs but to a lesser extent. Twitter has been an important one and facebook and of course the website.

I: Good. How much has public participation, giving a voice to those underrepresented come in to play with your project?

R: Yes in our particular area there are a couple of organisations. One is the Vaal environmental justice organisation. They have a good awareness and they come to forum meetings and they do participate. Another community that we work closely with is Bophelong. They have a very active water and sanitation committee which is made up of residents. In fact we have recently invited the chairman of that committee to join the save the vaal committee because we think he can provide valuable input to us in terms of what’s happening there. We do work with them. They are very active, they have water awareness days, they recently did a door to door educating people on the importance of reporting water leaks. We are a very water dry country. We have a lot of water shortage here. They do very good work and we kind of go along with them and help them when we can, they do a lot of clean up campaigns. Those are the two main communities that we are involved with. I do get calls from a number of other communities as well and we try to pull them in as well.

I: Thank you, I think that summarises everything I wanted to ask you about. Thank you very much for joining and best of luck in the future.

R: Thank you, you too.

**NGO4**

I: OK, thank you very much for that explanation. Well done for the great work that you are doing. So my first question is a bit of a scale back really. It’s quite a broad one. Could you give an overview of the severity of water scarcity in South Africa and the factors that contribute to it?

R: Oh yeah, we are a very water scarce country. I am sure you’d be able to get the stats on that. But I think for me, the severity of the water scarcity is that the problems that I am experiencing with the Hennops river, what I think almost every river in South Africa that goes past or through an urban has the same problem. So, with us already being a water scarce country. The problem that we’ve got is that our rivers are getting increasingly polluted. With solid waste, which is from, because of the lack of proper waste removal on the solid waste side. It is in almost every town or city. We often drive down to the cape and you go through the small towns. The small towns have got even bigger problems than what we’ve got here. Also, the water treatment, because we have so many informal settlements and because our waste water plants aren’t working properly, there is basically raw sewage going into the rivers which is killing the rivers. Also, because the dams, like Hartbeespoort dam, there are massive problems there, because of the nutrients, there’s increased growth in algae and water hyacinth. As a water scarce country, my overview is that with the problems that I see, with the pollution of the water that goes past my house. It’s happening all over the country.

I: Yes. What do you think are the main contributors to water scarcity?

R: Ok, well there’s climate which we don’t have much control over. But, I think what we’ve got control over, I think it’s the pollution. That’s mainly to do with the problems with municipalities. Not ensuring that the infrastructure is there. Also, sewage management and solid waste management. I think those are the main factors.

I: Yes, waste water treatment is probably one of the biggest issues in South Africa at the moment. I think it’s something like 60% of the waste water treatment facilities are dysfunctional.

R: Yes, have you had a look at a website called iris?

I: No, I haven’t.

R: I was made aware of it quite recently. While we’re talking I’ll send it to you, so I don’t forget.

I: Thank you. I’ve received it.

R: I’m just going to quickly go on to it.

I: Me too.

R: So if you go on to that. The one you are looking at now is Olifantsfontein. The treatment works just upstream of us. You’ll see that out of 2,800 analyses there are 997 failures. I can send you a lot of information on this water treatment works, but it’s absolutely shocking.

I: The e.coli count is crazy!

R: Yes, 14 million! If you look at view all, to the right there.

I: Oh wow.

R: Those are all the water treatment works in the country. I think it’s probably more than 60%, it’s probably over 80% that are dysfunctional. The water treatment works are in a very very bad state.

I: That’s a really good website thank you for that. So, moving back to rivers now. There are not many natural reservoirs in South Africa, so rivers are of great importance in South Africa. Especially for irrigation and for drinking water aren’t they?

R: Yeah.

I: So the Hennops river specifically, how important is that?

R: So it’s very important. Because the Hennops river joins up with the Crocodile river, that flows in to the Hartbeespoort dam and drinking water is taken from that dam.

I: Ok.

R: All along the way, they’ll be people taking water all along the river for irrigating crops. Then what happens is that from the Hartbeespoort dam, the water goes in to the Limpopo river. Which is one of the most important rivers in the country. So, yeah, the Hennops, I think every single river is important, but the importance of the Hennops river is that it ends up in the Limpopo river.

I: Ok, that’s good to know thank you. Is it of ecological important as well? Is it of high biodiversity or any important species?

R: Yeah, mostly definitely. So once you get to the Limpopo river, obviously that goes through the Kruger national park and those areas from an ecological point of view. But all the way along, the hennops has got really important areas from an ecological point of view. As I mentioned, just where I live is a green area, a green belt within a city, I guess you could call it that. From an ecological point of view, there is still wildlife there, there’s Jackals there, porcupines, so yeah. Even where it passes through the city, from an ecological point of view, it is very important. The river that goes past me now, it doesn’t sustain any life. It is black. It’s got foam in it. It’s really not supporting anything, I don’t think there are any fish in it. So it’s really bad. As it goes down, the Hennops river goes through an area which is called the cradle of human kind, in that area there are a lot of small game reserves and ecologically important areas. So yeah, from an ecological point of view it’s close to important areas.

I: That’s good. Before, I started my PhD I helped a community where there was a development proposal to build on a floodplain. I wrote an ecological report for them and it was the act of bringing awareness to the ecological important that helped to stop the development. Do you think that also has power in South Africa? Or do you think that the awareness is not the same?

R: Ecology is very important in South Africa but we’ve just got this competing problem with waste management. So yeah, I think ecology is very important. I mean, even from a tourism point of view it is very important to us. But we’ve got these competing things. The problem that we’ve got with waste management.

I: Definitely. As an attorney, are you familiar with the policies surrounding water in South Africa?

R: Unfortunately I am not an expert in that area. I am a patent attorney. So, I can’t really comment on the water acts, I don’t have enough knowledge of it. My involvement is more on an activist kind of side.

I: Yes, no worries. The national water act of 1998 got a lot attention worldwide as a being a very good piece of policy. But where it falls down is implementation, but where it falls down is implementation. That seems to be a common theme in South Africa.

R: I agree with that 100%.

I: You mentioned to me in emails before, that helping these vulnerable communities would be powerful and have a trickle down effect. Do you think public participation, empowering these vulnerable communities that don’t have much of a voice, do you think that’s a powerful tool for change?

R: Most definitely, I think it will be one of the most powerful things for change. But I also think it will be education within those communities as well. For those communities to see the value of water. So what actually not to do. Yeah, so those communities have got the problem where, the municipality doesn’t supply enough services for the waste removal. So as a result, what the communities do, like I said earlier, instead of having dustbins to throw the waste in to, all the waste ends up in a small plastic bag and will get deposited on the street corner. From there it ends up in the river. It’s 2 fold, first of all having the services there and also for education, for people to be able to use those services. I mentioned, Samuel Mshimbi, he’s an activist and that’s exactly what he’s trying to do. He’s doing cleanup campaigns at these illegal dumps and trying to explain to these community, the effect that those actions have on the environment.

I: That sounds like very good work that he is doing. Do you have any direct experience of acid mine drainage affecting the Hennops river?

R: No, not at all. I’ve got no knowledge of AMD. There are not many mines upstream from where I live. It is informal communities and industrial areas that are causing the pollution.

I: Okay. So we spoke about public participation. Are there any other solutions that you think have potential that we might not have mentioned?

R: I think the most important thing is for the municipalities to be accountable and to provide the services and the main services they need to provide waste removal, water treatment plants, but then also, the enforcement of bylaws, to stop illegal dumping. What’s happening upstream from us is that there are wetlands upstream of us and what’s happening is that people are bringing in building rubble, putting the building rubble on top of the wetland and then selling that area to erect shacks, informal housing. So the wetlands are destroyed, the informal housing, all the shacks, don’t have any services, all of that waste, the solid and the liquid goes straight in to the river there. It’s also a massive danger because those areas will get flooded. So yeah, I think for me the most important thing for me is for the municipalities to manage those areas.

I: Yes, to stop it at the cause. My last question is are there any case studies of good water management in South Africa that you should be applied in this situation?

R: In South Africa, no, I know that there are people doing work on rivers in KwaZulu Natal and in the cape but I’m not sure of the success of those.

I: No worries, that sums up everything I wanted to ask you. Thank you very much for your time.

R: Thank you.

**NGO5**

R: Yes. So from that point of view we have always been water conscious. From a development point of view, in terms of storm water management retention we’ve got large dams on our properties which were used by the mines as a water resource. There’s three main dams which we use for water supply. There were other smaller ones. But there’s only one which still actually has water in it and is used for recreational purposes. The crown one sits in a valley to the south of the city and that over the years, about 40 years we got some arial photography shows that as a recreational facility but over the decades it’s filled with silts, which is obviously gold bearing. Gold being what gold is, it goes to the bottom. So that clearing operation which started in the late 80s, the reclamation, removal of the dumps, the slimes, dams, the sand dumps, which were the residues from the mining, the mine plan has always had the removal of the valley silts. The valley silts have always been the last part of the reclamation process of land rehabilitation and we started to work on some of these areas in the south of Joburg. In fact while I’m talking I’m going to pull up a map quickly, just to give you some idea of where I’m talking about.

I: Okay, I will give you permission to screenshare.

R: Those silts now are being removed and the dam is the next part of that project they will be starting that by the end of the year. Now, the important of why I’m telling you this is is that the Vaal and the Klip river all rise in the centre of Joburg.

I: Okay.

R: Okay, on the water shed. The rivers run through these old mining areas and as a result you get a lot of pollution. From these old mining areas and from the cities. Which are going all the way down to the Vaal and this is where the catchment forum and I’m sure you’ve been told about reservoir.co.za which has got all the catchment forum results. We have quarterly meetings and these results are presented. You see high salt contents, there’s other nasties in the water. Which is a problem. But it is being monitored carefully and we do have to try and do something about it to get rid of it. So, let me just share my screen. So from a water point of view, my involvement with water, I joined the company rand mines properties in the early 80s and I’ve been basically working on the mining land since then. That’s the centre of Joburg and the water shed basically runs on a line round about here, OK. So this area drains from the south down to the Vaal and will ultimately go in to the Orange river and in to the Atlantic ocean, north of the water shed drains in to the crocodile and Limpopo river and in to the Indian ocean. It’s always been a varsity joke, because Wits University sits right on the middle here. So that’s the University of Witwaterstrand right there and the great wall sits there and that’s sitting on the water shed point. So excuse what I’m going to say now, but if you’re a student and you piddled out the front, the North it ended up in the Indian ocean if you did it to the South it ended up in the Atlantic ocean. That was part of the joke of being at varsity there, either going to the Indian or Atlantic. So it runs through there, but if you have a look at it there’s a lot of city below there. That’s from the old mining, so these are the old mining areas, these are the dumps which are being cleared. These are deposition sites which have been decommissioned, they are on a long term reclamation. There’s about 750 hectares sitting underneath there. That’s a quarry. But the crown valley silts is sitting here. Ok. Now all of this is mining land.

I: Okay.

R: These are the areas that are being reclaimed at the moment and being developed.

I: I see.

R: The main shafts were in this area. We’ve had three lines of shafts where they struck gold was the outcrop. So if you look at the outcrop, this is north and it dips to the south. They started at the outcrop and went down as far as they could. They put the first line of shafts in and then they put a second line of shafts in and that allowed them to get to about 3,000 metres below surface. If you look at it from an aerial points of view. Let me just find it. So, I’m actually talking to you from here in Mondiel. There’s collenbien avenue there and just south of that avenue is the end of the underground mining. About 3,500 metres below surface. All of that is now field with water.

I: Oh wow!

R: Going all the way back here. Your outcrops ran, there’s main reef road which is named after one of the main outcrops. This area is built on shallowly undermined land. This is also reclaimed mining land. Crown city had the largest sand dump in the southern hemisphere, man made. That released 75 hectares of land. The thing is that as we are clearing these dumps and developing them we are reducing the amount of acid mine drainage runoff.

I: Ah, yes. That’s a good point.

R: Right. As we look at the city, we’ve got all these mining areas that are being reclaimed. We’ve got all these silts, that area there has been largely reclaimed and finishing off. Those little piles of soil there are actually valley silts. Which are being sundried to reoxygenate them to put them in to plant. Because in the valley with all the reeds and vegetated material which is deoxygenated. OK. So after many years, we’ve tried all sorts of things. Including pumping oxygen in to pipelines. They found that, what we call sundried tomatoes and let it dry. So they’re finishing up here, so the next stage is this area. The valley silts. So we will move on down the area. Now I’m going to stay up here for starters because then here is a canal. Which drains the central city and it drains the south west quadrant of the central area. When they put the services in to Joburg they created tunnels underground which had a v base and they put all their pipes, their cables, their electricity, gas, water, everything were going through the tunnels. The storm water was also going through these tunnels.

I: Oh!

R: And the sewers were planted underneath. It’s very sensible, very logical, all the services in one corridor, easy to get to manage etc.. etc.. what they didn’t realise was the little darlings of this generation, like to pinch manhole covers because they are metal and they sell them. They also do sewer mining, so they will bloke the sewer and they will look for treasures and anything of value in what comes out of the sewer. That is a living.

I: Wow.

R: That is how people make their living. The problem is, that we are ending up now with sewage and storm water now in the same drain.

I: Yeah.

R: That is giving us a huge amount of pollution coming out of what we call Robinson canal right down through here. There it is there. It goes under the motorway and comes out over to Overton and then it drops in to the crown valley. Now part of this reclaimed area here, this was two dumps. Part of this reclaimed area is going to be developed and there’s a motorway, the M17, it terminates there and it was built here as part of 2010 infrastructure. The design we did in the 80s is to actually link these two and it comes through this valley. The alignment of that road gives us about 20 hectares to the south which we are going to turn in to an artificial wetland.

I: Oh, that’s good.

R: And actually do a preliminary scrub of that water coming out. That water will then carry on down. So there you see the whole cycle we are involved. This is me as a consultant with my client. My client owns all this land. To actually try and contribute to a high pollution level coming out of the city centre storm water systems. The sewage infrastructure and storm water have completely broken down and welded together. So it’s a huge problem. The pollution levels coming through here are so toxic. It is actually scary. Have you been put it contact with ARMOUR and Anthony Duigan?

I: Yes I have.

R: Anthony Duigan, yeah. They run ARMOUR and you can find it on Facebook. They have a very powerful facebook page and it’s worth following it. Because there you can see what the river warriors are actually doing to clean it up. That’s to the north of the water shed. So he looks after the north and I look after the south.

I: Great.

R: I’ll come to I look after the south in what my other capacity is. So as an urban development consultant, as a town planner. We are trying to design and use green infrastructure in our development processes to manage the storm water and manage the water and keep it clean as far as possible. Quantity and quality are of importance. We try and do that throughout urban design processes and our developmental processes. Also trying to encourage our clients to do, rain water collection. The basis is that at the moment all the rainwater lands here, disappears all the way to the south and then it’s pumped back here for us to use. So if we can do rainwater harvesting in here that must save something. So this area is Soccer City where the world cup was held. There’s gold reef city here. Gold reef city has got the only working shaft in Johannesburg.

I: Ok.

R: It is maintained as a working shaft. They dropped tourists down there during the week as well. But we also sent mining experts and researchers down to monitor the water and see what’s happening and also to do exploration.

I: That’s good.

R: So, there’s a line of shafts. There was a shaft here. We had 17 shafts. There was a shaft here. Then there’s 15 shaft which was here. 14 was at gold reef shaft. That’s the last line of shafts here.

I: Is that a government project or is it private?

R: That’s all old mining, private. Private sector owned the mining rights.

I: And is that private sector doing the monitoring?

R: Yes, it will be private concerns going down and doing research or whatever.

I: Yeah.

R: The AMD is managed through DWS. OK. They have a company which they use to actually manage it and do the cleaning. The first phase. That’s a sore point about the AMD. So, those shafts are sealed, 15, 16 and 17 are sealed.. But 14 is open. Actually, maybe 17 is still open. But there’s also a possibility that we can look at hydroelectricity generation using shafts. There are research projects on the go at the moment to use the water in the shafts and creating energy.

I: That’s good.

R: There’s an opportunity here from this water. Not only to pull it up, clean it and use it and clean it to industrial standard or palatable. But also to use it for energy generation.

I: That would be great.

