



The Canal Story

Canal du Midi, a water infrastructure
in Southern France.

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Figure 1 Canal du Midi at the Montferrand, Aude, France

Context.

Location: Occltanle Region, South France
 Area: 2088200 ha
 Type: Artifical system
 Function: Transporation, Trading, Irrigation
 Water Quality: Fresh Water & Brackish Water

At the end of the 17th century (1662 - 1681), a French engineer, Pierre-Paul Riquet designed "one of the most extraordinary civil engineering achievements of the modern era": the Canal du Midi. It brings together the canal itself (240km), as well as the canals and gullies that feed it (120km in all) (GRAHAL i-pat, 2020). The canal located in the Occltanle region of south France. The original objection of the canal is to link the Mediterranean to the Atlantic without going through Spain (perilous passage through the Strait of Gibraltar), to develop trade under the reign of Louis XIV. The Canal combines technological innovation, architectural quality and the beauty of the landscapes, it becomes a reference structure, set precedents for many engineering feats (French Waterways, 2021).



Figure 3
Occltanle region in France



Figure 2
Country

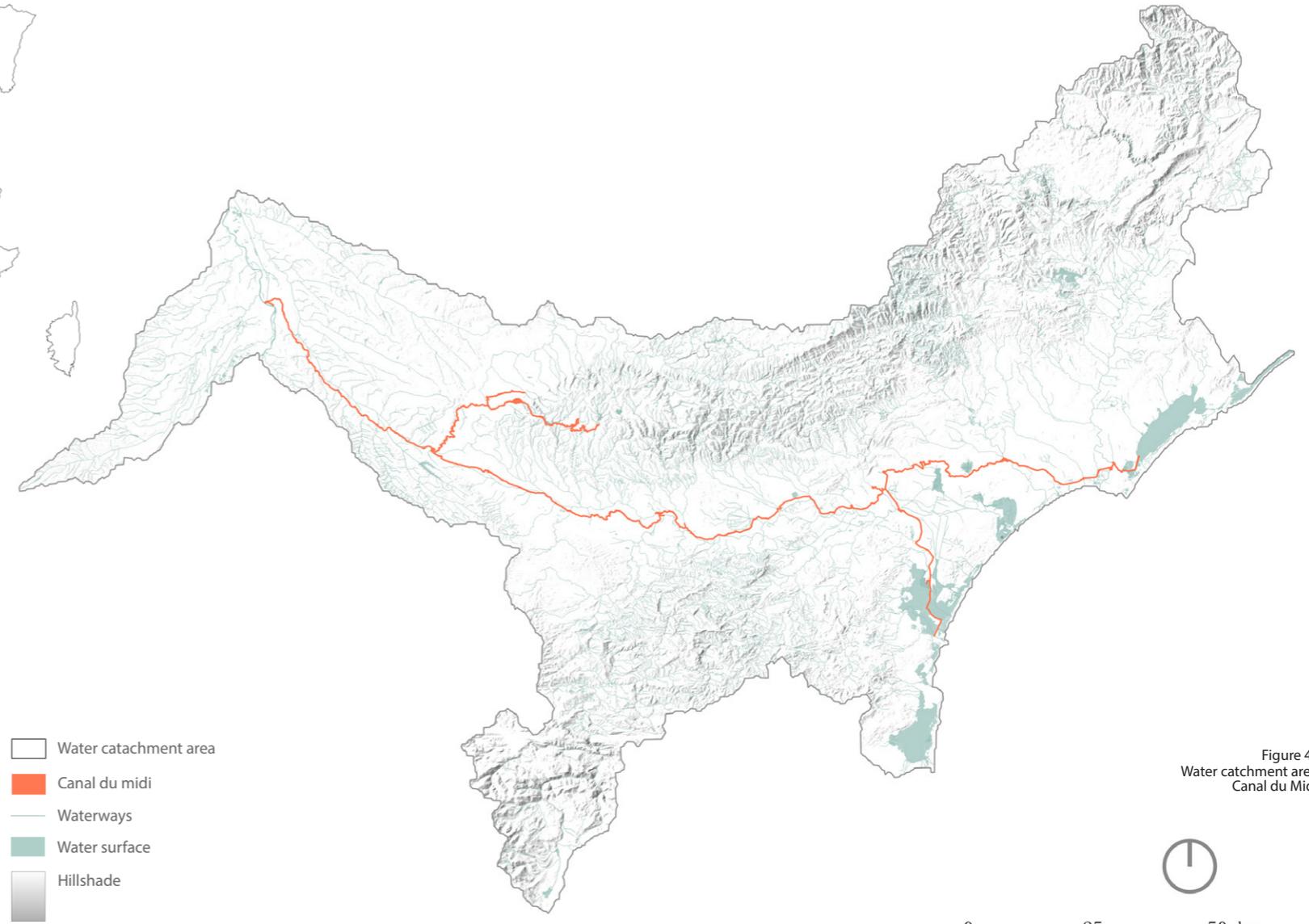


Figure 4
Water catchment area
Canal du Midi

Civil engineering structures

The Canal du Midi remarkable as the first large canal with a division reach, built to meet a strategic spatial planning objective. It represents excellently a significant period in European history, that of river transport through the mastery of hydraulic civil engineering. It is the living testimony of the art and creativity of the engineers of the time of Louis XIV who triumphed over the difficult conditions of geography and hydrography to realize the immemorial dream of the "junction of the seas" (GRAHAL i-pat, 2020).

With 328 structures, the hydrologic works remark the 'heavy engineering' of this truly unique canal, where nature forms a constantly delightful backdrop to all manner of staircase locks, aqueducts, siphons, spillways, feeders, dry docks, and a tunnel (10 dams, 63 active locks of the main route, 90 aqueducts and 14 canal bridges) (French Waterways, 2021).

The Canal is representative of the technological blossoming that paved the way for the industrial revolution and contemporary technology. In addition, it combines technological innovation with great aesthetic concern in terms of architecture and in terms of landscapes created by man, an approach that is rarely found elsewhere (GRAHAL i-pat, 2020).



Figure 5 The lock at the Montferrand (top left)
Figure 6 The Répudre Canal-bridge (bottom left), took by author
Figure 7 Dry docks in the Toulouse (top right)
Figure 8 Épanchoir des Patiasses (bottom right)

Activities along the canal

Except for the extraordinary achievements of engineering combined art, the constructions linked to the life of the canal that also contribute to lively human activities along the canal - an immaterial attribute: the memory of the "people of the water", available in the canal archives as well as at the oral level (GRAHAL i-pat, 2020).

Travelling by boat then and now - the activities of crossing the lock and watching the lock in action: when boats enter into a lock, water is drained from the basin, or filled into it, allowing the boat to move on to the next section. Along the canal, some locks are flanked with cafes and gardens, while others are simpler in nature. For bikers, various locks serve as water distribution points and lock keepers are usually friendly and open to chatting (Phineas Rueckert, 2019).

Activities in the water - The canal's source (the Bassin de Saint-Ferreol) is a nice spot for swimming and diving, boating, camping, traditional water competition, etc. are popular along the canal.

Along the canal - by walking, cycling, enjoying local communities' culture, food, wine is the most popular activity for visitors. The water bank also works as a public space that contains diverse cultural and excesses activities for local people.

