The idea of placing at the edge of the canal some morphological structures that never existed before in that part of the lagoon had initially aroused perplexity on the part of supporters of a poorly understood protection of the lagoon environment, but the elderly engineer did not care too much and loved to repeat often: 'it would be desirable that these people, hastily judging the intervention beyond its potential effectiveness to be impossible, knew how to stifle their feelings, giving space to reasoning and a well-conducted and controlled experimentation, able to shed light on the complex interactions of lagoon morphodynamics produced by the insertion of these structures'. Beyond the inertia of the decision-making mechanisms, the construction of the sandbanks at the edge of the canal was nevertheless necessary to counter the amplitude of the waves deriving from the increasingly frequent *bora* storms that regularly cross the lagoon on one side, and the growing lagoon traffic that crossed the channel on the other. D'Alpaos, who, as already mentioned, dedicated a large part of his life as a scholar and professional to the integrity of the lagoon and its equilibrium, could never have imagined that these first terraforming processes would become a pretext for upsetting the initial project, plotting the concep-


pedestrian path
dock
navigation lock
Lake of Venice
(Central Lagoon)
pedestrian path
Alberoni octagon
tram and bike lane
shack / fishermen's hut
Hoodgates
dock
navigation lock
barena
San Pietro octagon
South Lagoon Park
Mouth of Malamocco
navigation lock

tual foundations of a process which, by legitimizing the idea of a radical transformation of the central lagoon, would sooner or later also authorize the possibility of its division. In fact, it is precisely on these first salt marshes, initially created through the simple arrangement of cordons of polyester huts filled with stones, that over the years, together with the higher sea levels, the increasingly solid elements have settled, thus giving rise to the current massive embankment that separates the central lagoon.

The consolidation of the salt marshes and their transformation into the current embankment followed the acceleration of the rhythms dictated by the return times of the high waters which with climate change became more and more frequent, imposing after more than fifty years the almost daily closure of the mobile dams located at the Lido and Malamocco mouths. Naturally, the daily closure of the MoSE, even if widely expected at the beginning of the century, had now become unsustainable as well as a continuous source of quarrels and accusations between the various decision-making bodies. The tensions due to the continuous closures were determined not only by the huge management costs exacerbated by the energy crisis, but also by the damage to the lagoon and to the nu-

merous activities linked to the tourist and industrial port, which was partly still located on the mainland. To further exacerbate the situation were the divergent interests represented by the defenders, on the one hand of the safeguarding of Venice, on the other of the fluid-dynamic equilibrium of the lagoon, not to mention the functioning of the port located between the mainland and the mouth of Malamocco.

The first to introduce the idea of the permanent closure of the lagoon to protect Venice was Georg Umgiesser, a German oceanographer of the CNR of Venice. He did so more or less in the same years in which D'Alpaos formulated the operational hypotheses useful for preserving the fluid-dynamic equilibrium of the lagoon. According to Umgiesser, who had made mathematical models of the lagoon to simulate its breathing, closing the lagoon was not optional. 'The problem is not if it will happen, but when it will happen ...,' he would often repeat to the local press, which relaunched the news with sensational headlines. It was a few decades later, towards the second half of the 21st century, when it became clear that the MoSE, despite its name, would no longer be enough to save everything (Venice, together with its port and the lagoon), when the only solution which at that point seemed fea-

sible gained ground. The construction site was thus launched for the largest work built after the MoSE to save Venice, an embankment of 14,350 metres located to enclose the central lagoon which, having reached the tip of the Alberoni on the Lido, was linked to the ancient system of *Murazzi* in Istrian stone, accordingly extended and raised for the entire length of the island. The infrastructure was connected to a system of 46 kilometres of reinforced banks and beaches to defend against storm surges towards the sea, and 45 kilometres of waterproofed shores and banks towards the polluted sites of the hinterland to build a single large infrastructure of embankments, dunes and sheet piles that isolate the central lagoon. The construction of the tram line above the embankment appeared then to be the most obvious thing to do, as a natural consequence of an unexpected opportunity or compensation for the bereavement suffered.

Together with the construction of the embankment, the former *Petroli Canal* has gradually been transformed and today has become the fundamental connection between the two port facilities, now located between the inlet of Malamocco and the ancient port of Marghera. Along the canal run hundreds of medium and large-sized ferries used for the transport of

goods and people, powered by the nearby Hydrogen Park in Marghera. The connection between the canal and the lake of Venice is governed by complex systems of navigation basins, pumps, and transfer ports that selectively cut into the embankment. These hydraulic devices and great works of architecture inspired by Leonardo da Vinci are entrusted with the task of maintaining the heights of the lake at the warning levels of the first half of the 20th century, when the high waters marked the rhythms of the Serenissima and were still a manageable threat.

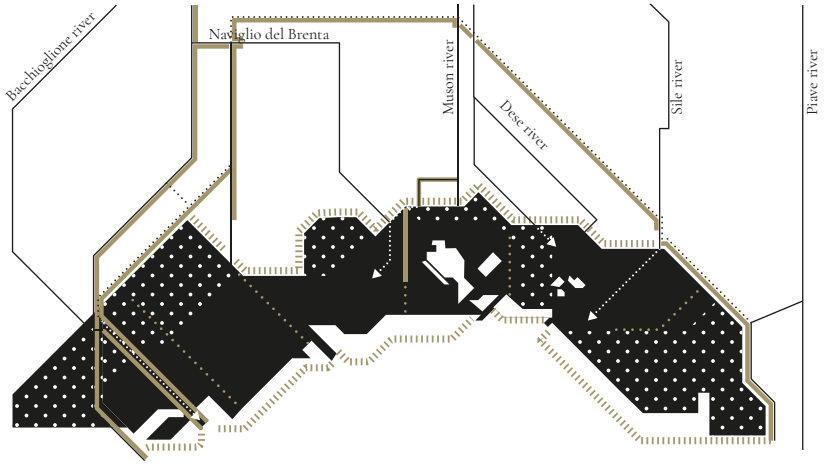
Alongside the embankment towards the lake, and on the other side of the channel towards the lagoon, remain the now consolidated traces of the ancient *barene* built by D'Alpaos, that define a modern archaeology of mudflats on which the new southern lagoon, at least in part, was founded.


