SOILS2SEA DELIVERABLE NO. 1.2

BONUS
SCIENCE FOR A BETTER FUTURE OF THE BALTIC SEA REGION

# Requirements Report

SOILS2SEA

Reducing nutrient loadings from agricultural soils to the Baltic Sea via groundwater and streams

## 3.3 Kocinka

### 3.3.1 Description

The Kocinka catchment (surface area of 257.8 km$^2$) is located in the south of Poland (Figures 3-5 and 3-6) in the Oder river catchment. The 40.2 km long Kocinka river discharges to the Liswarta river. The catchment is covered by 1 - 33 m thick Quaternary deposits (Paczyński, Sadurski, 2007) of fluvio-glacial and aeolian origin underlain by the Upper Jurasic limestones (Fig. 3-7). The Jurassic strata contain one of the largest groundwater bodies in Poland – the Major Groundwater Basin 326 (MGWB-326). Dominant soils are mainly sandy and clay soils (Figure 3-9). The topography is slightly undulating with elevations varying between 185 to 317 m a.s.l (Figure 3-10). The climate is temperate with an average annual precipitation of 600-700 mm/yr and average air temperatures between 7.5 to 8°C. The average discharge and the baseflow discharge at the gauging station (Figure 3-6) were 218 mm/yr and 158 mm/yr, respectively for the period 1974 - 1983. The catchment is mostly agricultural with pine forests dominating in the lower reach (Figures 3-9 and 3-11).

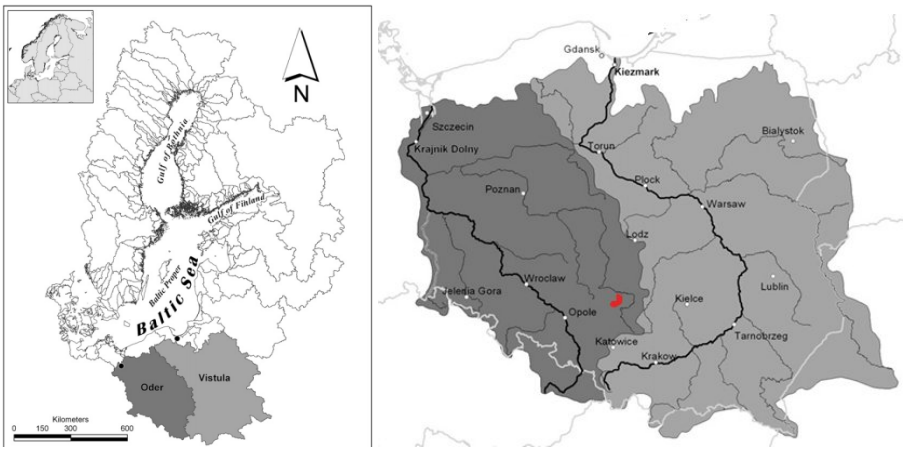


*Figure 3-5 The Kocinka catchment (in red) in Poland and in the Oder river catchment.*

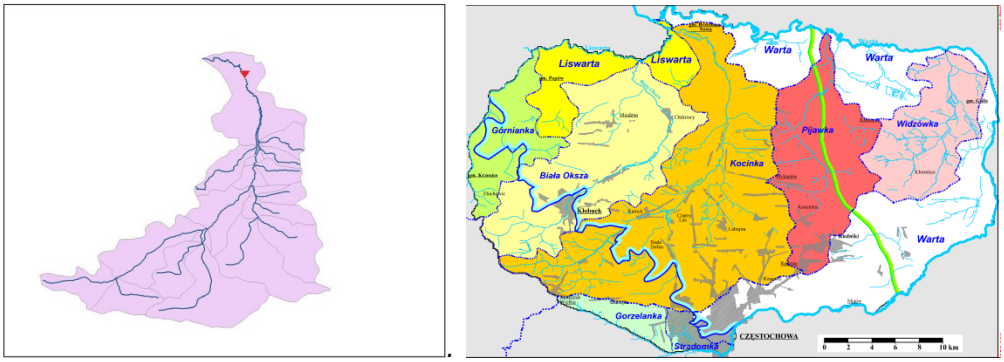


*Figure 3-6 River network of the Kocinka and the neighbouring catchments. Location of the gauging station marked by the red triangle.*