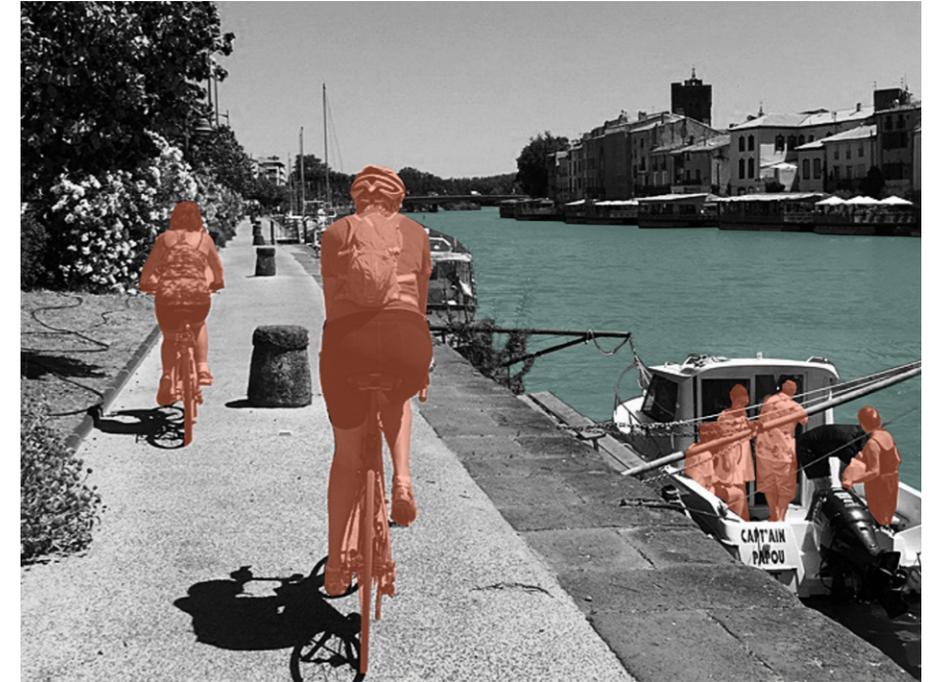


Figure 9 People waiting to cross the lock (top left)
Figure 10 Swimming, diving, boating, rest at water basin (bottom left)
Figure 11 Water jousting game (top right)
Figure 12 Boating, cycling, walking at canal bank (bottom right)

Climate

Climate zone : Temperate
 Sub-climate:
 Cfa - Humid subtropical climate
 Csa - Hot-summer Mediterranean climate

Climate & Weather Averages

High t: 29°C
 Low to: 2°C
 Mean to: 14°C
 Precipitation: 285 - 777 mm (per year)
 Humidity: 75%
 Dew point: 9 °C
 Wind: 15 km/h
 Pressure: 1018 mbar
 Hottest Months: Jul & Aug (29°C avg)
 Coldest Month: Jan (9.5°C avg)
 Wettest Month: May (127mm avg)
 Driest month: July (18 wmm avg)
 Windiest Months: Apr (17km/h avg)
 Annual Rainfall: 508-823 mm

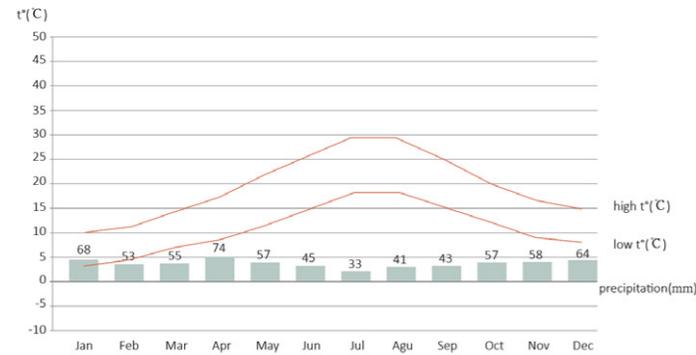


Figure 13 Annual Temperature and amount of rainfall

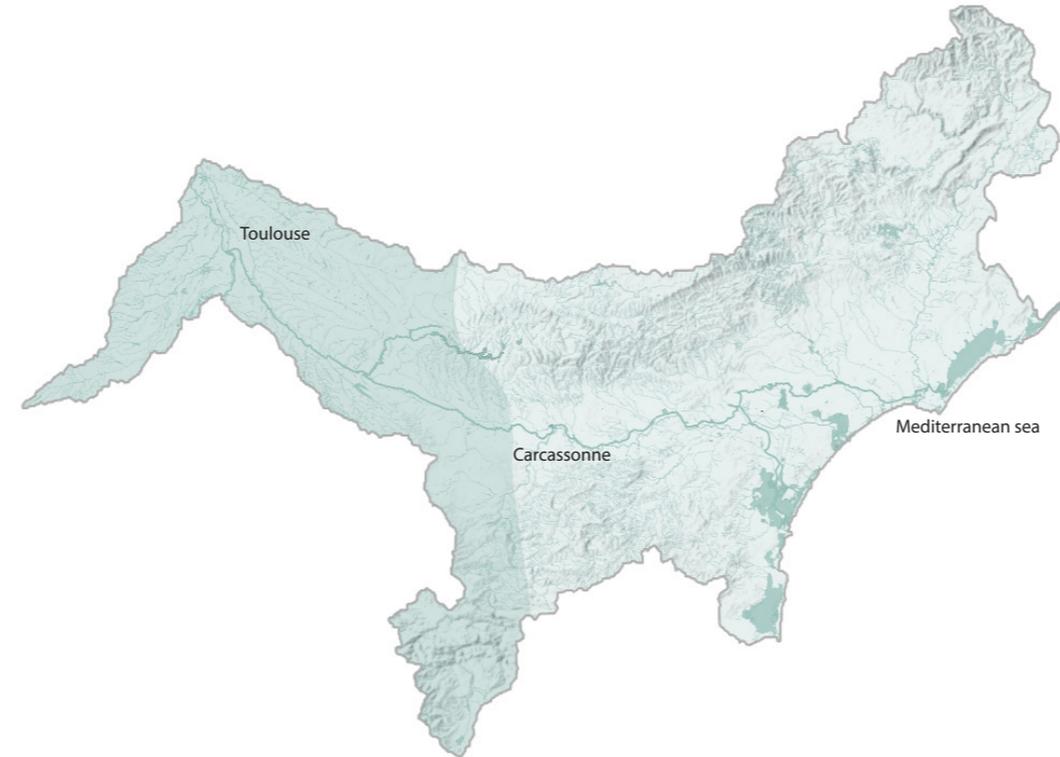


Figure 14

Sub climate

- Humid subtropical climate
- Hot-summer Mediterranean

The area crosses two sub-climate zones - mostly characterized by a hot-summer Mediterranean climate, that is closer to the sea on the east; partly characterized by humid subtropical climate from Toulouse to place near Carcassonne. Two different climate zone become the reason for varified planting and agricultural typology in the area.

