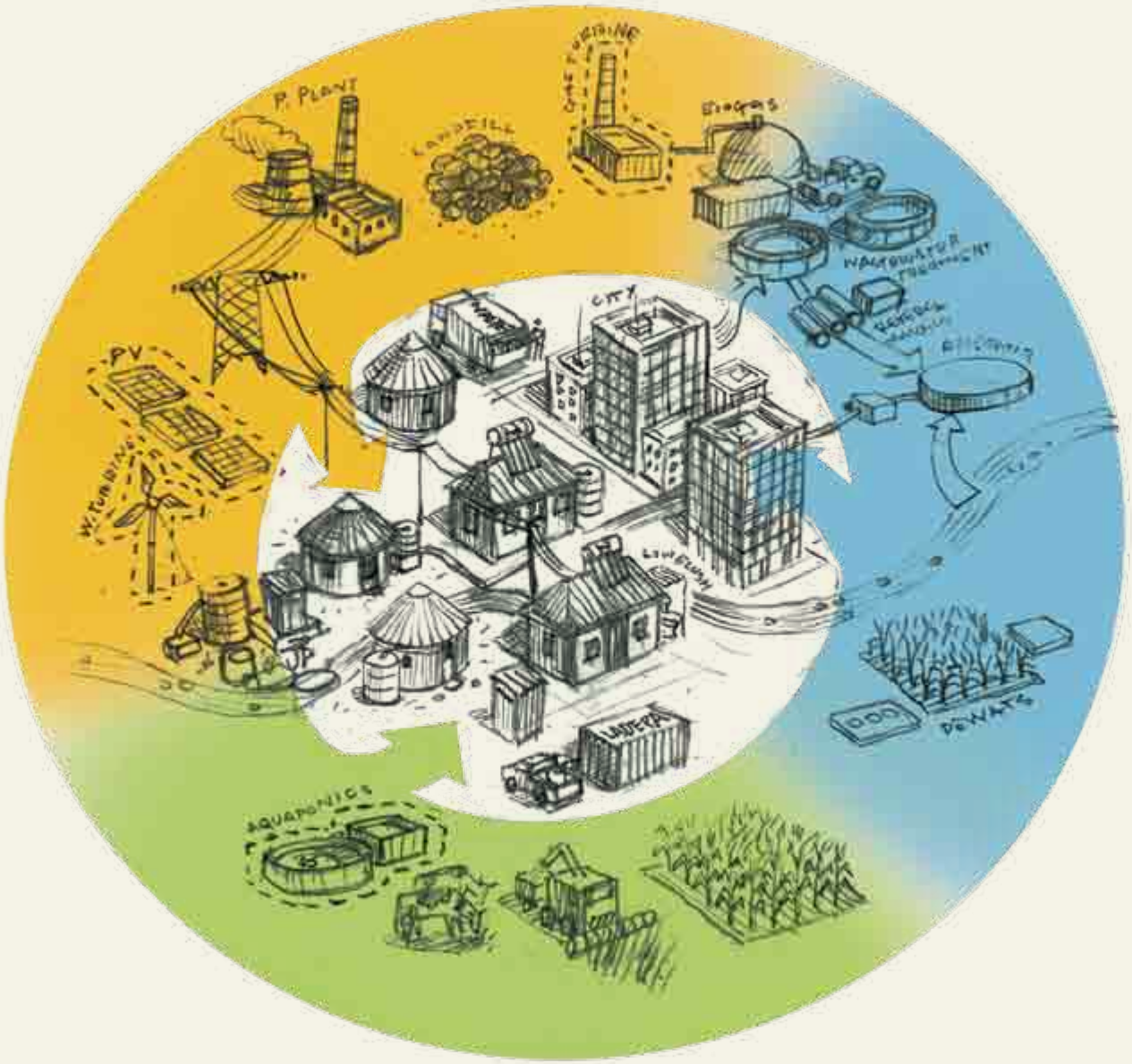
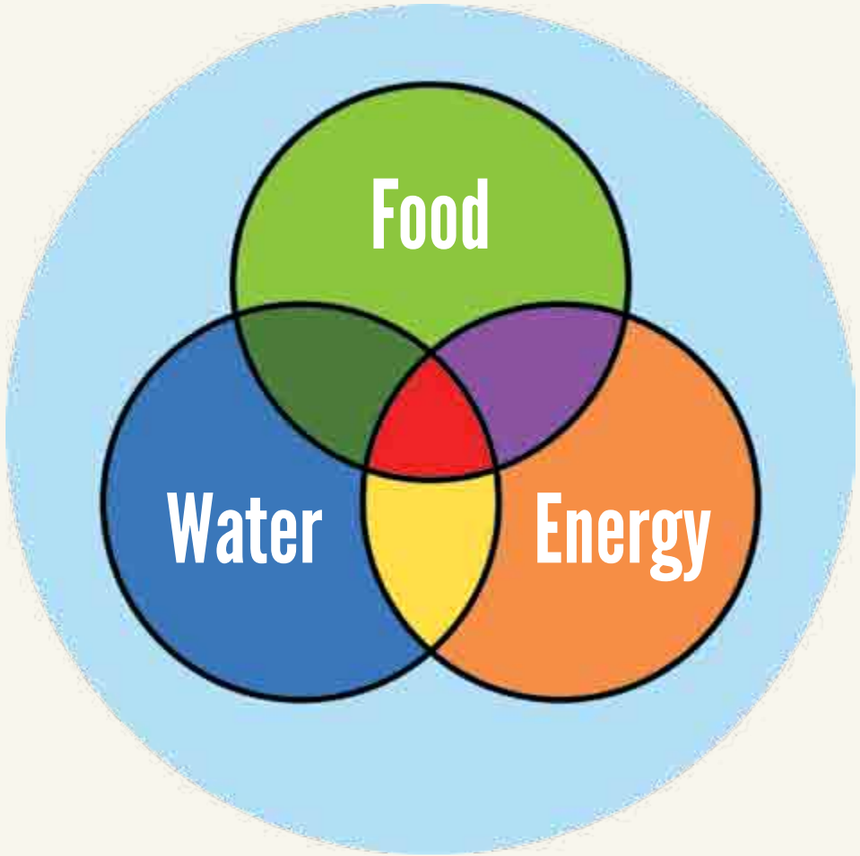
ETHEKWINI MUNICIPALITY

WATER AND SANITATION

FOOD WATER nexus ENERGY CLIMATE



Projects undertaken by the eThekwini Municipality, Durban



Aim and structure of the booklet

This booklet aims to show case the projects undertaken by the eThekwini Municipality that fall within the food-water-energy-climate nexus. It provides an overview of the Municipality and the way in which the various Units work together to meet the common goals of service delivery and environmental and health protection. The Municipality believes that good science leads to good policy and therefore collaborates with a number of research and private organisations in order to provide scientific support for their initiatives.

A description of each project is provided in the booklet together with an indication of the point at which it sits within the food - water-energy-climate nexus, and which Units within the Municipality are responsible for the project.

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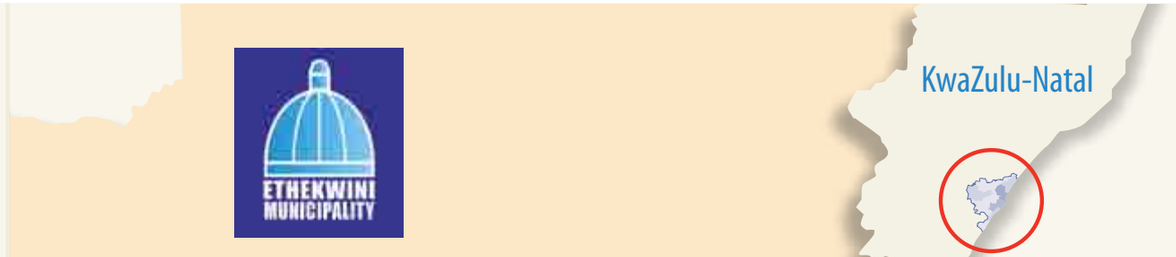

Introduction to the eThekwini Municipality

eThekwini Municipal Area (EMA) is located on the eastern seaboard of South Africa within the Province of KwaZulu-Natal and covers an area of 2 297 square kilometres. While the total area of the EMA is only 1.4% of the total area of the province, it contains just over a third of the population of KwaZulu-Natal (approximately 3.6 million people) and 60% of its economic activity.

