

# TACIS project

**Water Management in Lake  
Chudskoye Catchment**

# Organizations involved

- | Sponsor: EU (through EU Delegation in Moscow)
- | EU Contractor: Consortium Soil&Water/Halcrow/BCEOM
- | Local (official) partners: Neva-Ladoga Water Basin Administration and Pskov oblast administration
- | Other beneficiaries: large number of federal and oblast level state bodies
- | Cooperation with EU LIFE project and GEF/UNDP project
- | Subcontractors (several Russian companies in connection with pilot projects and delivery of equipment)

# Project objectives

- | To improve environmental management capabilities of the Russian regional and local environmental authorities in the Russian-Estonian cross-border region of the lake Chudskoe, the Narva River/Reservoir and their basin
- | To enhance institutional/technical capacity for cross-border co-operation and for effective response to the transboundary water quality problems within the water basin.

# Main activities

- | Review of the current regulatory and institutional situation in water management within the lake water basin
- | Ecological data collection and analysis
- | Assessment of the ecological state of the Lake Chudskoe Catchment
- | Preparation of Nutrient Reduction and Prevention Strategy
- | Preparation of Lake Chudskoe Water Basin Management Plan
- | Reviewing laboratory and monitoring capacities
- | Preparation of Monitoring Strategy for the Lake Chudskoe Catchment
- | Selection and implementation of two demonstration projects
- | Preparation and implementation of training and awareness raising plans
- | Building data management system
- | Dissemination of project results
- | Reporting and other administrative tasks

# Phased work

## **Work on the Management Plan was phased as prescribed in the Terms of Reference**

- | **Inventory and updating of data** (consideration of the results of the previous projects and studies, water management methodologies, a huge amount of ecological data was handled).
- | **Diagnostics** (To provide support of the Management Plan GIS database was developed; collected ecological, economical and social data were analysed).
- | **Preparation of Action Plan** (The Plan includes short-, medium- and long-term measures identified based on the results of Diagnostics. The measures are grouped in 11 target programmes covering the most important water management issues. Description of priority measures includes goals, specific measures to be undertaken to achieve set goals, and recommendations on obtaining funds from local or international sources).
- | **Publication of Water Management Plan** (publication of Water Management Plan, Atlas of maps).

# Structure of the Management Plan

## Introduction

1. Description of the Narva River and Lake Chudskoye catchment
2. Waterbodies exploitation
3. Anthropogenic impact on water systems
4. Waterbodies quality analysis
5. State management and protection of waterbodies
6. Programme of measures – Action Plan
7. Financing of the Action Plan
8. Conclusions and recommendations

# Brief conclusions on Diagnostics: Chapter 1

## Description of nature

- | The Narva River and Lake Chudskoye basin occupies 56 855 km<sup>2</sup> and is located within four countries: Russia (63%), Estonia (30%), Latvia (6%), and Byelorussia (less than 1%).
- | Natural factors account for abundance of surface waterbodies, ground and soil waters and high biodiversity in the basin (about 2000 plant species and 400 vertebrate animal species, a lot of protected species).
- | Wetlands occupy about 19% of the Russian side of the basin. The role of wetlands in natural processes and life of humans is extremely important and versatile, wetland ecosystems are particularly vulnerable. Thus to provide sustainable development of the entire watershed it is important to provide conservation of wetlands and their functions.

# Brief conclusions on Diagnostics: Chapter 1

## **Socio-economical situation**

- | Russian side of the basin is located within three oblasts of Russian Federation – Pskov (92%), Leningrad (7,8%) and Novgorod (0,3%) oblasts. Currently the population of the basin amounts to about 540 000. The demographic setting is negative (the death rate greatly exceeds the birth rate, reduction of average life expectancy).
- | Heavy industry is practically lacking in the basin (i.e., metallurgy, chemical production, heavy mechanical engineering), which is a favourable factor for the basin ecology; the basin features quite favourable environmental situation as compared to other regions of Russia. Food and light industries, machinery building are represented in the basin. Agriculture includes milk production, some commercial pig and poultry farming, vegetable-growing and flax growing).

