

Joint water management of the Finnish-Norwegian river basin district (2022-2027)

Tana, Neiden and Pasvik catchment areas in Finland and Norway



The Finnish-Norwegian River Basin District



Troms og Finnmark fylkeskommune
Romssa ja Finnmarkku fylkkagielda
Tromssan ja Finmarkun fylkinkomuuni



Elinkeino-, liikenne- ja
ympäristökeskus

On 22 of May 2014, a bilateral agreement aiming at fulfilling the requirements of the Water Framework Directive (WFD) entered into force. The agreement designates the four catchments Tana, Neiden, Munkelva and Pasvik as an International River Basin District (IRBD). The purpose of the agreement is to establish a common framework to secure a stronger bilateral cooperation and coordination between the River Basin Authorities (Troms and Finnmark County Council and ELY-Centre of Lapland). The agreement covers the planning and implementation of River Basin Management Plans (RBMP) and Programmes of Measures (PoM). Detailed procedures for the coordination are laid down in a Memorandum of Understanding attached to the bilateral agreement. The Memorandum states that a common Roof Report for the whole international river basin district must be produced in order to meet the requirements of the WFD, in the form of a comprehensive “executive summary” of the two national RBMPs.

This document is available in Finnish, Norwegian, Sami and English. The document, along with further information and regional river basin management plans, can be accessed at:

- www.vannportalen.no/norsk-finsk
- www.ymparisto.fi/vaikutavesiin

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1. Introduction and background

According to article 3 of the Water Framework Directive (WFD), river basins covering the territory of more than one Member State shall be assigned an international river basin district. In order to comply with the WFD and national legislation, Norway and Finland signed an agreement concerning a Finnish-Norwegian River Basin District. The agreement sets the framework for bilateral cooperation and administrative arrangements for the river basin district. The agreement encompasses Tana and Neiden water districts, Munkelva with tributaries, and Norwegian and Finnish territory in the Pasvik water district. A Memorandum of Understanding pursuant to the Agreement has also been produced, which addresses the procedures for the coordination of the water management in the Finnish-Norwegian River Basin District at a more detailed level.

River Basin Management Plans are an important tool for securing and improving the status of our aquatic resources. The management plans are intended to summarise the ecological and chemical status of the water bodies, set environmental goals and form a base for local, regional and national authorities' activity, by administering water resources with a holistic approach. This joint document is a summarising and comparative appendix to the national river basin management plans for the Finnish-Norwegian River Basin District. An agreement between the two countries was signed in 2013, effectively creating an international river basin district that encompasses Tana, Pasvik and Neiden water basin districts. Prior to the agreement, the water districts that now form the international river basin district had been administrated as part of Norwegian-Finnish River Basin District in Norway, and as Tana, Neiden and Pasvik River Basin District in Finland.

The regional authorities Troms and Finnmark County Council, the Office of the Troms and Finnmark County Governor and Lapland ELY-centre (Centre for Economic development, Transport and the Environment) have had meetings periodically since 2011 to coordinate and set common goals for water management. The meetings have addressed delineation of water bodies, the methodology behind characterisation, classification and risk assessment, and which level of coordination can be attained for the river basin management plans, programmes of measures and monitoring programmes (Appendix I). In addition, meetings for all the river basin districts in northern Scandinavia (North Calotte) have been held to exchange information and better coordinate processes. Meetings at the local level have also been held between municipalities in Norway and Finland.

Cooperation between Finnish and Norwegian authorities regarding water management predates the WFD. In 1980, the Norwegian and Finnish government signed an agreement concerning The Finnish-Norwegian Transboundary Water Commission¹, ensuring local, regional and national cooperation regarding the transboundary watercourses. The commission remains as an important arena for discussion and input in relation to the WFD.

¹ http://www.ymparisto.fi/fi-fi/Vesi/Vesiensuojelu/Rajavesistoyhteistyö_Lapissa/Suomalaisnorjalainen_rajavesistokomissio [in Finnish]
<http://fylker.miljostatus.no/Finnmark/Tema-A-A/Internasjonalt-samarbeid/Grensevassdrag/> [in Norwegian]

Multiuse plan for Pasvik and Grense Jakobselv 2021-2030

Norwegian, Russian and Finnish authorities co-operate on updating the multiuse plan for the transboundary rivers of Pasvik and Grense Jakobselv. The overall objective of the Multi-Use plan is to sustain and improve the state of the environment within Pasvik and Grense Jakobselv river basins, to the benefit of local people and to increase the viability of the local economy. The time scope of the plan is from 2021-2030. The County Governor of Troms and Finnmark is the Lead Partner. The project is implemented together with Pasvik State Nature Reserve in Russia and the Centre for Economic Development, Transport and Environment of Lapland, Finland. Troms and Finnmark county are represented in the project steering group. The roof-report and the multiuse plan have many common goals and measures and it is important to see both plans in context. More information about the roof-report is available at www.statsforvalteren.no.