A significant proportion of the population lives in low-income townships, including informal settlements. This makes it difficult to identify the exact number of households within the Municipality and numbers are estimated based on aerial photography. A survey carried out in 2011 identified the presence of just over 912 400 households within the EMA consisting of formal houses (54%); informal settlements including backyard shacks (34%); and rural households (12%). The diverse nature of the landscape, the mix of urban, peri-urban and rural households, and the rapidly growing migration of people to the city all pose a challenge to the Municipality in terms of provision of services such as housing, water, sanitation and energy.

The city's vision is as follows: "By 2030, eThekwini will enjoy the reputation of being Africa's most caring and liveable City, where all citizens live in harmony". In order to achieve these goals, the 2013/14 draft Integrated Development Plan (IDP[1]) has identified 14 key development challenges and outlined an Eight Point Plan to address these challenges. These are divided into the following focus areas:

Plan One: Develop and sustain the spatial, natural and built environment

Plan Two: Developing a prosperous, diverse economy and employment creation

Plan Three: Creating a quality living environment

Plan Four: Fostering a socially equitable environment

Plan Five: Creating a platform for growth, empowerment and skills development

Plan Six: Embracing cultural diversity, arts and heritage

Plan Seven: Good governance and responsive local government

Plan Eight: Financially accountable and sustainable city

1 http://www.durban.gov.za/City_Government/City_Vision/IDP/Documents/eThekwini%20IDP%202013_14.pdf

eThekwini Municipality Units

The Municipality is divided into a number of Units, each of which has a clear role in achieving the aims of the IDP. With regards to projects falling within the Food-Water-Energy-Climate nexus, the following Units are key in the formulation, piloting and implementation phases:

- Water and Sanitation
- Energy Office
- Environmental Planning & Climate Protection
- Infrastructure Management & Socio - Economic Development
- Economic Development
- Cleansing and Solid Waste

Water and Sanitation

The Water and Sanitation Unit (EWS) is responsible for the provision of water and sanitation services to all customers in the municipality. Their core values are a customer focus, cost consciousness and a concern for the well-being of their staff. The Unit is continually looking for new and innovative ways to provide services to customers and has been recognised through many awards and acknowledgements.

Initiatives such as free basic water, flow limiters, the use of plastic bodied water meters, polypropylene water piping, ground tanks and semi-pressure water service levels, urine diversion toilets, anaerobic baffled reactors, the use of grey water for urban agriculture, customer services agents, condominial sewerage and a customer water debt repayment policy were first introduced to South Africa by EWS.

In order to ensure that decisions are made based on scientific research, EWS have co-operative research agreement with the University of KwaZulu-Natal and the Durban University of Technology to further this agenda.

The Unit has been able to use GIS based tools, specifically developed call centre and an electronic workflow and document management software to further improve service delivery.

Energy Office

The eThekwini Energy Office is a small unit situated within the Treasury Department. The Energy Office is responsible for conceptualising and initiating projects in the following areas:

- Renewable Energy (generating energy from renewable sources such as the sun)
- Energy Efficiency (helping use less energy)
- Climate Change Mitigation (reducing our greenhouse gasses)

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The Energy Office's mission statement is to position the eThekwini Municipality as the sustainable energy manufacturing hub for the Southern Africa region.

In 2008, the eThekwini Municipality embarked on a concerted energy efficiency drive in response to the National Power Conservation Programme which set energy saving targets of between 10 and 15% across all sectors in the country. This resulted in the establishment of the eThekwini Energy Office in February 2009, a first of its kind in South Africa and which set a precedent for local government participation in sustainable energy interventions at a local scale.

Environmental Planning and Climate Protection

The environmental management function of the municipality was established in 1994. Since this time, the department has grown from a single staff member to a fully-fledged department with a current staff complement of over 30. At the same time the area of jurisdiction has increased as the municipal area expanded from 300 km^2 to 2 290 km^2 extending from a highly urbanised city core to a tribally controlled rural periphery.

The Environmental Planning and Climate Protection Unit aims to conserve biodiversity and the ecosystem goods and services it provides for the benefit of present and future generations; and to plan for mitigation of and adaptation to the impacts of climate change.

Infrastructure Management & Socio - Economic Development

The Infrastructure Management & Socio-economic Development Unit (IMS) provides the appropriate guidance and expertise in terms of project and programme management. The main functions of IMS are to:

- Coordinate the City's Contractor Development Programme: Sustainable contractor enterprise development.
- Implementation of the agricultural programme for the city: Food sovereignty and job creation
- Facilitation and coordination of the asset management process through the various unit / departments for the eThekwini Municipality
- Programme management of the municipal infrastructure grant cities (MIG Cities). It aims to cover the capital cost basic infrastructure for the poorest of the poor.
- Overall coordination of the Expanded Public Works Programme (EPWP) which aims to alleviate poverty and create jobs
- Implementation of Rural Economic Development programme for the city: development of sustainable livelihood

Economic Development

The Economic Development Unit (EDU) is mandated to promote economic development; job creation, economic transformation and economic intelligence within the municipal region.

It is guided by policies established by National and Provincial Government and articulates the approach to economic development through the Municipality's Integrated Development Plan (IDP) and an Economic Development Strategy (EDS) from which all activities are guided by, but not restricted to, as the Unit also responds to the broader challenges facing the greater region by endorsing other initiatives such as the Millennium Development Goals.

Cleansing and Solid Waste

The Cleansing and Solid Waste Unit (DSW) of eThekwini Municipality is the leading provider of comprehensive waste management service. The department is committed to a foundation of service excellence and superior customer service and waste management is tailored to meet the needs of each customer to ensure consistent exemplary service. The core aim of the Unit is to contribute to a clean and healthy environment and vibrant economy for the eThekwini area, through responsible solid waste management practices, recognising solid waste as a useful resource wherever possible.

The department's network of business and operations includes:

- 23 Operational Centres;
- 6 Transfer Stations;
- 3 Active Landfill Sites;
- 23 Recycling Plants;
- 3 Landfill Gas Projects; and
- 2 Leachate Plants.

These assets enable DSW to offer a full range of services to 3.6 million residential, industrial and commercial customers. Drawing on its resources and experience, DSW endeavours to make a positive difference for the environment and the communities.

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Key Collaborating Organisations

The majority of the projects undertaken by the Municipality are carried out in conjunction with collaborating organisations. These include tertiary education institutions such as the University of KwaZulu-Natal and the Durban University of Technology, and international research organisations such as the Bremen Overseas Research and Development Association (BORDA) and the Swiss Federal Institute of Aquatic Science and Technology (Eawag). Those organisations that play a key role in the projects listed in this document are described in the section.

University of KwaZulu-Natal – Pollution Research Group

The Pollution Research Group (PRG) at the University of KwaZulu-Natal (UKZN) is a professional research centre based in the School of Chemical Engineering and which conducts innovative research projects on water resources, waste water reclamation, the impact of effluents on local environments, sanitation systems, and other related environmental issues. Funders include the South African Water Research Commission, eThekwini Municipality, the Bill & Melinda Gates Foundation and Sasol. A key success factor is the ability of the PRG to form close co-operations with other research organisations both locally and internationally in order to build up expertise in the field of water and sanitation. The PRG has an existing contractual relationship with the municipality, assisting with research and development activities and providing feedback loops on large scale rollout of projects.

Durban University of Technology – Institute for Water and Wastewater Technology

The Institute for Water and Wastewater Technology based at the Durban University of Technology has developed into a "Centre of Excellence" and proficiency. The focus is largely based on developing and optimising technology for the treatment of water and wastewater and to satisfy the needs of industry and the community. Research projects are selected and designed in close consultation with industrial partners. Projects are mainly aimed at helping industries maintain acceptable levels of effluent discharges, thus reducing negative environmental impact and commercialisation of products generated from waste streams. The strength of the Institute lies in the development of essential skills through student training, to satisfy the much needed human resource needs of the water sector (including industry) in South Africa.

Khanyisa Projects

Khanyisa Projects is a Durban based organisation that seeks to empower citizens and customers through communication and education toward self-improvement, and sustainable community development. Khanyisa Projects has vast experience in the delivery of community development programmes, awareness programmes, skills training and public participation initiatives.

Khanyisa Projects have partnered with eThekwini Water and Sanitation for 11 years on a number of water and sanitation projects including rollout of rural water and sanitation services, communal ablution blocks, composting from sludge, and various grey water reuse initiatives. Khanyisa Projects' responsibilities on the above projects have included stakeholder engagement, construction and testing of technologies, community education, project management and research.

