

WO-master Programme in
Urban Water and Sanitation
IHE-Delft
Institute for Water Education

11 February 2019

Table of Contents

1	Executive summary	4
2	The procedure	6
3	Description of the programme	8
3.1	General	8
3.2	Profile of the institution	8
3.3	The master's programme Urban Water and Sanitation	8
4	Assessment per standard	10
4.1	Standard 1: Intended learning outcomes	10
4.2	Standard 2: Teaching-learning environment	11
4.3	Standard 3: Assessment	15
4.4	Standard 4: Achieved learning outcomes	16
4.5	Conclusion	17
5	Overview of the assessments	18
	Annex 1: Composition of the panel	19
	Annex 2: Intended learning outcomes	21
	Annex 3: UWS Programme Structure 2016-2018	27
	Annex 4: Schedule of the site visit	29
	Annex 5: Documents reviewed	32
	Annex 6: List of abbreviations	34

1 Executive summary

The Master's programme Urban Water and Sanitation is an 18-month master's programme offered by the IHE Delft Institute for Water Education (IHE-Delft). The programme offers the following specialisations: Sanitary Engineering, Water Supply Engineering and Urban Water Engineering and Management (joint degree specialisation with the School of Engineering and Technology of Asian Institute of Technology (AIT) Bangkok).

The programme prepares graduates to plan and design, operate and maintain drinking and industrial water and wastewater treatment systems, as well as stormwater and wastewater collection infrastructure, drinking water transport and distribution systems and integrated management of the urban water cycle. The panel deems the subjects offered in this programme very relevant for the target groups and is of the opinion that the cooperation with AIT for the Urban Water and Engineering (UWEM) specialisation is a valuable addition since it offers students the opportunity to benefit from expertise and experiences in different countries and continents.

The panel concluded that the intended learning outcomes of the programme indicate that the programme has successfully met the level that has to be acquired for an academic master's programme. Specifically, the program clearly meets the Dutch qualifications framework and ties in with the international perspective of the requirements set by the professional field and the discipline.

The curriculum has a modular structure with teaching organised in three-week blocks. After a period of two blocks there is a week for examinations. In principle the curricula of the four 18 months master degree programmes of IHE-Delft have the same structure. Most modules are worth 5 EC, the master preparatory course has 9 EC and the master thesis contains 36 EC. The programme starts with a one week introduction for all IHE-Delft students followed by the foundation courses. All education at IHE-Delft follows the concept of aligned teaching and active learning within a framework of incremental learning. Each module therefore comprises a balance of formal lectures, supervised and unsupervised workshops, case studies, field trips, field work, and self-study by the student. The panel very much appreciates the intensive efforts IHE-Delft puts into tutoring and guidance of the students. The teaching and learning environment created by IHE-Delft is very inspiring and motivating. Students feel part of a community and are stimulated to achieve on a high level. The panel in particular appreciates the introductory week with its focus on 'ways of knowing' and encourages IHE-Delft to maintain this element in the programme. The panel thinks that the interdisciplinary focus is an exciting element of the programme which should be deepened.

The academic and didactic qualities of the staff are good, although the percentage of teaching staff with a UTQ lags behind. The panel suggests that all academic staff should be encouraged to work towards earning UTQ. The panel noticed that diversity among academic staff is an issue in IHE-Delft which still needs consideration. It finds the representation of women in higher academic positions to be too low. In particular gender diversity related to leadership positions should be improved.

The panel established that the assessment and examination regulations are clearly described in the Education and Examination Regulations. The Examination Board has reliable procedures and the necessary level of independence. The panel finds the assessment policy coherent and transparent. The interim examinations and the thesis assessments are transparent, valid and reliable. The panel also established that there are assessment forms in place for the master thesis.

The panel studied 15 theses to establish whether the graduates had achieved the intended learning outcomes of the programme and found that the theses are appropriate as the final product of an academic master degree programme.

The panel appreciates the information provided by the institute, particularly the student reflection report and is very positive about the quality culture in the institute, illustrated, among others, by the direct improvements the institute applied in reaction to the student's reflection.

The chair and the secretary of the panel hereby declare that all panel members have studied this report and that they agree with the judgements laid down in the report. They confirm that the assessment has been conducted in accordance with the demands relating to independence.

Date: 11 February 2019

Grietje Zeeman
(chair)

Barbara van Balen
(secretary)

2 The procedure

IHE-Delft master's programmes were accredited by the NVAO in 2013. In order to be able to apply for re-accreditation IHE-Delft started to prepare an assessment procedure and composed an international panel of independent experts for the assessment of its programmes. The NVAO approved of the proposed panel of experts on 30 August 2018.

The panel consisted of:

Chair:

Prof.dr. G. Zeeman, professor emeritus in New Sanitation at Wageningen University, the Netherlands;

Panel members:

- Dr. K. Rebel, assistant professor in Sustainable Development at Utrecht University, the Netherlands;
- Prof. A. Schleiss, professor emeritus in Hydraulic Constructions engineering at the Swiss Federal Institute of Technology in Lausanne, Switzerland;
- Prof. E. Manzungu, professor in Agricultural Landscapes, Waterscapes and Environmental Management at the University of Zimbabwe;
- Dr. Leila Harris, associate professor at the Institute for Resources Environment and Sustainability and at the Institute for Gender, Race, Sexuality and Social Justice at the University of British Columbia, Canada;

Student member:

- E.L. Okoro, master student in Law and Technology at Tilburg University, the Netherlands.

