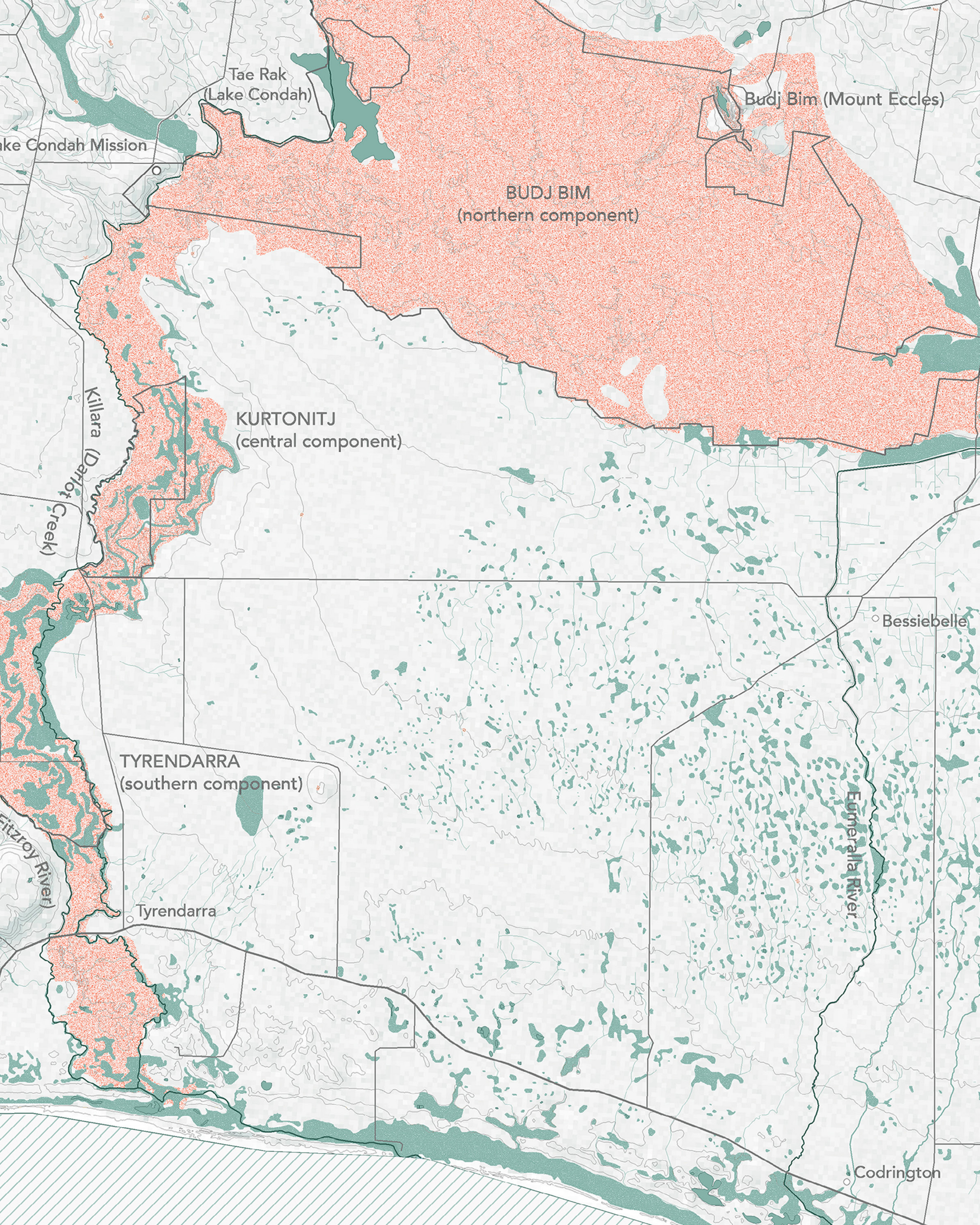

Tae Rak
(Lake Condah)
Budj Bim (Mount Eccles)
ake Condah Mission
BUDJ BIM
(northern component)
KURTONITJ
(central component)
Killara (Darlot Creek)
Bessiebelle
TYRENDARRA
(southern component)
Fitzroy River
Eumeralla River
Tyrendarra
Codrington

