



Evaluation of the
International Groundwater Resources Assessment Centre
(IGRAC) as a Category 2 Centre
under the auspices of UNESCO:
2016 - 2019

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List of Acronyms and Abbreviations

AMCOW	African Ministers' Council on Water
BGS	British Geological Survey
BGR	Federal Institute for Geosciences and Natural Resources (Germany)
CEREGAS	Regional Centre for Groundwater Management in Latin America and the Caribbean
FAO-AQUASTAT	FAO's global water information system
GEF	Global Environment Facility
GGIS	Global Groundwater Information System
GGMN	Global Groundwater Monitoring Network
IAH	International Association of Hydrogeologists
IGRAC	International Groundwater Resources Assessment Centre
IHE Delft	Institute for Water Education
ISARM	Internationally Shared Aquifer Resources Management
IWMI	International Water Management Institute
MIE	Ministry of Infrastructure and Environment, Government of The Netherlands
OSS	Sahara and Sahel Observatory
SADC-GMI	Groundwater Management Institute of the Southern African Development Community
SDG	Sustainable Development Goal
UN	United Nations
UNEP-GEMS	United Nations Environment Programme-United Nations Global Environment Monitoring System (GEMS)
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNESCO-IHP	UNESCO Intergovernmental Hydrological Programme
UNESCO-WWAP	UNESCO World Water Assessment Programme
UN-Water	United Nations inter-agency coordination mechanism for all freshwater related issues, including sanitation
WMO	World Meteorological Organization

Executive Summary

IGRAC was successfully established in 2011 as a UNESCO Category 2 Centre, located in Delft, The Netherlands, at the premises of the Institute for Water Education. The agreement between UNESCO and the Government of the Netherlands was renewed on 6 December 2016 and will expire on 31 December 2021. The Government of The Netherlands, through the Ministry of Infrastructure and Water Management, expressed its willingness to submit IGRAC to evaluation, in order to renew the Agreement for the continuation of its activities. This evaluation report presents the results and recommendations of the 2020 review and aims to assess to which extent IGRAC's objectives as set out in the Agreement signed with UNESCO were achieved.

As the only global centre dedicated to groundwater assessment and monitoring, IGRAC's role is more important than ever. In the coming decades, sustainable utilization of groundwater resources will be critical to achieving sustainable development at large, and the SDGs of UN Agenda 2030 in particular. Seen in this light, IGRAC's role in compiling and disseminating groundwater data is critical to achieving the SDG agenda.

IGRAC's expertise and leadership in moving the global groundwater assessment and dissemination of critical groundwater information is recognized by all contacted UN, scientific and donor organizations. As the only global centre dedicated to groundwater assessment and monitoring, IGRAC contributes largely to UNESCO-IHP and to the work of a number of other United Nations agencies. IGRAC also fulfils an important role in raising awareness on the importance of groundwater and its unique challenges.

Based on these considerations it is recommended that IGRAC's status as a UNESCO Category 2 Centre should be renewed, in recognition of the quality of their work and the strategic importance of groundwater monitoring and assessment globally.

Introduction

Background

With most surface water resources already allocated, groundwater plays an increasingly important role in fulfilling the growing global water demand. This is especially true in the arid and semi-arid regions of the world where groundwater sustains the livelihoods of millions in rural areas, provides food security for growing populations and helps building resilience against climate change.

The sustainable management of groundwater resources depends on our understanding of the dynamics of the innumerable aquifer systems being tapped, an up-to-date knowledge of their status in quantitative and qualitative terms and their uses. With so much at stake, it is a paradox that our knowledge of many of the world's aquifers is partial at best, that groundwater monitoring systems are declining in numerous countries and that little information on the status of groundwater resources at a scale required for planning and management purposes, is publicly available.

The proposal to set-up an international groundwater centre originated at the WMO/UNESCO Joint Assembly of 1999 in Geneva. The objective was to provide Member States and the 'international science community' with a reference centre on groundwater. The International Groundwater Resources Assessment Centre (IGRAC) was launched in March 2003, during the third World Water Forum in Kyoto. In 2011 IGRAC was successfully established as a UNESCO Category 2 Centre, located in Delft, The Netherlands, at the premises of the UNESCO Institute of Water Education (UNESCO-IHE).

Rationale of the review

The agreement between UNESCO and the Government of the Netherlands establishing IGRAC as a centre under the auspices of UNESCO (category 2), signed in November 2011, was renewed on 6 December 2016 and entered into force on 23 August 2017 (see Annex 1). It will expire, in accordance with its own provisions, on 31 December 2021. The Government of The Netherlands, through the Ministry of Infrastructure and Water Management, expressed its willingness to submit IGRAC to evaluation, in order to renew the Agreement for the continuation of its activities. Depending on the outcome of the renewal evaluation, the Kingdom of the Netherlands also expressed the wish to explore the legal scope for strengthening cooperation between IGRAC and the IHE Delft Institute for Water Education.

Document 40 C/79 and its annexes, as adopted by the UNESCO General Conference (November 2019), contains the 2019 Strategy for Category 2 Centres, as currently applied to all proposals for the establishment of category 2 institutes and centres, and all renewals of existing agreements. The principles for renewal and of the evaluation are set out in Annex Section E.2 of the same document and are attached in Annex 2.

The review aims to assess to which extent IGRAC's objectives as set out in the Agreement signed with UNESCO were achieved. In a broader sense the review looks at the relevance of the IGRAC's activities to the achievement of UNESCO's Approved Programme and Budget.

Structure of the review

The Terms of Reference for the evaluation drafted by UNESCO are attached in Annex 3. UNESCO entrusted Marcus Wijnen, formerly Groundwater Focal Point at the World Bank Water Practice, to coordinate the 2020 review of the International Groundwater Resources Assessment Centre (IGRAC) in the Netherlands.

The review was carried out between September and November 2020 and included the following phases:

1. Document review (desk study);
2. Interviews with stakeholders (face to face, phone/skype);
3. Questionnaires/surveys with stakeholders, such as UNESCO staff and / or Partners.

Because of travel limitations due to the COVID-19 pandemic no field visits were conducted.

As part of the desk study the following documents were reviewed:

- ✓ UNESCO-Netherlands IGRAC Agreement (2016)
- ✓ Strategy for Category 2 Institutes and Centres under the Auspices of UNESCO (2019)
- ✓ Ministry of Infrastructure and Environment Subsidy Scheme for IGRAC 2016-2021
- ✓ IGRAC Foundation Board Minutes of Meeting, 2016, 2017, 2018, 2019, 2020 (5)
- ✓ IGRAC Annual Report 2016, 2017, 2018-2019 (3)
- ✓ Evaluation of the Category 2 Centre IGRAC 2011-2015 (2016)
- ✓ IGRAC Strategy 2019-2023 (2019)
- ✓ IGRAC Governing Board Minutes of Meeting, 2016, 2017, 2019 (3)
- ✓ IGRAC Work Plan 2020-2021
- ✓ IGRAC Financial Report 2016, 2017, 2018, 2019 (4)
- ✓ IGRAC Newsletter, Highlights 2016, 2017, 2018, 2019 (4)

In addition, a selection of IGRAC reports and publications were reviewed:

- ✓ SADC-GMI, IHE-DELFT and IGRAC (2020), Good practices for sharing groundwater geospatial data.
- ✓ SADC-GMI, IGRAC, IGS (2019) SADC Framework for Groundwater Data Collection and Data Management
- ✓ Groundwater Overview: Making the invisible visible (2018), IGRAC for UN-Water
- ✓ GGMN Portal Instruction Manual (2016), IGRAC
- ✓ User Manual MAR Portal
- ✓ Groundwater Monitoring in Small Island Developing States in the Pacific (2016)

In the next chapter the activities deployed by IGRAC during the review period (2016-2020) will be evaluated against the light of its objectives and strategic goals.

In the following chapter feedback from the interviews with and questionnaires from key international partners and institutions working in the field of groundwater management will be discussed to understand how the role of IGRAC is being perceived and how it's work contributes to the global groundwater agenda.

Based on the findings of these 2 review components conclusions and recommendations have been formulated on IGRAC's performance, key orientations and how IGRAC's role as the key global groundwater knowledge institute could be strengthened.

Evaluation of IGRAC's activities 2016-2019

IGRAC's Objectives

IGRAC's mission is to contribute to world-wide availability of relevant information and knowledge on the groundwater resources of the world, with particular emphasis on developing countries, in order to support sustainable utilisation and management of the groundwater resources, to promote the role of groundwater in integrated water resources planning and to elucidate the importance of groundwater for aquatic ecosystems.

As per the 2016 agreement between IGRAC and UNESCO the main objectives of the Centre shall be:

1. To contribute to achieving the Strategic Objectives of UNESCO and in particular to the implementation of the UNESCO-IHP programme through contribution to availability of relevant information and knowledge on groundwater resources of the world.
2. To promote sustainable groundwater resources utilization and management by developing tools to facilitate global exchange of knowledge in accordance with UNESCO's Open Access Policy. The Centre will continue to pursue in particular the following specific objectives:
 - a) Facilitate and promote groundwater monitoring and assessment, particularly at regional and global level;
 - b) Develop procedures and methodologies for collection and processing of groundwater related data and information necessary for informed groundwater management;
 - c) Contribute to the development of a Global Groundwater Information System;
 - d) Support UNESCO-IHP in carrying out groundwater related activities with all its partners in the promotion of groundwater related data compilation at the regional and global level;
 - e) Increase public awareness on groundwater resources sustainable use, and provide technical support in the area of media communication on this subject.
3. The Centre shall pursue the above objectives and perform the above-mentioned functions in close coordination with UNESCO-IHP.

UNESCO-IHP

IGRAC's objectives are closely linked to the UNESCO Intergovernmental Hydrological Programme (IHP), the only intergovernmental programme of the United Nations system devoted to water research and management, and related education and capacity development. The IHP started out in 1975 as an internationally coordinated hydrological research programme.

Since then, it has evolved to facilitate an interdisciplinary and integrated approach to watershed and aquifer management, incorporating the social dimension of water, and supports international cooperation in hydrological and freshwater sciences and at the interface with policy-makers, and reinforces institutional and individual capacities. The main objective of IHP's current, eighth phase (IHP-VIII 2014-2021) is to put science into action required for water security.

The Intergovernmental Hydrological Programme stimulates and encourages hydrological research and assists Member States in research and training activities. Its eighth phase focuses on six thematic areas:

1. water-related disasters and hydrological changes;
2. groundwater in a changing environment;
3. addressing water scarcity and quality;
4. water and human settlements of the future;
5. ecohydrology, engineering harmony for a sustainable world; and
6. water education, key to water security.

More details about the work under the UNESCO-IHP are included in Annex 5.

IGRAC's work is relevant to all thematic areas of the IHP although its activities contribute mostly to **thematic area 2, Groundwater in a changing environment**. Objectives of this thematic area include enhancing sustainable groundwater resources management, addressing strategies for management of aquifers recharge, adapting to the impacts of climate change on aquifer systems, promoting groundwater quality protection, promoting management of transboundary aquifers.

In order to achieve its objectives, for the remainder of the current Agreement period and beyond, IGRAC formulated its **Strategy 2019-23: Groundwater in a Changing World**, which adapts its work programme to the challenges of a world in which water scarcity is growing under global warming and innovative technology is facilitating new approaches to its core agenda.

The IGRAC objectives and core agenda are clearly aligned with the UN-Sustainable Development Goals for 2030 (especially those of SDG-6: Clean Water & Sanitation) and the UN-SDGs make a core reference for all major IGRAC activities.

For the period 2019-23 IGRAC is aiming to:

- ✓ Amplify products and services which support groundwater assessment, monitoring and management;
- ✓ Intensify strategic partnerships to achieve a stronger societal impact of its outputs;
- ✓ Improve the Centre in terms of increasing institutional strength and effectiveness.

IGRAC's achievements

Global Groundwater Monitoring Network (GGMN)

As the only global centre dedicated to groundwater assessment and monitoring, IGRAC contributes largely to IHP and to the work of a number of other United Nations agencies. Groundwater monitoring is one of the core activities of IGRAC, and the Global Groundwater Monitoring Network (GGMN) Programme continued with its mandate of improving quality and accessibility of groundwater monitoring information.

GGMN is a participative, web-based network of networks, set up to improve quality and accessibility of groundwater monitoring information and subsequently the knowledge on the state of groundwater resources. GGMN is a UNESCO programme, implemented by IGRAC and supported by many global and regional partners. The GGMN portal gives insights on the availability of groundwater monitoring data across space and time. Groundwater level data and changes occurring in groundwater levels can be displayed on a regional scale. Additional data layers and information are available to understand the monitoring data in a broader water-related context.

During the 2016-2019 period IGRAC has made significant progress in expanding the Global Groundwater Monitoring Network (GGMN):

- A new version of the GGMN portal was completed in 2016;
- In 2018, IGRAC has added new data and new functionalities to the GGMN portal. Automatic on-line data exchange using a so-called SOS connection with the Groundwater Information Network Canada sets an example for the future;
- Cooperation with national organisations in charge of groundwater monitoring has been extended, particularly in the Americas. In 2018, a total of 16.318 new wells from 8 different countries were added to the GGMN Portal, including data from Australia, Austria, Chile, Czech Republic, The Gambia, India, Spain and Switzerland. In addition, groundwater monitoring data for Brazil, Germany and Sweden were updated;
- In 2019 IGRAC released the GGMN app, a tool complementary to GGMN to assist groundwater specialists in the field, enabling them to georeference and register groundwater monitoring stations and groundwater level monitoring data without having to use paper forms;

IGRAC also contributes to several initiatives of the World Meteorological Organisation (WMO) related to groundwater monitoring, as the Global Climate Observation System (GCOS) through the Terrestrial Observation Panel for Climate (TOPC) and the WMO Global Hydrological Status and Outlook System (HydroSOS).

Global Groundwater Information System (GGIS)

The Global Groundwater Information System (GGIS) is an interactive, web-based portal to groundwater-related information and knowledge. The main purpose of the system is to assist in collection and analysis of information on groundwater resources and the sharing of this information among water experts, decision makers and the public. The GGIS consists of several modules structured around 6 themes: Transboundary Groundwater, Global Country Data, Managed Aquifer Recharge, Small Islands, Groundwater Monitoring and Project-related Modules. Each module has its own map-based viewer with underlying database to allow storing and visualizing geospatial data in a systematic way.

During the 2016-2019 period the Global Groundwater Information System (GGIS) was further updated and extended with a number of portals developed on request from the user community:

- The GGIS was expanded through an extended collaboration with the SADC-Groundwater Management Institute (SADC-GMI) based in Bloemfontein, South-Africa. In cooperation with the British Geological Survey (BGS) and the SADC, IGRAC has developed the Africa Portal dedicated to present and share information related to groundwater resources in Africa.
- The SADC Hydrogeological Atlas was developed as part of the Regional Groundwater Management Programme;
- IGRAC set up the Ramotswa Information Management System (RIMS) under the Ramotswa Transboundary Aquifer Project, involving South-Africa and Botswana;
- IGRAC continued to maintain the Transboundary Waters Assessment Programme (TWAP) information portal and finalised a follow-up TWAP study whereby a number of transboundary aquifers were evaluated based on their importance for humans and ecosystems, on their ability

to sustain current groundwater development rates, on identified pollution and on their vulnerability to climate change and pollution;

- The Mar Portal - the first structured database on Managed Aquifer Recharge sites globally - was presented during the 9th International Symposium on MAR (ISMAR9) in Mexico City in 2016, covering 1200 case studies from over 50 countries from around the whole world;
- During the 2016-2019 period IGRAC's contributions to the UNESCO-IHP further expanded (in particular to Focal Areas 2.4 and 3.4) through its efforts in compiling and sharing groundwater quality information, shared through the Groundwater Quality Portal in GGIS, and its contribution to global groundwater quality assessments, through the UN-Sustainable Development Agenda-2030 and the Global Water-Quality Assessment Programme;
- In 2019 EAWAG and IGRAC connected the on-line Groundwater Assessment Platform (GAP) and GGIS by sharing a number of groundwater quality maps. IGRAC also started an overview of national groundwater quality monitoring programmes and this work continued in 2020.

