



MEMORANDUM

To: Executive Committee of Faculty Council (March 21, 2017)
Faculty Council (April 10, 2017)

From: Professor Vladimiro Papangelakis
Department of Chemical Engineering & Applied Chemistry
Department of Materials Science & Engineering

Date: March 26, 2017

Re: **Establishment of the Institute for Water Innovation (IWI) as an
Extra-Departmental Unit:C (EDU:C)**

REPORT CLASSIFICATION

This is a major policy matter that will be considered by the Executive Committee for endorsing and forwarding to Faculty Council for vote as a special motion (requiring a 2/3 majority of members present and voting to carry).

MOTION FOR FACULTY COUNCIL

THAT the Faculty establish the Institute for Water Innovation (IWI) as an Extra-Departmental Unit:C (EDU:C), as described in Report 3537, effective upon the approval of Faculty Council.

1. INTRODUCTION

Water is a critical resource. It is essential to life and is also an essential component of global and local economies. However, as economies grow and diversify, competing demands for water arise to meet the needs of more municipal, agricultural, and industrial uses. According to the United Nations Environment Programme (UNEP) “the total usable freshwater supply for ecosystems and humans is 200,000 km³ of water, which is less than 1% of all freshwater resources, and only 0.01% of all water on earth.” By 2050, global water demand is projected to increase by 50% due to growing demands from manufacturing, thermal electricity generation, and domestic use. As global water scarcity and water stress

continue to persist, solutions are needed to reduce pressure on freshwater assets. Now more than ever, a focus on innovation is necessary to combat water challenges.

The Faculty of Applied Science & Engineering (FASE) at the University of Toronto is well poised to address local and global water challenges in the 21st century. FASE researchers are recognized for their expertise in process equipment design, materials science, and water treatment.

Recognizing the water research strength within FASE, in 2014 select faculty members from the Departments of Chemical Engineering & Applied Chemistry, Civil Engineering, and Materials Science & Engineering came together as a working group to support the development of an Institute for Water Innovation (IWI), under the interim directorship of Professor Vladimiros Papangelakis of Chemical Engineering & Applied Chemistry. The IWI is supported by a diminishing three-year grant from the Dean of the Faculty of Applied Science & Engineering's Strategic Fund. Although currently housed in the Department of Chemical Engineering & Applied Chemistry, IWI involves faculty from across FASE and will have office space in the Centre for Engineering Innovation & Entrepreneurship building upon completion of construction.

This proposal provides the case for elevating the existing working group to an Extra-Departmental Unit:C (EDU:C) within FASE, where it will be a formal multidisciplinary, multi-departmental unit that fosters research and scholarly interest in the defined domain of water research, and where active administrative and budgetary responsibility will reside. IWI will have the mandate to engage in research activities with industry, government and public utilities, to provide research-based evidence to address industrial and municipal water challenges including problems facing the indigenous communities, to provide science-based guidance to policy developers and NGOs, to engage and collaborate with other University Centres, to enhance the training of students, and to increase the external profile of FASE and the University of Toronto.

In subsequent sections of this proposal, the mission; positioning; academic rationale and goals; objectives, benchmarks and measures of success; structure; teaching role; resources, consultation, and governance and reviews of the proposed EDU:C are described in detail.

2. MISSION

IWI's mission is to expedite research and development of advanced water technologies by creating a multi-disciplinary, multi-departmental network focused on sharing knowledge, ideas, and resources. It aligns with the University of Toronto and FASE strategic priority area *Enabling Technologies for the 21st Century*. IWI will strive for global leadership in water research by developing breakthrough water management, treatment and remediation technologies, by providing science-based guidance to policymakers, and by contributing to the education and training of highly qualified personnel in the water sector.

3. POSITIONING

IWI was founded in 2014 with support from the Departments of Chemical Engineering & Applied Chemistry (ChemE), Civil Engineering (CivE), and Materials Science and Engineering (MSE), as well as the Dean's Strategic Fund (DSF) in 2015. The focus of the DSF was on developing industry support for the IWI from the natural resource sector (mining, metallurgy and petrochemicals).