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Visualizing Water: Using the Illustrative Method to Learn from Long-Lasting Water Systems

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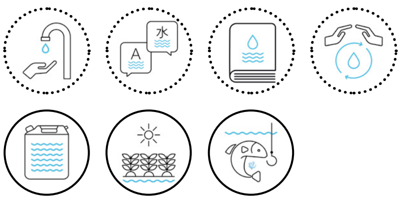
To analyze traditional water systems and their development over time, researchers I. Bobbink and M. Ryu developed the so-called Illustrative Method in 2017 based on former water systems studies (Bobbink and Loen 2010; Ryu 2012). The method visualizes connections between spatial, social and cultural aspects of water systems in a standardized way. It provides insight into unique local patterns, forms the foundation for comparative analysis and can ultimately inform the creation of new water systems for future sustainable development.

KEY THEMES



< Fig.1 Fragment from Catchment area (Source: M. José Zúñiga).

Introduction

The Illustrative Method is a tool to analyze Traditional Water Systems (TWS) (Bobbink 2019). The term "traditional" emphasizes the focus on water systems that functioned for hundreds of years.

The method has been designed as an educational tool for landscape architecture graduates at TU Delft. It has been used since 2018 to visualize the site specificity of human-made water systems, in students' final year projects and in projects conducted by students who are already practicing. Five generations of graduates have developed Circular Water Stories (CWS) in laboratories (2018/2019 – 2022/2023) and have used their knowledge to tackle today's spatial challenges.

The Illustrative Method focuses on spatial and visual aspects of water systems. It represents these in a standardized form to allow viewers to better understand the geomorphological and sociocultural context of water systems. The visualization must follow the representation guidelines while leaving considerable freedom to personal graphic expression. Students are given a limited color palette: black, grays of different opacities, white, light blue, green for the water, and orange for highlighting relevant parts of the drawing.

The Illustrative Method requires students to focus on elements worth displaying and it simplifies information. Students learn to interpret and decode water systems in the context of their unique physical geography and the natural elements of the surrounding environment. By reading the anthropic formations, architectonic settlements, and landscape interventions, students can grasp the essential aspects of these systems and integrate the practices of traditional water systems within well-performing new designs. The analytical drawings also focus on specific social aspects of water systems, including a comprehensive assessment of water heritage. A comparative evaluation of the analyzed water systems will follow in the coming years.

To display the complexity of a TWS, multiple types of visuals are combined – pictures, maps, diagrams, and architectural drawings (plans, sections and 3D). Sometimes, various maps are needed to show transformations through time or to find connections between water systems, soil information and height differences. Ideally, the main illustration per case is a map on the scale of the whole water system (e.g. catchment area, including the waterworks built structures like sluices, weirs and pumping stations), revealing the system's complexity. Students have used pictures at different scales to show the relation to the surrounding landscape, the water, waterworks, and other elements such as plants, buildings, and people. "Drawings may be done by hand or computer. The images are organized from large to small scale: from territorial landscapes through water systems to waterworks, from general overviews to specific details. Finally, after consulting the whole set of images and drawings, the reader should be able to grasp the water system, its waterworks, and the system's specifics regarding usage and landscape.

The Illustrative Method consists of ten components as represented below – context, climate diagram (fig. 2), climate zones and a world map (fig. 3, 4), catchment area (fig. 5), transformation over time (fig. 6), human interaction (fig. 7), the functionality of the water system (fig. 8), circularity including water elements, waterworks, and water stories (fig. 9.1, 9.2), detailing (fig. 10) – and a conclusion describing values and lessons. Each component is illustrated by one or more illustrations to demonstrate the drawing technique and to show the freedom in the handwriting. The method provides insight into many kinds of cases and possibilities for representing them. More illustrations can be found on the Circular Water Stories site (*https://circularwaterstories.org*).

Context

An overview image, preferably a bird's eye view photo of the water system, provides a visual introduction to the water landscape. This image is followed by geographical maps that locate the water system on a continental, national, and regional scale, integrated with a concise text description (year or period of development, primary function[s], surface, principal components, waterworks, status, etc.).