Khanyisa Projects also has a great deal of experience in sourcing, contracting and training of small contractors on other types of infrastructure projects such as rural biogas rollout, rainwater harvesting and retrofitting of green technologies at low costs housing projects.

Partners in Development

Partners in Development (PID) have 20 years of experience with the design, construction and management of water and sanitation systems and has collaborated with eThekwini Metro Municipality on numerous sanitation related research projects. Past projects include work on various aspects of faecal sludge management including pit filling rates, pit emptying methods and technologies, the deep row entrenchment of faecal sludge for beneficiation of timber and development of pit emptying technologies. Current projects include the development of pour flush and low flush technologies.

Bremen Overseas Research & Development Association

The Bremen Overseas Research & Development Association (BORDA) is a specialist non-governmental organisation active in the fields of poverty alleviation, sustainable protection of natural resources and the strengthening of social structures. BORDA advises and facilitates projects in the sectors of decentralised sanitation, wastewater treatment, water and energy supply, and solid waste management in Asia, Africa and Latin America, with the mission of improving the living conditions of disadvantaged communities and ensuring the viability of the environment. The non-profit organisation specialises in the design and implementation of Decentralised Wastewater Treatment System (DEWATS) plants, over 1 500 of which have been implemented worldwide. BORDA received the prestigious International Water Association Development Solution Award in 2011 for their innovative design.

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The Hering Group

The Hering Group is a family owned construction company based in Burbach Germany. An international industry specialist, Hering develops products for areas of use by the public, ranging from architectural facades to construction and maintenance of rail/transit infrastructure. In the area of sanitation, Hering designs modular system solutions for public and semi-public areas which are adapted to their surroundings and offer the user optimum hygiene, while at the same time ensuring minimal maintenance costs for the operator. Hering collaborated with EWS, the Pollution Research Group and BORDA to construct pre-fab toilets for a school in a rural area of eThekwini municipality.

Swiss Federal Institute of Aquatic Science and Technology

The Swiss Federal Institute of Aquatic Science and Technology, or Eawag, is a world-leading aquatic research institute based in Zurich, Switzerland. Its research, which is driven by the needs of society, provides the basis for innovative approaches and technologies in the water sector. Through close collaboration with experts from industry, government and professional associations, Eawag plays an important bridging role between theory and practice, allowing new scientific insights to be rapidly implemented. Eawag is the primary partner on the VUNA recovery of nutrients from urine project.

Centre of Expertise

The Centre of Expertise wants to improve the South-African water supply and sanitation sector by introducing Dutch knowledge and technology. It is hosted in Durban by eThekwini Water & Sanitation (EWS) and will introduce innovations and best practices in the South-African water and sanitation sector.

It is funded by the Dutch government through the Transition Facility. The Dutch are internationally renowned for their knowledge and expertise in the areas of, amongst others, water technology, water treatment and the installation and management of water and sanitation infrastructure. The Centre of Expertise was officially launched on May 8th 2012 in Cape Town.

The Bill & Melinda Gates Foundation

Guided by the belief that every life has equal value, the Bill & Melinda Gates Foundation works to help all people lead healthy, productive lives. In developing countries, it focuses on improving people's health with vaccines and other life-saving tools and giving them the chance to lift themselves out of hunger and extreme poverty. In the United States, it seeks to significantly improve education so that all young people have the opportunity to reach their full potential. Based in Seattle, Washington, the foundation is led by CEO Jeff Raikes and Co-chair William H. Gates Sr., under the direction of Bill and Melinda Gates and Warren Buffett. The Foundation's top priority is sanitation, because this critical issue has oft been a neglected area that is ready for significant change.

The Water Research Commission

The Water Research Commission was established in 1971, as part of the Water Research Act (Act No 34 of 1971), after national recognition of the importance to generate new knowledge and to promote research on the country's water resources. The WRC was formed to establish a research and development base for water research, and promote coordination, cooperation, communication and capacity development in this area. The WRC provides the country with applied knowledge and water-related innovation, by continuously translating needs into research ideas and, in turn, transferring research results and disseminating knowledge and new technology-based products and processes to end-users.

Veolia Water Solutions & Technologies

Veolia Water Solutions & Technologies South Africa is part of Veolia Water Solutions and Technologies, which falls under the Veolia Water branch of Veolia Environnement. The company offers professional services including the design, construction and commissioning of water and wastewater treatment plants, supply of chemicals and consumables such as imported and locally manufactured membranes, financing and service and maintenance of plants.

These services extend from divisions within the company, each addressing various aspects of the market. Veolia Water Solutions & Technologies South Africa also owns a membrane manufacturing unit and has minority shareholding in a black empowerment company and majority shareholding in Durban Water Recycling (Pty) Ltd.

nexus

The Food-Water-Energy-Climate Nexus

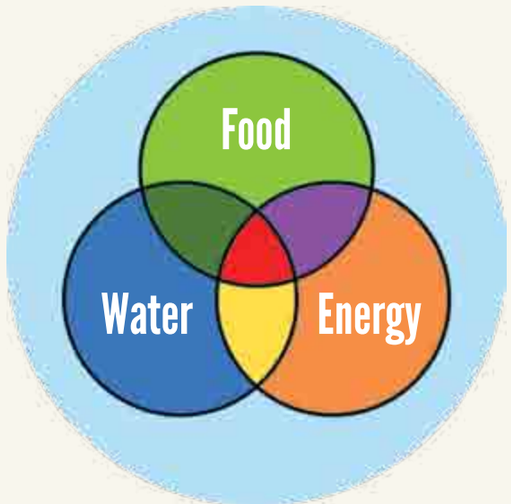
Nexus: *"the connection or series of connections linking two or more things" (Oxford Dictionary).*

What is the "Nexus"?

The world is facing enormous challenges with the supply of food, water and energy becoming increasingly scarce particularly in developing countries. Actions can be taken to improve one of more of these problems, but often to the detriment of another. It is therefore essential to understand how food, water and energy are interlinked and how they impact on one another, and to increase awareness on why greater coordination is necessary. For example, more food or energy has, so far, come at a high cost of rising water consumption. It is therefore clear that in an interlinked world isolated solutions aimed at just one sector are not sustainable. This will require the work of individuals, businesses and government.

The eThekwini Municipality Approach

The eThekwini Municipality has come to understand the importance of the nexus approach in implementing projects to improve food, water and energy supply. The impact of these three sectors on climate is also of concern and it is recognised that climate must become the driver for the municipality. For this reason, the nexus diagram for the Municipality is represented by the three inter-linked circles of food, water and energy, surrounded by a larger circle representing climate.



A number of projects have been implemented by the Municipality in order to address water security, food supply and sustainable energy such as reducing non-revenue water, supporting the development of community gardens, reusing wastewater for irrigation, rain water harvesting, producing electricity from methane, and the installation of solar waters among many others. All of these projects aim to improve the sustainability of the municipality and to meet the goals of the IDP.

Projects

There are a large number of projects and initiatives underway within eThekwini, but only those that fall under the food-water-energy-climate nexus are described in this booklet. A brief description of the various projects is provided, together with an indication of where they sit with respect to the nexus. The projects are divided according to the leading Unit with collaborating organisations listed and the status of the project provided.

Water and Sanitation

EWS drive and fund or co-fund a number of projects relating to the provision of water and sanitation services within the municipality.

Decentralised Wastewater Treatment (DEWATS)

Funding: EWS, South African Water Research Commission (WRC), Bremen Overseas Research and Development Association (BORDA)
Project lead: Pollution Research Group (UKZN)
Collaborating organisations: Hering South Africa

BORDA DEWATS has potential in South Africa for densely populated communities where there is an urgent need for sanitation services. These systems could be installed as a temporary service technology treating domestic wastewater from communal ablution blocks (CABs) - showers, laundry area, flushing toilets, until such time the settlement is upgraded or relocated to a housing project. Alternatively, it could be implemented in areas where septic tanks are not appropriate such as densely clustered low-cost housing areas.

EWS has established a pilot DEWATS plant at Newlands Mashu in order to investigate the applicability of the DEWATS system to treat the wastewater from a small housing development, and to identify any operational problems and how these could be overcome. In addition, the use of the treated wastewater from the Anaerobic Baffled Reactor (ABR) for agricultural purposes is being assessed in terms of impact on plant growth, soil quality and health implications.