Barena
wetland
fishermen's hut
Malamocco-Marghera Canal
San Leonardo port and
boat storage
tram and bike lane
Lake of Venice
(Central Lagoon)
navigation lock
port and boat storage
dock
dock
pedestrian path
Malamocco-Marghera Canal
South Lagoon Park

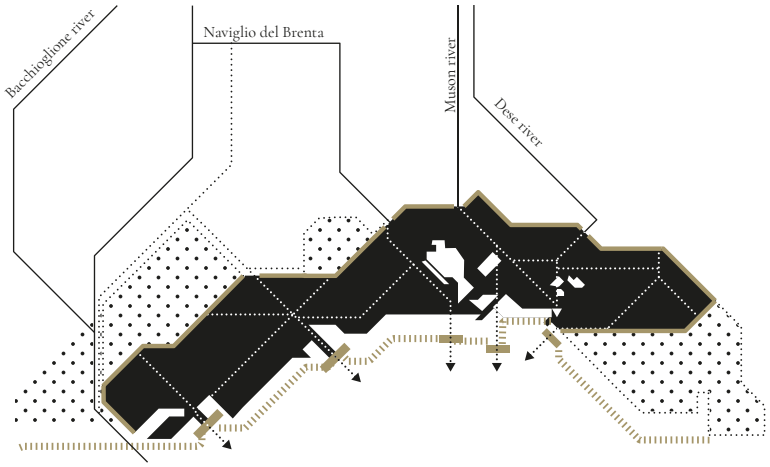
Watersheds, embankments, and locks

The myth of the origin of Venice, carefully constructed and updated by the Serenissima Republic of Venice over the centuries until its definition in the 13th century (Bettini 2006, p. 125), went and often still goes hand in hand with another myth. Or rather, with another dogma: the unity of the lagoon. On the contrary, historical maps show how the lagoon space has always been understood in a non-homogeneous way, and how in fact there was never a single lagoon. We are also aware of centuries-old customs linked to the presence in the Venice lagoon of watersheds that transformed it in everyday life into independent lagoons that can be traced back to the inlets. Watersheds that both fishermen and ship captains were well aware of, and whose existence had been taken into account by hydraulic experts in order to develop projects for the lagoon.

Starting from the 16th century, a new awareness and sensitivity regarding the consistency of the urban fabric and its relationship with the surrounding environment developed in Venice, as well as in other Italian cities including Milan, Florence, Verona, Ferrara, and Rome (Calabi 2006, p. 2). It is precisely in this perspective that



Sabbadino's lagoon
Approx. year 1550. The diagram illustrates the project for the diversion of rivers and protection of the lagoon developed by Cristoforo Sabbadino: the diversion of rivers outside the lagoon in gold; inside the lagoon the new embankments in gold; towards the sea, along the shores, the coastal protections. Note on the left the embankments protecting the outlet to the sea of the new course of the Brenta, that separate the ancient Brondolo lagoon (now filled in) from the southern lagoon; between the central lagoon and the southern lagoon the preparation for the *traversagno* to protect Venice.



Cornaro's lagoon
Approx. year 1550. The diagram illustrates the hypotheses for the closure of the lagoon developed by Alvise Cornaro: towards the mainland, in gold a continuous embankment separating the land and the water; towards the sea, in gold, the coastal protections along the shores; inside the lagoon, in dotted white, the navigable canals. Note the contraction of the lagoon caused by the reclamation and conversion of dead lagoon areas into arable land; the closure of the lagoon mouths.

the proposals made by the *proto* of the *Magistrato alle Acque* (Magistrate to the Waters), Cristoforo Sabbadino, should be read: in two maps from 1547 (Archivio di Stato di Venezia, Savi ed Esecutori alle Acque, Disegni, Laguna 9) (Image 1, p.96) and 1556 (Archivio di Stato di Venezia, Savi ed Esecutori alle Acque, Disegni, Laguna 13) (Image 2, p.96) he elaborates one of the first attempts to avoid that the sediments carried by the rivers were pushed by the sirocco towards Venice through a 'light' instrument. This tool –alternatively referred to as a *traversagno* or *parador*– consisted of a barrier of wooden poles coinciding with the watershed south-west of Venice. Only later, in 1558, did Sabbadino himself elaborate a more radical project (Archivio di Stato di Venezia, Savi ed Esecutori alle Acque, disegni, Diversi n.106) (Image 3, p.97) of deviation of the major rivers that flow into the lagoon, first of all the Brenta which is directed towards the sea by two robust embankments through the mouth of the port of Chioggia, effectively separating the southernmost part from the rest of the lagoon.
In the same years Alvise Cornaro, contrary to Sabbadino who wanted to allow free expansion of the lagoon waters towards the mainland, proposed clearly separating the lagoon from the mainland through the construction of an embankment (Archivio di

Stato di Venezia, Savi ed Esecutori alle Acque, Atti, filza 231, reg.3, 0006, 003r) (Image 4, p.98). This structure was also extended into the lagoon to ensure that the sediments of the Brenta –in the meantime forced into a new bed that diverted it from the lagoon– were led towards the sea and as far as possible away from Venice. The alternative visions developed by Sabbadino and Cornaro would have a strong echo also in the following centuries. It is no coincidence that around 1660 an expert in hydraulics (probably Federico Gualdi or Fantin Contarini) reworked Alvise Cornaro's proposal to create an embankment that embraced the entire lagoon, locating it halfway between the mainland and the urbanized islands, including Venice (Archivio di Stato di Venezia, Savi ed Esecutori alle Acque, filza 123, 0790, 362-r) (Image 5, p.98). In this way the structure separated the living lagoon and the dead lagoon, while channels that led in a straight line to the lagoon mouths were dug.

A few years later, in 1673, engineer Alfonso Moscatelli –originally from Brescia– presented a plan for dividing the lagoon into four phases to ensure its survival, radically changing its morphology (Archivio di Stato di Venezia, Savi ed Esecutori alle Acque, b.131, dis.2) (Image 6, p.99)[▸1].

Viewed from a contemporary angle, Moscatelli's proposal may appear naive, difficult to implement –in particular with the technical means of the late 17th century– and of dubious effectiveness. However, it reiterates once again how in past centuries the hydraulic engineers –even the most 'unlikely' ones like Sabbadino himself– did not consider the unity of the lagoon as a dogma and were willing to make radical choices in order to guarantee its existence.

