



# F · I · E · L · D · N · O · T · E

December 2011

**INTEGRATING SCIENCE, POLICY AND PRACTICE:**  
A win-win working collaboration between eThekweni Water and Sanitation and the University of KwaZulu-Natal in enhancing local service delivery



**SALGA**  
South African Local Government Association



## Introduction

The eThekweni Water and Sanitation Unit (EWS) is responsible for the provision of water and sanitation services to more than 3.7 million people within the eThekweni municipal boundaries. This includes unserved households in both urban and rural areas and has resulted in a number of challenges that needed to be overcome. With the expansion of the boundaries of the municipality to create a Metro in 1996, and then again in 2001 to become a Unicity, there was a rapid increase in the number of households with no access to water or sanitation being incorporated into the EWS service area. EWS then had to identify the best methods of providing

sustainable basic water and sanitation services to these communities whilst at the same time maintaining existing infrastructure. Innovative thinking taking into account the long term health and environmental impacts was therefore required. Employment opportunities and skills development were also a key consideration in the EWS programme.

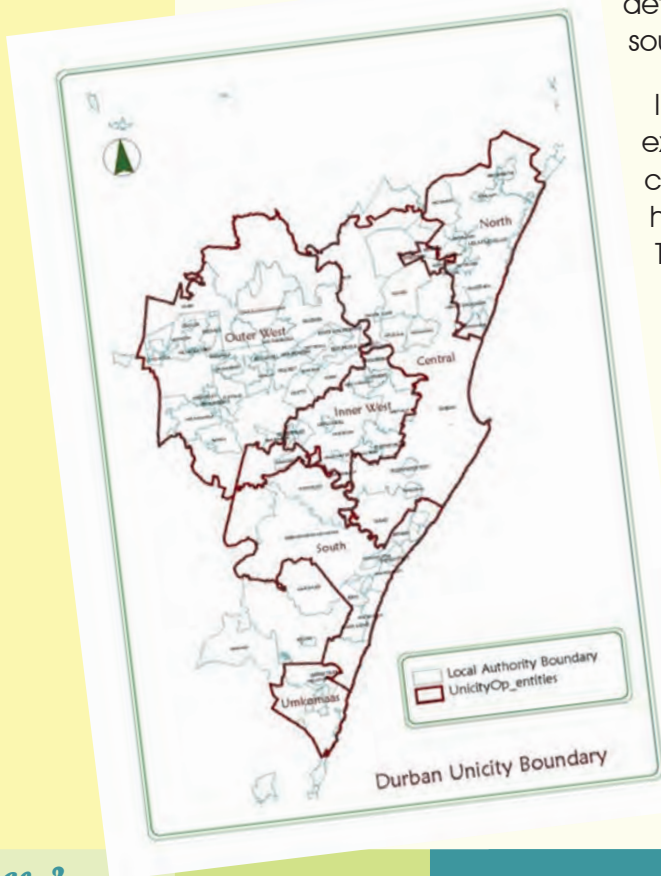
"We recognised the need for applied research that was relevant to the needs of the eThekweni Municipality," states Neil Macleod, Head of Water and Sanitation. "New ideas for improved service delivery were being investigated within EWS, and we required a reputable organisation to be able to research and test these ideas to determine their viability and to be able to base decisions on sound scientific facts."

In-house capacity for this type of research does not exist within EWS and they therefore looked to forming a collaborative relationship with a research organisation that had the capacity and the skills to undertake such work. The EWS also recognised the need to develop improved understanding and management of water and sanitation by a wide range of people with whom EWS interacts. Particular emphasis was to be placed on previously disadvantaged people.

Macleod also indicated that whilst they have undertaken collaborative projects with other organisations such as the Water Research Commission (WRC) with some success, it was difficult to focus these projects on research issues specifically geared to the requirements of EWS, as the WRC has a national responsibility. There was therefore a need to look closer to home for collaborative relationships. The Pollution Research Group (PRG), at the University of KwaZulu-Natal (UKZN), Durban, was ideally placed to fulfil the research and



*Neil Macleod, Head of Water and Sanitation and Professor Chris Buckley, Head of the Pollution Research Group, University of KwaZulu-Natal.*





skills development needs. In addition, the PRG was already involved in water and sanitation research projects, and had access to students willing to undertake targeted applied research projects.