2. Area description

Geographical and ecological description

The Finnish-Norwegian River Basin District is composed of Tana, Neiden and Pasvik water districts. While Tana and Neiden cover territory in Norway and Finland, Pasvik water district also stretches into Russia (figure 1). However, Russia is not part of the agreement concerning the international river basin district.

The Finnish-Norwegian River Basin District covers the catchments for the rivers Tana, Neiden, Pasvik and Munkelva, which drain into the Barents Sea. The total land area of the river basin is roughly 48 000 km², with roughly two-thirds located in Finland. The area is sparsely populated and there are only a few bigger towns in the area. The population on the Finnish side of the area is roughly 8000 and the population density is 0.3 people/km². There are roughly 20 000 inhabitants living on Norwegian side of the river basin. This results in few influences for a majority of the water bodies in the river basin district, and thus the ecological status is high or good for most of the area. Most of the river basin district is in the Sami native region.

Altitude differences in the mountain area are large, ranging from 150 to 600 m above sea level. The area around Lake Inari is hilly, where the altitude varies from 100 to 200 m above sea level. Vegetation is sparse in many parts of the area, and outcrops are abundant. In the valleys (e.g. River Tana and Utsjoki valleys) there are ridges and deltas. Large sand deposits are formed in the rivers, which have dug out various levels in the sandy river terraces, which are used for cultivation and settlements. The bedrock varies from sandstone to granite and gneiss rock. The land is characterised by moraines, valleys with sandbanks and terrace surfaces, and vegetation varying from barren mountains and plains to pine forests and large marshy areas. The Pasvik water district borders the Siberian Taiga forest. The Tana water district is formed of the same geological rock formation as the rest of Northern Finland like granite gneiss, slate and abyssal rock areas. As a result of the rock formation and its acidic nature, which can be seen also in the soil, the vegetation is typical for that kind of selective environment.

Apart from the Pasvik River, the aquatic environment in the area is typically nutrient-poor and clear, and waterbodies contain very little organic matter. The watersheds are rich in species both in terms of vegetation, fish, birds and mammals. The biggest rivers in the area are the main stem of the river Tana, including tributaries as Kárášjohka, Anárjohka and Utsjoki, Neiden, Vaskojoki, Ivalojoki, Juutuanjoki, Pasvik/Paatsjoki, Munkelva and Grense Jakobselv/Vuorjemijoki.



Figure 1. Overview of the Finnish-Norwegian river basin district and its administrative borders: Tana-Teno river basin, Neiden-Näätämöjoki (including Munkelva-Uutuanjoki) and Pasvik-Paatsjoki river basin (excluding the Russian part).

The biggest lake in the area is Lake Inari, from which the waters run into the Barents Sea along the Pasvik River.

The waterbodies in Norway are grouped into eco-regions based on climatic conditions and biogeographical distribution patterns. The Norwegian side of the river basin district belongs to the Inner Northern-Norway eco-region, which has more fish species than other regions due to a distinct migration history.

Water dominates the landscape in the Finnish-Norwegian River Basin District. Table 1 shows the number of water bodies in the river basin district, as well as their combined area or length.

Table 1. Water bodies in the Finnish-Norwegian River Basin District (as of 07.04.2021 for Norway).

Water Category		Rivers		Lakes		Coastal waterbodies		Groundwater	
		Amount	Length (km)	Amount	Area (km ²)	Amount	Area (km ²)	Amount	Area (km ²)
Norway	Tana	514	13 613	156	248	20	964	31	231
	Pasvik	127	2357	91	187	9	836	10	78
	Neiden	85	2520	54	73	9	261	2	8
Finland	Tana	39	967	46	63	-	-	397	304
	Pasvik	66	1 475	184	1 550	-	-		
	Neiden	18	234	76	176	-	-		
Total		830	22 310	606	2 296	37	3063	437	561

The waterways in the river basin district are of great importance for the Sami culture and all residents. Rivers and lakes enable livelihoods such as agriculture, forestry, fishing, hunting and industry, as well as leisure activities. There are several national parks and nature reserves in the area. Several of the rivers in the river basin district are important spawning rivers for Atlantic salmon; Tana is one of Europe's largest salmon rivers. There are special protection regimes for protecting the salmon stocks in the national salmon fjords and rivers in Norway. The delta of the river Tana is also Northern Europe's largest river delta in a pristine state and has high importance for wetland birds (Ramsar-area).

Management structure

In Norway, the river basin districts are managed by the County Councils, which are appointed competent authorities in the Water Management Regulation, §20. The competent authority is responsible for facilitating and coordinating the processes behind producing a river basin management plan, a programme of measures and a monitoring programme. The Office of the County Governor is appointed as the environmental authority for each river basin district. A River Basin District Board is appointed, with representatives from regional sector authorities, the Office of the County Governor, the County Council, municipalities and other affected authorities. If the river basin encompasses several County Councils, a steering group is appointed, however this is not the case in Troms and Finnmark County. Public participation and involvement are secured by inviting other stakeholders and interest-organisations to participate in regional and local references groups and other collaborative meetings.

