SCIENCE FOR TECHNOLOGICAL INNOVATION

Kia kotahi mai –
Te Ao Pūtaiao me
Te Ao Hangarau

SCIENCE FOR TECHNOLOGICAL INNOVATION
NATIONAL SCIENCE CHALLENGE

Call for Expressions of Interest
Clean Water Technology

Science for Technological Innovation (SfTI) are calling for Expressions of Interest (EoIs) from researchers to support the implementation of a new Spearhead project arising from the 2018 Clean Water Technology (CWT) Mission Lab.

EoI Applications close 7 February 2020, the application form is at the end of this document and also available as a separate file for editing and return on our website here.

About Spearhead projects

Science for Technological Innovation (SfTI) Spearhead projects are intended to deliver specific innovative technologies to help achieve SfTI's mission of enhancing New Zealand's capacity to use physical sciences and engineering for economic growth. They should be mission-led and bring nationwide teams together to have a broad impact on this country's technology ecosystem, including capacity development activities.

Eligibility

Researchers from New Zealand based organisations are eligible.

Clean Water Technology background

In November 2018 SfTI hosted a Mission lab with the water sector and Māori stakeholders, and a wānanga at the Whanganui River in March 2019 (Wai Māori Wai Hangarau Wānanga). The purpose of these meetings was to discuss some key challenges for the water sector ahead of forming a Spearhead project. The outcomes of these discussions can be found in Appendix 2: 'Background to the EoI'.

Clean Water Tech is an important direction for New Zealand, not least because of our dependence on water for agriculture and tourism. International markets are also relevant to meet SfTI's mission to 'Enhance New Zealand's capacity to use physical sciences and engineering for economic growth'. Our ideal project will incorporate a Māori view of water as integrally linked to its surrounding environment in order to create new technology that addresses issues facing Aotearoa-New Zealand and the rest of the world.

The broad research area of CWT has been formed into four possible research directions:

1. Information-Based Solutions
2. Preventing and Remediating Contamination at Source
3. Autonomous Treatment
4. Transforming Contaminants

At this time, we are calling for researchers to identify their expertise and capability relevant to CWT and indicate which of these four research directions they would be interested in exploring further during the upcoming invitational Researcher Workshop.

Please note: We are **not** interested in investigator-led research ideas and proposals.

The Spearhead development process

This project is at Stage three of the Spearhead project development process (see Appendix 1), the purpose of this EoI stage is to assemble researchers to form a 'best' research team via Expressions of Interest.

Researcher Workshop (10 March 2020)

From the Expressions of Interest, a group of **researchers** will be **invited** to participate in the process to establish the team that will put together a CWT research proposal for SfTI Board approval. The selected researchers are expected to attend a workshop in Wellington on 10 March 2020 to explore components of a research programme and organise into a multidisciplinary team. It is important that the selected researchers attend the workshop with a willingness to consider a range of different ideas about the core research questions and ensure these fit with the overarching CWT mission, and to work towards achieving group consensus on next steps. The workshop may focus on two or three of the four possible research directions, depending on the EoIs received.

It is likely that only a subset of researchers attending the Wellington workshop will be selected to form the project team, and this will depend on fit of research capability and disciplines offered by the researchers to the draft research programme project developed during the workshop. SfTI will fund travel to attend the Wellington workshop, as well as any on-going costs involved in bringing the selected team together to further develop the research programme proposal.

The process will finish with the development of a formal research programme proposal covering a maximum of three strands of work. Given the importance of water to Māori, the eventual project will need to strongly address Vision Mātauranga. The project funding level will be in the order of $1m per annum for up to three years, starting from as soon as possible after 1 July 2020.

How to apply

Register your interest by sending your completed application form, and CV, to SfTIChallenge@callaghaninnovation.govt.nz. Applications close **7 February 2020**. The application form asks for a brief summary of where your research interest lies, and your experience. The form is at the end of this document, or it can be downloaded from our website: https://www.sftichallenge.govt.nz/news-updates/clean-water-tech-mission.
Please note: long applications will not be considered so do not exceed the word limit.

