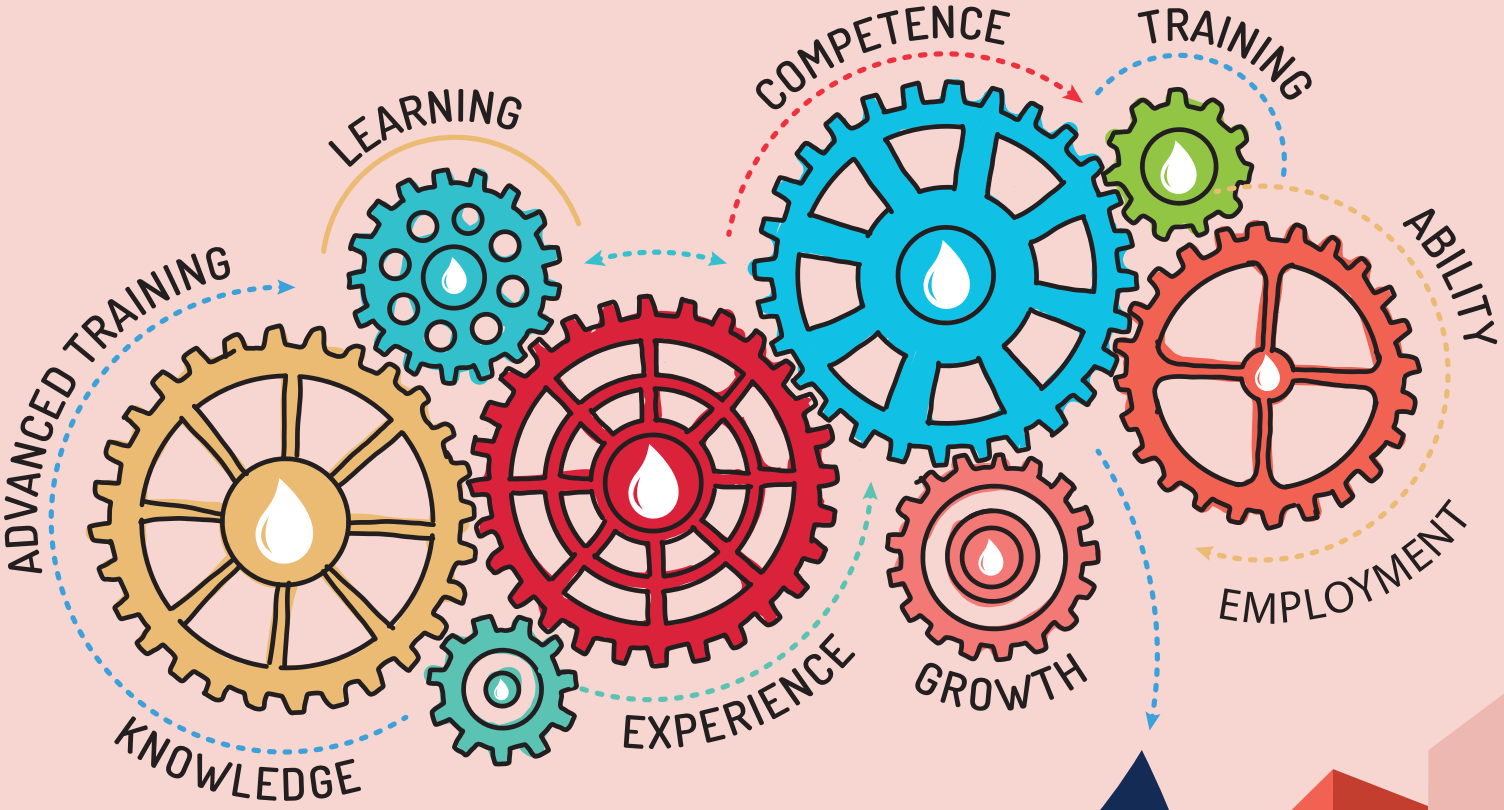
WATER RESEARCH DEVELOPMENT AND INNOVATION (RDI) ROADMAP SKILLS MAPPING STUDY

VOLUME 2: POSTGRADUATE TRAINING MAP

N Nel, N Moodley and MJ Jackson



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WATER RESEARCH DEVELOPMENT AND INNOVATION (RDI) ROADMAP SKILLS MAPPING STUDY

VOLUME 2: POSTGRADUATE TRAINING MAP

Report to the
Water Research Commission

by

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Volume I: Updated RDI Roadmap Capability Map **(WRC Report No. TT 865/1/21)**
Volume II: Water Sector Postgraduate Training Map **(This report)**
Volume III: Short Course Skills Mapping Study **(WRC Report No. TT 865/3/21)**
Volume IV: A Water Sector Skills Demand Report **(WRC Report No. TT 865/4/21)**

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EXECUTIVE SUMMARY

BACKGROUND

The Water Research, Development and Innovation (RDI) Roadmap is a high-level planning intervention that facilitates and guides refocusing of research, reprioritisation of funds, synergising of existing initiatives and ring-fencing of the new resources to facilitate a more optimal water innovation system. The water sector postgraduate Honours, Master's and Doctoral training map and gap analysis is the second volume of the RDI Water Sector Skills Mapping Study and its purpose is to map the postgraduate landscape and promote more focused Higher Education Institution (HEI) coordination, collaboration and response to gaps in water sector-related postgraduate training. The main objective of this study is to develop a detailed map of, and identify gaps in, current water sector-related postgraduate training (Honours, Master's, PhD) offered at all 27 HEIs in South Africa.

METHODOLOGY

The methodological process adopted for this study included the identification of a targeted set of stakeholders within all HEIs to ensure high-quality engagements and feedback to inform the research objectives. This was followed by data collection through a desktop study, literature review, an online survey questionnaire, semi-structured interviews and data verification, data analysis and reporting. Raw data was grouped by specialised and generalist degrees per HEI and mapped to the thematic clusters in the RDI Roadmap. Research Focus Areas (RFAs) in the Roadmap were used for the mapping process in the desktop study. A second activity was to group the Honours, Master's, and PhD programmes according to disciplines: Engineering & the Built Environment, Commerce, Social Sciences and Humanities, Law, Medicine & Health Science, Agricultural Science, Environmental Science, and Applied Science. A comprehensive analysis of opportunities, overlaps and gaps was then undertaken by using a gap analysis process.

RESULTS AND CONCLUSION

Relevant water sector-related postgraduate degree programmes (both general and specialised) were identified at 21 of the 27 HEIs. Those HEIs not offering postgraduate programmes in the water field are all Historically Disadvantaged Institutions (HDIs) or newly established. 107 general degrees were identified as having a water research specialisation across 19 HEIs, and 55 specialised postgraduate degree programmes were identified at 14 HEIs. Of these specialised degrees, nine Honours-level courses were identified with the remainder offered at a Master's and Doctoral level. Water-related research institutes, centres, units, clusters or groups were identified at 16 HEIs.

The following table is a summary of the findings of this study in terms of the number of specialised water-related postgraduate programmes, the number of general postgraduate programmes with the option to specialise in water and the applicable discipline on offer at each of the HEIs.

Summary of findings in this study (number of specialised and general water-related postgraduate programmes, and applicable disciplines on offer at each of the HEIs).

HEI	Water Institute/Research cluster	No. of Specialised Postgraduate Programmes	No. of General Postgraduate Programmes	Disciplines								
				Engineering & Built Environment	Commerce	Social Science & Humanities	Law	Medicine & Health Science	Education	Agricultural Science	Environmental Science	Applied Science
CPUT*		**1**	**3**	x							x	
CUT*	x	**0**	**1**								x	
DUT*	x	**0**	**2**	x							x	
IIE MSA		**2**	**0**		x						x	
LU		**2**	**5**		x	x	x			x	x	
MUT*		**0**	**0**									
NMMU	x	**0**	**2**	x							x	
NWU	x	**1**	**5**	x	x	x	x				x	
RU	x	**3**	**2**		x						x	
SMU		**0**	**0**									
SPU		**0**	**0**									
SU	x	**4**	**13**	x					x	x	x	x
TUT*		**0**	**0**									
UCT	x	**12**	**13**	x	x	x	x	x			x	x
UFS	x	**3**	**3**							x	x	x
UFH	**x**	**0**	**2**			x					x	
UJ	x	**0**	**1**								x	
UKZN	**x**	**4**	**18**	x	x	x		x		x	x	x
UMP		**0**	**0**									
UP		**8**	**5**	x			x			x	x	x
UNISA	x	**0**	**8**		x	x					x	
UNIVEN		**2**	**4**	x			x				x	
WITS	x	**6**	**8**	x	x		x				x	
UWC	x	**4**	**6**			x	x				x	x
UNIZULU		**3**	**4**								x	x
VUT*		**0**	**2**	x								x
WSU		**0**	**0**									
Total		**55**	**107**									
		162										
**University of Technology*												

With the exception of the Cape Peninsula University of Technology (CPUT), specialised postgraduate water-related programmes are only on offer at traditional universities as opposed to Universities of Technology. The highest number of specialised programmes are offered by the University of Cape Town (UCT) followed by the University of Pretoria (UP). UCT and the University of KwaZulu-Natal (UKZN) offer the broadest range of specialised courses in terms of disciplines (i.e. faculties). UKZN followed by the UCT and the Stellenbosch University (SU) have the largest offering of water-related general degree programmes. The largest number of water-related specialised and general programmes on offer at HEIs are in the disciplines of Environmental Science followed by Engineering and the Built Environment, with the fewest offered in the disciplines of Education, Commerce, Social Science and Humanities, and Medicine/Public Health.

There is a strong correlation between the existence of water-related research institutes at specific HEIs and the offering of water-related postgraduate degree programmes at those HEIs. A further correlation between the presence of a research institute and postgraduate dissertation topics is not as evident across the HEIs with the only linkages evident in water resource management/urban water management at the University of Cape Town, groundwater at the University of the Western Cape and the University of the Free State and water quality and sanitation at UKZN. Additionally, structured Master's (comprising electives, coursework and a mini dissertation) versus unstructured Master's (comprising full research thesis or dissertation) offerings appear to be institutionally and departmentally dependent with no clear correlation emerging.

The mapping of the postgraduate programme findings to the RDI Roadmap's thematic clusters of needs and interventions relating to supply and demand for the water community revealed that Cluster 2 [*Governance, planning, and management of supply and demand*] was the strongest thematic cluster. This was followed by Cluster 1 [*Increase ability to make use of more sources of water*] and Cluster 6 [*Efficiency use of water (Agriculture, industry, and consumers*)]. The weakest cluster was Cluster 3: [*Adequacy and performance of supply infrastructure and operational performance (Built and ecological infrastructure)*]. These cluster strengths correlate with the capability mapping of HEIs in Volume 1 of this project as well as the investment and postgraduate student targets per cluster in the Water RDI Roadmap.

Gaps in the postgraduate water landscape have been identified through a gap analysis process as follows:

Operational Gaps:

- There are no water-related postgraduate programmes at the University of Mpumalanga (UMP), Mangosuthu University of Technology (MUT), Sefako Makgatho Health Sciences University (SMU), Sol Plaatje University (SPU), Tshwane University of Technology (TUT), and Walter Sisulu University (WSU).
- There are few general and specialised postgraduate degrees in the disciplines of Education, Commerce, Social Science/Humanities and Medicine/Public Health.
- There are few specialised water-related postgraduate programmes at Universities of Technology.
- There is a lack of diversity in terms of specialised water programmes with the majority in the Hydrology and Water Resource Management space.
- There is minimal representation of certain disciplines including Education, Medicine/Public Health, Law, Humanities and Social Sciences, and Commerce at the various water-related research institutes.

- There is inconsistent funding for water-specific postgraduate study. This aligns with World Bank (2014), which found that investment in postgraduate studies is a key driver.
- There is a lack of depth or succession plans should academic staff leave academia, which affects the longevity of certain research.

Strategic Gaps:

- There is a lack of consistent inter-institutional collaboration for the pooling of resources.
- There is a lack of consistent industry/institution/statutory body partnerships that would foster collaborative programmes.
- There is a lag between research driven by demand from industry and local government. Postgraduate research is mostly internally supply driven.
- There is a lack of subsidies for coursework Master's which is a gap in terms of increasing skills sets of postgraduates beyond a niche dissertation. This may impact specialised course offerings.

In terms of key drivers of water-related research, focus group interviewees highlighted the importance of supervisory capacity/networks and the personalities of academic staff. A particularly unique research driver identified in the semi-structured interviews was the undertaking of consulting work/externally funded projects by a particular research team and the generating of postgraduate research as a result.

RECOMMENDATIONS

The following approaches are recommended to address the gaps identified through this study: to achieve postgraduate targets as per the RDI Roadmap, to enhance the quantity and quality of postgraduates, and institutional research and innovation capacity:

- Organise water-related postgraduate education and research on a regional scale using the WaterNet example as presented by Jonker *et al.* (2012). WaterNet is an independent network organisation that evolved from a regional network of academic departments and offers a joint and regional Master's programme where member institutions offer course modules in the fields in which they have a comparative strength. The pooling of resources will assist in building capacity at HEIs with no or very few postgraduate programmes, increasing accessibility for prospective students, encouraging cooperation and diverse ideas and innovative solving of African water problems "by Africans for Africans" (World Bank, 2014). Harnessing online learning and virtual platforms will be key for collaboration. Nurturing and developing strong thematic clusters and stimulating additional research to address weaker thematic clusters should be undertaken by sharing expertise between academic departments.
- Increase the number of specialised degrees (course modules) particularly at Universities of Technology in a broad range of topics and in various disciplines. Specialised courses at an Honours and Master's level will provide an important platform for further water research and broader skills sets related to research, development and innovation activities. The pooling of resources as discussed above may provide further opportunity for a diverse offering of specialised course modules.
- Intensify and cultivate existing water-related research institutes at HEIs as valuable collaborative platforms and drivers of research, and to broaden discipline-specific representation in the water research space particularly to include the disciplines of Education and Medicine/Public Health.
- Foster and build on collaborative programmes with the private sector, government, Catchment Management Agencies and landowners. A greater representation of HEIs or public research institutions on certain statutory or unitary and professional bodies such as the Institute of Municipal Engineering of Southern Africa (IMESA), the South African Local Government

Association (SALGA) could facilitate collaboration and knowledge transfer. A global example of engagement with the private sector to encourage innovation in research includes support for Mexico's Technology Institute of Monterrey (TIM) by the business community in the State of Nuevo Leon (UNESDOC, 2008).

- Retain or attract highly skilled research personnel through, for example, tax incentives for returning postgraduates (UNESDOC, 2008).
- Increase investment in research in recognition of the fact that a lack of funding is a key barrier to the uptake of postgraduate studies. Explore options such as: public/private funding models, consulting work and scholarship funding through "sandwich programs" (World Bank, 2014). Draw on the success of the Millennium Science Initiative in increasing Ugandan researchers and Master's students in science (World Bank, 2014).
- Pursue policies to improve the quality and quantity of postgraduate water research. This could include, for example, government subsidies for structured Master's as an additional offering for exposure to broader concepts and themes in the water sector.

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ABBREVIATIONS

APRU	Association of Pacific Rim Universities
ARUA	African Universities Research Alliance
CET	Community Education and Training
CHE	Council on Higher Education
CHEC-WCG	Cape Higher Education Consortium – Western Cape Government
CIWaRD	Centre in Water Research & Development
CMA	Catchment Management Agencies
CoE	Centres of Excellence
CPD	Continued Professional Development
CPUT	Cape Peninsula University of Technology
CSIR	Council for Scientific and Industrial Research
CUT	Central University of Technology
D	Doctoral Research
DFID	Department for International Development
DHET	Department of Higher Education and Training
Dip	Postgraduate Diploma
DSI	Department of Science and Innovation
DUT	Durban University of Technology
DWS	Department of Water and Sanitation
EGS	Environmental and Geographical Science
ENGEO	Environmental & Geographical Science Department
ESSRI	Earth Stewardship Research Institute
EWSETA	Energy and Water Sector Education and Training Authority
FAO	Food & Agriculture Organisation of the United Nations
H	Honours
HEI	Higher Education Institution
IIE MSA	Independent Institute of Education Monash SA
IMESA	Institute of Municipal Engineering of Southern Africa
IMWaRU	Industrial & Mining Water Research Unit
IWMI	International Water Management Institute
IWRM	Integrated Water Resource Management
LGSETA	Local Government SETA
LU	Limpopo University
M	Master's degree
MBA	Master of Business Administration
MESHWR	Master of Earth Sciences in Hydrology and Water Resources
MUT	Mangosuthu University of Technology
NanoWS	Nanotechnology and Water Sustainability
NDP	National Development Plan
NETD	National Electronic Theses and Dissertations
NMMU	Nelson Mandela Metropolitan University
NQF	National Qualifications Framework
NUFFIC	Netherlands Universities for International Cooperation
NWRS2	National Water Resource Strategy of 2013 – second edition
NWU	North West University
PSET	Post-school education and training

QC	Quality Council
RDI	Research, Development and Innovation
RDD	Research, Development and Deployment
RFA	Research Focus Area
RU	Rhodes University
SA	South Africa
SADC	South African Development Community
SALGA	South African Local Government Association
SAQA	South African Qualification Authority
SEERU	Sustainable Energy and Environment Research Unit
SIDA	Swedish International Development Corporation Agency
SMU	Sefako Makgatho Health Sciences University
SPU	Sol Plaatje University
STI	Science, Technology and Innovation
SU	Stellenbosch University
SUWI	Stellenbosch University Water Institute
TIM	Technology Institute of Monterrey
TUT	Tshwane University of Technology
TVET	Technical and Vocational Education and Training
UCT	University of Cape Town
UFH	University of Fort Hare
UFS	University of the Free State
UJ	University of Johannesburg
UKZN	University of KwaZulu-Natal
UMP	University of Mpumalanga
UNISA	University of South Africa
UNIVEN	University of Venda
UNIZULU	University of Zululand
UP	University of Pretoria
UPaRF	UNESCO-IHE Partnership Research Fund
UWC	University of the Western Cape
VUT	Vaal University of Technology
WITS	University of the Witwatersrand
WRC	Water Research Commission
W:SATE	Water – Systems & the Environment
WSU	Walter Sisulu University
WUN	Worldwide Universities Network

CHAPTER 1 INTRODUCTION AND CONTEXT

1.1 Contextualisation

The Water Research, Development and Innovation (RDI) Roadmap is a high-level planning intervention that facilitates and guides refocusing of research, reprioritisation of funds, synergising of existing initiatives and ring-fencing of the new resources to facilitate a more optimal water innovation system. The Roadmap is run as a partnership by the Department of Science and Innovation (DSI), Department of Water and Sanitation (DWS) and the Water Research Commission (WRC) (WRC, 2015).

The vision of the Roadmap is that South Africa is a leader among middle income countries in the development and deployment of water management practices and technologies.

One of the main pillars and focus areas of the Roadmap is to support high-end human capacity development for water RDI. The primary focus of this Roadmap's skills development efforts is centred around postgraduate level skills. Highly skilled individuals are key to enabling faster and more effective development and deployment of context-appropriate solutions to water sector challenges. The Roadmap, thus, has a range of targets around postgraduate student support over a 10-year period in the specific thematic clusters of the plan. These targets are based on an analysis and associated set of assumptions around the pipeline of capacity needed to drive mature research teams in the sector.

An objective of the RDI Water Sector Skills Mapping Study focuses on understanding water sector skills demand, mapping and analysing the water sector postgraduate training landscape, mapping the RDI relevant short course training landscape and updating the Water RDI Capability Map.

The water sector postgraduate Honours, Master's and Doctoral training map and gap analysis is the second volume of the RDI Water Sector Skills Mapping Study. Its purpose is to map the postgraduate landscape and provide recommendations as a tool synergising university activities and research focus areas.

The context of Volume 2 (and the focus of this report) is depicted in Figure 1.

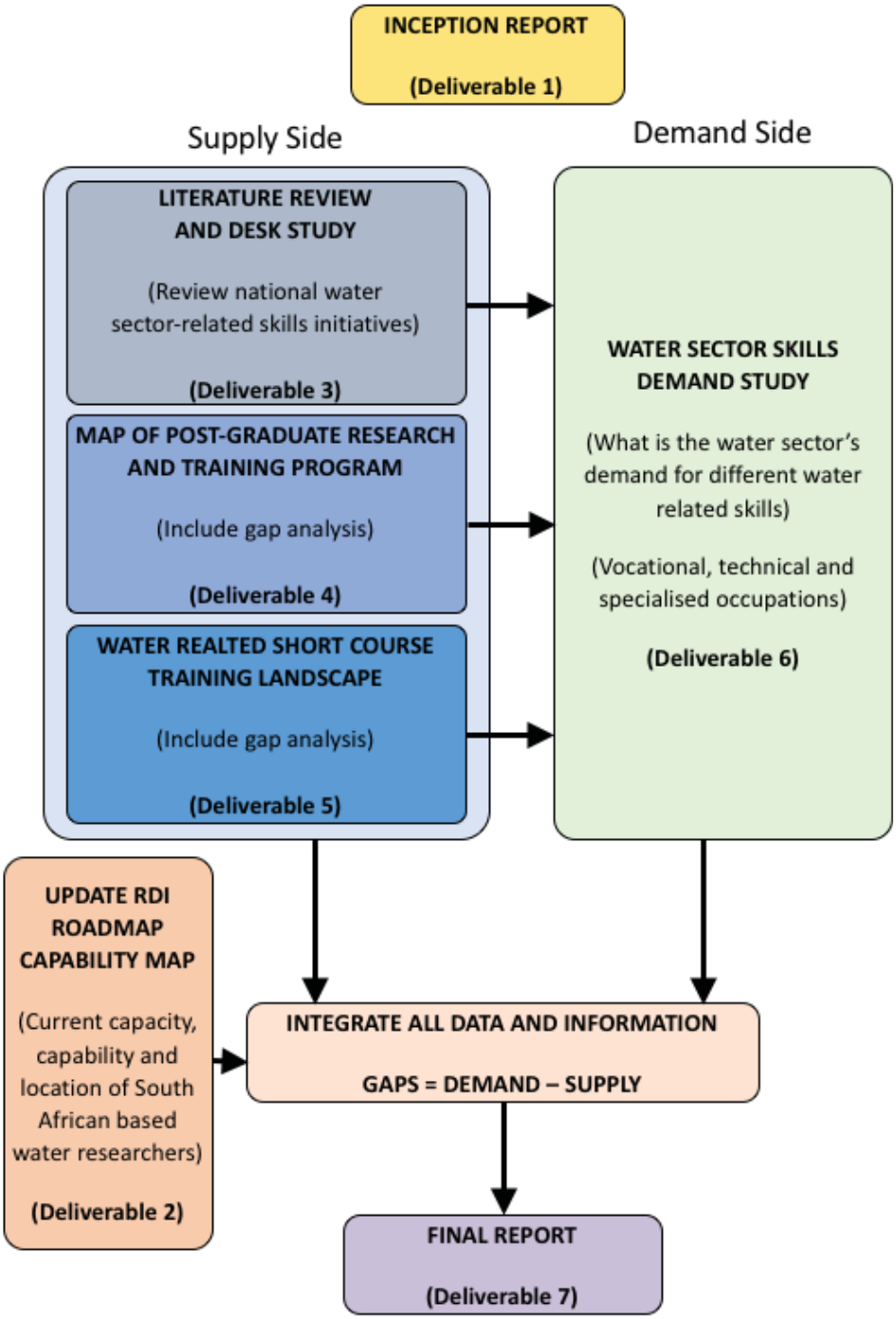

Figure 1: Volume 2 Contextualisation

1.2 Background and rationale

Research and innovation have been a major contributor to meet the increasing demands for water in South Africa. The development of skills in the water sector and high-level knowledge about water is still a priority for rapid progress to ensure that all citizens have safe and secure access to water of good quality.