During the 2016-2019 period IGRAC initiated and participated in a range of activities focusing on groundwater knowledge generation & sharing, including:

- In 2016 WMO and IGRAC published a joint report on Groundwater Monitoring in Small Island Developing States in the Pacific;
- IGRAC's brief on 'Groundwater in the Context of the Sustainable Development Goals: Fundamental Policy Considerations' was published on the official United Nations Sustainable Development website and used as input to the 2016 Global Sustainable Development Report;
- In October 2016 IGRAC presented IGRAC's transboundary groundwater activities at UN Head Quarters in New York during a seminar on 'Groundwater Resources and the Law of Transboundary Aquifers' to highlight the importance of groundwater resources and transboundary aquifers in the framework of SDG 6 on water;
- In July 2017 Kirstin Conti successfully presented and defended her PhD thesis at the University of Amsterdam (UvA) Institute of Social Science Research and was awarded with a Doctoral degree on her research conducted with IGRAC on 'Norms in Multilevel Groundwater Governance & Sustainable Development';
- On World Water Day 2018 IGRAC launched the 'Groundwater overview: Making the invisible visible' during the World Water Forum in Brasilia;
- IGRAC gave a presentation on 'Initiatives towards sustainable groundwater management', during the G-WADI Global Conference that was held in October 2016 in Beijing, China;
- In July 2017 the World Bank and IGAD Secretarial organised a regional workshop to discuss and validate the outcome of the preliminary groundwater knowledge & capacity assessments in the Horn of Africa where IGRAC was invited to contribute on several subjects, namely: transboundary groundwaters, groundwater monitoring and Managing Aquifer Recharge (MAR);
- In 2018 IGRAC participated in the 2nd Latin-American Symposium on Monitoring of Groundwater in Belo Horizonte, Brazil to discuss monitoring techniques and best practices and the XIV Latin American Congress of Hydrogeology in Salta, Argentina where IGRAC presented the status of groundwater monitoring networks in Latin America in collaboration with CeReGAS;

- IGRAC gave a keynote lecture at the tenth biennial Rosenberg International Forum on Water Policy, in San Jose, California (October 2018). The Forum gathered scientists and practitioners from all over the world to discuss a state of groundwater resources globally and challenges of development and implementation of policies for long-term sustainability of groundwater;
- October 2018, IGRAC took part in the inception workshop for the ANBO project ‘Strengthening the institutional capacity of African Network of Basin Organization (ANBO), contributing to the improved transboundary water governance in Africa’ in Dakar, Senegal;
- In July 2018 IGRAC’s provided a keynote lecture at the AWRA (American Water Resources Association) summer conference in Fort Worth, Texas, dedicated to transboundary groundwaters. and participated in fruitful discussions throughout the conference.
- In April 2019 IGRAC participated and contributed to a special session on “Groundwater Pollution: Challenges and Opportunities for Action” during the World Bank Water Week in Washington DC;
- On IGRAC initiative, Friends of Groundwater also organised a side event at the 10th International Groundwater Quality Conference (GQ2019) in Liège, Belgium, informing the conference participants on various global groundwater quality activities and encouragings.

During the 2016-2019 review period capacity building remained an important part of IGRAC’s activities, becoming the main activity during the 2018-2019 period, also in part as follow-up of major data collection and management projects like the SADC Groundwater Information Portal. IGRAC has developed several courses, such as on Transboundary Aquifers, Groundwater Monitoring, Data and information Management, Managing Aquifer Recharge, Groundwater Governance. These courses are given on request of countries or regional organization, mostly in Africa and Asia:

- In October 2016, the international training on “Monitoring for Regional and Transboundary Groundwater Management” was held in Hanoi, Vietnam. This workshop was organised by IGRAC in cooperation with the National Center for Water Resources Planning and Investigation (NAWAPI) and the Ministry of Natural Resources and Environment (MONRE) Vietnam;
- Together with IHE Delft and the Institut National de l’Eau (INE) from Benin, IGRAC organised in October 2017 a tailor-made training on groundwater governance in Cotonou, Benin, funded by the Netherlands Fellowship Programmes (NFP) of Nuffic;
- IGRAC, IHE and Deltares organized a two-day training on groundwater governance and monitoring for a high-level delegation from Thailand (March 2017). In July 2018 IGRAC organized in Bangkok a 3-day training on Groundwater Governance for 80 professionals of the Thailand Department of Groundwater;
- IGRAC organised an expert meeting on groundwater management and development of a numerical model for the Pretashkent Aquifer, shared between Republic of Kazakhstan and Republic of Uzbekistan. The meeting took place in Tashkent (May 2018);
- IGRAC was also one of the partners in the 2nd phase of the Ramotswa project, further developing the Ramotswa Information Management System and ‘institutionalising’ the system through capacity development to ensure the management of the system after the lifespan of the project;

- IGRAC is leading the project Capacity Building on Groundwater Data Collection and Management for SADC Member States (SADC-GWdataCoM), financed by the SADC-GMI executed together with the Institute of Groundwater Studies (from the University of the Free State, in South Africa);
- In January 2019 the Regional Centre for Groundwater Resources Education, Training and Research in East Africa organised a regional training programme on Integrating Groundwater Management within River Basins in partnership with UNESCO-IHP, IGRAC, BGR and KEWI;
- October 2019, IGRAC carried out the International Training Course on Monitoring for Regional and Transboundary Groundwater Management at the UNDP Azerbaijan Country Office in Baku, Azerbaijan. This training was co-organised within the framework of the UNDP-GEF Kura Project.

IGRAC is associated partner in the Erasmus Master's Programme Groundwater and Global Change - Impacts and Adaptation (GroundwatCH) conducted by IHE Delft (the Netherlands), IST Lisbon (Portugal), and TU Dresden (Germany) and has supervised several MSc. research projects. IGRAC has provided various guest lectures at IHE-Delft and also served as external examiner for MSc thesis in several occasions.

IGRAC also fulfils an important role in raising awareness on the importance of groundwater and its unique challenges through its contributions to a series of United Nations World Water Development Reports prepared by the UNESCO WWAP. Together with the UNESCO-IHP, IGRAC has been very active in mobilizing support for the 2022 World Water Day on Groundwater and has been instrumental in getting the partners together. UN-Water decided that "Groundwater: making the invisible visible" – proposed by IGRAC – will be the theme for the World Water Day 2022.

Linkages to the Sustainable Development Goals

In the coming decades, sustainable utilization of groundwater resources will be critical to achieving sustainable development at large, and the SDGs of UN Agenda 2030 in particular. Even if only one target (target 6.6 on water-related ecosystems) references groundwater explicitly in target wording, fifty-three (53) targets have interlinkages with groundwater use, management and/or sustainability¹.

Although groundwater literature globally is substantial and growing, there is still a paucity of well-structured, globally useful, up-to-date and SDG-relevant groundwater data available. This means that making globally relevant recommendations for groundwater use, management and sustainability in the SDG era is difficult and plagued with uncertainty.

Seen in this light, IGRAC's role in compiling and disseminating groundwater data is critical to achieving the SDG agenda.

¹ Guppy, L., Uyttendaele, P., Villholth, K. G., Smakhtin, V. 2018. Groundwater and Sustainable Development Goals: Analysis of Interlinkages. United Nations University Institute for Water, Environment and Health, Report Series, Issue 04.

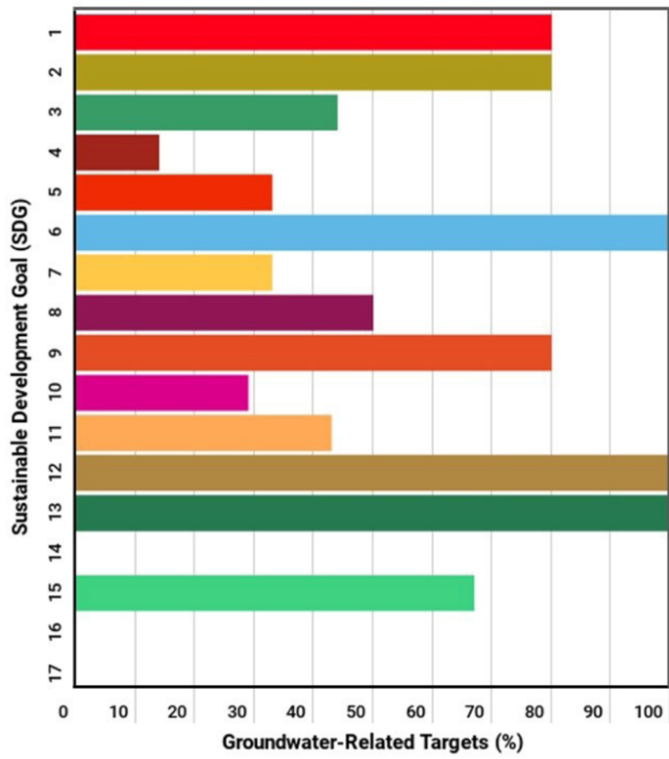


Figure 1 – Percentage of groundwater-related targets per SDG (from Guppy et al., 2018)

IGRAC's financial Situation

During the first four years (2016-2019) of its new agreement with UNESCO as a Category 2 Centre IGRAC has received a baseline financial contribution of Euro 1,600,000 from the Dutch Ministry of Infrastructure and Environment (MIE), and has captured substantial additional funding from extra-budgetary projects, bringing the total funding during the 2016-19 period to Euro 2,218,000 (see table below).

Budget component	2015	2016	2017	2018	2019	2016-19
Baseline financial contribution	500,000	400,000	400,000	400,000	400,000	1,600,000
Extra-budgetary income	387,520	77,519	95,508	277,749	166,745	617,521
TOTAL INCOME	887,520	477,519	495,508	677,749	566,745	2,217,521
Staff remuneration, insurance and pension	298,901	245,866	301,544	363,819	347,104	1,258,333
Consultants	20,998	74,419	28,254	8,823	14,240	125,736
Project expenses	274,828	311,376	25,220	172,113	102,706	611,415
Housing, office and other fixed expenses	158,169	111,295	109,688	115,119	111,209	447,311
TOTAL EXPENSES	752,896	742,956	464,706	659,874	575,259	2,442,795
Interest	6,783	-1,327	435	-558	260	-1,190
Balance	141,407	-266,764	31,237	17,317	-8,254	-226,464
Own reserve	559,331	292,567	323,804	341,121	332,867	
Obligations	36,831	41,102	42,024	278,520	30,367	
Available reserve	522,500	251,465	281,780	62,601	302,500	

Table 1 – Evolution of IGRAC budget over the period 2016-2019. The last year of the previous agreement is shown for reference (all amounts in euro).

Termination of long-term projects commissioned by UNESCO-IHP and reduction of core financing led to a substantial decrease of IGRAC turnover in 2016. In response IGRAC increased its efforts to compensate these setbacks through acquisition of new projects and invested about 15% of its total working hours on project acquisition.

Figure 1 shows how, as a result of these project acquisition efforts, income has steadily grown in the following years with 2018 being the most successful till date. However, income has not reached the 2015 levels, in part also because of the absence of new projects commissioned by UNESCO. As can be seen from Figure 1, the structural reduction in income also led to a reduction in the available reserve level, making IGRAC more vulnerable to fluctuations in its income.

IGRAC has currently a staff of 6, including a Director, 4 researchers and a communication specialist. Project acquisition and implementation of consultancy assignments claim a non-negligible share of their time, reducing the time available for IGRAC's core tasks, groundwater assessment and monitoring.

The budget projections for the 2020 – 2021 period foresee a modest grow in external project funding. In line with its 2019 – 2023 strategy IGRAC's core agenda for these years is to intensify global advocacy and awareness, to amplify products and services which support groundwater assessment, monitoring and management, and to improve the Centre in terms of strategic partnership, increasing institutional strength and technological effectiveness.

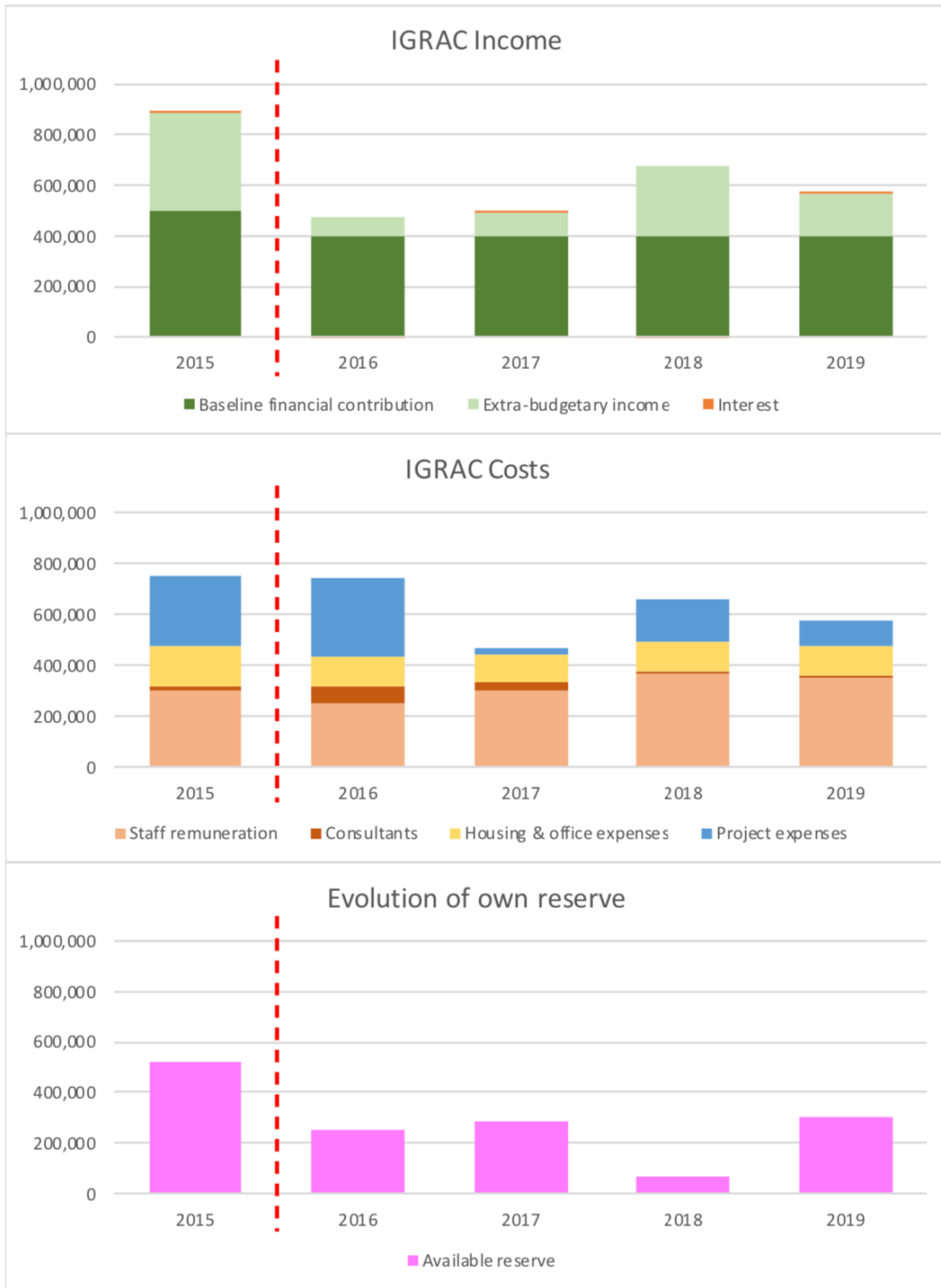


Figure 2 – Evolution of IGRAC income, costs and reserve for the period 2016-2019 (all amounts in euro)

Stakeholder Survey

Survey design

A survey among key stakeholders has been conducted with the objective to gauge how IGRAC's role and work is perceived by its partners, which part of IGRAC's work is most relevant to the global groundwater community and how their role could be further strengthened.