Municipalities in the water districts are encouraged to organise the local work in an inter-municipal project, where one municipality takes responsibility for the coordination and local processes. A Water District Board should also be appointed, consisting of the involved municipalities at the political and administrative level. A local reference group is often merged with the water district board to create better conditions for participation and strengthen local involvement. For Tana sub- district, Tana municipality leads the work, while Sør-Varanger municipality is responsible for Pasvik and Neiden sub-districts.

All documentation, updates, contact information, and minutes from meetings are available at www.vannportalen.no/norsk-finsk.

Lapland Centre for Economic Development, Transportation and the Environment (Lapland ELY-centre) is the responsible authority for river basin management on the Finnish side. River basin management plans are produced in ELY-centre in cooperation with regional interest groups consisting representatives of the various economic sectors and regional actors. The responsibility of implementing the proposed measures are divided between the economic sectors in concern, municipalities and other authorities. ELY-centre will compile the proposal for river basin management plans, which require final approval from the national council of state.

All documentation of the river basin management work is available at www.ymparisto.fi/vaikutavesiin.

3. Public information and consultation

Public consultation and information is important in order to ensure participation and secure local knowledge. Planning program, significant issues and the management plans for the river basins are published for public consultation for a period of six months in Finland and three months in Norway. To enhance collaboration, the main consultation documents are translated into the mother tongue of the neighbouring country.

Public consultation of planning program and significant issues

In the process of preparing planning program and significant issues there have been differences in the timetables in Norway and Finland. The public consultation in Norway was from 1st of April to the 31st of July. During the public consultation a national public consultation conference was held, as well as regional and local information meetings. During the last part of 2019 in Norway the results of the public consultation were processed, and alterations and updates were made. The public consultation in Finland was from 8th of January to the 9th of July 2018. Feedback emphasized the issues of water level regulation, migration barriers and wastewater point source loading.

Public consultation of the river basing management plan

In the process of preparing river basin management plans and program of measures there have been differences in the timetables in Norway and Finland. The public consultation period in Norway was from the 1st of April to the 31 of May 2021. During the public consultation a national public consultation conference was held, as well as regional and local information meetings. In Norway the results of the public consultation were processed, and alterations and updates to the management plan were made. The management plan will then be submitted for approval in the River Basin District Board and then submitted to the Troms and Finnmark County Council for political approval. After political consideration, the ministry of climate and environment must approve the plans before they are considered final.

The public consultation period in Finland lasted from the 3rd of November 2020 till the 14th of May 2021. Results from the public consultation were processed during 2021 in co-operation with stakeholders and authorities. Two separate documents will be processed, the water management plan and a program of measures, which is a more detailed document on water management measures. The Finnish government will approve the water management plan at the end of 2021.

The management plans were also notified in accordance with Article 10 of the Protocol on Strategic Environmental Assessment to the Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention).

The Finnish water management plan draft was translated into Norwegian, and the Norwegian documents were translated into Finnish. The translated documents were linked on both authorities' consultation web pages.

This joint report will be an unofficial appendix to the respective national river basin management plans.

4. Significant water management issues and pressures identified

Significant water management issues in the river basin districts are mapped as bases for river basin management planning. Pressures to the aquatic environment are human activities that cause deterioration of water quality or change hydro-morphology in water bodies. A pressure is considered significant, when it poses a risk to or causes ecological status to deteriorate.

Pressures from human activity include nutrient loading, physical alterations of watercourses (including fish migration barriers), alien and invasive species, pollution of harmful substances. Sources of pollution include both point sources and diffuse sources, such as industry, wastewater, industry, and leaching from landfills, disused industrial areas and mining sites. The Norwegian part of the river basin also has polluted sediments in most harbours. Nutrient loading from human activities is rather small in the area and the ecological status is mainly classified as good or high. Sources of nutrient loading can be forestry, wastewater (both from households and municipal wastewater), agriculture and other diffuse sources.

Alien and invasive species

There are two originally Pacific species introduced to the area: King crab and Pink salmon, which have colonized the coastal region. King crabs prey on the bottom fauna causing change in their species composition and sediment quality. The Norwegian black list of 2018 has evaluated king crab to have a very high risk of ecological impact. However, in the eastern parts of Troms and Finnmark King crab is managed as an important economic fishing resource with quota restrictions.

Pink salmon is a Pacific Ocean salmon species which was introduced to North-West Russia from the late 1950's till year 2000. Pink salmon spawns in the same habitats with Atlantic salmon, but earlier in the summer. However, there potentially is negative interaction with the native salmon when both species are present in a river. In 2019 and 2021 an unusual amount of pink salmon was reported in the rivers on the Norwegian side. The Norwegian Scientific Committee for Food and the Environment published in January 2020 an assessment of the risk to Norwegian biodiversity and aquaculture from pink salmon. The committee concludes that the high numbers of pink salmon to eastern Troms and Finnmark in 2017 and the expansion to western Troms and Finnmark in 2019 indicate an ongoing expansion within Norway.

