Final report – Harmonized water quality monitoring program (ENG)

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Preparers: Federal State Budgetary Institution "Hydrochemical Institute" (FSBI "HI") and Federal State Budgetary Institution "Buryat Center of Hydrometeorology and Monitoring of Environment"

THE HARMONIZED WATER QUALITY MONITORING PROGRAM IN THE SELENGA RIVER BASIN

Preparers: Mongolian Institute of Meteorology and Hydrology; Central Laboratory of Environment of Mongolia

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Table of Contents

1. Background information

The basin of Lake Baikal is one of the most outstanding ecosystems previously untouched by any significant impacts of economic activity. Preservation and maintaining of the natural condition of the Selenga river ecosystem (a part of Lake Baikal's ecosystem) serve not only the national interests of the Russian Federation and Mongolia, but the entire world community.

The surface waters condition and pollution monitoring system in the territory of Russia and Mongolia should be orientated towards strengthening of transboundary cooperation, acquisition of universal and commeasurable information. Alongside with the information on the condition of other environmental media it will serve as a basis for the support of executive decision making for the integrated water resource management in the basins of Lake Baikal and Lake Khubsugul to provide sustainable functioning and protection of the unique ecosystems under the conditions of economic development of the states concerned.

The harmonized water quality monitoring program in the Selenga river basin is aimed at the drawing together of the monitoring systems in Russia and Mongolia, exposure and fixing of discrepancies and disagreements in the course of its organization and maintenance.

The harmonization principles of the surface waters condition and pollution monitoring reside in:

- the systematic character of observations;
- coherence of their schedule and the characteristic phases of the hydrological regime of water bodies;
- water examination by universal or commeasurable methods;
- formation of an observation program based on a universal scheme, which includes the mandatory data for all observation sites and characteristic of waters on a given site. These definable data should be determined on the basis of information about wastewater composition in the observation site area and preliminary examination of a water body;
- the use of certified, sensitive and selective measurement methodologies;
- maintaining of a constant internal measurement quality control and recurrent outside control (interlaboratory comparative testing of water composition measurement methodologies).

The use of the aforementioned principles by all Russian and Mongolian participants of the monitoring in their work will allow obtaining of reliable and commeasurable information for monitoring and assessment of the condition of the transboundary water objects.

2. Monitoring systems in the Selenga river basin in the territories of Russia and Mongolia

Nowadays state-maintained monitoring of the condition and pollution of the ground surface waters (GSW) in the Selenga river basin in the territory of Russia is carried out on 26 monitoring observation sites (5 on the river and 16 on its

tributaries), which Russia suggests to include into the Harmonized Water Quality Monitoring Program in the basin.

The detailed characteristics of the provisions is given in Annex A.

Programs of pollution content monitoring on the Russian national monitoring network sites (NMN) on the Selenga river and its tributaries include the list of 34-43 indices presented in Annex B.

In accordance with the authorized categories, on-site observations should be carried out on certain types of programs within the time frame of water sampling.

At present the sampling frequency requirement is violated due to the climatic conditions (for example, through freezing of rivers at cripples), or because of absence of watercraft, or funds for their purchase or rental, and shortage of funds for the purchase of fuel, oil and lubricants. Another reason is the remoteness of some sites from the laboratories where samples are analyzed, shortage of professional chemists and observers on sites, etc.).

Besides the pollutants some mandatory indices are measured on the monitoring points. They are **water temperature, pH value, suspended solids, color of water, transparency, odor, dissolved oxygen, carbon dioxide, silicium, calcium ions, sulphate, chloride and hydrocarbonate ions and water hardness. The following indices are determined by calculation: dissolved oxygen saturation percentage, sum of ions, sodium and potassium ion sum, mineral nitrogen sum, magnesium ion concentration.**

Out of 26 monitoring points controlled waste water disposal exists only on 6 sites (see Annex A). The main polluters in these areas are the enterprises of the housing and utility services and shipping (the Selenga river, Ulan-Ude), mining and drainage waters of the defunct Dzhida tungsten and molybdenum plant (the Modonkul' river, Zakamensk), Central Heating and Power Plant (CHPP) and aircraft plant (the Uda river, Ulan-Ude). In other areas without controlled waste water disposal the main pollution is a result of unauthorized disposal and land runoff from the adjacent territories. In the recent 10 years there were no cases of gross and extremely gross pollution on the monitoring points.

A subsystem of monitoring of the transboundary surface waters includes both the monitoring observation of the state monitoring system of the Federal Service of Russia on Hydrometeorology and Monitoring of the Environment (RHM) on the Selenga river and its tributaries Chikoi, Menza and Kiran and the sites on the left bank tributaries of the Selenga, the Zheltura and Kyakhtinka rivers. The works there are carried out in accordance with the agreement between the governments of the Russian Federation and Mongolia on the protection and use of transboundary waters signed on 11 February 1995.

The transboundary water bodies' quality monitoring in the Mongolian territory is carried out in 13 sites agreed upon earlier. Additionally there are 6 stations in the Selenga river basin. Chemical analysis of the transboundary waters is conducted in cooperation with the Central Laboratory on Environment and Weights and Measures (CLEWM) in 5 more regional laboratories.

There is no monitoring of hydrochemical indices on the rivers Menza and Chikoi in Mongolia. In 2011 the Mongolian side conducted a single sampling and analysis of water on the river Kiran.

At their end, Mongolia conducts monitoring on the transboundary sites on the rivers Selenga, Zheltura and Kyakhtinka.

The characteristics of the transboundary sites, proposed for the inclusion into the Harmonized Monitoring Program in addition to the sites of the monitoring observation of the RHM (see Annex A) in the Selenga river basin by the Russian and Mongolian parties is presented in Tab. 1.

Table 1. Transboundary monitoring points in the territories of Russia and Mongolia

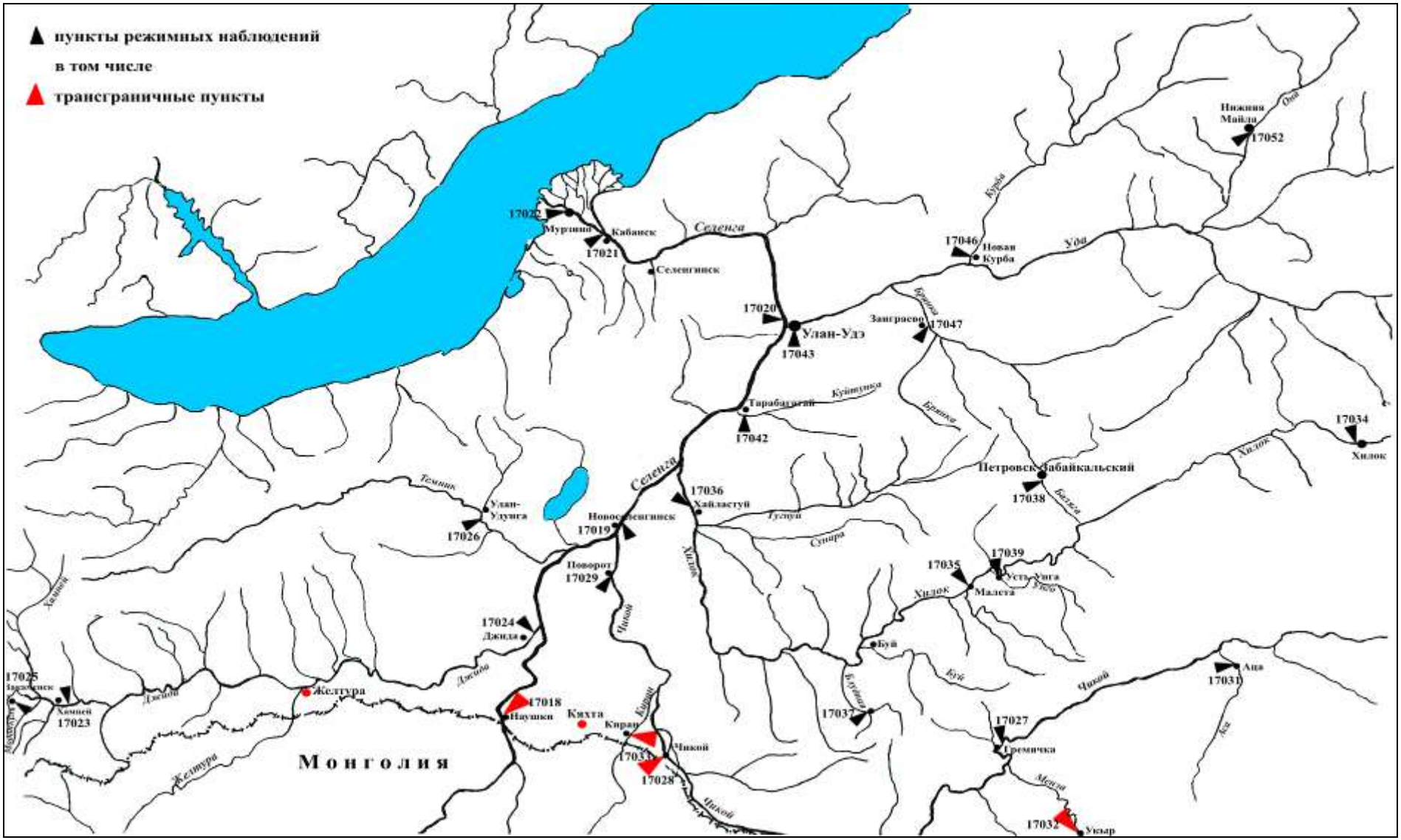
State	Monitoring point	Cross section	Year of opening of a monitoring point	Distance from the cross section to the border in km	Distance from a gauging station (GS)	Periodicity of observations, samples per year
Russia	The Selenga river, Naushki settlement	1.5 km west-southwest from the settlement, stream gauging	1970	0.1	In the cross section GS-1, Naushki	7.9
Mongolia	The Selenga (Selenge) river, town of Sukhe-Bator	7 km northwest of Sukhe-Bator		0.05		12
Russia	The Kyakhtinka river, town of Kyakhta*	On the southern outskirts of Kyakhta	1999	0.1	GS is missing	4
Mongolia	The Kyakhtinka (Khiagt) river, town of Altanbulag	On the western margins of the Mongolian-Russian border crossing point in Altanbulag		0.05		6
Russia	The Zheltura river, Zheltura	Zheltura village	2000	15	In the cross section GS	4