A total of 17 organizations and institutions has been contacted, as shown in Table 2 below. Contacted institutions include UN agencies, multi-lateral donors, global and regional groundwater knowledge institutes and national governments and agencies. Fourteen organizations returned the questionnaire and/or participated in an online interview.

The filled questionnaires and interview summaries are attached in Annex 4.

Partner	Contact person	Questionnaire	Interview
IHE-Delft	Eddy Moors	X	
BGS UK	Alan MacDonald	X	X
BGR Germany	Ralf Klingbeil	X	
IAH secretary general	Bruce Misster	X	
IWMI	Karen Villholth		X
Government of Thailand	Arissara Painmanakul	X	
SADC-GMI	James Sauramba	X	
CeReGAS	Alberto Manganeli	X	
UNECE Water Convention	Sonja Koeppel	X	
Geological Survey of Canada	Alfonso Rivera	X	
GEF	Astrid Hillers		
WMO	Dominique Berod	X	
UN-Water	Federico Properzi		X
UNESCO-IHP	Alice Aureli	X	
NL Ministry of I&W	Monique Berendsen		
NL MFA	Aart van der Horst		
World Bank	Lucy Lytton	X	

Table 2 – List of contacted organizations for the stakeholder survey and received responses

Key Observations from Stakeholder Survey

- ✓ IGRAC's expertise and leadership in moving the global groundwater assessment and dissemination of critical groundwater information is recognized by all contacted UN, scientific and donor organizations;
- ✓ IGRAC has a strong mandate to fulfill its critical role in the effort to build a global knowledge base on groundwater. IGRAC's contribution to this collective effort is seen as critical and receives full support. IGRAC should focus on monitoring, data curation and dissemination of groundwater

information and should not disperse, in order to achieve a critical mass of shared groundwater knowledge, essential to the implementation of the SDG agenda;

- ✓ IGRAC should develop an ambitious strategy to develop GGMN and bring more data, give it more visibility and expand its use. Together with UNESCO-IHP and other partners, promote support for monitoring, data curation and archiving and develop incentives (participation in research efforts, access to funding, etc.). Can donors systematically include data archiving clauses in their contracts? Maximize value of partnerships and connect to initiatives. Develop links to 3rd party data sets like FAO-AQUASTAT, UNEP-GEMS, etc;
- ✓ IGRAC should strengthen collaboration, capacity building efforts and data exchange practices with regional groundwater institutes like SADC-GMI (Southern Adrica), IGAD (Horn of Africa), OSS (Northern Africa and Sahel), CEREAS (Latin America and Caribbean) and RCGRE (East Africa);
- ✓ IGRAC should continue to engage in advocacy and building partnerships to promote the importance of groundwater data compilation, sharing and dissemination;
- ✓ An unequivocal independent and neutral status (UN) is essential in convincing countries to share data. Avoid conflicts of interest by working as a consultant that could benefit from the data put at your disposal;
- ✓ Besides core groundwater data, IGRAC should continue and expand the generation of global groundwater related global overviews and develop key information products that are relevant for donors and other knowledge institutions, for example on the status of monitoring networks, data availability and emerging groundwater issues. Partners and donors may have unrealistic expectations about what it takes to compile global groundwater data so it is important to identify relevant and achievable objectives;
- ✓ As global data sets are used more and more used in a wide range of interdisciplinary research, provide information with the necessary guidance and recommendations how to use modeled and remotely sensed data and engage with research institutes and universities;
- ✓ IGRAC might consider to expand staff by providing research opportunities for post-graduate or PhD students (from IHE and other universities) that contribute to groundwater data compilation and analysis. Maximize work force by deepening the partnership with IHE and other universities. Engage PhD students and post-graduate students in targeted research opportunities or secondment of staff from other groundwater centres and institutions;

Conclusions and Recommendations

Conclusions

Based on the review of IGRAC's activities and budget during the 2016 – 2019 period in the light of the objectives of its 2016 agreement with UNESCO and the feedback received from stakeholders the following observations can be made:

- ✓ IGRAC has obtained significant results towards the achievement of each of the specific objectives listed in the 2016 UNESCO-IGRAC Agreement, making tangible contributions to achieving the Strategic Objectives of UNESCO and in particular to the implementation of the UNESCO-IHP Programme;
- ✓ As the only global centre dedicated to groundwater assessment and monitoring, IGRAC's role is more important than ever. IGRAC's role in compiling and disseminating groundwater data is critical to achieving the Sustainable Development Goals-2030 agenda. Efforts to expand and update GGIS should remain a key priority
- ✓ IGRAC's efforts in raising global awareness on the importance of groundwater have been successful. Together with the UNESCO-IHP, IGRAC has been very active in mobilizing support for the 2022 World Water Day on Groundwater and has been instrumental in getting the partners together. Raising awareness about the importance of groundwater monitoring and assessment, especially through collaborative efforts with other UN-Water member/partner agencies, should remain a priority;
- ✓ During recent years IGRAC has made a substantial contribution to the global groundwater quality assessment efforts through the UN-Sustainable Development Agenda-2030 and the Global Water-Quality Assessment Programme. As groundwater quality deterioration is an increasing threat to the sustainable use of groundwater resources across the globe, these efforts should be maintained;
- ✓ IGRAC's expertise and leadership in moving the global groundwater assessment and dissemination of critical groundwater information is recognized by all contacted UN, scientific and donor organizations;
- ✓ A strong profile and an unequivocal independent and neutral status as a UN-affiliated centre is essential in convincing countries and partners to continue to share data.

Recommendations

- ✓ GGMN has to be regarded as the most critical component of IGRAC development. IGRAC should develop an ambitious strategy to develop GGMN and bring more data, give it more visibility and expand its use;
- ✓ There is still a paucity of well-structured, globally useful, up-to-date and SDG-relevant groundwater data available. IGRAC's role in compiling and disseminating groundwater data is critical to achieving the SDG-2030 agenda and efforts to expand and update GGIS should remain a key priority;

- ✓ Besides core groundwater data, IGRAC should continue and expand the generation of groundwater related global overviews and develop key information products that are relevant for donors and other knowledge institutions, for example on the status of monitoring networks, data availability and emerging groundwater issues;
- ✓ IGRAC should step up efforts on its core tasks of maintaining and expanding the GGIS and GGMN but funding is challenging. IGRAC should find ways to expand its structural core funding because acquisition and implementation of externally funded activities claims a significant share of the time of IGRAC researchers and potentially diluting the strong institutional image that IGRAC has built;
- ✓ IGRAC should continue to explore synergies with regional groundwater organisations and global partners and pursue engagement in regional, transboundary and large-aquifer groundwater assessments as opportunities arise with the aim of developing specific data compilation and curation initiatives to expand the impact of IGRAC work;
- ✓ Increased coordination with donor organisations is required to ensure data archiving efforts in publicly accessible databases are systematically included in groundwater projects and studies.
- ✓ Capacity building in groundwater monitoring, assessment and management being a key objective of IGRAC, the collaboration with IHE-Delft should be strengthened by working more closely together on assignments both from Dutch ministries and international institutions and by facilitating PhD and Post-Graduate research on sustainable groundwater management issues;
- ✓ **It is recommended that IGRAC's status as a UNESCO Category 2 Centre should be renewed, in recognition of the quality of their work and the strategic importance of groundwater monitoring and assessment globally.**

ANNEX 1 – 2016 AGREEMENT BETWEEN THE UNITED NATIONS EDUCATIONAL,
SCIENTIFIC AND CULTURAL ORGANIZATION, AND THE KINGDOM OF THE NETHERLANDS,
REGARDING THE INTERNATIONAL GROUNDWATER RESOURCES ASSESSMENT CENTRE IN
THE NETHERLANDS AS A CENTRE UNDER THE AUSPICES OF UNESCO (CATEGORY 2)

AGREEMENT BETWEEN
THE UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL
ORGANIZATION,
AND
THE KINGDOM OF THE NETHERLANDS,
REGARDING
THE INTERNATIONAL GROUNDWATER RESOURCES ASSESSMENT CENTRE
IN THE NETHERLANDS
AS A CENTRE UNDER THE AUSPICES OF UNESCO (CATEGORY 2)

The United Nations Educational, Scientific and Cultural Organization,
and

The Kingdom of the Netherlands,

Recalling that the General Conference of UNESCO, at its 34th session (34 C/Resolution 26) approved the establishment of the International Groundwater Resources Assessment Centre (IGRAC) as a centre under the auspices of UNESCO (category 2) and authorized the Director General to sign the corresponding agreement,

Recalling that the Agreement between the Kingdom of the Netherlands, and the United Nations Educational, Scientific and Cultural Organization, concerning the establishment and operation of the International Groundwater Resources Assessment Centre in the Netherlands as a category 2 centre under the auspices of UNESCO was concluded in Paris on 15 November 2011,

Considering that the Executive Board at its 200th session decided to renew to IGRAC the category 2 status under the auspices of UNESCO and authorized the Director General to sign the corresponding agreement (include reference to EXB decision when adopted),

Having regard to the Medium-Term Strategy for 2014-2021, approved by UNESCO's General Conference at its 37th session (37 C/4),

Underlining that Strategic Objective 4 of the said Strategy is “Strengthening science, technology and innovation systems and policies – nationally, regionally and globally”, and that its Strategic Objective 5 is “Promoting international scientific cooperation on critical challenges to sustainable development”,

Acknowledging the importance of applying the guidelines and criteria for category 2 institutes and centres adopted by the General Conference in the Integrated Comprehensive Strategy for Category 2 Institutes and Centres under the auspices of UNESCO (37 C/Resolution 93),

Desirous of defining the terms and conditions governing the framework for cooperation with UNESCO that shall be granted to IGRAC in the present Agreement,

HAVE AGREED AS FOLLOWS:

Article 1 – Definitions

1. In this agreement, “UNESCO” refers to the United Nations Educational, Scientific and Cultural Organization.
2. “Government” means the Government of the Netherlands.
3. “Centre” means the International Groundwater Resources Assessment Centre (IGRAC).
4. “UNESCO-IHP” refers to UNESCO’s International Hydrological Programme.

Article 2 – Operation of the Centre

The Government agrees to take, in the course of the year 2017, any measures that may be required for the continuation of the Centre in the Netherlands as provided for under the present Agreement.

Article 3 – Purpose of the Agreement

1. The purpose of this Agreement is to define the terms and conditions governing collaboration between UNESCO and the Government and also the rights and obligations stemming therefrom for the Parties.

Article 4 – Legal Status

4.1 The Centre shall be independent of UNESCO, and shall operate and act under Dutch law as an independent organization.

4.2 The Government shall ensure that the Centre enjoys within its territory the functional autonomy necessary for the execution of its activities and the legal capacity:

to contract;

to institute legal proceedings;

to acquire and dispose of movable and immovable property.

Article 5 – Constitutive Act

The constitutive act of the Centre shall include provisions describing precisely:

- (a) the legal status granted to the Centre, within the national legal system, the legal capacity necessary to exercise its functions and to receive funds obtain payments for services rendered, and acquire all means necessary for its functioning;
- (b) a governing structure for the Centre allowing UNESCO representation within its Governing Board.

Article 6 – Functions/Objectives

The mission of the Centre is to contribute to world-wide availability of relevant information and knowledge on the groundwater resources of the world, with particular emphasis on developing countries, in order to support sustainable utilisation and management of the groundwater resources, to promote the role of groundwater in integrated water resources planning and to elucidate the impact of groundwater on the ecosystems of the Earth. The main objectives of the Centre shall be:

1. To contribute to achieving the Strategic Objectives of UNESCO and in particular to the implementation of the UNESCO IHP programme through contribution to

availability of relevant information and knowledge on groundwater resources of the world.

2. To promote sustainable groundwater resources utilisation and management by developing tools to facilitate global exchange of knowledge in accordance with UNESCO's Open Access Policy.

The Centre will continue to pursue in particular the following specific objectives:

- (a) Facilitate and promote groundwater monitoring and assessment, particularly at regional and global level;
 - (b) Develop procedures and methodologies for collection and processing of groundwater related data and information necessary for informed groundwater management;
 - (c) Contribute to the development of a Global Groundwater Information System
 - (d) Support UNESCO-IHP in carrying out groundwater related activities with all its partners in the promotion of groundwater related data compilation at the regional and global level;
 - (e) Increase public awareness on groundwater resources sustainable use, and provide technical support in the area of media communication on this subject.
3. The Centre shall pursue the above objectives and perform the above-mentioned functions in close coordination with UNESCO-IHP.

Article 7 – Governing Board

1. The Centre shall be guided and overseen by a Governing Board which shall include:
 - (a) a representative of the Government or his/her appointed representative, who will be the Chairperson;
 - (b) representatives of Member State(s), which have sent to the Centre notification for membership, in accordance with the stipulations of article 10, paragraph 2 and have expressed interest in being represented on the Board and substantially contributing to the activities of the Centre;
 - (c) a representative of the Director-General of UNESCO;

- (d) representatives from regional, international and intergovernmental organizations that are able to contribute to the activities of the Centre.
2. The Governing Board shall:
- (a) approve the long-term and medium-term programmes of the Centre;
 - (b) approve the annual work plan of the Centre, including the staffing table;
 - (c) examine the annual reports, including biennial self-assessment reports of the Centre's contribution to UNESCO's programme objectives;
 - (d) examine the periodic independent audit reports of the financial statements of the Centre and monitor the provision of such accounting records necessary for the preparation of financial statements;
 - (e) adopt the rules and regulations and determine the financial, administrative and personnel management procedures for the Centre in accordance with the laws of the Netherlands;
 - (f) decide on the participation of intergovernmental organizations and international organizations in the work of the Centre.
3. The Governing Board shall meet in ordinary session at regular intervals, at least once every calendar year; it shall meet in extraordinary session if convened by its Chairperson, either on his or her initiative or at the request of the Director-General of UNESCO or of the majority of its members.
4. The Governing Board will follow its own rules of procedure as decided at its first meeting.