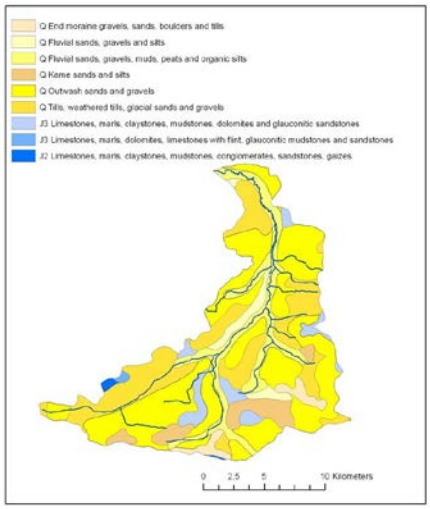


*Figure 3-7 Geological map*

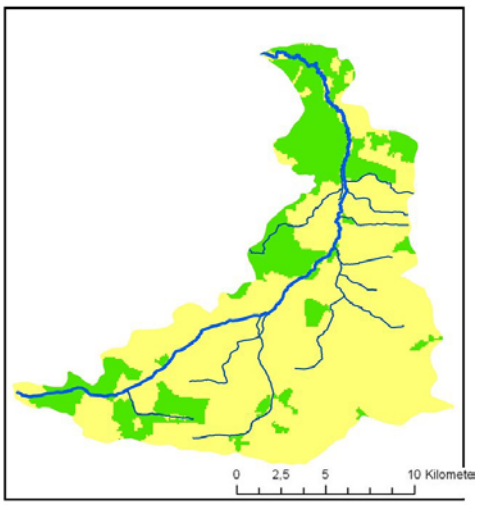


*Figure 3-8 Simplified land-use map. Green colour denotes forests, yellow colour – other land-uses*

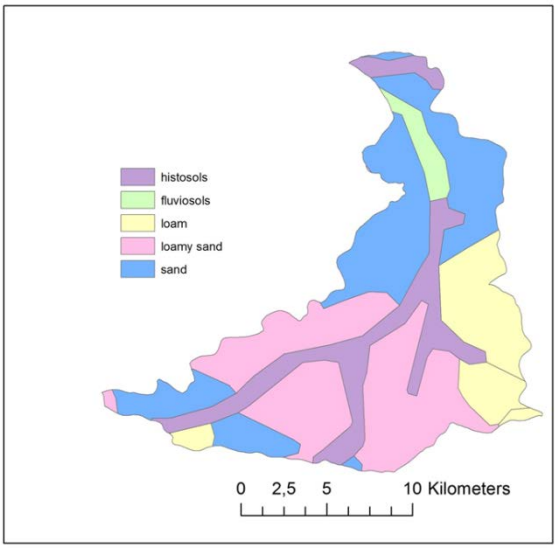


*Figure 3-9 Soils of the Kocinka catchment.*

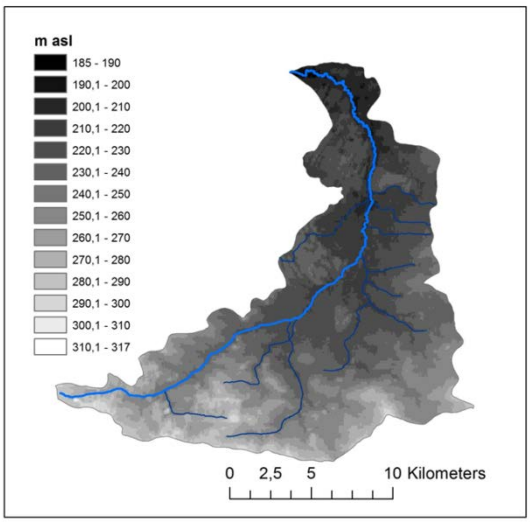


*Figure 3-10 Relief of the Kocinka catchment.*

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*Figure 3-11. Regulated stretch of the Kocinka and the riparian forest in the lower part of the river.*

### 3.3.2 Data availability and previous studies

Data availability for the area is generally poor, except for the data available at the regional and national levels.