# Brief conclusions on Diagnostics: Chapter 2

## Water resource exploitation

- | **Water consumption** – in past five years abrupt reduction of water consumption (surface and ground water) and waste water discharge rates occurs.
- | **Drinking water** – ground water in general complies with set standards except for Fe, B, Br. Drinking water quality issue is acute for Pskov - drinking water quality in the distribution network doesn't comply with the norms for free chlorine residual, odor, taste, turbidity, microbiological parameters, colour and iron. Currently 90% of the raw water intake is from river Velikaya.
- | **Drinking water treatment** – in Pskov there is a problem of discharge of waste water after drinking water treatment by adding aluminium sulphate. Process water discharges adversely affect the environmental status of the Velikaya River delta, around the point of discharge there is a “dead zone”, where the fauna appears to be mostly dead.

# Brief conclusions on Diagnostics: Chapter 2

## Water resource exploitation

- | **Water supply and sewage system** – water supply networks and water supply and sewage facilities require immediate rehabilitation, upgrading and major overhaul.
- | **Problem of leakages** – in fact, total process consumption and losses of water may amount to 50% of the total water consumption due to depreciation of the main production assets which ranges between 30 to 100%.
- | **Provision of water supply services (drinking water, hot water and central heating)** – provision of water supply services is poor in Novorzhev and Krasnogorodsk (less than 1/4 of the population is connected to water supply network). In rural areas (Strugokrasnensky, Pustoshkinsky, Novorzhevsky and Plussky districts) between 3-5% only of rural houses are connected to centralized water supply. This represents a major health risk, since unconnected houses obtain their water predominantly from private boreholes, often situated adjacent to unsewered toilet facilities, and therefore at great risk of contamination.

# Brief conclusions on Diagnostics: Chapter 2

## Water resource exploitation

- | **Waste water discharge** – in the past decade considerable reduction of waste water discharge has occurred in the basin. This is mainly explained by reduction of the number of industrial enterprises (by 2003 - by *110 mln. m<sup>3</sup> per annum*) only 50% of which are located in Pskov region. The portion of insufficiently treated waste water is rather large: untreated 25 % (i.e. no treatment provided at all due to lack or malfunction of WWTW), insufficiently treated 75%. 60% (280 ths.) of the population of the basin is sewerred.
- | **Sewage sludge** – sludge lagoon of Pskov WWTW contains 1200 th m<sup>3</sup> of sewage sludge (moisture content 98-99%) of the second hazard class. The lagoon is currently 100% full and requires reclamation.
- | **Storm sewage** – storm sewage network exists only in big cities, however treatment of sewage is not provided (not even in Pskov).

# Brief conclusions on Diagnostics: Chapter 3

## Point nutrient pollution sources

- | **Points of waste water discharge** – the greatest load for BOD<sub>5</sub>, nitrogen and phosphorus is provided by municipalities and largest enterprises of the City of Pskov, Ostrovsky, Gdovsky, Pechorsky, Bezhanitsky and Strugokrasnensky districts. The HELCOM standard requirements are met only by the WWTW of the village of Kryuki, and Ostrov WWTW (WWTW of Pskov and the village of Palkino will meet the standard after planned rehabilitation).
- | **Solid waste landfills** – the majority of solid waste landfills represent potential environmental pollution hazard. The following landfills should be closed: Pskovskaya, Novorzhevskaya, Krasnogorodskaya, OPOCHETSKAYA, Ostrovskaya, Pluskaya, Strugokrasneskaya.
- | **Mineral fertilizer storages**
- | **Mines** – oil-shale deposits in the town of Slantsi, phosphorite deposits in the town of Kingissepp, limestone, clay, sand and dolomite in Pskov region.
- | **Livestock farms** – 100% of pig farms and 80% of poultry farms and livestock complexes are pollution sources of surface, soil and ground waters.

# Brief conclusions on Diagnostics: Chapter 3

## **Diffuse nutrient pollution sources**

- | **Farming** – pollution load occurs due to natural and process nutrient leakages from agricultural lands and partly also due to nutrient leakage occurring as a result of erosion processes.
- | **Natural lands (forests, meadows and wetlands)** – the percentage of forest land area is 58%, of wetlands - 18% of the basin area. The outflow of nutrients from the forest area is 8-10 times less for nitrogen compounds and 2-3 times less for phosphorus compared to agricultural lands. Wetlands are capable of retaining moisture, retaining and transforming pollutants. Arrangement of forest protection stripes in the form of meadows and wetlands serve as a good example of preventing pollution of waterbodies.
- | **Atmosphere** – atmospheric air quality in the basin has not deteriorated in past years, mean annual concentrations of main substances – according to available data – comply with sanitary norms. The role of transboundary air pollution is particularly great.