Project status: Pilot scale moving towards full-scale implementation

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Promoting Sanitation & Nutrient Recovery through Urine Separation (VUNA - Valorisation of Urine Nutrients in Africa)

Funding: The VUNA Project is mainly funded by the Bill & Melinda Gates Foundation. Additional funds are provided by the Swiss National Science Foundation and the US National Science Foundation
Project lead: EAWAG
Collaborating organisations: Pollution Research Group (UKZN)

By recovering nutrients from urine in small decentralised reactors, the project aims to develop a dry sanitation system, which is affordable for the poor, produces a valuable fertilizer, promotes entrepreneurship and re¬duces pollution of water resources.

This project consists of a number of smaller research projects each of which are undertaken by masters and doctorate students in both the PRG (Durban, including two employees from EWS) and EAWAG (Switzerland). These projects can be broadly divided into the following aspects:

- Technology (reactors): Two reactor setups are being tested to recover the nutrients from urine for use as a fertiliser: (i) a struvite reactor and (ii) a combination of nitrification and evaporation. These reactors are installed and operating at Newlands Mashu research facility.
- Social: The Role of Health and Hygiene Education in the Acceptance, Utilisation, and Maintenance of Urine Diversion Dry (UDD) toilets in Rural Communities, and the acceptance of using urine as a fertiliser.
- Logistics: Developing a logistical system for collecting urine using an institutional approach.

Project status: Pilot scale moving towards full-scale implementation

Nutrient Recovery from Wastewater Treatment Works

Funding: EWS
Project lead: EWS
Collaborating organisations: Centre of Expertise

The eThekwini Municipality operates 27 wastewater treatment plants within the municipal area. Some of these plants have to comply with special standards for discharge of the final effluent as they are located close to a sensitive environment such as wetlands or small streams. This means that the nutrient concentration e.g. phosphate concentration in the effluent of the plant has to be very low (under 1 mg P/L). A common way to achieve these strict limits is to upgrade the biological treatment process to a biological nutrient removal process by capturing the nutrients in the sludge. In most cases, however, a process step is added which removes the nutrients by chemical dosing and flocculation. The disposal of the produced sludge of these processes is however problematic as they may contain heavy metals and in many cases have to be transported to hazardous landfill. However in recent years processes have been developed that allow nutrients to be recovered instead of being removed. The products of these processes are nutrient rich fertilisers which can be either used within the municipality, or sold to the market or fertiliser producing companies. In this way the nutrient loop is being closed and valuable and scarce resources such as phosphorus being recovered. The municipality is planning to install a pilot plant for nutrient recovery at the Northern wastewater treatment plant at the sludge dewatering step together with the support from the Centre of Expertise.

Project status: Feasibility study

Black Soldier Flies for the Processing of Urine Diversion Toilet Sludge

Funded by: Bill & Melinda Gates Foundation
Project lead: Khanyisa Projects (Principal Agent) in association with Partners in Development (PID)
Collaborating Organisations: Pollution Research Group (UKZN)

The eThekwini Municipality has over the last 10 years provided over 85 000 urine diversion double pit toilets (UDDTs) to residents of the city who previously had no sanitation services. These residents typically live on the urban fringe. The original plan was that residents remove the safe decomposed contents and bury onsite.

However, research has shown that the contents are not decomposing sufficiently and consequently residents are at risk when removing or burying the waste.

The project will design a rollout programme that will provide a safe, cost effective service through partnerships and performance based contracts with private organisations and contractors. Investigations are currently underway to determine the feasibility of transporting the sludge to a central processing plant or smaller decentralised plants which will convert the waste into valuable products by the use of black soldier flies. These products can be used in agriculture.

Project status: Feasibility study

Processing of Sludge from Ventilated Improved Pit Latrines (LaDePa)

Funding: EWS
Project lead: EWS
Collaborating organisations: Particle Separation Systems Technologies (Pty) Ltd, Pollution Research Group, Water Research Commission

The latrine dehydration and pasteurisation (LaDePa) pelletiser was developed by EWS in conjunction with their technology partner, Particle Separation Systems (PSS) for the dehydration and pasteurisation of VIP sludge and the production of pellets. The machine works on the use of heat and medium-wave infrared technology to deactivate the pathogens and create a pellet-type product that can be used as a fertilizer. The pellets which are produced are analysed to determine the mechanical, chemical and biological properties. Trials to determine the effect as a fertiliser have also been undertaken. Research funding is provided by the Water Research Commission.

A laboratory scale version of this machine is housed at the PRG laboratories and is being used by masters students to investigate the effect of various operational changes on the efficiency of the process.

Project status: Pre-production scale moving towards full commercialisation

Rainwater Harvesting

Funded by: Municipal Infrastructure Grant (MIG)

Project lead: EWS

Collaborating Organisations: The Valley Trust; EThekwini Rural Area Based Management Team; Khanyisa Projects

High levels of poverty and unemployment, coupled with the increases in food prices has resulted in hardship in the rural areas of eThekwini. To address this problem, the eThekwini Water and Sanitation Unit initiated a programme for the construction of rain water harvesting tanks and the development of community co-operative gardens. This has resulted in a reliable and sustainable supply of water for the irrigation needs of community gardens as well as other domestic needs.

As of 2012, more than 3 600 tanks had been installed in 3 areas (4 wards) as follows:

- Inanda, Ntuzuma and KwaMashu areas - 498 tanks were installed to individual households, 120 tanks to 60 schools and 4 tanks to 4 clinics
- Clifton - a total of 347 tanks were installed
- Crowder - 47 tanks were installed
- Zwelibomvu – 1 500 tanks installed
- Mzinyathi – 1 050 tanks installed

The cost to build one tank was R 9 500 per unit.

Other infrastructural benefits include:

- Improvements to the structure of houses in order to allow for installation of the gutter system
- Supply of an innovative gutter system which can be adapted to suit local conditions
- Supply of a tap at the base of the tank

Households received training in organic farming and permaculture practises. For example, mulching is promoted to reduce the water needs of seedlings. Following practical workshops every household received basic start up tools and materials to assist with the establishment or expansion of their garden. Thereafter, residents receive mentoring at their homes during the establishment of their homestead gardens by a highly skilled organic farming facilitator.

Project status: Implemented and continuing

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The Durban Water Recycling Project

Funding: Public-Private Partnership (PPP)

Project lead: Durban Water Recycling (Pty) Ltd – lead by Veolia Water

Collaborating organisations: Zetachem, Khulani Holdings, Umgeni Water and Marubeni Europe

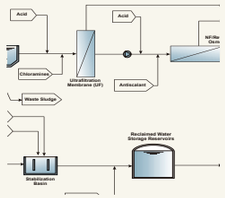
In 1993 EWS developed a reclamation process for the production of high quality reclaimed water and tested it at laboratory and pilot scales in 1994 and 1995. It was envisaged that Mondi Paper, situated in the southern part of Durban adjacent the Southern Wastewater Treatment Works (SWTW), who had previously approached EWS, would be the major customer for the reclaimed water. In 1999, after a formal tender process, Durban Water Recycling (Pty) Ltd was awarded a 20-year concession contract for the production of high quality reclaimed water. Construction commenced in 2000 and was completed in 14 months.

Located in the south of Durban in the grounds of the eThekwini Water Services' SWTW, the plant was commissioned in May 2001 and was designed and installed by Veolia Water (VWS Envig). Officially opened by the then Minister of Water Affairs and Forestry, Ronnie Kasrils, the R74m sewage-to-clean-water recycling plant treats 47.5 ML of domestic and industrial wastewater to a near potable standard which is sold to industrial customers for direct use in their processes. In addition, the plant frees up sufficient drinking water for approximately 300 000 people in Durban.

A considerable benefit to industries is the lower tariff when compared to the normal tariff paid by industries for potable water. The two largest customers so far are the Mondi Paper Mill in Merebank and the Sapref Refinery, owned by Shell and BP. The first private water-recycling project in South Africa, this plant is the culmination of a 20-year Build Own Operate and Transfer (BOOT) contract awarded to treat 10% of the city's wastewater. Vivendi Water is the major stakeholder in Durban Water Recycling and its partners are Zetachem, Khulani Holdings, Umgeni Water and Marubeni Europe. Some of the key elements for the success of the project is ETW's vision in initiating the project, Vivendi's ability to provide finance and to implement innovative, tailor-made technical solutions and Mondi's endorsement of the project, by committing its entire paper production at its Merebank Mill to recycled water.

Project status: Implemented and continuing

Water Reuse for Potable Water



Funded by: EWS
Project lead: EWS
Collaborating Organisations: Golder Associates Africa (Pty) Ltd, in association with WRP & Kwezi V3

In 2008, the Department of Water Affairs and Forestry (DWAF) concluded their KZN Coastal Metropolitan Areas – Water Reconciliation Study, 2008 (Reconciliation Study) . The report contains the background, analysis and proposed further development for bulk water resources for the KZN Coastal Metropolitan area and concluded that the water supply needs in the eThekwini Municipality and surrounding areas currently exceed the reliable yield of the local water resources.