The panel was supported by dr. B.M. (Barbara) van Balen, who acted as secretary.

This composition reflects the expertise deemed necessary by NVAO. (Annex 1: Composition of the panel). All the panel members signed a statement of independence and confidentiality.

The panel has based its assessment on the standards and procedures described in the NVAO Assessment framework for the higher education accreditation system of the Netherlands (Stcrt. 2016, nr 69458). Prior to the site visit, the NVAO developed a new assessment framework which is projected to come into effect on 1 February 2019. Anticipating this new framework, the panel (in consultation with the institute) decided to assess the programme using binary judgements. All standards are judged satisfactory, which means that the programme meets the requirements for re-accreditation.

After consultation with the chair and the secretary of the panel the institute prepared a site visit for the panel and scheduled interviews with representatives of all four degree programmes. The panel members prepared the assessments of the programmes by analysing the documents provided by the institution for each degree programme (Annex 3: Documents reviewed). The panel organised a preparatory meeting on 14 November 2018. During this meeting, the panel members shared their first impressions and formulated questions for the site visit.

The site visit took place on 14-16 November 2018 at IHE-Delft. During its visit, the panel was able to discuss the formulated questions and to gather additional information during several sessions (Annex 2: Schedule of the site visit). Afterwards, the panel discussed the findings and considerations

and pronounced its preliminary assessments per programme, per theme and per standard. At the end of the site visit, the initial findings were presented to the institute.

Based on the findings, considerations and conclusions the secretary produced a draft advisory report for each programme that was first presented to the panel members. After the panel members had commented on the draft report, the chair endorsed the report. On 22 January 2019 the advisory report was sent to the institute, which was given the opportunity to respond to any factual inaccuracies in the report. The institute replied on 5 February 2019. All suggested corrections were adopted. Subsequently the final report was endorsed by the panel chair. The panel composed its advice fully independently and offered it to the institute on 11 February 2019.

3 Description of the programme

3.1 General

Country	: The Netherlands
Institution	: UNESCO-IHE Institute for Water Education
Programme	: Programme in Urban Water and Sanitation
Level	: master
Orientation	: (wo)
Specialisation	: Sanitary Engineering Water Supply Engineering Urban Water Engineering and Management (joint degree)
Degree	: Master of Science
Location(s)	: Delft
Study Load (EC)	: 106 EC
Croho	: 75008

3.2 Profile of the institute

IHE Delft Institute for Water Education (IHE-Delft) is the largest international graduate water education facility in the world. IHE-Delft aims to create impact on the ground by developing problem oriented researchers and knowledge. IHE-Delft envisions a world in which people manage their water and environmental resources in a sustainable manner, and in which all sectors of society, particularly the poor can enjoy the benefits of basic services. The mission of IHE is to contribute to the education and training of professionals, to expand the knowledge base through research and to build the capacity of sector organizations, knowledge centres and other institutes active in the fields of water, the environment and infrastructure in developing countries and countries in transition.

IHE-Delft has three Academic Departments with academic staff responsible for education, training and research programmes. These are the Environmental Engineering and Water Technology, Water Science and Engineering, and Integrated Water Systems and Governance departments. Each Academic Department is composed of Chair Groups, each of which is based on a particular discipline or specialisation.

The institute's education activities include a PhD programme, several masters' programmes and an array of short and online courses, with a focus on practicing and mid-career professionals.

3.3 The master's programme Urban Water and Sanitation

Globally 633 million people do not have access to safe water supply and 2.4 billion people do not have access to basic sanitation. Safe water supply is a basic need and essential for human survival while access to sanitation is dignity and essential for public health and environmental protection. Universal and equitable access to safe and affordable water supply and adequate sanitation and hygiene to all is one of the main Sustainable Development Goals for 2030. To help achieve these SDGs, developing capacity of water sector institutions by imparting the adequate knowledge and

skills on planning, design, operation and maintenance, and management of water supply and sanitation systems is crucial. In this context the master's programme Urban Water and Sanitation (UWS) aims at providing the essential skills and knowledge required to plan and design, operate and maintain drinking and industrial water and wastewater treatment systems, as well as stormwater and wastewater collection infrastructure, drinking water transport and distribution systems and integrated management of the urban water cycle.

The UWS programme (106 EC) offers the following specialisations: Sanitary Engineering, Water Supply Engineering and Urban Water Engineering and Management.

In recent years the number of specialisations within the masters programme has grown, as a result of the institute's participation in international initiatives such as the Erasmus Mundus Programme. Some specialisations are offered jointly with European and overseas partners. These joint specialisations have a somewhat different structure and (longer) duration than the 18-month specialisations that are solely based in Delft. One of these joint specialisations resides under the UWS programme: the joint degree specialisation 'Urban Water Engineering and Management' offered jointly with Asian Institute of Technology (Bangkok, Thailand).

4 Assessment per standard

4.1 Standard 1: Intended learning outcomes

The intended learning outcomes tie in with the level and orientation of the programme; they are geared to the expectations of the professional field, the discipline, and international requirements.

Outline of findings

The academic domain of the UWS programme concerns water supply and sanitation in urban areas. The programme aims to educate professionals in the field of water and waste water engineering and management particularly in urban areas. It falls under the domain of Environmental, Civil and Chemical Engineering. It mainly focuses on issues of relevance to developing countries and countries in transition.