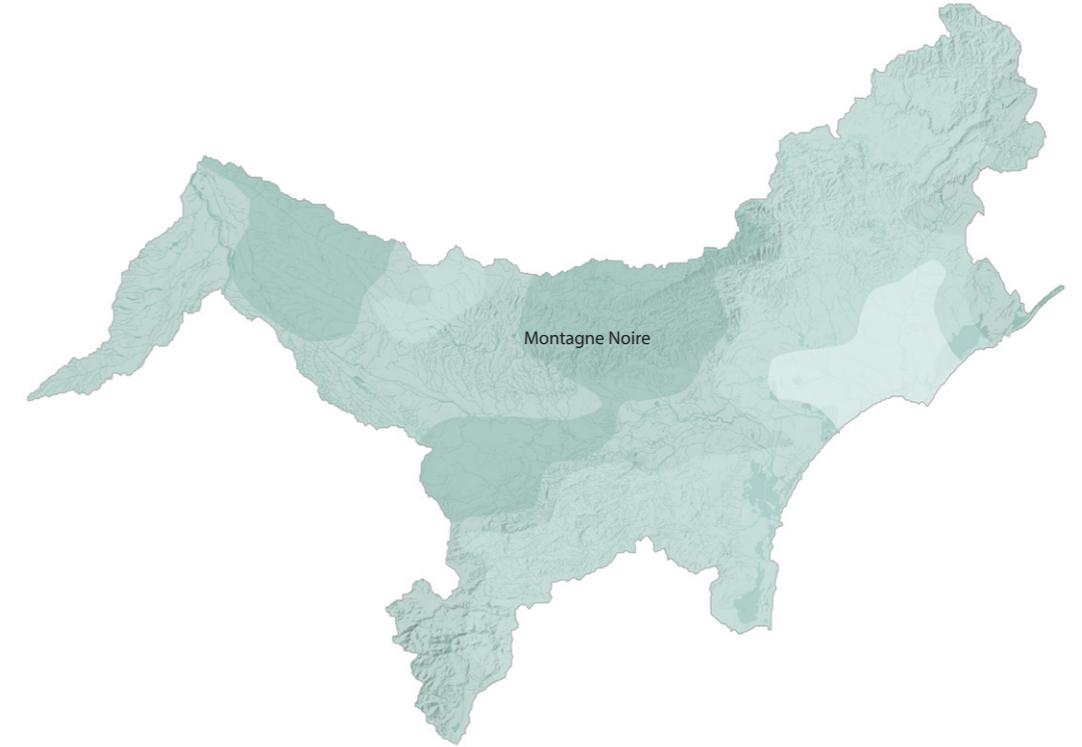


Figure 15

Annual Precipitation

- 1400
- 1000
- 800
- 500

The rainfall in the entire catchment area varies greatly, and there are also strong topography and seasonal changes. The Montagne Noire is a region with twice the rainfall of the plain area with 1400 millimeters per year at around 500–600m above sea level, which is the reason that it became the main source for the water supply for the whole canal.

Landscape transformation

The construction of the Canal du Midi started in 1665 by creating a test canal to check the project's feasibility between Alzeau and Naurouze. 1666 marks the official permission of the navigation canal to be built - works start on the creation of the port of Sète. In 1681, the Canal was completed, filled, and inaugurated in May. The main structure of the canal basically remains the same after that, while many extension and improvement works are continuing until now and slightly changing the canal. (The community of canal and river enthusiasts, 2017)

PERIOD 1

During this time, Toulouse, Castelnaudary, Carcassonne, Trebe, Narbonne, Bezier, Adge were all castal-shaped cities, they are situated at higher ground along the rivers running mainly from north to south, ending up in the salt water lagoon areas along the coast mud that linked to the Mediterranean sea.

PERIOD 2

Since 1695, the canal was constructed by drawing off some flows destined for the Mediterranean Sea that he diverted (Source: map) for Canal du midi, by abstracting water flowing at Naurouze, the water from black mountain been used for the water resource for the canal.

Figure 16

PERIOD 1
1600



Figure 17

PERIOD 2
1700



Later, branches of the canal were added, including the 'Canal latéral de la Garonne' and the 'Canal de la Robine Narbonne'. Trade blossomed and brought wealth to the communities along the Canal du Midi. The Canal du Midi was constructed for transport goods (great diversity of products such as cereals - wheat, barley - wine and brandy, but also marble from Caunes, used for the construction of the Trianon, etc.) and passenger transport thanks to the post boat service which linked Toulouse to Agde in 4 days (The good life france, 2021, <https://thegoodlifeFrance.com/the-history-of-the-canal-du-midi/>). The cities alongside the canal seem a rapid development.

PERIOD 3

The main structure of the canal remains the same, the existing cities grow dramatically forwards the canal and more towns and rural settlements were developed along it. The wetland (saltwater lagoon) areas along the coast changed the shape and reduced by natural process. Today the canal is used mainly for recreation. Except for the construction land, the mainland around the canal was for cropland and vineyards.