State	Monitoring point	Cross section	Year of opening of a monitoring point	Distance from the cross section to the border in km	Distance from a gauging station (GS)	Periodicity of observations, samples per year
	village					
Mongolia	The Zheltura (Zelter) river	On the northeastern outskirts of Zelter sum		0		4
Russia	The Chikoi river, Chikoi village	2 km east of the village, stream gauging	1968	3.0 on the straight to the state border	In the cross section GS-2, the Chikoi tannery	8.7
Russia	The Kiran river, Kiran village	3 km from the state border, 17.5 upstream from GS	1964	3.0	17.5 upstream from GS-1, Ust'-Kiran	4
Russia	The Menza river, Ukyr village	0.4 km upstream from the village, stream gauging	1986	30.0	In the cross section GS-2, Ukyr	5
* - the point is not included into the network of the national monitoring points						

Except for the monitoring point on the river Kyakhtinka where the controlled waste water disposal of Kyakhta-3 town is carried out, on all above-listed points there is no controlled waste water disposal. Water pollution here may be a result of pollution influx from the surface runoff, unauthorized discharges of household waste waters, accidental pollution, cross-border transfer of pollutants and so on.

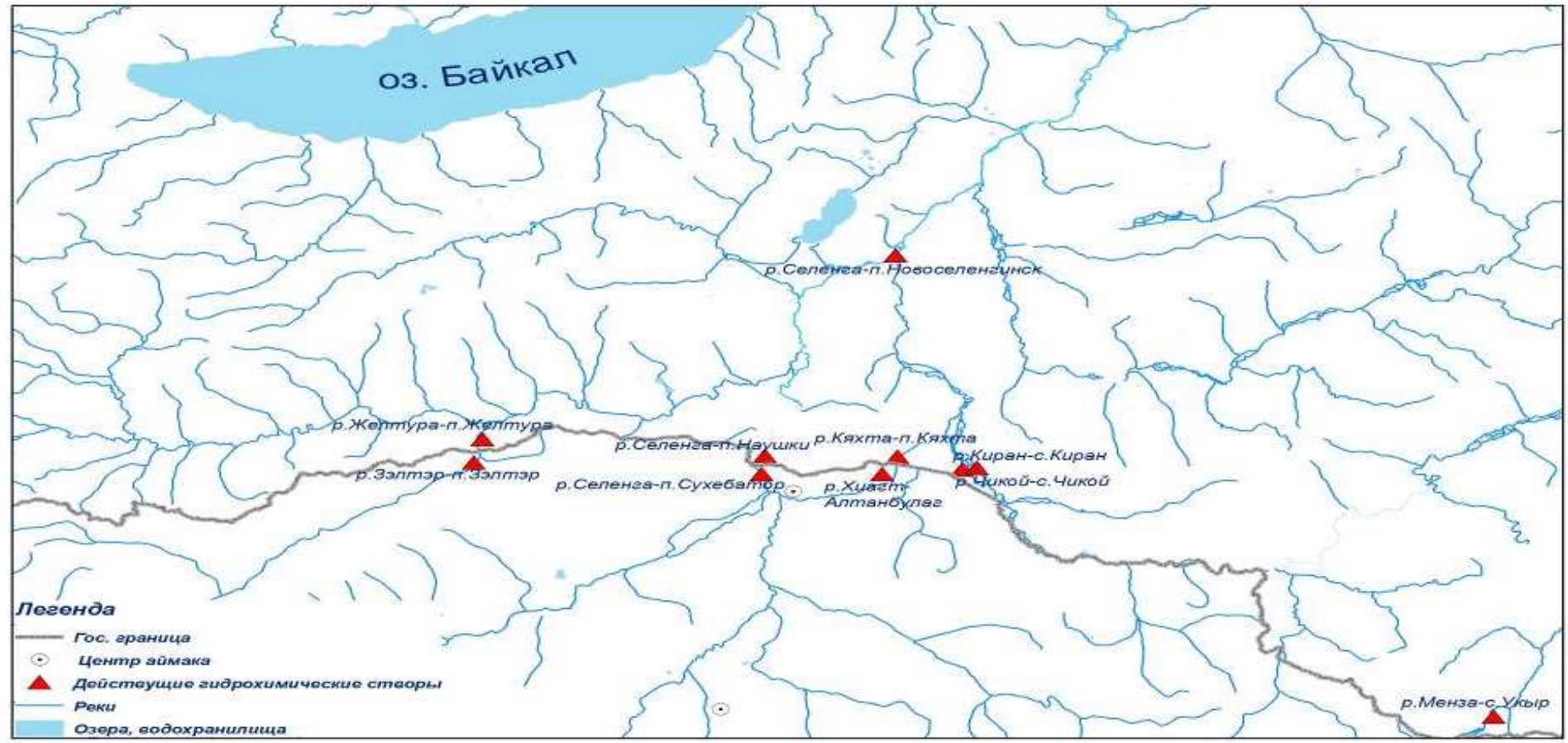
Fig. 1 shows the location diagram of all monitoring points in the Selenga river basin in the territory of the Russian Federation.

Fig. 2 shows the location diagram of the transboundary monitoring points in the Selenga river basin in the territory of Russia and Mongolia.



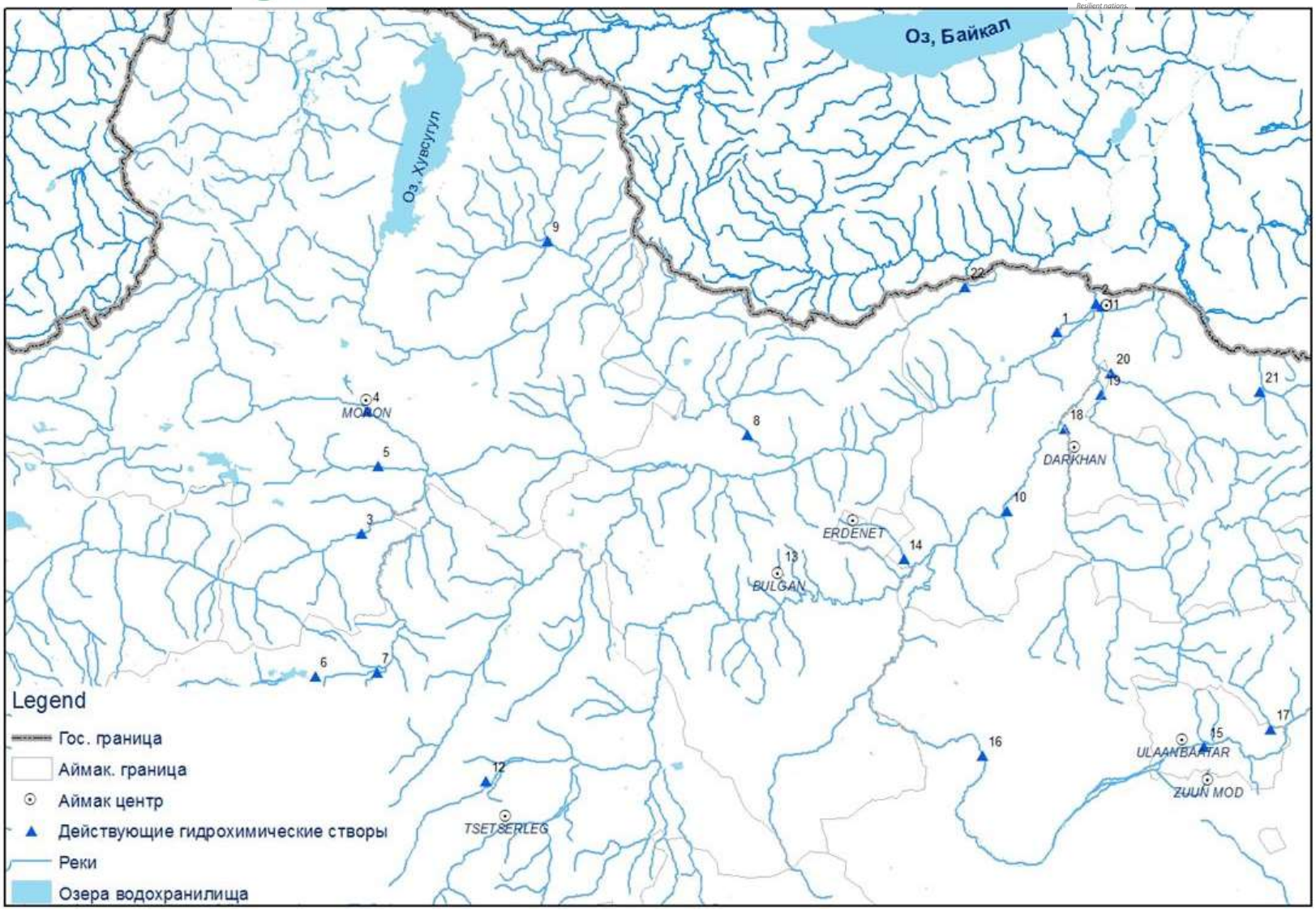
Legend: black triangle – monitoring observation points, including (red triangle) transboundary points

Figure 1. Location diagram of the monitoring points in the Selenga river basin in the territory of the Russian Federation.



