

Poland

Reda River: Construction of the planned fish pass



Photo: Gdynia Maritime University

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| Country | Poland |
| River | Reda |
| Site | The town of Reda |
| Type of sea trout population | Stocked with fry and sea trout smolt. In some tributaries the natural production is observed. |
| Type of restoration | Construction of the planned fish pass and supporting infrastructure |
| Temporal scale of the restoration | Long term |
| Spatial scale of the restoration | One stretch |
| Responsible organisation | National Water Holding "Polish Waters" (Państwowe Gospodarstwo Wodne "Wody Polskie") |
| Duration of the project | planned |
| Geographical location WGS84 | 54-36.6845, 18-21.6838E |
| Total budget | Ca. 1.05 million € |

General Information

Restoration case: Construction of the planned fish pass on Reda River.

Location of restoration site: Reda river is located in the town of Reda (commune of Reda, Wejherowo County, Pomorskie Voivodeship) in Poland (Figure 35).

Sea trout population: The Reda River is stocked with fry and sea trout smolt by a Polish Angling Association in Gdańsk and under the Polish Marine Areas restocking program. But in some tributaries the natural production is observed and monitored by Department of Migratory Fish of the Inland Fisheries Institute in Olsztyn during ICES monitoring programme.

Restoration aim: The planned fish pass with the water inlet on the Mrzezino Canal and the outlet below the weir to the Reda river is intended to enable the migration of aquatic organisms between the upper and lower site of the Ciechocino weir at 7.8 km from river mouth, which will contribute to increasing the biodiversity of the Reda river and recreating the historical spawning grounds of salmonids above the weir in the Reda river and flowing watercourses.

Responsible authority/investor: The construction investor is the national authority National Water Holding "Polish Waters" (Państwowe Gospodarstwo Wodne "Wody Polskie").

Documentation: According to the Polish law (Journal of Laws of 2010, No. 213, item 1397), the planned investment is qualified as a project with potential significant impact on the environment, therefore specific technical documentation and Environmental Impact Assessment (EIA) were ordered in 2017 as the "Construction of a fish pass with the implementation of accompanying infrastructure" tender. Both reports were prepared by Biuro Projektów Wodnych Melioracji i Inżynierii Środowiska BIPROWODMEL Sp. z o.o. and officially approved afterwards.

Budget: All permits have been already issued by responsible authorities and are valid until 2025, with the possibility of their extension. The only remaining issue is finding proper funds for the investment – the total estimated cost of fish pass and surrounding infrastructure is currently 4.65 million PLN (ca. 1.05 million EUR). National and international financing sources are being taken into the account, with hope of starting the construction process in 2021.

Technical parameters

Planning phase: The fish pass and its accompanying infrastructure will be constructed on the left bank of the Reda river at the weir at 7.8 km from river mouth in the town of Reda. It should be noted that the construction of the fish pass is limited to the area between the Mrzezino Canal, the Reda riverbed and the area in the immediate vicinity of the existing weir on the Reda River.

Considered options: Due to the function of damming water for the needs of rainbow trout farms with valid water permits, the weir cannot be removed. Possible variants of the fish pass project have been analysed in EIA report:

Option "0" – withdrawal from the investment. This variant is unfavourable for the environment, the Investor, residents and recreational users (anglers) of the Reda River.

Option "1" – Construction of a technical fish pass in the form of a slot fish pass. It is a type of chamber fish pass, where the partition walls are equipped with a vertical crack running through the entire height of the wall. Benefits:

- maintenance-free facility;

- structure insensitive to changes in the lower water level and works well in conditions of changing upper water level;
- vertical crevices meet the behavioural requirements of both deep and bottom fish, and if the bottom material is continuous in the crevices, also zoobenthos can utilise it;

Option "2" – The construction of a fish pass in the form of a stone half-timbered ramp along the left bank of the Reda River between the Mrzezino Canal and Reda. A fish pass limited by tight walls on both sides to prevent water filtration under a structure, with a reinforced concrete bottom, slopes and walls lined with fieldstone on a mortar and boulders fixed in the bottom with a stone-gravel embankment (structure classified as close to nature). Benefits:

- maintenance-free facility;
- construction close to natural;
- ensures free migration of all aquatic organisms.