Article 8 – UNESCO's Contribution

1. UNESCO may provide assistance, as needed, in the form of technical assistance for the programme activities of the Centre, in accordance with the strategic goals and objectives of UNESCO by:
- (a) providing the assistance of its experts in the specialized fields of the Centre;

- (b) engaging in temporary staff exchanges when appropriate, whereby the staff concerned will remain on the payroll of the dispatching organizations;
 - (c) seconding members of its staff temporarily, as may be decided by the Director-General on an exceptional basis if justified by the implementation of a joint activity/project within a strategic programme priority area;
 - (d) encouraging intergovernmental and non-governmental financial entities, as well as member states of UNESCO, to provide financial and technical assistance and to propose appropriate projects to the Centre, and by facilitating contacts with other international organizations relevant to the functions of the Centre;
 - (e) providing the Centre with IHP publications and other pertinent materials and disseminating information on the activities of the Centre via the UNESCO-IHP website, newsletters and other mechanisms at its disposal;
 - (f) participating, when appropriate, in the scientific and training meetings held by the Centre. The costs of such participation will be borne by the Centre.
- 2 In all the cases listed above, such assistance shall not be undertaken except within the provisions of UNESCO's programme and budget, and UNESCO will provide Member States with accounts relating to the use of its staff and associated costs.
- 3 UNESCO may contract the Centre to implement concrete programme activities envisaged in UNESCO's approved work plans in accordance with UNESCO's rules and regulations.

Article 9 – Contribution by the Government

1.The Government shall provide resources, either financial or in kind, needed for the administration and proper functioning of the Centre.

2.The Government thereto undertakes to make available to the Centre an annual subsidy of 400 000 Euro (four hundred thousand Euros) per year until 31st December 2021;

Article 10 – Participation

1. The Centre shall encourage the participation of Member States and Associate Members of UNESCO which, by their common interest in the objectives of the Centre, desire to cooperate with the Centre.
2. Member States and Associate Members of UNESCO wishing to participate in the Centre's activities, as provided for under the present Agreement, shall send to the Centre notification to this effect. The Centre shall inform the Parties to the agreement and other Member States of the receipt of such notifications.

Article 11 – Responsibility

As the Centre is legally separate from UNESCO, the latter shall not be legally responsible for the acts or omissions of the Centre, and shall not be subject to any legal process, and/or bear no liabilities of any kind, be they financial or otherwise, with the exception of the provisions expressly laid down in the present Agreement.

Article 12 – Evaluation

1. UNESCO may, at any time, carry out an evaluation of the activities of the Centre in order to ascertain whether:
 - (a) the Centre makes a significant contribution to UNESCO's strategic programme objectives and expected results aligned with the four-year programmatic period of C/5 document (Programme and Budget), including the two global priorities of UNESCO, and related sectoral or programme priorities and themes;
 - (b) the activities effectively pursued by the Centre are in conformity with those set out in the present Agreement.
2. UNESCO shall, for the purpose of the review of this Agreement, conduct an evaluation of the contribution of the Centre to UNESCO's strategic programme objectives, to be funded by the Government or the Centre.

3. UNESCO undertakes to submit to the Government, at the earliest opportunity, a report on any evaluation conducted.
4. Following the results of an evaluation, each of the Parties shall have the option of requesting a revision of its contents or of denouncing the Agreement, as envisaged in Articles 17 and 18.

Article 13 – Use of UNESCO name and logo

1. The Centre may mention its affiliation with UNESCO. It may therefore use after its title the mention “under the auspices of UNESCO”.
2. The Centre is authorized to use the UNESCO logo or a version thereof on its letter headed paper and documents including electronic documents and web pages in accordance with the conditions established by the governing bodies of UNESCO.

Article 14 – Territorial application

With respect to the Kingdom of the Netherlands, this Agreement shall apply to the European part of the Netherlands.

Article 15 – Entry into force

This Agreement shall enter into force, following its signature by the Parties, when they have informed each other in writing that all the formalities required to that effect by the domestic law of the Kingdom of the Netherlands and by UNESCO’s internal regulations have been completed. The date of receipt of the last notification shall be deemed to be the date of entry into force of the present Agreement.

Article 16 – Duration

This Agreement will expire the 31st December 2021. The Agreement shall be renewed upon common agreement between the Parties once the Executive Board made its comments based on the results of the renewal assessment provided by the Director-General.

Article 17 – Denunciation

1. Each of the Parties shall be entitled to denounce the present Agreement unilaterally.
2. The denunciation shall take effect on the thirtieth day following the receipt of the notification sent by one of the Parties to the other.

Article 18 – Revision

This Agreement may be revised by written consent between the Government and UNESCO.

Article 19 – Settlement of Disputes

1. Any dispute between UNESCO and the Kingdom of The Netherlands concerning the interpretation or application of this Agreement, if not settled by negotiation or any other appropriate method agreed to by the Parties within three months after one Party giving notice to the other Party, shall be submitted for final decision to an arbitration tribunal. The tribunal shall be composed of three members, one of whom shall be appointed by the Government, another by the Director-General of UNESCO, and a third, who shall preside over the tribunal, shall be chosen jointly by the first two. If the two arbitrators cannot agree on the choice of a third, the appointment shall be made by the President of the International Court of Justice. The language of the arbitration will be English.
2. The Tribunal's decision shall be final.

IN WITNESS WHEREOF, the undersigned have signed this Agreement,

DONE in Paris, in two copies in the English language, on

.....

For the United Nations Educational,
Scientific and Cultural Organization

.....

For the Kingdom of the Netherlands

Annex 2 - Renewal procedure for UNESCO's Category 2 Centres

UNESCO document 40C/79 – Annex Section E.2

The renewal procedure for category 2 institutes or centres shall comprise four stages:

(i) Renewal evaluation

- (a) UNESCO will launch the renewal process with communication to the Member UNESCO State(s) and category 2 institute or centre, reminding them of the impending termination of the agreement and status of institute or centre under the auspices of UNESCO.
- (b) Should the Member State(s) and the category 2 institute or centre wish to renew the designation of institute or centre under the auspices of UNESCO, the Member State(s) shall, cognizant of the timeline required by the Member State's national procedures for entry into force, submit twenty-four to thirty-six months prior to the expiration of the agreement, a request for renewal of the agreement. Further to this submission, an evaluation of the activities of the institute or centre and of its contribution to UNESCO's Approved Programme and Budget (C/5), including global strategies and action plans as well as sectoral programme priorities, shall be conducted by a team of gender-balanced independent experts, in line with the provisions of this Strategy. The conclusions of the renewal evaluation shall serve as the basis for the Intersectoral Review Committee's recommendations to the Director-General as to whether an agreement with a category 2 institute or centre should be renewed or not.
- (c) UNESCO Programme Sectors shall be responsible for the management of the renewal evaluation and contracting the independent experts in accordance with its rules and regulations. In consultation with the global coordination focal point, Programme Sectors shall draft the terms of reference of the renewal evaluation and select the independent experts who shall be responsible for conducting the evaluation and preparing the report. The category 2 institute or centre or the Member State(s) concerned shall cover all costs related to the renewal evaluation.
- (d) The following parameters shall be considered by the independent experts contracted to undertake the renewal evaluation. The independent experts shall have had no prior affiliation with the institute or centre, and shall draft the renewal evaluation in English or French:
 1. the extent to which the institute or centre's objectives as set out in the agreement signed with UNESCO were achieved;
 2. the relevance of the contribution of the institute or centre's programmes and activities to the achievement of UNESCO's prevailing Approved Programme and Budget (C/5) at the time in which it was designated, including global strategies and action plans as well as sectoral programme priorities, as defined in the agreement;
 3. the relevance of the contribution of the activities of the institute or centre to global development agendas;

4. the quality of coordination and interaction with UNESCO, both at Headquarters and in the field, as well as with National Commissions, other thematically-related category 1 and 2 institutes or centres with regard to planning and implementation of programmes;
5. the partnerships developed and maintained with government agencies, public or private partners and donors;
6. the nature and efficiency of the institute or centre's governance, including organizational arrangements, management, human resources and accountability mechanisms;
7. the financial resources available for ensuring sustainable institutional capacity and viability, and,
8. the extent to which the institute or centre enjoys within its territory the autonomy necessary for the execution of its activities and legal capacity to contract, institute legal proceedings, and to acquire and dispose of movable and immovable property.

The conclusions of the renewal evaluation shall be shared with the category 2 institute or centre and Member State(s) concerned and the report made available on the relevant Programme Sectors website.

- (e) The renewal agreement, which shall conform to the provisions of the model and take into consideration the recommendations of the evaluation report, shall be prepared by UNESCO in consultation with the Member State(s) concerned and the category 2 centre or institute.
- (f) The renewal evaluation, including the negotiations with the Member State(s) and the category 2 institute or centre on the draft agreement, must be completed two months prior to the examination by the Intersectoral Review Committee of the renewal evaluation report and the draft agreement.

(ii) Assessment by the Intersectoral Review Committee

The Intersectoral Review Committee shall examine all renewal evaluation reports and their corresponding draft agreements during the months of: April - for submission of recommendations to the autumn session of the Executive Board -, and October for submission to the spring session of the Executive Board.

(iii) Examination and approval by the Executive Board

- (a) The Director-General shall provide recommendations as to whether the designation as category 2 institute or centre under the auspices of UNESCO should be renewed or not based on the outcomes of the assessment by the Intersectoral Review Committee, in his or her report to the Executive Board.
- (b) The Executive Board shall examine all renewal requests submitted to it by the Director-General and decide on the renewal or non-renewal of the designation of the institution as a category 2 institute or centre under the auspices of UNESCO and authorize the Director-General to conclude an agreement between UNESCO, the Member State(s) concerned and the category 2 institute or centre. Once the renewal of the designation and the agreement are approved by the Executive Board, the terms of the draft agreement may no longer be modified.

(iv) Signature of agreement and entry into force

- (a) The agreement for the renewal of the designation of a category 2 institute or centre under the auspices of UNESCO, to be concluded for a maximum period of eight years, shall enter into force on the date of the signature of the agreement by UNESCO, the Member State(s) concerned and the category 2 institute or centre. Alternatively, and at the request of the Member State(s), the date of entry into force may be the date of receipt by UNESCO of a letter from the Member State(s) informing of the completion of national procedures required for the entry into force of the agreement. In the event that signing of a tripartite agreement is not feasible for a Member State, UNESCO and the Member State shall enter into a bipartite agreement containing similar provisions to those included in the model tripartite agreement. UNESCO will also enter into an agreement with the proposed institution, which could take the form of a Memorandum of Understanding or an exchange of letters, in order for the institution to accept the rights and obligations that are incumbent upon it pursuant to the granting of the Category 2 status under the auspices of UNESCO.
- (b) If the agreement has not entered into force within the period of two years following the decision of the Executive Board, the designation of category 2 institute or centre under the auspices of UNESCO shall be considered null and void. Should the Member State(s) concerned wish to pursue the designation of category 2 status for the institution, the process shall be reactivated by the submission of a proposal to UNESCO in compliance with E.1.1.
- (c) Institutes and Centres may only use the designation of category 2 institutes and centres under the auspices of UNESCO in the presence of a valid agreement with UNESCO and the Member State(s) concerned. In the absence of a valid agreement, the institute or centre may not use UNESCO's name and/or logo, and the Member State(s) concerned will be held accountable for protecting the integrity of UNESCO's name and logo from abuse within its territory.

**Terms of Reference
for the Evaluation of the
International Groundwater Resources Assessment Centre (IGRAC) in
Delft, The Netherlands,
as a Category 2 Centre under the auspices of UNESCO**

1. BACKGROUND INFORMATION

1.1. Historical background

In the recent past, UNESCO has established a number of Category 2 centres (C2C) in the field of water management. These centres serve in their fields of specialization as international or regional centres and pools of expertise to provide services and technical assistance to Member States, cooperation partners and also internally to the network of UNESCO field offices. In this context, the water-related Category 2 centres (WC2C) are expected to contribute directly to attaining the strategic objectives and programmatic priorities of UNESCO's Intergovernmental Hydrological Program (IHP).

The International Groundwater Resources Assessment Centre (IGRAC) in Delft, The Netherlands, is one of UNESCO's 36 water-related Category 2 centres.

The International Groundwater Resources Assessment Centre in the Netherlands as a centre under the auspices of UNESCO (category 2), was established through an Agreement signed on 15 November 2011, renewed on 6 December 2016 and entered into force on 23 August 2017. It will expire, in accordance with its own provisions, on 31 December 2021. The Government of The Netherlands, through the Ministry of Infrastructure and Water Management, expressed its willingness to submit IGRAC to evaluation, in order to renew the Agreement for the continuation of its activities. Depending on the outcome of the renewal evaluation, the Kingdom of the Netherlands also expressed the wish to explore the legal scope for strengthening cooperation between IGRAC and the IHE Delft Institute for Water Education.

For more information on the Centre, please consult the IGRAC's webportal:

<https://www.un-igrac.org/>

1.2. Status of the Centre

IGRAC is independent of UNESCO. The Centre enjoys, in accordance with the laws and regulations of The Netherlands, the functional autonomy necessary for the execution of its activities, and the legal capacity to contract, institute legal proceedings, and acquire and dispose of movable and immovable property.

1.3. Purpose of the Centre

Since 2003, IGRAC facilitates and promotes sharing of groundwater information and knowledge,

focusing from early days on aquifer assessment and groundwater monitoring. Gradually, IGRAC is expanding its interest to other groundwater-related topics, such as governance, training and climate change adaptation.

IGRAC's mission is to contribute to world-wide availability of relevant information and knowledge on the groundwater resources of the world, with particular emphasis on developing countries, in order to support sustainable utilisation and management of the groundwater resources, to promote the role of groundwater in integrated water resources planning and elucidate the impact of groundwater on the ecosystems of the Earth. The main objectives of the Centre are:

1. To contribute to achieving the Strategic Objectives of UNESCO and in particular to the implementation of the UNESCO IHP programme through contribution to availability of relevant information and knowledge on groundwater resources of the world.
2. To promote sustainable groundwater resources utilization and management by developing tools to facilitate global exchange of knowledge in accordance with UNESCO's Open Access Policy.

The Centre pursues in particular the following specific objectives:

- a) Facilitate and promote groundwater monitoring and assessment, particularly at regional and global level;
 - b) Develop procedures and methodologies for collection and processing of groundwater related data and information necessary for informed groundwater management;
 - c) Contribute to the development of a Global Groundwater Information System;
 - d) Support UNESCO-IHP in carrying out groundwater related activities with all its partners in the promotion of groundwater related data compilation at the regional and global level;
 - e) Increase public awareness on groundwater resources sustainable use, and provide technical support in the area of media communication on this subject.
3. The Centre shall pursue the above objectives and perform the above-mentioned functions in close coordination with UNESCO-IHP.

1.4. Rationale for the review and underlying principles

Document 40 C/79 and its annexes, as adopted by the UNESCO General Conference (November 2019), contains the 2019 Strategy for Category 2 Centres, as currently applied to all proposals for the establishment of category 2 institutes and centres, and all renewals of existing agreements. The principles of the evaluation are set out in the same document.

1.5. Budget

As per paragraph D.2 of document 40C/79, the Institution or the Government shall meet the costs of the feasibility study related to the renewal evaluation for the Centre, including the mission costs of the expert(s), and possibly the visit of one staff of the UNESCO Division of Water Sciences.