R: They’re actually doing experiments here. That’s the flower market here. There’s a shaft there. In there, that structure there is actually a mine headgear. We are developing this as an agricultural hub. So the land is being cleaned up. The mining infrastructure reused to create an agricultural hub which will link in to the fresh produce market. Also use this land behind, there’s about 120 hectares there which can be used for agriprocessing and agrobusinesses within the agricultural value chain. But we are looking at energy generation possibly out of that shaft using the mine water.

I: That would be fantastic, because South Africa is very reliant on fossil fuels.

R: Oh absolutely, look, we are also looking at solar farms. Possibility of a solar farm here and here to the west. Some of the mining land here in this area that we can’t use. Also possibly a solar farm in that area.

I: That’s good.

R: So you can see that the whole urban development. Now, mining land here is under a rehabilitation resuscitation. If you think of your cities that grew on rivers and coastlines. A lot of those shore, those land water interfaces have been regenerated. If you look at London, the east end, it has all been revamped with lots of houses and factories and all sorts of stuff and it has regenerated those areas. Now we are looking at this land strip as an opportunity. We didn’t have a blue border. We actually had a river of gold. Okay, so our origins under gold are now being rehabilitated to redevelop and create this because there’s a bit of a north south situation with the mining land and it tends to be politicised and racialised and all sorts of stupid things quite frankly. Because the mines and the mining and the gold was here a long time before the people were and the city grew around what was happening. And now the city is regrowing. It’s very exciting. So that is my one major involvement in the mining land here. So the underground mining, the underground mining, but also surface development, storm water management, rainwater harvesting, cleaning it up and also implementing various initiatives to try and sort out the stream of water that runs through here. So, one of the other dams of the 3 that I mentioned is here.

I: Okay.

R: And that dam wall breeched in about 2010.

I: Oh no!

R: These silts started to flow down the river. There is currently a guy working on these silts and removing them. Cleaning out the dam. Once we see what that dam looks like without its silts we can decide what we can do with that dam wall. Do we take it out? Do we fix it? Do we make it higher? What do we do? What’s the best option? Because it is taking all this water from the city centre, outside the areas to the north and arrives in this dam and then sends it off down through Sowetto. Then you go in to Sowetto and past Orlando stadium which was also fixed up for 2010. It sort of runs all the way down here. Have a look at it. You can’t really see it on these photos. You can see some of it there, some of the valley silts which are being deposited from the dam. These wetlands are being hammered by these silts but they are also being hammered by communities, infrastructure failure, rubbish, plastics and that is where ARMOUR is doing a huge amount of work on dams in the northern areas. So the river runs all the way down through here, there’s kilpspruit valley road, there’s some of the deposits coming from the dam. It joins another part of the Klip river which runs in to this area. That brings me to the south of Joburg which is my passion.

I: Ah!

R: That’s where I live. From my window down there. That range of hills, it’s called the Klipriviersberg.

I: Oh nice!

R: We have the Klipriviersberg game reserve. Which is about 680 hectares of pristine bushfelt in this area.

I: Lovely.

R: It is a proclaimed nature reserve and it is being threatened by development in surrounding areas. Not directly but often indirectly. In terms of, biodiversity corridors, catchment areas and rivers running through it. So there is a need not to only look at the nature reserve and the management of it, but also the context within the nature reserve sits. About 12 years ago myself and a colleague who was then chairman of the klipriviersberg game reserve association, which is a community organisation that helps to look after the nature reserve. Clem and I founded what we now call KlipSA. Klipriviersberg Sustainability Association. You’ll find our website on there as well. Our purpose is to protect, promote and enhance the value of our natural assets in the south of Joburg for sustainable social economic development. Okay, so it’s not just a case of there’s something special don’t touch. There’s something special, how can we add value? How can we promote it but also protect it?

I: Yep.

R: So we take that sort of approach and just say that nature reserve is what we call the jewel and the setting of that jewel has to be protected and looked after. Now part of this is the Klip river which runs to the south. Okay, so we’ve got it running through here and we’ve got some small holdings to the south and many years ago the farmers actually created an irrigation channel which runs along here which has affectively dried up the wetland area here. Now, going back to the pollution levels. These wetlands play a vital role in terms of cleaning the water. To the extent, that there is a water research commission report, that notices the value of wetlands and peatland. It is estimated that this wetland has a value to the cleaning of the water of, the contribution is 140 to 180 billion rand. Okay. But it’s not doing that function at the moment. So as part of it, KlipSA has four main projects. One is to address poverty through the south of Joburg through agriculture. So we are running a number of agriculture initiatives, the agriculture hub in city deep is the pinnacle project that we are working on. But also to bring agricultural activities in to people’s backyards. To bring food and employment opportunities to where people are living. Alright? Address their at home problems, so they start to feed themselves and then they create excess that they can sell. Together they can create more excess that they can start to sell and they become viable businesses and the whole thing is around creating what I call an agritropolis. So the agritropolis concept is growing an urban area through the agricultural value chain. And creating socioeconomic development through agricultural value chain opportunities.

I: That’s good.

R: So it’s not just the planting, it’s the processing, it’s the processing, it’s the eating, it’s the preparing it’s the whole value chain. Plus all it’s various linkages that come in to it. And obviously we need good water for that.

I: Yes.

R: So our interest in the Klip river becomes not only in terms of the pollution management but also agricultural because this area here appears to be the food basket of Joburg. And we want to try and reinstate it for small farmers. Joburg has a farm down in this area, it’s there. Here. It’s about 270 hectares it’s the Eikehof farm, those are actually tunnels and then they’ve got various people doing pigs and poultry and goats and sheep and all sorts. And then there’s open crop land here. They’re using water directly from the river which is highly polluted. Okay, so we told them you can’t draw water from the river with the pollution levels and then expect to sell it on the market.

R: Definitely.

I: With this, this group of farmers, we are trying to help them address their water supply issues and this is why the reinstatement of this wetland is so important. To manage the quality and quantity of water in this area. To address the pollution. That river then flows all the way down to the south. It runs down here. That’s a rand water pump station. It runs through here, there’s a Heineken brewery and down to the Vaal barrage. Just below the Vaal dam. Okay, so you get the Vaal dam and then you get the water coming out of it which feeds in to the barrage and then carries on down in to the Orange river at the end. So this valley is very important you can see here, that’s waste treatment works. You can see the wetlands here are pretty well in tact still, whereas here they are not too healthy. So we want to make it healthy again. So that’s our second project. Our third project is around an education centre. We are looking for funding to help us create an education centre at the existing Klipriviers recreation centre which was built in the 70s and could do with a revamp so we want to turn it in to an environmental education centre so if you’ve got some nice fat donors we’ll certainly happily talk to them. Our third project is to promote tourism in the south of Joburg. Which is also a good opportunity for employment. We offer ecotourism as being a unique aspect of the south of Joburg. Bearing in mind that a lot of people come in to Sandton and then go up to Kruger to find some bushes, some animals. Klipriviersberg has got 680 hectares, it is fenced and it has wildebeest, springbock, zebra, it has over 270 bird species identified in the area. It is ideal for people who just want to a break from the city and get in to nature. It’s 15 minutes from Sandton and it’s free. So we’re trying to promote this as an ecotourism opportunity. It’s part of the tourist strategy for Joburg. So we work very closely with the city and promote tourism through the city as well. So those are our four key projects as KlipSA. So as far as the Klip river is concerned we said right we want to reinstate this and clean it up and sort it out. We were looking at creating dikes and reinstate those peatlands. But when we started to look in to it in more detail a clever boff told us you can’t do that because there’s dolomite caverns through this valley. One of the gold reefs runs through here, is the black reef. One thing associated with it is the dolomites. The black reef you can actually see the line of it. This is always a fascinating one. That line of trees is on the reef, where it outcrops. Those trees are growing around holes that were made in to the outcrop for exploration.

I: Oh wow!

R: What is happening is the moist air coming out of the underground has created a microenvironment those areas and that’s why you’ve got that line of vegetation. It’s always a fascinating insight in this area.

I: Yes.

R: We have got a problem though in this area with illegal miners, they now are just randomly digging this area to try and find gold. It’s a big problem on all our mining land, illegal zumazumas. So, we had to stop that project. So we understood the geohydrological nature of this valley, with the dolomites are constant streams which come from the north from the Klipriviersberg and from the south there’s a rich area which also has streams coming out of it which we think may be part of this dolomitic hydrological connection. So the water runs down in to the dolomites and comes back up, we don’t know, we need to find out, we need to research. And that’s going to cost us quite a bit of money and over a couple of years and again, ideal opportunity for some research! Okay, so we said well, how do we do this then? And we realised that if we don’t, we back up the catchment, we’re going to have constant problems. Unless we start to deal with the communities and start to talk to communities and start to get them involved in managing their areas.

I: That’s good.

R: Because at the moment, if you look at the streets of Joburg and not only the lower income areas but some of the high income areas as well. People are ruthless, they just toss stuff out the window.

I: Yeah.

R: Ends up in the storm water drains, ends up in the rivers. So we need to create a complete shifted culture. It’s not an overnight thing, this is a generational thing that we have to initiate where people start to realise the value of these water systems to them and that’s a big trend that’s coming out of work in the city as a whole at the moment. It’s not just picking up the litter. It’s becoming ingrained in your culture not to throw it away to start with. Oh, what about recycling? Yes! Good idea, let’s look at recycling. You start to get this whole green thinking coming through, through the kids, so we are talking to schools, we are looking at vegetable gardens. We’re looking at teaching the kids about rubbish management, about recycling, about rainwater harvesting, greywater usage, things like that. Hopefully, they will take that back to their parents. We then start to filter that thinking in to the next generation above them. While they grow up hopefully they will have a greater interest in water and it’s importance, because we are a dry country, you have got to look after the water and take some responsibility about managing the catchment areas of our water supplies and so, we as KlipWASH, we have a Klipriviers water stewardship initiative, which is working with communities and one of the examples is here. That’s xhosa park and there’s a dam called Rocka dam and it has a catchment that goes up in to the communities here and there’s another leg which comes back here. Okay, now in the bad old days, when rivers and wetlands were not important, people flattened them and built cricket pitches there.

I: Oh!

R: So there’s a cricket pitch here and it’s quite fascinating because it has still got water seeping out of it, they have drains along the bottom here in to a storm water drain. Which goes back in to the Marocca dam. But the area below is flooded, so there’s the cricket pitch, so the area below there’s the cricket pitch there, so if you look closely, you see those lines, those are underground drainage channels. Okay, they drain in to here and disappear down here, they flood mainly in to here. This area is just a soggy mess. But the irony is that they are busy irrigating this field, so the water they are putting on here for irrigation is also coming out here and disappearing down there. So we have a scheme and as part of one of the projects is to initiate with the University of Johannesburg, some sort of recycling, you can see a reservoir there, to get some sort of recycling process, the water gets used several times, before it is allowed out.

I: That makes sense.

R: So this is working with the community, with schools, working with local leaders within the community, to try and address these projects and make the water important in their lives and the management of their water important. Because if we don’t do that we are going to end up with on going problems, one of the things we picked up when we did this sight visit is you can see this drain going all the way along here. That’s also coming through and it joins back in the stream here. We did this sight visit. The Marocca dam was black. We walked all the way up here, we visited all the way up here and then we were shown this gully here this outlet, it was just raw sewage so we tracked it back up, storm water drain, storm water drain, here, you can sort of see the area here, there was a sewer which was blocked and enterprising residents had created a drain which they dropped in to the storm water drain and ran all the way down here. It was just pure sewage coming in to here. We got hold of Joburg water they sorted out the sewer, they tidied it up, cleaned it up, got it working again and within weeks that stream was running clean again, well relatively clean compared to what it was.

I: That’s good.

R: So essentially an open sewer running here, past schools, past houses. We are working with that school on a vegetable garden initiative. But open sewage goes in to this water. Now you have got to remember this water has not only an agricultural incentive it has a spiritual importance to the people. They use it for baptisms, ok. You’ve got people using these dams which are just sewage ridden and using it to baptise them. Not healthy! So you know, this catchment from this little dam, we are working with one of the community leaders, some of the schools and trying to create this culture, to start managing the area. Don’t litter, if you see a sewage break report it, get it fixed. If you see water leaking, report it, get it fixed and start to take some responsibility for your area and then at the end of it you can have a nice dam to play in. You can have boats and canoes and sorts of stuff on it, we can reinstate that, but until you start taking responsibility for this it’s not going to happen. But that is a slow educational process, that you’ve got to start working on. We are working with other organisations who are involved in vegetable gardens at schools and educating people about water quality, water management, recycling. We network and we use the term network of networks, we are only a small team, but we have a big network and each of those network nodes has a network. The idea is to create those resources together that can start to address some of these problems. While Anthony looks after the north I look after the south. You have got to also remember that, I came up with this model that talks about catchment to catchment. When you look at the water landing here in Joburg, lands in Joburg, goes all the way down to the Vaal and we use it again, either as tap water, sewage, whatever, ends up in the sewage plants, goes in to the streams. That is catchment to catchment. So within the catchment, you have a catchment to catchment cycle, where in that cycle? Can we interrupt it? To create a better water supply, it’s better in quality and in quantity. If we can avoid the excess costs and pumping it up using it and letting it all drain down again. The other aspect of catchment to catchment is that all the water coming from the south from the Vaal goes over the watershed and in to the urban areas to the north.

I: Okay.

R: So there’s a south catchment in to a north catchment. Okay. So there’s that relationship as well that we have got to look after and ensure that they still get supply because that water ends up draining out to Hartbeespoort dam. Okay. So Jukskei and the Crocodile they drain the north, they come all the way through here, so, the Jukskei actually rises just eat of the city centre, that’s Ellis park, Rugby 1995! Yay South Africa! That was actually built on a wetland. The Jukskei river daylights in this area and it drains here. So the catchment runs through here and the Jukskei starts here. So as we are draining from the south western quadrant, the Jukskei drains from the north eastern point . We’ve got Hilbrow, all sorts of very problematic urban areas which are going through horrible degeneration processes. The infrastructure is completely breaking down and as a result there was a recent report done by UJ which was released a few months ago which raises the huge flag regarding the toxicity of the Jukskei. The Jukskei runs all the way down through here, there’s broomer lake, so that’s the Jukskei and then it disappears through the urban areas and disappears out north. To the Hartbeespoort dam. So that’s the other catchment to catchment concept. Those are very important concepts to understand in terms of the management and how do we intervene to address the quality and quantity of water it comes out of this urban area. So it is through the urban development programme and then working with communities and organisations to try and address some of the environmental issues and qualities of this area. What else? Oh! Let me tell you the other exciting one! In your reading you’ve probably come across the integrated Vaal river system.

I: Yes.

R: Okay, now. That is a dam called Sterkfontein Dam. Which is just off the entry which is the main highway between Joburg and Durban. There’s a little town called Harrismith here. Which you drive out of Harrismith and there’s Olifantshoek path and there’s Sterkfontein dam. Below that is another dam and in that area there is a power station.

I: Okay.

R: A hydrostation. They have at the top of Olifanshoek path, there, you can sort of see it. Those structures there are actually vertical tunnels and at the bottom are reversible generator pumps. So when the off peak in terms of electricity supply, they actually draw the water up from below here and you’ve got to bare in mind there’s over a thousand metre difference between the two. Between this dam down here and the wall here between the two. So they pump the water up and store it. Then when there’s a peak demand they drop it down and generate electricity.

I: That’s clever.

R: It’s part of this Eskom electricity system. But, this area is also important because what they do is, we have the Tugela river which rises in this area in a beautiful nature reserve called royal natal national park and this escarpment is very famous. It’s amphitheatre, coming out of the amphitheatre is the Tugela river and the Tugela river feeds in to this dam here, this catchment and it actually feeds water in to Sterkfontein which is part of the integrated Vaal river system that when we run out of water in the Vaal dam they release water in to Sterkfontein and it runs down through these rivers here in to the Vaal, there. It’s part of our water supply. Associated with that is the Lesotho highlands water scheme.

I: Yes I’ve heard about that one.

R: It’s also part of the integrated water system. So that is a dam sitting up here in Lesotho. There’s a tunnel which daylights just here near Clarens. Comes from these dams in Lesotho. You need to look at this because it’s all part of the hydrological system that we are dealing with, alright. My other pet project is. I have a number of them.