Bridges, roads, and docks

Radical choices, such as those proposed by the engineer Eugenio Miozzi in the second half of the last century. In the Sixties of the 20th century, at the end of a long career and a few years after the dramatic flood of 1966, the engineer proposed a futuristic solution to the 'sinking' of Venice caused by the combined action of sea level rise and land subsidence: to lift the entire city by injecting large quantities of water into the subsoil to reconstitute the artesian aquifers, emptied in particular by the feverish industrial activity of Porto Marghera. Through the construction of a compression chamber –delimited in the lower and upper part by layers of

▸1 The four phases of Moscatelli's proposal respectively involved:

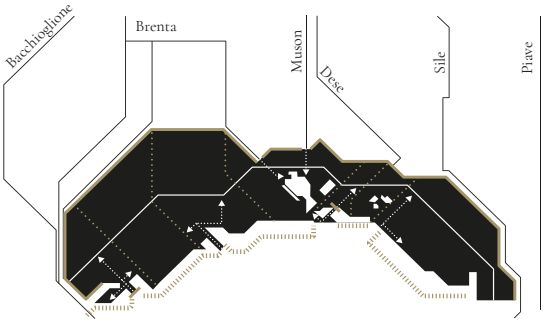
Phase 1:
- Closure of the Chioggia mouth with construction of navigation locks for maritime navigation;
- closure of the Sant'Erasmo mouth;
- creation of a watershed between the mouths of Chioggia and Malamocco following the closure of the mouth of Chioggia;
- creation of a watershed between the Port of Venice and the Treporti mouth following the closure of the Sant'Erasmo mouth.

Phase 2:
- Construction of an embankment that closed the Chioggia lagoon behind the Mont'Albano canal to maintain a sustained level of water in Chioggia;
- construction of locks to allow navigation from the Chioggia lagoon to the Lombardy canal (which connected the lagoon to the river Po). The locks could be opened for maintenance purposes, thus letting the water flow from the lagoon to the canal, favouring the excavation of the latter;
- creation of gates to be opened as needed to replace the water in the Chioggia lagoon and reinforce the zosane (ebb tides) in the lagoon area adjacent to the Malamocco mouth.

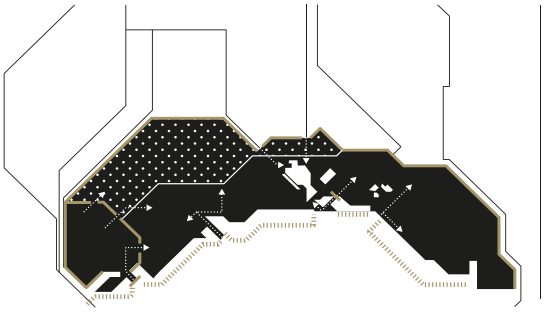
Phase 3:
- Construction of an embankment punctuated by openings that longitudinally separated the dead from the living lagoon;
- creation of a canal parallel to the embankment on the side of the dead lagoon;
- maintenance of canals and cuts in the dead lagoon so

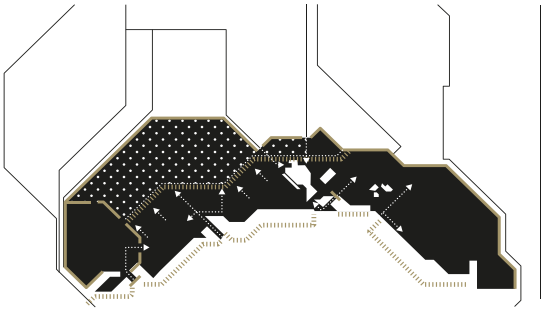
that the water could drain as needed when the locks that dotted the embankment separating the two lagoons were opened.

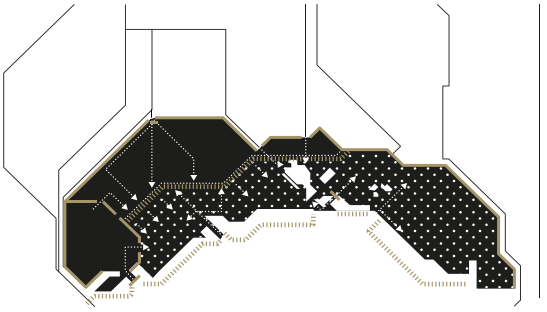
Phase 4:
- Simultaneous opening of one or more locks that dotted the embankment that separated the two lagoons to excavate the living lagoon;
- construction of a lock in the embankment that divided the *Taglio Novissimo del Brenta* from the dead lagoon, and opening of the same lock during the flood waves of the Brenta in order to excavate the dead lagoon and reinforce the zosane in the living lagoon.



phase 1


phase 2


phase 3


phase 4

Moscatelli's lagoon
Year 1673. The diagrams illustrate the four phases of subdivision of the lagoon elaborated by Alfonso Moscatelli. Note the reconceptualization of the dead lagoon as a hydraulic service system in function of the living lagoon.

caranto, a thick layer of natural clay, and on the sides by artificial diaphragms– the goal was to raise the ground, which over the centuries had lowered also due to the phenomenon of eustatism, and bring the average piezometric altitude back to +4.00 m, the altitude measured in 1858 (Miozzi 1974, pp. 1-47).