While a number of supply schemes are currently under investigation and/or development, these will not be sufficient to meet the water demand going forward. Treated effluent reclamation and re-use is considered to be a viable water resource to overcome the medium-term water constraints. It has been successfully implemented in other parts of the world, as well as locally in Namibia and Beaufort West. The treatment technology is well established and the quality of water produced exceeds current drinking water standards.

On this basis, the Ethekwini Municipality initiated a study in early 2009 to assess the techno-economic feasibility of treated effluent reclamation and re-use as the basis for water supply augmentation. Golder Associates Africa (Pty) Ltd, in association with WRP and Kwezi V3 were appointed by eThekwini Municipality to complete the study.

Outcomes of the initial assessment indicated that the most feasible route is that treated sewage effluent from the KwaMashu and Northern WWTW's, be reclaimed and treated to potable standard. The potable water from KwaMashu potable water reclamation plant will then be discharged into the existing trunk main of the northern aqueduct in the vicinity of Duffs Road while the potable water from the Northern WWTW potable water reclamation plant will be discharged to the northern aqueduct at the nearest practical point from the works.

An Environmental Impact Assessment (EIA) is currently underway. A public participation process is being followed together with media releases.

Project status: Feasibility study

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Grey Water Reuse – Agritubes

Funding: EWS
Project lead: Khanyisa Projects and EWS
Collaborating organisations: School of Life Sciences (UKZN); Development Bank of South Africa

The project involved the piloting of agritubes or vertical food gardens and the use of greywater in an informal settlement in the Municipality. The project was undertaken by the eThekwini Municipality in 2010 and 2011.

The South African Government has adopted a "one house, one food garden " policy. This was also adopted by the eThekwini Municipality as a way of combating poverty and enhancing food security. Many informal settlements are densely populated and are often situated on extreme gradients. This means that there is limited space for normal homestead gardens. For this reason a vertical tube (agritube) was piloted in the Johanna Road Informal Settlement.

Consistent supply of water for a food garden is paramount. In informal settlements the most reliable supply is greywater (used water from bathing, washing clothes and dishes). However, there are associated risks with some forms of greywater. EThekwini Municipality partnered with UKZN who researched the risks associated with different forms of greywater as well as which types of greywater can be used safely in different scenarios i.e. different levels of water quality testing / monitoring. The key objective of this project was to test the use of agritubes as vertical food gardens in an informal settlement scenario in terms of food production and safe use of greywater.

The process steps were:

- Selection of agritube design and materials
- Assembly of 30 agritubes
- Selection of beneficiaries
- Development of educational material
- Installation and operation workshops
- Provision of seedlings
- Monitoring and evaluation

The tube consists of mesh and plastic and is filled with a soil and compost mix. A tyre acts as a base and provides stability to the structure. Seedlings are grown on the top and sides of the tube. A slotted pipe is placed at the top to ensure greywater is transferred directly to the root zone of the plants. This reduces opportunities for contamination of the leaves. Water that flows right through the tube can be collected and recycled.

Project status: Implemented and completed

Grey Water Reuse – Community Gardens

Funding: Imagine Durban
Project lead: AQUALIMA
Collaborating organisations: EWS and Agricultural Management Unit (AMU)

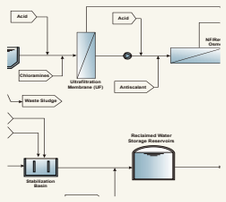
The project assisted seven households or beneficiaries directly. Research showed that there were a total of 50 indirect beneficiaries to the project (mainly family members). In terms of the objectives of demonstrating that the re-use of greywater can be convenient, safe and improve food security, the following can be stated:

- all the target beneficiaries are using the system to irrigate their gardens
- survey results showed that 89% of other residents in the area are interested in setting up a greywater system
- no evidence of pooling or erosion is evident at the gardens
- significant increases in agricultural yield has been achieved through the establishment of 30 one meter by six meter beds at the seven homesteads
- vegetables (mainly spinach) are being used in meals daily at present but no sales have been recorded
- when potable water supply became more reliable, greywater use reduced.

The AMU are in favour of an expansion of the programme to other areas and beneficiaries. EWS are more focused on addressing greywater in informal settlements but would support the AMU with rural rollout.

Project status: Implemented and completed

Reuse of Treated Wastewater for Agriculture



Funding: EWS
Project lead: Khanyisa Projects and EWS

The waste water of Magabheni is treated by means of a number of ponds. Once treated the water is returned to a stream which flows to the sea. This project uses a portion of that water to irrigate a community farm adjacent to the ponds.

Activities that have taken place during 2009 are:

- Rehabilitation of electrical pump
- Establishment of storage tanks and gravity feed irrigation system

- Construction of packshed
- Implementation of safety procedures to reduce health risks as per World Health Organisation Guidelines (WHO)
- Capacity building of community garden members on water use and organic farming practices.

Key challenges have been community conflicts, loss of agricultural land due to construction of informal houses and theft of electrical cables

Project status: Implemented and completed

Permitting to Promote Industrial Wastewater Reuse /Recycling

Funding: Norwegian Pollution Control Authority
Project lead: EWS – Pollution Control Division

All trade effluent discharge to the sewerage system is controlled via a permit system. Trade effluent will not be accepted if it contains concentrations of substances above stated limits. Separate sets of these limits are given in the by-laws for sewerage works of a capacity both greater than, and less than, 25 ML/d capacity. A third set of limits is applied when discharge directly to one of the two sea outfalls is permitted.

In line with Norwegian and European permitting conditions relaxations to the by-law limits may be granted to existing industries but a five-year improvement program must be submitted and approved. For new industries relaxations to the by-law limits may also be considered provided the company can prove it has implemented the best available techniques/ technologies to both minimise waste production and to treat the resulting trade effluent.

Project status: Implemented and continuing

Non-revenue Water

Funding: EWS
Project lead: EWS

Non-revenue water (i.e. any water that is not billed) is one of the most important issues within EWS and various initiatives have been developed in order to identify ways in which this can be reduced. The department monitors the status quo across the city and all departments within EWS are committed to contributing to actions that can prevent water losses. Some activities that have been introduced include:

- Pressure reduction valve (PRV) project: recognised as an important contributor to reducing losses and has saved in the region of R 32 million per year. For this financial year 129 new PRV sites have been identified and 63 new PRV sites commissioned.
- Leak detection and repair: In the region of 27 662 km of mains were surveyed in this financial year and 31 648 visible and non-visible leaks repaired by Leak Detection contractors Cat A and Cat B plumbers, and 6 582 Cat B/C leaks (rural) found and repaired.
- Reporting of leaks: 14 439 visible leaks were reported into Faultman by Community Water Service Agents.
- Replacing old meters - 764 Non-domestic meters and 5 181 Domestic meters installed in this financial year
- Removal of illegal connections: 3 000 Illegal connections found and removed, and 1 116 Illegal connections have been regularised in this financial year

Project status: Implemented and continuing

Reinvent the Toilet Challenge: Data Aquasition and Field Support

Funded by: Bill & Melinda Gates Foundation
Project lead: Pollution Research Group (UKZN)
Collaborating Organisations: Various organisations

The project awarded to the Pollution Research Group (PRG) at the University of KwaZulu-Natal builds on the knowledge, strengths and experience gained by the team during the Reinvent the Toilet Challenge Phase 1 implementation. The objective is to characterise physical and chemical properties of excreta streams from dry on-site sanitation systems or from decentralised low-water consuming sanitation systems. The data are

being passed to other grantees for use in their research. EWS work closely with the PRG to provide access to sanitation facilities and field trials.

A number of other Grantees under this project are interested in collaboration with EWS and the PRG to further develop and test their prototypes in the field. These trials are taking place during 2014 and into 2015 and include systems for the emptying of pits, systems for processing sludge to generate power and pour flush toilets.

Project status: Feasibility and pilot stage

Biodiesel from Microalgae

Funded by: EWS
Project lead: Institute for Water and Wastewater Technology; Durban University of Technology
Collaborating Organisations: HITACHI (Japan)

Biodiesel is a mono-alkyl ester produced from various types of oils and is currently produced from soybean oil, canola oil, animal fat, palm oil, corn oil, waste cooking oil and jatropha oil. Algae are perfect candidates for biodiesel production as micro algal productivities can be 15 to 300 times that of oilseed crops, they have faster growth rates, can grow in saline waters, have greater photosynthetic efficiencies than higher plants, require minimal nutrients for growth and have moderate to high lipid content. Domestic wastewater has shown great potential as a nutrient source whilst having the added benefit of tertiary treatment of the wastewater.

