MINISTRY OF DEVELOPMENT OF COMMUNITIES, TERRITORIES AND INFRASTRUCTURE OF UKRAINE

State Enterprise «State project development and research institute for marine transport «ChernomorNIIproekt» (SE «CHERNOMORNIIPROEKT»)

12, Shevchenko Avenue, Odesa, 65058, Code of Legal Entity 01128110
+38(0482) 33 60 09 blasdari.project@gmail.com http://www.blasdari.com

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«DELTA-PILOT» BRANCH of SE «USPA»

RECONSTRUCTION OF CONSTRUCTION PROJECTS «ARRANGEMENT OF DEEP-WATER NAVIGATION FAIRWAY DANUBE RIVER – BLACK SEA IN THE UKRAINIAN PART OF THE DELTA»

REPORT OF ENVIRONMENTAL IMPACT ASSESSMENT

Responses to the comments and observations provided by the Romanian party as a result of the review of the environmental impact assessment report of the planned activity "Reconstruction of the construction facilities "Creation of a Deep-water navigation fairway on the Danube river - Black Sea on the Ukrainian part of the delta"

V.V. Patynskyy	**Technical Director**
M.V. Turzhanskyy	**Design Manager**
V.I. Kalinichenko	**Head of LGDPA Research Lab.**

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Table - Responses to the comments and observations provided by the Romanian party as a result of the review of the environmental impact assessment report of the planned activity "Reconstruction of the construction facilities "Creation of a Deep-water navigation fairway on the Danube river - Black Sea on the Ukrainian part of the delta"

In-dex	Remarks and comments	Consideration in the materials of the environmental impact assessment
1	2	3
I Key aspects		
I.1	We regret that the report does not take into account some key aspects, such as - integration of mathematical models of climate change in the Danube delta, - assessment of the impact on the entire delta area, - creation and analysis of complex multilayer maps of surface and groundwater bodies in the area of influence of the planned activities and the adjacent area, - conducting hydraulic surveys of the Kiliya arm before and after the project implementation (to properly assess the changes introduced by the project), - Assessment of the cumulative impact of the project with other projects developed both in the Kiliya arm and in the delta, - assessment of the project's impact on transitional and coastal waters, - assessment of the impact on the reservoirs on both banks of the river, - assessment of the impact on fauna, especially sturgeon, - cumulative impacts of economic activities on water bodies and Natura 2000 sites, which are fundamental as a proper precautionary measure for a proper environmental impact assessment of the Danube river and the Danube delta.	**The EIA report's assessment of the impacts of the DWNC reconstruction on coastal and transitional waters**, performed by means of mathematical modeling, is contained in subsections 9.5 and 9.6; additional results on the assessment of impacts on Ptashina spit are provided in Annex A to the "Response to the comments and observations provided by the Romanian side", namely in response to question 2.8. Impacts on the salinity gradient in the Bystryi arm are described in Section 1.6 of the EIA report. **Assessment of the cumulative impacts of the reconstruction of the DWNC and economic activities in the Danube delta, including the cumulative impact of the project with other activities in the Kiliya arm, including on fauna**, is presented in the EIA report in Sections 5.5 and 9.10. Additional results of the cumulative impact assessment are provided in Annex B to the Response to Comments and Observations Provided by the Romanian Party. **Additional results of the assessment of the impact of the reconstruction of the DWNC on the fauna, and in particular on the sturgeon fauna**, are presented in Annex C to the "Response to the comments provided by the Romanian party". Annex C also contains additional results of the **assessment of the impact of the DWNC reconstruction on water bodies and Natura 2000 sites.** The assessment of the impact of the **reconstruction of the DWNC on the reservoir on the left bank of the Kiliya arm** is presented in Annex F. More substantiated assessments on these issues will be obtained through the procedures of post-project analysis (Article 7 and Annex V of the Convention on Environmental Impact Assessment in a Transboundary Context) and post-project monitoring (Article 13 of the Law of Ukraine "On Environmental Impact Assessment). The following aspects will also be processed using the same procedures, with the use of additional baseline data from the Ukrainian and

		Romanian studies, including the results of hydraulic studies of the Kiliya arm before and after project implementation - assessment of the impact on the entire delta area; - integration of mathematical models of climate change in the Danube delta; - assessment of the impact on the reservoirs on both banks of the river; - assessment of the cumulative impact of economic activities on water bodies and Natura 2000 sites.
I.2	The report focuses on aspects that are of lesser transboundary importance, but pays little attention to aspects such as: hydrological changes of the river in terms of morphological conditions: depth and width of the channel, bed, channel structure and substrate; hydrological regime flow rate, disruption of sediment transport, water velocity, etc., as well as their impact on sturgeon migration, which is mainly carried out along the Kiliya arm.	In determining the most important transboundary aspects of the studies, the EIA developers were guided by the conclusions of the Espoo Convention Commission on the request of the Espoo Convention, as presented in Section 9.3 of the EIA report. The original text of the Commission's conclusions on the significance of certain impacts of the DWNC of Danube-Black Sea on the environment is given in the final report of the Commission [Report on the likely significant adverse transboundary impacts of the Danube-Black Sea Navigation Route at the border of Romania and Ukraine. ESPOO Inquiry Commission, July, 2006], which is provided as a separate appendix. Additional results of the assessment of the impact of the reconstruction of the DWNC on the sturgeon fauna are presented in Annex B to the "Responses to the comments and observations provided by the Romanian side".
I.3	As for the hydrological impact, the study proves the insignificant nature of the impact by referring to the percentage of increase in flow (1%), without providing technical arguments for this. In addition, the motivation for the insignificant hydrological impact is a decrease in the debit on the Kiliya arm due to navigation works related to the ports of Tulcea and Sulina, without technical data to support this statement. The mentioned works are existing works, the impact assessment report should address the impacts created by both existing works and proposed works. This aspect should also be taken into account in the cumulative impact assessment. A comparative analysis and an appropriate response in this regard can be provided after the analysis of hydrological data in the relevant sections for the Romanian side as a result of hydraulic modeling. These results are not presented in detail in the study, only possible percentages of increase/decrease in the level are presented.	The results of the mathematical modeling of the long-term dynamics of flow distribution between the main arms of the Danube delta and the impact of navigation activities on it are presented in Annex D to the "Responses to the comments and observations provided by the Romanian side". More substantiated estimates of hydrological impacts will be obtained through post-project analysis and post-project monitoring procedures provided for by the Espoo Convention and the Law of Ukraine "On Environmental Impact Assessment", respectively, with the use of additional baseline data from studies by the Ukrainian and Romanian parties, including hydraulic studies of the Kiliya arm and other arms of the delta before and after project implementation.
I.4	In the same context, it is clarified that "Regarding the likely impact of such flow	The procedures of post-project analysis and post-project monitoring provided for by the Espoo

	redistribution on the Musura arm, appropriate hydraulic mitigation measures may be developed during the post-project analysis phase if a significant downward trend in flows in this arm is identified". Thus, reference is made to post-implementation mitigation measures, an aspect that does not support the acceptability of the terms of the environmental impact assessment documentation in the context of the Espoo Convention. It is necessary to assess this impact and, at the same time, identify and describe mitigation measures for the impact of the proposed project works, the installation of which in the post-implementation period is insufficient. Regarding the impacts on coastal morphology, it is stated that "due to insufficient information, it was not possible to form an opinion on the significance of any possible transboundary impacts of the DWNC on the Romanian coastal areas between Cilia and Sulina, thus no opinion can be formed". In this sense, we consider this assessment incomplete.	Convention and the Law of Ukraine "On Environmental Impact Assessment", respectively, will provide more substantiated assessments of the hydrological impacts on the Musura arm, using additional baseline data from studies by the Ukrainian and Romanian parties before, during and after project implementation.
I.5	With regard to the assessment of possible transboundary impacts of the DWNC structures on the coastal zone and in terms of direct impacts on the morphological conditions of transitional (Kiliya-Perebeynaya) and coastal (Perebeynaya-Kap Singol) waters, a series of modeling simulations of waves - sea currents - alluvium/sand transport - reshaping are presented. A reference is made to the "no DWNC dams" scenario, but the study does not provide details on this (which DWNC dams are taken into account, what are the considerations for determining such a scenario). In addition, the inclusion of a scenario that excludes the existing hydraulic structure (the "no build" scenario) in the modeling is methodologically incorrect. Clarifications are needed in this regard.	The EIA report's assessment of the impact of the reconstruction of the DWNC on coastal and transitional waters, performed by means of mathematical modeling, is contained in subsections 9.5 and 9.6. The procedures of post-project analysis and post-project monitoring provided for by the Espoo Convention and the Law of Ukraine "On Environmental Impact Assessment", respectively, will provide more substantiated estimates of the possible transboundary impact of the DWNC facilities on the coastal zone and direct impact on the morphological conditions of transitional and coastal waters, using additional baseline data from studies by the Ukrainian and Romanian parties before and after the project implementation.
I.6	The study is presented in the "Description of the specifics of the activities during the preparatory and construction works and implementation of the planned activities - Section 1.3" as target areas: city Vilkovo - Izmail Chatal on the Kiliya arm and Izmail Chatal - Reni, on the Danube River. Due to the dredging works to be carried out, we believe that this will affect the morphological conditions of the Isakcha Shallow Water and Kiliya arm, especially the condition of the riverbed substrate. The study does not provide any references to this impact, nor does it indicate possible mitigation measures in case of a negative impact. These aspects need to be clarified.	Explanation to para. 1. 6, set out in Annex A to the "Responses to the comments and observations provided by the Romanian side"

I.7	Intensive shipping traffic can cause disturbance, so when ships pass through coastal areas, artificial changes in water levels occur, consisting of large fluctuations in water levels over a short period of time. The effects of these anthropogenic changes in water level are manifested in the disruption of fish and benthic invertebrate breeding grounds, as well as the uprooting of aquatic vegetation and the potential for coastal erosion. Measures to stop these impacts should be aimed at protecting the shores using environmentally friendly methods, including gabions installed in front of the shores, to the extent possible. Similarly, limiting the speed of navigation, especially in areas with unprotected banks, can lead to a reduction in the production of waves and, consequently, a decrease in water level fluctuations on the banks. Another negative effect of ship engines is the lifting of fine sediments from the bottom of the riverbed, which leads to increased turbidity and damage to natural habitats and plant and animal species. The more sediment vessels have, the closer their engines are to the bed bottom and the more intense the sedimentation process. The measures introduced are aimed at implementing a comprehensive monitoring program for natural habitats and plant and animal species (hydrological, biological, chemical monitoring); another measure may be to improve the particle size distribution by supplying coarse sediments to areas where increased turbidity is observed.	Explanation to para. 1. 7 set out in Annex A to the "Responses to the comments and observations provided by the Romanian side"
I.8	For the passage of large-tonnage vessels, modern dredging works are required to maintain navigable depths of the fairway over 8 meters. This activity leads to a change in the sediment regime. The measures introduced are aimed at periodically conducting topobathymetric measurement campaigns every 3 or 5 years along the entire width of the Kiliya arm, especially in critical sectors, to ensure continuous monitoring and obtaining the necessary data to assess the intensity of hydromorphological processes and to increase knowledge of the Danube channel dynamics. In addition, prudent management of dredging, sediment movement in the channel, and narrowing the channel width by dredging only a narrow part of the channel rather than the entire width are operational measures to reduce the impact of navigation on the sediment regime	Explanation to para. 1. 8 set out in Annex A to the "Responses to the comments and observations provided by the Romanian side"
II Specific aspects		
II.1	1. The report presents only the hydrological changes in the Starostambulsky and Bystryi arms as a result of deepening the channel near the bar and the sea access channel: At a water	For the initial predictive modeling studies of the impact of the DWNC reconstruction on the flow redistribution in the Danube delta, the arms where this impact is expected to be most pronounced

	flow rate of 6000 m3/s, an increase of +2.6% in the Bystryi arm will be recorded, and the Starostambulskyi arm will lose 2.4%. The distribution of the total Danube flow between the three main arms of the Danube delta - Kiliya, Sulina and St. George - is not modeled when the final envisaged parameters of the DWNC are reached (depths of about 10.00 m along the entire length of the Kiliya arm), taking into account that the Kiliya and Bystryi arms take a significant percentage of the Danube debit. Such modeling is necessary to determine the environmental changes in the entire Danube delta, a biosphere reserve and UNESCO World Heritage Site, after the construction of the DWNC with the characteristics specified in the project.	were selected. Since the modeling results showed these effects to be insignificant, modeling the flow redistribution in the remaining arms was assigned to further tasks. Estimates of the dynamics of flow redistribution between the main arms of the delta are provided in Annex D to the "Responses to the comments provided by the Romanian party". According to the procedures of post-project analysis and post-project monitoring provided for by the Espoo Convention and the Law of Ukraine "On Environmental Impact Assessment", more reasonable model forecasts of the distribution of the total Danube flow between the three main arms of the Danube delta - Kiliya, Sulina and St. George - will be obtained for achieving the intermediate and final parameters of the DWNF, using additional initial data from the Ukrainian and Romanian studies
II.2	2. No mention is made of the impact of the jet-directed dam at the bifurcation of the Bystryi and Starostambulskyi arms on sediment flow, especially on bottom sediments. In fact, the motivation for the construction of the dam was to direct the flow of sediment towards the Starostambulsky arm and to ease the burden of annual dredging at the bar of the Bystryi arm. On the other hand, the increased flow of fine and coarse sediments from the estuary of the Starostambulsky arm significantly changes the impact of these alluviums in the area of the estuary of the Sulinsky arm on the sea.	The construction of a jet-directed dam was relevant at the time of the development of the first stage of the DWNC Danube-Black Sea hydrosystem project, during a period of a steady increase in water and sediment flow through the Bystryi arm to stabilize this process. The results of the modeling of the dam's hydraulic impact conducted at that time are presented in Annex A to the "Responses to the Observations and Comments Provided by the Romanian Party". At present, due to the further reduction of water flow through the Kiliya arm and the estuary extension of the Bystryi arm, its natural stabilization has occurred. At the same time, it is expected that the trend of decreasing water flow and suspended sediments in the Starostambulsky arm will continue in the future. Taking this trend into account, the reconstruction project provides for the possibility of adjusting the length of the dam based on mathematical modeling, taking into account the monitoring results.
II.3	3. There is no mention of the impact of pollutant-laden wastewater that will flow into the Kiliya arm from 4 soil dumping sites 10 miles along the watercourse between Vilkovo and the port of Izmail. These aspects are important in view of the developer's conclusion that navigation in the Danube delta is fundamentally impossible without regular/permanent human intervention.	Explanation to para. II 3 regarding engineering solutions to prevent water pollution of the Kiliya arm by discharges from onshore soil dumps are set out in Annex A to the "Responses to the Observations and Comments Provided by the Romanian Party". The results of chemical and radiation studies of the soils of the Kiliya arm and the assessment of their impact on water quality are provided in Annexes G, I, K.
II.4	The report states that "a dredge of more than 10 meters" will be implemented to allow vessels with a draft of 7.2 meters to pass. In our opinion, this is an excessive insurance to prevent possible sedimentation at critical points; the maximum depth for this dredging is not specified and a	Explanation to para. II 4 are set out in Annex A to the "Responses to the Observations and Comments Provided by the Romanian Party".

	limit value should be set to take into account a proper assessment of the environmental impact, especially on the hydrodynamics and hydromorphology on the Kiliya and Tulcha arms, which affect the currents in the Sulinska arm, a waterway of international importance. The value of ">10 m" is new and contradicts what is currently established on the section between Bar Sulina - Sulinsky Canal - Tulcha Arm - Chatal-Izmail on the recommendation of the Danube Commission, which provides for a depth of 7.32 m for vessels with a draft of 7.01 m. Also, taking into account such elements as the vessel's draft and keel clearance, there is no need to deepen the fairway to 10 meters. The ship's draft is the level at which the ship sinks when it is moving, compared to the level when it is stationary, in waterways with a limited cross-section. The loaded ship has a draft of approx. 20-40 cm. The distance under the keel is defined as the distance between the bottom of the moving vessel and the highest point of the river bed. To avoid damage to the keel and/or propeller, it should be at least 20 cm for a gravel channel and 30 cm for a rocky channel. In this sense, for a vessel with a draught of 7.2, the minimum depth of the fairway that must be provided is 7.90-8 m.	
II.5	We would like to point out the fact that the continuation of navigation of vessels flying the flags of third countries through the Kiliya arm contradicts the Treaty between Romania and Ukraine on the Romanian-Ukrainian State Border, Cooperation and Mutual Assistance in State Border Issues, signed in Chernivtsi on June 17, 2003, as well as the 1948 Convention on the Regime of Navigation on the Danube, to which both Romania and Ukraine are parties.	Decide at levtl Ministry of Foreign Affairs Ukraine and Romania
II.6	It is known that the hydraulic works to transform the Sulina into a sea channel in the late 19th century affected the flow of water in the Kiliya Arm. The modifications to the arm proposed in the project will also have an impact on the distribution of the flow, which must be carefully and properly assessed before any decision is made. There are legitimate concerns that the hydraulic works on the Kiliya will affect the flow of the other two arms and the underground reservoirs, leading to serious ecosystem disruption and affecting the safety of navigation. These issues are even more worrisome when taking into account climate change and the drought of recent years. As stated in Chapter 10 - Difficulties identified in the process of preparing the environmental impact assessment report, we believe that without taking into account the cumulative effect of fluctuations in	An in-depth assessment of the hydrological impact using cross-sectional measurements of all delta arms and additional consideration of the cumulative effect of climate change can be obtained through the post-project analysis and post-project monitoring procedures provided for by the Espoo Convention and the Law of Ukraine "On Environmental Impact Assessment", respectively, with the use of additional baseline data from studies by the Ukrainian and Romanian parties. At the same time, the timeframe for obtaining and processing monitoring data should be minimized and ensure, if necessary, timely decision-making on adjusting the final design parameters of the DWNC reconstruction.

	climatic conditions, especially in the case of modeling the dynamics of water flow, sediment, etc., using a number of historical measurements, it is not possible to fully highlight the impact in the transboundary area of the planned works. Even if, in accordance with the Espoo Convention procedure, this can be done at the stage of post-project monitoring and post-project analysis, the results/effects identified later may raise problems related to the very nature of the work being carried out. Therefore, given the importance of the increasingly reduced flow of the Danube in the border area during drought, the presentation of such a scenario at the design stage is appropriate and necessary.	
II.7	The frequently cited bibliographic references (numbered 5-7), which contain detailed information on flora and fauna species, monitoring, water condition assessment, probability and significance of possible transboundary impacts, etc. are not available online to support the analysis, namely 5. Report on the strategic environmental assessment of the program of socio-economic and cultural development of the Odesa region for 2022. Kyiv. 2021. 107 p. 6. Lower Danube River basin Management Plan (2025-2030). Ministry of Environmental Protection and Natural Resources of Ukraine; State Agency of Water Resources of Ukraine. 2022. 57 p. 7. Lower Danube River Sub-basin Management Plan (2025-2030). Ministry of Environmental Protection and Natural Resources of Ukraine; State Agency.	In the list of references (Section 14 of the EIA report), the sources are grouped by individual sections of the report with separate numbering in each section. References related to detailed information on species of flora and fauna, monitoring, water status assessment, likelihood and significance of possible transboundary impacts are most likely related to Section 9, and therefore are included in the list of references to Section 9, namely: 5. Report "Environmental assessment of project options (at the stage of feasibility study of investments) for the creation of a deep-water navigation fairway Danube river - Black Sea in the Ukrainian section of the delta." / Institute of Hydrobiology. National Academy of Sciences of Ukraine. - Kyiv, 2002. 6. Creation of the deep-water navigation fairway Danube river-Black sea on the Ukrainian Area of delta of the river Work project. Fish protection measures. /Ukrrybproekt. - Kyiv, 2004. 7. Report on the likely significant adverse transboundary impacts of the Danube river - Black sea navigation route at the border of Romania and the Ukraine /Espoo inquiry commission. -2006. 67 p. The sources cited in the text of the commentary under numbers 5, 6, and 7 belong to the list of references for Chapter 3 and are mentioned in this chapter among a number of other sources of information on the current state of the region's environment.

II.8	The non-technical summary states that "The scope and parameters of the listed biotechnical measures (measures to artificially maintain optimal depths in the area of the Bystryi corner and in the water area separating Ptashyna spit from the main island) were subject to clarification in the fairway of additional field studies that were not carried out due to force majeure." the planned activities and works of the project in the transboundary context, namely the aquatic environment and the most valuable components of the delta biome, the existence of which is related to the aquatic environment - fish and birds, are not analyzed on the basis of detailed and substantiated information.	Explanations and additional information to para. II.8 are set out in Annexes A and C to the "Response to the comments provided by the Romanian side".
II.9	We reaffirm the importance of the Kiliya arm for the protection of the endangered Danube sturgeon, for which our research shows that more than half of the adults and more than two-thirds of the juveniles use the Kiliya arm to get to and from the Black Sea, and regret that the report does not take into account data provided by the Romanian Institute for Environmental Studies, and does not clarify the project's impacts on migration and population, giving only one paragraph to this issue and concluding that dredging is "unlikely to have significant transboundary impacts" and that impacts on fish migration are classified as "likely negative transboundary impacts, but insufficient information to judge their significance". Keeping in mind the negative example of the dredging of the Sulinsky arm in the late nineteenth century, which led to a sharp decline in sturgeon migration along this arm, there is a high probability of a similar situation happening again with the construction and use DWNC on the Bystryi arm. If the Kiliya arm also becomes an inaccessible area for sturgeon migration, as is confirmed by the situation with the Sulinsky arm, the only possibility of sturgeon migration will remain in St. George, with a reduction in migration routes of more than 67%. From the data collected during the long-term studies, which tracked both the behavior and migration of adult sturgeon and juveniles from aquaculture and released into the Danube to support wild populations, by analyzing the behavior of ultrasonically tagged juveniles, it was found that 70% of them chose the Kiliya arm as their main migration route to their Black Sea habitat, as opposed to the other arms. Studies have also shown an increase in the distribution of migration routes in favor of the Kiliya Arm. The results showed that the Kiliya branch is an important route for sturgeon migration to favorable habitats along the Danube, a route that	Explanation to para. II.9, additional results of the assessment of the impact of the DWNC reconstruction on the sturgeon fauna, the effectiveness of measures for their protection and reproduction are provided in Annexes C and E to the "Responses to the comments provided by the Romanian party".

	indirectly contributes to the conservation of these species and the natural maintenance of populations. Given the fact that the Sulinska arm has become a route used by sporadically migrating sturgeons due to anthropogenic pressure created by maritime transport, dredging and poaching, it is clear that the implementation of the Bystryi arm project will affect the population's migratory routes in the Kiliya arm. Analyzing the possible migration routes of the anadromous sturgeon population, if the sea route is provided through the Bystryi arm, there is a high risk that migration routes will be reduced in the future to 40% of the existing potential.	
III Additional remarks		
III.1	1. The coordinates included in Table 1.1 - Coordinates of cargo block centers, when loaded into the GIS system, indicate the Sulinsky district.	Explanation to para. III.1 are set out in Annex A to the "Responses to the comments and observations provided by the Romanian side"
III.2	2. Tables Table 5.28 - Summary of Impacts of deep-water navigation fairway (DWNF) during construction and Table 5.29 - Assessment of DWNC impact during operation after reconstruction refer to the presence of significant impacts, damage to biota (fish fauna and trophic base), for example: Table 5.28 - Summary assessment of the impacts of deep-water navigation fairway during construction "Deterioration of water quality due to pollutants from the soil. The impact is significant but local. Permissible given the planned compensation for damage to fish fauna. The impact on biota is significant. The impact is acceptable, taking into account the compensation for the loss of fish food base provided by the project. The impact is significant at the burial site, periodic and local. The impact is permissible, taking into account the compensation for damage to the fish fauna. " Table 5.29 - Assessment of the impact of DWNC during operation after reconstruction "The discharge is permissible only in the previously designated and used for this purpose area of the sea. The impact is significant at the burial site, fragmentary and local. The impact is acceptable, taking into account the provided compensation for damage to fish fauna. Potential for loss of safe nesting sites for protected bird species, disruption of coastal fish feeding migration and spawning grounds. The impact on wildlife is subject to monitoring, which will result in regulatory protective	We believe that the information provided in the tables is sufficiently complete for the format of the summary assessment.

	hydraulic engineering measures and monetary compensation for damages. " The information provided is not clear and/or complete, and clarification is needed.	
III.3	3. The impact on large areas is also mentioned (p. 73 of the English version of the Report): "In the conditions of the Danube delta, these changes not only affect the state of waters and coastal and aquatic biocenoses, but can also affect the water regime of large areas of the delta islands and even change the processes of its evolution."	This refers to the general features of the impact of hydraulic works in the delta, and not to the assessment of the impact of the reconstruction of the DWNC structures.
III.4	4. The Report repeatedly mentions the provision of compensatory measures for damage to the fish fauna and trophic base, in accordance with the compensation provided by the examples of situations presented below (p. 519 of the English version of the Report): "The damage that will be caused to living water resources during the works and is subject to compensation is due to the death of food organisms for fish as a result of - complete destruction of bottom biocenoses in the area of dredging and soil storage; - partial clogging of bottom biocenoses in the adjacent water areas; - death of zooplankton in the zone of increased turbidity formed during soil development and unloading" This aspect should be clarified, especially in view of the situations described by the application of compensatory measures (e.g., destruction, death of biological components).	The amounts of compensation for the expected damage to the fish fauna and trophic base, which are given on p. 519 of the English version of the Report are summarized. Direct calculations of the expected amount of compensation measures for damage to fish fauna and trophic base are provided in Annex M of the English version of the EIA Report. The Annex contains the estimated parameters of the areas of complete destruction of bottom biocenoses, partial fouling of bottom biocenoses and predicted death of zooplankton in the area of high turbidity. The use of compensation funds is regulated by the current legislation of Ukraine and is directed to environmental protection measures, which, in our opinion, should include a number of fish protection measures for the study and artificial reproduction of sturgeon species.

APPENDIXES

APPENDIX A

ENGINEERING AND TECHNOLOGICAL ASPECTS

Aspect. *The study is presented in the "Description of the specifics of the activities during the preparatory and construction works and implementation of the planned activities - Section 1.3" as target areas: city Vilkovo - Izmail Chatal on the Kiliya arm and Izmail Chatal - Reni, on the Danube River. Due to the dredging works to be carried out, we believe that this will affect the morphological conditions of the Isakcha Shallow Water and Kiliya arm, especially the condition of the riverbed substrate. The study does not provide any references to this impact, nor does it indicate possible mitigation measures in case of a negative impact. These aspects need to be clarified.*

Explanation. Given the organization of the canal dredging works, the technology of their implementation provides for the clearing of areas subject to siltation, i.e., places where the processes of accumulation of heavy and suspended sediments take place. That is, their periodic removal will not affect their further spread along the canal. The technology of works on the canal provides for gradual step-by-step removal of soils with artificial formation of slopes to secure the canal walls and prevent erosion and further destruction of the canal walls themselves. Canal bank slopes with natural or close angles of canal sediments in the water are stable and ensure the stability of the relief of the altered part of the canal and prevent bank erosion. Thus, the impact on the canal morphology is limited to localed areas of the canal. The dredging works will not affect the morphology and morphometry of water bodies, as they are carried out exclusively in the riverbed, and the likely intensification of water exchange between the river and water bodies will have a positive environmental effect, such as flushing of water bodies, change of water masses, and slowing down of eutrophication processes.

Aspect. *Intensive shipping traffic can cause disturbance, so when ships pass through coastal areas, artificial changes in water levels occur, consisting of large fluctuations in water levels over a short period of time. The effects of these anthropogenic changes in water level are manifested in the disruption of fish and benthic invertebrate breeding grounds, as well as the uprooting of aquatic vegetation and the potential for coastal erosion.* ***The measures*** *to stop these impacts should be aimed at protecting the shores using environmentally friendly methods, including gabions installed in front of the shores, to the extent possible. Similarly, limiting the speed of navigation, especially in areas with unprotected banks, can lead to a reduction in the production of waves and, consequently, a decrease in water level fluctuations on the banks. Another negative effect of ship engines is the lifting of fine sediments from the bottom of the riverbed, which leads to increased turbidity and damage to natural habitats and plant and* *animal species. The more sediment vessels have, the closer their engines are to the bed bottom and the more intense the sedimentation process.* ***The measures*** *introduced are aimed at implementing a comprehensive monitoring program for natural habitats and plant and animal species (hydrological, biological, chemical monitoring); another measure may be to improve the particle size distribution by supplying coarse sediments to areas where increased turbidity is observed.*

Explanation. Hydromorphological processes associated with changes in water discharge, current velocity, changes in relief, and dredging are accompanied by the paving of the bottom surface with particles of coarse sediment fractions.

As long as the flow velocity is greater than the nonerosive velocity for a given sediment size, fine particles are carried away and the content of coarse particles increases. The process is more intense when heterogeneous soils are spread. When the depth is artificially increased, the velocities are balanced and a self-suspending layer is formed, as large particles no longer move on the new canal topography. This process is stopped when the entire canal is covered with a coarse-grained surface and a layer of sediment accumulation is formed. Fine particles leave the layer during the operation of the propellers mainly in the process of suction, rather than agitation, as in the initial stages of the formation of the embankment.

In turn, the operation of the ship's screws intensifies the process of self-remediation of the canal by removing fine particles and increasing the content of coarse material in the bottom sediments that is resistant to erosion and that corresponds to the nonerosive velocities of the river flow and jets from the operation of the screws. This process occurs at all stages of the canal lining. The bed lining with a layer of coarse material leads to a self-regulating reduction of turbidity and does not require additional measures to improve the particle size distribution by supplying coarse sediments.

The process of forming a self-berm as a layer armoring the surface sediments was studied at analogous facilities in the Dnipro-Bug estuary, at the offshore dredge dump of DWNF and underwater dumps in the northwestern part of the Black Sea. Studies have shown that the armoring layer of the self-propelled riprap is formed even at considerable depths in the presence of weakened bottom currents, preventing soil surface erosion and increasing water turbidity.

Regarding the issue of wave formation during the passage of ships in coastal areas - surf waves and their impact on coastal ecosystems - it can be stated that according to the results of monitoring observations during the operation of the canal, no significant impact was observed. According to the recent studies of the Danube Biosphere Reserve, no significant impact of the operation of the Danube-Black Sea DWNF on plant and animal communities in the study area was observed. The impact of the consequences, directly, of shipping itself (pollution, wave phenomena, etc.) was also not noted. The development of the reserve's flora and fauna was determined mainly by the hydrometeorological features of the year.

Measures to protect the abrasive areas of the banks using environmentally friendly and environmentally friendly methods of strengthening with natural stone were implemented during the construction of flood control structures.

Aspect. *For the passage of large-tonnage vessels, modern dredging works are required to maintain navigable depths of the fairway over 8 meters. This activity leads to a change in the sediment regime. The measures introduced are aimed at periodically conducting topobathymetric measurement campaigns every 3 or 5 years along the entire width of the Kiliya arm, especially in critical sectors, to ensure continuous monitoring and obtaining the necessary data to assess the intensity of hydromorphological processes and to increase knowledge of the Danube riverbed dynamics. In addition, prudent management of dredging, sediment movement in the riverbed, and narrowing the riverbed width by dredging only a narrow part of the riverbed rather than the entire width are operational measures to reduce the impact of navigation on the sediment regime.*

Explanation. When making design decisions for the reconstruction of the canal, the volume of dredging and sediment movement during the works was based on the current morphometric features of the route sections and the parameters of the design vessel at full development: length - 125 m, width - 18.1 m, draft - 7.2 m. Taking into account the requirements of navigation safety, the minimum possible width of the canal along the bottom was determined in certain sections of the canal from 60 to 120 meters, taking into account the narrowing of the canal width. In particular, it is 85 meters on the sea approach canal, and 60 meters on the river part of the canal in some narrow sections of the route (1.5-10 km, 21-32 km, 60-77 km).

The places of work are the spillways of the Kiliya arm, the branching area of the Starostambulskyi and Bystryi arms, and the sea bar of the Bystryi arm. Floods in the Danube delta are usually confined to places of significant canal widening (for example, at 62 - 64, 56 - 58, 47 - 48 miles of the Danube, 52 -54, 60 - 63 km in the Kiliya arm), to places of outcrop of hard-to-wash rocks (for example, clay at 46-49 km in the area of the city of Kiliya and at 36-39 km, above the island Maikan), to areas of strong riverbed curvature below a large junction (for example, the Vylkove roll at 16-18 km, below the source of the Ochakiv arm). The depth in the shallowest reaches at the Danube estuary can drop to 3÷5 m.

Reducing the impact of navigation on the sediment regime and hydromorphological processes is ensured by:

- development of rifts without overdredging throughout the entire cut;

- systematic observations of long-term series of hydrological elements that are subject to change during the planned works at the hydrological stations of the Danube Hydrometeorological Observatory (DHMO);

- regular (currently once every 3-5 years, and more often in problem areas) detailed measurement work, including to ensure navigation safety, support dredging operations and monitor hydromorphological processes.

The problem of improving navigational conditions on rifts should be solved by constructing openings or setting up appropriate navigation facilities. The project envisages (**1.3.3 Ensuring shipping**) the installation of navigation equipment, pilotage and regulation of vessel passage by the Regional Vessel Traffic Control Service (RVTCS) "Danube" of the SE "Delta-locman".

Field studies have shown that the shoals are subject to permanent reformation in natural conditions, which is why they are characterized by underdeveloped macrozoobenthos and are not important as food and habitat for fish and birds. Therefore, both natural and man-made damage to these sections of the riverbed cannot lead to significant negative impacts on fish and bird life, especially in a transboundary context.

Aspect. *No mention is made of the impact of the jet-directed dam at the bifurcation of the Bystryi and Starostambulskyi arms on sediment flow, especially on bottom sediments. In fact, the motivation for the construction of the dam was to direct the flow of sediment towards the Starostambulsky arm and to ease the burden of annual dredging at the bar of the Bystryi arm. On the other hand, the increased flow of fine and coarse sediments from the estuary of the Starostambulsky arm significantly changes the impact of these alluviums in the area of the estuary of the Sulinsky arm on the sea.*

Explanation. Model studies of the impact of a jet-directing dam on water flows and water levels in the Bystryi and Starostambulskyi arms were carried out at the Institute of Problems of Mathematical Machines and Systems of the National Academy of Sciences of Ukraine (IPMMS).

According to the simulation results, during the construction of a jet-directing dam at the fork of the Bystryi and Starostambulskyi arms, the flow redistribution between them decreases by 59%, 49%, 43%, 46% and 50% relative to the DWNF option without such a dam, respectively, at costs of 7,600, 6,000, 3,400, 1800 and 1000 m^3/s and is from 0.3% to 0.6% of the flow of the Old Istanbul branch below the fork.

When calculating the volume of solid runoff according to the methodology of the Danube Hydrometeorological Observatory (DHMO), the volume of suspended VR and suspended sediment is described by the following ratio: $V_в=0.1V_R$. Thus, the operation of the flow-directing dam in redistributing the flow below the fork by 0.3-0.6% of the flow of the Starostambulsky arm does not give grounds to predict significant changes. At the same time, the river alluvium of the arm is partially used for siltation of Mosura Bay and formation of pioneer forms of coastal and marine genesis on the seashore, which is a natural process of development of this part of the Danube delta.

Reduction of solid and liquid runoff is expected with the construction of a shorter underwater dam. The project envisages the possibility of adjusting the length of the dam on the basis of mathematical modelling, taking into account the monitoring results.

Aspect. *There is no mention of the impact of pollutant-laden wastewater that will flow into the Kiliya arm from 4 soil dumping sites 10 miles along the watercourse between Vilkovo and the port of Izmail. These aspects are important in view of the developer's conclusion that navigation in the Danube delta is fundamentally impossible without regular/permanent human intervention.*

Explanation. The projector's proposed handling of dredged material from 10 shoals (rills) in the area between the towns of Vilkovo and Izmail is storage at 4 specially equipped onshore areas (onshore hydraulic dumps of dredged material No. 6, 9, 12b and 12c). When designing hydraulic dumps, it is envisaged to fill the territory with primary embankment dams, which ensure the formation of the initial capacity of hydraulic dumps, water filtration from the washed soil and prevent arbitrary spreading of the pulp, and the arrangement of the drainage base.

Along the dams of the primary embankment, along the outer boundary of the hydrodump site, drainage canals are provided, which ensure the interception of drained waters and their drainage through watercourses, thus protecting the adjacent territory from flooding. The design of the primary embankment dam was carried out taking into account the possibility of using local materials, the use of auto-mechanization, as well as taking into account the drainage capacity of the material. Areas set aside for project hydraulic dumps are composed of deposits represented by dusty sands with interlayers of silts, as well as silts, light and heavy loams, and light dusty clays. A layer of lightly peated loam was found in the areas of hydraulic dumps Nos. 6, 9, 12b.

Soil is to be applied to each section of the landfill in layers, without exceeding the level of the landfill.

The proposed technology provides for the discharge of clarified wastewater into the Danube River without introducing additional pollutants. Suspended solids with adsorbed metals, organic and radionuclides are retained in sedimentation ponds. Dissolved harmful impurities are not expected to be released when they are diluted with water from the embankment canals, given the low flow rates of return water. According to the results of monitoring studies, the soils to be stored at the onshore dumping sites can be classified as clean uncontaminated soils according to the PMAX world classification of dredged soils. The discharge of waste water will not have any additional impact on the aquatic environment.

Aspect. *The report states that "a dredge of more than 10 meters" will be implemented to allow vessels with a draft of 7.2 meters to pass. In our opinion, this is an excessive insurance to prevent possible sedimentation at critical points; the maximum depth for this dredging is not specified and a limit value should be set to take into account a proper assessment of the environmental impact, especially on the hydrodynamics and hydromorphology on the Kiliya and Tulcha arms, which affect the currents in the Sulinska arm, a waterway of international importance. The value of ">10 m" is new and contradicts what is currently established on the section between Bar Sulina - Sulinsky Canal - Tulcha Arm - Chatal-Izmail on the recommendation of the Danube Commission, which provides for a depth of 7.32 m for vessels with a draft of 7.01 m. Also, taking into account such elements as the vessel's draft and keel clearance, there is no need to deepen the fairway to 10 meters.*

The ship's draft is the level at which the ship sinks when it is moving, compared to the level when it is stationary, in waterways with a limited cross-section. The loaded ship has a draft of approx. 20-40 cm.

The distance under the keel is defined as the distance between the bottom of the moving vessel and the highest point of the river bed. To avoid damage to the keel and/or propeller, it should be at least 20 cm for a gravel riverbed and 30 cm for a rocky riverbed. In this sense, for a vessel with a draught of 7.2, the minimum depth of the fairway that must be provided is 7.90-8 m.

Explanation. The design depths for the sections of the DWNF were calculated in accordance with the applicable regulatory documents and in accordance with the customer's specifications for the design vessel. For the offshore part of the canal (bar part), the calculations were performed in accordance with the "Standards for the Design of Sea Canals RD 31.31.47-88". For the river part of the canal, the calculations were performed in accordance with the "Guidelines for the Design of River Ports, 1982. (NTP of ports on inland waterways, 1997). The parameters of the design vessel for full development are included in the calculations: length 125.0 m, beam 18.1 m, draft 7.2 m.

The design depth at the sea approach canal of the DWNF under maximum hydrometeorological conditions is 9.52 m - 10.0 (BS), at the turn - 10.5 m (BS). The canal width along the lower banks is 85 m, and 125 m at the turn. In the river part, the design depth to the Reni is 8.50 m, and the slope in the BS is 8.76 - 8.09 m. The canal width is 60-120 m.

The parameters of the deep-water canal obtained in the calculations ensure its safe operation in adverse weather conditions and, due to the greater depth margin under the ship's keel, the possibility of sediment erosion along the canal bed is reduced. This, in turn, will prevent the creation of additional turbidity zones and reduce the impact on the hydrodynamics and hydromorphology of the Danube River arms.

Aspect. *The non-technical summary states that "The scope and parameters of the listed biotechnical measures (measures to artificially maintain optimal depths in the area of the Bystryi corner and in the water area separating Ptashyna spit from the main island) were subject to clarification in the course of additional field studies that were not carried out due to force majeure." the planned activities and works of the project in the transboundary context, namely the aquatic environment and the most valuable components of the delta biome, the existence of which is related to the aquatic environment - fish and birds, are not analyzed on the basis of detailed and substantiated information.*

Explanation. The natural water level in the delta's maritime edge is unstable in different periods of the year. During the period of high water, the islands are flooded, and the reservoirs located on them are filled with water. The highest water level is observed at the end of March: lasts 2-3 weeks. At this time, the territory is almost 95% filled with water, and in September-October it reaches a stable equilibrium. Also, the water level, above all in the reservoirs of the eastern seaside part of the territory, depends on the direction and strength of the wind and can change by 90 cm during the day.

