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TECHNICAL REPORT

BAIKAL BASIN TRANSBOUNDARY DIAGNOSTIC ANALYSIS

The Pollution of Surface Waters at the Hot Spots on the Mongolian territory in the basin of Lake Baikal

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ABBREVIATIONS AND ACRONYMS

CFU	Colony Forming Unit
IWBM	Integrated Water Basin Management
SAP	Strategic Action Programme
TDA	Transboundary Diagnostic Analysis
UNDP	United Nations Development Programme
UNOPS	United Nations Office for Project Services

INTRODUCTION

The total daily output of all polluted drainage of Mongolia reaches 350000 cubic meters and the volume of drainage passing through these waste treatment facilities is equal to 120 million cubic meters a year.

Of all waste-treatment facilities 70 per cent are located in the Selenga basin, where 91 million cubic meters of drainage are treated annually. In this way, in theory the output of waste-treatment faculties surpasses the volume of waste water passing through them by three times. However the waste-treatment facilities have been in operation for 20-30 years. They are equipped with outdated water treatment technologies and require large amounts of electricity. According to the research data the level of waste treatment of these water treatment facilities amounts to 50-70 per cent

THE MAIN REASONS OF INEFFICIENT FUNCTIONING OF WATER TREATMENT FACILITIES

Factors concerning technology

- Outdated technology and non-optimal choice of technological processes of waste treatment
- Insufficient use of new and improved technologies of waste treatment
- Dimensions of the existing waste treatment facilities are no up to contemporary requirements and their change will cause numerous troubles
- The effluent quality is insufficient

Technical and climatic factors

- Non-compliance with the technological regime
- Harsh climatic conditions for the work of heavy equipment
- Unsteady and irregular intake of the polluted water to the waste treatment facility inconsistent with dates and volumes
- Incomplete procession of sediments in the course of waste treatment.

Table 1. Estimated and actual capacity of waste treatment facilities

№	Location	Estimated capacity	Usable capacity	Method of treatment
1.	Ulaanbaatar	230 000	170 000	Fully biological
2.	Darkhan	50 000	18 000	Biological
3.	Orkhon/Erdenet/	24 000	33 000	Biological
4.	Selenge	5 800	3 200	Biological

Contemporary state and future of waste treatment facilities of Orkhon aimag /Erdenet/

Waste treatment facilities of the city of Erdenet have been functioning since 1978 with the treatment capacity of 24000 cubic m of water per day. In 1991 full treatment capacity were introduced. They have five sand filters and three drum filters. These are the largest waste treatment facilities in Mongolia, where the volume of drainage to be waste-treated exceeds their estimated capacity of waste treatment facilities by 1.5 times. After waste treatment the waters flow into the Khangal river.

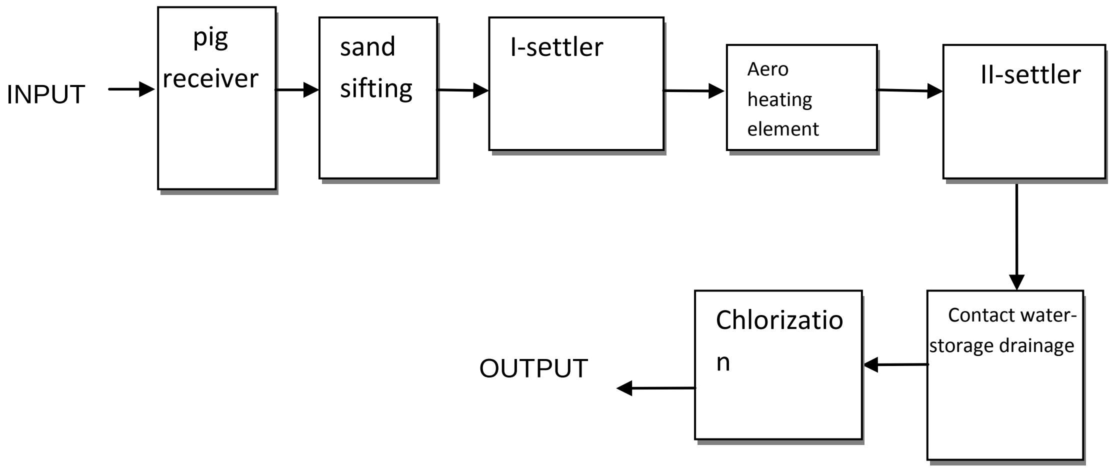

Fig. 20 Waste treatment facility operation scheme

Contemporary and future (expected) state of waste treatment facilities of the city of Darkhan

Waste treatment facilities of Darkhan became operative in 1965 with mechanical sewage treatment equipment. After reconstruction their capacity increased to 50000 cubic m per day and they release water after biological treatment. The level of waste water treatment is about 90 per cent. Sewage waters from the city industrial zone are received at the station by two water pumps marked FG 144/66 and through station 2 they reach Central Waste Treatment Facilities. At the Central Waste Treatment Facilities and pumping stations 22 water pumps are in action. Pumps and waste treatment equipment are expensive and they also consume quite a lot of electric energy.

