

WO-master Programme in  
Environmental Science  
IHE-Delft  
Institute for Water Education

11 February 2019

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## 1 Executive summary

The mission of the Master of Science programme in Environmental Science (ES) is to provide graduates with the knowledge and skills necessary to contribute, directly or indirectly, to the conservation and wise-use of natural resources for the benefit of society. It offers five specialisations: Environmental Science and Technology, Applied Aquatic Ecology for Sustainability, Environmental Planning and Management, the joint specialisation Limnology and Wetland Management, and the joint specialisation Environmental Technology and Engineering. It is the aim of the programme to prepare students to contribute to the goals of the 2030 Agenda for Sustainable Development by attaining technical and interdisciplinary proficiency and by developing a critical attitude.

The intended learning outcomes of the programme describe that the graduates of the programme have the knowledge, insights and skills required for professional work that is directly or indirectly related to the environment, and/or as a firm foundation for further research. The assessment panel subscribes to the mission of the programme. It in particular appreciates the connection to the 2030 Agenda for Sustainable Development.

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 comprises 18 months and has a modular structure with teaching organised in three-week blocks. Most modules are 5 EC, and the master's thesis comprises 36 EC. The programme starts with a one-week introduction for all IHE students followed by foundation courses, which are combined for all specialisations in ES. All education at IHE 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 panel very much appreciates the intensive efforts IHE puts into tutoring and guidance of its students. The teaching and learning environment created by IHE is very inspiring and motivating. Students feel part of a community and are stimulated to achieve a high level. The panel particularly appreciates the introductory week with its focus on 'ways of knowing' and encourages IHE to maintain this element in the programme. The panel thinks that the interdisciplinary focus is an exciting element of the programme which should be more exploited.

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 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 proper forms in place for the assessment of the master's 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's degree programme. The graduates are well prepared for enhancing their career in the water sector.

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 offers four 18-month Master of Science programmes (Environmental Science, Water Science and Engineering, Water Management and Governance, and Urban Water and Sanitation). IHE-Delft chose to invite an international panel of independent experts for the assessment of these four 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;

Members:

- 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;
- E.L. Okoro, master's 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 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 Institute for Water Education. 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, initial findings were presented to the institution.

Based on the findings, considerations and conclusions the secretary produced a draft advisory report for review 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 institution, which was given the opportunity to respond to any factual inaccuracies in the report. The institution 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	: IHE-Delft Institute for Water Education
Status	: Not publicly funded, higher education institution
Result institutional quality assurance assessment	: Positive 12 <sup>th</sup> May 2015
Programme	: Environmental Science
Level	: master
Orientation	: academic (wo)
Specialisation	: Environmental Science and Technology Applied Aquatic Ecology for Sustainability Environmental Planning and Management Limnology and Wetland Management (joint degree) Environmental Technology and Engineering (joint degree)
Degree	: Master of Science
Location	: Delft
Study Load (EC)	: 106 EC
Croho	: 75008

### 3.2 Profile of the institution

IHE Delft Institute for Water Education (IHE-Delft) is the largest international graduate water education facility in the world. 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-Delft is to contribute to the education and training of problem-oriented researchers and professionals, to expand the knowledge base through research, and to build the capacity of sector organizations, knowledge centres and other institutions 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, mid-career professionals.

### 3.3 The master's degree programme Environment Science

The institute describes that effective problem solving in the field of water and environment requires knowledge-based competence from the natural sciences, water engineering, and/or the social



sciences. The curricula should provide students with so-called T-shape competency profiles which enable them to cooperate within teams uniting various disciplines.

The vertical bar of the T stands for specialist deep knowledge-based competence. The horizontal bar represents preliminary or working knowledge and skills from neighbouring disciplines, and also general academic skills, communication competencies (e.g. empathic, intercultural, networking competency) and other professional skills. Thus, team members who each bring their respective specialist knowledge are able to 'embrace', i.e. sufficiently understand, each other in interdisciplinary problem solving.