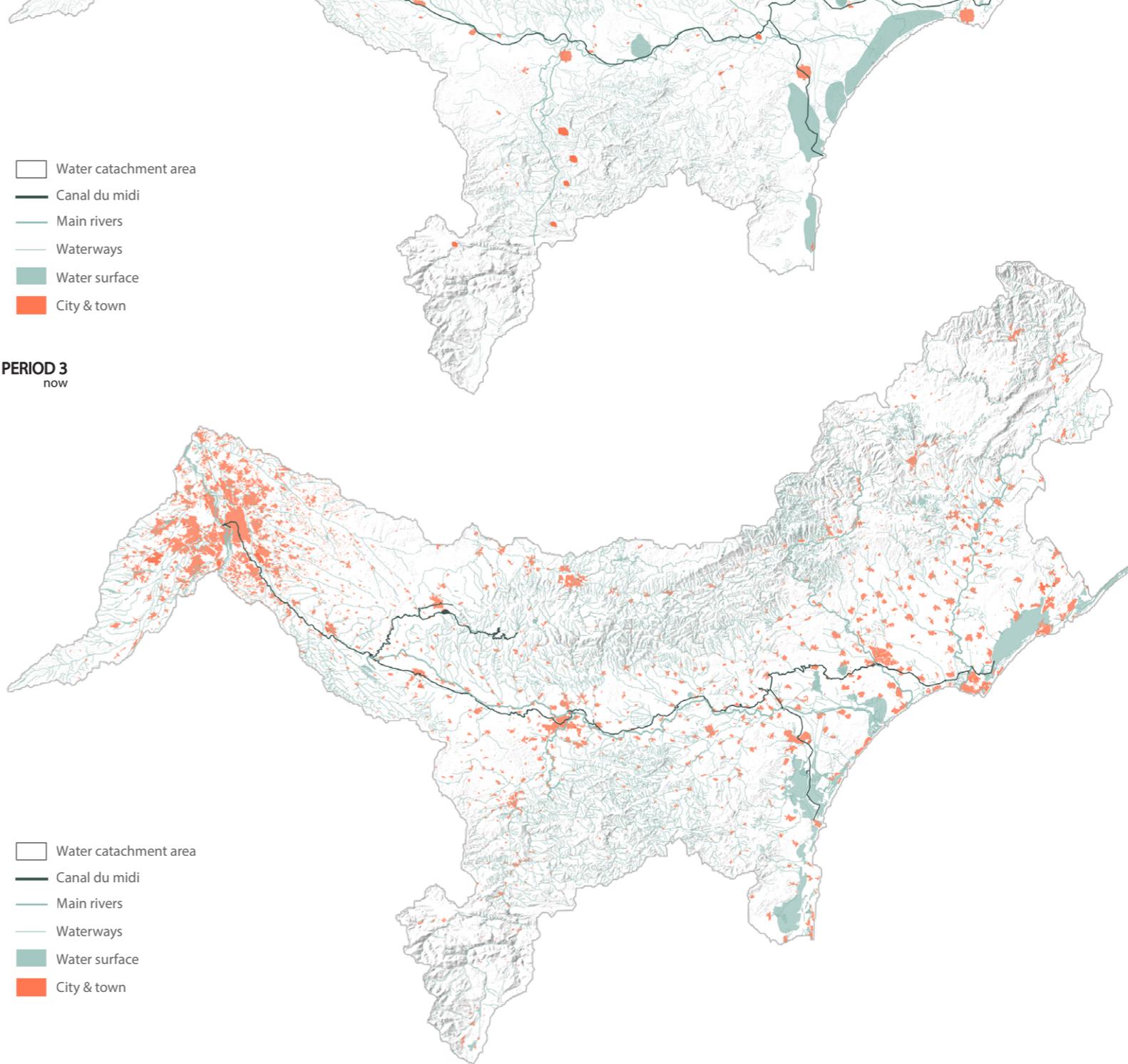


Figure 18

PERIOD 3
now

Figure 16 The catchment area before construction of the Canal du Midi (around 1600)
 Figure 17 The catchment area after the construction of the Canal du Midi (around 1700)
 Figure 18 The current situation of the catchment area

Catchment area

The map illustrates the main geographical features, the water catchment areas & watercourses, and the cities alongside the canal.

The canal is a complex hydraulic structure, the first of its size to link two large hydrographic basins (Adour-Garonne and Rhône-Méditerranée), the majority of canals following the slope of a single valley. It is dotted with engineering structures allowing both the maintenance of the correct water level and navigation on the whole of its route. The locks of the Canal du Midi make it possible to cross a cumulative drop of 246 meters.

The annual water requirement for the structure is estimated at 150 million m³. 40% of the water transport is used for navigation - this 40% includes losses by leakage, infiltration, and evaporation. The rest of the total volume is used for other uses, the first of which is the irrigation of agricultural land.

The hydraulic management of the canal need to take into account the changes in water needs and the availability of the resource during the year, in particular during the summer season, with the convergence of the most water withdrawals of peaks in traffic, agricultural withdrawals and the constraints of flows withdrawable from rivers. Every year, the lack of water in the areas crossed by the canal lead to management problems (GRAHAL i-pat, 2020).

Its green waters twist and turn by following the contours, through the cities and towns, of which many are famous historical cities such as Carcassonne, Bezïer, etc. (French Waterways, 2021)

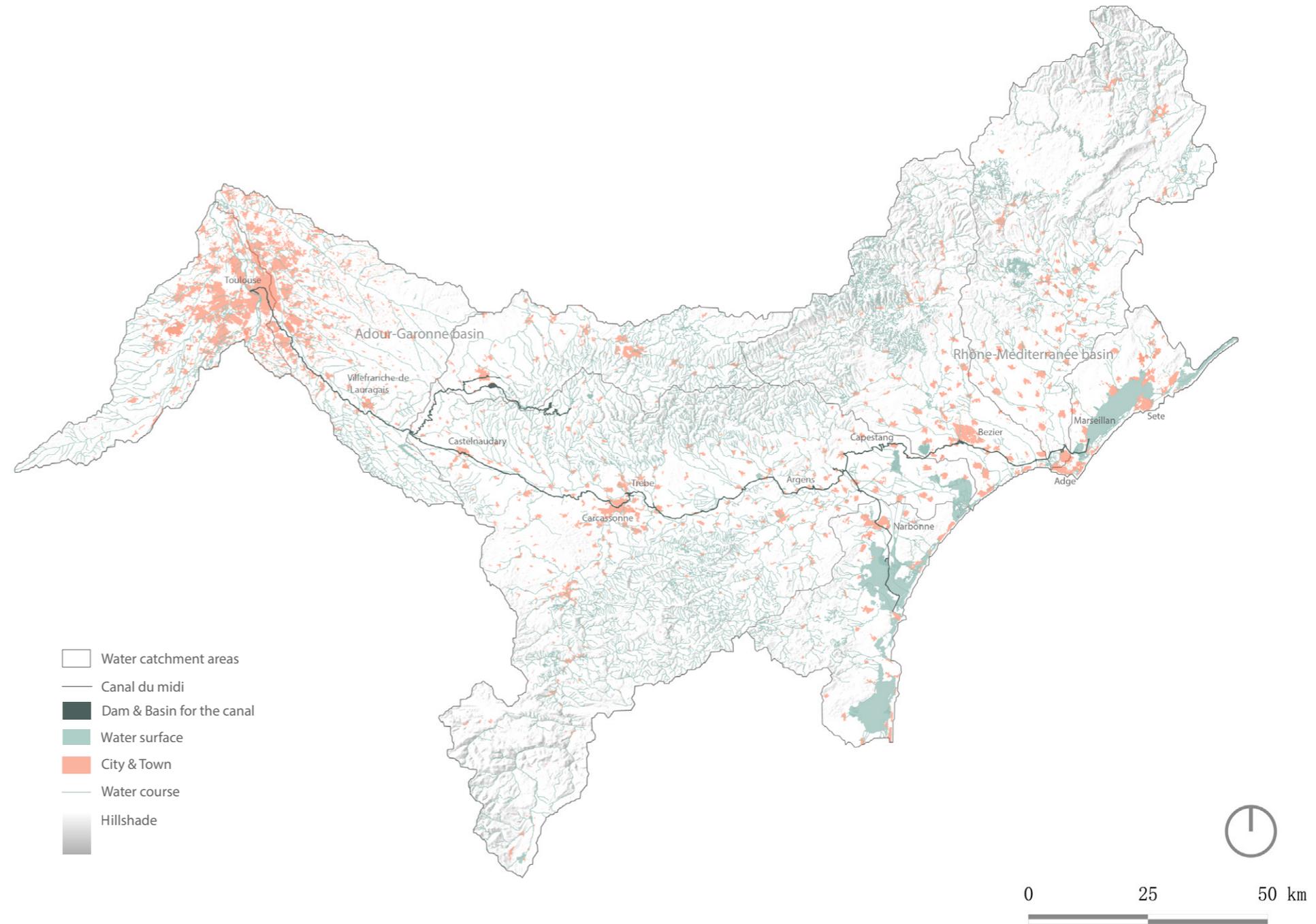


Figure 19

Figure 19 The catchment map shows the canal, water system, topography, and human settlements related to the Canal du Midi.

Water system

To explain more details in the canal system, this map shows specific of the flow of the Canal du Midi and its connection with the water network.

The canal du Midi has 360 km total route includes 278 km of canals and 82 km of supply system. The canal gets the water from the Montagnes Noires, the black mountains. The highest places of the watershed (threshold of Naurouze), the canal flows in two directions. The entire supply system of the Montagne Noire including the channels of the Mountain, the Plain and the Laudot river, from the Alzeau water intake and from the Pont-Crouzet water intake to " on arrival in the sharing reach at Naurouze integrating the St Ferréol basins. Except the main water source from the black mountains, the feeder ditches from the rivers spread over the length of the canal. The maps has illustrated several important rivers that connected with the canal such as River Garonne, Aude, Orb, etc. The reservoirs and ditches work together to provide the right water level.