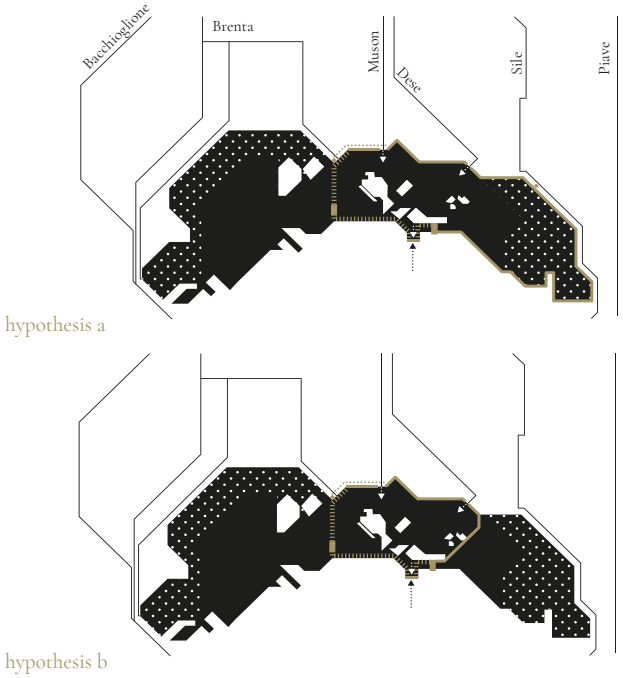
Faced with the enormous technological challenge that the solution of raising the ground would have represented, Miozzi imagined two alternative and more pragmatic versions for the protection of Venice at the end of the fourth volume, *Il Salvamento*, of his work *Venezia nei secoli* (*Venice over the centuries*) (1969, pp. 475–494). The first alternative consisted in the creation of a basin of 27,000 hectares including Venice and the entire northern lagoon. The second, more limited, was the creation of a basin of 9,000 hectares including Venice and the other historic island centres (Murano, Burano, Mazzorbo, and Torcello). The regulated closure of the basin provided for the mechanical removal of the 'old water'. It would have taken place through a system of vehicular embankments –which at the same time would have also radically redesigned the mobility of the lagoon– and the construction of gates and navigation locks at the Lido mouth, to some extent anticipating the MoSE project. In the first case (basin of 27,000 hectares), the barrier would have been double, built between Sant'Erasmo and Cavallino and between Sant'Erasmo and the Lido; in the second case (basin of 9,000 hectares), it would have been completed only between Sant'Erasmo and the Lido, thus leaving the northern lagoon with an open basin of about 18,000 hectares[▸2].

In more recent times, some of the protagonists of the debate around the advisability of creating the MoSE have raised once again the fundamental issue of lagoon unity, hypothesizing alternative solutions to the MoSE that in some ways recalled a centuries-old Venetian design tradition. In this sense, it is worth mentioning the proposal made by Professor Antonio Foscari[▸3] to divide the lagoon into three parts through the use of *palancole*, thus allowing to maintain different levels of water according to the preservation needs of the historic centres and operational conditions of Porto Marghera. This proposal pertains to the logic of graduality and reversibility that has guided the interventions in the lagoon area over the centuries, and has many elements in common with the barrier imagined centuries earlier by Sabbadino.

Today, in the light of the repetition of extreme high-water events,

▸2 As a demonstration of the profound historical knowledge of Venice and its lagoon, Miozzi recalls in his proposal (1969, pp. 482–483) precisely the *traversagno* located west of Venice, which specifically for the 27,000-hectare basin envisaged:
_ isolating the Lido basin from that of Malamocco with an earth bank crossing the entire lagoon, from the Terre Perse in the Lido to Fusina, 'renovating' the *traversagno* embankment built in the 16th century;
- closing existing communications with the open sea or with canals in turn communicating with the sea: in order not to jeopardize river navigation, these outlets would have been equipped with locks, in which one of the two doors would always be closed, thus ensuring isolation;
- closing the Canale di S. Erasmo with an embankment partly in earth and partly in masonry;
- closing the Lido mouth between S. Nicolò and S. Erasmo with an earth embankment in the shallower area and with a masonry dam in the navigation channel;
- the construction of two lifting stations for the 'old waters', one of them in Malcontenta, and one in Cava di Caligo near Jesolo;
- the construction of a dam with coastal pressurization on the lagoon edge with the mainland between Malcontenta and the area currently occupied by Marco Polo airport.

▸3 During a lecture held by Professor Foscari on 25 October 2019 at Palazzo Badoer in Venice as part of the 'Forms of knowledge, forms of rationality' module (lecturer Ludovico Centis) of the European Master in Urbanism.



Miozzi's lagoon
Year 1969. The diagrams illustrate the two hypotheses for dividing the lagoon developed by engineer Eugenio Miozzi after the 1966 Venice flood: the separation embankments in gold; hypothesis a) basin of 27,000 hectares; hypothesis b) basin of 9,000 hectares.

the environmental effects of the hydrodynamic and morphological relations between water and land re-emerge in a form particularly accentuated by the phenomena of subsidence and eustatism. As hypothesized by Umgiesser, the gates of the three mobile dams –under construction in the respective mouths of the Lido, Malamocco, and Chioggia– with an average sea level increase of 50 centimetres by the end of the century, will come into operation on average at least once per day.
In the perspective of a gradual but total closure of the lagoon, the studies and hypotheses developed over the centuries that we have retraced constitute a fundamental source of reflection for the advancement of the idea of a possible division of the lagoon into areas characterized by different landscapes, uses, hydraulic and ecological characteristics. Not only that: they oblige us to understand that the need to safeguard Venice necessarily implies –then as today– a project of radical transformation of the environment in which it is located.

