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The Cistercians large-scale water systems

Water was certainly the Cistercians' element – an order which, since Mediaeval times, realised its charisma by soil cultivation in the territory of Europe and later also by conducting business activity based on exploitation and processing of natural resources. Since their beginnings, the Cistercians were associated with rivers through the characteristic of their congregation valley locations of abbeys and as a consequence they were able to use water for their activities in a particularly conscious manner [10]. Today, we can see a real technical genius of the Cistercians by analysing the solutions of the large-scale water economy which was developed on the territories managed by this congregation in the past.

Until today, a technical and organisational sense of the Cistercians can be seen in monumental work undertaken in the abbeys in order to build water intakes, canals and economic usage of water power. Monks widely applied bold and – as for their times – modern technical solutions in order to gain control over rivers, swamps and fisheries. In the Cistercian abbeys – due to their countryside locations (which even today are characterised by a low level of urbanisation) there are still many relics of old water systems. Even though the abbeys as architectural complexes were destroyed – ponds, dykes and channels supplying water and its power to mills and other workplaces – they are still a visible part of the landscape. Researchers of the Cistercian heritage know impressive water systems, e.g. the Aubazine water network which drew water from a stream situated two kilometres from the abbey, while the aqueduct supplying water was partially grooved in the solid rock and partially hung on big arches situated over ravines [1]. However, the scale of spatial changes that were introduced by the Cistercians can be better assessed if we analyse a long-term water economy of certain selected abbeys and its present effects on the environment. At present, these solutions resulted in the landscapes characteristic of the congregation, whose identification and comprehensive protection ought to be included in numerous activities currently aimed at a harmonious process of the formation of historical landscapes of Europe. In the author's opinion, these landscapes culturally unite our continent showing strong and still present connections based on the Christian tradition [8].

This article is an attempt to show the principles of water systems formation as built by the Cistercians in their developments on the example of the parent abbey of Cîteaux and the Polish one in Mogiła. While in Cîteaux the water system is still functioning – in spite of the old abbey destruction – we have a completely different situation in Mogiła – the abbey as a historical spatial complex with mediaeval origins is still functioning today, but as part of the city landscape because the development of Kraków largely absorbed the agricultural landscape of Mogiła concurrently covering the old water system which in the past constituted an important element of the monastery spatial economy. Comparing the characteristic features of Cîteaux and Mogiła seems to convey a significant message concerning directions of transformations of these two structures.

Cîteaux water system

The oldest Cistercian abbey of Cîteaux in France constitutes an example of numerous explicit landscape transformations, which can be seen even today, brought about by the redevelopment of water courses, including the construction of ponds for stocking and water retention. The old abbey's 'water heritage' comprises, among other things, about twelve flour mills situated mainly on the water courses of Vogue and Cents-Fonts and about twenty ponds

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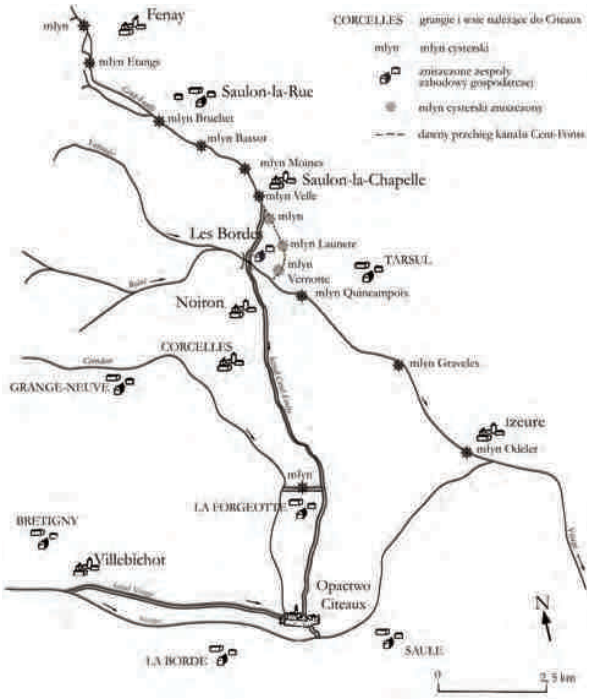

Fig. 1. Economic usage of the Cîteaux water system (sketch by author from: [14])

Il. 1. Gospodarcze wykorzystanie układu wodnego Cîteaux (odrys autorki z: [14])