In recent years the number of specialisations of the master's programme in Environmental Science 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 different structure and (longer) duration than the 18-month specialisations that are solely based in Delft. Two such joint degree specialisations reside under the ES programme, i.e. the specialisation Limnology and Wetland Management (120 EC) which is offered jointly with BOKU (Austria) and Egerton University (Kenya), and the specialisation Environmental Technology and Engineering (120 EC) offered jointly with Ghent University (Belgium) and UCT Prague (Czech Republic).

## 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 overall mission of the master's programme in Environmental Science (ES) is to provide graduates with the knowledge and skills necessary to contribute, directly or indirectly, to the conservation and wise-use of natural resources for the benefit of society. The general aim of the programme is to prepare students to contribute to the goals of the 2030 Agenda for Sustainable Development by attaining technical and interdisciplinary proficiency and developing a critical attitude. According to the critical reflection, this requires:

- developing the capacity to carry out independent scientific and technical research and assessments on environmental issues;
- learning to analyse and assess environmental systems and problems;
- being able to propose sustainable solutions to environmental planning; and
- acquiring a firm foundation of knowledge which allows critical evaluation to provide and assess solutions to environmental pressures.

Overall, the ES programme focuses on the aquatic environment and offers five specialisations: Environmental Science and Technology, Applied Aquatic Ecology for Sustainability, Environmental Planning and Management, the joint specialisation Limnology and Wetland Management and the joint specialisation Environmental Technology and Engineering. The programme aims to deliver graduates who are able to use their knowledge of physical, chemical and biological processes in order to develop and implement solutions for environmental problems. For the latter the graduates also need knowledge of social, economic, legal and management processes, and skills that enable them to work in multidisciplinary teams. While the name of the master programme Environmental Science covers a broad area, it is clear that the focus is on water issues.

The panel finds that the specialisations reflect the need for structural, sustainable responses to environmental/humanitarian crises -- which makes the programme an ideal career-enhancing one for mid-career professional or early researchers. The joint specialisation Limnology and Wetland Management, offered with BOKU (Austria) and Egerton University (Kenya) is a very valuable opportunity for students to profit from expertise in three institutes on complex subjects in three different contexts. The panel observes that the joint specialisation Environmental Technology and Engineering needs some reflection on interdisciplinarity and should work on fine tuning the courses of the three locations to the common objectives. The panel finds the cooperation between the three partner universities valuable.

The intended learning outcomes of the programme have been formulated at specialisation level (Annex 2). These intended learning outcomes describe that the graduates of the programme will have the knowledge, insights and skills required for professional work that is directly or indirectly related to the environment, and/or as a firm foundation for further research. The panel finds that the intended learning outcomes are comparable to those of other master's programmes in Environmental Science.

### **Considerations**

The panel subscribes to the mission of the programme. It in particular appreciates the connection to the 2030 Agenda for Sustainable Development. At the national and international level, the niche of the Environmental Science programme at IHE-Delft with its obvious emphasis on water issues is evident. The programme's focus on mid-career professionals and the cooperation with partners in the global South distinguishes it from other programmes on environmental science.

The panel finds that the programme management has established a good balance between high academic standards and the applicability of the theoretical knowledge. The panel judges the intended learning outcomes to be well-formulated. It concluded that they sufficiently indicate 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. The intended learning outcomes of the programme are well connected to the needs in society and the requirements in the professional field.

### **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 curriculum of the specialisations that are based in Delft has a duration of 18 months and a study load of 106 EC. It consists of a taught part, followed by an individual research project (36 EC). The taught part comprises a series of 5 EC modules, each lasting 3 weeks. An examination week is scheduled after every second module (see Annex 3 for an overview of the Environmental Science programme).

The programme has the following distinct phases:

- Foundation phase of four modules for all specialisations;
- Specialisation phase of six modules specific per specialisation;
- International fieldtrip and Groupwork environmental science;
- One-week summer course;
- Preparation of the research proposal followed by a defence;
- Research project and public defence.

The programme starts with an introduction week for all IHE students (except joint degree students starting in other universities). This week is described by the students as intensive and crucial for information concerning studying at IHE-Delft, teaching methods, staying in the Netherlands and getting acquainted with IHE staff and all fellow students. An important objective of the introduction week is community building, which is very much appreciated by students.