# Brief conclusions on Diagnostics: Chapter 3

## Nutrient load to the Lake Complex

- I Lake Pskov-Chudskoye preserves positive dynamics of the trophic status shift both in southern and northern parts of the lakes' system.
- I Efforts should be made to undertake current water protection measures in Pskov region and Tartu province, Estonia including improvement of treatment quality of waste water discharged from industrial and housing and communal enterprises. As the load to Lake Pskov-Chudskoye eventually adds up to the load to the Gulf of Finland, HELCOM recommendations (standard requirements for nitrogen and phosphorus discharges) should be taken as reference for nutrient loading reduction.

Estimated phosphorus loading **TP** provided by the Russian side of the catchment, t/a

	Point source	Diffuse	Total
Model 1	66	791	857
Model 2	66	413	479
Model 3	473	422	895

The bulk of the phosphorus load to lake Pskovskoe is developed at the Russian side of the basin, the contribution of the Russian side to the phosphorus load of Lake Chudskoye is not much higher than that of the Estonian side. According to the data of satellite images the Russian side of Lake Chudskoye is as eutrophicated as the Estonian water area of the lake.

# Brief conclusions on Diagnostics: Chapter 4

- | Different lake and river water quality assessment methodologies were compared to identify advantages and disadvantages as applied for this basin
- | River water quality assessment was undertaken by IZV (Russian water quality pollution index) and by Estonian classification schemes.
- | Water quality assessment in Lake Pskov-Chudskoye was undertaken by IZV, Ukrainian, Estonian and Finnish classification schemes. In addition, water quality was assessed by hydrobiological parameters (phytoplankton, zooplankton, macrozoobenthos and fish communities).

# Brief conclusions on Diagnostics: Chapter 4

Site	Quality classes by the Estonian scheme	Quality classes by IZV
upstream of OPOCHKA, River Velikaya	I	III (Cu, phenols, COD, Fe, oil products)[AI]
downstream of OPOCHKA, River Velikaya	I	III (Cu, phenols, COD, Fe, oil products)
upstream of Ostrov, River Velikaya	II (NH <sub>4</sub> <sup>+</sup> )	III (phenols, COD, Cu, Mn, Fe, oil products)
downstream of Ostrov, River Velikaya	II (NH <sub>4</sub> <sup>+</sup> )	III (phenols, COD, Cu, Mn, oil products, Fe)
upstream of Pskov, River Velikaya	II (NH <sub>4</sub> <sup>+</sup> )	III (COD, Cu, Fe, Mn, oil products)
downstream of Pskov, River Velikaya	II (NH <sub>4</sub> <sup>+</sup> , TP)	IV (Cu, COD, BOD <sub>5</sub> , oil products, Fe)
the village of Osinkino, River Sorot*	II (NH <sub>4</sub> <sup>+</sup> )	III (Cu, Fe, COD, phenols, Mn, oil products)
the village of Ryabovo, River Synaya*	II (NH <sub>4</sub> <sup>+</sup> )	III (Cu, Fe, COD, phenols, Mn, oil products)
Pskov, River Cherekha*	II (NH <sub>4</sub> <sup>+</sup> )	III (phenols, Mn, Fe, Cu, COD)
upstream of Pechory, Piuza*	I	III (Cu, phenols, COD, Fe, NH <sub>4</sub> <sup>+</sup> , oil products, Mn)
downstream of Pechory, Piuza	I	III (Cu, phenols, Fe, COD, Mn, oil products)
upstream of Pitalovo, River Utroya*	II (NH <sub>4</sub> <sup>+</sup> )	IV (Cu, phenols, COD, Fe, oil products, Mn)
downstream of Pitalovo, River Utroya*	III (TP, NH <sub>4</sub> <sup>+</sup> )	IV (Cu, COD, Mn, phenols, Fe, oil products)
Gdov, River Gdovka	V (TP, NH <sub>4</sub> <sup>+</sup> )	IV (Fe, Cu, Mn, BOD <sub>5</sub> , oil products, phenols)
Pskov, River Pskova*	II (NH <sub>4</sub> <sup>+</sup> )	IV (Fe, Cu, phenols, Mn, COD, Pb,
the village of Yamm, River Zhelcha	I	IV (Fe, Cu, Mn, BOD <sub>5</sub> , oil products)