At the same time, being under the influence of continuously changing abiotic conditions, the plants and animals of the delta have adapted to a wide range of fluctuations in environmental parameters (periodic flooding and drainage, changes in water salinity, movement of bottom sediments, etc.). The delta's biota is also characterized by the constant development of new territories near the delta's marine edge.

The main colonies of cormorants, herons and ibises are located in the secondary delta of the Kiliya arm of the Danube. Of particular importance in the life of waterfowl and near-water birds are the spacious shallow waters of the Kiliya avandelta of the Danube, where seasonal bird gatherings number more than 50,000 individuals. Most of the migrating ducks are concentrated here. In some seasons, the number of common terns alone in the shallow sea water reaches 16–20 thousand species, and the same number of coots live there. Other species are less numerous. From 500 to 5,000 mute swans molt almost every year in the southern muddy area of the avandelta.

Particularly valuable are the ornithological complexes of low coastal islands and spits. In particular, to the south of the estuary of the Bystryi arm, the Ptashyna spit emerged in the late twentieth century, where one of the two most important colonies of plover-like birds in the reserve is located. Nest here: magpie sandpipers (Red Book of Ukraine), terns (Red Book of

Ukraine), terns and terns, laughing gulls, terns.

On the Ptashyna spit, a delta formation in the area of the estuary of the Bystryi arm, in the years preceding the start of work on the construction of the DWNF sea access canal, there were one of the largest colonial nesting settlements of land-nesting birds in the Danube delta, mainly the yellow-legged martin, the river *Sterna hirundo* and pintaili *Thalasseus sandvicensis* terns. In 2004, the breeding success rate of colonial bird species on this spit fell sharply (by 9-15 times). For the red-billed tern – the main colonial species of the coastal spits of the front edge of the delta – in 2004 it was at the level of 3-5% against the usual 50-70% in previous years. For river tern - the second most numerous species, this indicator was slightly higher - 7-10% against the usual 60-80%. According to the conclusion from the act of inspecting the Ptashyna spit, the most likely reason for the unsuccessful reproduction and subsequent change of the nesting place should be considered to be storm phenomena that took place during the period of egg incubation (these phenomena are a natural factor that often leads to the destruction of nests on the spits, as a result of which in birds nesting in such biotopes have developed the ability to repeatedly lay eggs), but the effect of the disturbance factor caused by dredging works on the bar of the Bystryi arm at a distance of 500 m from the spit cannot be completely excluded. Starting from 2005, a gradual decrease of colonies was observed, and in 2008 they completely disappeared. The reason for the disappearance of the colonies, according to the ornithologists, is the progressive shallowing of the water area between the main delta island of the Kuban and the Ptashyna spit, which, since the winter of 2007-08, has led to the availability of the territory of the spit for terrestrial predators (foxes and raccoon dogs) and wild boar. Such a neighborhood in nature in the conditions of the Danube delta turned out to be impossible. As a result, the birds were forced to leave their traditional nesting places.

Species of disperse-nesting waders, which are more tolerant of the presence of terrestrial predators, continue to nest on the spit in normal numbers.

Over the past decades, the main places of colonial settlements of this group of birds in the Ukrainian part of the Danube delta have changed several times. From Ptashyna spit, the colonies moved to other territories - Nova Zemlya and Taranova spit- territories located near Ptashyna spit (table. This is evidenced both by the dynamics of their numbers in Nova Zemlya, and by the appearance of stilt-billed terns and terns nesting in this territory (Fig.

In order to study the impact of hydrotechnical construction and operation of the DWNF Danube river-Black sea on the colonial settlements of birds on the Ptashyna spit, it is important to determine the ratio of natural and artificially induced processes of the spit evolution.

According to long-term monitoring observations, in 2014 there were processes that were actively building up the island. They slowed down somewhat in 2015-2016, the contours of the island did not change significantly. In 2017, fluctuations in the area of the intracoastal space between the island and the shore were observed, and in August the southern part of the island closes with the shore. In 2018, the island turned into a peninsula and remains in this state to this day.

In recent years, there have been no significant changes in the configuration of the shores of Ptashynyi island (peninsula). Even in the spring, the southern part of the island closes with the coast - fluctuations in the area of the inner coastal space between the island and the coast are minimal.

Having a permanent connection with the mainland of the reserve, bird settlements and their nesting sites are under significant influence of predators. In order to prevent local impacts of the DWNF along Bystryi estuary on the nesting habitats of ground-nesting bird species, it is advisable to protect the Ptashynyi island spit from the mainland of the Reserve by clearing the canal. Taking into account the fact that the common jackal, whose diet includes birds and their eggs, has appeared in the coastal part of the DBR, and the fact that the jackal can swim well, it is necessary to install additional low fences around the perimeter.

The conditions of connection between the Ptashynyi island spit and the Black Sea through the Strait were modeled: on the northern section - the strait between the right dam of the DWNF and the distal part of the spit; on the southern flank - the strait between the Skhidne estuary and the southern distal part of the spit. To the north, the water area is bounded by the projected dam.

Between the shore and the Ptashynyi island spit, a strait with natural contours that coincide with the spit's generations adjacent to the shore has been formed. The depth of the strait is 0.5-0.7 m, the width in the central part of the island is 20-60 m (Fig. 1).

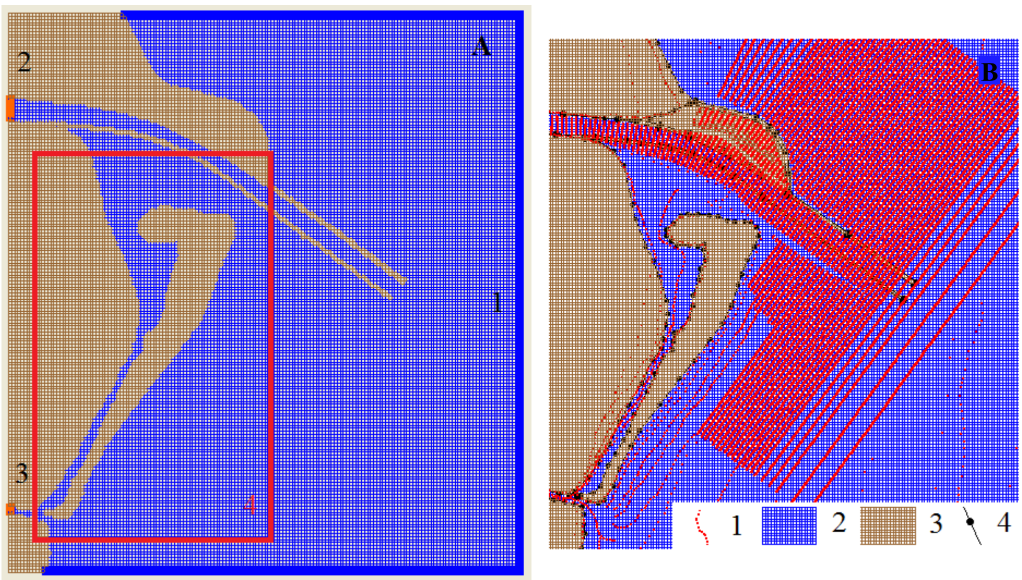


Figure 1 - Schematization of the modeling domain of the Ptashynyi island strait and spit. Modeling scheme (A): 1 - outer boundary of the modeling area (sea level), 2 - northern boundary (water discharge - Bystryi estuary), 3 - southern boundary (water discharge - Skhidne estuary), 4

- the Ptashynyi island strait and spit. Model output (B): 1 - depth measurement points, 2 - water, 3 - land, 4 - water cut.

The conditions of interaction between the eastern storm of 5% probability and the runoff flow of the Bystryi and Skhidne estuaries were modeled. The flow velocity of the Vostochne estuary was assumed to be 0.1 m/s. The wave height is 2.5 meters. The spit is composed of fine sand with a density of 1.95 t/m3.

According to the analysis of satellite images and cartographic material, the natural development of Ptashynyi island spit is the process of building up the northern distal tip and joining the southern, narrower part to the shore. For some time, there has been a strait between the spit and the shore, which is mainly filled with sediment supplied by the surf flow from the sea edge as storm waves splash over the spit body. The spit's sea edge is being built up by supplying bottom material to the cut, which is first used to build an underwater shoal along the spit's seaward edge. Now the southern and middle parts of the spit have joined the shore. The canal is filled with sediment and has dried up. In order to create a water barrier for predators entering the spit for some time, one of the alternatives is to maintain an artificial connection to the Black Sea and the Skhidne estuary and restore the strait between the spit and the shore.

The functioning of the alternative option with the strait was modeled in the CMS system. The Coastal Modeling System (CMS) is an integrated set of numerical models for simulating flow, waves, salinity, sediment transport, and morphology in coastal areas.

According to the modeling results, in the presence of the southern barrier of the DWNF, the northern part of the site will develop mainly under the influence of upwelling and compensatory water movements. During storm activity, a compensatory runoff flow with a velocity of 0.07 m/s is formed along the dam. The current along the distal spit of the Bird Island is directed to the shore with a velocity of 0.09 m/s (Fig. 2.A).

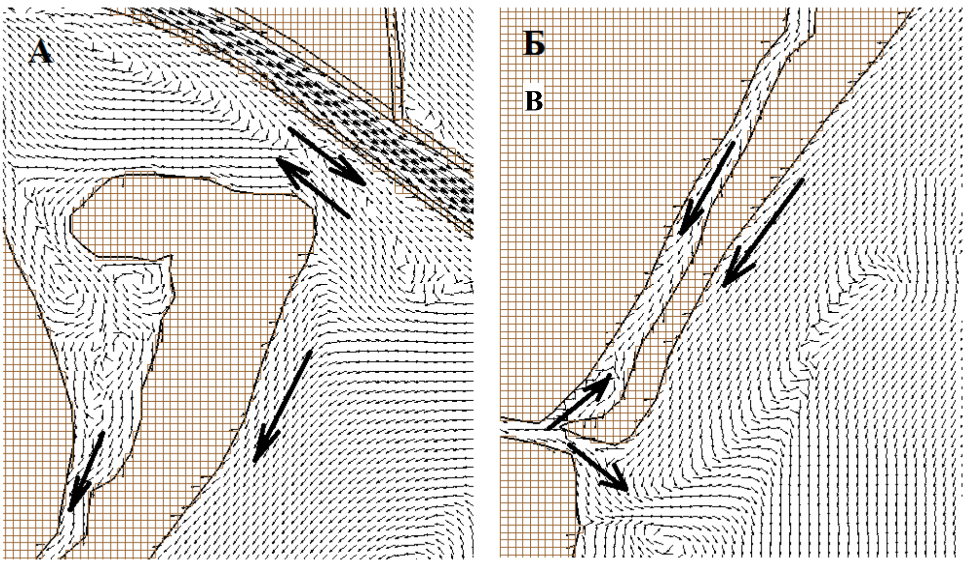


Figure. 2 - Model scheme of currents in the northern part of the site (A) and southern part (B)

Closed circulations are formed in the wave shadow of the spit, which repeat the contours of the coastline of its back part. At the same time, a southward current with a velocity of 0.04-0.1 m/s develops along the canal fairway. The current velocity increases in the direction of the Vostochne estuary. The current develops within 3 hours.

In non-stormy conditions, the formation of a current directed from south to north is observed. Its formation is associated with the effect of the runoff current of the Skhidne estuary, which spreads into the strait through the southern proran. The flow velocity can reach 0.05 m/s (Fig. II.8.2.B).

The modeling showed that the water barrier in the form of a strait functions in the presence of a connection with the Black Sea and the Skhidne estuary. Its depth and water exchange are maintained by storm surges, compensatory runoff flows, and the runoff flow of the Vostochne estuary. Water inflows from one of the ditches ensure the availability of water for a long time and the relative stability of its level.

The canal maintains a depth-averaged current of 0.04-0.1 m/s, which is non-dissolving at the height of the roughness protrusions for sediments with a particle size of 0.05-0.5 mm. Therefore, it can be expected that siltation processes in the canal will not be intense.

When a storm develops from the east or southeast, a rise in the level is formed in the northern part of the site in the corner of the enclosing dike due to the storm water run-up. In the presence of a strait, seawater enters the reservoir bounded by the dam, the shore and the back of the spit. The water level in the reservoir rises, and a current is formed that flows southward through the strait. When the storm subsides, the excess water returns to the sea by a compensatory current directed along the dam. The current is likely to maintain the depths in the northern ditch.

To ensure the growth of the Ptashynyi island spit in height and to prevent the surf flow from overlapping its body and transferring sediments to the strait, it is recommended to plant vegetation on the back of the spit. As a result of the development of the phytogenic barrier, an artificial barrier to predators will be formed, which at the same time will be an obstacle to the path of surf and wind-sand flow. This will lead to the accumulation of sediments transported through the spit body and an increase in its height, and, accordingly, its resistance to the effects of disturbance.

Fresh water inflow from the Vostochne estuary will help flush the canal with fresh water and promote the development of aquatic vegetation on the back of the spit.

The scope of clearing works and parameters of measures to artificially maintain optimal depths in the area of Bystryi corner and in the water area separating Ptashyna spit from the main island, aimed at preventing the entry of predators and destruction of nesting sites of valuable species, requires a series of field works to clarify the existing conditions, which is currently impossible under martial law. Decisions on the parameters of the cut are to be made in consultation with the administration of the Danube Biosphere Reserve.

Aspect. *The coordinates included in Table 1.1 - Coordinates of cargo block centers, when loaded into the GIS system, indicate the Sulinsky district.*

Explanation. The coordinates of the loading blocks centers specified in Table 1.1 are correct.

Table 1.1 – Coordinates of the centres of loading blocks

No.	Northern latitude	Eastern longitude
I	45°19'13"	29°51'58"
II	45°19'33"	29°51'58"
III	45°19'23"	29°52'23"
IV	45°19'03"	29°52'23"
V	45°18'53"	29°51'58"
VI	45°19'03"	29°51'33"
VII	45°19'23"	29°51'33"

In the table, the coordinates of the loading blocks are presented in the format dd mm ss (deg, min, sec). For displaying in the accepted mapping projection of the GIS system, the coordinates from the DD MM SS table format are recalculated in the form D,DDDDDD (Table. 2):

D,DDDDDD= DD + MM/60+SS/3600.

Table 2. Coordinates of boot blocks in the format D,DDDDDD

No.	Northern latitude (DD MM SS)			Eastern longitude (DD MM SS)			Lat (D,DDDDDD)	Lon (D,DDDDDD)
I	45	19	13	29	51	58	45.320278	29.866111
II	45	19	33	29	51	58	45.325833	29.866111
III	45	19	23	29	52	23	45.323056	29.873056
IV	45	19	3	29	52	23	45.317500	29.873056
V	45	18	53	29	51	58	45.314722	29.866111
VI	45	19	3	29	51	33	45.317500	29.859167
VII	45	19	23	29	51	33	45.323056	29.859167

The position of the centers of the loading blocks is shown on the Open Steet Maps (OSM) mapping base in the WGS-84 coordinate system (Fig. 2). The GIS QGIS software 3.18 was used.

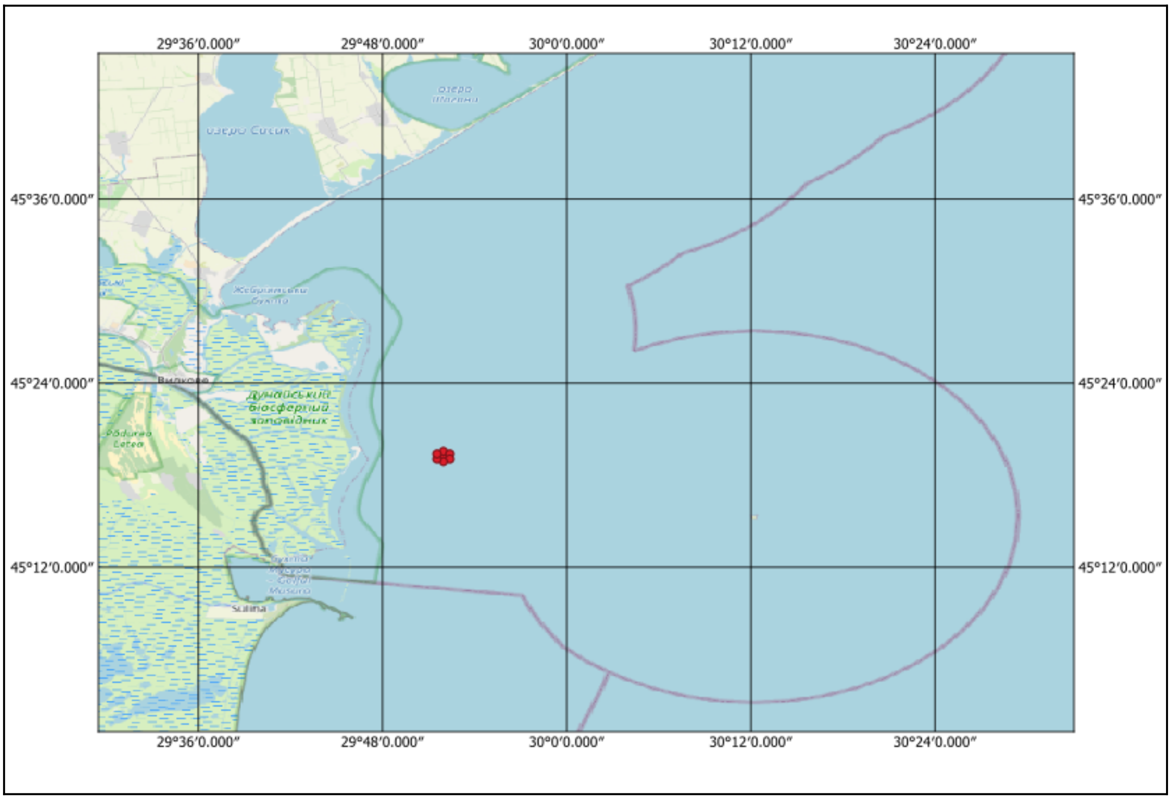


Figure 1. The position of the centers of the loading blocks of the offshore hydraulic dumping of DWNF dredged material (shown in red).

APPENDIX B

Taking into account the observations and comments provided by the Romanian party as a result of the review of the environmental impact assessment report of the planned activity "Reconstruction of the construction facilities "Creation of a Deep-water navigation fairway on the river Danube - Black Sea in the Ukrainian part of the delta". Cumulative impact assessment

The area of possible environmental impacts of the planned reconstruction of the Danube-Black Sea Deep-water navigation fairway (DWNF) within the territory of Ukraine covers the entire Kiliya delta and the adjacent seashore area, and the analysis of possible transboundary impacts extends to the Sulinsky delta. Thus, the subject of the analysis of cumulative impact factors of the planned activity is the sources of environmental impacts of industry, agriculture and infrastructure throughout the Lower Danube region.

Given that the route of the Danube-Black Deep-water navigation fairway passes through the Ukrainian part of the Danube River delta, along with the territory of the Danube Biosphere Reserve, which is part of the bilateral Romanian-Ukrainian Danube Delta Reserve and other protected areas, including Natura 2000 sites and wetland biocenoses of the Danube delta, As the Danube delta is classified by the Ramsar Convention as particularly sensitive to anthropogenic impacts, the impacts on flora and fauna are of particular importance in the comprehensive assessment of the impacts of the DWNF reconstruction and their cumulation with other activities.

It should be borne in mind that long-term negative environmental impacts can be caused by both recurring impacts directly related to the operation of the DWNF (shipping and repair dredging) and permanent impacts (changed morphological and hydrological parameters of the arms and the adjacent seashore) resulting from construction activities: dredging on the rifts of the branches and in the sea bar area, and creating hydraulic structures.

The objective of the analysis is to identify the most significant factors and sources of cumulative impacts on biota for the period of reconstruction and operation of the DWNF and, accordingly, the most effective environmental measures to minimize them.

Based on the above and taking into account the results of previous assessments, the priority biosphere elements whose environmental safety should be assessed in the context of the planned reconstruction of the DWNF, taking into account the cumulative impacts, are the populations of protected waterfowl species in the Danube delta, populations of sturgeon and Danube herring migrating through the delta arms, and species diversity of terrestrial vertebrates, including mammals.

Populations of waterfowl and near-water birds are the most valuable component of the animal world of delta of the river Danube. Protected species occupy a prominent place among the total species diversity of the delta birds. The populations of these birds in the area of the gas storage facility's impact are highly sensitive to all factors of impact during its reconstruction and operation. Danube is the last river in the Black Sea basin, where the natural cycle of sturgeon reproduction is carried out. Bystryi arm is one of the main routes of their migration. Adult individuals of sturgeon during the spawning migration period and juveniles during the spawning and grazing period are quite sensitive to the factors of influence during the operation of the DWNF.

The Danube herring is a Danube endemic and the most massive species of passing fish in the delta of the river Danube occupies a leading place in commercial fishing in the Danube region. Bystryi arm is one of the main routes of its migration. Adult specimens of the Danube herring during the spawning migration period and juveniles during the spawning period are quite sensitive to the impact factors during the operation of the DWNF.

Mammals are not very numerous, but an important part of the animal world of the delta of river Danube. Preservation of their species diversity is important for maintaining the stability of local animal groups. Among the mammals in the zone of influence of the DWNF are representatives of protected species. Mammals are very sensitive to the factors of influence in the conditions of operation of DWNF.

For the listed animal communities, the impact factors of the planned activity, which may be cumulative with the impacts of other economic activities in the Danube region, are loss of habitats and breeding grounds, water pollution, air pollution, loss of feeding grounds, acoustic impacts propagating in the air, vibrations in the aquatic environment, direct mechanical impacts causing damage, changes in water flow characteristics. These factors are produced by the main sources of impacts of the planned DWNF reconstruction activities, which include: shipping, dredging, changes in the morphometry of the Bystryi arm and its bar, and hydraulic structures.

Each of these sources can cause a range of direct and indirect negative environmental impacts.

Shipping: Possibility of coastal erosion due to waves generated by ships passing through the DWNF, disturbance of animals caused by engine noise and sound signals from ships, emissions of pollutants from ship engines and in the event of fires or explosions on ships, pollutants entering the water in the event of shipwrecks, damage to planktonic organisms by ship propellers, scaring away fish going to spawn, vibration from ship engines, damage to fish by ship propellers.

Operational dredging: loss of areas along the shores allocated for onshore dumping and seabed areas allocated for offshore dumping, engine noise and sound signals during dredging operations, suspended and dissolved pollutants entering the water as a result of soil loss during dredging operations, dumping to the offshore dumping ground and with return water from the shore dumps, emissions from the engines of the technical means used for dredging, destruction of benthos organisms during dredging and dumping to the offshore dumping ground, destruction of fodder grounds on a part of the island Yermakiv, used for dumping, the devaluation of such lands in other parts of the island due to the deterioration of the water regime due to the presence of these dumps, scaring away fish going to spawn by vibration from the engines of dredging vessels, and the entrapment of young fish in the working bodies of dredgers.

Changes in the morphometry of the Bystryi arm and its bar: The possibility of erosion of the shores of the Bystryi arm and the Ptashyna spit due to changes in the direction and speed of currents. Possibility of draining a part of the territories watered by the Ochakivskyi and Starostambulsky arm system below the Bystryi arm (due to redistribution of runoff between the delta arms), possible depletion of benthos in the Bystryi arm, which will be periodically penetrated by a wedge of salt water due to the opening of the bar, the possibility of a gradual increase in water flow rates and velocities in the Bystryi arm with a simultaneous decrease in these parameters in the systems of the Ochakivskyi and Starostambulskyi arms ((below the branch of the Bystryi Shvydkyi arm), the possibility of changing the parameters of flows near Ptashyna spit.

Hydraulic structures: occupation of animal habitats by dams and bank protection areas; loss of benthos in areas occupied by hard substrate structures and its replacement by communities of fouling with lesser feeding value; possible obstruction of sturgeon feeding and spawning migration by the sea access canal's barrier dams; changes in water flow parameters near hydraulic structures; changes in the characteristics of alongshore currents by the barrier dams, which may intensify the processes of reshaping the front edge of the delta; redistribution of water flow by the jet-directed dam at the branch of the Bystryi and Starostambulskyi arms.

Based on the results of the comprehensive analysis of factors and spectrums of cumulative impacts presented in Section 5.5 of the EIA report, a generalized description of the most significant cumulative impacts of the planned activities on animal communities is presented below, which makes it possible to assess in-depth their possible combination of the planned activities with the impacts of other economic activities in the Danube region in further studies under the post-project analysis and post-project monitoring procedure.

The loss of habitats and breeding grounds for animals may occur due to the destruction or rendering unsuitable for long-term habitat for birds and mammals as a result of dredged material being stored in shoreline dumps, possible bank erosion, possible drainage of part of the islands due to the redistribution of runoff between the delta arms, as well as due to the occupation of fish feeding areas by access canals, dredged material dumping sites and barrier dams.

Disturbance of animals due to noise impacts caused by engine noise and sound signals of ships passing through the access canals and arms of the delta, noise during dredging and port operations.

Deterioration of living conditions due to water pollution occurs due to changes in the chemical composition and increased turbidity of water during dredging, soil storage in shore dumps, offshore dumps, shipping and discharge of polluted waste water of various origins.

Deterioration of habitat conditions due to air pollution occurs as a result of emissions from ship engines, similar emissions from dredging, machinery and vehicles in ports, and accidental emissions from fires or explosions.

The loss of food sources can occur due to: occupation of land by shoreline dumps and reduction of the value of adjacent land due to deterioration of the hydrological regime induced by the dumps; difficulty in feeding birds on water due to shipping, due to the destruction of benthic organisms by dredging and dumping; depletion of the diet of predatory mammals hunting within the water area and along the shoreline of shipping arms, due to the loss of attractiveness of these areas for potential victims.

Interference with fish migration flows can be caused by the spread of vibration in the water from the working bodies of ships and dredgers.

Direct mechanical impacts can be caused by juvenile fish being dragged into dredgers' mechanisms, adult fish being damaged by ship propellers, and injuries to terrestrial animals swimming through shipping canals, which also impedes migration between the delta islands.

Changes in the hydraulic characteristics of coastal massifs and transitional characteristics of water flow due to the redistribution of runoff between branches, the presence of sea access canals and barrier dams may cause indirect impacts on animal communities, namely intensification of transformation processes in the adjacent formations of the delta's leading edge with possible disruption of the habitat of local bird populations, changes in the flow velocity fields and salinity gradients with possible difficulties for the migration of migratory fish.

The most significant factors of economic activity impact on the Danube environment, which will be cumulated with the impact of the planned reconstruction of the Danube-Black Sea DWNF, are the activities of the seaports of Reni, Izmail, and Ust-Dunaisk with the port of Kiliya. First of all, this concerns dredging and hydraulic works in the ports' waters. In particular, the priority measures for the implementation of the Strategy for the Development of Ukrainian Seaports for the period up to 2038, approved by the Order of the Cabinet of Ministers of Ukraine of 11.07.2013 No. 548 (as amended by the Order of the Cabinet of Ministers of Ukraine dated 23.12.2020 No. 1634-r) is assigned:

- for the seaport of Reni in the short and medium term (5-10 years) - coastal protection works in the area of the oil transshipment complex, as well as the left bank of the section of the Danube River from the state border of Ukraine with the Republic of Moldova to the seaport territory;
- for the seaport of Izmail in the short and medium term - maintaining the depth level in the seaport water area in accordance with the declared depths, which, in particular, correspond to the depth level at the DWNF of the Danube river - Black sea;
- for the Ust-Dunaisk seaport in the long term (25 years) - restoration of depths in the waters of the Ust-Dunaisk seaport, in particular the port point of Kiliya, and ensuring a stable level of depths at the DWNF in the fairway of the river Danube - Black sea.

In the context of Russia's aggression against Ukraine, the temporary loss of its seaports in the combat zone and the constant threat of a blockade of ports along the coast of Odesa region, traffic flows through the ports of the Ukrainian Danube region have increased several times, which has led to the rapid development of the latter and a corresponding increase in the volume of dredging in the adjacent sections of the Kiliya arm.

In particular, in the developed part of the water area of the Danube River which is located along the Vilkovo - Izmail Chatal shipping canal from 91.09 to 91.55 km and is part of the Izmail seaport, the company plans to start new construction of hydraulic structures on an area of 5.29 hectares with a volume of dredging of 112,000 m³ in the near future.

Other factors of impacts of economic activities in the Danube region that should be taken into account when assessing their cumulation with the planned activities include, first of all, impacts on the quality of natural waters of the Lower Danube sub-basin, which is primarily wastewater discharges.

According to the water use reports in the form No. 2TP-Vodkhoz (annual) in 2019, analyzed in the Annual Report on Water Management of the Lower Danube Subbasin for 2020 of the Black Sea and Lower Danube River Basin Water Resources Management Department of the State Agency of Water Resources of Ukraine [https://oouvr.gov.ua/diyalnist-buvr/plan-nush-dyn/], the total volume of wastewater discharged into surface water bodies of the Danube river basin, amounted to 57.46 million m^3, including: 32.59 million m3 of polluted water without treatment, 0.138 million m3 of polluted water with insufficient treatment, 22.23 million m^3 of normatively clean water without treatment, and 2.500 million m3 of normatively treated water. Characteristics of the main sources of wastewater discharges are shown in Table B.1.

Table B.1 - Wastewater discharges according to the form No. 2TP-water farm (annual) in 2019 in the Lower Danube sub-basin

Number on the list	Name of the organization or enterprise that is the source of environmental pollution	Discharge volumes, million m^3/year	Explanation and analytical environmental assessment	Coordinates of discharge sources
1	PJSC "Pulp and Paper Mill" (EDRPOU code 00278818)	2.503 of them: 0.004 2.499	 -- normatively clean without purification - normatively clean (BIO)	45°17'27,00"N 28°55'32.00"E
2	PJSC UDP Kiliya Shipbuilding and Ship Repair Plant (EDRPOU code 33113076)	0.031	(contaminated without treatment);	45° 26' 25.0"N 29° 15' 32.8"E
3	Titan LLC (EDRPOU code 25415133)	0.001	(normatively clean without treatment);	45° 25' 41.6"N 29° 16' 54.0"E
4	Municipal enterprise Svitlo (EDRPOU code 32319458)	0.138	(contaminated insufficiently cleaned)	45° 26' 05.2"N 29° 18' 11.8"E
5	Kamolino-Holding LLC (EDRPOU code 37905021)	5.715	(normatively clean without treatment)	
6	PJSC Izmail Navasco (EDRPOU code 24769509)	1.092	(normatively clean without treatment)	45° 28' 08.43"N 29° 9' 19.11"E
7	Pivden Agro Holding LLC (EDRPOU code 39688078)	1.285	(normatively clean without treatment)	45° 26' 53.6"N 29° 20' 14.0"E
8	Debut-2005 LLC (EDRPOU code 33757219)	11.93	(contaminated without treatment);	45° 27' 15.3"N 29° 30' 16.3"E
9	Individual entrepreneur Krivenko (taxpayer code 3062116515)	0.116	(normatively clean without treatment);	45° 26' 53.6"N 29° 20' 14.0"E
10	APC Mayak (EDRPOU code 30704515)	15.01	(contaminated without treatment (CDW);	45° 26' 53.6"N 29° 20' 14.0"E 45° 27' 01.1"N 29° 19' 35.0"E
11	LLC Blakytna Nyva-2005 (EDRPOU code 03889221)	0.088	(normatively clean without treatment);	45° 26' 34.2"N 29° 18' 43.4"E
12	PJSC Ukrtransgaz (EDRPOU code 30019801)	0.001	(normatively clean (BIO));	
13	Crocus (EDRPOU code 22505261)	0.177	(normatively clean without treatment (CDW)	45° 25' 26.97"N 29° 6' 40.46"E
14	Dunay-Agro LLC (EDRPOU code 25039859)	0.820	(normatively clean without CDW treatment);	45° 25' 38.13"N 29° 6' 16.66"E
15	APC Dunay (EDRPOU code 32443875)	1.635	(normatively clean without treatment (CDW);	45° 27' 09.9"N 29° 09' 21.9"E
16	LLC JV Danube-Agro (EDRPOU code 30819680)	3.388	(contaminated without treatment	45° 27' 09.9"N 29° 09' 21.9"E

Number on the list	Name of the organization or enterprise that is the source of environmental pollution	Discharge volumes, million m^3/year	Explanation and analytical environmental assessment	Coordinates of discharge sources
			(CDW))	45° 26' 53.6"N 29° 20' 14.0"E
17	APC Druzhba (EDRPOU code 03769497)	2.228	(contaminated without treatment (CDW));	45° 31' 28.5"N 29° 26' 49.6"E
18	Rice of Bessarabia LLC (EDRPOU code 36837333)	11.30	(normatively clean without treatment ((CDW))	45° 26' 41.2"N 29° 26' 49.6"E

Among the sources listed in the table, the following stand out in terms of discharge volumes: PJSC Pulp and Cardboard Mill, LLC Kamolino-Holding, LLC Debut-2005, APC Mayak, LLC JV Dunay-Agro, Druzhba, Rice of Bessarabia LLC, and four of them, namely Debut-2005 LLC, APC Mayak, Dunay-Agro LLC, and APC Druzhba, discharge polluted untreated water. To these polluting enterprises should be added the Municipal Enterprise Svitlo, which, despite its relatively small discharge volume, ranks first in terms of organic matter discharged (42 tons per year in terms of BOD, or almost 92% of all organic matter discharged according to reports in the form No. 2TP-water management.

When assessing the cumulative impact of these sources of pollution, it should be borne in mind that the main contribution to the water quality of the Danube delta is made by pollution sources located upstream of the Danube in the more intensively used parts of the river basin.

Thus, a systematic analysis of the emergence of a complex system is the basis for establishing and taking into account the cumulative effects of the repetition and simultaneous impact of the planned activities for the reconstruction of DWNF, agriculture and infrastructure of the Danube region: planned activity - economic activity in the area of its impact - environment.

This analysis will be carried out in full, taking into account the uneven distribution of cumulative impact components over time, as part of the post-project analysis and post-project monitoring procedure.

Based on the results of the impact assessment, the following conclusions were made:

1. The scope of hydraulic works (including dredging) during the reconstruction of the DWNF storage facilities and the likely environmental impacts of the construction significantly exceed the scope of other similar activities, which may result in a cumulative effect.

2. The volume of dredging activities during the period of operation of the DWNF is comparable to similar activities within the Danube delta, especially when taking into account dredging activities on the Romanian side; the cumulative effect of these activities is relatively minor

due to their separation in space and time and can be further reduced through interagency and transboundary coordination of these activities.

3. The impact of the reconstruction of the DWNF facilities and its further operationon the water quality of the Kiliya arm is commensurate with the impact of other individual sources of water pollution within this arm.

4. The projected emission of pollutants into the water column of the Danube delta arms and the adjacent sea area during the reconstruction of the DWNF facilities and its further operation is significantly lower than the content of the relevant substances in the water column of the lower reaches of the Danube river and will not significantly affect the quality of river, coastal, transitional and marine waters.

APPENDIX C

Taking into account the observations and comments provided by the Romanian party as a result of consideration of the environmental impact assessment report for the planned activity "Reconstruction of the construction facilities "Creation of a deep-water navigation fairway for the Danube River - Black Sea in the Ukrainian part of the delta". Aspects of the impact assessment on fauna, in particular sturgeon fauna, and NATURA 2000 sites

1. Ecological features of fauna in the Danube Delta

14 species of fauna have an unfavourable conservation status: European Red List: EN (endangered) - European mink (*Mustela lutreola*); VU (vulnerable) – Black Sea herring (*Alosa immaculate*), common umbra (*Umbra krameri*), Greek tortoise (*Testudo graeca*), steppe viper (*Vipera ursinii*), European polecat (*Spermophilus citellus*), common quail (*Vormela peregusna*), NT (Near Threatened) – lesser ramshorn snail (*Anisus vorticulus*), Morse's spotted newt (*Leptidea morsei*), decorated arrow (*Coenagrion ornatum*), Danube newt (*Triturus dobrogicus*), European marsh turtle (*Emys orbicularis*), Newton's hamster (*Mesocricetus newtoni*), river otter (*Lutra lutra*).

Taxonomic composition of fauna species in the Danube Delta. Danube Delta listed in Appendix II of Directive 92/43/EEC

Species			Protective status	
Group	**Code**	**Name**	**IUCN Red List**	**European Red List**
Invertebrates (INVERTEBRATES)				
MOLLUSCA type (MOLLUSCA)				
Red-legged class **(GASTROPODA)**				
Pulmonata type (Pulmonata)				
Snail family (Planorbidae)				
I	4056	*Anisus vorticulus* Lesser ramshorn snail	NT	NT
Class INSECTA (INSECTA)				
Order Coleoptera (Coleoptera)				
Dytiscidae family **(Dytiscidae)**				
I	1082	*Graphoderus bilineatus* Graphoderus bilineatus	VU	-
Cerambycids family (Cerambycidae)				
I	1089	*Morimus funereus* Morimus funereus	VU	-
Lepidoptera type (Lepidoptera)				
		Noctuidae family (Noctuidae)		
I	4027	*Arytrura musculus* Arytrura musculus	LC	-

		Cossidae family		
I	4028	*Catopta thrips* Catopta thrips	-	-
		Pieridae family		
I	4036	*Leptidea morsei* Leptidea morsei	-	NT
		Lycaenidae family		
I	1060	*Lycaena disappear* Large copper	NT	LC
Odonata type (Odonata)				
Coenagrionidae family (Coenagrionidae)				
I	4045	*Coenagrion ornatum* Coenagrion ornatum	LC	NT
Gomphidae family (Gomphidae)				
I	1037	*Ophiogomphus cecilia* Ophiogomphus cecilia	LC	LC
CHORDATA type (CHORDATA)				
Superclass PISCES (PISCES)				
Class ACTINOPTERYGII (ACTINOPTERYGII)				
Infraclass Teleostei (Teleostei)				
Order Clupeiformes (Clupeiformes)				
Clupeidae family (Clupeidae)				
F	4125	*Alosa immaculate* Black Sea herring	VU	VU
F	4127	*Alosa tanaica* Puzanok Azov	LC	LC
Salmoniformes type (Salmoniformes)				
Umbridae family (Umbridae)				
F	2011	*Shadow krameri* Umbra ordinary	VU	VU
Cypriniformes type (Cypriniformes)				
Cyprinidae family (Cyprinidae)				
F	1130	*Aspius aspius* Asp	LC	LC
F	1124	*Gobio albipinnatus* Gobio albipinnatus	LC	LC
F	2511	*Gobio kessleri* Gobio kessleri	LC	LC
F	2522	*Pelecus cultratus* Sicklefish	LC	LC
F	1134	*Rhodeus sericeus amarus* European bitter gourd	LC	LC
Cobitidae family (Cobitidae)				
F	1149	*Cobitis taenia* Common pinch	LC	LC
F	1146	*Sabanejewia aurata* Golden pinch	LC	LC
F	1145	*Misgurnus fossilis* Misgurnus fossilis	LC	LC
Perciformes type (Perciformes)				

Percidae family (Percidae)				
F	2555	*Gymnocephalus baloni* Balon's ruffe	LC	LC
F	1157	*Gymnocephalus schraetzer* Striped ruffe	LC	LC
F	1160	*Zingel streber* Chip small	LC	LC
F	1159	*Zingel zingel* Chip ordinary	LC	LC
AMPHIBIA class (AMPHIBIA)				
Caudata type (Caudata)				
Salamandridae family (Salamandridae)				
A	1993	*Dobrogic shredder* Danube triton	NT	NT
Anura type (Anura)				
Bombinatoridae family (Bombinatoridae)				
A	1188	*Bombina bombina* European fire-bellied toad	LC	LC
REPTILIA class (REPTILIA)				
Testudines type (Testudines)				
Emydidae family (Emydidae)				
R	1220	*Emys orbicularis* Emys orbicularis	NT	NT
R	1219	*Testudo graeca* Testudo graeca	VU	VU
Squamata type (Squamata)				
Serpentes infrared (Serpentes)				
Viperidae family (Viperidae)				
R	1298	*Vipera ursinii* Vipera ursinii	VU	VU
MAMMALIA class (MAMMALIA)				
Rodentia type (Rodentia)				
Muriformes type (Muriformes)				
Castoridae family (Castoridae)				
M	1337	*Castor fiber* European or river beaver	LC	LC
Cricetidae family (Cricetidae)				
M	2609	*Mesocricetus newtoni* Newton's hamster	LC	NT
Sciuridae family (Sciuridae)				
M	1335	*Spermophilus citellus* European polecat	VU	VU
Carnivora type (Carnivora)				
Mustelidae family (Mustelidae)				
M	1355	*Lutra lutra* True otter	NT	NT
M	2633	*Mustela eversmanii* Steppe polecat	LC	LC
M	1356	*Mustela lutreola* European mink	CR	EN

M	2635	*Vormela peregusna* Marbled polecat	VU	VU

Notes: Conservation status. IUCN Red List and European Red List categories: CR - Critically Endangered, EN - Endangered, VU - Vulnerable, NT - Near Threatened, LC - Least Concern.

The fauna of the Danube Delta has historically adapted to constant natural changes in their habitat, including seasonal changes in water content and hydroclimatic hydrobiotic parameters, so the impact of planned activities on it can be considered minimal.