Legend:
-State border; -Aimag center; -Functioning hydrochemical cross sections; -Rivers; -Lakes, reservoirs

Figure 2. Location diagram of the monitoring points in the Selenga river basin



Legend:
State border; Aimag border; Aimag center; Functioning hydrochemical cross sections; Rivers; Lakes, reservoirs

Figure 3. Location scheme of the monitoring points in the Selenga river basin in the Mongolian territory

3. Suggestions to harmonize monitoring programs in the Selenga river basin

Harmonization of the monitoring programs in Russia and Mongolia should be carried out according to:

1. Periodicity of observations:
2. Analysis methodologies used, regulating the requirements for sampling and preliminary preparation of water samples for analysis, time of their delivery to a laboratory, time and conditions of their storage;
3. List of determined indices;
4. Quality control of the analytical measurements.

As it follows from Tab. 1 the periodicity of sampling in Russia and Mongolia are somehow different.

Regarding the periodicity of observations we recommend that in accordance with the transboundary surface waters monitoring points **it is reasonable to conduct monitoring of the typical pollutants from 9 to 12 times a year** on these points. In the period of the main phases of the hydrological regime of water courses the indices should be determined in accordance with the full list.

Annex B presents lists of indices determined in the water samples and the analysis methodologies used:

- in Russia and Mongolia on commeasurable methodologies, which do not require any further harmonization (Tab. B. 1);

- by the Russian and Mongolian sides using the non-commeasurable analysis methodologies and in need of harmonization;

- indices, currently determined by the Russian side alone with the indication of the analysis methodologies used, which are proposed for implementation by the Mongolian side to expand the list of indices in the course of implementation of the Harmonized Monitoring Program (Tab. B.3).

For the expansion of the indices list during the implementation of the Harmonized Monitoring Program in the Selenga river basin the Mongolian side needs the following devices:

1. Membrane filter with pore diameter of 0.45 μm
2. Systems of microwave treatment of samples
3. Atomic absorption spectrophotometer with electrothermal and flame atomization
4. Mercury analyzer based on the method of atomic absorption of cool vapor
5. Gas chromatograph for the testing for organochlorine pesticides and other organic substances

Based on the detailed tables of Annex B a consolidated list of indices proposed for the inclusion into the Harmonized Monitoring Program of the Selenga river basin was prepared (Tab. 2).

Nowadays only the Russian side determines magnesium, aluminum, total chrome, total phosphorus, anionic synthetic surface active agents, alpha- and gamma HCH and 4.4'-dichlorodiphenyltrichlorethane. These indices are also

proposed for inclusion into the Harmonized Monitoring Program of the Selenga river basin.

The results of determining 15 indices by commeasurable methodologies (Tab. 2) may currently be used by both sides for the assessment of pollution of the Selenga river basin. For the 15 indices determined by non-commeasurable methodologies as well as 8 indices, whose monitoring is not carried out in Mongolia, new methodologies and devices should be introduced by the Mongolian side according to the action plan in part 5.

Table 2. The consolidated list of indices for the inclusion into the Harmonized Monitoring Program of the Selenga river basin.

List of indices determined by the Russian and Mongolian sides using commeasurable methodologies that do not require harmonization			List of indices determined by the Russian and Mongolian sides using non-commeasurable methodologies requiring harmonization	
No.	Name of an indicator	Note	No.	Name of an indicator
1	Temperature		1	Chlorides
2	Specific conductance		2	Hydrocarbonates
3	pH value		3	Ammonium nitrogen
4	Suspended solids		4	Total dissolved iron
5	Dissolved oxygen		5	COD
6	Sulphates		6	Petrochemicals
7	Calcium		7	Chrome (VI)
8	Magnesium	Limited commeasurability (at hardness over 0.5 mM/cubic dm^1	8	Zinc
9	Hardness		9	Cadmium
10	Sodium and potassium ion sum		10	Nickel
11	Nitrate nitrogen	Limited commeasurability (at nitrate nitrogen concentration of over 0.5 Ограничено сопоставимы (при концентрации азота нитратного более 0,5 mg/cubic dm)	11	Lead
12	Nitrite nitrogen		12	Copper
13	Phosphates (expressed as phosphorus)		13	Cobalt
14	Silicium		14	Mercury

15	$БПК_5$	Limited commeasurability (comparison is possible during the analysis of polluted waters)	15	Fluorides

[1] - mol/cubic decimeter AEC – amount of equivalent substance or milliequivalent/cubic decimeter

In such a way 11 indices presented on the left side of Table 2, particularly **temperature, specific conductance, pH value, suspended solids, dissolved oxygen, sulphates, calcium, sodium and potassium ion sum, nitrite nitrogen and phosphates expressed as phosphorus** do not require further intercalibration and may now be included into the Harmonized Monitoring Program.

Four more indicators: **magnesium, hardness, nitrate nitrogen and BOD in 5 days** may be used under limited conditions, first of all, in the course of polluted waters analysis.

For the harmonization of the rest of indicators carrying out of joint measures listed in the action plan is required.

After the implementation of the Action Plan in 28 observation points in Russia and 6 observation points in Mongolia the testing of 38 indicators will be carried out through the commeasurable methodologies that provide the acquisition of reliable information about the Selenga river basin water quality.

The harmonization of the monitoring program should be started with the implementation of new, more sensitive and selective certified testing methodologies for detection of **ammonium nitrogen, nitrites, total iron, chlorides (2013), nitrates, COD, petrochemicals, anionic synthetic surface active agents (2014), heavy metals (2015), organochlorine pesticides (2016).**

In the connection with the growing economic potential of mining and tourism and recreation industries in Lake Baikal and Lake Khubsugul basins, in case new industrial facilities or mines are launched, it will be necessary to consider expansion of the monitoring programs. This especially concerns the inclusion of testing for dangerous contaminants in water bodies in these programs.

Methodologies developed in the Hydrochemical Institute under the label RD 52.24 and proposed for the implementation during the monitoring of the transboundary water bodies may be passed over to the specialists from Mongolian hydrochemical laboratories free of charge.

4. Quality control of analytical measurements

In order to provide the system of quality control of the analytical measurements and increase the reliability of results in the water pollution monitoring laboratories of Russia and Mongolia the approaches towards creation and implementation of quality control systems should be similar.

The proposed system of information quality guarantees and control is provided due to:

- correct selection of priority indicators of water composition entitled to testing;

- selection of a representative water sample;

- adherence to specifications of sample preparation and analysis specified by measurement methodologies, executed according to GOST (national standard) 8.563 or in accordance with other regulatory documents;

- use of **certified** measurement procedure (MP) of the composition of water;

- **internal measurement quality control**, including sampling selection quality, operative control of the analysis procedure and analysis results stability control (assessment of the total aggregate of the analysis results during a controlled period);

- participation in the inter-laboratory comparative testing of measurement procedure (external measurement quality control).

The control of compatibility of analysis results obtained by the Russian and Mongolian laboratories should be carried out by:

- organizing of joint water sampling and their analysis by methods used by each side followed by a comparison of obtained results with due regard to measurement errors;

- carrying out of a special experiment – dissemination of control samples prepared in Russia by the Hydrochemical Institute for the external control of measurements.

5. Action plan for the implementation of the Harmonized Water Quality Monitoring Program in the Selenga river basin

For the implementation of the Harmonized Monitoring Program in the Selenga river basin in Mongolia and Russia the following Action Plan was worked out.