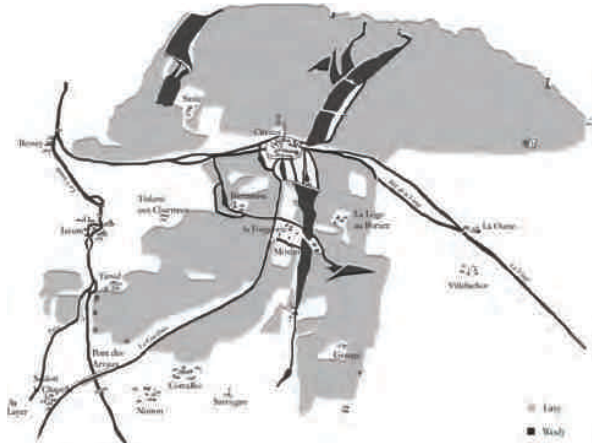

Fig. 2. Cîteaux Abbey on the background of water conditions in the 16th century (sketch by author from: [14])

Il. 2. Opactwo Cîteaux na tle uwarunkowań wodnych w XVI wieku (odrys autorki z: [14])

(Fig. 1). The changes aimed at land development, which were indispensable for running economic activity, were also made in the vicinity of the granges administered by the abbey such as la Borde, la Forgeotte and Tontenans. Analysing the contemporary Cistercian heritage in Cîteaux, we must bear in mind that the abbey and its surroundings underwent numerous transformations of the water system, mostly during the first two centuries since it was established when the water environment was diametrically rebuilt through the introduction of some significant changes in the natural structure of the area in question [14].

The first monastery was located on a flat terrain rise within the distance of 100 metres east of Coindon stream and water was probably supplied from a well. However, at the beginning of the 12th century in the times of abbot Alberic, the Cistercian community because of a shortage of water moved to a more convenient place situated about two kilometres south of la Petite Forgeotte. The abbey that was constructed then was supplied with water from Coindon and by the Vogue Canal; however, one hundred years later, apart from these two water courses, the water to the abbey was provided from Cent-Fonts from the intake situated ten kilometres above the monastery [14]. Between the years 1204 and 1216 the Cistercians started building about a 3.5 kilometres long canal from the Vogue water course, east of Villebichot village. However, this water supply was probably insufficient for the monks as starting from 1212 they began work on changing the course of Cent-Fonts stream by building a ten kilometres long canal near Saulon-la-Chapelle village. Additionally, between 1212 and 1218 the Cistercians worked on building a five-meter high bridge-aqueduct to make it possible to run the canal over the River Varaude. This work affected the existing water relations as a consequence of which the monks had to compensate for (as part of damages) three mills situated along the former river bed which dried out. In circa 1221 water was supplied to the abbey by means of a canal where a mill was built feeding new ponds in the vicinity of la Forgeotte grange. The Coindon stream was dammed up in two places, thanks to which another two new ponds came into being. As a consequence of these investments, the first convex three metres high earth dyke was built as well as another one that formed Grand Etang pond and it was 500 metres long, 12 metres wide and in its middle part reached the height of 7 metres. Grand Etang receives water by the canal from Cent-Fonts until today as it is situated 300 metres above the abbey, which is why it served as the abbey's water reservoir and a water tower[1].

On the plan illustrating the state of the Cîteaux water system, as early as in the 16th century (Fig. 2) we can see the abbey with its extraordinary location against the background of the water development artificially created by the monks. We can admire the system composed of numerous canals, dams and an impressive aqueduct where the central point joining up the entire complicated arrangement is the monastery. Huge storage reservoirs that surround it would surely guarantee the constant power supply produced by the dammed up waters, thus providing the basis for work of various devices situated within the abbey and at the same time irrigating extensive fields and gardens of Cîteaux (Fig. 3) as well as the granges administered by the abbey.

[1] Between the place where the Cent-Fonts canal crosses the monastery wall and the connection with Vogue the gradient is 1% for water flow intensity which today amounts to 140 litres a second while in the 19th century it was 320 litres a second – from: [14].