“This relationship therefore provided a win-win situation for both of us, with EWS obtaining access to a team willing to support our research needs, and the University being provided with specific research problems and financial support to attract students” states Macleod. This view is supported by Professor Chris Buckley, Head of the Pollution Research Group, who has been leading the various research projects carried out in conjunction with EWS.

## Collaboration Process

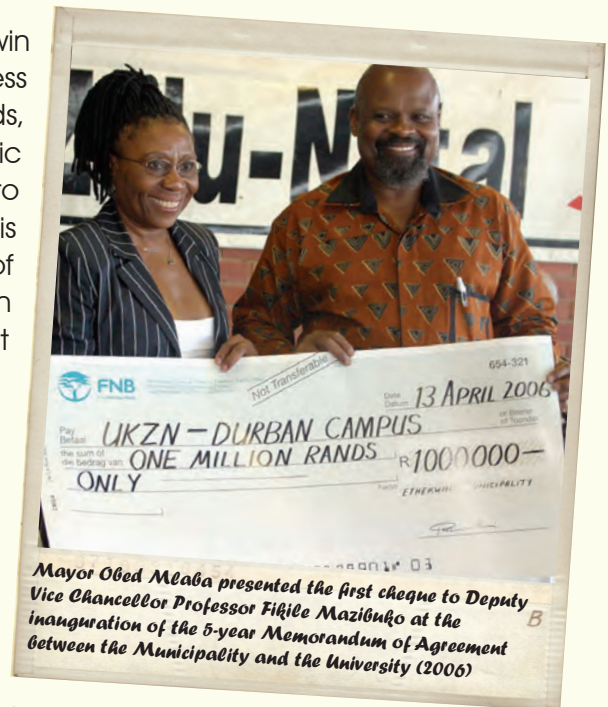
As far back as 2003 eThekweni Municipality and other businesses recognised the need to work with local tertiary organisations and a Memorandum of Understanding (MOU) was signed with three tertiary educational institutions (the University of KwaZulu-Natal, the Durban Institute of Technology and Mangosuthu Technikon). The aim of this MOU was to strengthen collaboration on research and development, capacity building and knowledge management, in order to achieve growth and development, in keeping with the Municipality’s Integrated Development Plan (IDP). The desired outcomes included a stronger economy, an improvement in the quality of life for all citizens and the development of a higher skills and technology base.

Following on from this MOU, a number of Memoranda of Agreement (MOA) have been signed between the Municipality and the University outlining specific collaboration undertakings within various departments in the University. The MOA specific to EWS and the Pollution Research Group was signed in February 2006 and formalised the desire of both parties to promote the knowledge base in water and sanitation delivery and to expand research capacity and expertise in this field.

Professor Buckley explains further, “The PRG had been involved in research projects related to water and sanitation issues for a number of years with the indulgence of the EWS. The agenda of these projects was set by the PRG and were mainly funded by the WRC. The change came when EWS encountered new challenges brought about by the expansion of the City, and started a dialogue with our Group to seek solutions”.

This MOA was initially signed for a period of 5 years (2006 to 2010) and was then extended for a further 2 years to end in 2012. Under this MOA, the eThekweni Municipality, through EWS, has committed an annual budget of R 1 million to fund applied research projects that would be undertaken by the Pollution Research Group.

The MOA specifies that co-ordination will be guided by Neil Macleod and Chris Buckley and outlines the role of EWS and the PRG. On the side of EWS, this involved identifying the issues



that required researching and prioritising them for the PRG. They also needed to provide access to data, internal expertise and their facilities for research, as well as field support for interaction with communities. In return, the PRG would provide students to undertake the research and laboratory facilities to produce scientifically credible results that would guide the decision making process within EWS.

The MOA had very broad objectives and aimed to “develop and pursue a broader interaction between the Parties involving a transdisciplinary team including, but not limited to, engineers, scientists, medical professionals, social scientists and economists, conducting research into

and developing research capacity in new areas such as gardens, health, transport, housing and economic development”.

Professor Keith Bristow from the University of Pretoria Water Institute, in commenting on this collaborative agreement states that the partnership is unique in that it is underpinned by a substantial retainer for the University, with additional funding from the Municipality for agreed projects. He further comments that this retainer approach has alternative benefits to that of the traditional approach of sponsoring a Professorial Chair, which can in some cases result in

a lock-in to a particular discipline and reduce the flexibility for the sponsor and the University. The retainer allows the University flexibility to develop and engage in multidisciplinary / transdisciplinary projects and the Municipality obtains a good return on their investment due to a multiplier effect through access to University research and other networks.