Table 3: Action plan of the Harmonized Water Quality Monitoring Program in the Selenga river basin

No	Name of event	Providers	Completion schedule
Events of 2013*			
1	Carrying out of inter-laboratory comparative tests (ILCT) initiated by the Hydrochemical Institute and coordinated with the Mongolian side: - preparation and distribution among the laboratories of control samples containing copper, lead and zinc ions due to periodical excess of the MPC for these chemical elements in the transboundary monitoring cross section.	Federal State Budgetary Institution "State Hydrochemical Institute" – coordinator of activities; Federal State Budgetary Institution "Zabaikal'skaya Territorial Administration for Hydrometeorology"	May-June 2013

No	Name of event	Providers	Completion schedule
		and Central Laboratory on Environment and Weights and Measures of Mongolia	
2	Carrying out of control samples' analysis and submission of the results to the coordinator Federal State Budgetary Institution "State Hydrochemical Institute" for the processing of data obtained.	Federal State Budgetary Institution "Zabaikal'skaya Territorial Administration for Hydrometeorology, Central Laboratory on Environment and Weights and Measures of Mongolia and Federal State Budgetary Institution "State Hydrochemical Institute"	July-August 2013
3	Processing of the analysis results of the control samples for the inter-laboratory comparative tests obtained in the laboratories of Russia and Mongolia and their submission to the providers	Federal State Budgetary Institution "State Hydrochemical Institute"	September 2013
4	Sampling of water in 2013 in the agreed-upon cross-sections for carrying out of the inter-laboratory comparative tests based on the divided water samples taken from the transboundary water bodies of Russia and Mongolia	Federal State Budgetary Institution "Zabaikal'skaya Territorial Administration for Hydrometeorology " and Central Laboratory on Environment and Weights and Measures of Mongolia and Institute of Hydrometeorology and Environment of Mongolia	Agreed upon at the meeting of the joint workgroup

No	Name of event	Providers	Completion schedule
5	Organization and carrying out of an internship of the specialists from the Central Laboratory on Environment and Weights and Measures (CLEWM) of Mongolia (2 persons) on the methodology issues of the surface water analysis and measurement quality control in order to introduce more selective and sensitive methods of the detection of ammonium, iron, chloride, nitrate, COD, petrochemicals and anionic synthetic surface active agents developed by the Federal State Budgetary Institution "State Hydrochemical Institute" and compliant to the international standards for the harmonization of methodological support.	Federal State Budgetary Institution "State Hydrochemical Institute" and Central Laboratory on Environment and Weights and Measures of Mongolia	June-July 2013, Rostov-on-Don
6	Introduction by the Mongolian side of new testing methodologies for nitrite, ammonium nitrogen, chlorides and iron detection.	Central Laboratory on Environment and Weights and Measures of Mongolia ЦЛОСМ Монголии	Сентябрь-October 2013
7	Wrapping up of the 2013 activities and making a decision about further cooperation.	Federal State Budgetary Institution "State Hydrochemical Institute," Federal State Budgetary Institution "Zabaikal'skaya Territorial Administration for Hydrometeorology" and Central Laboratory on Environment and Weights and Measures of Mongolia and Institute of Hydrometeorology and Environment of Mongolia	November 2013, Ulan-Ude
Events of 2014*			
8	Introduction by the Mongolian side of the new testing methodologies for the detection of COD,	Central Laboratory on Environment	January-March 2014

No	Name of event	Providers	Completion schedule
	nitrates, petrochemicals and anionic synthetic surface active agents	and Weights and Measures of Mongolia	
9	Delivery of the atomic absorption spectrophotometer with electrothermal and flame atomization to the Central Laboratory on Environment and Weights and Measures of Mongolia and Federal State Budgetary Institution "Zabaikal'skaya Territorial Administration for Hydrometeorology	With financial support from UNOPS With financial support from Rosgidromet	2013-2014
10	Delivery of the system of microwave treatment of water samples and benthic deposits for the detection of total metals to the Central Laboratory on Environment and Weights and Measures of Mongolia and Federal State Budgetary Institution "Zabaikal'skaya Territorial Administration for Hydrometeorology	With financial support from UNOPS With financial support from Rosgidromet	2014
11	Introduction of the atomic absorption detection of the dissolved forms of metals (Ni, Cd, Pb, Cu, Co, Zn, Al) on the transboundary points (within 6 months from the delivery of the atomic absorption spectrophotometer with electrothermal atomization).	Federal State Budgetary Institution "Zabaikal'skaya Territorial Administration for Hydrometeorology " and Central Laboratory on Environment and Weights and Measures of Mongolia	2014
12	Carrying out of the inter-laboratory comparative tests proposed by the Federal State Budgetary Institution "State Hydrochemical Institute" and coordination with the Mongolian side on: - Control solutions containing ammonium nitrogen, nitrate nitrogen, petrochemicals, COD.	Federal State Budgetary Institution "State Hydrochemical Institute" – coordinator of activities; Federal State Budgetary Institution "Zabaikal'skaya Territorial Administration for Hydrometeorology" and Central Laboratory on Environment and	May-June 2014

No	Name of event	Providers	Completion schedule
		Weights and Measures of Mongolia	
	Events of 2015*		
13	Implementation of the atomic absorption detection of suspended forms of metals or total metals (Ni, Cd, Pb, Cu, Co, Zn, Al) on the transboundary points (within 6 months from the delivery of the system of microwave treatment of samples) and in benthic deposits.	Federal State Budgetary Institution "Zabaikal'skaya Territorial Administration for Hydrometeorology " and Central Laboratory on Environment and Weights and Measures of Mongolia	2015
14	Carrying out of the inter-laboratory comparative tests (ILCT) proposed by the Federal State Budgetary Institution "State Hydrochemical Institute" and agreed upon by the Mongolian side on: - control solutions containing Ni, Cd and Mn ions.	Federal State Budgetary Institution "State Hydrochemical Institute" – coordinator of activities; Federal State Budgetary Institution "Zabaikal'skaya Territorial Administration for Hydrometeorology" and Central Laboratory on Environment and Weights and Measures of Mongolia	May-June 2015
15	Purchase of a specialized highly sensitive mercury analyzer based on the method of atomic absorption of cool vapor for the Central Laboratory on Environment and Weights and Measures of Mongolia and Federal State Budgetary Institution "Zabaikal'skaya Territorial Administration for Hydrometeorology"	With financial support from UNOPS With financial support from Rosgidromet	2015
16	Introduction of mercury detection using the new	Federal State	2015

No	Name of event	Providers	Completion schedule
	mercury analyzer (within 6 months after the delivery) by both sides	Budgetary Institution "Zabaikal'skaya Territorial Administration for Hydrometeorology " and Central Laboratory on Environment and Weights and Measures of Mongolia	
17	Sampling of water in 2015 in the agreed-upon cross-sections for carrying out of the inter-laboratory comparative tests based on the divided water samples taken from the transboundary water bodies of Russia and Mongolia	Federal State Budgetary Institution "Zabaikal'skaya Territorial Administration for Hydrometeorology " and Central Laboratory on Environment and Weights and Measures of Mongolia	Agreed upon at the meeting of the joint workgroup
18	Wrapping up of the 2015 activities and making a decision about the results of the activities of the Harmonized Monitoring Program in the Selenga river basin and its development prospects	Federal State Budgetary Institution "State Hydrochemical Institute," Federal State Budgetary Institution "Zabaikal'skaya Territorial Administration for Hydrometeorology " and Central Laboratory on Environment and Weights and Measures of Mongolia and Institute of Hydrometeorology and Environment of Mongolia	October – November 2015, Ulan-Ude

No	Name of event	Providers	Completion schedule
	Events of 2016*		
19	Delivery of the gas chromatograph for the testing for organochlorine pesticides and other organic substances in the Central Laboratory on Environment and Weights and Measures of Mongolia and Federal State Budgetary Institution "Zabaikal'skaya Territorial Administration for Hydrometeorology"	With financial support from UNOPS With financial support from Rosgidromet	2016
20	Introduction of the methodology for the detection of organochlorine pesticides	Institute of Hydrometeorology and Environment of Mongolia	2016
21	Sampling of water in 2016 in the agreed-upon cross-sections for carrying out of the inter-laboratory comparative tests based on the divided water samples taken from the transboundary water bodies of Russia and Mongolia	Federal State Budgetary Institution "Zabaikal'skaya Territorial Administration for Hydrometeorology" and Central Laboratory on Environment and Weights and Measures of Mongolia	Agreed upon at the meeting of the joint workgroup
22	Carrying out of the inter-laboratory comparative tests (ILCT) proposed by the Federal State Budgetary Institution "State Hydrochemical Institute" and agreed upon by the Mongolian side on: - control solutions containing mercury and aluminum ions	Federal State Budgetary Institution "State Hydrochemical Institute" – coordinator of activities; Federal State Budgetary Institution "Zabaikal'skaya Territorial Administration for Hydrometeorology" and Central Laboratory on Environment and Weights and Measures of Mongolia	Май-июнь 2016 г.

No	Name of event	Providers	Completion schedule
23	Wrapping up of the 2016 activities and making a decision about the results of the activities of the Harmonized Monitoring Program in the Selenga river basin and its development prospects	Federal State Budgetary Institution "State Hydrochemical Institute," Federal State Budgetary Institution "Zabaikal'skaya Territorial Administration for Hydrometeorology " and Central Laboratory on Environment and Weights and Measures of Mongolia and Institute of Hydrometeorology and Environment of Mongolia	October-November 2016, Ulan-Ude
*) Funding issues for the implementation of the Action Plan will be discussed in UNOPS			

Annex A

Table A.1: The characteristics of the functioning monitoring points of the National Monitoring System of the pollution of the Selenga River and its tributaries in the Russian territory.