While there is a range of water sector relevant postgraduate training offerings available in South Africa (including specific niche/focus courses and more general disciplinary courses with an opportunity to

specialise in water), it appears that this is a weakly coordinated space with limited awareness among HEIs about their overlaps, synergies and possible gaps.

This presents an opportunity to map out this space in a way that will promote more focused HEI coordination, collaboration and response to gaps for water sector postgraduate training and forms the rationale for Volume 2.

1.3 Aims and objectives

The main objective of this study is to develop a detailed map of, and identify gaps in, current water sector-related postgraduate training (Honours, Master's, PhD) offered at all 27 HEIs in South Africa. Further outcomes of the volume are to:

- Identify opportunities for enhancing existing programmes,
- Identify programmes that are particularly unique in terms of their approach, expanded skills development opportunities and their links with industry,
- Enable opportunities for collaborative programmes between different HEI or HEI and industry/government where synergy is possible, or the creation of entirely new programmes.
- Support the Department of Higher Education and Training (DHET) and Energy and Water Sector Education and Training Authority (EWSETA) to align qualification development with Research Development and Deployment (RDD) initiatives.

1.4 Scope and Approach

This study allows for the identification of gaps in the water-related postgraduate training landscape and facilitates improved coordination and synergising amongst the role players.

This study is specifically delineated as follows:

- To include generalist postgraduate degrees that, due to institutional expertise, tend to have a strong water sector offering as well as postgraduate programmes more specifically tailored to water.
- To include Council on Higher Education (CHE) accredited academic programmes.
- To include postgraduate programmes at Public and Private Universities and Universities of Technology.
- To include Honours, Master's, PhD or NQF Levels 8 to 10 postgraduate training.
- To exclude research and development organisations/public research institutions (e.g. Council for Scientific and Industrial Research CSIR) on the premise that postgraduate degrees are not awarded through the organisations themselves. Only HEIs offering Honours, Master's and PhD programmes were identified and included in the study.

The primary target audience of the volume is the various role players in the postgraduate training landscape including:

- Postgraduate curriculum developers, advisors and presenters,
- Subject matter experts.
- Research officers,

- Professional bodies and associations,
- Research and development specialist organisations, in both the public and private sector,
- Employers and individuals who may want to source specific postgraduate program opportunities, and
- The WRC as an information source for the sector.

CHAPTER 2 METHODOLOGY

2.1 Database and Stakeholder Development

The first step of the study was the identification of a highly targeted set of stakeholders to ensure high-quality engagements and feedback to inform the research objectives.

The stakeholder database consisted of key staff within all the HEIs (Public and Private Universities and Universities of Technology) offering postgraduate training (Honours, Master's, PhD or National Qualifications Framework (NQF) Levels 8 to 10) related to water that were identified, through a desktop study are listed in Table 1.

Table 1: HEIs included in this study offering Postgraduate Training.

	Institution	Province
1	Cape Peninsula University of Technology (CPUT)	Western Cape
2	Central University of Technology (CUT)	Free State
3	Durban University of Technology (DUT)	KwaZulu-Natal
4	The Independent Institute of Education (IIE MSA) (Previously Monash SA)	Gauteng
5	Limpopo University (LU)	Limpopo
6	Mangosuthu University of Technology (MUT)	KwaZulu-Natal
7	Nelson Mandela Metropolitan University (NMMU)	Eastern Cape
8	North West University (NWU)	North West
9	Rhodes University (RU)	Eastern Cape
10	Sefako Makgatho Health Science University (SMU)	Gauteng
11	Sol Plaatje University (SPU)	Northern Cape
12	Stellenbosch University (SU)	Western Cape
13	Tshwane University of Technology (TUT)	Gauteng
14	University of Cape Town (UCT)	Western Cape
15	University of Free State (UFS)	Free State
16	University of Fort Hare (UFH)	Eastern Cape
17	University of Johannesburg (UJ)	Gauteng
18	University of KwaZulu-Natal (UKZN)	KwaZulu-Natal
19	University of Mpumalanga (UMP)	Mpumalanga
20	University of Pretoria (UP)	Gauteng
21	University of South Africa (UNISA)	Nationwide
22	University of Venda (UNIVEN)	Limpopo
23	University of Witwatersrand (WITS)	Gauteng
24	University of the Western Cape (UWC)	Western Cape
25	University of Zululand (UNIZULU)	KwaZulu-Natal
26	Vaal University of Technology (VUT)	Gauteng
27	Walter Sisulu University (WSU)	Eastern Cape

The stakeholders or staff within these HEIs included:

- Persons involved in conducting water-related research,
- Lecturers and research supervisors,
- Academic heads,
- Subject matter experts,
- Project leaders, and

- Postgraduate students.

These institutions and stakeholders were mapped through a desktop study and additional filtering of respondents from the survey related to Volume 1 (Update RDI Roadmap Capability Map).

2.2 Data Collection

The collection of data was achieved through a literature review, desktop study of postgraduate programs offered by HEIs nationally, online survey questionnaire, and semi-structured interviews as outlined below.

2.2.1 Literature Review

A literature review of the South African water sector postgraduate landscape was undertaken to inform the desktop study of all HEIs that offer postgraduate Honours, Master's, and PhD programmes related to water.

The focus of the literature review was to understand the legislative framework, the state of water sector postgraduate initiatives in South Africa in terms of relevant RDI activity and the number of postgraduates, and to understand relevant targets as related to the landscape to inform the gap analysis.

2.2.2 Desktop Study

A preliminary desktop study of postgraduate programmes as per the delineations stated in section 1.4 was listed in a spreadsheet forming the foundation of the data set. HEIs as identified in Table 1 were targeted and a study of existing published literature, various curricula, and prospectuses were undertaken. The data set included the name of the HEI, the faculty, the department, the degree programme, the course name/research topic, and the Research Focus Areas (RFAs). Research institutes/clusters/units were also listed to determine any correlation with research themes.

As a first step, *all* postgraduate degrees with an implicit water sector offering (i.e. broad alignment with any of the WRC (2015) RFAs (Appendix A) were listed. Specialised degree programmes with an explicit water focus (e.g. MSc Hydrology or General degree with specialised water courses/modules) emerged during this process. Subsequent steps were then taken in order to determine which of the remaining generalist degrees and any additional degrees could have a specialisation in water either through courses/modules or research outputs. These steps included the following:

- A review of Master's and PhD dissertations on the National Electronic Theses and Dissertations (NETD) database was undertaken. A search of titles and/or abstracts containing" water" as a keyword yielded >10000 results. The search was therefore limited to the 5-year period from 2015 to 2020 in line with research conducted by Pouris & Thopil (2020). The results were further refined for applicability and due to time constraints, >4 research outputs for a specific degree programme were not included.
- A review of websites and course curricula was done to determine specific departmental research objectives and/or courses/modules on offer. Where water-related research capacity

was identified, it was applied to both the relevant Master's and Doctoral degree programme listings in the database.

The RFAs defined as areas of research expertise in water, were developed as part of the development of the National Water RDI Roadmap (WRC, 2015). The underlying discipline and sub-disciplines were used for defining each RFA or area of interest. Soil fertility was, for example, described by the following disciplines: Agricultural sciences (Discipline level 1), Soil Science (Discipline level 2) and Soil Fertility (Discipline level 3). The WRC managers mapped the 106 unique RFAs onto the Roadmap clusters to have a high-level view of the key disciplines and research specialisations that are driving research in different thematic clusters.

In this study, minor modifications were made to the taxonomy of RFAs provided by the WRC particularly where duplication occurred, before it was utilised for data collection and verification. The RFAs used in the study are listed in Appendix A. These RFAs informed the data analysis as discussed in Section 2.4.

Three RFA allocations per postgraduate programme were made to ensure the robustness of the data set.

2.2.3 Online Questionnaire

Primary data on available water sector postgraduate programs were collected through an online survey questionnaire (see Appendix B for survey sample) which was circulated to the various individuals listed in the postgraduate stakeholder database. To keep the questionnaire user-friendly, accessible, and quick-to-complete, respondents were asked to check the accuracy of the desktop findings as relevant to their specific institution and make changes/additions as necessary. In other words, to determine if the name of the HEI, the faculty, the department, the degree programme, the course name/research topic and the linkage to RFAs were correct.

Data was also used in understanding trends for postgraduate programmes, while emergent themes were identified for inclusion and further investigation in a series of interview sessions.

Approval for the questionnaires of this project was obtained from the Social, Behavioural and Educational Research ethics committee of Stellenbosch University (REC-2019-9608).

2.2.4 Semi-Structured Interviews

Identified stakeholders across a broad spectrum of HEIs (in terms of geographical location, public and private universities and universities of technology) were identified for semi-structured interviews to validate and triangulate the information generated through the desktop study and online questionnaires.

The interviews provided the opportunity to obtain, explore, and unpack additional information (e.g. barriers and drivers, unique approaches and expanded skills development opportunities and their links with industry), also key themes that emerged during the desktop and survey questionnaire process.

2.3 Verification

Qualifications registered by the South African Qualifications Authority (SAQA) were used to validate the findings in the desktop study. The search word of "water" in the database was extracted from the SAQA website on the 15 October 2019 and contained the most recent updated information.

While the online survey questionnaire also served to verify and validate the data obtained through the desktop study, additional contact was made with a representative sample of staff and the water-related research institutions at the various HEIs where they exist.

2.4 Data Analysis

Generalist degrees with an implicit water sector offering but where courses and/or water-related dissertation outputs were not found, were excluded from the data analysis.

Where water-related research capacity was identified, it was applied to both the relevant Master's and Doctoral degree programme listings in the database and counted in the data analysis as one programme.

Raw data was grouped by specialised and generalist degrees per HEI and mapped to the WRC (2015) seven clusters. Identified RFAs in the desktop study were used for the mapping process as outlined in WRC (2015). For consistency across all volumes in this project, the adjusted clusters as depicted in Table 2 were utilised.

Table 2: Clusters of needs and intervention: WRC (2015) and current project.

No	Clusters WRC (2015)	Adjusted Clusters for current project
1	Increase ability to make use of more sources of water, including alternatives	Increase ability to make use of more sources of water
2	Improve governance, planning and management of supply and delivery	Governance, planning, and management of supply and demand
3	Improve adequacy and performance of supply infrastructure	Adequacy and performance of supply infrastructure and operational performance (Built infrastructure).
		Adequacy and performance of supply infrastructure and operational performance (Ecological infrastructure / ecosystems)
4	Run water as a financially sustainable "business" by improving operational performance	Running the water sector as a smart business
5	Improve governance, planning, and management of demand and use	
6	Reduce losses and increase efficiency of productive use	Efficiency use of water (Agriculture, industry, and consumers)
7	Improve performance of pricing, monitoring, billing, metering and collection	Monitoring and metering

The second activity was to group the Honours, Master's, and PhD programmes according to the following disciplines:

- Engineering & the Built Environment,
- Commerce,
- Social Sciences & Humanities,
- Law,

- Medicine & Health Science,
- Agricultural Science,
- Environmental Science, and
- Applied Science.

A comprehensive analysis of opportunities, overlaps and gaps was then undertaken by using a gap analysis process. The findings in this study from both an operational and strategic standpoint were compared to a desired future state in terms of the sector needs and the roadmap targets (WRC, 2015). Recommendations were then formulated around bridging the identified gaps.

2.5 Reporting

A detailed technical report including a literature review, a results/data matrix, data analysis, and gap analysis was compiled with the target audience in mind.

The following linkages have been made:

- Unique water-related postgraduate programmes,
- Collaborative programmes where synergy is possible,
- Trends that can be observed and strategies for future postgraduate programme implementation.
- Comparisons to literature.
- Gaps, overlaps, and opportunities.

CHAPTER 3 LITERATURE REVIEW POSTGRADUATE LANDSCAPE

3.1 Introduction

A comprehensive literature review of the South African water sector postgraduate landscape was undertaken to inform the desktop study, provide an understanding of the legislative framework, the state of water sector postgraduate initiatives in South Africa in terms of both research activity and graduates, global best practice and relevant targets to inform the gap analysis.

3.2 A Brief Overview of Higher Education and Training in South Africa

Global consensus states that individuals with high-level skills are essential to generate knowledge and drive the technological advances and innovation required to promote the economic and social welfare of a nation. This requires an optimally functional education system, capable of producing sufficient numbers of graduates with the requisite knowledge and skills. In South Africa, this would contribute to the National Development Plan (NDP) vision of eliminating poverty, reducing inequality, growing the economy, and reducing unemployment by the year 2030 and meet RDI-related demands.

An increasing emphasis at South African universities is to produce more postgraduate students in order to increase the subsidy received from the Department of Higher Education and Training (DHET) and the research output for students and staff (Sonn, 2016).

The second edition of the National Water Resource Strategy of 2013 (NWRS2) has an aim to give effect to this 2030 Vision by aligning its strategies with the goals of that of the NDP. One of the goals of the NWRS2 is to *'Develop capacity and skills to address all elements of water resource functions (protection, development, conservation, management and control)'*. The alignment of the NWRS2 with the NDP, as it relates to skills development in the water sector is to develop a suite of qualifications of excellent quality and improve skills planning strategies through specific water sector programmes.

In addition, the Water Research Commission (WRC) established in terms of the Water Research Act (Act No 34 of 1971), aims to establish water research needs and priorities, stimulate and fund water research (according to priority) and enhance knowledge and capacity building within the water sector.
In the postgraduate space, the training of doctoral graduates and researchers, while a long and costly endeavour, is essential in a knowledge-based and complex economy (Pouris & Thopil, 2020). Postgraduates are considered the best qualified for creating, implementing and disseminating new knowledge and innovation.

The Department of Higher Education and Training (DHET)/Department of Science and Innovation (DSI) are responsible for all aspects of post-school education and training (PSET) in South Africa. PSET is provided by Public Universities and Universities of Technology (collectively referred to as HEIs), Private HEI, Technical and Vocational Education and Training (TVET) colleges, Community Education and Training (CET) colleges, Private colleges, Workplace training providers, Non-profit organisations, and Professional colleges.

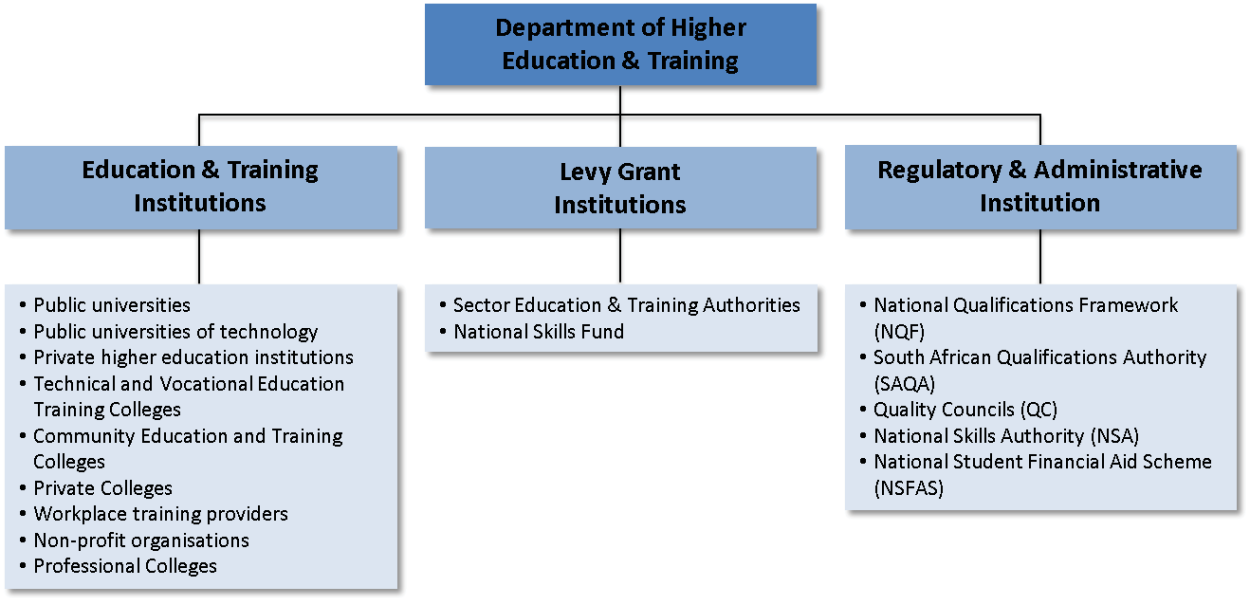

Figure 2: An organogram of the Department of Higher Education and Training (DHET)/Department of Science and Innovation (DSI) and Subsidiary Institutions (DHET, 2019)

The Skills Development Act (1998, amended) mandates the Sector Education and Training Authorities (SETAs) to manage skills development. Each SETA must conduct a review of its sector market to identify the skills needs and priorities, with particular focus on identifying scarce and critical skills. To address the corresponding supply of skills, the SETAs are mandated to facilitate the development, implementation and access to skills appropriate learning programmes (DHET 2011, 2013 and 2019). The responsibility for the coordination of education, training and skills development in the Water Sector lies with the Energy and Water SETA (EWSETA) and Local Government SETA (LGSETA).

The South African Qualifications Authority (SAQA) oversees the implementation of the National Qualifications Framework (NQF). All education and training qualifications are integrated into the NQF to ensure quality, coordination and facilitate progression or articulation from one qualification to another as an individual's career path progresses. Besides the registration of qualifications, SAQA is also mandated to recognise Professional Bodies and register Professional Designations. The purpose of this mandate is to protect and promote trust in professions, while encouraging the adoption of international best practice, accountability, social responsibility and the implementation of Continuing Professional Development (CPD).

The NQF consists of 10 exit levels, separated into three qualifications sub-frameworks, with a designated Quality Council (QC). Of relevance to this volume are NQF Levels 8 to 10 which indicate Bachelor Honours, Master's and Doctoral degrees. The relevant QC is the CHE which ensures the quality of offerings, assesses the offerings and in some instances certifies qualifications.

3.3 The Current State of Water Sector Postgraduate Initiatives in South Africa

Adequate undergraduate graduation rates are required not only to provide the skills required by the South African economy, but also to enhance the number of students available to enrol in postgraduate programmes.

'*Dysfunctionality on all levels of the higher-level education system'* and a lack of human capital development are noted in the Ministerial Review of the South African Science Technology and Innovation (STI) Institutional Landscape (DST, 2017). It is noted that while enrolment rates in the higher education sector have increased, no corresponding increase in graduation rates or the number of academic staff has taken place. While the DST draft white paper records an expansion in the STI institutional landscape, a threefold increase in publication numbers, a more demographically representative work force, and an increase in the number of doctoral graduates since the previous 1996 White Paper, certain limiting factors are noted. These include '*inadequate high-level science, engineering and technical skills for the economy, an undersized research system, a poor environment for innovation, and significant levels of underfunding*' (DST, 2018).

Additional limiting factors to sufficient numbers of quality graduates and therefore postgraduates from HEIs are noted by DST (2017) and in the NWRS2 and include:

1. An insufficient number of high school learners graduating with adequate literacy, math and science skills that enable them to enrol at HEIs,
2. A stagnant higher education graduation rate despite an increase in enrolment,
3. A lack of qualified academic staff to act as graduate supervisors, and
4. A shortage in funding for bursaries, research and related infrastructure.
5. No coordinated mechanism to plan, deliver and assure the quality of programmes intending to build capacity, train and develop skills
6. Multiple institutions and providers in the sector facilitating education, training and skills development
7. Lack of capacity amongst institutions and providers to deliver qualifications that meet the Sector's needs
8. Education, training and skills development are governed by a complex regulatory system (NQF, sub-frameworks and a Quality Council)
9. Uncoordinated funding mechanisms drive education, training and skills development leading to overlaps, or gaps in critical areas
10. A significant time lapse between obtaining a higher education qualification and professional registration (between 3 to 5 years)
11. Absence of a sector skills intelligence hub
12. Poor human resource planning in the sector (i.e. no succession planning, weak retention strategies and insufficient induction of professional entrants)
13. No Water Occupations Framework guiding planning and classification of occupations

The 2016 postgraduate enrolment and graduation statistics, relating to public HEI, are summarised in Table 3. Of the 975 837 students enrolled at public HEIs in 2016, 17.5% were enrolled in postgraduate programmes. This falls short of the 25% targeted for 2030 by the NDP.

Table 3: Public HEI postgraduate enrolment and graduation statistics for 2016. The category "Postgraduate, below Master's" includes Postgraduate and Post-Diploma Diplomas, Postgraduate Bachelor's degrees and Honours degrees. (DST, 2017)

Statistics	Postgraduate, below Master's	Master's degree	Doctoral Degree	Total
Enrolled (#)	91 866	57 290	21 510	170 666
Enrolled (%)	53.8%	33.6%	12.6%	100%
Graduated (#)	40 213	12 862	2 797	55 872
Graduated (%)	72%	23%	5%	100%

– number; % – percentage

Specific initiatives, aimed at enhancing the quantity and quality of postgraduates as well as institutional research and innovation capacity, are outlined in both the NDP and the Draft White paper on STI (2018) (Table 4). The intention of these high-level planning initiatives is to give impetus to creating a better functioning higher education sector that produces postgraduates with the required high-level skills to support RDI in South Africa. This will, however, depend on the extent to which the policy recommendations are implemented.

Table 4: Policy initiatives outlined in the NDP and Draft White Paper on STI (2018) pertaining to the improvement of PSET, as well as the innovation and research capacity of academic institutions.

Policy initiative	NDP	Draft White Paper STI (DST, 2018)
Increase the participation rate at universities	• Increase enrolments by at least 70% from 950 000 (2010) to 1.62 million by 2030.	• Strengthen the postgraduate human resource development pipeline by improved teaching and learning of English, Mathematics and Physical Science in schools.
Increase the throughput rate for degree programmes	• Increase graduation rates to more than 75%, corresponding to 425 000 by 2030, with a significant increase in the number of sciences, technology, engineering and mathematics graduates.	
Increase postgraduate enrolment at universities	• Increase the number of Master's and PhD students to 25% of university enrolments by 2030	• Develop a framework across SET government departments to implement a postgraduate bursary programme to fund student support.
Increase the number of doctoral graduates	• Increase the number of doctoral graduates from 28 per million (2010) to 100 per million by 2030. • To lead innovation, most of the doctorates should be in science, engineering, technology and mathematics.	
Improve postgraduate student supervisory capacity and the qualifications of higher education academic staff to benefit RDI	• Increase the percentage of PhD qualified staff to 75% by 2030.	• Support existing university staff to enrol in PhD programmes. • Expand existing successful initiatives that have promoted research and postgraduate outputs (e.g. South African Research Chairs Initiative). • Put in place programmes to establish full-time research positions at universities. • The DST and DHET will prioritize the development of black and female emerging researchers, and mentor them after qualifying to promote their ability to take up positions in senior management. • Retain a percentage of PhD graduates in postdoctoral programmes for eventual absorption into academic and research system. • Formulate a set of guidelines to optimise the contribution of postdoctoral fellows to the research system and postgraduate student mentoring.
Improve research and innovation capacity at universities	• Double the number of graduate and postgraduate scientists at universities	• Strategic development of research-intensive universities while supporting universities of technology and historically disadvantaged institutions. • Increased incentives for research outputs, particularly for researchers performing inter-, multi-, and transdisciplinary work. • Promote research partnerships between universities and science councils. • Upgrade research and innovation infrastructure.

