European Union Water initiative + for Eastern Partnership countries (EUWI+)

DNIPRO RIVER BASIN MANAGEMENT PLAN
DESNA AND UPPER DNIPRO SUBBASINS

Significant water management issues

Short summary for public consultations

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Contains

1. General overview 3
   1.1 Surface waters 5
   1.2 Groundwaters 5
2. Significant water management issues 6
   2.1 Surface waters 6
   2.2 Groundwaters 9
3. Risk assessment of failing to achieve good ecological and chemical statuses 10
   3.1 Surface waters 10
   3.2 Groundwater 11
4. Protected areas 12
5. Water monitoring 12
   5.1 Surface waters 13
   5.2 Groundwaters 13
6. Economic analysis 14

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More detailed technical reports for the Dnipro RBMP are available on euwipluseast.eu
The goal of this document is to present the significant water management issues (SWMIs) identified in the two sub-basins: Upper Dnipro and Desna to the specialists and wide public in frame of the preparation of Dnipro River Basin Management Plan (RBMP).

River Basin Management Plan (RBMP) is a document, which contains river basin analysis and the relevant program of measures to achieve the goals, identified for each river basin district in the defined terms. The need of RBMP development is stated in the Art. 13 of the Water Code of Ukraine as well as mentioned in the EU-Ukraine Association Agreement. Strategic environmental goal of the RBMP for each of nine river basin districts is to protect or enhance surface and groundwater bodies to achieve good ecological status and artificial of heavily modified surface water bodies to achieve good ecological potential.

RBMPs are developed by the State Agency of Water Resources (SAWR) jointly with State Agency of Geology and Ores Exploration, central and local executive authorities, local self-government bodies and other stakeholders taking into account the decisions of the relevant Basin Councils, according to the Decree of the Cabinet of Ministers of Ukraine dated 18 May 2017 № 336 «On Approval of the Order of the Development of River Basin Management Plan”. RBMPs should be developed by the end of 2024 and approved by the Cabinet of Ministers of Ukraine.

Public informing and relevant consultations during the RBMPs development, namely after identification of SWMIs is envisaged by the EU Water Framework Directive (Art. 14. 1. b), as well as Decree of the Cabinet of Ministers of Ukraine № 336 (par. 8).

**Significant water management issues** are diagnosis of the state of the river basin, the list of its illnesses. They are identified based on the different information and data, namely monitoring, water use, population equivalent, economic activities data, the data on use of fertilizers and chemical plants protection etc. The SWMIs include the issues, which are proven to be problems at present. Identification of the SWMIs is important because the Program of Measures will be further directed towards the identified SWMIs aimed to protect or enhance good ecological and chemical status of water bodies in the river basin.

### 1. General overview

Dnipro is one of the largest rivers of Europe. Its length is 2 201 km (within Ukraine it is 1121 km), the total area of the catchment is 504 thousands km². Dnipro river basin is transboundary: 20% of its catchment is in the Russian Federation, 23% – in the Republic of Belarus and 57% – within Ukraine. By its catchment, the river basin covers almost half of the territory of Ukraine (48%). Dnipro river basin district covers 19 oblasts of Ukraine and is fully located within 6 oblasts of Ukraine – Zhytomyr, Chernigiv, Poltava, Dnipropetrovsk, Rivne and Sumy oblasts.
Taking into account the large size of the Dnipro basin, river basin management is done by the basis of delineated subbasins. Within Dnipro river basin district, 5 subbasins were delineated, namely Upper Dnipro, Desna, Pripyat, Middle Dnipro and Lower Dnipro (Figure 1.).

Catchment area of the Upper Dnipro subbasin – the smallest subbasin is 2 315 km², and its river network includes Sozh river and some small rivers. Catchment area of the Desna subbasin is 33 482 km². More than 80% of Dnipro river discharge is formed in the upper part of the basin (upstream of Kyiv), it is distributed as follows: Dnipro, Berezhyna and Sozh - 35% of river water discharge, Pripyat - 26% and Desna – 21%.