Considerable resources already exist within CivE, ChemE, and MSE to support world-class water research, including:

- The Drinking Water Research Group (DRWG), which undertakes applied research and development projects to support ongoing improvements in municipal drinking water treatment and distribution systems.
- The BioZone Centre for Applied Bioscience and Bioengineering, an existing EDU:C, which leverages the dramatic progress in biology, particularly in genome science and genome analysis tools, to provide sound bioengineering solutions to real-world problems, including wastewater treatment and contaminated groundwater remediation.
- The Pulp & Paper Centre, an existing EDU:D, which engages in research and development work to advance the sustainability of the international pulp and paper industry. Founded in 1987, this centre has significant industry linkages. Water-related projects include biosludge dewatering and in-mill water reuse.
- An MEng emphasis program in Advanced Water Technologies and Process Design available to ChemE, CivE, and MSE students wishing to acquire in-depth knowledge of water treatment methods and design of process systems.
- The Lassonde Institute of Mining, with several researchers from CivE, ChemE and MSE having strong links to the mining sector, which is a considerable water user and faces many challenges in the way of operations that are both sustainable and have a low environmental impact.

A number of existing institutes and research groups in Canada deal with water-related issues. However these focus largely on climate change, ecology, hydrology, health, and water resources. IWI will differ from these research centres through its focus on developing innovative solutions (e.g. products and processes) that address water challenges facing industry, government, public utilities, and the end-consumer. IWI will address these challenges through harnessing research capabilities across four major themes:

1. **Management** covers the complete range of knowledge around the management of water systems. Research activities include watershed management, stormwater management, low impact development (LID) stormwater systems, urban water security and wet weather policy.

2. **Characterization** is the knowledge, techniques and facilities employed to characterize and model water systems on a chemical and biological basis. This theme also includes the study of the fate and transport of contaminants in water systems.
3. **Treatment** is the body of research activity involved in developing novel water treatment and purification technologies. IWI research in this area will focus on energy-efficient treatment/purification methods for the removal/inactivation of contaminants ranging from high levels of total dissolved solids (TDS), to bacteria, and trace levels of toxic, regulated, and emerging elements and compounds.
4. **Remediation** research examines new methods and technologies to treat contaminated water systems, as well as wastes and residues interacting with water systems. This includes chemical, physical, and biological methods.

IWI will be formed through a highly multi-disciplinary partnership of non-budgetary, cross-appointed faculty from FASE departments and institutes whose expertise encompass at least one of the four abovementioned themes.

4. ACADEMIC RATIONALE AND GOALS

Water research at the University of Toronto directly addresses the University's strategic research themes of *SUSTAIN: Humanity and the Environment* and *ENABLE: Technologies for the 21st Century*, and encompasses FASE's strategic research areas of Sustainability and Bioengineering.

The establishment of IWI as an EDU:C and fulfillment of its mandate will create a portal to leading water research and innovation at U of T, and serve to advance and increase the global competitiveness of Canadian water technologies.

The goals of IWI are to:

1. Support large-scale, high-impact water research
2. Increase the external profile of FASE and U of T as leaders in water research and innovation
3. Transfer research into practice
4. Engage and educate the next generation of highly qualified personnel

5. OBJECTIVES, BENCHMARKS, AND MEASURES OF SUCCESS

The following objectives and benchmarks will allow IWI to demonstrate the achievement of the goals outlined in the preceding section.

5.1 The objectives in support of satisfying the goal of supporting large-scale, high-impact water research are:

- Lead inter-Department and inter-Faculty research collaboration across FASE and the University
- Lead major multidisciplinary, multi-university projects, and network activities

- Develop collaborative research partnerships with industrial and governmental organizations around the world

Success against these objectives can be measured by:

- International recognition for the research of IWI members as quantified through the quality of publications produced, collective citation metrics, and the value of group/individual research awards
- Extent and value of research collaborations across FASE and U of T, and with other universities

5.2 The objectives in support of satisfying the goal of increasing the external profile of FASE and U of T as leaders in water research and innovation are:

- Establish a powerful presence on campus
- Establish IWI as a premier independent think-tank on water challenges facing industry, government, and the end-consumer

Success against this objective can be measured by:

- Number of outreach activities staged and numbers in attendance
- Coverage by media
- Extent of research facilities dedicated to water research

5.3 The objectives in support of satisfying the goal of transferring research into practice are:

- Develop solutions to major water challenges facing industry, government, public utilities, and the general public
- Engage with industry and government in knowledge transfer and commercialization activities

Success against these objectives can be measured by:

- Value of the initiatives funded, collaborations created, collaborative grants/contracts obtained, value of grants/contracts obtained, processes, products and services commercialized, and spin-off companies produced

5.4 The objective in support of satisfying the goal of engaging and educating the next generation of highly qualified personnel is:

- Build capacity in the training of highly qualified personnel

Success against this objective can be measured by:

- Number of trainees attracted, new courses developed, new or enhanced graduate programs created, enrolment in graduate courses, research accomplishments of trainees, and subsequent alumni career success

6. STRUCTURE

6.1 Naming

As an EDU:C, IWI be appropriately named as an institute because of its multidisciplinary and multi-departmental nature. The name can be adapted if IWI successfully identifies a donor willing to contribute at the level appropriate for naming rights.