2. PURPOSE AND USE OF THE REVIEW

The main purpose of the review is to evaluate IGRAC performance (since 2016) and hence provide UNESCO and The Kingdom of The Netherlands with a recommendation on the renewal of the Category 2 status of the Centre.

As per paragraph E.2 “renewal procedures” of document 40 C/79, the UNESCO Intersectoral Review Committee (IRC) examines all renewal evaluation reports and their corresponding draft agreements during the months of: April – for submission of recommendations to the autumn session of the Executive Board –, and October for submission to the spring session of the Executive Board. On the basis of the assessment of the Intersectoral Review Committee, the Director-General shall provide a recommendation, in his/her report to the Executive Board, as to whether the designation as a category 2 institute or centre under the auspices of UNESCO should be renewed or not. The responsible Sector’s focal point shall inform the concerned Member State(s) and Centre of this recommendation and prepare the related documents for submission to the Executive Board.

In addition, the review is also intended to inform the Member States of UNESCO, the UNESCO Secretariat and other stakeholders on the Centre’s overall performance, its contribution to the Strategic Programme Objectives of UNESCO and on the implementation of the 2019 Strategy for Category 2 Institutes and Centres (Document 40 C/79 and its annexes), and on potential improvements that may be suggested for the future.

The results of the review will be shared with the Natural Sciences Sector, the Government of The Netherlands and IGRAC. The final report of the review will also be made available on the Natural Sciences sector’s website.

3. REVIEW SCOPE

The evaluation, which must include a mission of 2 to 3 days consisting of a field visit to the Centre, will adopt both a retrospective and prospective approach. It should result in evidence-based and action-oriented recommendations and will be guided by the following overarching questions, to be further refined by the evaluators during the inception phase of this evaluation. In order to meet the objectives of the review, as described above, the following parameters shall be considered by the independent expert(s) contracted to undertake the renewal evaluation:

1. the extent to which the institute or centre’s objectives as set out in the agreement signed with UNESCO were achieved;
2. the relevance of the contribution of the institute or centre’s programmes and activities to the achievement of UNESCO’s prevailing Approved Programme and Budget (C/5) at the time in which it was designated, including global strategies and action plans as well as sectoral programme priorities, as defined in the agreement;
3. the relevance of the contribution of the activities of the institute or centre to global development agendas;
4. the quality of coordination and interaction with UNESCO, both at Headquarters and in the field, as well as with National Commissions, other thematically-related category 1 and 2 institutes or centres with regard to planning and implementation of programmes;
5. the partnerships developed and maintained with government agencies, public or private partners and donors;
6. the nature and efficiency of the institute or centre’s governance, including organizational arrangements, management, human resources and accountability mechanisms;
7. the financial resources available for ensuring sustainable institutional capacity and viability, and,
8. the extent to which the institute or centre enjoys within its territory the autonomy necessary for the execution of its activities and legal capacity to contract, institute legal proceedings, and to acquire and dispose of movable and immovable property.

4. REVIEW TEAM

The evaluation shall be conducted by a team of gender-balanced independent experts. One international reviewer will be selected to conduct the evaluation, who shall have had no prior affiliation with the institute or centre, and shall draft the renewal evaluation in English. The qualifications of the independent reviewer should be:

Required:

- At least 10 years of professional experience in research and/or capacity-building in the field of water management;
- Academic degree (PhD preferred) in the above-mentioned field (water management);
- At least five years' experience in policy and programme evaluation with strong knowledge and skills in applying various evaluation methodologies and methods of data collection;
- Excellent communication and report-writing skills in English;
- Knowledge of the role and mandate of UNESCO and its programmes;
- No involvement in current or past activities of the Centre under the Centre's present agreement.

Desirable:

- Understanding and application of the UN Mandates in Human Rights and Gender Equality.

Verification of these qualifications will be based on the provided curriculum vitae. Moreover, references, web links or electronic copies of one recently completed evaluation report conducted by the consultant should be provided as part of the technical proposals, preferably relevant to the thematic areas of the review.

The evaluation should follow [UNEG \(United Nations Evaluation group\)](#) norms and standards for evaluations, as well as be based UNEG ethical guidelines.

5. REVIEW METHODOLOGY

The review methods to be employed are to be clarified in the review framework to be proposed by the external evaluator, showing how each of the review dimensions mentioned in the review scope section will be addressed with regards to data sources and data collection methods. Among others, the following methods should be considered:

- Document review (desk study)
- Interviews with stakeholders (face to face, phone/skype)
- Direct observations through field visit(s), and
- Questionnaires/surveys with stakeholders, such as UNESCO staff and / or Partners.

The Division of Water Sciences (SC/HYD) and the Intergovernmental Hydrological Programme Secretariat (IHP) and IGRAC will provide the expert with relevant documentation to be reviewed in the desk study. Interviews are to be conducted with relevant UNESCO staff (SC/HYD), IGRAC staff and other key stakeholders (e.g., academics and professionals who have been involved in activities conducted by IGRAC).

IGRAC will make all relevant documents and information available to the evaluators, including:

- A copy of the existing agreement between the Member State and UNESCO establishing the centre;
- (Annual) progress and activity reports;
- Financial reports;
- List of staff;
- List of key publications;
- List of donors and project partners;
- Minutes of the Governing Board meetings;
- Available audit and evaluation reports;
- List of beneficiaries, people trained and countries assisted.

A number of between 10 and 15 working days are estimated to be required for the realisation of this evaluation project.

6. PLANNING AND IMPLEMENTATION ARRANGEMENTS

6.1 Management arrangements

SC/HYD will assist in the preparation and organisation of the review exercise. The evaluator will be responsible for being self-sufficient as regards logistics (office space, administrative and secretarial support, telecommunications, printing of documentation, etc.). However, suitable working space, when necessary, will be provided during the visit to Delft. While the evaluator is/are primarily responsible for the dissemination of all methodological tools (surveys, questionnaires), SC/HYD will facilitate this process to the extent possible (providing contact information, email addresses, etc.). Relevant stakeholders are being requested to provide planning documents, mission reports or other documents relevant to the evaluation.

6.2 Time schedule and deliverables:

The review will result in three deliverables, as follows:

1. The evaluator should submit an *inception report* consisting of:
 - i. Background, objectives and refined key review questions;
 - ii. Methodology (customized framework of how the exercise intends to cover the entire scope of the evaluation; and
 - iii. Work plan.
2. *Draft review report*: The process for preparing the draft review report shall allow adequate time for a discussion of the findings and the recommendations that have been proposed with SC/HYD and pertinent stakeholders, including the Government of The Netherlands and IGRAC.
3. *Final review report*: The final report (maximum 30 pages excluding annexes) should be structured as follows:

- Executive summary (maximum four pages);
- Purpose of the review;
- Scope of the review;
- Methodology;
- Findings;
- Recommendations (including a formal recommendation on (dis)continuation of the Category 2 status);
- Annexes (including interview list, key documents consulted, Terms of Reference).

The language of all reports will have to be English.

The final review report will be shared with the Centre and made available on the UNESCO's Natural Science Sector website.

Table 1: Tentative Schedule for the review

WHEN	WHAT	WHO
4 July 2020	Draft TORs	SC/HYD, SC/EO
15 July 2020	Finalization of TORs	ALL
	Searching for external evaluator candidates	SC/HYD, IGRAC
15 August 2020	Selection of external evaluator	SC/HYD, IGRAC
	Establishing a contract with evaluator	IGRAC
1 st September 2020	Briefing of external evaluator	IGRAC SC/HYD
	Completion of review framework (design)	Evaluator
Before 31 st October 2020	Field visit(s), workshop for presentation of emerging findings and validation of preliminary recommendations <u>including the draft Agreement negotiations</u>	Evaluator, and eventually SC/HYD
	Submission of draft evaluation report to UNESCO (Ms Alice Aureli as Focal Point for the Centre)	Evaluator
15 th November 2020	Review and comment on draft	SC/HYD, IGRAC
	Finalization of the review report	Evaluators, SC/HYD
Before end of February 2021	Presentation of final evaluation report plus draft agreement to the Intersectoral Review Committee for recommendation	Intersectoral Review Committee (IRC)

Annex 4 – Received Questionnaires from Stakeholder Survey

**Evaluation of the
International Groundwater Resources Assessment Centre (IGRAC)
as a Category 2 Centre under the auspices of UNESCO**

Questionnaire

Name of organization: UN-Water

Name and position of person filling the questionnaire: Federico Properzi, Chief Technical Adviser

Date of interview: 10/11/2020

1. What was the nature of your collaboration / interaction with IGRAC and over which period did it take place?

IGRAC is a partner of UN-Water (not a member as it is not a UN organization) and for that a very active one. IGRAC is very visible in discussions. Together with the UNESCO-IHP, IGRAC has been very active in mobilizing support for the 2022 World Water Day on Groundwater and has been instrumental in getting the partners together.

2. How would you rate the quality of the services / contribution provided by IGRAC ?

very poor	poor	fair	good	excellent
				X

3. In which way are the capacity and/or services provided by IGRAC important to the work of your organization?

IGRAC's expertise is quite unique and no one has that depth of understanding of groundwater issues and the challenges involved. UNESCO-IHP has a strong groundwater component and IGRAC as a Category 2 Centre contributes a lot to it.

4. To what extent are you familiar with IGRAC's core mission as a UNESCO Category 2 Centre?

Very familiar

5. Have you used data and information from the IGRAC website and the Global Groundwater Information System (GGIS)?

never	rarely	sometimes	often	very often
			X	

In case you used the IGRAC website, what type of information /data did you search for?

My colleagues working on monitoring use the GGIS

6. What are in your opinion the main challenges in establishing a global repository of groundwater quantity and quality data?

For too many years there has been a lack of attention to groundwater, among others because it is not visible and many countries did not want attention, either because they share aquifers with neighbors or semi-arid countries that hesitate to regulate a resource essential for economic development and enhancing water supply. We can compare it to the situation with WASH 15 years ago when for many countries there were no data nor clear guidance for countries. Because there has been a collective effort and so much attention the situation has changed completely.

The 2022 World Water Development Report and World Water Day on groundwater will be an important opportunity for advocacy, including on the importance to share data on groundwater quality, quantity and uses and the urgency to build a global knowledge base on the status of groundwater resources. It takes time to get understanding and trust and IGRAC has been very active in disseminating that message and working with countries and partners. UNESCO-IHP and IGRAC should use their respective competitive advantages to advance the global groundwater

agenda. For countries it takes effort to collaborate, so incentives (for example access to funding or technical support, or opportunity to show national capacity, ...) could help to convince countries to collaborate.

It will be important to expand funding, if difficult through bilateral funding there may be new sources like Green Climate Fund or GEF. Besides extra funding IGRAC might also expand its human capital through secondment, partnerships or providing research opportunities for PhD students.

**Evaluation of the
International Groundwater Resources Assessment Centre (IGRAC)
as a Category 2 Centre under the auspices of UNESCO**

Questionnaire

Name of organization: UNESCO Division of Water Sciences

Name and position of person filling the questionnaire: Mr Abou Amani, Director of the Division of Water Sciences

Date completed: 11/10/2020

1. What was the nature of your collaboration / interaction with IGRAC and over which period did it take place?

The Centre contributes largely to IHP and to the work of a number of other United Nations agencies, and it fulfils an important role in the preparation of a series of United Nations World Water Development Reports prepared by the UNESCO WWAP.

At the Fifth UNESCO/WMO International Conference on Hydrology (Geneva, 8-12 February 1999) it was recommended that consideration be given to the feasibility of setting up a Global Groundwater Information Centre under the auspices of UNESCO and WMO. Hence UNESCO and WMO initiated the process for evaluating the feasibility of establishing such a Centre. At the second World Water Forum in The Hague (March 2000), a decision was taken to consider the establishment of the Centre in the context of the Dutch follow-up to the second World Water Forum and Ministers Conference. The Dutch National Committee for UNESCO's IHP offered its support to the process intended to lead to the establishment of the Centre on its territory

1. How would you rate the quality of the services / contribution provided by IGRAC ?

very poor	poor	fair	good	excellent
				X

2. In which way are the capacity and/or services provided by IGRAC important to the work of your organization?

IGRAC is the only international UNESCO category 2 Centre fully devoted to Groundwater Resources. IGRAC plays an important role in the UNESCO water family. IGRAC has succeeded to build an international renowned 'brand identity' and has achieved recognition internationally. IGRAC is a crucial member of the UNESCO WATER family and a reference for the Water Resources scientific community. It provides UNESCO with a study and research scientific branch.

By the decision of the UNESCO General Conference in Agreement with the Dutch Government the mission of the Centre is clearly stated in the International agreement signed by the two parties. IGRAC mission is to contribute to world-wide availability of relevant information and knowledge on the groundwater resources of the world, with particular emphasis on developing countries, in order to support sustainable utilisation and management of the groundwater resources, to promote the role of groundwater in integrated water resources planning and to elucidate the impact of groundwater on the ecosystems of the Earth. The main objectives of the Centre are:

1. To contribute to achieving the Strategic Objectives of UNESCO and in particular to the implementation of the UNESCO IHP programme through contribution to availability of relevant information and knowledge on groundwater resources of the world.
2. To promote sustainable groundwater resources utilisation and management by developing tools to facilitate global exchange of knowledge in accordance with UNESCO's Open Access Policy.

The Centre specific objectives are:

- (a) Facilitate and promote groundwater monitoring and assessment, particularly at regional and global level;
- (b) Develop procedures and methodologies for collection and processing of groundwater related data and information necessary for informed groundwater management;
- (c) Contribute to the development of a Global Groundwater Information System
- (d) Support UNESCO-IHP in carrying out groundwater related activities with all its partners in the promotion of groundwater related data compilation at the regional and global level;
- (e) Increase public awareness on groundwater resources sustainable use, and provide technical support in the area of media communication on this subject.

The Centre pursues the above objectives and performs the above-mentioned functions in close coordination with UNESCO-IHP.

3. To what extent are you familiar with IGRAC’s core mission as a UNESCO Category 2 Centre?

N/A

4. Have you used data and information from the IGRAC website and the Global Groundwater Information System (GGIS)?

never	rarely	sometimes	often	very often
				X

In case you used the IGRAC website, what type of information /data did you search for?

IGRAC is an independent entity however UNESCO as member of the IGRAC governing board participates in the design of the IGRAC workplans. IGRAC hosts several UNESCO IHP data sets and UNESCO IHP Projects web pages. IGRAC is a partner of UNESCO in several regional and global projects.

5. What are in your opinion the main challenges in establishing a global repository of groundwater quantity and quality data?

IGRAC is more than a repository, it is providing support to AMCOW, WMO, OAS, UNESCO, WWAP, UNWATER and many other regional and international institutions. It is engaging in the crucial work of mapping groundwater resources in partnership with UNESCO and the geological surveys. It is providing training and policy advice to Member States. It is partner of the Water Quality initiative and contribute to the IAH commissions hosting their web sites. It is instrumental to put forward the transboundary aquifer agenda.

It should receive more financial resources and certainly remaining a visible entity having an international recognized brand already.

