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| **THRUST 1: WATER SENSITIVE AND RESILIENT SETTLEMENTS**  |
| ***Scope****:* The adequate provision of water services – including basic services – to South Africa’s citizens is one of the most significant challenges facing the country, and is felt most strongly in the rapidly growing urban areas.It is estimated that the proportion of urban dwellers will increase to over 70% by 2030. In this context water security is a major concern, particularly since climate change has the potential to worsen systemic water shortages and flooding over the medium to long term. Thus, new models of water capture, provision, treatment and water services governance must be developed to improve and enhance the effectiveness of interaction between the multiple actors who determine water use. The scope of this thrust is to influence the planning and design of smart human settlements and environments that is sensitive to the issues of water sustainability and environmental protection, while ensuring the efficient functioning of water service institutions and their viability are key to sustaining water services in rural and urban areas.  It will promote a holistic management of sewerage, stormwater and drinking water to achieve the goal Integrated Water Management (IWM) and a water supply mix.  |
| ***Programme 1:*** ***Smart water supply management*** | ***Scope:*** The scope of this thrust will focus on introducing new techniques and process, such as ICT, smart grids etc. in improving the technology for supplying water. It will give attention to better infrastructure asset management, energy management and generation, water loss minimisation, smart metering and all elements that will ensure secure and safe supply of water of good quantity and quality. Aligned to this will be improving management arrangements in achieving these outcomes. |
| ***Programme 2:*** ***Sustainable drainage futures*** | ***Scope:*** Currently the coordination of greywater, rainwater, sewerage and stormwater as an important resource mix in settlements is not well understood. Thus, the scope of this thrust will contribute to ensuring that the collection of water management practices align to modern drainage systems with natural water processes. Focus will be given to SuDS efforts make urban drainage systems more compatible with components of the natural water cycle and catchments, while modernizing monitoring and asset management systems towards development of a resource mix.  |
| ***Programme 3:*** ***Water efficiency and behaviour change*** | ***Scope:*** A fully-informed and empowered community or individual plays a vital role in the sustainable use of water services, which contributes to water efficiency and improved environmental health. This programme will address education and awareness aspects which contribute to efficient water use, improved behaviour and sustainable services. It will support the development of innovative tools, technologies and systems which contribute to water efficiency and behaviour change. |
| ***Programme 4:*** ***Water services Institutional and management programme*** | ***Scope:*** Relationships and partnerships between service providers, both external and internal, are important prerequisites to sustainable water service delivery. This programme’s objective is to generate knowledge and processes that would support this new form of service delivery. Innovative management techniques are a necessity for viable and sustainable water service provision. This programme intends to find innovative solutions to critical problems with the financing, cost recovery, regulation and management of essential services such as water supply and sanitation. |
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| **THRUST 2: WATER QUALITY FUTURES** |
| ***Scope***: *Problems arising from the deterioration of water quality still remains a major challenge in South Africa and across the world. In this era of growing uncertainties, addressing water quality challenges requires new imperatives and approaches that support a shift to more sustainable, integrated, and equitable approaches. The One Water concept considers the water cycle as a single integrated system, consisting of different sources – surface water, groundwater, stormwater, and wastewater. The quality of these interconnected sources needs to be managed in an integrated manner, considering the different multiple end uses, ie drinking, environmental use (reserve), industrial and agricultural uses, in order to benefit livelihoods, the environment and the economy. Thus, the research focus of this thrust will be on understanding the influence of major drivers (ie climate change, industrialisation, land use/cover, etc), as well as anthropogenic activities on water quality changes in raw water and treated water sources for different uses including; drinking; and agricultural and industrial uses. Research on contaminant sources, transport and partitioning and as well as their combined impacts will be key in determining appropriate risk management scenarios and developing the appropriate water quality management responses such as tools/technologies and regulatory/policy instruments.* |
| ***Programme 1:*** ***Smart water quality monitoring and decision making*** | ***Scope:*** Programme 1 aims to improve understanding on the economic and global change (climate change, land use/cover, urbanisation) drivers, as well as consequent pressures and uses (drinking, industrial and agricultural uses) that contribute to the deterioration of water quality within the ecosystem. This programme is also aimed at fostering an understanding of the sources, transport and partitioning of contaminants between the water component and sediment. This programme also supports research on the development of innovative methods for detection, monitoring and the subsequent use of the information for decision making. This encompasses data acquisition, use of innovative information communication technologies and models for real-time monitoring, as well as predicting and forecasting for water quality; development of knowledge hubs and cataloguing platforms for knowledge dissemination changes and subsequent use of the information for decision making.  |