Climate

Climate is an essential precondition for water systems. A diagram introduces the climate zone of the water system, combined with precipitation distribution over the course of a year and additional relevant information (highest, mean, and lowest temperatures; annual millimeters of precipitation; humidity; average wind speed; pressure; hottest, coldest, wettest and windiest months; yearly rainfall). To determine climate zones, the Köppen-Geiger classification is used. Since many of these systems originated from ancient times, students have not always been able to collect the corresponding climate information. In many cases, this research has brought to light the fact that climatic conditions were once different than they are today. As we are aware, today, the climate is changing even more rapidly due to human actions and will increasingly play a decisive role in the design of water systems.

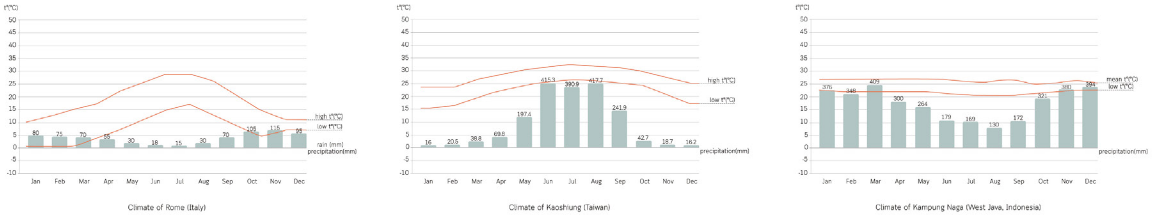
Catchment Area

Water systems change as significant conditions change, such as those in their catchment area. Defining the catchment area of a water system is a complex task. The outcome is often a map of the water system (plan) on a regional scale, from inlet to outlet (lake, river or ocean), with waterworks, a topographical map, and aspects of geomorphology, if relevant. Information about disappeared elements can also be represented.

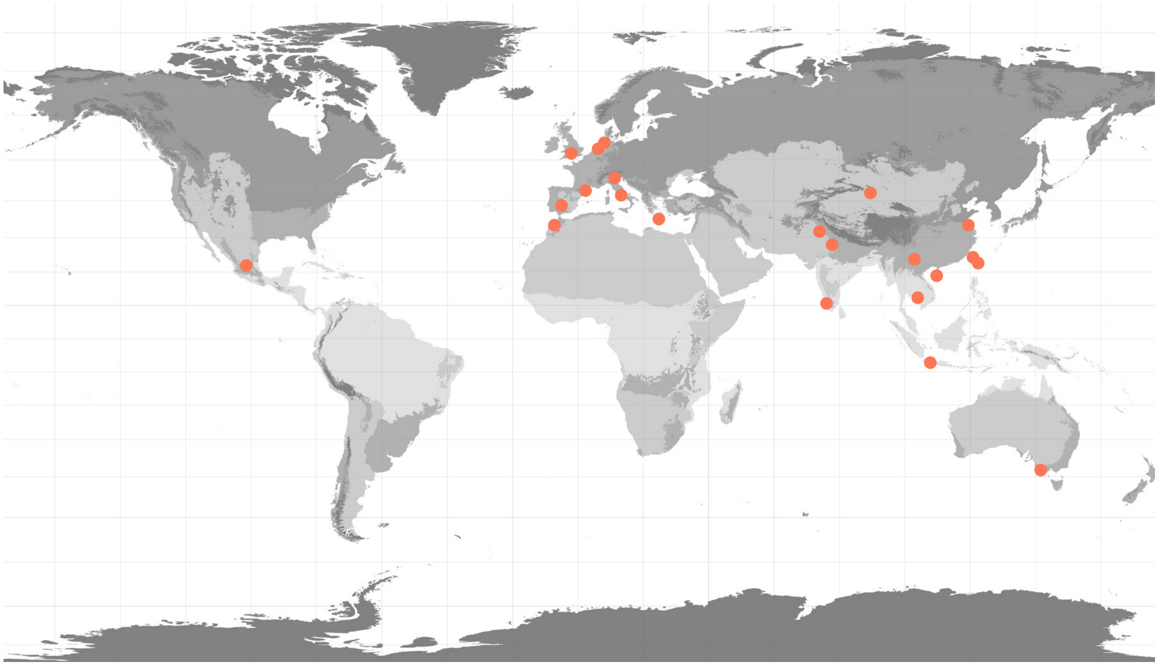
Transformation over Time

The development of a water system over time is synthetically drawn in a sequence of diagrams