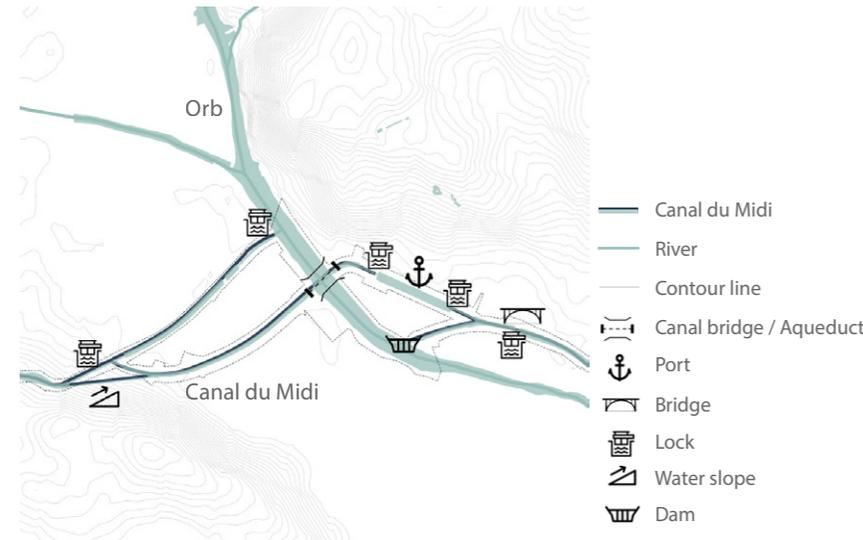


Figure 21 Zone in water system map shows the detailed section (Canal du Midi across river Orb)

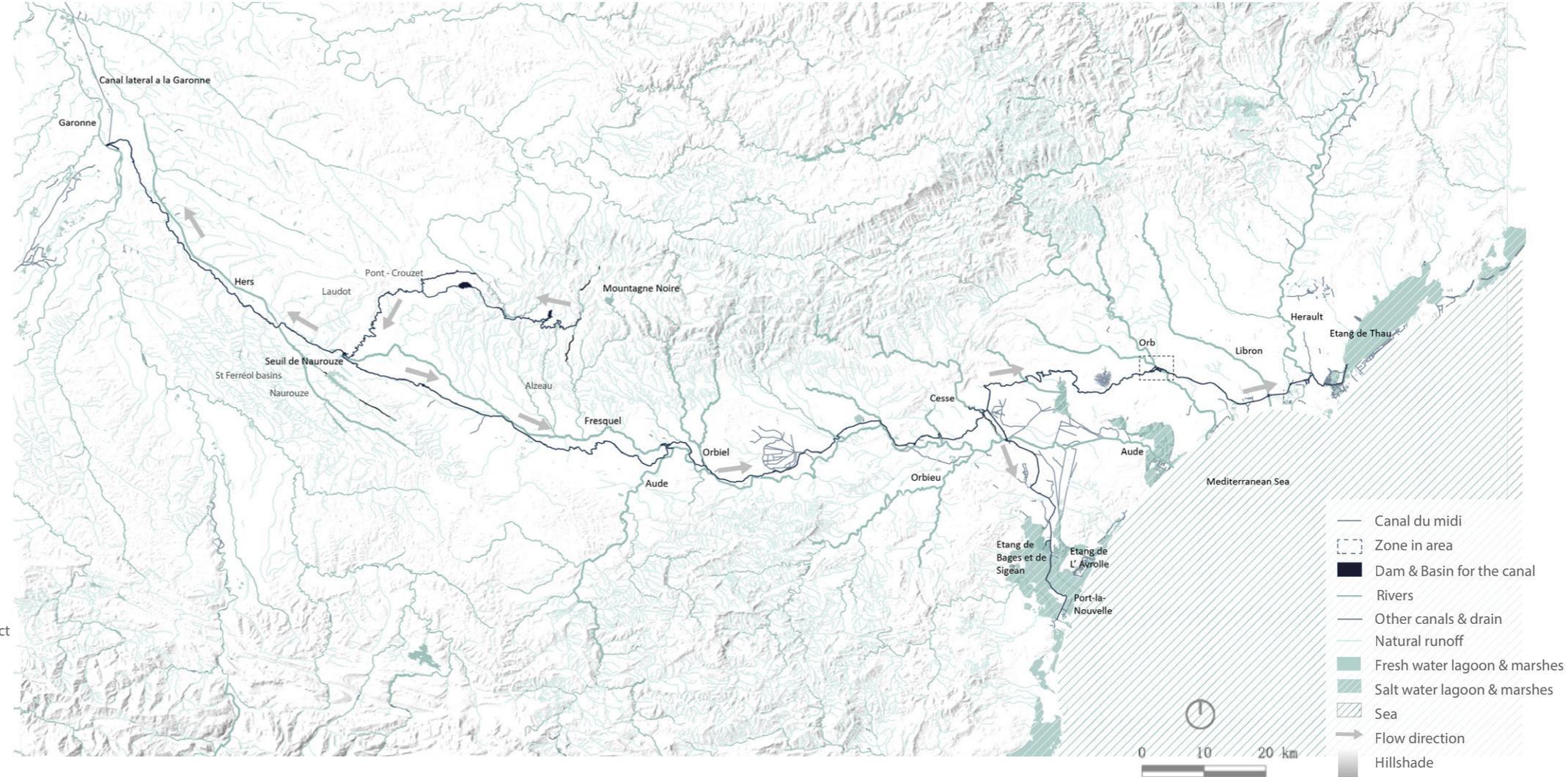


Figure 20 Water system map shows the flow of the Canal du Midi and its connection with the water network

Circularity diagram.

The water circularity flow starts from the reservoir to the water basin and is directed into Canal du Midi. Then, crossing and interacting with several rivers and streams reaching the saltwater lagoon, and ending up in the Mediterranean sea.

The canal remains its own watercourse almost all the way by constructing different types of aqueducts and some other innovative civil engineer works to make sure the navigation function. While there are many spillways, discharge channels, and intakes along the canal to adjust and control the amount of water in the canal.

In the 19 century, the irrigation of crops with canal water developed. This function was not originally intended. But the evolution of agricultural techniques coupled with a good mastery of the hydraulic operation of the canal made it possible to respond positively to the demands of farmers who wished to benefit from water intakes (GRAHAL i-pat, 2020).

Thus, this diagram shows a process about how the water from the reservoir (rivers and streams with water from both rainfall and underground) be directed to the canal. Along with the routing, the water of the canal exchanged with many watercourses and directed to agricultural land and wine-growing areas, run into lakes, marshes, and lagoons and finally end up to the sea.

The canal itself is a habitat for some species, the saltwater marshes and lagoons are great habitats for many birds, aquatic and amphibian species also plants. The flowing water is also used by people for many activities such as washing clothes and cleaning, swimming in some water basin areas, and mostly, boating.