As stated above the master's programme UWS aims to provide its students with the essential skills and knowledge required to plan and design, operate and maintain drinking and industrial water and wastewater treatment systems, as well as stormwater and wastewater collection infrastructure, drinking water transport and distribution systems and integrated management of the urban water cycle. Its academic domains are water supply and sanitation services. The programme targets mid-career professionals, with a background in civil, environmental and (bio)chemical engineering, who have at least 2-4 years' experience in water supply and wastewater companies, municipal authorities, government ministries or consulting companies.

The overall objectives of UWS are translated to objective intended learning outcomes that have been formulated for its three specialisations: Water Supply Engineering, Sanitary Engineering, and Urban Water Engineering and Management (Annex 2). The intended learning outcomes include newly defined final qualifications that are applicable for all 18-month master's programmes offered by IHE-Delft.

Considerations

The assessment panel subscribes to the general mission of the programme which ties in well with the 2030 Sustainable Development Goals. It finds the profile of the master's programme attractive and very relevant. The panel appreciates the cooperation with AIT for the UWS specialisation since it offers students the opportunity to benefit from expertise and experiences in different countries which provides new perspectives and experiences. The programme and its specialisations adequately fulfils a need to prepare students to address issues and questions concerning urban water and sanitation. As such it successfully contributes to the necessary increase of skilled workers in these domains.

The panel finds that the intended learning outcomes are formulated well and sufficiently reflect the level that has to be acquired in an academic master's programme. They meet the Dutch qualifications framework and tie in with the international perspective of the requirements set by the professional field and the discipline.

Conclusion

Satisfactory

4.2 Standard 2: Teaching-learning environment

The curriculum, the teaching-learning environment and the quality of the teaching staff enable the incoming students to achieve the intended learning outcomes.

Outline of findings

The programme comprises 106 EC and has a modular structure with teaching organised in three-week blocks. A week of examinations is scheduled after a period of two blocks. The programme offers the following phases and modules:

1. General overview and foundation phase.
This phase provides a common basis at the start of the programme, during which the students follow the institute-wide “week 1” providing a general overview and then three common modules on basic knowledge and understanding of chemistry, microbiology, hydrology, hydraulics, process technology as well as exposure to aspects of integrated urban water-management. In addition, these foundation modules also aim to strengthen academic and professional skills.
2. Specialisation phase.
Students follow five key modules related to their specialisation to further deepen their (technical) knowledge and acquire relevant skills on planning, design, implementation, and operation and maintenance of water supply and sanitation systems. Additionally, students can choose two elective modules either to deepen or broaden their knowledge and skills on water related topics.
3. Integration phase.
This common part towards the end of the taught part of the programme tests knowledge, insight and skills acquired in the preceding modules in a multidisciplinary, problem-solving environment. It consists of a two-week international field trip, followed by groupwork (three weeks) involving development of an integrated urban water management plan. In addition, a variety of summer courses are offered.
4. Final phase
Students develop a research proposal and follow an intensive course on research methodology and laboratory techniques. After approval of the proposal student carry out a 6-month thesis research project. If possible, students carry out fieldwork in their home country or work on an ongoing research project.

Students following the joint specialisation Urban Water Engineering & Management start their programme at AIT for one semester doing courses, then they come for seven months to Delft and finish their programme at AIT with the master thesis. During the skype meeting with the representatives of AIT was the interdisciplinary approach of the specialisation highlighted. AIT is an institute that only offers interdisciplinary programmes.

IHE-Delft recently started a one-year master’s programme in non-sewered sanitation. The panel believes that this can be a very attractive programme for a lot of mid-career professionals who do not have the option to stay away from home more than a year. In the opinion of the panel, the existence of the one-year programme should not lead to focussing the UWS programme merely to sewered sanitation systems. Non-sewered sanitation should also remain part of the 18 months master programme, while the subject is very relevant for the target groups. During the site-visit the programme committee explained that the non-sewered sanitation courses are offered in the elective space and that they aim at cross fertilisation between the two programmes. There is a small part engineering in the one year non-sewered sanitation programme and a small part non-sewered sanitation in the 18 months engineering programme.

Didactic concept and policy

All education at IHE-Delft follows the concept of aligned teaching and active learning within a framework of incremental learning. Each module therefore offers a balance of formal lectures, supervised and unsupervised workshops, case studies, field trips, field work, and self-study by the student. The knowledge and abilities of students are thereby gradually developed, so that both disciplinary knowledge and insights in problem analysis and problem solving, and general academic skills can be deployed to good effect in subsequent group work and research thesis studies. The master's research project provides a vehicle through which integration of the programme material is achieved.

Teaching staff

The master's programme in Urban Water and Sanitation is delivered by a team of 37 IHE-Delft staff members, with diverse academic and professional backgrounds. Together they cover the wide domain of urban water and sanitation. From this pool of staff members, 21 staff members are currently intensively involved in the programme. Actual staff input in the UWS programme for the taught part is 3.7 fte (student/staff ratio 5.9) and for the supervision of the research 0.9 fte.

The IHE-Delft staff members are actively involved in academic research, mostly as part of research programmes that are funded by competitive grants. The staff is well qualified academically: all full professors have appointments at research universities in the Netherlands, which testifies to their academic standing. All associate professors and lecturers hold PhD degrees or are in an advanced stage of obtaining their PhD degree. In addition, all staff members and the guest lecturers have extensive and relevant professional experience in developing countries and in countries in transition. This experience ensures that the educational programme is tailored to the professional and institutional context of the countries of origin of the students. 58 % of the staff members involved in teaching have fulfilled the requirements of the UTQ (University Teacher Qualification a certification set by the VSNU, the Dutch Association of Universities), most others are in the process of obtaining their UTQ diploma. In addition, IHE-Delft staff members regularly participate in specific workshops organised by the Institute to update their didactical skills. The students are positive about the quality of the teaching and report that they had some very good guest lecturers.