6.2 Director

Upon approval of the IWI as an EDU:C, a Director will be appointed by and report to the lead Dean, or designate, for a fixed term of not more than five years, renewable once by the Dean.

The Director is responsible for all policy development as well as administrative and financial decision-making. However, the proposed IWI is an EDU:C and as such, s/he is not appointed under the *Policy on Academic Administrative Appointments* and subsequently does not have signing authority. As a consequence, an EDU:C may not administer research funds or enter directly, and on its own authority, into commitments, agreements, or contracts. All monies and research funding will flow through the Department of Chemical Engineering & Applied Chemistry, or through the Dean's Office, in line with the Faculty's normal practice. Any research contracts or agreements similarly require approval and the signature of the Chair of the Department of Chemical Engineering & Applied Chemistry.

The Director is responsible for the administration and financial operations of the Institute, and is accountable to the lead Dean. The Director will promote the goals of IWI to the external community, liaise with senior University administrators, and recruit new student and faculty members. More specifically, the role of the Director is to:

- Coordinate with the Dean and Vice-Dean, Research on Faculty-level strategic vision
- Advise the Dean on the appointment of Advisory Board members
- Select Steering Committee members
- Chair Steering Committee and Advisory Board meetings
- Manage the input of the Steering Committee and Advisory Board in shaping the strategic vision of the Institute
- Administer the Institute's operating budget from the divisional budget(s)
- Liaise with Undergraduate and Graduate Coordinators regarding water-related undergraduate minors and certificates, graduate emphasis programs, and new course proposals to provide insight on complementarities across the Faculty

6.3 Manager

While the lead Dean is responsible for overseeing the disbursement of advancement funds, the Manager, reporting to the Director and working closely with the FASE Advancement Team and U of T Innovations and Partnerships Offices (IPO), is responsible for maintaining and attracting industrial partnerships, seeking funding from donors and industrial partners,

and managing IWI's operations on a daily basis. The manager will also play a leading role in the solicitation of funds to support IWI operations on an on-going and sustainable basis.

This includes:

- Helping to inform the Institute's academic direction and develop its strategic plan
- Playing a major role in writing proposals to a wide variety of potential funders, including granting councils, foundations, public sector agencies, and the private sector
- Working with FASE Advancement Team and IPO on seeking out and developing relationships with potential donors
- Leading IWI communications and outreach activities, including coordination of major IWI events
- Overseeing IWI contracts and accounts

In September 2015, Mr. Mandeep Rayat joined IWI as its full-time Manager. Funding from the Dean's Strategic Fund (DSF) is being used to cover his salary for three years. The daily operation of IWI is enabled by this support, which is critical to its success.

6.4 Academic Steering Committee

The Director and Manager will work with an Academic Steering Committee (ASC) to help inform the Institute's academic direction. The ASC will consist of:

- The Director and Manager. The Director will chair the committee.
- Three faculty representatives from the academic units most directly involved in IWI activities. These will likely include the FASE Departments of Chemical Engineering & Applied Chemistry, Civil Engineering, and Material Science & Engineering.
- The Chair of the Advisory Board.
- The FASE Vice-Dean, Research.

ASC members will be appointed on a two-year, rotating basis. The ASC is expected to meet three to four times a year.

6.5 Advisory Board

In accordance with the *Provost's Statement on the Role of Advisory Bodies (April 30, 1998)*, the Dean, with input from the EDU:C Director and the Academic Steering Committee, will establish an Advisory Board, consisting of senior industry, government, and public utility representatives with a direct interest in water research and innovation, to provide non-binding advice. Board members will fill one or more primary roles: (1) provide strategic connections between researchers and industry/government leaders in their sector; (2) fund research within IWI through industry research contracts and partnership programs; and (3) raise philanthropic funds for IWI. Continued service on the Board will require tangible contributions in one or more of these three areas. The value proposition for Board

members will include access to leading-edge research and access to trained HQPs for recruitment.

