

CONCLUSION

1. On the condition of Lake Baikal according to indicators observed in 2021.

The water level of Lake Baikal in 2021 changed depending on the useful inflow into the lake and the regulation of the operation modes of the Angarsk HPP Cascade, which was carried out in accordance with the “Basic rules for the use of water resources in the Angara HPP Cascade reservoirs”, Decree of the Government of the Russian Federation No. 654 “On the maximum and minimum values of the water level in Lake Baikal in 2021” dated April 27, 2021, decisions of the Interdepartmental Working Group on the regulation of the operating modes of the reservoirs of the Angara-Yenisei HPP cascade and Northern HPPs, the actual water level of Lake Baikal and instructions of the Federal Agency for Water Resources.

As of January 1, 2021, the average water level in Lake Baikal was around 456.64 metres according to the Pacific system, i.e. 0.16 m lower than on the corresponding date in 2020 (on January 1, 2020, this indicator amounted to 456.48 m PO) and 0.21 m above the average long-term value of the level (456.43 m PO).

In the period from January to April, the pre-flood drawdown of the lake was carried out. By April 26, 2021, the average level of Lake Baikal dropped to 456.20 m PO and remained at the minimum level until May 10, 2021. The breakup on Lake Baikal occurred 4–7 days earlier than the norm, on the Bratsk reservoir it was close to the long-term average date, and on the Ust-Ilimsk reservoir it was 2–4 days later than the norm.

The filling of Lake Baikal began on May 11, 2021 and continued until September 28. The water level during this period increased by 1.03 m to the mark of 457.23 m PO, which is 0.11 m higher than the maximum mark of 2020 (457.12 m PO). The drawdown of the Lake Baikal water level began on September 29, 2021, and at the end of the year the level amounted to 456.78 m PO.

The annual course of water level in Lake Baikal in 2021 was consistent with the high water content conditions.

Observations of the surface layer and water column in 2021 were carried out at the following points:

- at baseline deep-sea stations of the longitudinal section, running along Lake Baikal in its central part;
- on Southern Baikal – in the area of sewage influence from treatment facilities of Baykalsk Pulp and Paper Mill (BPPM) closed in December 2013, (currently - wastewater treatment facility (KOS));
- in the areas of the ports of Southern Baikal (Kultuk workers’ settlement, city of Baikalsk, Vydrino settlement, Bolshoe Goloustnoe settlement, Baikal settlement);
- at the Angara River source;
- in the area of the Selenga Shallow Waters;
- in the Kultuk–Slyudyanka area;
- on North Baikal – in the area of the Baikal–Amur Mainline route influence;
- in the area of Barguzin Bay;
- in the area of Maloe More.

In 2021, the results of hydro-chemical observations showed that the average content of oxygen dissolved in water, as well as mineral substances, organic substances per COD and BOD₅, nitrite nitrogen, nitrate nitrogen, ammonia nitrogen, phosphates, oil products, sulfates, chlorides, synthetic surfactants, lead, manganese, nickel, cadmium, iron, copper, zinc, cobalt, vanadium, molybdenum, silver, aluminium, chromium, mercury beryllium, and pH values were within the permissible limits. No organochlorine and chemical pesticides (p,p-DDT (dichlorodiphenyltrichloroethane), p,p-DDD (dichlorodiphenyldichloroethane), p,p-DDE (dichlorodiphenylethylene), α -HCH (alpha-hexachlorocyclohexane), γ -HCH (gamma-hexachlorocyclohexane) were detected in the water of Lake Baikal.

Compared to 2020, the content of nitrite nitrogen increased by 1.5 times, the content of organic substances per BOD₅, nitrate nitrogen, and sulfates - by 1.1 times, vanadium - from

zero values to $0.32 \mu\text{g}/\text{dm}^3$. The average concentration of silver, beryllium, zinc, chromium, cobalt, nickel, manganese and iron, cadmium, aluminum, aluminum, ammonium nitrogen, organic and total nitrogen, organic phosphorus, silicon and total phosphorus, organic carbon decreased by 12.8; 5.4; 4.6; 4.5; 4.1; 3.1; 2.9; 2.8; 2.2; 1.9; 1.6; 1.3; 1.2; 1.1 times respectively. The content of suspended particulate matter, oil products, and mercury decreased to zero values. The average content of oxygen dissolved in water, minerals, mineral phosphorus, phenols, synthetic surfactants, chlorides, copper, and molybdenum did not change. In comparison with 2020, the quality of lake water remained at the same level.

In 2021, in the area of influence of wastewater from the wastewater treatment facility (KOS), average and maximum concentrations of mineral substances, phenols, oil products, sulfates, chlorides, lead, manganese, silver, nickel, vanadium, molybdenum, cadmium, iron, copper, zinc, cobalt, aluminum, chromium, and mercury did not exceed the MAC. Compared to 2020, in the area of influence of wastewater from the KOS of Baikalsk, the average content of silicon in the water of Lake Baikal increased by 1.2 times. The concentrations of silver decreased by 2.6 times, of cobalt - by 1.9 times, of iron and beryllium - by 1.6 times, of zinc, lead and nickel - by 1.5 times, of aluminum - by 1.4 times, of cadmium - by 1.3 times, of total sulfur - by 1.1 times, the content of suspended particulate matter decreased to zero values (from $0.2 \text{ mg}/\text{dm}^3$). The average annual concentration of nitrate nitrogen in the water of the control 100-meter section increased by 2.7 times, of nitrite nitrogen - by 2.0 times, of total phosphorus - by 1.2 times, of total sulfates and sulfur - by 1.1 times, phosphates concentrations increased from zero values up to $0.007 \text{ mg}/\text{dm}^3$. The average content of total nitrogen decreased by 1.4 times, of chlorides - by 1.2 times, of organic carbon, organic substances per COD and organic phosphorus - by 1.1 times, the content of suspended particulate matter decreased to zero values.

In 2021, the average concentrations of regulated substances in the areas of South Baikal ports, with the exception of phenols, did not exceed the established water quality standards for water bodies of fishery significance. The maximum concentrations of phenols exceeded the MAC by 3.0 times in the area of Kultuk settlement, by 2.0 times in the ports of Vydrino, Baikalsk, and Baikal, and by 1.5 times in Bolshoe Goloustnoe settlement.