The presented variants (apart of Option "O") ensure the achievement of the intended goal while costs of implementation and subsequent operation are also similar. Option 2 is indicated as an investment variant, as it fully meets the Investor's requirements, and it can be assumed that its characteristics imitating natural rapids will match the surroundings and favour the migration of salmonids which spawning grounds are located above the weir at 7.8 km of the river Reda. The investment option (option 2) is the most beneficial for the environment, as it enables migration not only for fish but also for other aquatic organisms.

Construction stages: The planned work for Option 2 include the construction of a fish pass in the form of a half-timbered ramp in order to restore the continuity of the Reda river. The fish pass will be located with the upper water stand at the Mrzezino Canal and the water on the Reda river. The inlet of the Mrzezino Canal is located above the Ciechocino weir (Reda). Therefore, the investment begins with the construction of an inlet valve to the Mrzezino Canal. No reconstruction, or renovation of the early weir is planned. The subject of the investment also includes accompanying infrastructure in the form of the reconstruction of the valve on the Mrzezino Channel, construction of the PZIDD (data collection and distribution point), a wind power plant, connection to the power grid and the relocation of power cables colliding with the designed structure.



Figure 35. Detailed location of the planned fish pass in Reda. Credits: National Water Holding "Polish Waters".

The legal status of the fish pass construction area has already been regulated. The area of the planned investment covers the areas with functioning construction facilities. The area between the Reda river and the Mrzezino Canal, on which the fish pass is designed, is currently used as an access road to the weir at 7 + 800 km and the inlet with a gate on the Mrzezino (Figure 36). During the construction works at the fish pass, the weir on the Reda river will perform its function by passing water in an amount ensuring that the requirements of water permits are met.



Figure 36. Site plan of the Ciechocino weir in Reda. Credits: National Water Holding "Polish Waters".

The facility at the operational stage will not pose any threats to the environment. Its construction will enable the migration of aquatic organisms above the Ciechocino weir, which is currently practically impossible for most organisms, except for a few specimens of sea trout and salmon. It is assumed that the work of monitoring the fish pass will be automated, hence there is no need for a permanent stay of staff and the provision of social spaces.

The objects of the fish pass and gates will be marked with signs prohibiting the presence of bystanders and particularly dangerous places will be highlighted.

The actions to be executed are listed below in the expected order:

- Removal of the sheet piling and creation a circulation channel on the Mrzezino Canal
- Demolition of the existing degraded inlet with a gate to the Mrzezino Canal
- Construction of fish pass and gate facilities:
 - construction of a gate on the Mrzezino Canal with a working footbridge and steel stairs;
 - installation of protective barriers along the fish pass bed and the frame culvert from the side of the Mrzezino Canal, protecting bystanders against accidental falling into the fish pass bed;
 - structuring of the frame culvert with the joining plate;
 - structuring of fish pass segments
- Construction of a Data Collection and Distribution Point (PZIDD)
- Construction of a wind farm for supplying PZIDD
- Construction of an energy connection to supply the fish pass infrastructure
- Development of the area around the fish pass
- Strengthening of the bottom and slopes of the Mrzezino Canal at the upper position, in front of and behind the gate structure at the inlet to the fish pass

- Strengthening the Reda bottom with a gabion mattress at the bottom of the fish pass
- Profiling and strengthening the slope with a stone rip-rap between the fish pass and the Reda river bed
- Panel fencing along the left wall of the fish pass
- Leveling the area around the fish pass to the ordinate of 7.50 m above sea level
- sowing with a mixture of grasses on the humus of the area between the fish pass and the Mrzezino Canal on the plot no. 406/2 (Figure 37).