I: Yes you do, it keeps you busy.

R: Yes, too busy! We’ve got royal natal national park and we’ve got Sterkfontein which is also a nature reserve and here is a very very important biodiversity area it is also identified as a strategic water resource area for South Africa. There are twelve of them and this is one of them. Because of its importance in feeding water back to Gauteng. As well as down in to Durban and KwaZulu Natal and we are working at this stage on a about a 8,000 hectare natural reserve proclamation. With various land owners in this area. To actually protect the area as it is important from a water resource point of view, all out adventures is part of it, alpine heath resort, which is where my interest lies. I’m a trustee of the development there. There’s a cabin which is up in this area, little Switzerland. There’s a small development up there. All going through and linking to Sterkfontein. Creating this link between KwaZulu natal and Sterkfontein across this catchment area and from a protection of the strategic water resource area it is critical that we create that protected area to manage the run off, to manage silts, the water, to manage alien invasive plants, because alien invasive plants suck up the water. What the guys have been doing here for plenty of years, developments have been here for 80 years. The cabin celebrated it’s 80th anniversary recently. They have been managing alien invasive plants to release the water in to the system so that we could use it and it presents an economic opportunity for the community. We employ the local community, they take the wood and they sell it. So they could drive their own home and energy requirements. So it’s all related in to that and the communities in that area will be part of this nature reserve. In terms of their livestock, their agricultural skills, whatever we can bring in as part of the tourism which is the focus of this northern berg area. As an ecotourism area.

I: That’s great!

R: So those are some of the projects I have relating to water. Next question? Hahaha!

I: Haha!

R: Sorry I messed up your structured interview.

I: Well no, that’s okay it was very educational.

R: The question is now, go through your structured interview and ask me questions which I haven’t covered.

I: That’s it! Well the first question that I ask everyone is a very brief one. Could you briefly give an overview of the main factors contributing to water scarcity in South Africa.

R: It’s location is the main factor. If you look at the whole global geography and you look at the country as a whole there’s a lot of desert in this area and there’s a lot of water this side. That’s Joburg, ok. You’ve got cape town down there so a large part of the country is desertified and the desert is creeping eastwards. That is a major problem. The main water flows out of the east, yes you’ve got the Orange river. Look up Orange-Senqu. I’ve only recently been introduced to it. But they are a management agency for the Orange river and the Kliprivier systems which are joined as one. They call it the Orange-Senqu. Four countries, I think it’s 2,2000Km of river. Okay and the importance of the eastern border of South Africa in terms of water supply, is how do we get that water in to the central area? With great difficulty. The Orange is flowing in here. When you go and you visit, you drive down Uppington and these areas there are some amazing agricultural areas but they are within a few kilometres of the river. It’s not spread out, whereas you look at the agricultural activities, particularly Marisberg, Durban. This area is very very rich in agriculture and then you’ve got these open areas of free state which are used for your rain fed crops lately. A lot of irrigation systems and things like that, so yeah, I think it where it is in the world and what it has got around it, that is a big thing. In terms of people impact, I think what we have been talking about. In terms of littering, in terms of alien invasive, are all part of what we have to manage. To address that water scarcity. In terms of sustainable water supply. Because if we don’t then we’re not going to have it, it’s all going to drain out.

I: Yes definitely, speaking of that, what are your thoughts on rainwater harvesting? How much potential do you think that has? Because obviously the rainfall in South Africa is very inconsistent.

R: How much you would benefit from it, you take your building roof area, you take your rainfall and that’s what you could collect if you’ve got rainwater collection. We tried to initiate an initiative through Joburg some years back to say that all your buildings in Joburg should have some form of rainwater harvesting as part of its building structure so you don’t retrofit you actually design it and build it in. As a secondary water system.

I: That would be good.

R: But they had a huge policy problem. In that they don’t want buildings and developments to have potable water and grey water in the same place because people could use the grey water instead of the potable water and therefore make themselves sick. But it depends on how you manage it. I was brought up in Bulawayo, Zimbabwe and I was brought up in the 60s and the 70s in Bulawayo and we had waste water treatment which pumped water back in to the city and recycled water was part of all the municipal and all the government land areas to irrigate our playing fields, our parks, we had the most beautiful fields. Irrigated by reclaimed water. Two totally different systems live well together, because the reclaimed water everything is painted bright red.

I: Ah that’s good.

R: You grew up with it. You knew you didn’t drink that.

I: Yes!

R: You lived with it. If you look back at some of the pictures in the 60s and 70s in Bulawayo that was all reclaimed water. Otherwise it was a very very dry city and they reclaimed water. So it’s not new in this part of the world. It’s just that people get very picky and choosey about having dirty water and clear water next to each other. We’ve got to get over that.

I: The other issue would be that the waste water treatments plants in South Africa, most of them are dysfunctional aren’t they?

R: Now, yes. Now, yes. 25, 30 years ago they were efficient, they worked. It could be part of our water management. If we brought in to developments, grey water opportunities, so hand basins for example. You put that in to tanks and you reuse it in to toilets. So it goes from grey to black or whatever the system is called in terms of the gradation of dirtiness. There is a, I think I’m right in saying the water in the Vaal system is used 7 times. Because it comes up to Joburg and it goes in to the system back down and it comes back up to Joburg 7 times. So effectively, we are using recycled water. If we can get mother nature to help to clean it up better it obviously makes it cheaper for rand water because they haven’t got such heavy cleansing processes and problems. We can all benefit. But let us keep as much as possible up in the city as rainwater harvesting so there are a number of possible initiatives that one could look at as programmes to address water security in the future.

I: Yes, thank you. Speaking of, my next question is about public participation. I know that you are involved this. How powerful is giving a voice to these vulnerable communities?

R: It’s not just a powerful Jack, it’s a critical tool. If we do not bring communities on board, if we do not get the private sector involved, the state cannot do it. The challenge we have is many years ago our government said we will provide, we will provide houses, we will provide hospitals, we will provide this, we will provide that. They have not maintained what they took over 25 years ago. As a result the private sector has actually stepped in and taken over. So, our schools, our hospitals, our emergency services, our fire brigade, our security, these are just not doing there job, private sector is doing it. So when you talk public participation, active citizenry is what is critical. Citizens are getting involved. Some of the municipalities in South Africa are taken over and the services, being run by the private sector. Run by citizens, because there are active concerns about getting services. Harrismith is an example, the community took over. So the state is now starting to realise they can’t do everything. They are starting to realise collaborations and partnerships are probably a good idea. Because they see what we are doing as private sectors and as communities and they are nowhere near it. So what we are trying to encourage, from a business point of view, is that the state creates the right environment for business to do its business. They are not the providers of employment, they are the providers of the environment for employment to be created by the private sector. That’s either big corporations or small business enterprise. They have got to create the right environment. They are not doing that. They are creating more and more red tape and labour laws. People are disinvesting because as business it is too expensive, labour is too expensive, it is too much hassle so they are moving out. It takes us up to 5 years to proclaim a piece of land for a development to invest in.

I: Wow!

R: Which is nonsense! It’s things like this where the private sector is getting on. I talk to clients and I talk to communities, I say if it’s legal, if it’s within policy and it fits within what we are wanting to achieve in the area, do it. When the state wakes up, you’ve done it and they can’t complain because it’s legal, it fits within their policies and everything is what they are trying to achieve anyway. If we have to sit and wait for state, nothing is going to happen in the country. In terms of engagement regarding water and communities Anthony will tell you a lot about the work they are doing in the north. I come from a policy point of view with KlipSA, create the right environment for us to do what we want to do. So getting the policy, the ideas of tourism and agriculture, things like that, we got written in to strategic plans for the city, 10, 11 years ago. It’s enabled us to keep going and the city is now waking up and saying oh look what you’ve done, isn’t that marvellous? Come along if you want. But we are still keeping going. You better catch up. So community engagement and participation is absolutely vital.

I: Definitely. Speaking of policy then, my last question is, how familiar are you with NWA 1998?

R: I quite frankly am not. There are people like Mariette who keep us on the straight and narrow. But what’s important is that I work on the ground. The act is a national thing, yes it does trickle down to the ground. Don’t get me wrong, it is important, to me the important thing is we look after our water resources. Isn’t that what the act wants us to do? So if it’s moral, legal and within policy, do it! So basically I work on that basis. When we start to get in to details with projects, then we have to start looking in to the act. Water use licenses, permissions, yes we will have to do that, we respect that, environmental assessments, planning proposals, designs all of that sort of thing will have to be done at some stage. I work more at a strategic level and quite frankly, if the law doesn’t allow me to do it the law can be change and if it’s a change for the better. To make us do this in a better way, more efficiently and more affectively then we should have changed it a long time ago.

I: Yes, definitely.

R: That’s what we are finding now with some of the water issues but the city is starting to think about allowing developers to do their own sewer treatment. They are starting to look at how we can get private sector generating electricity. Coming up with partnerships, there is a lot of noise at the moment around Joburg because we are going through power cuts. The city and the ANC is using this as a great triumphant, look at what we’ve done we are not cutting you so often. Private sector, to get involved in power generation. We’ve been talking to them for 10 years and they haven’t allowed it. Another set of political promises.

I: That’s what I wanted to say, the NWA 1998 is a great act but it falls down in its implementation.

R: Absolutely. We have a brilliant constitution which is also globally lauded, we have brilliant policies and strategies we have brilliant legislation but it’s not being implemented. So DWS should be looking after our national water resource are not doing it. They are faffing around. Corruption and all sorts of hassle.

I: Yes.

R: As a result our water resources have gone to pot. So what’s happening is the private sector is getting involved and sorting it out. We pick up on the DWS, for example on pollution spills. They are over night on the back of the private sector but for the municipalities they turn a blind eye. But they can’t get involved because of intergovernmental cooperation. What the hell?! The national department are responsible for the water resources, municipal structures are destroying it. Take them apart, do something about it! But they say no, we can’t be nasty we have to be nice to them. But it shuts down a major piece of economy because they’ve dropped something in the water somewhere.

I: That’s crazy. What are your thoughts on desalination?

R: Not many, I suppose it’s relevant in terms of AMD. If you think of the millions of tonnes that is sitting on surface that is brought out from underground by the mines, turn that in to cubic metres of water supply. Okay, so if you take desalination = AMD management to clean up etc… then it is of vital importance if you look at it and come up with a cost effective solution. There have been several schemes to look at pumping water out of the shafts and cleaning it up and using it. But it just wasn’t cost effective at all compared to what rand water was bringing it in at. The same has been said in the past about electricity. Now electricity is going through the roof thanks to Eskom’s misdemeanours and problems. The private sector is now bringing the price of alternative energy down to a far better rate. Which is far cheaper than Eskom. Therefore it is growing. I foresee a similar process going with water. The private sector, because the cost of water is going to increase if the levels of pollution increase. It becomes more expensive then to clean it up, it will become more expensive for our plants and machinery which haven’t been maintained, because they are not worried about maintenance. We build it but we don’t worry about maintaining it. But now we’ve got big catch up in terms of maintenance and management. It’s going to cost a fortune. Private sector can do it for cheaper. We’re going to get the same thing coming through. As I said earlier on, schools, hospitals, security, emergency services, fire systems the private sector is coming in and doing it for cheaper, why shouldn’t it come in and do the same for energy and water? Which are vital to this economy which is the hub of southern Africa. So desalination? Somebody is going to come up with the right trick. As far as we are concerned, desalination as in using coastal sea water, has no relevance to us here. But if we look at desalination in terms of removing salt out of AMD mine water, yes, it has huge relevance. But we have got to make it viable. There’s reverse osmosis processes and things like that that have been floating around for decades. But nothing has actually come of it. We are going to get to that critical point where somebody is going to push it over the edge and come with a solution. Then we are sitting on the biggest water supply that we could ever hope for and we are sitting on the water shed! Even if we make that water river acceptable, we pump it out to feed the systems below us, to feed those agricultural areas below us, in terms of the catchment flow of water, it is something we have got to look at in the future. Actually using that water sitting underneath here for our own use from an industrial and potable point of view, but from a river quality point of view, actually recharging our water systems downstream. We are sitting at the highest point in the country on the national water shed, makes sense.

I: That’s great thank you. That concludes everything I wanted to ask you.

R: Thank you.

**NGO6**

**I:** Okay great, we are recording. The first question is a broad one – how depleted do you think the water resources are in South Africa overall?

R: Um, as a percentage?

I: No, more of a description.

R: In terms of access to clean water, drinkable water. I think largely depleted in most regions.

I: That’s good. Thank you. What do you think the main reasons are? In a management context rather than the geographic reasons.

R: You’re not looking at the runoff?

I: No, so rather than things like rainfall, more like management and maintenance.

R: Right, so South Africa is a water scarce country. I reckon with climate change we’ve been affected more radically. It seems to be, back if one does believe in the bible, to feast or famine. In the Eastern cape and KZN we’ve just had major storms. Other parts of the country have been through large drought. So climate change is playing a role. I think, that’s definitely not our problem in South Africa.

I: Okay, thanks. Do you think that water is distributed evenly among communities?

R: Definitely not. I don’t think water has ever been distributed evenly in South Africa, historically. Even now, your metropolitan areas get more than your rural areas. Even that would vary between for example the western cape and the eastern cape. Which are on a local level run by different political parties. There’s never been an even distribution. In South Africa there has always been the haves and the have nots. In terms of water that hasn’t really change.

I: Thank you. I know you do a lot to protect rivers. How important are rivers to water security in South Africa?

R: Rivers are vital. A lot of the smaller, rural towns actually rely on the river supply for their water. Even Gauteng the water is pumped from Lesotho but they use local rivers to transport that water. So yeah rivers are vital but our rivers are abused.

I: Do you think enough is being done by the government to protect them?

R: I don’t think anything is being done by the government to protect our rivers. One can blame it on historical past. But I think there comes a point where we can’t keep blaming things on what has happened in the past. I think government, they might think they have bigger issues to tackle but without water we are nothing, so to me, water should be our number 1 priority.

I: Definitely. Thank you. How familiar are you with the national water act?

R: I am not.

I: Okay. I just wanted to say that overall South Africa gets quite a lot of praise for great policy but where it falls down is implementation. So there might be good policies to protect water but nothing is being done to actually put that in to a practical sense.

R: Probably true. You know, we are meant to have the best constitution in the world. The most liberal constitution. Yet, our constitution fails us all the time. Because it is not implemented. So I can believe that our policies are good but yeah it comes down to the people in charge. If they are not getting back hands for doing something.

I: Do you think these problems could benefit from public participation?

R: There have been a couple of smaller towns where the local community has kind of stood up and started doing things and actually taking over. From even the local municipality, you know local government. They are fixing the sewage works and cleaning the run off areas and that kind of thing. So, people who are being affected first hand obviously are better to step up than people who hide behind closed doors.

I: Thank you. Are you part of any forums to discuss water?

R: I’ve joined a few but I’ve actually never sat in on any. I am a doer. Meetings and those kind of things frustrate me. I tend to do things on my own.

I: Do you find that these meetings are like too many cooks and it delays progress?

R: It’s often the case. Well intentioned people, the words never seem to translate in to action.

I: Okay. Thank you. So from your perspective what do you think is the solution to solving the issues with the rivers?

R: We need to take accountability as individual citizens. It’s often that groundswell that will bring about change. If local residents start doing things, the momentum will get created. I think human nature, tends to wait for catastrophe before we react. The warning bells are ringing and nobody is really doing anything about it. There are a number of people doing things but there are a bunch of individuals, there are groups but as I say I’ve kind of become disillusioned.

I: Do you think awareness is growing now amongst communities?

R: I think so. I think a lot of work is still to be done. That is why I started my project, around creating awareness. Making people aware, because when I grew up you could swim in any river. You can’t anymore, you’re going to get sick. That’s over the last 30 years.

I: Yes. Does any monitoring happen for e.coli counts or any pollution of the rivers?

R: Yes it does, in certain places. Guys like Umgeni water, Rand water they do monitor in places. I’ve used them when I wanted to plan my swims. They’ll tell you where is more acceptable or not. At the moment it seems to be that everywhere is not acceptable. Something like the Vaal river system for example.