No. subpt	Monitoring point and its number in the Administration for Hydrometeorological Monitoring	Monitoring cross section location	Point category	Year of point launch	Location of verticals, sections of river breadth from the left bank	Coordinate number of vertical	Distance from the estuary, km	Statement of purpose of the monitoring point launch
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1	The Selenga river, Naushki settlement, 17018	1.5 km west-southwest from the settlement, stream gauging	3	1970	0.5	502010600	402.0	Acquisition of information about river water quality in the area of state border with Mongolia
2	The Selenga river, p. Селенга, Novoselenginsk settlement, 17019	1.6 km downstream from the settlement, stream gauging	3	1970	0.1	510010630	273.0	Acquisition of information about large category river water quality near a settlement
3	The Selenga river, Ulan-Ude, 17020	**1.** 2 km upstream from Ulan-Ude. **2**. 1km downstream from the city, 0.5 km downstream from the waste water disposal of the city waste treatment facilities. **3**.22.5 km downstream from the city, stream gauging	2	1967	0.5 0.5 0.5	515110731 515010732 520010720	163.0 148.5 127.0	Acquisition of information about large category river water quality near a settlement with controlled waste water disposal and in the breeding and wintering area of commercially valuable fish
4	The Selenga river, village of Kabansk, 17021	1. 23.5 km upstream from the village, 3 km upstream from waste water disposal of the municipal waste treatment facility of the	2	1968	0.5 0.5	520010640 520010641	67.0 63.2	Acquisition of information about river water quality near a settlement with controlled waste water disposal. Special monitoring: in the chemical substances suffusion monitoring

		settlement of Selenginsk. 2. 19.7 km upstream from the village 0.8 km downstream from waste water disposal of the Selenginsk municipal waste treatment facility 3. 0.5 km downstream from the village, stream gauging			0.5	520010642	43.0	subsystem and in the national subsystem of GTOS/water.

Annex 1 cont-d

1	2	3	4	5	6	7	8	9
5	The Selenga river, village of Murzino, 17022	0.4 km downstream from the village, stream gauging	3	1970	0.3	521010620	25.0	Acquisition of information about the water quality on the main-stream station of the main tributary of Lake Baikal
6	The Dzhida river, village of Khamnei, 17023	4 km upstream from the village, stream gauging	4	1970	0.5	502010350	318.0	Acquisition of information about a medium category river water quality. Special monitoring: on the background monitoring point and in the national subsystem of GTOS/water
7	The Dzhida river, Dzhida railway station, 17024	3.5 km south-southwest from the railway station, stream gauging	4	1963	0.1	503010600	21.0	Acquisition of information about water quality on the main-stream station of a medium category river
8	The Modonkul' river, town of Zakamensk, 17025	**1**. 2 km upstream from the town, stream gauging **2**. 1.3 km downstream from the town	4	1976	0.5 0.5	502010310 502010311	1.0 1.0	Acquisition of information about river water quality near a settlement with controlled waste water disposal.
9	The Temnik river, ulus Ulan-Udunga,17026	1 km southwest from the ulus, stream gauging	4	1974	0.1	510010550	59.0	Background monitoring point for the acquisition of information about a medium category river water quality.
10	The Chikoi river, village of	0.2 km downstream from the village, stream gauging	4	1962	0.5	501010830	385.0	Acquisition of information about the water quality of a medium category

	Gremyachka, 17027							water course in the breeding and wintering area of commercially valuable fish
11	The Chikoi river, village of Chikoi, 17028	2 km east of the village, stream gauging	3	1968	0.1	501010650	130.0	Acquisition of information about the water quality of a medium category river in the area near the state border with Mongolia

Annex 1 cont-d

1	2	3	4	5	6	7	8	9
12	The Chikoi river, Povorot village, 17029	0.5 km upstream from the village, stream gauging	3	1969	0.5	505010630	22.0	Acquisition of information about river water quality on the main-stream station of a medium category river
13	The Asa river, Atsa village, 17031	4 km upstream from the village, stream gauging	4	1963	0.5	502010930	17.0	Acquisition of information about river water quality on the background monitoring point
14	The Mensa river, village of Ukyr, 17032	0.4 km upstream from the village, stream gauging	4	1986	0.5	492010850	182.0	Acquisition of information about river water quality at the crossing of the state boundary with Mongolia by the river
15	The Kiran river, village of Kiran, 17033	3 km from the state border, 17.5 km upstream from the GS	4	1964	0.5	52010641	20.0	Acquisition of information about river water quality at the crossing of the state boundary with Mongolia by the river
16	The Khilok river, town of Khilok, 17034	**1.** 0.2 km upstream from the town, 0.8 km upstream from the stream gauging **2.** 0.2 km downstream from the town, 3.5 km downstream from waste water disposal of the waste treatment facility of Khilok railway station	3	1965	0.5 0.5	512011020 512011021	522.8 517.0	Acquisition of information about river water quality near a settlement with controlled waste water disposal.
17	The Khilok river, village of Maleta, 17035	0.5 km upstream from the village, 0.5 km upstream from the stream gauging	4	1960	0.5	505010820	250.5	Acquisition of information about the water quality of a medium category river in the middle reaches

18	The Khilok river, Khailastui hunters' lodge, 17036	At the level of the hunters' lodge, stream gauging	3	1963	0.5	511010650	22.0	Acquisition of information about river water quality on the main-stream station of a medium category river
19	The Bludnaya river, village of Engorok, 17037	0.5 km upstream from the village, 0.7 km upstream from GS	4	1973	0.5	505011020	95.7	Acquisition of information about river water quality on the background monitoring point

End of Annex 1

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
20	The Balyaga river, town of Petrovsk-Zabaikal'skii 17038	**1.** 0.5 km upstream from the town **2.** 0.5 km downstream from the town	3	1976	0.5 0.5	511010850 511010853	51.5 35.0	Acquisition of information about river water quality near a settlement with controlled waste water disposal.
21	The Ungo river, village of Ust'-Ungo, 17039	1.5 km upstream from the village, stream gauging	4	1964	0.5	505010830	8.2	Acquisition of information about the water quality in the estuary of a medium category water course
22	The Kuitunka river, village of Tarbagatai, 17042	0.2 km upstream from the village, stream gauging км выше села, гидроствор	4	1963	0.5	512010720	12.0	Acquisition of information about the water quality in the estuary area of a polluted tributary
23	The Uda river, Ulan-Ude, 17043	**1.** 1 km upstream from the city, 7.9 km upstream from GS **2.** Within the city limits, 3.6 km downstream from the GS	3	1965	0.8 0.8	515010734 515010735	13.0 1.5	Acquisition of information about the river water quality in the area of controlled industrial waste water disposal
24	The Ona river, village of Nizhnyaya Maila, 17052	Within the village limits, stream gauging	4	1988	0.8	523011000	66.0	Acquisition of information about the river water quality of a medium category river
25	The Kurba river, village of Novaya Kurba,	3 km upstream from the village, stream gauging	4	1964	0.1	520010830	4.7	Acquisition of information about the water quality of a medium category river on the main-stream station

	17046							
26	The Bryanka river, Zaigraevo railway station, 17047	0.2 km upstream from the railway station, stream gauging	4	1986	0.5	515010811	37.1	Acquisition of information about the water quality of a medium category river

Table A.2: The characteristics of the functioning water quality monitoring points on the Selenga River and its tributaries in the Mongolian territory

No. subpt	River, monitoring point and its number in the National Agency for Hydrometeorology, Hydrology and Environmental Monitoring of Mongolia	Monitoring cross section location	Year of point launch	Location of vertical from the bank, m	Coordinate number of vertical	Distance from the estuary, km	Statement of purpose of the monitoring point launch
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1	The Selenga river, Dzunburen point, 20321	1.5 km west-southwest from the settlement, stream gauging	1964	0.3	500610548	503	Control over river water quality near the settlement
2	The Selenga river, Sukhe-Bator point, 20322	11 km from the state border, stream gauging	1980	0.3	501510608	470	Control over river water quality in an area near the state border with Russia
3	The Ider river, Dzurkh point, 20108	0.8 km downstream from the settlement, stream gauging	1958	0.5	485610010	80	Control over river water quality near the settlement
4	The Delgermuren river, Muren point 20103	8 km south-southwest from the town of Muren, cross section 400 meters downstream from waste	1942	0.5	493510009	66	Control over river water quality near the settlement

		water disposal					
5	The Bugsii river, Tomurbulag point, 20105	1.5 km upstream from the settlement, stream gauging	1963	0.5	491810016	35	Control over river water quality near the settlement
6	The Suman river, Tariat point, 20958	Within the settlement boundaries	1962	0.5	48099953	48	Control over river water quality near the settlement
7	The Chuluut river, Undur-Ulaan point, 20959	0.2 km downstream from the concrete bridge, stream gauging	1961	0.5	481210021	72	Control over river water quality in the vicinity of the gauging station
8	The Eg-Gol river, Khantai point, 20217	0.2 km downstream from the settlement, stream gauging	1958	0.5	493310316	48	Control over river water quality near the settlement
9	The Uri river, Tsagaan-Uri point, 20107	2 km from the village, stream gauging	1962	0.5	503310134	64	Control over river water quality near the settlement
10	The Orkhon river, Orkhon bagh point, 20323	0.4 km upstream from the village, stream gauging	1970	0.5	490910523	223	Control over river water quality near the settlement
1	**2**	**3**	**5**	**6**	**7**	**8**	**9**
11	The Orkhon river, Sukhebaatar point, 20324	3 km from the state border	1973	0.5	501410611	25	Control over river water quality near the settlement
12	The Khoittamir river, Ikhtamir point, 20955	2 km downstream from the settlement, stream gauging	1959	0.5	473910117	136	Control over river water quality near the settlement
13	The Zuunturuu river, Bulgan point, 20219	Within the town limits of Bulgan	1991	0.8	485010333	20.5	Control over river water quality near the settlement
14	The Khangal river, Zhargalant point, 216101	6 km southwest downstream from the village	1997	0.5	485410433	32.8	Acquisition of information about the river water quality near a settlement with controlled waste water disposal
15	The Tuul river, Ulaanbaatar point, 20430	Within the city limits of Ulaanbaatar	1942	0.5	475310656	547	Acquisition of information about the river water quality near a settlement with controlled waste water disposal
16	The Tuul river, Lun point, 20433	0.5 km upstream from the town	1997	0.5	475110511	351	Control over river water quality near the settlement