- *Climate data*. Institute of Meteorology and Water Management - National Research Institute (*Instytut Meteorologii i Gospodarki Wodnej - Państwowy Instytut Badawczy,* IMGW-PIB), Kraków Branch is responsible for monitoring at the Hydro-Meteorological Station in Częstochowa at the southern border of the catchment.
- *Discharge data*. Daily values exist for the only gauging station shown in Figure 3-5 for the period between 1974 and 1991. Monitoring was performed by the IMGW-PIB.
- *Geological data*. Polish Geological Institute - National Research Institute (*Państwowy Instytut Geologiczny – Państwowy Instytut Badawczy*, PIG-PIB) manages basic multisheet serial maps covering the whole country in the scale of 1: 50 000:

Detailed Geological Map of Poland, Hydrogeological Map of Poland and Geological Economical Map of Poland compiled with the use of the digital GIS technology.

- *Soil data.* Maps of land cover - Corine Land Cover (CLC) are available from the Chief Inspectorate of Environmental Protection (*Główny Inspektorat Ochrony Środowiska,* GIOŚ), soil maps are available from the Institute of Soil Science and Plant Cultivation in Puławy (IUNG-PIB). Analyses of soil parameters are performed by the Regional Chemical-Agricultural Station in Gliwice (*Okręgowa Stacja Chemiczno-Rolnicza* ,OSChR).
- *Land use and agricultural practice.* Information on crops and fertilizer application at field scale is prepared by Agricultural Advisory Boards in Częstochowa, Kłobuck and Pajęczno (*Powiatowy Zespół Doradztwa Rolniczego* - PZDR) and Central Statistical Office (*Główny Urząd Statystyczny* - GUS). Land use information available from CORINE will be refined by field observations.
- *Topography*. Digital Terrain Model – DTM from the IMGW-PIB.
- *River network geometry.* The river network geometry is built into the Digital Terrain Model – DTM and a map of the river network is prepared by IMGW-PIB.

In addition, many data were collected in research and monitoring projects on the MGWB-326. The most relevant for Soils2Sea are:

- Groundwater numerical model of groundwater flow and contaminant transport in VISUAL MODFLOW and data from 30 years of environmental tracer observations (Zuber et al., 2011).
- Groundwater quality and quantity monitoring is performed by Polish Geological Institute and by the Chief Inspectorate of Environmental Protection. Three hydrogeological stations belonging to this network (Kazimierski, 2012) are located in the case study area: spring in Wierzchowisko and two water supply wells (station number II/1346/1 in Częstochowa and station number II/951/1 in Cykarzewo).
- A detailed study on the Quaternary aquifer in the upper Liswarta river catchment adjacent to the Kocinka was performed between 2001 to 2003 (Guzik, 2009).

### 3.3.3 Water management issues

The main water management issue is in this case reduction of nutrient loads associated with agricultural and wastewater effluents that threaten water quality in:

- the Kocinka river and its tributaries,
- the MGWB-326 aquifer underlying the Kocinka catchment.

Interaction between the groundwater and surface waters is probably bidirectional as the upwelling groundwater may discharge into the river. The aquifer contains one of the largest groundwater bodies in Poland which supplies good quality drinking water to the inhabitants of the area. The unconfined, karstic fissured aquifer is vulnerable to pollution. Nitrate levels exceeding 50 mg/l have already been detected in the southern part of the groundwater body and water extracted from the polluted wells is subjected to denitrifying treatment. Two plausible sources of this pollution are: (i) inadequate sewage management in the town of Częstochowa and in the municipalities of the catchment and/or (ii) agricultural activities. In addition, the Kocinka river is popular for trout fishery.