I: That’s terrible. Moving to solutions, what do you think about rainwater harvesting?

R: Rainwater harvesting definitely has potential. Where I live in the western cape a few years ago we had a severe drought and everyone started putting in tanks to collect water. The problem in a lot of the rural areas is access to funds to put it up. It’s not just a matter of putting up a tank. You need to create a base for it. You need to have a guttering system. For example in the rural Transkei in the Eastern cape, where we use thatching you can’t harvest water. You can’t harvest water on a thatched roof. So I think it’s come a long way in South Africa. Rainwater harvesting. But I think access to funds is a problem. For a lot of people still.

I: Thank you. When you say you’ve witnessed the use of rainwater harvesting. Did you use any of that for drinking water? Or was it mainly for irrigation?

R: I think it is used for both, especially in rural areas. I put in a borehole at my house and I connected it to my system. So I don’t keep using municipal water. I don’t harvest the rainwater because I feel that because I am taking out of the ground it should go back in to the ground. But, I was recently in the eastern cape and some people even lock their taps. Because water is a scarce resource and they know especially in the wetter months where they don’t have rain that they need to protect every drop.

I: That’s crazy. What about salt water desalination what are your views on that?

R: It’s probably a lot more costly but I do think it has potential. I don’t know much about it.

I: That’s okay. It certainly would be quite energy intensive too.

R: Correct, which we don’t have.

I: Yes, there’s still a reliance on fossil fuels.

R: Correct, so maybe if there is a way of harvesting the energy from waves and desalination at the same time. I think if you look at the Israelis, they are the leaders in terms of desalination from being an importer of water to now an exporter of water. If they can do that then definitely there is potential for us to look in to it.

I: Thank you. What projects in South Africa are you proud of?

R: I think a lot of us, excuse the expression, are farting in to the wind. I think if you look at the Hennops river clean up. They take out tonnes of trash but it’s almost like a losing battle. I’m not aware of any stand out projects in terms of having turned a river around completely taking it from a dead river to a living river again. Which can be done. There are lots of people with good intention. Until we change the general behaviour, we will always be fighting against the odds.

I: Yes, you can’t do much until it is stopped at the root cause.

R: Correct. So until we get mind from government to fix infrastructural leaks and that kind of thing, mind from every day commuters not to chuck their trash out the window. Mind from small businesses, even medium and large businesses not to take the easy option in terms of getting rid of waste, until those things meet we are going to be bumping heads.

I: Definitely, it’s very complicated. That is great thank you.

**NGO7**

I: Okay great, I have started the recording. So my first question is, from your experience, how depleted have you found the water resources are in South Africa?

R: Well I think one just has to look at what’s happening in parts that have had drought. I think there are two main aspects. The one is drought, which obviously affects the ability to maintain a constant water supply in the event of lack of preparation for drought. Which, in fact in South Africa, we have always had drought so it’s not a real excuse to say there’s no preparation for drought. At the moment Port Elizabeth, in the eastern cape is already on day zero where it’s second dam is already below 8%. So I mean that’s common news now. That is sheer neglect of maintenance ineptness, corruption, you name it, from the authorities that should be actually managing water resources. So it’s no excuse to say caused by drought. That’s the excuse that might be used by authorities but it’s a lame excuse. So, I mean that’s only one of the reasons. The second thing is sheer bloodyminded ineptness which has left a lot of towns struggling with a lack of potable water and relying on tankers. Parts of the north west certainly. But also the way water has been missed used for the waste water treatment works that are now not working. So it’s two things it’s basically corruption and ineptness and to some extent drought. But the first thing is the biggest biggest problem in South Africa, not drought.

I: Thank you. My next question do you feel that water is distributed fairly in South Africa?

R: Is it distributed fairly? No. It certainly isn’t. I think that you have around all the major cities and even around the rural towns you’ve got informal settlements, or what they used to just call the old black townships. In many cases you will find that they don’t have potable water. They might have either central water dispensers, taps, or water tankers coming in. It’s not that they don’t have water but certainly it is not fairly distributed in South Africa. Because we don’t really have a proper rural development strategy that looks at rural areas in an analytical way which includes water services and other things, so no, there is inequality in water distribution.

I: Thank you. Who do you think benefits the most?

R: While there is a long heated debate, I’m going back quite a number of years. Between industry, agriculture and domestic use. Where does the priority lie? And I’m thinking particularly of one of the biggest irrigation schemes, it used to be one of the biggest in the Southern Hemisphere. It’s in the Northern cape. It’s called Vaalharts. They are a really productive irrigation scheme started in the 1940s basically and many years ago there was a big debate about the amount of water that we are using compared to what industry was using. They were taking water that was coming to Johannesburg. The question was should more money be going to business and less to agriculture. But then you’ve got the 3 prongs. Agriculture, business and then of course domestic. Who should get most? To be honest I think agriculture should be the priority because business can’t produce food from nothing. You can process food but you can’t produce the raw project unless you are growing it. Hydroponically or in the soil.

I: Thank you. What condition do you think the water service infrastructure is in on a national scale?

R: While I think it’s in a very poor state. I think there are statistics about the wastage, I can’t remember. The wastage through non-maintained, leaking, aging pipelines in city areas too. That’s for domestic and industrial use. I’m sure that statistic is available. Water going wasted. In urban areas particularly. I think that that is to do with lack of maintenance over three plus decades. So therefore I think that the water service entity, the function has been devilled by a mixture of corruption, lack of maintenance, lack of planning and I think it is generally in a poor state across the whole country. A lack of proper planning ahead. That’s one of the biggest drawbacks, bugbears that we face. In many areas, water particularly.

I: Speaking of implementation, do you come across much policy in your work?

R: We have more recently been involved, not myself personally, my colleague. He’s been more involved from a policy side with some of the top down people, the new minister and I think one needs to give the new minister a chance. Because we certainly had some good meetings. He seemed to listen well. But he’s got a hell of a job ahead of him, because he has got a department which has been laid low by corruption, misspending etc… So I think he needs to get all the support you can give him. He has been sharing policy, been opening the debate to grass root NGOs etc.. So I think that is a positive from his side. So I’d saying this is the first time certainly in our experience of 10 years, it’s the first time that we’ve really had that sort of accessibility and openness from people, from the level of the minister and his top people.

I: That’s encouraging. Speaking of collaboration are you involved in any forums with multiple stakeholders?

R: Yes. There are multiple stakeholders with other NGOs. In the former black townships there are a lot of active NGOs that are working to address sanitation issues, waste water issues. All those things cleaning up rivers etc… They are slowly gaining recognition from both local authorities and from national authorities. It’s slow and initially there is a reluctance from national authorities to recognise it. Even from local authorities it’s a battle to get the level of recognition and support that you need. In Pretoria, it is a good example of where cooperation is beginning to produce results. I think Johannesburg and the East rand they are slow but seem maybe slowly coming on board. But Pretoria is probably the best example but Cape Town is the best too. The best example of cooperation happening with grass root NGOs etc…

I: Thank you, how about with local communities, do you think there is enough public participation?

R: Generally there is the opportunity for public participation but I think in South Africa we are still way behind mobilizing public participation at a sufficient level to make a genuine impact. It’s still too low key and not well distributed. But because again, I think South Africa has had this attitude that the government must provide. The government unfortunately has reinforced that view, that they are the providers and the other people must just wait. That’s why after the democracy in 1994 a lot of the very vibrant NGOs that had created a groundswell of public and civil support for various things actually emasculated and a lot of them just died at that point in the years following. So now one must almost regenerate public participation. But there are the opportunities, it’s required by the constitution much more so than under the previous regime, there wasn’t really a principle of public participation under the previous regime now there is. How well it happens, that’s another thing, it’s often very patchy. At least it allows one where there has not been public participation to challenge this in the courts.

I: That’s good. Thank you. How important do you think education is for local communities and do you think South Africa is doing enough to educate communities about water usage?

R: No it’s definitely not enough. I think it’s the awareness of water, the awareness of rivers has been really brought to the fore by NGOs. I mention something like Hennops revival. I don’t know if you’ve spoken to them.

I: I have.

R: Okay, well Hennops revival have played a big role in raising the profile or the awareness of our waterways, I am not talking about groundwater. I am talking about rivers, streams wetlands etc..It has not been the government, it has been private sector bodies. You’ve got the wetlands forum, there are a range of private organisations, well over a hundred. My wife runs the facebook, she counts well over a hundred organisations just that she was able to connect with. Involved in various aspects of water, maybe to do with rivers and litter clean ups, oceans etc… So I think it has been the private sector, civil society that has raised the awareness, not government of the importance of rivers, wetlands and protecting them.

I: Okay, thank you. What do you think of the potential of rainwater harvesting has for South Africa?

R: Fantastic. It is actually part of the solution for everybody. For people to be encouraged to get their own rainwater tanks. It used to be, I’m going back to the 40s and 50s. I remember in certain parts of Johannesburg, every house had rainwater tanks. I don’t know if this happened to be a policy in those days but ironically, authorities like the city in Johannesburg actually banned rainwater tanks because they wanted to sell water. They didn’t want people to get free water. If you consider a place like Bermuda, I understand that it does not have its own water supply, water in Bermuda comes from the roofs and buildings. Rainwater collected. So if you think of it, everybody, I think it should become a policy, like for recycling. It should become a policy, each household recycles, each household should be encouraged to have a rainwater tank. So rainwater harvesting in that sense I think is a vital element of any future solution to water. Particularly to a water pure country like South Africa.

I: It is probably a climate friendlier alternative to Saltwater desalination

R: Ah yes, well, Saltwater desalination, I understand, I don’t know anything about it but it’s a very expensive option. Which can be afforded by maybe municipalities like Cape Town or the Eastern Cape but paid for by very wealthy retired land owners. That’s not a solution for even along the coastline for most places. So rainwater harvesting is a friendlier, very accessible solution. I would suggest that either the local authorities should subsidise that, should give tax breaks for tax rates, rates reduction whatever for people who do rainwater harvesting. It’s not going to happen otherwise, they need a friendly policy environment to encourage rainwater harvesting and that would require a review of how rates and taxes are levied etc.. and rebates provided but that’s something for a lobby group to begin doing I think.

I: That would be great. What projects do you think sets an example of good water management in South Africa?

R: I would certainly put forward Hennops revival because I think they’ve raised the awareness. They prop up in the cape, they employ local people with a special system, called the buddy system, where she had a team that were continually cleaning up and were getting subsidised or supported by various businesses etc.. now, I mean this could be sustainable this type of thing if the local authorities really embraced it. I think adopt a river, they used to be more active in the past, I don’t hear much about them now. But they are based in KZN. There’s other bodies like the wetland forum, there are so many organisation that I don’t know all that much about. There’s the community bin project, it’s innovative in the way they’ve tackled waste in a very difficult area in South Africa, a slum area basically. They had a chequered relationship with the city of Johannesburg waste management department who sometimes supported them and sometimes not. I think they are innovative in dealing with the route cause, which is in the city as opposed to what happens downstream in the rivers.

I: Thank you.

**WSP1**

**WSP 1**

I: Okay, we are recording, thank you. So, I am going to start with a few background questions first. So what do you think are the main management factors that are limiting water availability in South Africa?

R: Management factors influencing water availability?

I: Yes.

R: Holistically?

I: Yes.

R: Okay, well I think holistically the management issues are, I mean there has been quite a lot of planning. So I don’t want to say that there is no planning but maybe insufficient planning. Maybe, an insufficient infrastructure supply. In certain areas. It to some extent, it’s also, I’m being very careful when I say, political will.

I: Yes.

R: To implement it. You know, it seems, I’m not involved in politics at all.

I: No, that’s okay.

R: It seems as if a lot of political infighting and power play, whatever you would like to term it as. Has caused some of the issues that we have in the country.

I: Yes.

I: Do you think there are certain stakeholder types that have lost out more than others in this situation?

R: Yes, definitely. Look, I think the general public has lost out hugely. Because of some of the issues that are at play. But I would think that in certain areas, the poorer communities that are needing to be uplifted, have missed out on this. Or are missing out. One of the challenges that I see and this is from observation, it’s not a documented thing. There have been a huge influx, when I say huge I mean an enormous influx of people into the urban environment from the rural environment and that influx hasn’t been planned. That influx has just happened. People have just arrived, people put up shacks all over the place. In a sort of coordinated way, if I say coordinated, it’s coordinated on their own approach. So they are obviously informal groups etc.. Not from a town planning perspective, if I try and equate first world to third world. Let me put it that way maybe. You know, it isn’t happening in a coordinated approach. And because it’s not happening in a coordinated approach, the infrastructure is not in place to supply that. Whether it’s electricity or water or even proper roads to those communities. So yes, they are losing out because of that. I don’t know if I am explaining it correctly.

I: No, that makes perfect sense. Thank you. It’s hard to then build capacity in those areas and resilience. Do you think those communities get many opportunities for interactions with other stakeholders and opportunity to participate in water management?

R: No I don’t think so. I don’t think they get lots of opportunities. I don’t think the system is set up for that, I stay in a residential suburb, okay, I stayed in the same house for 30 years, in what used to be what they called peri-urban areas. So our residential plots are quite large. Just because of the way it was laid out originally. Many of them are still the same, it’s 1 acre. But, I mean there are very few opportunities to actually talk about water-related issues. Even in my community. So I don’t think it’s just for the poor. I think even for the wealthy there are not those opportunities as such. They will talk about strategic developments of areas, there were lots of meetings about that in my community and I am sure there are in other communities, because they have got to have those plans. But that talks at a high level about what parks are planned where or what types of buildings, high rises they will allow now, in certain areas, you know where they want the next industrial area. So, it’s that kind of planning it’s not saying okay, what are the water issues in your area that we need to address? So, for me I think that’s broad, across the spectrum, it’s not linked just to rich or poor or whomever communities.

I: Yeah, that’s a good point, so there needs to be more integration and more communication and fair representation across communities.

R: Yeah, look, I also think it’s really difficult. Because, if you are saying, what are people where do they get the opportunity to engage on water-related issues? Where do we get the opportunity to engage on electricity issues? I am sure you must have heard the problems that we have got with electricity.

I: Yeah, the blackouts.

R: We are calling it to load shedding or load whatever it is. You know, we have at times and we fluctuate at time up to 8 hours of no electricity. In areas, in all our suburbs and there are not the platforms where you are not allowed to engage, not allowed to, where you can engage. Political parties will do it and various WhatsApp groups will do it but its not a formalised approach so it’s not just about that. There’s issues of crime in South AFRICA, huge issues of crime, they don’t have community groups, where government come, it will be the community themselves that come together and talk about crime and communtiies themselves that say what do we do about it. So, I don’t want to put it out of perspective, I don’t want you to see it out of perspective, I think it’s just a general thing, environmental issues, I am an environmental manager I am passionate about the environment. There aren’t those opportunities, the government doesn’t come to. They will have big pow wows at times and they will have meetings at times but it’s more at a high level. It’s not down at a community level. There just isn’t the capacity to do that.

I: yes.

R: Whether they have the will or not is another issue. And I can’t answer for that.

I: That’s fair enough.

R: Yeah, it just doesn’t happen with all sorts of things. So I just want you to see that it’s a bigger picture it’s not just water in isolation.

I: I understand, thank you. A lot of the ground-level work seems to be coming from communities and NGOs, , in terms of managing the environment. Such as removing litter from rivers and things like that. There seems to be more action coming from NGOs.

R: Yes, you are so right about that. You are so right. Even at a municipal level, they are doing stuff but they are doing stuff. But they are not doing enough. At some municipalities they are doing basically nothing, kind of, you know even refuse isn’t being removed from people’s homes and it just piles up and pile up in certain communities. I am very grateful, in the municipality where I stay they collect the refuse regularly on a Thursday kind of thing. But there are many communities that just don’t have that. They can’t even say when it’s going to be removed, if ever, I work in those areas from, you know, the organisation that I work with.

I: So, why is that do you think? Do you think it’s a lack of capacity, staff, funding?