2. On the protection of sturgeon.

For almost 20 years, experts of the Danube Biosphere Reserve have been monitoring the impact of hydraulic structures on the delta's natural zoocoenoses and vegetation under agreements with the Ukrainian Research Institute of Ecology and Environmental Protection.

In this regard, in addition to the main EIA report prepared by UKRNIEP, we would like to report on a number of sturgeon protection measures that Ukraine has already implemented unilaterally and which have proven to be highly effective. They also stem from the Sturgeon Conservation Action Plan, which was approved by the Order of the Ministry of Ecology of Ukraine dated 28.12.2020 No. 391.

Indeed, as noted by the Romanian side, the Kiliiskyi arm is of particular importance for the protection of sturgeons and more than half of the adult sires migrate to spawn and more than two-thirds of the juvenile sturgeons migrate down it. The Pryamoye estuary is particularly important for migration.

The boundary Kiliya estuary upstream from the town of Vylkove branches into two arms, bending around the island of Yermakov. These are the northern, shallower Solomon arm and the southern, borderline, deeper Pryamyi arm. The peculiarity of the Pryamyi arm is that the main current of the Kiliiskyi estuary passes through it, it narrows from 850 m to 160 m, as a result of which the bottom is well washed and hard, there is no loose silt, no snags that are hooks for fishing nets, and accordingly, this arm is even better fished, as the weights of the nets stretch right along the bottom.

With the massive run of young sturgeons, their bycatch in this estuary is inevitable. Traditionally, this has always been the largest area of bycatch and spawning adults in the Ukrainian delta. That is why fishing in the Pryamyi arm has been banned completely for a period of time over the past 15 years. The last such ban took place in accordance with the order of the Black Sea Basin Directorate of the State Agency of Fisheries of Ukraine No. 209 dated

11.06.2021 and was in force from 12.06.2021 to 01.09.2021. However, an increased number of sturgeon bycatch, especially of adults on migration in the autumn and winter, occurs here on a regular basis.

In connection with the above, starting in 2022, a ban on fishing in the Pryamyy arm (22-31 km) was introduced throughout the year, which was reflected in the corresponding limit of the Ministry of Ecology of Ukraine. Scientific fishing conducted by specialists of the Institute of Marine Biology of the National Academy of Sciences of Ukraine in May-July 2022 confirmed an extremely high concentration of sturgeons of various sizes, from yearlings that rolled into the sea to two- to three-year-old individuals of various species. Sturgeons were caught in the amount of 3-16 specimens per 1.5 km of water in each case.

Scientific monitoring in this arm, which is indeed where the most massive run of juveniles passes through, provides extremely valuable scientific material on spawning efficiency and the reliable relative size of maternal sturgeon stocks and should be carried out regularly.

Since 2018, the use of nets in non-specialised fishing has been banned in the entire upstream area of the Danube River. Danube River, covering a total area of 24.2 thousand hectares, with a mesh size of more than 45 mm. It is in the mesh nets with a mesh size of more than 45 mm that sturgeon and dolphins, which are banned from fishing, are caught. This prohibition was introduced by the State Agency for Fisheries in the Black Sea Basin in 2018, approved by the Order of the Ministry of Agrarian Policy and Food of Ukraine No. 710 dated 29.12.2017, registered with the Ministry of Justice on 12.01.2018 under No. 48/31500, and then reflected in the annual Regulations each year.

Starting from 2017, the restrictions on the height of partial floating nets in the Danube River (not to exceed 6.5 m) were officially enshrined in the Black Sea Fisheries Regulation. Danube River (not to exceed 6 m, with a minimum mesh pitch of a = 200 mm allowed) and the thickness of the web and the mesh of partial floating nets (not to exceed 1.2 mm). This was of great positive importance for the conservation of sturgeon species, which previously could be caught with thicker nets.

Also approved by the Order of the Ministry of Energy and Environmental Protection of Ukraine No. 85 dated 13.02.2020, registered with the Ministry of Justice of Ukraine on 03.03.2020 under No. 226/34509. increasing the minimum mesh pitch in herring nets from 28 mm to 32 mm and enshrining this norm in the Black Sea Fisheries Regulation in 2020,

This innovation will help to increase the passage of this species to the spawning grounds and reduce bycatch of juveniles of various fish species and small rare species. This is very important for the Danube River, which is the only river flowing into the Black Sea that still has natural spawning grounds for sturgeon species and is home to many different species of fish listed in the Red Data Book of Ukraine and the European Red List.

At the end of June 2023, a massive run of juvenile sturgeons began in the Danube River. Suffice it to say that during the control fishing at the mouth of Solomon's Arm, 19 juvenile beluga with a mesh size of 40 mm were caught during a 20-minute run. Juvenile beluga were also caught en masse in industrial nets, primarily herring nets with a mesh of 32 mm, and even in partial nets with a mesh of 60 mm.

On 21.06.2023, during scientific fishing, 2 specimens of the now extremely rare Russian sturgeon were caught at the Pryamyi estuary, and its size clearly shows that it was migrating after natural spawning, which has not been observed for 5 years. According to our many years of experience, the main wave of sturgeon runs in about 10 days. In connection with the above, on the recommendation of the SAF, the Institute of Marine Biology of the National Academy of Sciences of Ukraine and fisheries protection authorities, a 10-day ban on commercial fishing was imposed (from 29 June to 07 July 2023). Such bans have already been justified jointly with fisheries authorities and have been repeatedly implemented over the past 30 years, and they have proven to be highly effective.

Undoubtedly, these measures had a positive impact on the number of sturgeons and, combined with the high water content of the Danube in 2023, led to the largest massive run of young sturgeon in the last 5 years. It should be emphasised that this was accompanied by large-scale dredging of the arms and the passage of an unprecedented number of vessels through the "grain corridor".

Therefore, we cannot agree with the Romanian side's conclusion that the operation of the Bystryi Estuary DWNF poses a high risk that migration will be reduced by 40%, as actual practice shows the opposite.

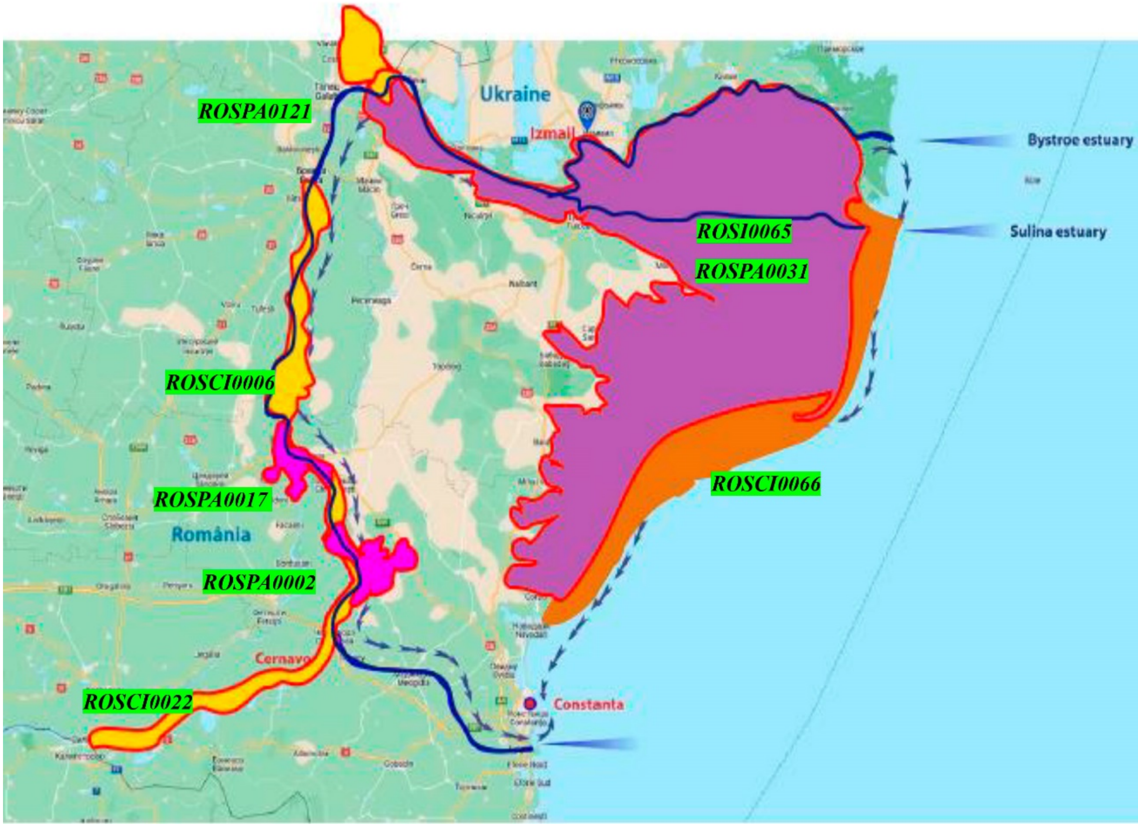
Also, the Romanian side's concerns about the possible complete loss of the Kiliia estuary's functions as a migratory route for sturgeon, similar to the Sulynske estuary, seem to be greatly exaggerated. Firstly, the Sulynske estuary is very different from the Kiliia estuary in terms of its parameters and the scale of anthropogenic change. Secondly, in June this year, a massive migration of young beluga whales was recorded on the Ukrainian section of the river, which has not been observed here for 5 years. Also, for the first time since 2019, the migration of juvenile Russian sturgeon from natural spawning was observed.

Obviously, favourable hydrological and climatic conditions in 2023 had a decisive impact on the success of natural spawning of migratory sturgeons, despite the significant dredging of the DWNF route in 2022-2023 and the significantly increased shipping traffic on the Ukrainian section of the river.

3. Impacts on the Natura 2000 site

The potential for impacts on species and habitats of the following NATURA 2000 Special Protection Areas **ROSCI0065, ROSCI0066, ROSPA0031, as well as ROSCI0022, ROSPA0002, ROSPA0017, ROSCI0006, ROSPA0121** was considered.

Areas of the NATURA 2000 Special Protection Areas in the Danube Delta.



No.	Name of SCI	Code	Surface of SCI (ha)	Biogeographical Region
4.	Canaralele Dunării	ROSCI0022	26109.9	100.00 % Steppic
5.	Balta Mică a Brăilei	ROSCI0006	20665.5	100.00 % Steppic
No.	**Name of SPA**	**Code**	**Surface of SCI (ha)**	**Biogeographical Region**
6.	Allah Bair - Capidava	ROSPA0002	11715.7	100.00 % Steppic
7.	Canaralele de la Hârșova	ROSPA0017	7304.8	100.00 % Steppic
8.	Lacul Brateș	ROSPA0121	0.0	100.00 % Steppic

Special Protection Area **ROSCI0022 "Canaralele Dunării", covering an area of 26109.9 ha,** is intended for the conservation of species/habitats of Community interest:

- 15 natural habitat types;

- species listed in Annex II to Council Directive 92/43/EEC: 2 species of plants and 22 species of animals (1 species of invertebrates, 14 species of fish, 2 species of amphibians, 2 species of reptiles, 3 species of mammals).

Special Protection Areas **ROSPA0002 "Allah Bair - Capidava", ROSPA0017 "Canaralele de la Hârșova", ROSPA0121 "Lacul Brateș"** are intended for the conservation of species of Community interest: 100 species of birds.

Special Protection Area **ROSCI0006 "Balta Mică a Brăilei", 20665.5 ha,** is designated for the conservation of species/habitats of Community interest:

- 9 natural habitat types;
- 16 species of animals listed in Annex II to Council Directive 92/43/EEC: 12 fish species, 2 amphibian species, 1 reptile species, 1 mammal species

Habitat types presented at sites ROSCI0022 and ROSCI0006.

Code	Name	
	Ukrainian	**English**
ROSCI0022		
40C0	Ponto Sarmatic deciduous thickets	Ponto-Sarmatic deciduous thickets
62C0	Ponto Sarmatic steppes	Ponto-Sarmatic steppes
91F0	Coastal mixed forests of Quercus robur, Ulmus laevis and Ulmus minor, Fraxinus excelsior or Fraxinus angustifolia, along	Riparian mixed forests of Quercus robur, Ulmus laevis and Ulmus minor, Fraxinus excelsior or Fraxinus angustifolia, along the
	great rivers (Ulmenion minoris)	Great rivers (Ulmenion minoris)
91I0	Euro Siberian steppic woods with Quercus spp	Euro-Siberian steppic woods with Quercus spp
91M0	Pannonian Balkanic turkey oak sessile oak forests	Pannonian-Balkanic turkey oak –sessile oak forests
91AA	Eastern white oak woods	Eastern white oak woods
92A0	Salix alba and Populus alba galleries	Salix alba and Populus alba galleries
92D0	Nerio-Tamaricetea та Securinegion tinctoriae (Nerio-Tamaricetea та Securinegion tinctoriae)	Southern riparian galleries and thickets (NerioTamaricetea and Securinegion tinctoriae)
3130	Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or of the Isoeto-Nanojuncetea	Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or of the Isoeto-Nanojuncetea
3140	Hard oligo-mesotrophic waters with benthic vegetation of Chara spp	Hard oligo-mesotrophic waters with benthic vegetation of Chara spp
3150	Natural eutrophic lakes with Magnopotamion or Hydrocharition type vegetation	Natural eutrophic lakes with Magnopotamion or Hydrocharition -type vegetation
3270	Rivers with muddy banks with Chenopodion rubri pp and Bidention pp vegetation	Rivers with muddy banks with Chenopodion rubri pp and Bidention pp vegetation
6430	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels
6440	Alluvial meadows of river valleys of the Cnidion dubii	Alluvial meadows of river valleys of the Cnidion dubii

6510	Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis)	Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis)
	ROSCI0006	
91F0	Coastal mixed forests of Quercus robur, Ulmus laevis і Ulmus minor, Fraxinus excelsior або Fraxinus angustifolia, along great rivers (Ulmenion minoris)	Riparian mixed forests of Quercus robur, Ulmus laevis and Ulmus minor, Fraxinus excelsior or Fraxinus angustifolia, along the great rivers (Ulmenion minoris)
92A0	Salix alba and Populus alba galleries	Salix alba and Populus alba galleries
92D0	Nerio-Tamaricetea та Securinegion tinctoriae (Nerio-Tamaricetea та Securinegion tinctoriae)	Southern riparian galleries and thickets (NerioTamaricetea and Securinegion tinctoriae)
3130	Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or of the Isoeto-Nanojuncetea	Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or of the Isoeto-Nanojuncetea
3270	Rivers with muddy banks with Chenopodion rubri pp and Bidention pp vegetation	Rivers with muddy banks with Chenopodion rubri pp and Bidention pp vegetation
6410	Molinia meadows on calcareous, peaty or clayey-silt laden soils (Molinion caeruleae)	Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae)
6430	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels
6440	Alluvial meadows of river valleys of the Cnidion dubii	Alluvial meadows of river valleys of the Cnidion dubii
6510	Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis)	Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis)

Taxonomic composition of flora and fauna species listed in Annex II of Directive 92/43/EEC, according to the data of ROSCI0022, ROSPA0002, ROSPA0017, ROSCI0006, ROSPA0121

Species			Protective status	
Group	**Code**	**Name**	**IUCN Red List**	**European Red List**
		ROSCI0022		
A	1188	Bombina bombina	LC	LC
A	1993	Triturus dobrogicus	NT	NT
F	4125	Alosa immaculata	EN	VU
F	4127	Alosa tanaica	LC	LC
F	1130	Aspius aspius	LC	LC
F	6963	Cobitis taenia Complex	LC	LC
F	2484	Eudontomyzon mariae	LC	LC
F	2555	Gymnocephalus baloni	LC	LC
F	1157	Gymnocephalus schraetzer	LC	LC
F	1145	Misgurnus fossilis	LC	LC
F	2522	Pelecus cultratus	LC	LC
F	5339	Rhodeus amarus	LC	LC
F	6143	Romanogobio kesslerii	LC	LC
F	5329	Romanogobio vladykovi	LC	LC
F	5347	Sabanejewia bulgarica	LC	LC
F	1160	Zingel streber	LC	LC
F	1159	Zingel zingel	LC	LC

I	4056	Anisus vorticulus	NT	NT
M	1355	Lutra lutra	NT	NT
M	2609	Mesocricetus newtoni	NE	NE
M	1335	Spermophilus citellus	VU	VU
P	2236	Campanula romanica	LC	DD
P	2079	Moehringia jankae	DD	DD
R	1220	Emys orbicularis	NE	NE
R	1219	Testudo graeca	NE	NE
ROSPA0002, ROSPA0017				
B	A019	Pelecanus onocrotalus	LC	LC
B	A021	Botaurus stellaris	LC	LC
B	A030	Ciconia nigra	LC	LC
B	A031	Ciconia ciconia	LC	LC
B	A041	Anser albifrons	LC	LC
B	A072	Pernis apivorus	LC	LC
B	A073	Milvus migrans	LC	LC
B	A075	Haliaeetus albicilla	LC	LC
B	A080	Circaetus gallicus	LC	LC
B	A081	Circus aeruginosus	LC	LC
B	A082	Circus cyaneus	LC	NT
B	A083	Circus macrourus	EN	NT
B	A084	Circus pygargus	LC	LC
B	A086	Accipiter nisus	LC	LC
B	A087	Buteo buteo	LC	LC
B	A089	Aquila pomarina	LC	LC
B	A092	Hieraaetus pennatus	LC	LC
B	A097	Falco vespertinus	VU	NT
B	A113	Coturnix coturnix	LC	LC
B	A133	Burhinus oedicnemus	LC	LC
B	A177	Larus minutus	NE	LC
B	A179	Larus ridibundus	LC	LC
B	A193	Sterna hirundo	LC	LC
B	A196	Chlidonias hybridus	LC	LC
B	A197	Chlidonias niger	LC	LC
B	A207	Columba oenas	LC	LC
B	A208	Columba palumbus	LC	LC
B	A210	Streptopelia turtur	NT	LC
B	A212	Cuculus canorus	LC	LC
B	A215	Bubo bubo	LC	LC
B	A221	Asio otus	LC	LC
B	A224	Caprimulgus europaeus	LC	LC
B	A229	Alcedo atthis	VU	VU
B	A230	Merops apiaster	LC	LC
B	A231	Coracias garrulus	LC	LC
B	A232	Upupa epops	LC	LC
B	A234	Picus canus	LC	LC
B	A236	Dryocopus martius	LC	LC
B	A238	Dendrocopos medius	LC	LC
B	A242	Melanocorypha calandra	VU	LC

B	A243	Calandrella brachydactyla	LC	LC
B	A244	Galerida cristata	LC	LC
B	A246	Lullula arborea	LC	LC
B	A247	Alauda arvensis	LC	LC
B	A249	Riparia riparia	LC	LC
B	A251	Hirundo rustica	LC	LC
B	A253	Delichon urbica	NE	LC
B	A255	Anthus campestris	LC	LC
B	A256	Anthus trivialis	LC	LC
B	A262	Motacilla alba	LC	LC
B	A275	Saxicola rubetra	LC	LC
B	A276	Saxicola torquata	NE	LC
B	A283	Turdus merula	LC	LC
B	A284	Turdus pilaris	VU	LC
B	A285	Turdus philomelos	LC	LC
B	A286	Turdus iliacus	VU	NT
B	A287	Turdus viscivorus	LC	LC
B	A307	Sylvia nisoria	LC	LC
B	A309	Sylvia communis	LC	LC
B	A310	Sylvia borin	LC	LC
B	A311	Sylvia atricapilla	LC	LC
B	A320	Ficedula parva	LC	LC
B	A321	Ficedula albicollis	LC	LC
B	A338	Lanius collurio	LC	LC
B	A339	Lanius minor	LC	LC
B	A340	Lanius excubitor	VU	VU
B	A351	Sturnus vulgaris	LC	LC
B	A363	Chloris chloris	LC	LC
B	A364	Carduelis carduelis	LC	LC
B	A365	Carduelis spinus	LC	LC
B	A366	Carduelis cannabina	LC	LC
B	A379	Emberiza hortulana	LC	LC
B	A383	Emberiza calandra	LC	LC
B	A393	Phalacrocorax pygmeus	LC	LC
B	A397	Tadorna ferruginea	NT	LC
B	A402	Accipiter brevipes	LC	LC
B	A403	Buteo rufinus	LC	LC
B	A429	Dendrocopos syriacus	LC	LC
B	A459	Larus cachinnans	LC	LC
B	A511	Falco cherrug	VU	VU
B	A533	Oenanthe pleschanka	LC	LC
ROSPA0017				
B	A043	Anser anser	LC	LC
B	A103	Falco peregrinus	LC	LC
B	A163	Tringa stagnatilis	EN	LC
B	A168	Actitis hypoleucos	NT	LC
B	A214	Otus scops	LC	LC
B	A233	Jynx torquilla	LC	LC
B	A260	Motacilla flava	LC	LC

B	A271	Luscinia megarhynchos	LC	LC
B	A273	Phoenicurus ochruros	LC	LC
B	A277	Oenanthe oenanthe	LC	LC
B	A299	Hippolais icterina	LC	LC
B	A337	Oriolus oriolus	LC	LC
B	A435	Oenanthe isabellina	LC	LC
ROSCI0006				
A	1188	Bombina bombina	LC	LC
A	1993	Triturus dobrogicus	NT	NT
F	4125	Alosa immaculata	EN	VU
F	4127	Alosa tanaica	LC	LC
F	1130	Aspius aspius	LC	LC
F	2555	Gymnocephalus baloni	LC	LC
F	1157	Gymnocephalus schraetzer	LC	LC
F	1145	Misgurnus fossilis	LC	LC
F	2522	Pelecus cultratus	LC	LC
F	5339	Rhodeus amarus	LC	LC
F	6143	Romanogobio kesslerii	LC	LC
F	5329	Romanogobio vladykovi	LC	LC
F	1160	Zingel streber	LC	LC
F	1159	Zingel zingel	LC	LC
M	1355	Lutra lutra	NT	NT
R	1220	Emys orbicularis	NT	NT
ROSPA0121				
B	A052	Anas crecca	LC	LC
B	A050	Anas penelope	VU	LC
B	A053	Anas platyrhynchos	LC	LC
B	A041	Anser albifrons	LC	LC
B	A396	Branta ruficollis	NT	NT
B	A196	Chlidonias hybridus	LC	LC
B	A197	Chlidonias niger	LC	LC
B	A097	Falco vespertinus	VU	LC
B	A125	Fulica atra	LC	LC
B	A459	Larus cachinnans	LC	LC
B	A179	Larus ridibundus	LC	LC
B	A019	Pelecanus onocrotalus	LC	LC

Notes: Conservation status. IUCN Red List and European Red List categories:
NE - not assessed, NT - Near Threatened, EN - Endangered, VU - Vulnerable, LC - Least Concern, DD - Data Deficient.

Characteristics of the impact of the planned activities within the protected area.

Based on the results of the environmental impact assessment (EIA Report), it can be stated that the main likely sources of impact on species and habitats of the Natura 2000 sites are air pollution by emissions of pollutants into the atmosphere and noise from machinery, as well as discharges of pollutants into the surface waters of the Danube River, including during dredging operations.

According to the relevant sections of this report, these types of impacts do not exceed the regulatory limits and are compensated for by measures and design solutions.

The closest areas to the proposed activity are the territories of the Romanian Special Protection Areas "NATURA 2000**" ROSCI0065, ROSCI0066 and ROSPA0031**. The impact of the planned activity on the species and habitats of these areas is considered to be absent, since none of the environmental factors are affected, the level of air, water and soil pollution remains within the regulatory limits, and, accordingly, the living conditions of living organisms in these areas remain unchanged.

Transport activities are also carried out along the waterways of the Danube River. Danube through the mouths of the Bystre, Sulina and Chernovod rivers, which pass through the territories of the NATURA 2000 special protection areas **ROSCI0022, ROSPA0002, ROSPA0017, ROSCI0006, ROSPA0121**.

The species and habitats of these areas are already adapted to natural changes in their environment, including seasonal changes in water availability, changes in hydroclimatic and hydrobiological indicators, as well as to anthropogenic impacts associated with the movement of transport vessels.

The planned activity will not result in additional types of anthropogenic impacts on species and habitats of the protected areas, but the planned activity will increase the intensity of ship traffic. At the same time, the impact of the planned activity on the species and habitats of these areas can be considered minimal.

APPENDIX D

Taking into account the observations and comments provided by the Romanian party as a result of consideration of the environmental impact assessment report for the planned activity "Reconstruction of the construction facilities "Creation of a deep-water navigation fairway for the Danube River - Black Sea in the Ukrainian part of the delta". Aspects of modelling the dynamics of flow redistribution between the delta arms

Reliable forecasts of possible changes in the hydrological regime of the Danube Delta as a result of hydraulic engineering works within the delta, such as deepening of arms and estuary bars, can only be made using mathematical models. One of the variants of a computer mathematical model for calculating the distribution and redistribution of water flows in the Danube Delta arms is described in detail in the monograph Hydrology of the Danube Delta, 2004. This mathematical model is based on the method of total hydraulic resistance modules. The advantage of this method is the possibility of direct analytical calculation of the distribution of water discharge in the delta arms given the actual or design morphometric characteristics of delta watercourses.

This model was used to calculate the expected distribution of water flow in the main arms of the Danube Delta for the period up to 2015. It was concluded that if the current trend of water flow redistribution continues, the water content of the Kiliya and Tulchyn arms will initially equalise, and then a larger share of the Danube flow will pass through the Tulchyn arm. According to the calculations for 2005, 2010 and 2015, the expected share of the Kiliya arm flow was to be 51.2, 49.8 and 48.3% respectively. This forecast, which was made in 2003, is currently confirmed, including by observations of Romanian experts for the period 2005-2020. Thus, according to these data (Table. D.1), obtained in the framework of annual exchanges of hydrometeorological information at the border gauges, the share of the flow of the Kiliya arm at 115 km in the Izmail Chatal area decreased from 51.1 to 49.0% over the period 2005-2015, and in 2020 amounted to 47.5% of the total Danube water flow at 54 miles in the Isacca gauge.

The good correspondence between the predicted and actual data on the redistribution of water flow in the upper Danube Delta between the Kiliya and Tulchyn arms allows us to consider the further results and conclusions obtained with the help of the above-mentioned mathematical model to be quite reliable and reasonable.

Table D.1 - Average annual discharge (Q) and water flow (W) of the Danube and its Kiliya Delta

2005 year				2010 year			
	Q, cubic metres per second	**W, cubic km**	**%**		**Q, cubic metres per second**	**W, cubic km**	**%**
54 miles	8700	274	100	**54 miles**	9580	302	100
115 km	4450	140	51.1	**115 km**	4800	151	50.0
2015 year				**2020 year**			
	Q, cubic metres per second	**W, cubic km**	**%**		**Q, cubic metres per second**	**W, cubic km**	**%**
54 miles	6170	195	100	**54 miles**	4890	154	100
115 km	3030	95.6	49.0	**115 km**	2320	73.2	47.5

The significant impact of straightening the bends in the Georgiyevskyi arm on the distribution of water flow through the main arms of the delta was confirmed by calculation. Hydraulic calculations have shown that the reduction in the length of the Georgievskyi arm will lead to an increase in the share of runoff in this arm by 3% of the Danube runoff by 2015.

The share of runoff in the Sulinsky arm will not change significantly in the next 10-15 years, as the amount of dredging that is constantly being carried out there is small and is only intended to maintain the guaranteed depth of navigation (7.32 m).

Deepening the rifts of the Kiliya arm may have some impact on the process of redistribution of flow between the main arms of the Danube Delta. In this case, the water discharge of the Kiliya arm is projected to increase by 0.8% of the Danube runoff.

At the same time, the projected increase in the depth of the Georgievskyi arm due to its erosion will have the opposite effect on the redistribution of water flow through the delta arms. As a result, the erosion of the Georgiyevskyi arm should have a stronger impact. Thus, the artificial deepening of the Kiliya arm will not change the overall trend of redistribution of water flow in favour of the Tulchyn arm system, but will only slow down this process.

APPENDIX E

Taking into account the observations and comments provided by the Romanian party as a result of consideration of the environmental impact assessment report for the planned activity "Reconstruction of the construction facilities "Creation of a deep-water navigation fairway for the Danube River - Black Sea in the Ukrainian part of the delta". Aspects of sturgeon protection and reproduction

Today, sturgeons are protected at both international and national levels. Since 2000, Ukraine has imposed a complete ban on commercial fishing for sturgeon in the Azov-Black Sea basin and inland waters, as well as on the sale of caviar harvested from wild sturgeon.

Sturgeon fishing is allowed in extremely small quantities, exclusively for reproduction purposes, and only with special permits from the Ministry of Ecology and Natural Resources of Ukraine. In 1999, Ukraine joined the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). The extraction of black caviar is allowed only from sturgeon fish raised on special fish farms under aquaculture conditions, and they must also be labelled accordingly. At the same time, consumers are increasingly demanding the valuable delicacy of sturgeon meat and equally valuable black caviar.

The development of aquaculture, including not only fishing but also fish farming, including the subsequent stocking of water bodies, is important for the conservation of sturgeon.

Based on the data on fish farming in 2016-2021, Table E. 1 and Figs. E.1, E.2.

Table E.1 - Cultivation of fish populations, area

	european carp/carp	herbivores	catfish	**sturgeons**	salmonids	other
2016	9865000	9154417.6	107523.7	**116384.0**	330345.5	1850986
2017	9624010.8	7750359.4	146246.3	**137947.5**	344241	2165442.1
2018	9584815	7990355.7	133684.7	**111496.4**	261418.5	2111200
2019	8516402.6	7665773.8	224329	**97094.7**	225856.5	1874254.5
2020	8014228.9	7704250.4	274846.3	**79191.5**	230877.4	2264401.9
2021	7410551.7	6039554.2	283754.1	**77105.0**	312092.5	2758750.2

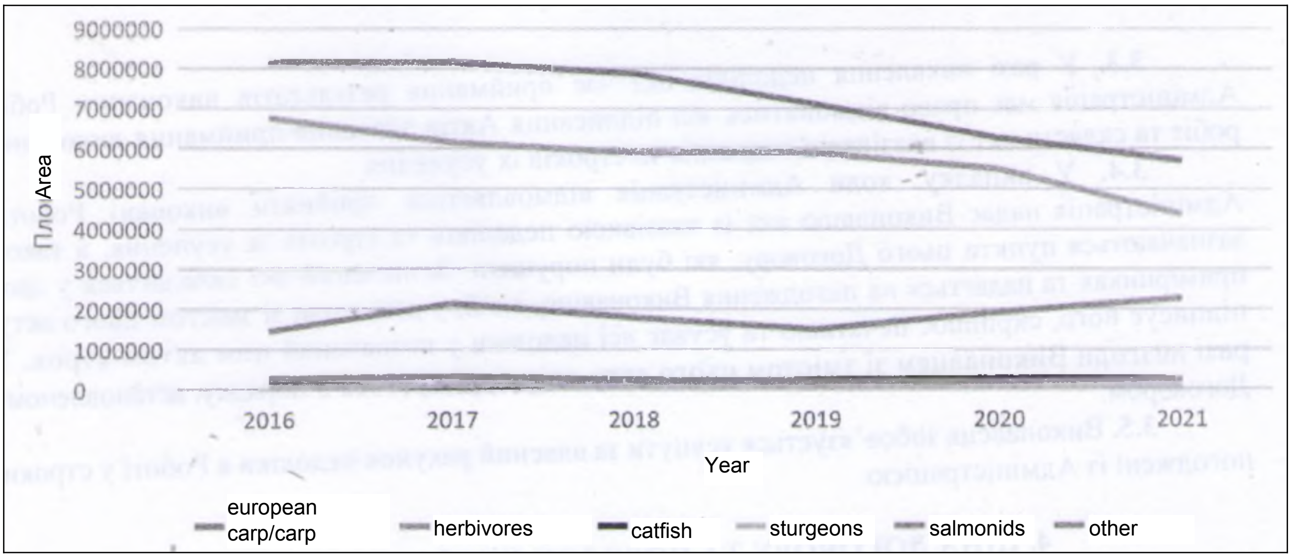


Figure E.1 - Dynamics of fish species production in 2016-2021.

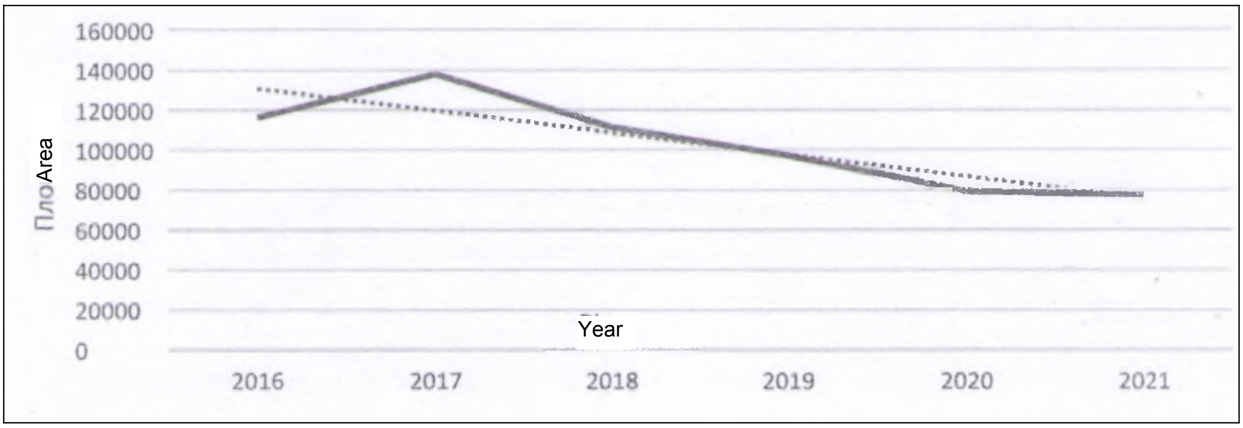


Figure E.2 - Dynamics of sturgeon farming

According to the data, sturgeon farming areas increased in 2016-2017, but since 2017 there has been an annual decline in farming, only in 2020-2021 it stabilised, but at low levels. Analysing the trend line, in the period 2016 - mid-2018, the line occupied almost the same level of area, but from mid-2018, a sharp decrease in cultivation began, and only in the period 2020-2021 did the indicators stabilise.

For a better understanding of the analysis of fish farming and catch, it is necessary to compare these figures. For a better understanding, tables were created (Table E.2) and the corresponding graphs (Fig. E.3).

Table E.2 - Growth and catch of fish populations, area

Year	Sturgeon	
	farming	catch
2016	116384.0	62789.0
2017	137947.5	100460.0
2018	111496.4	88917.8
2019	97094.7	53054.7
2020	79191.5	39574.1
2021	77105.0	40545.9

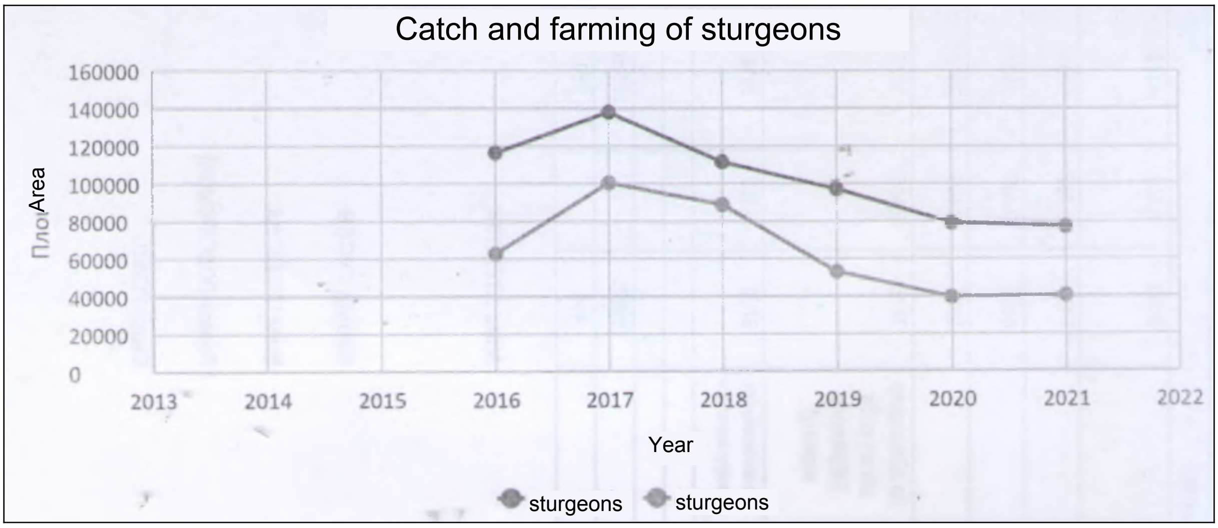


Figure E.3 - Comparison of sturgeon catch and farming during 2016-2021.

The comparison shows that there are no threatening trends, as the dynamics of catch and farming volumes are completely the same. In addition, the volume of catches is lower than the volume of farming.

In fact, sturgeon farming as of 2021 has decreased compared to 2016. Therefore, it is possible to increase the volume of cultivation by increasing the farming area. When modelling the further development of sturgeon farming volumes under the optimistic scenario, a polynomial trend line was chosen with the initial conditions of a gradual increase in sturgeon farming areas - three times the level of 2016 (Fig. E.4).

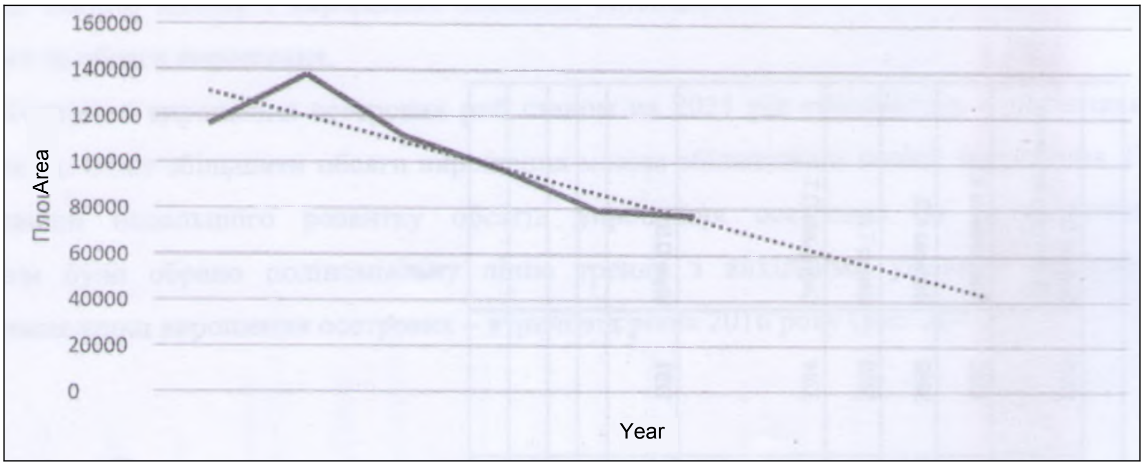


Figure E.4 - Forecasting sturgeon farming

Cultivation of sturgeon to the level of marketability simultaneously makes it possible to obtain black caviar that is not inferior in quality to products obtained from sturgeon in natural conditions.

Fresh fish obtained in the process of breeding broodstock by dividing the stock into males and females and culling those that grow too slowly can also become an additional marketable product.

Natural sturgeon stocks are found in small areas due to water pollution and overfishing. Therefore, sturgeon aquaculture can change the situation, but this is possible only if the balance of farming to catch is maintained.

In the context of the impact of the Project on the status of sturgeons in the Danube River, there are opportunities to develop a system of risk insurance measures to prevent such negative consequences of the reconstruction of the Danube-Black Sea DWNF on sturgeon migration, which are unlikely to occur.

The analysis showed that the main one is the active development of sturgeon aquaculture.

Increasing the volume of fish farming will help solve a number of problems, the main ones being the preservation of the sturgeon population while meeting the population's demand for fish. With the growing demand for animal proteins, aquaculture can meet this demand, as it is a highly efficient food production system and has obvious environmental benefits compared to other forms of animal food production. In addition, in most developed countries, consumers prefer aquaculture products because they believe that they are of higher quality and healthier due to their cultivation in ecological conditions rather than being caught in natural and polluted waters.

The ability to meet the demand for fish without threatening the biodiversity of natural water bodies as a result of fishing is important for the development of aquaculture.

Ukraine has sufficient capacity to meet this challenge. Sturgeon species are mostly grown by fish farms located in Zaporizhzhia, Cherkasy, Odesa, Chernivtsi and Kyiv regions. In recent years, the development of sturgeon farming in Ukraine has also been associated with the development of recirculating aquaculture, and to a lesser extent, with the development of cage fish farming. The leading Ukrainian farms engaged in sturgeon farming are: LLC "Osetr" (Kyiv region), PE "SPE "Bester" (Kyiv region), PJSC "Chernihivrybhosp" (Chernihiv region), LLC "Ukrainian Service Enterprise" (Kyiv region), PE "Fortuna-XXI" (Kyiv), LLC "Kind fish" (Kyiv region), "Odesa Sturgeon Complex" (Odesa region), FG "Ishkhan" (Chernivtsi region), GC "Aquasvit", LLC "Aqua Top" (Odesa), LLC "Research and Production Centre "Forel" (Volyn region), SE "Irkliyivskyi fish hatchery" (Cherkasy region), LLC "Biosila" (Kyiv), LLC "Aquaresurs Plus" (Zhmerynka).