## Water quality assessment in rivers by Estonian and Russian (IZV) classification schemes

✓ Poor quality class identified by IZV is accounted for high concentrations (MPC excess) of substances included in the estimation equation, with no regard of their background origin (metals).  
 ✓ Estonian methodology gives a more realistic view of the lake's water quality as it considers nitrogen and phosphorus as main substances contributing to eutrophication

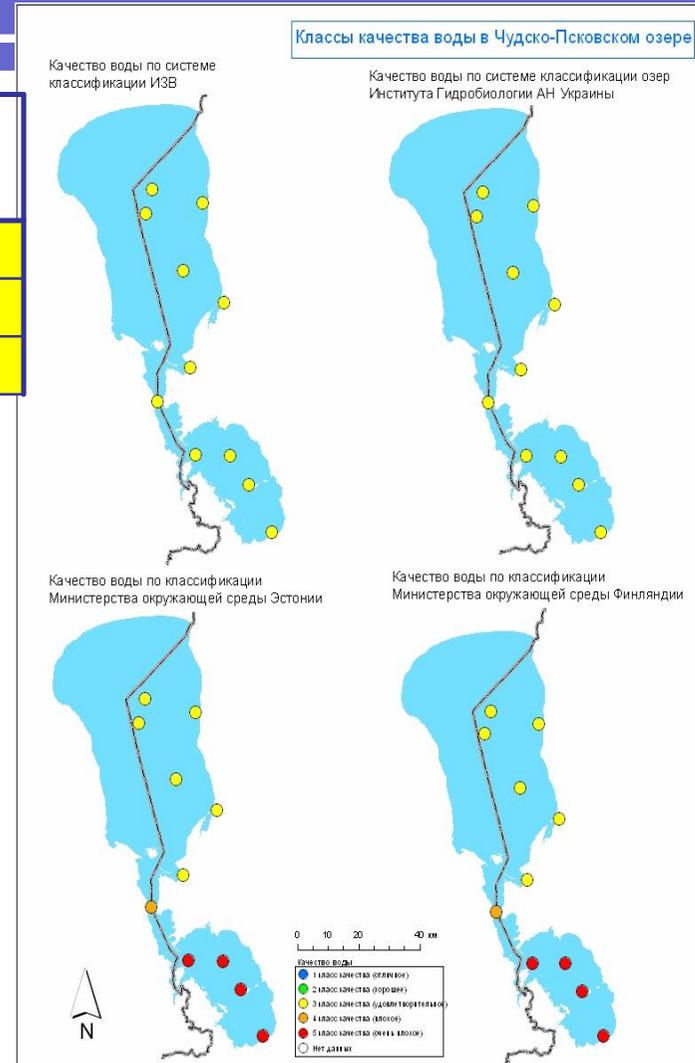
\* substances featuring MPC excess concentrations are given in brackets

# Brief conclusions on Diagnostics: Chapter 4

Lakes	IZV	Estonian classification scheme	Finnish classification scheme	Ukrainian classification scheme
Pskov	III	V (TP)	V (TP)	III
Teploye	III	IV (TP)	IV (TP)	III
Chudskoye	III	III	III	III

## Assessment of lake's water quality by four classification schemes

- ✓ Estonian and Finnish classification schemes give a more precise identification of obvious difference in the trophic status and quality of the lakes. Lake Pskov featuring natural high trophic status displays lower quality class as compared to Lake Chudskoye, Lake Teploye takes an interim position.
- ✓ However, despite a range of signs showing increase of trophic status and deterioration of water quality in Lake Pskov the assessment should consider environmental status indicators (hydrobiological parameters – status of phytoplankton, zooplankton, macrozoobenthos and fish communities) of all lakes constituting the Lake Pskov-Chudskoye system.



# Brief conclusions on Diagnostics: Chapter 4

## Subsoil water quality

- | Cases of serious and extremely serious subsoil water pollution in Pskov region were not identified (2000). The study area is characterized by quite moderate environmental anthropogenic impact and can be classified as one of the least polluted and most environmentally favourable regions of the European side of Russia
- | Zones of **low stage pollution** were identified in the southern side of the basin
- | Zones of **moderate pollution** of natural origin were identified in the northern side of the basin; of anthropogenic origin – in the central and southern parts of the basin.