R: It’s capacity, it’s funding, it’s having the will to do it. I must be very honest, I don’t see the will from a lot of people to fix the things that need to be fixed. I say the things, because I mean as much as what we are talking about is water, you know, it’s about electricity, it’s about the refuse in the streets that you refer to.We have a huge pollution problem here. There’s even a partial, I say a partial because it’s not everybody, I would hope it’s not everybody, but there are people that believe that if I just throw the litter on the floor I am actually creating a job for somebody else to pick up that litter. You know, that’s the mindset. It’s horrific, but that’s what you hear people saying sometimes and I really don’t want to put that down as a large percentage, I hope it’s not a large percentage, but a large percentage do litter anyway. People will just throw it out the window or whatever. It will just do my nut.

I: Yes, I can imagine. That’s crazy.

R: You know all of those things impact the water environment. You know, where does the litter end up? The litter ends up quite often in the water sources. You know in the wetlands etc.. and if your wetlands are more degraded, well then your water source is more and more degraded kind of thing, unfortunately, there is a ripple effect on so many of these things that we are dealing with.

I: Thank you. Do you think that education needs to be ramped up to influence communities and individuals to manage the water more effectively, also the pollution so that they have a better understanding?

R: That is a big thing, we have got to, one of the department that reports to me is the adult water wise education, and unfortunately we don’t have lots of resources but we do as much as what we can and that just rarely scratches the surface. Just because we don’t have enough resources. I really am not blaming my organisation they’ve got you know put some into engineering, some into HR and some into whatever, so yeah, a lot more can be done all over. Whether it is government, whether it is us who is parastatal whether it is private individuals, whether it’s neighbours, you know, you and I could be a neighbour to each other, kind of thing and yeah, what are we saying to eachother how are we educating each other? What are we saying about what we see happening in our local communities? I write for a local newspaper in my community which is a small community, you know, on horticultural and gardening related things often but I bring in the environmental aspects, I bring in the water conservation aspects. As much as what I can, to try and raise that awareness as well. So yeah, I think it’s everybody needs to do and we can do a lot more. But I also believe that you will never solve all the problems, one of the questions that you had pre-sent to me was, I thought about it, you were asking me about, my thinking was at the time to say hold up, we will never solve all of the world problems, oh it was about the SDGs, I mean I pulled them up to make sure I was thinking correctly, etc… just give me a second

I: No worries.

R: I know I am going off track a bit but I really think it’s something that needs to be looked at. You know, by 2030 achieve universal and equitable access to safe and affordable drinking water for all. I understand that is a goal. But I can promise you we will never that achieve that, not in the life time of this world will we achieve that. Because the world, I understand that you have got to have goals that you should strive towards. But the goal is a little bit too ambitious. Even if you go back into biblical days, into pre-biblical days. Whatever you would like to refer it to, there were rich and poor. You know and the poor have always suffered in some way and maybe had a better lifestyle in some way, than some of the rich people if you look at lifestyles etc.. you know, how did the Egyptians and Pharaohs and whatever, they didn’t always have a lovely lifestyle but there were also the poor that had to work for them that were most likely, look at the evidence, didn’t have the resources, the access to water and food and ablutions etc.. as did the rich.You know, so this has been a problem that’s been with us for decades. So to solve it by 2030 aint gonna happen. I just think we are setting ourselves up for failure even by saying those things, in the SDGs. They should be thinking more practically or more whatever, I am not the expert at this kind of wording, but, do you understand where I am coming from?

I: Yeah, exactly, you can never achieve complete equality because of certain circumstances such as the environment, and political factors.

R: Yeah and I know that you have got to have a date and a deadline that you strive to and I know that you should actually have a specific amount that you know, a volume or percentage, but I think to say by 2030 all, etc.. even if you look at the next one under, you know, under SDG 6.2 it says by 2030 achieve access to adequate and equitable sanitation and hygiene, for all! Open defacation pays special attention to the needs of women and girls and the vulnerable situations. Well, you won’t solve all open defecation. It’s just physically impossible. Because you don’t have sufficient water in many areas and if people start settling in those areas, how do you solve those problems? Who’s fault is it that they are settling there? It’s me and my community who have decided to settle there. For whatever reason. Maybe out of choice, maybe we were forced there, I don’t know, but you hear what I am saying?

I: Yes, I understand.

R: I don’t want to belittle the SDGs at all, so please don’t get me wrong. I am not saying we mustn’t strive for these. But I think achieving them is very ambitious. Practically, a hurdle. Sorry.

I: No, that’s fine. The other thing about the SDGs is a lack of indicators to monitor progress, do you think enough monitoring is happening in South Africa? To monitor the pollution levels of rivers, these kinds of things?

R: Yes, agreed and it comes down to capacity. It comes down to resources it comes down to the will to do it. Some people start doing it and then because of too many issues and headaches, they slowly quit or move on, yeah, it’s a whole mindset change that I really believe we need to have in South Africa. Which is lacking. And it’s being bogged down by too many external issues.

I: Yeah, one perhaps positive thing that I found in my research with the SDGs inSA, is that it seems to have generated collaboration with forums amongst different stakeholders, for example, some of the NGOs have been speaking with the government and communities, so it seems to have created some forums that are good leverage for communication.

R: Oh yes, there are quite a lot of forums out there. But again, like, coming back to your first question, to say, is everybody involved, those forums cannot include everybody. The reality is that they can’t. But the reality is then that a lot of people are left out of those forums. You know, a lot of those forums are for those people that are connected to the world wildlife foundation that do quite a lot about you know, regarding water in South Africa as forums. Even rand water has various forums but again those forums are focussed on municipal employees and their departments that deal with water, there are forums that deal with certain river catchment areas. Now, you are not going to rope in the general household person into a river catchment forum. Because that’s just their focus, it’s just not where they are interested. So you will be pulling in environmentalists, the catchment management specialists, those kinds of people will be linked to those kind of forums. I don’t want to belittle those kinds of forums, I am on some of them, and I think they are really great. But again, just getting back to your first question, you are going to lose some of the people in that. That’s a reality, I’m sure it’s the same in your country as well, it would be the same, there are no ways that you can pull everybody in. It just doesn’t happen and won’t happen.

I: Exactly, because the end user doesn’t really have the knowledge about water management. If I had shortages in water hear, I wouldn’t know, whom to go to and how to fix the problem.

R: Yeah, I h hear you.

I: So focussing on water services again, holistically, what sort of conditions do you think the water service facilities are in? The pipelines, the treatment facilities in South Africa?

R: Okay, they were great, they are not great anymore. The systems, let’s just look at what is the average reported leak rate in South Africa, about 41%.

I: Wow

R: That just answers the question. The leak rate that high tells you systems are not being maintained. Something is falling apart somewhere. That’s average. If you start from that point of view then you realise there is a problem. The system as a whole, in local areas there are areas that are okay. There are really bad areas as far as the system and the network is concerned. Even at the government level, the government is responsible not in all cases but in many cases. Even from a government level there are a few challenges there and on a municipal level or a bulk water supply, we’ve got our own challenges in-house, trying to keep up the rate of maintenance. Our leak rate is sitting at about 6%, so we are not bad. But if you look at the fact that we are a bulk supplier 6% of 4 megalitres per day is still quite a lot of water that is being lost. So as I say, at a municipal level it is really poor. In many areas, not all areas, it’s really poor. Part of that is again because of capacity, again part of it is because of political will. You look on Facebook and Twitter and things like that, you see that people in some municipalities report a leak and it doesn’t get fixed for days or weeks. For a long time in some areas, not all over, in some areas. So yeah, those are some of the challenges.

I: Yeah, that’s great thank you. So my last couple of questions are focussed on solutions. So do you think that rainwater harvesting has any potential in SA?

R: Okay, Rainwater harvesting has the potential, however, the cost, like with so many things, the cost is a problem. Now, if you look at it a kilolitre is a thousand litres, I quickly went on to the internet yesterday just to make sure of the prices, a 5,000L tank if you are going to harvest your rainwater directly into a tank, is going to cost R6,000 now on a sliding scale, depending on where which municipality, you are looking at, between and 7 and 15 kilolitres, it will cost you 27R a kilolitre so that’s even more than 5,000L. So let’s just assume 5KL which is your tank for R6,000, times 27 if I quickly get my calculator, that’s a few hundred rand, so it will cost me 135R to fill up a 5KL tank that cost me R6,000. I think the rest is up to you to make that conclusion. The economics of it is a challenge for many people. It really really is. Unless you are really wealthy, unless you are wanting it for convenience, even if you are wealthy, you are not necessarily, going to do it, I know a lot of wealthy people that don’t have tanks at all. I haven’t got a tank because our water supply where I live has been very stable. There isn’t a problem with it. So I haven’t even considered putting in a tank based on that. What I have done is put in solar because we have a huge problem with that. I took an extra bond on my home to pay for it. So RWH is brilliant it is a good idea, and I agree with it, we educate people on it, and we actually push that when we are doing our water conservation education, the reality is that for a lot of people, it cannot be done. What I do in my garden with rainwater harvesting is all the water that comes off my house actually stays in my garden. So I’ve created where the water collects and then infiltrates into the groundwater in certain areas in my garden. My rain gutters all go in the same areas that I would like them to in my garden. My slope is a bit of a challenge so I can’t do it as well as I would like to in all areas. But you, all the runoff water focuses on feeding my flower beds because I really believe in water conservation in the landscape and that was part of what my PhD was about, yeah, my garden is landscaped to conserve water, you know the highest water use, the thing I have in my garden pots, that I water individually and then I have a small vegetable garden that obviously vegetables use a fair amount of water. So that gets watered once a week as such.

I: That’s good.

R: So I took a bit of a round circle again, but I hope I’ve explained to you about rainwater harvesting. Yes, it will work, if you look at the reality a lot of rural people actually have to. That’s how they survive. I come from a farm and my parents lived on several farms, they didn’t own their own until right very at the end of my father’s life before he passed away. But on every farm that they stayed, they had to have their own water supply and their own tanks on the farm etc.. All farmers will have that kind of, they do not have a reticulation system that’s like we do in suburbs and rural communities as well, many of them if not all of them rainwater tanks, that they harvest water and they save water into.

I: Yeah that’s great thank you, so it’s a shame really because the people that perhaps need it most won’t get it because of how expensive the initial start-up is, fitting it to certain types of homes, like dense communities.

R: I mean, just to add to that, just for your information as well. I mean a 750L tank will cost you R,2,275 as per yesterday, please don’t convert that into your pounds, because that will be nothing, it will be for free, haha, but for us, that’s very expensive.

I: Yeah, relative to household income it is quite a lot.

R: Correct. For some people that would be almost their entire household income for the month. R2,275 that’s the reality that we have in South Africa.

I: Yeah, so going from one expensive approach to an even more expensive approach. What do you think of saltwater desalination?

R: Okay, look I must be very honest I haven’t delved into it that much at all, just because we are nowhere near the cost so I haven’t focussed on that from a business perspective.

I: No worries.

R: However, what I’ve read about is that the electricity issues with it are a huge problem because it takes quite a lot of power to do that. So that’s one problem. The other problem is that if you just think about it from a, you don’t live here so let me just explain, what I am seeing in my head and what I am understanding and what I know, is that the water will come from inland and be stored in dams, further inland. So whether that’s 10km or 50km away from the cost, the water is stored in dams. Then from the dams it is in many cases gravity fed, but in some cases, they do have to pump as well and then it gets pumped and it gets purified and then it gets in many cases, gravity fed from the pumping stations. Then it gets gravity fed all the way down to the residential areas. A lot of them as we would assume are along the coast as well. So now if you are going to desalinate what are you going to have to do? You desalinate now you’ve got to have another system or you have to reverse the system to pump uphill again if I’m making any sense.

I: Yes.

R: Look I’m not an engineer, this is just my own thinking about it to say well hold on, to implement that correctly on a larger scale will be a problem.

I: Yes.

R: Sorry, I’m not really adding huge value to that statement. Just because I don’t work in that field at all.

I: That’s fine. It’s a very energy-intensive approach when there is already shed loading.

R: You are right.

I: So really it’s going to take a mix of different approaches, participation and government will, a lot needs to happen. It’s more complex than just one solution.

R: Oh, yes, most definitely. There are no ways you can try and deal with this in one approach. Also, our country is really vast and large. Because of that, you have a whole mix of different needs across the country. Trying to implement a solution in one area won’t necessarily be a solution you can apply to another area. I think you have to be fit for purpose for that area.

I: Yes. So do you think integrated water resource management is a good thing?

R: Yes, I think it is a good thing. When I think of IWRM it’s not just about the supply of potable water but it’s the whole value chain of the IWRM. So if you are dealing with it from a conservation point of view, from a withdrawal point of view to the supplier, to the wastewater that comes back into the environment again. Yes, we sorely need that. Because we have a huge problem with the sewerage facilities that are not well maintained. That is putting substandard and in some cases well below sub-standard water back into the natural environment. Which is a problem, yeah. The organisation that I work for actually has stopped taking and withdrawing water from one particular, what we call water barrage system because the water is so polluted that it is a problem to purify and put back in, not that it’s not possible but there is a cost and an expense. A whole change in our purification system that we will have to cater for that. They are reconsidering it now because of the water issues that we have, you know, the rainfall and climate change but for, I’m going to guess, a good 15 or 20 years they haven’t used that entire network system. They’ve taken from another system to withdraw the water. So yes, an integrated approach is really critical because it impacts everybody. You know whether you are a withdrawer or somebody on the receiving end.

I: That’s great, thank you.

**WSP2**

I: I will start with a very broad question and it’s more speaking on a holistic scale, what do you think the main management factors are that are limiting water availability in South Africa?

R: Indeed it is very general. I think the standard thing and it is not in any particular order of importance. The most obvious is the limitation of the available water in there to begin with.

I: Yes.

R: That is almost a given. The actual geographical availability overall is lower than average, relatively speaking. But, having said that the way in which from a management and stewardship perspective, the way in which we interface with the water systems so to speak, leaves a lot to be desired. So some of us sometimes we begin to redefine, tongue and cheek, the type of droughts, there are droughts that are happening as a result of the usual challenges that we have and there are droughts that happen because the management thereof is not happening properly. So I don’t believe for once that the physical shortage of water, I think it is less serious than our ability to interface with the system of water management and stewardship. Then you have got the usual thing and obviously if that inability can be managed in terms of human capital, aspects in terms of capability, who is managing who is not. I think one of the things that we tend to overlook is the fact that the water domain even as a subject matter. You don’t necessarily train it from lower levels, the tendency is for it to train it, not even at first year level at universities or so on. So there is a gap in the manner in which, even our own curriculum is constructed.

I: So there is a lack of trained personnel to deal with the management problems.

R: I would say there is not enough. Because I think what we do have we are not necessarily utilising them better. Because water connects with everything, a practical example, when we talk about agriculture, you have to be an expert to know that on the whole more than 60% of the water goes in to agriculture. But if you talk to agricultural people they would tell you, when they have one drought they want all the water to go to agriculture for food security and everything that goes with it. So there’s an element there of saying even the capacity that we have needs to be redirected or directed in a manner that gets maximum benefit or maximum impact.

I: Yeah and with the systems in place at the moment, are there particular stakeholders that are losing out more than others as a result?

R: Look, I think my response to that is, the first thing that comes to mind we cannot overlook the fact that historically speaking there has been asymmetries resulting from whether you call it the colonial era or apartheid era or whichever way from a social construct you present the reality is that there has not been a holistic way of looking at some of these things. So the first thing is that you would do your statistics, even today, you still have gaps that are a result of the historical, you know, the historical aspects of where we come from. That’s why our policies even say we must deal with inequality, both in terms of what is happening currently and what may have happened in the past. There’s lots of examples to that, when change came some 20 years ago. We had quite, in terms of water services, we had quite a very low level of access. We ramped it up during the millennium development goals period, we are talking about 95% access in all of that. We were very exemplary. But now when you start looking at sustainable development domain, you find that the numbers are going down because at that time for example, we had a policy that you may be aware of what we call free basic services, which was 25L per person per day. 200M from the standpipe. Now we are saying universal access yard connections. So that gap needs to be closed in one way or the other and you will find that most of the towns and rural areas, because of the nature of the design of supply systems, you still have serious gaps there. Whether you are looking at it in terms of sustainability, continuous supply, or you are looking at it from the point of view of historical inequality that was there. Then you can put in a whole lot of other things, is it rural vs town, is it poor vs rich, you know those kind of things, so you’ve got a lot of, multiple factors.