Vendace has been introduced in Lake Inari and it established there by 1970's. Since then it has spread down to the Pasvik River, where it has made pelagic whitefish densities decline through competition.

There is salmon and rainbow trout farming on the coast. The Kolarctic Salmon project, a project funded by the EU's Kolarctic programme, established that escaped farmed salmon is present in the coastal catch (Niemelä et al. 2014). Escaped rainbow trout is occasionally found in the Neiden River. Spread of alien Salmonids is considered a threat to the native salmon populations.

Contamination from metallurgy in Russia

One of the biggest pollution sources in the river basin district is the Kola GMK nickel smelter in the Russian town Nikel, located 7 km from the Norwegian border. The smelter was closed down in December 2020, but the Kaula mine in Nikel is still being operated. The plant has been a local source of sulphur dioxide (SO₂) along with other heavy metal emissions (nickel and copper) to air-

and waterways. Wastewater from the smelter was released to the Pasvik River watercourse via Lake Kuetsjärvi. Due to the prevailing south western winds, the airborne emissions tend to be carried northeast of the source. The pollution has thus seriously affected water quality and the ecological status in several waterbodies in the lower Pasvik River basin and in the Norwegian Jarfjord area (figure 2).

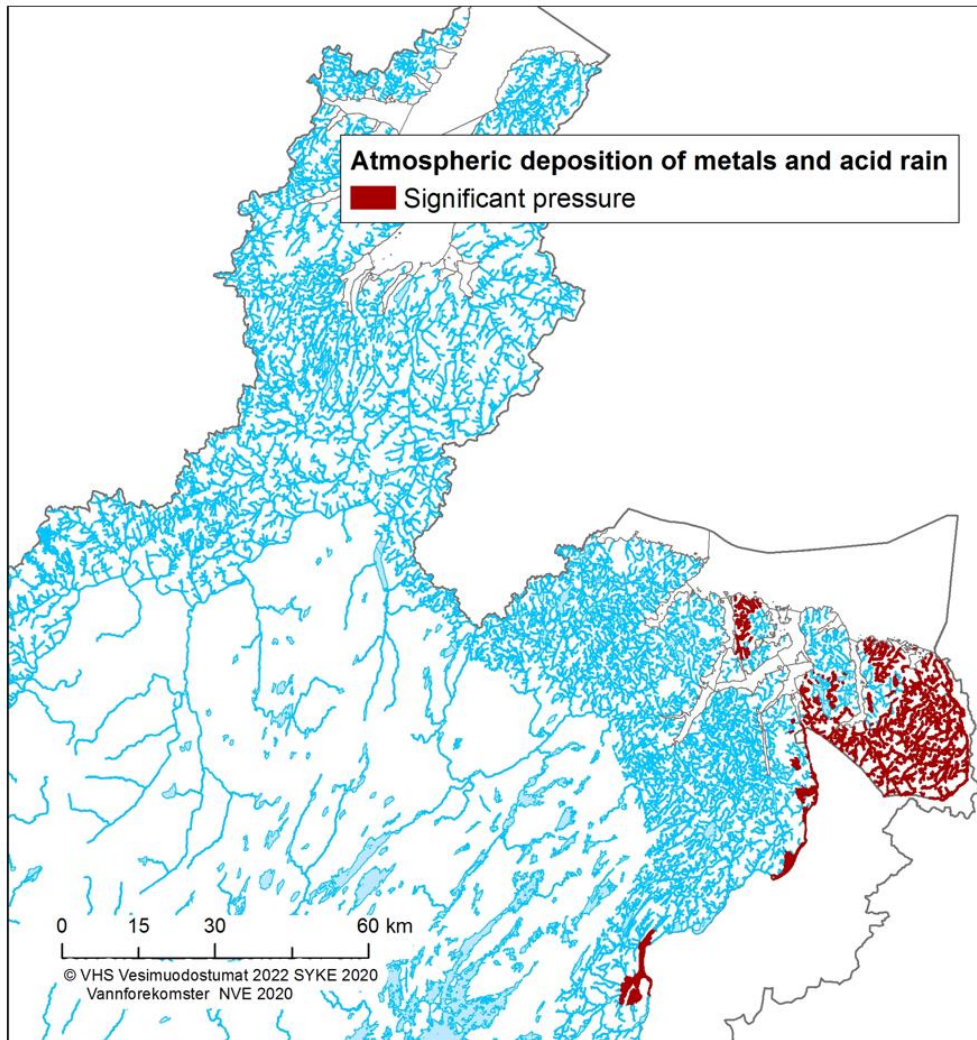


Figure 2. Significant pressure from atmospheric deposition of metals and acid rain.