Compared to 2020, the average content of nitrate nitrogen at the Angara River source increased by 1.2 times; other average contents decreased: of oil products - by 2.0 times, of mineral phosphorus - by 1.8 times, of organic and total nitrogen - by 1.6 times, of total phosphorus - by 1.5 times, of ammonium nitrogen - by 1.4 times, of organic phosphorus - by 1.2 times, of organic carbon - by 1.1 times, suspended particulate matter content decreased to zero values (from $0.2 \text{ mg}/\text{dm}^3$).

In the middle part of Lake Baikal, in the area of the Barguzinsky Bay, in the reporting year, the average content of silicon in the water increased by 4.0 times, of organic phosphorus - by 1.3 times, of sulfates, organic carbon and oxygen dissolved in water - by 1.1 times. The concentrations of ammonium nitrogen decreased by 3.0 times, of organic and total nitrogen - by 1.8 times, of nitrate nitrogen - by 1.2 times, suspended particulate matter and mineral phosphorus concentrations decreased to zero values.

In the area of the Selenga Shallow Waters, in 2021, the average concentration of organic phosphorus increased by 3.3 times, of nitrite nitrogen - by 3.0 times, of silicon - by 2.2 times, of suspended particulate matter - by 2.0 times, of nitrate nitrogen - by 1.5 times, of sulfates - by 1.3 times, of total phosphorus - by 1.2 times, of minerals and organic carbon - by 1.1 times. The concentrations of organic and total nitrogen decreased by 2.0 times, of ammonium nitrogen - by 1.4 times, of mineral phosphorus - by 1.3 times.

On North Baikal (BAM route), in the reporting year, the concentrations of nitrite nitrogen increased by 2.0 times, of total phosphorus and oxygen dissolved in water - by 1.1 times, of vanadium - from zero values to $0.4 \mu\text{g}/\text{dm}^3$, of mercury - from zero values to $0.0075 \mu\text{g}/\text{dm}^3$. The concentrations of the following substances decreased: chromium - by 8.0 times, cadmium - by 6.5 times, manganese - by 4.6 times, iron - by 4.4 times, cobalt - by 3.1 times, aluminum - by 3.0 times, total nitrogen and lead - by 1.9 times, ammonium and organic nitrogen - by 1.8 times, silicon and organic carbon - by 1.3 times, nitrate nitrogen - by 1.2 times, sulfates - by 1.1 times, the concentrations of suspended substances, nickel, zinc and beryllium decreased to zero values.

In the area of Maloe More, in 2021, the average content of organic substances per BOD₅ increased by 9.2 times, of organic phosphorus - by 2.5 times, of chromium - by 1.4 times, of sulfates and oxygen dissolved in water - by 1.1 times, of nitrite nitrogen - from zero values up to 0.002 mg/dm³. In 2021, the concentrations of the following substances decreased: iron - by 11.6 times, cobalt - by 6.7 times, cadmium - by 5.9 times, aluminum - by 4.4 times, mineral phosphorus - by 4.0 times, silicon - by 3.3 times, lead - by 2.4 times, ammonium nitrogen - by 2.2 times, organic and total nitrogen - by 2.1 times, oil products - by 2.0 times, manganese - by 1.8 times, chlorides - by 1.3 times, nitrate nitrogen and organic carbon - by 1.2 times, organic substances per COD - by 1.1 times, concentrations of particulate matter, zinc, nickel, beryllium and mercury decreased to zero values.

Regarding the bottom sediments of Lake Baikal, in 2021, in the area of municipal wastewater discharge of the city of Baikalsk, the concentrations of easily hydrolyzed carbohydrates increased by 1.6 times, of carbohydrates resistant to hydrolysis - by 1.8 times, the ratio of the sum of easily hydrolyzed carbohydrates and the lignin-humus complex to total organic matter increased by 1.7 times, the concentration of organic carbon - by 1.2 times, and of lignin-humus complex - by 1.1 times. The average content of organic nitrogen did not change. Compared to 2020, the average concentrations of iron and lead increased by 1.8 and 1.1 times, respectively. The concentrations of nickel, copper, manganese, zinc, cadmium and cobalt decreased by 2.7; 1.6; 1.5; 1.4 and 1.1 times, respectively. The average mercury content remained at the level of the previous year. Based on the most representative indicator - sulfide sulfur content, in the reporting year, the state of bottom sediments improved. Compared to 2020, the average sulfide sulfur content decreased by 1.9 times.

In bottom sediments at the forefront of the Selenga River, the average content of easily hydrolyzed carbohydrates increased by 1.8 times, of carbohydrates resistant to hydrolysis - by 1.5 times; the content of the lignin-humus complex of decreased by 5.8 times, of organic nitrogen - by 1.9 times, the ratio of the sum of easily hydrolyzed carbohydrates and the lignin-humus complex to total organic matter decreased by 1.5 times, and the organic carbon content - by 1.4 times. The average sulfide sulfur content decreased by 1.6 times compared to 2020.

In the north, in the area of the Baikal–Amur Mainline route influence, in the bottom sediments of Lake Baikal, the average content of the lignin-humus complex increased by 1.1 times and the ratio of the sum of easily hydrolyzed carbohydrates and the lignin-humus complex to total organic matter increased by 1.2 times. The content of carbohydrates resistant to hydrolysis decreased by 1.8 times, of organic nitrogen and easily hydrolyzed carbohydrates - by 1.4 times, of organic carbon - by 1.3 times. The average content of sulfide sulfur in the bottom sediments decreased by 6.6 times.

Hydrobiological societies. During 2021, the average quantitative indicators of hydrobiont groups in the areas of the KOS of the city of Baikalsk and the BAM route, as well as the Selenga Shallow Waters of Lake Baikal are comparable to the values of previous years. There are no trends indicating increases or decreases in the parameters. Throughout the surveyed water area, chara algae of the genus *spirogyra* link, unusual for Lake Baikal, was found. The amount of *spirogyra* increased towards the end of the vegetational season. In the area of the KOS of the city of Baikalsk, during the period of ice survey, filamentous algae was found in 34% of the selected soil samples with macrozoobenthos. Thread algae were found in the soil sampled from depths of 18 to 120 m at the landfill, mainly on the eastern side of the point of release of conditionally clean waters. In the background area, *spirogyra* was recorded at a depth of 50 m. In the water column, when sampling zooplankton with a Juday net, in March, single threads of algae were caught at one station located 1 km west of the discharge pipes and 1.2 km from the shore. In June, thread algae was discovered in 7% of samples (the distance from the shore was from 300 m to 4 km). In August, *spirogyra* was found in 61% of zooplankton samples taken in the eastern and western sections of the landfill. The maximum accumulation of algae was registered at the point of release of conditionally clean water and northeast of the discharge pipes, at a distance of up to 2.5 km from the shore. At the reference station, *spirogyra* was not found.