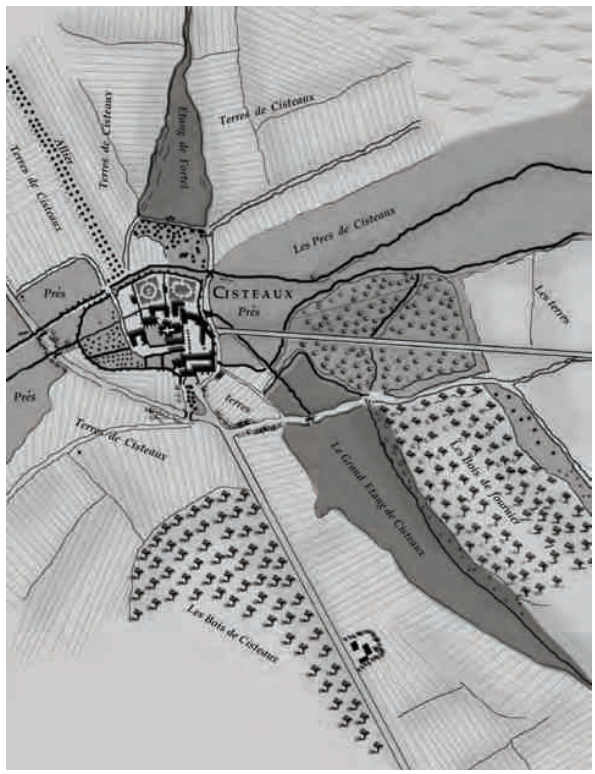

Fig. 3. Cîteaux Abbey surrounded by woodlands and water reservoirs, plan from 1755 (sketch by author from: [14])

Il. 3. Opactwo Cîteaux w otoczeniu lasów i zbiorników wodnych, wg planu z 1755 roku (odrys autorki z: [14])

Nowadays, only scarce relics the old water system of Cîteaux within the old monastery survived, however, the analysis of an aerial photograph[2] that shows this area as part of a larger territory proves that the old extensive system of water connections is still functioning although not in the same form as in the times when the whole area was managed by the Cistercians. In spite of being situated in the heart of France, modern Cîteaux is in fact a secluded spot, with a characteristic monotonous agricultural landscape. Deciduous forests surround a large meadow the centre of which is situated on a little depression with relics of the Cistercian monastery development. A new monastery, which is now occupied by the Trappists, was built a little north of the historical Cistercian complex. It is surrounded by a wall and has strict rules of enclosure. The fields, which surround the complex, are used for cultivating various plants which are afterwards processed in the monastery manufacturing plants because the Trappists run a plant and food farm [8]. It is worth emphasising that in spite of significant modifications within the monastery development, Cîteaux still retains features of a hermitage with forests and fields around and a landscape that is undisturbed by modern times. The impressive water system that was built by the Cistercians on this territory is a significant and extremely valuable element of this landscape today.

[2] http://mapy.google.pl/ – entry: Cîteaux, Saint-Nicolas-lès-Cîteaux, Burgundia, France – 01.2011.

Mogiła water system

Another equally interesting example of a comprehensive water development can be encountered on the Polish ground, namely in Mogiła. According to the documents kept in the abbey's archives, activities of these monks were also impressive and the effects of terrain transformations as regards water relations can still be seen in the landscape even today. Unfortunately, due to a scarcity of historical information in this regard, it was not possible to reconstruct the beginnings of these transformations, however, three important documents allowed for determining the manners of open waters development within the Cistercian premises in the 19th century[3]. The state of water development in the Mogiła monastery in the scope of water systems formation is described in the three following plans: 'Mogiła – property of Cistercian Fathers Monastery' [11] (Fig. 4), 'Situational plan of the River Dłubnia, watercourses and water plants in districts of Mogiła, Krzesławice and Bieńczyce' [3] (Fig. 5) and 'Plan of the Vistula course near Rybitwy and Płaszowski Forest' [13] (Fig. 6). The following characteristics can be deducted from the first of these plans: the monastery which was then situated north of the Vistula was surrounded on both sides by the River Dłubnia, which also fed water into the system of monastery ponds and gave rise to the existence of large swamps and meadows. In the vicinity of the monastery, the river flowed meridionally, it formed three river beds with the middle one being the main stream while the two outer ones were canals – watercourses. The western canal was well-regulated and it

Fig. 4. Plan of Mogiła Abbey against the background of the water system (collection of Mogiła Abbey Archives, photo: M. Milecka)

Il. 4. Plan opactwa w Mogile na tle układu wodnego (zbiory Archiwum Opactwa w Mogile, fot. M. Milecka)

[3] More on history and architecture of Mogiła in: [5].