Unfortunately, as a result of the destruction of the Kakhovka hydroelectric power station, the state sturgeon plant "Production and Experimental Dnipro Sturgeon Fish Breeding Plant named after Academician S.T. Artyushchuk" located in the village of Dniprovske village, Bilozersky district, Kherson region. It has been operating since 1984 and has been compensating for the reproduction of sturgeon species in Ukraine that have lost the ability to reproduce naturally due to the regulation of the Dnipro River by a cascade of reservoirs. However, there is every reason to believe that private business will take on the task of stocking Ukraine's water bodies with sturgeon until the state enterprise's capacity is restored.

In addition, Ukraine and Romania are currently developing joint approaches to stocking the Danube with sturgeon. This was discussed during a meeting between Deputy Minister of Agrarian Policy and Food Vitaliy Holovnya and Ambassador Extraordinary and Plenipotentiary of Romania to Ukraine Alexandru Victor Micula on 23 May 2023. The parties discussed cooperation between Ukraine and Romania to restore and develop the biodiversity of the Danube. In addition, the meeting focused on areas of cooperation between the countries in the fisheries sector. In particular, they discussed cooperation between Ukrainian and Romanian scientists in common water bodies - the Danube River and the Black Sea, exchange of experience and best practices in researching populations of valuable fish species.

The Ministry of Environmental Protection and Natural Resources of Ukraine has approved an action plan for the conservation of sturgeon (Acipenseridae family) in Ukraine for 2021-2030 by order dated 28 December 2020. The plan provides for the protection of wild sturgeon populations, maintaining the population structure, and increasing the number of fish.

The experience of the WWF-Ukraine project on the restoration of sturgeon populations in Ukraine can be considered positive. In particular, the National Action Plan for Sturgeon Conservation in Ukraine, which in 2021, on the International Danube Day, saw the stocking of

10,000 freshwater sterlet into the Danube River. The Danube stock was genetically confirmed and tagged for further tracking.

The opportunities of the EU project "LIFE Boat for Sturgeon", which runs until 2030, will be used to solve the tasks. Within the project, 10 partners from Austria, Romania, Bulgaria, Hungary, Slovakia, Slovenia, and Ukraine will work together along the Danube Danube River to stabilise the populations of Danube sturgeons - beluga, stellate sturgeon, freshwater sterlet, Danube sturgeon and Russian sturgeon. The project includes the establishment of two live genebanks with broodstock in Austria and Hungary, genetic mating schemes, juvenile releases of all 4 species and a standardised monitoring scheme, accompanied by large-scale actions and cooperation with fisheries authorities, local authorities and fishermen along the Danube River.

There are also opportunities to attract European funds through the Interreg NEXT Black Sea Basin Programme, which is focused on certain regions of the Black Sea countries, such as Bulgaria, Romania, Ukraine, Greece, Turkey and all territories of Moldova, Georgia and Armenia. The amount of funding is from EUR 250 thousand to EUR 1,500 thousand, and the implementation period is from 18 to 30 months. The programme can be used to conduct research on integrated management of coastal and marine areas, the use of innovative technologies for sustainable fisheries and ecological aquaculture, etc.

The development of sturgeon aquaculture in the region will contribute to the development of local economies. It can become an important factor in the development of ecotourism, which will help to provide income for local communities and reduce dependence on industry. Opportunities for ecotourism are associated with observing sturgeons in the process of breeding, organising excursions, as well as visiting museums and community centres where you can learn more about the importance of sturgeons for local culture. In addition, ecotourism development can help create new jobs and increase the income of local communities that depend on natural resources. Supporting ecotourism can also lead to increased investment in rural infrastructure and improve the quality of life for local residents. Thus, sturgeon aquaculture is not only a relevant and necessary issue for biodiversity conservation and environmental sustainability, but can also be an important factor for economic development.

Therefore, the proposed measures for the further development of sturgeon aquaculture in Ukraine with the participation of partner countries, including Romania, will help to address the threat of the Danube sturgeon's extinction. Increasing the volume of sturgeon farming with subsequent stocking of the Danube River by all countries interested in this will provide conditions not only for the conservation of the population, but also for its increase and will prevent threats that can be assessed as minimal.

It is also advisable to take into account the objectives of the 4BIZ project (Development of the Blue Economy in the Black Sea Region through the establishment of a business cooperation framework in the fields of fisheries and aquaculture, coastal and maritime tourism and maritime transport), which aims to develop a cooperation framework that will bring together blue economy stakeholders in the Black Sea countries to identify and address capacity building needs at the local level to stimulate innovation, digitalisation and investment in the Black Sea blue economy, with a focus on fisheries and aquaculture, coastal and maritime tourism, and maritime transport.

According to the 4BIZ Partner Countries Report, published on 23.03.2023, including on Romania's Blue Economy, presented by the speakers of the Chamber of Commerce, Industry and Agriculture of Galati (CCIA GALATI), among the achievements of the country's "green course" are the development and further expansion of aquaculture, development of maritime and river transport, improvement of navigation on the Danube and modernisation of port infrastructure, to increase the competitiveness and sustainability of the Blue Economy sector Romania.

A similar report from Ukraine states that the Ukrainian economy is experiencing a major negative shock from the effects of the war. Despite the large-scale economic crisis and growing financial problems, the economy continues to operate and the importance of the sea for the Ukrainian economy will increase in the long term. Ukraine has favourable conditions for the development of the blue economy and maritime activities in all areas, including fisheries and aquaculture, coastal and marine tourism and maritime transport.

In the current situation (the threat to the existence of the "grain deal"), the use of cargo transportation opportunities through the Bystryi Estuary with simultaneous loading of the Sulina Canal capacity becomes even more relevant for global food security.

As for the negative experience of the consequences of the deepening of the Sulina Canal in the late nineteenth century, it cannot be compared with the consequences of dredging in the mouth of the Bystryi. The Bystryi mouth is a natural mouth and requires dredging, which was not carried out for a long time, while the Sulina canal was straightened during construction, including the construction of a part of the canal on land. Thus, the anthropogenic impact on the environment during the construction of the Sulina was much more severe than in the case of dredging in the Bystryi mouth.

The same goes for poaching. Today, sturgeons hold a very sad record of population decline in the world. In general, from the 1970s to the present day, their numbers have decreased by about 90% according to monitoring data. In 2022, the International Union for Conservation of Nature listed two sturgeon species as endangered - the sturgeon and the European sturgeon. Currently, one of the main threats to sturgeons is poaching and illegal trade in their meat and caviar. In recent years, Ukraine has tightened penalties for violations of legislation on fisheries in general and sturgeon in particular. Further adaptation of Ukrainian legislation to the European Union's regulatory framework will help improve the situation. Shipping is not a factor affecting the level of poaching at all, nor is dredging.

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7. Information on the volume of fish and other aquatic bioresources caught in fishery water bodies and on the continental shelf of Ukraine as of 01.01.2017. URL: https://data.gov.ua/dataset/8fcc570f-812d-4712-8eac-2d26a7d1e122/resource/527f5ee5-748c-4914-8e58-b0ab3e8456a0/download/informatsiia-pro-obsiagi-vilovu-za-vidami-rib-u-rozrizi-vodoim-administrativnikh-odinits-richkov.xls
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9. Information on the volume of fish and other aquatic bioresources caught in fishery water bodies and on the continental shelf of Ukraine as of 01.01.2019. URL: https://data.gov.ua/dataset/8fcc570f-812d-4712-8eac-2d26a7d1e122/resource/527f5ee5-748c-4914-8e58-b0ab3e8456a0/download/informatsiia-pro-obsiagi-vilovu-za-vidami-rib-u-rozrizi-vodoim-administrativnikh-odinits-richkov.xls
10. Certificate on the volume of fish and other aquatic bioresources caught in fishery water bodies and on the continental shelf of Ukraine as of 01.01.2020. URL: https://data.gov.ua/dataset/8fcc570f-812d-4712-8eac-2d26a7d1e122/resource/527f5ee5-748c-4914-8e58-b0ab3e8456a0/download/informatsiia-pro-obsiagi-vilovu-za-vidami-rib-u-rozrizi-vodoim-administrativnikh-odinits-richkov.xls
11. Certificate on the volume of fish and other aquatic bioresources caught in fishery water bodies and on the continental shelf of Ukraine as of 01.01.2021. URL: https://data.gov.ua/dataset/8fcc570f-812d-4712-8eac-2d26a7d1e122/resource/527f5ee5-748c-4914-8e58-b0ab3e8456a0/download/informatsiia-pro-obsiagi-vilovu-za-vidami-rib-u-rozrizi-vodoim-administrativnikh-odinits-richkov.xls

12. Certificate on the volume of fish and other aquatic bioresources caught in fishery water bodies and on the continental shelf of Ukraine as of 01.01.2022. URL: https://data.gov.ua/dataset/8fcc570f-812d-4712-8eac-2d26a7d1e122/resource/527f5ee5-748c-4914-8e58-b0ab3e8456a0/download/informatsiia-pro-obsiagi-vilovu-za-vidami-rib-u-rozrizi-vodoim-administrativnikh-odinits-richkov.xls

13. Certificate on the volume of fish and other aquatic bioresources caught in fishery water bodies and on the continental shelf of Ukraine as of 01.01.2023. URL: https://data.gov.ua/dataset/8fcc570f-812d-4712-8eac-2d26a7d1e122/resource/527f5ee5-748c-4914-8e58-b0ab3e8456a0/download/informatsiia-pro-obsiagi-vilovu-za-vidami-rib-u-rozrizi-vodoim-administrativnikh-odinits-richkov.xls

APPENDIX F

ASPECTS OF ASSESSING THE IMPACT OF THE RECONSTRUCTION OF THE DWNF FACILITIES ON THE LAKES ON THE LEFT BANK OF THE KILIYA ARM

The group of Danube reservoirs includes freshwater reservoirs located on the left bank of the Kiliya arm of the Danube between Reni and the Black Sea coast (Figure F.1). All of them have been regulated by dams and converted into reservoirs.

Figure F.1 - Location of the Danube reservoirs and canals

They include:

Kahul reservoir

Kartal reservoir

Yalpug-Kuhurluy reservoir

Safian reservoir

Katlabukh reservoir

Kytai Reservoir

Sasyk Reservoir

The hydrological regime of these reservoirs depends on a number of factors, among which the most important factor affecting the hydrological regime of the reservoirs is the water level in the Danube river.

In order to improve water quality (reduce salinity) in case of favourable hydrological conditions in the Danube River. Water exchange is carried out in the Danube River, namely, in the spring and summer, the reservoirs are filled, and in the autumn and winter, water is discharged from the reservoirs into the Danube River to the level of the DVL (dead volume level).

Kahul Reservoir

The Kahul reservoir is a freshwater reservoir.

The area of the Kahul reservoir is 10134 hectares.

The maximum depth of the reservoir is 3.5 m.

The area of shallow water is 2060 hectares.

The hydraulic structures of the Kahul reservoir include: Viketa control gate, Orlovsky control gate, Luzarsa control gate, and canals: "Viketa, Orlovsky, Luzarsa.

The NDL of the Kahul reservoir is 3.5 mbsf.

The DVL of the Kahul reservoir is 2.0 mBS.

The reservoir capacity at NDL is 250.67 million m^3.

The usable capacity is 144.18 million m^3.

The reservoir is located in Reni district of Odesa region.

Kartal reservoir

The Kartal reservoir is a freshwater reservoir.

The area of the Kartal reservoir is 2330 hectares.

The maximum depth of the reservoir is 2.9 m.

The area of shallow water is 2000 hectares.

The hydraulic structures of the Kartal reservoir include the Prorva gateway and Prorva canal.

The NDL of the Kartal reservoir is 2.8 mbsf.

The DVL of the Kartal reservoir is 1.6 mBS.

The reservoir capacity at NDL is 31.16 million m^3.

The usable capacity is 22.56 million m^3.

The reservoir is located in Reni district of Odesa region.

Yalpug-Kuhurluy reservoir

The Yalpug-Kuhurluy reservoir is the largest freshwater reservoir in Ukraine.

The reservoir covers an area of 27,000 hectares.

The maximum depth is 6.4 m.

The hydraulic structures of the Yalpug-Kuhurluy reservoir include: Skunda control sluice, Repida control sluice, 105 km control sluice, and canals: "Skunda, Repida, 105 km.

The reservoir's NDL is 2.8 mBS.

The reservoir's DVL is 1.6 mBS.

The reservoir capacity at NDL is 888.0 million m^3.

The usable capacity is 347.4 million m^3.

The reservoir is located in the Reni, Bolhrad and Izmail districts of Odesa region.

Safian Reservoir

The Safian reservoir is a freshwater reservoir.

The area of the Safian reservoir is 419 hectares.

The maximum depth is 4.0 m.

The area of shallow water is 190 hectares.

Water is exchanged with the Safian reservoir via the Gromadsky Canal.

The NDL of the Safian reservoir is 1.7 mBS.

The DVL of the Safian reservoir is 0.7 mBS.

The reservoir capacity at NDL is 6.85 million m^3.

The usable capacity is 4.05 million m^3.

The reservoir is located in Izmail district of Odesa region.

Katlabukh reservoir

The Katlabukh reservoir is a freshwater reservoir.

The area of the Katlabukh reservoir is 6,850 hectares.

The maximum depth is 2.7 m.

The area of shallow water is 2900 hectares.

The hydraulic structures of the Katlabukh reservoir include: Zhelyavsky regulator sluice, Zhelyavsky canal, Gromadsky sluice, and Gromadsky canal.

The NDL of the Katlabukh reservoir is 1.7 mbsf.

The DVL of the Katlabukh reservoir is 0.7 mBS.

The reservoir capacity at NDL is 131.0 million m³.

The usable capacity is 68.5 million m³.

The Katlabukh reservoir is located in the Izmail district of Odesa region.

Kytai Reservoir

The Kytai reservoir is a freshwater reservoir.

The area of the reservoir is 6000 hectares.

The maximum depth is 3.0 m.

The area of shallow water is 2300 hectares.

The hydraulic structures of the Kytai reservoir include: Lock No. 1 and Lock No. 2, a canal through Stepovyi Island, the Kofa Canal, and the Kofa Canal lock.

The NPD of the Kytai reservoir is 1.5 mBS.

The DVL of the Kytai reservoir is 0.6 mBS.

The reservoir capacity at NDL is 111.9 million m³.

The usable capacity is 49.3 million m³.

The reservoir is located in the Kiliya district of Odesa region.

All the Danube reservoirs have a complex purpose, and Kahul and Yalpuh also have a transboundary purpose. The reservoirs are important for the concentration of wetland birds during migration (in August, there are up to 5-6,000 individuals, among which the proportion of the rare white-eyed duck can be as high as 5%), as well as a nesting reserve for waterfowl.

The Danube reservoirs are used for gravity filling up to the NDL (normal design level) with Danube water, as well as for discharging water from the reservoirs into the Danube River. Danube in the autumn and winter period up to the DVL (dead volume level), canals were constructed (see Fig. F.1). The water exchange process in the reservoirs is regulated by control gates. The morphometric characteristics of the canals are as follows.

Viketa Canal

The Viketa Canal connects the Danube River and the Kahul reservoir.

A sluice regulator divides it into two parts:

- a 1200 m long supply canal,
- a 2100 m long transport canal.

According to the design data, the width of the canal is 10.0 m along the bottom, the water mirror is 30 m, and the bottom level of the canal is (- 0.10 m) BS.

Orlovsky and Luzarsa canals

The Orlovsky Canal connects the Danube River. Danube River and the Kahul reservoir.

A sluice regulator divides it into two parts:

- a 300 m long supply canal.
- a 1500 m long transport canal.

The Luzarsa Canal connects the Kahul reservoir with the Kartal reservoir.

The length of the Luzarsa Canal is 3.9 km, and the bottom of the canal is (+1.3 m) BS.

Prorva Canal

The Prorva Canal connects the Danube River and the Kartal reservoir.

A sluice regulator divides it into two parts:

- a 50-metre-long supply canal.
- and a 2850 m long transport canal.

According to the design data, the width of the canal is 10.0 m along the bottom, 25 m along the water mirror, and the bottom level of the canal is (+0.84) mBS.

Skunda Canal

The Skunda Canal is used to fill the Yalpug-Kuhurluy reservoir.

According to the design data, the canal has a width of 10.0 m along the bottom and a water surface of 30 m, with a bottom elevation of (+0.3) mBS.

The length of the supply canal is 280 m.

The length of the transport canal is 1600 m.

Canal "105 km"

The 105 km canal is intended for water exchange between the Yalpug-Kuhurluy reservoir.

The length of the supply canal is 150 m.

The length of the conveyance canal is 1400 m.

According to the design data, the width of the canal is 10.0 m along the bottom, 25 m along the water mirror, and the bottom level of the canal is (- 0.25) mBS.

Repida Canal

The Repida Canal is intended for water exchange between the Yalpug-Kuhurluy reservoir.

According to the design data, the canal is 20 m wide along the bottom, 40 m along the water mirror, and the canal bottom elevation is (-1.0) mBS.

The volume of siltation in the canal is 30.2 thousand m^3.

The length of the inlet canal is 300 m.

The length of the conveyance canal is 9.9 km, the bottom of the canal is - (- 1 m) BS.

HROMADSKYI canal

The Hromadsky Canal is intended for water exchange activities in the Staro-Nekrasivsky floodplains and the Lung and Safian reservoirs.

The length of the canal is 4670 m.

The supply canal is 170 m long.

The transport canal is 4500 m long.

The bottom of the canal is (- 0.7 m) BS.

Zheliavsky Canal

The Zheliavsky Canal is used for water exchange from the Katlabukh reservoir.

The length of the canal is 3.1 km.

The length of the supply canal is 100 m.

The length of the transport canal is 3000 m.

The bottom level is (- 0.7 m) BS.

Kofa-Stepovyi Canal

The canal is intended for water exchange in the Kytai reservoir.

The length of the canal is 1370 m.

The length of the inlet canal is 70 m.

The length of the transport canal is 1300 m.

The bottom level is (-0.6) mBS.

The Kofa Canal is 3200 m long.

The Danube-Sasyk Canal

The canal (Fig.) is intended for water exchange in the Sasyk reservoir.

The length of the canal is -14.1 km.

The length of the inlet canal is -210 m.

The length of the transport canal is 13890 m.

The bottom level is (-3.0) mBS.

Small rivers. The flow of small rivers flowing into the Danube reservoirs does not exceed 10% of the reservoirs' surplus and amounts to about 100 million m³ in high-water years. The main small rivers flowing into the Danube reservoirs flow from north to south and enter the tops of the reservoirs, which are also elongated in a north-south direction. The southern parts of the reservoirs are connected to the Danube River or its branches by canals.

The Danube River basin includes small rivers. Danube River basin includes small rivers: The Yalpuh, Karasulak, Tashbunar, Katlabukh (Big and Small), Yenika, Kyrhyzh-Kytai, Aliyaha, Nerushai, and Drakulya.

The Yalpuh River belongs to the Danube River basin. The Yalpuh River flows through the territory of the Republic of Moldova and Bolhrad district of Odesa region and enters the northern part of the Yalpuh reservoir. The river basin is located within the steppe zone. The Yalpuh river is a water body of national importance. Main parameters: the total length of the river is 142 km, the total catchment area is 3180 km². Within Ukraine, its length is only 8 km and the catchment area is 52 km². The annual flow rate of the small Yalpug River is 35.1 million cubic metres.

The **Karasulak** Small **River** is located in Bolhradsky District of Odesa Region, originating in the north-east of the village of Krasnoarmiyske, flowing south-west and entering the Yalpug Reservoir in the south-west of the village of Krynychne. The Karasulak River is a water body of national importance. Main parameters: The river is 52 km long and has a catchment area of 221 km², with one tributary, which is 13.5 km long. The valley is relatively narrow. In summer, it dries up in many places (mainly in the upper reaches). The annual runoff rate of the Karasulak River is 1.74 million cubic metres.

The small **Tashbunar River** is located in Bolhrad and Izmail districts of Odesa region. The river basin is located within the southern steppe zone. The Tashbunar originates north of the village of Kalcheva (Bolhrad district), flows mainly to the southeast (partly to the south) and empties into the Tashbunar Bay in the western part of the Katlabukh reservoir. The Tashbunar River is a water body of national importance. Main parameters: The river is 40 km long and has a catchment area of 281 km². The riverbed is winding, and for a stretch of 20 km it has been cleared and straightened. In summer, the river dries up, and there are ponds and artificial reservoirs along the riverbed. The annual flow rate of the Tashbunar River is 2.3 million m³.

The small **Yenika River** belongs to the Danube River basin. Danube River basin and flows through Artsyz, Bolhrad and Izmail districts of Odesa region. The Yenika flows mainly to the south and flows into the Gulf of Hasan in the eastern part of the Katlabukh reservoir. The river basin is located within the steppe zone. The Yenika River is a water body of national importance. Main parameters: The river is 40 km long and has a catchment area of 243 km². The riverbed is 2 m wide on average, partially regulated. It often dries up in summer. There are several ponds on the riverbed. The annual flow rate of the small Yenika River is 1.99 million cubic metres.

The small river **Velyky Katlabukh** belongs to the basin of the Danube River. Danube River, flows through the territory of Artsyz, Bolhrad, Izmail districts of Odesa region and empties into the Katlabukh reservoir. The Velykyi Katlabukh originates in the north-east of the village of Novi Troiany, flows through the Black Sea Lowland mainly to the south and empties into the north-western part of the reservoir. The river basin is located within the steppe zone. The Velykyi Katlabukh River is a water body of national importance. Main parameters: The river is 49 km long and has a catchment area of 536 km². The V. Katlabukh River has one tributary, which is 45 km long. This tributary is called.

Small Katlabukh with a catchment area of 235 km². The river slope is 2.2 m/km. The valley is symmetrical, 2-3 km wide and up to 30-50 m deep; the valley is divided by ravines in the upper reaches. The floodplain is 300-500 m wide. It dries up in summer, especially in the upper reaches. Several ponds have been constructed. It is used for agricultural purposes. The annual runoff rate of the small Katlabukh River is 3.78 million m³.

The **Kirhyzh-Kytai** small river is located in Bolhrad, Tarutino, Kiliya and Artsyz districts of Odesa region and flows into the Kytai reservoir. The Kyrhyzh-Kytai River is 64 km long with a catchment area of 725 km² and a slope of 1.9 m/km. It has its source on the southern slopes of the Podolsk Upland near the village of Tvarditsa in Taraklia district of Moldova. The river then flows southwards, passing through Tarutino, Artsyz and Kiliya districts of Odesa region, and then flows into the Kytai reservoir near the village of Stari Troiany. Flowing down from the heights of the Podilska Upland, which is covered with gorges and ravines, the river forms a valley up to 2.5 km wide. The river floodplain is swampy in some areas, up to 300-500 m wide. It flows into the Kytai Reservoir near the Danube Lowland. Near the village of Ostrovne, its tributary, the Kirgizh River, flows into the Kirgizh-Kytai. In the summer season, the river's flow is significantly reduced. The riverbed is canalised and its water is used for drinking water supply and land irrigation. The river water is mineralised. The annual flow rate of the small Kyrgyzh-Kytai river is 6.94 million m³.

The small **Aliyaha River** is located in Tarutino, Kiliya and Artsyz districts of Odesa region and flows into the Kytai Reservoir. It is 67.5 km long and covers an area of 467 km². The river slope is 1.8 m/km. The valley is wide (up to 2.8 km). The riverbed is winding, 8-12 m wide. There are oxbows, often drying up in summer. It is partly used for domestic purposes. The water is bitterly salty and unsuitable for drinking. The Aliyaha originates in a gully 4 km south-west of Tarutyne. It flows mainly to the south and (partially) to the south-east. It flows into the Kytai reservoir west of the village of Novoselivka. Main tributaries: Novoselovka, Tashlyk (left). The annual flow rate of the small Aliyaha River is 4.42 million m³.

The **Nerushai** Small **River** is located in the Kiliya, Tatarbunary and Artsyz districts of Odesa region and flows into the Stentsivsky Plavni. The Nerushai has its source near the village of Dmytrivka. It flows within the Black Sea lowlands mainly to the south. It flows into the Murza southeast of the village of Myrne. It is 52.5 km long and covers a catchment area of 346 km². The river slope is 0.68 m/km. The valley is 1-1.5 km wide and up to 20-30 m deep. The floodplain is 0.3-0.5 km wide. The riverbed is meandering, largely swampy, drying up in summer, with flat areas at the mouth. Ponds and a reservoir have been constructed. The annual flow rate of the small Nerushai River is 7.14 million cubic metres.

Problematic issues: Dams built along the riverbed have led to the decline of small rivers. The rivers are drying up, the riverbeds are overgrown with reeds and disappearing. Revival of small rivers is possible if the number of dams is reduced and springs are cleared.

For management decision-making, it is advisable to determine the quantity and quality of water in the local runoff by constructing water gauging stations on small rivers.

Current environmental status of the Danube reservoirs. In the context of global climate change, the agricultural sector in the Danube region suffers the most from drought, which is supported by irrigation. In order to maintain the ecological condition of the lakes and irrigate the surrounding fields, it is necessary to fill the reservoirs (if necessary, by force) and to clear the canals, which are gradually reducing their capacity due to excessive siltation. In particular, to address the problematic issues of water bodies and reservoirs in Izmail district, as of 27 April 2023, the Hromadsky Canal, which supplies water to Lung and Safiany lakes, as well as the water exchange between Lake Katlabukh and the Danube River, was completed. The total length of the canal cleared by the Izmail Water Management Department was 4 km and its depth was 1.7 m. In its current state, the Hromadske Canal is an important link in maintaining the water content of these lakes.

In order to prevent a critical situation in the Danube reservoirs, the Danube reservoirs are filled by gravity to the NRF levels in accordance with the operating regime approved by the State Water Agency of Ukraine in case of favourable hydrological conditions on the Danube River. Monthly state monitoring of surface waters is also carried out.

Water samples are taken by specialists of the Danube Hydrometeorological Observatory, according to the approved schedule, and then transported to the laboratory of the Black Sea and Lower Danube Rivers BWR "Black Sea Centre for Water Resources and Soils" for measurement of pollutants.

Thanks to the monitoring of water levels in the Danube, the use of forced filling, and the timely opening and closing of locks, as of April 2023, the environmental situation in the Danube lakes is in an acceptable hydrological regime.

In *Kugurluy*, *Yalpug* and *Kartal* lakes, forced filling is currently impossible due to the lack of a working pumping station, so they have been filled by gravity. As of April, the water level in Lake Yalpug was 274 cm (dead volume level - 180 cm). The issue of launching a pumping station on Lake Yalpug is being resolved, either by building a new one or by decommissioning the existing one.

In Lake *Katlabukh*, the water level is currently 769 cm (DVL - 699 cm). Forced filling is possible here, which was used in 2022 and this year. This is an estuarine-type floodplain lake in the lower reaches of the Danube on its left bank, separated from the river by a dam, and operates as a reservoir. It fills the Safiany and Lung lakes, the Staronekrasivsky Plavni, Loschynivske and Kamianske reservoirs and Pokrovsky Pond, from which water is abstracted and supplied to irrigated areas of the district.

The lakes *Katlabukh*, *Safiany* and *Lung* are home to the town of Suvorove, the villages of Stara Nekrasivka, Kyslytsia, Bahate, Utkonosivka, Pershotravneve and Safiany, which abstract water for household needs and for irrigation of crops. The water reservoir is crucial for the nutrition of agricultural land and the economic activities of local residents. The water level also affects the groundwater level, which directly affects the filling of wells and artesian wells from which the population uses water for household needs.

As for *Kytai* Lake, as of June 2022, with a dead volume of 139 cm, the water level did not stop at 135 cm, but generally dropped to 86 cm in November. The water salinity reached 6 g/dm3. Clearing of the Mezhkolkhozny Canal and forced filling prevented a catastrophe from developing. Currently, the water level is 189 cm.

Mineralisation during the autumn low water mark (in September, October and November) in 2022 was as follows:

- in the Kahul Lake Reservoir - 867, 984, 990 mg/dm3;
- in the Kuhurlui Lake Reservoir - 1299, 1351, 1374 mg/dm3;
- in the Yalpug Lake Reservoir - 827, 827, 1247 mg/dm3;
- in the Katalbuh Lake Reservoir - 1062, 331, 2217 mg/dm3;
- in the Kytai Lake Reservoir - 6005, 5590, 7205 mg/dm3;
- in the Sasyk Reservoir - 3045, 3921, 2846 mg/dm3.

During the spring flood (March, May) of 2023, the water salinity was as follows

- in the Kahul Reservoir - 770, 568 mg/dm3;
- in the Kuhurluy Reservoir - 933, 1007 mg/dm3;
- in the Yalpuh Lake Reservoir - 1299.9, 1069 mg/dm3;
- in the Katalbuh Lake Reservoir - 1249, 1590 mg/dm3;
- in the Kytai Lake Reservoir - 1297, 4642 mg/dm3;
- in the Sasyk Lake Reservoir - 2081, 1005.23 mg/dm3.

The ecological condition of the lakes will continue to require attention, including monitoring of water levels and chemical composition, timely operation of pumping stations and clearing of connecting canals in case of reduced capacity.

Assessment of the possible impact of the planned activities on the water resources of the Danube region. Thanks to the constructed canals, the Danube lakes are hydraulically connected to the Kilyia arm, which is regulated by hydraulic structures. In the context of the delta of the Kilyia arm with natural fluctuations in water levels and the state-owned use of water resources, the lakes are characterised by periodic fluctuations in water levels. Probable predicted impact of the reconstruction of the hydraulic structures of the Danube-Black Sea on the level regime of the Kiliya arm will not exceed several centimetres, which is significantly less than the natural fluctuations in water levels in the arm. Under such conditions, the impact of the planned activities on the lake level regime is expected to be insignificant and fully regulated by the existing hydraulic structures, which should be ensured through monthly state monitoring of surface waters. Based on the results of the monitoring studies, the water level in the reservoirs will be regulated in a timely manner (taking into account the appearance of even minor waves of rising water levels in the Danube) and the corresponding optimisation of water resources use, which will contribute to the creation of efficient and environmentally safe conditions for the operation of the Danube reservoirs in conjunction with hydromelioration systems.

APPENDIX G
METAL CONTENT IN SURFACE WATERS AND BOTTOM SEDIMENTS BASED ON THE RESULTS OF EXPEDITIONARY STUDIES

G.1 Determination of metal content in surface water and sediments

In accordance with the regulations of expeditionary research, in May 2023, in terms of monitoring the content of metals in river water, the content of *iron, manganese, zinc, copper and nickel* was determined, and the content of *iron, manganese, zinc, copper, nickel, lead and cadmium* was determined in bottom sediments.

The analysis of samples of surface water and bottom sediments, taken in the course of the works, was carried out by the laboratories of the analytical centre of the UKRNDIEP. The quality of analytical work is checked in accordance with the requirements of the "Quality Manual", which was developed taking into account DSTU ISO/TR 10013, DSTU ISO/IES 17025:2017.

The measurements are made using calibration samples made from reference materials certified in accordance with DSTU ISO 17034:2020 General requirements for the competence of reference material manufacturers (ISO 17034:2016, IDT).

Samples were selected and analysed in accordance with the regulations for carrying out expeditions:

- river water at 4 observation points;
- sediments at 4 observation sites.

Each sample was studied in three parallels. A total of 48 elemental determinations were performed to determine the metal content of *iron, manganese, zinc, copper and nickel* in river water and *iron, manganese, zinc, copper, nickel, lead and cadmium* in bottom sediments, including 20 for water and 28 for bottom sediments (excluding parallel determinations).

Sampling methods and metal content determination. Sampling was carried out in accordance with the requirements of DSTU ISO 5667-6-2001, DSTU ISO 5667-12-2001, GOST 17.1.5.05, GOST 17.1.3.10.

Mixed samples of surface water, taken by a bathometer from different points and layers in the river bed and averaged, were studied. Discrete samples from separate layers and points along the cross-section of the structure were combined into one mixed sample. When taking water samples for the determination of metals, the samples were not filtered, the gross content of metals in the river water was determined.

Elemental determinations in surface water samples were performed by atomic absorption spectrometry.

For the study of **bottom sediments**, mixed samples were taken from different points of the shafts from the surface layer of silt deposits (up to 15 cm). The sampling was performed with a bucket grab sampler. The appearance of the collected mixed samples and visual features of the mechanical composition of bottom sediments (silt), depending on the sampling points, are given in Table G.1.1.

Table G.1.1 - Sampling points of bottom sediment soils along the study route of the city of Reni Reni - Izmail - Kiliya - Vylkove and their appearance - (May 2023)

Sample number and place of sampling	Photo of the soil sample
R01. 2 km above Reni	
R06. 1 km below Izmail	
R07. Above Kiliya	

R09. Below Kiliya	
R11. Ochakivskyi arm, 17 km	
R12. Starostambulskyi arm, 11 km	
R13/0. Solomon's arm, Danube-Sasyk canal	
R13/1. Vylkove	

R13/9. Starostambulskyi arm, 14 km	
R14. Ochakivskyi arm, 6 km	
R15. Starostambulskyi arm, 4 km	

Elemental determinations in the sediment samples were also performed using the above-mentioned methods of atomic absorption spectrometry.

In addition, chemical analytical studies of the chemical composition of water extracts from sediment samples were carried out, as well as radiation determination of gamma and beta radiation.

G.2 Metal content in river water sampled during the expeditionary survey in May 2023

According to the results of chemical and analytical studies, the metal content in surface waters has the following values (Table G.2.1).

The gross iron content averaged 0.77 mg/dm^3 (2.6 MPC p-value) at the studied sites. The highest value was recorded at the observation points of t.2 R06 (Kiliiskyi arm, 89 km, 1 km below the town of Izmail) and t.4 R 13/9 (Starostambulskyi arm, 14 km) - 0.9 mg/dm^3, the lowest value was recorded at t.1 R01 (Danube River, 71 mile, 2 km above of the town of Reni) - 0.53 mg/dm^3 (1.8 MPC p-value / 5.3 MPC RG)

The average value of *gross manganese* for the site was 0.078 mg/dm^3 (0.78 MPC p-value). The highest value was recorded at monitoring station t.4 R 13/9 (Starostambulskyi arm, 14 km). - 0.87 MPC p-value, the lowest value was recorded at site 1R01 (Danube River, 71 mile, 2 km above of the town of Reni) - 0.060 mg/dm^3 (0.60 MPC p-value).

The average value of *gross zinc* content for the site was 0.020 mg/dm^3 (0.020 MPC p-value / 2.0 MPC $_{RG}$). The highest value was recorded at the observation point T.4R 13/9 (Starostambulskyi arm, 14 km). - 0.028 mg/dm^3 (0.028 MAC p-value / 2.8 MPC $_{RG}$), the lowest value was recorded at t.1R01 (Danube River, 71 mile, 2 km above of the town of Reni) - 0.010 mg/dm^3 (0.01 MPC p-value/1.0 MPC $_{RG}$).

The *gross copper* content at no point exceeded the MPC p-value and averaged 0.0069 mg/dm^3. The maximum value was recorded at point t.2 R06 (Kiliiskyi arm, 89 km, 1 km below the town of Izmail) - 0.017 mg/dm^3 (0.017 MPC p-value).

Exceedance of the MPC $_{RG}$ was recorded at observation points T.2 R06 (Kiliiskyi arm, 89 km, 1 km below the city of Izmail) and t.4 R 13/9 (Starostambulskyi arm, 14 km), where the established multiplicity of exceedance was 3.4 MPC $_{RG}$ and 1.28 MPC $_{RG}$, respectively.

The *gross nickel* content at no point exceeded the MPC p-value and MPC $_{RG}$ and averaged 0.0020 mg/dm^3 (0.02 MPC p-value / 0.2 MPC $_{RG}$). The maximum value was recorded at t.4 R 13/9 (Starostambulskyi arm, 14 km) - 0.0027 mg/dm^3 (0.03 MPC p-value / 0.27 MPC $_{RG}$).

Table G.2.1 - Heavy metal content in the water of the Danube River in May 2023 according to the expeditionary research data

No. of item	No. of point	Sampling point	Elements under investigation and their content in mg/dm^3					Sampling date
			Fe	**Mn**	**Zn**	**Cu**	**Ni**	
			Gross content	Gross content	Gross content	Gross content	Gross content	
1	**R 01**	**Danube River, 71 miles,** 2 km above Reni	0.53	0.060	0.010	0.0013	0.0015	05.2023 mixed from point
2	**R 06**	**Kiliiskyi** arm, 89 km, 1 km below the town. Izmail	0.90	0.084	0.019	0.017	0.0016	05.2023 mixed from point
3	**R 09**	**Kiliiskyi arm, 32 km,** below the town of Kiliya	0.75	0.082	0.023	0.0029	0.0023	05.2023 mixed from point
4	**R 13/9**	**Starostambulsky river, 14 km.**	0.90	0.087	0.028	0.0064	0.0027	05.2023 mixed from point
Average content along the river section			0.77	0.078	0.020	0.0069	0.0020	
Minimum			0.53	0.060	0.010	0.0013	0.0015	
Maximum			0.90	0.087	0.028	0.017	0.0027	
MPC c.dd. (for cultural and domestic and drinking water use)			0.3	0.1	1.0	1.0	0.1	
MPC f.u. (for fishery use)			0.1	0.01	0.01	0.005	0.01	

G.3 Metal content in the sediments collected during the expeditionary survey in May 2023

The metal content of sediment samples from the Danube estuarine branches is given in Table G.3.1.

The content of *gross iron* in the sediments at the study sites ranges from 19700 mg/kg to 26100 mg/kg. The maximum content was recorded at the observation point of the Starostambulskyi river, 14 km. The average value for this indicator is 22830 mg/kg.

The *gross manganese* content averaged 659.8 mg/kg, with the highest value at the monitoring station t.4 R 13/9 (Starostambulskyi arm, 14 km), which was 908 mg/kg.

The *gross zinc* content in the study area ranged from 70.7 mg/kg at site 1 R01 (Danube River, 71 mile, 2 km above of the town of Reni) up to 92.1 mg/kg at point t.3 R 09 (Kiliiskyi arm, 32 km below the town of Kiliya). The average value is 79.45 mg/kg.

The gross copper content in the study area had the highest value of 44 mg/kg in R 13/9 (Starostambulskyi arm, 14 km). The average value was 39.88 mg/kg.

The *gross nickel* content ranges from 30.3 mg/kg to 45.7 mg/kg. The maximum content was recorded at the monitoring station t.3 R 09 (Kiliiskyi arm, 32 km, below the town of Kiliya). The average value for this indicator is 37.85 mg/kg.

The *gross lead* content ranges from 13.8 mg/kg to 23 mg/kg. The maximum content was recorded at the monitoring station t.2 R06 (Kiliiskyi arm, 89 km, 1 km below the town of Izmail). The average value for this indicator is 18.58 mg/kg.

The *gross cadmium* content ranges from 0.34 mg/kg to 0.48 mg/kg. The maximum content was recorded at the monitoring station t.3 R09 (Kiliiskyi arm, 32 km below the town of Kiliya). The average value for this indicator is 0.383 mg/kg.

According to the results of chemical and analytical studies, the content of heavy metals in the samples of soil (silt) of sediments does not exceed background levels, which, according to the comparative characterisation of soil quality according to the world classification of PMAKS dredged soils, allows them to be classified as clean uncontaminated soils.

No adverse impact on the aquatic environment is expected from the discharge of waste water.

The storage of sediments in the hydraulic dumps will not lead to contamination of the soil cover, groundwater and surface water in the areas of the hydraulic dumps formation and will not lead to changes in the water quality of the Danube river.

Table G.3.1 - Content of heavy metals in the bottom sediments of the Danube River based on the data of the May 2023 expeditionary research of the Ukrainian Research Institute of Environmental Policy

No. of item	No. of point	Sampling point	Elements under investigation and their content in mg/kg							Date of sampling, type of sample
			Fe	**Mn**	**Zn**	**Cu**	**Ni**	**Pb**	**Cd**	
			Gross content	Gross content	Gross content	Gross content	Gross content	Gross content	Gross content	
1	**R 01**	**Danube river, 71 miles,** 2 km above Reni	19700	520	70.7	36.4	37.2	13.8	0.34	05.2023 Mixed from point
2	**R 06**	**Kiliiskyi** arm, 89 km, 1 km below Izmail	22100	561	78.7	38.1	38.2	23	0.36	
3	**R 09**	**Kiliiskyi arm,** 32 km, below Kiliya	23400	650	92.1	41	45.7	18.9	0.48	
4	**R 13/9**	**Starostambulskyi river, 14 km.**	26100	908	76.3	44	30.3	18.6	0.35	
Average value for the river section			22830	659.8	79.45	39.88	37.85	18.58	0.383	
minimum			19700	520	70.7	36.4	30.3	13.8	0.34	
Maximum			26100	908	92.1	44	45.7	23	0.48	
MPC			None established for metal content in bottom sediments							
MPC for soils (gross content) According to SanPiN 42-128-4433-87			-	1500	+ 50 to the background	+ 35 to the background	+ 45 to the background	32	-	These are for indicative comparison only

APPENDIX I
ASSESSMENT OF THE SOIL COVER CONDITION BASED ON THE RESULTS OF STUDIES OF THE CHEMICAL COMPOSITION OF WATER EXTRACTS OF SOILS

I.1 Natural landscape and geochemical features of the study area

The research area belongs to the Steppe *bioclimatic zone to the calcium class* of landscapes (Ca2+ is a typical element) and is characterized by the development of landscapes in the physical and geographical zone - Southern Steppe.