Contemporary state and future of waste treatment facilities of Selenge aimag

Biological waste treatment facilities of this aimag with the 6000 cubic m per day capacity became operational in 1985. In 2012 they were reconstructed and this fact improved the state of waste treatment facilities.

Sources of pollution of the Selenga river basin

On Mongolian territory the most economically developed northern and central regions of Mongolia are located in the Selenga river basin. They produce a bulk of gross regional products. In general in the Mongolian part of the Selenga river basin occupying only 20 per cent of the country's total territory 70 per cent of all population resides, 80 per cent of industrial and over 60 per cent of agricultural products are produced. In addition, here 34 per cent of all entire livestock population (11 million heads) live and graze. This territory also accounts for 93 per cent of Mongolia's industrial withdrawal of water. Country's largest cities such as Ulaanbaatar, Darkhan, and Erdenet are also situated here.

The main anthropogenic pressures on the territory of Mongolia are formed in the basins of the rivers Tuul, Kharaa, Orkhon forming a hydrographic network in the basin of the Selenga.

Sources of pollution of the Selenga in Mongolia are waste waters from a number of enterprises belonging to the largest Ulaanbaatar and Darkhan industrial hubs, and the industrial center at Erdenet , which is centered on the joint Russian-Mongolian copper and molybdenum ore processing plant “Erdenet”.

The sources of substances polluting the surface waters of the Selenga river basin are mostly associated with the locations of mining and ore procession and urban territories.

The sources of pollution of the river Selenga in Mongolia are waste treatment facilities discharging waste water in Selenga’s tributaries: 1) disposal of sewage water from five waste treatment facilities located in Ulaanbaatar, 2) disposal of sewage water from waste treatment facilities located in the town of Erdenet belonging to the Erdenet industrial hub; 3) disposal of sewage water from the central waste treatment facilities located in Darkhan.

The city of Ulaanbaatar is one of the most polluted settlements in Mongolia. Sewage disposal from the Central Waste Treatment Facilities are the main source of water pollution. The Central Waste Treatment Facilities of Ulaanbaatar are the main source of pollution of the Tuul river. The Central Waste Treatment Facilities receive massive amounts of industrial effluents and lack the required technological capabilities for proper treatment of this waste. Repair and reconstruction of these objects are carried out annually. New waste treatment technologies are implemented.

Due to dilapidation of the utility system in Mongolia (over 70 per cent wear and tear) the number of emergencies over the last 10 years increased.

In the sewage water of other waste treatment facilities at the airport, Nailakh settlement, Songino settlement, Songino biofactory the concentration of water pollutants rarely exceeds the sewage water normative standard MNS4349-2011. The content of sewage waters discharged in the river Tuul.

The main pollutant and the cause of deteriorating quality of the water of the river Khangal are considered to be sewage waters from the waste treatment facilities of the Erdenet Ore-Dressing and Processing Enterprise and waste treatment facilities of the city of Erdenet and Erdenet industrial hub. The water pollution level in the Khangal was very high until 2004.

Concentrations of biogeneous and easily oxidable organic substances annually exceeded norms in 50-100 per cent of samples, the content of ammonium and nitrites exceeded 10 MPCs, which resulted from the discharge of sewage waters in the Khangal from the waste treatment facilities of the ore-dressing and processing enterprise. Beginning in 2004 the enterprise ceased the discharge of sewage waters into the Khangal river, which resulted in an improvement of river water quality and a decrease of nitrogen and easily oxidable organic substances. Water in the Khangal river at a point below the city of Erdenet is characterized as “clean”, of the 2nd quality category. The pollution index value in the recent period from 2005 to 2012 equals 0.68-1.86.

Large industrial centers in the Mongolian part of the Selenga river basin are also situated in the city of Darkhan. The municipal waste treatment facilities of Darkhan discharge sewage waters into the Kharaa river. Pollutants get to the municipal waste treatment facilities from the waste treatment facilities of metallurgical and other plants. The content of pollutants in the discharged sewage waters from the central waste treatment facilities of Darkhan almost does not exceed the normative standard MNS4349-2011.