17	The Terelzh river, Terelzh station, 20431	1.5 km upstream from the village, stream gauging	1969	0.8	475810728	14	Control over river water quality near the settlement
18	The Kharaa river, Darkhan point, 20743	1 km upstream from the city, 7.9. km upstream from GS	1989	0.5	493510552	12	Acquisition of information about the river water quality in the area with controlled industrial waste water disposal
19	The Sharyn Gol river, Zhims station, 20744	Within the village limits, stream gauging	1996	0.8	494610610	6	Control over river water quality near the settlement
20	The Iro river, Dulaankhaan point, 20328	Stream gauging	1981	0.5	495310615	5	Control over river water quality near the settlement
21	The Khuder river, Khuder point, 20326	3 km upstream from the village, stream gauging	1981	0.8	494610728	38	Control over river water quality near the settlement
22	The Zheltura river, Zheltura point, 203146	0.2 km upstream from GS, stream gauging	2003	0.8	502110503	15,6	Control over river water quality near the settlement

29

Annex B

Table B.1: Program of measurement of pollutant content on the National Monitoring System monitoring points on the Selenga river and its tributaries in the Russian territory in 2012

No. sub pt	Monitoring point	Cross section number	Vertical	Monitoring point category	Type of measurement program with sampling frequency	Measured pollutants																			
						COD, BOD_5	NH_4, NO_2 , NO_3	Phosphates, total phosphorus	Polyphosphates	Organic phosphorus	Volatile phenols	Petrochemicals	Resins and asphaltenes	Anionic synthetic surface active agents	Total iron	Cu, Zn, Cd, Pb	Total chrome	Hexavalent chrome	Mn, Ni	Mercury	Aluminum	V, Co	Fats	Fluorides	Hydrogen sulphide	α, γ-HCH, DDT
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
1	The Selenga river, Naushki settlement	1	0,5	3	Reduced program # 3 (RP # 3)[1] : 9 times Mandatory program (MP)[2] : 7 times	9	7	7	7	-	9	9	9	7	7	9	-	-	-	9	-	-	-	9	-	6
2	The Selenga river, Novoselengins k settlement	1	0,1	3	RP # 3: 9 times MP: 7 times	9	7	7	-	-	9	9	-	7	7	9	-	-	-	-	-	-	-	-	-	-
3	The Selenga river, Ulan-Ude	1	0,5	2	RP # 1[3]: 36 times RP # 3: 12 times MP: 7 times same RP # 3: 12 times MP: 7 times	36	7	7	-	-	36	36	12	12	7	12	-	7	7	7	7	-	12	7	-	-
		2	0,5			36	7	7	-	-	36	36	12	12	7	12	-	7	7	7	7	-	12	7	-	-
		3	0,5			12	7	7	-	-	12	12	12	12	7	12	-	7	7	7	7	-	12	7	-	-

No. subpt	Monitoring point	Cross section number	Vertical	Monitoring point category	Type of measurement program with sampling frequency	Measured pollutants																				
						COD, BOD_5	NH_4, NO_2 , NO_3	Phosphates, total phosphorus	Polyphosphates	Organic phosphorus	Volatile phenols	Petrochemicals	Resins and asphaltenes	Anionic synthetic surface active agents	Total iron	Cu, Zn, Cd, Pb	Total chrome	Hexavalent chrome	Mn, Ni	Mercury	Aluminum	V, Co	Fats	Fluorides	Hydrogen sulphide	α, γ-HCH, DDT
4	The Selenga river, village of Kabansk	1	0,5	2	RP # 3: 12 times MP: 7 times RP # 3: 8 times MP: 5 times	12	12	7	-	-	12	12	12	7	7	12	-	-	-	-	-	-	12	-	12	-
		2	0,5			8	8	5	-	-	8	8	8	5	5	8	-	-	-	-	-	-	8	-	8	-
		3	0,5			12	12	7	7	7	12	12	12	7	7	12	-	-	-	-	-	-	12	-	12	6
5	The Selenga river, village of Murzino	1	0,3	3	RP # 3: 9 times MP: 7 times	9	9	9	-	-	9	9	9	9	9	9	-	-	-	-	-	-	-	-	-	-
6	The Dzhida river, village of Khamnei	1	0,5	4	MP: 5 times	5	5	5	-	-	5	5	-	5	5	5	-	-	-	-	-	-	-	-	-	-
7	The Dzhida river, Dzhida railway station	1	0,1	4	MP: 5 times	5	5	5	-	-	5	5	5	5	5	5	-	-	-	-	-	-	-	-	-	-
8	The Modonkul' river, town of Zakamensk	1	0,5	4	MP: 5 times	5	5	5	-	-	5	5	-	5	5	5	-	-	-	-	-	-	-	5	-	-
		2	0,5			5	5	5	-	-	5	5	-	5	5	5		-	-	-	-	-	-	5	-	-
9	The Temnik river, Ulan-Udunga settlement	1	0,1	4	MP: 4 times	4	4	4	-	-	4	4	-	4	4	4	-	-	-	-	-	-	-	-	-	-
10	The Chikoi river, Gremyachka	1	0,5	4	MP: 4 times	4	4	4	-	-	4	4	-	4	4	4	4	-	4	-	-	4	-	-	-	3

No. subpt	Monitoring point	Cross section number	Vertical	Monitoring point category	Type of measurement program with sampling frequency	Measured pollutants																			
						COD, BOD_5	NH_4, NO_2 , NO_3	Phosphates, total phosphorus	Polyphosphates	Organic phosphorus	Volatile phenols	Petrochemicals	Resins and asphaltenes	Anionic synthetic surface active agents	Total iron	Cu, Zn, Cd, Pb	Total chrome	Hexavalent chrome	Mn, Ni	Mercury	Aluminum	V, Co	Fats	Fluorides	Hydrogen sulphide	α, γ-HCH, DDT
	village																								
11	The Chikoi river, Chikoi settlement	1	0,1	3	RP # 3: 8 times MP: 7 times	8	8	8	-	-	8	8	8	8	8	8	-	-	-	-	-	-	-	-	3
12	The Chikoi river, Povorot village	1	0,5	3	RP # 3: 8 times MP: 7 times	8	8	8	-	-	8	8	-	8	8	8	-	-	-	-	-	-	-	-	-
13	The Asa river, Atsa village	1	0,5	4	MP: 4 times	4	4	4	-	-	4	4	-	4	4	4	4	-	4	-	-	4	-	-	-
14	The Menza river, Ukyr village	1	0,5	4	MP: 5 times	5	5	5	-	-	5	5	5	5	5	5	5	-	5	-	-	5	-	-	3
15	The Kiran river, Kiran village	1	0,5	4	MP: 4 times	4	4	4	-	-	4	4	4	4	4	4	-	-	-	-	-	-	-	-	3
16	The Khilok river, town of Khilok	1 2	0,5 0,5	3	MP: 5 times same	5 5	5 5	5 5	- -	- -	5 5	5 5	- -	5 5	5 5	5 5	5 5	- -	5 5	- -	- -	5 5	- -	- -	4 -
17	The Khilok river, Maleta village	1	0,5	4	MP: 5 times	5	5	5	-	-	5	5	-	5	5	5	5	-	5	-	-	5	-	-	-
18	The Khilok river, Khailastui hunters' lodge	1	0,5	3	MP: 7 times	7	7	7	-	-	7	7	-	7	7	7	-	-	-	-	-	-	-	-	-
19	The Bludnaya	1	0,5	4	MP: 4 times	4	4	4	-	-	4	4	-	4	4	4	4	-	4	-	-	4	-	-	-

No. subpt	Monitoring point	Cross section number	Vertical	Monitoring point category	Type of measurement program with sampling frequency	Measured pollutants																			
						COD, BOD_5	NH_4, NO_2 , NO_3	Phosphates, total phosphorus	Polyphosphates	Organic phosphorus	Volatile phenols	Petrochemicals	Resins and asphaltenes	Anionic synthetic surface active agents	Total iron	Cu, Zn, Cd, Pb	Total chrome	Hexavalent chrome	Mn, Ni	Mercury	Aluminum	V, Co	Fats	Fluorides	Hydrogen sulphide	α, γ-HCH, DDT
	river, Engorok village																								
20	The Balyaga river, town of Petrovsk-Zabaikal'skii	1 2	0,5 0,5	3	MP: 5 times	5 5	5 5	5 5	- -	- -	5 5	5 5	- -	5 5	5 5	5 5	5 5	- -	5 5	- -	- -	5 5	- -	- -	- -	- -
21	The Ungo river, Ust'-Ungo village	1	0,5	4	MP: 4 times	4	4	4	-	-	4	4	-	4	4	4	4	-	4	-	-	4	-	-	-	3
22	The Kuitunka river, Tarbagatai village	1	0,5	4	MP: 4 times	4	4	4	-	-	4	4	-	4	4	4	-	-	-	-	-	-	-	-	-	-
23	The Uda river, Ulan-Ude	1 2	0,8 0,8	3	RP # 3: 12 times MP: 7 times То же	12 12	7 7	7 7	- -	- -	12 12	12 12	12 12	7 7	7 7	12 12	- -	7 7	7 7	- -	7 7	- -	12 12	7 7	- -	- -
24	The Ona river, Nizhnyaya Maila village	1	0,8	4	MP : 4 times	4	4	4	-	-	4	4	-	4	4	4	-	-	-	-	-	-	-	-	-	-
25	The Kurba river, Novaya Kurba village	1	0,1	4	MP: 4 times	4	4	4	-	-	4	4	-	4	4	4	-	-	-	-	-	-	-	-	-	-
26	The Bryanka river,	1	0,5	4	MP: 4 times	4	4	4	-	-	4	4	-	4	4	4	-	-	-	-	-	-	-	-	-	-