In the area of the BAM route, chara algae of the genus *Spirogyra* Link was found in

zooplankton samples throughout the whole season. In summer, thread algae was found in almost half of the samples (48%) taken along the western coast and at the northern end of the lake. The largest accumulations were registered in the area from the mouth of the Slyudyanka River to the port of Severobaikalsk. In September, spirogyra was found in zooplankton samples along the entire perimeter of the water area and at the northernmost reference point - in the middle of the Nizhngangarsk-Dagar Bay section. Mass accumulations were discovered both along the western shore (from Tolstiy Cape to the port of Severobaikalsk) and near the eastern shore - 0.5 km from the mouth of the Tompuda River.

In the area of the Selenga Shallow Waters, spirogyra was found in the water column in the southwestern part of the water area: in one phytoplankton sample and in one third of all zooplankton samples. In addition to this, phenol-oxidizing microorganisms were discovered in 83% of samples; the highest value was noted at the station located opposite the mouth of the Galutai Creek. Indicators of oil pollution (hydrocarbon-oxidizing bacteria) were detected in all samples.

The results of the study of the ichthyofauna and the ringed seal population indicate that the reserves of wild-caught species of aquatic biological resources of Lake Baikal are fairly stable, with the exception of the Baikal omul. In 2021, the total number of Baikal omul species coming into spawning streams amounted to 2.1 million specimens. This indicator is comparable to the 2015 level (2 million specimens), but significantly lower than the long-term annual average (4.3 million specimens). The positive dynamics of changes in the number of spawning omul is preserved in the Upper Angara River (about 1.28 million specimens). The number of omul spawning in the Barguzin River and its tributary, the Ina River, in 2021 (0.09 million specimens) was higher than in 2020 (0.06 million specimens). The total allowable catch (TAC) of omul for 2022 is approved at the level of 2021 - 150 tons.

As in previous years, the reserves of other wild-caught fish remain fairly stable. The TAC of Baikal grayling (white and black) for 2022 is set at 30 tons, of whitefish — at 40–50 tons. For 2022, the recommended catch of pike is slightly higher than in 2021 — 46 tons. The recommended common carp catch is 45 tons. The statistically recorded catch of burbot in 2021 amounted to 23.8 tons. For 2022, the recommended catch of burbot is 28 tons.

The total population of the Baikal ringed seal in 2021 amounted to 164.6 thousand specimens. The estimated number of offspring for the entire lake is 31.7 thousand specimens. According to calculations, the possible annual allowable withdrawal of ringed seals is at least 5-6 thousand specimens. The TAC for ringed seals for 2021 and 2022 is set at 3,000 heads.

Rivers flowing into Lake Baikal. Observations of the surface water quality of Lake Baikal basin in the Republic of Buryatia were carried out on 25 rivers (at 43 stations). The above-MAC values in the waters of the rivers of Lake Baikal basin were registered for 13 (in 2020 - for 12) chemical ingredients out of 17 recorded. Compared to 2020, there was an increase in the average concentrations of total iron, aluminum, and manganese. The decrease in concentrations was recorded by the content of easily oxidizable organic substances (per BOD5), nitrates, and nickel. The pollution of the waters of the Baikal basin was characterized by a high level of manganese, and an average level of total iron and copper. According to the content of difficult-to-oxidize organic substances (per COD), zinc, and oil products, stable pollution was observed; indices of easily oxidizable organic substances (per BOD5), aluminum, volatile phenols, and fluorides are indicative of unstable pollution; of sulfates, nitrogen, nitrites, ammonium, and nickel - of single low-level pollution.

Observations of the surface water quality of Lake Baikal basin in the Trans-Baikal Krai were carried out on seven rivers (at eight stations). The above-MAC values in the waters of the rivers of Lake Baikal basin were registered for nine (in 2020 - for 10) chemical ingredients out of 15 recorded. Compared to 2020, there was an increase in the annual average concentrations of difficult-to-oxidize organic substances (per COD), total iron and copper. In terms of the content of easily oxidizable organic substances (per BOD5), manganese and oil hydrocarbons, a decrease in average annual concentrations was noted. The pollution of the rivers of the Baikal basin was characterized as average-level in terms of the content of difficult-to-oxidize organic substances (per COD), total iron, copper and manganese; as low-level in terms of the content of

easily oxidizable organic substances (per BOD5); as stable medium-level per the content of oil hydrocarbons; as single average-level per the content of volatile phenols; and single low-level - in terms of the content of nitrite nitrogen and zinc.

In the Irkutsk region, the degree of water pollution according to the specific combinatorial index (SCIWP) was assessed in ten rivers. The water in Goloustnaya, Sarma, Bolshaya Sukhaya, Manturikha, Snezhnaya, Vydrinaya, Khara-Murin and Utulik rivers was characterized as “conditionally clean”. The water in the Buguldeyka River was characterized as “slightly polluted”. Compared to the previous year, the quality of water in the Buguldeyka deteriorated, as indicated by the increase in the concentration of organic substances (per COD) by 2.2 times and that of copper by 1.6 times. Water quality in Goloustnaya, Sarma, Bolshaya Sukhaya, Manturikha, Snezhnaya, Vydrinaya, Khara-Murin and Utulik rivers remained at the same level.

Overall, in 2021, the quality of Lake Baikal surface water in terms of its hydro-chemical indicators was mainly affected by hydrological and climatic conditions, as well as the anthropogenic factor.

Groundwater. In general, in 2021, no significant changes in the state of the underground hydrosphere were registered within the Baikal Natural Territory (BNT).

