

# Abstracts of the Projects 2014

## Branch of Hydraulics, Hydrology and Hydrogeology

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### **Critical source areas of phosphorus in watersheds as the decisive factor of transport – a trial of the expression of the dependence on the source areas of runoff and the way of land management**

*Project manager:* Ing. Šárka Blažková, DrSc.  
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*Duration:* 2012–2015

*P-pathways is a project of the American-Czech cooperation on the leaching of phosphorus from agricultural land and/or diffuse pollution leaching from small municipalities and buildings with insufficient removal of sewage.*

We work on four agricultural catchments with a different intensity of agricultural production. In 2012, we have constructed a device for artificial rain in order to be able to work with intensities which occur only very rarely; checked the absence of the pesticides with P on 1 catchment; and carried out a preliminary trial with sprinkling on 2 catchments.

In 2013, further experiments with artificial rain and phosphorus leaching have been carried out. Samples have been taken in a number of points in the catchments in order to map the diffused pollution sources.

In 2014, the sampling of diffuse sources continued. An experiment with artificial rainfall has been done in the protection strip near the river.

### **Uncertainty in Water Footprint and a new way of working with the predictions of climate models**

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*Duration:* 2014

*Project is dealing with water footprint in our conditions. The grey water (water polluted with nutrient) seems to be the most important problem, in the Czech Republic.*

We are studying the diffuse pollution during various flow events – floods and droughts and compare the agricultural pollution with the pollution from small municipalities. Also, the efficiency of waste water treatment plants, the various influences on the effluent from the plant and the variability of inflow and outflow play a role in the nutrient pollution of our rivers.

Further we intend to use a new English way of work with the predictions of climate models and use it for the evaluation of dam safety during floods.

### **Proposal of a system for managing emergency situations associated with drought and water scarcity in the Czech Republic**

*Project managers:* TGM WRI – Ing. Radek Vlnas, Ing. Ladislav Kašpárek, CSc., RNDr. Tomáš Hrdinka, Ph.D., Ing. Magdalena Mrkvičková, Ing. Martin Hanel, Ph.D., Ing. Adam Vizina, Ph.D., Mgr. Pavel Tremel, Mgr. Marta Martínková

Czech University of Life Sciences – prof. Ing. Pavel Pech, CSc., Ing. Petr Máca, Ph.D., Ing. Jiří Pavlíšek, Ph.D., Ing. Lukáš Jačka, Ing. Petr Bašta

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*Duration:* 2010–2014

*The objective of the project is to develop a methodology and procedures to manage emergency situations caused by drought similarly as methodology that have been implemented and stipulated in the Czech legislation for protection against floods. The solution lies in defining degrees of drought (similarly to those defined for floods) selected according to the thresholds of indicators of drought and the general consensus agreed by representatives of water authorities, state institutions and other stakeholders involved in availability of water resources and water demands, particularly in dry periods. The strategy should define not only the degrees of drought but also powers of the authorities of public administration, involved in water management and water use priorities, particularly in drought periods.*

In 2014, a methodology for determination of hydrological drought indices and their threshold values, a methodology for specification of drought measures hierarchy for particular drought severity threat, a concept layout for troubleshooting of crisis instance arising from drought occurrence including a draft of institutional and legislative arrangements, plans for drought mitigation and authority competencies allocation, were provided. A supplementation of information system using the proposed indices was provided, as well as a map application to visualize drought indices.

Using an archived 19th century press the water level observations were reconstructed back from the early instrumental era. Therefore, the observation in Prague's gauge on the Vltava River is available in the 1825–1866 period, too. The severe drought episodes like in 1746, 1790, 1834–1836 and 1904 were described. These episodes could be used as extreme annual and perennial drought scenarios for planning purposes.

The software for simulation game MaWaR was adopted for final drought indices, their threshold levels and corresponding mitigation strategies. A follow-up workshop was organized.

## **Development of a tool and methodology for continuous measurements of snow water equivalent in the field**

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*Duration:* 2011–2014

*The objective of the project is the development of a field measurement device and a methodology for continuous determination of snow water equivalent, its comprehensive testing in various types of terrain and vegetation cover conditions and creating a methodology of installation and handling the device to measure the snow water equivalent, including in places which are difficult to reach but which have the greatest influence on the computed snow water storage.*

The repeated manual inspecting measurement of snow water equivalent continued in second part of winter 2013/2014 in vicinity of all prototypes installed in field – locality Jezdecká in the Jizera Mountains, 3 localities in the Orlice Mountains, locality Šindelová in the Ore (Krušné) Mountains. The behavior of devices in low snow conditions was observed because of the extremely mild winter. The manual inspecting measurement was carried out in week intervals during snow occurrence. The data measured by the devices at individual localities were compared with control measurements. The device documentation was modified based on gathered data and final version of snowmeter was created. The snowmeters previously installed in the Jizera Mountains and the Ore Mountains were modified. Two new localities for installation of the device were selected in autumn 2014. The two devices of prototype IV were installed in the foothills of the Krkonoše Mountains and in Lučany nad Nisou village in the Jizera Mountains.

Ing Šepelák et al. created the methodology "Location and installation of the snowmeter LDSMS for representative continuous determination of snow water equivalent and other snow properties". The methodology is based on practical experience gained during development, installation, manual inspecting measurements and improvement of the developed snowmeter. The methodology was peer reviewed and certified. At the same time, the contract on the use of the methodology by the Administration of The Krkonoše Mountains National Park was concluded.

## **Support of long-term planning in water management sector in context of climate changes**

*Project team:* Ing. Martin Hanel, Ph.D., Ing. Magdalena Mrkvičková, Ing. Stanislav Horáček, Ph.D., et al.

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*Duration:* 2012–2014

*The project objective is the creation of the methodology for verification of the measures proposed in the frame of long-term planning in water management regarding their effectivity under conditions of climate change and distribution of selected data via information portal.*

In 2014, the web portal has been finished. The portal is available at rscn.vuv.cz. The portal contains two separated parts: first part is a presentation of certified methodology and second part provides visualization of the data; it allows derivation of climate change scenarios for selected space units and download of scenarios and other data. It also contains the detailed description of the methodology of the derivation of the presented time series (selection of the catchment, description of the input data and calibration of the hydrological model, description of the creation of the climate change scenarios, their implementation in the hydrological model and evaluation of the change in elements of water balance and uncertainties).

## **Ensuring the quality of drinking water supplied to small municipalities from local sources**

*Project managers:* RNDr. Josef Vojtěch Datel, Ph.D., Ing. Anna Hrabánková

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*Duration:* 2012–2015

*The objective of the project supported by the Technology Agency of the CR is the creation of certified methodology “Comprehensive Management of Small Water Sources for Optimal Securing of Quality of Drinking Water at Usual and Exceptional Situations” that is aimed for administrations of small municipalities (focused at municipalities with up to 1000 inhabitants) with own local water sources and smaller water suppliers. The objective of the intended methodology is to make the ensuring of quality of drinking water in rural areas as good as it is in big cities while respecting the different economic situation of small municipalities and small water suppliers.*

In 2014, the research continued on local water resources in the pilot localities in the Rakovník District (Omice, Svatoslav, Velký Šenov, Všechnovice and Višňové). The purpose is to formulate the methodology properly and to continuously evaluate the methodology in practice. The detailed sampling of quality of collected water was going on. The field work was focused on evaluation of vulnerability of a used water body (usually shallow groundwater), level of protection of water resources and identification of problems with their anthropogenic pollution. The second version of methodology was created. The preliminary results were presented at national and international conferences. The results were published in peer reviewed journal (Vodní hospodářství, 64, 8, 1-4).

## **Increasing the safety and reliability of culverts with regards to the transfer of flood flows**

*Research team:* Ing. Pavel Balvín, Ing. Miroslava Benešová

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*Duration:* 2014–2016

*The aim of proposed project is increasing safety, reliability of culverts and throughput of traffic on roads leading over culverts in terms of passing flood flow through objects using the results of proper hydraulic design of new structures and reconstruction and maintenance of existing structures*

*throughout their service life. Moreover, the results of the project will also enhance economic aspect of their design, manufacture, installation and maintenance.*

The project objective is to improve hydraulic calculations of flow through culverts under different flow conditions and to solve the problems of newly designed culverts. The proposed measures will help to increase the safety and service life of transport infrastructure. The project will also focus on finding simplified procedures for designing culverts that are draining very small watersheds.

TGM WRI in cooperation with Road and Motorway Directorate of the Czech Republic (RSD CR) and the Railway Infrastructure Administration, state organization (SŽDC) focused on identification of localities potentially at risk in terms of hydraulic characteristics caused by improper design solutions. The field survey has been carried out based on data provided by RSD CR and SŽDC. The results were implemented in preparation of methodology of the project for 2015. The project will focus mainly on physical and mathematical models in 2015. The field survey will continue in 2015, because the RSD CR and SŽDC continue in selection of localities potentially at risk. The methodology of the research on hydraulic physical model was prepared based on obtained results. This research will be carried out in TGM WRI and at the Department of Hydraulics and Hydrology of the Czech Technical University in Prague.

### **Compensation of negative climate change impacts on water supply and ecosystems using the localities for potential accumulation of surface water**

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*Duration:* 2014–2017

*The main objective of the project is to provide a more accurate data basis for 1) the General Plan of protected localities for surface water accumulation, and 2) for the third round of the River Basin Management Plans update. This refinement will consist of the data replenishment from the non-observed localities and evaluation of storage function security for the individual protected localities (potential reservoirs). In addition the results will be summarized in the form of specialized maps reflecting a vulnerability of the individual basins and security of the storage function of particular potential reservoirs. The individual procedures will be generalized in the methodology used for the comprehensive assessment of security of the storage function of potential reservoirs with respect to climate change. In addition, the impact of near-natural retention and storage measures will be assessed. The procedures will be encapsulated into a software package.*

In 2014, the hydrometric network has been built at protected localities for surface water accumulation with insufficient monitoring. 17 stations have been built. The monitoring was initiated in the autumn at the most of localities. The stations will operate at least until the end of the project. Hydro-meteorological data for catchment of individual reservoirs were collected at the same time.

### **Evaluation of the chemical and quantitative state of groundwater bodies for the 2nd cycle of River basin plans in the Czech Republic**

*Research team:* RNDr. Hana Prchalová, Ing. Marie Kozlová, Ing. Petr Vyskoč, Mgr. Pavel Rosendorf, et al.  
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*Duration:* 2013–2014

*The project objective was to process the evaluation of the chemical and quantitative state of groundwater bodies in the Czech Republic after the previously created methodology.*

It was necessary in the short term to gather needed data and evaluate the chemical and quantitative state of groundwater bodies. The data from monitoring of CHMI were also evaluated. The nitrate concentrations in groundwater withdrawals and data from old contaminated sites were also evaluated. The evaluation of chemical state of groundwater bodies contained the evaluation of receptor groundwater, evaluation of groundwaters that directly influence achieving ecological and chemical state of surface waters and evaluation of trends and evaluation of trends and reversing

of trends of pollutants in groundwaters. It was necessary to check whether the water withdrawals are filed under relevant groundwater bodies and gather available values of natural groundwater resources. Beside the regularly processed data of hydrological balance, the new preliminary data from the project Review of Groundwater Resources in the Czech Republic were used. The data from the project on hydrogeological rayons were used as additional data.

Evaluation contained besides the aggregated results many detailed partial data (e.g. evaluation of individual parameters on the level of working units of groundwater bodies).

## **Reporting of the Nitrate Directive (91/676/EEC) and vulnerable areas**

*Research team:* Ing. Anna Hrabánková et al.  
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*Duration:* 2014

*Regular revisions of vulnerable areas are carried out every four years in accordance with Government Decree no. 262/2012 Sb. and obligations under the Directive no. 91/676 / EEC (Nitrate Directive). In 2015, the third revisions of vulnerable areas should take place and subsequently new definition of vulnerable areas would be published. Revisions are conducted on the basis of detailed analysis of all available documents concerning the quality of surface water and groundwater.*

In 2014, the project was divided into three main areas. All activities in 2014 were aimed at preparing the third revisions of vulnerable areas. The main outcome of 2014 was the evaluation of data from monitoring of surface and groundwater. The results of evaluation will be the main input for the third revision of vulnerable areas. The other outcome was the analysis of potential vulnerable areas delimited in 2011. Simultaneously, the permanent activities to meet the requirements of Council Directive 91/676 / EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources were carried out.

## **The methodology of evaluation of the effectiveness of the action programme (detailed monitoring)**

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*Duration:* 2014

*The Member States are obliged to establish monitoring programmes for the monitoring of the effectiveness of the action programmes pursuant to Council Directive 91/676/EEC (Nitrate Directive) concerning the protection of waters against pollution caused by nitrates from agricultural sources, article 5, paragraph 6. The relevant activities (monitoring the effectiveness of the action programme) are bound almost exclusively on the monitoring of selected pilot farms. Agrotechnical practices and selected critical operations are very closely evaluated on these farms. The main objective of the project is to enable a closer link to the existing monitoring of farming in vulnerable areas with the monitoring of water quality.*

The result of the project is the methodology that has been validated on the four pilot river basins. It can be concluded that this general guide can be used on a wider scale in other locations threatened by nitrates. The content of the project (also due to the fact that the project was short) was the first stage of the activities, which is the preparation for detailed monitoring of selected parameters, which allow at a particular place threatened by nitrates to determine the source and type of pollution and then make proposals for adjustments to the programme of action. Next stage of activities should focus on seasonal variation in nitrate pollution, as well as the annual variations and the additions to the time series for the evaluation of long-term trends of water monitoring results.

## **Hazard assessment of dangerous landslides and glacial lake outburst floods, Cordillera Blanca, Peru**

*Research team:* Ing. Petr Bouška, Ph.D., Ing. Miroslava Benešová, RNDr. Jan Klimeš, Ph.D. (IRSM AS CR), doc. RNDr. Vít Vilímek, CSc. (Faculty of Natural Sciences, Charles University in Prague) tel.: (+420) 220 197 268, e-mail: miroslava\_benesova@vuv.cz

*Duration:* 2011–2014

*The project deals with the assessment of natural hazards (landslides and floods from glacial lakes) in selected glacial valleys in the Cordillera Blanca in Peru. A part of the research is focused on stability of sides near glacier lakes, rainwater infiltration modeling, vulnerable and hazard landslides. TGM WRI provides research on the modeling of floods caused by overflow or dam breaks of glacial lakes due to the landslide of rock and ice into a lake. The entire project should contribute to increase the safety of local inhabitants and to develop a methodology applicable in other mountain areas.*

In 2014, project focused on simulation of flood events according to selected scenarios on the model of Chucchún River. The real event from 2010 and other potentially possible events were simulated.

Main objective in 2014 was creation of the model in newly selected cross section Cojup and simulation of several potential scenarios based on selected water levels in suitable cross-sections.