Key dates and process

- CWT EoI released – 17 December 2019
- EoI Applications close – 7 February 2020
- Workshop invitations sent to researchers – End of February 2020
- Researchers Workshop in Wellington – 10 March 2020
- CWT Spearhead research commences – 1 July 2019

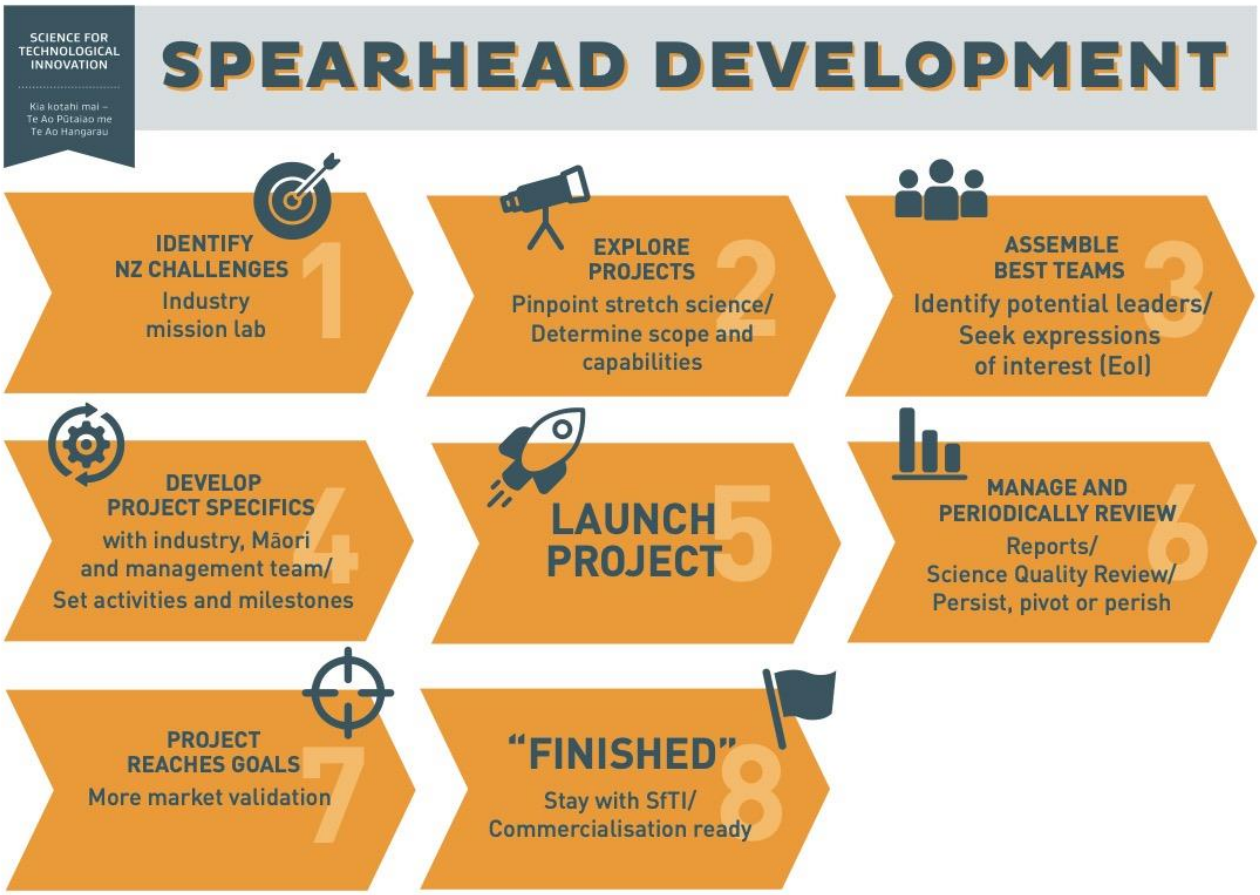
Contact information

If you have any questions about the EoI process, email Denise Cutler, SfTI Contracts Manager: denise.cutler@callaghaninnovation.govt.nz

For all other questions relating to CWT, expertise and capability, email SfTI Leadership Team members:

Don Cleland d.cleland@massey.ac.nz or Ian Woodhead ian.woodhead@lincolnagritech.co.nz

Appendix 1: Spearhead project development process



Appendix 2: Background to the EoI

Introduction

The Clean Water Technology Mission is one of several new topics being explored by the Science for Technological Innovation (SfTI) National Science Challenge as a big idea for Phase two (2019-2024).

Wai (Water) is central to life. It symbolises the lifeblood of Papatūānuku (earth mother) and the tears of Ranginui (sky father). It is the element that binds the physical and spiritual realms together.

Rivers and lakes are integral to Māori cultural identity. Their health and wellbeing is viewed as intrinsically connected to the health and wellbeing of iwi and hapū. As the Whanganui pēpeha recites – *Ko au te awa, ko te awa ko au* (I am the river and the river is me). Wai, therefore, does not exist in isolation, but as a holistic system. This is reflected in the Māori view of water bodies as an indivisible whole, including all their physical and metaphysical elements.

The Clean Water Technology Mission recognises the importance of the relationship between water and the environment as a central focus, and understands that shared values and collective understanding will support us in meeting the suite of challenges presented by increasing demands on water: locally, regionally and nationally.