## Ground water quality

- | Ground water quality within the basin, in the sites where ground water quality was studied, and chemical composition of ground water at water abstraction sites mainly complies with the SanPiN standards.
- | However, the following pollutants were identified: iron belonging to 3. hazard class or 'hazardous'; phenols, oil products attributed to 4. hazard class 'moderately hazardous' and elevated concentrations of organic substances (permanganate oxidability), hardness and colour.

## Brief conclusions on Chapter 5

# State management of waterbodies exploitation and protection

- | **Structure of water management authorities**
- | **Status of water legislation** (Water Code of Russian Federation (1995, 2006) and Federal Law “About environmental protection” (2002) )
- | **Water exploitation management** (agreements, licenses, payments)
- | **Waterbodies monitoring** (state supervision and monitoring)
- | **Cooperation in the field of water management**
- | **Financing of water management**
- | **Development of environmental awareness of the population**

# Identification of priority Programmes of measures

- | Various Programmes were worked out based on the Project Terms of Reference, preferences of the Project Beneficiaries and results of assessment of the status and threats to the water management in Lake Pskov-Chudskoye basin undertaken in previous chapters.
- | Totally 11 activity areas were identified based on which 11 target programmes were developed using the following criteria:
  - *type of activity,*
  - *types of environmental impact,*
  - *and institutional agents and groups of interests involved.*

# List of Target Programmes

- | Programme of measures for reduction of point source nutrient load
- | Programme of measures for reduction of diffuse source nutrient load provided
- | Programme of measures for drinking water
- | Programme of measures for small hydraulic works and flood prevention
- | Programme of measures for land use management
- | Programme of measures for water resources assessment and monitoring
- | Programme of measures for fish resources management
- | Programme of measures for biodiversity conservation
- | Programme of measures for involving public (non-commercial) organizations and other concerned groups (parties)
- | Programme of measures for advanced training of the personnel in connection with concrete plans and final recipients
- | Programme of measures for Russian-Estonian cooperation in the field of reasonable utilization and protection of transboundary water

# Typical description of Programmes

- | Background of the issue
- | Goals and tasks of the programme
- | Methodologies for selection of priority measures
- | List of projects (Table)
- | Priorities for significance
- | Priorities for urgency
- | Anticipated effect
  
- | Beneficiary and Agent

# Selection of priority projects

- | To provide appropriate management an integrated system of priorities should be developed for the projects included in different programmes. This would contribute to easier planning, search for finance and achievement of final outputs of the Management Plan.
- | Due to great variety of programmes in terms of character of proposed activities application of a system of scores appears to be appropriate.

# Description of the methodology of priority projects selection

- | Five-score scales (1, 2, 3, 4, 5) and extended five-score scales (1, 2, 3, 4, 5, 5+) are preferable for interpretation by the beneficiaries.
  - | The highest score/number of points (5 or 5+) stands for most desirable (favourable) output or development scenario, the least score (0 or 1) – to least favourable output.
  - | The projects obtained maximum number of highest scores will be considered a major priority for implementation.
- Three scoring scales were applied:
- | 1) five-score scales of the **efficiency** (fullness) of the achievement of the planned result
  - | 2) five-score scale of the project **deliverability** based on the general assessment of preconditions (funding, keeping in line with the state policy in the filed water management policy, availability of personnel, willingness to pay, institutional factors). The scoring is based on expert examination:
  - | 3) five-score combined two-factor **scale of managerial complexity of the project implementation and the project attractiveness in international context**

# Priority projects (Programme for point pollution sources)

No.	Location	Type of work	Efficiency of the result	Feasibility	Management complexity	Total
1	Gdov	Construction of city waste water treatment works	4,8	4,3	4,7	13,8
2	Pskov	Completion of the 2nd line of WWTW (post-treatment)	3,6	4,4	3,2	11,2
3	Ostrov	- rehabilitation of sewage pumping stations №1, 3, 5 - construction of pumping mains in order to transport sewage from WWTW “Ostrov-2” and “Ostrov-3” to the central city treatment works of Ostrov	3,7	4,3	3	10,9
4	Pskov	Introduction of nitrification and phosphorus removal process	4,6	2,4	3,5	10,5
5	Ostrov	- construction of mechanical dewatering room; - conservation of sludge drying-beds; - construction of 2nd biological pond - installation of sewage balancing tank	3,5	4,2	3	10,4
6	Pskov	Completion of the 6th secondary sedimentation tank	2,5	4,3	3,5	10,3
7	The village of Pskovkirpich	Rehabilitation of WWTW	3,5	3,5	3,2	10,2
8	Pskov	Arrangement of surface run-off treatment	3,2	4,5	2,5	10,2
9	Pskov	Rehabilitation of the sludge lagoon (hydraulic works)	2,6	4,4	3,2	10,1

