



# Aquatic Ecosystems and their Long-Term Sustainability Relationship in the Czech Republic

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## Abstract

Long-term territory sustainability is an essential prerequisite for its utility properties. The given principle applies universally. Its importance was enhanced especially in the industrial landscape and industrial agglomerations. Prerequisite for the sustainability of the area is balanced state of aquatic ecosystems, their protection and recoverability in different natural cycles. The Czech Republic is dependent on their own resources of surface and groundwater due to the fact that a relative roof of Europe does not have any significant water inflow into its territory from neighboring countries. With the changing climatic conditions around the world including Europe we can expect at least a number of decades to a lack of water to a different technological or energy utilization. Restrictions on the amount of water for implementation are reflected in industrial agglomerations necessary reduction in water consumption, at least periodic character. The given condition must be prepared by the infrastructure that is already in the preventive phase development scenarios of solutions, depending on the potential threat of water scarcity in the subject region. The following article deals with this issue in question not only in terms of natural hazards, but also in terms of what the potential risks creating industrial landscape on aquatic ecosystems and suggests what means and ways to minimize threats to make them acceptable in the trend of long-term state environmental sustainability.

*Keywords: environment, industrial landscape, aquatic ecosystems, climate change, risk, security threats, elimination threat*

## Introduction

Different countries in the world have different needs or need to manage their territories. The Czech Republic is one of those that must be handled judiciously with every piece of its territory. The actual area is not often usable enough without basic conditions that increase or reduce its usability. One of the basic and main assumptions is the natural balance and water sufficiency. Water is often perceived as a natural and very important raw material which is everywhere enough. In the Czech Republic it is not coming as a result of climate change, the situation will be worse.

Surface water or groundwater is not only a natural medium but as it is known it is both life condition, flora and fauna, including humans. In an industrialized society which is included in all European countries, it is also an essential prerequisite for its industrial use. The environment is necessary not only to use and enjoy, but also to protect. Protection must be structured, depending on the threat that could potentially change the nature or seriously disrupt the balance between the various processes.

## Czech Republic environment in industrial land context

The Czech Republic is located in a relatively warm climate without natural effect threat (seismic events, etc.) which have a potential to disturb standard human living conditions or to destroy infrastructure facilities. This given stability is accompanied by negative conditions. One of these conditions is relatively lack of sur-

face water, for example for energy recovery because of small flow rate capacity for a large part of watercourses, see fig. 1.

Given facts affect industrial usability areas at least in following areas:

- use the waterway as a transport route for oversized industrial products,
- draw on a receiving greater volumes for water technological use,
- significantly increases the cost for industrial waste water cleaning-up,
- necessitates significant cleaning rainfall fallen on the territory of an industrial enterprise before being discharged into watercourses.

The above-mentioned basics and other specific local factors are original characters of the Czech Republic. With the upcoming climate change and the current rainfall distribution change (hydrological drought / rainfall intensity), the water will force the authorities of individual regions of the Czech Republic to change the licensing conditions for surface water from watercourses and also significantly tighten limits of the discharged treated industrial wastewater quality.

Despite some negatives the Czech Republic has good natural conditions for use and environmental symbiosis with industrial needs. One of these conditions is a legislation protecting territory and also scientific and technical awareness of the Czech Republic.



Fig. 1. The usual water flow rate capacity in the river Ostravice, Ostrava [1]

Rys. 1. Średni przepływ wody w rzece Ostarvica w Ostrawie [1]

### **Natural and anthropogenic threats to the environment in the industrial landscape**

Primary natural and anthropogenic threats to the environment in industrial land should be divided into two areas:

#### ***Threats created by industrial landscape in the environment***

For the industrial landscape there can be considered extremely industrialized regions with high demands on energy resources. At the same area with high potential for environmental contamination or air pollution substances contaminating aquatic ecosystems. For the full range of symptoms there can be can be exemplarily selected in following areas:

- air exhalation in the surroundings,
- soli contamination by chemicals,
- risk or real contamination of aquatic ecosystems in watershed,
- higher or high demands on transport infrastructure,
- reduced ability to withstand natural environment industry.

