

ENGG1000: HUMANITARIAN ENGINEERING **Impact Engineers and Sustainable Water in Walgett**

Objectives

More than ever, engineers are turning their attention to areas in the world where the need is greatest. This project will allow you to learn from those who have taken their engineering skills to developing or remote regions, and to work on a project started by UNSW's Impact Engineers student group. You will learn about the social, cultural, global and environmental responsibilities of engineering.



The Barwon River in Walgett, a major source for the local community, has dried up in the recent drought. Photo by ABC News, <https://www.abc.net.au/news/2018-12-11/health-experts-warn-walgetts-water-too-high-in-salt/10599186>.

Design Task Summary and Background

Impact Engineers (IE) is a group of students from a variety of different backgrounds, coming together to work towards making a positive change to society. Their goal is to empower communities in need with the skills and assets to develop and sustain a better quality of life. The group is part of UNSW's ChaliENG program, connecting students, academics and industry partners to real-world projects.

The Dharriwaa Elders Group (DEG) is an association of Aboriginal Elders in Walgett, NSW, working together for cultural, community & country wellbeing. The group has long held concerns for the health of surface and ground waters of Walgett. The DEG understands the cultural significance and vital importance of water to the Social and Emotional Wellbeing of the Walgett Aboriginal Community. 'Yuwaya Ngarra-li', which means 'Vision' in the Yuwaalaraay/Gamilaraay language, is a unique partnership between the DEG and UNSW to work towards the DEG's positive vision for change in Walgett, by growing and building on community strengths and assets. One element of the partnership relates to ongoing efforts to "drought-proof" the Walgett Aboriginal Medical Service (WAMS) Community Garden as part of part of a broader program to improve community wellbeing through healthy hydration and nutrition.

In 2018, DEG invited Impact Engineers to scope water solutions for the WAMS Community Garden and the design of chilled drinking water kiosks for the township as early projects. The team has focused on redesigning the garden so that it takes into consideration four different elements - water sources and availability, a suitable yield of diverse

crops, drought-proofing, and accessibility to all residents. A key component of this design has been the installation, testing and (future) upscaling of garden wicking beds that promote the efficient use of water and growth of plants during drought. There are opportunities to innovate around the materials used to build the garden beds and the source of water for the beds.

Your task will be to design a garden wicking bed system that could be adopted by the community garden in Walgett. You will build a prototype of this system to increase community engagement and depth of understanding. The system should:

- Optimise use of available water;
- Be made of largely sustainable or recycled materials found in the community; and
- Consider the needs and resources of the local community, including current water sources.

The designs and innovations that result from your project could make a direct contribution to the work that Impact Engineers is undertaking in Walgett.

The potential source of water must be considered in your design. Rainwater is less likely to be available during sustained drought periods, bore water is available but with no infrastructure on site, recycled water may be logistically too difficult, and town water is generally not available for gardens during water restrictions. You will need to consider both water quality and quantity. Your design should also consider how waste materials from the local community might be recycled to form the wicking beds. The size of the beds will be critical to make efficient use of the space, but to ensure that the water is properly wicked into the plants. The design should be simple and effort should be made to use locally available materials. You are encouraged to innovate.

Project Lectures

A series of lectures will be given to complement the project as outlined in Table 1. **You will need to attend all lectures.**

Table 1: Lecture template for the project

Project-specific lectures	Lectures in common with all Projects offered by the School of Civil and Environmental Engineering
Introduction to the project, Impact Engineers, Walgett, and cultural considerations Principles of Humanitarian Engineering Water and climate concerns for developing or remote regions	Teamwork & Technical Report Writing Engineering drawing (CAD). Sustainable design and construction technologies and practices. Societal and environmental ethics

Design Specifics

Your design team is to provide advice on the most suitable designs to assist the sustainable development of the community. Design solutions should be consistent with the information provided in lectures regarding the local culture and context.

Your project will involve the following stages:

- Calculate the ideal size and dimensions of your beds
- Identify materials for the bed including potential geotextiles/gravel/soil and consider where they may be sourced
- Consider the opportunities and constraints for possible designs, including water sources
- Design a system that can:
 - Be easily installed and maintained
 - Be upscaled for the whole community garden
- Recommend how the system should be maintained to ensure future sustainability



Remember: BE CREATIVE! THERE IS NO RIGHT ANSWER!

Deliverables

At the conclusion of the course, you will submit a written report and a working model of your water collection system.

Deliverable 1: The Written Report.

The report should include details on:

- Identification of alternative options and the justification used in the selection of your final design, with a particular focus on its appropriateness to the local community and culture;
- Details of the conceptual design, analysis and final design;
- Description of how your design is appropriate to the social, environmental, economic and technical context;
- Cost of construction and operation and economic benefits
- Discussion of ethics, long term sustainability and maintenance of the engineering work that would be completed as a consequence of the design
- Provide basic advice on the construction and operation of the design, including the role of the community;

Deliverable 2: Working model of the garden wicking bed system

You are required to develop a concept plan, schematic and physical (i.e. working) model for the wicking bed system.

On the day of testing, you will present the rationale for your chosen design and then demonstrate whether it is capable of meeting the criteria specified during the lectures. The winning design will be evaluated in regards not only to performance, but also expected reliability, ease of construction and maintenance, anticipated cost, and quality of construction. Designs that fulfil all criteria will be viewed favourably.

Marking Criteria

The **Final Report** will be marked according to the following criteria:

1. *Process* – how was the final design reached; alternatives considered and justification of final decision.
2. *The Design Solution* – creativity and sound use of engineering principles; effective and efficient solution to the problem. Calculations to support the chosen layout and solutions are required.
3. *CAD Drawings* – plan and cross section drawing in CAD showing the details of your final design
4. *Design Sustainability and Ethical Responsibility* – demonstrated understanding of the social, cultural, environmental and economic context of the project; clearly communicated principles of sustainable design; community involvement and benefit.
5. *Cost and economic benefits* – what is the cost including initial costs, operation and maintenance?
6. *Communication* – logical report format; grammar; correct referencing; use of tables and figures; clear executive summary.

The **Working Model** will be marked according to the following criteria:

1. Five minute verbal explanation of the design;
2. Quality, novelty and innovation of the design and construction;
3. Ability to properly wick water
4. Cost and sourcing of materials

Date of Completion

The **Draft Report** is due Monday, Week 7.

The **Final Report** and **Model** are due Monday, Week 11.