The model has been built (as well as in previously studied cross section) from cross sections in 1D programme HEC-RAS.

## **Assessing water quality improvement options concerning nutrient and pharmaceutical contaminants in rural watersheds**

*Research team:* doc. RNDr. Zbyněk Hrkal, CSc., et al. tel.: (+420) 220 197 463, e-mail: zbynek\_hrkal@vuv.cz

*Duration:* 2014–2017

*The project is financed by so called Norway Grants and it is focused on determination of the origin of pollution sources in surface water and groundwater (nutrient and pharmaceutical contaminants). Other project objective is to determine the shares of point and non-point sources of pollution in catchments under different hydrological situations. The goal is to evaluate the effectiveness of different approaches to wastewater management including possibilities of using root zone wastewater treatment plants preliminary in small municipalities (up to 500 or 2000 IE). Regarding pharmaceuticals, identification of processes during their leaching into water, migration in unsaturated and saturated zones and further "fate" of these substances is in the centre of interest. The results which will be brought by this project are currently not available in the Czech Republic and partly not available in Norway. These intended results are crucial for fulfillment of mandatory targets of the Water Framework Directive, Nitrates Directive and the Groundwater Directive. They should be taken into account in the preparation of conceptual and technical documents for water management and soil protection management in catchments where the drinking water resources are.*

In 2014, the inspection of technical state of all monitoring points (natural-watercourses and artificial- wells and boreholes) and sampling in frame of first series of pharmaceuticals analyses in surface and groundwater was carried out at pilot locality Horní Beřkovice. The output data will be available in the beginning of 2015.

## **Review of Groundwater Resources in the Czech Republic: Hydrology documentation for Activities 2, 4 and 6**

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*Duration:* 12/2011–6/2014

*The project coordinator is the Czech Geological Survey. TGM WRI, p.r.i., is responsible for the Activities 2, 4 and 6.*

***Activity 2 The processing of source part of the evaluation of the quantitative state of groundwater bodies***

*The objective is the simplified determination of natural groundwater resources for 55 hydrogeological rayons.*

The natural reserves of the groundwater have been calculated for 55 hydrogeological rayons using several methods in 2013. At the beginning of 2014, the final report was submitted to the client and comments were settled.

***Activity 4 Hydrological measurements including the construction of gauging stations on selected surface watercourses***

*The Activity is focused on selection of sites for new gauging stations, designs and construction of approximately 80 gauging stations, monitoring including the hydrometric measurements, processing and evaluation of obtained data.*

In the first half of 2014, the monitoring of water surface elevation (stage) continued at 67 gauging stations (constructed as addition to the network of CHMI). The monitoring processed only for Activity 2 was finished. In the second half of 2014, monitoring continued only at 13 selected stations.

The maintenance of equipment of the stations was performed. Necessary adjustments and repairs were performed mainly at stations on watercourses where floods occurred. The digital data were collected in field, the data were checked and water levels were evaluated. The discharge time series were quantified, the time series were checked and the data were implemented in long-term discharge balance.

***Activity 6 Processing of hydrological models based on existing and newly measured data***

*The Activity is focused on determination of the development of groundwater recharge in time using the water balance models for 56 hydrogeological rayons.*

In 2014, the hydrologic water balance was finished for 56 hydrogeological rayons. The main output is the time series of groundwater recharge from precipitation for individual rayons in monthly time step and time period 1981–2010.

***Sub-basin district plans of the Upper Vltava, the Berounka and other Danube tributaries – part “groundwater”***

*Research team: RNDr. Hana Prchalová, Ing. Petr Vyskoč, Ing. Anna Hrabánková, Mgr. Pavel Rosendorf, Ing. Marie Kozlová, et al.  
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*Duration: 2013–2014*

*The project objective was to create the Sub-basin district plans of the Upper Vltava, the Berounka and other Danube tributaries – part groundwater, protected areas and to include the results of the project "Emissions".*

For the second cycle of plans, plans for sub-basins were processed according to the requirements of the new methodologies and the previously approved plan template. TGM WRI activities included all parts of plans regarding the groundwater and protected areas. In addition, evaluation of the sources and pathways of pollution of surface water, including quantification of the individual inputs, and identification of the surface water bodies at risk have been incorporated in the plans.

## **Review of Groundwater Resources in the Czech Republic – geological activity for the hydrogeological survey in Area 3**

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*Duration:* 2014–2017

*Review of groundwater storages in rayons of northern part of the Bohemian Cretaceous Basin (Area 3) is the main objective of the project. The project is funded by the European Regional Development Fund, from the Operational Programme “Environment” and by State Environmental Fund of the Czech Republic. It will make possible to determine the quantity of groundwater, the optimal conditions for the water withdrawal, and define measures to protect them in evaluated groundwater rayons thanks to obtained data and newly built models.*

*Part of the project is preparation of the methodological and organizational platform for system review of groundwater resources every six years in accordance with the rules of the European Union determined by the Water Act and related legislation. The future regular review of groundwater storage will require only minimum financial costs and will use the models and technical results of the current project.*

In 2014, the documentation was processed and the hydrodynamic tests were carried out at these new hydrogeological boreholes: 4611\_3C Milešov, 4612\_1C Všebořice, 4640\_1T Zdislava, 4650\_3Cn Valteřice, 4650\_1Cn Folknáře, 4620\_4T Ludvíkovice, 4660\_2T Hřensko a 4660\_2C Hřensko.

## **The study on the possibilities of enhanced retention effects of the Nechranice Reservoir**

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*Duration:* 2013–2014

*The study was carried out on the basis of orders by Povodi Ohre, state enterprise. The objective of the study was to evaluate the possibilities of enhanced retention effects of the Nechranice Reservoir.*

To decrease a level of storage volume is one of the options how to increase the retention effects of Nechranice reservoir. The level is currently located at an elevation of 269 m above sea level. Five options have been evaluated (two of them are historical, one represents current state and last two represent possible future state). The range of the options was chosen so that the function and purpose of the reservoir are representatively characterized. Simultaneously, the turning points of history of Nechranice reservoir are well represented since its commissioning in 1967, through the present to the possible future.

The aim of the historical options was to describe then the function of Nechranice reservoir and evaluate then achievable retention effects. The period from 1967 until 1979 was chosen for the first historical option. The Nechranice reservoir was supposed to be a reservoir with a storage function primarily for industry, energy and agriculture. The manageable protective volume was not defined in this period. The level of storage volume (the level sv) was at an elevation of 271.90 meters above sea level, which is currently the level of manageable storage.

The second option evaluates the historical period from 1979 until 2004. In 1979, the function of Nechranice reservoir was re-evaluated and the level sv was lowered on 269 m above sea level. The difference between the two historical options is not only in different levels of the storage volume, but also in the manner of handling of hydrostatic segments at the spillway.

The third option evaluates the period from 2004 to the present. The middle part of the emergency spillway was reconstructed in 2004 and the hydrostatic segment was replaced by the moving segment. The security of the Nechranice reservoir was greatly enhanced when converting flood flows and the protection of the territory under the reservoir was also enhanced.

Options four and five describe the possible future situations. Both options are based on the current dam operation protocol (and operation rules observed during flood situations). The reduced level of storage volume is considered (from current 269 m above sea level to 268 m above sea level



and to 267 m above sea level. Consequently, the retention volume was increased and storage volume was decreased in the two options representing the possible future. The impact of lowering the level of storage volume on the other functions (storage, energy etc.) of the Nechranice reservoir has been also evaluated.

## **Hydraulic research of the relief shaft of the Praha-Ruzyně Airport**

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*Duration:* 2014

*The aim of the research was to build a hydraulic model to verify the capacity of the relief shaft with variable flood gate level at the inlet to the waste water treatment plant (WWTP). There was water level in the relief shaft and the position of the floodgate measured during the experiments. Simultaneously, the inflow from the shaft to the WWTP was measured. The inflow should not exceed the limit of  $5.8 \text{ m}^3 \cdot \text{s}^{-1}$ .*

The research was conducted on the hydraulic model on a scale of 1 : 10, which was built in the hydraulic laboratory in TGM WRI. The client required to split the function of the relief shaft into winter and summer mode. In winter mode, there was a low inflow with high concentrations of harmful substances expected. According to calculations the maximum inflow should not exceed  $Q = 3.7 \text{ m}^3 \cdot \text{s}^{-1}$ . The whole inflow had to be transported to WWTP. In summer mode, there were inflow rates up to  $Q = 17.0 \text{ m}^3 \cdot \text{s}^{-1}$  expected. With more dilution of the wastewater the lightweight amount was dependent on the requirement not to exceed the capacity limit of the WWTP  $Q = 5.8 \text{ m}^3 \cdot \text{s}^{-1}$ . The result of the hydraulic research was the optimal setting of the permanent lift height of the flood gate at the inlet to the WWTP.

## **Review of monitoring for location of new nuclear source at Dukovany nuclear power plant**

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*Duration:* 2014–2015

*The purpose of the project is the hydrological and hydrogeological monitoring in the wider area of the planned new nuclear source. The project objective is to evaluate possible qualitative and quantitative influence of hydrological and hydrogeological conditions in the area about 3–5 km from the future construction site.*

In 2014, the basic network of the surface water monitoring system has been built. The system was placed into service and preliminary results have been evaluated. During 2014, the groundwater monitoring network has been built and detailed monitoring of surface water and groundwater was launched.

## **Processing of supporting documents and drafts of national River basin plans of the Elbe, the Oder and the Danube – part groundwater**

*Research team:* RNDr. Hana Prchalová, Ing. Petr Vyskoč, Ing. Anna Hrabánková, Mgr. Pavel Rosendorf, et al.  
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*Duration:* 2014–2015

*The project objective is to process supporting documents and drafts of national River basin plans of the Elbe, the Oder and the Danube – part groundwater.*

It was necessary to create the national plans according the results of river basin district plans, international plans, the requirements of the European Commission on the basis of bilateral negotiations and the previously approved plan template. TGM WRI was involved in all parts of the plans related to the groundwater. Although a large part of the work consisted in the aggregation of the results of the plans for sub-basins and international plans, part of the job was, inter alia, to propose and process the specific objectives of water protection – i.e. the proposal of the exceptions for groundwater bodies.

## Reference Laboratory of Environment Components and Wastes

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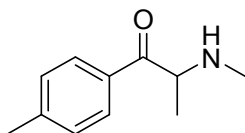
### New drugs – market analysis, epidemiology of use and identification of preventive and harm minimisation strategies

*Project manager:* MUDr. Tomáš Záborský, Ph.D. (Charles University Prague)

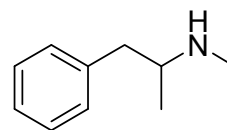
*Research team (TGM WRI):* Ing. Magdalena Kvíčalová, Ing. Danica Pospíchalová (May 2014),  
Ing. Alena Svobodová  
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*Duration:* May 2013–December 2015

*The project is focused on new types of drugs and TGM WRI contributes to it by 1) qualitative analysis of new synthetic drugs that are used in the Czech Republic and 2) dealing with issues of their identification and quantification in waste water and consequent mathematical estimates of amount of consumed drugs. These estimates are based on detected values and knowledge of degradation processes in waste water and metabolic processes in human body. The project is focused mainly on cathinones (e.g. mephedrone). The GS/MS and LC/MS apparatuses will be used for analyses of solid substances and waste water samples.*



Mephedrone, 4-MMC, 4- methylmethcathinone  
NSD



Methamphetamine, crystal meth  
"classic drug"

In the second project year (2014) we focused mainly on development of methodology for determination of 4 selected NSD (New Synthetic Drugs) – mephedrone, 4-methylethcathinone, metylone and pentedrone in waste waters using mass spectrometry with gas or liquid chromatography. After a series of experiments methodology based on LC/MS was found. This methodology was subsequently used for the analysis of real samples, collected in the last year at selected sites in Prague sewerage system. At the end of the year, six NSD were added to original list: ethcathinone, MDPBP (metylenedioxy-pyrrolidinobutyrophenone), PVP (pyrrolidino-valerophenone), flephedrone, MePPP (4- metyl-pyrrolidinopropiophenone) and nor-mephedrone (metabolite of mephedrone).

The last year we also analysed a series of solid samples of narcotics after previous derivatization by GC/MS. We identified mostly MDPBP and mephedrone.

The results of the project were presented on conferences: Hydrochémia 2014 and 49th Advances in Organic, Bioorganic and Pharmaceutical Chemistry.

### Alternative sources of water in municipalities during the state of emergency – exploitation of original local sources and springs

*Project manager:* Ing. Eva Mlejnská

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*Research team:* RNDr. Josef Fuksa, CSc., Ing. Lenka Matoušová, Mgr. Pavel Eckhardt, Ing. Alžběta Petráňová, et al.

*Duration:* 2011–3/2015

*The project is focused on research of possibilities of using of preserved springs in urban areas of municipalities over 20 000 inhabitants for emergency water supply.*

The planned field and laboratory activities were finished in 2014. Four case studies in selected municipalities over 20 000 inhabitants (Decin, Brno, Plzen and Praha) were finished. The project was presented at the conference Říční krajina (River landscape) 2014 in Brno.

The obtained results indicate that the water quality of the monitored springs (chemical parameters) is relatively stable and the prediction of water quality is possible for potential emergency supply for a longer period. The values of microbiological indicators of water quality are significantly influenced by the state of the springs and their source areas. One of the chapters of case studies is devoted to the issues of the modification of source areas. The using of water from the springs requires disinfection/sterilization in most cases.

In the last project year, the certified methodology will be finished and approved. The title of the methodology is "Identification, registration, water quality monitoring and protection of alternative water resources in municipalities and securing of their usability in the case of emergencies and crisis situations". The Handbook for municipalities will be finished.



U Jezírka Spring, Petřín, Praha

### **Investigation of the impact of the Temelín Nuclear Power Plant accident on contamination of the Vltava and Elbe Rivers up to the Elbe boundary profile at Hřensko**

*Project managers:* Ing. Eduard Hanslík, CSc., Ing. Eva Juranová  
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*Duration:* 2012–2014

*The project objective is to evaluate migration of radioactive substances in water environment in case of accident in the Temelín nuclear power plant.*

The migration of tritium along the Vltava and Elbe Rivers was monitored. The tritium discharged during the usual operation of the plant was used for monitoring as a tracer. The time of transfer of the tritium dependent on river flow was evaluated. The proposed method of determination of the distribution coefficients of radionuclides among water and river sediments or soluble substances was approved as a certified methodology of the Ministry of the Environment of the Czech Republic. The data were prepared for analysis for localization, needs and possibilities of automated monitoring station for continual sampling and radiological analysis.