#### ***Threats of industrial land due to lack of water implementation***

The above mentioned threats and others are almost always the potential backlash. Industrial landscape due to its characteristics has a potential to significantly lower infiltration of rain and snowfall on its territory. A large amount of paved surfaces quickly drain rainwater outside the given industrial landscape and in the basin hydrological situation arises following:

- volumetric lack of surface water in the recipient,
- gradual reduction of groundwater reserves in soil layers,
- potencial restriction on water pumping and thereby reducing the utility area for production processes expansion.

Given primary and secondary threats are not always seen as necessary accompaniment to the industrial landscape. A suitable method is possible at early risk analyzes and discern them through scientific and technological elimination [2].

#### **Options for eliminating aquatic and environmental threats**

Aquatic ecosystems protection is one of the basic prerequisites for subsequent effective use of land for various purposes, including use for industrial activities. The Czech Republic, as a strongly export-oriented state, is heavily dependent on the development industrial base existence.

The aquatic ecosystems protection as a basic prerequisite developing industry requires not only protection of stored surface water or groundwater but also long-term maintenance of their physical and chemical properties.

#### ***Volume maintaining water in the industrial landscape***

Maintaining volumes of water in the area can be achieved by a number of rational actions [3]. With the rapidly changing climatic conditions in the world and in Europe there is a need to rapidly adopt at least the following measures:

- a) to reduce the runoff of rainwater infiltration by changing capabilities of the territory industrial landscape by changing the surface of most paved surfaces,
- b) in industrial areas and zones to build storage device and seized progressive infiltration of rainfall,
- c) urgently implement multiple recirculation of water used for technological purposes.

#### ***Surface and groundwater protection from contamination alternative***

Passing next step preventive area protection against potential negative effects of industrial land on the

aquatic ecosystems are possibly to perform following technical and operational measures:

a) to reduce the risk of spread contamination from the territory of extremely loaded industrial activities or of old environmental burdens, the construction is so-called Milanese wall,

b) to realize a hydraulic barrier material protecting underground sources of drinking water in the basin from industrial areas with less or finishing potential contamination,

c) by monitoring wells to monitor groundwater quality in the industrial landscape,

d) through a safety risk analysis to identify all potential sources of danger and subsequently identified them to implement sufficient safeguards.

Preparation for threats elimination of aquatic ecosystems and industrial landscape by climate change is becoming increasingly important. If previously it was possible to protect the landscape and aquatic ecosystems, for example by sector, in the new climate conditions would be this protection counterproductive in many cases. Creating the impression would provoke environmental regions protection but in fact conserved the threat.

#### **New protection trend in landscape area**

The effective protection of any territory including industrial landscape is largely dependent on scientific knowledge and technical maturity states. Both these factors are not always a guarantee that it will achieve optimum results. The basic prerequisite for achieving the requirements must be determined only those targets which respect the natural balance while respecting the local landscape conditions and have long-term sustainability [4]. In terms of reality should observe trends such as the following structure and sequence:

- developing a comprehensive mind map for solving the problem,

- perform a primary analysis of natural and anthropogenic risks that have a potential to rise and consequently endanger the natural territory conditions,
- planning documents that define individual steps sequences, depending on the threat weight and its realization probability,
- always define in detail the ways and means, prevention in the field of public administration and infrastructure would be coordinated [5],
- develop contingency plans and emergency preparedness plans for effective crisis and management arising from extraordinary events [6].

The foregoing and other activities respecting new knowledge and technical resources must be regularly screened in the emergency plans of entities operating in the industrial landscape and superstructure into emergency plans across the region.