I: What seems to be happening a lot from what I’ve noticed is there is a lot of migration from rural communities to urban areas, they are not well planned, there’s no infrastructure, so it’s hard to provide the communities with their needs.

R: Obviously that gives you a dimension of the inequality of the differentiated supply in all of that. People would migrate to where services are happening and where the economy is happening. One of the things that I think especially as researchers, we need to start thinking about. Is this thing that actually migration is triggered by other things, things other than services of water. Generally within the water domain. It’s more, if you look at it holistically. It has to do with socioeconomic standing of communities.

I: Like job opportunities.

R: Yes, communities want to go in to places where they are able to make a livelihood. The second area is this issue of migration and the development of built up areas like your cities and all of that. I don’t think it’s a problem of SouthAfrica, that type of migration. I think it’s a problem globally. Africa, sub-sahara and all of that where we are arguing that more than 60%, I can’t remember the exact statistics, you can check that, is becoming cities. Myself as a researcher, I would say it’s a problem because it looks like we have normalised that kind of movement of people. We assume that it is normal and nothing can be done about it. Yet, at the same we are talking about stewardship of natural systems and water in particular. So there’s a bit of a challenge there when you start looking at it from the point of view of the management of the water system if I can put it that way. The system across the board, whether it’s natural state, or you transfer it other areas and so on. The last point is that we need to take in to account the historical aspects in terms of South Africa, where the economy was largely based on mineral sources and so on. So you end up with areas where under normal circumstances you would not have the kind of development that has taken place, but because of this mineral industrial complexity, whatever it is, you then end up with places where water had to be transported, through very expensive infrastructure. To try to address that requirement. Within the Guateng area, when Randwater was established in the early 1900s, the uptaker in terms of the user of the water was mainly the mineral industry. The numbers are suggesting about 90%. When you start looking at the systems that we are managing now, it has reversed, it’s now 10% mining and 90% usual usage of other requirements.

I: Wow.

R: It doesn’t take rocket science to see that in terms of replacement of the infrastructure that was developed and maintenance thereof. There will always be a shortfall. Because the infrastructure and the systems that were created were created for a particular scale, size and shape. It’s no longer required. I always use an example of saying: It’s like you have a 14tonne truck used to carry cement bags to build skyscrapers, you keep it, but you use it to carry 10 bags of cement to build a shack.

I: Haha

R: Haha, it doesn’t make economic sense. Another dimension is the dimension that talks to the original dimension of saying, yes, our economy now as we speak as a country, yes, it must be seen as bigger than the others in terms of South Africa and perhaps sub-sahara it’s amongst the top 5, whatever. But the reality is when you look at the infrastructure to support, whether you are looking at it from a water services provision or management of natural systems. You can’t finish the questions unless you connect the original transboundary issues. Because there are connections everywhere. The question is, how do you scale that? From local to national. When you ask a question of, what is the level of inequality or something like that? At what point does that inequality get impacted by the fact that you are dealing with a point in the scale where you are talking about South Africa with 380 million people?

I: That’s helpful thank you. So the infrastructure that is in place was designed for a different purpose. Also, the infrastructure now is poorly maintained there’s a lot of leakage. Do you think that comes from a lack of capacity to maintain it?

R: Yes. The numbers would say if you were to do a simple calculation that in the medical fraternity they do. Where they count a professional per thousand in people, you will find that in this domain the numbers are not adding up. One of the key issues is that by design, water is part of the network industry, which largely have to be dealt with centrally.Whatever that means. I am not wanting to go in to the social sciences, because I’m no expert there. But, the reality is that you have a situation whereby design, the water project or water system, is part of a network industry that is centrally determined. Or designed and so on. The same can be said for transport, communications and other things. So there’s a baseline that needs to be on a shared platform, but within the context of water it’s not as easy as electricity for example or energy, the transportation thereof. It becomes very expensive, whether you are talking about storage and distribution. I’ll give you a practical example, distribution dimension of the areawhere I am, which is Gauteng, is completely different from the eastern side like Kwazulu-Natal, the Indian ocean side. Because there, you are also talking about places where in the rural area, people are much more dispersed, so you can’t have a system that is so centralised that you can provide that, so you need to mix a distributed system in all of that.

I: So, each issue needs to be managed locally specific to the certain challenges.

R: Yes. If you look at the total country including some of the issues relating to climate change and so on. You will find that, yes we are saying, the western side of the country is drier, then the other side there are floods. So you want to be ale to manage. The other side is groundwater. You know that groundwater recharge and other things takes a life cycle of their own. So we need to manage it in a way that locally we are able to respond to the pressures that come with the changes that are induced by where we are.

I: Does that introduce integrated water resource management as a good approach?

R: That’s correct. Some of us are now talking about some sort of a transdisciplinary way of looking at it. Because a connector is not necessarily liquid water, the amount of water that can be connected within a land mass of South Africa and the amount of water that can actually be shared and transported and all of that, we’ve got enough numbers. It doesn’t really change much, so what we can change is these other factors.

I: Like the water energy food nexus. Interdisciplinary.

R: Yes.

I: Talking of a local scale. Often there’s communities that are negatively impacted, how can they get involved in water management. Are they fairly represented? Is there enough opportunity for public participation?

R: It’s a tough question because if you were to ask me when I was a full time official of government I was probably going to say yes. Now, in my capacity working within the research domain, I would say to you, on paper, yes. Meaning, our policies and strategies, if you look at them for what they are, that is what should happen. But, when you start checking the impact and drilling a little bit deeper, you find and I am being modest here, there is a lot to be desired. Because the issue of, this is very recent in terms of the conversation I’ve had, there’s one area I would be very interested to talk to other people who may be seeing this, one of the things that some of us are picking up is what we call knowledge and information flow dynamics. Some of us are moving away from saying a person must be taught how to determine PH or whatever. The technical knowledge and technical know-how. But, the biggest dimension is what I am calling knowledge and information flow dynamics because if you allow people to understand that which we are managing the rescilience will start happening because besides the improved access and even through media and other things we have not done much on the what I would call indigenous knowledge systems. In other words, we need to be able to look at some of the things that locally people interface with the natural systems and we need to incorporate that into our curriculum into our analytical tools and and and… you can hear that I did not say that we must Africanise the curriculum but somebody might say no you are talking about that. So meaning that you should work from the point of view of society, communities, being able to interface with the natural systems with water, all of these things. Then generate the capability through that.

I: Yeah, there’s a need to facilitate that because the indigenous knowledge is very beneficial because they have lived experience of the challenges. But one of the issues is that the end user might not know the complicated dynamics of water management, for example if I faced water shortages I wouldn’t know who to talk to and how to fix it. But there needs to be an interfacing of communication. So, how can that be facilitated? Would it be through forums?

R: Look that’s part of it because remember I carefully said, the difficulties in one of the questions, I can’t remember the exact question. When I came to the idea of knowledge and information flow dynamics, it’s because if you look at that we are not measuring things like knowledge sharing, because knowledge sharing may be happening but, the question could be, the moment you talk about how knowledge and information flows, sooner you will bring in the issue of power dynamics. You see. Who is the provider of the information the knowledge? And who is the recipient? You know what I mean, communication is a big part of it. Advocacy is a big part of it. There’s no doubt. But you need to shift a little bit to begin to say communities at different levels of scale and different levels of decision making, they need to be able to make informed decisions. Not necessarily because they were informed but because they have got an appreciation and an understanding of the complexities that we are dealing with. In the language that they will understand the systems.

I: That makes good sense, furthermore, the SA policies they are very well written and scientific but where they tend to fall down is implementation. That seems to be the common theme. Have you found that the SDGs have had any influence on water management? Target setting?

R: Target setting is very easy.

I: But achieving them is not!

R: Achieving the targets is very interesting you know. I want to approach this question of yours in two ways. The first one is, what is on paper as you have said, if you take the policies of South Africa and the region as in Southern Africa, then you go into subsahara and maybe even global and you make a list. From the individual community type of thing. You will see that these things are a lot you layer all of this. I tried it actually. I’ve got a student who is dealing with infrastructure and how we can measure the infrastructure in all of that. So I took a list, I counted to a particular locality, and municipality I think I only went to 15 or 20, just regionally from the integrated development plan, the water services development plan, strategies that are run by either a local traditional leadership, then you’ve got provisional development plan, you’ve got a national water resource strategy, I wrote the water security framing and all of that. Then you’ve got a whole list of things that you can actually put on top of each other. If you go in and look at the natural system in terms of water sources, they are all on top of one point. Then you can imagine the whole domain of multi-layered governance and rules and all of that. It’s quite onerous, I’ll give you an example. We say as scientists and everybody else that RWH is a very important issue locally. But still if you go to the majority of the municipalities, they do not have bilaws which would say when you build a particular infrastructure like this, you need to be able to make sure that you’ve got rainwater harvesting whether you are a factory or a house, you don’t do that. But the opportunity to do that is fairly straight forward because you simply consult and check with people, they agree and then you’ve got certain basic standards. Then rainwater harvesting can come in and and and… there’s quite a lot of things that can be done. The number of layers of plans, is something. You reach in what we are doing as a country, is also what they’ve recently introduced called the district development model. DDM. The objective of that is very simple, we want to see one plan at district municipality level, makes a lot of sense. But it’s taking us about 3 to 4 years to get the tool. So there is a bit of a element of planning in the issue that you have just raised and the tools that you use to do the planning.

I: Is there a need to simplify things, because there’s so many different policies?

R: Yeah, some of them are very good. No doubt about it. But they need to be realisable.

I: Within the limits of the capacity that the government has. My final question is we can speak about rainwater harvesting and different approaches, but, it seems like you are going to have to need specific mixes of different approaches to come together and adapt to the specific local environment in order to improve local water availability.

R: Definitely, the work that some of us have done.You know you probably talk about this as well in your own environment, where we talk about alternative sources of water. What we have done which we are still debating in terms of whether it makes sense or not and I can throw it at you from a research perspective, some of us have been arguing that you probably need to have a category and I am putting it as category to simplify my explanation, of what has been described as virtual water. So far when you talk about alternative water, you talk about groundwater, rainwater harvesting, reuse, so on so on, waste water reuse and other things, recycling and all of that. But we speak of virtual water only from water footprinting, I’m suggesting that we need to talk about virtual water as some sort of a category, because it will then compel us, it will force us to bring in or to mainstream the economy of water.At the present moment, you will see it in some of the plans as in the integrated plans, and so on, development related. Often, you will find perfect plans done but water comes after the plan has been done. So, you spoke about migration, you know that the movement of goods and services will also impact on the deficit or surplus of water that is available to do whatever it is that you want to do.Whether it is about development, or about bringing in those that don’t have access to water in to the mainstream. And so on, so that to me also, it sorts of compels us to start talking about water from value chains perspective. You see, it’s avery nuanced difference. It’s something that we think we are doing it but I don’t think we are. But we talk about nature based solutions and so on. If you walk in to a water utility that provides bulk water and you tell them about nature based solutinos and systems that we can do, my organisation, will take a long time to try and go in to that because we are running infrastructure that has been developed over more than 100 years. So if it works and you start getting various old values of why fix it if it aint broken?

I: Thank you.

**WSP3**

I: What are the main causes of water scarcity in South Africa?

R: South Africa is a semi-arid country, which means there’s less available water in rivers and dams. When it comes to the available water, the water is not distributed equally which makes it a scarce resource. I have picked up that agriculture consumes above 50% of available freshwater in South Africa.

I: What groups or stakeholders lose out most in the distribution of water? Who gains the most?

R: Agriculture gains more water in South Africa, while people get less especially in rural areas, there is no water.

I: How well do you think water resources are being managed to prevent water scarcity in South Africa?

R: It is managed well, and some different laws and regulations are applied to water management in South Africa. The big problem of water challenges in the country is water pollution. Most companies are discharging untreated effluent into the rivers and dams which makes it hard to treat such water. Then most of our resources are polluted.

I: How efficient are the water service infrastructures?

We are also battling with old infrastructure in the water sector, due to a lack of investments, a lack of qualified personnel in the water sector, and poor maintenance. This has a huge effect on the water services and infrastructure, where now old water treatment plants are still used without being serviced or building new ones.

I: What condition are wastewater treatment works in on a national scale? What are the causes for this?

R: Wastewater treatment works are deteriorating, most are old, and few new ones are building. With the old ones existing, there's no personnel to operate such machines and you find that at night, there's a breakdown and spill. This results in effluent discharged to be not in a good standard. There are a lot of reasons why it is happening, with political interferences and the national crisis of load shedding (sharing of electricity) being the top reasons.

I: Have the SDGs given a good framework to work on reaching water security in South Africa? How has South Africa been progressing with SDG6?

R: Yes, there's little progress in that sense because the country is facing political and electricity uphill which is making everyone forget about other objectives and problems. SDG 6 will be achieved even though it's at a snail's pace. We find political interference in service delivery so making a whole thing a mess.

I: Are you familiar with the National Water Act 1998 (NWA 1998), what are its strengths and weaknesses?

R: Yes, it's our drive in the Department of Water and Sanitation. The strength in the regulation, implementation part, and management of resources using the NWA, 1998. You still find dams being managed by Department and there's application to anyone who uses water. I think that’s great up to so far. However, the gap is on polluter pay principles. We find companies can pay a hefty fine for polluting the environment, but the amount is not equivalent to the damage it has caused. Also, in the financial management part of it, a lot of funds are mismanaged which are means for rehab, citation of environment, and water sector especially in the Acid mine drainage.

I: Are mining companies doing enough to address their impact on water security?

R: Mining companies are not doing enough, there's a lot of acid mine drainage in the country and there are few experts in that section. Water discharged from mines ends up polluting rivers, and underground aquifers without anything happening to the mines and companies. Polluter principles it's not covering everyone or money doesn’t solve environmental issues.

I: Are you a part of any forums to discuss water scarcity in South Africa with other stakeholders?

R: Yes, am part of the Youth Parliament for Water in South Africa, it's an organization that’s involved in the water sector. It's more of education, awareness, emulating ideas, and trying to solve the water crisis in the country. Benefits, yes, my colleagues went to New York as part of delegations to represent South African youth in the water sector. Opportunities are there but they are also scarce. You need to keep looking and sometimes, get a hook-up from someone to get the opportunity.

I: Do you think there is enough public participation in water management?

R: I think it's 50/50 based that there are a lot of NGOs who are doing public participation and are involved in the water sector in Urban areas while there's most people in rural areas don't have the background and know much about water quality and water distribution. The government is also involved in public participation, but it will never be enough as there's a lack of education and a lack of career choices in the water sector.

I: Ultimately – What needs to happen to improve access to water in South Africa?

R: I think we need stability in terms of politics and electricity problems. Then from there, we go back to appoint relevant people in water departments and sections. From there, educate existing staff and update them on SDG6 and what needs to be achieved. From there, follow up on mining industries on what are they doing to remedy Acid mine drainage and air pollution which has an impact on water quality and people. From there, we can do boreholes for people who don’t have water and fix existing infrastructure, especially waste to be able to transport and treat wastewater to reach an acceptable level.

**WSP4**

I: South Africa is quite a unique and different country in its natural geography than the east, which is a lot wetter than the West and the natural geography geology of the country. So what do you think are the main challenges for the water infrastructure to distribute water equally how can we go about that with such a challenging climate?

R: Yeah, not really that it is wetter in the West. Actually it is semi-arid, we struggle, people suggest droughts, everyone else, our problems are not actually unique compared to the rest of the world. In south Africa in particular, divided in to two different provinces. Still the challenges are still not the same. So the challenges are always geographical.

I: Okay, so for instance and Johannesburg was built around the mines and usually cities are built around water sources, so the transboundary aspect of water transfer schemes. That must be a real challenge for water service providers?

R: Look, Johannesburg, it is a city within the province of Gauteng, it is not a very wet city. But we’ve got transfer schemes that are coming from different countries.

I: So in terms of the water infrastructure in South Africa, what condition do you think they are in?

R: Yeah, so it is difficult to tell, because also it differs from geographic area to geographic area. For example here in Gauteng, Johanessburg, there is no challenge when it comes to water infrastructure from the water utilities, well advanced, we produce for example, almost 5,000 Megalitres of potable water per day. That is one of the day, actually one of the largest in the world if you think along those lines. But you find that other provinces produces much less compared to that.