The following overview of the current state of postgraduate water-related initiatives in South Africa in terms of both human resources and research activity provides a foundation for this water sector postgraduate training map and gap analysis.

3.3.1 Human Resources

Pouris & Thopil (2020) report on a tracer investigation of Doctoral degrees related to Water and Sanitation awarded between 2013 and 2017 from South African universities. The authors identified 112 PhD theses for this period. In alignment with this, Pouris (2018) indicates that each university produced approximately 2,5 Doctorates per year between 2000 and 2015 which is substantially lower than the approximate 200 PhD degrees per year suggested by the RDI Roadmap (Table 5) and indicates an apparent lack of focus on water research in South Africa. The top universities in terms of PhDs awarded between 2000 and 2014 were UP, UCT, Rhodes, UFS, Wits, UWC, SU, NWU and UKZN (Pouris, 2015).

In terms of Master's degrees awarded in the water sector, Pouris (2015) report around 100 between 2000 and 2014 at South African HEIs. The top universities in the production of Master's degrees were SU, Wits, NWU, UP and UWC.

While Researchers and Doctoral Candidates are distributed across South Africa, they are in "sub critical size groups" with the most prolific number of Doctoral candidates in water-related research were located at UP; UCT; Rhodes University and UFS (Pouris, 2018).

3.3.2 Research Activity

South Africa is ranked nineteenth in the world for its contribution to published research related to water and wastewater (Pouris, 2013). The challenge, however, has been to translate this research into innovations due to various constraints including funding access, a lack of linkages and partnerships in the innovation ecosystem (WRC, 2018).

Siebrits *et al*. (2014) performed a scientometric analysis of water research publications and identified the following prevailing paradigms that have influenced water research in South Africa over a period of four decades

- 1977-1991: research publications were dominated by *technical and engineering* solutions, as well as designs and plans to secure water supply.
- 1992-2001: publications on *water pollution, water quality, water resource management and planning* are prominent.
- 2001-2011: research on *planning, modelling, catchment-scale studies and a multidisciplinary approach* to research.
- End of 2011: a period characterised by uncertainty, although showing the prominence of key concepts such as *participation, governance and politics in water management*.

Subsequent to this (between 2005 and 2014), Pouris (2015) indicate that journal articles were published on a range of subjects, most notably water resources, environmental science, engineering and geology.

Siebrits *et al.* (2014) also identified that the majority of research questions proposed by a range of researchers in the South African water sector dealt with relatively short- to medium term research requirements such as service delivery, water supply and technical solutions.

A bibliometric analysis undertaken by Pouris (2018) between 2005 and 2015 had the following findings in terms of postgraduate water research activity in South Africa:

- There were approximately 100 water-related publications produced on average per year.
- The research conducted was in line with international literature.
- The most prolific organisations in the field were: UKZN; UP; UCT and UJ.
- Water research was produced from a variety of departments ranging from civil engineering to applied chemistry and department of soil, crop and climate sciences.
- There is a lack of critical mass in terms of water expertise as it is dispersed across a range of institutions.
- Classification of the articles to various Roadmap clusters show that the highest number of articles applied to the infrastructure cluster while the least number of articles applied to the 'run the water sector as a smart business' and 'reduce losses and increase efficiency of productive use'.

3.4 Postgraduate Programmes: Global Examples

Conditions for excellence in postgraduate education are identified in UNESDOC (2008) as (i) top-class students; (ii) cutting edge research carried out with solid Information Technology (IT) connectivity; (iii) generous resources and (iv) favourable governance conditions. In the case of IT, it offers access to education and engagement with a research community via alternative learning modalities (UNESDOC, 2008). A further 18 objectives are listed in the report for the advancement of postgraduate education with examples of successful practices. These objectives for instance, include the promotion of collaborative research, increasing investment in research and linking research communities worldwide.

Jonker *et al.* (2012) argue the case for postgraduate education and research on a regional scale using an independent network organisation, WaterNet, as an example. The authors state that jointly developing educational programmes by sharing expertise and resources allowed capacity for the intense intellectual and financial requirements; and encouraged cooperation, diversity of ideas and distributed knowledge and skills. WaterNet offers a joint and regional Master's programme where member institutions offer course modules in the fields in which they have a comparative strength. Inter disciplinary research programmes have as a result been developed which provide research subjects and findings that can be fed back into the curricula. In line with this, Van der Zaag (2009) describes a regional capacity-building network that pools knowledge, offers a joint Master's program, conducts research and disseminates research findings. The author postulates that the promotion of knowledge sharing and knowledge generating systems should be a priority particularly in acknowledgement of the special character of water.

Uganda is identified by WorldBank (2014) as making headway in terms of the quality and quantity of scientific research where the Millennium Science Initiative (a US$33 million investment) helped increase the number of Ugandan researchers from 261 to 720 and the number of Master's students more than doubled.

The differentiation between general degrees and specialised degrees is a key aspect of this report. Specialised degrees (including Master's degrees with specialised course work) provide in depth knowledge on a specific topic for students to become experts in their field (Loades, 2019). While this may provide a competitive advantage, it can also narrow career options. Master's programmes that

offer specialised coursework (i.e. taught Master's with a mini dissertation) in contrast to a thesis Masters can provide a broader skill set and advanced knowledge of a subject (Studee, 2020).

3.5 Postgraduate targets

3.5.1 Research capacity requirements-seven cluster of needs and interventions for the water community

As part of the Road mapping process, research capacity required to carry out RDD programme per year is presented in WRC (2015). The annual target for Doctoral and Master's students is mapped against seven clusters of needs and interventions relating to supply and demand for the water community as is depicted in Table 5.

Table 5: Postgraduate (Master's and PhD) annual targets as related to the seven clusters of needs and interventions of the water sector (WRC, 2015)

		Cluster Objective	Target RDD Outcome/Ideal State	Annual Target Master's Students (WRC, 2015)	Annual Target Doctoral Students (WRC,2015)
Water Supply	1	Increase ability to make use of more **sources** of water, including alternatives	Technology development for utilisation of diverse water sources at catchment level, with source localisation and exploitation driven by fitness for use is a key point of excellence in South African practices.	26 (needs) 79 (potential)	17 (needs) 52 (potential)
	2	Improve **governance, planning and management of supply** and delivery	Optimised reallocation and distribution of supplies and improved ability to manage water flows. Focus on improved quality and resilience of planning for the future – ability to respond to changes including climate change (groundwater, seawater and wastewater).	17	12
	3	Improve adequacy and performance of supply **infrastructure**	Availability of increased volume and adaptability of storage capacity for raw water and treated effluent. Increased levels of protection and reliability of ecological infrastructure and built infrastructure.	9 (ecological infrastructure) 9 (built infrastructure)	6 (ecological infrastructure) 6 (built infrastructure)
	4	Run water as a financially sustainable **"business"** by improving operational performance	Financial sustainability of the water services system secured (policy, technology and capacity).	26	17
Water Demand	5	Improve **governance, planning and management of demand** and use	Equitable and transparent access to water supplies that are managed at catchment level and transparency over rights, quotas, allocations and transfers has been achieved for demand governance and demand and planning management.	13 (planning & manage-ment) 5 (governan-ce)	9 (planning & management) 3 (governan-ce)
	6	Reduce losses and increase efficiency of **productive use**	Non-productive uses of water eliminated or minimised (losses, leakages, volume of water use, output too unrecoverable sources, volume and toxicity of pollution, discharge of poor-quality water).	26 (technical loss) 59 (deliberate demand)	17 (technical loss) 39 (deliberate demand)
	7	Improve performance of **pricing, monitoring, billing, metering** and collection	Improved accuracy in terms of water use monitoring, billing and management.	5 (cost) 17 (volume)	3 (cost) 12 (Volume)

The proportion of the above Master's and PhD targets (combined) as related to the seven clusters is depicted in a pie chart format in Figure 3. Figure 4 is the investment requirement proportions per cluster as per the Roadmap (WRC, 2015). It is evident that there is a correlation between investment and student requirements across the clusters; with the greatest requirements in Cluster 1 (Increase ability to make use of more sources of water, including alternatives) and Cluster 6 (Reduce losses and increase efficiency of productive use).

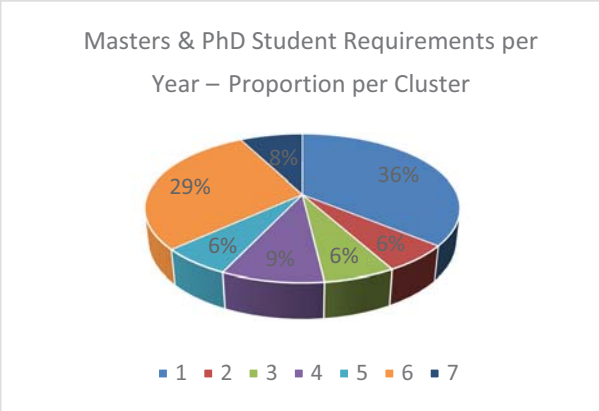

Figure 3: Master's and PhD Student Requirements proportion per cluster (WRC, 2015)

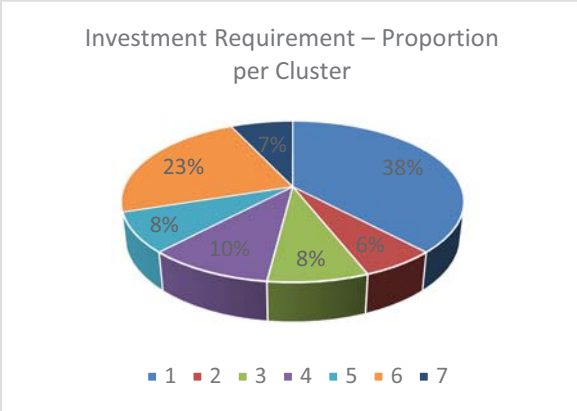

Figure 4: Investment requirement – proportion per cluster (WRC, 2015)

CHAPTER 4 RESULTS AND DATA ANALYSIS

The following chapter shows results from the data collection and verification processes and the subsequent data analysis which inform this postgraduate mapping study.

4.1 Data Collection Results

4.1.1 Database and Stakeholder Consolidation

In the study 168 stakeholders at the 27 HEIs (Table 1) were identified for engagement in this study; with an average of 6 stakeholders per HEI. Unique titles of these stakeholders included: Head of Department, Director, Faculty Director, Acting Director, Manager, Liaison Manager, Operations Manager, Dean, Acting Dean, Deputy Dean, Assistant Dean, Executive Dean, Researcher, Research Coordinator, Professor, Associate Professor, Emeritus Professor, Chair, Vice Chair, Department Chairperson, Lead Researcher, Program Leader, Head of Research and Graduate Studies, Academic Head, and Academic Leader.

4.1.2 Desktop Study

General degrees (with the option to specialise in water) and specialised water-related postgraduate programmes were identified at 21 HEIs (see Appendix C for raw data). The differentiation between the two provides insight into the vehicles for further water research and skill sets beyond a niche dissertation and is analysed in Chapter 4.2.

The study identified 107 general degrees as having a water research specialisation across 19 HEIs. Table 6 outlines 55 specialised postgraduate degree programmes that were identified at 14 HEIs. Of these specialised degrees, nine Honours level courses (*) were identified with the remainder offered at a Master's and Doctoral level.

Water-related research institutes/centres/units/clusters/groups were identified at 16 HEIs as indicated in Table 7 in order to determine any correlation with these and postgraduate programmes.
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Table 6: Desktop Study Results for Specialised Water Postgraduate degrees, courses and modules

HEI	Postgraduate Degree	Course/Module (where applicable)
CPUT	Master of Environmental Management	Water Resource Management (Elective)
IIEMSA	MPhil Integrated Water Management	Water governance & policy, Science of Water, Sustainability & Development
	Postgraduate Diploma in Water Management	Project Management for Water Managers, Collaborative Water Planning
LU	Bachelor of Science Honours Aquaculture*	
	MSc Aquaculture	
	PhD Aquaculture	
NWU	MA in Development & Management (structured): Water Studies	Cultural Dynamics of Water, Integrated Water Management, Hydro Politics
	PhD in Development & Management (thesis)`Water Studies	
RU	MSc Hydrology	
	PhD Hydrology	
	Honours in Environmental Water Management*	Environmental Quality, Hydrology, Freshwater Quality, Integrated Environmental Management
	MSc Water Resource Science	
	PhD Water Resource Science	
SU	MEng Civil Engineering: (Water Engineering)	1.Design of Hydraulic Structures, Flood Hydrology, Water Resources Analysis & Management, Pipeline Hydraulics & Pump station design, Water Networks & Services Planning, Water & Wastewater treatment, 7 Numerical simulation of fluids (1), Special Hydrology, Special Hydraulics, Port & Coastal Engineering
	Postgraduate Diploma in Aquaculture	
	MSc Agric in Animal Science (Aquaculture)	
	PhD in Animal Production Systems (Aquaculture)	
UCT	MEng/MSc Eng in Civil Engineering	Principles of wastewater treatment & wastewater characterization, Modelling & simulation of wastewater treatment systems, Aquatic chemistry part A, Aquatic chemistry part B, Integrated urban water management, Master of water engineering project END5129S Sustainable Water Management
	Bachelor of Architectural Studies Honours and Bachelor of City Planning Honours*	Natural Systems (incl. water system)
	MSc Chemical Engineering	*Sustainability in Chemical Engineering:* (including the provision of water)
	Master of Philosophy specialising in Space Studies	*Space Applications for Sustainable Development*: space technology to

		address sustainable development challenges including water security
	Master of Public Health	*Children's Environmental Health* (including water pollution) *Climate Change, Pollution and Health* – (including water pollution)
	Masters Humanities	*Environmental Law for Non-Lawyers* – (includes water pollution)
	MPhil & LLM	*Environmental Law* (includes water pollution), *Natural Resources Law* (includes freshwater &marine resources), *Pollution Law* (includes water pollution)
	Honours or Master's in Environmental & Geographical Science*	*Water Resource Management*
	MSc Biological Sciences	*Applied Ocean Sciences Coursework* – (includes water quality).
	MPhil Environment, Society, and Sustainability	*Water Resources Management*
UFS	Postgrad Diploma in Integrated Water Management	Introduction to integrated water resources, economics & governance, Integrated water resources science, Water resources management and legislation.
	MSc in Integrated Water Management (coursework & research Master's)	Water resources and environmental change, Water resources in arid environments; Water Management in and urbanising world
	PhD in Integrated Water Management	
	MSc Geohydrology	
	PhD Geohydrology	
UKZN	Honours Hydrology*	
	MSc Hydrology	
	PhD Hydrology	
	MSc Water Resource Management	
UP	MSc Water Resource Management	Water quality management, Water conservation & demand management, Water supply and sanitation
	PhD Water Resource Management	
	MEng Water Utilisation Engineering	
	MEng Chemical Engineering	Biological water treatment, Chemical water treatment, Water Quality Management & Research
	MEng (Water Resources Engineering)	
	MSc Applied Science Water Utilisation	
	MSc Applied Science Water Resources	
	MSc Hydrogeology	
	PhD Hydrogeology	
UNIVEN	Doctor of Philosophy in Hydrology and Water Resources (PhD).	
	Master of Earth Sciences in Hydrology and Water Resources (MESHWR)	

UWC	MSc (Environmental and Water Science)	
	PhD (Environmental and Water Science)	
	MPhil Integrated Water Resource Management	
WITS	MSc in Civil and Environmental Engineering (Course work/Research);	Wastewater Engineering
	LLM Environmental Law	Water Law
	BSc Honours Animal, Plant and Environmental Science*	River and Wetland Ecology
	BSc Honours Geochemistry*	Hydrogeology
	BSc Honours Geography*	Water Challenges in Southern Africa
	MSc Hydrogeology (coursework and research)	Hydrological Processes, Hydrogeochemistry, Environmental Isotopes, Physical Hydrogeology, Contaminant Hydrogeology, Hydrogeophysics Geochemical Toolbox for Hydrology, Water Resources Management, Applied Structural Geology
UNIZULU	Honours in Hydrology*	
	MSc Hydrology	
	PhD Hydrology	

* Honours programme

Table 7: Desktop Study Results: Water-Related Research Institute/Cluster/Unit at South African HEIs

HEI	Research Institute/Cluster/Unit
CPUT	Community Water Supply & Sanitation Unit: Research into sustainable supply of water & sanitation services
CUT	Industrial Design, Communication & Development Research Cluster (unit for sustainable water & environment)-Programme in Sustainable Engineering & Water Resource Management
	Quality of Health and Living Research Cluster – Programme in Sustainable Farming Systems
DUT	Institute for Water & Wastewater Technology – developing & optimising technology for water & wastewater treatment, & green energy communities & industry.
UFH	Research niche area in water resource management
UKZN	*CRECHE*: Environmental Engineering Group (wastewater treatment), Estuary & Coastal Research Group (coastal water monitoring, fluid dynamics) & Satellite Applications & Hydrology Group (flood studies, rainfall modelling, etc.)
	Energy, Food & Water Engineering Research Group: design flood estimation, water use quantification & accounting, water table fluctuation modelling, irrigation performance, soil & water conservation efforts in agriculture
	Centre for Water Resources Research: hydrological process studies & model development, agricultural water management, land & water research, measuring & modelling
NMMU	Sustainability Research Unit (integrated water management, water security)
	Institute for Coastal and Marine Research
	Earth Stewardship Research Institute (AEON ESSRI) – groundwater, river basin and water management
NWU	Unit for Environmental Sciences and Management: Aquatic Microbiology Research Group
	Unit for Environmental Sciences and Management: Algae Research Group (Water Quality and Purification)
	Unit for Environmental Sciences and Management: Persistent Organic Pollutant and Toxicant Research Group
	Unit for Environmental Sciences and Management: Water Research Group
	African Centre for Disaster Studies: Water as a Disaster Risk
	Environmental Management Programme – Water Management Policy Implementation Interface & hydrological catchment management
	Centre for Water Sciences & Management: groundwater
Rhodes	Institute for Water Research: Hydrology & Water Resource Assessment (Hydrological models & software, Water Quality Systems Assessment Model, Rainfall Runoff Modelling, Water Resource Assessment Uncertainty Analysis, Climate Change Adaptation & Decision-Support System, Rehab of grasslands after invasive tree eradication) Ecology & Environmental Flow Management: (Environmental Water Requirements, Ecotoxicology & Water Quality)
SU	Stellenbosch University Water Institute
UCT	Future Water Institute: Research into water sensitive design, resource recovery for a circular economy, diverse relationships & values around water, integrated water use

	Environmental Policy Research Unit: Research in environmental & natural resource issues including energy, water & waste.
UFS	Rapids Group Research into improved sustainability in the use & management of natural resources – water & land. (Determination & control of social & economic impacts of floods & water restrictions, economic impacts & management of saline irrigation water, capacity sharing in water use, and rainwater harvesting).
	Institute for Groundwater Studies
UJ	Water and Health Research Centre: Relationship between water & human health – improved general health, access to safe water and improved domestic hygiene and sanitation
	Water Research Group: Use of nanoporous polymers for removing organic pollutants in water purification.
UNISA	Nanotechnology and Water Sustainability (NanoWS) research unit
UP	Water Institute: water & agriculture, health, global change; water treatment & infrastructure; & water governance
UWC	Institute for Water Studies
Wits	Centre for Water and the Environment
	Centre in Water Research & Development (CIWaRD). Water – Systems & the Environment (W:SATE). Water Recovery – Recycle, Re-use & Remediate. Society for Water – Citizenship & Stewardship. Water – Education.
	Industrial & Mining Water Research Unit (IMWaRU): mine drainage; mine water footprinting & accounting; biological passive solutions, Physico-chemical passive solutions, engineering &/or biotechnological solutions for specific effluents; unique technologies for cheap, potable drinking water.
	Sustainable Energy and Environment Research Unit (SEERU): sustainable Environmental Technology (wastewater treatment, bio desulphurization & CCSU)

4.1.3 Online Questionnaire

The response rate for the questionnaire was relatively low (<16%), with a 40% response rate by HEIs where many respondents verified information on behalf of others in their relevant departments.

The profile of respondents included lecturers, senior lecturers, postdoctoral researchers and Institute directors with the vast majority operating in the Environmental Science space. Responses were received from the following HEIs: CPUT, CUT, UFH, SU, UCT, UFS, UP, UWC, UNIVEN, WITS and UNIZULU.

4.1.4 Semi-Structured Interviews

Of the eight stakeholders approached, the following semi-structured interviews were held with lead institutions:

Table 8: Semi-Structured Interviews

Institution	Participants	Date
University of Cape Town	Dr Kevin Winter (Senior Lecturer in Environmental & Geographical Science Department (ENGEO), & Future Water Institute)	25 November 2019
University of the Western Cape	Professor. Dominic Mazvimavi (Professor of Environmental & Water Sciences, Dept of Earth Sciences), Director of the UWC Institute for Water Studies	27 January 2020
University of Stellenbosch	Professor Heinz Jacobs (Associate Professor Civil Engineering & Head of Department) Professor Kobus du Plessis (Professor in Hydrology and Environmental Engineering)	12 February 2020
University of Free State	Dr Francois Fourie (Institute for Groundwater Studies)	3 February 2020

4.1.5 Verification

Verification emails were sent out on 6 October 2020 to stakeholders at each of the 27 HEIs where 11 verification responses were received from MUT, RU, UNIZULU, UNIVEN, UKZN, DUT, UJ, UKZN, UNISA, WITS and NMMU.

4.2 Data Analysis

4.2.1 Desktop Study and Online Questionnaire

Overview

Table 9 is a summary of the general and specialised water-related postgraduate degrees per HEI mapped to the clusters of needs and interventions (WRC, 2015) and broad disciplines as obtained during the desktop study and the online questionnaire.

The postgraduate degree programmes include the following:

- Doctorate (PhD, DEng, DPhil)
- Research Master's by coursework and dissertation and Research Master's by full dissertation (MSc., MPhil, MTech)
- Postgraduate Diplomas (PGDip)
- Honours (Honours Course, BTech, Advanced Diploma)

Water relevant degrees were identified at 21 of the 27 HEIs, namely: CPUT, CUT, DUT, IIEMSA, LU, NMMU, NWU, RU, SU, UCT, UFS, UFH, UJ, UKZN, UP, UNISA, UNIVEN, WITS, UWC, UNIZULU and VUT. Those HEIs not offering water-related postgraduate programmes include: UMP, MUT, SMU, SPU, TUT, and WSU. While those not offering are previously disadvantaged HEIs or newly established HEIs; other previously disadvantaged HEIs including UFH, LU, UNIVEN, UWC and UNIZULU offer water-related postgraduate degrees.

Specialised water degrees are evident at 14 HEIs: CPUT, UKZN, LU, IIEMSA, NWU, RU, SU, UCT, UFS, UP, UWC, UNIVEN, WITS, and UNIZULU. There are no specialised water-related programmes at the following HEIs: CUT, DUT, MUT, NMMU, SMU, SPU, TUT, UFH, UJ, UMP, UNISA, VUT and WSU. With the exception of CPUT, there are no specialised postgraduate water-related programmes at any of the Universities of Technology. There is an average of 2 specialised programmes per HEI with UCT offering the highest number of specialised degrees (12) followed by UP (8).