It should continue to host the Global Groundwater Monitoring Network (GGMN)

**Evaluation of the
International Groundwater Resources Assessment Centre (IGRAC)
as a Category 2 Centre under the auspices of UNESCO**

Questionnaire

Name of organization: International Water Management Institute (South-Africa)

Name and position of person filling the questionnaire: Karen Villholth, Principal Researcher and Groundwater Focal Point, Coordinator of GRIPP

Date of interview: 22/10/2020

6. What was the nature of your collaboration / interaction with IGRAC and over which period did it take place?

IWMI has collaborated with IGRAC for many years on a range of activities. IWMI and IGRAC collaborate on joint initiatives like GRIPP, that intends to build a global collaborative platform for sustainable groundwater management, and on joint activities, like supporting the SADC-Groundwater Management Institute (SADC-GMI).

4. In which way are the capacity and/or services provided by IGRAC important to the work of your organization?

There are many points of contact between IWMI's work and IGRAC. As the leading global institute promoting and supporting groundwater monitoring and global groundwater assessment IGRAC has a strong role. With their mandate as UNESCO's groundwater centre they could be more ambitious and do more and should not shy away from difficult issues.

There is a challenge out there, to make groundwater visible in the broader global water agenda. As a partner of GRIPP IGRAC contributes to this collective effort, coordinated by IWMI. Their initiative to organize a World Water Day Groundwater event is a very welcome.

7. What are in your opinion the main challenges in establishing a global repository of groundwater quantity and quality data?

Groundwater challenges are unique and they get drowned in the water agenda that is mostly focused on surface water. How do we make groundwater more visible and mobilize global efforts? This may also require IGRAC to be very focused and build a clear identity because there are a lot of players out there. Working on too many things may dilute the impacts of their efforts. Giving access to groundwater advisory and training materials like the GW-MATE archive is important but there many new topics and developments and IGRAC needs to be at the forefront.

GGMN should be more promoted, it has been too much in the background. What is it, in what is it different from other initiatives and why is it important? It is important to build a more ambitious strategy how to bring more data and how to convince countries to collaborate. IGRAC could aim to systematically collaborate with ongoing initiatives in countries and regions to harvest grey literature and could do a campaign among donors to enhance the critical mass of a global groundwater data repository and get the system going. There is a clear demand for information on the status of groundwater resources, how to make the system grow?

Also, more and more information is now available from models that can add knowledge to the scarce groundwater data in some regions and can point to where more work needs to be done. Can this information also be made available?

**Evaluation of the
International Groundwater Resources Assessment Centre (IGRAC)
as a Category 2 Centre under the auspices of UNESCO**

Questionnaire

Name of organization: [British Geological Survey](#)

Name and position of person filling the questionnaire: [Prof Alan MacDonald, Head of Groundwater Resilience](#)

Date completed: [6/11/2020](#)

1. What was the nature of your collaboration / interaction with IGRAC and over which period did it take place?

[We sub contracted IGRAC in a project we had with SADC-GMI \(World Bank funded\) 2020](#)

<http://sadc-gla.org/SADC/home.html>

[Collaboration in developing groundwater maps for ECOWAS region West Africa \(non-funded\) 2019/2020](#)

[Provided IGRAC maps developed by BGS for IGRAC to use in their portal](#)

<https://apps.geodan.nl/igrac/ggis-viewer/viewer/groundwaterafrica/public/default>

[Worked with IGRAC to host time series datasets developed for Africa https://www.un-](https://www.un-igrac.org/chronicles-long-term-groundwater-level-anomalies-across-sub-saharan-africa)

[igrac.org/chronicles-long-term-groundwater-level-anomalies-across-sub-saharan-africa](https://www.un-igrac.org/chronicles-long-term-groundwater-level-anomalies-across-sub-saharan-africa)

[Also I helped to review IGRACs strategy in 2019](#)

2. How would you rate the quality of the services / contribution provided by IGRAC ?

very poor	poor	fair	good	excellent
			X	

3. In which way are the capacity and/or services provided by IGRAC important to the work of your organization?

[It is useful to have an organization to curate and supply data. We find it useful as a way of broadening the use of BGS developed datasets](#)

4. To what extent are you familiar with IGRAC's core mission as a UNESCO Category 2 Centre?

[Very familiar](#)

5. Have you used data and information from the IGRAC website and the Global Groundwater Information System (GGIS)?

never	rarely	sometimes	often	very often
	X			

[In case you used the IGRAC website, what type of information /data did you search for?](#)

[Generally, we supply data to IGRAC. However, I have used an IGRAC report on global salinity which I found useful](#)

6. What are in your opinion the main challenges in establishing a global repository of groundwater quantity and quality data?

[Encouraging organizations to supply data with the necessary permissions to use it. I think the confusion of whether IGRAC is a consultancy or independent data centre can detract people from supplying data.](#)

**Evaluation of the
International Groundwater Resources Assessment Centre (IGRAC)
as a Category 2 Centre under the auspices of UNESCO**

Questionnaire

Name of organization: IHE Delft

Name and position of person filling the questionnaire: Eddy Moors, Rector

Date completed: 28 October 2020

7. What was the nature of your collaboration / interaction with IGRAC and over which period did it take place?

I interacted with IGRAC since I started working at IHE Delft in 2017.

8. How would you rate the quality of the services / contribution provided by IGRAC ?

very poor	poor	fair	good	excellent
				x

9. In which way are the capacity and/or services provided by IGRAC important to the work of your organization?

Both the services as well as the capacity of IGRAC is important for IHE Delft because:

- The data and reports of IGRAC help our students to understand the impact and problems on groundwater better, especially for transboundary groundwater systems;
- IGRAC's experience on data collection and processing is also valuable for our training courses;
- IGRAC supervises some of the theses of our MSc students;
- IGRAC is a valuable partner in some collaborative projects because of their groundwater knowledge and database.

10. To what extent are you familiar with IGRAC's core mission as a UNESCO Category 2 Centre?

Quite well, because IHE Delft is also a UNESCO category 2 center, we are therefore in some of the same meetings and events.

11. Have you used data and information from the IGRAC website and the Global Groundwater Information System (GGIS)?

never	rarely	sometimes	often	very often
		x		

In case you used the IGRAC website, what type of information /data did you search for?

12. What are in your opinion the main challenges in establishing a global repository of groundwater quantity and quality data?

It starts with the difficulty to collect the data (including costs) and secondly with accessibility of the data, not all data that exist are also made available for global repositories. These challenges are even bigger for water quality data.

**Evaluation of the
International Groundwater Resources Assessment Centre (IGRAC)
as a Category 2 Centre under the auspices of UNESCO**

Questionnaire

Name of organization: [World Bank](#)

Name and position of person filling the questionnaire: [Lucy Lytton, Sr WRM Specialist \(groundwater\)](#)

Date completed: [26 October 2020](#)

1. What was the nature of your collaboration / interaction with IGRAC and over which period did it take place?
 - a) [Co-presenters for a session on groundwater quality for WB water week 2019](#)
 - b) [co-members of the WWQA-FoG committee on world groundwater quality \(ongoing since early 2020\)](#)
2. How would you rate the quality of the services / contribution provided by IGRAC ?

very poor	Poor	fair	good	excellent
			a), b)	

3. In which way are the capacity and/or services provided by IGRAC important to the work of your organization?

[Global groundwater facts and figures, groundwater reference books and other reference material is useful.](#)

4. To what extent are you familiar with IGRAC's core mission as a UNESCO Category 2 Centre?

[Not really.](#)

5. Have you used data and information from the IGRAC website and the Global Groundwater Information System (GGIS)?

never	Rarely	sometimes	Often	very often
		✓		

In case you used the IGRAC website, what type of information /data did you search for?

- [Reliable global groundwater statistics for presentations](#)
- [Identifying and naming transboundary aquifers to satisfy internal \(World Bank\) reporting requirements on activities in TBAs.](#)
- [Identifying and naming transboundary aquifers as a kick-off for further online research.](#)

6. What are in your opinion the main challenges in establishing a global repository of groundwater quantity and quality data?

- [Availability of data \(ALL institutes/countries hoard data to some extent prior to release, some never release it\), academics are particularly poor at releasing data – even if they work for government agencies or are funded by government](#)
- [Variability in data accuracy and standards](#)
- [Variability in standards of monitoring networks that deliver data](#)
- [Reliability of groundwater quality data](#)
- [Reliability of ML/statistical predictions trained on unreliable data](#)

**Evaluation of the
International Groundwater Resources Assessment Centre (IGRAC)
as a Category 2 Centre under the auspices of UNESCO**

Questionnaire

Name of organization: [World Meteorological Organization \(WMO\)](#)

Name and position of person filling the questionnaire: [Dominique Berod, Head a.i., Earth System Monitoring Division](#)

Date completed: [26 October 2020](#)

1. What was the nature of your collaboration / interaction with IGRAC and over which period did it take place?

[IGRAC is one of the three global data centers for WMO and I'm participating to the governing board since 2016. IGRAC is the main partner to WMO for groundwater area; they are participating to specific tasks such as groundwater monitoring concept for given countries or as expert in a working group of the WMO Hydrological Status and Outlook System \(HydroSOS\).](#)

2. How would you rate the quality of the services / contribution provided by IGRAC ?

very poor	poor	fair	good	excellent
				X

3. In which way are the capacity and/or services provided by IGRAC important to the work of your organization?

[WMO is dealing with the full hydrological cycle and IGRAC is providing the main support for the groundwater component.](#)

4. To what extent are you familiar with IGRAC's core mission as a UNESCO Category 2 Centre?

[As a member of the governing board, I'm quite familiar although not following developments at a daily basis.](#)

5. Have you used data and information from the IGRAC website and the Global Groundwater Information System (GGIS)?

never	rarely	sometimes	often	very often
X				

[In case you used the IGRAC website, what type of information /data did you search for?](#)

[\(Note: I never used GGIS because I'm not a user, but the GGMN app is on my phone...\)](#)

6. What are in your opinion the main challenges in establishing a global repository of groundwater quantity and quality data?
 - [Being interoperable with other systems](#)
 - [Becoming a reference \(authoritative?\) repository, knowing many other may exist](#)
 - [Combining data from many different sources \(including satellite, research, private sector, etc.\)](#)
 - [Keeping it updated](#)
 - [QA/QC](#)
 - [Data policy](#)
 - [Outreach and statistics of uses \(including user profiles and purposes\)](#)

**Evaluation of the
International Groundwater Resources Assessment Centre (IGRAC)
as a Category 2 Centre under the auspices of UNESCO**

Questionnaire

Name of organization: Federal Institute for Geosciences and Natural Resources (BGR), Germany

Name and position of person filling the questionnaire: Dr. Ralf Klingbeil, Senior Groundwater Expert

Date completed: 23 Oct 2020

1. What was the nature of your collaboration / interaction with IGRAC and over which period did it take place?

BGR cooperates with IGRAC since IGRAC's start in many different projects especially related to mapping of groundwater resources at global and regional level, international joint activities to raise the awareness for groundwater management and protection, joint organization of meetings, seminars, training courses and conferences. Among others BGR and IGRAC together with other partners developed training material on groundwater management for transboundary river basin commissions. Both cooperate in a sub-regional project with other institutions on developing common standards for hydrogeological maps in West Africa.

As of 2017 BGR and IGRAC collaborate with c. 30 other partners in the global Groundwater Solutions Initiative for Policy and Practice (GRIPP). Since 2018 BGR and IGRAC cooperate together with other organisations under the UNEP-led World Water Quality Alliance (WWQA) in the work group "Friends of Groundwater (FoG)" to facilitate the groundwater quality related aspects of the World Water Quality Assessment (WWQA). This comprises the joint drafting of a perspective paper on global groundwater quality, a joint project proposal for the assessment of groundwater quality at global level.

2. How would you rate the quality of the services / contribution provided by IGRAC ?

very poor	poor	fair	good	excellent
			X	

3. In which way are the capacity and/or services provided by IGRAC important to the work of your organization?

IGRAC's global mandate on groundwater and its outreach into international organisations such as UN-Water and esp. its members UNESCO (IHP) and WMO helps in introducing groundwater activities and awareness raising to UN processes and decision making.

It's organisational form allows IGRAC also sufficient flexibility to undertake externally funded projects at different budget levels and from various funding sources. In this way, IGRAC as a collaboration partner for common groundwater interests is of interest to BGR as a German governmental institution that may not be in the position to submit financially competitive own project proposals under all kind of international calls.

4. To what extent are you familiar with IGRAC's core mission as a UNESCO Category 2 Centre?

BGR is familiar with IGRAC's core mission as a UNESCO Cat 2 Centre. BGR is also represented in the IGRAC Strategic and Advisory Committee (STAC).

5. Have you used data and information from the IGRAC website and the Global Groundwater Information System (GGIS)?

never	rarely	sometimes	often	very often
		X		

In case you used the IGRAC website, what type of information /data did you search for?

IGRAC website is a very useful repository of groundwater related global information, either directly the specific groundwater data or meta data.

6. What are in your opinion the main challenges in establishing a global repository of groundwater quantity and quality data?

Access to groundwater data is in many countries not publicly available. Neither IGRAC nor its partners UNESCO / WMO have the mandate to request groundwater quantity and quality data from the UN member States. To advance the global collection of groundwater data it would be important to have an international agreed convention that such information is useful for addressing the water and sustainable development challenges of humankind globally. It is unlikely that this is developing anytime in the near future. However, with such a convention or international agreement as a basis, IGRAC could easily develop into a global environmental repository for groundwater data similarly to the European Environment Agency (EEA) and the water data portals under the EU WFD that have been developed and hold substantive groundwater related data of EU member states for public access.

Beside of the access to groundwater data, such data may require further validation and standardization before it can be made available publicly.

To substantiate more and a longer-term perspective for IGRAC and an IGRAC-led global repository for groundwater data, it may require further cooperation with other countries beside of The Netherlands to ensure a more substantive international funding base. Such financial support from other countries might be also possible through seconded staff from other national agencies.

**Evaluation of the
International Groundwater Resources Assessment Centre (IGRAC)
as a Category 2 Centre under the auspices of UNESCO**

Questionnaire

Name of organization: Regional Centre for Groundwater Management in Latin America and the Caribbean (CeReGAS)

Name and position of person filling the questionnaire: Alberto Manganelli - Executive Director

Date completed: October 15, 2020

1. What was the nature of your collaboration / interaction with IGRAC and over which period did it take place?

Our first formal participation in a work carried out by IGRAC was in 2013 when the presentation of the Global Groundwater Monitoring Network took place in Montevideo, Uruguay. See the document: "Summary report of information shared during the Regional Workshop on Groundwater Monitoring."

CeReGAS has a Memorandum of Understanding signed with IGRAC since 2018.

In addition, a joint work was recently carried out to collect groundwater monitoring data in Latin America, the main results of which were presented at the XIV LATIN AMERICAN CONGRESS OF HYDROGEOLOGY - X ARGENTINE CONGRESS OF HYDROGEOLOGY - VIII HISPANIC-LATIN AMERICAN SEMINAR ON CURRENT ISSUES OF UNDERGROUND HYDROLOGY."

This year the work "Current Status of Groundwater Monitoring in Latin America and Introduction to the GGMN Program" carried out jointly between IGRAC - CeReGAS - ALHSUD was published in the journal of the intergovernmental Hydrological Program for Latin America and the Caribbean (Aqua-LAC - Vol. 12 March 2020)

2. How would you rate the quality of the services / contribution provided by IGRAC ?

very poor	poor	fair	good	excellent
			x	

3. In which way are the capacity and/or services provided by IGRAC important to the work of your organization?

Our objectives are consistent in that we are both category II centers and have groundwater and aquifers as a common subject.