The foundation phase facilitates a baseline of learning and knowledge across the cohort of students, who arrive with a variety of degrees and a variety of cultural backgrounds. The foundation modules place strong emphasis on integrating different academic fields and developing academic skills. Most specialisation modules are given as modules in more than one specialisation. The panel finds this is an efficient way for organising the curriculum. It also strengthens interactions between students from different specialisations, thus contributing to the interdisciplinary nature of the programme. Module 9 is the international fieldtrip and fieldwork. This module is taken by students of all

specialisations together, except for IMETE and LWM students. Module 13 is the group work module, where EST, EPM, WQM and LWE students work together to apply the learned knowledge, techniques and skills in a multidisciplinary project. This module is considered as core in the programme and very much appreciated by students. The panel concludes that this module is 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 and its specialisations to ensure that they all learn to work with a variety of experts of different disciplinary backgrounds.

Prior to arrival at the IHE-Delft, the students must already select their specialisation. Each specialisation offers six specialisation-specific modules, two of which are electives. The international fieldtrip is carried out in the Rhine-Meuse catchment. The trip contains detailed fieldwork. Nature conservation issues are discussed as well as flood protection and nature compensation measures. Various research skills are applied and the students have to present their findings in a group report and in an individual report.

The joint curriculum Limnology and Wetland Management (120 EC in a two year programme) starts with a foundation part (knowledge and skills) at BOKU University in Austria. After that the students move to Kenya for more applied courses on tropical systems. These courses apply skills and knowledge from the first trimester, and add new knowledge and skills. The third trimester takes place in Delft and has a focus on solving environmental problems and further developing critical thinking. Based on the interest of the students and the expertise of the institutes involved, the students choose a thesis topic and carry this out in one of the institutes.

The joint International master's programme in Environmental Technology and Engineering (120 EC) starts with foundation courses at UCT Prague. The second semester the students move to IHE-Delft where students attend specialised courses on water treatment technologies. Between year 1 and 2 the students have the opportunity to do an internship with one of the industrial partners of IHE. In the third semester students follow advanced courses and further specialisation courses in Delft and at the UGent. The last semester is dedicated to research for the master's thesis either at one of the three partner institutes or in other internationally recognised institutes. The main supervisor of the research comes from one of the three partner institutes.

#### *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 Environmental Science is delivered by a team of 40 IHE staff members, taking into account the multidisciplinary aspects from all three academic departments (Environmental Engineering and Water Technology, Water Science and Engineering, and Integrated Water Systems and Governance), and about 40 guest lecturers from industry and academia. Out of the 40 IHE staff 13 are more closely involved in developing and assessing the various modules as Module Coordinators. Actual staff input in the ES programme for the taught part is 3.6 fte

(student/staff ratio 6.6) and for the supervision of the research 1.1 fte. On average a student has 23 contact hours per week.

The IHE 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. Half 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) while most others are in the process of obtaining their UTQ diploma. In addition, IHE 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-Delft, 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.

#### **Considerations**

After studying the various aspects of the programme's teaching and learning environment, the panel established that the contents and structure of the curriculum enable students to achieve the intended learning outcomes. The programme provides a good basis in the natural sciences and the socio-economic concepts that are required to understand complex issues in the field of environmental science and to play a role at an academic level in analysing and solving environmental problems in a sustainable way. The specialisations provide the necessary depth. The elective modules, the fieldtrip and fieldwork, and the group work introduce interaction among students from the different specialisations. The learning outcomes of the modules are in line with the final qualifications, the curriculum enables the students to achieve them. The panel appreciates that several teaching methods 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 do not generally perceive the study load as impossible. This asks for continuous attention of the staff.

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 cannot participate in the introduction week, which is crucial for the community building. The panel sees this as a disadvantage for these joint programmes. However, the

advantages of ,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 finds that the interdisciplinary focus is 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 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 encouraged to work towards earning UTQ. The panel also recommends to implement senior UTQ trajectory, 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 advises to consider the introduction of a teaching-based career, enabling lecturers to become professor 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 leading 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**

*Assessment system*

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 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 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 exams as well as the quality of the organisation and procedures concerning examinations. 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 which 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 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 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. According to the panel 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 this quality.