01

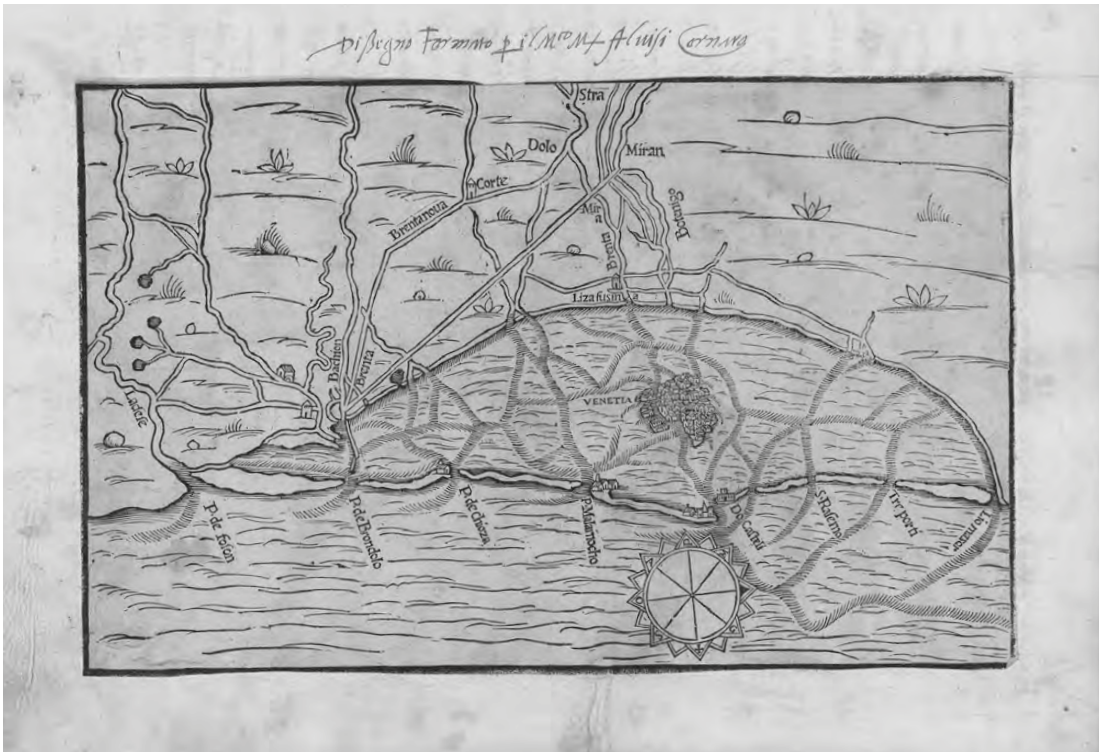
02

03

Image 01. Map of the central lagoon basin produced by Cristoforo Sabbadino (1547)
Archivio di Stato di Venezia, Savi ed Esecutori alle Acque, disegni, Laguna n.9.
In red at the top the quarries that intercept the terminal stretch of the Brenta diverting its waters towards Malamocco. In the centre, the straight line of the *traversagno* (perhaps only planned) which coincides with the watershed and consists of a double order of poles and planks to prevent the sediments of the Brenta from being carried towards Venice by the sirocco.

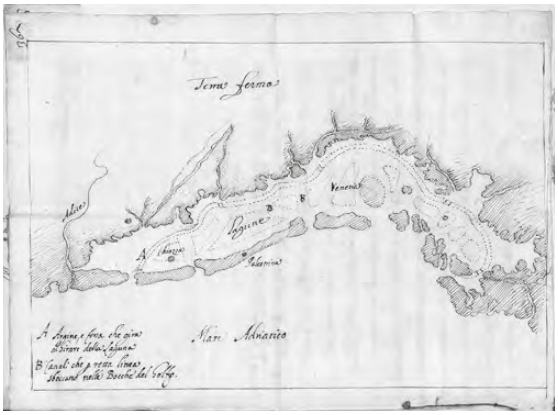
Image 02. Map of the entire lagoon produced by Cristoforo Sabbadino (1556), copy by Angelo Minorelli from 1695
Archivio di Stato di Venezia, Savi ed Esecutori alle Acque, disegni, Laguna n.13.
Map showing rivers and canals in dark blue and the *barene* in light brown. The watersheds are indicated in text form on the map; the *traversagno* between Venice and the mouth of Malamocco is also traced.

Image 03. Map of the lagoon produced by Cristoforo Sabbadino (1558) with the Brenta diversion project
Archivio di Stato di Venezia, Savi ed Esecutori alle Acque, disegni, Diversi n.106.
Deviation project of the Brenta-Muson towards the mouth of Chioggia. Real embankments that separate the southern lagoon from the rest of the lagoon are imagined.



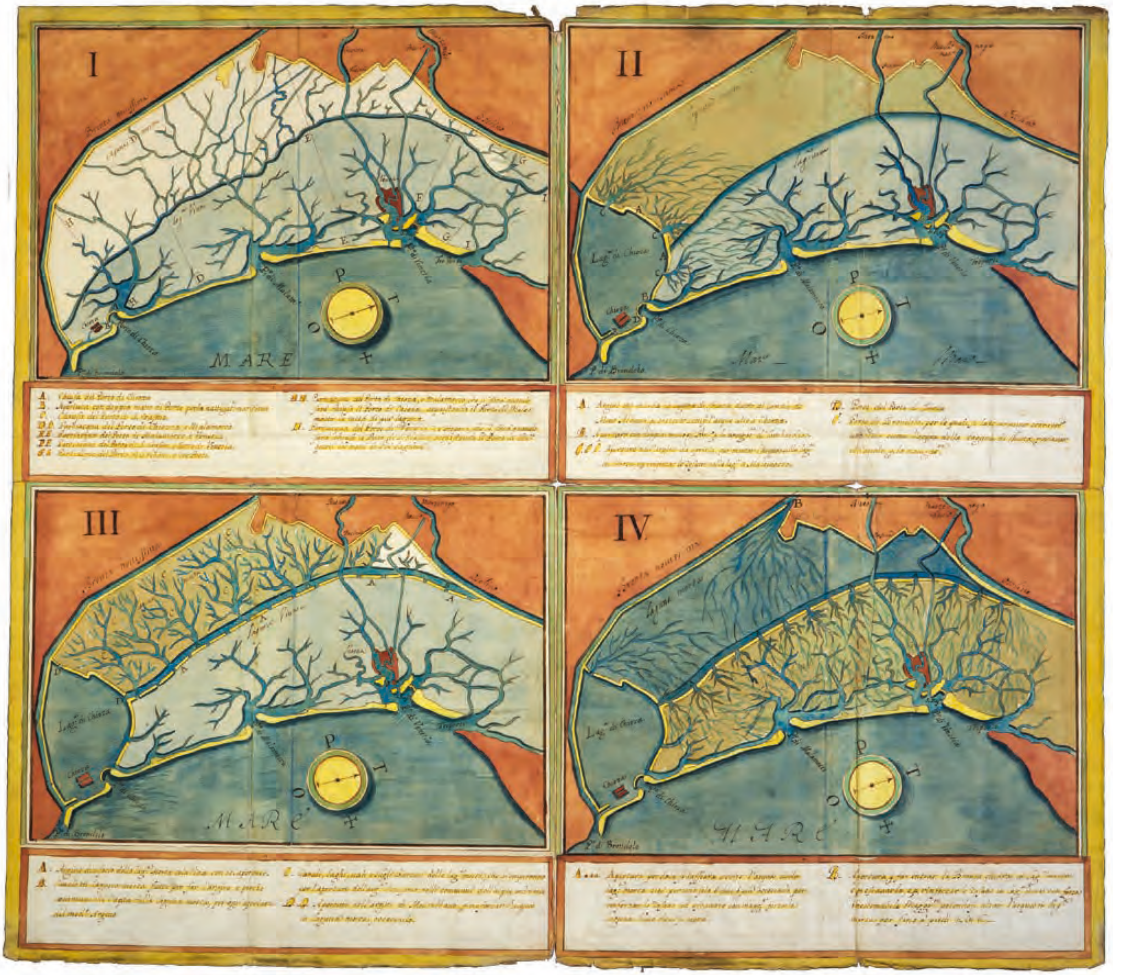
04

Image 04. Map by Alvise Cornaro dating back to the mid-16th century, depicting an embankment that clearly separates the lagoon from the mainland
Archivio di Stato di Venezia, Savi ed Esecutori alle Acque, Atti, filza 231, reg.3, 0006, 003r.
A new embankment is built that clearly separates the lagoon from the mainland and which also extends into the lagoon to ensure that the sediments of the Brenta are diverted towards the sea away from Venice. It is relevant to note the presence of more lagoon mouths than those existing today.