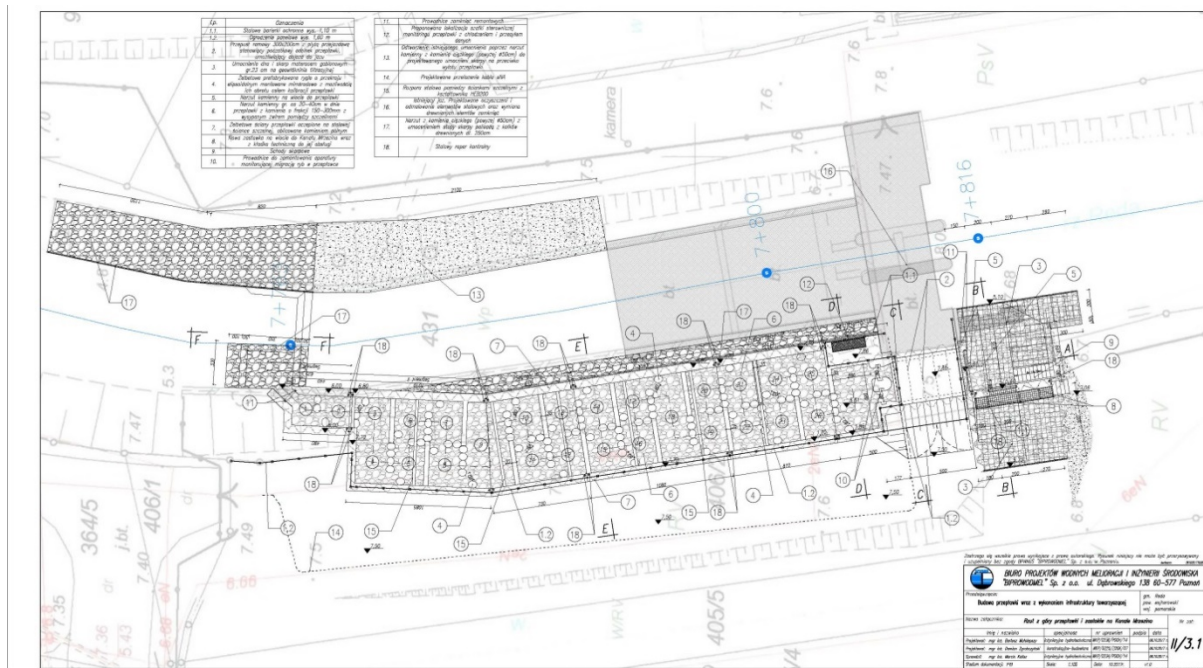


Figure 37. Planned fish pass in Reda – technical drawing. Credits: National Water Holding “Polish Waters”.

Fish Monitoring Systems: PZIDD (Data Collection and Distribution Point) is a fish monitoring device equipped with supply section, broadcasting section and fish monitoring section. The effectiveness of the new fish pass will be confirmed by the monitoring of the Hydroacoustic Monitoring System (HSMR). HSMR is a complete solution for monitoring fish migration without restricting their freedom of movement and introducing a stress factor. The fish monitoring system is based on the inverted side scanning sonar principle in which the acoustic head is stationary, and the fish are scanned as they pass through a narrow acoustic beam. The operation of hydroacoustic transducers is synchronized with the operation of the optical camera, which facilitates data recording and archiving.

Natural conditions

The fish pass will be located in the Reda river valley (Figure 38). It is a watercourse 44.9 km long, with a catchment area of approximately 1.546 km². The Reda river starts in the village of Strzebielno and continues in the ice-marginal valley shared with Łeba. From the village of Kłębówko, the river flows in a wide and marshy valley, and the areas adjacent to the regulated watercourse are used for agriculture. Further on, the river flows through Lake Orle, which was created as a result of flooding the former excavation of the cement plant in Wejherowo. Below, the river is canalised. Before the weir of the cement plant, its greatest tributary, the Bolszewka, flows into the Reda canal. The weir

directs almost all the water to the cement plant's canal, while the old Reda riverbed is supplied mainly with exudate water. From Wejherowo it flows along the original bed. The river clearly accelerates, it flows strongly, meandering in the vicinity of the forest. It slows down near the town of Reda, where it flows into the coastal, wetland plain. The damming weir located in Ciechocino for the purposes of breeding facilities discharges part of the river's water to the Łyska Canal. Below the weir, Reda has a straight regulated riverbed. Before its estuary, the river slows down as it flows among meadows, pastures and reeds. It flows into the Puck Bay near the village of Rekowo.