Hydropower regulations

On the Finnish side, the lakes Inarijärvi and Rahajärvi are regulated for hydropower, but the relatively light regulation practice does not meet the criteria for heavily modified water bodies. However, there has been an intend to adjust Lake Inarijärvi's regulation to climate change and to better suit the aquatic biota. Possibilities to end lake Rahajärvi regulation have been under consideration in 2020.

Along the Pasvik river, there are five Russian and two Norwegian hydropower stations built shortly after World War II. The hydro power regulations have changed the river into a series of reservoirs, altering the ecology of the river. Hydropower dams in the Pasvik river basin pose a total migration barrier to fish. Hence migration connection between Lake Inarijärvi and the sea is lacking. In Neiden sub-district in Norway, there are also hydropower regulations in several rivers and lakes (figure 3).

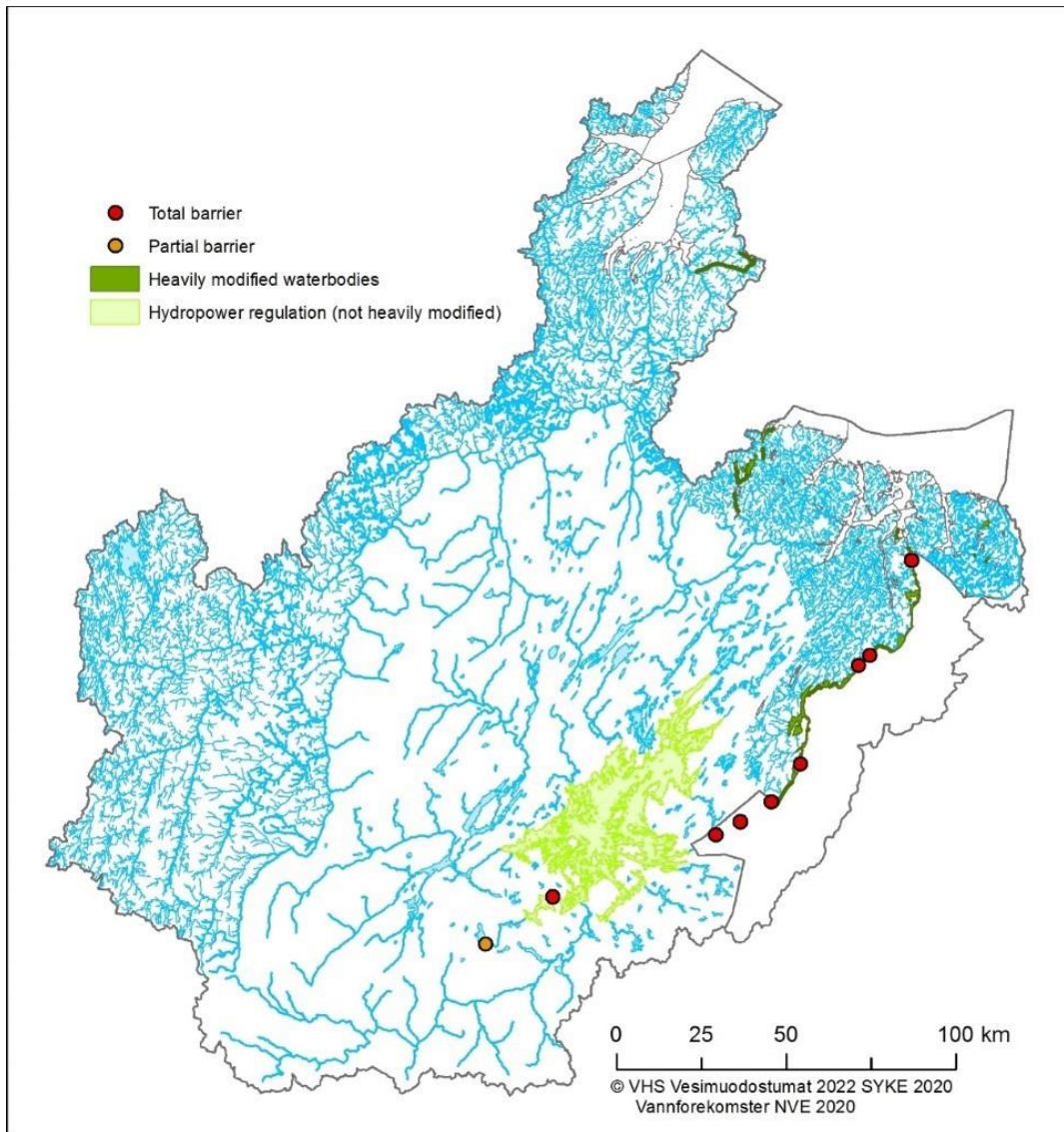


Figure 3. Heavily modified and other regulated water bodies and migration barriers from hydropower regulation.