## *Highlights of projects undertaken*

There have been a number of research projects undertaken, the results of which have assisted EWS in their service delivery. These projects include not only technical issues, but also social and economic aspects. In some cases, these projects are funded solely by the EWS, while in others, joint funding from the WRC and other international sources is used.

“The relationship between ourselves and the PRG is recognised internationally, resulting in access to further funding from Donor organisations through research projects with the London School of Tropical Medicine, the Swedish Institute for Infectious Disease Control, and Eawag - Swiss Federal Institute of Aquatic Sciences and Technology. Two of these projects are funded by the Bill & Melinda Gates Foundation”, reports Mr Teddy Gounden, who manages the Education Department in EWS. “Through this collaboration and the research undertaken, EWS are now recognised as global leaders in water and sanitation delivery in a developing country context”.



*Spinach grown over buried waste at the test site*



Collaborative research between the two organisations dates back to the early 1990s with an investigation into the anaerobic digestion of textile effluent. The project, while funded by the WRC, made use of the anaerobic digesters at the Umbilo Wastewater Treatment Works, and laboratory support was provided by the staff at the Works. EWS also funded one of the first pilot-scale anaerobic baffled reactors (ABR) for co-digestion research undertaken by the PRG in 1999. Other related projects included the formation of the first waste minimisation clubs in eThekweni, cross flow microfiltration projects and modelling of wastewater treatment works. Much of the research work carried out since the signing of the MOA has been built on the outcomes of these earlier projects and the realisation that the results could be applied to real problems.



A number of research projects are currently being investigated under the MOA. A project which has received international recognition is the research into the design and operation of ventilated pit latrines (VIPs) and urine diversion toilets (UDTs). This collaboration dates back to an International Water Association (IWA) conference at Victoria Falls in 2004 which was attended by staff from both organisations. A question arose as to what could be done with the solids (sludge) that came out of UDTs, and could it be used to grow trees or would they die?

“Ultimately, the only way to find out was to do it” reports Professor Buckley, “and EWS provided the funding and hardware to establish a test site to undertake this research, along with other investigations”. These investigations provide scientific support for the design and operation of VIPs and UDTs, such as determining the transformation processes of waste degradation, the use of commercial pit additives to improve degradation rates and the fate of *Ascaris* eggs in the sludge.

The literature indicated that *Ascaris* eggs (which are excreted in the faeces of people that are infected with worms) would die after a short period outside of the human body. Research by the PRG indicated that the eggs persisted for a much longer time in the environment than expected. The WRC has published a guide on the new analytical method that was developed and courses have been held around the country on the method. The use of this improved method has indicated a far wider infection rate than previously thought. Specific guidelines have been developed to protect the health of people working with faecal material.

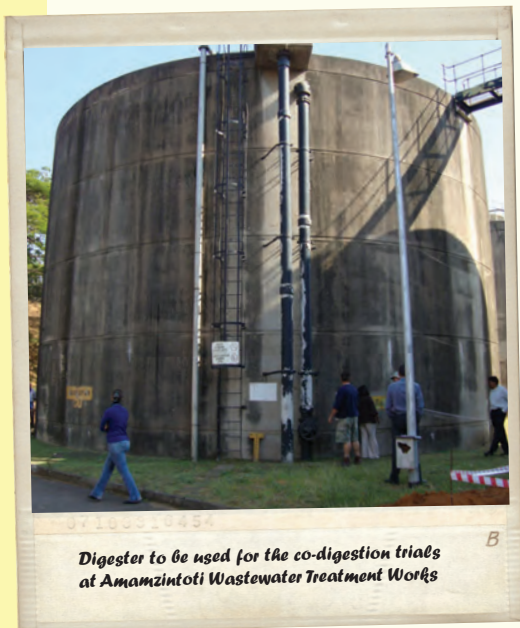
As Mr Gounden explains, all of this research provides EWS with a scientific basis for their decisions in providing sanitation solutions. As an example, commercial pit additives are widely promoted to reduce the volume of pit contents. However, the extensive research that has been undertaken by the PRG has proven that this is not true. As Mr Gounden points out, these scientific results will now prevent other Municipalities from spending money on these additives.