Research is currently being carried out in collaboration with eThekwini Municipality on optimising technology for biodiesel production using final effluent from a wastewater treatment facility. A 300 000 m3 demonstration plant is situated in the south of Durban.

Project status: Pilot scale

Mini Hydropower

Funded by: EWS
Project lead: EWS
Collaborating organisations: ENTURA (Tazmania, Australia)

The municipality intends to install between two and four mini turbines fed by the city's Northern Aqueduct water distribution system. The aqueduct supplies water from the large Durban Heights treatment works to the city's northern suburbs.

Due to the differences in elevation between Durban Heights and the reservoirs, there is excess pressure at the inlets to the reservoirs which is currently dissipated by pressure reducing valves. The proposed turbines will use this pressure to generate electricity, which will be fed into the municipal low tension grid. The expected output of the turbines ranges from 120 kW to 180 kW.

The project consists of a feasibility study phase, a construction phase and a three month operation and training phase.

Project status: Feasibility study

Co-digestion

Funded by: EWS and the South African Water Research Commission (WRC)
Project lead: Pollution Research Group (UKZN)
Collaborating Organisations: DHI (for software)

The project co-digestion of high strength industrial concentrates with sewage sludge is currently being undertaken at the Amanzimtoti Wastewater Treatment Works, south of Durban and at the laboratories of the Pollution Research Group. Anaerobic digestion consists of a series of processes in which microorganisms break down biodegradable material in the absence of oxygen. Co-digestion is the co-disposal of different waste streams in the same digester. The advantage of combining these streams is that if they have complimentary characteristics it may result in a combined feed stream that is more easily digestible and generates larger amounts of biogas.

The general principle of this research is to capture understanding of the digestion processes and especially the effect of different types of industrial waste streams on the digestion in a process model which is run on the WEST platform. The model is then used to simulate the real digester and to predict how the digester will perform under different feeding scenarios, in order to schedule the treatment of the effluent streams.

Future work for the co-digestion project includes the upgrade of Southern Wastewater Treatment Works, to determine the impact of industrial wastewater on anaerobic digestion at Southern WWTW and inform design of full-scale digestion process, determining the feasibility of treating textile dye-bath effluent at the Mpumalanga Works sludge digesters to reduce colour and salt loading at the Hammarsdale Waste Water Treatment Works.

Currently high strength COD waste streams are being sought for discharge into the digester at Amanzimtoti Wastewater Treatment Works.

Project status: Pilot scale

Methane to Electricity from Wastewater Treatment Works

Funding: EWS
Project lead: EWS
Collaborating organisations: Royal HaskoningDHV

As part of the sewerage infrastructure, the Unit operates 28 wastewater treatment works (WWTW) which treat over 460 ML/day of sewage, producing the equivalent of 100 tons of sludge per day. A common way of treating this sludge is anaerobic digestion, a by-product of which is the generation of methane gas (biogas). Of the 28 WWTWs, 10 operate anaerobic digesters and it is the aim of the EWS to convert the methane produced at the larger of these WWTWs into electricity. Approximately 50% of the power used by the works can be supplied by the methane, and it is a renewable source of energy that is available as long as the WWTW is operational.

The Water and Sanitation Unit intends to undertake an initial methane to electricity project at the Northern WWTW which will give an output of approximately 350 kW.

The objectives of the project are:

- maximising generation of methane in digesters
- collecting, cleaning and conditioning the digester gas
- generating electricity from the methane
- feeding the electricity into the treatment works electrical system

- providing heat to the existing digesters, while keeping existing heating system as a standby
- operating the plant for 7 years under a contract that provides incentives for generation of electricity and supply of heat to digesters

Fuel cells are also being considered at an alternative to conventional gas engines. Since fuel cell technology is very new, the municipality would require significant support from a technical partner.

Project status: Feasibility study

Energy Office

The Energy Office lead a number of projects aimed at promoting energy efficiency and the use of renewable energy.

Low Cost Solar Water Heating

Funding: ESKOM subsidy and Clean Development Mechanism
Project lead: Energy Office
Collaborating organisations: Supported by UNIDO through the Durban Industry Climate Change Partnership Project

The eThekwini Municipality developed the low cost solar water heater programme to reduce the amount of energy used by low cost households to heat water. The aim of this program was to implement affordable solar water heater (SWH) installations in low cost housing developments within the eThekwini Municipal Area (EMA) at no direct financial cost to the eThekwini Municipality.

The program has had 2 phases of roll-out. In the first phase (Jan – Jul 2011) a total of 9 042 SWHs were installed across the municipality providing low income residents the service of having their hot water heated for free. Following on from this, the second phase saw the installation of an additional 10 000 units. The programme was implemented in the following areas of eThekwini Municipality; Welbedacht West and East, Parkgate, Nazareth Island and Cato Crest.

The SWH units were funded by a combination of the ESKOM subsidy for low pressure SWH units (approximately 90% of cost) and Carbon Credits through the Clean Development Mechanism (10% of costs). In some instances there was also private sector sponsorship.

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The program has seen significant energy and greenhouse gas reductions throughout the city. There have also been significant secondary social and economic additionalities. As part of the programme, community training was also provided by the service providers who trained and employed members of the respective communities in SWH installation. The project has also been far reaching in increasing the public's awareness of renewable energy and climate change.

Project status: Implemented and continuing

Solar Water Heating for Hostels

Funding: eThekwini Municipality
Project lead: Energy Office

The KwaDabeka Hostel Hot Water Pilot aims to reduce energy consumption and carbon emissions associated with heating of residential water.

eThekwini Municipality is responsible for managing numerous Community Residential Units: CRUs (formerly known as Hostels). There are almost 14 000 residential units within the 10 hostel complexes in the city and they house approximately 100 000 people. Of these approximately 25% currently have geysers for hot water and the bulk of residents use kettles and two plate stoves to heat water for bathing and washing. This results in large monthly electricity usage in many hostels.

The purpose of this project was to pilot the installation of industrial sized solar water heaters on one floor of the KwaDabeka Hostel to determine the viability of a renewable energy solution to this problem. The viability is being assessed according to cost effectiveness, social acceptance and supply of hot water. Eighteen 2m2 solar arrays were installed in June 2011, supplying 100 litres of hot water per person to 25 flats.

Project status: Pilot scale

Solar City Framework (photovoltaic)

Funding: eThekwini Municipality
Project lead: Energy Office

The aim of this program is to pilot a "Solar City" concept to promote the uptake of solar technologies in South African cities. Objectives are to

- Develop the framework and action plan to pilot the solar city concept.
- Promote the uptake of solar technologies in residential and commercial properties in the city.
- Promote the local manufacturing or solar technologies
- Promote information sharing among municipalities to encourage further solar development.

An important outreach tool is the web-based Solar Map of eThekwini that allows resident to identify potential and costs of PV installations on their roofs. This Solar Map is currently being developed.

Project status: Feasibility study

Wind Map

Funding: eThekwini Municipality
Project lead: Energy office

In order to better understand the wind resources of Durban, the Energy Office enlisted the services of a consultant to develop a wind map for the city.

The consultant was briefed to create a wind map for the entire municipal area show the level of wind power generation potential within Durban. Furthermore, the study identified key sites within the city that could offer opportunities for the generation of wind farms with an output of 20 MW each.

The study was conducted using the WAsP method to determine wind speeds at heights of 100 metres, in line with the height of wind turbines masts (hubs) after incorporating information from existing wind stations as well as satellite data. The information was then plotted onto a wind map.

The wind map revealed that the EMA has very favourable wind power generation potential. Many areas recorded speeds of over 6.2 m/s, sufficient for wind farms. The study singled out ten specific sites recommending further investigation for the application of 20 MW wind farms. The outlook throughout much of the city is also very favourable for smaller scale wind power production to power homes and smaller industries.

Project status: Feasibility study

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Improved Energy Efficiency at Water and Wastewater Infrastructure

Funding: Energy Office
Project lead: Energy Office
Collaborating organisations: UKZN

EThekwini Water and Sanitation (EWS) is one of the largest users of electricity in the municipality and the costs for electricity to the department will increase significantly over the next few years. There are limitations to the current electricity measurement system that make it difficult to monitor consumption and identify opportunities for energy savings.