05

Image 05. Anonymous map (Federico Gualdi? Fantin Contarini?) dating back to around 1660, depicting an embankment that embraces the entire lagoon
Archivio di Stato di Venezia, Savi ed Esecutori alle Acque, filza 123, 0790, 362-r.
A new embankment that separates the living and dead lagoon as well as canals that connect to the lagoon mouths is built.



06

Image 06. Phased project by the Brescian engineer Alfonso Moscatelli to divide the living lagoon from the dead lagoon (1673)
Archivio di Stato di Venezia, Savi ed Esecutori alle Acque, b.131, Dis.2.
Moscatelli updates and develops the suggestions of Alvise Cornaro. Specifically, he plans to close the ports of Chioggia and Sant'Erasmo, an embankment to enclose the lagoon of Chioggia, the excavation of a large perimetral collector channel along the demarcation between the living and dead lagoon, and the introduction of the Brenta Novissima into the dead lagoon.

Designing edges

The lagoon is made up of amphibious territories on which the effects of climate change and sea rise will become more evident. For this reason, in the future, as has already been the case in the past, it will be subject to the definition of new limits and the modelling of its edges, followed by important and radical transformations. A privileged point of view on these aspects can be more clearly grasped at the edges of the lagoon, where the effects of transformation on the territory induced by the interventions initiated with the government of the Serenissima are still clearly visible. The construction of the *argine di intestadura* (an embankment acting as a dam), begun by the Venetians starting from the 14th century with the aim of diverting the rivers that were responsible for the lagoon's silting phenomena, continued through trial and error until the mid-16th century (D'Alpaos 2010, pp. 32–37).
The embankment and the canals associated with it were a complex infrastructure, operating at the same time on a hydraulic, ecological, and territorial governance level, that was to 'act as a clear element of separation between fresh and salt water' (D'Alpaos 2010, p. 32) setting the limits, including political ones, between the interior and exterior of an environment which by nature would otherwise be in continuous and perennial transition. At the northern limit of the central lagoon, in the stretch between the park of San Giuliano and the airport of Tessera, the effects of the transformations induced by the construction of the embankment and the Osellino canal in 1507 can still be read: a straight line of about 15 kilometres on which the waters of the Marzenego, Dese, Zero and Sile rivers flow. Here, beyond the net limit defined by the edge, a system of *barene* that were previously cultivated fields is located on the side towards the lagoon. On the other side, towards the hinterland, there is countryside where once stood marshes and lowland forests. The *barene* along the Osellino canal are 'well known because they can be easily reached from the ground [...], they owe their high stability to the continental soils on which they rest, so that to this day can be recognized the signs of the agrarian structure prior to their separation from the mainland in some straight *ghebi*, which once were ditches' (Bonometto 2014, p. 22). On the other side of the canal are the territories today characterized by widespread urbanization, and the countryside resulting from the 20th-century reclamation, readable by the reg-

ular rhyth. ı of the fields, ditches, and locks for water regulation. 'Five Veneti. n feet high (~ 1.75 m) above sea level and up to 20 (~ 7 m) wide a. the base' (D'Alpaos 2010, p. 33), the embankment remains a comple. nd multidimensional infrastructure on which hydraulic, ecosystemic nd legal rationalities overlap. Along the embankment is it still possible to find the *Pietra d'Istria* markers that defined (and still define) the limits of the *conterminazione lagunare* and the jurisdiction of the *Magistrato alle Acque*.

Here the border takes on the character of a peremptory straight line that artificially separates two worlds that would otherwise be blurred and, with them, the main design rationalities that from the times of Cornaro and Sabbadino to Umgiesser and D'Alpaos define these spaces. The edge separates, on the one hand, a lagoon whose survival is linked to the maintenance of those environmental systems of *barene* and halophytic plants on which the health of its own waters depends; on the other, a territory of countryside, towns, metropolitan infrastructures and widespread urbanity, whose survival depends on the sophisticated and fragile mechanical drainage system and dewatering pumps inherited from the past.

100 Venetian markers

In recent years there has been discussion of a possible division of the Venetian metropolitan area not only in physical terms, through projects involving the construction of barriers made of sheet piles or embankments, but also in administrative terms. Various *referendum*, the most recent in 2019, have proposed the division into two different municipalities, those of Venice and Mestre. Despite having all had negative results, these referendums expose unsolved problems and tensions by now consolidated between the lagoon and mainland spheres of the metropolitan city. The definition of a possible new administrative border has pushed both citizens' committees in favour of separation, and research groups in the university field (DeVine *et al.* 2016) to reflect on a boundary that can realistically be shared and effective for this purpose. In most cases this boundary takes up large sections of the perimeter of the *conterminazione lagunare*, the area historically under the control of the *Magistrato alle Acque*.

As we have seen, since the days of Sabbadino and Cornaro, defining both a physical and political/administrative boundary of the Venice lagoon poses tremendous issues in terms of space and time. In spatial terms, we face the problem of the management and the construction of the border –as a territorial and legal entity– for a mutable physical body with an extension of 550 square kilometres fed by a hydrographic basin more or less four times larger. In temporal terms, we face the phase displacement between geological time and human providential time, between the natural and man-driven evolution of the morphology of the lagoon and the myth of the origin of the Venetian Republic.

The case of the Venice lagoon is one of the most fascinating case studies in territorial terms. If, according to Robert Sack, we consider territoriality as the means by which space and society are interrelated, as the basic geographic expression of influence and power, as 'the attempt by an individual or group to affect, influence, or control people, phenomena and relationships, by delimiting and asserting control over a geographic area' (Sack 1986, p. 19), few other cases might be more relevant –and thoroughly historically documented– than that of the Venice lagoon.