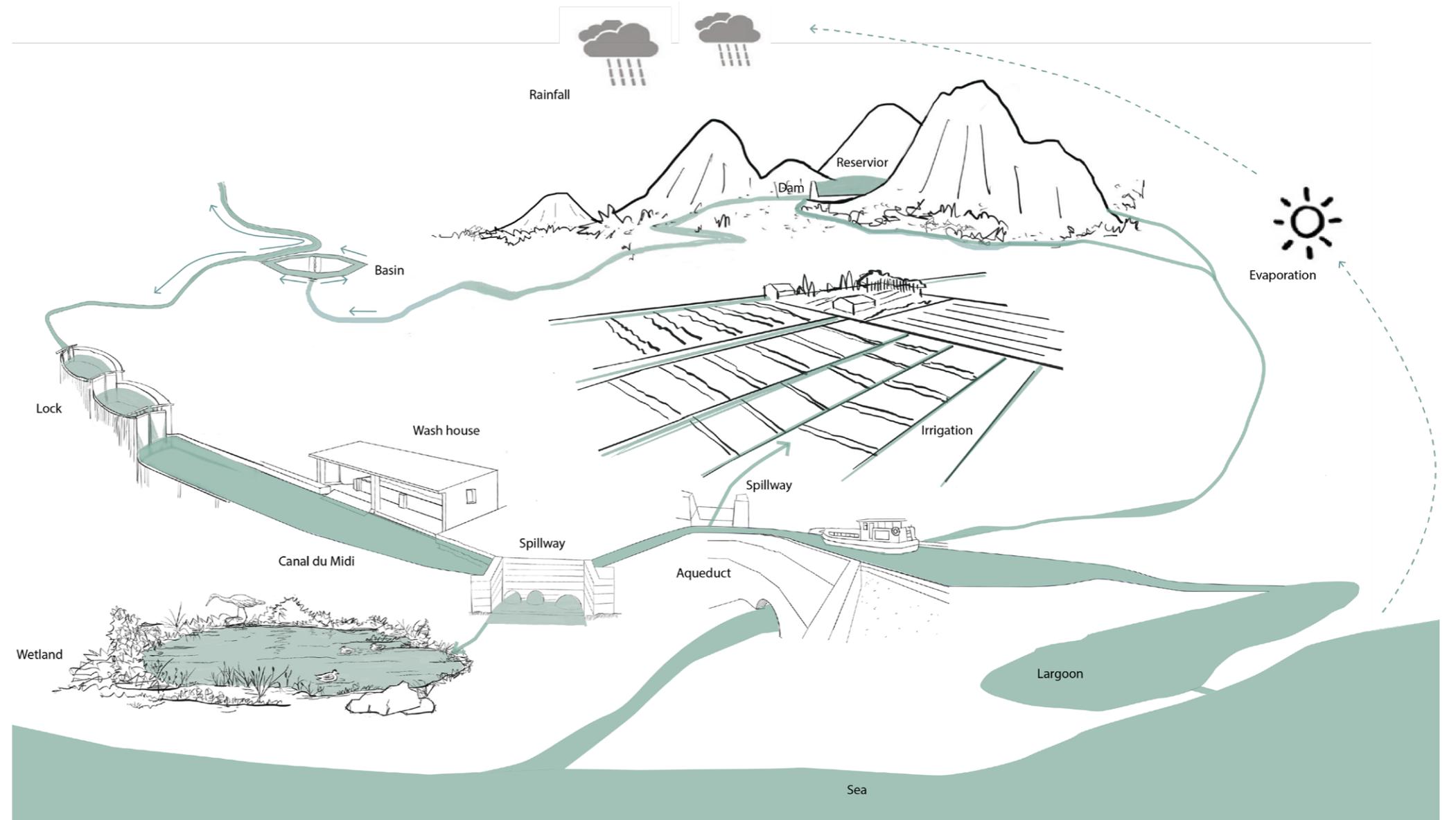


Figure 22

Conclusion.

The purpose of the research is to understand the story behind the Canal du Midi, which worked now for 340 years. The canal, “a masterpiece of human creative genius” (GRAHAL i-pat, 2020), includes tangible and intangible meaning. The following are several values explaining the tangible and intangible meaning of the system.

Universal values - Canal du Midi was inscribed in 1996 considering that the site is of Outstanding Universal Value being one of the greatest engineering achievements of the Modern Age, providing the model for the flowering of technology that led directly to the Industrial Revolution and the modern technological age (UNESCO, 2021).

Landscape values - Different landscapes (both the natural landscape and cultural landscape) can be found along the canal: urban & rural landscape, heritage landscape, historical city landscape, agricultural & vineyard landscape, mountain & valley & plain & coastal plain landscape, wetland landscape, etc.. The Canal du Midi as an artificial factor, highly blended into this ground, working together with the diversity of the landscape, becoming an oasis of peace with beautiful romantic spots on and along the sailing route which not only created a fantastic traveling and exploring experience for people but also being a habitat for wildlife such as aquatic plants and biota.

Architectural values – This 360km network of navigable waterways through 328 structures (locks, aqueducts, bridges, tunnels, etc.) is one of the oldest running channels in Europe. Built between 1667 and 1694, the construction of the canal took in the design and the way it blends with its surroundings turned a technical achievement into a work of art (high aesthetic architectural and landscape design that has few parallels) (UNESCO, 2021).

Functional values – The canal as a transportation infrastructure used to contribute a lot to the trading and economic development of the country. Now as world heritages, it is also a lever of attractiveness for the territories of tourism and maintaining its navigation functionality which attracted the boating enthusiast to sail through the canal from all over the world. In addition, it is also working as one of the important sources of freshwater going through the territory for irrigation and other usages. The canal still remains a diverse functionality today.

Ethnographic and identity values –The Canal du Midi has played an important role as part of the identity of France and New Rome during the time. Before France was a nation, France was promoted as a New Rome and the French as descendants of ancient Gaul. The campaign to make France a New Rome inadvertently provided a basis for French national identity. The Canal du Midi, one of the infrastructural projects for the New Rome, came to define France and stand for French native genius. By the nineteenth century, Pierre-Paul Riquet, the canal’s entrepreneur, had become a national hero; the New Rome and the French nation had become one (Mukerji, C, 2009).

Lesson to learn - today the Canal du Midi as a world heritage, provides solid evidence showing the human knowledge about water management of the time and gives a unique perspective to review the relationship between artificial and nature, modernity and the past.

The construction of the canal combines ingenuity, innovation, and aesthetics. The people working on constructing the canal not only carefully observed and study the natural flow, geographical and architectural elements (topography, soil, weather, local materials, etc.) of all the land it crossed, they also collected and used a wide range of knowledge of water management and architecture from old roman tradition to the latest scientific development, and make innovation based on this knowledge. For example, you can find a spillway with an exquisite Romanesque facade and with a piece of siphon equipment inside that still works perfectly today. Or the first canal tunnel in the world that gets advantages from the complicated and difficult geographical conditions.

Although the railway, air transportation, and other transportation modes are developed more efficiently and cheap today, building a canal as a trade route is no longer an option. But as the Unesco Commission claims, “The South Canal is clearly an exceptional example of a designed landscape (UNESCO, 2021)”. It provides our generation with insight into how artificial grants work become part of our landscape as an infrastructure, a cultural and natural vehicle, on the one hand working against nature for the sake of human will, but on the other hand, also conforms to nature and becomes part of it. The bright and dark sides of this man-made project, the success it has achieved, the conflict it has triggered, and the challenges it is facing today, are all lessons for us to learn.