Two measures are being proposed to increase the energy efficiency of the Water and Sanitation Department:

1. Improve information on electricity consumption through the installation of an Energy Management System
2. Implement energy saving measures through the replacement of outdated installations with highest consumption

Project status: Feasibility

Environmental Planning and Climate Protection

uMngeni Ecological Infrastructure Programme

Funding: eThekwini Municipality
Project lead: EPCPD
Collaborating organisations: EWS, South African National Biodiversity Institute - SANBI, KZN Department of Water Affairs - DWA, Umgeni Water World Wildlife Fund – WWF, Water Research Commission - WRC and others

Water from the uMngeni catchment is the cornerstone of the eThekwini and uMgugundlovu municipality's growing economies. However the demand for water is now well beyond the available supply according to the 2009 Water Reconciliation Strategy for the KZN Coastal Metropolitan Areas. In response to this a series of expensive engineering solutions have been identified and are in the process of being implemented. These include, amongst others, the construction of inter-basin transfer schemes in the adjacent catchments of the Mooi and Mkomazi Rivers. However, it is recognised that these interventions will not be sufficient to address the water rapidly growing demand.

This situation has prompted eThekwini's Water and Sanitation department to explore alternative solutions to address water security. A growing body of evidence has shown that investing in ecological infrastructure can enhance the efficiency of water service delivery through improving water quality, reducing sediment loads, reducing flood risk and increasing yield through increased winter baseflows. This in turn augments and enhances the efficiency of the engineering investments. The management and restoration of ecological infrastructure in the catchment therefore has huge potential to provide much of the additional water required to meet the demands.

River bank restoration work carried out by Working for Water on a stretch of the uMngeni River downstream of the Albert Falls Dam has illustrated the delivery of these services through a significant improvement in water quality at a fraction of the cost currently being incurred by the Water Services Authorities in the catchment. This work has shown that for approximately 10% of the current water treatment spend, much of the length of the uMngeni River's riparian area could be restored and maintained through initiatives such as Working for Water, which would result in ecological restoration, improved delivery of water services, and the employment of local people.

The Greater uMngeni River Catchment, together with the upper Mooi and Mkomazi River Catchments, still have a substantial amount of their land surface (approximately 64%) that is in a relatively natural condition and which therefore retains its potential to deliver the water related ecological services listed above.

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SANBI and the eThekwini Municipality's Water and Sanitation Department together with the KZN Regional Office of DWA, Umgeni Water and the Water Service Authorities of the uMgungundlovu District and Msunduzi Local Municipalities, have spearheaded the establishment of a partnership to foster better collaboration and coordination of ecological infrastructure investments aimed at improving water security in the greater uMngeni catchment. The partnership is comprised of 36 government and civil society organisations who are in the process of finalising a memorandum of understanding for the establishment of the uMngeni Ecological Infrastructure Partnership (UEIP). The UEIP presents an opportunity to tangibly demonstrate the benefits of ecological infrastructure investments and its relevance to the South Africa's broader water security challenges. Lessons from this catchment then be replicated in other areas of strategic significance in the country.

Project status: Implementation

Buffelsdraai Landfill site Community Reforestation Programme

Funding: eThekwini Municipality
Project lead: EPCPD
Collaborating organisations: Wildlife Conservation Trust

As a host city for South Africa's 2010 FIFA World Cup, the eThekwini Municipality decided to host a "climate neutral" event, and offset associated carbon emissions. The total unavoidable carbon footprint was declared as 307 208 tons carbon dioxide (CO2) equivalent. The municipality has committed to mitigating this carbon footprint through a series of local natural habitat restoration projects. This will not only achieve the stated climate mitigation objective, but will also result in increased local climate adaptation capacity, within ecosystems and communities.

In terms of the offset, a 'reforestation' project aiming to offset approximately 50 000 tons CO^2 equivalent was established in the buffer zone of the municipality's Buffelsdraai Regional Landfill Site. The landfill is situated north of Durban, near Verulam, and aims to create a natural carbon sink. The project was initiated in November 2008. By 1 October 2012 approximately 284 hectares, of the buffer zone had been replanted to forest habitat. The total area projected to be reforested is approximately 520 hectares, the balance being made up of woodland and riverine forest already on the site.

While the project is a 'carbon sequestration' initiative it is simultaneously ensuring the improved supply of a large number of other ecosystem services (e.g. flood attenuation, sediment regulation, biodiversity refuge conservation, river flow regulation). All of these further enhance the long term climate change adaptation needs of local communities, as well as short term resilience to dangerous weather patterns such as storms and droughts. All reforested areas were previously either farmland (currently under sugarcane), with limited productive capacity, or infested with invasive alien plants.

The eThekwini Municipality appointed the Wildlands Conservation Trust (WCT) as implementing agent for the reforestation project at Buffelsdraai. This includes the roll-out of the WCT's well-established Indigenous Trees for Life Programme (ITFL), as well as all on-site tree planting. The ITFL programme assists unemployed people, who are subsequently known as 'Treepreneurs', to set up small-scale indigenous tree nurseries at their homes. The project has engaged 685 local community members, as Treepreneurs, in the surrounding Osindisweni, Buffelsdraai, Ndwedwe and KwaMashu communities. Tree seedlings are exchanged for credit notes, which can be used to obtain food, basic goods and/or pay for school fees, at regular 'Tree Stores' that are held in the participating communities.

Since inception, the project has created a total of 374 jobs (24 full-time, 10 part-time, 340 temporary) for members of the surrounding communities. At regular intervals, mass planting drives are held, during which members from the local communities are employed to assist with planting the trees out at the project site.

Early indications are that the socio-economic benefits of programme are significant, with increased education and food security being reported (Greater Capital, 2011). Communities benefitting from the project are some of the most impoverished and vulnerable in Durban. The social impact assessment found that the first 2 years of project implementation demonstrated the following positive impacts:

- Improved schooling for children
- Additional disposable income to cover additional needs (i.e. transport).
- Access to adequate food supply by project participants in two of the project communities has increased by 40%.

The project has highlighted the way that natural ecosystems support and protect human communities, and the way that human communities can support, restore and protect local ecosystems. This mutually supportive relationship is one of the reasons why the concept of Community Ecosystem Based Adaptation (CEBA) was proposed for Durban. CEBA is seen as an important and necessary extension of the existing 'Ecosystem Based Adaptation' concept.

Since initiating the Buffelsdraai Landfill Site Community Reforestation Project, the eThekwini Municipality has also established a similar community reforestation project at Inanda Mountain (west of Durban). Local communities around this site are rebuilding a 250 hectare coastal scarp forest, which was badly degraded, over many years, through uncontrolled fires and over-harvesting.

In November 2011, Durban hosted the COP17 CMP event, and at that time, launched the 'Durban Community-Ecosystem Based Adaptation' (Durban CEBA) initiative. The initial project site, situated in the Umbilo Catchment, forms the core of the municipality's investment into mitigating the CO2 emissions associated with the COP17-CMP7 event. The first component of this is a reforestation project, implemented by the Wildlands Conservation Trust, at the Paradise Valley Nature Reserve. A concurrent large-scale alien plant control project is also being implemented at the site, through the municipal Working for Ecosystems programme.

Project status: Implementation

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uMhlangane catchment management project

Funding: eThekwini Municipality
Project lead: EPCPD
Collaborating organisations: City of Bremen (Germany)

To explore how a 'business unusual' approach that encourages cross-sectoral planning and decision-making, broad stakeholder engagement and a focus on the city's natural resources as the base for adaptation, can enhance efforts to manage geographic units such as catchments, as key climate change adaptation tools within eThekwini Municipality. The project aims to demonstrate climate change adaptation 'in action' to cities locally and globally, and to influence broader city planning and management around issues such as biodiversity conservation and climate change, to ensure that Durban's resilience to climate change is enhanced.

One of the most significant outputs from COP 17/CMP 7 for Durban, was the Durban Adaptation Charter (DAC). The DAC committed its signatories to a number of actions towards enhanced adaptation, including incorporating climate change adaptation into city planning, addressing governance and institutional issues in relation to project implementation, prioritizing the enhancement of natural ecosystems as part of a climate change response, building government and non-government partnerships and developing suitable measuring, reporting and verification (MRV) systems to assess the progress made in adapting to climate change. While good in theory, the implementation of these principles is extremely challenging. If Durban is to lead in this arena, it is critical to begin to demonstrate practical examples of how these principles can be incorporated into projects on the ground. The EPCPD is therefore currently playing a lead role in coordinating a number of city sectors to develop a conceptual and management framework for the uMhlangane catchment that will bring these sectors together to work towards implementing projects that collectively contribute to enhanced climate change adaptation within the catchment. The project provides an important opportunity to investigate the complex institutional and governance issues that can either enhance or undermine progress in projects of this nature. It also provides an opportunity to investigate how progress can be monitored and reported on in a meaningful way, something that has not been achieved globally. This project is also being integrated into the CEBA programme.