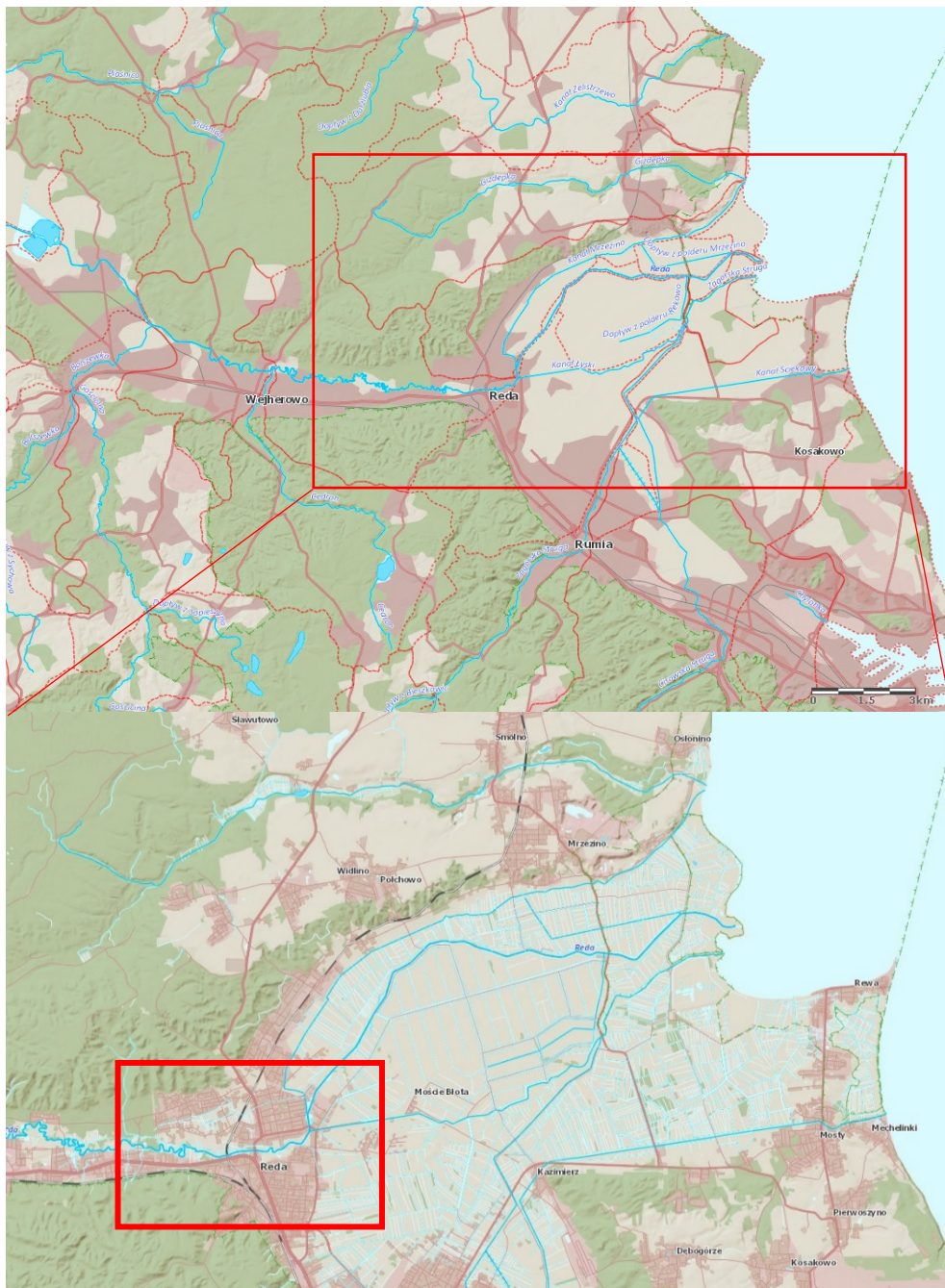


Figure 38. A map with the hydrographic system over the restoration site. Source: www.kzgw.gov.

The location of the planned fish pass is in relation to Natura 2000 areas and other forms of nature protection is illustrated in Figure 39. The investment area is beyond their reach, the border of the Darżlubski Primeval Forest is the closest.