Guidance and facilities

Much attention is paid to the tutoring and guidance of the students. Prior to their arrival students receive a Preparation Guide with practical information on travelling to and living in the Netherlands. Upon arrival they are given a Practical Guide about the services provided by IHE, about formal issues such as housing, immigration and health care, and about everyday life in the Netherlands. Information about the programme, its contents, rules and regulations and study-related facilities is provided in the Handbook that students receive at the start of the programme.

Non-academic support is given by the Student Affairs office. A student counsellor is available to help students with emotional problems. Students with study problems are in principle referred back to their Programme Coordinator or the Specialisation Coordinator.

The UWS programme is multidisciplinary in nature and requires a range of lab-facilities to support the delivery of the programme. The IHE-Delft laboratories are used during several modules for microbiological and chemical analysis, experimentation simulating different water and wastewater treatment processes during the specialised part of the programme and in the master thesis research. During the site visit the panel visited the lab-facilities in the IHE building including the new

'sanitation' lab. The facilities labs are used for training in the foundation courses and for specific research projects. Students can use the laboratories during their master's thesis projects although they report an issue with lab availability. Despite a registration system for lab use being in place, the frequent use of lab facilities by PhD-students makes it hard to find lab space for master's students.

Considerations

The panel established that the UWS curriculum is well structured. The learning outcomes of the modules are in line with the intended learning outcomes, and the curriculum enables the students to achieve them. The panel appreciates that several teaching forms are used in the modules and that the programme has a high amount of contact hours. Although time pressure is high, the panel established that students find the programme feasible. This requires ongoing attention of the staff to make sure it is not detracting from learning goals, or overall student life/well-being.

The panel very much appreciates the intensive efforts IHE-Delft puts into tutoring and guidance of the students. In the opinion of the panel the teaching and learning environment created by IHE-Delft is very inspiring and motivating. Students feel part of a community and are stimulated to achieve a high level. The students following the double degree specialisations have different schedules and can't participate in the introduction week, which is crucial for the community building. The panel sees this as a disadvantage for these joint programmes. The advantages, being able to profit from the specific expertise of the universities involved in the joint degree, partly compensate for this.

Curriculum, staff, services and facilities constitute a coherent teaching-learning environment. The panel in particular appreciates the introductory week with its focus on 'ways of knowing' and encourages IHE-Delft to maintain this element in the programme.

The panel also appreciates module 13, the group work module, and considers this module crucial for developing competences in cooperation and interdisciplinary studies/interdisciplinarity. This module could be further strengthened by organising the same module for students from all master degree programmes in IHE-Delft to ensure that they all learn to work with a variety of experts of different disciplinary backgrounds.

The panel thinks that an interdisciplinary focus could be an exciting element of the programme. The existence of other master's programmes in the same institute and the various disciplinary backgrounds of the academic staff provides an excellent opportunity to strengthen this element. The panel has identified a few options that might be considered to strengthen the interdisciplinary perspective of the programme:

- Allow the selection of more elective modules across the master degree programmes and promote and encourage students to take different courses;
- Consider integrating more interdisciplinary content in individual modules;
- Promote interdisciplinary engagement in the thesis development phase;
- Consider a mandatory lecture series to expose students to broad fields of knowledge.

The panel in particular appreciates the UWEM specialisation. Students following this joint programme benefit from the expertises and experiences of experts and students in the different countries and that way are able to broaden their knowledge and understanding. The panel finds it certainly useful for students to do part of the programme in both places.

The panel advises to pay attention that non-sewered sanitation remains part of the programme IHE-Delft has very good laboratory facilities and dedicated staff to support the students with their research. The panel advises to ensure students are aware of a protocol in terms of access to the laboratory equipment.

The academic and didactic quality of the staff are good, although the percentage of teaching staff with a UTQ lags behind expectations. The panel thinks that all academic staff should be stimulated to work towards earning UTQ. The panel also recommends to implement senior UTQ, in particular for those academic staff members who already have earned their credits in this regard by developing new programmes and implementing didactic innovations. In line with this recommendation the panel suggests consideration of introducing a teaching-based career, enabling lecturers to become professors based on leadership in teaching. Furthermore, the panel recommends that all academic staff with UTQ and PhD be allowed to and to be given credit for supervision of master's theses.

The panel appreciates that IHE-Delft managed to attract teaching staff members with diverse cultural and national backgrounds. It, however, also noticed that the women are underrepresented in the top academic positions. It encourages the management to pay continuous attention to this issue and improve the gender diversity related to leadership positions.

Conclusion

Satisfactory

4.3 Standard 3: Assessment

The programme has an adequate system of student assessment in place.

Outline of findings

The critical reflection describes that Education and Examination Regulations is the backbone of the assessment policy. It provides a detailed overview of the nature, frequency and marking of assessments as well as the possibilities for re-examination and appeal procedures for both the taught and thesis part of the programme. The assessments are safeguarded by the Examination Board. All students are informed about the Education and Examination Regulations in the study guide.