In the Republic of Buryatia, in 2021, the average annual levels of groundwater in quaternary deposits of intermountain artesian basins (IAB) were higher than the previous year. In 2021, groundwater pollution was detected at 12 water intakes and 13 sites. The maximum man-made impact on groundwater is concentrated within settlements, on the territories of industrial enterprises, in areas where industrial waste is stored, etc. Groundwater of unprotected aquifers is polluted with a wide range of components of I, II and III hazard classes.

On the territory of the Irkutsk region within the Central environmental zone of the BNT (CEZ BNT) in 2021, the average annual groundwater levels were higher than the long-term averages of the previous year. Groundwater monitoring was carried out at eight state basic observing network sites, including 12 stations, and at two local observing network sites, including four wells. As in previous years, intense pollution of groundwater occurred in the area of influence of the BPPM, on the territory of the Kultuk oil depot, as well as within rural residential areas on the coast of Lake Baikal without sewage systems.

In the Trans-Baikal Krai, within the Baikal Natural Territory, in the reporting year, no observations of the groundwater levels were carried out. In 2021, a planned survey of water intake facilities in the cities of Petrovsk-Zabaykalsky and Khilka for aluminium oxychloride and oil content was performed. According to the results of this study, the well water met the requirements of SanPiN 1.2.3685-21 in terms of determined indicators.

Endogenous geological processes. In 2021, the Baikal Natural Territory was characterized by low seismic activity. During the year, one earthquake of the energy class $K > 12.6$ (magnitude $M > 4.6$) was registered, the maximum earthquake shaking intensity was five points. In the reporting year, the annual total seismic energy released within the BNT was $\Sigma E = 7.8 \cdot 10^{12}$ J, which is noticeably lower than in the previous year of 2020 ($\Sigma E = 533.7 \cdot 10^{12}$ J). This also indicates that seismic activity within the BNT during 2021 was low.

Exogenous geological processes. In 2021, no catastrophic EGP manifestations were observed. The activity of ravine formation processes in 2021 was below the long-term average. The activity of landslide processes was low. The activity of the aeolian accumulation process was average in 2021. In the reporting period, the flooding activity was low; the process manifested itself during the period of seasonal rise in the level of groundwater.

Mineral resources. In 2021, compared to the indicators of subsoil use in 2020, the following changes took place in the Baikal Natural Territory. In the CEZ BNT, according to the State Register of Mineral Reserves of the Russian Federation and the Collection of Summaries of the Reserves of Common Minerals of the Russian Federation, the number of valid licenses has decreased for the Irkutsk region and remained unchanged for the Republic of Buryatia. In the CEZ BNT in the Republic of Buryatia, the number of valid licenses has decreased. Extraction of minerals is carried out only at a small part (less than 10%) of the total number of licensed deposits, in contrast to the Buffer Environmental Zone of the BNT (BEZ BNT) in the Trans-Baikal Krai, where almost 50% of the deposits are involved in production.

Land resources. Overall, some insignificant redistribution of land between categories took place in municipal entities within the BNT in 2021. The area of industrial land increased by 0.025%; settlement land - by 0.76%; agricultural land - by 0.024%; forest lands decreased by 0.003% and reserve land - by 0.394%. The area of land under specially protected territories and water resources has not changed.

Forests. In 2021, in the Baikal Natural Territory in the Irkutsk region, the reforestation fund amounted to 263.6 thousand ha, of which more than 50% (144.3 thousand ha) were burned areas and dead plantations. In the Irkutsk region, the area covered with forests decreased by 276.5 thousand ha, or 3.2%, compared to 2020. The felling volume decreased by 7.9%. In the reporting year, a forest pathological survey was carried out in the Republic of Buryatia on an area of 645.50 ha, sanitary and recreational activities were carried out on an area of 672.93 ha, of which 514.04 ha were chosen for complete sanitary felling, 158.76 ha - for selective sanitary felling, and 0.13 ha - for harvesting non-merchantable wood. Compared to 2020, the felling volume increased by 3.4 %. In the BNT in the Trans-Baikal Krai, reforestation was carried out on an area of 7.8 thousand ha; the area under forest plantations amounted to 0.8 thousand ha. 0.9 thousand ha of young stand was added to the category of valuable tree plantations. The area covered with forest vegetation in the Trans-Baikal Krai increased by 6.4 thousand ha, or by 0.13%, compared to the previous year.

The state of atmospheric air above the BNT is determined by the anthropogenic impact of emissions from vehicles, industrial and municipal enterprises, life support facilities and infrastructure located both in the CEZ and the BEZ of the BNT, as well as from enterprises of the Irkutsk-Cheremkhovo complex within the Environmental Zone of Atmospheric Effect of the BNT (EZAE BNT). Compared to 2020, the pollution level in the CEZ BNT (city of Baikalsk, city of Slyudyanka, Kultuk workers' settlement, Listvyanka workers' settlement) did not change and remained low. One case of high pollution was registered in the city of Baikalsk in August 2021, when the concentration of suspended PM10 reached 23.3 in terms of daily mean MAC. The unfavorable ecological situation in the CEZ BNT is associated with a high degree of atmospheric air smoke caused by forest fires in the Republic of Yakutia and in the north of the Irkutsk region.

Over the territory of the BEZ BNT, the level of air pollution in the city of Ulan-Ude and the urban settlement of Selenginsk in 2021 was defined as "very high" and "high" in the city of Gusinoozyorsk. A "low" level of air pollution was registered in the city of Petrovsk-Zabaikalsky. Above the EZAE BNT, an extremely high level of atmospheric air pollution was not detected. Compared to 2020, in the reporting year, the level of atmospheric air pollution in the cities of Angarsk and Irkutsk did not change and remained "high"; in the Meget settlement it did not change and remained "low"; in the cities of Svirsk, Usolie-Sibirskoe, Cheremkhovo, Shelekhov, the air pollution level did not change and remained "very high".

Precipitation, snow cover. Precipitation in the BNT was near or above the long-term average in 2021. In winter, the amount of precipitation was distributed unevenly. In January-

February, the amount of precipitation exceeded the average long-term values, in October-December, the recorded amount of precipitation was below the average long-term values. In the spring, summer, and autumn seasons, precipitation was near or above the long-term average. The snow cover depth in most of the BNT was above the long-term average. The breaking up of stable snow cover occurred in late March-early April, the formation of snow cover was observed from early October to mid-November.