| ***Programme 2:*** ***Water quality regulation, compliance and reporting*** | ***Scope:*** Research under thisprogramme is aimed at strengthening the implementation of a smart and integrated water quality management approach, where the water cycle is considered as a single integrated system, consisting of different interconnected sources whose quality have to be managed in an integrated manner, considering the different multiple end uses, ie drinking, environmental use (reserve), industrial and agricultural uses. Research supported under this programme include development of customized regulations and standards by presenting good practice related to water quality risk management and surveillance, and by providing health-based targets. In addition, research on the development and implementation of innovative water quality solutions and responses, including technological, management, regulatory and investment frameworks for water quality management as well as partnership models for water quality that lead to compliance and capacity development. |
| ***Programme 3:******Risk assessment for environmental water quality management*** | ***Scope*:** Research in thisprogramme will focus on assessing the risks and impacts of water pollution on sustainable development. Specific focus areas include selection of indicators and biomarkers for assessing the cost/benefit of water pollution on human health, ecosystem and the economy. With regards to human and environmental health, studies aimed at researching and assessing water quality risks as a result of non-point and point pollution to both human and ecological systems are encouraged. Risk analysis that will be sought after in this programme include, both quantitative and comparative risk assessment, integrated human and ecological risk, risk perception/communication as well as epidemiological studies and animal to human extrapolation. All risk analysis that are conducted in this programme should be meaningful in terms of having an impact on either assessment, communication or management (real time or predictive). |
| ***Programme 4:*** ***Emerging issues and substances of concern in water*** | ***Scope***: The specific research focus for programme 4 is on tracking the emergence new water quality issues and substances of concern considering the three types of emerging waterborne pollutants: (1) emerging chemicals of concern deposited from the atmosphere, (2) emerging chemicals of concern from wastewaters, and (3) microbes that are either newly discovered pathogens or long-established agents recently rendered more resistant and/or virulent. Research supported under this theme involves the integration of state-of-the-art analytical and environmental forensic technologies for studying the sources, concentrations, transport and fate of these substances within the aquatic ecosystem. In addition, research on the development and application of environmental toxicology techniques for determining the health effects of these emerging substances on humans and the ecosystem.  |
| ***Programme 5: Innovations in water treatment technologies*** | ***Scope***: This programme is aimed at supporting the development and demonstration of innovative water treatment technologies for addressing both the traditional and emerging threats to water resources. Research supported under this programme includes; the development and demonstration of innovative technological solutions for drinking water purification (both municipal and household); desalination of seawater or brackish water, as well as in situ water treatment technologies for environmental remediation. Technology demonstrations supported under this programme should clearly demonstrate primary linkages and trade-offs between energy use efficiency (and cost), and related water supply implications and water quality goals; as well as linkages to better outcomes in terms of health, livelihoods and economic gains.  |

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| **THRUST 3: SUSTAINABLE INTEGRATED WASTEWATER RESOURCES FUTURES** |
| ***Scope***:Although wastewater effluents from municipal, industrial and mining operations are a critical component of the water management cycle, they are generally considered a burden to be disposed of. However, in the face of ever-growing demand, wastewater is gaining momentum as a reliable alternative source of water, shifting the paradigm of wastewater management from “treatment and disposal” to reuse, recycle and resource recovery. Therefore, the scope of this thrust is to address wastewater as a resource, encourage the valorisation and reuse of wastewater effluents and promote sustainable wastewater management through reducing pollution, removing pollutants, reusing/recycling reclaimed water and recovering useful resources. The need to transition to a circular economy will be a key driver for a successful sustainable integrated wastewater future, with water, materials and energy used as transition pathways. To address the challenges associated with the integrated wastewater sector in a sustainable manner, the thrust will prioritize research, development and innovation that deliver the required solutions, innovations, processes and interventions at scale.  |
| ***Programme 1:*** *Quantification and Minimization of Water Use and Effluent Production* | ***Scope:*** Programme 1 will focus on development of new tools, methodologies and models that aid the evaluation (prediction, quantification, minimization) of sustainable water use. Furthermore, the programme aims to establish capabilities for preventing and reducing pollutants from entering the environment through minimisation of pollution at source as part of managing effluent impact on the environment in support of regulations. |
| ***Programme 2:****Effluent Treatment, Volarization and Reuse* | ***Scope:*** Reclaimed water offers opportunities for a sustainable and reliable water supply for industries and municipalities as an alternative source to meet increasing demand. Under programme 2, the treatment of wastewater effluents and volarization to a quality standard acceptable by users (i.e. ‘fit-for-purpose’ treatment) will be prioritized to supplement the ever-growing demand of water supply in support of sustainable reuse.  |