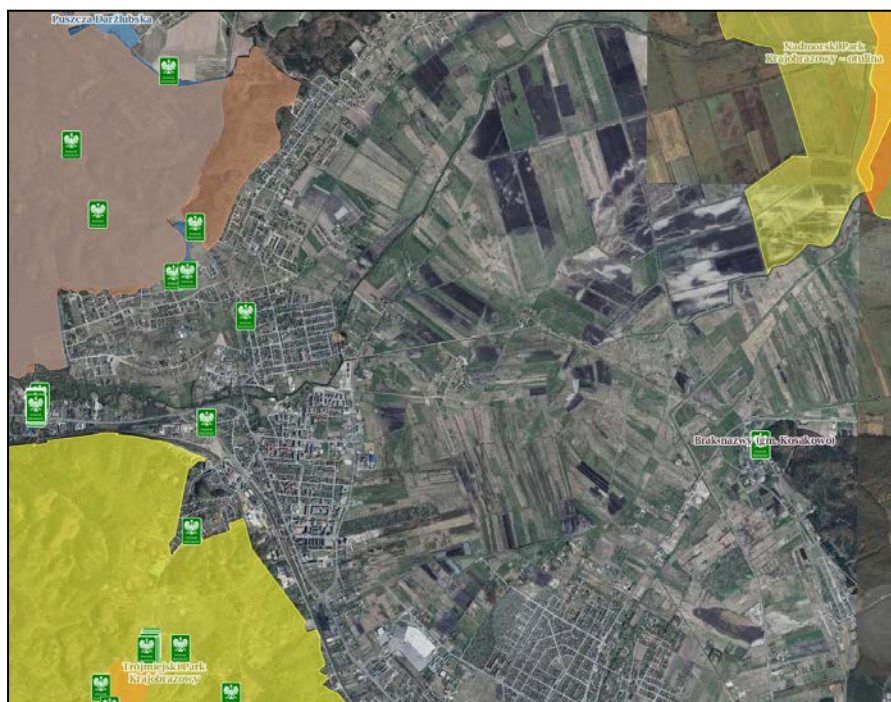


Figure 39. Location of the investment in relation to the nature protection areas. Source: General Directorate for Environmental Protection.

Flora: Environmental Impact Assessment highlight environmental conditions that shape the potential vegetation of the area, which is still being transformed as a result of human activities (settlement network, changes in water system etc.) towards the actual, present vegetation. The planned project of a fish pass will be implemented on the left bank of the Reda, between the Mrzezino Canal and the Reda River. The scope of work planned in the Reda riverbed was limited to strengthening the bottom at the mouth of the fish pass canal and cutting down trees and shrubs. The investment area is therefore a separated space, currently used for the needs of the existing Ciechocino weir. Common synanthropic vegetation (*Artemisietea*) is dominating in the area. It is typical for ruderal (related to settlement) and segatal (related to agriculture) grounds. Both of these functions are performed in areas adjacent to the investment area (Figure 40, 41).



Figure 40. View of the Ciechocino weir and the left bank of the Reda River. Photo credit: National Water Holding "Polish Waters".



Figure 41. View of the Mrzezino Canal, the site of the fish pass construction. Photo credit: National Water Holding "Polish Waters".

No protected plant species were found in the fish pass area. Noteworthy is the presence of an invasive species, *Echinocystis lobata* (Figure 42). An inventory of dendroflora was carried out in the area of the

planned investment. Trees and shrubs are described by species, size, diameter and length of the trunk circumference. Each specimen of a tree or shrub was given an inventory number. Tree trunk circumferences are given in cm, measured in the so-called breast height at a height of 130 cm. The area of shrubs is given in m². In the area covered by the investment, a total of 40 tree trunks and 7 m² of shrubs were inventoried and planned to be cut as part of this investment. Most of the trees were felling relatively young, healthy and not showing signs of decay. They were not inhabited by protected lichen species.



Figure 42. View of the escarpment with *Echinocystis lobata*, an invasive species. Credits: National Water Holding "Polish Waters".

Ichthyofauna: The ichthyofauna of the Reda basin has been studied by Inland Fisheries Institute in Olsztyn. According to the study¹, the Reda river flows from Wejherowo to Reda in its natural bed, significantly accelerating the current, which is reflected in the structure of ichthyofauna. There are numerous brown trouts and graylings, as well as single individuals of sea trout, perch, pikes, sticklebacks, stone loach and gudgeons. Further downstream of the Reda, high numbers of sea trout are noted. Brown trout, whitefish and pike had a smaller share. On the other hand, within the pre-estuary section near Mrzezino, there was a clear decrease in the number of fish. Only single individuals of brown trout, sea trout, common dace, perch, pike and three-spined stickleback were caught in the area.