In 2017 the IHE-Delft rectorate approved an institution-wide policy framework on assessments. It outlines four key areas of importance for developing and implementing assessments:

1. The content of assessments (formats, levels, criteria);
2. The organisation of assessments;
3. Strengthening competence for assessment among staff;
4. Quality assurance for assessment.

Programme committees bear the overall responsibility of the content of assessments and the alignment with the final qualifications of each programme and its specialisations.

The master's programme ES uses a variety of assessment methods, such as written examinations, oral examinations, assignments, oral presentations, and take-home examinations. Most modules include two or more methods of assessment to accommodate the multiple intended learning outcomes of the modules. Some assessments are carried out by small groups to facilitate team-working skills. To adequately assess individual performances within a group, student-peer assessments are introduced for extensive group assignments. All written examinations are compiled by the module coordinator and peer-reviewed by the programme and/or specialisation coordinators. The programme committee approves the module plans prior to the start of the academic year. The panel appreciates the IHE-Delft procedures to assure the quality of the examinations. Further improvement of these assurance procedures can be achieved by including external review of the module examinations.

Students are informed about the assessment methods and their relative weight for each module. They are listed in the module sheets and are explained in more detail by the module coordinator at the start of each module, including the evaluation criteria that will be used for marking the various assessments. Written hand-outs with instructions are provided for assignments. Sample questions are usually available for students during the module and tutorials are organised to practice the application of the knowledge in preparation for the examinations.

Examination Board

IHE-Delft has an Examination Board, which is autonomous and has the responsibility to safeguard the quality of examinations as well as the related quality of the organisation and procedures concerning. The Examination Board monitors the proper implementation of the regulations and planning of examinations, including the assessment of grading results. Recently IHE-Delft had an institutional audit in which was established that the quality assurance system met all the requirements. The Examination Board appoints examiners and ensures that quality assurance mechanisms are in place to monitor the appropriateness and quality of assessments. The quality of the examinations of the modules offered by other universities is safeguarded by the examination

boards of the those universities. The panel concluded that the Examination Board performs all tasks expected from an Examination Board in Higher Education according to the WHW.

The panel had an interview with members of the Examination Board during the site visit. The panel studied the form used for the assessment of the master's theses and had some questions concerning the use of the rubric and the equal weighting of the criteria. The Examination Board mentioned that it reviewed the rubric last year and furthermore evaluated the whole process of the thesis assessment. The proposal to introduce weighting is still in discussion within the Institute. The panel believes that the Examination Board has a good overview of the quality of assessments and examinations. The panel, in particular, appreciates that the Board is pro-actively involved in safeguarding quality of examinations.

Considerations

The panel established that the assessment and examination regulations are clearly described in the Education and Examination Regulations. The Examination Board has reliable procedures and the necessary level of independence. The panel finds the assessment policy coherent and transparent. The interim examinations and the thesis assessments are transparent, valid and reliable. The panel also established that there are adequate assessment forms in place for the master thesis. During the site visit the panel discussed the thesis assessment form with the programme committee and the Examination Board and concluded that some improvements can be made in the assessment form and the corresponding rubric. For instance, the panel advises to give weight percentages to the different criteria and to add criteria for the public/oral defence. Furthermore, the quality of the discussion in a thesis should be part of the rubric. The panel also advises to develop a clear procedure for reconciliation of the differences in mark allocation between the internal and external examiners.

The panel recommends that the Examination Board regularly checks the thesis assessments by taking a sample to review whether the thesis assessment is of high enough quality to be endorsed.

Conclusion

Satisfactory

4.4 Standard 4: Achieved learning outcomes

The programme demonstrates that the intended learning outcomes are achieved.

The panel concluded that the learning goals of the modules are in line with the intended learning outcomes of the programme and that the assessments adequately test the learning goals. It is convinced that students who have finished the master programme Urban Water and Sanitation will have achieved the programme's intended learning goals.

The panel studied 15 theses. The panel established that the graduates had achieved the intended learning outcomes of the programme. The panel found the theses appropriate as the final product of an academic master degree programme and of sound academic quality. They showed good analyses, correct application of methods and correct application of theory. The panel would have graded some of the theses slightly lower and other theses slightly higher, but the differences were within acceptable boundaries.

The achievements of students are also reflected in the number of master's theses resulting in publications in scientific journals and presentations at international conference with the students as co-authors. 15 % of the theses directly resulted in or contributed to publications in international peer-reviewed scientific articles. The panel found this clear evidence of the quality of the master's theses.

The panel spoke with alumni of the programme and concluded that they were all very satisfied with their training at IHE-Delft. The alumni still feel closely connected and are very willing to promote and support the institute in their home country. They definitely see the added value of their education at the institute and would encourage professionals in their vicinity to study at IHE-Delft.

Considerations

The panel concludes that graduates of the master's programme UWS have achieved the intended learning outcomes. The graduates are well-prepared for enhancing their career in the water sector. The panel had the opportunity to speak to a few alumni, but did not have a complete overview of the current positions of all UWS alumni. The panel learnt that the Education Bureau plans to set out a survey among alumni in the (near) future. The panel advises to systematically investigate what alumni are doing, how they are using their degrees, and how they look back on their master programme.

It became clear to the panel that IHE-Delft has an amazing outreach to alumni. This can be considered a clear strength of the programme and evidence of dedication of IHE-Delft and teaching staff.

Conclusion

Satisfactory

4.5 Conclusion

The panel assessed each of the four standards as satisfactory. Following the NVAO decision rules, the panel's general conclusion is that the programme meets the criteria for accreditation.