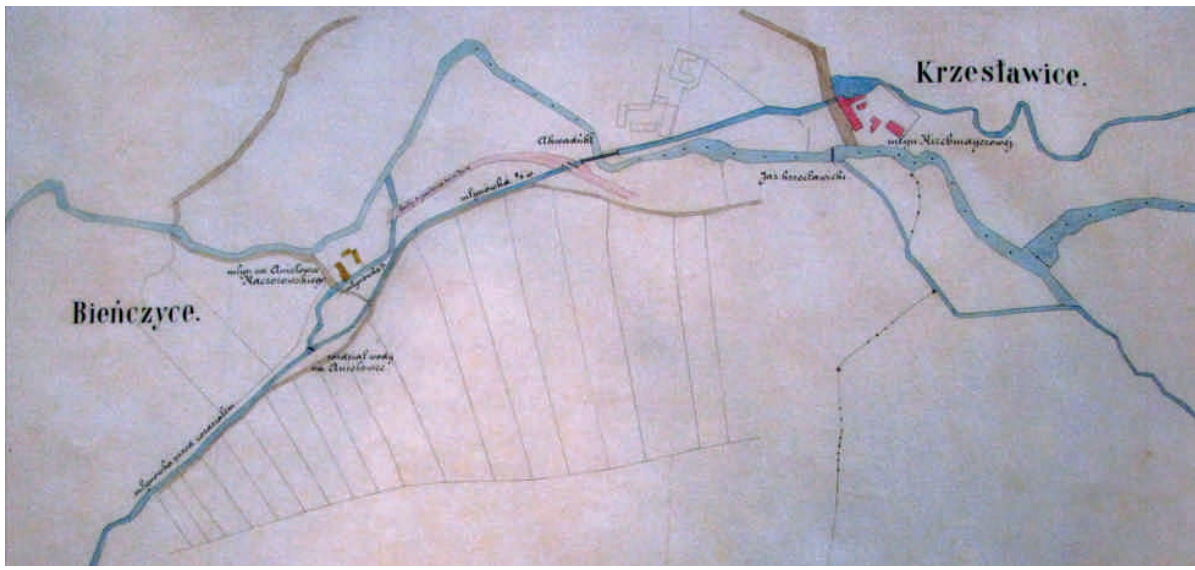

Fig. 5. Plan of water system development of the Płonia River on the stretch Bieńczyce–Krzesławice (collection of Mogiła Abbey Archives, photo: M. Milecka)

Il. 5. Plan rozbudowy układu wodnego rzeki Płonii na odcinku Bieńczyce–Krzesławice (zbiory Archiwum Opactwa w Mogile, fot. M. Milecka)

performed the role of the canal accompanying the main road leading to the monastery. This well-disciplined water course directly serviced the whole development; it was also the source of a minor canal that supplied water to the seven ponds and the dykes situated north of the monastery, which specifically complemented the complex of monastery gardens. These ponds (now we can see only their relics) had geometrical shapes, close to rectangles. They were connected to the middle one, i.e. the natural current of the River Dłubnia through the other canal – this solution enabled to regulate the water level between the two courses of the little river. The aforementioned watercourse surrounding the monastery collected the wastes from the buildings in the south and flowing under the farm buildings (among other things, under the mill) sup-

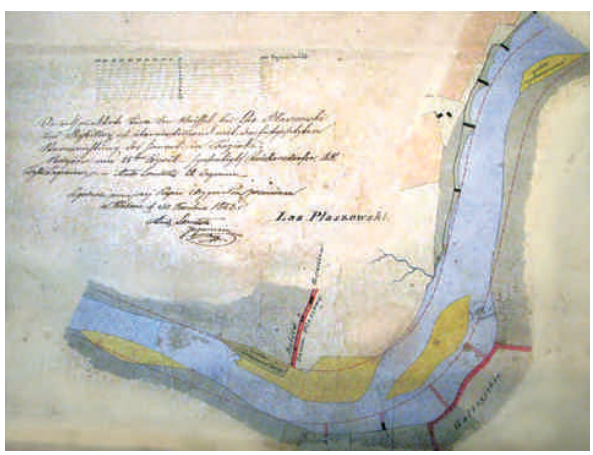

Fig. 6. Plan of the Vistula course near Rybitwy and Płaszowski Forest (collection of Mogiła Abbey Archives, photo: M. Milecka)