^ *Fig. 2 Context. Continental, national and regional scale, fishing valleys, Italy (Source: A. Chouairi).*



^ *Fig. 3 Climate. Average precipitation and highest and lowest temperatures of three cases (Sources [from left to right]: Rome, Italy – C. Di Nicola; Kaohsiung, Taiwan – M. Lin; Kampung Naga, Indonesia – A. Prestasia and B. Kim; Images processed by: A. Chouairi).*



^ *Fig. 4 Climate. Köppen-Geiger climate classification maps at 1 km resolution. The orange dots indicate the 22 locations of TWS analyzed in the CWS laboratories (2018–2021). From light to dark grey: tropical, dry, temperate, continental and polar (Source: M. Pouderoijen).*

^ *Fig. 5 Catchment area. The watershed defines the borders of the water system (Sources [from left to right]: fishing valleys in the Venetian Lagoon, Italy – A. Chouairi; The delta, Xinghua Duotian agrosystem, China – P. Surajaras; A seasonal river, Aboriginal eel aquaculture, Australia – M. José Zúñiga; Images processed by: A. Chouairi).*

based on historical maps and charts. The diagrams represent an extended period and the water system's different functions and seasonal usages. Historical illustrations help reveal the strong connection between the water system and the evolution or decline of a civilization. The period worth studying is selected from a range of historical moments. Since many of these systems are declining, today's situation is not always the most interesting one to explore. Therefore, the students can choose a period and proceed with the analysis.

Human Interactions

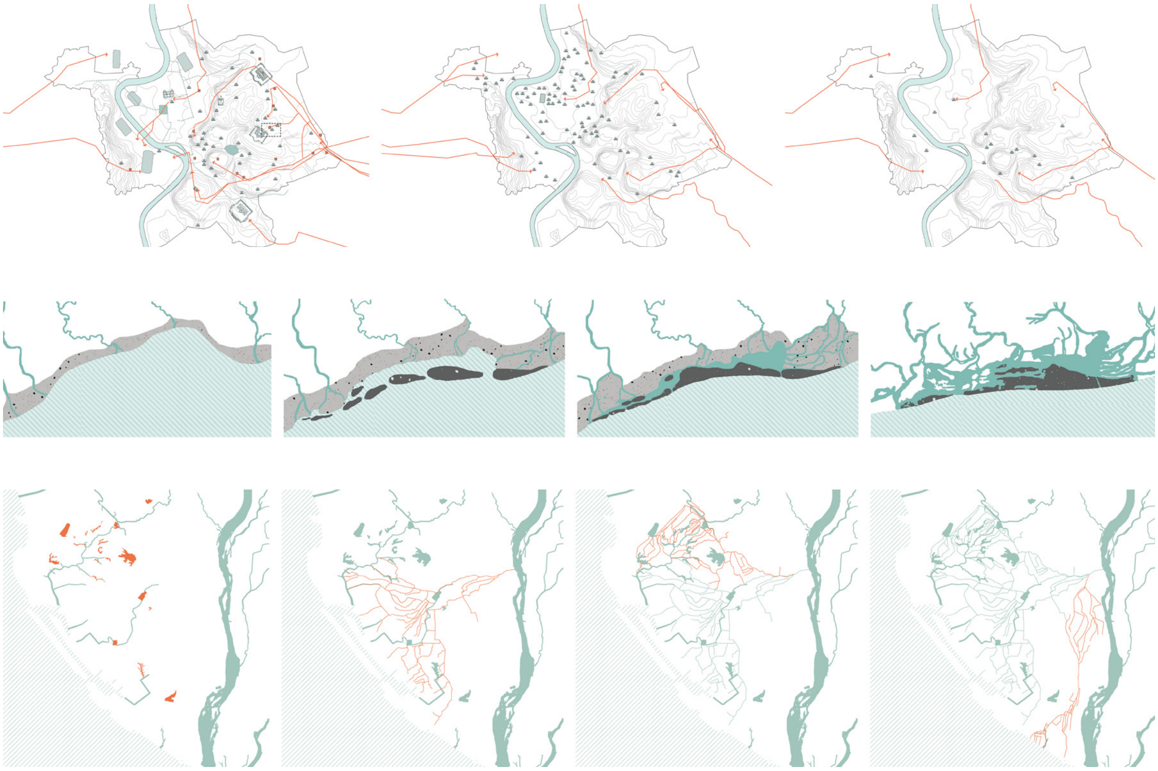
To capture human engagement with water systems, students include pictures or paintings as a base on which the interaction between humans, the landscape, the water system, and, if possible, flora and fauna are highlighted. Water and people are marked in blue-green and orange; depending on the use of the color; the essence of their relationship is indicated. The pictures may represent workers and visitors, water landscape elements, waterworks, working tools, site-specific housing, transportation, and so on. The images are collected consulting historical sources, often studies conducted by anthropologists or historians. Recent photographs are employed to show, where possible, the structure of the remaining elements and their relationship with the modern context.