## **Determination of the amount of illicit drugs and their metabolites in municipal wastewater – new tool for obtaining of complementary data on illicit drug consumption in the Czech Republic**

*Project manager:* Ing. Věra Očenášková

*Project team:* Ing. Petr Tušil, Ph.D., MBA, Ing. Danica Pospíchalová, Ing. Alena Svobodová  
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*Duration:* 2012–2015

*The objective of the DRAGON project is applying “sewage epidemiology” in the Czech Republic. The project is carried out in the frame of security research (Ministry of Interior of CR). The sewage epidemiology is epidemiology of waste water. The project aims to create methodological approach for estimation of amount of consumed illicit drugs and their metabolites in municipality waste waters. The estimation is then used for calculation of illicit drugs consumption among the population. In comparison with classical methods of research and screening of illicit drugs consumption among the population, the methods of sewage epidemiology are less financially demanding, anonymous and can be performed almost in real time. The sewage epidemiology method has also many general advantages in comparison with conventional methods of research. The method is more universal than conventional methods and consequently can be used for fast identification of hot-spots (the sites with high consumption of illicit drugs), testing of comparability of different programmes of drugs abuse prevention in specific locality, the validation of results of conventional methods of determination of illicit drugs consumption among the population and estimation of value of financial resources at illicit drugs market at the given locality.*

The new approach of the project DRAGON (abbreviated name) is the monitoring of illicit drugs concentration and concentration of their metabolites in raw municipality waste waters not only at the inflow to a waste water treatment plant but also in nodes of the sewage network. It will allow estimate the amount of consumed illicit drugs in individual town districts that are connected to common town waste water treatment plant. The agglomerations selected for the monitoring are Praha, Brno, Ostrava, Plzeň (Pilsen) and Ústí nad Labem. Other monitored localities are Havířov, Český Těšín, Orlová, Frydek-Místek and Karviná (2013). The following localities were monitored in 2014: Opava, Nový Jičín, Cheb, Aš, Mariánské Lázně, Františkovy Lázně, Karlovy Vary, Liberec, Jablonec, Pardubice, Hradec Králové, Jihlava, Zlín, Olomouc, Bruntál a České Budějovice.

In 2012, the suitable analytical method was implemented and validated. In 2013, four seven-day sampling campaigns were carried out at each of monitored localities. The differences during the week can be detected thanks to the seven-day campaigns.

The ACCENDO – Centre for science and research, o.p.s., processed the "Socio- demographic study including analyses of spatial distribution of population and identification of risk groups of users of addictive substances (drugs)" for the DRAGON project.

Preliminary results of the project were presented at the national and international conferences and workshops: Hydrochémia, Hydroanalytika, Testing the waters: first international multidisciplinary conference on detecting illicit drugs in wastewater (Lisbon, Portugal), Drinking Water, Magdeburg Seminar of Water Protection etc. The results were published in journals, e.g. Vodohospodářský spravodajca, Vodní hospodářství and Bulletin Národní protidrogové centrály.

## **Optimization of the method for detection of assimilable organic carbon by optic detection**

*Project managers:* RNDr. Dana Baudišová, Ph.D., Ing. Miroslav Váňa, et al.

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*Duration:* 2012–2014

*The project objective is experimental development of the method and instrument (functional specimen) for determination of assimilable organic carbon (AOC) by optical detection, comparison of the results with cultivation method and research of AOC in waterworks facilities with risk technology (ozonization).*

The AOC turbidimeter for determination of AOC including user software was finished in 2014 (in cooperation with Faculty of Mathematics and Physics of the Charles University in Prague). The optic detection method was optimized, the sampling at selected water treatment plants was finished (Hosov, Heraltice, Nová Říše, Štítary) for the detection of changes in AOC concentration during water treatment. All the results were processed, the main project results were prepared (functional specimen, software, certified methodology). The results were presented in scientific journal and at several seminars and conferences.

## **Research of optimization possibilities of operation and of effectiveness increase of wastewater treatment from small municipalities using non-conventional technologies**

*Project team:* Ing. Eva Mlejnská, Ing. Miloš Rozkošný, Ph.D., Ing. Alžběta Petránová, et al.  
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*Duration:* 2012–2015

*The project is focused on research of possibilities how to increase the effectiveness of waste water treatment from individual buildings or small municipalities in soil filters, root zone waste water treatment plants and biological tanks (so called extensive technologies of waste water treatment). The main goal of the project is to develop the new technology components for increase of effectiveness of the treatment by the extensive technologies. Other goal is the development of suitable bacteria preparations aimed to support the treatment processes of above mentioned technologies and most of all the regeneration of clogged filtration fillings of root zone waste water treatment plants and soil filters.*

In the third year of the project (2014), the main attention was focused on laboratory and field research of new technology components and bacterial preparations. The research followed up the activities in 2013 and it was going on at many localities with a root zone waste water treatment plant or final treatment biological tanks, in laboratories and also at outdoor premises of TGM WRI.

The main attention was paid to the new biological preparations aimed to decrease the clogging of a filtration filling of root plants and soil filters and to increase the effectiveness of devices for mechanical pretreatment including the testing of first model of mobile device for cultivation and dose of bacterial preparations. The filters for decrease the secondary contamination discharged from biological tanks were tested along with planted and unplanted floating islands aimed to improve oxygen conditions and to reduce the discharge of floating dirt from biological and final treatment tanks. The use of nontraditional species of wetland plants for vegetation cover of filters was also tested. The technology components were developed and tested: new types of regulation shaft with aim to increase the volume of oxygen presented in filtration filling (pulse filling and emptying), new distribution piping for root plants and soil filters and new type of distribution shaft.





Sampling of gravel of clogged inflow zone of the root wastewater treatment plant

### **Processing of supporting documents for the reporting in accordance with Article 15 of Council Directive No 91/271/EEC**

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*Duration:* permanent activity

*The project objective is to create supporting documents that would allow check the status of fulfillment of Article 15 of Council Directive No 91/271/EEC.*

In 2014, the data imported to UWWTD WEB DEM Tool (<http://uwwtd.eionet.europa.eu/>) were updated, corrected and verified. The data were exported to the page of Eionet Central Data Repository (<http://uwwtd.eionet.europa.eu/>). Export is possible only after correction of all bugs that UWWTD WEB Tool automatically identifies and labels in the imported files. The final version (.xml) was exported within the deadline.

### **Support to activities of the permanent and emergency component of the nationwide Radiation Monitoring Network**

*Project managers:* Ing. Eduard Hanslík, CSc., Ing. Barbora Sedlářová  
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*Duration:* permanent project

*The objective of the project is to monitor the levels of radionuclides in hydrosphere in normal and, where appropriate, in the emergency regime in cooperation with laboratories of the river basin administrations (Povodí, state enterprise).*

Respecting the Framework Agreement on the activities of the components of the nationwide radiation monitoring network (RMS) between the Ministry of the Environment and the State Office

for the Nuclear Safety, the Reference Laboratory of TGM WRI, p.r.i., guarantees the activities of the permanent and emergency component of nationwide radiation monitoring network in cooperation with water management laboratories of the river basin administrations. In the period of the monitoring in the normal radiological situation (in 2014), the development of the concentrations of radioactive substances in surface and drinking waters, sediments, water sludge and fish biomass was monitored at selected gauging stations. Increased concentrations of tritium in comparison with the background were identified in the Vltava River at Prague-Podolí and at the outlets of the Elbe River and the Morava River. This is a consequence of discharges of waste water from the Temelín Nuclear Power Plant and Dukovany Nuclear Power Plant. The results of the monitoring are continuously transmitted to nationwide radiation monitoring network (RMS) in the scope of the information system of the State Office for the Nuclear Safety.

### **Monitoring and assessment of surface water and groundwater quality and its changes in relation to the impact of the Temelín Nuclear Power Plant construction and operation on its vicinity**

*Project manager:* Ing. Eduard Hanslík, CSc.  
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*Duration:* 2000–2014

*The objective of the project is given by its name.*

Monitoring and evaluation of the influence of the Temelín Nuclear Power Plant on the environment was carried out for the needs of CEZ, respecting the conclusions of the examination of the effects of changes in buildings (EIA) on the environment. The outputs of the projects provide the new reference level before a construction of a new nuclear source at the Temelín Power Plant.

### **Content of radioactive substances in the Orlík Reservoir and its tributaries after commissioning of the Temelín Nuclear Power Plant – period 2014**

*Project managers:* Ing. Eduard Hanslík, CSc., RNDr. Diana Marešová, Ph.D.  
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*Duration:* 2014

*The objective of the project was to monitor and evaluate the concentrations of radioactive substances in the Orlík reservoir and its tributaries for the needs of the river administrator.*

Development of concentrations of tritium volume activity was monitored in surface water: downstream from the waste water discharge from the Temelín Nuclear Power Plant including the vertical distribution of tritium in the Orlík reservoir and further the reference (unaffected) localities. The monitoring was carried out for the needs of the Vltava River Basin Administration.

### **Evaluation of the results of inspection measurements of the changes in gamma radiation dose rate and the content of radioactive compounds in the vicinity of the buildings included in remediation programme of the Nuclear Research Institute in Řež, 2014**

*Project managers:* Michal Novák, Ing. Eduard Hanslík, CSc.  
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*Duration:* 2014

*The project objective is the monitoring and the evaluation of the effects of remediation of impacts of past contaminations at the ÚJV Řež, a. s., on the environment.*



In the framework of the project, the effects of remediation of impacts of past contaminations at the ÚJV Řež, a. s., on the hydrosphere and other components of the environment were monitored. These are part of the bases for the assessment of the effectiveness of remedial measures taken in the framework of the Implementation project of the remediation activities.

### **The research of detection and determination methods of radioactive contamination**

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*Duration:* 2012–214

*The project objective is development of a fast method for determination of total volume activity Beta and strategy of sampling in case of nuclear accident.*

The possibility of fast determination of total volume activity Beta in water samples in case of nuclear accident in the Czech Republic or abroad was verified. The proposed method was verified in cooperation among TGM WRI, p.r.i., water contamination measuring sites and water management and radiological laboratories. Newly, the possibility of calibration with use of standard Strontium 90–yttrium 90 was verified. The results show that values of the total volume activity Beta indicator will be higher in case of this calibration in comparison with the use of standard Potassium 40. The evaluated method was processed and published as the CSN 75 7613.

From point of view of samples collecting, the irreplaceable role of water management radiological laboratories of river basin administrators (Povodí, s.e.) has been proved. The fast screening measurements for determination of samples contamination with special focus on drinking water resources and water supplied to the public water supply networks proved to be also very important.

### **Accuracy Classification for Existing Delimitation of Flood Plain Areas in the Czech Republic and Implementation of the Results in Delimitation Methodology**

*Project manager:* Ing. Hana Nováková, Ph.D., et al.  
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*Duration:* 2010–2014

*The main objective of the project is to carry out a comparison study on the accuracy of delimitation of flood plain areas in selected reference locations (watercourse sections), which are specific in terms of various parameters – morphology of the area, the type of land-use (the characteristics of the surface of landscape, vegetation, urban areas), hydrological and other parameters, affecting the accuracy of the results of hydrodynamic modeling, and subsequent delimitation of the flood plain areas. The project will compare the existing delimitation of these areas specified with the use of available vertical surveying technologies of varying accuracy (photogrammetry, geodetic surveys, vertical surveying ZABAGED<sup>®</sup>) with the results of a new hydrodynamic modeling (1D or 2D), and delimitation of flood plain areas using new elevation data for the territory of the Czech Republic acquired by aerial laser scanning, launched at the end of 2009. Conclusions from the results of the comparison for the reference sites will be used to develop a classification method for the flood plain areas delimitation accuracy. The classification method will be a suitable additional tool for decisions on priorities of new delimitation of flood plain areas. Subsequently, the method will be used for the development of a methodology for delimitation of flood plain areas according to the requirements on inputs, hydraulic aspects of mathematical modeling, and outputs.*

Compilation of the Designing of the Floodplain Definition Methodology has been carried out in the last project year. The review of the related legislative rules, characteristics of input information, modelling data and description of the floodplain flow modelling method were included to the Methodology. There was a strong focus on defining the rules of flood curves interpretation in different cartographical bases and on Floodplain Studies output data and documentation.

The results were published in technical magazine and as a poster on international conference ESRI ArcGIS in Prague in the final stage of the project. The specialized maps of floodplains and their accuracy classification in the Czech Republic were created. Project results are available at [www.dibavod.cz](http://www.dibavod.cz).

### **Development of Methodological, Planning and Monitoring Measures for Solving of the Fragmentation of the River Continuity in the Czech Republic**

*Research team:* Mgr. Aleš Zbořil et al.

*Duration:* 2014–2016

*The project objective is to develop innovative approach for solution of fragmentation of the rivers, to obtain and verify relevant data and to build one central database cumulating all relevant data. The aim is to build central data storage and to propose the structure of the outputs that would be effectively used by professionals, scientists, civil service and general public. A system of monitoring of the realized fish-passes will be also designed and tested. A standardized methodology of functionality evaluation and long-term monitoring of fish-passes will be created. The project started in July 2014.*

For the database functionality, it is necessary to define the competence of management and the flow of data to suggest its structure and outputs to be useable for professionals, including reporting to the EU. This comprehensive approach is completely innovative in the Czech Republic, and probably in the EU. The data will be collected on migration barriers in rivers, small hydroelectric power plants, status of ichthyofauna, status of existing and prepared fish passes (FPs).

Different methods of FPs monitoring will be compared regarding effectivity and economy. The system of on-line monitoring of FPs will be developed. The system will use special probes. The result will be a standardized methodological approach for evaluation of the functionality and

monitoring of FPs. The system will be used in the preparation of future programs to support the construction of FPs. The project will include an analysis of the relevant legislation and proposals for amendments with respect to supporting the construction of FPs. The outcome will contribute to solving the problems of unblocking the river network to aquatic organisms, and thus improve the status of the environment in the Czech Republic.

## **Water Recreation – Bathing in Bathing Sites and Other Freshwater Bodies**

*Research team:* Ing. Tomáš Fojtík, Ing. Arnošt Kult, RNDr. Dana Baudišová  
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*Duration:* 2014–2015

*The project objective is to reevaluate the current status of the list of natural bathing places and bathing surface waters. The reevaluation will be carried out via Methodological Guidance of the Chief Hygienist for Identification of New Bathing Waters. The second output will be the set of specialized maps, which would be useable as a supporting document of the Methodological Guidance.*

In 2014, the project preparatory phase was carried out: the existing data were collected, evaluated and described. Subsequently, various analyzes were performed, implemented into the maps and evaluated. Test localities were selected for field survey and the communication with relevant authorities was established. Questionnaires for data collection were created before the bathing season. The questionnaires survey was conducted during the bathing season and selected localities were explored. The obtained data were processed and evaluated. The project was presented in Proceedings of the Vodárenská biologie 2015 conference (Water Supply Biology 2015).