Climate at the territory of the subbasins is moderately continental, mild and relatively wet. The winter is with low snow, in the most years – stable, comparatively warm; summer is warm and relatively wet. The average amount of precipitation per year is 656 mm, varying from 607 to 704 mm along the catchment. Around 70 % from average amount of precipitation falls in the warm period of the year. Regime of Upper Dnipro and Desna is characterized by clearly visible spring flood, low summer low water period, which is sometimes interrupted by rain floods and sometimes increased water levels standing in autumn because of rains and in winter because of thaw. During spring flood, there are highest water level rises; the water enters the floodplain and it is the time of 40 - 80 % of the river discharge.

The catchment area of the subbasins is mainly lowland, sometimes wavy landscape, as it belongs to Polissya lowland (north) and Prydniprovsk lowland. The lowlands are cut by river valleys; there are quite large forest “islands” and wetlands valuable for biodiversity conservation at the terraces.
1.1 Surface waters

Surface water body (SWB) is a management unit of RBMP. It can consist of a single surface water body as a whole or its part. SWB should be unique, namely differ from others, for e.g. by hydrological features; it should be solid (it cannot cross with others or consist of a few water bodies); each SB has its start and the end. Ecological goals are set particularly to SWBs, and their achievement is assessed by SWBs as well.

SWBs of the Upper Dnipro and Desna subbasins were delineated for the three categories: rivers, lakes and heavily modified SWBs (Figure 2). Although there are no weirs at Desna or Sozh itself, half of the SWBs of the river basins are heavily modified because of impoundment (ponds, water reservoirs at the tributaries) and hydromorphological alterations. In total, 290 SWBs were delineated, which make only 7.5% from total number of delineated SWBs in Dnipro basin.

1.2 Groundwaters

The area of the subbasins of Upper Dnipro and Desna is located within the largest geological region of Ukraine – Dnipro-Donetsk artesian basin. Water bearing horizons belong to the zone of active water exchange, contain water of drinking quality and are used for centralized water supply of settlements and enterprises.

Groundwater body (GWB) is a management unit for groundwaters. For them, ecological goals are set. Depending on geological-hydrogeological conditions 4 zero-head and 6 pressured GWBs are delineated in these basins. Zero-head GWBs belong to the youngest – quaternary stratums. Pressured GWBs are protected from pollution from surface by large powerful masses of water-resistant rocks, covering them. They belong to the stratums of different age – from quaternary to Jurassic and located at different depths.

Upper Dnipro and Desna subbasins are rich for groundwaters. At present, use of the groundwater at the subbasins in average is 3% from their predicted resources only.
2. Significant water management issues

Having analyzed anthropogenic activity and pressures in the Dnipro basin and its subbasins, the following significant water management issues were identified:

1. Organic pollution as a result of insufficient wastewater treatment or its absence;
2. Nutrients pollution as a result of insufficient wastewater treatment or its absence, as well as washing out from fields;
3. Hazardous substances pollution, which enter with wastewaters of industrial and municipal enterprises, pesticides and other means of chemical plants protection as well as result of washing out of hazardous sites or during emergency pollution;
4. Hydromorphological changes, related to flood protection, hydropower, flow regulation (ponds, water reservoirs), riverbed straightening.

In addition to these SWMIs, littering (namely by plastic) and climate change (floods and droughts) should be included.

Program of measures in RBMP is directed towards these issues. It is worth to mention that these SWMIs are typical for many river basins of Ukraine and the European Union.

2.1 Surface waters

Pollutants enter waters by the two ways: from source discharges of wastewaters and diffuse ones in time and space.

2.1.1. Organic pollution

Danger of the organic pollution is related to decrease of contains of dissolved oxygen in water till to critical for water inhabitants levels.