In this context, 'water' relates primarily to bodies such as streams, lakes and inshore marine environments (excluding coastal waters), but also includes potable supplies and waste water treatment/disposal. The scope includes related science and technology aimed at improving water quality, such as monitoring, robotics and direct prevention of contamination, as well as remediation.

As with all SfTI research, in order to be funded, each new Mission is required to demonstrate how it would leverage NZ's unique strengths, capability and/or resources to take a measurable, future-oriented leadership position. Incorporating the relationship that Māori have with water is an obvious way to do this, and it is a cornerstone of the approach that SfTI wishes to take. We are in the process of further refining this concept to identify where there is key 'stretch and NZ-sticky' research potential.

Refining the research programme

SfTI has carried out initial discussions with industry, Māori and central and regional government, to explore where there are feasible technology-based (non-policy) solutions***. At this stage we are seeking to devise and prioritise research programme elements that would align to the recommendations and priorities already established.***

We want to develop a bold new research plan, including what might be achieved (with indicative milestones) and more detail for the first two years of the project. The plan may have multiple work streams but there must be an over-arching (longer-term) logic to what is going to be attempted. A key element of the process will be the formation of a 'best NZ team', and looking for opportunities to collaborate with iwi and other organisations, such as Our Land and Water National Science Challenge, working in aligned areas.

Ultimately, this technology mission will meet all or most of the following criteria:

- Is relevant to Vision Mātauranga, i.e. to unlock the innovation potential of Māori knowledge, resources and people. This criterion is considered essential for the Clean Water Technology Mission;
- Involves new, emerging and potentially world-leading science and/or technologies;
- Can be applied in a unique way in NZ to generate economic growth for NZ;
- Takes advantage of an opportunity or set of conditions that is unique to NZ;
- Makes good scientific sense to carry out original research in NZ; and
- Builds capability in clean water technology areas where NZ cannot afford to be deficient.

Potential Research Directions

Consultations and wānanga have revealed a high level of interest in, and enthusiasm for, the potential of science and technology to *monitor, prevent* and *remediate* poor water quality, with each of these three elements highlighted as essential for an effective nationwide response.

Further, it is clear that Vision Mātauranga has a central place in developing best approaches that lead to the improved health and wellbeing of Aotearoa's people and land. Establishing and building long term relationships and growing shared understandings will support knowledge and technology transfer between Western Science and Mātauranga Māori. This can be achieved through:

- *Involving Māori and Mātauranga Māori in projects from the outset*. This includes: creating values-based design and methodology; taking the time to build relationships; understanding and enacting kaitiakitanga (guardianship), pono (honesty), and tikanga (correct practices); acting collectively; incorporating long-held knowledge about local waterways; and developing solutions with long term relevance and applicability.
- *Prioritising collaboration with local hapū/iwi/marae to understand specific local needs.* In practice this means working to co-design and develop approaches and solutions that support the health and wellbeing of both water and tangata whenua (people of the land).
- *Recognising the relationship with Te Taiao (natural environment), and holding a holistic view of waterways as mahinga kai (natural ecosystems) rather than viewing water as separate from its setting*. This approach brings the wider environment into frame, including riparian planting and kai moana, for example.

It is expected that a Governance Group will oversee the project to bring together the necessary range of perspectives and expertise. This group is likely to include representatives from iwi, rangatahi, regional/local government, central government (e.g. MfE), consultants (e.g. planning or engineering), researchers, Our Land and Water National Science Challenge, and conservation groups.

In essence, we want to determine what the missing physical sciences and technologies are that could make a significant difference to NZ in the clean water space. And in support of this, we must be clear about how new technologies can achieve the outcome of clean water while taking into account Māori water-related practices and philosophies. One specific question yet to be answered is whether the research should take a nationwide approach, or focus on a specific catchment, such as the Whanganui River, as a case study.

Potential research directions that provide a basis for subsequent refinement by researchers are outlined below (they arose from a Mission Lab of stakeholders and a wānanga held in November 2018 and March 2019 respectively).

1. Information-based solutions – utilising data as a key tool for monitoring the health of water ecosystems and evaluating mitigation activities.

In the first instance, this research direction may focus on developing new sensing technology that allows monitoring at a scale, frequency and precision, not currently feasible. Potential applications might include monitoring the health of indigenous species of fish, birds and wetlands, or identifying contamination sources in finer detail to allow threats to be quickly identified and treated. One approach could be iwi/hapū-led monitoring at sites identified as significant. It should be noted that the SfTI research stable already includes some sensor work (Nitrate Sensor Arrays) and it is important not to duplicate that here.