#### *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.*

#### ***Outline of findings***

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's programme Environmental Science have achieved the programme's intended learning outcomes.

The panel studied 15 theses to establish whether the graduates had achieved the intended learning outcomes of the programme, among which theses of the joint specialisations Limnology and Wetland Management and Environmental Technology and Engineering. The panel found the theses appropriate as the final product of an academic master's 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 in marking were within acceptable boundaries. The panel observed that theses could use a discussion section and would recommend to consider to require a context section in the master thesis in which students situate their work in relation to the field. The critical reflection describes that the success of the students is also reflected in the number of master's theses resulting in publications in scientific journals and presentations at international



conferences with the students as co-authors. In an annex to the critical reflection an overview of journal publications by students is presented. The critical reflection also describes that the majority of alumni go back to their home countries and obtain senior positions in the water sector. This is confirmed by the alumni who were interviewed during the site visit. The panel concluded that the alumni were all very satisfied with their education at IHE. They still feel closely connected to IHE-Delft 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 ES 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 ES alumni. The panel learnt that the education bureau of IHE 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 institute 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 Environmental Science

Standard	Assessment
<b>Intended Learning outcomes</b> <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
<b>Teaching-learning environment</b> <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
<b>Student assesment</b> <i>Standard 3: The programme has an adequate system of student assesment in place.</i>	satisfactory
<b>Achieved learning outcomes</b> <i>Standard 4: The programme demonstrates that the intended learning outcomes are achieved..</i>	satisfactory
<b>Conclusion</b>	satisfactory

## **Annex 1: Composition of the panel**

### Chair:

Prof.dr. G. Zeeman, professor emeritus in New Sanitation at Wageningen University, the Netherlands. Grietje Zeeman has teaching and testing experience as well as more than 35 years in scientific, technological and research application projects. She is expert in Environmental Technology, Sanitation, Wastewater treatment and Urban Systems Engineering.

### 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 ES-EST*

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

#### Knowledge and Understanding

- be able to place the knowledge gained through their own specialisation into a broader understanding of contemporary global water issues, challenges, debates and developments
- understand the required basic chemical, physical, (micro)biological and ecological principles commonly applied in the field of environmental science
- understand the socio-economic dimensions of environmental systems
- identify the way to prevent environmental pollution through resource management and application of re-use technologies
- identify the way polluted water, waste, gas, soils and sediments can be treated to reduce environmental risk

#### Applying Knowledge and Theory

- formulate research questions and hypotheses, select and apply research methods, theories and techniques, and prepare a research plan
- conduct independent research
- contribute to multidisciplinary and creative problem solving
- contribute to the development of knowledge and integrate it with knowledge from other fields
- integrate disciplinary knowledge and skills in an environmental science context
- collect, process and analyse field data
- develop, design and apply technologies for the prevention and remediation of environmental pollution by searching scientific information, conducting scientific research in the field of environmental technology and engineering, and reporting their findings by means of scientific reports and papers

#### Making Judgements

- identify relevant research, ideas and approaches from literature and other sources in view of their potential for helping understand or solve particular water-related problems
- critically discuss, as well as comparatively evaluate and judge existing knowledge, ideas and approaches against each other, as well as against own research approaches and outcomes
- recognize and address ethical and sustainability dimensions in professional practice
- use research outcomes to inform well-founded, original conclusions, solutions or recommendations
- critically analyse and evaluate a range of options for the prevention or remediation of environmental problems under prevailing socio-economic conditions

#### Communication

- communicate and present effectively, both in writing and orally, employing the appropriate information and communication technologies
- debate and defend findings and insights, in a clear, systematic and convincing manner
- cooperate effectively in multi-/interdisciplinary and intercultural teams

#### Learning skills

- have the competencies to further develop and expand their knowledge and skills on their own initiative