The Functionality of the Water System

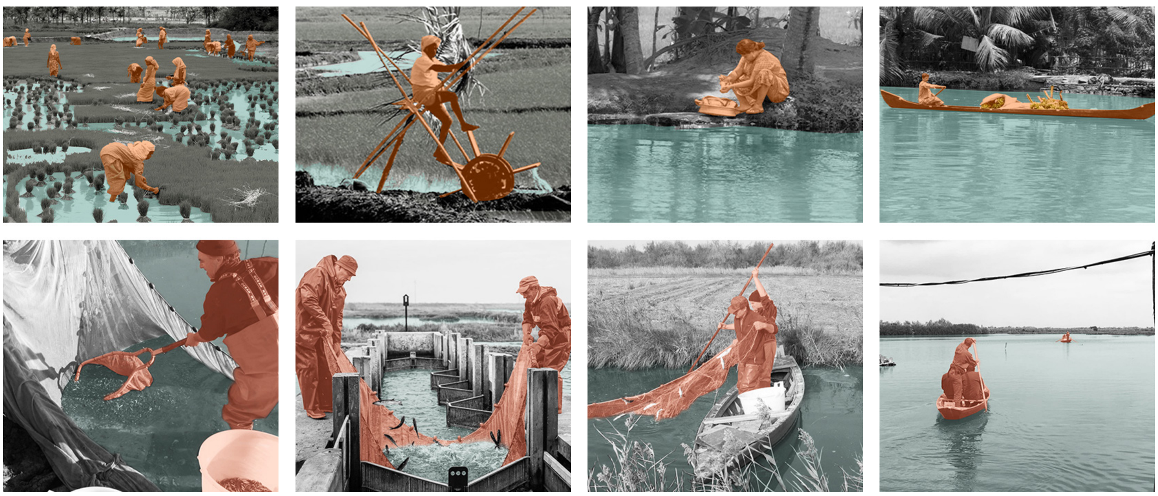
The functionality of the water systems is portrayed through maps representing the management of water (plan), using the height map on a local level as the base map. The plan presents the water system's extension, type of water (salt, brackish or fresh), water landscape elements, flooded areas, underground water, dry soil and marshes, fields and crops growing on land or water, relevant vegetation, buildings, waterworks and other features. The drawing, representing functional landscape elements, determines the available and spatial dimensions of the system. In making the drawing, students figure out how the water system works; arrows show its flow direction.

Circularity

The circularity of the water system is shown through an axonometric section. This is considered one of the essential drawings since it explains the interaction between water flows, system functioning, activities, human action and ecology related to seasonality. The diagram represents significant aspects such as sustainability or the spiritual or symbolic importance of the water system. Scaleless drawings connect the regional and local scales and incorporate relevant elements from the research. The students use water landscape elements, waterworks, and water stories to create the drawing. Water landscape elements indicate those components of a large-scale water system made with materials like soil or stones, etc., reshaping the water flow. These are systems that have been created by people using mainly natural materials that differ according to the territory. Waterworks are built structures, like sluices, weirs and pumping stations, involving a certain amount of craftsmanship: they are created by people using mainly artificial materials. Most of these innovations developed simultaneously in different places, and many were installed on different continents as knowledge spread. Water stories illustrate actions (spiritual, cultivation or other) of people or animals related to the water. A person or animal in action is added to the drawing to highlight the relationship between the element and culture (Bobbink and Loen 2020).