## **Introduction of New Market-based Tools to Increase the Efficiency of the Surface Water Allocation**

*Research team:* Ing. Lenka Slavíková, Ph.D., prof. Ing. Jiřina Jílková, CSc., Ing. Ondřej Vojáček, Ph.D., Ing. Jan Slavík, Ph.D. (IREAS), Ing. Lubomír Petružela, CSc., Ing. Jiří Dlabal, Ing. Arnošt Kult (TGM WRI)  
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*Duration:* 2014–2015

*Project is aimed on the issue that the permission to withdraw surface water is currently free of charge (and therefore overused). It causes increasing ineffectiveness in water allocation. The emission of new permissions might be threatened; public water management is burdened with extra costs for the supply of water that is not used at the end. Project proposes introduction of the payment for permitted amount of water. The aim is to increase the efficiency of the allocation and to open the door for possible future permission transfers among water users.*

The database (MS Excel) of all surface water abstractions (mainly based on data acquired by TGM WRI from the Water Balance in accordance with Reg. No. 431/2001 Coll.) was built up in 2014. The data were structured by a river basin, years (a period of about 10 years) and water users. Data were adjusted so that disproportion between the allowed and actual abstraction can be subsequently evaluated.

This data file was analyzed using basic visualization and statistical methods so that extent of the gap (measure of the use of permit for surface water withdraw) can be unambiguously determined in each basin and each year. At the same time, the relationship among abstractions, payments and structure of the using of surface water was analyzed. The nationwide analysis of surface water abstractions was carried out.

The result is a data file in MS Excel format and a technical study Slavíková et al.: *Analýza odběrů povrchové vody v ČR v letech 2001–2013* (Analysis of surface water abstractions in the Czech Republic in the years 2001–2013), IREAS, Prague, 2013, 32 p.

## **Regulation of Public Services in Water Management with Emphasis on Drinking Water Supply and Sewerage Sector**

*Research team:* doc. Ing. Miroslav Hájek, Ph.D., Ing. Roman Sloup, Ph.D., prof. Ing. Luděk Šišák, CSc., Ing. Vilém Jarský, Ph.D. (CULS), Ing. Lubomír Petružela, CSc., Ing. Václav Šťastný, Ing. Arnošt Kult, Ing. Jiří Dlabal (TGM WRI, p.r.i.)  
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*Duration:* 2014–2015

*The two-year project monitors the regulation of services of general interest: the public drinking water supply and sewerage. It is based on the EU's approach, on the specifics of water management and regulation in national level. It focuses on the sub-regulatory principles, their interactions and complex operation in relation to economic and social efficiency of the public services and the innovation potential. Results will be used to improve management of the regulation institutions.*

Literature review of the approaches to regulation of services of general economic interest (SGEI) – water supply and sewerage in the EU and the Czech Republic was compiled in 2014; circuits, types of regulation and instruments factors affecting prices and the database containing information review.

Tools and all factors affecting pricing were analyzed and institutional framework, tools and efficiency factors affecting the price of water and sewerage in the country were designed. Other indirect and social ties of water and sewage criteria targets of regulation were analyzed.

Interim results of the project were presented at international conferences (“EMAN”, Rotterdam, March, 2014; “Pitná voda” (Drinking Water, Tábor, May 2014).

## **Updating of Water Resource Protection Zones**

*Project manager:* Ing. Viktor Levitus  
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*Duration:* 2014

*The project objective was to update the spatial data of water resource protection zones and protection zones of water supply reservoirs from provided documents.*

The update of relevant spatial and tabular data has been carried out. The update has been carried based on the e-mail complaints and other data sources (data of Forest Management Institute etc.). The data have been checked; the geometry and attribute components were adjusted where appropriate. The documents were compiled in .pdf format. The essential component of the project was the communication with representatives of water management authorities regarding the given topic.

## **Bathing Waters Reporting: Update of the List of Identified Bathing Waters**

*Project manager:* Ing. Tomáš Fojtík  
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*Duration:* 2014 (long-term activity)

*The project objective was the update of the List of identified bathing waters, gathering information on new sites for reporting to the EC and professional support of the preparation of reporting templates in accordance with Directive 2006/7/EC.*

The National Institute of Public Health supplied the coordinates of the sites suitable for bathing and a dataset of bathing waters was created. The dataset has been checked using spatial analysis and compared with current data. Questionnaires were developed to collect the programs of measures for each region and river basin administrators (Povodí, s.e.). The results of these questionnaires were compiled for each bathing area.

## **The Support of the Representation of the Czech Republic in Activities of the International Commission for the Protection of the Elbe River (ICPER)**

*Project managers:* Ing. Marie Kalinová, RNDr. Hana Prchalová, Ing. Pavel Balvín  
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*Duration:* long-term activity

*The aim of the project is to provide expert support for ICPER activities in certain fields, the preparation of documents and participation of the TGM WRI employees at the activities of the ICPER expert groups – in 2014 at the activities of expert group Surface Water, expert group Groundwater, ad-hoc group Management of Water Quantity. The employees of the other organizations (River Boards, s.e., CHMI etc.) participate also in activities of expert groups.*

The main task of the expert groups in 2014 was cooperation on preparation of the International Elbe River Basin Management Plan for 2016–2021 period, creation of materials for public participation and preparation of the next planning cycle. Specifically, the International Program of Measurements on the Elbe was updated. The common principles for dealing with lack of water were created. The data were exchanged: the information on methodologies of assessment of ecological status of surface water including the measures to decrease the loss of nutrients and methodologies of the evaluation of a status of groundwater.

## **The Support of the Participation of the Czech Republic in Activities of Permanent Committee Saxony and Permanent Committee Bavaria of the Czech-German Commission for Cross-Border Water**

*Project team:* Ing. Marie Kalinová, Ing. Věra Kladivová, Mgr. Pavel Eckhardt et al.  
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*Duration:* long-term activity

*The objective of the project is a long term provision of expert materials to Ministry of the Environment for cooperation on cross-border water and a support of activity of both the Permanent Committees. The issues are solved in Czech-German expert groups, alternatively in direct collaboration of Czech and German experts. Employees of TGM WRI, p.r.i., participate on preparation of expert materials for meetings of expert groups and superior bodies of this cooperation. The project activities are diverse: from conceptual and methodological documents to solving of specific problems of individual localities, e.g. protection of *Margaritifera margaritifera* and *Unio crassus*. The procedures of the Water Framework Directive are implemented on border waters. Employees of other organizations (Povodí, s.e., CHMI etc.) also participate in this activity.*

In 2014, the experts from TGM WRI participated in direct collaboration of Czech and German expert institutions on solution of the problems of cross-border water bodies, the quality of surface water and groundwater protection.

## **Support of the Reporting: ICPER, ICPDR and ICPO**

*Research team:* Ing. Tomáš Fojtík, Ing. Michael Jakš  
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*Duration:* 2014 (long-term activity)

*The project objective was preparation, construction and transmission into the bilateral agreed format of the data sets HPOINT and HSTRETCH of water bodies (surface water-type river) for the Czech-Austrian border. Another aim was preparation, construction and transmission in the ordered format of the data sets of ICPER and ICPO and their reporting.*

The support to international commissions was focused mainly on reporting to ICPER and ICPO. The exception was the corrections, update and sending the data files HPOINTS and HSTRECH for ICPDR. These two data sets were reprocessed during January and February 2014. The work on data set RWSEGGEOM started in March 2014. The provided data set of water bodies was updated fundamentally in the attribute part and minimally in the graphical part. These mentioned difficulties

have come to light during processing because it took quite some time to deliver guaranteed correct version of source data. Subsequently, the follow-up data sets and remaining data sets were constructed.

## **Report on Water Management in the Czech Republic – Comprehensive Preparation of Documents in the Field by the Ministry of the Environment**

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*Duration:* permanent activity

*The project objective is to collect, to analyze and publish the summary information on water in the Czech Republic based on projects of TGM WRI. The information is published in several forms according to the requirements of the Ministry of the Environment. In 2013, the project was thematically reduced and the main activity became the processing of comprehensive supporting documents for Report on status of water in the Czech Republic.*

In 2014, the relevant supporting documents for the Report on status of water in the Czech Republic (part Ministry of the Environment) were processed. The data were related to water management, the progress of produced and discharged pollution from point sources, the progress of pollution from non-point sources, the accidental pollution, the surface water quality and its development from 1990, the constructions for protection of water (overview of constructed and reconstructed communal/industrial waste water treatment plants in 2013) etc. In the end of 2014, the additional data for chapter 'Water' in Statistical Yearbook of Environment in the Czech Republic have been sent to CENIA agency.

## **Creation of the Report for the European Commission on Changes in General and Water Management Characteristics of Basins**

*Research team:* Ing. Petr Vyskoč, Ing. Pavel Richter, RNDr. Renata Filippi  
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*Duration:* 2014–2017

*The project objective is to provide expert support to the Ministry of the Environment of the Czech Republic in the exercise of state administration at processing the Report to European Commission (EC) on implementation of river basin plans in the Czech Republic including electronic sending of required data in 2016. Activities are based on recommendations of EC on processing of plans in the Czech Republic, on requirements specified in the working document WFD Reporting Guidance 2016 (EC, November 2014) and on requirements of the Commission for Planning in Water Resource Management in the Czech Republic.*

In 2014, the converter of delimitation of water bodies in the 1st and 2nd cycle of planning was created. The comparison of the evaluation of status of water bodies in 1st and 2nd cycle was carried out including the evaluation of chemical status of surface water bodies according to the directives 2013/39/EU and 2008/105/EC and statistical evaluation of the delimitation of water bodies and their status. The results were submitted to the contracting authority (Ministry of the Environment) and presented to Commission for Planning in Water Resource Management in the Czech Republic.

## **Reporting of Emissions into the Aquatic Environment**

*Research team:* Ing. Petr Vyskoč, Mgr. Silvie Semerádová, Ing. Jiří Dlabal  
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*Duration:* 2008–2017

*The objective of the multi-year project is to provide expert support to the Ministry of the Environment of the Czech Republic in exercising of state administration regarding the reporting to the EEA*

on emissions in water environment “Water emissions quality, WISE-1” that is a part of annual reporting on status of the environment (SoE). The objective of the report is obtaining the data on emission of substances into the water environment from point and non-point sources of pollution. The data are reported to EEA through the Central Data Repository EIONET.

In 2014, the evaluation of data on emissions into water was focused on point sources of pollution (the data on non-point sources are currently implemented in sub-basins plans and will be available for the reporting in 2015). Data on emissions from point sources were implemented after “fundamental data submitted by polluter to water management authority, the river basin administrator and authorized expert organization” according to paragraph 38 of Act N. 254/2001 Coll., the data registered in the list of discharged water sources for requirements of water balance according the Decree 431/2001 Col. and data of ownership and operation of water networks and sewage systems in register led by the Ministry of Agriculture according the Decree N. 428/2001 Coll. Data on discharges into water from the Integrated Register of Pollution were used for checking.

## **Water Balance, Audit and Evaluation in the Field of Water Quantity and Quality**

*Project manager:* Ing. Jiří Dlabal et al.  
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*Duration:* permanent activity

*The objective is to process the Summaries of water balance of main basins of the Czech Republic according to the paragraph 1 article 2 of the Decree of the Ministry of Agriculture N. 431/2001 Coll. on the content of water balance, the methodology of its creation and data for water balance.*

The following outputs were prepared:

- record of data on realized water abstractions and discharges submitted to Povodí, state enterprises according to Decree N. 431/2001 Coll. (updated data sets on abstractions and discharges for 2013 and data transformed for calculations in the form of database files etc,
- the checking balance calculations after the previous water balance or Methodological instruction of Ministry of Agriculture for processing the water balances of river basin districts,
- the summarized hydrological balance,
- the summarized water management balance (the amount of surface and groundwater).

## **Emissions and Their Impact on Water Environment**

*Project team:* Ing. Petr Vyskoč, RNDr. Hana Prchalová, Mgr. Pavel Rosendorf, Ing. Alena Kristová, Ing. Tomáš Mičaník, RNDr. Jitka Svobodová, Ing. Petr Tušil, Ph.D., MBA, Ing. Jiří Píček, Ing. Pavel Richter, RNDr. Renata Filippi, Mgr. Silvie Semerádová, Ing. Martin Durčák, Ing. Jaroslav Beneš (River Board Povodí Vltavy, s. e.)

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*Duration:* 2012–2014

*The objective of the project was creation of tools (methodology and relevant software) for assessment of impacts of emissions on status of water. Methodology and software allow for each of water bodies, where emergency not to meeting the objectives of water protection regarding the specific criterion exists, to quantify the share of individual pollution sources that cause the adverse status. Consequently, the information basis for the proposal of measures will be provided. The tools respect the specific properties of the substances and characteristics of their pathways to water (soil, rock environment). The project was supported by the Ministry of Agriculture of the Czech Republic in frame of the Program of Agriculture applied Research and Experimental Development “Complex Sustainable Systems in Agriculture 2012–2018” (project ID QJ1220346). The organizations participating in the project are TGM WRI, p.r.i., and River Board Povodí Vltavy, state enterprise.*

In the project last year, the methodology of evaluation of impact of emission on water environment was certified by the Ministry of Agriculture. The relevant software was completed. The methodology defines the procedures for evaluation of level of significance of contaminants

sources and path to the surface water. The procedures were created to be useable in whole territory of the Czech Republic and according to the Directive 2000/60/EC (Water Framework Directive) mainly in relevance with water management planning. The procedures are specific for individual substances and for individual paths of pollution. The methodology defines the principles for the evaluation of the impact of emissions, describes the individual steps of evaluation: identification of relevant polluting substances in a basin, analysis of pollution sources and paths and classification of significance of groups of pollution sources and paths for individual substances and water bodies. The procedures of the methodology were described in an expert journal (VTEI, 2014, vol. 56, n. 1, p. 2–7). The procedures were also presented to future users at a workshop. The methodology and software were used in preparation of plans for second cycle of water management planning in the Czech Republic.

### **Jointly Used Groundwater on the Czech-Saxony Border (GRACE)**

*Research team:* Ing. Marie Kalinová et al. (TGM, WRI, p.r.i.), Dr. Anna-Katharina Böhm (LfULG)  
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*Duration:* 2011–2015

*The project is supported by European Regional Development Fund via Program Objective 3 for support of cross-border activities between the Czech Republic and the Free State of Saxony, in which TGM WRI, p.r.i., is the lead partner and Sächsisches Landesamt für Umwelt, Landwirtschaft und Geologie (LfULG) in Dresden.*

*The Czech partner and the German partner as well use the groundwater resources in the areas of Hřensko–Křinice/Kirnitzsch and Petrovice–Lückendorf–Jonsdorf–Oybin for public water supply. The objective of the project is protection of water sources and identification of causations of dropping of groundwater levels in the two mentioned cross-border areas.*

In 2014, groundwater flow models, study on monitoring of springs abundance, study on age and mixing of groundwater, study on climate change impact on water in both areas and study on groundwater fauna were finished. Cooperation between Czech and German experts and public participation are the important parts of the work. Two meetings with public where the outputs of the project were presented were organized.