*Socialisation: ES-EPM*

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

Knowledge and Understanding

- be able to place the knowledge gained through their own specialisation into a broader understanding of contemporary global water issues, challenges, debates and developments
- understand the required basic chemical, physical, (micro)biological and ecological principles commonly applied in the field of environmental science
- understand the socio-economic dimensions of environmental systems
- understand different common practices and approaches in river basin and environmental management
- understand how the legal, cultural, technical, ethical, socio-economic, and/or political context influences environmental planning and management, and sustainable outcomes, from local to global levels
- analyse policy and planning instrument to improve management of water and natural resources
- analyse concepts, methods and tools for strategic decision-making such as policy analysis, planning and environmental and social impact assessment

Applying Knowledge and Theory

- formulate research questions and hypotheses, select and apply research methods, theories and techniques, and prepare a research plan
- conduct independent research
- contribute to multidisciplinary and creative problem solving
- contribute to the development of knowledge and integrate it with knowledge from other fields
- integrate disciplinary knowledge and skills in an environmental science context
- collect, process and analyse field data
- apply and reflect upon concepts, methods and tools for strategic decision-making
- design and implement water and environmental plan for various levels of decision-making

Making Judgements

- identify relevant research, ideas and approaches from literature and other sources in view of their potential for helping understand or solve particular water-related problems
- critically discuss, as well as comparatively evaluate and judge existing knowledge, ideas and approaches against each other, as well as against own research approaches and outcomes
- recognize and address ethical and sustainability dimensions in professional practice
- use research outcomes to inform well-founded, original conclusions, solutions or recommendations

Communication

- communicate and present effectively, both in writing and orally, employing the appropriate information and communication technologies
- debate and defend findings and insights, in a clear, systematic and convincing manner
- cooperate effectively in multi-/interdisciplinary and intercultural teams

Learning skills

- have the competencies to further develop and expand their knowledge and skills on their own initiative

*Specialisation: ES-AAES*

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

Knowledge and Understanding

- be able to place the knowledge gained through their own specialisation into a broader understanding of contemporary global water issues, challenges, debates and developments
- understand the required basic chemical, physical, (micro)biological and ecological principles commonly applied in the field of environmental science
- understand the socio-economic dimensions of environmental systems
- understand different common practices and approaches in river basin and environmental management
- understand and evaluate the physical, biogeochemical, and ecological processes to the functioning of natural and degraded aquatic ecosystems

Applying Knowledge and Theory

- formulate research questions and hypotheses, select and apply research methods, theories and techniques, and prepare a research plan
- conduct independent research
- contribute to multidisciplinary and creative problem solving
- contribute to the development of knowledge and integrate it with knowledge from other field
- integrate disciplinary knowledge and skills in an environmental science context
- collect, process and analyse field data
- integrate stakeholder objectives and scientific knowledge to create management objectives for the sustainable management, restoration, and conservation of aquatic ecosystems

Making Judgements

- identify relevant research, ideas and approaches from literature and other sources in view of their potential for helping understand or solve particular water-related problems
- critically discuss, as well as comparatively evaluate and judge existing knowledge, ideas and approaches against each other, as well as against own research approaches and outcomes
- recognize and address ethical and sustainability dimensions in professional practice
- use research outcomes to inform well-founded, original conclusions, solutions or recommendations

Communication

- communicate and present effectively, both in writing and orally, employing the appropriate information and communication technologies
- debate and defend findings and insights, in a clear, systematic and convincing manner
- cooperate effectively in multi-/interdisciplinary and intercultural teams
- effectively communicate the responses of lakes, rivers, and wetlands to anthropogenic pressures to stakeholders and peers

Learning skills

- have the competencies to further develop and expand their knowledge and skills on their own initiative

### *Specialisation ES-LWM*

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

#### Knowledge and Understanding

- to demonstrate understanding of natural environmental processes, the socio-economic concepts underlying functioning and exploitation of environmental systems, and of the complex interrelationships between protection and wise use of environmental resources
- to describe the rationale for an integrated and interdisciplinary approach for the sustainable management of water and environmental resources
- to identify the impacts of human activities on freshwater ecosystems in different socio-economic contexts
- to demonstrate knowledge and understanding of the international water quality guidelines
- to name and explain concepts, instruments and technologies for protection and remedial actions of freshwater ecosystems