Based on the results of snow cover pollution monitoring in 2021, the average concentrations of non-sulfate sulfur, sulfates and total sulfur, and minerals in the BPPM area increased; concentrations of phenols, oil products, and chlorides decreased. The average content of suspended particulate matter remained at the same level. The average total densities of dropout cobalt, manganese, and lead compounds increased. The average density of dropout iron, zinc, and cadmium compounds decreased. On the site Kabansk settlement-city of Baikalsk, the average concentrations of mineral substances, chlorides, and sulfates increased; concentrations of suspended particulate matter decreased; average concentrations of phenols and oil products remained at the level of the previous year. The average total densities of dropout cobalt, copper, manganese, and lead compounds increased. The average density of dropout iron, zinc, and cadmium compounds decreased. In the area of Kultuk workers' settlement and the city of Slyudyanka, the average concentrations of suspended particulate matter, oil products, sulfates, minerals, and chlorides decreased. Average concentrations of phenols decreased to zero values. The average total densities of dropout cobalt, manganese, copper, and lead compounds increased. The average density of dropout iron and zinc decreased. The average density of dropout cadmium compounds did not change significantly.

Climatic conditions. In 2021, the average annual air temperature within BNT exceeded the long-term values due to the significant positive temperature anomalies observed for the majority of the year. The greatest positive anomalies were observed in the autumn and winter periods on the territory of the Republic of Buryatia. On the territory of all subjects of the Russian Federation included in the BNT, the steady upward transition of the average daily air temperature through 0°C took place earlier, compared to the average long-term values. The downward transition of the average daily air temperature through 0°C was registered later, in comparison with the long-term average values. In the warm period of the year, frequent displacements of cyclones led to the predominance of warm, unstable, rainy weather, with strong gusts of wind, which contributed to the formation of dangerous meteorological phenomena.

In 2021, the radiation environment in the settlements of the Baikal Natural Territory remained stable; the levels of radiation contamination of natural environment locations did not pose a danger to the population.

2. Anthropogenic impact. In 2021, 391.3 thousand tons of pollutants were released into the atmosphere on the Baikal Natural Territory, which is 7.2% less than in 2020 (421.8 thousand tons, respectively). The volume of wastewater discharge in 2021 increased by 6.6% and amounted to 950.8 million m³ (891.8 million m³ in 2020).

In the Republic of Buryatia, the volume of wastewater discharges decreased by 57.02 million m³ and amounted to 488.11 million m³ (431.09 million m³ in 2020).

This is mainly due to the increase in electricity generation by the Gusinoozyorsk SDPP branch of INTER RAO-Electrogeneratsiya JSC.

In the Irkutsk region, Lake Baikal is contaminated by municipal unitary enterprise "Sewer Treatment Facilities of the Baikal Municipality". In 2021, 2.08 million m³ of contaminated sewage was discharged into Lake Baikal (1.87 million m³ in 2020). In the Trans-Baikal Krai, the volume of wastewater discharges increased by 3.44 million m³ and amounted to 21.12 million m³ (in 2020 - 17.68 million m³).

The total mass of pollutants entering Lake Baikal amounted to 298.44 tons (in 2020 - 328.60 tons), which is 30.16 tons or 9.20% less than in 2020.

In 2021, such pollutants as total BOD - 14.48 tons (in 2020 - 15.36 tons), sulfate anion - 69.93 tons (in 2020 - 87.47 tons), chloride anion - 79.65 tons (in 2020 - 78.57 tons), suspended particulate matter - 18.94 tons (in 2020 - 29.99 tons), oil products - 0.04 tons (in 2020 - 0.07

tons), nitrate anion - 63.63 tons (in 2020 - 67.70 tons), nitrite anion - 0.80 tons (in 2020 - 0.58 tons), phosphates - 3.72 tons (in 2020 - 3.07 tons), non-ionic synthetic surfactants - 0.66 tons (in 2020 - 0.48 tons), ammonium ion - 23.11 tons (in 2020 - 21,01 tons), COD - 23.36 tons (in 2020 - 32.18 tons), aluminium - 0.06 tons (in 2020 - 1.12 tons) entered the Lake Baikal basin along with the sewage.

The volume of waste generation in 2021 amounted to 59,829.5 thousand tons.

The area of the Baikal Pulp and Paper Mill. In 2013 the Government of the Russian Federation adopted a resolution on the closure of Baikal Pulp and Paper Mill OJSC. On September 14, 2013 the main production activities, associated with the production of sulfate viscose pulp, were discontinued. After the closure of the Baikal Pulp and Paper Mill the main remaining environmental issues are waste disposal, remediation of sludge deposit areas, rehabilitation of the industrial site, and elimination of contaminated groundwater mount.

The intake (withdrawal) of water resources from Lake Baikal in the area of the BPPM was carried out by Baikal PPM OJSC until April 29, 2021. From April 29, 2021, the intake (withdrawal) of water resources is carried out by Teplosnabzhenie LLC per water use agreements No. 38-16.01.01.001-О-ДЗИО-Т-2021-05016/00 (on transfer of withdrawn water for the needs of thermal power industry) concluded on April 29, 2021, for a period up to April 28, 2041, and No. 38-16.01.01.001-О-ДЗИО-Т-2021-05181/00 (on the transfer of withdrawn water for the purposes of drinking and household water supply) concluded on August 17, 2021, for a period up to August 16, 2041. The volume of water resources withdrawn from Lake Baikal in 2021 amounted to 0.97 million m³ (1.94 million m³ in 2020), which is 0.97 million m³ (50.0%) less than in 2020, due to the reduction of water transfer for the needs of public utilities and thermal power. In general, compared to previous year, the volume of water use in the area of the Baikal Pulp and Paper Mill decreased.

The volume of wastewater discharged into Lake Baikal in 2021 amounted to 2.08 million m³, which is 0.21 million m³ more than in 2020 (1.87 million m³). This is connected with the increase in wastewater coming from the population to sewage treatment plants.