The key stakeholders in the area interested in the reduction of nutrient loads to the aquifer, to the Kocinka river and to the Baltic Sea are:

- *Częstochowa Regional Association of Municipalities for Water and Sewage System (Związek Komunalny Gmin d/s Wodociągów i Kanalizacji w Częstochowie).* Ten municipalities forming this association have a common network of drinking water supply, sewage disposal and wastewater treatment. The association creates a strategy for the development of this network and supervises the integrated system of management and protection of the groundwater resources in the area (Malina et al., 2007).
- *Water and Sewage System Company of the Częstochowa District - Joint Stock Company (Przedsiębiorstwo Wodociągów i Kanalizacji Okręgu Częstochowskiego Spółka Akcyjna w Częstochowie* - http://www.pwik.czest.pl/en*)*. This enterprise provides drinking water and is responsible for the management of wastewater on the area of the ten municipalities forming the Association.
- *„WARTA" S.A. w Częstochowie* is the sewage plant of Częstochowa for the Warta river (http://www.wartasa.eu/news)*.Authorities*.
    - *Municipality of Mykanów (Gmina Mykanów – www.mykanow.pl) and three other municipalities of the catchment.* The municipalities are responsible for preparation of the development plans that regulate activities affecting the environment, in particular the quality of surface water and groundwater. For instance, the municipality of *Kłobuck* installed a wastewater system in 2013 that directly affects the water quality in the Kocinka river (http://www.gminaklobuck.pl/samorzad/Opis_projektu.html).
    - *National Water Management Authority – KZGW (Krajowy Zarząd Gospodarki Wodnej – www.kzgw.gov.pl)* and *Regional Water Management Board (RZGW) in Poznań* are responsible for implementation of the WFD in Poland and in the Warta river catchment, respectively.
    - *Institute of Meteorology and Water Resources Management – IMGW (Instytut Meteorologii i Gospodarki Wodnej – www.imgw.pl)* is responsible for carrying out hydrological and meteorological measurements and observations, their collection, analysis, processing and dissemination, as well as assessing the water resources quality. The IMGW cooperates with and supports the public sector and offers various services and expertises in the field of meteorology and hydrology.
    - *Chief Inspectorate of Environmental Protection – GIOS (Główny Inspektor Ochrony Środowiska - www.gios.gov.pl)* and its regional branch *WIOS* are responsible for monitoring of the surface water and groundwater quality and for inventorying of point sources of pollution.
- *Industries*.
    - *SD Huta Czestochowa Sp. z o.o*. is one of the largest steel producing companies in Poland (http://huta.isd-poland.com/in-english).
    - The *Koksownia Częstochowa Nowa* is a leading manufacturer of coke in Poland (http://www.koksownianowa.pl/).
    - *Guardian Częstochowa* is a glass plant that belongs to an American company (http://guardian-czestochowa.com/index.php?Lang=en).

  - There are also several automotive components suppliers, e. g. *TRW Automotive* (security systems), *CSF Poland* (cables, anti-vibration systems and seals), *Brembo* (brake system components) *or CGR Polska.*
- *Mykanów Circle of the Polish Angling Association – PZW (Polski Związek Wędkarski - http://www.pzwmykanow.zafriko.pl)* supervises the Kocinka fishery.
- *Razem na wyżyny* is a local action group (LAG) of the European Union LEADER project. A regional development strategy is developed to enhance the quality of life in the region. The LAG already held an environmental workshop, however environment in general is not a main focus of their work http://www.razemnawyzyny.pl/index.php?option=com_content&view=article&id=90&Itemid=100.
- Green organizations. There is a regional branch of the Polski Klub Ekologiczny (Friends of the Earth Poland) in Gliwice (http://www.pkegliwice.pl/kontakt/onas.html).
- Farmers. The Polish Union of Farmers and Farmers Associations (KZRKIOR) has a regional branch in Czestochowa (http://kolkarolnicze.eu/O-nas/Struktura-KZRKiOR/Regionalny-ZRKiOR-Czestochowa).

### 3.3.4 Case study focus

Work performed in this case site will address the following issues:

- identification of nutrient pollution sources,
- characterization of spatial and temporal variations of nutrient levels and fluxes in the Kocinka,
- retention of nutrients in the river.
- interactions between groundwater and surface water in the catchment with respect to the fluxes of nutrients exchanged between these two compartments and exported from the catchment,
- time lags in responses of river water quality to the measures undertaken with respect to agricultural activities and land-use (Kania and Witczak, 2009; Witczak, 2011).