#### Applying Knowledge and Theory

- to design, optimise and interpret environmental monitoring and assessment schemes (including statistics and modelling) in order to gain an understanding of problems, trends, causes and effects
- to design, optimise and interpret environmental monitoring and assessment schemes for freshwater ecosystems
- to conduct research, independently/ in multidisciplinary teams, including formulation of research questions and hypotheses, selection and application of research methodologies and techniques and the formulation of well-founded conclusions and recommendations

#### Making Judgements

- to critically analyse and evaluate a range of options and alternatives for the prevention or remediation of environmental problems, under different socio-economic, cultural and legal contexts, and under often data-poor conditions
- to critically analyse and evaluate a range of options and alternatives for the prevention or remediation of problems related with freshwater ecosystems, under different socio-economic and legal contexts, and under often data-poor conditions
- to contribute in interdisciplinary teams in developing solutions for prevention / remediation of aquatic ecosystem problems by linking scientific knowledge to engineering interventions and management decisions in different cultural/socio economic contexts.

#### Communication

- to communicate, debate and defend, clearly and systematically, findings and generated insights, and provide rational underpinning of these in oral and written presentations to a variety of audiences

#### Learning skills

- to demonstrate academic attitude and learning skills (including thinking in multidisciplinary dimensions and distinguishing main issues from minor ones), to enhance and keep up-to-date the acquired knowledge and application skills in an independent manner



*Specialisation: ES-IMETE2*

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

Knowledge and Understanding

- be able to place the knowledge gained through their own specialisation into a broader understanding of contemporary global water issues, challenges, debates and developments
- understand the required basic chemical, physical, (micro)biological and ecological principles commonly applied in the field of environmental science
- understand the socio-economic dimensions of environmental systems
- understand different common practices and approaches in river basin and environmental management
- identify the way to prevent environmental pollution through resource management and application of re-use technologies
- identify the way polluted water, waste, gas, soils and sediments can be treated to reduce environmental risk

Applying Knowledge and Theory

- formulate research questions and hypotheses, select and apply research methods, theories and techniques, and prepare a research plan
- conduct independent research
- contribute to multidisciplinary and creative problem solving
- contribute to the development of knowledge and integrate it with knowledge from other fields
- integrate disciplinary knowledge and skills in an environmental science context
- collect, process and analyse field data
- develop, design and apply technologies for the prevention and remediation of environmental pollution by searching scientific information, conducting scientific research in the field of environmental technology and engineering, and reporting their findings by means of scientific reports and papers

Making Judgements

- identify relevant research, ideas and approaches from literature and other sources in view of their potential for helping understand or solve particular water-related problems
- critically discuss, as well as comparatively evaluate and judge existing knowledge, ideas and approaches against each other, as well as against own research approaches and outcomes
- recognize and address ethical and sustainability dimensions in professional practice
- use research outcomes to inform well-founded, original conclusions, solutions or recommendations

Communication

- communicate and present effectively, both in writing and orally, employing the appropriate information and communication technologies
- debate and defend findings and insights, in a clear, systematic and convincing manner
- cooperate effectively in multi-/interdisciplinary and intercultural teams

Learning skills

- have the competencies to further develop and expand their knowledge and skills on their own initiative



### Annex 3: Environmental Science programme overview 2017-2019

(The IMETE2 specialisation is not included in this scheme )

Module	EST	EPM	WQM	LWM
1	Week one introduction Introduction to environmental science 1			Programme at BOKU Vienna
2	Introduction to environmental science 2			
	Examination week			
3	Introduction to environmental science 3			
	Free period			
3	Introduction to environmental science 3			
4	Integrated project environmental science			
	Examination week			
5	Industrial resource management and cleaner production	Water and environmental law	Water and environmental law	Programme in Egerton Kenia
				Lake ecology
6	Environmental systems analysis	Environmental systems analysis	Water quality assessment	Ecology of streams & rivers
	Examination week			
7	Environmental engineering	Water and environmental policy analysis	Constructed wetlands for wastewater treatment	Wetlands for water quality
8	Environmental monitoring and modelling	Environmental planning and implementation	Environmental planning and implementation	Fisheries and aquaculture
	Examination week			To Delft
9	Foreign fieldtrip and fieldwork ES			Data analysis & modelling for aquatic systems
10	Aquatic ecosystems processes and applications or Environmental assessment for water-related policies and developments			Aquatic ecosystems and applications
11	Solid waste management or Strategic planning for rivers basin and deltas or IWRM as a tool for adaptation to climate change or Wetlands for livelihoods and conservation or A module from another programme			Wetlands for livelihoods and conservation
	Examination week			
12	Summer course			
13	Groupwork ES			
	Examination week			
	free			