Another project that is based on long standing co-operation and which is currently being evaluated at full scale is the co-digestion of industrial waste. Following on from the co-digestion of textile effluent in the anaerobic digesters at the Umbilo Wastewater Treatment





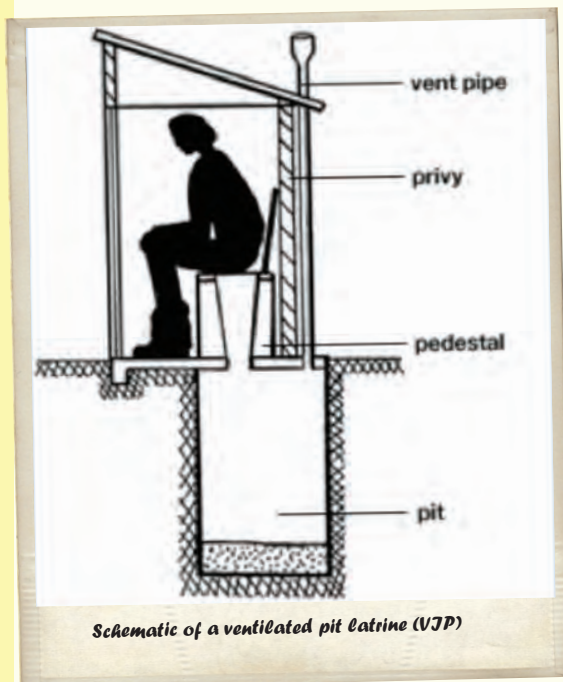
Works, laboratory investigations were undertaken into the treatment of high strength chemical oxygen demand (COD) effluents. The interest in this work was revisited ten years later in 2010 with EWS expressing an interest in investigating the impact of co-digestion of industrial waste at the Southern Wastewater Treatment Works. The aim was to improve the quality of the final effluent from the treatment works and reduce impact on the sea bed. It was agreed that full-scale trials would be conducted at the Amamzintoti Wastewater Treatment Works in order to obtain the design data. This information would then be used to guide the refurbishment of the Southern Wastewater Treatment Works.



*Digester to be used for the co-digestion trials at Amamzintoti Wastewater Treatment Works*

EWS funded the refurbishment of one digester at the Amamzintoti Wastewater Treatment Works and established a fully equipped laboratory to undertake the necessary analyses. In parallel with this work, the PRG received funding from the WRC to investigate co-digestion on a laboratory scale using the same effluent. According to Chris Buckley, all tests and analyses carried out on laboratory scale at the PRG will be replicated in the EWS laboratory by their staff. In this way, all results and techniques will be disseminated to EWS to build in-house capacity and skills. Additionally, this project requires sampling of the various sludges entering the works, and together with EWS, the PRG have initiated a sampling process to determine which sludges are suitable for co-digestion.

This project also links with various modeling projects carried out by the PRG, the University of Cape Town and Sasol to better understand the operation of wastewater treatment works and the impact of various conditions and effluents on the operation. This work has resulted in researchers involved in the modeling of wastewater treatment processes (Chris Broukaert and Kitty Foxon from the PRG, and Prof George Ekama from UCT) being invited onto an IWA task team to assist in the development of improved computer models to predict the performance of wastewater treatment processes.



*Schematic of a ventilated pit latrine (VPL)*

“This co-operation with EWS turned what could have been a small research project into a viable full-scale trial with international scientific collaboration” concludes Chris Buckley. “Without their interest and funding, this work would not have been possible”.

It is not only technical issues that are being addressed through this collaboration. Other research projects include investigations into the acceptance of sanitation systems by the communities and how to improve the awareness and education around the use of UDTs and hygiene practices. One of the water engineers at EWS used his work experience for a MBA (Water) thesis. The results of his thesis enabled EWS to

improve their tariff design by introducing a pro-poor, welfare maximizing, water tariff which is used to address the various levels of service delivery in a holistic manner so that a number of objectives could be simultaneously met.

## *International Recognition*

The work carried out by EWS and the PRG has received international recognition, and various projects are carried out in collaboration with other research organizations and through donor funding such as the London School of Hygiene and Tropical Medicine (VIP toilets), and more recently, the Swiss Federal Institute of Aquatic Science and Technology (Eawag) into developing practical, community-scale nutrient recovery systems from urine.