Il. 6. Plan biegu Wisły koło Rybitw i lasu płaszowskiego (zbiory Archiwum Opactwa w Mogile, fot. M. Milecka)

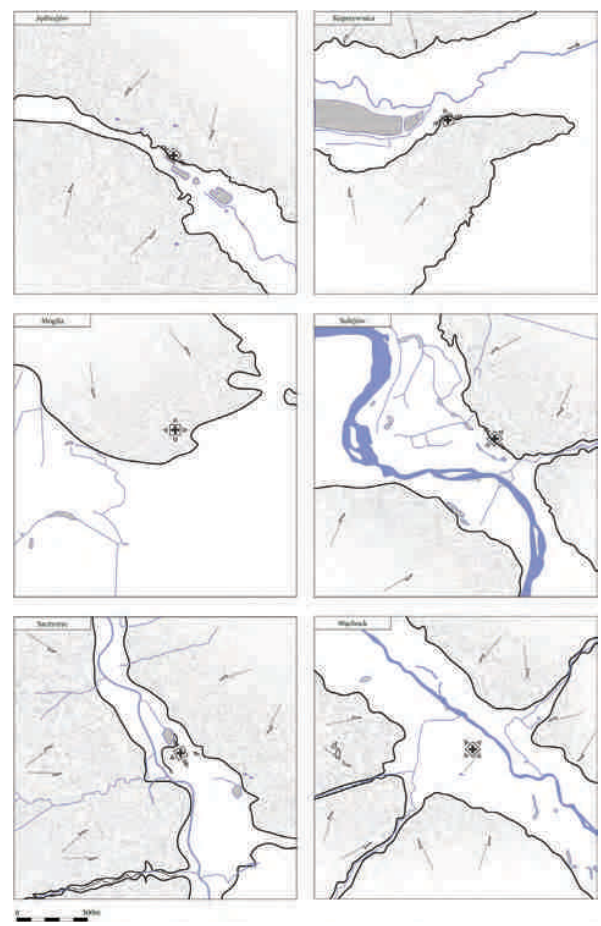

Fig. 7. Situational sketches of the abbey locations of Małopolska Group against the background of the water system (elaborated by author)

Il. 7. Szkice sytuacyjne lokacji opactw grupy małopolskiej na tle układu wodnego (oprac. autorki)

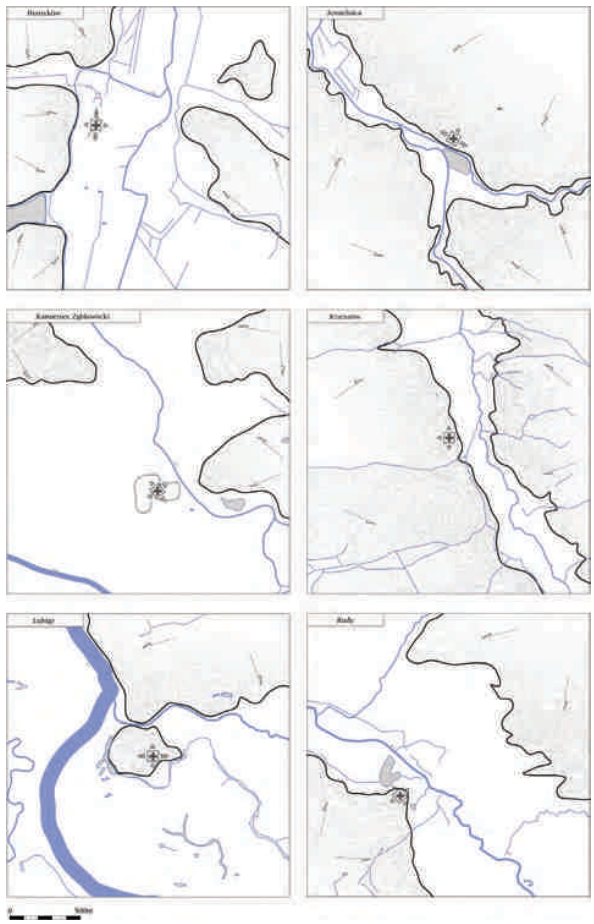

Fig. 8. Situational sketches of the abbey locations of Silesian Group against the background of the water system (elaborated by author)

Il. 8. Szkice sytuacyjne lokacji opactw grupy śląskiej na tle układu wodnego (oprac. autorki)