14	Master research proposal development for ES
	Examination week
15	Research, thesis and defence (6 months)
	Final examination week – diploma awarding

## **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
<b>Wednesday 14 November 2018</b>		
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 Engineering	Programme Chair Professor Programme coordinator 3 Programme committee members Student member

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17.30	Rounding up	
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**Thursday 15 November 2018**

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08.45 – 09.45	Guided tour of the premises	
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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
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10.30 – 11.15	programme committee Urban Water and Sanitation	Programme Chair Professor 3 Programme Committee members Programme coordinator
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11.15 – 11.45	Break	
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11.45 – 12.15	Skype meeting with Management committee joint degree UWEM	3 Committee members, IHE Delft 3 Committee members, AIT Bangkok
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12.15 – 13.00	Lunch	
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13.00 – 13.45	Students master programme Environmental Science	Student from Bhutan Student from Nepal Student from Kenya
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13.45 – 14.30	Programme committee Environmental Science	Programme Chair Professor Programme coordinator 3 Programme committee members
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14.30 – 14.45	Break	
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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
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15.15 – 15.45	Break	
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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
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16.15 – 17.15	Meeting with lecturers	8 IHE Delft lecturers
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17.45	Rounding up	
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**Friday 16 November 2018**

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09.00 – 09.45	Examination Board and Registrar	Chair Examination Board 2 members Examination Board Registrar
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09.45 – 10.00	Break	
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10.00 – 11.00	Alumni by skype	Alumnus, Albania, UWS Alumnus, Sudan, ES Alumnus, Zambia, WSE Alumnus, India, WMG
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11.00 – 11.30	Break	
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11.30 – 12.15	Preparation for second meeting with Institute's Management	
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12.15 – 13.00	Lunch	
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13.00 – 14.00	Second meeting with Institute's Management	
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14.00 – 16.30	Deliberations panel, formulating preliminary findings and conclusions	
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16.30 – 17.00	Feedback to IHE community	
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## Annex 5: Documents reviewed

### *Programme documents presented by the institution*

- 1) Critical reflection Master of Science Programme in Environmental Science
- 2) Annexes to the Critical Reflection:
  - a. IHE vision on education and the quality of education
  - b. Review of the joint Limnology and Wetlands Management Programme
  - c. Final qualifications and alignment with module learning objectives
  - d. Schematic overview EST, EPM, AAES and LWM curricula
  - e. IMETE2 curriculum
  - f. IHE staff involved in teaching in the ES Master programme
  - g. Guest lecturers involved in teaching in the ES Master programme
  - h. IHE assessment policy
  - i. IHE examination regulations
  - j. Rubric for MSc thesis examinations
  - k. Overview of MSc theses 2016-2018
  - l. Publications based on MSc thesis research in which MSc student is (co)author
- 3) Administrative Information Existing Joint Degree Programme Limnology and Wetland Management
- 4) Administrative Information Existing Joint Degree Programme Environmental Technology and Engineering
- 5) Students' Critical Reflection on IHE Master Programmes
- 6) Annual Reports Examination Board 2016-2017, 2017-2018
- 7) Dossier Module 7
- 8) (15) Master Theses





## **Annex 6: List of abbreviations**

EC	European Credit
EPM	Environmental Planning and Management
EST	Environmental Science and Education
IHE	IHE Institute of Water Education
ILO	Intended Learning Outcome
IMETE	Master of Science Programme in Environmental Technology and Engineering
LWM	Limnology and Wetland Management
NVAO	Nederlands-Vlaamse Accreditatieorganisatie
OER	Education and Examination Regulations
UTQ	University Teaching Qualification
WSE	Water Science and Engineering
WQM	Water Quality Management