5 Overview of the assessments

WO-master Programme in Urban Water and Sanitation

Standard	Assessment
Intended Learning outcomes <i>Standard 1 : The intended learning outcomes tie in with the level and orientation of the programme; they are geared to the expectations of the professional field, the discipline, and international requirements</i>	satisfactory
Teaching-learning environment <i>Standard 2 : The curriculum, the teaching-learning environment and the quality of the teaching staff enable the incoming students to achieve the intended learning outcomes.</i>	satisfactory
Student assesment <i>Standard 3: The programme has an adequate system of student assesment in place.</i>	satisfactory
Achieved learning outcomes <i>Standard 4: The programme demonstrates that the intended learning outcomes are achieved..</i>	satisfactory
Conclusion	satisfactory

Annex 1: Composition of the panel

Chair:

Prof.dr. G. Zeeman, professor emeritus in New Sanitation at Wageningen University, the Netherlands.

Panel members:

- Dr. K. Rebel, assistant professor at Utrecht University Copernicus Institute of Sustainable Development, the Netherlands.
- Prof. A. Schleiss, professor emeritus at the Swiss Federal Institute of Technology Lausanne (EPFL) with professional field and academic expertise in hydrology, hydraulic engineering, applied hydraulics and hydraulic structures.
- Prof. E. Manzungu is professor in Agricultural Landscapes, Waterscapes and Environmental Management at the University of Zimbabwe, where he served as Chairperson of the Department of Soil Science and Agricultural Engineering and Deputy Dean of the Faculty of Agriculture.
- Dr. L. Harris, associate professor at the Institute for Resources Environment and Sustainability and at the Institute for Gender, Race, Sexuality and Social Justice at the University of British Columbia (UBC), Canada.

Student member:

- E.L. Okoro, master student in Law and Technology at Tilburg University, the Netherlands.

Annex 2: Intended learning outcomes

Specialisation Water Supply and Engineering

After successful completion of the programme, graduates will be able to:

Knowledge and understanding

1. Place the specialized knowledge gained into a broader understanding of water issues, challenges, debates and developments.
2. Understand the required basic chemical, physical and (micro)biological principles commonly applied in the field of water supply and sanitation.
3. Understand the engineering- and socio-economic aspects of urban water systems
4. Understand different international practices and approaches in wider urban water systems.
5. Understand the configuration of drinking water supply systems, including treatment, water transport, and distribution.
6. Understand water quality criteria and their standards, and their relation to public health, environment and urban water cycle.
7. Explain physical, chemical and biological processes that take place within water supply systems.
8. Identify how water quality affects selection of water treatment process.
9. Explain hydraulic concepts and their relationship to water transport within treatment plants and distribution networks.
10. Recognize and understand the importance and methods for operation and maintenance of water supply systems.
11. Identify options for centralized and urban systems versus decentralized and rural systems.

Applying knowledge and understanding

1. Draft a research plan, including the formulation of research questions and hypotheses and the selection of research methods, theories and techniques.
2. Conduct research independently in a scientifically sound and ethically responsible manner.
3. Contribute to interdisciplinary and evidence-based knowledge development and problem solving.
4. Integrate disciplinary knowledge and skills in a broader urban water system problem solving context.
5. Collect, process and analyse field/lab data related to water supply and sanitation systems.
6. Design and rehabilitate raw water abstraction, transport, treatment and distribution processes and systems.
7. Select treatment processes depending on the nature of impurities to be removed and the intended use of the treated water.
8. Apply modelling tools for simulation, prediction of performance and operation of water supply system components.

Making judgements

1. Identify and appraise relevant research, concepts and approaches in view of their potential for helping understand or solve water-related problems.
2. Critically discuss and evaluate own research approaches and outcomes within the context of existing knowledge and approaches.
3. Interpret research findings critically in order to formulate evidence-based conclusions, solutions and/or recommendations.
4. Define, evaluate and select water supply technology alternatives on the basis of chosen selection criteria.

Communication

1. Communicate and present effectively, both in writing and orally, employing the appropriate information and communication technologies.
2. Debate and defend findings and insights, in a clear, systematic and convincing manner.
3. Communicate effectively across disciplines and cultures to enhance collaborations in teams.

Learning Skills

Develop competencies required to further develop and expand their knowledge and skills on their own initiative.

Specialisation Sanitary Engineering

After successful completion of the programme, graduates will be able to:

Knowledge and understanding

1. Place the specialized knowledge gained into a broader understanding of water issues, challenges, debates and developments.
2. Understand the required basic chemical, physical and (micro)biological principles commonly applied in the field of water supply and sanitation.
3. Understand the engineering- and socio-economic aspects of urban water systems.
4. Understand different international practices and approaches in wider urban water systems.
5. Understand and explain the role of sanitation in urban water cycle and its relation to public health and environment;
6. Develop rational approaches towards sustainable waste(water) management via pollution prevention, appropriate treatment, resources recovery and re-use on both centralized and decentralized level;
7. Understand in-depth relevant physical, chemical and biological processes, and their mutual relationships within various sanitation components.

Applying knowledge and understanding

1. Draft a research plan, including the formulation of research questions and hypotheses and the selection of research methods, theories and techniques.
2. Conduct research independently in a scientifically sound and ethically responsible manner.
3. Contribute to interdisciplinary and evidence-based knowledge development and problem solving.
4. Integrate disciplinary knowledge and skills in a broader urban water system problem solving context.