#### **Conclusion**

The aim of this article is warning public and private infrastructure's operators in the industrial landscape of security threats that infrastructure creates their nature and the environment in particular aquatic ecosystems. Without some risk of threats to the natural environment cannot operate in practice, now or in the future, any technical, transport and other infrastructure. To reduce the risk of threats in the case of aquatic ecosystems it is advisable to respect certain principles mentioned in this article by means of which can be prevented or at least the risk is eliminated to an acceptable level.

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## Literatura – References

1. KROČOVÁ, Š.: THREATS OF WATER CONTAMINATION IN AN INDUSTRIAL LANDSCAPE. Inżynieria Mineralna. 2015, Vol. 36, č. 2, 125–130. ISSN 1640-4920.
2. BERNATIK, A., SENOVSKY, P., SENOVSKY, M., a D. REHAK. (2013). TERRITORIAL RISK ANALYSIS AND MAPPING. Chemical Engineering Transactions, Vol 31, 79–84.
3. KROČOVÁ, Š: PROTECTION OF AQUATIC ECOSYSTEMS AGAINST ACCIDENTS IN THE CZECH REPUBLIC. Inżynieria Mineralna. 2015, Vol 36, n. 2, 225–230. ISSN 1640-4920.
4. KROČOVÁ, Š., BOUCHALOVÁ, M.: CLIMATE CHANGES AND THEIR IMPACT ON THE SURFACE WATER QUALITY. In Water, resources, forest, marine and ocean ecosystems conference proceedings, Vol.1 Sofia : STEF92 TECHNOLOGY LTD, 2016, 161–167. ISBN 978-619-7105-61-2.
5. POKORNÝ, J., GONDEK, H. Comparison of theoretical method of the gas flow in corridors with experimental measurement in real scale. (2016) Acta Montanistica Slovaca, 21 (2), Košice: Technická univerzita v Košicích. 146–153. ISSN 1335-1788.
6. ADAMEC, V., MALÉŘOVÁ, L., ADAMEC, M. How to assess territory vulnerability. The Science for Population Protection . Volume 1/2016, Population Protection Institute of Lázně Bohdaneč, 2016, 117 stran, 35–40, ISSN 1803-568X.

### *Ekosystemy wodne i ich długofalowy związek w zakresie zrównoważonego rozwoju w Republice Czeskiej*

*Długoterminowa stabilność terenu jest warunkiem koniecznym jego wykorzystania. Zasada ta ma znaczenie uniwersalne. Znaczenie stabilności wzrosło szczególnie w krajobrazie przemysłowym i aglomeracjach przemysłowych. Warunek wstępny do zrównoważonego rozwoju obszaru jest zrównoważony stan ekosystemów wodnych, ich ochrona i możliwość odzyskania wody w różnych cyklach naturalnych. Republika Czeska jest uzależniona od własnych zasobów wód powierzchniowych i podziemnych ze względu na fakt, że nie ma znacznych dopływów wody na jej terytorium z sąsiednich krajów. Wraz ze zmieniającymi się warunkami klimatycznymi na całym świecie w tym w Europie możemy spodziewać się przynajmniej kilku dziesięcioleci niedostatku wody do wykorzystania technologii lub energii.*

*Ograniczenia ilości wody do konsumpcji znajdują odzwierciedlenie w koniecznej redukcji ilości zużywanej wody w aglomeracjach przemysłowych. Infrastruktura musi zostać przygotowana na możliwe ograniczenia, w zależności od potencjalnego zagrożenia niedoborem wody w badanym regionie.*

*W artykule omówiono tę kwestię nie tylko pod kątem zagrożeń naturalnych, ale także pod względem potencjalnego ryzyka tworzenia krajobrazu przemysłowego w ekosystemach wodnych. Przedstawiono środki i sposoby minimalizowania zagrożeń, aby były akceptowalne w aspekcie długoterminowej równowagi środowiskowej państwa.*

Słowa kluczowe: środowisko, krajobraz przemysłowy, ekosystemy wodne, zmiana klimatu, ryzyko, zagrożenie, bezpieczeństwo, eliminacja zagrożenia