Organic pollution load is split between source and diffuse pollution as 38% and 62%.

The impact of point sources is almost fully related to communal wastewaters; the share of industry is not more than 0.6%. There is only one large city in Desna subbasin with population more than 100 thousands – Chernigiv. It forms about one third of organic load at surface waters. The peculiarity of the sub-basins is that almost half of population lives in middle-size towns with population equivalent (EH) 10 - 100 thousands. EH reflects load by wastewater treatment facilities and equals to 60 g BOD₅/day, becoming the main factor of organic pollution – 64%. The following rivers are under the biggest organic load – Bilous, Seym, Shostka. Diffuse pollution is related to households without wastewater treatment facilities. It is mainly rural population (settlements with EH < 2000) and partly towns. Within the subbasins, there are 68 settlements of town type, out of which only 18 ones are equipped by wastewater treatment systems. Such a system is absent in 8 middle-size towns with EH > 10 thousands.
2.1.2. Nutrient pollution

Increase of nutrients concentrations (nitrogen and phosphorus) causes eutrophication, leading to species diversity decrease, deterioration of water body status and water quality. Between point and diffuse sources, this load is shared as 24% and 76% (Figure 3). Diffuse sources of nitrogen is mainly agriculture (mineral fertilizers, manure, erosion caused by ploughing); its input into the total load is more than 50%. The indicator of pollution load from diffuse sources of agricultural origin is nitrogen balance in soil, which in majority of administrative districts within the subbasins is positive. The highest load is fixed in the basins of small rivers Pakulka, Dubrovka, Polonka, Serna, Konopelka, Lyutistya, Rudka, Zheliznystya, Okonka, where excess nitrogen in soil is more than 100 kg N/ha. Catchment areas of the subbasins are covered mainly by sod-podzolic soils of light texture; because of it, nitrogen in form of easily dissolved nitrogen compounds is washed out by rains. Nature background contributes 22% into a general indicator of nitrogen emission.

Figure 3. Load by total nitrogen (TN) in subbasins of Upper Dnipro and Desna subbasins

Point sources contribute more than 1100 tons of $N_{\text{total}}$ annually. This value is almost by 99 % is related to the communal wastewaters. A little bit more than half of total load by nitrogen is brought by Chernigiv city, 44% is formed by towns with PE 10-100 thousands. Maximum load is fixed in Bilous and Shostka rivers because of wastewaters from Chernigiv and Shostka accordingly.
Annual load by $P_{\text{total}}$ is 1172 tons, out of which 73% enters due to erosion and is in inactive form. There is a correlation between increase of phosphorus emission and increase of the share of ploughed land (Figure 4). 322 tons of $P_{\text{total}}$ annually enter the surface waters in dissolved form. Between point and diffuse pollution, this load is shared as 83% and 17%. Impact of point sources, with which 270 tons $P_{\text{total}}$ enters annually is almost completely related to communal wastewater treatment. Out of them 46% is brought by Chernigiv, 48% - towns with PE 10-100 thousands. The biggest load is fixed at Bilous, Seym, Shostka, Oster rivers. In general man caused share of phosphorus emission is 93%, share of natural conditions is 7%.

![Figure 4. Load by $P_{\text{total}}$ in Upper Dnipro and Desna subbasins](image)

2.1.3. Hazardous substances pollution

Hazardous substances include a large group of substances, mainly herbicides, insecticides, heavy metals and polynuclear aromatic carbons with acute or persistent toxic effect and significant danger for human water use and life of water inhabitants. List of 45 priority substances, which should be monitored are identified in the Order of the Ministry of Ecology and Natural Resources of Ukraine №45 dated 6 February 2017.

Data about the surface waters pollution by hazardous substances, especially synthetic ones, are lacking. At present, it is planned to identify these substances in frame of water quality monitoring.
in the laboratory of SAWR for the Northern region (Vyzhgorod, Kyiv Oblast). None of the enterprises in the subbasins do not report about the discharge of hazardous substances.