5. Collect, process and analyse field/lab data related to water supply and sanitation systems.
6. Apply gained knowledge and skills in practice.
7. Prepare conceptual engineering and process design of sanitation components.
8. Apply modern tools for technology selection and carry out modelling of sanitation components.
9. Identify, develop and conduct independent research including formulation of hypotheses selection and application of research methodologies, and the formulation of conclusions and recommendations.
10. Carry out desk studies, field work, and laboratory based research.
11. Contribute to the development of innovative approaches to the provision of adequate and sustainable sanitation services in developing countries and countries in transition.

Making judgements

1. Identify and appraise relevant research, concepts and approaches in view of their potential for helping understand or solve water-related problems.
2. Critically discuss and evaluate own research approaches and outcomes within the context of existing knowledge and approaches.
3. Interpret research findings critically in order to formulate evidence-based conclusions, solutions and/or recommendations.
4. Define and critically analyse, assess and evaluate various urban drainage and sewerage schemes, and wastewater, sludge and solid waste treatment process technologies.
5. Analyse, synthesize, integrate, interpret, and discuss both scientific and practical information in the context of various research and engineering projects including preparation of Master plans, feasibility studies and preliminary designs.

Communication

1. Communicate and present effectively, both in writing and orally, employing the appropriate information and communication technologies.
2. Debate and defend findings and insights, in a clear, systematic and convincing manner.
3. Communicate effectively across disciplines and cultures to enhance collaborations in teams.

Learning skills

Develop competencies required to further develop and expand their knowledge and skills on their own initiative.

Specialisation Urban Water Engineering and Management

After successful completion of the programme, graduates will be able to:

Knowledge and understanding

1. Place the specialized knowledge gained into a broader understanding of water issues, challenges, debates and developments.
2. Understand the required basic chemical, physical and (micro)biological principles commonly applied in the field of water supply and sanitation.
3. Understand the engineering- and socio-economic aspects of urban water systems.
4. Understand different international practices and approaches in wider urban water systems.

5. Understand the urban water cycle and its water system components, their characteristics and functioning within greater urban infrastructure systems.
6. Understand urban water management problems including ability to: identify water systems' demand; deal with climatic and hydrologic uncertainties and/or extremes (e.g., flooding); institutional limitations; and work within a data-constrained environment.
7. Understand water infrastructure/asset planning, financing and management, and utility management.
8. Familiarize with the concept of integrated water resources management (IWRM) and its application to a variety of water management problems at the urban catchment scale.

Applying knowledge and understanding

1. Draft a research plan, including the formulation of research questions and hypotheses and the selection of research methods, theories and techniques.
2. Conduct research independently in a scientifically sound and ethically responsible manner.
3. Contribute to interdisciplinary and evidence-based knowledge development and problem solving.
4. Integrate disciplinary knowledge and skills in a broader urban water system problem solving context.
5. Collect, process and analyse field/lab data related to water supply and sanitation systems.
6. Make appropriate and critical use of methods, techniques and tools necessary to monitor, analyse and design urban water systems including: water supply infrastructure; drinking water treatment and distribution; wastewater collection, treatment, transport and disposal systems; drainage and flood protection systems.
7. Identify, articulate, analyse and solve problems of the urban water cycle and systems, integrating theory and applications.
8. Collect, summarize, analyse and interpret technical data/materials in a structured form to gain knowledge on urban water system design and operation and maintenance.
9. Work with a range of information technology tools (e.g., GIS tools) available for solving urban water management problems and for effectively communicating with fellow water managers, researchers, scientists, planners, and policy-makers.

Making judgements

1. Identify and appraise relevant research, concepts and approaches in view of their potential for helping understand or solve water-related problems.
2. Critically discuss and evaluate own research approaches and outcomes within the context of existing knowledge and approaches.
3. Interpret research findings critically in order to formulate evidence-based conclusions, solutions and/or recommendations.
4. Critically analyse and assess the need for continued-education and research on planning, design, maintenance and management of urban water systems.

Communicate

1. Communicate and present effectively, both in writing and orally, employing the appropriate information and communication technologies.
2. Debate and defend findings and insights, in a clear, systematic and convincing manner.
3. Communicate effectively across disciplines and cultures to enhance collaborations in teams.

Learning skills

1. Develop competencies required to further develop and expand their knowledge and skills on their own initiative

Annex 3: UWS Programme Structure 2016-2018

UWS 2016-2018				
No	Water Supply Engineering	Sanitary Engineering	Urban Water Engineering & Management	EC
1	Week 1, Hydrology, GIS and Water Supply & Water Demand Management		Watershed Hydrology, Drinking Water Treatment, Wastewater Treatment and Integrated Water Resource Management (AIT)	5
2	Chemistry and Public Health			5
3	EPT, Microbiology and Integrated Urban Water			5
4	Surface Water Treatment 1	Urban Drainage and Sewerage		5
5	Surface Water Treatment 2	Conventional Wastewater Treatment	Asset Management	5
6	Groundwater Treatment and Resources	Resource Oriented Wastewater Treatment and Sanitation	Managing Water Organisations	5
7	Water Transport and Distribution	Wastewater Treatment Plants Design and Engineering	Water Transport and Distribution	5
8	Advanced Water Treatment and Reuse	Modelling Wastewater Treatment Processes and Plants	Urban Flood Management & Disaster Risk Mitigation	5
9	International Fieldtrip and Fieldwork			5
10	Elective modules programme wide			5
11	Elective modules IHE-wide		Research proposal development for AIT	5
12	Summer courses			1
13	Groupwork St. Maarten		Thesis research work	5
14	Preparatory course and thesis research proposal			9
15	Thesis research work			36