Baikal-Amur Mainline route zone. The discharge of wastewater into the Baikal-Amur Mainline zone rivers in 2021 was as follows: in the city of Severobaykalsk - 0.98 million m³ of insufficiently treated wastewater flow into the Tyya River (in 2020 - 0.99 million m³); in Kichera settlement - 0.03 million m³ of insufficiently treated wastewater flow into the Kichera River (in 2020 - 0.03 million m³); in Angoya settlement - 0.02 million m³ of insufficiently treated wastewater flow into the Upper Angara River (in 2020 - 0.004 million m³); in Novy Uoyan settlement - 0.07 million m³ of insufficiently treated wastewater flow into the Upper Angara River (in 2020 - 0.04 million m³); in Yanchukan settlement - 0.008 million m³ of insufficiently treated wastewater flow into the Upper Angara River (in 2020 - 0.002 million m³); in Tonnelniy settlement - 43.07 million m³ of regulatory clean wastewater flow into the Itykit River (in 2020 - 46.14 million m³); in Solnechniy area of the North Baikal District - 0.065 million m³ of regulatory clean wastewater flow into the Akulikan River (in 2020 - 0.056 million m³).

3. Measures aimed at conserving Lake Baikal taken in 2021 were as follows.

Statutory regulation and coordination of Lake Baikal conservation. In 2021, within the operations of the Government Commission on the Protection of Lake Baikal under the leadership of Deputy Prime Minister of the Russian Federation Victoria Abramchenko, four meetings of the Interdepartmental Working Group and the Government Commission were held. The topics under the discussion were the issues of eliminating the accumulated environmental damage caused by the activities of Baikal Pulp and Paper Mill OJSC and organizing the protection of Lake Baikal. The participants of these meetings were Governor of the Irkutsk Region and the Head of the Republic of Buryatia, Presidential Envoy in the Siberian Federal District, representatives of the Presidential Administration, the Ministry of Natural Resources, Rosprirodnadzor, the Ministry of Emergency Situations, Ministry of Foreign Affairs, Ministry of Construction, Ministry of Economic Development, Ministry of Finance, Rospotrebnadzor, Ministry of Health, Roshydromet, Rosrybolovstvo, Rosvodresursy, Rosreestr, Rosatom State Corporation, Russian Academy of Sciences, VEB.RF, State-Run Non-profit Company "REO",

Russian Railways OJSC. On behalf of the Deputy Chairman of the Government of the Russian Federation, a command unit was set up at the site to coordinate and implement priority measures, as well as to promptly manage the elimination of accumulated environmental damage. A unified system for monitoring the progress of such liquidation measures was created. Measures to eliminate the accumulated damage were taken within the framework of the National Project “Ecology”. During the meeting, the implementation of the instructions of the President of the Russian Federation regarding the development of indicators for the protection of the unique ecological system of Lake Baikal and its condition using state environmental monitoring data was discussed.

Members of the Interdepartmental Working Group discussed issues related to the development of the city of Baikalsk. It was decided to develop Baikalsk as an eco-city. The City-Planning Council of the Irkutsk region prepared a master plan for the integrated development of the city, as a result of which the Government of the Irkutsk Region, together with the Baikal Region Development Center, the administrations of Baikalsk and the Slyudyansky District, developed a draft order of the Government of the Russian Federation on the approval of the Program for the Socio-Economic Development of the Baikal Municipality until 2040 and an action plan for its implementation. A list of PPP investment projects planned for implementation within the framework of this master plan was compiled.

Rosreestr was instructed to prepare a legislative initiative similar to the forest amnesty, which will eliminate contradictions in state registers and allow establishing the boundaries of settlements without overlaps.

During the final meeting of 2021, the preparations for the UNESCO monitoring mission, issues related to the water protection zone of Lake Baikal, water level regulation and waste management in the BNT were discussed and planned.

In 2021, pursuant to Federal Law No. 189-FZ “On Amendments to Article 25.1 of the Federal Law “On the Protection of Lake Baikal”” dated June 11, 2021, Article 25.1 was supplemented with Clause 4 as follows:

“In the event that territorial planning documents establish the boundaries of settlements formed from rotational and other temporary settlements created before January 1, 2007 within the boundaries of forest lands for timber harvesting, provided that such settlements are located outside the boundaries of specially protected natural territories, the provisions of Sub-clause 2, Clause 1, Article 11 of this Federal Law shall not apply.”

Following the adoption of the new law on state and municipal control, Federal Law No. 170-FZ “On Amendments to Certain Legislative Acts of the Russian Federation in Connection with the Adoption of the Federal Law “On State Control (Supervision) and Municipal Control in the Russian Federation” dated June 11, 2021, clarified the powers of federal and regional authorities. In Russian legislation, the concept of “state supervision” is subdivided into “federal state supervision” and “regional state supervision”. In the Federal Law “On Specially Protected Natural Territories”, the phrase “state supervision” is replaced by “state control (supervision)” in the field of protection and use of specially protected natural territories.

Federal Law No. 445-FZ “On Amendments to the Federal Law “On Fisheries and Conservation of Aquatic Biological Resources” and Certain Legislative Acts of the Russian Federation” dated December 30, 2021, amended other federal laws. In particular, a list of activities that can be completely or partially, permanently or temporarily prohibited or limited in fishery protected areas was defined. To preserve aquatic biological resources, it was established that onshore protection zones, protected areas, water protection zones of water bodies for fishery purposes, created before the Law on Fisheries entered into force, fish protection zones created before January 1, 2022, and a water body or part of a water body to which such zones are adjacent, should be recognized as fishery protected areas for the period until January 1, 2025. Part of the amendments apply to the definition of the boundaries of the fishery protected area of Lake Baikal.

According to the Decree of the Government of the Russian Federation No. 2399 dated December 31, 2020, the newly-developed list of activities that are prohibited in the central environmental zone of the Baikal Natural Territory came into force on January 1, 2021. This document replaced the Decree of the Government of the Russian Federation No. 643 “On Approval of the List of Activities Prohibited in the Central Environmental Zone of the Baikal Natural Territory” dated August 30, 2001. The validity period of the Decree expires on January 1, 2027.

Measures for protection of Lake Baikal. In 2021, within the framework of the regional project "Preservation of Lake Baikal", the Irkutsk region carried out measures to lower the level of above-sludge waters in the storage cards of the Solzansky and Babkhinsky landfills.