Due to the existing hydrotechnical structure and an ineffective fish pass, the hydrological continuity on the Reda river is currently challenged. Efforts should be undertaken to improve this condition. When implementing new and renovating existing facilities, it is necessary to take pro-environmental solutions, i.e., those that allow for the continuity of the watercourse and free migration of aquatic organisms. Stone ramps are such a solution. The investment in question complies with the adopted parameters of the structure ensuring the continuity of migration of aquatic organisms. A slightly smaller stone diameter was adopted (for 0.5 m) to keep the fish pass width sufficient for the salmon. The adopted parameters result from the WWF guidelines in accordance with the study "Fish passes - design, dimensions and monitoring" (published 2016 by P. Nawrocki). These solutions were also consulted with local ichthyologists. From an ecological point of view, the construction of ramps with

¹ Published in the Scientific Journal of the Polish Angling Association in 2007.

a very rough bottom and a low slope is the best way to restore continuity in rivers where obstacles cannot be completely removed. Through structures of this type, all aquatic organisms can freely move, both up and down the watercourse.

Environmental Impact Assessment (EIA)

Environmental Impact Assessment was ordered in 2017 by The Board of Amelioration and Water Facilities Pomeranian Voivodeship in Gdańsk and prepared by the team of Biuro Projektów Wodnych Melioracji i Inżynierii Środowiska BIPROWODMEL Sp. z o.o., in accordance with guidelines in force².

EIA states that the construction of fish pass will not change the degree of use of anthropogenically used land. Completion of construction works will enable the reconstruction of the biologically active surface. Therefore, no permanent negative impact (both national and transborder) is expected and the scope of the impact will mainly cause a temporary limitation appearing only at construction stage and returning to normal afterwards. Those temporary impacts are related to construction noise, quality of water (phytobenthos, phytoplankton etc.), as well as effect on flora and fauna. In longer terms, the investment is favourable for the functioning of the natural environment, due to ensuring the hydrological continuity of the watercourse. There will be no oil, waste and noise associated with the long-term use of fish-pass.

Selected EIA conclusions regarding flora and fauna are:

- In the area of direct implementation of the task, the presence of legally protected plant species was not found [Regulation of the Minister of the Environment of 9 October 2014 on the protection of plant species (Journal of Laws of 2014, item 1409)].
- As part of the planned project, it is planned to cut trees and bushes from the immediate area of the planned works. The age structure, species structure and health condition of the trees do not indicate the necessity to qualify them as potential habitats for protected insects. There were also no bird nests or tree hollows found there.
- No plant stands or patches of plant communities listed in Annex I of Council Directive 92/43 / EEC were found in the area under the task's impact in the study area. There were no breeding species of avifauna covered by Art. 4 of Directive 2009/147/WE.
- In accordance with the Regulation of the Minister of the Environment of 9 September 2011 on the list of plants and animals of invasive species which, if released into the natural environment, may pose a threat to native species or natural habitats, the invasive plant species *Echinocystis lobata* was discovered at certain sites.

This section of Reda river has been classified as significant in terms of maintaining morphological continuity, which is a necessary condition for achieving good ecological status. A representative species of fish is salmon. The assumed intact flow in the watercourse channel meets the requirements of the ordinance of the Director of the Regional Water Management Board in Gdańsk.

The stage of exploitation of the investment will not change the function of the area which is used for the weir and will remain so. The pressures from maintenance and land use will not change. In the initial period, the biological function of the surface will be restored, after completion of the works, the

² "Recommendations of the Minister of Infrastructure and Development, the Minister of Environment and the General Director of Environmental Protection for investors/beneficiaries and competent institutions in the field of verification and ensuring that undertakings co-financed from EU funds in the programming period 2007-2013 and meeting the requirements of the Water Framework Directive" (February 2014).

ground surface will be tidied up and re-sown with grass. It should also be expected to have a long-term positive impact on the environment by improving the biological continuity of Reda river.

This Reda river fish pass case study report is based on an interview with PZG Wody Polskie in Gdańsk and provided documentation including Technical Report and Environmental Impact Assessment Reports (2017) conducted by Biuro Projektów Wodnych Melioracji i Inżynierii Środowiska BIPROWODMEL Sp. z o.o.