General degrees with the opportunity to specialise in water are offered at 20 HEIs: CPUT, CUT, DUT, LU, NMMU, NWU, RU, SU, UCT, UFS, UFH, UJ, UKZN, UP, UNISA, UNIVEN, WITS, UWC, UNIZULU and VUT. There are no general water degrees offered at: IIE MSA, MUT, SMU, SPU, TUT, UMP and WSU. There is an average of approximately 4 general degrees per HEI with UKZN having the largest offering of general degrees (18) followed by UCT and SU (13).

There is a strong correlation between the existence of Water Research Institutes/clusters (see Table 7) and the offering of water-related postgraduate degree programmes.

The only linkages evident in terms of broad research themes for the generalist degrees include: water services and port/coastal engineering at SU, water resource management/urban water management at UCT, groundwater at UWC and UFS and water quality/sanitation at UKZN.

Structured Master's (comprising electives, coursework and mini dissertation) versus unstructured Master's (comprising a full thesis or dissertation) offerings appear to be institution and departmentally dependent with no clear correlation emerging.

Cluster 2 [*Governance, planning, and management of supply and demand*] emerged as being the strongest thematic cluster by having the largest number of RFAs mapped to all the postgraduate

programs. This was followed by Clusters 1 [*Increase ability to make use of more sources of water*] and 6 [*Efficiency use of water (Agriculture, industry, and consumers*)] with a similar RFA count. Cluster 3: [*Adequacy and performance of supply infrastructure and operational performance [Built infrastructure/Adequacy and performance of supply infrastructure and operational performance (Ecological infrastructure / ecosystems*)] was the weakest cluster with the fewest RFAs.

It is evident that postgraduate activity is being undertaken in a variety of disciplines with the largest number of specialised and general degrees in the discipline of Environmental Science followed by Engineering and the Built Environment. The least number of general postgraduate degrees are offered in the Education and Medicine/Public Health space with the least number of specialised postgraduate programmes in Education, Commerce, Social Science/Humanities and Medicine/Public Health. The overwhelming majority of specialised courses/programmes include Hydrology and/or Water Resource Management.

UCT and UKZN offer general and specialised postgraduate degrees in the largest range of disciplines, with UCT offering specialised degrees in the broadest range of disciplines.

Honours offerings are evident in the discipline of science. It is acknowledged, however, that four-year bachelor's degree programmes in other faculties such as Engineering, Honours is classified as part of the undergraduate degree.

Table 9: Data Analysis – Specialised and General Postgraduate degrees per HEI identified in this study mapped to clusters

HEI	Water Institute/Research cluster	Research Strength Volume 1	Specialised Degree (S)	General Degree (G)	Disciplines								Total Specialised Degrees	Total General Degrees	Number of RFAs per cluster						Comments
					Engineering & Built Environment	Commerce	Social Science & Humanities	Law	Medicine & Health Science	Education	Agricultural Science	Environmental Science	Applied Science			Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 6	Cluster 7	
CPUT^	x		Master of Environmental Management*									S		1	3	2	2	1	1	2	1	
				Master/Doctor of Horticultural Science								G				1	3	0	0	2	1	
				Master/Doctor of Engineering in Chemical Engineering	G											3	3	3	3	3	3	
				Master/Doctor of Engineering in Mechanical Engineering	G											3	3	3	3	3	3	
CUT^	x			Master of/Master of Technology Health Sciences in Environmental Health								G		0	1	2	2	1	2	2	2	
DUT^	x			Master/Doctor of Engineering	G									0	2	3	3	3	3	3	2	
				Master/Doctor of Technology Environmental Health								G				3	3	3	3	3	2	
IIE MSA			Master of Philosophy in Integrated Water Management*									S		2	0	3	3	3	3	3	3	Only specialised degrees
			Postgraduate Diploma in Water Management*			S										3	3	2	3	3	3	
LU			Bachelor of science Honours Aquaculture								S			2	5	3	3	2	0	3	3	
			MSc/PhD Aquaculture								S					3	3	2	0	3	3	
				Master of science/PhD in Soil Science							G					3	3	0	0	3	3	
				MSc/PhD Biochemistry, Botany, Microbiology, Physiology & Environmental Health Zoology								G				3	3	2	3	3	3	
				Masters/PhD Development Studies			G									3	3	2	3	3	2	
				LLM				G								3	3	3	3	3	3	
				Master/PhD of Public Administration and Management		G										2	3	2	2	2	3	
MUT^														0	0	0	0	0	0	0	0	0 PG Offerings
NMMU	x			Master of Technology/Doctor Agriculture in Nature Conservation								G		0	2	3	3	2	2	3	3	
				Master of Technology/Doctor of Engineering	G											3	3	3	3	3	3	
NWU	x		MA*/PhD in Development & Management (thesis): Water Studies		S									1	5	3	3	2	3	3	3	
				Master of Science/PhD: Natural Sciences: Geography and Environmental Science								G				3	3	3	3	3	3	
				Meng/PhD Mechanical Engineering	G											3	3	3	3	3	3	
				LLM				G								3	3	3	3	3	3	
				MBA		G										3	3	3	3	3	3	
				Master of Arts/PhD Public Management and Governance			G									3	3	2	3	3	3	

RU	x		MSc/PhD in Hydrology									S		3	2	3	3	3	2	3	3	
			Honours in Environmental Water Management									S				3	3	2	3	3	3	
			MSc/PhD in Water Resource Science									S				3	3	3	3	3	3	
				Mecon/PhD Economics and Economic History		G										3	3	1	3	3	1	
				MBA		G										3	3	3	3	3	3	
SMU														0	0	0	0	0	0	0	0	0 PG offerings
SPU														0	0	0	0	0	0	0	0	0 PG offerings
SU	x		MEng Civil Engineering: Water Engineering*	MEng/PHD Civil Engineering: Water Engineering	S G									4	13	3	3	3	3	3	3	Specialised water modules offered in Civil Engineering, Water Engineering in a broad range of water disciplines. Only HEI offering Port and Coastal Engineering
			Postgraduate Diploma in Aquaculture								S					3	3	2	1	3	3	
			MScAgric in Animal Science (Aquaculture)								S					3	3	2	1	3	3	
			PhD in Animal Production Systems (Aquaculture)								S					3	3	2	1	3	3	
				MEng/PhD Process Engineering	G											3	3	3	3	3	3	
				MSc/PhD in Food Science									G			3	3	1	2	3	2	
				PhD in Forestry and Wood Sciences;								G				2	3	1	1	3	2	
				MSc in Wood or Wood Products Sciences								G				2	3	1	1	3	2	
				MScAgric/PhD Soil Science							G					2	3	1	1	1	1	
				MSc/PhD Horticultural Science								G				1	3	1	1	2	1	
				MSc/PhD in Science									G			3	3	1	3	3	1	
				MSc/PhD Geology								G				3	3	2	2	3	3	
				MSc/PhD a in Microbiology								G				3	3	3	2	2	2	
				MSc/PhD in Biochemistry									G			3	3	3	3	3	3	
				Master/PhD in Geo-Informatics								G				3	3	3	3	3	3	
				MSc/PhD in Curricular Studies						G						3	3	2	2	3	3	
TUT^														0	0	0	0	0	0	0	0	0 PG offerings
UCT	x	x	Master of Science in Civil Engineering*	Master of Science/PhD in Civil Engineering	S G									12	13	3	3	3	3	3	3	Large number of research outputs in Urban Water Management (in civil engineering & EGS) Broad range of specialised and general degree programmes
			Bachelor of Architectural Studies Honours*		S											3	3	2	2	3	2	
			Bachelor of City Planning Honours*		S											3	3	2	2	3	2	
			Master of Science Chemical Engineering*	Master of Science/PhD in Chemical Engineering	S G											3	3	2	3	3	3	
			Master of Philosophy specialising in Space Studies*									S				3	3	3	3	3	3	
				Masters/Doctor of Commerce in Economics		G										3	3	3	3	3	2	
			Master of Public Health						S							3	3	1	2	3	3	
			Masters Humanities Faculty*				S									3	3	3	3	3	3	
			MPhil & LLM					S								3	3	3	3	3	3	
			Honours in Environmental & Geographical Science									S				3	3	3	3	3	3	
			Master's in Environmental & Geographical Science																			
			MPhil Environment, Society, and Sustainability									S				3	3	3	3	3	3	
			BSc (Honours) Biological Science										S			3	3	2	2	3	3	
				Master of Science/PhD in Property Studies	G											3	3	2	3	3	3	

				MBA		G										3	3	3	3	3	3	
				Master/Doctor of Development Policy and Practice			G									3	3	2	3	3	2	
				Master/Doctor of Management Studies		G										3	3	2	3	3	3	
				Masters/PhD Historical Sciences			G									3	3	3	3	3	3	
				Masters/PhD Environmental and Geographical Science								G				3	3	3	3	3	3	
			MSc Biological Science*	MSc/PhD Biological Science									G			3	3	2	3	3	3	
				MSc/PhD Oceanography								G				3	3	2	3	3	3	
				MSc/PhD Geological Science								G				3	3	3	3	3	3	
				BSc (Honours) Geological Science								G				3	3	3	3	3	3	
UFS	x		Master/PhD of Science in Geohydrology									S		3	3	1	1	0	0	1	0	Research in groundwater modelling, geophysics, groundwater hydraulics research
			Postgrad Diploma in Integrated Water Management									S				3	3	2	3	3	2	
			MSc/PhD in Integrated Water Management (coursework & research masters)									S				3	3	2	3	3	2	
				Master of Science/ Doctor of Philosophy Biochemistry									*G*									
				Master/PhD in Disaster Management							G					3	3	2	3	3	2	
				Master of Science/PhD: Agriculture: Agricultural Economics							G					3	3	1	1	3	3	
UFH	x			Master/Doctor of Science Microbiology								G		0	2	3	3	3	3	3	3	
				Master/Doctor of Social Science			G									3	3	3	3	3	2	
UJ	x			MSc/Doctor Geography								G		0	1	3	3	3	2	3	3	
UKZN	x	x	BSC Honours in Hydrology									S		4	18	3	3	3	1	3	3	Large number and broad range of general degrees with opportunity to specialise in water research Research outputs in water quality/sanitation
			MSc Hydrology									S				3	3	2	1	3	3	
			DPhil Hydrology									S				3	3	2	1	3	3	
			MSC Water Resources Management									S				3	3	3	3	3	3	
				MSc/PhD Geography								G				3	3	2	2	3	2	
				MSc/PhD: Urban and Regional Planning: Environmental Planning	G											3	3	2	3	3	2	
				MSc/PhD: Urban and Regional Planning: Development Planning	G											3	3	2	3	3	2	
				MSc/PhD Public Health					G							3	3	3	3	3	3	
				MSc/PhD Environmental Science								G				3	3	2	2	3	2	
				MAgricMgmt/PhD Agricultural Management							G					3	3	1	1	3	3	
				MSc/PhD Crop Science							G					3	3	0	0	3	2	
				MSc/PhD in Animal Science							G					3	3	2	1	3	3	
				Master/Doctor of Conflict Resolution and Peace Studies			G									3	3	3	3	3	3	
				MSc/PhD Geology								G				3	3	3	3	3	3	
				Master/Doctor of Development Studies			G									3	3	2	3	3	1	
				Masters/PhD in Public Governance			G									3	3	2	3	3	1	
				MSc/PhD Microbiology								G				2	3	1	1	2	2	
				Master/Doctor of Commerce in Management		G										3	3	3	3	3	3	
				MSc /PhD Agrometeorology							G					2	3	0	0	3	1	
				MSc Agric/PhD Agricultural Economics		G										2	3	1	2	2	1	
				MSc/PhD Chemistry									G			3	3	0	0	3	3	
				MSc/PhD Chemical Engineering	G											3	3	3	3	3	3	

UMP														0	0	0	0	0	0	0	0	0 PG offerings
UP	x	x	MSc Water Resource Management (coursework)									S		8	5	3	3	3	3	3	2	
			PhD Water Resource Management									S				3	3	3	3	3	2	
			MEng Water Utilisation Engineering	S												3	3	3	3	3	3	
			MEng Chemical Engineering*	S												3	3	3	3	3	3	
			Master of Engineering (Water Resources Engineering)	S												3	3	3	3	3	3	
			MSc Applied Science Water Utilisation										S			3	3	3	3	3	3	
			MSc Applied Science Water Resources										S			3	3	3	3	3	3	
			MSc/PhD Hydrogeology									S				3	3	3	2	3	3	
				Master of Science/PhD in Agriculture in Agricultural Economics							G					3	3	1	1	3	2	
				Master of Science/PhD in Agriculture in Soil Science								G				3	3	0	0	3	3	
				Master /Doctor of Environmental Science in Wildlife Management								G				3	3	3	3	3	2	
				LLM/LLD				G								3	3	3	3	3	3	
				Master/Doctor of Engineering in Electric, Electronic and Computer Engineering	G											3	3	2	3	3	3	
UNISA	x			MSc/PhD Environmental Science								G		0	8	3	3	3	3	3	3	
				Masters/PhD Public Administration and Management		G										2	3	3	2	3	3	
				MSc/PhD Geography								G				3	3	3	3	3	3	
				MSc/PhD Environmental Management								G				3	3	2	3	3	2	
				Masters/PhD in History			G									3	3	3	3	3	3	
				MA/PhD Development Studies			G									3	3	3	3	3	3	
				Masters/PhD Biblical and Ancient Studies			G									3	3	3	3	3	3	
				MPhil/PhD Accounting Sciences		G										3	3	2	3	3	3	
UNIVEN			Doctor of Philosophy in Hydrology and Water Resources (PhDG).									S		2	4	3	3	3	1	2	3	
			Master of Earth Sciences in Hydrology and Water Resources (MESHWR)									S				3	3	3	1	2	3	
				Master/Doctor of Philosophy in Geography								G				3	3	3	3	3	3	
				Master/Doctor of Rural Development	G											2	3	3	2	3	3	
				Master/Doctor of Environmental and Geographical Science								G				3	3	3	3	3	3	
				LLB				G								2	3	3	2	3	3	
Wits	x		MSc in Civil and Environmental Engineering (Course work/Research)*	MSc in Civil and Environmental Engineering (Research) & PhD	S G									*6*	*8*	3	3	3	3	3	3	
				MSc/PhD Chemical Engineering	G											3	3	3	3	3	3	
				Masters/PhD Architecture	G											3	3	2	3	3	3	
				MCom/PhD		G										2	3	0	2	2	3	
			LLM Environmental Law*					S								3	3	3	3	3	3	
			BSc Honours Animal, Plant and Environmental Science*									S				3	3	2	1	2	3	
			BSc Honours Geochemistry*									S				2	2	2	2	2	2	
			BSc Honours Geography*									S				3	3	2	3	3	3	
				MSc/PhD Geography and Environmental Studies								G				2	3	3	2	3	3	
			MSc Hydrogeology (coursework and research)									S				2	2	2	2	2	2	
				MSc/PhD Environmental Sciences								G				3	3	3	3	3	3	

				Masters/PhD in Development Studies			G										3	3	2	3	3	2	
				Masters/PhD Social Work			G										3	3	3	3	3	3	
UWC	x		MSc (Environmental and Water Science)										S		4	6	3	3	3	2	3	3	Main research in Integrated Water Resource Management and Groundwater studies
			PhD (Environmental and Water Science)										S				3	3	3	2	3	3	
			MPhil Integrated Water Resource Management (3881)										S				3	3	3	3	3	3	
			MSc	MSC/PhD Applied Geology									G				2	2	2	2	2	2	
				MSc/PhD in Chemistry										G			3	3	3	3	3	3	
				MSc/PhD Earth Science									G				3	3	3	3	3	3	
				MA/PhD Development Studies			G										3	3	2	3	3	3	
				LLM/LLD				G									3	3	3	3	3	3	
				MAdmin/PhD Admin			G										3	3	1	2	3	2	
UNIZULU			Honours in Hydrology										S		3	4	3	3	2	2	3	3	
				Doctor of Philosophy in Chemistry										G			3	3	3	3	3	2	
			Doctor of Philosophy in Hydrology										S				3	3	3	1	2	3	
			Master of Science: Hydrological Sciences										S				3	3	3	2	2	3	
				Honours in Zoology									G				3	3	1	2	2	3	
				Masters/Doctor of Philosophy in Microbiology									G				3	3	3	3	3	2	
				Masters/PhD Anthropology and Development									G				3	3	3	3	3	3	
VUT^				Master/Doctor of Technology: Chemical Engineering	G										0	2	3	3	3	3	3	3	
				Master/Doctor of Technology Applied and Computer Science										G			3	3	3	3	3	3	
WSU															0	0	0	0	0	0	0	0	0 PG offerings
Total				General degrees	18	12	15	5	1	1	9	36	8			104	436	452	353	361	437	402	
*** Course/structured Master's**				Specialised degrees	10	1	1	2	1	0	5	30	3	55			Total RFAs						
^ University of Technology				Total	20	13	16	7	2	1	14	66	11	159									

4.2.2 Semi-Structured Interviews

Apart from further verification of desktop data (see Appendix C), key findings from these semi-structured interviews are summarised in Table 10.

Table 10: Key Findings from Semi-Structured Interviews on Postgraduate Initiatives

Research Driver	Comment
Academic Staff	While pockets of research activity are driven by industry and local authorities (see below), the largest drivers of water-related postgraduate research are internal such as supervisory capacity/expertise, and networks and personalities of academic staff. There is therefore a lag between external industry demand driven research, and internal supply driven postgraduate research activity. A lack of depth or succession plans should academic staff leave academia is a challenge in terms of longevity for research activity.
Funding	Some local industries/institutions driving research activity at certain HEIs through bursaries include the following: • Cape Higher Education Consortium – Western Cape Government (CHEC-WCG) • Council for Scientific and Industrial Research (CSIR) • Local Government (e.g. City of Cape Town Scientific Services; eThekwini Metro) • Water Boards (e.g. Umgeni Water) • Eskom • The WRC
	A deterrent for postgraduate enrolments has been a lack of a consistent funding source for the water industry. The restructuring of the National Research Foundation (NRF) over the last 2 years for instance has affected the availability of funding to many students wanting to enrol for postgraduate research.
	Some research activity at certain HEIs has been driven by foreign industry/institutions including: • Fraunhofer Society • African Research Universities Alliance (ARUA) • British Government • Dutch Government (through Netherlands Universities for International Cooperation: Nuffic) & Orange Knowledge program • European Union • Food & Agriculture Organisation of the United Nations (FAO) • CGIAR • International Water Management Institute (IWMI) • Swedish International Development Corporation Agency (SIDA) • UNESCO-IHE Partnership Research Fund (UpaRF) • Department for International Development (DFID) • South African Development Community (SADC) WaterNet
Consulting	Certain postgraduate research has emanated from HEI research units undertaking consulting work and as a result generating research outputs.
Uniqueness	It is evident that certain HEIs strategically try to differentiate their research activity from other HEIs.
Subsidies	The South African Government offers higher subsidies to HEIs for research postgraduate degrees compared to coursework/thesis Master's degrees.

Interdepartmental/disciplinary collaboration	Institutes/Strategic Research Units exist at many HEIs [e.g. Stellenbosch University Water Institute (SUWI), Future Water Institute at UCT; Institute for Water Research at RU and the Earth Stewardship Research Institute at NMMU] to facilitate interdepartmental collaboration, joint funding, postgraduate capacity building and training in the water sector. It is evident that these institutes are dominated by natural sciences and engineering.
Inter-Institutional Collaboration	There appears to be a lack of inter institute partnerships in the water sector. Challenges with regards to collaboration, sharing of resources and offering combined postgraduate courses include cumbersome administration and a lack of depth of academic staff expertise to ensure the longevity of these partnerships.
Industry/Institutions/Statutory Body partnerships	Research Chairs in consultation with public research institutions are held at certain HEIs within the water sector to strengthen and improve research and innovation capacity of public universities to produce high quality postgraduate students and research and innovation outputs (e.g. the NRF/DST Chair: Sustainable Process Engineering: sustainable water management in chemical processes at WITS). There appears to be ad hoc partnerships/working relationships with Catchment Management Agencies (CMAs), landowners, etc. for certain water-related postgraduate research. There is minimal representation of HEIs or public research institutions on certain statutory or unitary bodies such as the Institute of Municipal Engineering of Southern Africa (IMESA), and the South African Local Government Association (SALGA) which would facilitate collaboration and knowledge transfer.

4.2.3 Gap Analysis

Table 11 is a gap analysis of the postgraduate landscape with the "current state" taken from the results of the desktop study, online questionnaire and semi-structured interviews.

Table 11: Data analysis: Postgraduate Landscape Gap Analysis

Current State of Postgraduate Initiatives at South African HEIs	Ideal State of Postgraduate Initiatives at South African HEIs	Gap
Operational		
Water relevant postgraduate programmes (both general and specialised) were identified at 21 of the 27 HEIs.	Postgraduate programmes at all HEIs to increase accessibility to prospective students (MG, 2016).	There are no water-related postgraduate programmes at UMP, MUT, SMU, SPU, TUT, and WSU.
The largest number of specialised and general postgraduate programmes fall within the disciplines of Environmental Sciences followed by Engineering and the Built Environment.	The opportunity to specialise in water in a broad range of disciplines/faculties.	There are few general and specialised postgraduate degrees in the following disciplines: Education, Commerce, Social Science/Humanities and Medicine/Public Health. .
The majority of specialised postgraduate programmes are offered at universities.	Specialised postgraduate programmes at all HEIs to increase accessibility. Specialised programmes allow for a broader skill set and advanced knowledge of a subject (Studee, 2020).	There are few specialised water-related postgraduate programmes offered at Universities of Technology.
The majority of specialised courses are in Hydrology and/or Water Resource Management.	A wider range of specialised courses will allow for a broader skill set and advanced knowledge of a subject for postgraduates (Studee, 2020).	There is a lack of diversity in terms of specialised water programmes with the majority in the Hydrology and Water Resource Management space.
"Science heavy" Research Institutes are driving science degree programmes.	A broader representation of disciplines at Research Institutes to drive diverse and interdisciplinary water-related research (UNESDOC, 2008).	There is minimal representation of certain disciplines including Education, Medicine/Public Health, Law, Humanities and Social Sciences, and Commerce at the various Water Research Institutes.
Inconsistent funding sources for postgraduate research was identified in the semi-structured interviews.	Consistent funding for postgraduate research in recognition of the fact that a lack of funding is a key barrier to postgraduate studies (WorldBank, 2014).	Inconsistent water-specific postgraduate funding was identified in the semi-structured interviews as a gap. This aligns with WorldBank (2014) who state that investment in postgraduate studies is a key driver.
As identified in the semi-structured interviews, a lack of depth or succession plans should academic staff leave academia affects the longevity of certain research. This is in alignment with DST (2017) where it is noted that while postgraduate enrolment rates have increased, there has been no corresponding increase in the number of academic staff.	The retention and attraction of highly skilled postgraduates in the academic space (UNESDOC, 2008).	A lack of depth or succession plans should academic staff leave affects the longevity of certain research.
Strategic		
There is ad hoc inter institutional collaboration as identified in the semi-structured interviews.	Consistent inter institutional collaboration, with postgraduate education and research on a regional scale through the sharing	There is a lack of consistent inter institutional collaboration for the pooling of resources.

	of expertise and resources (Jonker *et al*., 2012).	
There are ad hoc Industry/Institutions/Statutory Body partnerships as identified in the semi-structured interviews.	Consistent Industry/Institution/Statutory Body partnerships (UNESDOC, 2008).	There is a lack of consistent Industry/Institution/Statutory Body partnerships that would foster collaborative programmes.
The strongest thematic clusters for all of the postgraduate programmes are Cluster 2, 1 and 6. The weakest cluster is Cluster 3.	Strength in Cluster 1 and 6 is a roadmap target (WRC, 2015)	No gap. The findings in the study align with the postgraduate targets as identified in WRC (2015) for strength in Clusters 1 and 6.
Research activity is driven by academic staff.	Industry and local government demand driven research.	There is a lag between industry and local government demand driven research. Research is mostly internally supply driven.
There is a lack of government subsidies for research Master's as identified in the semi-structured interviews.	Policies to improve the quality and quantity of postgraduate water research, e.g. subsidies for both research and coursework Master's.	There is a lack of subsidies for coursework Master's which is a gap in terms of broadening skills sets of postgraduates beyond a niche dissertation. This has an impact on specialised course offerings (see above).