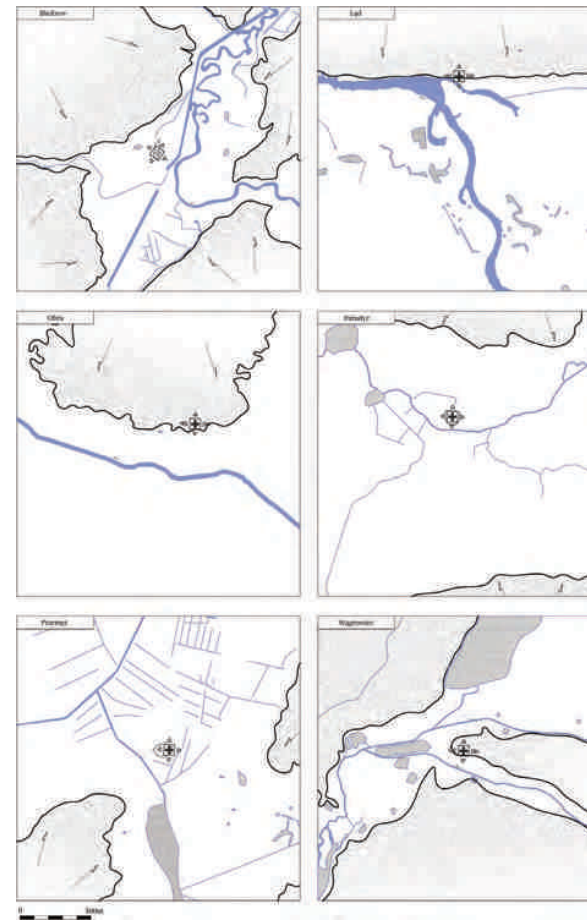

Fig. 9. Situational sketches of the abbey locations of Wielkopolska Group against the background of the water system (elaborated by author)

Il. 9. Szkice sytuacyjne lokacji opactw grupy wielkopolskiej na tle układu wodnego (oprac. autorki)

plied its power to their devices. The plan shows in detail crossings across the river in form of bridges, water structures (weirs) as well as mills; moreover, it precisely presents flood-lands, meadows, dykes and swamps, giving in some cases their proper names. Thanks to the analysis of this document, we gain detailed information concerning the development of the Vistula oxbow in the south of the Cistercian premises – its contents are ponds, swamps and forests. We can also see a wide complex of ponds in the east in Czyżyki, whereas in the eastern part of the abbey on the River Dłubnia and the eastern watercourse there are numerous dams and smaller canals.

This information is made even more detailed by the analysis of the situational plan of the River Dłubnia watercourses and water plants (Fig. 5). On the area shown in the previous plan, we could see the whole system of open waters and technical water devices. On the western border of the area shown on the plan, we can see that from the River Dłubnia a canal is separated that supplies water to the Bieńczycki mill. Dłubnia continues flowing along its natural river bed above the watercourse in parallel to it. Water separation on Anielówka divides the watercourse into two arms: one supplies another mill on Anielówka and afterwards flows back into the Dłubnia river while the other arm flows in parallel, a little to the south. The two water courses intersect and change their structures at the point of the railway line leading to the mill as follows: the watercourse flows on as an aqueduct above the River Dłubnia, the river continues flowing on the southern side through the Krzesławicki weir, while the watercourse from this point is called 'lower', supplies a rent mill, next the Cistercian mill and afterwards the nail mill. Beyond the weir the river is separated and flows in two arms: as a main stream (middle water course) and the 'upper' watercourse. It is this watercourse that contains (according to the information on the plan) one third of all the waters, flowing around the monastery buildings and supplying the monastery mill, which functions at the edge of the monastery premises as well as the next mill (both given for lease by the Cistercians). All the three river beds of Dłubnia (one natural and two watercourses) get connected below the monastery. When all the work entrusted to the water is done, all the devices in its way put in motion and the terrains irrigated, the river finds its end in the Vistula waters.