Easily oxidable organic substances and biogeneous substances get into the Kharaa river as a result of a surface washoff during high water period and floods. In this connection excess of water quality normative standard MNS4586-1998 is observed 1-2 times a year. The water of the Kharaa in Darkhan is characterized as “clean” belonging to the 2nd quality category and the pollution index value in the recent period from 2005-2012 is 0.34-0.50.

APPENDICES

Table 2. The Characteristics of pollution sources affecting the quality of surface waters in the basin of the Tuul river as of 2009

Water body, point, category, name of section	Sources of pollution	Capacity of waste treatment facilities /annual average /	Capacity of waste treatment facilities				Pollutants discharge alongside sewage waters mg/l				
			Highest	Month	Lowest	Month	Suspended substances	BOD_5	ПО	Σ nitrogen	Phosphorus
River Tuul, Songino settlement, 3rd category, 15 km down the river from the city.	Ulaanbaataar. Tolgoit Central waste treatment facilities	60	93	III	30	VIII	58.0	160	32.8	24.83	1.846
River Tuul, Songino settlement, 3rd category, 0.2 km down the river from the the settlement	Waste treatment facilities of Songino biofactory	52	85	IX	8.8	II	18.0	43.0	9.9	18.68	1.240
River Tuul, Songino settlement, 3rd category, 0.2 km down the river from the	Waste treatment facilities of Songino settlement	62	87	III	30	XI	22.5	23.0	4.8	2.09	1.017

settlement											
River Tuul, Songino settlement, 3rd category, 10 km down the river from the city	Waste treatment facilities of airport	76	92	III	49	VIII	174	89.7	10.9	19.32	2.052
River Tuul, Nalaikh settlement 3rd category, 45 km up the river from the city.	Waste treatment facilities at Nalaikh settlement	66	93	VIII	36	X	32.0	49.5	10.5	21.29	1.515

Table 3. The Characteristics of pollution sources affecting the quality of surface waters in the basin of the Kharaa river as of 2009

Water body, point, category, name of	Sources of pollution	Number of observations	Capacity of waste treatment facilities /annual	Capacity of waste treatment facilities %	Pollutants discharge alongside sewage waters mg/l

section			average / %	Highest	Month	Lowest	Month	Suspended substances	BOD_5	ПО	Σ nitrogen	Phosphorus	Chlorides	Sulphates	Chrome VI
River Kharaa, city of Darkhan, 3rd category, 2,5 km down the river from the city	City of Darkhan. Central waste treatment facilities	12	86	94.5	I	66.7	X	71.0	7.7	7.9	12.80	1.436	38.3	36.6	0.014
City's central collecting header	City of Darkhan. Waste treatment facilities of the skinnery	3	48	50.0	I	45.6	X	148	83.0	100	6.30	1.479	106	140	0.537
City's central collecting header	City of Darkhan, waste treatment facilities of the smelter	4	66	83.3	IV	56.2	IX	85.0	8.3	5.9	2.20	0.085	41.3	61.4	0.036
City's central collecting header	City of Darkhan. Waste treatment facilities of Sharyn gol settlement.	4	65	78.6	V	50.0	IX	60.9	13.0	9.7	14.70	1.010	39.2	64.8	0.018
City's central collecting	City of Darkhan. Waste treatment facilities of	3	64	73.0	XI	54.0	IX	85.2	9.4	10.8	9.90	1.622	39.0	74.9	0.015

header	Salkhit settlement.														

Table 4. Pollution sources affecting quality of surface waters in the basin of the river Khangal as of 2009

Water body, point, category, name of section	Sources of pollution	Number of observations	Capacity of waste treatment facilities /annual average / %	Capacity of waste treatment facilities %				Pollutants discharge alongside sewage waters mg/l							
				Highest	Month	Lowest	Month	Suspended substances	BOD_5	ПО	Σnitrogen	Phosphorus	Chlorides	Sulphates	Chrome VI
River Khangal, city of Erdenet, 3rd category, 0.5 km down the river from the city	City of Erdenet, waste treatment facilities of the ore dressing and processing plant	12	81	92.5	II	51.0	VIII	28.1	8.9	8.9	13.52	0.443	25.3	56.8	0.007

River Khangal, Zhargalant village, 3rd category, 25 km down the river from the city.	City of Erdenet, waste treatment facilities at Ulaan tolgoi.	10	56	71.2	IV	33.3	XII	<u>184</u>	<u>29.0</u>	15.5	<u>20.20</u>	0.500	22.8	83.6	0.022