CHAPTER 5 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

5.1.1 General

This study involved exploratory research through a desktop study, questionnaire and semi-structured interviews with regards to the South African water sector postgraduate landscape.

Water relevant degrees (both general and specialised) were identified at 21 of the 27 HEIs (namely CPUT, CUT, DUT, IIEMSA, LU, NMMU, NWU, RU, SU, UCT, UFS, UFH, UJ, UKZN, UP, UNISA, UNIVEN, WITS, UWC, UNIZULU and VUT). Those HEIs not offering postgraduate programmes in the water field (UMP, MUT, SMU, SPU, TUT, and WSU) were all previously disadvantaged/newly established.

With the exception of CPUT, specialised water degrees are only evident at universities (UKZN, LU, IIEMSA, NWU, RU, SU, UCT, UFS, UP, UWC, UNIVEN, WITS, UNIZULU) as opposed to universities of technology. There are no specialised water-related programmes on offer at the following HEIs: CUT, DUT, MUT, NMMU, SMU, SPU, TUT, UFH, UJ, UMP, UNISA, VUT and WSU. The highest number of specialised programmes are offered by UCT followed by UP, with UCT and UKZN offering the broadest range of specialised courses in terms of disciplines. The largest number of water-related specialised programmes are in the disciplines of Environmental Sciences followed by Engineering and the Built Environment; with the least programmes offered in Education, Commerce, Social Science/Humanities and Medicine/Public Health. The overwhelming majority of specialised courses include Hydrology and/or Water Resource Management. Nine specialised Honours courses were identified mostly in the science discipline; however, it is acknowledged that four-year bachelor's degree programmes in other faculties such as Engineering, the Honours program is classified as part of the undergraduate degree.

General degrees with the opportunity to specialise in water are offered at: CPUT, CUT, DUT, LU, NMMU, NWU, RU, SU, UCT, UFS, UFH, UJ, UKZN, UP, UNISA, UNIVEN, WITS, UWC, UNIZULU and VUT. There are no general water degrees offered at IIE MSA, MUT, SMU, SPU, TUT, UMP and WSU. UCT and SU have the largest offering of general degrees. The majority of general degrees are in the Environmental Sciences followed by Engineering and the Built Environment with the least number of general postgraduate degrees being in Education and Medicine/Public Health.

The findings are in broad alignment with research conducted by Pouris (2018) who indicates that UKZN, UP and UCT published the highest number of water research articles between 2014 and 2018. UJ, however, while identified by Pouris (2018) as an HEI with prolific water research activity, did not emerge in this study as having a significant number of postgraduate offerings. UCT, UKZN and UP are also identified in Volume 1 as having mature and established research strength.

There is a strong correlation between the existence of Water Research Institutes/clusters (see Table 7) and whether or not there are postgraduate degree programmes. A further correlation between the Institute and dissertation topics is not as evident with the only patterns including water resource management/urban water management at UCT, and groundwater at UWC and UFS and water quality/sanitation at UKZN.

Structured Master's (comprising electives, course work and a mini dissertation) versus unstructured Master's (comprising a full thesis or dissertation) offerings appear to be institution and departmentally dependent with no clear correlation emerging.

Cluster 2 [*Governance, planning, and management of supply and demand*] emerged as being the strongest thematic cluster by having the largest number of RFAs mapped to all the postgraduate programmes. This was followed by Clusters 1 [*Increase ability to make use of more sources of water*] and 6 [*Efficiency use of water (Agriculture, industry, and consumers*)] with a similar RFA count. Cluster 3: (*Adequacy and performance of supply infrastructure and operational performance [Built infrastructure)/Adequacy and performance of supply infrastructure and operational performance (Ecological infrastructure / ecosystems*)] was the weakest cluster with the fewest RFAs.

In the Update of the RDI Capability Map Study (Volume 1) the clusters with the highest reported percentage of water-related RDI activities (including Master's and Doctoral students) were Cluster 1 (*Increase ability to make use of more sources of water*) at 45% followed by Cluster 6 (*Efficiency use of water (Agriculture, industry, and consumers)* at 39% and Cluster 2 *(Governance, planning, and management of supply and demand)* at 31%. The strongest thematic clusters in the 2 volumes are therefore in alignment.

According to the WRC RDI Roadmap (2015-2025) these clusters are also the three clusters with the highest percentage of Master's and PhD student requirements (Figure 3) and the highest percentage of total investment budget requirements (Figure 4).

5.1.2 Gaps, overlaps and drivers

Gaps in the postgraduate water landscape have been identified as follows:

Operational Gaps:

- There are no water-related postgraduate programmes at UMP, MUT, SMU, SPU, TUT, and WSU.
- There are few general and specialised postgraduate degrees in the disciplines of Education, Commerce, Social Science/Humanities and Medicine/Public Health.
- There are few specialised water-related postgraduate programmes at Universities of Technology.
- There is a lack of diversity in terms of specialised water programmes with the majority in the Hydrology and Water Resource Management space.
- There is minimal representation of certain disciplines including Education, Medicine/Public Health, Law, Humanities and Social Sciences, and Commerce at the various Water Research Institutes.
- There is inconsistent funding for water-specific postgraduate study. This aligns with WorldBank (2014) who state that investment in postgraduate studies is a key driver.
- There is a lack of depth or succession plans should academic staff leave academia which affects the longevity of certain research.

Strategic Gaps:

- There is a lack of consistent inter institutional collaboration for the pooling of resources.
- There is a lack of consistent Industry/Institution/Statutory Body partnerships that would foster collaborative programmes.
- There is a lag between industry and local government demand driven research. Research is mostly internally supply driven.
- There is a lack of subsidies for coursework Master's which is a gap in terms of increasing skills sets of postgraduates beyond a niche dissertation. This may impact specialised course offerings.

In terms of key drivers of water-related research focus group interviewees highlighted the importance of supervisory capacity/networks and the personalities of academic staff. A particularly unique research driver identified in the semi-structured interviews was the undertaking of consulting work/externally funded projects by a particular research team and generating postgraduate research outputs as a result.

5.1.3 Study limitations

A key limitation in this research due to time constraints was the method used to filter the research outputs (i.e. dissertations) that were correlated to the general degrees. A broader time period and the use of other keywords would have produced a larger result set and more robust list of general degree programmes.

A poor response rate for the semi-structured interviews was a further limitation and hindered the unpacking of certain themes.

Certain four-year bachelor's degree programmes include Honours as part of the undergraduate programme and therefore the findings in this study may be limited particularly in terms of understanding the drivers and barriers which may be different to Master's and Doctoral studies.

5.2 Recommendations

The following approaches are recommended to address the gaps in this study (see Table 11) to achieve postgraduate targets as per the RDI Roadmap (WRC, 2015), to enhance the quantity and quality of postgraduates, and institutional research and innovation capacity:

- Organise water-related postgraduate education and research on a *regional scale* using the WaterNet example as presented by Jonker *et al.* (2012). WaterNet is an independent network organisation that evolved from a regional network of academic departments and offers a joint and regional Master's programme where member institutions offer course modules in the fields in which they have a comparative strength. The pooling of resources will assist in building capacity at HEIs with no/very few water-related postgraduate degree programmes, increasing accessibility for prospective students, encouraging cooperation and diverse ideas and innovative solving of African water problems "by Africans for Africans" (WorldBank, 2014). The regional and transboundary nature of water is a further justification towards regional postgraduate training opportunities scope. Harnessing online learning and virtual platforms will be key for collaboration. Nurturing and developing strong thematic clusters and stimulating additional research to address weaker thematic clusters should be undertaken by sharing

expertise. Further examples of collaborative research and linking research communities regionally and globally include: ARUA (includes RU, UCT, SU and UKZN), the Association of Pacific Rim Universities (APRU), Universitas 21, Worldwide Universities Network (WUN). Dual laboratories for top scientists (the Tsinghua University, China and Carnegie Mellon University, USA centre) (UNESDOC, 2008).

- Increase the number of specialised degrees (course modules) particularly at Universities of Technology in a broad range of topics and in various disciplines. Global examples of postgraduate water-related programmes in some of the identified gap disciplines of Education, Commerce, Social Science/Humanities and Medicine/Public Health, include:
    - MSc in Public Health and Health Systems – Water (University of Waterloo)
    - Postgraduate course in Water and Global Health (University of Michigan)
    - MSc in Water Science, Policy and Management (University of Oxford)
    - PhD Water Law, Policy and Science (University of Dundee)
    - Interdisciplinary – MSc Water and Sanitation for Development (Cranfield University)

  Specialised courses at an Honours level may provide an important platform for further water research and at a Master's level broaden skill sets beyond a niche dissertation. The pooling of resources as discussed above may provide further opportunity for the offering of a diverse range of specialised course modules.
- Intensify and cultivate existing Water Institutes at HEIs as valuable collaborative platforms and drivers of research, and to broaden discipline-specific representation in the water research space particularly to include the disciplines of Education and Medicine/Public Health.
- Foster and build on collaborative programmes with the private sector, government, CMAs, landowners, etc. A greater representation of HEIs or public research institutions on certain statutory or unitary and professional bodies such as the Institute of Municipal Engineering of Southern Africa (IMESA), and the South African Local Government Association (SALGA) could facilitate collaboration and knowledge transfer. Global examples of engagement with the private sector to encourage innovation in research include the UNESCO/L'Oréal National Prizes for women professors and postgraduate students in science, KPMG Study on the "Competitive Alternatives Knowledge Economy", support for Mexico's Technology Institute of Monterrey (TIM) by the business community in the State of Nuevo Leon (UNESDOC, 2008).
- Retain or attract highly skilled research personnel through for example, tax incentives for returning postgraduates (UNESDOC, 2008).
- Increase investment in research in recognition of the fact that a lack of consistent funding is a key barrier to the uptake of postgraduate studies. Explore options such as: public/private funding models, consulting work and scholarship funding through "sandwich programs" (WorldBank, 2014). Draw on the success of the Millennium Science Initiative in increasing Ugandan researchers and Master's students in science (WorldBank, 2014). Increased government subsidies for structured Master's would assist in exposure to broader concepts and themes in the water sector.

CHAPTER 6 REFERENCES

1. Department of Science and Technology (DST) (2017). A review of the South African science, technology and innovation institutional landscape. 'Ke Nako Research and Innovation for Socio-economic impact now!'.

2. Department of Science and Technology (DST) (2018). Draft White Paper on Science, Technology and Innovation.

3. Department of Higher Education and Training (DHET). (2019). National Skills Development Plan 2030. 'An Educated, Skilled and Capable Workforce for South Africa'.

4. Department of Higher Education and Training (DHET). (2013). White paper for Post-school education and training.

5. Department of Higher Education and Training (DHET). (2011). National Skills Development Strategy III.

6. Jonker, L., Van der Zaag, P., Gumbo, B., Rockström, J, Love, D. and Savenije, H. (2012). A regional and multi-faceted approach to postgraduate water education – The WaterNet experience in Southern Africa. Hydrology and Earth System Sciences. 16. 4225-4232. 10.5194/hess-16-4225-2012.

7. Loades, R. (2019). What's the Difference between Specialized and General Business Master's Degrees? February 14, 2019. Available at: https://www.mba.com/articles-and-announcements/articles/masters/difference-between-specialized-and-general-business-masters.

8. National Water Resource Strategy (NWRS2) (2013). The second edition of the National Water Resource Strategy of 2013.

9. Pouris, A. (2013). A pulse study on the state of water research and development in South Africa. WRC Report No. 2199/1/12

10. Pouris, A. (2015). State of Water Research in South Africa. WRC Report No. SP 92/15

11. Pouris, A. (2018). Mapping out the water research, development and innovation ecosystem in relation to the water RDI investment Priorities. A WRC Report. Unpublished

12. Pouris, A. and Thopil, G. (2020). Trace Study of Water PhDs in South Africa. A WRC Report.

13. Siebrits, R., Winter, K., Jacobs, I. (2014). Water research paradigm shifts in South Africa. S Afr J Sci. 2014;110(5/6), Art. #2013-0296, 9 pages. http://dx.doi.org/10.1590/ sajs.2014/20130296.

14. Sonn (2016). The challenge for a historically disadvantaged South African University to produce more postgraduate students. South African Journal of Higher Education. Vol 30 No. 2.

15. Studee (2020). Taught v research: which master's will you choose? Available at: https://studee.com/guides/taught-v-research-which-masters-will-you-choose/.

16. UNESDOC (2008). Trends and Issues in Postgraduate Education: Challenges for Research; international experts' workshop, 5-7 March 2008, Dublin City University (DCU), Dublin, Ireland; Final report.

17. Van der Zaag (2009). Sharing knowledge for water sharing. Irrigation and Drainage 58(S2): S177-S187.

18. Water Research Commission (2015). South Africa's Water Research, Development and Innovation (RDI) Roadmap: 2015-2025. Report No. 2305/1/15.

19. Water Research Commission (2018). The South African Water Innovation Story. Report no TT 743/17

20. WorldBank (2014). A decade of development in Sub-Saharan African science, technology, engineering & mathematics research. A report by the World Bank and Elsevier. Available at: http://documents1.worldbank.org/curated/en/237371468204551128/pdf/910160WP0P126900disclose09026020140.pdf.

CHAPTER 7 APPENDICES

APPENDIX A: Taxonomy of Research Focus Areas (RFAs)

The list of Taxonomy of RFAs taken from the RDI Roadmap (2015-2025) with minor modifications

	RFA
1	Agricultural Meteorology
2	Agriculture Ecosystems and Environment
3	Agroforestry
4	Agrometeorology
5	Animal, human, public, and environmental health
6	Aquaculture
7	Aquatic Ecosystems
8	Beneficial agricultural use of municipal sludge
9	Biodiversity and Conservation
10	Bioethics
11	Biological Science
12	Business efficiency
13	Catchment hydrology
14	Civil engineering aspects of water cycle
15	Climate dynamics, resilience, adaptation
16	Climatology
17	Contaminant hydrology
18	Corporate social responsibility and environmental management
19	Crop production
20	Desalination
21	Development Economics
22	Ecohydrology
23	Ecological informatics and modelling
24	Ecology Evolution and Systematics
25	Ecosystem functioning
26	Ecosystem functioning and health
27	Ecosystem services and ecological infrastructure
28	Education
29	Efficient agriculture
30	Environment
31	Environmental and Analytical Chemistry
32	Environmental health and ecosystem functioning
33	Environmental pollution
34	Environmental protection & pollution control
35	Environmental water quality
36	Enzymes

37	Flood defence
38	Food security and business efficiency
39	Geomembrane linings and covers for potable water storage
40	Governance
41	Health
42	Horticulture
43	Human health
44	Human, public, and environmental health
45	Hydrodynamics
46	Hydrologic engineering
47	Hydrology
48	Hydrology and Water Resources
49	Hydromechanics
50	Hydrometeorology
51	Improved food production
52	Improved food security
53	Integrated Water Resources Management IWRM
54	Irrigation and Drainage
55	Land surface hydrology
56	Local Government
57	Management
58	Membrane Technology
59	Mining Hydrogeology
60	Natural resource management
61	non-Newtonian fluid mechanics
62	Ocean Wave Power
63	OM Rural Water Services
64	Plant life extension Technologies
65	Process automation and control – potable and wastewater treatment
66	Public health
67	Public participation
68	River Basin management
69	Sanitation
70	Soil Chemistry
71	Soil Fertility
72	Soil Management
73	Soil microbiology and biochemistry
74	Soil morphology and genesis
75	Soil Physics
76	Subsurface hydrology
77	Sustainability
78	Sustainability in mining
79	Systems Ecology
80	Technoeconomic
81	Unsaturated zone
82	Urban Economics

83	Wastewater and potable treatment
84	Wastewater and potable treatment, ecosystem functioning, environmental water quality, animal, human, public, and environmental health
85	Wastewater treatment
86	Water and Wastewater Microbiology
87	Water and wastewater treatment
88	Water Engineering
89	Water infrastructure development
90	Water quality and water resources
91	Water quality monitoring, ecosystem functioning, environmental water quality, animal health
92	Water quality monitoring, ecosystem functioning, environmental water quality, animal, human, public, and environmental health
93	Water resource governance and management
94	Water Resources Management
95	Water Science
96	Water science management, policy and legislations
97	Water treatment
98	Waterborne Pathogen characterisation
99	Wave Powered Desalination
100	Weather and Forecasting
101	Other
102	Water governance, resilience, security, IWRM
103	Groundwater Modelling
104	Hydrochemistry
105	Physical Hydrogeology
106	Contaminant Transport and Tracer Hydrogeology
107	Field Methods in Hydrogeology
108	Eco hydrogeology
109	Climate smart agriculture
110	Microplastic pollution

APPENDIX B: Data Verification: Email Survey Sample

A sample of the text contained in the email survey

Dear Prof/Dr, etc.

We thank you for your generous contribution to the **Water Research, Development and Innovation (RDI) Capability Mapping study (K5 2982)** conducted by Stellenbosch University, on behalf of the Water Research Commission (WRC) thus far.

You will recall an email in October 2019 alerting you to the survey we would be sharing with you relating to the Water RDI Roadmap **Postgraduate Mapping Study**. This third outcome of the study is to gain a better understanding of the present and future water sector skills demand by mapping and analysing the **water sector postgraduate training landscape.** As a key player in postgraduate research and training programmes at the *NAME of HEI you* are invited to participate in this research.

We would appreciate it if you could:

- refer to the **attached spreadsheet** listing the NAME *of HEI* postgraduate water related programmes as obtained through a desktop study, and
- check the **accuracy** thereof making **changes/additions** as necessary and highlighting these changes accordingly. If we could draw particular attention to columns F, G and H ("Drop Down Lists" of relevant Research Focus Areas).

The process will take approximately 15 minutes to complete.

We thank you for your valuable time and input.

Kind regards
The Project Team

APPENDIX C: Results: Postgraduate Water Programmes at SA HEIs

The following table is the results of the initial desktop study (raw data) from which both general and specialised water-related degree programmes were extracted for data analysis.

HEI	Faculty	Dept	Postgraduate Degree	Course	Research Output	Research Focus Area 1	Research Focus Area 2	Research Focus Area 3
CPUT	Applied Science	Agricul-ture	Master of Agriculture	0	0	0	0	0
0	Applied Science	Chemis-try	Master of Applied Sciences in Chemistry	0	0	0	0	0
0	Applied Science	Chemis-try	Doctor of Philosophy in Chemistry	0	0	0	0	0
0	Applied Science	Food and Nutrition	Master of Consumer Science in Food and Nutrition	0	0	0	0	0
0	Applied Science	Conser-vation and Marine Science	Master of Conservation Science	0	0	0	0	0
0	Applied Science	Conser-vation and Marine Science	Magister Technologiae: Oceanography	0	0	0	0	0
0	Applied Science	Environ-mental and Occupa-tional Studies	Master of Environmental Health	0	0	0	0	0
0	Applied Science	Environ-mental and Occupa-tional Studies	Master of Environmental Management	Elective course in Water Resource Management	Hydrogeochemical assessment of groundwater quality in the Soutpansberg Basin around Tshikondeni, Limpopo Province, South Africa	Water Resources Management	Groundwater Modelling	Environmental health and ecosystem functioning
0	Applied Science	Environ-mental and Occupa-tional Studies	Doctor of Philosophy in Environmental Health	0	0	0	0	0
0	Applied Science	Food Science & Techno-logy	Master of Food Science and Technology	0	0	0	0	0
0	Applied Science	Food Science & Techno-logy	Doctor of Food Science and Technology	0	0	0	0	0
0	Applied Science	Horticul-ture	Master of Horticultural Science	0	0	Horticulture	Plant life extension Technologies	Agriculture Ecosystems and Environment
0	Applied Science	Horticul-ture	Doctor of Horticulture	0	It will also provide the opportunity to specialise in horticulture related fields such as: biotechnology, breeding and genetics, crop physiology, floriculture, integrated pest management, landscape design horticulture (scarce skills), modelling and quantitative systems analysis, nursery production, tissue culture, plant growth and development, plant nutrition, postharvest biology and technology, precision agriculture, revegetation/restoration, and water relations.	Horticulture	Plant life extension Technologies	Agriculture Ecosystems and Environment
0	Engineer-ing	Enginee ring: Chemi-cal	Master of Engineering in Chemical Engineering	0	Forward osmosis membranes for direct fertigation within the South African wine industry	0	0	0
0	Engineer-ing	Enginee ring: Chemi-cal	Doctor of Engineering in Chemical Engineering	0	0	0	0	0
0	Engineer-ing	Enginee ring: Civil	Master of Engineering in Civil Engineering	0	0	0	0	0
0	Engineer-ing	Enginee ring: Civil	Doctor of Engineering in Civil Engineering	0	0	0	0	0
0	Engineer-ing	Enginee ring: Mechani cal	Master of Engineering in Mechanical Engineering	0	Design optimisation of pillar-mounted sun tracking solar-water purifiers for large households	Water infrastructure development	Water treatment	Water Engineering
0	Engineer-ing	Enginee ring: Mechani cal	Doctor of Engineering in Mechanical Engineering	0	0	Water infrastructure development	Water treatment	Water Engineering
0	Health and Wellness	Biomedi cal	Master of Science in Biomedical Technology	0	0	0	0	0