The project has already drawn together a cross-sectoral city team to work together to investigate what it means to implement climate adaptation planning at the scale of a catchment. Sectors currently represented in the team include the Coastal Stormwater and Catchment Management Department (focusing on wetland rehabilitation and stormwater management), Economic Development Unit's 'Green Corridor Project' (focusing on job creation and social upliftment through initiatives such as rehabilitation of open space, effective management of public open spaces and creation of sport and recreational opportunities), eThekwini Water Services Unit (focused on monitoring water quality and investigating energy efficient wastewater treatment works), PINK (Phoenix, Inanda, Ntuzuma and KwaMashu) ABM (focusing on social and economic issues), Framework Planning (focused on planning issues such as densification) and the Environmental Planning

and Climate Protection Department (focused on the overall climate change adaptation objectives, and the coordination of the project). The International and Governance Relations Department is also involved in helping to facilitate an ongoing climate change partnership with the Free Hanseatic City of Bremen in Germany, a city that is currently working with Durban in implementing certain components of the project. This partnership with Bremen has also facilitated a number of technical exchange visits between the two cities and has provided funding for pilot projects within the uMhlangane catchment. These interactions have been critical opportunities for learning and exchange of ideas within the programme.

Project status: Implementation

Infrastructure Management & Socio - Economic Development and Economic Development Unit

IMS and EDU drive a number of projects within the Municipality. Two of these related to the Nexus are described in this section.

Aquaponics

Funding: IMS

Project lead: IMS, Economic Development

Ethekwini Municipality have realised the importance of protein in the diet of all people. Many children suffer from low protein diets and as a result struggle to achieve at school. Aquaculture (fish farming) is a way of inducing healthy protein into peoples' diet.

In 2010 eThekwini commissioned a fish hatchery to be built. Later the following year the tilapia hatchery was completed. The hatchery has a capacity of producing 2.0 mil fingerlings for distribution each year.

In 2011 a new concept of rural fish ponds was designed and built at Northdene Agro-ecology Centre. It underwent extensive testing.

In 2013 a program of constructing rural fish ponds was started. The design was based on the experience of the Northdene pond but was enhanced by some new modifications. The programme aims to bring fish (and therefore protein) into the lives of the rural community.

The first phase established 5 new ponds in the community and in 2014 it is hoped that additional ponds will be constructed.

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The community ponds provide not only fish but also nutrient rich water for the vegetable gardens which often are cultivated alongside the fish ponds.

The natural progression from aquaculture is aquaponics. This is the cultivation of fish and vegetables together on the same recycled water. The fish provide nutrient rich water. This water is recycled past the vegetable which extract the nutrients from the water and purify the water. The water is then recycled back to the fish.

A couple of aquaponics schemes are being planned for eThekwini and should be complete by the end of 2014.

Project status: Pilot scale

Community gardens

Funding: IMS

Project lead: IMS

Collaborating organisations: Khanyisa Projects

The eThekwini Municipality has been providing technical and social support to 100 farm groups during 2013 and 2014. The process involved an agricultural and social assessment followed by a rollout programme. The rollout included the following:

- Access roads
- Office container and packshed construction
- Irrigation including capture, storage and reticulation. Systems include rainwater harvesting, gravity systems, wells, ram pumps and portable diesel pumps.
- Sanitation
- Fencing
- Training
- Seedling and compost supply

Project status: Implementation

Cleansing and Solid Waste Management (DSW)

Landfill Gas to Electricity

Funding: eThekwini Municipality (some seed funding from Department of Energy and Department of Trade and Industry)
Project lead: DSW

Waste in landfills undergoes biological, chemical and physical transformation, giving rise to the formation of landfill gas. Landfill gas (LFG) can be extracted and safely utilised to generate power – aka "green energy".
This project introduced a first-of-a-kind to South Africa and the African continent as a whole. It was one of the very first CDMs worldwide when it was first introduced in 2002/3 and went on to become the first registered Kyoto Protocol's Clean Development Mechanism (CDM) type project in Africa in 2006.

The project comprises several landfill sites namely Mariannhill, La Mercy and Bisasar that contain approximately 2.7 and 1.2 million m3 of disposed municipal solid waste respectively. Landfill gas is extracted through gas wells that are either vertically driven into the waste or inclined "gas riser" pipes located around the landfill perimeter laid on top of the slope lining system. Wells are typically not deeper than 25 m in depth.

The landfill gas is sucked from the landfill at low pressure (15~50 millibars) and blown into a flare unit and reciprocating spark ignition engine through a roots blower system. Previously gas was flared at Mariannhill Landfill through 6 "baseline" gas wells.

This CDM project is termed "Component One" (Mariannhill and La Mercy Landfills) of the Durban Landfill Gas to Electricity CDM project. "Component Two" is the larger Bisasar Road Landfill CDM project. Waste is to be deposited at the Mariannhill landfill beyond 2024, and it is predicted that 1 775Nm^3/h of landfill gas will be produced by 2024.

Some statistics:

- Gas to Electricity on two sites: Mariannhill & Bisasar
- Mariannhill was the first landfill gas to electricity project in Africa and the second registered CDM project in South Africa.
- Mariannhill: 1 MW capacity
- Bisasar: 6,5 MW capacity
- Electricity generated to date: 254 GWh
- Revenue saved by the City: R100m
- Reduction of C02 Equivalents to date: 1 550 000 tons

Project status: Implemented and ongoing

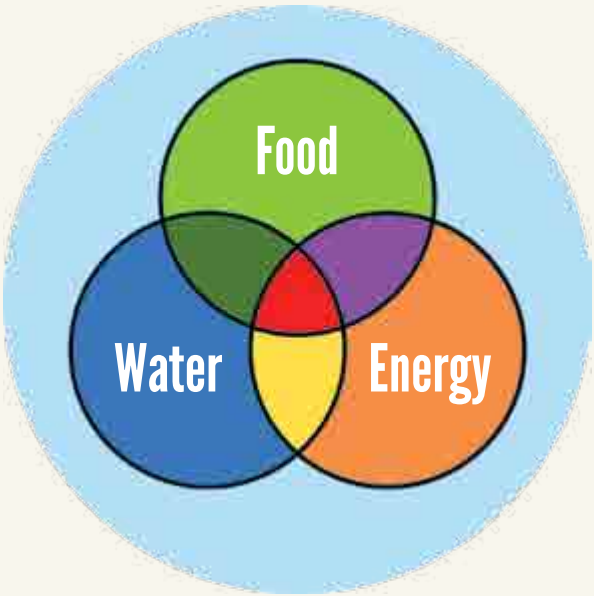
Further Information

eThekwini Municipality

Line Department	Web site
Water and Sanitation	www.durban.gov.za/City_Services/water_sanitation/
Energy Office	www.durban.gov.za/Resource_Centre/Current%20Projects%20and%20Programmes/energyoffice
Environmental Planning and Climate Protection	www.durban.gov.za/City_Services/development_planning_management/environmental_planning_climate_protection/
Infrastructure Management and Socio Economic Development	www.durban.gov.za/City_Services/engineering%20unit/imsed/
Economic Development	www.durban.gov.za/City_Services/Economic_Development/
Cleansing and Solid Waste Management	www.durban.gov.za/City_Services/cleansing_solid_waste/

Key Collaborating Organisations

Organisation	Web site
University of KwaZulu-Natal – Pollution Research Group	prg.ukzn.ac.za
Durban University of Technology – Institute for Water and Wastewater Technology	www.dut.ac.za
Khanyisa Projects	www.khanyisapr.co.za
Partners in Development	www.pid.co.za
Bremen Overseas Research & Development Association (BORDA	www.borda-net.org
The Hering Group	www.heringinternational.co.za
Swiss Federal Institute of Aquatic Science and Technology (EAWAG)	www.eawag.ch
Centre of Expertise	www.coe.org.za
The Bill & Melinda Gates Foundation	www.gatesfoundation.org
The Water Research Commission	www.wrc.org.za
Veolia Water Solutions & Technologies	www.veoliawaterst.co.za



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