As a result of the execution, the volume of above-sludge water was reduced by 40 thousand m³. Funds spent for these purposes amounted to 338,937.34 thousand rubles, of which 335,547.6 thousand rubles were funds from the federal budget.

The implementation of the program “Reconstruction of wastewater treatment facilities on the right bank of the city of Irkutsk” was continued; in 2021, the sixth stage was completed, works on the seventh stage were continued, and the eighth and ninth stages of reconstruction commenced. The financial support for the program in 2021 amounted to 2,756.1 million rubles, of which 2,645.8 million rubles were funds from the federal budget, 105.8 million rubles - from the regional budget, and 4.4 million rubles - from the local budget. To reduce the negative impact of waste on the environment in the CEZ BNT, The Ministry of Natural Resources and Environment of the Irkutsk Region provided subsidies to local budgets for the creation of places (sites) for the accumulation of municipal solid waste within the framework of the state program. In 2021, 21 container sites were equipped, and 177 containers were purchased. To introduce separate collection of municipal solid waste, 142 special containers for separate collection were purchased. In addition, subsidies to local budgets were provided for the implementation of measures for the collection, transportation and disposal (burial) of municipal solid waste from unauthorized waste disposal sites. As a result, in 2021, three landfills were eliminated on the territory of the Olkhonsky district, the Irkutsk region. They had an area of 0.3 hectares and a volume of 2.7 thousand m³.

In 2021, within the framework of the federal project “Preservation of Lake Baikal”, the Republic of Buryatia planned activities the funds for which amounted to 18,160.60 thousand rubles (9,400.00 thousand rubles from the federal budget, 8,760.60 thousand rubles from the budget of the Republic of Buryatia). The activities were aimed at the reduction of the total area of territories subjected to high and extremely high pollution and affecting Lake Baikal. To implement measures aimed at eliminating the subsoil accumulation of oil products that pollute the waters of the Selenga River in the area of Steklozavod settlement in Ulan-Ude, reclamation of disturbed lands, and protection of surface and groundwater, it was planned to allocate 9,400.00 thousand rubles from the federal budget and 600.00 thousand rubles from the regional budget. These funds had not been disbursed. It was also planned to allocate 590.00 thousand rubles from the republican budget for the development of design documentation for the project “Elimination of the Environmental Consequences of the Activities of the Dzhida Tungsten-Molybdenum Plant”. In the reporting year, these funds were not disbursed, as, per the assessment of Rosprirodnadzor, the Dzhida Tungsten-Molybdenum Plant project needed

additional adjustments in terms of its design specification and estimates.

In connection with the refusal of Rosprirodnadzor to approve this project, the funds provided for the implementation of measures to eliminate the environmental consequences of the activities of the Dzhida Tungsten-Molybdenum Plant had not been disbursed.

Within the framework of the state program “Development of the Construction and Housing and Communal Complexes of the Republic of Buryatia”, the government is taking measures to reconstruct the right-bank sewage treatment facilities in Ulan-Ude. In 2021, the adjustment of the design documentation for the project “Reconstruction of the right-bank sewage treatment facilities of Ulan-Ude. Stage 1. The second start-up complex. Adjustment” was completed. The design documentation was sent to the Ministry of Construction of Russia to check the effectiveness of the use of federal budget funds for the implementation of planned measures: 1,255,169.2 thousand rubles in 2022; 759,951.8 thousand rubles in 2023; 2,088,768.3 thousand rubles in 2024.

Within the framework of the regional project “Preservation of Lake Baikal (Trans-Baikal Krai)”, the government of the Trans-Baikal Krai is implementing measures for the construction (reconstruction) of treatment facilities in the Baikal Natural Territory. The development of budgetary allocations aimed at the construction (reconstruction) of treatment facilities in 2021 was 20.29 million rubles. The reconstruction of the treatment facilities in the city of Khilka (completion date - October 15, 2022), the construction of treatment facilities in Tarbagatai settlement of the Petrovsk-Zabaykalsky District (completion date - November 15, 2022), as well as the construction of treatment facilities in the settlement near the Zhipkhegen railway station, Khiloksky District (completion date - October 15, 2022) that are part of this program will ensure the achievement of the target value set for the Trans-Baikal Krai in the document “Reduction of the volume of discharges of polluted wastewater into water bodies of the BNT to 16,654 m³/year”.

Measures for the overhaul of hydraulic structures and the protection of water resources in 2021 were financed by Rosvodresurs from the federal budget in the amount of 306.12 million rubles, of which 50.324 million rubles were for activities in the Republic of Buryatia, 1.256 million rubles - for the activities in the Trans-Baikal Krai, and 254.540 million rubles - for activities in the Irkutsk region.

Environmental impact assessment. In the Irkutsk region, in 2021, 96 conclusions of the state environmental expertise of the federal level were prepared and approved for facilities located in the Baikal Natural Territory, of which 13 were negative conclusions for facilities planned for construction in the BNT. For projects planned for implementation in the CEZ BNT, nine state environmental assessments were carried out, and a negative conclusion was issued for four facilities.

In the Republic of Buryatia, in the reporting year, 61 conclusions of expert commissions for the state environmental expertise of the federal level were prepared and approved for facilities located in the BNT, of which six were negative conclusions. For projects planned for implementation in the CEZ BNT in 2021, 10 state environmental assessments were carried out. Eight facilities received positive conclusions.

In the Trans-Baikal Krai, the state environmental expertise was carried out for eight federal-level facilities located in the BNT, and for two facilities planned for construction in the CEZ BNT. All projects received positive conclusions.

In 2021, a regional-level state environmental expertise of materials substantiating the limits and quotas for the extraction of hunting resources during the 2021-2022 hunting season was carried out on the territory of the hunting grounds of the Irkutsk region and the Republic of Buryatia. In the Trans-Baikal Krai, there were no regional-level environmental assessments of facilities located in the BNT.