	Sciences	Techno-logy						
0	Health and Wellness Sciences	Biomedi cal Techno-logy	Doctor of Philosophy in Biomedical Sciences	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
C U T	0	0	Master of Technology & Doctor of Engineering in Civil Engineering	0	0	Civil engineering aspects of water cycle	Water Engineering	Hydrology
0	0	0	Master of Agriculture	0	0	Agriculture Ecosystems and Environment	Efficient agriculture	Climate smart agriculture
0	0	0	Master of Health Sciences in Environmental Health	0	0	Health	Climate dynamics, resilience, adaptation	Environmenta l health and ecosystem functioning
0	0	0	Master of Technology: Environmental Health	0	0	Health	Climate dynamics, resilience, adaptation	Environmen-tal health and ecosystem functioning
0	0	0	Postgraduate Diploma in Agricultural Management	0	0	Agriculture Ecosystems and Environment	Management	Efficient agriculture
0	0	0	0	0	0	0	0	0
D U T	Faculty of applied Science (Biotech-nology, chemical enginee-ring, civil enginee-ring and Chemistry)	0	Doctor of Engineering	0	0	Water Engineering	Water treatment	Local Government
0	Faculty of applied Science (Biotech-nology, chemical enginee-ring, civil enginee-ring and Chemistry)	0	Master of Engineering	0	Optimization of irrigation water in South Africa for sustainable and beneficial use (2017) Non-revenue water : most suitable business model for water services authorities in South Africa : Ugu District Municipality (2016) Synthesis of a model for optimising a potable water treatment plant and water usage analysis in the Ugu District (2017) Evaluation of a small scale water disinfection system using WFMF (2017)	Irrigation and Drainage	Water treatment	Local Government
0	Faculty of health (Environ-mental health) and Manage-ment Science	0	Master of Technology Environmental Health	0	Determinants of key drivers for potable water treatment cost in uMngeni Basin (2015)	Water Engineering	Water treatment	Urban Economics
0	0	0	Doctor of Environmental Health	0	0	Water Engineering	Water treatment	Urban Economics
0	0	0	Master of the Built Environment	0	0	Sustainability	0	0
0	0	0	0	0	0	0	0	0
U F H	Science and Agriculture	0	Master & Doctor of Agriculture in Agricultural Economics	0	0	Agriculture Ecosystems and Environment	Efficient agriculture	Natural resource management
0	0	0	Master & Doctor of Agriculture in Agricultural Extension	0	0	Agriculture Ecosystems and Environment	Sustainability	Education
0	0	0	Master & Doctor of Agriculture in Animal Science	0	0	Agriculture Ecosystems and Environment	Animal, human, public, and environmental health	Water quality monitoring, ecosystem functioning, environmental water quality, animal health
0	0	0	Master & Doctor of Agriculture in Crop Science	0	0	Crop production	Improved food production	Efficient agriculture
0	0	0	Master & Doctor of Agriculture in Horticultural Science	0	0	Agriculture Ecosystems and Environment	Horticulture	Plant life extension Technologies
0	0	0	Master & Doctor of Agriculture in Soil Science	0	0	Soil microbiology and	Soil Fertility	Soil Management

						biochemistry		
0	0	0	Master & Doctor of Science: Agriculture	0	0	Agriculture Ecosystems and Environment	Efficient agriculture	Water quality monitoring, ecosystem functioning, environmental water quality, animal health
0	0	0	Master of Science in Agriculture in Pasture Science	0	0	Sustainability	Efficient agriculture	Improved food security
0	0	0	Master of Science: Agriculture: Agro-forestry	0	0	Agroforestry	Food security and business efficiency	Improved food production
UKZN	0	0	0	Water, Environment & Biodiversity: Hydrology; Wastewater & Sanitation Management; Micrometeorology & Agrometeorology; Hydrological Engineering, Limnology	0	Hydrology	Wastewater treatment	Hydrologic engineering
0	Agricultu-re, Enginee-ring and Science	0	BSC Honours in Chemistry	0	0	Wastewater treatment	Flood defence	Hydrology
0	Agricultu-re, Enginee-ring and Science	0	BSC Honours in Environmental Science	0	0	0	0	0
0	Agricultu-re, Enginee-ring and Science	0	BSC Honours in Horticultural Science	0	0	0	0	0
0	Agricultu-re, Enginee-ring and Science	0	BSC Honours in Hydrology	0	0	Hydrology	Hydrodyna-mics	Water Resources Management
0	Agricultu-re, Enginee-ring and Science	0	BSC Honours in Microbiology	0	0	0	0	0
0	Agricultu-re, Enginee-ring and Science	0	BSC Honours in Soil Science	0	0	0	0	0
0	Agricultu-re, Enginee-ring and Science	Geogra-phy	MSc Geography	0	Informal Communities – influence on water quality & free basic water and sanitation services; urban water service delivery – impacts on food security, water resource management	Water quality and water resources	Food security and business efficiency	Water Resources Management
0	Agricultu-re, Enginee-ring and Science	0	DPhil Geography	0	0	Water quality and water resources	Food security and business efficiency	Water Resources Management
0	Agricultu-re, Enginee-ring and Science	0	MSc Soil Science	0	0	0	0	0
0	Agricultu-re, Enginee-ring and Science	0	DPhil Soil Science	0	0	0	0	0
0	Agricultu-re, Enginee-ring and Science	0	MSc Horticultural Science	0	0	0	0	0
0	Agricultu-re, Enginee-ring and Science	0	DPhil Horticultural Science	0	0	0	0	0
0	Built Environ-ment and Develop-ment Studies	Town and Regional Planning	Master of Science: Urban and Regional Planning: Environmental Planning	0	Environmental impacts of informal settlements on water	Environmental health and ecosystem functioning	Environmen-tal protection & pollution control	Human, public, and environmental health
0	Built Environ-ment and Develop-ment Studies	Town and Regional Planning	Master of Science: Urban and Regional Planning: Development Planning	0	Remote sensing in determining water turbidity as a water quality indicator	Water quality monitoring, ecosystem functioning, environmental water quality, animal, human, public, and environmental health	Water and Wastewater Microbiology	Human, public, and environmental health
0	0	Public Health	MSc Public Health	Evaluation of drinking water quality	0	Water quality and water resources	Water quality monitoring, ecosystem functioning, environmental water quality, animal, human, public, and	Water treatment

							environmental health	
0	0	Public Health	PhD Public Health	0	0	Water quality and water resources	Water quality monitoring, ecosystem functioning, environmental water quality, animal, human, public, and environmental health	Water treatment
0	Agricultu-re, Enginee-ring and Science	Environ mental Science	MSc Environmental Science	Water treatment residue characterisation; surface and groundwater quality	0	Water treatment	Water quality and water resources	Groundwater Modelling
0	Agricultu-re, Enginee-ring and Science	Environ mental Science	DPhil Environmental Science	0	0	Water treatment	Water quality and water resources	Groundwater Modelling
0	0	0	Master of Laws in Environmental Law	0	0	Environmental protection & pollution control	Environmen-tal pollution	Water governance, resilience, security, IWRM
0	Agricultu-ral, Earth and Environ-mental Sciences	0	MAgricMgmt Agricultural Management	0	Evaluation of water treatment costs, soil water measurements and modelling	Water treatment	Soil Management	Efficient agriculture
0	Agricultu-ral, Earth and Environ-mental Sciences	0	DPhil Agricultural Management	0	0	Water treatment	Soil Management	Efficient agriculture
0	Agricultu-ral, Earth and Environ-mental Sciences	0	MSc Crop Science	0	Water use characteristics of crops, response to water stress	Crop production	Efficient agriculture	Food security and business efficiency
0	Agricultu-ral, Earth and Environ-mental Sciences	0	DPhil Crop Science	0	0	Crop production	Efficient agriculture	Food security and business efficiency
0	Agricultu-ral, Earth and Environ-mental Sciences	0	MSC Agric Crop Science	0	0	0	0	0
0	Agricultu-ral, Earth and Environ-mental Sciences	0	DPhil Agric Crop Science	0	0	0	0	0
0	Agricultu-ral, Earth and Environ-mental Sciences	Animal and Poultry Science	Masters in Animal Science	0	Physiological responses of animals to water quality	Water quality and water resources	Animal, human, public, and environmental health	Efficient agriculture
0	0	0	Doctor in Animal Science	0	0	Water quality and water resources	Animal, human, public, and environmental health	Efficient agriculture
0	Graduate School of Business and Leader-ship	0	Masters	0	Water, Sanitation and local economic development (rural household income)	Sanitation	Water and wastewater treatment	OM Rural Water Services
0	Social Science	0	Doctor of Conflict Resolution and Peace Studies	0	Water access policies and positive peace	Water science management, policy and legislations	Governance	Water governance, resilience, security, IWRM
0	0	0	Master of Conflict Resolution and Peace Studies	0	0	Water science management, policy and legislations	Governance	Water governance, resilience, security, IWRM
0	0	0	MSc Geology	0	Effect of mining on surface water quality	Water quality and water resources	Mining Hydrogeology	Water Resources Management
0	0	0	DPhil Geology	0	0	Water quality and water resources	Mining Hydrogeology	Water Resources Management
0	0	0	Master of Development Studies	0	Consumer Perceptions & private sector participation in Water Supply & Sanitation Services, link between access, quality and health; gender, water & livelihoods	Sanitation	Water quality and water resources	Public health
0	0	0	Doctor of Development Studies	0	0	Sanitation	Water quality and water resources	Public health
0	0	0	Masters Health	0	Water, sanitation and hygiene	Sanitation	Public health	Water quality

			Promotion					and water resources
0	0	0	Masters Degrees (English, Media and Performance Studies)	0	Water in Visual Art	Other	0	0
0	0	0	Master's in Public Governance	0	Revenue management of water and sanitation	Urban Economics	Sanitation	Management
0	0	0	PhD in Public Governance	0	0	Urban Economics	Sanitation	Management
0	0	0	MSc Microbiology	0	Impact of irrigation water on the quality of fresh produce	Irrigation and Drainage	Water and Wastewater Microbiology	Efficient agriculture
0	0	0	DPhil Microbiology	0	0	Irrigation and Drainage	Water and Wastewater Microbiology	Efficient agriculture
0	Manage-ment, IT and Governan-ce	0	Masters of Commerce in Management	0	Policy, planning and provision of water	Governance	Water science management, policy and legislations	Water infrastructure development
0	0	0	Doctor of Commerce in Management	0	0	Governance	Water science management, policy and legislations	Water infrastructure development
0	0	0	MSc Agrometeorology	0	Total evaporation and soil water relations of trees	Soil Management	Agricultural Meteorology	Agrometeoro-logy
0	0	0	DPhil Agrometeorology	0	0	Soil Management	Agricultural Meteorology	Agrometeoro-logy
0	0	0	MSc Agric Agricultural Economics	0	Economics of smallholder irrigation water management	Urban Economics	Irrigation and Drainage	Management
0	0	0	DPhil Agricultural Economics	0	0	Urban Economics	Irrigation and Drainage	Management
0	0	0	DPhil Agricultural Economics	0	0	Urban Economics	Irrigation and Drainage	Management
0	0	Chemis-try and Physics	MSc Chemistry	0	Analysis of water and sedimentation, sorption behaviour of crops	Crop production	Agriculture Ecosystems and Environment	Efficient agriculture
0	0	0	PhD Chemistry	0	0	0	0	0
0	0	Chemi-cal Enginee ring	MSc Chemical Engineering	0	Water usage in industry, recycled water	Water Resources Management	Integrated Water Resources Management (IWRM)	Water Engineering
0	0	0	PhD Chemical Engineering	0	0	Water Resources Management	Integrated Water Resources Management (IWRM)	Water Engineering
0	0	0	MSc Civil Engineering	0	0	0	0	0
0	0	0	DPhil Civil Engineering	0	0	0	0	0
0	0	0	MSc Environmental Engineering	0	0	0	0	0
0	0	0	DPhil Environmental Engineering	0	0	0	0	0
0	Agricultu-ral, Earth and Environ-mental Sciences	0	MSc Hydrology	0	0	Hydrology	Agriculture Ecosystems and Environment	Water Resources Management
0	Agricultu-ral, Earth and Environ-mental Sciences	0	DPhil Hydrology	0	0	Hydrology	Agriculture Ecosystems and Environment	Water Resources Management
0	Agricultu-ral, Earth and Environ-mental Sciences	0	Bachelor Honours Agriculture	0	0	Agriculture Ecosystems and Environment	Efficient agriculture	Animal, human, public, and environmental health
0	0	0	Bachelor Honours Agricultural Management	0	0	0	0	0
0	Agricultu-ral, Earth and Environ-mental Sciences	0	Master of Agriculture in Food Security	0	0	Food security and business efficiency	Efficient agriculture	Animal, human, public, and environmental health
0	Agricultu-ral, Earth and Environ-mental Sciences	0	Master of Agriculture: Rural Resource Management	0	0	Water Resources Management	Efficient agriculture	Animal, human, public, and environmental health
0	0	0	Master of Arts: Geography and Environmental Management	0	0	Environmental health and ecosystem functioning	Management	Environment
0	0	0	Master of Education: Science Education: Teacher and Educational Management	0	0	Education	Water Resources Management	Water governance, resilience, security, IWRM
0	0	0	MSc in Agriculture in Agricultural and Environmental Instrumentation	0	0	Agriculture Ecosystems and Environment	Animal, human, public, and environmental health	Efficient agriculture

UL	0	0	Masters/Doctoral Research	Geomorphology, hydrology and water resources, rainwater harvesting, soil erosion and conservation, geography education, quantitative techniques and research methods.	0	Hydrology	Hydrology and Water Resources	Integrated Water Resources Management (IWRM)
0	Science and Agriculture	Agricul-tural & Environ mental Scien-ces	Master of Agricultural Management in Agricultural Extension	0	0	Agriculture Ecosystems and Environment	Management	Efficient agriculture
0	Science and Agriculture	Agricul-tural & Environ mental Scien-ces	Master of Agriculture in Plant Protection	0	0	Biodiversity and Conservation	Agriculture Ecosystems and Environment	Animal, human, public, and environmental health
0	Science and Agriculture	Agricul-tural & Environ mental Scien-ces	Master of Agricultural Management	0	0	Sustainability	Agriculture Ecosystems and Environment	Management
IIEMSA	0	0	Master of Philosophy in Integrated Water Management	Science of Water (ZPG4824): Properties of water, natural hydrological cycle & ecology of inland aquatic systems, human uses of water, relationship between human & natural aquatic systems, resilience & systematic freshwater conservation & planning.	Water Science	Ecosystem functioning and health	Aquatic Ecosystems	
0	0	0	Master of Philosophy in Integrated Water Management	Water, Sustainability & Development (ZPG4825) Elements & background to the world's water crisis, sustainable development thinking about water & water resources (livelihoods & poverty, water supply & sanitation, gender, community participation & water as a human right.)	Sustainability	Water Resources Management	Human, public, and environmental health	
0	0	0	Master of Philosophy in Integrated Water Management	Water governance & policy (ZPG4826): Political, social, economic & administrative arrangements for water resource management & meeting water needs of different sectors of society.	Water resource governance and management	Water Resources Management	Water governance, resilience, security, IWRM	
0	0	0	Master of Philosophy in Integrated Water Management	Research Project (ZPG4827) Water security, climate resilient societies, river basin & floodplain management, urban water design, water use in agricultural value chains, social-hydrological system analysis, resilience & ecological engineering, & water governance and policy, to combine knowledge across disciplines.	Climate dynamics, resilience, adaptation	Water governance, resilience, security, IWRM	Efficient agriculture	
0	0	0	Postgraduate Diploma in Water Management	Module 1: Project Management for Water Managers – issues relating to water management project planning, design and management.	Management	Water Resources Management	Water governance, resilience, security, IWRM	
0	0	0	Postgraduate Diploma in Water Management	Module 2: Collaborative Water Planning – water planning frameworks at international, national, regional/basin, transboundary & local levels. (Themes: sustainable development, collaborative management, water rights & access, & equity for marginal groups).	Sustainability	Water governance, resilience, security, IWRM	Management	
UMP	0	0	0	0	0	0	0	0
MUT	0	0	Master's degree Nature Conservation	0	0	Nature conservation	0	0
NMMU	0	0	Master of Technology of Agriculture	0	0	Sustainability	Efficient agriculture	0
0	0	0	Doctor of Agriculture	0	0	0	0	0
0	0	0	Master of Technology Agriculture in Nature Conservation	0	0	Sustainability	Efficient agriculture	Biodiversity and Conservation
0	0	0	Doctor of Agriculture in Nature Conservation	0	Shallow water estuaries: conservation & management, Blue carbon ecosystems & responses to climate change, Ecophysiology of estuarine macrophytes; & Water quality management	Sustainability	Efficient agriculture	Biodiversity and Conservation
0	0	0	Master of Technology of Engineering	0	The development of a framework to reduce water and energy consumption through the use of water and energy value stream mapping for the South African manufacturing industry	Water Engineering	Hydrologic engineering	Hydrology and Water Resources
0	0	0	Doctor of Engineering	0	A sustainable water quality framework for South Africa towards 2050	Water Engineering	Hydrologic engineering	Hydrology and Water Resources
0	0	0	Master of Technology of Environmental Health	0	0	Environmental health and ecosystem functioning	Environment	Environmen-tal protection & pollution control
0	0	0	Doctor of Environmental Health	0	0	0	0	0
0	0	0	Master of Science in Agricultural Management	0	0	Agriculture Ecosystems and	Efficient agriculture	Management

						Environment		
0	0	0	Master of Science in Forestry	0	0	Agroforestry	Efficient agriculture	Water Science
NWU	School of Social & Govern-ment Studies	0	PhD in Development & Management (thesis)`: Water Studies	Specialization in Water Studies	0	Management	Water Science	Water Resources Management
0	School of Social & Govern-ment Studies	0	MA in Development & Management (structured master's degree): Water Studies	Module: Cultural Dynamics of Water Module: Integrated Water Management Module: Hydro Politics	The management of potable water supply in Mogwase Township, Moses Kotane Local Municipality	Management	Water Science	Water Resources Management
0	0	0	Doctor of Philosophy: Physical Sciences: Geography and Environmental Science	0	0	Environmental protection & pollution control	Water Science	Environment
0	0	0	Master of Arts: Geography and Environmental Science: Research	0	0	Environmental protection & pollution control	Environmen-tal health and ecosystem functioning	Environment
0	0	0	Master of Science: Agriculture: Animal Science	0	0	Agriculture Ecosystems and Environment	Animal, human, public, and environmental health	Efficient agriculture
0	0	0	Master of Science: Agriculture: Crop Science	0	0	Crop production	Efficient agriculture	Agriculture Ecosystems and Environment
0	0	0	Master of Science: Natural Sciences: Geography and Environmental Science	0	Determination of the quality of environmental water using GC-MS based faecal sterol analysis The applicability of advanced treatment processes in the management of deteriorating water quality in the Mid-Vaal river system	Environmental protection & pollution control	Environment	Water Science
RU	Faculty of Science	0	MSc in Hydrology	0	Modelling water quality : complexity versus simplicity	Water Resources Management	Hydrology	Hydrology and Water Resources
0	0	0	PhD in Hydrology	0	Fire and water : a transdisciplinary investigation of water governance in the lower Sundays River Valley, South Africa	Water Resources Management	Hydrology	Hydrology and Water Resources
0	Faculty of Science	Geogra-phy	Honours in Environmental Water Management	Modules: Environmental Quality, Hydrology, Freshwater Quality, Integrated Environmental Management	0	Water Resources Management	Environment	Management
0	0	0	MSc in Water Resource Science	0	Exploring the development of an integrated, participative, water quality management process for the Crocodile River catchment, focusing on the sugar industry Water security amongst impoverished households in the Sundays River Valley Municipality : community experiences and perspectives	Water Resources Management	Integrated Water Resources Management (IWRM)	Water Science
SMU	0	0	0	0	0	0	0	
SPU	0	0	0	0	0	0	0	
SU	Enginee-ring	Civil Enginee ring	MEng Civil Engineering: Water Engineering	Modules: 1.Design of Hydraulic Structures 2 Flood Hydrology 3 Water Resources Analysis & Management 4 Pipeline Hydraulics and Pump station design 5 Water Networks and Services Planning 6 Water and Wastewater treatment 7 Numerical simulation of fluids(1) 8 Special Hydrology 9 Special Hydraulics 10. Port and Coastal Engineering	Guideline for a robust assessment of the potential savings from water conservation and water demand management Predicting water quality in bulk distribution systems	Water infrastructure development	Water Engineering	Hydrology and Water Resources
0	Enginee-ring	Civil Enginee ring	PhD Civil Engineering	0	a) River hydraulics & Design of hydraulic structures (Prof Basson) b) Bulk water pipeline hydraulics & pump-station design (Prof Basson) c) Hydrology (Prof du Plessis) d) Water Services (water distribution and sewer networks) (Prof Jacobs and Mr Loubser) e) Water quality and treatment (Dr Brink) f) Stormwater and drainage systems (Ms. Bosman)	Water infrastructure development	Water Engineering	Hydrology and Water Resources
0	Enginee-ring	Process Enginee ring	MEng Process Engineering	0	Water Technology Research Interest: Reclamation and reuse of mine wastewater, industrial wastewaters, agricultural processing wastewaters, and fishing industry wastewaters Potable water provision, with a particular focus on technologies for developing economies and rural communities Technology development on forward osmosis, membrane distillation and Donnan Dialysis Innovative water disinfection technologies	Wastewater treatment	Mining Hydrogeology	Mining Hydrogeology

					Membrane bioreactors			
0	Enginee-ring	Process Engineering	PhD Process Engineering	0	Water Technology Research Interest: Reclamation and reuse of mine wastewater, industrial wastewaters, agricultural processing wastewaters, and fishing industry wastewaters Potable water provision, with a particular focus on technologies for developing economies and rural communities Technology development on forward osmosis, membrane distillation and Donnan Dialysis Innovative water disinfection technologies Membrane bioreactors	Water Engineering	Water treatment	Water quality monitoring, ecosystem functioning, environmental water quality, animal, human, public, and environmental health
0	Agriscien-ces	Depart-ment of Conser-vation Ecology and Entomo-logy	PhD Sustainable Agriculture	0	0	Sustainability	Efficient agriculture	Agriculture Ecosystems and Environment
0	0	0	MSc Sustainable Agriculture	0	0	0	0	0
0	Agriscien-ces	Depart-ment of Conse-vation Ecology and Entomo-logy	MSc in Conservation Ecology	0	0	Sustainability	Ecology Evolution and Systematics	Biodiversity and Conservation
0	0	0	PhD in Conservation Ecology	0	0	0	0	0
0	Agriscien-ces	Depart-ment of Food Science	MSc in Food Science	0	Use of anaerobic digestion technology, ozonation & other pre-treatment techniques to improve the efficiency of the water treatment efficiency, & reducing water usage in general food processing environment.	Improved food production	Water treatment	Efficient agriculture
0	0	0	PhD in Food Science	0	Use of anaerobic digestion technology, ozonation & other pre-treatment techniques to improve the efficiency of the water treatment efficiency, & reducing water usage in general food processing environment.	Improved food production	Water treatment	Efficient agriculture
0	Agriscien-ces	Depart-ment of Forest and Wood Science	PhD in Forestry and Wood Sciences;	0	Wood properties: biological, physical & chemical properties of importance during the processing & use of wood-based products. Include micro & macro structures, biodegradation, wood/water relationship, thermal, mechanical strength, & electrical and acoustic properties.	Agroforestry	Efficient agriculture	Environment
0	0	Depart-ment of Forest and Wood Science	MSc in Wood or Wood Products Sciences	0	Wood properties: biological, physical & chemical properties of importance during the processing & use of wood-based products. Include micro & macro structures, biodegradation, wood/water relationship, thermal behaviour, mechanical strength, & electrical and acoustic properties.	0	0	0
0	Agriscien-ces	Depart-ment of Soil Science	PhD Soil Science	0	THE EFFECT OF WINERY WASTEWATER IRRIGATION ON THE PROPERTIES OF SELECTED SOILS FROM THE SOUTH AFRICAN WINE REGION	Wastewater treatment	Irrigation and Drainage	Soil microbiology and biochemistry
0	Agriscien-ces	Depart-ment of Soil Science	MScAgric Soil Science	0	The effect of domestic greywater on soil quality of urban soils from the Cape Town and Stellenbosch areas SOIL AND GRAPEVINE RESPONSES TO IRRIGATION WITH TREATED MUNICIPAL AND WINERY WASTEWATERS	Wastewater treatment	Irrigation and Drainage	Soil microbiology and biochemistry
0	Agriscien-ces	Depart-ment of Horticul-tural Science	PhD in Horticultural Science	0	Quantifying water use of high performing commercial apple orchards in the winter rainfall area of South Africa	Water Resources Management	Irrigation and Drainage	Horticulture
0	Agriscien-ces	Depart-ment of Horticul-tural Science	MSc Horticultural Science	0	Apple orchard water use under shade netting	Water Resources Management	Irrigation and Drainage	Horticulture
0	Agriscien-ces	Depart-ment of Agricul-tural Econo-mics	Master of Agricultural Management	0	0	Agriculture Ecosystems and Environment	Business efficiency	Efficient agriculture
0	Agriscien-ces	Depart-ment of Agricul-tural Econo-mics	Master of Agriculture in Agri-business Management	0	0	Agriculture Ecosystems and Environment	Business efficiency	Efficient agriculture
0	Agriscien-ces	Depart-ment of Animal Scien-ces	Postgraduate Diploma in Aquaculture	0	Water Research and Innovation	Aquaculture	Aquatic Ecosystems	Animal, human, public, and environmental health
0	Agriscien-ces	Depart-ment of Animal	MSc Agric in Animal Science (Aquaculture)	0	Water Research and Innovation	Aquaculture	Aquatic Ecosystems	Animal, human, public, and