The third plan (Fig. 6) presents a fragment of the Vistula course, near the place called Rybitwy, in the area of Płaszowski Forest. This drawing, rich in details, contains a precise project of the river regulation and what

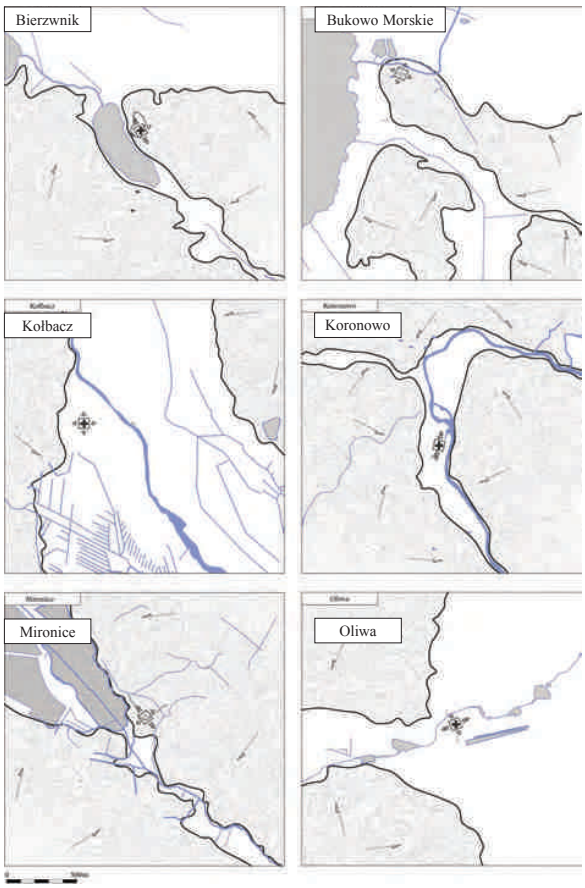

Fig. 10. Situational sketches of the abbey locations of Pomorska Group against the background of the water system (elaborated by author)

Il. 10. Szkice sytuacyjne lokacji opactw grupy pomorskiej na tle układu wodnego (oprac. autorki)

would be named today as a valley biological development. On it, along the river banks, we can see regularly placed dams built in order to regulate its course (judging by the drawn axes of the target river bed). At Rybitwy, we can find a small riverside area with the following information: 'freshly planted osier bed', and its appropriate symbolic marking appears in three places along the river. There are visibly marked places in which the river bends were to be liquidated and where the river was to be given a smooth flow thanks to river bed dams in order to prevent the process of meander or sandy backwater creation.

All the three documents presented above confirm the engineering artistry of the Polish Cistercians as regards water economy and they also show the scale of transformations which the monks made in their properties. Monastic ponds and water canals on the premises of the abbey were an element of a wide spatial policy and the entire area was intensively redeveloped with regard to water relations in order to utilise the water power most effectively as well as for rational development of open terrains.

Nowadays, in Mogiła abbey we can see the surviving relics of the complex of ponds and monastic canals (partly outside the monastery walls) and the water system of the River Dłubnia, now much impoverished in comparison with its 19th century condition as described above. Construction of the new working class estate Nowa Huta, which took place in the mid-twentieth century on the territories of the former Cistercian agricultural premises where the water devices and structures were situated, was connected with major transformations of the environment, including significant modifications of the water relations. It is worth realising how enormous these changes were and consequently, when elaborating urban plans concerning this part of Kraków, take into consideration some actions aimed at identification and protection of the relics of the old Cistercian water structures and devices.

Conclusions

Summing up the analyses presented above, we ought to emphasize the fact that flowing and standing water constituted an inseparable attribute of the Cistercian developments. The constructions erected by the Polish monks against the background of the European solutions are not worse as regards the level of technology and spatial dynamics[4]. The way the abbeys were located clearly shows that the Cistercians chose the places directly situated in valleys although on a place which was slightly elevated and thus protected from flooding. These were local rises or slight slopes. Topographical analyses of the Cistercian terrains prove that in selecting a place for building a permanent monastery, monks first of all took into consideration the following aspects: width of the valley, orientation and current of the river along with its accessibility and possibility of its subjugation. Convenient uptake and discharge of water was one of the factors conditioning the proper functioning of the abbey [8].