In 2014, common strategies of groundwater resources protection in both areas were prepared. These strategies will be discussed and finished by 31st March 2015. The project publicity and project outputs publishing are provided via web pages of the project (<http://www.gracecz.cz>).

### **The Projection of Water Use Sites for Drawing up of a Water Balance**

*Research team:* Ing. Jiří Dlabal, Ing. Jiří Pícek, Ing. Petr Vyskoč  
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*Duration:* April–November 2014

*The objective was to evaluate the localizations of structures on river network that are necessary as data inputs for drawing up of the surface water balance.*

The evaluation has been carried out regarding:

- The river structures have been newly localized on river network on a scale of 1 : 10 000 (structural model of river network: detailed classification) for processing of surface water balance (2012–2013).
- Several models of river network are generally used (DIBAVOD, CEVT, different versions).
- Czech Hydrometeorological Institute updated the delimitation of the hydrological catchments.



### **A safety assessment of the emergency infrastructure components – drinking water**

*Project managers:* Ing. Václav Šťastný, Ing. Jana Hubáčková, CSc., Ing. Lubomír Petružela, CSc.  
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*Duration:* 2010–2014

*Project is focused on solutions of main current and expected issues, threats and challenges of water supply sector. The main threats are associated with large-scale accidents caused by new pathogenic organisms and chemical contaminants or aging infrastructures, issues associated with climate change (floods or long-term droughts) resulting in the loss of freshwater resources and treatable water. To satisfy the growing demands for water as a result of the society's development is the challenge that is closely linked to the previously mentioned issues. The main project objective is the risk analysis of drinking water supply infrastructure of municipalities with regard to interdependence with other infrastructures and the possible synergistic and domino effects. The other part of the strategic goal is the proposal of general procedure how to reduce the risk of a significant reduction of operation of public water supply or interruption of water supply in the substitute and emergency water supply during emergency events (pollution accidents and natural disasters).*

The TGM WRI research team completed "The methodology for assessing the vulnerability of distribution systems and water accumulations". The necessary supporting documents were also processed (the methodological analytical table including its evaluation and model example of solution of the specific situation). The preliminary projects results have been presented at several conferences (including two specialized seminars). The project results have been also published in peer reviewed journals.

### **Research on the intensification of rural and small wastewater treatment plants by non-capital means**

*Project managers:* Ing. Václav Šťastný, Ing. Martina Beránková, Ing. Eva Mlejnská  
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*Duration:* 2011–2015

*The objective of the project is to show whether the utilization of biotechnological products can improve the status and the function of small wastewater treatment plants, both activated and extensive. The main objective of the project is then to develop optimum method for monitoring of the application of biotechnological products on wastewater treatment plants.*

Verification and development of optimum method was carried on standardized domestic wastewater treatment plant in the laboratory of TGM WRI and at rural extensive wastewater treatment plant in Kobylice village. Final verification was carried out at several rural wastewater treatment plants in Pardubice region. In 2014, the long-term observation of Kobylice wastewater treatment plant was finished. The research in 2014 was focused also on long-term status after finishing of the application of biotechnological product. The verification field measurements were carried out at wastewater treatment plants in Lhota pod Libčany and in Dolní Roveň villages. The final report and supporting documents for project outputs were processed. The project outputs are "Verification of using the biotechnology products of programme SEKOL on small domestic wastewater treatment plants via standardized procedure" and "Verification of using the biotechnology products of programme SEKOL on extensive domestic treatment plants". Interest in the implementation of these technological procedures was expressed by several organizations and owners of domestic wastewater treatment plants.

Two methodologies have been prepared: Šťastný, V. and Mlejnská, E. Methodological procedure for verification of the influence of biotechnological products on functionality of a wastewater treatment plant (certified methodology) and Šťastný, V., Beránková, M., Mlejnská, E.,

Marková, A., and Marek, V. The methodology of application of biotechnological products of the Sekol® program to achieve optimal results when used on small wastewater treatment plants (certified methodology). The certification authority is in both cases the Ministry of the Environment of the Czech Republic and the certification process will be finished by June 2015. Methodologies are designed for operators and owners of small and rural wastewater treatment plants institutions and organizations responsible for supervising the operation of wastewater treatment plants.

### **Final treatment pools used with low intensity**

*Project team:* Ing. Filip Wanner, Mgr. Ondřej Simon  
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*Duration:* 2012–2015

*The project is focused on potential of final treatment of wastewater from activating wastewater treatment plants (WWTP) in final treatment pools that are newly designed. The project is based on prototype WWTP Zbytiny for 500 Hab. Eq. The objective of the project is a quantification of processes that take place in final treatment pools under various conditions and optimization of the processes. Concurrently, the attention is focused also on potential of pools while the domestic WWTPs are used.*

The retention experiment was launched in 2014. The aim is to describe the effect of the accumulation of waste water on the overall treatment efficiency. The monitoring of influence of final treatment pools on overall treatment efficiency continued. The construction of the final treatment pools was finished at three domestic WWTPs. The pools were put into operation. The pool experiments continued in TGM WRI.

Many modifications and sizes of tanks and their effect on the overall treatment efficiency were tested. The prototype WWTP for 500 Hab. Eq. has been realized without being based on the experience from the Zbytiny locality.

### **Activity of the Testing laboratory for water management facilities in 2014**

*Research team:* Ing. Věra Jelínková, Ing. Martina Beránková, Vojtěch Mrázek  
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*Duration:* permanent activity (according to contract)

*The Testing laboratory for water management facilities is a part of the Testing laboratory of Technologies and Environmental Components in WRI TGM, p.r.i., which is accredited by the Czech Accreditation Institute under the number 1492. The Testing laboratory for water management facilities tests mainly treatment efficiency of domestic waste water treatment plants (WWTP) according to the ČSN EN 12566-3. Since 2014 it is possible to test treatment efficiency of domestic waste water treatment plants behind septic tank according to the ČSN EN 12566-6. We also do accredited tests of separators for light liquids (according to the ČSN EN 858-1) and grease separators (according to the ČSN EN 1825-1) in the Testing laboratory. It is also possible to test different water management installations according to customer's requirements in a non-accredited way.*

In 2014 two domestic WWTPs were tested by an accredited test procedure in the Testing laboratory. One tested WWTP which is used for waste water treatment on a boat was tested according to the standard MEPC.227(64). At the end of the year other WWTPs were delivered to the Testing laboratory. They will be tested according to the corresponding standards. During the year 2014 two separators for light liquids and a grease separator were tested.

### **Strategy for Protection against Negative Impacts of Floods and Erosion Phenomena by Nature-friendly Measures in the Czech Republic**

*Research team:* Mgr. Mark Rieder, Ing. Karel Drbal, Ph.D., et al.  
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*Duration:* 2014–2015

*The comprehensive project of infrastructural nature for universal long-term use will provide an evaluation of the entire territory of the Czech Republic regarding the society-wide benefits of financial and material parameters of the projects submitted by applicants for grant programs. Outcomes of the project will create a comprehensive strategy of the Ministry of the Environment addressing flood protection, diffuse pollution, water erosion and restoration of the water regime.*

Proposals of the systems of nature-friendly flood and erosion control in basins with the most urgently needed solutions to these issues are the project objectives. The project results will be available on the map portal to target groups of users. The systems of flood protection will be supplemented by elements of local protection and effective measures to protect the soil against erosion in order to adapt to the potential impacts of climate change. Documentation will be created to complement existing planning agendas in rural areas especially for sub-basin plans, projects of landscaping modifications, territorial systems of ecological stability, and regional plans of forest development and registration of agricultural land use.

Implementation of the project will be the major contribution towards achieving the objectives of the Water Framework Directive and fulfillment of tasks of relevant resolutions of the government of the Czech Republic.

### **The Expert Support for the Evaluation and Mitigation of Flood Risks**

*Research team:* Ing. Karel Drbal, Ph.D., Mgr. Pavla Štěpánková, Ph.D., et al.  
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*Duration:* 2007–2012

*The overall goal of the project is to design an effective procedure and suitable tools for the implementation process of the Directive of the European Parliament and the Council on the Assessment and Management of Flood Risks (2007/60/EC) in the legal environment and institutional framework of the Czech Republic.*

The project gradually reacts to the requirements of the Directive of the European Parliament and the Council on the Assessment and Management of Flood Risks (2007/60/EC) in relation to the relevant legal standards applicable in the Czech Republic. The methodological tools were prepared in the previous years for preliminary evaluation of flood risks in the Czech Republic including approaches how to cover the issues of flash floods in this process. In 2014, the expert support was provided and text was prepared for the Plan for flood risk management in international river basins in accordance with Decree N. 24/2011 Coll. The proposals of variants were developed for the issue of long-term financing of flood prevention and flood operative management as a public service on the basis of available analyzes and forecasts of the Czech Republic GDP growth. The contribution to parameterization of aims to the flood risk management on a national level for the current planning period was the evaluation of the possible effects of the application of certain requirements on protection. The evaluation was based on the analysis of the new characteristics data in the areas with a significant flood risk. Simultaneously, the cooperation was ensured at addressing the issues of connections of the Flood Directive and related directives and requirements of other ministries (the Ministry of Regional Development).

## **Analysis and Evaluation of Socio-economic Impact on the Development of Society in Areas Protected for Surface Water Accumulation**

*Project team:* Ing. Milena Forejtníková, Mgr. Jana Ošlejšková, Ing. Alžběta Petráňová, Mgr. Jiří Kroča  
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*Collaborating organization:* Masaryk University Brno, Faculty of Social Studies

*Duration:* 2014–2015

*The project objective is to create suitable tools that will provide the expert and objective basis for land use decisions. It will highlight various aspects, positive and negative impacts of further protection of area or construction of planned structures. The project will take into account the variability of a solution in a specific location by variability of requirements, including the possible energy recovery.*

The list of localities that are suitable for accumulation of surface water (regarding morphology, geology and hydrology) is a part of the document 'The general plan of protected areas for surface water storage'. The aim is to reduce the adverse effects of droughts. Detailed assessment of the socio-economic and societal impacts of the current limitations associated with such protection will be an important basis for decision-making at all levels of management.

The detailed analysis and impact assessment is carried out on existing reservoirs. The localities of various types (regarding the difficulty of solving social and economic relations associated with the construction and land use change) have been selected for this evaluation. Concrete impacts on the lives of citizens will emerge from the results of the questionnaires. Another part of the project focuses on the analysis and evaluation of the impacts of current constraints and planned measures in the areas under consideration for future surface water accumulation. A detailed analysis of social, economic and environmental impacts on the environment and residents takes place in selected locations. Specialists from the Faculty of Social Studies of the Masaryk University in Brno participate in the project to guarantee expertise in this respect.

Results of the analysis and relevant data of the evaluated areas as well as other findings which can be generalized will be processed to a methodology to determine the current and future impacts on the socio-economic relations. The project outcomes will be used mainly for land use planning at various levels.

## **Identification of Significant Areas with Cultural and Historical Values Threatened by Natural and Anthropogenic Stresses**

*Project team:* Ing. Milena Forejtníková, Ing. Miriam Dzuráková, Mgr. Igor Konvit, RNDr. Hana Mlejnková, Ph.D., Mgr. Jana Ošlejšková, Ing. František Pavlík, Ing. Miloš Rozkošný, Ph.D., Ing. Pavel Sedláček  
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*Collaborating organization:* National Heritage Institute, Prague

*Duration:* 2012–2015

*The objective is to evaluate the size of threat for selected categories of historical objects (Cultural Heritage Objects and UNESCO objects) and protected areas (urban monuments preservation areas, village heritage sites, archeological heritage sites and other heritage sites) by important natural, industrial and agriculture hazards in the Czech Republic using unified procedure.*

The categorization of historical objects is carried out according to the size of potential threat individually for each hazard. Consequently, the synthesis of all threats and comprehensive evaluation of objects and sites listed above will be processed. Special attention is paid to the Cultural Heritage Objects of global importance. The evaluation is processed based on spatial map analyses using the available databases, field surveys and process modeling. The results have been verified by comparison with findings of regional offices of the National Heritage Institute.

The project outputs will extend the integrated information system of National Heritage Institute by systematic findings in form of thematic databases. The set of specialized maps has been generated from these databases. The maps will show the size of potential threat to all observed historical objects by evaluated hazards: river floods, torrential rains, water and wind erosion,

landslides, atmospheric deposition, industrial activity and also threats to the objects bound to the water including changes of their diversity. Additional outcome is web map application that will present the results to the public interactively.

The methodology describing how to evaluate the selected potential threat to the other historical objects is an independent project output. The methodology also describes which documentation should be used preferentially and which procedures should be chosen. It is possible to use the methodology at the repeated (updated) evaluation of historical objects and its use will allow compare the size of threat in time and space. All the project activities are carried out in such manner that it will be possible to successfully complete all the planned project outputs in the last project year (2015).

## **Expert Support of the Czech Republic's Participation in the International Commission for the Danube River Protection**

*Project manager:* Ing. Stanislav Juráň, RNDr. Denisa Němejcová  
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*Duration:* 2014–2017

*The objectives of the project were aimed at supporting a wide variety of activities, resulting from the participation of the Czech Republic in the activities of the International Commission for the Protection of the Danube River (ICDRP) and its key expert groups. There are especially activities provided by Pressures and Measures Expert Groups (P&MEG), the Monitoring and Assessment Expert Group (MAEG) and the Task Group for Nutrients (NTG). The results and outcomes of the project are an important source for solutions of defined issues and facilitate the process of preparing the planning and meetings of the expert groups.*

The activities of ICDRP proceed from the planning process according to the legislative order of EU, which is the Water Framework Directive.

In 2014, the project activities were focused on to refining of the defined problems and significant pressures in the first Danube River Basin Management Plan (DRBMP). The changes were implemented in the proposal of second DRBMP in such way to be prepared for the public discussion. The expert groups prepared the current supporting documents. The documents allow to assess the state of water stress and to analyze the expected changes in the Danube River Basin. Corrective measures to achieve good water status in the Danube River and the Black Sea will be reconsidered using the model after refining the analysis and consideration of anticipated developments at the national level.