		Scien-ces						environmental health
0	Agriscien-ces	Depart-ment of Animal Scien-ces	PhD in Animal Production Systems (Aquaculture)	0	Water Research and Innovation	Aquaculture	Aquatic Ecosystems	Animal, human, public, and environmental health
0	Medicine and Health Sciences	Epide-miology	MSc in Science	Epidemiology and Clinical Epidemiology	0	Public health	Water Science	Human, public, and environmental health
0	Medicine and Health Sciences	Epide-miology	PhD in Science	Epidemiology and Clinical Epidemiology	0	0	0	0
0	Medicine and Health Sciences	Commu-nity Health	MSc in Science	0	0	0	0	0
0	Medicine and Health Sciences	Commu-nity Health	PhD in Science	0	Contribution of Water Pollution From Inadequate Sanitation and Housing Quality to Diarrheal Disease in Low-Cost Housing Settlements of Cape Town, South Africa	Public health	Water quality and water resources	Human, public, and environmental health
0	Medicine and Health Sciences	Food and Nutrition Security	MSc in Science	0	0	0	0	0
0	Medicine and Health Sciences	Food and Nutrition Security	PhD in Science	Food and Nutrition Security	0	Public health	Food security and business efficiency	Crop production
0	Science	Depart-ment of Earth Science	MSc Geology	0	Hydro-geochemistry and pollution	Environmental pollution	Hydrology and Water Resources	Subsurface hydrology
0	0	Depart-ment of Earth Science	PhD in Geology	0	Hydro-geochemistry and pollution	Environmental pollution	Hydrology and Water Resources	Subsurface hydrology
0	Science	Microbio logy	MSc in Microbiology	0	Monitoring & optimisation of domestic rainwater harvesting tanks, profiling of waterborne pathogens for antibiotic & metal resistance, water treatment & sanitation, as well as water resource management & utilization. The latter extends to environmental science, specifically to assess the various demands (e.g. for food production, energy) on natural resources.	Water and Wastewater Microbiology	Water quality monitoring, ecosystem functioning, environmental water quality, animal health	Waterborne Pathogen characterisati on
0	0	Microbio logy	PhD in Microbiology	0	Monitoring & optimisation of domestic rainwater harvesting tanks, profiling of waterborne pathogens for antibiotic & metal resistance, water treatment & sanitation, as well as water resource management & utilization. The latter extends to environmental science, specifically to assess the various demands (e.g. for food production, energy) on natural resources.	0	0	0
0	Science	Biochemistry	MSc in Biochemistry	0	Applied research for industry and medicine: to develop membrane applications for the monitoring and improvement of water quality, e.g. in industrial effluent treatment.	Wastewater treatment	Membrane Technology	Water quality monitoring, ecosystem functioning, environmental water quality, animal health
0	0	Biochemistry	PhD in Biochemistry	0	Applied research for industry and medicine: to develop membrane applications for the monitoring and improvement of water quality, e.g. in industrial effluent treatment.	0	0	0
0	0	Geography & Environmental Studies	Master in Geo-Informatics	0	Managing spatial technologies for managing resources	0	0	0
0	Science	Geography & Environmental Studies	Doctor of Philosophy in Geo-Informatics	0	Managing spatial technologies for managing resources	Other	Water Resources Management	Integrated Water Resources Management (IWRM)
0	Education	Curricu-lum Studies	MSc and in Curricular Studies	0	Environmental education: This area encompasses research on education and sustainability, and on environmental education, professional development (before and in-service training), and the development of life skills for sustainable lifestyles.	Sustainability	Education	Water Resources Management
TUT	0	0	Doctor of Agricultural Studies	0	0	Agriculture Ecosystems and Environment	Animal, human, public, and environmental health	Efficient agriculture
0	0	0	Doctor of Engineering	0	0	Water Engineering	Hydrologic engineering	Water Resources Management
0	0	0	Doctor of Environmental Health	0	0	Environmental health and ecosystem functioning	Environment	Environmental protection & pollution control
0	0	0	Doctor of Philosophy in Civil Engineering	0	0	Water Engineering	Hydrologic engineering	Water Resources Management

0	0	0	Doctor of Philosophy in Health Science	0	0	Human health	Water Science	Health
0	0	0	Master of Agricultural Science	0	0	Agriculture Ecosystems and Environment	Efficient agriculture	Environmen-tal health and ecosystem functioning
0	0	0	Master of Agriculture	0	0	Agriculture Ecosystems and Environment	Efficient agriculture	Environmen-tal health and ecosystem functioning
0	0	0	Master of Technology: Agriculture	0	0	Agriculture Ecosystems and Environment	Efficient agriculture	Environmen-tal health and ecosystem functioning
0	0	0	Master of Health Sciences	0	0	Human health	Public health	Health
0	0	0	Master of Technology: Engineering: Civil	0	0	Water Engineering	Civil engineering aspects of water cycle	Water Resources Management
0	0	0	Master of Technology: Environmental Health	0	0	Environmental health and ecosystem functioning	Animal, human, public, and environmental health	Environment
UCT	Enginee-ring and the Built Environ-ment	Civil Enginee ring	Master of Science in Civil Engineering	0	Research Specialisation in Urban Water Management; Water Sensitive Design and Sustainable Drainage Systems Influence of real-time information provided by a mobile phone on the management of rural water supply quality The feasibility of augmenting the Stellenbosch potable water supply by establishing a direct potable reuse plant Urban Water Management Critical assessment of right to safe water and sanitation in a South African informal settlement: a case study of Marikana, Cape Town Critical assessment of right to safe water and sanitation in a South African informal settlement: a case study of Marikana, Cape Town Sustainable water governance: An incremental approach towards a decentralised, hybrid water system An experimental investigation of leakage flow paths in soil surrounding leaks in water distribution systems Evaluating water conservation and water demand management in an industrialised city: a case study of the City of uMhlathuze in Richards Bay	Sustainability	Civil engineering aspects of water cycle	Integrated Water Resources Management (IWRM)
0	0	Civil Enginee ring	Doctor of Philosophy in Civil Engineering	0	Research Specialisation in Urban Water Management; Water Sensitive Design and Sustainable Drainage Systems The prospects for stormwater harvesting in Cape Town, South Africa using the Zeekoe Catchment as a case study	0	0	0
0	0	Civil Enginee ring	Doctor of Philosophy in Civil Engineering	0	Research Specialisation in Wastewater treatment	0	0	0
0	Enginee-ring and the Built Environ-ment	Civil Enginee ring	Master of Science in Civil Engineering	0	Research specialisation in Wastewater treatment Advanced water metering and its application in low income communities	Wastewater treatment	Sanitation	Water and wastewater treatment
0	Enginee-ring and the Built Environ-ment	Civil Enginee ring	M Eng/MSc Eng in Water Quality Engineering	Various courses on theory, design, modelling and operation of Waste Water Treatment, Urban Water and Water Distribution. CIV5032Z Principles of Wastewater Treatment & Wastewater Characterisation CIV5049Z Modelling & Simulation of Wastewater Treatment Systems CIV5051Z Aquatic Chemistry PART A CIV5052Z Aquatic Chemistry PART B CIV5107Z Integrated Urban Water Management CIV5145Z Master of Water Engineering Project	0	Wastewater and potable treatment, ecosystem functioning, environmental water quality, animal, human, public, and environmental health	Water Engineering	Civil engineering aspects of water cycle
0	Enginee-ring and the Built Environ-ment	Con-struction Econo-mics and Manage ment	Master of Science in Property Studies	0	Research Specialisation in Sustainable construction or Green building	Sustainability	Environment	Development Economics
0	Enginee-ring and the Built Environ-ment	Con-struction Econo-mics and Manage ment	PhD in Property Studies	0	0	0	0	0
0	Enginee-ring and the Built Environ-ment	Con-struction Econo-mics and Manage ment	Bachelor of Science Honours in Construction Management	CON4049S Construction Innovation	0	Sustainability	Environment	Environmen-tal protection & pollution control
0	Enginee-ring and	Architec-ture,	Bachelor of Architectural Studies Honours	APG4029F Natural Systems (elective course): explores relationship with	Water sensitive urban design as a transformative approach to urban water	Natural resource	Environment	Animal, human,

	the Built Environment	Planning & Geomatics		settlements & natural systems (incl. water system)	management in Cape Town: A case study of the proposed River Club development	management		public, and environmental health
0	Engineering and the Built Environment	Architecture, Planning & Geomatics	Bachelor of City Planning Honours	APG4029F Natural Systems: explores relationship with settlements & natural systems (incl. water system)	0	Natural resource management	Environment	Animal, human, public, and environmental health
0	Engineering and the Built Environment	Chemical Engineering	All Masters Postgraduate Programmes (MSc, MPhil x2)	CHE5064Z Sustainability in Chemical Engineering: to raise awareness of the issues surrounding a sustainable process industry including the provision of water	0	Sustainability	Management	Water Resources Management
0	Engineering and the Built Environment	Chemical Engineering	Master of Philosophy specialising in Sustainable Mineral Resource Development	Special topics in sustainable development	0	Sustainability	Animal, human, public, and environmental health	Water Resources Management
0	Engineering and the Built Environment	Chemical Engineering	Master of Science in Chemical Engineering	0	Crystallization & precipitation research focusing on metal recovery in mineral processing & metal removal for environmental protection & crystallization for water treatment Research in Water remediation, treatment, recovery and footprinting	Water treatment	Environment	Environmental health and ecosystem functioning
0	Engineering and the Built Environment	Chemical Engineering	Doctor of Philosophy in Chemical Engineering	0	Crystallization & precipitation research focusing on metal recovery in mineral processing & metal removal for environmental protection & crystallization for water treatment Research in Water remediation, treatment, recovery and footprinting	0	0	0
0	Engineering and the Built Environment	Interdepartmental	Master of Science, Master of Engineering	END5129S Sustainable Water Management	0	Sustainability	Water resource governance and management	Water quality and water resources
0	Engineering and the Built Environment	Mechanical Engineering	Master of Philosophy specialising in Space Studies	EEE5125Z SPACE Applications for Sustainable Development: space technology to address sustainable development challenges including water security	0	Sustainability	Water Resources Management	Water resource governance and management
0	Commerce	School of Economics	Master's in economics	ECO5052S Natural Resource Economics – Theoretical analysis – specific environmental policies as applied to climate change, biodiversity, renewable & non-renewable resources. Better understanding of current debates & issues in the environmental field	0	Urban Economics	Natural resource management	Climate dynamics, resilience, adaptation
0	Commerce	School of Economics	Masters of Commerce in Economics	0	Behavioural economics (understand the way in which people in developing economies assess risk & make decisions, e.g. water usage). Saving water in schools: evidence on the use of smart water meters and behavioural insights	Urban Economics	Water Resources Management	Water resource governance and management
0	0	School of Economics	Doctor of Philosophy in Economics	0	Behavioural economics (understand the way in which people in developing economies assess risk & make decisions, e.g. water usage).	Urban Economics	Water Resources Management	Water resource governance and management
0	0	School of Economics	MBA	0	Can trade effluent charges promote compliance and address water security risks in Nairobi's manufacturing industries?	Water governance, resilience, security, IWRM	Water Resources Management	Water resource governance and management
0	0	0	Master of Development Policy and Practice	0	An Assessment of the Effectiveness of Water Quality Monitoring and Drinking Water Quality Compliance by Environmental Health Practitioners at Selected Metropolitan and District Municipalities in South Africa during 2013-2014	Water quality monitoring, ecosystem functioning, environmental water quality, animal, human, public, and environmental health	Public health	Integrated Water Resources Management (IWRM)
0	0	0	PhD Development Policy and Practice	0	0	Water quality monitoring, ecosystem functioning, environmental water quality, animal, human, public, and environmental health	Public health	Integrated Water Resources Management (IWRM)
0	0	School of Economics	Masters Management Studies	0	A Theory and Process Evaluation of the Umhlathuze Water Stewardship Programme of the International Water Stewardship Programme	other	Management	Integrated Water Resources Management (IWRM)
0	0	School of Economics	PhD Management Studies	0	0	other	Management	Integrated Water Resources Management (IWRM)
0	Commerce	School of Economics	Honours in Economics	ECO4052S Environmental Economics – Pollution control, mine management, forests & fisheries, funding biodiversity & putting the environment into project and policy decision-making (emphasis on of economic tools).	0	Urban Economics	Biodiversity and Conservation	Environmental pollution
0	Health Sciences	School of Public	Master of Public Health	PPH7099S CHILDREN'S Environmental Health – Focus on	0	Ecosystem functioning and	Environmental pollution	Health

		Health		environmental health issues linked to children's health, including water pollution PPH7097F/S Climate Change, Pollution and Health – Focus on environmental health issues including water pollution		health		
0	Humani-ies	0	0	PBL5045S Environmental Law for Non Lawyers – Basic legal principles & resources (natural resource laws – biodiversity, water and marine living resources, & pollution laws fresh water)	0	Governance	Environmen-tal pollution	Water science management, policy and legislations
0	0	0	PhD Historical Sciences	0	0	Water Resources Management	Water governance, resilience, security, IWRM	Integrated Water Resources Management (IWRM)
0	0	0	Master Historical Sciences	0	The politics of water supply: the history of Cape Town's water supply 1840-1920	0	0	0
0	Law	0	MPhil & LLM	PBL4502F Environmental Law Focus on law applicable to selected environmental problems including resource conservation (water, marine living resources, biodiversity); & pollution law (water, land, air). PBL4642S Natural Resource Law – Domestic legal frameworks which have emerged to regulate the use & conservation of natural resources, e.g. fresh water resources & marine resources. PBL4643S PBL5643S Pollution Law Domestic legal frameworks which have emerged to regulate land, air & water pollution	Water management: distilling criteria for effective management at catchment level Decentralisation of water resource management a comparative review of catchment management authorities in South Africa and Victoria, Australia	Governance	Environmen-tal pollution	Water science management, policy and legislations
0	Science	0	Honours or Masters in EGS and Master of Science/Master of Philosophy by coursework and minor dissertation, specialising in Climate Change & Sustainable Development (EGS06)	EGS5046F Water Resource Management – water quality, monitoring & compliance; new directions in SA water research; biological treatment of water; participation in water governance; how corporate enterprises are becoming leaders in water stewardship, shared water risk & value creation.	Views and behaviours of municipal actors relating to climate change and water management: the case of local municipal water management and social networks The implementation of water demand management strategies in two South African case studies : Stellenbosch and Hermanus An illustration of changing paradigms in water resource management in South Africa Applying water footprint assessment with the aim of achieving sustainable water resource management at a large commercial beef cattle feedlot in Gauteng Province Barriers and enablers to water access and community wellbeing in the Onesi constituency of Namibia: the case of Okalonga B and Onandjandja villages Exploring impacts and effectiveness of the City of Cape Town's interventions on household water use practices during the drought	Water Resources Management	Water treatment	Integrated Water Resources Management (IWRM)
0	Science	0	PhD EGS	0	Participative water demand management as an adaptive response within complex socio-institutional systems: a case study of Cape Town, South Africa The concept of shared risk in public and private sector water security: a case study of Grabouw and the Elgin Valley, Western Cape, South Africa	Water Resources Management	Water treatment	Integrated Water Resources Management (IWRM)
0	Science	0	MPhil Environment, Society, and Sustainability	EGS4017F – Water resources management	0	Water Resources Management	Water resource governance and management	Integrated Water Resources Management (IWRM)
0	Science	0	BSc (Honours) Biological Science	Ocean and atmospheric science, Marine Biology	0	Aquatic Ecosystems	Environment	Animal, human, public, and environmental health
0	0	0	MSc Biological Science	BIO5012W Applied Ocean Science Course Work – Interdisciplinary training in applied aspects of oceanography & marine biology for future ocean professionals, focusing on operational & conservational activities, food, water quality & recreation preservation.	Growth, water use efficiency and stable carbon isotopes in commercial clones of Eucalyptus	Aquatic Ecosystems	Water quality monitoring, ecosystem functioning, environmental water quality, animal health	Biodiversity and Conservation
0	0	0	PhD Biological Science	0	Growth, water use efficiency and stable carbon isotopes in commercial clones of Eucalyptus	Aquatic Ecosystems	Water quality monitoring, ecosystem functioning, environmental water quality, animal health	Biodiversity and Conservation
0	0	0	MSc Oceanography	0	0	Aquatic Ecosystems	Water quality monitoring, ecosystem functioning, environmental water quality, animal health	Biodiversity and Conservation
0	0	0	PhD Oceanography	0	A fine-scale volumetric census of the water masses of the Agulhas retroflection area	Aquatic Ecosystems	Water quality monitoring, ecosystem functioning, environmental	Biodiversity and Conservation

							water quality, animal health	
0	0	0	MSc Geological Science	0	0	0	0	0
0	Science	0	BSc (Honours) Geological Science	0	Cape Town Isoscape: groundwater H, O, Sr isotope signatures from Table Bay to Milnerton	Physical Hydrogeology	Environmental and Analytical Chemistry	Hydrochemistry
0	0	0	MSc Geological Science	0	Understanding the mantle water cycle: Correlating Hydrogen isotope, trace element and radiogenic isotope variations in hydrous minerals from the Saltpeterkop Complex, Sutherland, Northern Cape	Physical Hydrogeology	Environmental and Analytical Chemistry	Hydrochemistry
0	0	0	PhD Geological Science	0	0	Physical Hydrogeology	Environmental and Analytical Chemistry	Hydrochemistry
0	Science	0	Master of Landscape Architecture	0	0	Aquatic Ecosystems	Environment	Biodiversity and Conservation
UFS	Natural and Agricultural Sciences	Centre for Environmental Management	Postgrad Diploma in Integrated Water Management	IWRM 5810: Introduction to integrated water resources, economics & governance. IWRM 5820: Integrated water resources science. IWRM 5846: Water resources management and legislation.	0	Integrated Water Resources Management (IWRM)	Natural resource management	Water Resources Management
0	Natural and Agricultural Sciences	Centre for Environmental Management	MSc in Integrated Water Management (coursework masters)	IWRM 7395: Water resources and environmental change; IWRM 7965: Water resources in arid environments; IWRM 7985: Water Management in and urbanising world	0	Integrated Water Resources Management (IWRM)	Natural resource management	Water Resources Management
0	Natural and Agricultural Sciences	Centre for Environmental Management	MSc in Integrated Water Management (research masters)	0	0	Integrated Water Resources Management (IWRM)	Natural resource management	Water Resources Management
0	Natural and Agricultural Sciences	Centre for Environmental Management	PhD in Integrated Water Management	0	0	Integrated Water Resources Management (IWRM)	Natural resource management	Water Resources Management
0	Natural and Agricultural Sciences	Centre for Environmental Management	Postgraduate diploma in Disaster Management	0	0	0	0	0
0	Natural and Agricultural Sciences	Disaster Management and Training Centre for Africa	Master in Disaster Management	Research into water and sanitation related disaster management	An Assessment of the Water and Sanitation Problems in New Forest, Bushbuckridge Local Municipality, South Africa An assessment of groundwater vulnerability, quality and pollution risk in Ga-Segonyana Municipality area, Kuruman, Northern Cape in South Africa An assessment of the possible introduction of rain water harvesting to build resilience in Marikana informal settlement in Ekurhuleni Municipality, South Africa The assessment of drought preparedness measures in urban schools of Mbabane, the capital city of Swaziland	Sanitation	Water treatment	Management
0	Natural and Agricultural Sciences	Disaster Management and Training Centre for Africa	PhD in Disaster Management	Research into water and sanitation related disaster management	0	Sanitation	Water treatment	Management
0	Natural and Agricultural Sciences	Department of Agriculture	Postgraduate diploma in Sustainable Agriculture	0	0	0	0	0
0	Natural and Agricultural Sciences	Department of Agriculture	Master of Agriculture: Agricultural Management	0	0	Sustainability	Animal, human, public, and environmental health	Management
0	Natural and Agricultural Sciences	Department of Agriculture	Master of Agriculture: Irrigation Management	0	0	Irrigation and Drainage	Agriculture Ecosystems and Environment	Efficient agriculture
0	Natural and Agricultural Sciences	Department of Agriculture	Master of Science: Agriculture: Agricultural Economics	Water-footprint & water-management research projects for food production	Water footprint assessment of maize and associated broiler production in South Africa	Agriculture Ecosystems and Environment	Development Economics	Animal, human, public, and environmental health
0	Natural and Agricultural Sciences	Department of Agriculture	Master of Science: Agriculture: Agronomy	0	0	Sustainability	Animal, human, public, and environmental health	Efficient agriculture

0	Natural and Agricultural Sciences	Department of Agriculture	Master of Science: Agriculture: Animal Breeding	0	0	Sustainability	Animal, human, public, and environmental health	Efficient agriculture
0	Natural and Agricultural Sciences	Department of Agriculture	Master of Science: Agriculture: Animal Nutrition	0	0	Sustainability	Animal, human, public, and environmental health	Efficient agriculture
0	Natural and Agricultural Sciences	Department of Agriculture	Master of Science: Agriculture: Animal Science	0	0	Sustainability	Animal, human, public, and environmental health	Efficient agriculture
0	Natural and Agricultural Sciences	Department of Agriculture	Master of Science: Agriculture: Food Science	0	0	Food security and business efficiency	Crop production	Efficient agriculture
0	Natural and Agricultural Sciences	Department of Agriculture	Master of Science: Agriculture: Grassland Science	0	0	Soil Management	Environment	Efficient agriculture
0	Natural and Agricultural Sciences	Department of Agriculture	Master of Science: Agriculture: Plant Breeding	0	0	Plant life extension Technologies	Horticulture	Efficient agriculture
0	Natural and Agricultural Sciences	Department of Agriculture	Master of Science: Agriculture: Plant Pathology	0	0	Plant life extension Technologies	Horticulture	Efficient agriculture
0	Natural and Agricultural Sciences	Department of Agriculture	Master of Science: Agriculture: Soil Science	0	0	Soil Physics	Soil microbiology and biochemistry	Soil Chemistry
0	Natural and Agricultural Sciences	Department of Agriculture	Master of Sustainable Agriculture	0	0	Sustainability	Agriculture Ecosystems and Environment	Efficient agriculture
0	Natural and Agricultural Sciences	Institute for Groundwater Studies	Coursework MSc	0	0	0	0	0
0	Natural and Agricultural Sciences	Institute for Groundwater Studies	PhD	0	0	0	0	0
UJ	Science	Geography	Master of Environmental Management	0	0	0	Environment	Management
0	0	0	Doctor of Environmental Management	0	0	0	Environment	Management
0	0	0	Doctor of Engineering in Civil Engineering	0	0	0	Civil engineering aspects of water cycle	Water Engineering
0	0	0	Doctor of Engineering in Engineering Management	0	0	0	Civil engineering aspects of water cycle	Water Engineering
0	0	0	Doctor of Engineering: Civil Engineering	0	0	0	Civil engineering aspects of water cycle	Water Engineering
0	0	0	Doctor of Engineering: Engineering Management	0	0	0	Sustainability	Water Engineering
0	0	0	Doctor of Philosophy in Natural Sciences	0	0	0	Natural resource management	Integrated Water Resources Management (IWRM)
0	0	0	Master of Arts in Environmental Management	0	0	0	Environment	Management
0	0	0	Master of Science in Aquatic Health	0	0	0	Aquatic Ecosystems	Environmental health and ecosystem functioning
0	0	0	Master of Science in Environmental Management	0	0	0	Environment	Environmental health and ecosystem functioning
0	0	0	Master of Science: Nanoscience	0	0	0	Water treatment	Water and wastewater treatment
0	0	0	Master of Sustainability Management	0	0	0	Sustainability	Management
0	0	0	Master of Sustainable Energy	0	0	0	Sustainability	Water Resources Management
0	0	0	Master of Sustainable Urban Planning and Development	0	0	0	Sustainability	Water Engineering
0	0	0	Master of Systems Engineering	0	0	0	Sustainability	Water Engineering