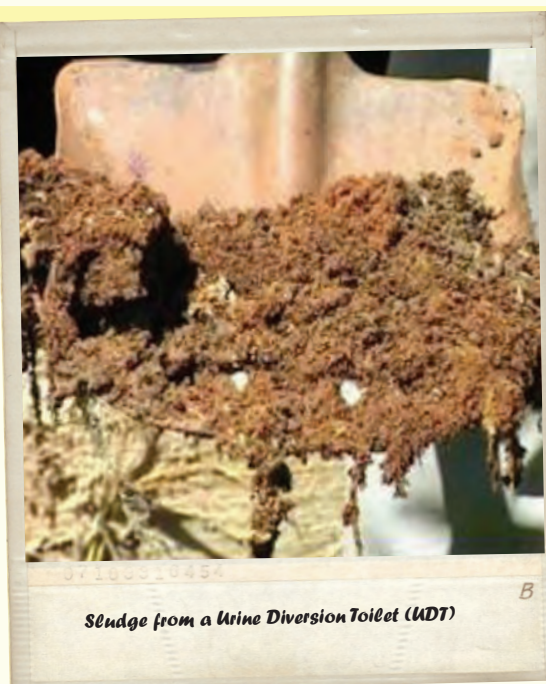
Another example is collaboration with the Bremen Overseas Research and Development Association (BORDA) which was initiated in 2008 when Neil Macleod and Chris Buckley were invited to Bremen to attend a general meeting on the use of Anaerobic Baffled Reactors (ABRs). Following on from this meeting, BORDA and EWS entered into an agreement to design and build a technical evaluation ABR plant in Durban based at Newlands Mashu. The WRC funds the research carried out at the facility by the PRG.

A further collaborative agreement between these parties was signed in June last year (EWS, PRG and BORDA), together with Hering GmbH & Co. KG (a German company) into the provision of pre-fabricated community ablution blocks for informal settlements.

All of these examples illustrate how the particular partnership between EWS and the PRG has opened up access to further funding that might not have been made available to either party on their own. The challenge is for other municipalities and universities to engage with one another for their mutual benefit.

## *Benefits*

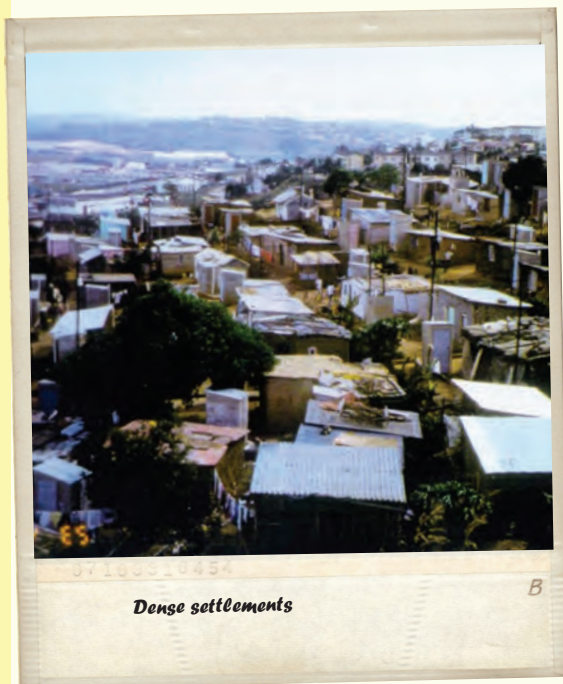
There are a number of benefits to both the EWS and the University. For EWS, the main benefit has been that decisions can now be made based on scientific facts rather than on assumptions. Research can be undertaken on a relatively small scale in the field and the results incorporated into strategic decisions. In this way, money is not wasted as the results are directly relevant to the needs. Another important benefit is the development of post graduate students who have skills, knowledge and experience in the water and sanitation field. Students are being made more employable in the sector and when vacancies open up, these students are encouraged to apply.



*Sludge from a Urine Diversion Toilet (UDT)*

To date one EWS staff member has completed their masters degree with the PRG. Three other staff members are preparing to enrol for masters degrees. However part time study is demanding and it is necessary to undertake preliminary work prior to registering so that the dissertation can be completed in the necessary time. Other students that have undertaken projects with the EWS and the PRG have entered the general water industry.

For the University, the collaboration has meant access to funding and applied research projects which has attracted local and foreign students. The results of the work has been published in research publications and presented at conferences, both locally and internationally, providing publicity for the University and assisting in securing access to other sources of funding. Many international research institutions send their students to the PRG to undertake field work for their post graduate degrees on the work that is being carried out by EWS.