Over-exploitation of anadromous fish

The Atlantic salmon in the Tana River comprises around 35 sub-populations, some of which are declining due to the extensive exploitation both in the sea and along the river. The Finnish-Norwegian Tana Monitoring and Research Group estimates the attainment of local spawning targets yearly. Stock status over the years (2016-2019) was poor (probability of reaching target < 40 %) in 7 of the 15 stocks that were evaluated. These comprise the Tana/Teno river stem, and the siderivers of Kárášjohka, Iešjohka, Anárjohka/Inarijoki, Lakšjohka, Válgjohka and Akujoki (figure 4).

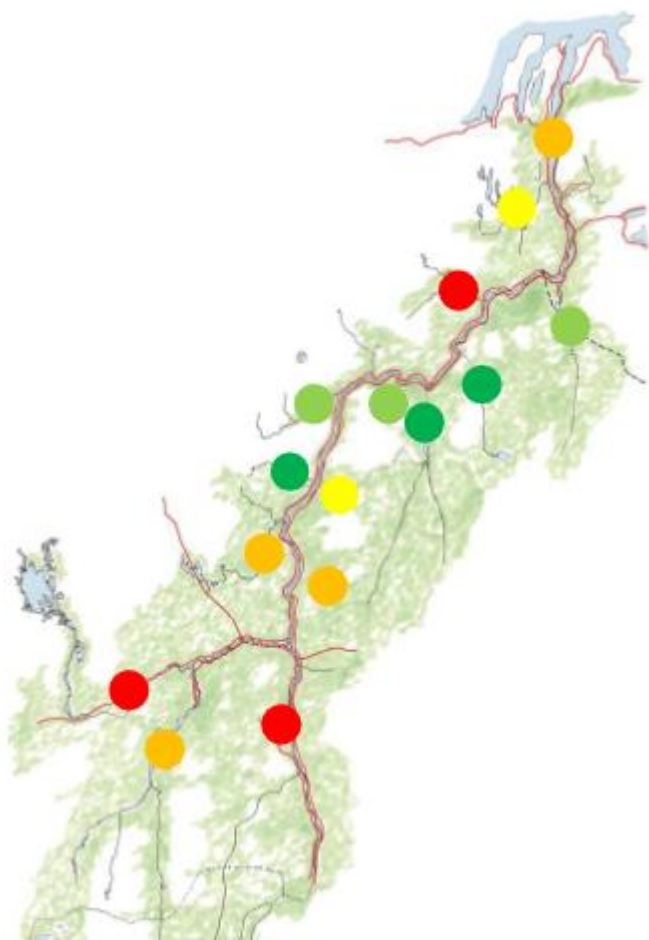


Figure 4. Spawning stock attainment in years 2016-2019 (Status of the Tana/Teno River salmon populations in 2019).

- 1) Probability of reaching the spawning target over the last four years higher than 75 % and attainment higher than 140 % (dark green colour in the summary map below)
- 2) Probability higher than 75 %, attainment lower than 140 % (light green)
- 3) Probability between 40 and 75 % (yellow)
- 4) Probability under 40 %, at least three of the four years with exploitable surplus (orange)
- 5) Probability under 40 %, more than one year without exploitable surplus (red)

Pressures from mining in Norway and Finland

On the Norwegian side the mine of the AS Syd Varanger is situated in Bjørnevatn. The mine was closed in 2014, but a re-opening is being planned. Pressures resulting from previous operations are still prevalent. The coastal water bodies Bøkfjorden midtre has poor chemical status due to the mining. For waterbodies surrounding the mine at Bjørnevatn (Lake Ørnevatn and it's catchment), there is a need for new studies to define the pressures and the biological and chemical status. In addition, several small lakes close to the centre of Kirkenes are polluted from dioxins from previous processing.

There are no industrial mines on the Finnish side, but instead scattered gold prospecting poses a risk to aquatic environment in parts of the Pasvik River tributaries, namely the Lemmenjoki and Ivalojoiki. The main impact to water quality being turbidity from the loading of suspended solid

particles and morphological changes caused by excavating riverbanks. Gold prospecting is estimated to be a significant pressure in three rivers: the Sotajoki, Postijoki and Miessijoki.

Pollution in harbours and coastal areas

As a result of past and present activity along the coast, some harbours are heavily polluted. Contaminated sediments are found near population centres and harbours, where there may be many sources of pollution of various kinds. Pollutants in sediments can spread to the surroundings. They may spread from the sediment to water, re-suspend when sediments are disturbed, or be absorbed by benthic organisms (bioaccumulation). Because of these mechanisms contaminated sediments may continue to release hazardous chemicals to the surroundings for a long period after the land-based sources of the pollution have been eliminated. Consequently, contaminated sediments can have serious effects on living organisms and ecosystems. To reduce the ecological and human risk, contaminated sediments need to be assessed and managed.