At present, in Ukraine around 190 active pesticides, as a part of 842 substances are allowed for use. Modern phosphorus-organic pesticides quickly deposit in environment up to non-toxic products. The main danger is in their overuse, spraying near sanitary zones.

### 2.1.4 Hydromorphological alterations

As it was mentioned above, more than half of SWBs are heavily modified. Out of them 58% of SWBs are hydromorphologically altered; 27% of SWBs have impoundments and artificial structures and 15% SWBs have impoundments and artificial structures and are hydromorphologically altered (Figure 5).

![Figure 5. Types of heavily modified WBs](image)

Right side tributaries of Snov are significantly altered– 70% of SWBs (21 out 30) are pHMWBs; impoundment - 2 SWBs, hydromorphological alterations – 15 SWBs, impoundment + hydromorphological alterations – 4 SWBs.

It is worth to mention Oster river basin, where 9 out of 10 SWBs are hydromorphologically altered. 62% of rivers of Bereza basin are also hydromorphologically altered: 7 out 13 SWBs are straightened, 1 SWB – straightening and impoundment.

Out of 142 rivers of the subbasins only 42 rivers (30%) are not hydromorphologically altered.

### 2.2 Groundwaters

**Water quality.** Groundwaters are strategic source of drinking water. However, they alike surface waters are polluted by man-caused activities. Zero-head GWBs are under the highest pollution risk, as they are under the biggest pressure from human activities. On the contrary to zero-head SWBs, most of pressured GWBs have a water resistant cover, preventing entering point sources pollution.

GWBs are under the pressure of diffuse sources of pollution, including settlements, industry, agriculture (where pesticides and mineral fertilizers are used). As a results, zero-head GWBs are characterized almost everywhere by high contains of nitrogen compounds. Pollution from diffuse
sources of pollution is concentrated in the upper part of soil, so they do not affect the pressured GWBs.

Water quantity. Zero-head GWBs (except in wetland quarterly deposits) are used for individual consumption in rural settlements, pressured GWBs – for central water supply. There are a lot of prognosed resources of groundwater at the territory of the subbasins: Sumy oblast - 3 432, Chernigiv – 8 326, Kyiv – 4 185 thousands m³/day. Current level of their use is in Sumy oblast - 2,7%, Chernigiv – 1,3%, Kyiv – 5%. Such a low level of use of groundwater explains why there is no risk of their depletion and visa versa allows increasing significantly the volume of their extraction.

3. Risk assessment of failing to achieve good ecological and chemical statuses

3.1 Surface waters

Risk assessment for point sources is done using two criteria: organic and nutrient pollution was assessed using index «Share of polluted wastewaters», for hazardous waters - «Indicator of wastewaters».

Results show that 21 SWBs or 7% from the total number are at risk of failing to achieve good ecological status because of point sources. Pollution of vast majority of SWBs are caused by municipal wastewaters.

Risk assessment for diffuse sources is done using the criterion “Balance in soil”, which allows assessing the impact of harvesting and index “Share of animal husbandry», which reflects the impact of cattle breeding.

Results show that 13% from the total number of SWBs are at risk of failing to achieve good ecological status because of diffuse sources of pollution, 27% are possibly at risk. Risks of water pollution are caused by plant growing, whereas the impact of cattle breeding is minimal.

In order to assess the risk of failing to achieve good ecological status, results of risk assessment for point, diffuse sources and hydromorhological alterations are united. The final assessment of ecological status is done by the worst parameter. The general assessment of risk of failing to achieve good ecological status by SWBs is presented at Figure 6, and its space description – at Figure 7.
Because of very limited input data, risk assessment of failing to achieve good chemical status for SWBs was done based on expert judgement. Taking into account natural conditions, which favor decrease of toxicity and large buffer capacity of waters, one can say that there is no risk of toxic impact of hazardous substances for SWBs.