Dense settlements

Between the period of June 2009 and June 2010, 40 students have worked on EWS related projects, and 5 EWS staff members have expressed an interest in registering for higher degrees in the Water and Sanitation field.

Regular feedback is provided to EWS to account for the way in which the funding is used, including the number of students employed on the projects, operating costs for research material, and the

publication of reports and papers.

In the words of Professor Bristow "this partnership has also demonstrated the benefits of minimising the growing number of bureaucratic and administrative processes that impede research, and others could learn from this experience and increase the value and impact of their research to the benefit of their organizations and society as a whole".

## Success Factors

It is important to look at the factors that have contributed to the success of this collaborative relationship and to identify ways in which similar partnerships could be established in other Municipalities. Talking to key staff within EWS and the PRG, there are four key aspects that resulted in the success of this collaboration.

### Pre-existing relationship

The PRG has a long standing relationship with eThekweni Municipality and EWS in particular. The two organisations have collaborated on various projects since the early 1990s. This has



resulted in trust being formed between the two parties. Professor Bristow, in his analysis also states that there are strong personal relationships based on respect and trust between key staff in the Municipality and University which took time and effort to develop.

## *Leadership*

Another success factor is the strong leadership of the people employed by EWS and the PRG. Neil Macleod, as head of EWS provides clear guidance on the needs of the Municipality and also provides strategic guidance and assistance to other utilities and municipalities at both national and international level, while Professor Chris Buckley, head of the PRG, is recognised as an international expert in the field of water and sanitation and understands the needs, risks and benefits of research. In the words of Professor Bristow, "both have a common focus on serving the needs of the ultimate beneficiaries, in this case the community and the environment, which also played a role in the development of these relationships".

## *Identification of needs*

In order for such a collaboration to be successful, it is important that there is a clear understanding of the needs of the Municipality to allow focussed research to take place. As reported by Professor Bristow, EWS recognised the importance of creating new knowledge and understanding to solve difficult and complex water and sanitation problems faced by a rapidly growing city. This need has also been driven by a focus on service delivery and not just by academic interests. This view is supported by Chris Buckley who also warns that it is important that other Municipalities choose a research organization who is interested in solving their problems rather than just looking at the financial gains.

## *Institutional willingness*

Another key aspect is the willingness on both the side of the Municipality and the University to enter into an agreement. The benefits to both parties need to be understood and there needs to be long term commitment and transparency. This is evident in the flexible MOA signed by the EWS and the University which is focussed on collaboration and projects that deliver practical outcomes.

## *Challenges and Gaps*

A gap that has been identified is the lack of more general dissemination of the results of the projects to a wider audience. While theses, papers and presentations are published in academic media and WRC reports and workshops on some research topics are arranged by the Water Institute of Southern Africa (WISA), very little dissemination is carried out that reaches other Municipalities. There is therefore a need for the results to be disseminated in a more accessible way so that others can learn from the experiences and apply the results. Other avenues such as Win-SA and Salga are being investigated.

## *Way forward*

### *Further potential for collaboration*

The two organisations are continually investigating further opportunities for research that will provide answers to the water and sanitation requirements of the Municipality. Both organisations have benefitted from the collaboration in a number of ways and see the importance of further extending the agreement. As Neil Macleod states, "There are more research needs than students. As long as the high quality of research continues, the collaborative relationship between EWS and PRG will continue".

### *Replication in other municipalities*

How could this type of collaboration be replicated in other municipalities? Teddy Gounden responds by saying that the first step should be for these Municipalities to identify what their needs are, and then to contact EWS and the PRG to determine what research has already been undertaken to prevent duplication, and to assist in prioritising the needs that are specific to the region. The next step would be to identify a suitable research organisation. It is important to choose an organisation that understands the local needs and is based within a reasonable distance of the Municipality. As Neil Macleod states "it is important to be able to undertake research in their own back yard". The facility also needs to have access to research fields across the various disciplines such as engineering, micro biology, economics and social studies. Chris Buckley also cautions that it takes time for a research organisation to fully understand all the issues and estimates that a period of between 2 and 3 years is required to master a topic.

Once a suitable organisation has been identified, a MOA can be entered into. EWS is happy to provide their MOA to other Municipalities to use as a template. A final step would then be to develop structures both in-house and within the research organisation to roll out the programme.

## *Contact details and References:*

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