^ *Fig. 6 Transformation over time (Sources [from top to bottom]: Roman aqueducts and their decline [from 312 B.C. to 226 A.D., 5th to 15th century and 16th to 17th century], Italy – C. Di Nicola; Kuttanad Kayalnilam agrosystem evolved because of sedimentation and fixation of the coastal area [Pre-Holocene, Middle-Holocene, Late-Holocene and early nineteenth century], India – N. Ali; Ksôkong Tsùn irrigation system [before 1837, 1837–1838, 1842 and 193], Taiwan – M. Lin; Images processed by A. Chouairi).*



^ *Fig. 7 Human interactions. First row – Kuttanad Kayalnilam agrosystem, India: planting rice, ploughing, washing and sailing (Source: N. Ali). Second row – Fishing valleys, Italy: sowing juvenile larvae in the valley, standing on the lavorièro (fish trap) with nets, capturing fish, inspecting the valley lakes (Source: A. Chouairi).*

^ *Fig. 8 Water systems. From left to right – Aboriginal aquaculture, Australia: system plan of the Muldoons Trap Complex, where the Indigenous population, taking advantage of the natural elements and the composition of the land, built canals and dikes, regulating the course of the river. They were thus able to fish for eels, according to the seasons (Source: M. José Zúñiga). Xinghua Duotian agrosystem, China: the polder landscape system was developed to cultivate crops; dike and roads form the border of the polder in which the water system is controlled by water gates (Source: P. Surajaras).*

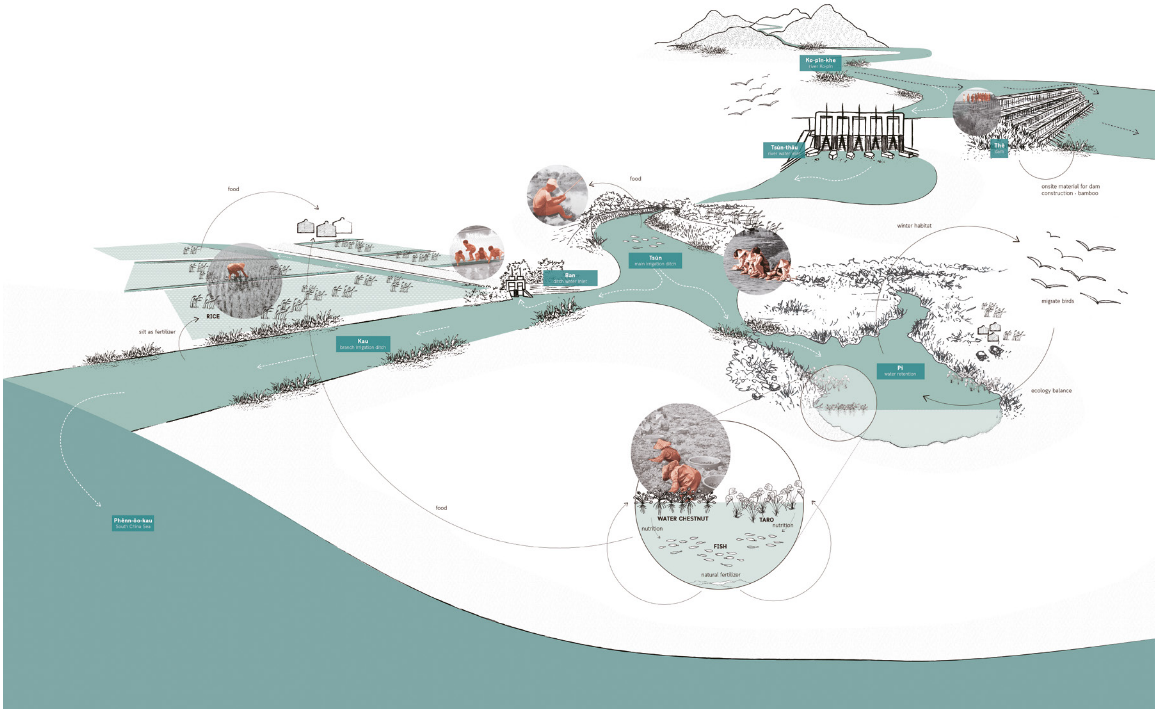
Details

Technical drawings (schemes and diagrams) and pictures of waterworks complement the other visuals. They show the spatial composition of the water flow and provide more insight into the process in which a water system is made (design). Drawing details reveal the craftsmanship and the materials used in construction, which often come from the site or region where the water system is located, providing another layer of local integration.