Territoriality is the first form of spatial expression of political

power, and this also translates into legislation. Silvano Avanzi, superintendent of the *Guardia di Finanza* in Venice and among the three experts who guided the most recent process of redefinition of the area of *conterminazione lagunare* in 1991, expressed very clearly the relevance of the Venice lagoon case study in territorial terms: 'The assumption that the territory constitutes an essential element for the existence of the state –together with the people and the legal system– is normally understood as a reference to that well-defined amount of space in which sovereignty is exercised. [...] Venice, an island city-state, offers the singular example of a state that fights above all for the defence of the "quality" of its lagoon territory. The protection of the lagoon against events likely to change its status understood as "quality of the soil" constitutes the rationale for all legislation on water, while on a political level it becomes the *raison d'état* that determines the choices that lead to the creation of grandiose hydraulic engineering works' (Avanzi 1989, p. 55).[▸4]

And if the quality of the lagoon territory is rather unique, it is also rather unique the way in which different notions of time overlap above and below the surface of this expanse of water and islands. As Tafuri reminded us, after having carefully shaped and redefined through the Late Medieval period its own origin, 'Venice tried to *endure within her origin*: Venice will become the symbol of such a resistance, when continuity in her begins to be betrayed by repetition and impotent fetishism' (Tafuri 1995, p. X).

Venice, according to Carlo Ossola (2003), has always anticipated its beginnings and on the other hand has precipitated its end, dissolving by its own initiative a pluri-centennial Republic in 1797. Only a few years earlier, between 1791 and 1792, the Venetian Republic had placed 100 markers –for the sake of precision, 98 markers and one wall with an inscription that counted as two markers (Caniato 1991, p. 52)– to define once and for all the borders of the Venice lagoon. Yet, as we know, the boundaries of Venice and the boundaries of its lagoon are by their very nature unstable and subject to continuous negotiations. The whole operation revealed a paradox: how to define for eternity the boundary of 550 square kilometres of marshes and navigable waters that made the existence of the Republic possible? The positioning of these humble markers –made either in *Pietra d'Istria* or bricks and mortar, and ranging from 1 to 1.5 metres in height– proved obviously inade-

▸4 'L'assunto che il territorio costituisce elemento essenziale per l'esistenza dello Stato – congiuntamente al popolo e all'ordinamento – viene inteso di regola come riferimento a quella quantità ben definita di spazio nel cui ambito si esercita il potere di sovranità. Venezia, Città-Stato insulare, offre invece il singolare esempio di Stato che lotta soprattutto per la difesa della "qualità" del suo territorio lagunare. La tutela della laguna contro gli eventi suscettibili di mutarne lo status inteso come "qualitas soli" costituisce sul piano giuridico la ratio di tutta la legislazione sulle acque, mentre su quello politico diviene la ragion di Stato che determina le scelte che portano alla realizzazione di grandiose opere di ingegneria idraulica' (auth.trans.).

quate to fulfil such an ambitious goal and represented the swan song of the Republic that dissolved itself a few years later before Napoleon conquered it.

An ecological fable

Essendo il principal objecto del Stado nostro la conservation de queste nostre lacune [5]
(Savi ed Esecutori alle Acque, 1534)

Venetorum urbs | divina disponente Providentia | in aquis fundata | aquarum ambitu circumsepta | aquis pro muro munitur. | Quisquis igitur | quoquomodo detrimentu | publicis aquis inferre ausus fuerit | et hostis patriae iudicetur | nec minore plectatur poena | quam qui sanctos muros patiae violasset. | Huius edicti ius ratum perpetuumque esto. [6]
(Latin inscription for the headquarters of the Magistrato alle Acque in the Doge's Palace, 16th century, Museo Correr).

The conservation of the lagoon has always been a dogma and represented one of the major economic and technological efforts for the Venetian Republic. It is not by chance then that in the collective imaginary guaranteeing eternal life to the lagoon equalled guaranteeing eternal life to the Republic. The fact that the lagoon should have been preserved for eternity did not obviously mean that the Venetians –and above all experts in hydraulics such as Cristoforo Sabbadino, head of the *Magistrato alle Acque* around the mid-16th century– were not aware that the lagoon was a living and mutable body. A mutable body divided in *laguna viva* –living lagoon, where some areas are always submerged and others are periodically submerged during high tides– and *laguna morta* –dead lagoon,[7] where the areas have emerged or are invaded only exceptionally by the waters (Morandini 1960, p. 71). A mutable body related both to daily cycles, as the one of the rising and decreasing tide illustrated by Sabbadino himself, and long-term modifications, as reported by ancient historians such as Strabo and by the capillary activity of survey and preservation led by the Venetian Republic since the Late Medieval period.
The borders of the Venice lagoon played a crucial role in the military and political tradition –historic or mythical– of the Republic, to the point of being considered as the true walls of the Republic (Ortalli 2003, p. 104). The history related to the maintenance of these 'walls' has been described as an 'ecological fable' (Bevilacqua 2009, p. 13), with a wise governance capable of preserving a delicate and vulnerable habitat with the consent and contribution of the universality of citizens.

[5] Being the main objective of our state the conservation of our lagoon (auth.trans.).

[6] The islands of the Venetians at the behest of divine Providence founded on the waters and surrounded by the waters, are protected by waters instead of walls. Anyone therefore daring to cause harm in any way to public waters is condemned as an enemy of the homeland and is punished no less seriously than the one who violated the holy walls of the homeland. The right of this edict is immutable and perpetual (auth. trans.).

[7] Sabbadino underlined that while Alvise Cornaro considered the lagoon only the *laguna viva*, he considered fundamental the preservation of both the *laguna viva* and *morta* for the survival of the lagoon: 'Ben è vero che essa laguna è divisa, parte lago disocupato e parte canedi e canali salsi, e dove puol entrar il salso, non essendo ocupato dal dolze, ma tutto in un corpo della laguna, e volendola conservar, il tutto bisogna conservar, e pur essendo sforzati in qualche parte perderne per salvar il resto, perderne mancho che si possa, com'ei dice nel suo fondamento 22 delle acque salse, là dove dice che la conservation della laguna consiste in conservarla in largezza, grandezza et empiezza. Hor volendo lui quella parte, ch'egli intende laguna, conservar, consiglia che'l si faci l'arzere e canali soprascriti. Dico io ch'egli propone non solamente cosa difficilissima e quasi impossibile a farsi, ma cosa dannosissima quando la si facesse'. See Cessi (1987, p. 122).