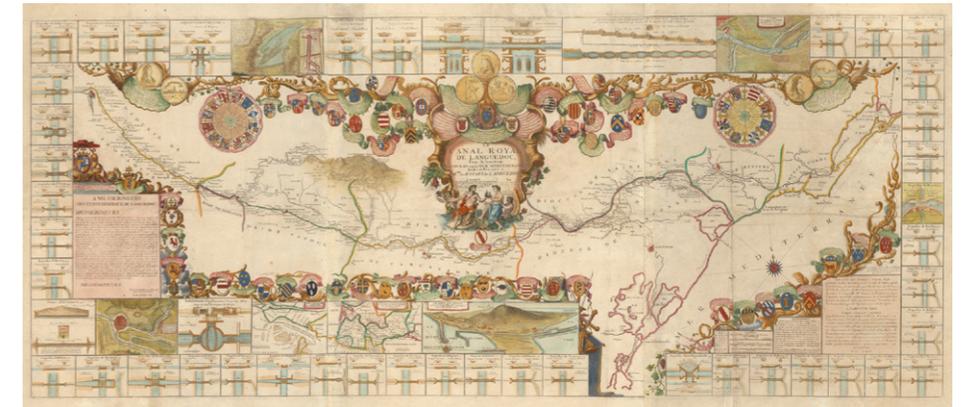


Figure 23 Color map of the Royal Canal of Languedoc (Canal du Midi) by J.B. Nolin (1697)

References.

Project x - Canal du Midi, a water infrastructure in Southern France.

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Note: Some of the drawing have based on information from website and news of following sources, then elaborated and interpreted by author.

Illustration Credits

Figure 1 Canal du Midi at the Montferrand, Aude, France [Image]. Took and retrieved by author

Figure 2,3,4 Country/Occltanle region in France/Water catchment area Canal du Midi [Figure]. Made by author

Figure 5,6, The lock at the Montferrand [Image], The Répudre Canal-bridge [Image]. Took and retrieved by author

Figure 7, Dry docks in the Toulouse [Image]. Retrieved from <https://paulette.bike/fr/blog/20-sites-touristiques-incontournables-long-du-canal-du-midi-n90>

Figure 8 Épanchoir des Patiasses [Image]. Retrieved from <https://www.canaldumidi.com/Minervois/Cesse/Epanchoir-des-Patiasses.php>

Figure 9, 10 People waiting to cross the lock [Image], Swimming, diving, boating, rest at water basin [Image]. Took and retrieved by author

Figure 11 Water jousting game [Image], Retrieved from https://en.wikipedia.org/wiki/Water_jousting

Figure 12 Boating, cycling, walking at canal bank [Image], Retrieved from <https://www.francecomfort.com/en/sights/739/Canal-du-Midi-holiday-fun-on-the-water>

Figure 13 Annual Temperature and amount of rainfall [Figure]. Made by author, information from <https://weather-and-climate.com/average-monthly-Rainfall-Temperature-Sunshine> and <https://www.timeanddate.com/weather/france/toulouse/climate>

Figure 14 Sub climate [Figure]. Made by author, information from <https://about-france.com/geo/climate-map.htm>

Figure 15 Annual Precipitation [Figure]. Made by author, information from <https://www.eaufrance.fr/les-volumes-de-precipitations>

Figure 16 The catchment area before construction of the Canal du Midi (around 1600) [Figure]. Made by author, information from <https://www.oldmapsonline.org/map/rumsey/1494.041>.

Figure 17 The catchment area after the construction of the Canal du Midi (around 1700) [Figure]. Made by author, information from <https://www.davidrumsey.com/rumsey/download.pl?image=/168/12044065.jp2>

Figure 18 The current situation of the catchment area [Figure]. Made by author.

Figure 19 The catchment map shows the canal, water system, topography, and human settlements related to the Canal du Midi [Figure]. Made by author.

Figure 20 Water system map shows the flow of the Canal du Midi and its connection with the water network [Figure]. Made by author.

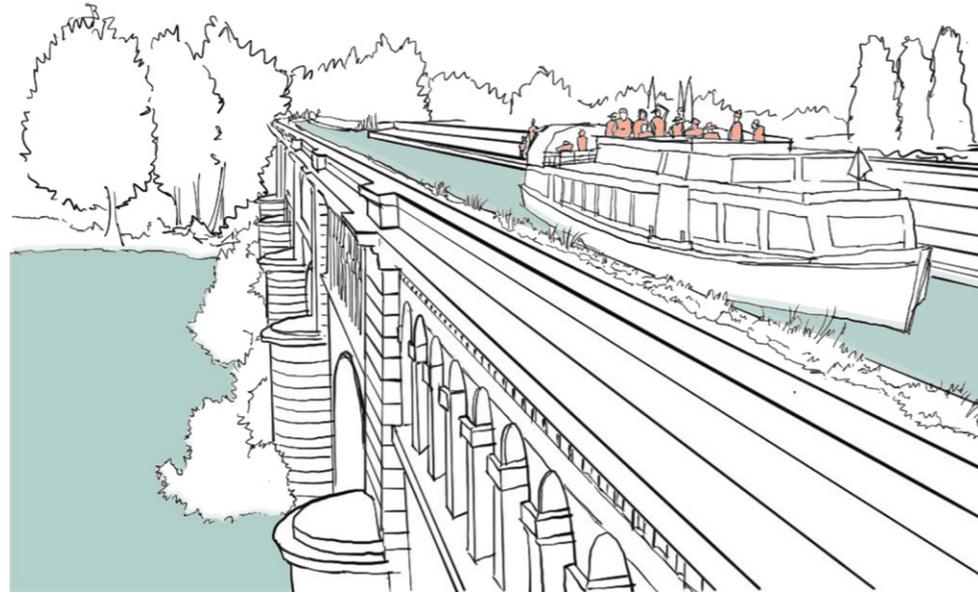
Figure 21 Zone in water system map shows the detailed section (Canal du Midi across river Orb) [Figure]. Made by author.

Figure 22 Water system circular diagram. Made by author. Some of the drawings inspired by images on website including: https://en.wikipedia.org/wiki/Canal_du_Midi#/media/File:Pont-canal_de_l'Orb004.JPG; <https://www.canaldumidi.com/Photos.php?style=PasDeStyle>; https://www.flickr.com/photos/gerard_michel/3068832282/

Figure 23 Color map of the Royal Canal of Languedoc (Canal du Midi) by J.B. Nolin (1697) [Image], source: <https://www.davidrumsey.com/rumsey/download.pl?image=/171/11642000.jp2>



Water works.



Aqueduct
Pont - canal de l'Orb

The Orb Aqueduct is a bridge which carries the Canal du Midi artificial made watercourse over the Orb in the city of Béziers. The aqueduct is the longest on the Canal du Midi.

Project: The Canal story - Canal du Midi, a water infrastructure in Southern France.