IWI is currently identifying Advisory Board candidates in consultation with the Vice-Dean, Research and the Advancement Office for recommendation to the Dean for appointment to the Board.

6.6 Faculty Membership

IWI is intended to be the hub of water-related research in FASE. Numerous faculty members across U of T have research interests in water; twenty-six from departments as diverse as Mechanical & Industrial Engineering, Civil Engineering, Materials Science & Engineering, and Chemical Engineering & Applied Chemistry, have agreed to be associated with the Institute¹. These faculty members are listed in Appendix A.

7. TEACHING ROLE

As mentioned in Section 3, an MEng emphasis program in Advanced Water Technologies and Process Design already exists. IWI will support this program and contribute to the development of professionals in industry and government by offering specialized courses and workshops on water treatment and remediation technologies.

8. RESOURCES

The success of IWI as an EDU:C hinges upon securing stable ongoing funding sufficient to cover its operating costs. The Dean's Strategic Fund is currently providing initial funding for three years (July 2015 to June 2018). Four companies (and a fifth most likely) have committed funds for an Industrial Research Chair on "Water and Sustainable Extractive Metallurgy" at the level of \$1 million over five years. An NSERC-IRC application will be launched in the winter of 2017. Approximately \$1 million has been approved by FASE for the renovation of a laboratory in the Wallberg building that will be assigned to water research as part of the Federal Government's Post-Secondary Institutions Strategic Investment Fund (renovation to be completed by the fall of 2017).

It is expected that overhead from research and consulting contracts will provide sustainable base support for longer-term operations. IWI is actively seeking collaborative research opportunities with companies that have an interest in water-related research and innovation. Overhead from successful project proposals will be used to support IWI operations. The Director, Manager, and Academic Steering Committee are actively working to make IWI financially independent of Faculty and University sources. This commitment is reflected in the goals and objectives of the Institute.

¹ As an EDU:C, IWI may only hold non-budgetary cross-appointments of tenure and teaching stream faculty.

9. CONSULTATION

In developing its vision, membership, and strategic plan, IWI consulted with representatives from the Departments of Chemical Engineering & Applied Chemistry, Civil Engineering, and Materials Science & Engineering.

An overview of the proposed EDU was also presented at a meeting of FASE Chairs and Directors in December 2016. The feedback from this meeting was positive and their recommendations have been incorporated in this proposal. Letters of support from several Chairs and Directors are included in Appendix B.

10. GOVERNANCE AND REVIEWS

The creation of an EDU:C requires Divisional governance approval only and is reported to the Office of the Vice-President and Provost for information.

The governance and periodic reviews of the EDU:C will be conducted in accordance with the guidelines established by the University of Toronto Governing Council's *Guidelines for Administrative Functions and Protocols for Extra-Departmental Units* (February 26, 2007) and the Faculty's *Framework for Review of Institutes and Centres* (September 2013).

In line with normal practice, an EDU:C is subject to periodic review at fixed intervals (normally every five to seven years), conducted by the lead Dean. Any review would normally assess the EDU's sustainability, performance and achievements relative to the goals set out at its establishment. Possible outcomes of the review could include closure.

Appendix A – List of Associated Faculty

Name and Title	Faculty of Applied Science & Engineering Department
Edgar Acosta, Professor	Chemical Engineering & Applied Chemistry
Grant Allen, Professor	Chemical Engineering & Applied Chemistry
Robert Andrews, Professor	Civil Engineering
Susan Andrews, Professor	Civil Engineering
Gisele Azimi, Assistant Professor	Chemical Engineering & Applied Chemistry / Materials Science & Engineering
Mansoor Barati, Associate Professor	Materials Science & Engineering
Amy Bilton, Assistant Professor	Mechanical & Industrial Engineering
Erin Bobicki, Assistant Professor	Materials Science & Engineering / Chemical Engineering & Applied Chemistry
Jennifer Drake, Assistant Professor	Civil Engineering
Elizabeth Edwards, Professor	Chemical Engineering & Applied Chemistry
Ramin Farnood, Professor	Chemical Engineering & Applied Chemistry
Murray Grabinsky, Associate Professor	Civil Engineering
Ron Hofmann, Associate Professor	Civil Engineering
Charles Jia, Professor	Chemical Engineering & Applied Chemistry
Donald Kirk, Professor	Chemical Engineering & Applied Chemistry
Yuri Lawryshyn, Associate Professor	Chemical Engineering & Applied Chemistry
Radhakrishnan Mahadevan, Professor	Chemical Engineering & Applied Chemistry
Roger Newman, Professor	Chemical Engineering & Applied Chemistry
Vladimiro Papangelakis, Professor	Chemical Engineering & Applied Chemistry
Chul Park, Professor	Mechanical & Industrial Engineering