The territory is included in the area of abnormal total soil contamination with heavy metals, which, taking into account their biogenic activity in landscapes, ranges from up to 100 conventional units (in Ukraine, total soil contamination ranges from relatively low contamination to 30-600 u.u.). The polluting elements are: *chromium, cobalt, manganese, barium, vanadium, strontium, and zirconium*. Their genesis is caused by industrial waste.

The elemental composition of contamination and the density of total soil contamination in the clusters of concentration within the anomalous zone are characterized as ***Cr - 15; Co - 1-12.5; Mn - 1.0-6.9; Ba - 2-10,*** respectively.

In general, the landscapes of the Steppe zone are characterized by:

- Increased planar migration of chemical elements associated with soil washout in the calcium landscapes of the uplands of the northern steppes;
- predominant accumulation of most heavy metals and toxic substances in accumulative forms of landscapes;
- low self-purification capacity of calcium and soda class landscapes.

The integral indicator of biogenic activity of heavy metals and *radionuclides* in landscapes is 0.2 (in Ukraine, its values range from 0.05 to 2.6. The maximum values of the indicator (2.6) are typical for the acid-gley landscapes of Polissia, and the minimum values (0.05) are typical for the saline landscapes of Prysyvash).

The pollutant elements are:

- for soils - Pb, Zn; as well as Ve and nitrates that pollute soils in the course of agricultural activities;
- for surface waters - Mn, Zn;
- Fe, Mn, Pb, Zn for the upper horizons of groundwater (groundwater).

The total value of *geochemical load* on biota is up to 30-100 conventional points; (in general, in Ukraine it ranges from 30 to more than 50,000 conventional points).

The intensity of migration of toxic substances with water ranges from 0-200 to 300 conventional points (in general, in Ukraine it varies from 0 to 800 units).

In accordance with these features of the geochemical landscape of the study area, as well as the features of possible environmental pollution, geochemical studies of soils and surface waters were carried out.

Based on the specifics of the geochemical landscape of the study area, as well as the peculiarities of the possible impact of the study objects on the soil, the following components were determined *macro-components* with mandatory determination of pH, chlorides, nitrates, sulfates, oil products, nitrates, phosphates.

I.2 Examination of the ground cover soil samples

In accordance with the requirements, soil samples were collected at each point using the "envelope" method with the location of the "pits" in the corners and in the centre of the "envelope" with a side length of 5.0 m and 1.0 m. Sampling from the pits was carried out using the furrow method, with a furrow section of 5×5 cm along the entire depth of the pit. The sampling interval was 0.00-0.20 m. The single samples collected from the "pits" at each test point were combined into one, thoroughly mixed, and quarted (5 single soil samples at each point, from which 1 group sample was formed). After that, one group sample weighing 1.8-2.0 kg was taken.

The samples were taken At sites located at a distance of 60.0 m from the surface water and sediment sampling points within the left-bank floodplain of the Kiliya arm. Point 1 is located in the vicinity of Izmail. Izmail, point 2 - near the town of Kiliya, point No. 3 - near the town of Kiliya. Vylkove. The number of sampling points was 3. Soil samples were taken at each point in the depth range of 0.0-0.30 m. The results of the research are presented in Table I.2.1.

Table I.2.1 - Macrocomponent composition of water extracts of soil cover in the area of Izmail, Kiliya and Vylkove (based on the results of the research conducted by the Ukrainian Research Institute of Ecology and Environmental Protection in May 2023)

Ingredients	Units of measurement	Measurement result		
		T. 1, soil cover in the area of Izmail	T. 2, soil cover in the area of Kiliya	T. 3, soil cover in the vicinity of Vylkove
pH	*pH unit*	7.51	7.49	7.24
Hydrocarbons	*mmol/dm3 /mg/100 g*	2.2/134.2	2.0/122.0	1.8/108.8
Chlorides	*mmol/dm3 /mg/100 g*	1.7/60.35	1.6/63.9	1.6/63.9
Sulfates	*mmol/dm3 /mg/100 g*	2.0/96.0	1.9/91.2	2.1/100.8
Calcium	*mmol/dm3 /mg/100 g*	2.6/52.5	2.9/58.0	2.4/48.0
Magnesium	*mmol/dm3 /mg/100 g*	2.6/31.72	2.0/24.4	2.4/29.28
Sodium potassium	*mmol/dm3 /mg/100 g*	2.0/50.0	2.2/55.1	1.4/35.0
Mineralization	-«-	321.15	414.6	385.78
Dry residue	-«-	314.0	395.0	370.0
Ammonium	-«-	<0.5	<0.5	<0.5
Nitrates	-«-	3.04	2.86	2.32
Phosphate (P2O5)	-«-	<2.5	<2.5	<2.5
Oil products	-«-	<2.0	<2.0	<2.0
Water type of water extraction		C^{CaMg}	C^{Ca}	S^{CaMg}

Macrocomponent composition of water extracts of soil cover

Soil samples were taken to determine the macrocomponent composition of water extracts to identify the peculiarities of their pollution and salinity.

In order to determine the condition of soils under spring flood conditions, soil samples were collected in the vicinity of the towns of Izmail, Kiliya, and Vylkove (Table I.2.1).

In accordance with the peculiarities and intensity of the impact predicted on the components of the natural environment, which may occur due to the peculiarities of the *hydrological and hydrochemical* regime of the Kiliia Arm during floods and low water, as well as considering the natural landscape and geochemical features of the territory in aggregate, elements of the macrocomponent composition of water extracts were selected as priority ones to determine the content of soil cover (both in bottom sediment soils and in surface and groundwater).

In the water extracts of soil samples taken in the vicinity of the city of Izmail, a significant predominance of *hydrocarbonate* anions over *sulphate and chloride* anions is determined. In the cationic composition, there is an excess of *calcium and magnesium cations over sodium ions*. In the region of the town of Kiliya, *there is also an excess of hydrocarbonate* anions over *sulphate and chloride* anions; in the cationic composition, *calcium* cations exceed the content of *sodium and magnesium* cations. In the region of the town of Vylkove, *sulphate anions and calcium and magnesium cations* predominate. This results in the formation of *calcium-magnesium bicarbonate* (C^{CaMg}), *calcium hydrogen carbonate* (C^{Ca}), and *calcium-magnesium sulphate* (S^{CaMg}) water types of aqueous solution, respectively (Table I.2.1).

The mineralisation of water extracts of soil cover varies depending on the sampling sites and is 0.32 - 0.41 - 0.39 g/dm3, respectively, and the dry residue is 0.31 - 0.40 - 0.37 g/dm3.

The content of biogenic substances (*ammonium nitrogen, nitrates*) is within the limits typical for the seasonal periods of the year and during the *spring flood of 2023* does not exceed the norm and is within its limits. The *phosphate* content was recorded at all locations at almost the same level within the regulatory requirements. According to the hydrogen index, the soils are characterised as neutral with a pH of 7.24-7.49.

According to the results of chemical and analytical studies, in general, the ground cover soils sampled in the vicinity of the above cities are characterised as *uncontaminated* in terms of chlorides and sulphates.

It should be noted that under both natural and technogenically disturbed conditions, the chemical composition of water extracts of soils in the floodplain of the Kiliya arm largely depends on the degree of soil cover flushing during spring flooding.

APPENDIX K

ASSESSMENT OF THE IMPACT OF SEDIMENTS ON VEGETATION, GROUNDWATER AND SURFACE WATER DURING THEIR STORAGE IN HYDRAULIC DUMPS (BASED ON THE RESULTS OF STUDIES OF THE CHEMICAL COMPOSITION OF WATER EXTRACTS)

K.1 Macrocomponent composition of water extracts of sediment soils

The assessment of the safe for groundwater and vegetation storage of sediments of the Kiliya arm during the formation of dumps under the conditions of the planned dredging was carried out by determining their chemistry and salinity.

To determine the content of readily soluble salts in the soils (silt) of the sediments, the water extraction method was used, since this method allows, in addition to salts in the liquid phases of soils, to remove salts present in solid phases.

The water extraction method is quite simple and is widely used in mass determinations that are carried out to obtain a general characterisation of soil salinity.

When assessing the salinity of sediment soils in the Kiliya arm, anions (HCO_3, Cl^-, SO_4^{2-}) and cations (Ca^{2+}, Mg^{2+}, Na^+, K^+) of readily soluble salts were determined in the water extracts of the combined samples.

Soil samples from the bottom sediments were taken to determine the macrocomponent composition of water extracts to identify the peculiarities of their pollution and salinity.

In order to identify the contribution to soil and water pollution in the areas of sediment dumping, as well as to determine the possible impact on plant health depending on the degree of salinity, and to justify the specifics of the technology for the formation of sediment dumps, the elements of the macrocomponent composition of water extracts were selected as priority.

The results of chemical and analytical studies are given in Tables K.1.1-K.1.2, where the salt content in ionic form is given in mg/100 g of soil and in mg-eq/100 g of soil.

According to the results of the analyses, in the water extracts of sediment samples, a significant predominance of *hydrocarbonate* anions over *sulfate and chloride* anions is determined. In the cationic composition, *calcium cations predominate over magnesium* and sodium ions. Only in the 6 km Ochakivskyi aquifer is *there an excess of sodium cations over calcium and magnesium* cations. At the same time, mainly calcium *hydrocarbonate* (C^{Ca}) *and calcium-magnesium hydrocarbonate* (C^{CaMg}) types of water extracts are formed (Table K.1.1, K.1.2).

The mineralisation of water extracts of bottom sediment soils varies between 0.15 and 0.21 g/dm^3, and the dry residue is 0.10 and 0.15 g/dm^3, i.e. the soils contain a lot of organic matter of natural origin.

The content of biogenic substances (*ammonium nitrogen, nitrates*) is within the limits typical for the seasonal periods of the year and during the *spring flood of 2023*, does not exceed the norm and is within its limits. The *phosphate* content was recorded at all locations at almost the same level of 0.28 - 0.68 mg/dm^3, which is within the regulatory requirements. According to the hydrogen index, the soils are characterised as neutral with a pH of 7.42-7.84.

According to the results of chemical and analytical studies, in general, the sediment soils sampled in the area of existing economic activity are characterised as *not contaminated* in terms of chloride and sulphate content, and are not aggressive in terms of chloride and sulphate content.

Based on the content of macro-components in the bottom sediment samples of the Kiliya, Ochakiv and Starostambulsky arms, which were taken in the area of existing economic activity, their concentrations do not exceed the maximum permissible levels, and the soils are characterised as "clean" at the sampling sites.

It should be noted that under both natural and man-made disturbed conditions, the chemical composition of water extracts from the bottom sediments of the Kiliya Arm largely determines the peculiarities of the *formation of the chemical composition of surface and groundwater (groundwater) in the places of their storage in hydraulic dumps.*

Accordingly, it is important to characterise soils by determining their toxicity, i.e. the presence of toxic and non-toxic salts.

Table К.1.1 - Chemical composition of water extracts of selected sediment soils (May 2023)

Name of indicators	Units of measurement	T.1 - 2 km above Reni	**T.** 2 - 1 km below Izmail	T.3 - Above Kiliya	T.4 - Below Kiliya	T.5 - Ochakivskyi arm, 17 km	T.6 - arm. Starostambulskyi, 11 km
pH	pH unit	7.68	7.59	7.79	7.70	7.57	7.59
Hydrocarbons	mg/100g	1.6/97.6	1.8/109.8	1.2/73.2	1.8/109.6	1.6/97.6	1.4/85.4
Chlorides	-«-	0.2/7.1	0.4/14.2	0.3/10.6	0.3/10.6	0.2/7.1	0.35/12.4
Sulfates	-«-	0.5/24.0	0.7/33.6	0.4/19.2	0.2/9.6	0.2/9.6	0.4/19.2
Stiffness of the product	mmol/100g	1.9	2.3	1.6	1.3	1.5	1.7
Calcium	mg/100g	1.1/22.0	1.2/24.1	0.9/18.0	1.1/22.0	0.8/16.0	1.0/20.0
Magnesium	-«-	0.8/9.8	1.1/13.4	0.7/8.5	0.2/2.4	0.7/8.5	0.7/8.5
Sodium potassium	-«-	0.4/10.0	0.6/15.0	0.3/7.5	1.0/25.0	0.5/12.5	0.4/10.0
Mineralization	-«-	170.5	210.1	137.0	179.2	151.3	155.5
Dry residue	-«-	121.0	155.0	101.0	124.0	102.0	112.0
Ammonium	mg/100g	<0.5	0.32	0.23	0.28	0.23	0.37
Nitrates	-«-	<0.2	<0.2	2.87	2.15	<0.2	<0.2
Phosphates	-«-	0.42	0.68	0.32	0.44	0.36	0.29
Humidity	%	30.0	20.0	10.0	20.0	20.0	10.0
Chemical type		C^{Ca}	C^{CaMg}	C^{Ca}	C^{CaNa}	C^{CaMg}	C^{Ca}

Table К.1.2 - Chemical composition of water extracts of selected sediment soils (May 2023)

Indicator name	Units of measurement	T.7 - Ochakivskyi arm, 6 km	T.8 - Starostambulskyi arm, 4 km	T.9 - Vylkove	T.10 - Starostambulskyi arm, 14 km	T.11 - Solomon's arm, Danube-Sasyk canal
pH	pH unit	7.84	7.65	7.46	7.63	7.42
Hydrocarbons	mg/100g	1.6/97.6	1.4/85.4	1.6/97.6	2.0/122.0	1.6/97.6
Chlorides	-«-	0.2/7.1	0.3/10.6	0.35/12.4	0.3/10.6	0.3/10.6
Sulfates	-«-	0.4/19.2	0.8/38.4	0.6/28.8	0.4/19.2	0.6/28.8
Stiffness of the product	mmol/100g	1.2	1.9	2.0	2.2	1.9
Calcium	mg/100g	0.9/18.0	1.0/20.0	1.2/24.1	1.4/28.0	1.3/26.0
Magnesium	-«-	0.3/3.6	0.9/11.0	0.8/9.8	0.8/9.8	0.6/7.3
Sodium potassium	-«-	1.0/25.0	0.6/15.0	0.5/12.5	0.5/12.5	0.6/15.0
Mineralization	-«-	170.5	180.4	185.2	202.1	185.3
Dry residue	-«-	121.0	137.0	136.0	141.0	136.0
Ammonium	mg/100g	0.36	1.61	1.80	0.23	0.32
Nitrates	-«-	<0.2	<0.2	<0.2	2.51	<0.2
Phosphates	-«-	0.28	0.62	0.42	0.34	0.41
Humidity	%	25.0	30.0	35.0	30.0	25.0
Chemical type		C^{NaCa}	C^{CaMg}	C^{Ca}	C^{Ca}	C^{Ca}

К.2 Determination of sediment chemistry (type) and salinity

К.2.1 Methodology for assessing soil chemistry and salinity

Classification of saline soils

Salinisation of soils is the process of formation of halogenated soils. This phenomenon can be caused by a natural salinity factor (presence of saline parent or genetic rocks), as well as an anthropogenic factor related to economic activity, in particular, the use of improper reclamation regimes, irrigation of soils with industrial wastewater, usually saline, etc.

Due to the fact that different salts are not equally toxic to plants, saline soils are distinguished by their salt composition.

The chemistry (type) of salinity is determined by analyses of water extracts, and is based on the ratio of anions. The classification of soils by chemistry is given in Table К.2.1.

Salinity type	Ratio of mg-eq of anions			Ratio of mg-eq cations
	$\frac{Cl}{SO_4}$	$\frac{HCO_3}{Cl}$	$\frac{HCO_3}{SO_4}$	
Chloride and sulphate Chloride	1-2,5 and Above	–	–	–
Chloride-sulphate	≤0,2–1,0	–	–	–
Sulphate	<0,2-0,3	–	–	–
Soda-chloride	> 1	< 1	> 1	HCO3 > Ca-Mg
Soda-sulphate	< 1	> 1	< 1	Na > Mg
Chloride soda	> 1	> 1	> 1	Na > Ca
Sulphate sodium	< 1	> 1	> 1	–
Sulphate or chloride Hydrocarbonate	–	> 1	> 1	HCO_3> Na

Table К.2.1 - Distribution of soils by salinity chemistry (type) (Egorov et al.)

The name of the salinity type indicates those anions whose content exceeds 20 % of the sum of anions in mg-eq; the predominant anion is put in the last place in the name.

According to the degree of salinity, soils are divided into non-saline, slightly saline, moderately saline, highly saline and very highly saline (salt marshes) (Table К.2.2).

Table K.2.2 - Classification of soils by salinity (after N.I. Bazylevych, E.I. Pankova, 1972)

Degree of salinity	Salinity chemistry, sum of salts (dense residue), %					
	Chloride Cl: $SO_4 \geq 2{,}5$	**Sulfate-chloride Cl:** $SO_4=2{,}5\text{-}1$	**Chloride-sulphate** Cl:SO4≤1-0.3	**Chloride-soda, soda-chloride Cl:** $SO_4>1$ $HCO_3 \approx Cl$	**Sulphate** Cl: $SO_4 \leq 0{,}3$	**Soda-sulphate, sulphate-soda** Cl: $SO_4 \leq 01$ $HCO_3 \approx SO_4$
Non-saline	**<0.03**	**< 0.05**	**< 0.10**	**< 0.1**	**<0.15**	**<0.15**
Slightly saline	0.03-0.10	0.05-0.12	0.10-0.25	0.1-0.15	0.15-0.30	0.15-0.25
Medium saline	0.10-0.30	0.12-0.35	0.25-0.50	0.15-0.30	0.30-0.60	0.25-0.35
Strongly saline	0.30-0.60	0.35-0.70	0.50-0.90	0.30-0.50	0.60-1.40	0.35-0.60
Very strongly saline (salt marshes)	>0.60	> 0.7	>0.9	>0.5	>1.4	>0.6

The same amount of salts, depending on their composition, may indicate different degrees of soil salinity, which is due to the unequal toxicity of salts to plants. Therefore, the degree of soil salinity is determined by the value of the dense residue and the content of ions that determine the chemistry (type) of salinisation (Table K.2.2).

Methodology for calculating the content of toxic salts based on water extract analysis

Toxic salts include: Na^+, Mg^{2+}, Cl^-, CO_3^{2-} ions; SO_4^{2-} and HCO^{3-} ions bound to Na^+ and Mg^{2+}; Ca^{2+} ions bound to Cl^-. The calculation of toxic salts based on the analysis of water extracts is carried out as follows.

Depending on the composition of the water extract, the following options for calculating toxic ions are possible:

1. If the HCO^{3-} ion content is less than Ca^{2+} and the Ca^{2+} content is less than SO_4^{2-}, only the toxic SO_4^{2-} ion bound to Na^+ and Mg^{2+} is calculated by the formula:

$$SO_4{}^{2-}\ tox = (Na^+ + Mg^{2+}) - Cl^-.$$

1. 2. If the HCO_3 content is less than Ca^{2+} and Ca^{2+} is greater than SO^{2-}, calculate the toxic Ca^{2+} bound to Cl^- by the formula:

$$Ca^{2+}\ tox = Cl^- - (Na^+ + Mg^{2+})$$

2. 3. If the content of HCO^{3-} ion is greater than Ca^{2+}, toxic HCO_3- is calculated by the formula:

$$HCO_3 -_{tox} = HCO_3 -_{total.} - Ca^{2+}$$

The content of ions expressed in milliequivalents is multiplied by the milliequivalent
4
mass, which is equal to: Ca^{2+} — 0,02; Mg^{2+} — 0,012; Na^{+} — 0,023; K^{+} — 0,039; Cl^{-} — 0,035; HCO^{3-} — 0,061; CO_3^{2-} — 0,031; SO_4^{2-} — 0,053.

As a result, the content of toxic ions is obtained as a percentage (%) of the mass of dry soil. Their sum gives the amount of toxic salts in percentage (%).

According to the ratio of ions (type of soil salinity) and the amount of toxic salts (%), according to Table K.2.2, the degree of salinity corresponding to a certain gradation is established.

Table K.2.3 is used to determine the condition of medium-resistant field crop plants that can grow on soils of the corresponding salinity degree.

Table K.2.3 - Salinity level and condition of field crops

Degree of salinity Soils	Condition of medium-resistant plants
Non-saline	Good growth and development (plants do not fall out, yield is normal)
Slightly saline	Weak inhibition (plant loss, yield reduction by 10-20%)
Medium saline	Medium salinity (plant loss, yield reduction by 20-50%)
Strongly saline	Strong inhibition (plant loss, yield reduction by 50-80%)
Very highly saline	Only a few plants survive (almost no harvest)

The direction of the soil salt regime (salinisation or desalinisation) is indicated by the anionic composition of the water extract. ***"Chloride"*** type of salinisation is typical for soils with progressive salt accumulation, ***"chloride-sulphate"*** - for soils of intermediate series, and ***"sulphate"*** - for desalination series (in the presence of gypsum accumulation).

K.2.2 Assessment of the chemistry and degree of salinity of the soils of the Kiliya arm sediments and calculation of the content of toxic salts based on water extract data

The chemistry and degree of salinity of the soils of the Kiliya arm sediments and the content of toxic salts were determined using water extract data according to the methodology described in Chapter K.2.1.

To determine the chemistry and degree of soil salinity, we used the ion content in mg-eq/100 g of soil. The chemical composition of soils based on water extraction data in mg-eq per 100 g of soil is given in Table K.2.4.

Chemistry and type of soil salinisation

Soil salinity chemistry was determined based on the ratio of anions and cations (in mg-eq).

Table K.2.5 shows the numerical values of this ratio for the soil (silt) samples taken. According to the data in the table, the ratio of Cl^-: SO_4^{2-} ratio in most samples is in the range from 0.375-0.5 to 1.0. The ratio of more than 1.0, namely -1.5, is observed only at point No. 4,

According to Table K.2.1, such values belong to the gradation "$\underline{Cl}$:$SO_4 \leq 1$-0.3", which corresponds to ***"chloride-sulfate"*** salinisation of soils, except for the sample at point 4, where the ratio value belongs to the gradation Cl: SO4 = 2.5-1, which corresponds to the ***"sulphate-chloride"*** type of salinisation.

Thus, the sediment soils in the Danube branches are characterised by *chloride-sulfate* salinity and, in a single case, *sulfate-chloride* salinity (Table K.2.5).

Since the salinity chemistry distinguishes between soils with "neutral" (pH < 8.5) and "alkaline" (pH > 8.5) salinity, according to the results of the water extract analysis, the salinity of the sediment soils is *"neutral"* (pH value varies from pH = 7.42 to pH = 7.84, which is less than 8.5).

The same amount of salts, depending on their composition, indicates a different degree of soil salinity, which is due to the unequal toxicity of salts to vegetation.

Plant nutrition conditions depend on the concentration and composition of salts in soil solutions. Soil solution has a direct impact on plants.

Given that different salts are not equally toxic to plants, we will calculate the content of toxic salts in the soils of the bottom sediments of the Kiliya arm, which are planned to be stored in dumps.

Calculation of toxic salts in the soils of the Kiliya Arm sediments

The content of toxic salts in sediments was calculated only for samples taken in the Kiliya arm in the area where dredging and formation of hydraulic dumps are planned (sample No. 2, taken 1 km below the town of Izmail; sample No. 3, taken 1 km below the Izmail; samples No. 3 and No. 4, taken respectively above and below the town of Kiliya; sample No. 9, collected in the area of Vilkovo. Vylkove) and for the sample collected in the Danube River. Danube (sample No. 1, collected 2 km above the town of Reni).

The calculation of toxic salts in sediment soils was based on the results of quantitative analysis of the water extract. The content of ions in mg-eq per 100 g of soil is given in Table K.2.4.

According to the methodology, if the content of HCO_{3-} ions is >Ca^{2+}, only toxic HCO_{3-} is calculated. In our case, the HCO_{3-} ion content is greater than Ca^{2+}. In this case, we calculate the content of the toxic HCO_{3-} ion by the formula:

$$HCO_3\text{-}_{tox} = (HCO_3\text{-}_{tot} - Ca^{2+}.$$

Table K.2.4 - Results of the analysis of water extraction of sediments of the Kiliya arm, in mg-eq/100g of soil

Point numbers	HCO^{3-}	Cl^-	SO_4^{2-}	Ca^{2+}	Mg^{2+}	$Na^+ + K^+$	The sum of salts, mg-eq/100g	Sum of toxic salts, % / Σ = (Na^++ Mg^{2+}):15, (%)	Depth of soil sampling, cm
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1	1.6	0.2	0.5	1.1	0.8	0.4	4.6	9.57 / 11.21	0,0-15,0*
2	1.8	0.4	0.7	1.2	1.1	0.6	5.8	5.9 / 7.73	0,0-15,0*
3	1.2	0.3	0.4	0.9	0.7	0.3	3.8	2.83 / 3.23	0,0-15,0*
4	1.8	0.3	0.2	1.1	0.2	1.0	4.6	2.97 / 3.35	0,0-15,0*
5	1.6	0.2	0.2	0.8	0.7	0.5	4.0	3.63 / 4.03	0,0-15,0*
6	1.4	0.35	0.4	1.0	0.7	0.4	4.25	4.39 / 4.91	0,0-15,0*
7	1.6	0.2	0.4	0.9	0.3	1.0	4.4	6.22 / 7.29	0,0-15,0*
8	1.4	0.3	0.8	1.0	0.9	0.6	5.0	15.31 / 13.53	0,0-15,0*
9	1.6	0.35	0.6	1.2	0.8	0.5	5.05	6.31 / 7.33	0,0-15,0*
10	2.0	0.3	0.4	1.4	0.8	0.5	5.4	2.8 / 3.25	0,0-15,0*
11	1.6	0.3	0.6	1.3	0.6	0.6	5.0	2.24 / 2.64	0,0-15,0*

Note* - samples were taken in the upper 15 cm layer of sediments.

Table K.2.5 - Results of calculations of the type and degree of salinisation of soils in the bottom sediments in the Kiliya arm by the content of toxic salts

No. of points	pH	Ratio mg-eq Cl-:SO_4^{2-}	Salinity type	$HCO_3^-{}_{tox} = HCO_3^-{}_{total.} - Ca^{2+}$, mg-eq/%.	Content of toxic ions (%)				Sum of toxic ions (%)	Σ tox. ions $Na^+ + Mg^{2+}/15$*
					Cl^-	SO_4^{2-}	Mg^{2+}	Na^+		
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
1	7.68	0,2:0,4=0,5	Cl-S	0.5 / 0.0305	0.0070	0.0265	0.0096	0.0092	0.1048	11.21
2	7.59	0.57	Cl-S	0.6 / 0.0366	0.0140	0.0371	0.0132	0.0138	0.1387	3.23 3.25
3	7.79	0.75	Cl-S	0.3 / 0.0183	0.0105	0.0212	0.0084	0.0069	0.0833	3.23 2.64
4	7.70	1.5	S-CL	0.7 / 0.0427	0.0105	0.0106	0.0024	0.0230	0.1112	3.35 1.95
5	7.57	1.0	Cl-S	0.8 / 0.0488	0.0070	0.0106	0.0084	0.0115	0.1003	4.03 2.53
6	7.59	0.875	Cl-S	0.4 / 0.0183	0.0123	0.0212	0.0084	0.0092	0.0894	4.91 2.77
7	7.84	0.5	Cl-S	0.7 / 0.0427	0.0070	0.0212	0.0036	0.0230	0.1155	7.29 6.45
8	7.65	0.375	Cl-S	0.4 / 0.0244	0.0105	0.0424	0.0108	0.0138	0.1219	13.53 8.83
9	7.46	0.583	Cl-S	0.4 / 0.0244	0.0123	0.0318	0.0096	0.0115	0.1136	
10	7.63	0.75	Cl-S	0,6 / 0,0366	0.0105	0.0212	0.0096	0.0115	0.1174	
11	7.42	0.5	Cl-S	0.3 / 0.0183	0.0105	0.0318	0.0072	0.0138	0.1076	
	"Neutral " salinity		**"Chloride-sulphate" type of salinity**	Calculation coefficients:					Σ (%) =0,08:-0.117	
				0.061	**0.035**	**0.053**	**0.012**	**0.023**	"Non-saline" and "slightly saline" soils	

Note * - an empirical equation for an approximate estimate of the amount of toxic salts (according to V.S. Muratov and V. Margulis)

The results of calculations of the content of toxic ion HCO_{3-} in the selected soil samples of bottom sediments are given in Table 11.2.5. The calculated values were used to determine the sum of toxic salt content by the sum of mass fractions (%) of individual ions.

Degree of salinity of soils

The degree of salinity of soils using the water extraction method was assessed taking into account the chemistry (type) by the sum of mass fractions (%) of individual ions. To determine the content of toxic ions as a percentage of dry soil mass, multiply the ion content (in milliequivalents) by the milliequivalent mass, which is equal to Ca^{2+} - 0.002; Mg^{2+} - 0.012; Na^{+} - 0.023;, Cl- - 0.035; HCO^{3-} - 0.061; SO_4^{2-} - 0.053. The sum of multiplication gives the amount of toxic salts in the soil in percentage (%).

The calculated amount of toxic salts (%), taking into account the content of toxic ions in the soils of bottom sediments, is given in Table K.2.5.

In our case, the amount of toxic ions in soils varies from 0.083% to 0.125% depending on the location.

Given that the ion ratio in the bottom sediment soils indicates that the salinity chemistry (type) is ***"chloride-sulfate"***, according to Table K.2.2, the salinity level corresponds to the gradations **"<0.10"** and **"0.1-0.25"**, which classifies the bottom sediments in the rivers Danube, in the Kiliya, Ochakiv, Starostambul, Solomon and Solomon arms and the Danube-Sasyk canal as ***"non-saline"*** and ***"slightly saline"***. The salinity is ***neutral***.

The direction of the salt regime in the bottom sediment soils (salinisation or desalinisation) determines the nature of the anionic composition of the water extract, according to which in our case the ***"chloride-sulfate"*** type of salinisation prevails, which is typical for soils of the intermediate series between soils of progressive accumulation and desalinisation.

According to the calculations, ***both salt accumulation and desalination processes*** occur in the bottom sediments during the spring flood.

According to Table K.2.3, in the locations where ***"non-saline"*** sediment soils will be stored in the hydraulic dumps (T.3 - above the town of Kiliya, and T.No. 6 - Starostambulskyi arm, 11 km), plants will have good growth and development. In the areas of ***"slightly saline"*** sediment dumps, slight inhibition of plants and a 10-20% reduction in yield is possible.

K.2.3 Assessment of soil toxicity of sediments

The method of calculating the presence of toxic and non-toxic salts in soils is based on the binding of ions in a certain sequence into hypothetical salts, starting with the less to more soluble ones.

First of all, ***carbonate*** cations and anions are bound in this order: Na_2CO_3, $MgCO_3$, $Ca(HCO_3)_2$, $NaHCO_3$, $Mg(HCO_3)_2$. *Then* - with ***SO^{2-}_4 anions*** in the sequence: $CaSO_4$, $NaSO_4$, $MgSO_4$. *Lastly,* ***with Cl anions*** in the sequence: NaCl, $MgCl_2$, $CaCl_2$.

CO_3^{2-} ions are very toxic. The analysis of water extraction did not reveal these ions, so no calculations were performed for them.

HCO_{3-} ions in the water extract can be caused by the presence of both *toxic* salts - $NaHCO_3$, $Mg(HCO_3)_2$, and *non-toxic* - $Ca(HCO_3)_2$.

First of all, let's determine the possible content of such salt as $Ca(HCO_3)_2$ in the aqueous extract, for which the amount of HCO_{3-} ions is bound to the equivalent amount of calcium. If the amount of HCO_{3-} ions remains free after this binding, it is first bound to Mg^{2+} and then to Na^+.

The ***$SO^{2}{}_{-4}$ ion*** is *non-toxic* when it is part of *gypsum* ($CaSO_4$), and *toxic* when it is bound to Mg^{2+} (*Mg*SO_4) or Na^+ (Na_2SO_4).

Chloride salts *are toxic.* The binding of the ***Cl^- ion*** to hypothetical salts is performed in the sequence of the following series of salts: NaCl, $MgCl_2$, $CaCl_2$, i.e., starting with less soluble salts.

Let's determine the formulas of hypothetical salts for soil samples taken from a depth of 0-15 cm in the *upper layer of bottom sediments* (points 1, 2, 3, 4, 9) during the spring flood of 2023.

Let's analyse the presence of hypothetical salts in the samples. According to the results of analyses of water extracts (Table K.2.1) and the results of calculations at the soil sampling points, the following non-toxic and toxic salts are present in 100 g of water extracts (Table K.2.6 - K.2.10).

Table K.2.6 - Ratio of toxic and non-toxic salts in the sediment soil sample (T.1) collected in the Danube River (May 2023)

Formulas of hypothetical salts	%	Total % of salts
Non-toxic salts		
$Ca(HCO_3)_2$	43.4	65.4
$CaSO_4$	22.0	
Toxic salts		
$NaHCO_3$	5.6	34.6
$Mg(HCO_3)_2$	18.0	
Na_2SO_4	3.3	
NaCl	7.7	

Table K.2.7 - Ratio of toxic and non-toxic salts in a sediment soil sample (T.2) collected in the Kiliya arm 1 km below the town of Izmail (May 2023)

Formulas of hypothetical salts	%/mg-eq	Total % of salts
Non-toxic salts		
$Ca(HCO_3)_2$	45.8	70.0
$CaSO_4$	24.2	
Toxic salts		
$NaHCO_3$	26.6	30.0
$MgSO_4$	3.4	

Table K.2.8 - Ratio of toxic and non-toxic salts in the soil sample (T.3) collected in the Kiliya arm above the town of Kiliya (May 2023)

Formulas of hypothetical salts	%/mg-eq	Total % of salts
Non-toxic salts		
$Ca(HCO_3)_2$	45.8	69.6
CaSO4	23.8	
Toxic salts		
$NaHCO_3$	18.0	30.4
NaCl	12.4	

Table K.2.9 - Ratio of toxic and non-toxic salts in the soil sample (T.№4) collected in the Kiliya arm below the town of Kiliya (May 2023)

Formulas of hypothetical salts	%/mg-eq	Total % of salts
Non-toxic salts		
$Ca(HCO_3)_2$	40.0	53.9
$CaSO_4$	13.9	
Toxic salts		
$NaHCO_3$	36.2	47.1
NaCl	10.9	

Table K.2.10 - Ratio of toxic and non-toxic salts in the soil sample (T.№9) collected in the Kiliya arm near Vylkove (May 2023)

Formulas of hypothetical salts	%/mg-eq	Total % of salts
Non-toxic salts		
$Ca(HCO_3)_2$	53.1	79.3
$CaSO_4$	26.2	
Toxic salts		
$NaHCO_3$	20.7/4.8	20.7

According to the results of calculations, the content of non-toxic salts in bottom sediments is 1.5-3 times higher than the content of toxic salts. These salts form the chemical composition of groundwater and surface water under disturbed natural conditions.

At the same time, their storage in hydraulic dumps and discharge into the surface waters of the Kiliya Arm and groundwater with the return water will not cause any environmentally undesirable situations.

According to the Classification of Soils by Salinity, the bottom sediments are characterised by *chloride-sulfate and sulfate-chloride salt content.*

The results of the calculations indicate the presence of toxic salts in the water extracts of soils in small quantities. These data show the following:

- in the composition of readily soluble salts during spring floods, all soil samples do not contain calcium chloride (CaCl2), which usually characterises continental sediments, is retained in them and does not play a significant role in salinisation; the toxic salt Mg(HCO3)2 is also absent in all samples;
- during the spring flood of 2023, all solid residues contain a significant amount of non-toxic salts from their total amount: 79.3% - ***in the vicinity of the town of Vylkove***; 53.9-69.6% - ***in the area of the town of Kiliya*** and 70.0% - ***in the area of Izmail.*** $Ca(HCO_3)_2$ and $CaSO_4$ predominate among them.

Based on the content of macro-components in the bottom sediment soil samples collected in the Kiliya arm, their concentrations do not exceed background values and MPCs, i.e. at the sampling sites, the soil during the study period (spring flood of 2023) is "clean" and will not affect the vegetation and the chemical composition of groundwater and the chemical composition of surface water of the Kiliya arm when dumps are formed.

K.3 Assessment of the radiation status of the bottom sediments of the Danube River bottom sediments and ground cover soils based on the results of radiometric surveys performed by the UkrNIEP in May 2023.

The main objects subjected to field radiometric observations and laboratory studies were, respectively, the soil cover and bottom sediments (silt) in the Danube River branches in the Ukrainian part of the delta.

The radiometric surveys were conducted during a reconnaissance survey of the land cover soils in the vicinity of the cities of Izmail, Kiliya, Vylkove and bottom sediments in the Danube Danube, Kiliiskyi, Ochakiv and Starostambulsk arms with measurements of β- and γ-radiation in accordance with the following regulatory documents:

- "Methodological Recommendations for Assessment of Radiation Situation in Settlements in the Zone of Radioactive Contamination with Average Density of Up to 5 Cu/Sq.km of Cesium-137", Ukrainian Interagency Commission for Radiation Control of Environmental Pollution, Kyiv, 1992;
- DHN 6.6.1.-6.5.001-98. State hygiene standards. Radiation Safety Standards of Ukraine (NRBU-97) Kyiv, 1998;
- Regulation on Radiation Control at Construction Sites and Enterprises of the Construction Industry and Building Materials of Ukraine RSC 356-91 of the State Construction Committee of Ukraine, Kyiv, 1991,
- "Methodological Recommendations on Radiation Monitoring in Construction", Ministry of Health of the State Construction of Ukraine, Kyiv, 1991;
- Radiation Safety Standards of Ukraine (NRBU-97), Kyiv, 1991.

In accordance with the requirements of these regulatory documents, 5 group samples were taken at each test point and combined geochemical samples were formed. The sample weight was 1.8-2.0 kg.

Special samplers were used to collect **topsoil** samples, which allow reaching a depth of 20-30 cm or more. When analysing the topsoil - the soil-plant layer - the sampling depth was approximately 5-10 cm. Inclusions of biotic and abiotic origin (stones, debris, plant roots, etc.) were removed from the sample. The soil was dried and sieved through a sieve with a mesh diameter of 1-2 mm.

Reconnaissance radiometric surveys of the soil cover were aimed at solving the following tasks

- study of gamma and beta radiation dose rates and assessment of the radiation situation within the floodplain of the Danube River floodplain in the territories adjacent to settlements;
- detailed surveys at local sites, in case of detection of increased radiation background at certain points.

Soil samples for gamma and beta radiation measurements were taken at 3 locations in the vicinity of settlements. Points 1a, 1b - in the region of Izmail. Izmail; Points 2a, 2b - in the region of Kiliya; Points 3a, 3b. - in the region of Vylkove.

Measurements were made in samples taken at each point in the depth range:

- soil-plant layer sample - 0.0 - 0.05 m
- black soil sample - in the depth range of 0.20 - 0.30 m;

This method of sampling allows assessing the radiometric state of rocks differentiated by depth, which will determine the radiological characteristics of groundwater in the future, depending on the depth of dredging during the reconstruction of the construction project "Creation of a deep-water shipping route for the Danube River - Black Sea in the Ukrainian part of the delta".

Sediment samples were taken at the surface water geochemical sampling points. The number of points of radiometric measurements of gamma and beta background of sediments is 11 (points No. R01 (2.0 km above the city of Reni), R06 (1.0 km above the city of Reni), R06 (1.0 km below the town of Izmail), R07 (above the town of Kiliya), R09 (below the town of Kiliya), R13/1 (Vylkove), R11 (Ochakivskyi arm, 17 km), R14 (Ochakivskyi arm, 6 km), R12 (Starostambulskyi arm, 11 km), R15 (Starostambulskyi arm, 4 km), R13/9 (Starostambulskyi arm, 14 km), R13/0 (Solomoniv arm, Danube-Sasyk channel).

The measurements were made in silt samples taken at each point from the surface layer of sediments - at a depth of 0.15 m of the upper sediment layer. In accordance with the above list of selected measurement points, gamma and beta radiation measurements were performed in the samples according to the accepted radiometric methodology.