Climate: Hot-summer Mediterranean

Year: 1858 till now

Water type: Freshwater

Landscape: Canal landscape

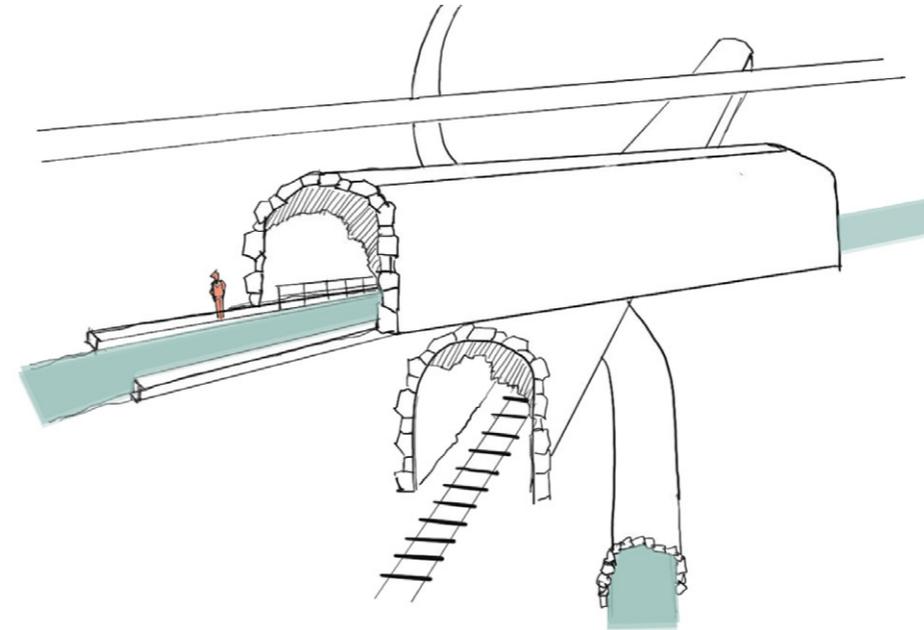
Soil condition: Fluvisols

Material: Stone

Temporality: Maintaining

Form: Surface (Mid-air)

Use or Function: Navigation



Canal tunnel
Malpas tunnel, beneath l'Oppidum d'Ensérune

The Malpas tunnel carries the Canal du Midi under the d'Ensérune hill in Hérault, France. It was Europe's first navigable canal tunnel and is a monument to the determination of Pierre-Paul Riquet, the chief engineer.

Project: The Canal story - Canal du Midi, a water infrastructure in Southern France.

Climate: Hot-summer Mediterranean

Year: 1679 till now

Water type: Freshwater

Landscape: Plain landscape

Soil condition: Calcosols

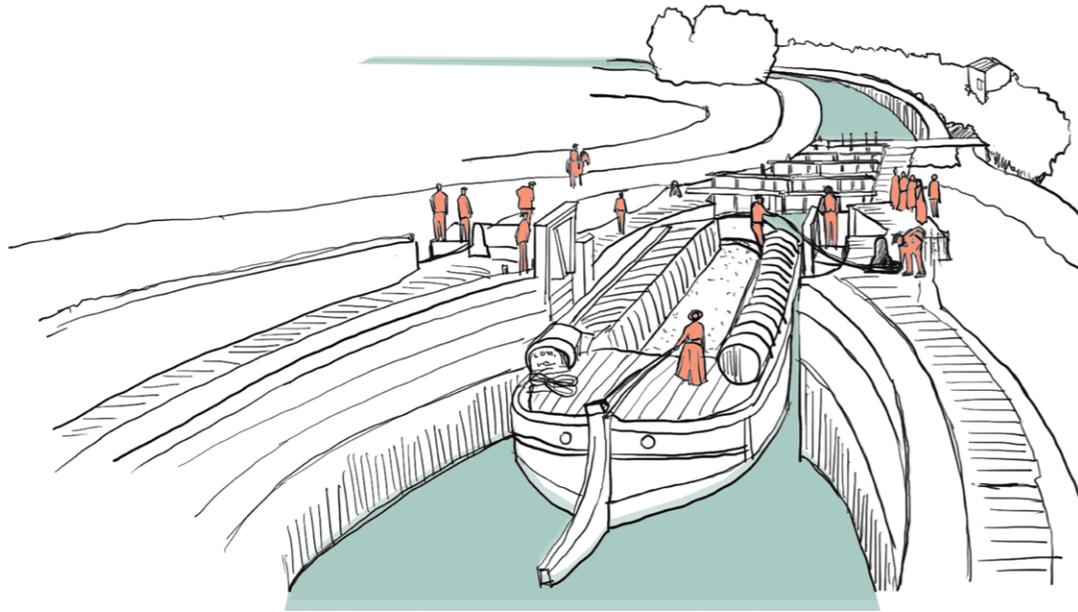
Material: Concrete

Temporality: Maintained

Form: Carved tube

Use or Function: Navigation

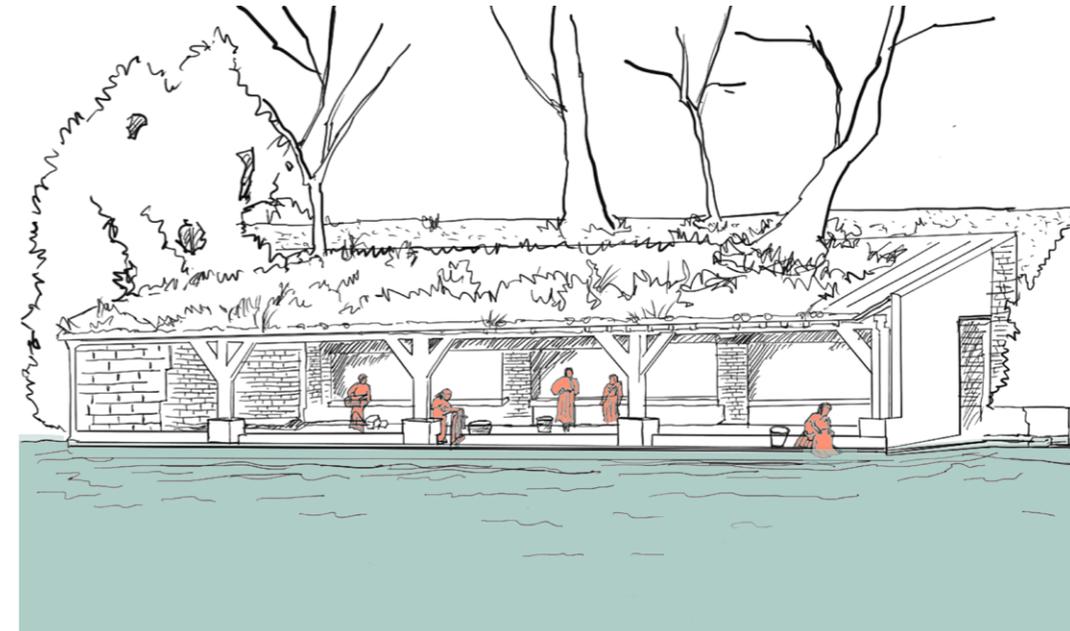
Water stories.



Lock
Lock keeper and sailers

The locks are water works to help the boat to overcome height difference. There are several actions needed to be taken to cross different levels of water, the lock keeper opens and closes the lock and lets water in and out into the compartment, the visitors always like to watch the whole process and interact with the people on the boat.

Project: The Canal story - Canal du Midi, a water infrastructure in Southern France.
Climate: Hot-summer Mediterranean
Year: 1685 till now
Water type: Fresh water
Landscape: Canal landscape
Meaning: To overcome height differences and to meet
Water workers and users: Lock keeper and crew
Material: Brick, stone, concrete, iron
Temporality: All seasons
Use or Function: Navigation



Wash house
Washing & cleaning

People built the wash house along the canal to use the water from the canal for cleaning clothes. Water was taken out of the canal and after washing released back into the canal.

Project: The Canal story - Canal du Midi, a water infrastructure in Southern France.
Climate: Hot-summer Mediterranean
Year: around 17th to 18th century
Water type: Fresh water
Landscape: Canal landscape
Meaning: cleaning
Water workers and users: Fishers
Material: wood, brick, concrete
Temporality: All seasons
Use or Function: washing and cleaning