I: So what do you think is going well to make sure that the water infrastructure you’ve experienced is in good condition?

R: For us it’s experience, the skills, quality of skills. Probably over 120 years already, knowledge of water treatment plants. Especially, potable water treatment.

I: So for areas where the water infrastructure isn’t as good, do you think it’s important for education and train to take care of the water facilities?

R: Absolutely, correct.

I: Yeah, is that a challenge?

R: Yeah, I could say that. It is not really a challenge, it is there but not really to the much bigger extent that we would want to see as a country.

I: And it is harder for the rural communities.

R: Yes, that is true.

I: How do you think the rural communities could be better supported with their rural infrastructure?

R: Look, put some more investment. It’s a matter of doing it. The skill is there, the capacity is there. We must simply do it.

I: Yeah. So do you think there is a lack of political will to invest?

R: Not really, I think there is a political will. Because water resources are very important.

I: So, what do you think is preventing the investment and successful implementation of these water facilities?

R: Challenges, I would guess. Obviously, I can’t pinpoint on one thing. The legacy that we inherited from the previous government. So there is a huge backlog and the population keeps on increasing.

I: It’s also worsened by climate change.

R: Yeah, correct. From your side there, what are your challenges there?

I: In terms of the water here, we have a lot of pollution at the moment there's been a lot of issues and protests around the wastewater so faeces is being pumped into our water systems and the sea.

R: Okay. Also, the problem of education is also similar?

I: That’s the thing. The challenge is you may know about the water but this is who do you speak to if you have a problem like for example in my experience if I had a lack of water I wouldn't know who to speak to about it and what to do so I think in both situations public participation and the connection between stakeholders is really important.

R: Yeah.

I: So do you think that happens in South Africa, are there opportunities for to collaborate and communicate indicate with water service providers and the government?

R: Yeah, yeah there is. Yeah, there’s not so much politics when it comes to water resources, it is a resource that everybody agrees it is important. The issues of water conservation we take them very seriously.

I: Are there initiatives to help support local communities and give them opportunities to participate in decision making?

R: Sometimes you get this public comment, public involvement in terms of policy drafting. Those things are involved. The entire public have got the opportunity to contribute and the department they make decisions on the recommendations.

I: Yeah, so it is important to have that opportunity to listen to the community.

R: Yes.

I: Brilliant. So, in terms of policy, how much does the National Water Act 1998 influence the work that you do?

R: Yeah we’ve got the standards that is obviously linked to WHO, which is a guideline for potable water. So, 99% of the time we meet those targets. In terms of policy and laws, water is a right. Actually a right. We don’t have issues and disputes around the issues of national interests.

I: So do those standards tend to be around the concentration of pollutants?

R: Look we’ve got the national standards. We call it South African national standards 241, that’s for potable drinkable water. We have other ones that are related to air pollution, waste water discharge, they differ from municipality. Each municipality have got their bi-laws that governs the discharge of waste.

I: Okay, I understand. So, how big of an issue is acid mine drainage from your experience?

R: Well, I am actually doing a project related to that, also for my PhD. It’s a challenge, I’m still working on it and I am working on the treatment methodologies around that. We are looking various techniques in nanotechnology in order to solve this problem. We are also looking at you know, biodegradation side of it, using waste to treat those things. So there are a lot of innovations that are going on when it comes to that. Yeah, South Africa has invested a lot of funds into water research when it comes to AMD.

I: That’s good, those kinds of technologies must be quite expensive.

R: They are, nanotechnology is.

I: But in terms of preventing pollution and the economics of removing the pollution, that should pay itself off in the long term?

R: Yeah, I would guess. Wherever people are making money in terms of industry, there is a certain level of pollution and waste.

I: That’s true. So in terms of mining in South Africa now, after mine closure, does the mining company have responsibility to clean it up themselves?

R: The companies have got responsibility to rehabilitate after they have done whatever operations they are doing. They have been doing it. Probably there will be a few who are non-compliant or something like that. Yeah, there is a procedure and a policy to rehabilitate after they function.

I: Yeah, so what does that involve, does that neutralising the Ph?

R: Yeah, you see the problem with neutralisation is you are still putting another problem of putting more salt in to the system. That affects the potability of water downstream. It makes it very difficult to treat. So neutralisation is also not the solution of the future.

I: Okay, so do you think the solutions of the future will be technological?

R: It will be technological, it will require the involvement of all the stakeholders. Including the communities, it is just going to be a multi-disciplinary solution.

I: The same goes for water management in general and people working collaboratively.

R: Yes, correct.

I: In terms of that, do you think the sustainable development goals have provided a good framework for working together to reach targets?

R: Yeah, I agree. In line with the sustainable development goals.

I: Yeah, we have SDG6 for water, do you come across that in your work, does it give you any support or targets?

R: I guess it is a national interest, we are working towards that goal. In terms of the partnership that is required, the innovation that is required. The kind of involvement that is required.

I: It is a collaborative approach.

R: That side, how does it work there?

I: From my side in England, we know that we have to work towards to the SDGs, you don’t here about it much in terms of what is required in terms of every individual. It doesn’t trickle down. I think it is better at supporting corporation and large industry by giving them targets. Like my university we have targets to be carbon neutral and that kind of thing. In terms of water management we don’t really hear about it from my side.

R: Yeah, so tell me about the problems that you have that side?

I: South Africa is a very country politically with the legacy of the apartheid and how water was distributed very unfairly, now you have new policy and a democratic government that want to distribute water equitably. I’m interested in sustainable development and my degree was in ecology so I am passionate about the environment. So it is interesting to see how the government are trying to address the inequalities of the past. The policy that I found in South Africa is very good, but there’s struggles in the implementation. So I am interested in why the policies aren’t being implemented as effectively as they could be.

R: Okay, interesting.

I: So, why did you choose this area of work and acid mine pollution as your PhD focus?

R: Like I said before, waste is very interesting. Waste alone is very interesting. The idea of starting a business, each and every business they produce a certain level of waste. We have undermined that area, somebody must treat it. So, it becomes very interesting including the acid mine drainage. It is a product of money and waste.

I: So my master was in the green economy which is about trying to balance economics and the environment so, how can humans function with the environment, so functioning without polluting the environment. Limiting the environmental impact. So for example in South Africa you have got loadshedding really badly at the moment, that must be impacting your day to day life and everything, irrigation. When you have so much solar potential in that country.

R: Yeah.

I: For example, the electricity South Africa is still very reliant on coal.

R: Look, the coal this side is almost abundant and it works very and you’ve got the infrastructure and you’ve got the capacity at management and they know how to use it. Really, other things, it is not as sunny as you would actually think here, especially in the winter certainly we are struggling. Some of the provinces, because the day is very short, sometimes it is not true and besides that it is just expensive to have solar especially for many many of the households.

I: That’s the thing and the same with rainwater harvesting is it could be a good solution but the initial setup costs can be off putting. But really the biggest change would be from the government and the investment in solar, rather than small-scale household solar projects. Larger, solar projects, not just solar but renewable energy to ease that reliance on coal because yes, it may be plentiful now but eventually it will run out and at the same time it is contributing to climate change.

R: Yeah, because if most of the coal is being bought by people like you in England and you keep using and then advise other countries not to use it, that much.

I: That’s true as well there’s a hypocrisy from developed countries where we used coal to develop and now we are a well developed country and now we are telling developing countries not to do that. It is unfair in that sense.

R: For sure, yeah.

**WSP5**

I: My first question is about the natural environment of South Africa and the natural geology, the climate. So what challenges does the natural environment of South Africa present in terms of water service provision?

R: I think, firstly from a climate aspect the country is a water scarce country by nature. The east of the country gets more rainfall than the west. I am in the East province, we do get rainfall but I think we’ve had 5 to 7 year cycles of drought and then we have a 5 to 7 year cycle of rain. In the last 5 years we’ve seen things we haven’t seen for a long time, which is extreme flooding events, normally out of season. We had major events last year on the East coast, in the middle of winter, this is a summer rainfall area. The west coast, around Cape Town have had significant droughts and so on. It is typically the dryer side. South Africa has had to construct large storage dams to fill with water. It’s very beneficial in terms of drought. We can typically run on the storage water for at least 3 to 4 years, you know. While implementing water rationing and your systems for managing drought. So, saying that, then the management of water involves social engineering, as you know, to transfer to water management that serves everybody and that is basically in our constitution and our bill of rights where access to water and sanitation are a basic right in our country. So, after 1994, providing that right has been a big challenge. Because there are areas that practically have not much infrastructure. So the government decided to build infrastructure to extend access and provide basic services. That presents a lot of challenges. Providing access. The economics around that have proven to be really challenging. Depending on the economics of the council and the affordability of water, it puts stresses on the quantity available and the biggest risk we currently face around losses. Going forward, we have to do a lot of rethinking around that.

I: Yeah, you transitioned nicely in to the second question that I was going to ask. Which was about, how does the water infrastructure deal with the challenges of the natural environment. So what condition do you think the water infrastructure is in in general, the waste water treatment and the pipelines?

R: It needs to be, we have some very good infrastructure, from a water screening perspective, our dams and large infrastructure, it’s been there for a long time and was very constructed. They have proven to be quite convenient and safe. Transportation systems for the dams typically works, actually very good. We are in the process of rethinking how do we secure that type of infrastructure. We have had to deal with a number of new water works and providing new access. Again, water quality is an important aspect, it is not just providing the quantity, you have to make sure that water is safe for consumption. It is in a very delicate state a local government level. So what we have in South Africa are water boards. We are basically a bulk service provider, we sell it in bulk in the municipality. Who then charge a retail fee. In many parts of the country there are no water boards to govern it. So the municipality have chosen not to use a water board. Who then bring a legal aspect, our laws allows the municipality, are called water service authority, which means they have the power to choose the service provider. Although I work for a state owned enterprise, it is a bulk service provider. We provide them with water, in many cases, they choose to do it on their own and that has proven to be very challenging, because the skill and the capacity and the knowledge and capacity to maintain it are really challenging, so those systems are failing, those municipalities do not have good support, especially in rural areas. It is very challenging for the people who run the infrastructure and then you will find the level of quality of water decreasing, from a natural area, a built up area. Wastewater infrastructure is not so good. We used to do very well, but recently because it wastewater costs a lot of money to run, it does not have any revenue attached to it, so therefore, investments are limited and that is extremely challenging, we are not compliant in the effluent standards, and as such we are limiting the water resources. It is a hard sell, people don’t want to have to pay for waste water. If you don’t invest enough in treating water, it’s very expensive. The economics around wastewater is already challenging.

I: In terms of water quality, there are a lot of challenges in pollution, what approaches are in place or what approaches do you think will contribute to alleviating the pollution levels and protecting water quality in South Africa?

R: Pollution is a very serious problem. The water act is probably one of the leading documents around the world. In terms of how we look at it, it deals with many aspects. Then we have a water services act which deals with how we provide the services. In that, you have the department of water and sanitation which is an administrative tool. At national level you have the minister of water and sanitation, it receives attention at the highest level. For regulation. We have the green drop and the blue drop system. These are good indicators of how you are performing in water quality. The blue drop deals with potable water quality, the green drop deals with wastewater and it’s impact. Those are indicators that paint the picture of where we are. The risk associated with environmental aspect. We are also have department of fisheries and agriculture. These looks at different portfolios. They look at how we can impact water and the many aspects. There is a plan to try and improve that going forward. More importantly, how should we do the investment structures? You’ll find that we have a national water and sanitation master plan, basically at national level it paints a picture of what we should be doing going forward and what are the key strategic investments required? What is the cost of that? Those are segmented down to municipalities. The state provides significant grant funding to make sure those aspects are dealt with and managed going forward. So it is quite a good idea of where we are. A very good angle of where we need to be. Obviously, from a funding aspect, there needs to be more grant funding. A certain percentage will be used to deal with compliance. But it is a complete model, yes we are there. Basically we know what the problem is and we have really good plans and responses to it, but those are multi year plans. Those plans could be better or quicker, depending on the events we have.

I: Thank you. Like you say, South Africa tends to have very good policy, but where it falls down is its implementation. Do you think there is enough monitoring, for example speaking of water quality, is there enough actual implementation of the policies, so, are we implementing it and monitoring it to make sure that what the policy is doing is working?

R: Yeah. I think the monitoring is in place and the regulations also, very well, I agree with you, in terms of the interventions and the level of commitment to it, at a municipal level, that requires significant effort. We work very well at the middle level as a bulk supplier, capable and able to capacitate utilities. Municipalities on the other end, it’s like running a business, you don’t provide services to both the rich and the poor, so if you have municipalities of largely rural nature, their revenue streams are much less, you find the level of compliance in those areas to be quite challenging or significant. The state acknowledges that. There is a required funding, to improve monitoring and also to provide compliance. So you are quite correct, you find the peri urban and rural areas are the ones that are particularly challenging. It is primarily an economic impact on how it is maintained and upgraded. So there I think is a universal challenge we have, around the world and in South Africa particularly, the economic impacts are significant. The funding from the national government, which is there, but you can’t get all that funding in the first year, because you have got to spread that funding across the country. But certainly, I recognise, there is a lot more to be done there. We are now finding that the metropolitan areas, there is a significant migration. People moving from rural to urban areas. So the big city populations are on a steep trajectory and what that is doing at the same time is putting the city funding under immense pressure. So, it is overloaded and running at full capacity and requires significant funding to improve. Migration is certainly upping. Those are all the social dynamics around it. Certainly more urban infrastructure in cities are under immense pressure. So you are finding the same compliance now moving towards it. While you can see it, manage it and measure it, the responses are much more difficult. Trying to provide more liberal conforming. Certainly in Durban where I live, within the last 10 years we went from 2 million to 4 million people. They are looking at projecting to 2030 and 2045, the impacts of climate change, that figure could go to about 10 million. So, to build infrastructure and keep up with that level of growth is almost impossible, especially in built up areas. So, you can see that, type of challenge is becoming damning to areas that are working well. I think it is a universal phenomenon. It is starting to impact all the businesses and infrastructure.

I: Thank you for your answer there, that is very informative and like you say, it needs funding, but then also there are also other very important and critical parts of government that also need funding, like energy as well. So it is hard to balance the allocation of the funds. Do you find that the sustainable goals provide any valuable framework in your work?

R: I think, it certainly does. We have embraced the SDGs into government planning. Into regulation. Together with climate change compliance, COP27, all these things are drivers. They certainly provide more momentum, more access to funding and more sense of collaboration. So yes, the SDGs play a significant role. I think all this can impact water in a big way.

I: Yes. Are you part of any forums to discuss management with other stakeholders?

R: Absolutely. Scientists, NGOs, activists, environmentalists, and various other people that engage. All that provides the momentum to make sure the dialogue is at the forefront. That level of discussion amongst professionals is allowed to take place. It allows stakeholders to voice matters of concern and overall share a caring way of trying to solve problems. I think these kinds of issues must have social dynamics; water is a very social entity. It is not just about the engineering or the science. I have learned over time that you have got to build with the social and behavioural impact of water. Which is across many disciplines, you know. So yes, we do engage quite a lot.

I: That’s great to hear, it must be challenging though where different stakeholders have different ideas and different needs for the water, it is hard to balance it so that everybody is equal.

R: You know, farmers and agriculture will always be the ones that access water first. If you look at our distribution of water, agriculture are the biggest users of water in the country. Domestic use is small. But, if we push domestic efficiencies, domestic use would be less, but agriculture has been very inefficient. So, the driver now is to get agriculture to become more efficient. Farmers are realising that. It becomes a real ethical balancing act, to provide access throughout.

I: So in terms of farmers having the larger share of water, how do we incentivise them to waste less water especially if they are not paying for water. It must be difficult to encourage them and for them to understand the need to conserve water?

R: It has been a difficult one, but I think, water rights were given to people many years ago. Before democracy, the process of change around water rights in the legislation has been reviewed. People are now applying for licenses again, with different conditions, different abstraction, different yields. So you have got to look at those licenses. I must say, farmers are really coming on board. In Cape Town, it almost went to zero, it was only adverted because farmers came in, reduced their abstractions and allowed the city to recover. It is a positive thing, they will see it, also realise they could actually do better business by optimising and using the irrigation better. There have been real developments in irrigation around the world, smart irrigation is saving a lot of water, efficiency has certainly been upped in that space.