UNISA	0	0	Doctor of Philosophy in Agriculture	0	0	Agriculture Ecosystems and Environment	Animal, human, public, and environmental health	Efficient agriculture
0	Science	0	Master of Science in Agriculture	0	0	Agriculture Ecosystems and Environment	Water Science	Efficient agriculture
0	Science	0	Master of Science: Nature Conservation	0	0	Biodiversity and Conservation	Ecosystem functioning and health	Natural resource management
0	0	0	Master of Technology: Engineering: Chemical	0	0	Other	Wastewater and potable treatment	Water Engineering
UP	0	Environmental Studies	MSc Water Resource Management (coursework)	Modules: EWM 810:Water quality management EWM 821:Water conservation and demand management EWM 822: Water supply and sanitation	0	Water quality and water resources	Integrated Water Resources Management (IWRM)	Sanitation
0	0	Environmental Studies	PhD Water Resource Management	0	0	Water quality and water resources	Integrated Water Resources Management (IWRM)	Sanitation
0	Engineering	Chemical Engineering	MEng Water Utilisation Engineering	Module: Free Surface Flow	Research in Water Utilisation	Water quality and water resources	Integrated Water Resources Management (IWRM)	Water Resources Management
0	0	0	MEng., Chemical Engineering	Module: Biological water treatment Chemical water treatment Water Quality Management & Research	0	Water quality and water resources	Water treatment	Water Engineering
0	0	0	Doctor of Engineering	0	0	Water quality and water resources	Water treatment	Water Engineering
0	0	0	MEng Electric, Electronic and Computer Engineering	0	Optimal energy-water nexus management in residential buildings incorporating renewable energy, efficient devices and water recycling	Sustainability	Management	Water resource governance and management
0	0	0	Doctor of Engineering in Electric, Electronic and Computer Engineering	0	0	Sustainability	Management	Water resource governance and management
0	0	0	Doctor of Engineering in Environmental Geology	0	0	Geohydrology	Environment	Water Engineering
0	0	0	Doctor of Environmental Science in Wildlife Management	0	0	Environmental protection & pollution control	Environment	Biodiversity and Conservation
0	0	0	Doctor of Food Science	0	0	Food security and business efficiency	Improved food production	Efficient agriculture
0	0	0	Doctor of Horticultural Science	0	0	Horticulture	Environment	Efficient agriculture
0	0	0	Doctor of Medicine in Public Health	0	0	Public health	Health	Human health
0	0	0	Master and Doctor of Philosophy in Agricultural Economics	0	0	Agriculture Ecosystems and Environment	Animal, human, public, and environmental health	Efficient agriculture
0	0	0	Master of Engineering (Water Resources Engineering)	0	0	Water Engineering	Water Resources Management	Integrated Water Resources Management (IWRM)
0	Agriculture	0	Master of Agriculture in Animal Production Management	0	0	Agriculture Ecosystems and Environment	Animal, human, public, and environmental health	Efficient agriculture
0	0	0	Master of Agriculture in Crop Protection	0	0	Crop production	Improved food production	Efficient agriculture
0	0	0	Master of Agriculture in Extension	0	0	Agriculture Ecosystems and Environment	Animal, human, public, and environmental health	Efficient agriculture
0	0	0	Master of Agriculture in Horticulture	0	0	Horticulture	Environment	Efficient agriculture
0	0	0	Master of Agriculture in Rural Development Planning	0	0	Rural development	Local Government	Efficient agriculture
0	0	0	Master of Arts in Environment and Society	0	0	Environmental health and ecosystem functioning	Animal, human, public, and environmental health	Ecosystem services and ecological infrastructure
0	0	0	Doctor of Agriculture in Soil Science	0	0	Soil Management	Agriculture Ecosystems and Environment	Soil Fertility
0	Commerce	0	Master of Commerce in Agricultural Economics	0	0	Agriculture Ecosystems	Urban Economics	Efficient agriculture

						and Environment		
0	0	0	Master of Institutional Agriculture: Agricultural Economics	0	0	Agriculture Ecosystems and Environment	Urban Economics	Efficient agriculture
0	0	0	Master of Institutional Agriculture: Agronomy	0	0	Agriculture Ecosystems and Environment	Crop production	Efficient agriculture
0	0	0	Master of Institutional Agriculture: Rural Engineering Technology	0	0	Agriculture Ecosystems and Environment	Water infrastructure development	Efficient agriculture
0	0	0	MBA	0	Leveraging information and communication technologies for effective water stewardship: probing the future preparedness of water service authorities	Water governance, resilience, security, IWRM	Management	Local Government
0	Science	0	Master of Science in Agriculture in Agricultural Economics	0	Influence of water source points location on households" willingness to pay for water supply reliability in Maseru Lesotho	Agriculture Ecosystems and Environment	Urban Economics	Efficient agriculture
0	0	0	PhD in Agriculture in Agricultural Economics	0	0	Agriculture Ecosystems and Environment	Urban Economics	Efficient agriculture
0	0	0	Master of Science in Agriculture in Agronomy	0	0	Agriculture Ecosystems and Environment	Crop production	Efficient agriculture
0	0	0	Master of Science in Agriculture in Food Science and Technology	0	0	Food security and business efficiency	Improved food production	Efficient agriculture
0	0	0	Master of Science in Agriculture in Pasture Science	0	0	Soil Management	Agriculture Ecosystems and Environment	Efficient agriculture
0	0	0	Master of Science in Agriculture in Soil Science	0	Estimating the volumetric water footprint of swiss chard (Beta vulgaris) and carrot (Daucus carota) grown in the Highveld Region South Africa	Soil Management	Agriculture Ecosystems and Environment	Efficient agriculture
0	0	0	PhD in Agriculture in Soil Science	0	0	Soil Management	Agriculture Ecosystems and Environment	Efficient agriculture
0	0	0	Master of Science in Environment and Society	0	0	Environmental health and ecosystem functioning	Animal, human, public, and environmental health	Ecosystem services and ecological infrastructure
0	0	0	Master of Science in Environmental Ecology	0	0	Environmental health and ecosystem functioning	Ecosystem functioning and health	Environment
0	0	0	Master of Science in Environmental Economics	0	0	Environmental health and ecosystem functioning	Environment	Development Economics
0	0	0	Master of Science in Environmental Education	0	0	Environmental health and ecosystem functioning	Education	Environmental protection & pollution control
0	0	0	Master of Science in Environmental Management	0	0	Environmental health and ecosystem functioning	Environmental water quality	Management
0	0	0	Master of Science in Chemistry	0	0	Environmental health and ecosystem functioning	Environmental water quality	Hydrochemis-try
0	0	0	PhD Chemistry	0	0	Environmental health and ecosystem functioning	Environmental water quality	Hydrochemis-try
0	0	0	Master of Environmental Science in Wildlife Management	0	Viability, from a quality perspective on the reuse of wastewater effluents in the Southern Gauteng region, South Africa	Water quality and water resources	Sanitation	Water Resources Management
0	0	0	Doctor of Environmental Science in Wildlife Management	0	0	Water quality and water resources	Sanitation	Water Resources Management
0	0	0	MSc Applied Science Water Utilisation	0	research	Water governance, resilience, security, IWRM	Water resource governance and management	Water Resources Management
0	0	0	MSc Applied Science Water Resources	0	0	Water governance, resilience, security, IWRM	Water resource governance and management	Water Resources Management
0	0	0	MSc Hydrogeology	0	Research	Hydrology	Mining Hydrogeology	Field Methods in Hydrogeology
0	0	0	PhD Hydrogeology	0	Research	Hydrology	Mining Hydrogeology	Field Methods in Hydrogeology
UWC	Earth Science	Environmental & Water Science	MSc (Environmental and Water Science)	0	Interaction of humans with the environment, the processes operating in the environment & affecting our water resources & the influence of natural phenomena on the environment. Assessment of the contributions of	Animal, human, public, and environmental health	Hydrology and Water Resources	Water quality monitoring, ecosystem functioning, environmental water quality,

					water allocation reforms to achieving equitable access to water by smallholder emerging farmers in the Breede-Gouritz catchment management agency Assessing groundwater-surface water interaction as a decision-making tool licensing water use South Africa : case study area of Gevonden farm			animal, human, public, and environmental health
0	Earth Science	Environmental & Water Science	PhD (Environmental and Water Science)	0	Interaction of humans with the environment, the processes operating in the environment & affecting our water resources & the influence of natural phenomena on the environment.	Animal, human, public, and environmental health	Hydrology and Water Resources	Water quality monitoring, ecosystem functioning, environmental water quality, animal, human, public, and environmental health
0	Earth Science	Integrated Water Resources Management	MPhil Integrated Water Resource Management (3881)	Access – sustainability trade off, equity, vulnerability and resilience, resource protection, land use & optimal water use, governance	0	Sustainability	Water governance, resilience, security, IWRM	Water Resources Management
0	Science	Geology	MSc	Hydrogeology	0	Other	Physical Hydrogeology	Ecohydrogeology
0	Science	Geology	PhD	Hydrogeology	0	0	0	0
0	Science	Geography	Master of Science & Doctor of Philosophy in Geography	0	0	Other	Water Science	Environment
0	Science	Nanoscience	Master of Science: Nanoscience	0	0	Water treatment	Water Science	Water and wastewater treatment
0	Science	Chemistry	MSc in Chemistry	Water & Wastewater treatment technology	0	Water and Wastewater treatment	Environmental and Analytical Chemistry	Water quality monitoring, ecosystem functioning, environmental water quality, animal health
0	Science	Chemistry	PhD in Chemistry	Water & Wastewater treatment technology	Chemistry and speciation of potentially toxic and radioactive elements during mine water treatment	Water and Wastewater treatment	Environmental and Analytical Chemistry	Water quality monitoring, ecosystem functioning, environmental water quality, animal health
0	Natural Sciences	Biodiversity and Conservation Biology	MSc	Marine biology and Estuarine ecology	0	Biodiversity and Conservation	Ecology Evolution and Systematics	Aquatic Ecosystems
0	Natural Sciences	Biodiversity and Conservation Biology	PhD	Marine biology and Estuarine ecology	0	0	0	0
0	0	0	PhD Earth Science	0	An assessment of the influence of water allocation on sustainable water resources management: A case study of the Nyando river basin, Kenya	Sustainability	Water Resources Management	Integrated Water Resources Management (IWRM)
0	0	0	MSc Earth Science	0	0	Sustainability	Water Resources Management	Integrated Water Resources Management (IWRM)
0	0	0	MA Development Studies	0	An assessment of social consequences of using water management devices on the poor households in Harare. The case of Sunningdale high density suburb prepaid water meter project in Harare.	Management	Water resource governance and management	Integrated Water Resources Management (IWRM)
0	0	0	PhD Development Studies	0	0	Management	Water resource governance and management	Integrated Water Resources Management (IWRM)
0	0	0	LLD	0	Sustainable Development Goal 6: A watershed moment for ensuring sustainable freshwater development and management?	Sustainability	Water resource governance and management	Integrated Water Resources Management (IWRM)
0	0	0	LLM	0	0	Sustainability	Water resource governance and management	Integrated Water Resources Management (IWRM)
0	Economic & Management Sciences	Public Administration	MAdmin	0	Assessing groundwater-surface water interaction as a decision-making tool licensing water use South Africa : case study area of Gevonden farm Controlling Cape Town's poor through water management devices: the case of Saxonsea, Atlantis	Groundwater Modelling	Water resource governance and management	Management
0	0	0	PhD Admin	0	0	Groundwater Modelling	Water resource governance and management	Management
0	0	0	0	0	0	0	0	0
0	0	0	Research topics incl.	Enhancing Sustainable Utilisation of	0	Sustainability	Groundwater	River Basin

			MSc & PhD	Groundwater in South Africa, Hout/Sand River Catchment, Limpopo			Modelling	management
0	0	0	Research topics incl. MSc & PhD	Human Capacity Development	0	Public participation	Management	Water Resources Management
0	0	0	Research topics incl. MSc & PhD	Building Capacity and Training for Institutional Management and Water Governance	0	Governance	Management	Water governance, resilience, security, IWRM
0	0	0	Research topics incl. MSc & PhD	The management and regulation of saline groundwater	0	Groundwater Modelling	Environment	Management
0	0	0	Research topics incl. MSc & PhD	Capacity needs assessment for groundwater challenges in SADC	0	Groundwater Modelling	Management	Ecosystem functioning and health
0	0	0	Research topics incl. MSc & PhD	Ecologically Sustainable Management of Non-Perennial Rivers	0	Sustainability	River Basin management	Ecosystem functioning and health
0	0	0	Research topics incl. MSc & PhD	Ash backfill feasibility	0	Wastewater treatment	Environment	Ecosystem functioning and health
0	0	0	Research topics incl. MSc & PhD	Catchment scale surface water-groundwater interactions	0	Catchment hydrology	Groundwater Modelling	River Basin management
0	0	0	Research topics incl. MSc & PhD	Wetlands Monitoring and Assessment Service for Transboundary Basins in Southern Africa	0	Catchment hydrology	River Basin management	Water quality monitoring, ecosystem functioning, environmental water quality, animal health
0	0	0	Research topics incl. MSc & PhD	Saldanha Bay Municipality groundwater supply and management	0	Catchment hydrology	Groundwater Modelling	Management
VUT	0	0	Doctor of Engineering in Civil Engineering	0	0	Water Engineering	Civil engineering aspects of water cycle	Hydrologic engineering
0	0	0	Doctor of Philosophy in Chemistry	0	0	Hydrochemis-try	Water Science	Wastewater and potable treatment
0	0	0	Doctor of Technology: Chemistry	0	0	Hydrochemis-try	Water Science	Wastewater and potable treatment
0	0	0	Master of Applied Sciences in Biotechnology	0	0	Water and Wastewater Microbiology	Water Science	Hydrochemis-try
0	0	0	Master of Technology: Engineering: Civil	0	0	Water Engineering	Civil engineering aspects of water cycle	Water Science
0	0	0	Master of Technology: Engineering: Metallurgy	0	0	Water Engineering	Water Science	Hydrochemis-try
UNIVEN	Environ-mental Science	Hydrology and Water Resour-ces	Doctor of Philosophy in Hydrology and Water Resources (PhDG).	0	Towards efficient water utilisation in South African HEIs: A case study of University of Venda	Hydrology	Water Resources Management	Land surface hydrology
0	Environ-mental Science	Hydrology and Water Resour-ces	Master of Earth Sciences in Hydrology and Water Resources (MESHWR)	0	0	Hydrology	Water Resources Management	Land surface hydrology
0	0	0	Doctor of Agriculture in Horticultural Sciences	0	0	Horticulture	Agriculture Ecosystems and Environment	Environment
0	0	Ecology and Resour-ces Manage ment	Doctor of Philosophy Environmental Science	0	0	Environmental protection & pollution control	Environmen-tal and Analytical Chemistry	Physical Hydrogeology
0	0	0	Doctor of Philosophy in Geography	0	Water security in rural Limpopo in a changing climate: A study of the Greater-Giyani Local Municipality, South Africa	Environmental health and ecosystem functioning	Environment	Water Science
0	0	0	Master of Philosophy in Geography	0	0	Environmental health and ecosystem functioning	Environment	Water Science
0	0	0	Doctor of Philosophy in Mining and Environmental Geology	0	0	Mining Hydrogeology	Environment	Ecohydrology
0	0	0	Doctor of Rural Development	0	Gender dynamics in water use and management at Nyanyadzi Smallholder Irrigation Scheme in Zimbabwe	Other	OM Rural Water Services	Water Resources Management
0	0	0	Master of Rural Development	0	0	Other	OM Rural Water Services	Water Resources Management
0	0	0	Master of Environmental and Geographical Science	0	Suffering for water: infrastructure, household access and its fluid negotiations in peri-urban Tamale, Ghana	Water Resources Management	Integrated Water Resources Management (IWRM)	Water governance, resilience, security, IWRM
0	0	0	Doctor of Environmental and Geographical Science	0	0	Water Resources Management	Integrated Water Resources Management (IWRM)	Water governance, resilience, security, IWRM
0	0	0	Master of Science in	0	0	Sustainability	Agriculture	Efficient

			Agriculture				Ecosystems and Environment	agriculture
0	0	0	Master of Science in Agriculture in Agricultural Economics	0	0	Agriculture Ecosystems and Environment	Efficient agriculture	Urban Economics
0	0	0	Master of Science in Agriculture in Plant Production	0	0	Plant life extension Technologies	Crop production	Environment
0	0	0	Master of Science in Agriculture in Soil Science	0	0	Soil Management	Soil microbiology and biochemistry	Soil Fertility
0	0	0	Master of Science: Agriculture: Animal Science	0	0	Sustainability	Animal, human, public, and environmental health	Efficient agriculture
0	0	0	Master of Science: Agriculture: Horticultural Sciences	0	0	Horticulture	Agriculture Ecosystems and Environment	Environment
WSU	0	0	Doctor of Philosophy in Health Sciences	0		Human health	Health	Human, public, and environmental health
0	0	0	Doctor of Philosophy in Natural Sciences	0		Environmental health and ecosystem functioning	Systems Ecology	Water Science
Wits	Engineering and the Built Environment	Civil Engineering	MSc in Civil and Environmental Engineering (Course work/Research); MSc in Civil and Environmental Engineering (Research)	CIVN 7013A Wastewater Engineering CIVN 7016A Hydraulic Structures CIVN 7059A Water Management CIVN 7061A Water Supply and Urban Drainage CIVN 7065A Water Resources Planning; Research Report or Research Dissertation	Towards direct wastewater reuse for potable and non-potable uses: an urban water balance, costing and assessment of perceptions at a South African community Development of water quality index (WQI) for the Jukskei River catchment, Johannesburg. Challenges of water management at local government municipal level in the Eastern Cape of South Africa An examination of Rand Water's skills development for the production of quality drinking water locally	Water Engineering	Integrated Water Resources Management (IWRM)	Water and wastewater treatment
0	Engineering and the Built Environment	Civil Engineering	PhD in Civil and Environmental Engineering	0	0	Water Engineering	Integrated Water Resources Management (IWRM)	Water and wastewater treatment
0	Engineering and the Built Environment	Chemical Engineering	MSc Chemical Engineering	0	Water management at a base metals refinery	Water Engineering	Integrated Water Resources Management (IWRM)	Water Resources Management
0	Engineering and the Built Environment	Chemical Engineering	PhD Chemical Engineering	0	0	Water Engineering	Integrated Water Resources Management (IWRM)	Water Resources Management
0	Engineering and the Built Environment	0	MSc Eng. in Mining Engineering	Environment and Sustainable Development	0	Sustainability	Environment	Mining Hydrogeology
0	Engineering and the Built Environment	0	PhD in Mining Engineering	0	0	0	0	0
0	Engineering and the Built Environment	Architecture	Masters Architecture	0	Ai-Games: underground aqua-tecture: a Namibian thermal bathhouse & water research hub Infra-structuring architecture: rethinking the ideas of water management within an urban Johannesburg context	Integrated Water Resources Management (IWRM)	Water Resources Management	Management
0	Engineering and the Built Environment	0	PhD Architecture	0	0	Integrated Water Resources Management (IWRM)	Water Resources Management	Management
0	Commerce	School of Accountancy	MCom	0	The development of an Activity Based Costing model for the Water Trading Entity of South Africa	Business efficiency	Development Economics	Management
0	0	0	0	0	0	0	0	0
0	Commerce, Law and Management	Law	LLM Environmental Law	Water Law	0	Water science management, policy and legislations	Water resource governance and management	Water governance, resilience, security, IWRM
0	0	0	Master of Health Sciences Education	0	0	0	0	0
UNIZULU	Science & Agriculture	Hydrology	Honours in Hydrology	0	Soil Hydrology, Groundwater Studies, Hydrological Modelling, Water Resources Management, Hydroinformatics, Disaster Management	Water Resources Management	Catchment hydrology	Soil Management

0	Science & Agriculture	Chemis-try	Doctor of Philosophy in Chemistry	0	Dry Sanitation Research	Sanitation	Water and Wastewater Microbiology	Wastewater treatment
0	Science & Agriculture	Hydro-logy	Doctor of Philosophy in Hydrology	Hydrological Sciences	0	Hydrology	Catchment hydrology	Land surface hydrology
0	Science & Agriculture	Hydro-logy	Master of Science: Hydrological Sciences	Hydrological Sciences	The variance in the water quality of the lower orange river	Contaminant hydrology	Catchment hydrology	Land surface hydrology
0	Science & Agriculture	Agricul-ture	Master of Science in Agriculture	Agricultural Economics	0	Sustainability	Efficient agriculture	Agriculture Ecosystems and Environment
0	Science & Agriculture	Geogra-phy	Master of Science: Geography and Environmental Studies	Applied Climatology	0	Environmental health and ecosystem functioning	Climatology	Climate dynamics, resilience, adaptation
0	Science & Agriculture	Zoology	Honours in Zoology	0	Ecotoxicology, Freshwater Ecology, Estuarine Ecology, Population Dynamics and Aquatic Production	Aquatic Ecosystems	Environmen-tal health and ecosystem functioning	Ecohydrology
0	Science & Agriculture	Zoology	Master of Science: Zoology	Environmental health and ecosystem functioning	0	Aquatic Ecosystems	Environmen-tal health and ecosystem functioning	Ecosystem functioning
0	Science & Agriculture	Zoology	Doctor of Philosophy in Zoology	Environmental health and ecosystem functioning	0	Aquatic Ecosystems	Environmen-tal health and ecosystem functioning	Ecosystem functioning
0	Science & Agriculture	Botany	Honours in Botany	Aquatic Botany	0	Aquaculture	Aquatic Ecosystems	Environment
0	Science & Agriculture	Geogra-phy	Honours in Geography	Applied Climatology, Environmental Management	0	Climatology	Climate dynamics, resilience, adaptation	Environmen-tal protection & pollution control
0	Science & Agriculture	Bioche-mistry and Microbio logy	Doctor of Philosophy in Microbiology	0	Bioflocculation research	Sanitation	Water and Wastewater Microbiology	Water treatment
0	Science & Agriculture	Bioche-mistry and Microbio logy	Masters of Science in Microbiology	0	Bioflocculation research	Sanitation	Water and Wastewater Microbiology	Water treatment