No.	Location	Type of work	Cost of work, mln. Rub.	Financing source	Project proposal	Term of implementation	Anticipated effect
1	Gdov	Construction of city waste water treatment works	33	EU investment, regional and local budget	n/a	Medium-term	Achievement of the HELCOM standard values, achievement of standard sewage treatment values
2	Pskov	Completion of the 2nd line of WWTW (post-treatment)	200	Not identified	Available	Medium-term	Achievement of standard sewage treatment values
3	Ostrov	-rehabilitation of sewage pumping stations №1, 3, 5	4,7	Not identified	n/a	Short-term	Reduction of pollution loading to the Velikaya River
		-construction of pumping mains in order to transport sewage from WWTW "Ostrov-2" and "Ostrov-3" to the central city treatment works of Ostrov	4,5	Not Identified	n/a	Short-term	
4	Pskov	Introduction of nitridenitrification and phosphorus removal process	8,5	EU investment	Available	Short-term	HELCOM
5	Ostrov	-construction of mechanical dewatering room; - conservation of sludge drying-beds; - construction of 2nd biological pond - installation of sewage balancing tank	3	Not identified	n/a	Medium-term	Observance of the rules on protection of surface waterbodies and achievement of standard sewage treatment values
			0,1	Not identified		Medium-term	
			1,5	Not identified		Short-term	
			1,5	Not identified		Short-term	
6	Pskov	Completion of the 6th secondary sedimentation tank	12	Regional budget	Available	Short-term	Observance of treatment process rules
7	The village of Pskovkirpich	Rehabilitation of WWTW	0,2	Investments	Available	Short-term	Reduction of pollution, achievement of standard sewage treatment requirements

# Priority projects (Programme for drinking water)

No.	Location	Type of work	Efficiency of the result	Feasibility	Management complexity	Total
1	Pskov	Construction of water-supply pipe in Strelkovaya Division St.	4,8	4,3	4,7	13,8
2	Pskov	Construction of submerged piped across the Velikaya River at the water abstraction site	4,8	4,9	4,1	13,8
3	Pskov	Arrangement of zonal water supply in Zapkovye District	3,2	4,5	2,5	10,2
4	Pskov	Arrangement of water abstraction site for the village of Rodina	2,07	4,4	3	9,4
5	Pechory	-rehabilitation of water abstraction site, -construction of water supply networks and pumping stations	2,45	4,4	2,5	9,3
6	Gdov	Construction of new water abstraction site and pumping station	2,9	3,1	2,9	8,9
7	Ostrov	-rehabilitation of water abstraction site, -construction of new water abstraction site and water supply networks	3,4	2,0	2,8	8,2

# Appendices

- | Big tables
- | Graphs and diagrammes
- | Selected maps
- | Topical selection of pictures
- | Topical reports
- | Monitoring Strategy
- | Nutrient Load Reduction Strategy

# Other project output

- | Pilot demonstration project in Pskov WWTW: rehabilitation of aeration tank
- | Equipment supplied to Gdov WWTW
- | Sedimentation pool system constructed in the town of Gdov
- | Laboratory equipment worth EUR 72 000 supplied to 8 analytic laboratories
- | 3 study tours organized
- | A series of seminars organized on core tasks of the Project
- | Special publication on questions of diffuse pollution from agriculture
- | GIS equipment supplied and GIS system introduced compatible with the existing system of Neva-Ladoga water basin administration in St. Petersburg
- | A thematic Atlas of maps (35 pcs) with explications produced

# Future outlook

- | Recommendations and Action plan of the WBMP is anticipated to get positive response both at Federal level and from international sponsors
- | Concrete immediate result in international context is starting cooperation between the City of Pskov and Pskov oblast administration and the Finnish Ministry of Environment
- | Excellent cooperation with the Neva-Ladoga Water Basin Administration and the Pskov oblast administration during the Tacis project is continuing and new actions are anticipated in nearest future.