**WSP6**

I: What do you think are the main threats to water quality in South Africa currently?

R: I think as a water scarce country, I think we can look at climate change, I think the lowest rainfall that we receive, it limits the amount of water that we have. Also looking at increase in population, growth in population compared to the water demand and the water resources that we have. I think, for now, I can say those are the two major, OK, maybe I can add a third one, because I feel like the water resources that we have, we also deal with a lot of pollution. So you find that we do have rivers, but now it is polluted beyond, to a point where we can’t really use that, it is no longer suitable. So I will say it is climate change, increase in population, the increase in water demand and the availability of water resources and also, river system pollution. I think those are the main three points that contribute largely.

I: Thank you, what do you think are the main sources of pollution?

R: I think in urban areas, I can say that we deal with a lot of different companies and factories that release effluent into the river system. You find that effluent does not really conform with the standards of the department of water and sanitation, but they can always say, if you can’t really treat your water to this certain extent, you can always pay a fine. But still, we lose that water. Also looking at, we have a lot of issues with our waste-water treatment plants. Municipalities and staff, you find that they actually release water that is not well treated, into the river system. For instant, in Gauteng we have the Vaal river, we can no longer use that river for drinking water purposes because it is contaminated beyond repair. Municipalities releasing waste-water into the river, so now we cannot use that water anymore. So, I would say it is issues like that in urban areas. Then in rural areas, it is more of the community sharing water or rivers, with animals, where you find that, most of the pollution doesn’t come from the people but it comes from the catchment itself and what is being driven into the river. Now you find that maybe there is eutrophication or any other type of impact from not human themselves, but the surroundings. We try to educate people on water conversation and just how to take care of rivers and staff, obviously in rural areas this is an issue. It is not really implemented to benefit everyone, I think.

I: Yes, so before we get to that, why do you think the water treatment facilities are in a poor condition? What is preventing them from being improved?

R: I think we have a problem with infrastructure maintenance, not just for waste-water treatment, but also for potable water treatment. I think it is one thing that for decades and decades it wasn’t really a priority and we have population growing that has more demand. We have waste-water that you have to treat. It’s now in larger quantities, compared to the infrastructure that we have. So things like decentralisation of these systems or building new ones, or modifying the ones that we have are not done as much as they should be done. Also, I think with the municipalities, they have a gap in terms of, qualified people to run the systems. People who really understand the importance of not just, doing one, two, three, but understanding the consequences of each action and how it contributes to the environment. So, I think that is the gap that we are really lacking on as a country.

I: Yeah, do you think there is enough training for skilled personnel to meet the criteria of people that can maintain and fix problems with the water infrastructure?

R: Not really, I feel like we do have, because we have a huge amount of unemployed youth. With all these qualifications, but there still feels like an imbalance in terms of giving opportunities to the young people that can actually come up with innovations or even do the work properly, according to the standards and the older generation. So you find that we still have older people, while they have been doing this for many years, they have experienced, but when it comes to skills there is a gap, so yeah.

I: That comes in to public participation as well, building a connection between the local communities and the other stakeholders, government, water service providers, do you think there is enough opportunities for local communities, if they have an issue, they know who to talk to and they can collaborate and share ideas about water management?

R: Yeah, I think those platforms are there, we as one of the water boards in South Africa, we have programmes that we run, even though we sell water to the municipality, but we, take up on ourself to make sure that we reach out to the community, we teach them how to do these things. How to report leaks, who to talk to when they have all these problems. So I think the reach out, the platform between stakeholders and government and water boards, it is there, but it could be better. It could have more engagement. But, so far, I think we are trying. We have another big board, they are also doing more or less similar things. They are reaching out to communities, they are teaching them how to preserve water, how to manage water, how to make sure that when there is something is wrong with the infrastructure, who to talk to. So I think that it is there. We are doing good, in that department.

I: That’s great, that is good to hear. The water that you provide to communities, does that tend to be free or do they pay for it?

R: They pay for it, but it depends, the rate depends on the location. Which also, I think, that is how it is with most of the basic human needs. But yeah, it depends. There are places, where I think water is free, if I am not mistaken. But most places, you pay for it.

I: So that might help to encourage water conservation? It could work as an incentivisation?

R: But now, I get your point and it is a valid point. But now you get that, in places like urban areas, you can have a structure like that. In big cities, you can have a structure like that. But the moment you step out of that environment and now you go to your informal settlements, you go to your semi-urban areas, rural areas, it is no longer, it doesn’t hold as much there as in sub-urban areas people understand because they pay rate, they pay for everything and they know, if you tell them, Okay there is still programme, if you do one, two, three, this is how we are going to compensate you and they sort of understand how that works and normally it does work. But, when it comes to informal settlements, it is a different story, because now you find that these places are overcrowded and they will not understand the importance as much as someone, not to discriminate, but it is how South Africa is, you find that you have a part where people are well educated, middle-class, they understand, you know how the system. Then you find the poorer parts of South Africa, where now you still need to deliver the same services and sort of use the same system, but it is never received the same. The level of understand, accountability, it comes in to play as well as, some of these cases, they don’t even pay for water and if they do, it’s not in sub-urban areas.

I: Yeah, so how do we encourage them to conserve water?

R: We have NGOs, we have the water research commission, they do a lot of community engagement and capacity building when it comes to areas like that. Rural areas, informal areas. So they do a lot of education and other NGOs that actually like engage community, because I think, I was in Cape Town a few months ago and we had an opportunity to attend, we were working on different projects and we had an opportunity to actually go to an informal settlement and see how they managed their waste because they don’t have systems like in big cities. So there are efforts in terms of educating people and teaching them ways of caring about the environment and taking care of the environment.

I: So, if they don’t have services like the waste removal, what do they do with their waste?

R: Yeah I know, they normally do, but it is not as frequent as in other areas. But, in some places they use like, the ones that are outside and they dig a hole and it is not within the household. They don’t use water to flush, but they actually go outside and that system is actually maintained in a way you pour some agent and you dissolve the mass of the waste. Then, with the waste you find that they have groups within the community, they have days where they collect the waste and then they put it in one place. So you find that there is a place that works as a landfill. So they will just take it from their informal settlements and there is like no space, it is crowded, it is in no condition of people living there, but we have people that live inside such places. So it is a matter of just having those solutions and once in a while you find that they will have services come and service the place, but it is not as frequent as it should be.

I: It must be difficult because those settlements are formed based on migration, without, the planning of where the services are so to cater to them is challenging.

R: Yeah, it is.

I: Going back to policy, do you have much interaction with the national water act?

R: Not really, I think the people that work a lot with this are the people from the department of water and sanitation. I only know the basic, like, what is the law and who does it apply to, what are the benefits and what are the challenges when it comes to implementation and that is about it. But in terms of like, breaking it down and giving you like details, it can be someone who works with the department of water and sanitation.

I: That’s good. I just wondered how much your organisation has to understand and interpret the national water act?

R: Okay, in that sense, okay, I think with our organisation obviously we have to make sure that we supply water, we do have water, it is a basic need for everyone, so we need to make sure that the municipalities, they receive the amount of water that they are supposed to receive. In order to cater for the communities. Also, in terms of water resource management, we need to understand that part, because we are required to take care of the catchment that we are within. So we need to do environmental assessments in terms of our groundwater, are we not polluting our groundwater? And also when we receive rain, we need to keep track of that as well as the catchment management. So, we work hand in hand with the municipality and, yeah, even when we had this issue with the Vaal river being polluted, my organisation had to now, buy in to the municipality and come up with ways of assisting the municipality with the wastewater treatment.

I: Because, from my studies, the policies in South Africa are very good, but when it comes down the implementation of those policies, there are several factors that are causing a lack of implementation of these policies, some scholars say that it can be overly scientific and confusing for water managers to understand and comply with.

R: Yeah, I think that also, I agree with you, we struggle with what is on paper and what is happening in real time. Because we have these acts, regulations, policies and stuff, but when it comes to these people that work with these policies and they are supposed to implement them, you find that, they don’t really get the policies or how to do it. So I think with my organisation, 2 years ago, they started restructuring the organisation, so now they are pulling in more younger people, qualified people and also building relationships and also working with the municipality, especially the one that is around the area that we are based at. Because that was one of the gaps, so my organisation supplies the municipality with people that can understand this act and they can relate to the municipality people and work hand-in-hand with them, also they have graduate programmes that take postgraduates, take them in and they train them and also they expose them into the municipality systems and just to get the understanding so that we get young professionals that actually understand. Because we have been struggling with implementation, it is not just the water sector only. It is like the whole of South Africa, I think the older generation, they did their best, but they are gaps in there.

I: It also comes down to political will. The want to actually implement and there are several factors like corruption as well that are holding back progress.

R: Yeah, we struggle a lot with that. Politics, as a whole. It is a different subject. If they are involved in a lot of things, you find that it is just about reaching certain people and not really delivering to the community.

I: Yeah, do you think that is also the case with monitoring? To make sure that the water qualities are appropriate and safe, do you think these is enough monitoring happening to feedback and report?

R: I think it is a lack of implementation. The department tried to come up with these programmes and policies and regulations, but still, I think there are gaps, like, yeah there are still gaps.

I: Do you ever have any interactions with the sustainable development goals? Has that ever influenced your work?

R: Actually, I have, I think we are doing quite a lot of work when it comes to this. But, I feel like, it started the buzz, two or three years ago, before that, I think everyone knew that the UN came up with this concept and it started in 2015. But I think now, a lot of organisations are chipping in and taking responsibility, I think this year, my organisation has an MOU with the Netherlands and the UN and I think Umgeni water did the same thing, within the country you have companies with CSIR, different organisations that actually do work on this. Even universities have taken this as part of their curriculum, when you do your postgraduate studies, they introduce you to this. So there is research, the work that is done surrounds achieving, I think there are about four SDGs that are the most important ones but obviously, number one being SDG 6. So, I think the effort is there and we are doing quite a lot of things, in terms of exposing, the young water professionals and professionals from the food industry and energy, there is quite a lot of research there, like the water research commission is also doing a number of projects in actually assisting us to achieve the SDG.

I: That’s good, it is also a good way of raising awareness and attention amongst different stakeholders of something to work towards.

R: Yes, yes they started this thing of, the problem before was that the system that was used was like, different sectors working in silos. But when you look at the whole system it is like, yes, you are in the food industry but at the end of the day, what do you use to grow your fruits or your vegetables? You use water. You utilise the land. So what is the point of you only focussing on one thing? So now they came up with this concept of looking at thing as a circular economy system. So they are bringing everyone in terms of your water, energy, food, each sector affects the next one. So there is quite a lot of projects and forums, webinars, done on that. So, I think they are on the right track, I am not sure if by 2030 we will achieve the goals but yeah we are on the right track.

I: I think that is true for a lot of nations, I don’t think even in the UK I don’t think we will achieve our goals by 2030, but it sets a benchmark to work towards and like you say, it is a recognition that water management is interdisciplinary, the water energy food nexus, right now with South Africa and the loadshedding the energy is influencing the water.

R: Yes, influencing everything, like every little thing. I think it is an opportunity to look at how can we use your hydropowers, and like other alternatives, because we are now only concentrating on Eskom and that’s like coal generated energy. So what if we look at other renewable energies, what if we look at systems that are going to benefit all these sectors and also be friendly to the environment as well, I think we are trying, I think since last year a lot of these things are being discussed and implemented and so we are going there, baby steps, but we will get there.

I: Yeah, it seems like it takes a crisis to push people to encourage them to start thinking of the alternative, like the cape town crisis with the water, that pushed them to start thinking more about conservation and now with loadshedding that will push them in in to thinking about other options but there is not much foresight and thinking of other solutions or we are going to run out of energy, there is still a heavy reliance on coal when there is potential for alternatives.

R: Yes, these things when they happen, they raise questions and obviously people pay attention, so hopefully it is one of those things that we will be able to address as soon as possible, because it is a pain.

**WSP7**

I: What groups or stakeholders lose out most in the distribution of water? Who gains the most?

R: Water Boards and Local Municipalities lose out the most in the distribution of water. This is due to non-revenue water because of aging infrastructure and non-payment by users. These stakeholders invest significantly in water conservation and demand management practices to ensure consumers have access to good quality water in sufficient quantities. In addition, water services provider is also restricted in terms of legislation to increase water tariffs.

I: Speaking of loadshedding, what is the relationship with electricity and water in SA, how did it influence water security?

R: Loadshedding disrupt the continuous pumping of water to Municipalities and subsequently to the consumers. Loadshedding contributes to more concerns around water security in SA. Disrupt flow of water in municipal pipelines also have a negative impact on water quality, when water pressure is increased and reduced in the pipelines. The latter mentioned have an influence on the biofilms in pipes which contain micro-organisms, organic matter, and inorganic particles. Longer stages (e.g., stages 5 and more) pose a challenge for Bulk Water Providers like Rand Water to maintain a specific water quantity or level in reservoirs. Low reservoir levels may result in low capacity of municipalities to provide enough water.

I: What is limiting the uptake of solar energy?

R: The installation of solar place an extra financial burden on consumers or households since it is too expensive for most people in SA. Most South Africans are already experiencing financial constraints and depend on loans and other financial support to maintain their livelihoods; therefore, most people may never be able to afford solar energy. The middle class of South Africa might be able to instal solar energy, but not to supply their households completely.

I: How efficient are the water service infrastructures? What are the causes for this?

R: Water service infrastructures are not functioning efficiently. Several challenges like water scarcity, aging infrastructure, weak governance, and limited investment in water infrastructure and maintenance have also contributed to the inefficiency of water services in the country. South African government, together with international agencies, have been working towards improving the efficiency of water services, and there have been some improvements in recent years.

I: How are transboundary water networks working to reach water security? Are they successful?

R: Transboundary water networks can play a crucial role in improving water security by fostering cooperation and addressing shared water challenges between different countries. In South Africa, there are several transboundary water networks, including the Orange-Senqu River Basin Commission, the Incomati River Basin, and the Limpopo River Basin Commission. While these networks have made some progress in promoting cooperation and collaboration between South Africa and its neighbours, challenges such as unequal distribution of water resources, increasing water scarcity, and the impact of climate change remain obstacles. While South Africa has made significant investments in water infrastructure and management in recent years, the success of transboundary water networks in the country ultimately depends on continuous investment in infrastructure and management, as well as consistent communication and cooperation between all stakeholders involved, including governments, water users, and civil society.

I: What are the particular challenges for achieving water security in rural areas?

R: Poor governance by local municipalities, which include poor financial management and a lack of professional skills. Political factors contribute to some of key challenges, such as political officials that are not informed and not always making decisions to support water security in rural areas. Due to the apartheid area (prior to 1994) rural areas are isolated and situated remotely from the central economic activities of towns. These areas are not well-developed, and where some developments took place, the quality of these development are not up to standard.

I: Is there enough opportunity for public participation?

R: The opportunities for public participation are limited in most areas of South Africa. Participation is mostly hindered by factors such as language barriers, low educational capacity, and poverty. In most areas the roads are in poor conditions, which make access to these areas impossible. Also, most areas outside the urban areas do not have access to information communication technology, which make participation difficult. The livelihoods of many South Africans remain below the poverty line; thus, many people are not willing to participate.

I: How easy is compliance with legislation?

R: Compliance is relatively easy; however, this may require skilled and experienced professionals. Legislation and compliance are well-structured but not always easily implemented.

I: How much does acid mine drainage affect water security in South Africa?

R: Not significantly since it is well managed. Research institutions in South Africa are making good progress to manage AMD.

R: Do you think that rainwater harvesting has the potential to benefit water security in South Africa?

I: This is an easy option for households, particularly in rural areas. However, this needs to be supported and by local authorities and government. Not all parts of the country receive good annual rainfall, many regions in South Africa are suffering from droughts, especially in the western and southern parts of the country.

R: What needs to change in the governance of water in SA in order to achieve water security?

I: Government should allow the private sector and individuals to be more involved in water services. More power should be given to the private sector and the people with the support of government and not vice versa. When government is taking sole responsibility of water security, failure is guaranteed due to corruption, no accountability and responsibility, the rule law not always followed and voice of the people are not recognized.