For this reason, we consider IGRAC as a partner to count on for all those common issues, and especially on those issues in which IGRAC has more experience than we do.

4. To what extent are you familiar with IGRAC's core mission as a UNESCO Category 2 Centre?

As a centre with similar characteristics to IGRAC, we are familiar with its mission as a category II centre of UNESCO.

5. Have you used data and information from the IGRAC website and the Global Groundwater Information System (GGIS)?

never	rarely	sometimes	often	very often
		x		

In case you used the IGRAC website, what type of information /data did you search for?

Download documents and reports, visits to the information system, etc.

6. What are in your opinion the main challenges in establishing a global repository of groundwater quantity and quality data?

Access to information on the quantity and quality of groundwater is often quite limited in many countries. Above all, quality data, since in many countries there are no groundwater quality databases, among other things due to the high costs of chemical analysis.

On the other hand, the quality of the information also presents an additional difficulty, since data often exist but its reliability is quite doubtful.

**Evaluation of the
International Groundwater Resources Assessment Centre (IGRAC)
as a Category 2 Centre under the auspices of UNESCO**

Questionnaire

Name of organization: SADC Groundwater Management Institute (SADC-GMI)

Name and position of person filling the questionnaire: James Sauramba - Executive Director

Date completed: 09 November 2020

1. What was the nature of your collaboration / interaction with IGRAC and over which period did it take place?
IGRAC assisted us to revive the SADC Groundwater Hydrogeological Map and establishment of the SADC Groundwater Information Portal (SADC-GIP) in the period 2017 - June 2018. Since Oct 2019 to Oct 2020 IGRAC supported us to upgrade the SADC-GIP. In collaboration with BGS, IGRAC is assisting with upgrading the SADC Groundwater Literature Archive since March 2020 to date. We also collaborated with IGRAC in hosting the SADC Groundwater Conferences in 2018, 2019 and 2020
2. How would you rate the quality of the services / contribution provided by IGRAC ?

very poor	poor	fair	good	excellent
				X

3. In which way are the capacity and/or services provided by IGRAC important to the work of your organization?
We acknowledge IGRAC as an invaluable partner on groundwater data collection and management and therefore they serve as our point of reference for all issues in this regard as we also endeavor gain capacity to run some of the similar systems that they run, but at a regional level
4. To what extent are you familiar with IGRAC's core mission as a UNESCO Category 2 Centre?
We are familiar in as much as we access their services that are enabled by their core mission.
5. Have you used data and information from the IGRAC website and the Global Groundwater Information System (GGIS)?

never	rarely	sometimes	often	very often
				X

In case you used the IGRAC website, what type of information /data did you search for?

Transboundary Aquifers data as well as the SADC-GIP as it was hosted on the IGRAC website

6. What are in your opinion the main challenges in establishing a global repository of groundwater quantity and quality data?

Mains challenges include:
 1. Inconsistencies in data formats
 2. Lack of resources and capacity to operationalize time-series data collection
 3. Competing interests from other bodies establishing their own repositories

**Evaluation of the
International Groundwater Resources Assessment Centre (IGRAC)
as a Category 2 Centre under the auspices of UNESCO**

Questionnaire

Name of organization: International Association of Hydrogeologists (IAH)

Name and position of person filling the questionnaire: Dr Teodora Szocs & Dr Stephen Foster

Date completed: 21.10.2020.

1. What was the nature of your collaboration / interaction with IGRAC and over which period did it take place?
The International Association of Hydrogeologists is closely connected and supportive of the work of IGRAC, practically collaborating with IGRAC since its establishment. IAH has a representative in the Strategic and Technical Advisory Committee of IGRAC and contributed in 2019 in the review of IGRAC's draft Strategic Document "Groundwater in the Changing World".
2. How would you rate the quality of the services / contribution provided by IGRAC ?

very poor	Poor	Fair	good	excellent
				x

3. In which way are the capacity and/or services provided by IGRAC important to the work of your organization?
We have collaborated and coordinated on many initiatives, several publications, and have jointly presented at Groundwater conferences. Eg. worked together on the World-wide Hydrogeological Mapping and Assessment Programme, the Internationally Shared Aquifer Resources Management (ISARM) programme.
4. To what extent are you familiar with IGRAC's core mission as a UNESCO Category 2 Centre?
We know and are supportive of the IGRAC core mission.
5. Have you used data and information from the IGRAC website and the Global Groundwater Information System (GGIS)?
This is difficult to answer as our membership is large and all our contact with the GGIS are not recorded in detail. Some of IAH's Commissions and Networks use the IGRAC GGIS regularly.

never	Rarely	sometimes	Often	very often
			X	

In case you used the IGRAC website, what type of information /data did you search for?

Transboundary aquifers, MAR related data and information are often used.

6. What are in your opinion the main challenges in establishing a global repository of groundwater quantity and quality data?
In many places, records are unavailable, and in many cases in the developing world actual field measurement have either not been taken or are sparse. The different data formats also make difficult the compilation of common global maps and databases. Often the willingness of potential data providers is also lacking, which might be due in the case of the European Union, to there being other database systems into which countries upload data/information (eg. WISE, ICPDR).

**Evaluation of the
International Groundwater Resources Assessment Centre (IGRAC)
as a Category 2 Centre under the auspices of UNESCO**

Questionnaire

Name of organization: Geological survey of Canada and IAH-TBA Commission

Name and position of person filling the questionnaire: Dr Alfonso Rivera, former Chief Hydrogeologist at the Geological Survey of Canada and Chairman of the IAH Transboundary Aquifers Commission

Date completed: November 15, 2020

1. What was the nature of your collaboration / interaction with IGRAC and over which period did it take place?

There have been many activities and cooperation of different nature over the last 15 years.

2. How would you rate the quality of the services / contribution provided by IGRAC?

very poor	poor	fair	good	excellent
				XX

3. In which way are the capacity and/or services provided by IGRAC important to the work of your organization?

In various ways. Data infrastructure, information gathering, generation of maps (e.g., TBA map of the World), and coordination of international events related to groundwater and transboundary aquifers. IGRAC is a key source of information for those, like me, whose research work is entirely dedicated to groundwater resources.

4. To what extent are you familiar with IGRAC's core mission as a UNESCO Category 2 Centre?

I am familiar with IGRAC's core mission as a UNESCO Category 2 Centre to a large extent. My former employee (GSC) and myself (TBA Commission) have strongly collaborated in many activities over the years. Some of these are: two World Water Forums (2006-2009), ISARM-Americas network (2005-2015), GIN (GSC's groundwater Information Network), and others.

5. Have you used data and information from the IGRAC website and the Global Groundwater Information System (GGIS)?

never	rarely	sometimes	often	very often
			XX	

In case you used the IGRAC website, what type of information /data did you search for?

Mostly maps on TBAs, GGRETA, GW Monitoring, MAR.

6. What are in your opinion the main challenges in establishing a global repository of groundwater quantity and quality data?

The diversity of GW data and the standardization of the original sources of data globally.

**Evaluation of the
International Groundwater Resources Assessment Centre (IGRAC)
as a Category 2 Centre under the auspices of UNESCO**

Questionnaire

Name of organization: United Nations Economic Commission for Europe (UNECE), secretariat of the Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention)

Name and position of person filling the questionnaire: Ms. Annukka Lipponen, Environmental Affairs Officer

Date completed: 18 November 2020

1. What was the nature of your collaboration / interaction with IGRAC and over which period did it take place? IGRAC is a partner to UNECE and the Geneva Water Hub in a project on the Senegalo-Mauritanian Aquifer providing expertise on assessment of transboundary aquifers and groundwater data (in 2020, foreseen to continue to 2021). IGRAC has shared experience, moderated group discussion and provided views on the Water Convention's groundwater guidelines at the global Global workshop on exchange of data and information in transboundary basins (4 - 5 December 2019, Geneva).

2. How would you rate the quality of the services / contribution provided by IGRAC ?

very poor	poor	fair	good	excellent
				X

3. In which way are the capacity and/or services provided by IGRAC important to the work of your organization?

IGRAC provides solid technical expertise on monitoring, assessment as well as information and data on transboundary aquifers

4. To what extent are you familiar with IGRAC's core mission as a UNESCO Category 2 Centre?

Well familiar

5. Have you used data and information from the IGRAC website and the Global Groundwater Information System (GGIS)?

never	rarely	sometimes	often	very often
		X		

In case you used the IGRAC website, what type of information /data did you search for?

Data about groundwater use globally or regionally. Delineations of transboundary aquifers and their main characteristics. A colleague has used it to check some information provided by countries in the reporting on Sustainable Development Goals indicator 6.5.2 (measuring progress in transboundary cooperation) or to understand better the countries' contexts in terms of groundwater.

6. What are in your opinion the main challenges in establishing a global repository of groundwater quantity and quality data?

Data ownership and rights of use. IGRAC is gathering and making available data and information on aquifers and groundwater resources in countries. While this is a good thing, if data gathered in projects is to be made publicly available in a repository, it should be made clear to the providers of data for the sake of transparency and consent asked for, if necessary. Transferability of data (in terms of formats, etc.) to Governments and to legitimate bodies like water cooperation institutions at the request of Governments should be ensured.

Sustainable access to data may also eventually turn out to be a challenge. IGRAC secures financing for some years ahead at a time, but those who provide data probably expect them to be available in the long term.

Awareness about the IGRAC database and ownership could be improved.

**Evaluation of the
International Groundwater Resources Assessment Centre (IGRAC)
as a Category 2 Centre under the auspices of UNESCO**

Questionnaire

Name of organization: Department of Groundwater Resources (DGR), Thailand

Name and position of person filling the questionnaire: Dr. Arissara Painmanakul, Director of Training Section,
Bureau of Central Administration

Date completed: 19 November 2020

7. What was the nature of your collaboration / interaction with IGRAC and over which period did it take place?
- Training courses in Groundwater Governance and Monitoring Network in Thailand, July 2018
 - Site Visits of DGR officials at IGRAC Headquarter in February 2020
8. How would you rate the quality of the services / contribution provided by IGRAC ?

very poor	poor	fair	good	excellent
				√

9. In which way are the capacity and/or services provided by IGRAC important to the work of your organization?

The services and cooperation enable us to gain more knowledge and experiences regarding Groundwater Governance and Monitoring Network which can be applied to our work and missions in Thailand.

10. To what extent are you familiar with IGRAC's core mission as a UNESCO Category 2 Centre?

We are quite familiar with it because IGRAC members always provide this information with us.

11. Have you used data and information from the IGRAC website and the Global Groundwater Information System (GGIS)?

never	rarely	sometimes	often	very often
			√	

In case you used the IGRAC website, what type of information /data did you search for?

- Groundwater governance
- Groundwater projects
- Events in Groundwater

12. What are in your opinion the main challenges in establishing a global repository of groundwater quantity and quality data?

It's difficult to gain accurate groundwater quantity and quality data from every country because many countries have still not sufficient and efficient data collection system. Also, some countries regard this information as their security information. However, it's a good project so that the countries start to realise the importance of groundwater data for better management of this collective resource.

Annex 5 - The UNESCO Intergovernmental Hydrological Programme

The Intergovernmental Hydrological Programme (IHP) is the only intergovernmental programme of the United Nations system devoted to water research and management, and related education and capacity development. The IHP started out in 1975 as an internationally coordinated hydrological research programme. Since then, it has evolved to facilitate an interdisciplinary and integrated approach to watershed and aquifer management, incorporating the social dimension of water, and supports international cooperation in hydrological and freshwater sciences and at the interface with policy-makers, and reinforces institutional and individual capacities. The main objective of IHP's current, eighth phase (IHP-VIII 2014-2021) is to put science into action required for water security.

The Intergovernmental Hydrological Programme stimulates and encourages hydrological research and assists Member States in research and training activities. Its eighth phase focuses on six thematic areas:

1. water-related disasters and hydrological changes;
2. groundwater in a changing environment;
3. addressing water scarcity and quality;
4. water and human settlements of the future;
5. ecohydrology, engineering harmony for a sustainable world; and
6. water education, key to water security.

Under each Thematic Area a number of Focal Areas has been identified. A brief overview of the Focal Areas under the IHP is given with additional detail on the Focal Areas under Thematic Area 2, **Groundwater in a changing environment**, to which IGRAC's work contributes most, even if groundwater knowledge is key to many of the Focal Areas under the other thematic areas.

Thematic Area 1 - Water-related Disasters

Water-related hazards or hydro-hazards are the results of complex interactions in the ocean atmosphere-land process cascade. Floods and droughts are expected to increase due to global warming. Increased hydro-hazard impacts and costs are attributable to such factors as increased event frequency and magnitude, unplanned urbanization, degradation of ecosystem services, vulnerable livelihoods, and inaccurate public perception of risk. The challenge is to identify appropriate and timely adaptation measures in a continuously changing environment.

Actions under the Thematic Area 1 are structured under the following Focal Areas:

- Focal Area 1.1: Risk management as adaptation to global changes;
- Focal Area 1.2: Understanding coupled human and natural processes;
- Focal Area 1.3: Benefiting from global and local Earth observation systems;
- Focal Area 1.4: Addressing uncertainty and improving its communication;
- Focal Area 1.5: Improve scientific basis for hydrology and water sciences for preparation and response to extreme hydrological events.

Thematic Area 2 - Groundwater

Groundwater represents 98% of the world's unfrozen freshwater. It drives many geological and geochemical processes and sustains various ecological functions and services. The use of groundwater has increased significantly over the past 50 years due to its high reliability during drought seasons, good quality and generally modest development costs. We know more about groundwater and aquifers from work completed during previous Intergovernmental Hydrological Programme (IHP) phases, but we need to learn more about the complexity of aquifer systems, the increasing global risk to groundwater depletion, quality deterioration and pollution, and the resilience of communities and populations dependent on groundwater sources.

Objectives include promoting measures addressing the principles of sustainable management of groundwater resources, addressing methods for the sound development, exploitation and protection of groundwater resources, developing new groundwater resource maps, and strengthening groundwater governance policy and water user rights in emergency situations. These challenges call for comprehensive research, implementation of new science-based methodologies and the endorsement of principles of integrated management, and environmentally-sound protection of groundwater resources.

Actions under the Thematic Area 2 are structured under the following Focal Areas:

- Focal area 2.1: Enhancing sustainable groundwater resources management;
- Focal area 2.2: Addressing strategies for management of aquifers recharge;
- Focal area 2.3: Adapting to the impacts of climate change on aquifer systems;
- Focal area 2.4: Promoting groundwater quality protection;
- Focal area 2.5: Promoting management of transboundary aquifers.

2.1 - Managing for sustainability

This focal area addresses the safety and reliability of groundwater resources as a vital necessity for human life, social and economic development, poverty alleviation and healthy functioning ecosystems. Sustainable groundwater management is based on holistic, multidisciplinary and environmentally sound approaches and studies that include groundwater quantity and quality, relationships between groundwater and surface water and groundwater dependent ecosystems and land use planning and practices. These studies take into consideration ethical, religious and cultural traditions of society and should be based on a participatory approach involving decision and policy makers, water scientists and managers, planners, water stakeholders and general public. This focal area addresses quantitative attributes of groundwater resources management and protection while groundwater quality attributes are addressed in Focal area 2.4.