Radiometric surveys of soil samples were performed using the RKS-20.03 Pripyat radiometer. The Pripyat dosimeter has the widest scope of use in radioecological monitoring during geological and hydrogeological surveys due to the simultaneous ability to measure both gamma and beta radiation and is a direct measurement device, the value of the level of radioactive contamination is read immediately from the digital indicator.

The date of verification of the device is 16.06.2022, valid until 16.06.2023, certificate No. 5365 on verification of a legally regulated measuring instrument.

Preparation of the device for operation, monitoring of its stability, field and laboratory measurements of gamma radiation DER of sediments and desk processing of field survey materials were carried out in accordance with the specified instructions and methodological recommendations. The measurement results are presented in Tables K.3.1 and K.3.2.

Table K.3.1 - Results of radiometric surveys of soils of the ground cover in the areas adjacent to settlements (May 2023)

No./p	Test point	Sampling depth, m	Results of radiometric studies	
			Dose γ-radiation dose, μR/h	Radioactive contamination, β-radiation, fraction. min/cm2
1	**Point 1a.** In the region of Izmail. Sample of soil and vegetation layer	0.0 - 0.05	4.16	2.1
2	**Point 1b.** Black soil sample near Izmail	0.20 - 0.30	4.10	1.2

3	**Point 2a.** Sample of soil and vegetation cover (Kiliya)	0.0-0.05	4.50	1.4
4	**Point 2b.** Black soil sample in the vicinity of Kiliya.	0.20-0.30	5.10	2.5
5	**Point 3a.** Sample of soil and vegetation cover (Vylkove village).	0,0 - 0, 05	4.66	3.1
6	**Point 3b.** Black soil sample (Vylkove village)	0.20 - 0.30	5.07	2.9

Table К.3.2 - Results of radiometric studies of bottom sediments (silt) in the branches of the Danube River (May 2023)

No./p	Test point	Depth of sampling* *Sampling depth	Results of radiometric studies	
			Dose γ-radiation dose, μR/h	Radioactive contamination, β-radiation,fraction. min/cm2
1	Point R01 (bottom sediments), 2.0 km above Reni	0,5-0,15 m	4.33	0.8
2	Point R06 (bottom sediments), 1.0 km below Izmail	0,5-0,15 m	2.66	1.8
3	Point R07 (bottom sediments). Above Kiliya	0,5-0,15 m	3.66	0.4
4	Point R09 (bottom sediments). Below Kiliya	0,5-0,15 m	5.0	2.0
5	Point R13/1 (bottom sediments), Vylkove	0,5-0,15 m	5.0	3.2
6	Point R11 (bottom sediments), Ochakivskyi arm, 17 km	0,5-0,15 m	4.3	2.0
7	Point R14 (bottom sediments), Ochakivskyi arm, 6 km	0,5-0,155 m	4.66	1.4
8	Point R12 (bottom sediments), Starostambulskyi arm, 11 km	0,5-0,15 m	4.66	1.6
9	Point R15 (bottom sediments), Starostambulskyi arm, 4 km	0,5-0,15 m	4.0	1.0
10	Point R13/9 (bottom sediments), Starostambulskyi arm, 14 km	0,5-0,15 m	3.33	1.6
11	Point R13/0 (bottom sediments), Solomoni arm, Danube-Sasyk canal	0,5-0,15 m	4.33	2.6

**Note* - silt samples were taken in the upper

According to the results of the studies, ***the gamma radiation dose rate:***

- for the *soil* samples *of the soil cover* varies in the range from 4.16 to 4.66 μR/h at a depth of 0.0-0.05 m (Tk. 1a, 2a, 3a); and from 4.10 to 5.07 mR/h at a depth of 0.20-0.30 m (Tk. 1b, 2b, 3b) (Table K.3.2);

- for *bottom sediments* (silt) in the Danube River and in the Kiliya arm (respectively from point R01 - 2.0 km above the town of Reni to point R13/1). Reni to point R13/1 - Vylkove village. Vylkove, including intermediate points R06 - below the town of Izmail and points R06 and R09 - above and below Kiliya) varies from 2.66 to 5.0 μR/h;

- for *bottom sediments* (silt) in the Ochakivska arm is 4.33-4.66 μR/h, in the Starostambulska arm - 3.33-4.66 μR/h, in the Solomonova arm - 4.33 μR/h.

The ***beta radiation*** density for soil samples depending on the depth of their sampling is as follows: in the region of the town of Izmail (vol. 1a, 1b) - 2.1 - 1.2 ppm/cm^2; in the area of the town of Kiliya - 1.4 -2.5 parts per minute/cm^2; in the area of Vylkove urban-type settlement. Vylkove - 3.1 - 2.9 parts/min/cm^2. These values correspond to the background values of the rocks and practically do not change depending on the depth and location of sampling.

Beta-radiation density for bottom sediments (silt) in the Danube River and in the Kiliya Arm varies between 0.4 and 3.2 ppm/cm^2; in the Ochakiv Arm it is 2.0 to 1.4 ppm/cm^2; in the Starostambul Arm it is 1.0 to 1.6 ppm/cm^2; in the Solomon Arm it is 2.6 ppm/cm^2, which corresponds to background values and practically does not vary depending on the sampling location.

It should be noted that γ- and β-radiation values in all samples collected during radiometric surveys in May 2023 are characterised by almost the same low values within the background values for the region (12-14 μR/h).

Thus, ***it can be stated that at present there are no facilities in the study area that may have an impact on the radiation status of both the soil cover and the water environment of the territory.***

K.4 Assessment of the possible impact of the reconstruction of the construction objects "Creation of a deep-water shipping lane on the Danube River - Black Sea in the Ukrainian part of the delta" on soils, groundwater and vegetation of the floodplain of the Kiliya arm during the formation of sediment dumps

Taking into account the recommendations given in the "Methodological Recommendations...", the gamma radiation dose rate and beta radiation density are very low, do not exceed the lower threshold of anomalies (do not exceed the level of radiation safety) and practically represent the natural radiation background. Therefore, further investigation of specific activity of radionuclides in the bottom sediments is not advisable.

According to radiometric surveys conducted in May 2023, gamma radiation dose rates and beta radiation density confirm the absence of radioactive contamination of both bottom sediments (silt) in the Kiliya, Ochakiv and Starostambulsky arms and soil cover in the areas adjacent to the cities of Izmail, Kiliya and Vylkove.

This indicates the radiation safety of the investigated territories for agricultural activities and residence of residents of nearby settlements in the conditions of the planned reconstruction of the construction facilities "Creation of a deep-water shipping lane of the Danube River - Black Sea in the Ukrainian part of the delta".

Thus, it can be stated that the reconstruction of the construction objects "Creation of a deep-water navigation route of the Danube River - Black Sea in the Ukrainian part of the delta" will not further affect the radiation status of the soil cover in the adjacent territories and at the sites (areas) where it is planned to place the dumps of sediments from the Kiliya arm.

It should be noted that the absence of radioactive contamination of bottom sediments (silt) in the study area indicates the absence of radioactive contamination of river waters in the delta of the Kiliya arm of the Danube.

In addition, the results of studies of the chemical composition of soils (silt) in the Kiliya arm show that they are classified as ***"non-saline"*** and ***"slightly saline"*** in terms of salt content, which is not safe for both soils and groundwater, as well as for vegetation in the areas of waste dumps.

The results of the study show that the planned activities to deepen the channel of the Kiliya arm will not pose a risk of radiation and chemical contamination of environmental components during dredging and does not threaten radiation contamination of the water environment, soil cover and vegetation suppression when the level regime in the Danube River changes. Danube River, including during the formation of hydraulic dumps of sediment silt.

ESPOO INQUIRY COMMISSION

REPORT

ON THE LIKELY SIGNIFICANT ADVERSE TRANSBOUNDARY

IMPACTS OF THE

DANUBE - BLACK SEA NAVIGATION ROUTE

AT THE BORDER OF ROMANIA AND THE UKRAINE

July, 2006

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Contributions by the Members of the Commission

Dr. Mircea Staras
Danube Delta National Institute, Tulcea, Romania.

Rom. 1 Documentation on the likely significant transboundary impact of the Ukrainian Deep-water Navigation Canal Danube-Black Sea in the context of ESPOO Convention, 1991. February, 2005
Rom. 2 Additional information requested for the third meeting of the Inquiry Commission on the likely significant transboundary impact of the Ukrainian Deep-water Navigation Canal Danube-Black Sea in the context of ESPOO Convention, 1991. October, 2005
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Dr Lyudmyla Anischenko
Ministry of Environment Protection of Ukraine, Kharkiv, Ukraine,

Ukr. 1	The assessment of transboundary impact of the navigation route reopening in the Ukrainian part of the Danube Delta Report + Annex 1 - 14, February 2005
Ukr. 2	Annex 15 - 28, October 2005
Ukr. 3	Annex 29 - 32, December 2005
Ukr. 4	Annex 33 - 40, April 2006
Ukr. 5	Annex 41 - 47, May-June 2006
Ukr. 6	Report on Scientific Research Work: "Environmental Assessment (EA) within the framework of the project "Creation of the Danube – the Black Sea deep-water navigable passage in the Ukrainian part of the delta. Stage 1". Ministry of Environment Protection of Ukraine. Kharkiv, Ukraine, 2003

EXECUTIVE SUMMARY

The Inquiry Commission came unanimously to the following conclusions:

1. *Likely significant* adverse transboundary impact:
    - impact of dredging or deepening of the rifts on the distribution of the flow discharge between the Bystre and the Starostambulski branches and on the water level dynamics along the Bystre branche, resulting in loss of floodplain habitats, important for fish (spawning and nursery) and birds (nesting, feeding)
    - impact of habitat loss by coverage of riparian dump sites and dredging through the offshore sandbar and measures for bank protection on birdlife and fish
    - impact on the increase of suspended sediment concentration, downstream of the dredging site on fish
    - impact on the turbidity of marine waters as a result of dumping of spoil at the dump-site at sea, under conditions of southbound alongshore currents
    - impact of repeated maintenance dredging hampering the recovery processes of affected areas for fish in the long term
    - cumulative impact of loss and/or disturbance of habitats and by shipping traffic on fish and bird life on a large scale and long time
2. *Hardly likely significant* (inconclusive) adverse transboundary impact:
    - impact of increased salt penetration in the Bystre Channel
    - impact of dredging the sandbar and construction of the retaining dam on the migratory behaviour of sturgeon and shed
3. *Unlikely significant* adverse transboundary impact:
    - impact of dredging on the hydro-morphological developments over larger distances and time scales
    - impact of dredging on the distribution of the discharges and the associated water level dynamics between the Chilia and the Tulcea branches
    - impact of dredging in the sandbar section of the Bystre Channel
    - impact of dredging on the increase of nutrient concentrations
    - impact of toxic sediment contamination
    - impact of overall increase of nutrients, heavy metals and organic micro-pollutants
    - impact from fish entrainment in dredgers
    - impact of the dump site in the Black Sea on fish
4. *Likely* adverse transboundary impact but *insufficient information* to judge significance:
    - impact of dredging on the turbidity of the river and marine waters
    - impact on the coastal morphology of the Romanian coastal section between the Chilia and the Sulina Branches from the construction of the retaining dam and the maintenance dredging of the Bystre sandbar section
    - impact of the navigation on fish and bird life
    - impact of increase of suspended sediment concentration at and near the dredging site
    - impact on migratory fish, passing the dredging area and/or shifting between different habitats across the border during dredging operations
    - impact of morphological modifications (e.g. bank protection), resulting from dredging activities, causing more uniform and degraded habitat conditions
    - effect of the dump site in the Black Sea on the benthic fauna at and around the dump site in relation to the increased suspended sediment concentrations and deposition, loss of habitat and burial of fish food organisms

5. *Unlikely* adverse transboundary impact but *insufficient information* to judge significance
    - presence of toxic concentrations of Zinc and Copper.

The Inquiry Commission came to the following evaluation:

- All impacts of the dredging of the Navigation Route in the Chilia Branch and the Starostambulski Branch are ipso facto transboundary, because the dredging is operated at and on the state boundary between Romania and the Ukraine. The question is whether the effects are likely significant and adverse.
- The deepening of the rifts will not result in a significant effect on the distribution of the water discharge between the Chilia and the Tulcea branches and therefore on the frequency distribution of the water levels along the Chilia Branch. Hence it is unlikely that the frequency of flooding of the floodplains and riparian wetlands will change significantly. In addition the anticipated effects for fish and birdlife are unlikely.
- As a result of the deepening of the rifts the discharge distribution between the Bystre and the Starostambulski branches will change significantly. As a consequence the frequency of high water levels along the Bystre Branch will increase significantly, which has a likely adverse transboundary impact on fish and birdlife. In addition, the dredging especially on the sand bar, results in a loss of habitat of some 600.000 m2, which has a likely adverse transboundary impact on birdlife, specifically on terns.
- The sediment delivery to the coastal system will change due to the increased discharge by the Bystre, the effects of the retaining dam and the sediment injection at the sea dump site. At the moment there are insufficient data to quantify this change, but a preliminary indication revealed that the effect might possibly be transboundary. The inferred increase of the concentration of inorganic suspended sediments at the Romanian state border seems to be in the same order as the existing background.
- Changes in sediment transport patterns may also influence the morfological developments of the area of the Ptichiya spit and the nearshore mud flats, but these developments are expected to be relatively slow, because of the rather low sediment concentrations and deposition rates. These shallow areas are very important as habitats for fish and particularly birds.
  This supply of sediment to the nearshore system is however not yet considered as adverse, because it is not anticipated that this will result in a reduction in food availability or in a rapid siltation of the area between the spit and the mainland or in a reduction in food availability for fish and birds.
- Local and restricted likely adverse transboundary impacts on fish and bird life may result from habitat loss by dredging and maintenance of rifts and sandbar and of bank protection measures; in the vicinity of and during the dredging operations; by covering of riparian dump sites and by shipping traffic (ship waves, noise, pollution, accidents etc). Especially the riparian areas are important habitats for fish and birds. However, in the case of migratory fish species, the cumulative impact is likely to be a large scale and long term effect.
- It seems hardly likely, that the dredging of the sandbar and the construction of the retaining dam will have a significant adverse transboundary effect on the migratory behaviour of the commercially important sturgeon and shed. In addition, it is unlikely that the dump site in the Black Sea will have an adverse transboundary effect on fish.
- From the point of view of the hydro-morphology and the pollution aspects the conclusions for Phase 2 does not deviate from those of Phase 1. However it is anticipated. that the length of the retaining dam will reduce the sediment influx from the North and will also hamper the

Northbound sediment transport during southern wind. It is anticipated that the delta section between the Bystre and the Sulina branches will receive a smaller sand input. than it does today, which may influence the developments of the Ptichya spit, which represents a very high ecological value.

- The deeper Navigation Route will require additional dredging of the sills, larger maintenance dredging, extended dump sites and possibly larger and longer bank protection measures. It is anticipated that the adverse transboundary impacts will at least be similar of those for Phase 1, but in some aspects even greater.
- As larger ships can be accommodated in the deeper Navigation Route also the disturbance of fish and bird life may increase.

The Inquiry Commission presents the following recommendations

1. The Commission identifies under point 4 and 5 of the above conclusions important subjects for which no conclusive evidence was available to judge the transboundary consequences of the Navigation Route.
   The Commission, realising that the Navigation Route is and will be an political issue, recommends that a bilateral research programme is started as soon as possible, addressing the gaps in scientific information and knowledge related to the general problem of dredging a Navigation Route at and in the vicinity of the Romanian-Ukraine boundary. Such a research programme may contribute to a realistic evaluation of such Route and to adequate mitigation measures. Suggestions for the subjects of such research programme have been proposed.
   International funding and assistance for the start of the proposed research programme may be organised via the Secretariat of the UNECE.

2. The present Inquiry Commission was the first that has been established in the framework of the ESPOO Convention and therefore some learning experiences may be mentioned.
   - it is recommended that *before* an Inquiry Commission is established a budget is agreed and paid to a trust fund by the parties. The trust fund may technically, financially be handled by the Secretariat of the UNECE, under special rules which reflects the independent and the specific nature of the Commission and which ensures a quick, adequate and alert handling of the financial matters and contracts.
   - a site visit of the Commission and the experts is strongly recommended. During this visit consultations with the governmental and local authorities; the national and local NGO's and the local population may be organised. In addition an extensive field reconnaissance of the problem area is very rewarding.
   - a time limit of 4 months for the delivery of a final report is very tight. Especially the experts need time to familiarise themselves with the key points of the problem and the existing (sometimes detailed) information.

Through this scientific evaluation the Inquiry Commission has come to the conclusion that a significant adverse transboundary impact is likely and thus the provisions of the UNECE Convention on Environmental Impact Assessment in a Transboundary Context (hereafter referred to as the Espoo Convention) apply. This means in concrete terms that Ukraine is expected to send a notification about the Canal to Romania and that the procedure in the Convention should start including communication between the Parties and public participation in the two Parties concerned should be held.

1. INTRODUCTION

1.1 History

The Danube Delta is a pristine area of high environmental values. It is an important wildlife habitat, the second largest delta in Europe. It has the largest number of birds of any South European wetland, being a key area for passage of migrants and wintering birds; the number of winter wildfowl may exceed 2 million. Over 320 species of birds are of European importance, of which 12 are globally threatened.
A large part of the Danube Delta, now some 580,000 ha, is incorporated into the transboundary Danube Delta Biosphere Reserve which was designated a Wetland of International Importance under the Ramsar Convention in 1991, inscribed on the World Heritage List in 1991 and internationally recognised as a Biosphere Reserve under UNESCO's Man and the Biosphere Programme in 1992.

Some branches in the Danube Delta are adapted for navigation from the inland to the Black Sea and vice versa. Navigation by larger ships is important for the economic development of the upstream cities and areas and for the sea-related activities: ship building, ship repair and fish processing.
It is anticipated that the Danube River may develop as a important cargo route between the Atlantic European and the Asian regions.

In 2001 an Ukrainian Company (Delta-Lotsman Company, now Delta Prospect) submitted a Feasibility Study to the Ukrainian Government covering the dredging of a Danube-Black Sea Deep Water Navigation Route, partly in the Ukrainian part of the Danube Delta and partly in the Danube River, which forms the boundary between Ukraine and Romania. The feasibility study included an Environmental Impact Assessment.

In 2002 a revised feasibility study was prepared addressing the various options for the Deep Water Navigation Route. This study also included an EIA.
In 2003 the Ukraine Cabinet approved the Project and adopted the Bystre variant as the seaward branch of the Navigation Route. The Government of Romania was informed accordingly. The construction of the Navigation Route raised concern in Romania.

In May 2004 The Ukraine Minister of Transport approved Phase 1 of the Project, consisting of the deepening of the sandbar section of the Bystre Branch and the dredging of some rifts (sills) in the River section between Ismail and Vilkove and the construction of a part of the retaining dam into the sea perpendicular to the coastline. The waterway was opened for navigation in august 2004. Also in august 2004 an EIA was completed for Phase 2 of the project, addressing the dredging of various rifts upstream; the location of the dump sites and the outbuilding of the retaining dam. It was anticipated that Phase 2 would be completed at the end of 2005, but that the works may continue up till 2007.

1.2. Establishment of the Inquiry Commission

The concern of the Romanian Government resulted in the initiation of a inquiry procedure under the UNECE Convention on Environmental Impact Assessment in a Transboundary Context (the 'ESPOO-Convention'). In the context of this procedure an Inquiry Commission may be established with the objective to advice the Parties concerned on the likelihood of significant adverse transboundary impacts of the construction and use of Navigation Route.

The Commission should consist of three scientific or technical experts, one nominated by each of the Parties and a third independent chairperson, agreed by both parties.

On 16 december 2004 the Permanent Mission of Romania forwarded to the Executive Secretary of the UN Economic Commission for Europe (UNECE) a letter from the Romanian Ministry of Foreign Affairs informing that no common agreement on the composition was reached and requesting the nomination of a third expert, according to article 3, Appendix IV of the Convention.
The Inquiry Commission was established by a letter of 11 January 2005 of the Executive Secretary of the UNECE.

The Commission started with a meeting on 26 January 2005.
The work of the Commission was temporarily hampered from March to October 2005 due to problems with the settlement of the budget of the Commission and other administrative difficulties.

The Commission visited Bucharest and Kiev for consultations and discussions of the relevant authorities and representatives of NGO's and other organisations and also for a visit to the Danube Delta.
The Commission presented their Final Report on 16 July 2006.

1.3. Terms of Reference of the Commission.

- The objective of the Commission is to assess the likelihood of a significant adverse transboundary impact of the dredging and maintenance of the entrance channel and the rifts in the Danube River and the dumping of dredged spoil on riparian land or at a dump site offshore at sea.
- The Commission will operate according the provisions of Appendix IV of the ESPOO Convention of 25 February 1991.
- The Commission will include the views and findings of experts on specific matters or subjects.
- The Commission will provide a Report to the Executive Secretary of the UNECE by mid July 2006.

1.4 Composition of the Inquiry Commission

The Commission consisted of:

- Prof. Dr Joost H.J. Terwindt, Chairperson
  Emeritus Professor Physical Geography, Faculty of Geosciences, Utrecht University, The Netherlands.
- Dr. Ludmila Ja Anischenko,
  Ministry of Environmental Protection of Ukraine. Ukrainian Scientific and Research Institute of Ecological Problems. Head of Laboratory. Kharkiv, Ukraine.
- Dr. Mircea Staras,
  Ministry of Environment and Water Management. Danube Delta Institute, Scientific Director. Tulcea, Romania.
- Mr. Wiek Schrage, Executive Secretary, appointed by the Commission, UNECE, Geneva

1.5 Contributions and References

It should be noted, that the Commission and the Experts entirely rely on the information which was provided by both parties and/or could be retrieved from international accessible literature. There was no time for executing additional measurements, field/laboratory work or model studies in the framework of this Report.

This Report was drafted by the Chairman and unanimously agreed by all members of the Commission.

In this Report at various places reference will be made to the contributions to the Commission by both Parties. The following abbreviations will be used.

Ukr.1: The Assessment of Transboundary Impact of the Navigation Route Reopening in the Ukrainian Part of the Danube Delta. February 2005
Ukr.2: The Assessment of Transboundary impact of the Navigation Route Reopening in the Ukrainian Part of the Danube Delta.
(Annexes No 15-28). October 2005
Ukr.3: The Assessment of Transboundary impact of the Navigation Route Reopening in the Ukrainian Part of the Danube Delta. Annexes No 29-32). December 2005
Ukr.4: Annexes No 33-40. April 2006
Ukr.5: Annexes No 41-46. May 2006
Ukr.6: "Environmental Assessment (EA) within the framework of the project "Creation of the Danube – the Black Sea deep-water navigable passage in the Ukrainian part of the delta. Stage 1". Kharkiv, 2003

Rom.1: Documentation on the likely Significant Transboundary Impact of the Ukrainian Deep-water Navigation Canal, Danube -Black Sea in the Context of the ESPOO Convention, 1991. February 2005.
Rom.2: Additional Information Requested from the Third Meeting of the Inquiry Commission on the likely Significant Transboundary Impact of the Ukrainian Deep-water Navigation Canal, Danube -Black Sea in the Context of the ESPOO Convention, 1991. October 2005

Rom.3: Comments to Annexes No 15-28 Presented by the Ukrainian Expert at the Third Meeting of the Inquiry Commission on the likely Significant Transboundary Impact of the Ukrainian Deep-water Navigation Canal, Danube -Black Sea in the Context of the ESPOO Convention, 1991. December 2005

Rom.4: Comments on Documentation Presented by Ukrainian Expert at the Fourth Meeting of the Inquiry Commission (16 Dec.2005)

All information presented to the Commission and the full reports of the Experts have been added to this Report on the attached CD-ROM.

DANUBE AT TULCEA

FLOODED WETLAND

2. DEFINITIONS

2.1 Transboundary

Upstream of Ismail the Danube River forms the boundary between Romania and the Ukraine. Downstream of Ismail the Chilia Arm and the Starostambulsky Arm mark the boundary between the two countries. More precise the boundary is situated in the middle of the river course between the two banks.
Romania and the Ukraine have established agreements as to the maintenance of the navigation channel.

2.2 Transboundary impact

In the Guidance on the Practical Application of the ESPOO Convention, Annex 1, Article 1 (lit.1) the terms "impact" and "transboundary impact" are defined as follows:
"Impact means any effect caused by a proposed activity on the environment including health and safety, flora, fauna, soil, air, water, climate, landscape and historical monuments or other physical structures or the interaction among these factors; it also includes effects on cultural heritage or socio-economic conditions resulting from alterations to those factors".

"Transboundary impacts means any impact, not exclusively of a global nature, within an area under the jurisdiction of a Party caused by a proposed activity the physical origin of which is situated wholly or in part within the area under the jurisdiction of another Party".

These definitions mean that the subject of the focus of the Inquiry Commission is the *adverse transboundary impact* of the dredging of a navigation route via the Bystre Canal and the lower deltaic part of the Danube River on the Territory of the Ukraine and in the River, being the border upstream of Vilkove, on the territory of Romania aswell.

2.3 Likely Significant

Appendix IV of the ESPOO Convention describes the Inquiry Procedure. In article 1 it is stated that the main subject of the Inquiry Commission is: "the question of whether a proposed activity, listed in Appendix 1 (of the Convention) is *likely to have a significant adverse transboundary impact....."*. Keywords are: "*likely significant"*.

In natural systems variables pertinent to the system may show a rather large variability due to daily, seasonal, yearly or decadal conditions and to unknown inherent system-specific causes. This means that time series of measurements of such variables show a certain realm in which the measurements vary. Such variations may be random or systematic related to daily, seasonal etc. conditions.

When the boundary conditions of a system are changed some variables may be affected, resulting in a change of the realm of the measurements and/or the systematic conditions. This may result in a change or a break in the trend in the measurements.
The above described main subject of the Inquiry Commission strictly speaking require that these changes in realm and/or trend should be significant: distinguishable with some certainty. The problem is, that engineering works mostly result in abrupt changes in the boundary conditions and that the conclusion that they are significant can only be based on measurements in the future.

Shortly after the change in boundary conditions the measurements will be inconclusive in a strict statistical sense.

This reflects the problem of the prediction of the consequences of a sudden change in the system.
In the *a-biotic* world there is a lot of knowledge, which may be systematised into models. Predictions may be gained by changing the boundary conditions of the models or to introduce some adaptations in modules. The significance of the results of the models can be tested in confronting these with real world measurements or observations.

In the *biotic* world predictions are much more difficult because the relationships are very complex and the speed of adaptation is variable for different organisms. In addition some organisms (e.g. birds, fish) may have a large spatial reach (they fly and swim over great distances). They use habitats over the whole delta and state boundaries are irrelevant in this respect. Furthermore their numbers show large variations in time also for reasons outside the Danube Delta. Therefore it is almost impossible to assess the impact of a certain human interference quantitatively. Normally reduction or extension of areas of habitats may be used as a qualitative indication of the order of magnitude of the change due to an human interference, but a quantitative prediction is very hard.

In addition it may be noted, that sometimes effects of a human activity may generate other additional effects. In such cases *cumulative effects will occur*. The prediction of cumulative effects may be difficult, because it requires a good knowledge of the functioning of the ecosystems of habitats. Reliable quantitative knowledge of these complex systems is sometime insufficient.

These problems of evaluation of impacts of human activities have been envisaged in the ESPOO Convention by the Document: "Current Policies, Strategies and Aspects of Environmental Impact Assessment in a Transboundary Context" (lit.2). In Part Three, Section 2 of this document, a treatise is presented on the "Significance of Adverse Transboundary Impact". Some relevant quotes may be reproduced here. "Criteria on the significance of any impact should be set in a general decision-making framework. In some cases, it may be possible to establish generally acceptable *criteria on significance.* In most cases, however, the decision that an adverse transboundary impact is likely to be significant would be based on a comprehensive consideration of the characteristics of the activity and its possible impact. An element of judgement would always be present".
It is noted here that "judgement" implies an undefined uncertainty; it is based on knowledge and experience(s) from other, more or less similar areas or phenomena.

The Inquiry Commission, realising the above described difficulties, has sought the advice of internationally renown experts in order to receive the best-professional judgement on certain aspects of the present subject of the Commission. This is especially important for assessing the *adverse character* of the impacts for the environment.

The Commission has categorised the "likely significance of adverse transboundary impacts" as follows:
* unlikely
* hardly likely (inconclusive)
* likely
* very likely

Lit. 1. Guidance on the Practical Application of the ESPOO Convention.
Convention on Environmental Impact Assessment in a Transboundary Context. (UN/ECE). 2003: 48 pp.

Lit. 2. Current Policies, Strategies and Aspects of Environmental Impact Assessment in a Transboundary Context. Environmental Series No 6. United Nations Economic Commission for Europe. Geneva, 1996: 75 pp.

DELTA

VEGETATED BANK

3. TECHNICAL DETAILS OF THE DISPUTED ACTIVITIES

3.1 General outline

The activities comprise the creation of a deep-water navigation route from the city of Ismail seawards via the Chilia Branch and the Bystre (Bystroe) Channel and Outlet towards the Black Sea (see figures at the end of this chapter for locations).

The engineering works are planned in a section with an overall length of 162.2 km. In general it involves the dredging of 14 rifts (sills) in the river part of the delta and the construction of flow guidance and bank protection measures, seawards of Vilkove and in the Bystre Branch and the dredging of the seaward access channel and the building of a retaining dam offshore.
As explained in the Introduction the activities will be carried out in two phases.

Phase 1 consists of the dredging of the rifts in the Chilia Branch upstream of Vilkove; the dredging of the access channel in the sandbar at the mouth and the construction of a part of the retaining dam in the sea. The objective is to facilitate the navigation of vessels with a draft of 5.85 m (Ukr.1, Annex 8; Ukr.6).
This Phase 1 is almost finished by now, but from October 1, 2005 all dredging operations under Phase 1 were suspended by the Ukrainian Government, till the end of flooding and spawning period in 2006 (information Dr Anischenko, April 26, 2006).

The Phase 2 envisages the deepening of the route in the River (Ukr.4, Annex 40) the construction of the engineering works seaward from Vilkove (Ukr.1, Annex 3) and the remaining part of the retaining dam. Phase 2 has not started yet (information Dr Anischenko, April 26, 2006).

An extensive description of the characteristics and developments of the river and the delta and the environmental effects of the construction of the Navigation Route is presented in the Environmental Assessment (EA) for Phase 1 (Ukr.6). The EA for Phase 2 was not provided to the Commission.
An account of the characteristics of the river part of the Danube River Deep Water Navigation Route is presented in Ukr.3, Annex 29 and Rom.1, Annex 1.

3.2. Phase 1.

3.2.1. Dredging of rifts

According to Ukr.1, Annex 2, the navigation channel in the river up to the sea has a projected design width of 120 m (some parts 60 m) and a projected design depth of 7 m with slopes ranging from 1:6 to 1:1,5. This involves a dredging volume of in total about 1,9 million m3.
Comparison of Ukr.2, Annex 15 and 17 learns that for various rifts the design depth ranges between 7,1 and 7,2 m.

From Ukr.2, Annex 17 it can be seen that the designed increase in depth over the rifts ranges from some 0,5 m to 3,8 m. The following table gives an impression of the position of the incisions larger than 1 m.

Incision depth (m) below present bed	Location Km (approx.)
> 3	31, 61
2-3	30, 32, 37
1-2	29, 30, 31, 36, 47- 49, 62, 65, 73

It turns out that most deeper incision are located around Km 29-32 and Km 61-65.

According to Ukr.2, Annex 25, by October 2005 1.327.570 m3 has been dredged in the river. As stated above by October 1, 2005 all dredging operations under Phase 1 were suspended by the Ukrainian Government. The channel widths in some river sections then were below the design values.

The spoil was dumped on land in 8 riparian storage sites along the river (Ukr.2, Annex 2 and 18) in which it was foreseen that some 1,725 million m3 of dredging material could be deposited. In fact some 1,686 million m3 has been stored on the onshore sites (Ukr.4, Annex 35).

Ukr.2, Annex 19 indicates, that in total some 125 ha of riparian land are expected to be covered with spoil from the dredging activities in the river. Annex 19 also indicates the original land cover before the storage of the spoil.

Ukr.1, Annex 2 shows, that the anticipated area of the river bed, affected by the dredging and storage covers some 1,7 million m2.

3.2.2. Dredging of sandbar

Ukr.1, Annex 2 also induces that the navigation channel in the sandbar area has a length of 3432 m, with a design width of 100 m, a depth between 7,6 and 8,3 m and slopes of 1:9, with a projected dredging volume of 1.684.000 m3 (Ukr.4, Annex 35). By October 2005 some 1.687.000 m3 has been excavated, which also includes the dredging for the retaining dam (90.000 m3, Ukr.4, Annex 35). These dredging operations are also suspended by October 1, 2005.
The spoil was dumped in the Black Sea at a circular site with an outline of 1 sea mile, almost 8 km offshore at a water depth of around 20 m (Ukr.2, Annex 15; Ukr.5, Annex 44). The projected volume of spoil to be dumped at the offshore site was in the order of 2,0 million m3 (Ukr.1, Annex 2).
Ukr.1, Annex 2 shows, that the anticipated area of the sea bed in the sand bar section and the access channel, affected by the dredging and storage, covers some 0,6 million m2.

3.2.3. Construction of retaining dam

The main purpose of the retaining dam is to reduce the siltation in the excavated access channel as a result of the sand transport driven by strong winds from the Northern-North Eastern direction.
As indicated in Ukr.2, Annex 23 the construction of the seaward end of the dam was planned for Phase 1. In Phase 2 the remaining part is foreseen in shallower waters.
Ukr.2, Annex 27 page 4 shows the seaward access channel and that part of the retaining dam, that has been constructed in Phase 1.
At the moment of the suspension of the execution of Phase 1 the length of the completed section was 360 m or 1/3 of the Phase 1 design length (Ukr.2, Annex 25).

3.2.4. Maintenance

As could be expected and was confirmed by the data in Ukr.3, Annex 29 it is very difficult to present an estimate of the volume of maintenance dredging in the Lower Danube River. The reason is the great seasonal and yearly variability of the sediment load, associated with the variability in the river discharge.
According to Ukr.3, Annex 29 it is suggested that as a rough estimate up to some 10% of the total annual suspended load, carried via the Chilia arm is retained and deposited along the river section between Ismail and Vilkove. This results in estimated annual sedimentation rates ranging between 0,31 to 3,39 million m3, with an average annual rate of 1,31 million m3 over the period of 1980-2004. An unknown part of it will be deposited on the dredged rifts and have to be removed. However these figures suggest a yearly average volume of maintenance dredging in the order of magnitude of several hundred-thousands m3 (see also Ukr.5, Annex 43, table 4).

In addition Ukr.3, Annex 29 also indicates, that the estimated volume of river-borne sediments, deposited in the seaward access channel of the Danube-Black Sea Navigation route in 2005 was between 0,8 to 1,2 million m3. In Ukr.4, Annex 38 it is stated, that the average annual volume of sediments deposited in the sand bar section over the period 1980-2004 is 2,5 million m3. This applies to the whole sand bar area. The seaward access channel is only a part of the sand bar area. The annual volume of sediments, deposited in the access channel accounts for up to 20-30% of the total volume of sediments deposited in the sandbar area; thus some 0,5-0,75 million m3, in the absence of the retaining dam. In the presence of the completed dam (Phase 2) this volume is estimated to be reduced to some 0,25-0,35 million m3 (Ukr.4, Annex 38).
This points to a yearly average volume of maintenance dredging of the order of several hundred-thousands m3 in the access channel.

3.3 Phase 2.

3.3.1. Dredging of the rifts and the sandbar.

Ukr.4 Annex 40 learns that the design depth of the Navigation Route in the river part is 8,4 m and in the sandbar section 8,72-9,52 m. All other design parameters are similar to those of Phase 1. For Phase 2 this means an additional dredging of about 4,5 million m3 in the river and sandbar sections and some 1,2 million m3 in the seaward access channel and some 0,03 million m3 along the retaining dam. In total 5,73 million m3. For comparison the total dredging volume for Phase 1 was 3,65 million m3.

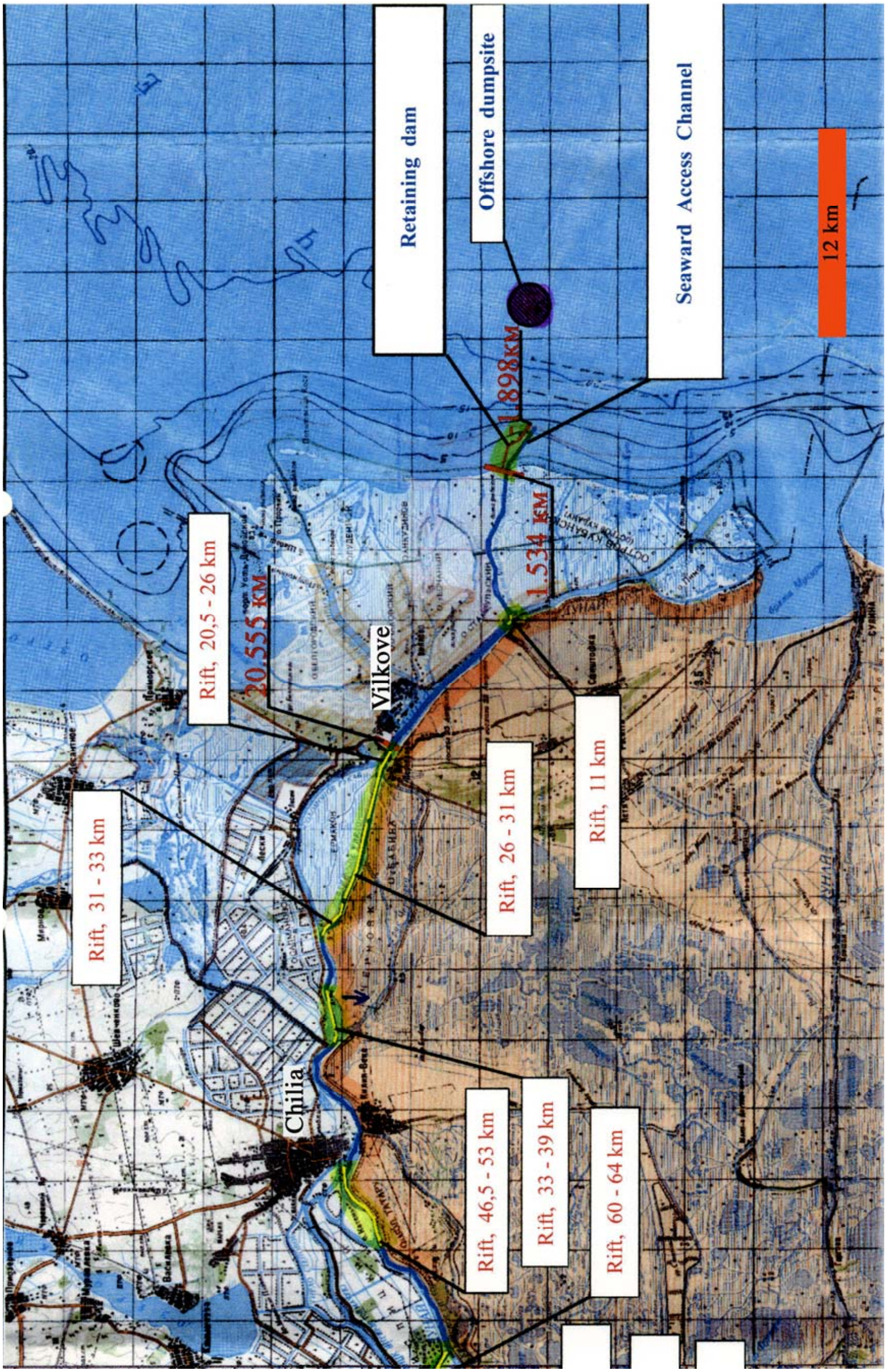
3.3.2. Construction of the retaining dam

In Phase 2 the remaining part of the retaining dam is foreseen in shallower waters (see Ukr.2. Annex 23; Ukr.4, Annex 40). The total design length of the dam is 2830 m. Of this 1040 m were foreseen in Phase 1, of which 350 m is completed yet.

3.3.3. Maintenance dredging in the seaward part

As stated in Ukr.1. Annex 8 it is anticipated that in Phase 2 some 1 million m3/year maintenance spoil will be dumped at the offshore site until it reaches its design capacity of some 5,4 million m3.


Annex 15
Rift, 64 - 68,5 km
Rift, 68,5-71 km
Rift, 71 - 75,5 km
Rift, 75,5 - 78 km
Ismail
12 km
Tulcea
Rift, 112,5 - 115 km
Rift, 139,7 - 142,4 km
Rift, 152,5 - 153,4 km



Retaining dam
Offshore dumpsite
Seaward Access Channel
12 km
1.898KM
1.534 KM
20.555 KM
Vilkove
Chilia
Rift, 20,5 - 26 km
Rift, 31 - 33 km
Rift, 26 - 31 km
Rift, 11 km
Rift, 46,5 - 53 km
Rift, 33 - 39 km
Rift, 60 - 64 km

4. STATEMENT OF THE CONTROVERSIES

4.1 Introduction.

The construction of the Danube-Black Sea Deep Water Navigation Route, partly in the Ukrainian part of the Danube Delta and partly in the Danube River, which forms the boundary between the Ukraine and Romania, created a dispute between both countries concerning the likely significant adverse transboundary environmental effects.