Fish migration barriers

In Lake Inarijärvi basin several natural ponds are being used for whitefish rearing, which demands closing the pools by dams and so cause minor migration barriers.

Connectivity through road culverts has been studied and partly restored in the region. In the Tana river course, migration barriers have been inspected at intervals over a period of 20 years. As a part of the international cooperation, many barriers have been restored. There remain a few culverts that are a total or partial barrier in the streams flowing to the Tana River and the Pasvik headwaters.

Other hydro-morphological changes

Many rivers in the Lake Inari basin have been used for timber floating and for that purpose their rapid sections have been cleared from stones. There is need for river habitat restoration in these locations, in the Finnish part of the Pasvik sub district.

Sewage wastewater

There are multiple larger wastewater treatment plants in the river basin district (figure 5). Treated wastewater discharge may pose a risk of nutrient enrichment and impair hygienic quality. Most wastewater treatment plants do not cause notable change in the recipients. The most notable effect from wastewater discharge has been observed in some side rivers in lower Norwegian parts of the Tana river and the river Akujoki in Finland (the Pasvik basin). In Rustefjellbma, in the lower parts of Tana in Norway, there is a water body where biological and chemical status is poor due to wastewater discharges, possibly in combination with other pressures. By Tanabru, status is affected in the immediate surroundings of the discharge point and the wastewater unit is being upgraded. In the Berlevåg harbour, there is a need to survey the effects of untreated sewage discharges.

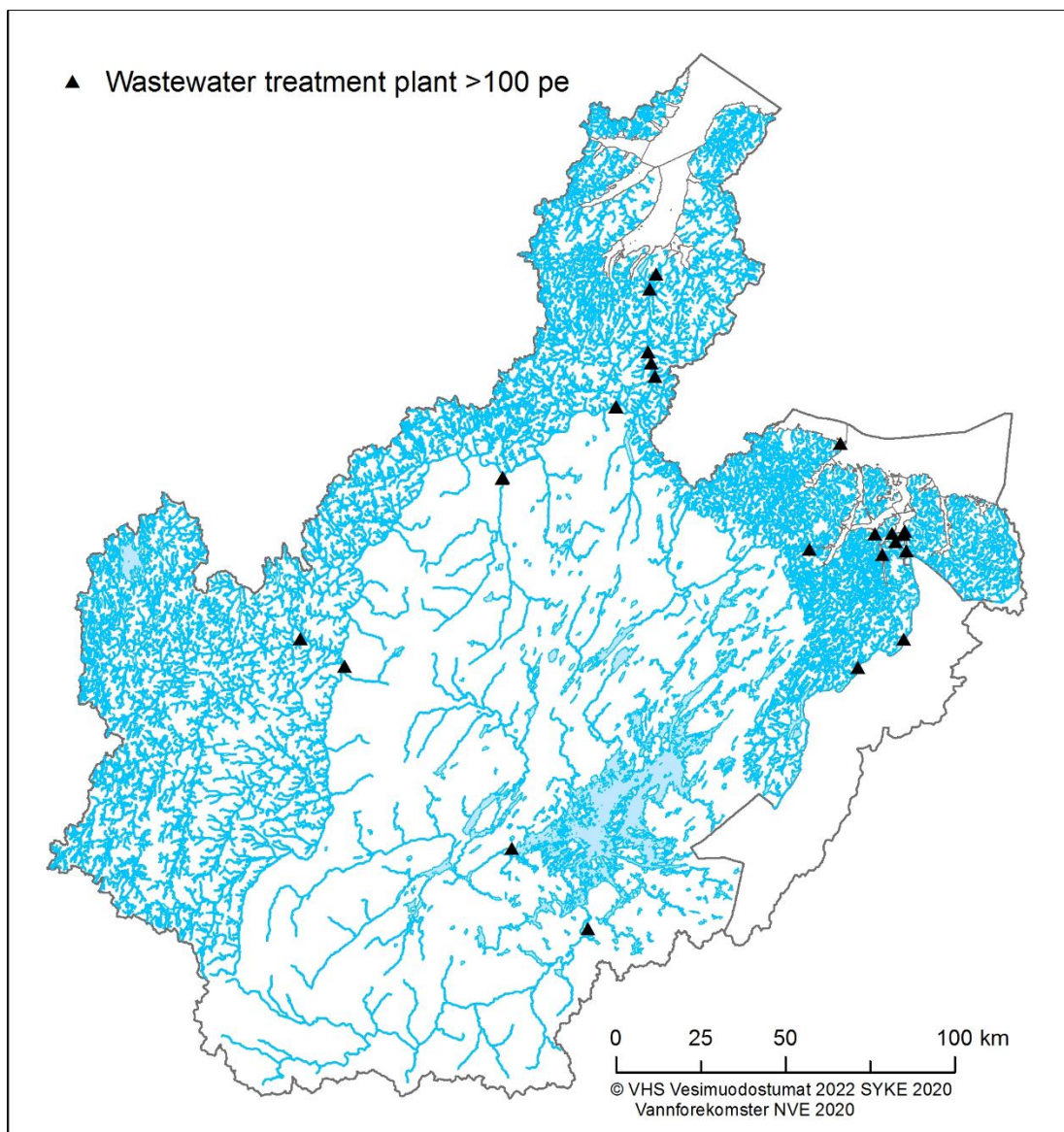


Figure 5. Wastewater treatment plants with person equivalent more than 100.