| ***Programme 3:*** *Advanced Technologies and Processes for Resource Recovery* | ***Scope*:** Under programme 3, innovative technologies, processes and solutions for resource recovery from wastewater effluents will be developed and used to demonstrate recovery of high value products that can be used as feedstocks for secondary industrial processes. The programme will also focus on scaled up recovery of material-based and energy-based resources. Technologies and processes to be developed, tested and applied under this programme will generally focus on the three key interrelated pathways (water, materials and energy) in support of the circular economy.  |
| ***Programme 4:****Nature-based Tools, Solutions and Innovations*  | ***Scope:*** Programme 4 will make use of many years of nature inspired solutions, and seeks to learn, emulate and use natural forms, processes and systems to contribute to the improved management of integrated wastewater. The programme will focus on building capacity, providing awareness, supporting the community of practice and strengthening nature inspired research, development and innovation traction targeting products and innovations.  |
| ***Programme 5:*** *Sustainable Mine Closure Management* | ***Scope*:** This programme will focus on addressing the environmental, social and economic challenges arising from mine closure including long-term mine water management post closure. Under the programme, innovative approaches to mine rehabilitation and land management that yield sustainable solutions as part of economic sustainability, community upliftment and local economic development and entrepreneurship will be prioritized in support of the green economy.  |

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| **THRUST 4: THE SANITATION TRANSFORMATION INITIATIVE (SANITI)** |
| ***Scope****:* Sanitation is a national and global development priority and is included in Sustainable Development Goal (SDG) 6. Current implemented models of sanitation are not able to deliver sustainable sanitation services to all within the limited development timeframes. The “Sanitation Transformation Initiative” (SANITI) was developed by the WRC as a new strategic approach to deliver sanitation through innovative technologies and approaches. The technical focus of SANITI will be non-sewered sanitation that moves away from the current linear design approach of collecting, transporting and treating human faecal wastes to the development of innovations and models that promote cost-effectiveness and longevity of infrastructure investment and introduces circular economy principles in which promote re-use, recovery and recycling through the sanitation value chain. SANITI has the potential to address the limitations of current sanitation interventions. These include accelerating sanitation provision through innovative technologies and approaches; minimising health risk through use of toilets; recycling / re-using limited resources, meeting user experience and acceptance; minimising environmental pollution; and the potential to link sanitation infrastructure to additional revenue streams from the valorisation of faecal wastes. The scope of this thrust is to provide impetus to the development of non-sewered sanitation solutions which would assist sanitation service providers to be more efficient and cost-effective. |
| ***Programme 1:*** ***Re-Engineered Toilets*** | ***Scope:*** The scope of this programme will include the development of innovative toilet options that combines the benefits of flush systems and dry sanitation systems while eliminating their limitations (reducing flush volumes, eliminating pathogens and sludge production, non-requirement for laying of sewers, appealing to users). Solutions developed must take into account circular economy principles as part of their design and operation, including the recycling of water and nutrients, energy-saving/generation and capability to generate by-products of commercial value. Solutions developed need to be complemented by appropriate business models to guide scale-up.  |
| ***Programme 2: Sanitation-Sensitive Design (SSD)*** | ***Scope:*** The development of institutional and municipal financial, planning, management, social and communication models that align to the objectives of SANITI is required for this new form of service delivery to achieve critical mass. The focus of this programme will therefore be the development, testing and evaluation of these models to ensure sustainability of approach. This programme will address institutional and municipal sustainable service provision through incorporation of “sanitation as a business” approaches; creating enabling environments for new sanitation models; training, education and awareness aspects which contribute to sanitation sensitive design; and improved city-wide hygiene behaviours and health indicators. |
| ***Programme 3:*** ***Municipal Sludge Valorisation*** | ***Scope:***  Municipal wastewater sludges and faecal sludges from on-site systems are technically challenging to deal with. There is a need for cost-effective solutions to deal with municipal wastewater and faecal sludges. The scope of this programme is to promote the development of appropriate and cost-effective techniques for municipal and faecal sludge treatment and/or valorisation. The focus of this programme on research, development and innovation that optimises current treatment options and future valorisation-focused systems. |
| ***Programme 4:******SaniBus – Sanitation Linked Business*** | ***Scope:*** The scope of this programme will include the development, inclusion, application and evaluation of business approaches as part of sanitation service provision. Traditionally, sanitation provision is subsidised through the public sector with little expectation of full cost recovery. The private sector can play an important role in accelerating sanitation provision by offering alternate sanitation products and services at appropriate prices while generating income. This programme will focus on the development, application and evaluation of business plans for the dual purpose of income generation and sanitation provision. This will include market research and analysis, financing arrangements, business legislation analysis, product and service development; business management, and financial planning associated with new sanitation models. |