The Kocinka catchment is fairly representative for Poland with respect to soil types, land-use and agricultural practices. Results of work performed in this case study will therefore be important for the development and testing of the differentiated regulations concept in Poland. The Kocinka case study will contribute to the fulfilment of Soils2Sea objectives related to WPs 2-4 and 6 particularly to:

- analysis of effects of current and future land-use and agricultural practices on nutrient loadings to groundwater and surface water,
- characterization on nutrient retention processes in the subsurface,
- characterization of groundwater – surface water interactions and of their role in nutrient retention,
- formulation of the new governance concepts relevant to Polish conditions.

### 3.3.5 Planned field and modelling studies

The Kocinka case will be studied in connection with the following Soils2Sea tasks:

- Tasks 2.2 and 2.3: data on nutrient losses will be collected for the Kocinka, modelling of nutrient losses under different scenarios will be performed.
- Task 3.5: observations and modelling of nutrient levels in groundwater in order to assess groundwater retention will be performed.
- Tasks 4.1 and 4.4: tracer experiments and observations of nutrient levels in the Kocinka in order to assess surface water retention will be performed.

### 3.3.6 Stakeholder's role in Soils2Sea

Unlike the Norsminde case study, stakeholders in Kocinka are not yet aware of problems related to N and P loadings – or are aware only to a certain extent. Furthermore, stakeholders are not yet engaged in preceding projects and therefore need to be approached from a different angle: 1) We need to build up a working relationship with stakeholders in the region in order to build social capital. 2) Stakeholders need to get to know the problems and challenges related to N and P loadings, where they come from and to what consequences this leads. 3) Stakeholders need to understand the facts related to 2) and then, 4) need to agree to it before they can become active and supportive stakeholders in the process. This process of "recruiting" stakeholders so that they become stakeholders in practice, i.e. interested and engaged, is not manageable within one workshop but needs a bit more time and communication. However, this process can start in parallel to the first workshop.

Like in Norsminde, two workshops are foreseen in Kocinka, in order to facilitate discussions with stakeholders. The first workshop is envisaged for November 2014:[1]

**Workshop in late 2014 on awareness raising and regulation**

- Participants: 8-10 stakeholders, maybe 50% farmers + representatives of green organisations and authorities/municipalities. In addition, experts and facilitators:
    - A key stakeholder seems to be the Water and Sewage System Company as they are directly interested in maintaining good water quality in the area and have means for that and the Municipality of Mykanów that is interested in maintaining agricultural development (fertilisation) on one hand and the quality of surface water and groundwater on the other. http://www.pwik.czest.pl/en
    - Częstochowa Regional Association of Municipalities for Water and Sewage System (Związek Komunalny Gmin d/s Wodociągów i Kanalizacji w Częstochowie)
    - Municipality of Mykanów (Gmina Mykanów – www.mykanow.pl) and three other municipalities of the catchment.
    - National Water Management Authority – KZGW (Krajowy Zarząd Gospodarki Wodnej – www.kzgw.gov.pl) and Regional Water Management Board (RZGW) in Poznań.

[1] In Poland, municipal elections are being held on 16 November 2014. The first workshop should preferably take place after that.

  - Institute of Meteorology and Water Resources Management – IMGW (Instytut Meteorologii i Gospodarki Wodnej – www.imgw.pl)
  - Chief Inspectorate *of Environmental Protection – GIOS (Główny Inspektor Ochrony Środowiska - www.gios.gov.pl)*
  - *Mykanów Circle of the Polish Angling Association – PZW (Polski Związek Wędkarski - http://www.pzwmykanow.zafriko.pl)*
- Output:
  - Raising stakeholders' awareness about the consequences of nutrient pollution for the surface water ecosystems and the Baltic Sea.
  - Stakeholders' views on monitoring concepts
  - Views on further process within Soils2Sea

The aim of the first workshop is to take aboard the stakeholders, to get them involved into the project, to pick them up and to take them along. To this end, the first series of workshops will use the Disney Method, a workshop method

- to depart from the usual way of thinking,
- to start group discussions, and
- to agree on action.

We propose to use this method combined with mind mapping (see chapter 8.2.2 for a detailed description of the workshop format).

A second workshop is planned for spring 2016. The aim of the second workshop is to present the policy options and to discuss them in depth. The World Café Method is very well suited to serve this end (see chapter 8.2.2 for a detailed description of the workshop format). Participants will be the same stakeholders that attended the first workshop so that the information circle is closed.

### 3.3.7 References

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