No. subpt	Monitoring point	Cross section number	Vertical	Monitoring point category	Type of measurement program with sampling frequency	Measured pollutants																			
						COD, BOD_5	NH_4, NO_2 , NO_3	Phosphates, total phosphorus	Polyphosphates	Organic phosphorus	Volatile phenols	Petrochemicals	Resins and asphaltenes	Anionic synthetic surface active agents	Total iron	Cu, Zn, Cd, Pb	Total chrome	Hexavalent chrome	Mn, Ni	Mercury	Aluminum	V, Co	Fats	Fluorides	Hydrogen sulphide	α, γ-HCH, DDT
	Zaigraevo railway station																								

[1] – RP # 3 is a reduced measurement program according to which all characteristic pollutants for a monitoring point are measured on a monthly basis. Also measured are temperature, electric conductivity, dissolved oxygen, COD, BOD5 and hydrological indices;
[2] – MP is a mandatory program according to which all indices for a monitoring point are determined;
[3] – RP # 1 is a reduced program according to which such indices as temperature, electric conductivity, dissolved oxygen and hydrological indices as well as 2-3 pollutants typical of a certain point are measured.

34

Table B. 2. Program of measurement of pollutant content on the monitoring points on the Selenga river and its tributaries in the Mongolian territory in 2012

No. subpt	Monitoring point	Cross section number	Vertical	Type of measurement program with sampling frequency	Measured substances													
					Water temperature, pH, electric conductivity, permanganate demand, suspended solids	O_2, BOD5	NH_4, NO_2, NO_3	Phosphates	Volatile phenols	Petrochemicals	Anionic synthetic surface active agents	Chrome (VI),	Total iron	Cu, Zn, Cd, Pb	Fluorides	Mn, Ni	Mercury (Hg)	
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
1	The Selenga river, Dzunburen point	1	0.3	MP: 12 times	12		12	12					12		12			
2	The Selenga river, Sukhebator point	1	0.3	MP: 12-24 times	24	24	12	12		2		12	24		24			
3	The Ider river, Dzurkh point	1	0.5	MP: 9 times	9		9	9					9		9			
4	The Delgermuren river, Muren point	1	0.5	MP:12 times	12	12	12	12		2		6	12		12			
5	The Bugsii river, Tomurbulag point	1	0.5	MP: 4 times	4		4	4					4		4			
6	The Suman river, Tariat point	1	0.5	MP: 5 times	5		5	5					5		5			
7	The Chuluut river, Undur-Ulaan point	1	0.5	MP: 5 times	5		5	5					5		5			
8	The Eg-Gol river, Khantai point	1	0.5	MP: 5 times	5		5	5					5		5			
9	The Uri river, Tsagaan-Uri point	1	0.5	MP: 5 times	5		5	5					5		5			

No. subpt	Monitoring point	Cross section number	Vertical	Type of measurement program with sampling frequency	Measured substances													
					Water temperature, pH, electric conductivity, permanganate demand, suspended solids	O_2, BOD5	NH_4, NO_2, NO_3	Phosphates	Volatile phenols	Petrochemicals	Anionic synthetic surface active agents	Chrome (VI),	Total iron	Cu, Zn, Cd, Pb	Fluorides	Mn, Ni	Mercury (Hg)	
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
10	The Orkhon river, Orkhon bagh point	1	0.5	MP: 5 times	5		5	5					5		5			
11	The Orkhon river, Sukhebaatar point	1	0.5	MP: 12 times	12	12	12	12		2		6	12		12			
12	The Khoittamir river, Ikhtamir point	1	0.5	MP: 6 times	6		6	6					6		6			
13	The Zunturuu, Bulgan point	1	0.8	MP: 6 times	6		6	6					6		6			
14	The Khangal river, Erdenet point	1	0.5	MP:12 times	24	24	12	12		2		6	24		24			
14	The Khangal river, Zhargalant point	1	0.5	MP: 6 times	6	6	6	6					6		6			
15	The Tuul river, Ulaanbaatar point	1	0,5	MP: 9 times	9	9	9	9		6		6	9	6	9	6	6	
16	The Tuul river, Lun point	1	0,5	MP: 6 times	6		6	6					6	6	6	6	6	
17	The Terelzh river, Terelzh station	1	0,8	MP: 5 times	5	5	5	5				5	5	2	5	2	2	
18	The Kharaa river, Darkhan point	1	0,5	MP: 12 times	12	12	12	12		7		7	12		12			
19	The Sharyn Gol river, Zhims	1	0.8	MP: 8 times	8	8	8	8				6	8		8			

No. subpt	Monitoring point	Cross section number	Vertical	Type of measurement program with sampling frequency	Measured substances													
					Water temperature, pH, electric conductivity, permanganate demand, suspended solids	O_2, BOD5	NH_4, NO_2, NO_3	Phosphates	Volatile phenols	Petrochemicals	Anionic synthetic surface active agents	Chrome (VI),	Total iron	Cu, Zn, Cd, Pb	Fluorides	Mn, Ni	Mercury (Hg)	
	station																	
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
20	The Iro river, Dulaankhaan point	1	0.5	MP: 9 times	9		9	9					9		9			
21	The Khuder river, Khuder point	1	0.5	MP: 4 times	4		4	4					4		4			
22	The Zheltura river, Zheltura point	1	0.8	MP: 4 times	4		4	4					4		4			

37

Annex B

Table B. 1: List of indices measured in the water samples by the Russian and Mongolian sides using commeasurable analysis methodologies

Measured indicator	Methodologies used and their characteristics				Note
	In Russia		In Mongolia		
	Methodologies used (cipher, measurement method principle)	Minimum detectable concentration	Methodologies used (cipher, measurement method principle)	Minimum detectable concentration	
Temperature	RD 52.24.496-2005, temperature, transparency and odor of the surface waters. Measurement method	0 °C		0 °C	-
Specific electric conductivity	RD 52.24.495-2005, pH value and specific electric conductivity of waters. Methodology of measurement by the electrometric method	0.005mS/cm	MNS ISO 4889:99 Methodology of measurement by the conductometric method	No data available	
pH value	RD 52.24.495-2005 pH value and the specific electric conductivity of waters. Methodology of measurement by the electrometric method	4 pH units	MNS ISO 10523:2001 Methodology of measurement by the electrometric method	3-10	
Suspended solids	RD 52.24.468-2005 Suspended solids and total content of impurities in water. Methodology of measurement by the gravimetric method	5 mg/cubic dm	MNS ISO 11923:2001 Methodology of measurement by the gravimetric method	2 mg/cubic dm	
Dissolved oxygen	RD 52.24.419-2005 Mass concentration of dissolved oxygen in water. Methodology of measurement by the iodometry method	1 mg/cubic dm	MNS (ISO) 4816:99 Methodology of measurement by the iodometry method	0.05 mg/cubic dm*	-
Sulphates	RD 52.24.405-2005 Mass concentration of sulphates in waters. Methodology of measurement by the turbidimetric method	2 mg/cubic dm	MNS 6271:2010 Methodology of measurement by the turbidimetric method	0.5 mg/cubic dm*	-
Calcium	RD 52.24.403-2007 Methodology of measurement of mass concentration of calcium in water by the titrimetric method of analysis with Trilon B	1 mg/cubic dm	MNS (ISO) 2572:99 Methodology of measurement by the titrimetric method of analysis with Trilon B	0.5 mg/cubic dm	-
Magnesium	RD 52.24.395-2007 Hardness of water. Methodology of measurement by the titrimetric method of analysis with Trilon B	-	Calculation method	-	Limited commeasurability
Hardness of water	RD 52.24.395-2007 Hardness of water. Methodology of measurement by the titrimetric method of analysis with Trilon B	0,06 ммоль/дм^3 КВЭ **	MNS ISO 6059:2001 Methodology of measurement by the titrimetric method of analysis	0.5 mg-eq/cubic dm	