![Map of the risk of failure to achieve good ecological status by SWBs](image)

**Picture 7. Map of the risk of failure to achieve good ecological status by SWBs**

### 3.2 Groundwater

**Risk of failure to achieve good quantitative status.** Dynamics of groundwater extraction during the last decades from pressured GWBs has decrease trend. This allows expecting no risk of deterioration of quantitative parameters of GWBs, used for water supply. This is supported also by the general trend to insignificant reduction of population number.

Taking about zero-head GWBs, there are no data on groundwater extraction, because those horizons are used by diffuse private water users, extracting water in small amounts, therefore risk of deterioration of quantitative parameters for these horizons is insignificant.

**Risk of failure to archive good chemical status.** From one side, following optimistic scenario of economic development, one can expect industrial growth and increase of man pressure at environment, including groundwaters. From other side, there is hope that industrial development will be based on the sustainability principles, so production will use less resources and comply with stricter ecological standards comparing to the current ones. So, one should not expect significant increase of man pressure at groundwaters.
Regarding diffuse sources, the situation is different. Significant demand for food at world market supports permanent growth of agricultural production. This leads to increased use of fertilizers and means of chemical protection. As far as pressured GWBs are protected from surface impact, unprotected zero-head GWBs will face diffuse pollution.

### 4. Protected areas

Protected areas are the areas, which require a special protection according to the existing national legislation depending of their use. Monitoring of such areas is done according to a special program (for e.g. drinking water intakes require additional monitoring of microbiological parameters. Out of five categories of protected areas three ones are delineated for the subbasins (Figure 8):

- Emerald sites;
- Drinking water intakes (zones of sanitary protection);
- SWBs / GWBs used for recreational, medical, recreational and rehabilitation goals as well bathing waters.

Nitrates vulnerable zones will be delineated after adoption of the relevant national legislation. Fish protected areas and shellfish protected areas do not play a significant role in national economy and are not delineated, therefore it should be done in the next RBM cycle.

**Figure 8. Share of different protected areas categories**

Protected area cover more than half of the area of the subbasins (53%), which is the highest percentage for Dnipro subbasins. In total there are 142 protected areas, out of them 25 Emerald sites, 80 drinking water intakes and 37 officially designated recreational zones.

### 5. Water monitoring

State water monitoring is aimed to collect, process, generalize and analyze the data about the water bodies status, to prognose the trends in their change and to develop scientifically grounded recommendations for sound decision-making in the field of water use, protection and restoration. Decree of the Cabinet of Ministers of Ukraine dated 19 September 2018 № 758 adopts a new order of the implementation of state water monitoring as it is done in the EU. The Order clearly distributes responsibilities between monitoring agents to avoid duplication; it states new monitoring parameters, which were absent in Ukraine before.
5.1 Surface waters

State monitoring program for surface waters include biological, hydromorphological (to be implemented by the State Agency of Emergency Situations (SAES)), priority and basin specific chemical parameters (to be implemented by SAWR) and physical-chemical parameters (to be implemented by SAES and SAWR at drinking water intakes.

Three types of monitoring - surveillance, operational, and investigative monitoring should be implemented according to basin principle. New system of water monitoring envisages 6-year cycle of monitoring and classification by five classes of ecological status and 2 classes of chemical status.

In order to implement state water monitoring, relevant state water monitoring programs are developed. At present, surveillance monitoring program for the Dnipro basin is under development and starts to be implemented in 2021. It will cover the SWBs at risk of failure to achieve good ecological and chemical statuses; at reference conditions, located within protected areas (especially at drinking water intakes) and transboundary ones.

According to the new requirements SAWR at present transforms existing monitoring system to distribute monitoring functions between existing laboratories and in order to avoid duplication. In order to monitor priority substances, it equips 4 key laboratories. Water samples analysis for subbasins of Upper Dnipro and Desna will be done by the laboratory of Northern region (Vyzhgorod, Kyiv Oblast). Obtained results will be uploaded at the web-site “Monitoring and ecological assessment of water resources of Ukraine”.