Better application of data science to clean water may contribute to an open software platform with multiple measures that allow evidence-based decision-making through providing a complete data picture. It would be a repository and analysis point for multiple data streams collected over time from multiple points around the country. Easily accessible information will be key to ensuring insights can be applied by any and all users to mitigate water quality problems.

2. Preventing and remediating contamination at source – using technology to eliminate or neutralise contaminants at/close to source before entry into the natural water system.
How do we protect what we have today for tomorrow? Preventing contaminants from entering waterbodies is without doubt a key element of any overarching clean water strategy. Developing effective methods for remediating inevitable

contaminants at or close to source would contribute to achieving non-polluting communities, farms and industries. Further, technology developed in this vein may also be applied in the wider environment when undesirable substances do make their way into rivers, lakes and marine environments.

The mining industry is noted as having achieved good progress in treating contaminants at source before water returns to the natural water system.

3. Autonomous treatment – developing mobile or fixed technology that is constantly identifying and treating contaminations at source or in the field without human oversight.

Devices that operate using a parallel loop of 'sense and treat' would ensure treatment is constant, and the existing time lag between sensing and action is minimised. Additionally, post-treatment, real-time measurements in situ might allow for new mitigation processes to be developed; the ability to achieve iterative improvements over time could be a key outcome. This type of solution could be deployed either at source or in the field after discharge.

One specific idea coming from industry consultation was a farm-based robot that could sense animal urine and then move to turn it into something harmless such as atmospheric nitrogen. The resulting technology could be part of a Closed System solution.

4. Transforming contaminants – transforming pollutants/problems into positive outputs as part of a transition towards a circular economy.

Creating positive consequences from current negatives (whether this takes place close to contamination sources or in the wider environment) could be achieved using clever science and technology. Novel extraction techniques may be one avenue of scientific exploration, for example, efficient and non-damaging methods for removing weeds from lakes before transforming them into a positive, such as a raw material for a new process or product.

This research direction may offer an excellent opportunity for collaboration with partners whose expertise lies in other areas, such as biology, so that multiple knowledge domains can cross fertilise to develop real world solutions. Examples such as creating plastic from didymo, or fuel from algae were noted by participants. Companies such as LanzaTech are already turning industrial gaseous emissions into fuels and reusable chemicals; this research direction offers the possibility of creating similar commercial opportunities for local communities from wastewater.

Clean Water Technology Spearhead Development 2020
Expression of Interest (EoI) to be part of a research team

Application Form

Please email your expression of interest **by 7 February 2020** using this application form to SfTIChallenge@callaghaninnovation.govt.nz

Note: Please submit only the completed application form and your CV.

We are calling for researchers to identify their expertise and experience, plus which research directions they are interested in exploring further. Note: we are **not** accepting research ideas or proposals.

For questions contact:

Don Cleland d.cleland@massey.ac.nz
Ian Woodhead ian.woodhead@lincolnagritech.co.nz
Denise Cutler (EoI process) denise.cutler@callaghaninnovation.govt.nz

Section 1: Applicant Information	
Researcher Name	
Faculty/Department/Group	
Organisation	
Researcher email address	
Mission Design	Clean Water Technology Spearhead 2020
Alignment with the CWT EOI call	Indicate which of the following research directions you are interested in (cross those not applicable): 1. Information-Based Solutions 2. Preventing and Remediating Contamination at Source 3. Autonomous Treatment 4. Transforming Contaminants
Availability to attend researcher workshop in Wellington on 10 March 2020?	Yes No
Section 2: Research Capability	
Research Expertise *~ 150 words.* *Summarise your research disciplines and expertise (from your CV)* *Describe how this could apply to the research directions.* *Use keywords when describing disciplines.* *Tell us about your research experience and the areas in which you work.* *Delete above text in italics*	
Relationship with other Research *~ 150 words.* *Tell us about any research you have been doing that could be relevant to the research directions proposed under this EOI.* *Explain how this related research is funded.* *Delete above text in italics*	
Section 3: Engaging with Māori	
~ 150 words	

Tell us about any previous experience of carrying out research in collaboration with Māori*, including your specific role.*
Explain how the initiative ensured mutual goals were achieved. What were the outcomes?
Outline how you see your research capability aligning with Māori *aspirations as outlined in the attached Background Information document.*
Delete above text in italics

Section 4: Fit with Team

~ 150 words.

Tell us why you would be a good fit for this project.

Make a convincing argument for why you think you could add value to a multi-disciplinary and multi-institutional team.

What do you think you could offer in terms of developing the project proposal?

Tell us why you would like to be part of the SfTI Challenge community.

Delete above text in italics

Section 5: Curriculum Vitae

Attach your CV using the NZ RS&T template, 5 pages maximum.
List relevant publications only.