Environmental monitoring. In 2021, the environmental monitoring was carried out by the organisations of Roshydromet (Federal Service for Hydrometeorology and Environmental Monitoring of Russia), Rosprirodnadzor (Russian Federal Service for Supervision of Natural Resource Management), Rosvodresursy (Russian Federal Water Resources Agency), Rosnedra (Russian Federal Subsoil Resources Management Agency), Rosrybolovstvo (Russian Federal

Agency for Fishery), Rosreestr (Russian Federal Service for State Registration, Cadastre and Cartography) as well as by the competent authorities of federal constituent entities - the Republic of Buryatia, Irkutsk region and Trans-Baikal Krai. In addition, some accounting and control records acquired by Rostekhnadzor (Russian Federal Service for Ecological, Technological and Nuclear Supervision), Rospotrebnadzor (Russian Federal Service for Supervision of Consumer Rights Protection and Human Well-Being), Rostransnadzor (Russian Federal Service for Supervision of Transport), Rosstat (Russian Federal State Statistics Service), and the Russian Ministry of Emergency Situations were used for the purpose of BNT monitoring.

In 2021, the Vostsibregionvodkhoz branch of the FGBVU "Tsentregionvodkhoz" continued monitoring the state of Lake Baikal as part of the state monitoring of water bodies. The data on the quality of the waters of the surface layer obtained in the course of this monitoring indicate that anthropogenic impact leads to changes in the hydrochemical regime of the entire Lake Baikal. There are zones with a stable negative impact of economic activity on the ecosystem. Such zones are characterized by regularly discovered anomalies in the composition of the aquatic environment. The reason for the anomalies is the unsatisfactory condition of the wastewater treatment facilities in Kultuk, Babushkin, Listvyanka, Slyudyanka and other settlements causing insufficiently treated wastewater and household waste enter the lake. This is evidenced by increased concentrations of nitrogen-containing substances, phosphate ion, copper, aluminum, and zinc. The excess of background values is also due to the annually increasing anthropogenic load, unorganized "wild" tourism, and the lack of treatment facilities.

Environmental supervision. In 2021, the federal supervisory bodies conducted 229 inspections in the Baikal Natural Territory, which is 8.8% fewer than in 2020 (251 inspections). The number of violations detected increased by 77% compared to 2020 and amounted to 485 offenses (in 2020 - 274 offenses).

Within the framework of the regional supervision in 2021, compared to previous year, the number of inspections in the BNT increased by 2.3 times, which is primarily due to lifting the restrictions imposed to limit the spread of COVID-19. Following the reduction in the quarantine measures, in 2021, the number of checks of individuals carrying out activities on Lake Baikal, including those related to the operation of water transport (22 checks), increased by 57%.

Environmental violations. In 2021, the number of administrative offenses in the field of environmental protection and nature management identified by the territorial bodies of Rosprirodnadzor in the BNT increased by 10.7% compared to 2020 (769 offenses) and amounted to 851. 47.8% of those offenses were detected in the Irkutsk region. The main administrative offenses registered within the boundaries of the BNT in 2021 were the concealment or distortion of environmental information; non-compliance with environmental and sanitary and epidemiological requirements when handling industrial and consumer waste, substances that destroy the ozone layer, or other hazardous substances; non-compliance with environmental requirements in the implementation of urban planning activities and the operation of enterprises, structures or other objects; violation of the rules for the protection of water bodies. In 2021, the number of environmental crimes registered in the Trans-Baikal Krai decreased by 46.8% compared to 2020 and amounted to 340 cases, the main of which were related to illegal logging at forest plantations (98.8% of the total number of detected crimes).

Scientific research. Measures aimed at the preservation of Lake Baikal that are being developed and put into practice are based on scientific research data. In the reporting year, the following institutions had been carrying out research in the BNT: Limnological Institute of the Siberian Branch of the Russian Academy of Sciences (SB RAS) (Irkutsk); the Baikal Institute of Nature Management, SB RAS (Ulan-Ude); V.B. Sochava Institute of Geography, SB RAS (Irkutsk); Institute of the Earth's Crust, SB RAS (Irkutsk); Siberian Institute of Plant Physiology and Biochemistry, SB RAS (Irkutsk); A.P. Vinogradov Institute of Geochemistry, SB RAS (Irkutsk), Institute of Solar-Terrestrial Physics, SB RAS (Irkutsk), Geological Institute, SB RAS (Ulan-Ude); Baikal Museum of the Irkutsk Scientific Center (Listvyanka workers' settlement, Irkutsk region); Irkutsk State University (Irkutsk), Research Institute of Biology of Irkutsk State

University (Irkutsk), East Siberian State University of Technology and Management (Ulan-Ude), Institute of General and Experimental Biology, SB RAS (Ulan-Ude), Institute of Natural Resources, Ecology and Cryology, SB RAS (Chita). The studies were also conducted by research specialists of scientific departments of specially protected natural territories.

International cooperation. From July 16 to July 31, 2021, the 44th session of the UNESCO World Heritage Committee was held online in Fuzhou (China). Issues regarding the Lake Baikal site were not on the agenda of this meeting.

On December 21, 2021, within the framework of the Agreement on the protection and use of transboundary waters concluded between the Government of the Russian Federation and the Government of Mongolia, a meeting of the Joint Working Group on the implementation of this Agreement was held using videoconferencing technology. The Parties heard information on the water situation in the basins of transboundary rivers, considered the results of observations of the state of surface waters of transboundary water bodies in the border sections for the reporting period, listened to reports on other substantive agenda items.

During the meeting, the Russian side expressed concern about the start of construction of a water reservoir in Mongolia on the transboundary Uldze River and the lack of information on the scientific research assessing the negative impact of this project on the ecosystem of the Russian-Mongolian section of the UNESCO World Natural Heritage Site “Landscapes of Dauria”, including on the ecosystem of the Torey Lakes (Transbaikal Krai, Russian Federation). The Mongolian party announced that it would provide full information on the construction of the hydraulic facility on the Uldze River at the regular meeting of the Envoys of the Government of the Russian Federation and the Government of Mongolia.

According to the Mongolian party, as part of the implementation of the decisions of the 41st and 42nd meetings of the World Heritage Committee, UNESCO is conducting an additional study (regional environmental assessment) of the possible impact of the Egiin Gol HPP on the biodiversity of the Selenga River and Lake Baikal, which is scheduled for completion in December 2022. The Mongolian party confirmed that it is ready to provide information on the progress of the study of the possible impact of the Egiin Gol HPP on the biodiversity of the Selenga River and Lake Baikal as related to this regional environmental assessment.

The obligations of the Russian party to implement the Agreement in 2021 have been fulfilled in full.