In the first meeting of the Inquiry Commission the representatives in the Commission of both countries were invited to identify the controversial problems and to present their views on these problems in the form of statements. These problem definitions and views are incorporated in the Ukr.1 and Rom.1 Reports. The Chairman of the Commission presented a summary of these statements, which were discussed and agreed in the Commission meeting on February, 24, 2005.
Additional information was provided by the members of the Commission: Rom.2, Rom.3. Rom.4 and Ukr.2, Ukr.3, Ukr.4. Ukr.5 and Ukr.6.

The following subjects are identified in the statements as being controversial:

1. transboundary impact on the hydrology of the River Danube
2. transboundary impact on sediment discharge and the storage and dumping of dredged material in the coastal zone
3. transboundary impact of dredging on pollution of the coastal waters
4. transboundary impact on fisheries
5. transboundary impact on biodiversity, because of loss of habitat of protected migratory birds
6. transboundary social-economic impact.

These subjects are treated in the next sections.

On the basis of this identification, four experts have been selected to advice the Commission in the following fields of expertise:

* hydrology, sediment discharge, siltation and erosion, water and associated sediment movement in the coastal zone including the fate of the dumped spoil
  (*Jos van Gils*, WL/Delft Hydraulics, Delft. The Netherlands)
* pollution of water and sediments and the input of pollutants during the dredging and the storage or dumping of dredged sediment
  (*Nico de Rooij*, Geochemistry consultant, The Netherlands)
* changes in fishery habitats due to engineering works in the river and the coastal and estuarine zone and the effects on the migration routes of commercially interesting fish species
  (*Stefan Schmutz*, University of Vienna, Austria)
* changes in the bird habitats due to engineering works in the coastal and estuarine zone and the effects on migration routes of birds
  (*Mark O'Connell*, University of West of England, Bristol, UK).

All experts have a great experience in their specific field and are internationally renown by their publications in high ranking international refereed journals and their contributions in congresses, symposia and scientific institutions.

4.2 Transboundary hydrological impact

Romania: *unlikely* for Phase 1, *likely* for Phase 2. Satisfactory calibrated (Sobek) model studies for Phase 1 revealed that the changes in the water flow of the Chila branch, due to the lowering of the rifts upstream and downstream of Bystre, will be insignificant.
However it is anticipated that the further lowering of the rifts in Phase 2 will result in an increase of some 7% at low water discharges and some 6 % at flood discharges (Rom.1, Annex 1, point 1). It is feared that this will change the hydrology and water distribution between the Danube branches systematically, which may have a potential significant impact on the water distribution inside the Romanian delta. In Rom.3 attention was given in this respect to the Cernovca Branch of the Chilia River.

Ukraine: *unlikely* for Phase 1, based on measurements March-December 2004. (Ukr.1, Annex 6, point 2). No detailed account of these measurements has been presented to the Commission yet.
The increase in discharge, due to the dredging of the rifts in Phase 2 will be only 10% of the value deduced by the Romanian party. Therefore it is stated that no indication of increase in flow discharges has been found, due to the dredging activities in the Bystre Branch.

4.3 Transboundary impact of sediment discharge and dumping of spoil in the coastal zone

Romania: *likely significant* by movement of sediments and pollutants affecting littoral fauna (Rom 1, On Annex 1, point 2). Although there is no information available on changes in water quality or enrichment in sediments in the Romanian territory it is anticipated that there is a risk and probability of a significant impact on the littoral fauna by sediment delivery alongshore to the south. It is further anticipated (see Rom 3, Annex 27) that the retaining dam will favour the accumulation of sand and that the siltation at the mouth and access channel will increase. In addition the erosion process at Ptichiya Island (see also Ukr. 2, Annex 27) will be stronger.
Finally it is stated, that the habitat of the sea bed at the dump site of the spoil will be detrimentally affected (Rom. 4, On Annex 30).
Another matter of concern is the measured oxygen deficit in the bottom water layer at depths below 18m, which may perhaps be associated with the dumping of the spoil and the "destruction of the bottom biocenosis, worsening of oxygen conditions, increase in trophic structure and toxic action of hydro-biotones" (Rom. 4, On Annex 30)

Ukraine: *unlikely*: the dredging activity has led to an increase in the Suspended Solids Concentration (further SSC) but only in a small area in the sandbar area in the order of 1 km (Ukr.3, Annex 30). A rapid decrease in SSC was observed away from the dredging site (3-5 times lower at about 1 km up- and downstream of the dredging site). The SSC from the dredging site is incorporated in the SSC from the river outflow (Annex 6, point 6). The dumpsite of the spoil is located 8 km offshore at a water depth of 20 m. It is stated that this is too far away that the spoil can add sediment to the coastal flow or the contaminated water flow from the dump site can enter and influence the coastal zone (Ukr.1, Annex 8).
It was furthermore stated (Ukr.3 Annex 30) that no elevation in the SSC was found in the location of the marine dump site and that the spoil was "conventionally clean and is allowed to be disposed at the marine dump, since it does not pose threat to the marine environment".

Ukr.4, Annex 38 stated that "there is no indication that the impact of dumping operations extends beyond the area of offshore dumping site".
The oxygen deficit in September 2005 in the bottom water layers of the Black Sea, below the halocline at 18 m depth developed regardless of their proximity to the offshore dumping site and therefore there are "no reasonable grounds for attributing this natural phenomenon to be the result of dumping operations (Ukr.4, Annex 38)

4.4 Transboundary impact of dredging on pollution of the coastal waters

Romania: *likely:* in Rom 1, page 2 mention is made of an impact study by the Ukrainian Academy of Science indicating the weight of various pollutants contained in the total dredged river sediment (5,14 million m3) to which should be added the pollution of 2,33 million dredged in the bar area and 1,17 million m3 of annual maintenance dredging, illustrating this concern.

Ukraine: *unlikely:* In Ukr.1, Annex2 it is mentioned that the total projected volume of dredged spoils is about 3,66 million m3 of which about 1,73 million m3 will be placed at the riparian storage site on the left bank of Chilia Arm and some 1,93 million m3 will be delivered to the offshore dump site.
The contamination of water and soil in the location of the offshore dump site for dredged spoil should be considered as a local and short-term impact. The monitoring data of 2004 provide no indication of a transboundary impact of dumping activity on water quality (Ukr.1, Annex 6; Ukr.2, Annex 26).
Monitored water quality parameters in the second half of 2004 revealed that 90 % of the parameters correspond to Water Quality Class III (i.e. moderately polluted water). On relatively frequent occasions the level of COD and nutrients were also within the limits set for water Quality Class III.
The observed mean concentrations of contaminants in the second half of 2004 are not higher than their respective average historical values. The same holds for the relatively higher concentrations of COD, BOD5, and some heavy metals (point 7 and 8 of Ukr.1, Annex 6, see also additional information in Ukr.4, Annex 33).
During dredging activity, in the sandbar section, no significant changes in the concentration of phosphorus, nitrogen and silicon as well as oxygen and soluble organic substances have been recorded over the monitoring period. The same holds for the 2005 monitoring period (Ukr.2, Annex 26).
In the Bystre Branch mouth high levels of organic substances were recorded; the content of ammonium nitrogen appeared to be highest.
It was concluded, that there is no transboundary impact on the marine water quality and littoral fauna (Ukr.1 section 2.1), because of dispersion and sedimentation, mixing and self-purification of discharged suspended and soluble matter in the mouth of the Bystre channel and in the adjacent coastal area.

4.5 Transboundary impact on fisheries

Romania: *likely:* citing several sources (Rom 1, Annex 1, point 3) it is stated that the major impacts might be the "changes in migration pattern of sturgeon species and Danube herring, disrupting fish migration routes, decrease in biodiversity, impact on threatened species and changes in species composition". In addition "the adverse effects of penetration of the salt water on living conditions of fresh water biota" are mentioned. Finally it is stated that

"dredging and filling disturbs benthic fauna, eliminate deep holes and alters substrate, all important for sturgeon" (Rom.1, Annex 1, point 3). It is further stated that "the protection dam of 1040 m length could act as a barrier for adult sturgeons and Danube herring coming from the main feeding area, located N-W of the Black Sea for spawning migration in the Danube River" (Rom.1 page 3).
It was further stated that an impact of the dredging on migratory fish species in most cases cannot be inferred immediately, but after a certain time span and therefore required long term systematic monitoring (Rom. 3, Re point 13-14).

Ukraine: *unlikely:* in the vicinity of the dredging sites the concentration of pollutants was above MAC values (maximum admissible concentration) used for fishery. The same holds for oil products and heavy metals Fe, Mn, Cu, and Zn. However the area involved was small and the concentrations drop away from the site to mean background values. (Ukr.1, Annex 6, point 10; Ukr.2, Annex 26).
In addition bio-tests indicated that '"none of the samples taken contained toxic substances at concentrations capable to produce acute toxic effects". (Ukr.1, Annex 6, point 11). Bio-tests on river molluscs for accumulation of heavy metals and arsenic as well as monitoring data on concentrations of DDT, lindaan, attrasine and chlorinated organic pesticides in 2004 are comparable with those measured during the Joint Danube Survey in 2001 (Ukr.1, Annex 6, point 13 and 14). Thus it was concluded, that "there have been no significant changes in the community structure and pollution levels in the Danube since the commencement of operation of the Danube-Black Sea Navigation Route. The only exception relates to the dredging sites in the Bystre Branch, where invertebrate fauna was found to have depleted significantly within a limited area....and the community structure of bottom species has been disturbed" (Ukr.1, Annex 6, point 15). The same conclusion appeared from the monitoring data of 2005 (Ukr.2, Annex 26)
It is further stated, that the "impacts on reproduction conditions for fish stock.... is *forecast* to be not significant in the transboundary context" (Ukr.1, page 3). This conclusion resulted also from the 2005 monitoring (Ukr.2, Annex 26).
In addition it is revealed that the retaining dam at the North side of the seaward access channel, which will extend to a depth of 7 m will have no impact on the "migration of sturgeons to their spawning areas because adult individuals usually travel at depth larger than 10 m" and "fish shoals will move around the outward face of the dam" (Ukr.1, page 3 and 4).

4.6 Impact on biodiversity because of loss of habitat of protected migrating birds

Romania: *likely;* The main effect may be the loss of habitat for feeding and nesting of birds because of the dredging in the sandbar and for the access channel. According to Rom. 1, Annex 1, point 5, 245 bird species are affected by the new Bystre Canal and up to 5600 couples of birds nest in the Bystre Canal area. Valued and strictly protected migratory birds nest on the Ptichiya island located in the area of dredging. Several protected birds nest on the small islands in the mouth of the Bystre Canal and the main feeding area of Pied avocet is located in this mouth. In Rom.3, Re point 13 and 14, it is stated that ornithologists reported disturbance of the bird population due to dredging. Dredging has an impact on benthic fauna, the basic food source of some species. Bird colonies in the influenced area are sensitive to noise disturbances. Therefore bird colonies are destroyed during dredging (Rom. 1, Annex 1, point 5).

Ukraine: *unlikely:* according to Ukr.1, Annex 6, point 21, no significant changes in vegetation cover have occurred in the vicinity of the construction site near the Ptichiya Spit. The population and structure of nesting bird community of the Ptichiya Spit remained the same after dredging.
However the level of disturbance increased significantly during the dredging activity in the sandbar section of the Bystre Canal, resulting in a reduction in successful reproduction rates in 2004, especially in the vicinity of the Navigation Route: from historically recorded 50-70% to 3-5% in speckled tern and from 60-80% to 7-10% in river tern.
In the Bystre Canal area, the post-dredging nesting community showed an increase in proportion accounted for by cormorant birds, due to their greater tolerance to noise and increase in area available for their rest and a decrease in proportion of waterfowl species showing lower tolerance to noise. The seasonal patterns showed an increase in proportion accounted for by pelicans, herons and sandpipers.
It is stated that "generally the 2004 monitoring results show that actually observed trends in the environment quality, caused by the channel reopening activity were well within, or often below the forecasted changes" (Ukr.1, Annex 6, point 22).

4.7 Social and economic impacts

Romania: *likely:* According to Rom.1, page 4, "the regulation and intense navigation of the Sulina branch reduced the importance of its fisheries based on anadromous sturgeons and Danube herring, but the Chilia and St George branches remains important". "Similar to the Sulina Canal, shad and three sturgeon species will loose one of their migration ways in short term. Romanian fisherman who use to fish on the Chilia branch and upstream will be affected".

Ukraine: *unlikely: "* the analysis of fish samples taken for research purpose, prior to and during the reopening of the deep water navigation route shows that there was no significant impact on the commercial fish fauna inhabiting the outer delta of the Bystre Branch" (Ukr.1, Annex 6, point 20).

4.8 Summary of statements by both Parties

1. Transboundary hydrological impact from Phase 1 and Phase 2
   Romania: *unlikely* for Phase 1, *likely* for Phase 2, (Rom.1, Annex 1, point 1)
   Ukraine: *unlikely* for Phase 1, (Ukr.1, Annex 6, point 2).

2. Transboundary impact of sediment discharge and dumping
   Romania: *likely significant* by movement of sediments and pollutants affecting littoral fauna (Rom 1, Annex 1, point 2; Rom.3,Annex 27); the effects of the retaining dam (Rom.3,Annex27) loss of habitat at seaward dump site (Rom.4 Annex 30).
   Ukraine: *unlikely*: (Ukr.1, page 3; Ukr.1, Annex 6, point 6; Ukr.1, Annex 8; Ukr.3, Annex 30; Ukr.4, Annex 30).

3. Transboundary impact of dredging on pollution of the coastal waters
   Romania: *likely:* (Rom.1, page 2)
   Ukraine: *unlikely:* (Ukr.1 page 3; Ukr.1, Annex 6; Ukr.2, Annex 26; Ukr.4 Annex 33).

4. Transboundary impact on fisheries
   Romania: *likely* (Rom.1, page 3; Rom.1, Annex 1 point 3, page 14).
   Ukraine: *unlikely:*. (Ukr.1, Annex 6, point 10, 11, 13, 14, 15; Ukr.1. page 3 and 4; Ukr.2, Annex 26).

5. Transboundary impact on biodiversity because of loss of habitat of protected migratory birds.
   Romania: *likely;* (Rom 1, Annex 1, point 5; Rom.3, point 13 and 14).
   Ukraine: *unlikely* (Ukr.1, Annex 6, point 21 and 22)

6. Transboundary social economic impact
   Romania: *likely:* (Rom.1, page 4)
   Ukraine: *unlikely:* (Ukr.1, Annex 6, point 20).

FLOODED LOWLAND

FISHERMAN'S SETTLEMENT

5. EXPERT VIEWS ON THE CONTROVERSIES

5.1 Introduction.

All relevant information, which was provided by the Members of the Commission was forwarded to the Experts. Two sessions were organised between the Commission and the Experts viz. in mid December 2005 in Amsterdam and end May 2006 in Geneva.
The reports of the Experts are integrally included as Appendices to this Report. In this chapter the conclusions of the findings of the Experts are presented.
Reference is made here to the constraints in evaluating the likely significant adverse transboundary impacts as described in chapter 2.

5.2 Impact on the hydro-morphology, sediment discharge and dumping of spoil.

The Report of the hydro-morpho-dynamics expert (further HM-expert) addresses the following major controversies (see chapter 4):

1. transboundary impact on the hydrology of the River Danube,
2. transboundary impact on sediment discharge and the storage and dumping of dredged material in the coastal zone.

From these impacts only the likeliness of the significance is treated in the report. The judgement whether the impact is adverse is not presented, because this requires an ecological or socio-economical assessment, which is outside the scope of the HM-report.

As to the first subject the HM-expert identifies the following relevant issues as to the impact of the dredging of the Navigation Route, which essentially consists of a lowering of the rifts:

- the impact on the discharge distribution over the various Danube and Chilia branches
- the impacts on the water level dynamics and sediment transport in the different branches

As to the second subject:

- the impact on sediment discharge in the river and from the river mouth to the coastal waters;
- the impact on the littoral system and the coastal morphology
- the impacts from protective structures.

  This also includes the effects near dredging areas, hydro-engineering constructions and spoil storage sites on the formation of a turbid cloud, or plume, which may have an impact on aquatic organisms and fish stocks.

Based on the available information, which was sometimes incomplete or unverifiable, the HM-expert came to the following conclusions:

1. *Effects of the dredging of the deepening of the rifts* on the distribution of the flow discharge between the Chilia and the Tulcea Branches, the HM Expert came to the conclusion that the project implementation will have a **transboundary effect** on the discharge distribution between the Chilia and the Tulcea-Sulina Branch, but the effect is **unlikely significant** if it is judged against the background of the autonomous development of this distribution.
2. *Dredging in the sandbar section* of the Bystre Channel: **no impact** is expected regarding the flow distribution between the main branches Chilia and Tulcea in Phase 1. On the basis of the available information regarding Phase 1, the expert does expect an **insignificant impact**

of the further deepening of the sand bar section in the Bystre Branch mouth during Phase 2 on the discharge distribution between Chilia and the Tulcea Branch.

3. *Flow distribution between the Bystre and the Starostambulski branches*: it turns out that in Phase 1 an increase of the discharge in the Bystre branch will be 12% and the HM-expert concluded that this represents a **likely significant transboundary** effect.
   It may be noted that this conclusion was criticized by the Ukrainian side on the basis of an alternative mathematical modelling exercise (Ukr.5, Annex 47). The HM-expert re-evaluated his findings on the basis of this new information. He arrived at the statement that: "on the basis of our perception of the Delta geomorphology and the sandbar section before and after deepening ..... and our experience in river hydraulics we consider it *highly unlikely* that the removal of the Bytre mouth sandbar would have *no* impact on the discharge trough the Bytre branche." The HM-expert came to the final conclusion that he sees no reason to adjust the original conclusions in his report. (see Addendum to this Report, dated 23 June 2006 of WL/Delft Hydraulics Z3975/23062006).
4. *Dredging of the rifts on the water level dynamics* (riparian water bodies and flood plains, relevant for the fish and bird fauna) the expert concluded on the basis of a modelling study that for the *Chilia* branch the impact is **unlikely significant.** For the *Bystre* branch however the impact is of the same order as the natural variation and therefore it is a **likely significant transboundary** effect. It is noted here that the water level dynamics are closely related to the discharge alterations and thus to the change in flow distribution (point 3).
5. *Turbidity of river water and marine waters as a result of dredging operations*: the HM-expert states that it is not possible to assess this impact in detail without having access to relevant information regarding the dredging works, the local river geometry and the environmental conditions. From the Ukrainian side it is reported, based on modelling that the average increase in the background concentration of suspended matter will be about 0.4 mg/l and that in the centre of the plume the increase in concentration of suspended solids will be about 10-25 mg/l.
   In addition in view of the fact that the state border between the Ukraine and Romania is situated along the Chilia Branch, exactly where the dredging is taking place, the impacts are of a **likely transboundary nature**. However the natural variability of the suspended matter concentrations in the river is very large (typically between 20 mg/l and several hundreds of mg/l). The concentration increase needs to be in the order of 100 mg/l in order to be significant. On the basis of the available data the HM-expert cannot estimate the extent of such impact. Therefore he qualified them as "**hardly likely significant** (inconclusive)". The final conclusion of the HM-expert is that there is **insufficient information to judge the significance** of the local and temporal transboundarty impact on the turbidity of the river water in the vicinity of and during the dredging operations
6. *Impacts over larger distances and time scales* the HM-expert concludes, that the extra load of sediment, evaluated against the background of the total river sediment load and variability therein, the transboundary impacts of dredging operations on the turbidity of river waters and marine waters over larger distances and time scales are considered **unlikely significant**.
7. *Turbidity of marine waters as a result of dumping of dredged spoil* the HM-expert came to the conclusion, that during the dumping operations under conditions with southbound currents, the increase of the concentration of inorganic suspended matter at the Romanian state border is of the same order as the existing background and that the impact of such activities must therefore be characterised as **likely significant transboundary**.
8. *Coastal morphology* the HM-expert came to the conclusion that the transboundary morphological impacts of the project on the Chilia-Bystre coast are restricted to the Romanian coastal section between the Chilia and the Sulina Branches (in the order of 10 km long), because the 8 km long Sulina jetties effectively prevents North-bound sediment

transport. This section will probably receive a smaller sand input. Although the Bystre branch may deliver somewhat more sediment, because of the increasing water discharge, the retaining dam may, (like the Sulina dam) act as a sediment trap, reducing the South-bound net sediment flux along the coast. However this aspect cannot be evaluated because of lack of data on the sediment fluxes from the North. In addition the maintenance dredging in the Bystre mouth and sand bar section and the subsequent dumping at the offshore dump site will remove an amount of sediment from the littoral system. The result of both effects may be, that the coastal section between the Bystre and the Sulina may receive less sediment. However a quantification is not possible on the basis of the available information. Therefore the HM-expert concludes that there is **insufficient information to judge the significance** of any transboundary morphological impacts on the Romanian coastal section between the Chilia and the Sulina Branches.

The findings of the HM-expert are summarised in the following table.

Summary of findings

Operations	Possible impact	• Transboundary impact? • Likely significant? • Impact duration • Impact spatial extent
Widening and deepening shipping channel (phase 1 and phase 2 of construction)	Modification of discharge distribution over main Danube branches (Chilia – Sulina)	• Transboundary impact • Phases 1 and 2: unlikely to be significant in view of natural variability • Permanent impact • Affects whole delta
	Modification of water level dynamics in main Danube branches (Chilia)	• Transboundary impact • Phases 1 and 2: unlikely to be significant in view of natural variability • Permanent impact • Affects whole delta
	Modification of sediment transport distribution over main Danube branches (Chilia)	• Transboundary impact • Phases 1 and 2: unlikely to be significant in view of natural variability • Permanent impact • Affects whole delta
	Modification of discharge distribution over Chilia Delta branches (Bystre, Starostambulski)	• Transboundary impact • Phases 1 and 2: likely significant in view of natural variability • Permanent impact • Affects Ukrainian Chilia delta
	Modification of water level dynamics in Chilia Delta branches	• Transboundary impact • Phases 1 and 2: likely significant in view of natural variability • Permanent impact • Affects Ukrainian Chilia delta
	Modification of sediment transport distribution over Chilia Delta branches (Bystre, Starostambulski)	• Transboundary impact • Phases 1 and 2: likely significant in view of natural variability • Permanent impact • Affects Ukrainian Chilia delta

Operations	Possible impact	• Transboundary impact? • Likely significant? • Impact duration • Impact spatial extent
Dredging operations during construction or channel maintenance	Strong increase of water turbidity near dredging works due to sediment losses during dredging	• Transboundary impact • Significance can not be assessed • Temporary (during dredging) • Local (vicinity of dredging sites, area can not be quantified)
	Overall increase of turbidity in riverine and marine waters due to sediment losses during dredging	• Transboundary impact • Unlikely to be significant in view of natural variability • Permanent (due to channel maintenance) • Affects Chilia branch, Chilia Delta and adjacent marine waters
Offshore dumping of dredging spoil	Increased turbidity in marine waters due to sediment losses during dumping	• Transboundary impact if marine currents are southbound • Likely significant in view of natural variability • Temporary (during dumping) • Affects marine waters over larger distances
Maintenance dredging of sandbar section in Bystry mouth, and subsequent off-shore dumping of spoil	Transboundary changes to coastal morphology due to removal of river sediment from littoral system	• Transboundary impact • Significance can not be determined • Permanent • Restricted to the appr. 10 km long Romanian coast section between the Chilia and Sulina branches long Sulina jetties
	Local changes to coastal morphology due to removal of river sediment from littoral system	• Not directly of a transboundary nature[1] • Significance can not be determined. • Permanent • Affects Chilia Delta coast (Ukrainian coastal section)
Construction of seaward retention dam	Transboundary changes to coastal morphology due to change of littoral sediment transport fluxes	• Transboundary impact • Significance can not be determined • Permanent • Restricted to the appr. 10 km long Romanian coast section between the Chilia and Sulina branches long Sulina jetties
	Local changes to coastal morphology due to change of littoral sediment transport fluxes	• Not directly of a transboundary nature[2] • Significance can not be determined. • Permanent • Affects Chilia Delta coast (Ukrainian coastal section)

[1] *Indirect transboundary impacts could be the result via an impact on birds and/or fish.*
[2] *Indirect transboundary impacts could be the result via an impact on birds and/or fish.*

5.3 Water and bed pollution

There are two main types of pollution viz. overdose of nutrients and toxicity of metals and organic micro-substances.

In the case of dredging especially the toxicity is of concern. This toxicity is caused by the adsorption or uptake of toxic compounds by living organisms in an amount that disturbs the normal biochemical processes. These compounds may occur dissolved in water or adsorbed to the suspended or bed sediment. Not all of these occurrences of toxic compounds are toxic to organisms. The major problem is to define standards above which the concentration of these compounds is toxic for organisms. Under geochemists there is much debate as to these standards. At the moment there is not a generally accepted European standard.

In the report of the geochemical expert it is stated that the Danube River in geochemical sense may be compared with the River Rhine and therefore the Dutch standards, which are in compliance with the EU guidelines and those of the International Commission of the Danube River: JDS (Joint Danube Survey) and TNMN (Trans National Monitoring Network) are used as reference.

From the data, gathered by the geochemical expert, he concludes that there are 3 problematic heavy metals: viz. Copper, Zinc and sometimes Cadmium, which exceed the JDS and Dutch standards, but that the exceedance, except for Cadmium and Copper in mussels, is rather small. He further concludes, that the concentrations of organic micro-pollutants in bottom sediments are below all standards.

Dredging of bottom material may result in an increase in the suspended sediment concentration. Associated with this, an increase in nutrients concentration (phosphorus, nitrogen) will result, because the concentrations of these compounds in the pore-water is much higher than in the surface water, related to the decay of organic matter in the sediment. Also a drop in oxygen concentration may occur. As stated by the geochemical expert these effects are normally local and of short duration.

In addition, the heavy metal concentrations in the water column may increase. This is the result of the fact that in the bottom these substances are mostly bound in very insoluble sulphides, but when dredged they will be oxidised and released. However the oxidation of Iron Sulphides will create Iron Hydroxides (FeOOH) on which the metals will adsorb. The net effect will depend on the final macro-chemical behaviour.

The important question is if by dredging the concentrations of nutrients, oxygen content and heavy metal concentrations in the water column will exceed the standards.

The geochemical expert came to the following conclusions.

1. Dredging may result in a local and short-term (some days) increase in nutrient concentrations, which are **insignificant** for the overall nutrient conditions.
2. Zinc and Copper exceed the standard most. However in recent year it has become apparent, that the standards for these compounds need refinements. So it is **uncertain** whether these metals are really present in toxic quantities
3. The amount of sediment contamination are all well below the Dutch standards for dumping fresh water sediments in the sea. Thus according to these standard there will be **no toxic effects**.
4. But even if toxic effects at present may occur it is **unlikely** that as a result of the dredging and dumping these effects will increase, because the dredged material has more or less the same composition as the present suspended material. An increase in only suspended material will not change the toxicity..

5. In conclusion: based on the available data it is **unlikely** that **adverse significant** effects will occur as to the nutrients, heavy metals and organic micro-pollutants as a result of the dredging and dumping in the river as well as in the sea.

5.4 Fish stock and migration

The expert on fishery presented an assessment of the present state of fishery in the Danube delta. State- of- the- art assessment of the quality of surface waters in the European Union is regulated by the Water Framework Directive (WFD). For rivers, estuaries and coastal waters, fish is used as indicators for the ecological status. The information provided to the Inquiry Commission and additionally collected does not fulfil the requirements of the WFD. Hence, the level of precision in the final assessment does not comply with the WFD.

The fishery expert came to the following conclusions as to the present state of fishery in the Danube delta:

1. Although the Danube delta already has suffered under a variety of human pressures it still inhabits a very divers and endangered fish fauna of high commercial value
2. As demonstrated by commercial catch statistics, the populations of sturgeon have severely decreased within the last decades due to over-fishing and other human impacts
3. There are no data on real stock sizes available. Comparison between the total commercial catches and fishing efficiency indicates, that the total stocks of rare Danube sturgeon (sub)populations e.g. Russian sturgeon and beluga are probably below or not far above minimum viable population levels of 1000 adults. As a result any further significant impact on these populations might increase the risk of their extinction.
4. Migratory and commercially important species i.e. sturgeons and Danube shad, use the Danube delta and its branches (e.g. Chilia, Bystre channel) for various purposes:
    - migratory route for adult fish, spawning in upstream parts of the Danube
    - partly spawning in the delta
    - nursery habitat for larval and juvenile fish in particular during the first year of life
    - pathway for adult and larval/juvenile fish migration to the Black Sea
5. Sturgeons migrate and are present in the Danube delta during the entire year
6. Any impact on migratory species in the Chilia branch and Bystre channel resulting from engineering activities affects the entire Danube populations
7. Besides migratory species, potamodromous species (river fish) support a valuable fishery, providing employment for several thousand fisherman.

The expert on fishery came to the following conclusions as to the effects of the dredging of the Navigation Route:

Dredging effects

Dredging activities might impose direct environmental impacts on fish because of direct removal/burial of organisms, turbidity and siltation, contaminant release and uptake, noise, disturbance and alteration/loss of physical habitat. Indirect harm to fish may be due to destruction of benthic feeding areas and of spawning migrations and deposition of resuspended fine sediments in spawning habitats. These impacts has been considered in the EIA for Phase 1.

After evaluation the expert on fishery concluded:

1. No data have been provided on the concentration of suspended sediments in and below the dredged area during operation. Therefore it is impossible to assess the likeliness of impacts due to suspended sediments based on data. However, comparing physical effects concentration with background concentration reflects that even a comparable slight increases might cause **(sub)lethal effects on fish at and in the vicinity of dredging sites.**

2. Effects are not only locally as migratory fishes are affected that pass the dredging area, use the area also temporally or shift between different habitats across the border between Ukraine and Romania within affected river sectors. Therefore the conclusion is that dredging activities during construction have **likely transboundary impacts** on the fish fauna. Due to missing monitoring data we are not able to quantify the transboundary effects.

3. During maintenance dredging the area affected by dredging continuously will be increased as recovery processes of affected areas takes several years. Therefore, it is **likely** that cumulative effects of Navigation Route construction and maintenance **will significantly affect the fish fauna and fishery** in the long term.

4. Morphological modifications resulting from dredging activities cause more uniform and degraded habitat conditions at a larger scale. No data have been provided on the expected morphological alterations and consequences for the fish fauna. Therefore it is impossible to quantify these effects. Channel fixation contradicts necessary side arm constructions to improve habitat quality in accordance with the Water Framework Directive. Based on the existing information it **is likely** that morphological chances will have **transboundary impacts on the long term**.

5. Alterations of hydro-morphological dynamics can have significant effects on flooding magnitude and frequency. It is **likely** that floodplain habitats, important for fish spawning and nursery, might be lost, causing **transboundary effects on fish and fisheries.**

6. Cumulative effects of increased suspended sediments, habitat loss, behavioural impacts, water quality deterioration, habitat modification and unknown effects make it even more **likely** that dredging activities have **significant transboundary effects on fish and fishery**.

Effects of penetration of salt water into the Bystre channel

Construction of the Navigation Route will increase the salinity at the inlet into the arm by about 1,5 2 times the length of salt field. This will result in significant local effects on the fresh water biocoenoses. No monitoring data on fish have been provided to assess the effects. Predictions of the change of the salinity indicated that affected area is lost for juvenile sturgeons and Ponti shad during their freshwater development. This represents a significant local impact in the Bystre channel on Ukrainian territory. However, the affected area, compared with the entire available freshwater habitat available for juveniles in the Danube Delta is small. Therefore the **transboundary effect** of increased saltwater intrusion is supposed to be **hardly likely**.

Effects of dredging the sandbar and constructing the retaining dam

The mouth of the delta branches are by nature very dynamic features that change their complete appearance within comparable short time frames. Cut off and filling of branches and creation of new braches is a typical phenomenon. It has to be anticipated that sturgeons and shad evolutionarily have developed strategies to react to these dynamic processes at delta entrances. They might find branch entrances even under changed conditions or are very flexible in using alternative braches to get into the river. Therefore, based on existing information, it is assumed that effects on the migratory behaviour on sturgeon and shad are **hardly likely**.

Effects of the dump sites in the Black Sea

Dumping dredged material in the sea causes similar effects as the dredging, i.e. sediment deposition in the vicinity of the dump site, changes in composition or size of bed materials, dispersal and settlement of suspended sediments, alteration of bottom habitat. Groups of aquatic organisms susceptible to dumping in marine and estuarine environments include fish and fish food organisms (shrimps, crabs, shellfish, benthic assemblages). Biological effects of dumping includes burial of organisms, habitat disturbance and habitat loss, Recolonization of spoil areas takes place only at the long term (years). Such effects my certainly occur at the dump site, but the question is: are these effects transboundary? This might be the case if, during dumping operations with southbound currents the increase of the concentration of inorganic suspended matter at the Romanian state boundary is in the same order as the existing background. The hydro-morphology expert indicated that even a doubling of the existing concentration would result in a concentration of less than 20 mg/l. Such a concentration is not supposed to cause any damage to fish. Consequently it is **not likely** that there is a **transboundary** effect on the environmental conditions for fish and the benthic biocoenoses outside the dump site over the Romanian border.

Effects of navigation

There have no data been provided on potential effects of navigation on fish for the DNC project. Effects may occur during channel constructions and maintenance work caused by dredging and supportive vessels. However the main impact might occur during the use of the channel as a navigation route. Information on types and frequency of vessels passing would be necessary in combination with estimates of hydraulic impacts caused by propellers and waves. Due to the lack of information it is **not possible to quantify likely effects**.

General conclusions

Due to the migratory behaviour of fish, significant impacts on the fish populations of the Chilia branch, Bystre channel and coastal area at the Ukrainian territory may have **transboundary effects** on the fish fauna and fishery at the Romanian territory.

As summarised in table below two of the six identified operational activities, viz. dredging and maintenance of the Navigation Route, have **likely transboundary effects** on fish and fishery. Effects of navigation can be significant or not, depending on shipping traffic. Cumulative effects of the entire project are **likely to be significant**.

Summary of operational aims and activities and their consequences and impacts on fish

Operational aim	Operational activity	Consequences for fish	Impacts on fish	Level of significance
Construction of the navigation channel in the Chilia arm downstream to the sea	Dredging of sills	Increased turbidity at dredging sites	Fish kills at dredging sites	Severe effect, but at very small scale ⇒ **Unlikely significant**
		Fish and fish food entrainment by dredging machines	Lethal	Severe effect, but at very small scale ⇒ **Unlikely significant**
		Increased turbidity downstream of dredging sites	Behavioural and physiological changes in the plume – chronic effects	In total a significant area chronically affected ⇒ **Likely significant**
		Reduction of flooding magnitude and frequency	Potential loss of spawning and nursery floodplain habitat	Potentially large areas are affected at long-term ⇒ **Likely significant**
		Deterioration of water quality parameters incl. toxics	No significant exceedance of standards	No effects ⇒ **Unlikely significant**
		Saltwater intrusion	Loss of freshwater habitat	Long term, severe impacts but spatially limited ⇒ **Unlikely significant**

Operational aim	**Operational activity**	**Consequences for fish**	**Impacts on fish**	**Level of significance**
Channel maintenance	Maintenance dredging	The same effects as above but for longer time and larger space	The same impacts as above but cumulated across longer time and larger space	In total a significant area acute and chronically affected ⇒ **Likely significant**
Channel dredging and maintenance	Dredging riparian enforcement	Homogenisation of channel morphology and riparian habitat alteration	Channel and riparian habitat deterioration	In total a significant area affected at long time scale ⇒ **Likely significant**
Sea entrance	Dredging of sandbar and construction of retaining dam	Altered habitat and flow conditions	Disruption of migratory behaviour	⇒ **Hardly likely significant** as delta entrances are very dynamic by nature
Spoil dumping	Dumping in the sea	Sediment deposition, increased turbidity	Habitat loss at dump site	Severe effect, but at small scale ⇒ **Unlikely significant**
Navigation	Ship traffic	Hydraulic disturbances (waves) propeller ship accidences	Behavioural changes riparian habitat disturbance Injuries to fish fish kills	Large scale, long-term effects depending on intensity of ship traffic ⇒ **(Un)likely significant**
Entire project	All activities listed above	Cumulative effects	Cumulative impacts	Large-scale, long term effects ⇒ **Likely significant**

5.5 Bird life and migration

The report of the birdlife expert indicates the following tasks as to the adverse transboundary impacts on bird life as a result of the reopening of the Navigation Route:

1. To review the contributions of both Parties in relation to the consequences for bird habitats and populations arising from the Bystre Canal developments
2. To provide an overview of relevant research findings that have characterised and quantified bird responses to human activities
3. To evaluate the consequences for bird habitats and populations aring from specific actions within the Bystre Canal development.

As already stated in Chapter 2 an evaluation of the effects of human activities on bird habitats and populations is difficult because of the great natural variability of these populations.
Therefore the birdlife expert first provides a theoretical framework which allows the identification of the human activities within the natural variability. This framework is based on a clear definition of the terminology.
The following definitions have been presented (for the in-depth clarification see the original expert report):

- *ecological effect and ecological impact*. Ecological effect: any noticeable change in behaviour, physical or chemical state brought about by an external influence. Ecological impact: a measurable change in an individual's survival or breeding output as a result of an external influence. This concept has particular relevance to migratory species as the ESPOO convention clearly refers to "activities that can make long term impacts in transboundary context includes activities potentially affecting migratory species".

- *bird population.* A distinct assemblage of individuals which does not experience significant emigration of immigration. Population can be considered at a number of scales, e.g. large spatial extents (flyway) and smaller scales "contained within landscape boundaries". The assessment of human impacts are based on impacts on populations of various scales.

- *significant impact.* In the biotic world predictions are more difficult because relationships are complex and the speed of adaptation is variable for different organisms. Normally a reduction or extension of areas of habitats may be a qualitative indication of the order of magnitude of the change due to human interference, but a quantitative prediction is extremely difficult. In addition in some cases it may be possible to establish generally accepted criteria on significance, but in most cases the decision that an adverse transboundary impact is likely to be significant would be based on a comprehensive consideration of the characteristics of the activity and its possible impact. An element of judgement is always be present. This judgement implies an undefined uncertainty and is based on experiences from other more or less similar areas or phenomena.

- *site*. The site is spatially referenced to: "the habitats and ecosystems of any area within Romanian territory where ecological impact can be shown". However, for wintering populations a transboundary impact might affect birds from other countries. It has also been assumed that all biological systems have a certain "**buffer**" in terms of their resilience to changes that can occur before integrity is compromised.

- *ecological integrity*. The term integrity is used to describe the coherence of a site's ecological structure and function, that enables it to sustain the complex of habitats and levels of populations of species considered to be at a 'baseline' level. Any changes to a site or population arising from a proposed human activity that is likely to move the baseline conditions further from that which constitutes ‘integrity’ for that system is said to have altered the site’s or population’s ‘favourable condition’.

- *favourable condition*. This means: "no further departure of the site or population from current species diversity, abundance and distribution, or ecosystem processes as a result of the activities associated with the canal development". It is however, accepted that some ecosystem elements (including birds) may already be declining for reasons other than the canal development. It is also assumed that in cases of reasonable doubt about the potential impacts of human activities on biological systems, that a "**precautionary**" approach will always be taken.

On the basis of this conceptual framework the birdlife expert comes to the following characterisation of the influence of human activities on birds:

The consequences of human activities on birds can be **direct** (e.g. noise causing individuals to seek cover), or **indirect** (e.g. siltation changing prey availability), and the severity of the perturbation determines whether it causes an ecological effect or impact. Additionally, the <u>consequences</u> of human activities can be classified into four broad areas:

Habitat loss

- Loss of habitat in a single large area.
- Loss of habitat in a many smaller areas (fragmentation).

Habitat degradation

- Structural changes e.g. availability of sites for breeding, feeding, roosting, *etc*.
- Changes in biotic quality e.g. food density and range.
- Changes in a-biotic quality e.g. water levels and regimes.
- Addition of materials and chemicals e.g. siltation, pollutants, nutrients, *etc*.

Disturbance

Although classified separately in this report, disturbance can also be regarded as a special transient case of habitat degradation or loss. Habitat loss through disturbance occurs where a habitat (or site) remains physically suitable, but cannot be occupied or utilised because of the disturbance. Some bird species will ameliorate their response to disturbance if it is presented frequently and for prolonged periods. This phenomenon is known as habituation.

There are three main classes of disturbance:

- <u>Visual</u> e.g. proximity of humans, or moving mechanical object (vehicle, boat, *etc*).
- <u>Noise</u>
- <u>Physical</u> e.g. wash from boat.