5.2 Groundwaters

State groundwater monitoring program envisages monitoring of their quantitative, chemical and physical-chemical parameters. Quantitative and chemical monitoring is done at the same monitoring stations (mainly wells). Groundwater monitoring system envisages 6-year monitoring cycle and classification by the two classes of chemical status.

Surveillance monitoring program for groundwater of Dnipro basin is under development and starts to be implemented in 2021. At present the number of monitoring stations in the state groundwater monitoring network at the area of the catchments of Upper Dnipro and Desna river is decreased to critical level and includes 13 wells: 6 – at zero-head groundwaters and 7 – at pressured waters.

According to the Order of implementation of state water monitoring, State Agency of Geology and Ores (SAGO) is responsible for development and optimization of existing groundwater monitoring
system. For the subbasins, it is planned to add 18 monitoring stations – 5 wells at zero-head wells and 13 bores at pressured SWBs.

It is envisaged that groundwater quality analysis for the subbasins of Upper Dnipro and Desna will be implemented by Central laboratory of Ukrainian geological company (Kyiv).

6. Economic analysis

The goal of economic analysis of water use is to show economic development of the river basin, including the assessment of modern water use and to assess the level of cost recovery for different sectors of economy following the polluter pays principle.

Dnipro basin is located within 19 oblasts, which differ significantly in terms of level of urbanization, industrial development and structure of agriculture.

Assessment of the importance of water use in the Dnipro basin (48.8% of the country area) for the national economy and society is as follows: water use from Dnipro makes 75% of total volume of used water in Ukraine; the majority of water is used by industry – 46%, agriculture – 18%, housing and communal services – 10%; the main polluters include housing and communal sector, industry, agriculture; the volume of gross regional product in the Dnipro basin makes 64% of GDP of the country; share of employed in economy sector in Dnipro basin makes around 50% of all employed in the country; the champions in water use by sectors are housing and communal sector, energy production, industry and agriculture.

In total, there are 6,137 enterprises in the Dnipro basin, which reports for water use, 1,291 out of them are housing and communal sector. In total, the amounts of received rent payment for special water use (55% of which goes to state budget, the rest - 45% - to local budgets) and tax incomes for pollutants discharges directly to water bodies (45% goes to state budget, the rest - 55% - to local budgets) in 2010-2018 have been increased in 1.5 times in Ukraine (Figure 9). In the same time, the total capital investments into wastewater treatment, soil rehabilitation, restoration of surface and groundwaters has been increased almost in three times. Calculated level of cost recovery of capital.
investments by these fiscal payments (rent payment for water and ecological tax) in 2018 was at the level of 45%.

Recently tariffs for water supply and water use by oblasts in the Dnipro basin are increased annually by 16-22%. However, population, budget organizations and other water users mainly cover the costs for central water supply and use (cost recovery coefficients are at the level of 90-120%). However, the cost recovery coefficients for the following category of water users – water supply and water use agents (water supply and treatment enterprises (vodocanals) and other) were at the level of 40-60%. In the same time, tariffs for the above mentioned category are 1,5-3 times less than the ones for population, budget organizations and other water users.

At the subbasins of Upper Dnipro and Desna river, the level of rent payment within Chernigiv oblast is 2,9% from the total amount for the basin, within Sumy oblast – 1,5%. In Chernigiv and Sumy oblasts the volumes of tax incomes are at the level of 6-8 % from the total amount of all tax incomes in the Dnipro basin. Average weighted tariffs for water users, who are not economic agents in Chernigiv oblast are at the average level comparing with other oblasts (8,60 UAH for m$^3$ of water supply and 8,41 UAH for water discharge), in Sumy oblast they are one of the lowest in the basin (7,13 and 6,15 UAH accordingly).