The prevailing attitude when dealing with the Venice lagoon has been one of extreme caution: if measures to control the evolving morphology of the lagoon have been taken since the origins of human settlements in this region, it was only between the 15th and 16th centuries that an original hydraulic doctrine was developed and institutionalized (Cessi 1960, p. 23). This was made possible by two fundamental facts: the sovereignty of the Republic over the Venetian hinterland, that meant control over the entire hydrographic basin of the Venice lagoon, and the division of the original lagoon, that in ancient times extended from Ravenna to Trieste. A further push came from the recognition, after the defeat of Agnadello in 1509 and the ensuing siege, of the fundamental role that the lagoon played in military terms.
The planned or realized interventions on the Venice lagoon therefore varied between a set of extremes, ranging from daily maintenance and fixing recurrent damage to radical modification of the morphology of the bodies of water to prevent long term problems; between a conservative approach that put military and salubrious aspects first and the pressure exercised by a diverse set of pri-

Drawing of a marker in bricks and mortar, 1791.
Archivio di Stato di Venezia, Savi ed Esecutori alle Acque, Busta 152

vate economic interests; between the determination to safeguard the lagoon guaranteeing public control and the free expansion of waters and the inexorable manmade transformation and possible overexploitation of resources.

At the beginning of the 18th century –after many radical interventions on rivers carried out during the 17th century, many of which had already been proposed by Sabbadino around 1550– the future of the Venice lagoon was to some extent considered to be secured from what in earlier centuries had been seen as the main menace, the landfilling caused by river sediments. The government of the Republic aimed thereafter at securing this *status quo* through a form of enforcement that took the name of *conterminazione lagunare*.

The *conterminazione lagunare*

While the unstable balance between water and earth has been allegorically represented on multiple occasions –as in the frontispiece of Bernardo Trevisan's *Trattato* of 1718 that carries the motto *Opponesi elemento ad elemento,*[▸8] where the two elements are depicted as two fighting women– the tangle of private but also public general interests that shaped this environment meant that for centuries the question of clearly delimiting the Venice lagoon did not arise. It was not discussed even during the intense debate on the destiny of the lagoon between Cristoforo Sabbadino and Alvise Cornaro in the mid-16th century. This inertia was broken only at the beginning of the 17th century, and it took more or less two hundred years to establish a final definition with the positioning of the 100 markers of the *conterminazione lagunare*, a kind of 'lagoon protection belt interposed between salt and fresh water' (Cessi 1960, p. 58). The safeguard of the lagoon required on one hand a juridical action, including the revising of specific legislation, and on the other technical interventions that radically modified the morphology of the borders of the lagoon. Since the 17th century the *Magistrato alle Acque* had continually issued proclamations related to the harm that incautious and fraudulent activities were causing and could cause to the Venice lagoon, stipulating very harsh punishments for those caught in violation. These proclamations were obviously not sufficient: the defence of this environment required a coordinated normative action to be enforced '*nel giro d'una fissa linea di conterminazione...per indi-*

▸8 'Elements opposing each other' (auth.trans).

carla veramente sacra dentro gli assegnati termini',[9] as Rompiasio (1733, p. 126) stated. The *conterminazione lagunare* was completed in four phases, starting from the south-western area of the lagoon, proceeding towards the north-east and then concluding with the coastal tract (Tiepolo 1992, p. 91):

- 1605-1615, between Chioggia and Lizza Fusina, in relation to the deviation of the Brenta river with the realization of the *Brenta Novissima* riverbed;
- 1616-1636, between Lizza Fusina and Marghera, continuing then along the Osellino canal until the Dese river;
- 1670-1683, between the Dese river and Torre del Caligo, following the deviation of the Sile river with the realization of the *Taglio del Sile* riverbed and the deviation of the Piave river;
- 1783-1792, from Torre del Caligo to Chioggia along the coast of Cavallino, Sant'Erasmo, the Lido and Pellestrina.

One hundred years passed between the completion of the third phase and the beginning of the fourth and final phase. A fundamental push came from the report produced in 1762 by Angelo Emo on the deterioration of the lagoon. The report followed his appointment to produce a map where every alteration to the lagoon border morphology, whether produced by nature or by private interests, was to be highlighted (E. Bevilacqua 1992, p. 56). After noticing severe alterations throughout the border of the lagoon, Emo strongly suggested that measures be taken to complete the *conterminazione lagunare* and the positioning of new markers as substitutes for those placed in the 17th century, which had in the meantime largely disappeared.

Even if since the fall of the Republic of Venice the pre-eminence of the symbiotic relation between Venice and its lagoon in relation to the mainland has disappeared, the *conterminazione lagunare* is still relevant as an expression of political and technical awareness, as a morphological and juridical element that reminds us of the necessity of defining a space devoted to the daily as well as long-term safeguarding of the unique environment of the Venice lagoon.

[9] 'Within a fixed boundary line ... to indicate it truly sacred within the assigned boundaries' (auth. trans.).

Immaterial division devices

The Venice lagoon is a space with mutable borders also from an administrative point of view. It is a 'regulated lagoon' not only with respect to its morphology but also through a series of legislative instruments that overlap and sometimes 'collide', creating a complex system of cross-linked constraints and safeguards that respond to heterogeneous rationalities.

Immaterial division devices

Administrative perimeters of the lagoon
Contermination of the lagoon, watersheds, municipal boundaries, reclamation consortia

Numerous intangible perimeters have been recognized, conceived, defined, and retraced over the centuries. The first, linked to the morphology of the Venice lagoon itself and to the presence of the lagoon mouths and related areas of influence, are the watershed lines. While not representing a fixed obstacle, these implied a relevant limit to navigation across the lagoon in the event of low tide. The *conterminazione lagunare* was officially established at the end of the 18th century: however, it had already been conceived at the beginning of the 17th century and was implemented over a long period, in the face of considerable discussions. To these borders were then added further ones, such as the administrative borders of the municipali-