## **Cooperation with the Slovak Republic on Transboundary Waters**

*Project manager:* Ing. Stanislav Juráň  
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*Duration:* 2014–2017

*The main objective of the project is to support the activities of the Czech-Slovak Working Group for Water Protection, which works under the Czech-Slovak Commission for Transboundary Waters. The project has been based on protocols created at meetings of the Commission in accordance with focus activity of the Group. The permanent main activity is the evaluation of the results of surface water monitoring on transboundary watercourses according to the national regulations, assessment of the trends and the prevention to eliminate the deterioration of the water bodies' status and quality of transboundary water.*

In 2014, the project was focused on evaluation of the results of the monitoring in 2013 at the permanent monitoring sites on the important watercourses. The quality of transboundary waters was evaluated at selected monitoring sites in accordance with the agreed program. The monitoring at measuring sites is rotating on smaller watercourses. The changes of the water quality (selected parameters) in time were evaluated. The changes and trend diagrams characterize the results of the monitoring in the period of 2000–2013. Update of the List of water bodies that belong to the first and second zone of defined border waters was realized. In 2014, two common meetings of the Group WP

took place. The meetings were focused on the tasks that followed up from the meetings of the Commission and on preparation of the common monitoring in 2015.

## **Technical Tools to Identify Pollution**

*Research team:* Ing. Stanislav Juráň et al.  
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*Duration:* 2014–2015

*The project objective is creation of maps useable for decision-making of public and state administration in the field of corrective measures in reducing of the nutrients contamination of water in the catchment of the Mostišťe water reservoir. The results will provide an overview of the size of load from point and non-point sources of pollution in the catchment.*

In 2014, the project dealt with the monitoring of water quality from drainage systems in five parts of the catchment, collecting the data on erosive runoff and potential of emissions of eroded soil in watercourses. Measured values of total phosphorus were used in the assessment of atmospheric deposition. The total phosphorus was not monitored by the national network until 2012. Many data regarding the pollution from point sources were received by the field survey. The project is supported by the Technology Agency of the Czech Republic.

## **Cooperation with Austria on Transboundary Waters**

*Project manager:* RNDr. Hana Mlejnková, Ph.D.  
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*Duration:* 2014 (with a view to a long-term activity)

*The project is a part of the activities carried out within the framework of the long-term state administration support for the Ministry of the Environment and under the Treaty between the Czechoslovak Socialist Republic and Austria on Water Management Issues on Transboundary Waters of 1967. The activities ensured by the WRI TGM focus on monitoring of water quality in transboundary watercourses and solving the issues related to water pollution crossing the state border that are within the competence of an expert on water quality of the Czech-Austrian commission for border waters.*

In 2014, the activities given by the Protocol from the 22nd meeting of the Czech-Austria Commission for transboundary waters were carried out. Minister of the Environment approved the protocol on 8th May, 2014. The monitoring of water quality of important boundary watercourses was carried out according to the program of the monitoring of the Czech-Austria watercourses for 2014. The program of the monitoring for 2015 was proposed and approved. The water quality in boundary watercourses in 2013 was evaluated in the Report on results of monitoring of the Czech-Austria transboundary waters for 2013. The Report is a part of the approved Protocol. Important topics were the issue of waste water discharge from the Austrian chemical factory in Pernhofen in connection with the pollution of the Dyje River and formulation of opinion of the Czech partner on issuing the new permit of waste water discharge in 2015. On the basis of activities of the Dyje working group (established to address this issue) the Czech partner informed the dissenting opinion to the issuing the new permit of waste water discharge. The reason is that it can be assumed that it will jeopardize the achievement of good ecological status in the Dyje River on the Czech territory. Simultaneously, many measures to improve the water quality in the Dyje River have been proposed on both sides of the state border.

## **Monitoring of the Impact of the Dukovany Nuclear Power Plant on the Quality of Water in the Jihlava River**

*Project manager:* RNDr. Hana Mlejnková, Ph.D.  
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*Duration:* 2012–2014

*The programme of monitoring of the impact of the Dukovany Nuclear Power Plant (NPP) on water quality is focused on implementation of the inspecting long-term monitoring in the Jihlava River and in the Dalešice-Mohelno reservoir system in order to assess the impact of discharge of waste water from the Dukovany NPP on surface water quality. The monitoring is based on the contract with CEZ.*

The Dukovany Nuclear Power Plant is a part of the water management on the Jihlava River (the Dalešice, and Mohelno reservoirs and the Dalešice pumped-storage hydroelectric power plant). The waste waters from the Dukovany NPP are discharged via Skryjský creek to the Mohelno water reservoir; the water from the reservoir is then pumped into the Dalešice reservoir. The monitoring programme monitors the water quality in long term in this water reservoir system and the independent evaluation of the influence of the Dukovany NPP on surface water quality is ensured in such way. The monitoring continued at following monitoring sites: Jihlava-Vladislav, backwater of the Mohelno-Dalešice reservoir, the Mohelno-pumping station of the Dukovany NPP, Skryjský creek and Jihlava-Mohelno. The scope of the monitoring is based on request of the costumer (CEZ).

In 2014, the results of monitoring showed contamination of water in the Jihlava River at the inflow to the water management system (as in previous years). The increased concentrations of nitrates were found at all monitoring sites. Wastewaters contained organic compounds and tritium in concentrations that exceeded the limit. The impact of the Dukovany NPP on the Jihlava River was also showed by higher concentrations of salts, solutes and tritium. Values of other monitored parameters (including biological) remain almost unchanged below the energy system.

### **Inundated Cultural and Natural Heritage of Southern Moravia**

*Project manager:* RNDr. Hana Mlejnková, Ph.D.  
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*Duration:* 2013–2016

*The project is focused on changes induced by construction of big water reservoirs: it evaluates the changes in settlement, culture, land use, water structures and the natural environment. The project deals with the most important localities of river engineering in Southern Moravia: the Nové Mlýny water reservoirs system, the Vranov and Brno water reservoirs.*

In 2014, the project focused on processing the data obtained in 2013. Individual chapters were processed in form of partial presentations and presented to the wide spectrum of professional public at professional events Říční krajina 10 (River Landscape 10) and XXII. Mikulovské symposium (Mikulov Symposium) and published in the relevant proceedings. Four selected topics were published as papers in the Jižní Morava and Acta Pruhoniciana journals. Simultaneously, the map graphical and photographic documents were collected and digitalized. The project database, recent information and curiosities are available at the web page of the project: zatopene-dedictvi.eu.

### **Drying out of Streams during Climate Change: Prediction of Risk and Biological Indication of Drought Periods as New Methods for Water Resources and Landscape Management**

*Project team:* RNDr. Petr Pařil, Ph.D., doc. RNDr. Světlana Zahradková, Ph.D., RNDr. Denisa Němejcová, Mgr. Vít Syrovátka, Ph.D., RNDr. Jiří Kokeš, Mgr. Pavel Tremel, Mgr. Marek Polášek, Mgr. Libuše Opatřilová, RNDr. Yvonne Puchýřová, Mgr. Jiří Kroča  
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*Duration:* 2012–2015

*The objective of the project is to create a map of watercourses complete dry-out vulnerability. The map will be based on abiotic data. The retrospective method of complete dry-out events identification will be proposed. This bioindicator method will be based on taxonomic and functional analysis of macrozoobenthos. The analysis will include metrics quantifying the frequency and extent of dry-out. The model for creation of the vulnerability map will be validated using this method. The project outputs will allow identification of areas that are at most under risk and they will allow to effectively focusing the protection measures.*

In 2014, the sampling at test sites was carried out similarly as in previous years (in spring, in autumn and also during the summer dry-out). The development of the utility model of the device for

sampling of Invertebrates from bottom sediments was finished. The database of species traits was finished. The species traits are used together with the indicator species for the detection of dry-out periods. The new approaches to creation of the risk maps were tested: they are based on GIS layers (mainly hydrogeological) and combined with the occurrence of the indicator species. Consequently, the maps were cross-validated by the occurrence of the indicator species. The development of the hydrological model capable to express the development of the dry-out in the test catchments continued. The robustness of the model was tested on observed data. The results were presented at conferences and at national and international project seminars.

## **The Anaerobic Separator of Suspended Solids and Nutrients**

*Project team:* Ing. Hana Hudcová, Ing. Miloš Rozkošný, Ph.D.  
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*Duration:* 2012–2014

*The project objective is to develop and validate an economically feasible device, functioning on the principle of combination of mechanical and biological anaerobic treatment and other new physically-chemical methods to ensure compliance with increased requirements to remove nutrients (N and P) and suspended solids from waste water from buildings with large variation in seasonal waste water production and to support its implementation into the practice. The project leader is the company ASIO, s.r.o. (project managers Ing. Oldřich Pírek).*

The collaborating organizations are TGM WRI, p.r.i., Faculty of Civil Engineering of Brno University of Technology and the Projekty VODAM, s.r.o., firm.

The project deals with the current situation resulting from new legislation in recent years, especially the Government Decree No. 416/2010 Coll., by which the requirements for discharges of waste water by an infiltration were modified. Achieving these requirements is particularly challenging, where it is not possible or convenient to use aerobic biological treatment; an example is a building with large variation in pollution production or with seasonal operation. Strict requirements for infiltration have their reasons – low content of suspended solids due to clogging and removal of nitrogen from point of view of the groundwater quality. The reason to develop the device has been the increasingly strict requirements for discharges into receiving recipients with high water quality or insufficient water flow.

2014 was a last project year. The study on issues of pretreatment continued. The different types of final treatment of treated waste water (including hygienisation) were tested. The following methods were designed and tested in a pilot plant: anaerobic technology for pretreatment of wastewater and separation of suspended solids in anaerobic conditions, dosing system for next stage of treatment, sorption processes, catalytic oxidation, electrochemical methods and sanitation of wastewater.

The testing of new and innovated devices for water treatment was successfully completed (septic tanks, grease traps, vertical filters, sorption filters, dosing systems, disinfection units, ozone units). Many laboratory experiments focused on sorption, disinfection and ozonification of water were carried out. The project also focused on analysis of quality and contamination of waste material from wastewater treatment plants and its processing for use as a resource.

The public could to acquaint with the project results at national and international conferences and also at the seminars organized by ASIO, s.r.o., in collaboration with the Expert group for small wastewater treatment plants and separators (ČAO CzWA). The presentation of the project results was carried out (e.g. YouTube video 'Anasep'). The public presentation of research is focused on commercialization of the results (an innovated septic tank, a sorption unit, dosing systems, disinfection units etc.).

## **Development of Technologies for Road and Other Paved Areas Storm Water Runoff Cleaning**

*Project manager:* Ing. Miloš Rozkošný, Ph.D.  
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*Duration:* 2013–2015



*The project objective is to design, build and verify on 3-stage pilot plant the complex technology of treatment of storm water from the transport infrastructure and paved areas in industrial parks and add missing data for a design of a type of equipment. The partial project objective is to develop the halophilic biopreparation for microbial degradation of the petroleum products and fuel residues. The preparation will be focused on elimination of the contamination of storm waters in wetland wastewater treatment system. Other project objective is the design and realization of percolation device including the dimensional parameters. The novelty of the projects is in the variability of the final solution that will reflect the specific situation or requests of the user. Innovative is the definition of the scale of the intensification of treatment processes while maintaining the minimum cost of operation and maintenance.*

In 2014, the monitoring of storm water from the road network (Prague circle, D1, R35, local roads) and retention reservoirs at commercial and industrial parks continued. The monitoring was focused on water, sediments and biological material with focus on macrophytes and algae. The testing and further development of sampling devices (samplers) continued in 2014.

The other project activities were: the development of new bio-preparations (Dekonta), the issues of using the macrophytes for treatment of storm water (Czech University of Life Sciences) and testing of percolation and sorption filters, the determination of hydraulic characteristics of retention and percolation units and preparation of mathematical methods of the treatment plants that are included in project (TGM WRI and Brno University of Technology). The pretreatment units were prepared based on mathematical modeling (functional sample, pilot plant). The testing of the pilot artificial wetlands continued. The wetlands have vertical and horizontal flow for treatment of storm runoff water.

The public could acquaint with the project results at national and international conferences and workshops. The project results were published in the Transactions on Transport Science scientific journal (4, 2014).

## **Assessment of Agricultural Land in the Areas of Former Fishpond Systems with the Aim of Supporting Sustainable Management of Water and Soil Resources in the Czech Republic**

*Project team: Ing. Miloš Rozkošný, Ph.D., Ing. Miriam Dzuráková, Mgr. Igor Konvit et al.  
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*Duration: 2012–2015*

*The aim of the project supported by the Ministry of Agriculture is primarily an inventory of the areas of abandoned fishpond systems (water bodies), assessment of the present landscape land-use of these areas and the proposal of a possible change to the strengthening of the sustainable management of water and soil resources.*

The Palacký University Olomouc is a project coordinator (project manager is RNDr. Renata Pavelková-Chmelová, Ph.D.); other collaborating organizations are TGM WRI, Czech Technical University in Prague and Ecological Consulting, a.s.

In 2014, the project focused on field survey of selected areas with former fishponds and preparation of supporting documents for the case studies. The criteria of evaluation of using the areas of former fishponds have been tested. The areas were grouped according to similar properties (altitude, production sector, the predominant use of the area) using cluster analysis. The issues of the influence of the draining the ponds and catches on the quality of surface water were studied. Selected fishponds were monitored repeatedly. The project focused also on informing the public about the project results and the fish ponds and their function in landscape (presentations and conference contributions). Scientific papers and a monograph 'Historical ponds in the Czech Republic – Comparison of the current status with the status in the second half of the 19th century' were published. Information on project outputs, scientific papers and interactive map of the Czech Republic are available at:

<http://heis.vuv.cz/data/webmap/datovesady/projekty/HistorickeRybniky/default.asp>

## **Flood Education and Research Centre**

*Project team:* Mgr. Pavla Štěpánková, Ph.D., Ing. Hana Hudcová, Ing. Monika Skotalová, Mgr. Martin Caletka, Radka Funková, doc. Ing. Aleš Dráb, Ph.D. (Faculty of Civil Engineering, Brno University of Technology), Mgr. Ing. Jana Soukopová, Ph.D. (Faculty of Economics and Administration, Masaryk University, Brno)  
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*Duration:* June 2011–May 2014

*The project is financed by the Operational Programme on Education for Competitiveness, supervised by the Ministry of Education, Youth and Sports. This project is focused on the development and innovation of education and its link with the research and development activities to improve competitiveness of the CR.*

The Flood Education and Research Centre project is primarily focused on the transfer of knowledge from research experience to students of collaborating universities and staff of partner institutions in flood protection. The Masaryk University in Brno, the Technical University in Brno and TGM Water Research Institute, p.r.i., participate in the project. The knowledge is shared with students primarily by organised workshops, conferences, excursions, short-term attachments etc.