In Poland, apart from the Mogiła development which is important in many aspects, some other extremely interesting water systems can be found in Bierzwnik, where the Cistercians were given lands surrounded by seven lakes

[4] We are informed about this by all researchers of the Cistercian heritage, for example, in the books about the situation of monasteries in Europe: [2], [4], in Poland: [5], [6], [12], [16] and France [1].

and a stream connecting them on which they created the entire spatial system based on a water system; also in Buków Morski where the monastery complex comprised three lakes, sixteen ponds, two pools and some minor rivers constituting a specific axis of the monastery economy. An impressive solution can be encountered in Kołbacz where the monks changed the lower course of the River Płonia by directing it to their settlement in Dąbie and dammed up water thus causing the water level in Miedwie lake to go up [15][5]. In this context, we cannot forget about a unique phenomenon on the worldwide scale which is part of the Cistercian heritage – it is an intersection of two rivers, called bifurcation. In Wągrowiec, not far from the monastery, two rivers Wełna and Nielba intersect at a right angle and as geographers and hydrologists assure both rivers roll their waters on independently of each other, which seems to be almost impossible. It is worth reminding that the Wągrowiec bifurcation is the only place of this kind in Europe and one of the two in the whole world[6].

However, there are many other remarkable water solutions in Poland – it is enough to analyse the presented situational sketches of the Cistercian locations to see that selecting a place for constructing a monastery was always preceded by detailed analyses in order to choose a place guaranteeing convenient living conditions and running business activity specialising in building water devices based on the power gained from water work (Fig. 7–10). The Cistercians efficiently took advantage of the conditions in which they settled and, as a consequence, they permanently transformed the natural environment on much larger territories than the range of their properties by changing whole valleys and river basins and, as a result, the landscape in a large-scale system.

Today we can vary in our assessments of this activity: on the one hand, it is worth appreciating the remarkably apt utilisation of the forces of nature and making them work for the good of man, while on the other hand, we must become aware that this is the beginning of a rapid and conscious transformation of the natural environment leading to permanent changes in spatial structures. When the thin border line between a rational economy and excessive exploitation has been crossed, the above issue ought to be addressed. It may seem a paradox that while the first Cistercians looked for an escape and asylum from civilisation in forests surrounded by rivers and swamps, some centuries later their successors regulated rivers, drained swamps and cut forests or moved them away from abbeys. All these activities obviously deteriorated the environment standard and degraded the landscape. Peculiarly, it seems that the process of this degradation was 'helped' exactly by deforestation – forests perform an extremely important role, still underestimated as it seems, of decelerating water circulation. When observing the floods we have been experiencing in the recent years, we ought to consider the alleged rationality of these widespread environment transformations and their long-range aims, although they are not fully specified.

[5] More on transformations of water systems and the Cistercians' activities with regard to water economy in: [7], [8] and [9].

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[11] *Mogiła, property of Cistercian Monastery – a copy of a cadastral map as of 1872*, made by J. Kempa in 1901, scale 1:2880, in colour, from the map archives of Cistercian Monastery in Mogiła, cat. no. 1.

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[13] *Plan of the Vistula course near Rybitwy and Płaszowski forest*, as of 30.04.1853, linear scale, in colour, from the map archives of Cistercian Monastery in Mogiła, cat. no. 23.

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Wielkoprzestrzenne układy wodne cystersów

Zakon cystersów, mający w swojej regule uprawę roli jako jedno z głównych zajęć, wyrobił w swoim zgromadzeniu pewne stałe zasady dotyczące wyboru terenu pod lokalizację klasztoru i sposobu jego rozplanowania. Nieodłącznym atrybutem ich założeń była woda, w niezwykle sprawny sposób wykorzystywana do celów gospodarczych i przemysłowych. Cysterskie strumienie i rzeki, których wody ujęto w kanały, młynówki i stawy, przez całe wieki były źródłem wody koniecznej do nawadniania użytków rolnych i ogrodów, do pracy „kunsztów wodnych" młynów, kuźni, browarów i foluszy. Artykuł prezentuje układy wodne na terenach administrowanych przez dwa opactwa: Cîteaux i Mogiłę, w celu ukazania stosowanych przez cystersów rozwiązań w zakresie wielkoprzestrzennej gospodarki wodnej. Przekształcenia krajobrazu, jakich dokonano na prezentowanych obszarach, i ich współczesne skutki winny stanowić podstawę dalszych badań nad wpływem działalności człowieka na środowisko przyrodnicze, historyczne układy i urządzenia wodne powinny zaś być szczegółowo zbadane i objęte ochroną jako dziedzictwo kulturowe białych mnichów.

Key words: Cistercians abbey, monastery, wather systems, natural values

Słowa kluczowe: opactwo cysterskie, klasztor, system wodny, walory naturalne