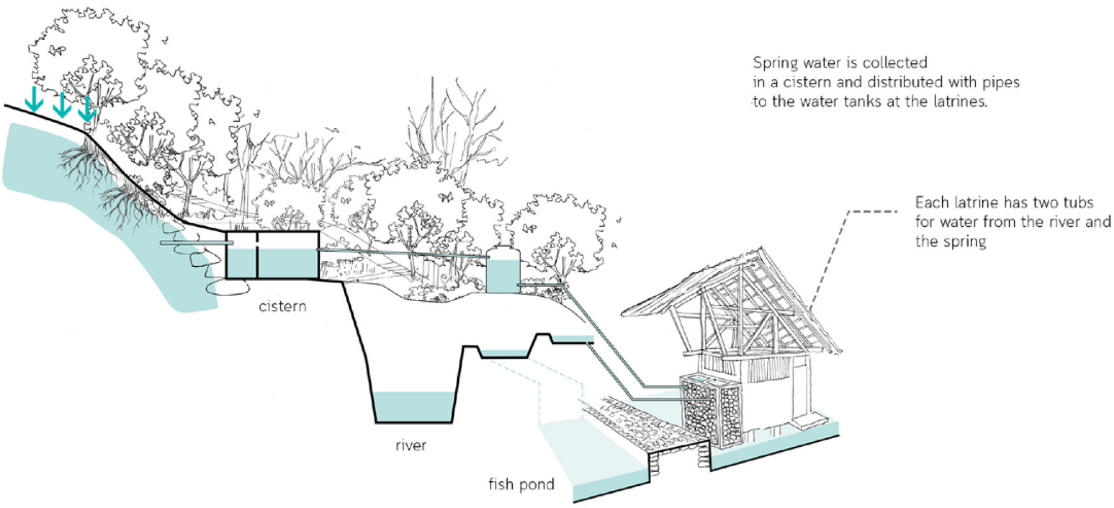
Values and Lessons to Learn

To understand TWS, values that conclude the analysis are named. By drawing and describing, students determine strategic, functional, material, tangible and ethnographic values, and values relating to landscape, identity and sustainability. These values are defined explicitly for traditional water systems based on the dissertation “The Architecture of a Productive Territory: The Water Mills of the Sierra de Cádiz” (G. Rivero-Lamela 2020).

By identifying such values, we gain insight and awareness of water heritage, its connection to the specific site, and similarities we can identify similarities between sites. Here, the interest lies not only in the objects per se but also in the tradition, the coexistence of tangible and intangible heritage. Consequently, the primary purpose of the “lessons to learn” is to inform contemporary landscape design proposals, whether for a heritage site or simply by assimilating the ingenuity of the water system.



^ *Fig. 9 Circularity. Ksôkong Tsùn irrigation system, Taiwan: A dam in the Ko-pin-khe river redirects water with the help of irrigation ditches and inlets to the plain to make farming possible. In addition to the rice fields, water plants, such as taros and water chestnuts, are part of the circular production systems. The Ksôkong irrigation system accommodated a variety of human activities (Source: M.C. Lin).*



^ *Fig. 10 Details. Schematic drawing of the collection and distribution of spring waters, Kampung Naga, Indonesia (Source: A. T. Prestasia and B. Kim).*

A large body of research has been accumulating since 2018, making it possible to dive deeper into knowledge of climate-, site-specific and adaptable water management related to beautiful cultural landscapes. So far, by developing the Illustrative Method and expanding it with knowledge gained from the landscape biography, this work has supported a rediscovery of human belonging to the landscape. What is achieved through the application of the Illustrative Method for TWS is a site-social analysis with room for further development. In the future, interviews and site surveys will contribute to the method's accuracy and complexity. Ideally, soil conditions, flora and fauna determination, and reflections on water quality should become an integral part of Traditional Water System research. Because of the Illustrative Method, the analyzed water systems are comparable. At this stage, there are enough analyzed projects for comparison to begin, which will make it possible to be more explicit about lessons for the future.

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