## **The Expert Support for the Mitigation of Flood Risks – Flood Hazards – Management of Flood Risks**

*Project team:* Mgr. Pavla Štěpánková, Ph.D., Mgr. Martin Caletka, Ing. Lukáš Smelík, doc. Ing. Aleš Dráb, Ph.D. (Faculty of Civil Engineering, Brno University of Technology), Ing. Lukáš Sýkora, Ing. Lucie Foltýnová (Pöyry Environment, a. s., Brno)  
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*Duration:* November 2013–August 2014

*The project is a public contract launched by the Ministry of the Environment. It is focused on expert support of the methodological preparedness for the 2014–2020 programming period.*

The project outputs are:

- update of the Methodology for creation of flood risk maps based on the requirements of reporting for EU and on experience from the completed mapping of the flood risk in the Czech Republic;
- the creation of supporting texts and thematic map layers of the Czech Republic for the central data storage for maps of flood risks and hazards according to the requirements of the reporting for the Flood Directive;
- the completion of commented outline including standardization minimum for the Documentations of the areas with a significant flood risk;
- the proposal of the content and the scope of the expert opinion of the expert guarantee to the final evaluation of the project supported from the “Environment” Operational Program;
- training for the relevant public in areas with a significant flood risk, including the proposal of training materials;
- compilation of a catalogue of flood protection measures with regard to the protection of cultural heritage.

The content of the project was discussed mainly at the Interdepartmental working group for the implementation of the Flood Directive in the Czech Republic. The project outputs will be used at the current and future cycle of flood risk mitigation plans and for presentation of the just completed stage of mapping of flood risks in the Czech Republic.

### **NAVARO – The development of early warning and rapid reaction tools in the area of surface water protection**

*Project managers:* RNDr. Přemysl Soldán, Ph.D., Ing. Martin Durčák, Mgr. David Chrastina, Ing. Jiří Šajer, Ing. Ivana Truxová  
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*Duration:* 2011–2014

*The project objective is the development of a certified methodology and a consequent manual describing the tools of rapid detection of pollution accidents and their causes, terrorist attacks or criminal activity with an impact on the quality of surface waters.*

In 2014, the project has been finished and the main output "Methodology of procedure of an emergency status declaration on watercourses" has been published. The methodology was certified by the Ministry of the Environment of the Czech Republic.

### **Documentation, passportization, archiving and conversion proposals of chimney reservoirs as an endangered group of industrial heritage sites in the Czech Republic**

*Project manager:* Ing. Robert Kořínek, Ph.D.  
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*Duration:* 2013–2015

*The main objective of the project is to get the data for protection, identification and presentation of one of the most endangered and very rare and unique monuments of industrial heritage – smokestacks with water reservoirs. The main outcome of the project is a technical book.*

In 2014, the second phase was conducted – locations of existing and already non-existing smoke stacks with reservoirs in the Czech Republic. For the nine remaining, still existing constructions a complete structural and historical survey on the spot (Přelouč, Prague-Vysočany, Prague-Ruzyně, Czechvítrol, Dvur Kralove nad Labem, Libčice nad Vltavou, Roudnice nad Labem, Pardubice, Sázava) was carried out. Furthermore, photographic documentation of these objects and update construction documentation was created. Archival research related to still existing and already non-existing factory chimneys was continued in government and corporate archives and in available literature. The final version of specialized maps of smoke stacks with water tanks was created and presentation of the achievements for professional and general public took place. A workshop was organized in October 2014.

### **Expert support to legislative regulations within the water management**

*Research team:* Ing. Petr Tušil, Ph.D., MBA, Ing. Martin Durčák, Ing. Tomáš Mičaník, Mgr. Pavla Štěpánková, Ph.D.  
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*Duration:* 2014–2017

*The project objective is to provide expert support to Department of Water Protection of the Ministry of the Environment of the Czech Republic in the creation and updating of legislative regulations in the context of water management. These include ensuring collaboration, preparation of expert opinions and comments of stakeholders and preparation of documents for the upgrade of selected pieces of legislation in the field of water management, including incorporating the requirements arising from incentives and notifications from the European Commission.*

In 2014, the project was focused on the preparation of documents for the amendment of legislative regulations in the field of water management. The supporting documents for the transposition of Directive 2013/39/EU of 12 August 2013 were prepared. The directive is amending the Directive 2000/60/EC and 2008/105/EC as regards priority substances in the field of water policy. Supporting documents have been developed to update these regulations:

- Government Regulation no. 61/2003 Coll., on indicators and values of permissible pollution of surface waters, details of the permit to discharge wastewater into surface water and sewerage systems and sensitive areas, as amended;
  - Decree no. 98/2011 Coll., on the assessment of the status of surface water bodies, the method of assessing the ecological potential of heavily modified and artificial bodies of surface water and essentials identification and assessment of surface waters;
  - Decree no. 24/2011 Coll., on river basin management plans and plans for flood risk management;
  - Decree no. 236/2002 Coll., on the manner and scope of the design and setting of floodplains.
- The project results in 2014 are primarily documents to update the above legislative documents.

## **Cooperation in transboundary waters with Poland**

*Project team:* Ing. Luděk Trdlica, RNDr. Jaroslava Procházková, Mgr. Pavel Eckhardt  
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*Duration:* 2006–2013

*The main objective of the project is to collect and provide requested water management fundamental data and information in the frame of the international activities and fulfillment of requests connected with issues of transboundary waters at Czech-Polish section on national borders. The important part is the preparation of basis documents for negotiations of representatives of Czech and Polish Republics.*

In 2014, the project has been divided in two subprojects:

In the frame of the subproject *Implementation of CD 2000/60/EC – Group WFD* the documents connected to geometrical harmonization of transboundary water bodies at the Czech-Polish border were handed over to Polish partners. The development of the International Oder River Basin Plan for 2nd planning cycle was coordinated with the managing group G1.

The subproject *Groundwaters in the area of Police Basin and Stěnava River* is focused on issues of transboundary groundwaters and surface waters in the following areas: Police nad Metují–Kudowa Zdrój, Krzeszów–Adršpach and in the upper and middle Stěnava River catchments. In 2014, two rounds of the common measurement of surface waters took place and the continual monitoring of water regime continued on groundwaters and surface waters. The daily measured data (flow rates and groundwater levels) were transmitted for the hydrological year. Two meetings of the joint group of experts (hydrologists and geologists from the Czech Republic and Poland) were organized for addressing issues of groundwater and surface water in the areas: Police nad Metují–Kudowa Zdrój, Krzeszów–Adršpach and in the upper and middle Stěnava River catchments.

## **Support to the participation of the Czech Republic in the activities of the International Commission for the Protection of the Odra River against Pollution**

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*Duration:* 2006–2013

*The objective of the project is to support the active participation of the Czech Republic (via TGM WRI) in the activities of International Commission for the Protection of the Odra River against Pollution (ICPO) and expert support for the activity of the Czech delegation in this commission. It includes the preparation of documentation for meetings of Czech parts of individual working groups and preparation of documentation for the meetings of heads of delegations and for the plenary meetings of ICPO.*

The project was divided in three subprojects:

In the frame of *Coordination of activities and works of individual subgroups by the managing group WFD-G1*, two meetings of group G1 were organized. The activities of subgroups GP, GM and GD were coordinated. The main focus during all meetings focused on the implementation of the second planning period in the international Odra River basin (IORB). Procedure for processing of update the Plan of IORB was agreed. The document "Terms of use and provision of data from data sources of ICPO" was created. The individual chapters of the proposal of the Plan of IORB were finished in order to submit the document at 17th plenary meeting of ICPO and published at internet platform of the Commission for consultations with the public.

In the frame of the *Support to the working subgroup Monitoring (GM)* two meetings were organized and the focus was on preparation of emissions list, discharge and leaks of all the priority polluting substances in accordance with paragraph 5.1 of CD 2008/105/EC. The harmonization of the geometry of the transboundary water bodies in cooperation for transboundary waters was carried out. Additional focus was on common procedure in case of different assessment of ecological status of transboundary water bodies. Common report on national methods of evaluation of ground water bodies' status in IORB was created. The workshop "Biological Quality Element: Macrophytes and Phytobenthos for purposes of assessing the ecological status of running waters" was organized in June.

In the frame of *The Support to activities of subgroup GP – Planning* amendment procedure on draft overview of the significant water management issues in IORB for the 2nd cycle planning was terminated. A consensus was reached on the issue of international harmonization of the characteristics of border and transboundary water bodies for the most border/transboundary water bodies after two meetings of experts from individual countries. The results of harmonization were implemented in text of the update of the Plan of IORB. The subgroup focused in 2014 on update of the Plan of IORB. The activities took place according the time schedule and effective cooperation with the secretary of ICPO and managing group G1 took place.

### **A comprehensive data base of actual emissions into the aquatic environment in the Czech Republic**

*Research team:* Ing. Alena Kristová et al.  
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*Duration:* 2014–2017

*The main objective of the project is effective access of data contained in the forms F\_VOD\_38\_4 reported in frame of the Integrated system of reporting obligations (ISPOP) particularly necessary for ensuring the professional activities of the Ministry of the Environment of the Czech Republic and state authorities.*

The data are sent annually in accordance with paragraph 4 § 38 of Act no. 254/2001 Coll., (Water act) as amended, which are transmitted by the polluter to the water authority, basin administrators and authorized professional body via the portal ISPOP in forms F\_VOD\_38\_4. These data are currently only source of such information. Portal ISPOP does not offer any feature that would allow bulk processing of data contained in the forms. The all data from these forms were processed in 2014 (sent until 31st March 2014). The database was then published at web pages of HEIS VUV. It is possible to work further with the data (selection according the specific conditions and display the data on a map).

### **Discover the secrets of science**

*Project managers:* Ing. Robert Korinek, Ph.D., Ing. Petr Tušil, Ph.D., MBA, et al.  
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*Duration:* 2014–2015

*The aim of the project is to strengthen the competitiveness of the territory through the development of human capital in science and research. Key activities include implementation of popularization activities in the field of science and technology, education of researchers in this field and implementation of science and research into teaching. To these activities Regional Centre of Science and Technology was created, which serves as a communication platform between scientists from institutions in the Moravian-Silesian Region and regional schools. The aim of this cooperation is to create three generations of scientists: senior experts, junior experts and interested in science and research.*

In 2014 the project started work on seven professional educational learning modules. In May and June in the Ostrava Branch, internship tours for elementary school students (those interested in science and research) was held. In the summer months, two summer schools for suburban camp took place at the Ostrava workplace. In September and October, four excursions for teachers of primary and secondary schools were realized. In November, the Ostrava branch held a three-day workshop titled Water and Water Management, which was also attended by experts from abroad – from Poland and Slovakia. At the end of the year the work on the modules was consulted with selected teachers who act as reviewers.

### **Possibilities of using information and resources of waste management data as a tool for identification and solution for unauthorized waste management**

*Research team:* Ing. Věra Hudáková, Ing. Dagmar Sirotková, Ing. Jana Zuberová, Ing. Světlá Pavlová, Ing. Eva Kajanová  
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*Duration:* 2012–5/2014

*The aim of the project was to process the information that can help with identification of unauthorized waste management. The project results can be used by members of governmental agencies and local authorities that might face the unauthorized waste management and its consequences in practice. The project results can be also useful for the waste management professionals.*

The certified methodology "The Methodology for Solutions of Unauthorized Waste Management" was finished in 2014. The proposals of procedures that would allow react on identified situation fast and in suitable way in case of suspicious waste management are described in the methodology. The methodology also summarizes the possibilities of using of available information and data resources for identification and solution of unauthorized waste management. The methodology also covers the descriptions of scenarios of unauthorized waste management and procedure of coordination of individual governmental bodies. Police of the Czech Republic, customs authorities and CEI (The Czech Environmental Inspectorate) have used previously prepared manuals. The manuals were finished in the end of 2013 and their titles are: "The Cross-border Transport of Waste" and "The Manual for Inclusion of Wastes in the Green List". The manuals are available in the electronic form on the website [www.ceho.cz](http://www.ceho.cz) in the folder SOLVED PROJECTS. The project was successfully finished and approved by the contracting authority.

### **The analysis of material flows of waste electrical equipment and possibilities of increase of their recycling and reuse**

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*Duration:* 2013–9/2014

*The project objective was a detailed analysis of material flows of waste electrical equipments from their origin to the final processing, the proposal of detailed inventory on material flows and proposal of calculation method for estimation of electrical waste formation in the next years.*

In 2014, the data obtained during 2013 were specified. "The Methodological guidance for calculation of weight of produced waste electrical and electronic equipments in the Czech Republic" was processed. The guidance includes the file for the calculation. The principle of verification of electrical waste formation was simplified thanks to the calculation described in the guidance. The same calculation formula is used by the other EU member states. Simultaneously, the supporting document for modification of inventory specifications by Decree no. 352/2005 Coll. was processed.

Many supporting documents were collected in the frame of the project. The documents specified the data on functionality of the electrical waste return system in the Czech Republic. All the topics specified in the project timetable were processed. The three times bigger amount of electrical waste than officially collected is formed in the Czech Republic. This finding corresponds to the conclusions of similar studies in Europe.

The flows of electrical waste that bypass the waste inventory system in the Czech Republic are still problematic. The study indicates a possible refinement of so far obtained data and possibilities of retreating of electrical waste flows from the illegal waste disposal.

### **Erosion washout: increased possibility of danger for population and water quality in connection with expected climate change**

*Project managers:* Mgr. Pavel Rosendorf, Ing. Martin Hanel, Ph.D., Ing. Jiří Pícek, doc. Dr. Ing. Tomáš Dostál (Czech Technical University in Prague)  
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*Duration:* 2012–2015

*Torrential precipitation accompanied by soil washout is a risk factor that threatens population, municipal infrastructure, even surface water resources and important recreation areas. The amount of torrential precipitation increases with climate change.*

*Future risks connected with these extreme events might influence important parts of the territory of the Czech Republic. The main objective of the project is to propose conceptual approaches for area assessment with regard to risks of erosion washout connected to expected climate change.*

In 2014, the project was focused on modeling of erosion hazard and sediment transport in connection with threat of settlements, critical infrastructure, selected water bodies and specific protected areas in current conditions. Simultaneously, characteristics were derived for regional changes in precipitation intensity in terms of the expected climate change and preparations began for modeling the impact of these changes on erosion risks in the Czech Republic with the consequent impact on settlements, water bodies and selected protected areas. Software tool was designed for visualization of results and possible proposals for systemic erosion control in critical areas. The testing was initiated in selected pilot catchments. Partial results were presented at several conferences and part of modeling results relating to changes in precipitation intensity was processed into a paper in a journal with impact factor.