Annex 4: Schedule of the site visit

for the four WO-master Programmes: Water Management and Governance, Water Science and Engineering, Urban Water and Sanitation, Environmental Science

Time	Subject	Participants
Wednesday 14 November 2018		
08.45 – 09.00	Welcome day 1	Rector IHE Delft Head of Education Bureau
09.00 – 09.30	Introduction on the Information provided	Head of Education Bureau
09.30 – 12.15	Preparatory meeting and initial discussion of the panel	
12.15 – 13.00	lunch	
13.00 – 14.00	Institute's management	Rector IHE Delft Vice-rector Business Director
14.00 – 14.45	Students master programme Water Management and Governance	Student from Egypt Student from Lebanon Student from Vietnam Student from Brazil Student from Afghanistan
14.45 – 15.30	Programme committee Water Management and Governance	Programme Chair Professor Colleague Prof. Programme coordinator 3 Programme Committee members
15.30 – 16.00	Break	
16.00 – 16.45	Students master programme Water Science and Engineering	Student from Nepal Student from Rwanda Student from Uganda Student from Egypt Student from Bangladesh
16.45 – 17.30	Programme committee Water Science and	Programme Chair Professor Programme coordinator

	Engineering	3 Programme committee members Student member
17.30	Rounding up	
Thursday 15 November 2018		
08.45 – 09.45	Guided tour of the premises	
09.45 – 10.30	Students master programme Urban Water and Sanitation	Student from Nepal Student from India Student from Uruguay Student from Zambia Student from Bhutan Student from United Republic of Tanzania
10.30 – 11.15	programme committee Urban Water and Sanitation	Programme Chair Professor 3 Programme Committee members Programme coordinator
11.15 – 11.45	Break	
11.45 – 12.15	Skype meeting with Management committee joint degree UWEM	3 Committee members, IHE Delft 3 Committee members, AIT Bangkok
12.15 – 13.00	Lunch	
13.00 – 13.45	Students master programme Environmental Science	Student from Bhutan Student from Nepal Student from Kenya
13.45 – 14.30	Programme committee Environmental Science	Programme Chair Professor Programme coordinator 3 Programme committee members
14.30 – 14.45	Break	
14.45 – 15.15	Skype meeting with Management committee Limnology and Wetland Management (Existing Joint Degree Programme)	2 Committee members, IHE Delft 3 Committee members, BOKU, Vienna 2 Committee members, Egerton University, Nijoro, Kenya
15.15 – 15.45	Break	

15.45 – 16.15	Skype meeting with Management Committee Environmental Technology and Engineering (Existing Joint Degree Programme)	1 Committee member, IHE Delft 1 Committee member, UTC Prague 1 Committee member, University Ghent
---------------	--	---

16.15 – 17.15	Meeting with lecturers	8 IHE Delft lecturers
---------------	------------------------	-----------------------

17.45	Rounding up	
-------	-------------	--

Friday 16 November 2018

09.00 – 09.45	Examination Board and Registrar	Chair Examination Board 2 members Examination Board Registrar
---------------	---------------------------------	---

09.45 – 10.00	Break	
---------------	-------	--

10.00 – 11.00	Alumni by skype	Alumnus, Albania, UWS Alumnus, Sudan, ES Alumnus, Zambia, WSE Alumnus, India, WMG
---------------	-----------------	--

11.00 – 11.30	Break	
---------------	-------	--

11.30 – 12.15	Preparation for second meeting with Institute's Management	
---------------	--	--

12.15 – 13.00	Lunch	
---------------	-------	--

13.00 – 14.00	Second meeting with Institute's Management	
---------------	--	--

14.00 – 16.30	Deliberations panel, formulating preliminary findings and conclusions	
---------------	---	--

16.30 – 17.00	Feedback to IHE community	
---------------	---------------------------	--

Annex 5: Documents reviewed

Programme documents presented by the institution

Critical Reflection Master of Science Programme in Water and Sanitation

Administrative Information Existing Joint Degree Urban Water Engineering and Management

Annexes to the Critical Reflection:

1. IHE Delft vision on education and the quality of education
2. Follow-up given to earlier accreditation panel recommendations
3. Final qualifications of the UWS programme per specialization
4. UWS programme curriculum structure
5. Instructional Methods and Didactic Approaches
6. Staff involved in the UWS programme in 2016-2018
7. Guest lecturers involved in the UWS programme in 2016-2018
8. Assessment policy
9. Examination regulations (including rubric MSc thesis examination)
10. Methods of assessment of UWS programme modules (Delft based)
11. Overview of UWS Programme MSc theses 2016-2018
12. List of publications based on MSc thesis research from 2013-2018 in which MSc student is a (co)author.

Students' Critical Reflection on IHE Master Programmes

Annual Reports Examination Board 2016-2017, 2017-2018

Dossier Module 1

(15) Master Theses

Annex 6: List of abbreviations

EC	European Credit
ILO	Intended Learning Outcome
NVAO	Nederlands-Vlaamse Accreditatieorganisatie
OER	Education and Examination Regulations
UTQ	University Teaching Qualification
UWS	Urban Water and Sanitation