Sustainable groundwater development and resource management very much depend on knowledge of aquifer systems, groundwater recharge and discharge rates and groundwater storage. Demographic changes and population growth in several regions and related increases in groundwater demand for drinking and other uses as well as influence of changing climatic conditions on groundwater are other factors which have to be studied to ensure sustainable development and management of groundwater resources for the future needs. Specific attention should be also given to the management of non-renewable groundwater resources whose exploitation always leads to storage reduction.

2.2 - Strategies for aquifers recharge

This focal area addresses the security and quality of water supplies in water scarce areas and aims to improve adaptation to climate change. A wide range of methods for enhancing groundwater recharge have been developed and applied over the centuries, depending on source, availability and quality of water, geological and hydrogeological conditions, uses of recovered water, socio-economic conditions, governance and institutional frameworks and public awareness and participation in water management. Considering the benefits of groundwater recharge management and its potential to be a significant contributor to the MDGs, the Programme Strategies for Managed Aquifer Recharge (MAR) in semi-arid regions was initiated in 2002 within UNESCO-IHP in cooperation with IAH. It aims to expand water resources and improve water quality in ways that are appropriate, environmentally sustainable, technically viable, economical and socially desirable. However, there is still room to increase knowledge and capacities for managing aquifer recharge, water harvesting and waste water recycling using combination of different engineering treatment techniques and natural attenuation processes. Particularly in arid and semi-arid regions, MAR has the potential to contribute to the MDG for drinking water more economically than other alternatives. MAR programme can also be highly effective in creating new water resources and increases also the security of drinking water supplies under climate change and population growth.

2.3 - Adaptation to change

This focal area seeks to assess the medium and long-term impacts of climate change on groundwater resources and establish relevant mitigation and adaptation strategies on the global, regional and local scales. Few studies have been done until recently on the potential impact of climate change on groundwater referencing its relation to surface water. The most important direct effect of climate change on groundwater is associated with recharge patterns. Spatial and temporal distribution of precipitation, air temperature, evapotranspiration, soil moisture, groundwater levels and response time of aquifers are the main natural factors controlling groundwater recharge in different climatic zones. Reaction of deep, non-renewable and fossil aquifers to climate change impacts will last centuries or millennia; reaction of shallow, karst and coastal aquifers can last in case of groundwater recharge only weeks, months or years.

Models for prediction and quantification of groundwater systems response to the impact of climate change are facing several uncertainties due to lack of a consistent soil and groundwater global dataset. To calibrate hydrological models for simulation of spatially and temporally changing groundwater recharge, discharge and storage and inclusion of a groundwater component into land surface models require improvements in terrestrial and satellite-based groundwater monitoring and monitoring data assessment and management. Coastal aquifers prone to depletion and accompanying land-level lowering contributing to sea-level rise need particular attention.

The potential impacts of climate change on groundwater quantity and quality have to be analyzed and quantified in terms of their social, economic and environmental effects on and risks for population and groundwater dependent ecosystems.

2.4 - Groundwater quality

This focal area aims to enhance knowledge of groundwater quality and groundwater protection policy. Many Member States included aspects of groundwater quality protection for drinking and other uses in their priorities for IHP VIII.

Establishment and operation of national groundwater quality monitoring networks effectively supports sustainable groundwater quality management, provides valuable data for assessing the current state of and forecasting trends in groundwater quality and helps to clarify and analyze the extent of natural processes and human impacts on groundwater system in time and space. Hydro-chemical maps depicting groundwater chemical types and quality are useful tools for regulatory and managerial purposes and help planners make informed, environmentally sound decisions regarding groundwater protection and quality conservation. Additional research is needed in the modeling of hydro-geochemical processes and in the study of the chemical and isotopic evolution of groundwater. This focal area addresses groundwater quality management with the view to improving groundwater pollution prevention policy, mitigate pollution risk and enhance effective in situ pollution remediation techniques.

2.5 - Transboundary cooperation

This focal area will enable Member States to improve their institutions, strengthen professional capacities and develop regulations for the sustainable management and environmentally sound protection of transboundary aquifers. More than half of the large continental aquifers are shared between two or more riparian countries. To compile a world inventory of transboundary aquifers and to develop wise practices and guidance tools concerning shared groundwater resources management UNESCO IHP established the long term ISARM (Internationally Shared Aquifer Resources Management) Programme launched at the 14th Session of Intergovernmental Council of the UNESCO IHP (2000). Within the first phase of the UNESCO ISARM programme, UNESCO – IHP provided technical support to the United Nations International Law Commission for the preparation of the draft articles on the Law of Transboundary Aquifers. The UN General Assembly adopted Resolution on the Law of Transboundary Aquifers in December 2008.

Strengthening groundwater monitoring activities of transboundary aquifers and filling their groundwater data gaps are a globally justified task and IHP will provide guidance to establish and promote: policies to encourage and assist organizations involved in the development of groundwater to monitor, record, assess and submit groundwater data and information; GIS databases to facilitate the storage and retrieval of groundwater data for different uses; and institutional and legal frameworks to manage, share and use data on international level.

Shared Aquifers (ISARM)

The worldwide ISARM (Internationally Shared Aquifer Resources Management) Initiative is an UNESCO and IAH led multi-agency effort aimed at improving the understanding of scientific, socio-economic, legal, institutional and environmental issues related to the management of transboundary aquifers.

The issue of shared international waters is as old as the national borders that make those waters international. During the last century, a significant progress has been made in regulation of joint management of surface watercourses; many international river-, lake- or basin commissions have been set up and the legal treaties signed. Although some of these activities address "a groundwater component" as well, major comparable efforts related to the invisible groundwater have started just a several years ago with the ISARM Programme.

Since its start in 2002, ISARM has launched a number of global and regional initiatives. These are designed to delineate and analyse transboundary aquifer systems and to encourage riparian states to work cooperatively toward mutually beneficial and sustainable aquifer development.

Thematic Area 3 - Water Scarcity and Quality

The planet's freshwater resources, if managed sustainably and effectively, can meet water demands of the world's growing population with good quality water. However, water scarcity and water quality degradation present major challenges in securing enough water of good quality to meet human, environmental, social and economic needs to support sustainable development of countries. The widespread water quality degradation across the world is the most serious water problem, threatening human health and ecosystems' integrity, but also representing a major concern for the water resources sustainability. New water quality challenges such as emerging pollutants and safe wastewater reuse bring even greater concerns, calling for urgent attention.

This theme focuses on the protection of the world's freshwater resources to reduce impacts on human well-being and the natural environment. Activities under the theme aim to protect the water resources from pollution, enhance and restore water quality, conserve water and use water efficiently. Related Intergovernmental Hydrological Programme (IHP) initiatives and projects include UNESCO-IHP International Initiative on Water Quality (IIWQ), Global Network on Water and Development Information for Arid Lands (G-WADI), International Drought Initiative (IDI) and the major UNESCO Project on Emerging Pollutants in Water and Wastewater.

Water scarcity is a natural as well as a human-induced phenomenon. For many countries, water scarcity represents the most pressing challenge to socio-economic and human development at large. Water scarcity due to over-use and the uneven distribution of water resources in both time and space, coupled with the growing water pollution, is becoming a growing concern. There is no global water scarcity as such, but a number of localities and regions in the world are short of water due to the fact that worldwide water use is growing at more than twice the rate of population increase in the last century. In addition, climate change exacerbates water scarcity, especially in arid and semi-arid zones, which are already water-stressed.

Water quality, due to its serious human health and environmental impacts, represent a crucial but often neglected aspect of water resources management. Primary causes of water pollution are rapid urbanization, increased agricultural activities, use of fertilizers and pesticides, land degradation and deforestation, and the lack of adequate wastewater treatment and disposal. Poor water quality not only negatively affects human health and ecosystems in multiple ways, but also makes water unfit for different uses and purposes and hence reduces the water resources availability. Consequently, water pollution is

also becoming one of the greatest threats to freshwater availability and re-use. As water treatment technologies are often expensive, wastewater management is inadequate or inexistent in most developing countries. Urgent action is needed to improve water quality and wastewater management. IHP makes a significant contribution to understanding and effectively managing water quality through activities focusing on issues both in developing and developed countries.

Objectives of the theme include: strengthening the knowledge base on the quantity and quality of the world's water resources; promoting catchment-based water resources management and planning; predicting and planning for water scarcity; improving the understanding and management of water quality; integrating quality-quantity management and science-based decision-making, enhancing legal, policy and institutional frameworks for improved water quality management, and promoting new innovative tools for water quality management and pollution control.

Actions under the Thematic Area 3 are organized under the following Focal Areas:

- Focal area 3.1: Improving governance, planning, management, allocation, and efficient use of water resources;
- Focal area 3.2: Dealing with present water scarcity and developing foresight to prevent undesirable trends;
- Focal area 3.3: Promoting tools for stakeholder's involvement and awareness and conflict resolution;
- Focal area 3.4: Addressing water quality and pollution issues within an IWRM framework - improving legal, policy, institutional, and human capacity;
- Focal area 3.5: Promoting innovative tools for safety of water supplies and controlling pollution.

Thematic Area 4 - Water for Human Settlements

Cities around the world are facing a range of pressures resulting from population growth, climate change and deterioration of urban infrastructure systems. As water demand continues to increase in the future, an increasing number of cities will face challenges of managing scarcer and less reliable water resources in an efficient way. Realities on the ground and the challenges of future pressures have made it obvious that business as usual is not the way forward.

Objectives include: exploring new approaches, technologies and system-wide changes towards integrated urban water management such as flexible and adaptive urban water systems, water sensitive urban design, and water (beneficiation) in urban areas; promoting effective governance and institutional structures of urban water management; and identifying and disseminating best practices for different economic and geographic settings in developed and developing countries. Water issues in emerging cities and rural settlements in developing countries merit a special emphasis, including the special needs and problems in slums or peri-urban areas that are often the most deprived. New approaches for water management in the city of the future have to be developed.

Strategies to build resilient urban water systems must adopt a broader perspective that recognizes the interdependence of the different water systems. Game-changing approaches and technologies that allow optimization of water quality, quantity, and the water and energy footprint in cities need to be explored.

Actions under the Thematic Area 4 are structured under the following Focal Areas:

- Focal area 4.1: Game changing approaches and technologies;
- Focal area 4.2: System wide changes for integrated management approaches;
- Focal area 4.3: Institution and leadership for beneficiation and integration;
- Focal area 4.4: Opportunities in emerging cities in developing countries;
- Focal area 4.5: Integrated development in rural human settlement.

Thematic Area 5 - Ecohydrology

In the face of increasing climate instability, demographic growth and human migration, there is an urgent need to reverse the degradation of water resources and stop further decline in biodiversity. Ecohydrology uses the understanding of relationships between hydrological and biological processes at different scales to improve water security, enhance biodiversity and further opportunities for sustainable development by lessening ecological threats and maximizing greater harmony within catchment processes.

The Ecohydrology programme aims to advance the integration of social, ecological and hydrological research, and to generate outcomes that enable the development of effective policies and practices for integrated water resources management. The Intergovernmental Hydrological Programme (IHP) supports research, networking and capacity building initiatives aimed at improving the understanding of the interlinkages of ecohydrological processes at the catchment scale.

Objectives include improving the understanding of the role of different types of terrestrial and wetland ecosystems, sharing knowledge on the integration of ecohydrological technologies with good agricultural and environmental practices, promoting model development to reduce hydropeaking impacts on ecosystems by integrating specific environmental science knowledge, as well as developing catchment scale ecohydrological early warning systems.

Guidelines will be developed for the integration of various types of biological and hydrological regulations to improve water quality, biodiversity and freshwater systems. Regional ecohydrological solutions on the impact of global changes on hydrologic cycles and coastal ecosystems to address the increasing vulnerability of aquatic resources will be shared and improved.

Actions under the Thematic Area 5 are structured under the following Focal Areas:

- Focal area 5.1: Hydrological dimension of catchment - identification of potential threats and opportunities for a sustainable development;
- Focal area 5.2: Shaping of the catchment ecological structure for ecosystem potential enhancement , biological productivity and biodiversity;
- Focal area 5.3: Ecohydrology system solution and ecological engineering for the enhancement of water and ecosystem resilience and ecosystem services;
- Focal area 5.4: Urban Ecohydrology - storm water purification and retention in the city landscape, potential for improvement of health and quality of life;
- Focal area 5.5: Ecohydrological regulation for sustaining and restoring continental to coastal connectivity and ecosystem functioning.

Thematic Area 6 - Water Education

Water education at all levels needs to be improved if the challenges identified in the previous themes are to be met. Water education must go beyond the teaching of hydrological sciences, and be both multidisciplinary and interdisciplinary. This approach would include advancing scientific knowledge through the training of scientists as well as increasing knowledge on water issues through courses aimed at water professionals and decision-makers. Water education should also reach out to media professionals so that they can communicate water issues accurately and effectively. The work will include community education strategies to promote communitywide water conservation, as well as enhance skills in local co-management of water resources. Efforts will be made to make water a significant component of the K-12 curriculum.

Objectives include supporting the enhancement of tertiary water education capacities, particularly in developing countries, promoting the continuous professional development of water scientists, engineers, managers and policy makers in the water sectors, as well as developing guidelines, briefing papers, prototype professional development programmes and case studies connected with water education for water security.

Water-related centres play an important role in this endeavour, in addition to the network of universities, institutes and research facilities linked to the Intergovernmental Hydrological Programme's other themes, projects and initiatives. Case studies of leading practices in sustainable water management will be developed to maintain and expand the training of technicians in water-related fields. UNESCO's Education Sector will continue to be a partner in the development of water-related materials and activities aimed at the K-12 curriculum.

Actions under the Thematic Area 6 are structured under the following Focal Areas:

- Focal Area 6.1: Enhancing tertiary water education and professional capabilities in the water sector;
- Focal Area 6.2: Addressing vocational education and training of water technicians;
- Focal Area 6.3: Water education for children and youth;
- Focal Area 6.4: Promoting awareness of water issues through informal water education;
- Focal Area 6.5: Education for transboundary water cooperation and governance.

Institute for Water Education (UNESCO-IHE)

IHE, a leading institute in the field of postgraduate water education, was a UNESCO Category 1 Institute from 2001 to 2016. In order to facilitate continuous funding beyond 2016 by the Dutch Government and allow the Institute's activities to grow and develop for the benefit of UNESCO Member States, the Organization's 39th General Conference (November 2017) accepted the proposal to turn it into a Category 2 'Institute for Water Education' under the auspices of UNESCO.

IHE Delft Institute for Water Education envisions a world free of poverty and injustice, in which people manage their water and environmental resources sustainably and equitably. The mission of IHE Delft works in partnership to strengthen capacity in the water sector to achieve global sustainable development. Through our overarching work on capacity development, IHE Delft aims to make a tangible contribution to achieving all Sustainable Development Goals in which water is key.

Operating from a water perspective, IHE Delft focuses on regional challenges, such as droughts, floods and deteriorating water quality, and global challenges, such as climate change, ecosystem degradation, land loss, urbanization, sanitation, poverty, hunger, and migration. IHE embraces clear, integrated approaches and holistic solutions.

To increase its impact on the water sector, IHE offers tailored, high-quality education and research in Delft and overseas, through strong partnerships within the Netherlands and with our main international partners, especially in the Global South.

IHE offers the following education:

- High-quality MSc degrees and short courses, customized to professional requirements;
- MSc for water professionals and a research MSc for professionals with PhD ambitions;
- Flexible modalities increasingly incorporating, online, lifelong learning in collaboration with partner universities.