### **The development of the system for automated monitoring of influence of water management structures on the environment using the technology of passive integrators TROVAN**

*Project manager:* Mgr. Libor Závorka  
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*Duration:* 2010–2014

*The main objective of the project is to create a new standardized system for automated monitoring of influence of water management structures on the environment using the technology of passive integrators. The mutual tuning of antennas, readers and used chip has very important role in the whole system.*

In 2014, the final stage of the project has focused on using the data and experience gained during the project to finalize the system for an automated monitoring of influence of water management structures on the environment. Emphasis was placed on the commercial viability and availability of the system for its potential users. Additionally, the data were collected in catchments where testing of modified versions of the system was previously conducted. The aim of this data collection was to obtain accurate information about the environmental and economic benefits of the system for its users. Final project outputs were processed into two utility models, prototype, methodology certified by the Ministry of the Environment and scientific paper in the international scientific journal *Biologia* (Závorka et al., 2014). The final version of the system is tuned on the basis of past project stages and it showed excellent properties when installed in a large or small watercourse. The system is therefore ready for widespread use. Thanks to certification of the methodology, the system is available for a wide range of users, has great potential utility and will be able to contribute to improving the monitoring of the environment in the Czech Republic.

## **Optimization of large wood structures for stream restoration and semi-natural stream regulation**

*Project managers:* Mgr. Pavel Kožený, Ing. Ondřej Motl, Ing. Ján Šepelák, Ing. Pavel Balvín, Mgr. Ondřej Simon  
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*Duration:* 2012–2015

*The aim of the project is to develop new technical solutions and methods for safe and effective application of large wood structures in stream restoration and semi-natural stream regulation. The project also deals with the management of woody debris in streams and its influence on water animals.*

In 2014, the testing of stability and functionality of the wooden structures continued at hydraulic model. The wooden structures are designed for insertion into watercourses. The influence of the structures on the flow direction and formation of new channel shapes was evaluated at flow rates from 30-day flood to 100-year flood. The transport of a wooden debris and resistance of structures to accumulate the debris were also tested. A separate experimental approach was set to determine the ideal ways of stabilizing models of trunks in the channel, including the weight of the load required. The changes in the number and distribution of important wooden debris objects were described at model localities on watercourses in the Šumava mountains and in the regions of Českomoravská vysočina and Litovelské Pomoraví. Results were analyzed with respect to the characteristic parameters of the stable and washed away pieces of woody debris. The work included an evaluation of the importance of woody debris for aquatic organisms. The analysis of the results confirmed the importance of wood as a habitat for communities of macrozoobenthos at sandy streams and generally channels with great mobility of bottom material.

## **The methods of optimization of the proposed measures in watersheds of reservoirs leading to effective decrease of their eutrophication**

*Project managers:* Mgr. Pavel Rosendorf, Ing. Libor Ansorge, Ing. Vlastimil Zahrádka (Ohře River Board, s. e.), doc. Dr. Ing. Tomáš Dostál (Czech Technical University in Prague)  
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*Duration:* 2012–2015

*One of important problems of status of water bodies according to Water Framework Directive (2000/60/EC) is nutrients loading in water reservoirs as it followed from approved District Water Management Plans for period 2010–2015. The most important nutrients are phosphorus and nitrogen. The issue expresses by eutrophication which is caused by increased nutrients loads in watercourses. In the end, the eutrophication may cause the changes of status of many water reservoirs. The project objective is to propose methodology and suitable technical tools for identification of such pollution sources that have the most negative impact on eutrophication of water reservoirs with regard to technical-economical possibilities and impacts of individual solutions.*

The project objective in 2014 was to finish the testing of methodology for evaluation of the influence of the pollution sources on the eutrophication in water reservoirs in the test catchment of the Stanovice reservoir and in the test catchment of the Nechranice reservoir and to prepare the methodology for certification. Because of the changes in methodology of determination of the different forms of phosphorus in the pilot area the testing of the methodology has been extended and methodology certification has been postponed to the beginning of 2015.

At the same time, a simulation model has been prepared that allows to apply procedures summarized in methodology in any territory and also allows to test proposals for measures with respect to their effectiveness in reducing eutrophication effective input of phosphorus into the river network and reducing its impact on the evaluated target reservoir. The data on different types of



measures to decrease of phosphorus input in waters have been collected. The economic costs of the measures were determined and their effectiveness has been estimated.

### **Effects of socio-economic changes in society on water consumption**

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*Duration:* 2014–2015

*The project objective is to implement the methods and tools for qualified assessment of the impact of social development on water consumption in current water management as a tool for projections of water demand based on the development of the main socio-economic indicators (the drivers) describing the state of the society. The methods and tools reflecting changes in the behavior and development of human society are not available. The introduction of these methods is important for the process of water management planning, which takes place in six-year cycles, and especially for the preparation of strategic and policy documents in the water management sector, sustainable development and environmental protection.*

In 2014, the analyses of available data on water use and state of the Czech society have been carried out. Relevant datasets were selected and methods for derivation of statistical models were selected. The models have to describe the dependence of water need on selected indicators describing the state of the society. The methodology for determining the water use based on indicators of drivers of water need was prepared at the end of the year.

### **Cost-appropriateness evaluation of ensuring a good status of water**

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*Duration:* 2014–2015

*The project aims to develop a cost-appropriateness evaluation of ensuring measures to achieve the environmental objectives. Cost-appropriateness will be processed in the form of the methodology. It will be based on the methodology of cost-benefit analysis (CBA) and will include a procedure for determining the benefits of measures, data sources (relevant for the Czech Republic) and guidance on the application of the provisions of Article 4 of Directive 2000/60/EC in the river basin management plans. TGM WRI collaborates on the project with Jan Evangelista Purkyně University, Ústí nad Labem (UJEP).*

In 2014, UJEP has carried out analyses of existing approaches to implementation of cost-appropriateness in EU countries. TGM WRI processed out the evaluation of potential benefits from improvement of water bodies status in connection with evaluation of their status that was carried out for 2<sup>nd</sup> cycle of water management planning. The outcome of the project activities in 2014 is the proposal of methodology of determination of cost-appropriateness. The methodology will be tested in 2015.

### **The analysis and solutions of the environmental risks of operation of small hydropower plants in connection with water organisms**

*Project team:* Ing. Jiří Musil, Ph.D., Ing. Tereza Barteková, Ing. Miroslav Barankiewicz (TGM WRI, p.r.i.) et al.  
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*Duration:* 2013–2014

*The project objective is the analysis of current risks connected with operation of small power plants in river network of the Czech Republic having regard to Council Regulation EC 2007/1001, which*

*establishes measures for regeneration of the population of European eel (*Anguilla anguilla*). The population of eel is importantly negatively influenced by hydropower. The proposal of measures leading to minimization of risks connected to the operation of small hydropower plants is the important part of the project. It is a part of a published methodology.*

The operation of small hydropower plants is one of the most important causes of population decline of European eel (*Anguilla anguilla*). This species ends its life cycle with catadromous (migration from fresh water to the sea) reproduction migration back to the sea. The turbines of hydropower plants cause mass wounding and mortality of the eels during this phase of their life cycle. This so-called turbine mortality is relevant for all water organisms. The project is focused on essential solution of these issues. The project aims are: 1) The determination of actual mortality of eel during the catadromous migration on meso-scale and large watercourse, 2) the study on behavioral aspects of eel while meeting with the obstacle to propose minimizing technical measures and 3) the creation of relevant methodology for the government administration.

## **Reporting on fish waters: update of delimitation**

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*Duration:* 2014

*The validity of Directive 78/659/EEC on the quality of fresh waters requesting protection or improvement in order to support fish life (codified in Directive 2006/44/EC) expired at the end of 2013. The issues of fish water are part of the Water Framework Directive 2000/60/ES. The aim of the project was to classify salmonid waters and cyprinid waters in the Czech Republic according the Directive.*

For the evaluation of the last period of Directive 78/659/EEC, we had 587 monitoring sites on 296 announced fishwater in the Czech Republic (from a total of 305 declared fish waters).

The permissible limits have not been met at 41 river sections of salmon and carp waters. Target levels in accordance with Directive 78/659/EEC are not met by 95% of assessed declared waters. These are mainly free ammonia, ammonium ions, BOD<sub>5</sub> and suspended solids.

Compliance with the limits of good ecological status of the WFD is in the end similar to the results of evaluation using the permissible limits at the fish water monitoring sites. All 340 of assessed monitoring sites have not fulfilled very good ecological status in the indicator ammonium ions and 210 monitoring sites have not fulfilled very good ecological status in BOD<sub>5</sub>.

The 142 outflow gauges does not comply with the limits for ammonia nitrogen according to the Government Regulation no. 61/2003 Coll. (On indicators and values of permissible pollution of surface waters, as amended). The 43 outflow gauges does not comply with the limits for BOD<sub>5</sub>. Target values in accordance with Directive 78/659/EEC are more stringent because of the method of calculation. Program to reduce pollution of surface waters suitable for life and reproduction of indigenous species of fish and other aquatic animals, which was declared by Government Regulation no. 169/2006 Coll., was evaluated.

## **Intercalibration for evaluation of biological components**

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*Duration:* 2014–2016

*The process of intercalibration is a complex and comprehensive set of general procedures and specific tasks arising from the requirements of the Water Framework Directive 2000/60/EC. The result is a comparison and subsequent harmonization of limits of ecological status for various biological quality components (macrozoobenthos, phytobenthos, macrophytes, phytoplankton and fish). These limits are harmonized between the Member States of the European Union divided into geographical intercalibration groups. The objective of the project is to provide professional support to intercalibration process.*

The activity in 2014 followed the previous results obtained in 2009–2013. The data sets have been prepared according to the requirements of coordinator of the intercalibration process Cross Geographical Intercalibration Group Large Rivers (X-GIG Large Rivers). The data sets have been used for intercalibration of methods of ecological status evaluation (macrozoobenthos, phytoplankton and fish) on big rivers.

The members of the research team participated at meetings of the intercalibration group and at the meeting of representatives of ECOSTAT member countries. ECOSTAT is a working group at EC for evaluation of ecological state.

### **Monitoring of catadromous migration of the European eel (*Anguilla anguilla*)**

*Project managers:* Ing. Jiří Musil, Ph.D., Ing. Tereza Vajglová, Ing. Miroslav Barankiewicz (TGM WRI, p.r.i.) et al.

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*Duration:* 2012–2014

*The goal of this radio-tracking telemetry project is to determine the migration success of European eel (*Anguilla anguilla*) within its native range of distribution concerning the territory of the Czech Republic.*

With regard to dramatic population decline of the European eel, every member state of EU had to prepare the Eel Management Plan (EMP) on the basis of the Council Regulation EC 1100/2007. This plan guarantees the free migration for at least 40% of the eel adult population with respect to population state before any negative human impacts had occurred. For the purpose of the EMP in the Czech Republic, used estimation models of eel migration success were based on the catch statistics and expert judgments since real, exact data are still missing. The actual migration success of the eel within its native area of distribution in the Czech Republic (Elbe and Oder rivers) was determined using the biotelemetry method.

### **Monitoring and nationwide mapping the species of European importance as a basis for finalizing the draft of Natura 2000 network in the Czech Republic**

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*Duration:* 2012–2015

*The project objective is monitoring and mapping of selected species of European importance on the specified territory for Natura 2000 in the Czech Republic according to the methodology by the Nature Conservation Agency of the Czech Republic for each species.*

Three species of water molluscs are monitored: Thick shelled river mussel (*Unio crassus*), Narrow-mouthed whorl snail (*Vertigo angustior*) and Ramshorn snail (*Anisus vorticulus*). The objective has been to search for new localities of their occurrence in Central Bohemia, South Bohemia, Hradec Králové Region, Pardubice Region and Vysočina Region. Species *Rhodeus sericeus amarus* and European weatherfish (*Misgurnus fossilis*) have been monitored in the whole territory of the Czech Republic. Monitoring is carried out as an annual in-depth ichthyological survey at selected localities with the occurrence of the species.

### **Processing of selected chapters of the Sub-basin Plan for Ohre (Eger), lower Labe (Elbe) and other tributaries of the Labe (period 2015–2021)**

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*Duration:* 2013–2014

*Project is focused on chapters specified by the client for Sub-basin Plan for the Ohre River, the lower Labe and other tributaries of the Labe River in frame of preparation of the 2nd cycle of River basin plans.*

In 2014, the texts have been completed and the supporting data and the outputs were handed over to the client.

## **The study on improvement of water quality in the Vranov – Frainer Thaya/Vranovská Dyje**

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*Duration:* May–December 2014

*TGM WRI has prepared an input data for a mathematical model of water quality in the Vranov Reservoir watershed. The outputs provided by the model (priority list of the measures against eutrophication) help to implement a rational and effective decrease of phosphorus input into the Vranov Reservoir. The contracting authority was River Board Povodí Moravy, s.e., and main contractor was Pöyry Environment, a.s.*

Three activities have been carried out in field:

1) single monitoring of 21 waste water treatment plants that completed information on all plants that were not monitored in frame of additional monitoring, 2) single monitoring campaign in watershed of Myslůvka to identify the problematic spots that followed during the construction of the model and 3) continuous monitoring using automatic samplers at outlets of the Želetavka and the Dyje rivers (limnigraphic stations Vysočany and Podhradí nad Dyjí).

The additional monitoring has proposed for the refinement information on the emissions from large settlements, the key points of the watershed and three exclusively agricultural and one forestry micro-watersheds. The results of monitoring since the 2000 have been processed and evaluated. The measuring stations have been selected for the calibration of the model. Characteristic values of the stations (concentrations of phosphorus and nitrogen) have been determined. Characteristic values of areal loss of phosphorus have been determined too. Phosphorus and nitrogen retention algorithms were defined. Finally, a proposal has been drawn up to update the regular monitoring network.

## **Supervision of the application of aluminium salts to the Mšeno reservoir in order to limit the development of cyanobacteria during the bathing season 2014**

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*Duration:* May–December 2014

*The project objective was hydrobiological supervision of potential application of aluminium salts to Mšeno reservoir during bathing season 2014. The project was divided into four stages: continuous assessment of the situation in the Mšeno reservoir and the determination of the optimum period for application of aluminium salts, the determination of the dose and mode of application the aluminium salts, co-ordination and supervision of the application and the monitoring, and report on the evaluation of the bathing season and the application of aluminium salts. The client was the city of Jablonec nad Nisou.*

Hygienic limits (number of cells of cyanobacteria, chlorophyll) were not exceeded in Mšeno reservoir during bathing season 2014. Consequently, the application of the PAX salts was not needed. However, the need to improve the knowledge of zooplankton communities (key mediator of phosphorus input concentrations and the resultant succession of phytoplankton) followed from the evaluation of water quality. Data were provided by the Institute of Public Health of Ústí nad Labem and the Regional Hygiene station of Liberec. Consequently, the water was sampled in the reservoir and in its tributaries in order to define the management priorities. The results revealed an urgent need for detailed knowledge of ichthyofauna and its influence on water quality through the zooplankton communities. The rest of the results, conclusions and details are listed in the final report. It will be discussed with stakeholders to determine the optimal management in the reservoir in 2015.