Lethal removal

- Hunting or sport shooting

<u>Evaluation</u>.

The birdlife expert give a detailed account of the positions of both Parties with respect to the human influence of the dredging and deepening of the Navigation Route, especially at the seaward part of the Danube Delta (Chapter 4 of the birdlife expert's report).

Applying this conceptual framework the birdlife expert recognised, that there is sufficient knowledge from a wide variety of cases around the world to permit valid broad-brush judgements of the likely response of birds to the human activities proposed in relation to the Bystre Canal.

The birdlife expert formulated three key evaluation questions:

- **Evaluation question 1**
  Will the Bystre canal development move Romanian bird habitats from favourable to unfavourable ecological condition ?
- **Evaluation question 2**
  Will the Bystre canal development induce changes to the size, extent and viability of bird populations associated with Romanian (and/or other) territories ?
- **Evaluation question 3**
  What is the likelihood of these changes occurring ?

The outcome of the evaluation of the birdlife expert was summarised in a table (see below).

The following conclusions were presented:

- the breeding and wintering populations of birds in the Danube delta (refer to definitions in Section 3.3), are of international importance.
- there is a considerable body of research-based evidence in relation to the consequences of habitat loss, degradation and disturbance to birds. Although not obtained directly from research in the Bystre canal area, this type of knowledge nevertheless permits a general evaluation of likely consequences of the proposed human activities in the Bystre canal development, as well as an assessment of their likelihood of occurrence.
- this knowledge of the bird-related consequences of human actions, has been integrated with the underlying principles of EIA, to construct a 'conceptual framework' for the assessment made in this report. Using this framework, it is suggested that the operational activities associated with future development and ongoing canal maintenance will have a **high likelihood** of resulting in the following:

    1. A change to the favourable status (as defined in Section 3.5) of Romanian and Ukrainian bird habitats, and thus a significant transboundary impact (as defined above). However, this will only occur over wide spatial extents and in the long term *if* further canal developments cause major hydrological changes. If changes to hydrology are predicted, there should be consultation with wetland habitat, fish and invertebrate experts to evaluate the specific likely impacts, and then this can be linked to the bird impact assessment.
    2. A changes to the size and viability of some breeding bird populations (and thus by definition a significant transboundary impact). However, this will only effect a wide range of species over a wide spatial extent if the canal causes major hydrological changes. Nevertheless, in the case of *tern* species, a **significant impact** has already occurred and continued development activities are extremely likely to worsen the previously inflicted impact. Any mitigation measures for changes to the sandbar spit (i.e. to undertake measures to increase the area of the reserve), should be tested ***prior*** to further development i.e. work to increase the spit's area could be undertaken *before* commencing canal development, to see if birds will occupy newly 'created' area.

3. Result in changes to the current availability of habitats and food resources for wintering bird populations (and thus by definition have a significant transboundary impact). However, this will only effect a wide range of species over a wide spatial extent if the canal causes major hydrological changes.

- Given the international importance and known sensitivity of birds breeding and wintering in the Danube region, a precautionary principle must always be invoked within all decision making processes.
- With specific reference to activities causing noise or visual disturbance (see table above), the main period of disturbance-sensitivity for breeding bird is from the beginning of April to mid-June, and for wintering birds from mid-October to mid-February. Activities causing noise or visual disturbance during these times should avoided.

These conclusions must be linked to the Inquiry Commission's hydrological report, to assess the potential spatial extent of changes to water regimes, water volumes, and sediments arising from the Bystre canal development. This is key to evaluating the potential extent and significance of the bird impacts resulting from by the component development activities. This linking will be presented in chapter 6.

EVALUATION OF TRANSBOUNDARY IMPACT ON BIRD LIFE

OPERATIONAL AIM	OPERATIONAL ACTIVITY	POTENTIAL CONSEQUENCES FOR BIRDS AND/OR BIRD HABITATS	• IMPACT DURATION • DIRECT or INDIRECT • TRANSBOUNDARY IMPACT ?	• IMPACT LIKELIHOOD • IMPACT SPATIAL EXTENT • IMPACT SIGNIFICANCE • COMMENTS
1. Dredging & widening of canal	Removal of sandbar material, rifts and river edges, construction of bank protection measures	Habitat loss by physical removal	• Permanent • Direct • Transboundary	• Probable • Local and restricted • Significant • Impact largely restricted to immediate vicinity of river banks. Further direct or indirect (siltation) removal of material from offshore sandbar will have major impact on a large number of breeding individuals of International, but involving only a few species (mainly terns). These ecologically utilise both Ukrainian and Romanian habitats (i.e. feed over wide area) and the issue is therefore transboundary. This will also have potential for impact on migratory wintering water birds in terms of a reduction in habitat availability. However, see Section 4.7 and 6 (below) in relation to mitigation measures.

		Habitat loss by hydrological changes (water levels, regimes, volumes)	• Permanent & transient • Direct • Transboundary	• Probable - ***if*** conditions realised (see comments below) • Widespread • Significant • This is perhaps the impact of greatest concern to the wider DBR. However, it will only occur if the dredging activity results in major hydrological changes over wide areas. This is something that must be referenced to the hydrological evaluation found elsewhere in this report. The impact would transboundary and impact both breeding and migratory wintering birds of international importance.
		Reduction in food availability by changes to invertebrates or fish communities	• Permanent & transient • Indirect • Transboundary	• Probable - ***if*** conditions realised (see comments below) • Widespread • Significant • This is perhaps the impact of second greatest concern to the wider DBR. However, it will only occur if the dredging activity results in major hydrological changes over wide areas. This is something that must be referenced to the hydrological evaluation found elsewhere in this report. The impact would transboundary and impact both breeding and migratory wintering birds of international importance.

		Exposure to terrestrial predators resulting from siltation of the area between the spit and the ‘mainland’.	• Permanent • Direct • Transboundary	• Probable - ***if*** conditions realised (see comments below) • Significant • There are conflicting views as to whether this will occur as it depends on the siltation of the area between the spit and the ‘mainland’. The matter needs to be referred to the relevant hydrology expert. A view should also be sought as to whether natural ‘background’ siltation rates will be enhanced Romanian view) or impeded (Ukrainian view) by the proposed development works.
	Operation of machinery i.e. disturbance by noise, visual, physical means	Exclusion from habitats resulting in reduction in feeding intake, breeding output, change in moulting and loafing areas	• Transient • Direct • Transboundary	• Probable • Local and restricted • Significant • Distance over which direct disturbance will cause exclusion is likely to be small, restricted to a small number of species, and some bird groups may display a degree of habituation in the longer term. However, for terns on the sand spit, the population level impacts will potentially be severe. The impact would transboundary and impact both breeding and migratory wintering birds of international importance.

		Increased density at alternative sites	• Transient • Indirect • Transboundary	• Probable • Local and restricted • Significant • For most breeding species this will not be an issue, as it will impact only a small number of individuals (relative to total DBR population), and most habitats will have some scope for increased bird densities. However, particularly for terns on the sand spits, movement away from area to other colonies could be a potentially negative impact if those colonies are approaching carrying capacity. It is also potentially more serious for wintering waterbirds.
2. Terrestrial accommodation of dredged spoil (21ha of land)	Placement of material at designated sites	Habitat loss by covering	• Permanent • Direct • Transboundary	• Probable **- *if*** conditions realised (see comments below) • Local and restricted • Significant • Likely to result in very small decrease in local breeding species – need for surveys to find out which species involved and to ensure that it does not include rare, endangered or sensitive protected species. The Ukrainian texts suggest that the dump sites are on 'degraded' land. This will need to be confirmed.
	Operation of machinery i.e. disturbance by noise, visual, physical means	Exclusion from habitats for feeding, breeding, moulting, loafing	• Permanent • Direct • Transboundary	• Probable • Local and restricted • Significant • Likely to result in exclusion for very local breeding species – need for surveys to find out which species involved and to ensure that it does not include rare, endangered or sensitive protected species.

		Reduction in breeding output and feeding intake	• Transient • Direct • Transboundary	• Probable • Local and restricted • Significant • Likely to result in small decrease in output and feeding intake for very local breeding species – need for surveys to find out which species involved and to ensure that it does not include rare, endangered or sensitive protected species.
		Increased density at alternative sites	• Transient • Indirect • Transboundary	• Probable • Local and restricted • Significant • For most species this will not be an issue, as it will impact only a small number of individuals (relative to total DBR population), and most habitats will have some scope for increased bird densities.
3. Shipping traffic	Low intensity (general) shipping pollution	Habitat degradation	• Transient • Indirect • Transboundary	• Probable • Widespread • Significant • Large volume of scientific evidence to suggest general shipping activity causes some pollution, and shipping accident has already occurred. However, impact of normal background pollution will not have major impact on bird populations.
	High intensity pollution event (accident)	Habitat degradation	• Transient • Direct and indirect (i.e. long term effects) • Transboundary	• Uncertain • Widespread • Significant • A single local pollution event (e.g. oil spill) could have major impact for species like terns where number of breeding sites are few, but numbers are large and close to Bystre canal operations.

	Boat noise, visibility & wash	Habitat degradation	• Permanent • Direct • Transboundary	• Probable • Relatively small • Significant • Distance over which impact will occur is likely to be small, and some groups will probably display a degree of habituation in the longer term. However, for terns on the sand spit, the population level impacts will potentially be severe. The proposed Ukrainian mitigation measures suggest regulating boat speed in the Bystre canal area to a maximum of 7 knots. The true reduction in impact of this measure will need to be discussed with relevant riparian habitat experts. There will also be need to check that this will not increase likelihood of accidents resulting from low avoidance maneuverability by slow moving vessels.
4. Maintenance of canal	All of the above	All of the above	• All of the above	• All of the above

5.6 Summary of Expert's findings

Hydro-morphology, sediment discharge and dumping of spoil.

- *dredging in the sandbar section* of the Bystre Channel, **no impact** on the flow distribution between the main branches Chilia and Tulcea in Phase 1. **Insignificant impact** of the further deepening of the sand bar section in the Bystre Branch mouth during Phase 2.
- *effects of the dredging or the deepening of the rifts* on the distribution of the flow discharge between the Chilia and the Tulcea Branches **likely transboundary effect** but **unlikely significant**
- *flow distribution between the Bystre and the Starostambulski branches* in Phase 1 **likely significant transboundary** effect.
- *impact of dredging of the rifts on the water level dynamics*: for the Chilia branch: **unlikely significant** and for the Bystre branch: **likely significant transboundary** effect
- *turbidity of river water and marine waters as a result of dredging* operations: **not possible to assess this impact** in detail without having access to detailed information. In addition in view of the fact that the state border between the Ukraine and Romania is situated along the Chilia Branch, exactly where the dredging is taking place, the impacts are of a **likely transboundary nature** but there is **insufficient information to judge the significance**
- *impacts over larger distances and time scales*: **unlikely significant transboundary** effect against the background of the overall sediment transport and variability
- *turbidity of marine waters as a result of dumping of dredged spoil* under conditions with southbound currents, the increase of the concentration of inorganic suspended matter at the Romanian state border is of the same order as the existing background.; the impact is characterised as **likely significant transboundary**.
- *coastal morphology*: **insufficient information to judge the significance** of any transboundary morphological impacts on the Romanian coastal section between the Chilia and the Sulina Branches, but **locally significant morphological impacts** on the Bystre-Chilia delta coastline from the construction of the retention dam and from the maintenance dredging of the Bystre sandbar section.

Water and bed pollution

- local and short-term (some days) increase in nutrient concentrations, by the dredging, which is **insignificant** for the overall nutrient conditions
- zinc and copper exceed the standard most, but in recent year it has become apparent, that the standards for these compounds need refinements. So it is **uncertain** whether these metals are really present in toxic quantities
- amount of sediment contamination are all well below the Dutch standards for dumping fresh water sediments in the sea; thus according to these standards there will be **no toxic effects**
- even if toxic effects may occur at present it is **unlikely** that as a result of the dredging and dumping these effects will increase, because the dredged

material has more or less the same composition as the present suspended material. An increase in only suspended material will not change the toxicity

- in conclusion: based on the available data it is **unlikely** that **adverse significant effects** will occur as to the nutrients, heavy metals and organic micro-pollutants as a result of the dredging and dumping in the river as well as in the sea.

<u>*Fish stock and migration*</u>

1. *Dredging effects*

- slight increases in the concentration of suspended sediments might cause **(sub)lethal effects on fish** at and in the vicinity of dredging sites.
- dredging activities during construction have **likely transboundary impacts on the fish fauna**.
- effect of reduction of flooding magnitude and frequency and potential loss of spawning and nursery floodplain habitats have **likely adverse transboundary impacts**
- cumulative effects of the Navigation Route construction and maintenance **will significantly affect the fish fauna and fishery** in the long term.
- based on the existing information it **is likely** that morphological chances will have **transboundary impacts on the long term.**
- although some losses from fish entrainment into the dredges would likely occur, it would probably be limited to a small percentage of the total number of fish living in and moving through the area. Therefore, based on the information available it is **unlikely that a significant transboundary effect** due to entrainment will occur.
- cumulative effects of increased suspended sediments, habitat loss, behavioural impacts, water quality deterioration, habitat modification and unknown effects make it even more **likely that dredging activities have significant trans-boundary effects on fish and fishery**.

2. *Effects of penetration of salt water into the Bystre channel*

- the transboundary effect of increased saltwater intrusion is supposed to be **hardly likely**.

3. *Effects of dredging the sandbar and constructing the retaining dam*

- effects on the migratory behaviour on sturgeon and shad are **hardly likely**.

4. *Effects of the dump sites in the Black Sea*

- transboundary effects on fish is **likely significant.**

5. *Effects of navigation*

- due to the lack of information it is **not possible to quantify likely effects**.

<u>*Bird life and bird migration*</u>

The operational activities associated with future development and ongoing canal maintenance will have a **high likelihood** of resulting in the following:

- a change to the favourable status (as defined in Section 3.5) of Romanian and Ukrainian bird habitats, and thus a **significant transboundary impact.** However, this will only occur over wide spatial extents and in the long term *if* further canal developments cause major hydrological changes.

- a changes to the size and viability of some breeding bird populations and thus by definition a **significant transboundary impact**. However, this will only effect a wide range of species over a wide spatial extent if the canal causes major hydrological changes. Nevertheless, in the case of tern species, a **significant impact** has already occurred and continued development activities are extremely likely to worsen the previously inflicted impact. Result in changes to the current availability of habitats and food resources for wintering bird populations (and thus by definition have a **significant transboundary** impact). However, this will only effect a wide range of species over a wide spatial extent if the canal causes major hydrological changes.
- given the international importance and known sensitivity of birds breeding and wintering in the Danube region, a precautionary principle must always be invoked within all decision making processes.
- with specific reference to activities causing noise or visual disturbance (see table above), the main period of disturbance-sensitivity for breeding bird is from the beginning of April to mid-June, and for wintering birds from mid-October to mid-February. Activities causing noise or visual disturbance during these times should avoided.

BANK

RIPARIAN DUMP SITE

6. FINDINGS OF THE INQUIRY COMMISSION

6.1 Introduction

The evaluation by the Inquiry Commission should be based on sound definitions and criteria. In chapter 2 an overview was presented of the definitions of the terms "likely"-"significant"-"adverse" and "transboundary"-"impact", as have been included in the texts of the ESPOO Convention and ESPOO publications.

In that chapter it was also mentioned that there is a difference between evaluations/predictions of the a-biotic effects and those of the biotic effects. In the a-biotic world there is a lot of knowledge, which may be systemised into models, the results of which may be confronted with real world measurements or observations. It is often possible, by the application of statistical techniques, to evaluate the significance of the impact. The a-biotic analysis is directed to detect traceable changes in the environmental boundary conditions, but do not give clues whether these changes are *adverse* or *favourable*. That judgement comes from the biological/ ecological analysis.
In the biotic world such predictions are much more difficult because the ecosystem relationships are very complex and not yet fully understood. In addition the speed of adaptation is variable for different organisms and particularly migratory species have a large spatial realm, using habitats over the whole delta, making state boundaries irrelevant. Finally some impacts may interfere and cumulative impacts may occur. For migratory organisms the problem is even more complex. It is hardly possible to assess the significance of impacts in a statistical sense and the word "significant' then seems inappropriate and will therefore not be used in the evaluation by the Inquiry Commission. As quantitative predictions, such as in the a-biotic world, are often impossible, qualitative assessments by experts may prevail, based on expertise and experiences from other similar areas.
For sessile organisms the impacts of the dredging of the Navigation Route may be judged by comparing the area influenced by the dredging to the unaffected area. Thus the reduction of habitat may be a measure.

This is shown in the contributions of the birdlife and fishery experts. The birdlife expert developed a theoretical framework for assessing the impact of the Navigation Route on birdlife (see chapter 5.5 and Appendix 5). This framework is based on a definition of the terminology of: "ecological effect and ecological impact"; "bird population"; "significant impact"; "site"; "ecological integrity" and "favourable condition". The developed framework can be applied to characterise the significance of ecological effects/impacts of human activities on bird populations. The *adverse* consequences of human activities were classified into four broad categories: loss of habitat, degradation of habitat, disturbance and lethal removal. This theoretical framework appears to be a valuable instrument to evaluate the impacts of the Navigation Route on birdlife.

This framework may also be used for the evaluation of the fishery aspects. For birds the habitats are used for feeding and nesting and for fish for feeding and spawning. Loss or degradation of habitats, disturbance (e.g. of tracking routes) and lethal removal therefore are also considered as the major indications of the *adverse impacts* of human activities on fish like the construction of the Navigation Route.

The *degree* in which an impact is *adverse* depends on the surface area of the habitat and/or the disturbance involved and on the environmental quality of the habitat. This quality may be judged by the number of species, the abundance of species and the complexity of the ecological relations. Evaluations in this respect should be performed with great caution, because of the complexity of ecosystems and the gaps in knowledge. But rough indications might be possible.

The Inquiry Commission fully acknowledges the problems, solutions and constraints sketched above in evaluating the likely (significant) adverse transboundary impact of the construction of the Navigation Route. The Commission has adopted the theoretical considerations presented above for their evaluation of the impacts of the Navigation Route.

A very important factor for the habitats for birds and fish is the water quality. For many years worldwide a huge amount of research has been devoted to develop standards for water quality (see the contribution of the fishery and geochemical expert, chapter 5.3 and 5.4 and Appendix 3 and 4).
The state- of- the-art assessment of the quality of surface waters in the European Union is regulated by the Water Framework Directive (WFD). For rivers, estuaries and coastal waters, fish is used as indicator to assess the ecological status. For example, for rivers the species composition, abundance, sensitive species and the age structures of the fish communities are taken into account. The high status (class 1) is the reference condition and reflects the situation normally associated with that water body type under undisturbed conditions and show no, or only very minor evidence of distortion.

The Inquiry Commission adopts the standards of the WFD, because these are based on a wealth of research and thorough international scientific debate and are in compliance with the latest international achievements of knowledge in this respect.

The birdlife and fishery experts have indicated that on specific points their evaluations has to be linked to the findings of the hydro-morphological and geochemistry experts. This linkage is incorporated in the final evaluations of the Commission in paragraph 6.8.

6.2 Controversial positions of both countries of the transboundary impact of the Navigation Route

In chapter 4 the following subjects are identified in the statements as being controversial:

1. Transboundary impact on the hydrology of the River Danube
2. Transboundary impact on sediment discharge and the storage and dumping of dredged material in the coastal zone
3. Transboundary impact of dredging on pollution of the coastal waters
4. Transboundary impact on fisheries
5. Transboundary impact on biodiversity, because of loss of habitat of protected migratory birds

6. Transboundary social-economic impact.

The transboundary social-economic impact as indicated by the Romanian side, solely addresses the impact on commercial fishery. It will be treated in the paragraph on fishery.

The Inquiry Commission after careful evaluation of the information provided by the Members of the Commission and of the Experts views and considering the problems outlined in paragraph 6.1 came to conclusions as described in the following paragraphs. In general the conclusions of the experts are adopted.
The conclusions of the Commission are unanimous.

Paragraph 6.3-6.8 address Phase 1 and paragraph 6.9 gives an outlook to Phase 2. In paragraph 6.8 the final integrated evaluation of the Inquiry Commission is presented.

6.3 Transboundary impact on the hydrology of the River Danube

1. *impact of the dredging or the deepening of the rifts* on the distribution of the flow discharge between the Chilia and the Tulcea Branches: **likely transboundary effect** but **unlikely significant**
2. *flow distribution between the Bystre and the Starostambulski branches* in Phase 1: **likely significant transboundary** effect.
3. *dredging in the sandbar section* of the Bystre Channel: **no impact** on the flow distribution between the main branches Chilia and Tulcea in Phase 1. **Insignificant impact** of the further deepening of the sand bar section in the Bystre Branch mouth during Phase 2.
4. *impact of dredging of the rifts on the water level dynamics* for the Chilia branch: **unlikely significant** and for the Bystre branch: **likely significant transboundary** effect

6.4 Transboundary impact on sediment discharge and the storage and dumping of dredged material and on the morphology of the coastal zone

1. *increase in turbidity of river water and marine waters during the dredging* operations: **likely transboundary effect** but **insufficient information to judge the significance**
2. *impact over larger distances and time scales*: in the river waters: **insignificant transboundary** effect against the background of the overall sediment transport and variability
3. *increase of turbidity of marine waters as a result of dumping of dredged spoil*: **likely significant transboundary**, under conditions with southbound alongshore currents, the increase of the concentration of inorganic suspended matter at the Romanian state border is of the same order as the existing background
4. *changes in coastal morphology*: **insufficient information to judge the significance** of any transboundary morphological impacts on the Romanian coastal section between the Chilia and the Sulina Branches, but **locally significant morphological impacts** on the Bystre-Chilia delta coastline from

the construction of the retention dam and from the maintenance dredging of the Bystre sandbar section.

6.5 Transboundary impact of dredging on pollution of the river and coastal waters

1. *impact of dredging on the increase of nutrient concentrations*: **unlikely significant transboundary** effect
2. *presence of toxic concentrations of Zinc and Copper*: **uncertain** if these exceed the standards
3. *impacts of toxic sediment contamination*: **unlikely significant transboundary**
4. *overall increase of nutrients, heavy metals and organic micro-pollutants*: **unlikely significant transboundary**

6.6 Transboundary impact on fisheries

1. *impacts of increase of suspended sediment concentration* and fish and fish food entrainment at the dredging site: **unlikely adverse transboundary**
2. *impacts of increase of suspended sediment concentration downstream* of dredging site: **likely adverse transboundary possibly (sub)lethal effects on fish**
3. *effect of reduction of flooding magnitude and frequency* and potential loss of spawning and nursery floodplain habitats: **likely adverse transboundary**
4. *impacts of deterioration of water quality*: **unlikely adverse transboundary** (see also 6.5)
5. *impact of repeated maintenance dredging*, hampering the recovery processes of affected areas in the long term: **likely adverse transboundary**
6. *impact of morphological modifications* (e.g. bank protection), resulting from dredging activities, causing more uniform and degraded habitat conditions: **likely adverse transboundary** on the long term
7. *impact of increased salt penetration* in the Bystre Channel: **unlikely adverse transboundary**
8. *impact of dredging the sandbar and sea access channel and the construction of the retaining dam* on the migratory behaviour of sturgeon and shed: **hardly likely transboundary**. This also excludes **adverse transboundary impacts** on commercial fishery
9. *impact of the dump site in the Black Sea* on the benthic fauna at and around the dump site in relation to the increased suspended sediment concentrations and deposition, loss of habitat and burial of fish food organisms: **unlikely adverse transboundary**
10. *impact of navigation*: **insufficient information** to access likeliness of transboundary
11. *cumulative impacts* of increased suspended sediment, habitat loss and modification, water quality deterioration etc: **likely adverse transboundary impact,** on a large scale and long term

6.7 Transboundary impact on birdlife

1. *impact of habitat loss by dredging and maintenance of rifts and bank protection*: **likely adverse transboundary**, but local and restricted
2. *impact of loss of habitat by dredging and maintenance of offshore sand bar*: **likely adverse transboundary**, especially for terns
3. *impacts of habitat loss by hydrological changes*: depends on character of these changes; see under 6.8
4. *impact of reduction in food availability*: depends on character of these changes; see under 6.8
5. *impact of siltation of the area between the spit and the mainland*: depends on character of these changes; see under 6.8
6. *impacts of disturbance on exclusion of habitats* (noise, visual, physical): **likely adverse transboundary**, but local and restricted
7. *impact of increased densities of birds at alternative sites*: **likely adverse transboundary**, but local and restricted
8. *impact on riparian dump sites*: habitat loss by covering: **likely adverse transboundary**, but local and restricted
9. *impacts of disturbance due to shipping traffic* (pollution, accidents, noise, ship waves): **likely adverse transboundary**, but local and restricted

6.8 Final integral evaluation and conclusions

For the final integral evaluation the Inquiry Commission selected those effects, which have been classified as "likely significant (adverse) transboundary impact". The unlikely impacts, the hardly likely (inconclusive) impacts and the impacts which could not be evaluated, due to lack of information, are left out of consideration.
It should be noted that a substantial number of potential impacts could not be assessed because of lack of sufficient and/or reliable data or information. These are "gaps in our knowledge". Therefore the present evaluation is of a *restricted value*, leaving open many important aspects. The evaluation concentrates on those aspects, which could be evaluated.

The Inquiry Commission came to the following final conclusions:

The **likely significant adverse transboundary impacts** are:

- impact of dredging or deepening of the rifts on the distribution of the flow discharge between the Bystre and the Starostambulski branches and on the water level dynamics along the Bystre branch, resulting in loss of floodplain habitats, important for fish (spawning and nursery) and birds (nesting, feeding)
- impact of habitat loss by coverage of riparian dump sites and dredging through the offshore sandbar and measures for bank protection on birdlife and fish
- impact on the increase of suspended sediment concentration, downstream of the dredging site on fish
- impact on the turbidity of marine waters as a result of dumping of spoil at the dump-site at sea, under conditions of southbound alongshore currents
- impact of repeated maintenance dredging hampering the recovery processes of affected areas for fish in the long term

- cumulative impact of loss and/or disturbance of habitats and by shipping traffic on fish and bird life on a large scale and long time

The Commission presents the following evaluation:

1. All impacts of the dredging of the Navigation Route in the Chilia Branch and the Starostambulski Branch are ipso facto transboundary, because the dredging is operated at and on the state boundary between Romania and the Ukraine. The question is whether the effects are likely significant and adverse.
2. The deepening of the rifts will not result in a significant effect on the distribution of the water discharge between the Chilia and the Tulcea branches and therefore on the frequency distribution of the water levels along the Chilia Branch. Hence it is unlikely that the frequency of flooding of the floodplains and riparian wetlands will change significantly. In addition the anticipated effects for fish and birdlife are unlikely.
3. As a result of the deepening of the rifts (sills) the discharge distribution between the Bystre and the Starostambulski Branch will change significantly. As a consequence the frequency of high water levels along the Bystre Branch will increase significantly, which has a likely adverse transboundary impact on fish and birdlife. In addition the dredging especially on the sand bar results in a loss of habitat of some 600.000 m2, which has a likely adverse transboundary impact on birdlife, specifically on terns.
4. The discharge via the Bystre will increase by some 12 %. Thus more water and sediment will be discharged via the Bystre Branch into the Black Sea. The effect is particularly felt during high and extreme river discharges at the mouth and adjacent coastal waters. Then a sediment laden fresh water plume will be injected over the heavier saltwater. This plume may shift southwards under conditions of southbound wave- and wind driven coastal currents. Meanwhile sediment may "rain out" of the plume on the bed, contributing to the deposition rate in the coastal waters. As such it is incorporated into the nearshore accumulation and extension of the coast and the up- and outbuilding of the Ptichiya spit.
5. Besides the sediment delivery due to the increased discharge by the Bystre, the sediment transport in the coastal system will change by the effects of the retaining dam and the sediment injection at the sea dump site. At the moment there are insufficient data to quantify these changes, but a preliminary indication revealed that the effect might possibly be transboundary. The increase of the concentration of inorganic suspended sediments at the Romanian state border seems to be in the same order as the existing background.
6. Changes in sediment transport patterns may also influence the morfological developments of the area of the Ptichiya spit and the nearshore mud flats, but these developments are expected to be relatively slow, because of the rather low sediment concentrations and deposition rate. These shallow areas are very important as habitats for fish and particularly birds. However this supply of sediment to the nearshore system is not yet considered as adverse, because it is not anticipated that this will result in a rapid siltation of the area between the spit and the mainland or in a reduction in food availability for birds and fish.
7. Local and restricted likely adverse transboundary impacts on fish and bird life may result from habitat loss by dredging and maintenance of rifts and sandbar

and of bank protection measures; in the vicinity of and during the dredging operations; by covering of riparian dump sites and by shipping traffic (ship waves, noise, pollution, accidents etc). Especially the riparian areas are important habitats for fish and birds. In the case of migratory fish species, the cumulative impact is likely to be a large scale and long term effect.

8. It seems hardly likely, that the dredging of the sandbar and the construction of the retaining dam will have a significant adverse transboundary effect on the migratory behaviour of the commercially important sturgeon and shed. This excludes a transboundary social-economic impact. In addition it is unlikely that the dump site in the Black Sea will have an adverse transboundary effect on fish.

6.9 Outlook to Phase 2.

From the point of view of the hydro-morphological and the pollution aspects the conclusions for Phase 2 does not deviate from those for Phase 1.
As to the retaining dam the HM-expert expressed his concern that the length of the projected dam will reduce the sediment influx from the North and will also hamper the northbound sediment transport during southern wind conditions. It is anticipated that the delta section between the Bystre and the Sulina branches will receive a smaller sand input. than it does today, which may influence the developments of the Ptichya spit, which represents a very high ecological value. The expert also presented some mitigation measures (see page 23 and 24 of his report).
The deeper Navigation Route will require additional dredging of the sills, larger maintenance dredging, extended dump sites and possibly larger and longer bank protection measures. It is anticipated that the adverse transboundary impacts will at least be similar of those for Phase 1, but in some aspects even greater.
As larger ships can be accommodated in the deeper Navigation Route also the disturbance of fish and bird life may increase.

VILKOVE, AFTER HEAVY RAINFALL

VILKOVE

7. RECOMMENDATIONS

7.1 General recommendations

In their contacts with scientists and NGO's the Commission has noticed that there was a general wish for more information and cooperation between the two countries with respect to the construction of the Navigation Route and other projects which have a possible transboundary impact. The Commission appreciate this common wish as an valuable step on the road for political cooperation of both countries in the sense of good neighbourship and the bilateral responsibility for the protection of the Danube Delta in the framework of the international conventions signed by both countries.

The Inquiry Commission also emphasize that several of the concerns of Romania with respect to the Navigation Route could be removed by a fully scientific appraisal of the feared impacts.

On the other hand it also appeared that several potential impacts could not be evaluated adequately because of the lack of substantial data. This means that even internationally renown experts were unable to judge the likely significance of transboundary effects on some subjects.

The Commission identifies the following important subjects for which no conclusive evidence was available to judge the transboundary consequences of the Navigation Route.

- effect of dredging on the turbidity of the river and marine waters
- effects of increase of suspended sediment concentration at and near the dredging site
- effects on the Chilia delta resulting from the construction of the retention dam and the maintenance dredging in the Bystre Channel
- effects on the coastal morphology of the Romanian coastal section between the Chilia and the Sulina Branches
- the presence of toxic concentrations of Zinc and Copper in relation to the standards
- effects on migratory fish, passing the dredging area and/or shifting between different habitats across the border during dredging operations
- effects of morphological modifications (e.g. bank protection), resulting from dredging activities, causing more uniform and degraded habitat conditions
- effect of the dump site in the Black Sea on the benthic fauna at and around the dump site in relation to the increased suspended sediment concentrations and deposition, loss of habitat and burial of fish food organisms.

Bilateral Research Programme

The Commission, realising that the Navigation Route is and will be an political issue, recommends to organise a Bilateral Research Programme related to activities with transboundary impacts in the framework of the bilateral cooperation under the ESPOO Convention.

The Commission recommends further that this research programme is started as soon as possible, addressing the gaps in scientific information and knowledge related to the general problem of dredging a Navigation Route at and in the vicinity of the Romanian-Ukraine boundary.

This Bilateral Research Programme may be connected with other more general national and international research activities e.g. the International Commission for the Protection of the Danube Delta (ICPDR); the bilateral Monitoring Programme; The Transboundary Co-operation Programme RO-UA 2007-2013: "Transboundary bilateral network for environment monitoring in the Danube Delta and adjacent coastal areas" and other EU-programmes.
International funding and assistance for the start of the proposed research programme may be organised via the Secretariat of the ESPOO Convention.

An elaboration of the Bilateral Research Programme has been included as addendum to this chapter.

7.2 Mitigation

In the EIA for Phase 1 (Ukr.6) several measures are described to mitigate the adverse environmental effects of the Navigation Route.

In addition, the Commission, following the suggestion of the hydro-morphological expert, recommends also the shortening of the retaining dam and to locate the sea dump site nearer to the shore.
Mitigation of the morphological impacts could be achieved in two ways. Firstly, keeping the retaining sea dam relatively short (i.e. covering the surf zone only) would help to maintain a certain influx of sediments from the north. It is recommended that "lessons learned" from the Sulina example, where 8 km long jetties have been constructed, could help optimise the design. Secondly, dumping the dredged material elsewhere, on a carefully selected site inside the littoral zone would keep this material available for littoral processes.

Finally the Commission may indicate two more measures which possibly might mitigate the environmental impacts of the Navigation Route. The first measure is the artificial change (by technical means) of the discharge distribution between the Bystre and Starostambulski Branches to diminish the expected increase in discharge in the Bystre. Such measure should only be considered after thorough hydrological field and model investigations with particular attention to the high river floods. In addition the environmental impacts should be evaluated. The second measure is consideration of modern dredging and dumping techniques, which might reduce the adverse environmental impacts.

7.3 Recommendations for the functioning of the Inquiry Commission

The present Inquiry Commission was the first that has been established in the framework of the ESPOO Convention and therefore some learning experiences may be mentioned.

- it is recommended that *before* an Inquiry Commission is established, a budget is agreed and paid to a trust fund by the parties. The trust fund may administrative and financially be handled by the Secretariat of the UNECE, under special rules which reflects the independent and the specific nature of the Commission and which ensures a quick, adequate and alert handling of the financial matters and contracts.
- a site visit of the Commission and the experts is strongly recommended. During this visit consultations with the governmental and local authorities; the national and local NGO's and the local population may be organised. In addition an extensive field reconnaissance of the problem area is very rewarding
- a time limit of 4 months for the delivery of a final report is very tight. Especially the experts need time to familiarise themselves with the key points of the problem and the existing (sometimes detailed) information.

Addendum

Elaboration of the Bilateral Research Programme

The Bilateral Research Programme may cover a characterisation of the baseline situation, an assessment of the expected impacts of the construction and operation of the Navigation Route, the identification and assessment of measures mitigating expected adverse impacts and a monitoring plan to follow the actual impacts in the years to come .

Including the suggestions of the Experts, the Commission proposes the following main subjects for thorough field and model investigations for such Bilateral Research Programme:

Water, sediment, dredging

There exists a significant database and knowledge base on both sides of the border regarding the subjects river hydrology, hydraulics, sedimentology and coastal morphology. It is recommended to carry out a joint bilateral research effort to characterise the baseline situation and assess the project impacts. This effort should include modelling studies by bilateral research teams and could make use of international experts in a supportive role. It is acknowledged that many building blocks for such an assessment already exist.

In more detail a bilateral full scale mathematical model study concerning the discharge distribution over the various river branches and frequency distributions of water levels is recommended in order to diminish the existing uncertainties. Such studies should be accompanied by measurements of relevant parameters (e.g. bed roughness) during high floods. International experts may be involved in a supportive role.

In addition there is a general lack of information on the spatial impact of the dredging e.g. gradients of suspended sediment concentration; bed deposition and habitat deterioration; nutrients and pollution gradients; effects on migratory fish during dredging etc. as a function of distance from the dredging site. The main problem is the interpretation of the existing and newly gained data. This can be achieved by collective and/or comparative modelling; existing models can be used.
The present available data sets about sediment quality do not contain any information about the vertical distribution within the sediment bed. Since dredging may occur up to a depth of about 3 meters, samples should be taken over the whole depth profile, to determine if older, more polluted sediment is present. The locations of these samples should be selected in such a way that a representative picture is obtained of all the material to be dredged.
In these samples not only the pollutants (in mg/kg of solid!) should be determined, but also the macro-chemical composition like grain size (<2μ, <16μ, etc) and the content of $CaCO_3$, Fe, sulphide and organic material (percentage organic C). Without these macro-chemical analyses it is difficult to judge the toxic effects of micro-pollutants. It is also advisable to measure the same parameters in the suspended solids. Finally it is recommended to determine the Dissolved Organic Carbon (DOC) in the water column.
It is important that a bilateral framework for the methodologies for sampling, laboratory analysis, and data handling is developed. In addition it is recommended to take cores from the bed at dredging sites and conduct macro-chemical analyses of samples.
These mentioned cores can also be used for sedimentological analysis. This may produce information on the lowering and subsequent upbuilding of the river bed during the passage of a flood; the changes in bed forms and bed roughness, the grain size gradients and the lateral facies (sediment characteristics) and habitat variations.

A problem of particular importance is the sediment fluxes at the mouth of the Bystre in the vicinity of the retaining dam. This addresses the sediment discharge and spreading over the mouth bar; the alongshore input of sediment from the North and the south and the effects of the retaining dam on the sediment transport pattern and deposition rate and the relation with the accretion of the coast and the spit formation (see also the Report of the Hydro-Morphological Expert)

In addition there is also great uncertainty about the spatial impacts of the dumping site at sea. Similar investigations as mentioned above, including the modelling and coring exercises are recommended.
In order to evaluate the effect of the marine dumping of spoil on the general coastal sediment transport pattern the spreading patterns of the spoil should be established and even so the net sediment fluxes in the near-shore zone, especially in the vicinity of the retaining dam.

Birds

To get an insight of the variability of the bird populations, field surveys on a frequent basis throughout the year over several years are indispensable. This may be

accompanied by a biological monitoring of different habitats in a standardised way to establish the Danube-related food-habitat relations. GIS is a very valuable research and modelling measure, which may provide detailed habitat information maps. As the loss or deterioration of habitats is an effective measure of evaluating impacts, the main emphasis should be directed to this subject.
There are three main concerns in relation to hydrology from the bird population perspective. The first is whether changes to river flow volumes/speed may generate spatial and temporal changes to water regimes in wetlands related with the river. This could have major implications for habitat types and invertebrate/fish prey populations. The second concern is whether changes to river flow volumes will cause changes in the sedimentation in wetlands related with the river and in the Black Sea (sand spit), which might result in loss or deterioration of habitats area. The third point of attention is whether 'engineered' edges to the canal will be created, thereby preventing outflow of water from the river to associated wetlands.

Fish

A similar reasoning may be used for fish, however with another approach and scale. Here too the main problem is the migratory behaviour of fish species and the relations with and connections between habitats.

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APPENDICES (on CD-ROM)

Final reports Experts

Report of the Hydro-Morphology Expert	(Jos van Gils)
Report of the Geochemistry Expert	(Nico de Rooij)
Report of the Fishery Expert	(Stefan Schmutz)
Report of the Birdlife Expert	(Mark o'Connell)

Contributions by the Members of the Commission

Dr. Mircea Staras
Danube Delta National Institute, Tulcea, Romania.

Rom. 1 Documentation on the likely significant transboundary impact of the Ukrainian Deep-water Navigation Canal Danube-Black Sea in the context of ESPOO Convention, 1991. February, 2005

Rom. 2 Additional information requested for the third meeting of the Inquiry Commission on the likely significant transboundary impact of the Ukrainian Deep-water Navigation Canal Danube-Black Sea in the context of ESPOO Convention, 1991. October, 2005

Rom. 3 Comments to Annexes no. 15-28, presented by the Ukrainian expert at the third meeting of the Inquiry Commission on the likely significant transboundary impact of the Ukrainian Deep-Water Navigation Canal Danube-Black Sea in the context of ESPOO Convention, 1991. December 2005

Rom. 4 Comments on documentation presented by Ukrainian expert at 4 th meeting of the Inquiry Commission (16 Dec. 2005)

Dr Lyudmyla Anischenko
Ministry of Environment Protection of Ukraine, Kharkiv, Ukraine,

Ukr. 1 The assessment of transboundary impact of the navigation route reopening in the Ukrainian part of the Danube Delta
Report + Annex 1 - 14, February 2005

Ukr. 2 Annex 15 - 28, October 2005

Ukr. 3 Annex 29 - 32, December 2005

Ukr. 4 Annex 33 - 40, April 2006

Ukr. 5 Annex 41 - 47, May-June 2006

Ukr. 6 Report on Scientific Research Work:
"Environmental Assessment (EA) within the framework of the project "Creation of the Danube – the Black Sea deep-water navigable passage in the Ukrainian part of the delta. Stage 1". Ministry of Environment Protection of Ukraine. Kharkiv, Ukraine, 2003