Name and Title	Faculty of Applied Science & Engineering Department
Elodie Passeport, Assistant Professor	Civil Engineering / Chemical Engineering & Applied Chemistry
Bradley Saville, Professor	Chemical Engineering & Applied Chemistry
Brent Sleep, Professor	Civil Engineering
Steven Thorpe, Professor	Materials Science & Engineering
Honghi Tran, Professor	Chemical Engineering & Applied Chemistry
Lesley Warren, Professor	Civil Engineering



Chemical Engineering & Applied Chemistry
UNIVERSITY OF TORONTO

February 21, 2017

Professor V. Papangelakis
Department of Chemical Engineering & Applied Chemistry
Faculty of Applied Science & Engineering
University of Toronto
200 College Street
Toronto, ON M5S 3E5

Dear Professor Papangelakis,

On behalf of the Department of Chemical Engineering & Applied Chemistry, I write to express my strong support for your proposal on establishing the Institute for Water Innovation as a new EDU:C unit. I believe the Institute for Water Innovation will help unify the many water-related capabilities and resources at the University of Toronto, fostering multi-disciplinary collaboration to address the most significant water challenges facing industry, government, and public utilities.

I wish you every success in this endeavor and, on behalf of the Department of Chemical Engineering & Applied Chemistry, offer my enthusiastic support for this program.

Sincerely,

D. Grant Allen, Ph.D., P.Eng.
Professor and Chair



Civil Engineering
UNIVERSITY OF TORONTO

February 22, 2017

Professor Vlad Papangelakis
Department of Chemical Engineering & Applied Chemistry
Faculty of Applied Science & Engineering
University of Toronto

Dear Professor Papangelakis,

On behalf of the Department of Civil Engineering, I write to express my strong support for your proposal on establishing the Institute for Water Innovation as a new EDU:C unit. I believe the Institute for Water Innovation will help unify the many water-related capabilities and resources at the University of Toronto, fostering collaboration across the Faculty of Applied Science and Engineering to address the most significant water challenges facing Canadians today. I expect that several faculty members in Civil Engineering will be active participants in the Institute.

Sincerely,

A handwritten signature in black ink that reads "Brent Sleep".

Brent Sleep
Professor and Chair



Materials Science & Engineering
UNIVERSITY OF TORONTO

Professor V. Papangelakis
Department of Chemical Engineering & Applied Chemistry
University of Toronto
200 College St.
Toronto, ON M5S 3E5

Dear Professor Papangelakis,

I am writing on behalf of the Department of Materials Science and Engineering to express my enthusiastic support for your proposal to establish the Institute for Water Innovation (IWI) as an EDU:C.

Water related issues are inherently interdisciplinary, and are certainly highly relevant to the research interests of many faculty in our department. I believe that the establishment of the IWI will facilitate collaboration in this important area between several FASE departments including MSE.

Sincerely,

A handwritten signature in black ink, appearing to read 'Jun Nogami', with a long horizontal flourish extending to the right.

Jun Nogami
Professor and Chair



Mechanical & Industrial Engineering
UNIVERSITY OF TORONTO

5 King's College Road, Toronto, Ontario, M5S 3G8, Canada

Jean W. Zu
Professor and Chair
zu@mie.utoronto.ca
Tel.: (416)978-7198
Fax: (416)978-7753

March 4, 2017

Professor Vladimiro G. Papangelakis
Department of Chemical Engineering and Applied Chemistry
University of Toronto
200 College Street
Toronto, Ontario M5S 3E5

Dear Professor Papangelakis:

On behalf of the Department of Mechanical & Industrial Engineering (MIE), I write to express my strong support to your proposal on establishing the Institute for Water Innovation as EDU:C in the Faculty. Water is an important area of research of multi-disciplinary nature. A couple of researchers from MIE are involved or interested in water-related research. The establishment of the new institute will help bring researchers working in the area together to make greater contributions and bigger impact. I wish you all the best and success in the new institute.

Sincerely yours,

Jean Zu