Measured indicator	Methodologies used and their characteristics				Note
	In Russia		In Mongolia		
	Methodologies used (cipher, measurement method principle)	Minimum detectable concentration	Methodologies used (cipher, measurement method principle)	Minimum detectable concentration	
			with Trilon B		
Sum of sodium and potassium ions	RD 52.24.514-2002 Methodology of calculation of the total molar (mass) concentrations of sodium and potassium ions, the total mass concentration of ions in the water		Calculation method		-
Nitrate nitrogen	RD 52.24.380 – 2006 Mass concentration of nitrates in waters. Methodology of measurement by the photometric method with Griess reagent after reduction in the cadmium reduction gear	0.01 mg/cubic dm	MNS 4217:1994 Methodology of measurement by the photometric method with sodium salycilate	0.1 mg/cubic dm	Limited commeasurability (commeasurable with nitrate nitrogen concentration of over 0.5 mg/cubic dm)
Nitrite nitrogen	RD 52.24.381- 2006 Mass concentration of nitrites in waters. Methodology of measurement by the photometric method with Griess reagent.	0.01 mg/cubic dm	MNS 4431:2005 Methodology of measurement by the photometric method with Griess reagent.	0.007 mg/cubic dm	-
Phosphates (expressed as phosphorus)	RD 52.24.382-2005 Mass concentration of phosphates and polyphosphates in waters. Methodology of measurement by the photometric method	0.01 mg/cubic dm	MNS ISO 6878:2001 Methodology of measurement by the photometric method with ammonium orthomolybdate	0.005 mg/cubic dm	-
Silicium	RD 52.24.432-2005 Mass concentration of silicates in the surface waters of the land. Methodology of measurement by the photometric method in the form of blue (reduced) form of molybdosilicic acid	0.1 mg/cubic dm	MNS ISO 3535:1983 Methodology of measurement by the photometric method with molybdosilicic acid	0.02 mg/cubic dm	-
	RD 52.24.433-2005 Mass concentration of silicates in the surface waters of the land. Methodology of measurement by the photometric method in the form of yellow form of molybdosilicic acid	0.5 mg/cubic dm			-
BOD_5	RD 52.24.420-2006 BOD in waters. Methodology of measurement by the light and dark bottle	1.0 mg/cubic dm	MNS ISO 5815:2001 Methodology of measurement by	3 мг/дм^3	Limited commeasurability

Measured indicator	Methodologies used and their characteristics				Note
	In Russia		In Mongolia		
	Methodologies used (cipher, measurement method principle)	Minimum detectable concentration	Methodologies used (cipher, measurement method principle)	Minimum detectable concentration	
	method.		the light and dark bottle method.		(comparison is possible during the analysis of polluted waters
Note – * - detection limit ** - mol/cubic dm molar equivalent or mg-eq/cubic					

Table B. 2: List of indices measured in the water samples by the Russian and Mongolian sides using non-commeasurable analysis methodologies

Measured indicator	Methodologies used and their characteristics				Note
	In Russia		In Mongolia		
	Methodologies used (cipher, measurement method principle)	Minimum detectable concentration	Methodologies used (cipher, measurement method principle)	Minimum detectable concentration	
Chlorides	RD 52.24.402-2011 Mass concentration of chlorides in waters. Methodology of measurement by the mercurymetric method	1 mg/cubic dm	MNS 3976-87 Methodology of measurement by the mercurymetric method	10 mg/cubic dm	Non-commeasurable (the concentration of chlorides for the observed water bodies is mostly lower than 10 mg/cubic dm
Hydrocarbonates	RD 52.24.493-2006 Mass concentration of hydrocarbonates and water alkalinity value of the surface waters of the land and treated effluents. Methodology of measurements by the titrimetric method	10 mg/cubic dm	MNS 4425-97 Methodology of measurements by the potentiometric method	0.5 mg/l	Insufficient information
Ammonium nitrogen	RD 52.24.383-2005 Mass concentration of ammonia and ammonia ions in the surface waters of the land. Methodology of	0.02 mg/cubic dm	MNS 4428-97 Methodology of measurement by the photometric method with Nessler's reagent	0.05 mg/cubic dm	Non-commeasurable, measurement with Nessler's reagent is

Measured indicator	Methodologies used and their characteristics				Note
	In Russia		In Mongolia		
	Methodologies used (cipher, measurement method principle)	Minimum detectable concentration	Methodologies used (cipher, measurement method principle)	Minimum detectable concentration	
	measurement by the photometric method in the form of indophenol blue				insensitive and non-selective
Total dissolved iron	RD 52.24.377-2008 Mass concentration of Al, Be, V, Fe, Cd, Co, Mn, Cu, Mo, Ni, Pb, Ag, Cr and Zn in waters. Methodology of measurement by the atomic absorption method with direct electrothermal atomization of samples	0.01 mg/cubic dm	MNS 4430:2005 Methodology of measurement by the photometric method with rhodanide	0.05 mg/cubic dm	Non-commeasurable, measurement with rhodanide is insensitive and insufficiently selective
	RD 52.24.358-2006 Mass concentration of total iron in waters. Methodology of measurement by the photometric method with 1.10-phenanthroline	0.02 mg/cubic dm			
COD	RD 52.24.421-2007 Methodology of measurement of COD in waters	4.0 mg/cubic dm	MNS ISO 6060:2001 Methodology of measurement by the titrimetric method	30 mg/dm	Non-commeasurable in sensibility
Petrochemicals	RD 52.24.454-2006 Mass concentration of petroleum components in waters. Methodology of measurement by the IR-photometric and luminescent methods using thin layer chromatography	0.05 mg/cubic dm	MNS 17.1.5.15-80 Methodology of measurement of petroleum components in waters	-	Insufficient information
Chrome (VI)	RD 52.24.446-2008 Mass concentration of chrome (VI) in waters. Methodology of measurement by the photometric method with diphenylcarbazide	1 µg/cubic dm	MNS ISO 11083:2001 Methodology of measurement by the photometric method with diphenylcarbazide	0.05 mg/cubic dm	Non-commeasurable, detection according to ISO 11083 is insensitive
Zinc	RD 52.24.377-2008 (see title above)	2 µg/cubic dm	MNS ISO 4421:99 Methodology of measurement by the atomic absorption method with flame atomization	0.05 mg/cubic dm	Non-commeasurable in sensibility
	MU 08-47/163 Natural water, drinking water, technologically pure, purified effluent. Methodology of measurement of mass concentration of Cd, Pb, Zn and Cu by the method of stripped voltammetry.	0.5 µg/cubic dm			
Nickel	RD 52.24.377-2008 (see title above)	5 µg/cubic dm	MNS ISO 4421:99 Methodology of measurement by	0.1 mg/cubic dm	Non-commeasurable in sensibility
	PND F 14.1:2:4.202-03 Methodology of	10 µg/cubic			

Measured indicator	Methodologies used and their characteristics				Note
	In Russia		In Mongolia		
	Methodologies used (cipher, measurement method principle)	Minimum detectable concentration	Methodologies used (cipher, measurement method principle)	Minimum detectable concentration	
	measurement of mass concentration of Ni in natural, drinking and waste water samples by the photometric method using "Fluorat 2" fluid analyzer.	dm	the atomic absorption method with flame atomization		
Cadmium	RD 52.24.377-2008 (see title above)	0.1 μg/cubic dm		0.02 mg/cubic dm	
	MU 08-47/163 (see title above)	0.2 μg/cubic dm			
Lead	RD 52.24.377-2008 (see title above)	2 μg/cubic dm		0.2 mg/cubic dm	
	MU 08-47/163 (see title above)	0.2 μg/cubic dm			
Copper	RD52.24.377-2008 (see title above)	1.0 μg/cubic dm		0.05 mg/cubic dm	
	MU 08-47/163 (see title above)	0.5 μg/cubic dm			
Cobalt	RD 52.24.377-2008 (see title above)	2 μg/cubic dm		0.1 mg/cubic dm	
Mercury	MU 08-47/162 Natural water, drinking water, purified effluent. Voltammetric method of measurement of mercury mass concentration	0.04 μg/cubic dm	MNS 6184:2010 Methodology of measurement by the cool vapor atomic absorption method	1 μg/cubic dm	Non-commeasurable in sensibility
Fluorides	RD 52.24.360-2008 Mass concentration of fluorides in waters. Methodology of measurement by the potentiometric method with ionoselective electrode	0.19 μg/cubic dm	MNS ISO 10359-1:2002	0,02 мг/дм^3	Non-commeasurable in sensibility

Table B. 3: List of indices measured in water samples by the Russian side only and analysis methodologies used

Measured indicator	Methodologies used (cipher, measurement method principle)	Minimum detectable concentration
Manganese	PND F 14.1:2:4.188-02 Measurement methodology of mass concentration of manganese in natural, drinking and waste water samples by the photometric method using "Fluorat-02" fluid analyzer.	10 µg/cubic dm
Aluminium	PND F 14.1:2:4.181-02. 02 Measurement methodology of mass concentration of aluminum in natural, drinking and waste water samples by the photometric method using "Fluorat-02" fluid analyzer.	10 µg/cubic dm
Total chrome	RD 52.24.377-2008 (see title above)	1 µg/cubic dm
Total phosphorus	RD 52.24.387-2006 Mass concentration of total phosphorus in waters. Measurement methodology by the photometric method after persulphate oxidation	0.02 mg/cubic dm
Anionic synthetic surface active agents	RD 52.24.368-2006 Mass concentration of anionic synthetic surface active agents in waters. Methodology of measurement by the extraction-photometric method.	0.01 mg/cubic dm
Alpha-, gamma-HCH	RD 52.24.412-2009 Mass concentration of HCB, alpha-, beta- and gamma-HCH, dicophol, dihydroheptachlor, 4,4'- dichlorodiphenyltrichloroethane, 4,4'- dichlorodiphenyldichloroethylene, 4,4'-dichlorodiphenyldichloroethan and trifluraline in waters. Methodology of measurement by the gas chromatographic method	0.002 µg/cubic dm
4,4'-dichlorodiphenyltrichloroethane		0,02 µg/cubic dm