Diffuse source nutrient loading

Diffuse loading from scattered settlements' wastewaters is generally low due to centralized wastewater treatment. The status of many of these units is unknown and should be controlled. Estimated numbers of scattered settlements' wastewaters in Norway are 209 (Karasjok municipality), 1100 (Tana municipality) and 657 (Sør-Varanger municipality). On the Finnish side there is altogether 3 720 scattered settlements: 716 in the Tana, 244 in the Neiden and 2 760 in the Pasvik River basin.

There is small-scale grass farming and dairy livestock centered along the river valleys, mainly in the Norwegian part of the Tana basin and the southernmost parts of the Pasvik basin. These pressures are classified as having insignificant or unknown impact. In Norwegian parts of the Tana watershed, where agriculture is most intensive, impacts are to be monitored, providing new knowledge on potential ecological effects.

Fish farming and parasites

The region's Eastern coastal areas have industrial fish farming. Emissions from aquaculture mainly consist of organic particles and dissolved nutrients, which can cause local fertilization. Sea lice are salmon parasites that thrive in coastal fish farms. Sea lice damage the host fish and may spread from farms into the wild fish. Interbreeding with escaped, migrant, farmed salmon is detrimental to wild salmon. However, no water bodies in the Norwegian part of the river basin district are registered with a significant pressure due to fish farming activities.

There is one fish farm in the Finnish Pasvik River basin, in the Juutuanjoki River, which is rearing salmonids for Lake Inarijärvi fish stocking. Its nutrient loading is not significant for the recipient.

Gyrodactylus salaris is a salmon parasite non-native to the Atlantic area and its infection could cause irreversibly damage for the salmon stocks. The threat has been noted in both countries and by the Finnish-Norwegian Transboundary Water Commission. The prevention of *Gyrodactylus* spreading relies on information dissemination and disinfection of fishing equipment. Preventing further spreading is also of great public concern.

Table 1. Significant water management issues and pressures.

Pressures/Issues	Finland	Norway
Sewage wastewater	X	X
Diffuse source nutrient loading		X
Fish farming and parasites	(X)*	(X)*
Over-exploitation of anadromous fish	X	X
Pressures from mining	X	X
Contamination from metallurgy in Russia		X
Hydropower regulation	X	X
Migration barriers	X	X
Alien and invasive species	X	X
Pollution in harbours (contaminated sediments)		X

* *The threat of Gyrodactylus spreading is an essential issue for the whole district.*

5. Monitoring networks

Monitoring of surface water quality aims to provide an overview of the state of waters. Monitoring may focus on water physio-chemical quality, biological quality elements or in some cases hydrological indicators. Both countries have their own monitoring programmes, where different reaches of the Tana river are included in both. Monitoring can be divided in terms of its purposes as surveillance, investigative or operational.

Surveillance monitoring provides long-term time series from major water bodies in the region as well as reference locations. It usually includes all the necessary biological quality elements too.

Operational monitoring is carried out to establish the environmental status of those water bodies do not meet their environmental objectives and also to track environmental changes from major human activities, such as mines and sewage plants. Operational monitoring typically includes also at least the most sensitive biological quality elements to the respective pressure.

Investigative monitoring may be carried out if there is a need to ascertain the status of the water bodies, as well as to ascertain the magnitude and impacts of accidental pollution.

The regional monitoring program as whole should give a representative picture of aquatic environment's quality the river basin district considering the level of pressures and variety of surface water types.

Monitoring frequency may be adjusted according to the environmental pressures and significance of the water body. Typically monitoring frequency is set to annual, or once in three or six years.

There is a long history of common water monitoring activities on transboundary rivers between Finland and Norway. Water quality has been monitored in the Tana River for decades already in co-operation between Finland and Norway. Chemical parameters have been measured a longer time, and during the latest years biological monitoring has also been carried out. In 2017, a joint Norwegian-Finnish monitoring programme for the Tana river was developed[1].

[1] <https://prosjekt.fylkesmannen.no/GVK/Tana/Vannovervaking---Vesiston-seuranta/>

For the Pasvik river basin, a trilateral monitoring programme was developed in 2008 to monitor pollution from industry and, in particular, effects of the emissions of the Kola GMK smelter in Nikel, Russia. The aquatic parts were updated in 2015 according to WFD requirements[1].

[1] http://www.pasvikmonitoring.org/norja/seurantaalue_n.html

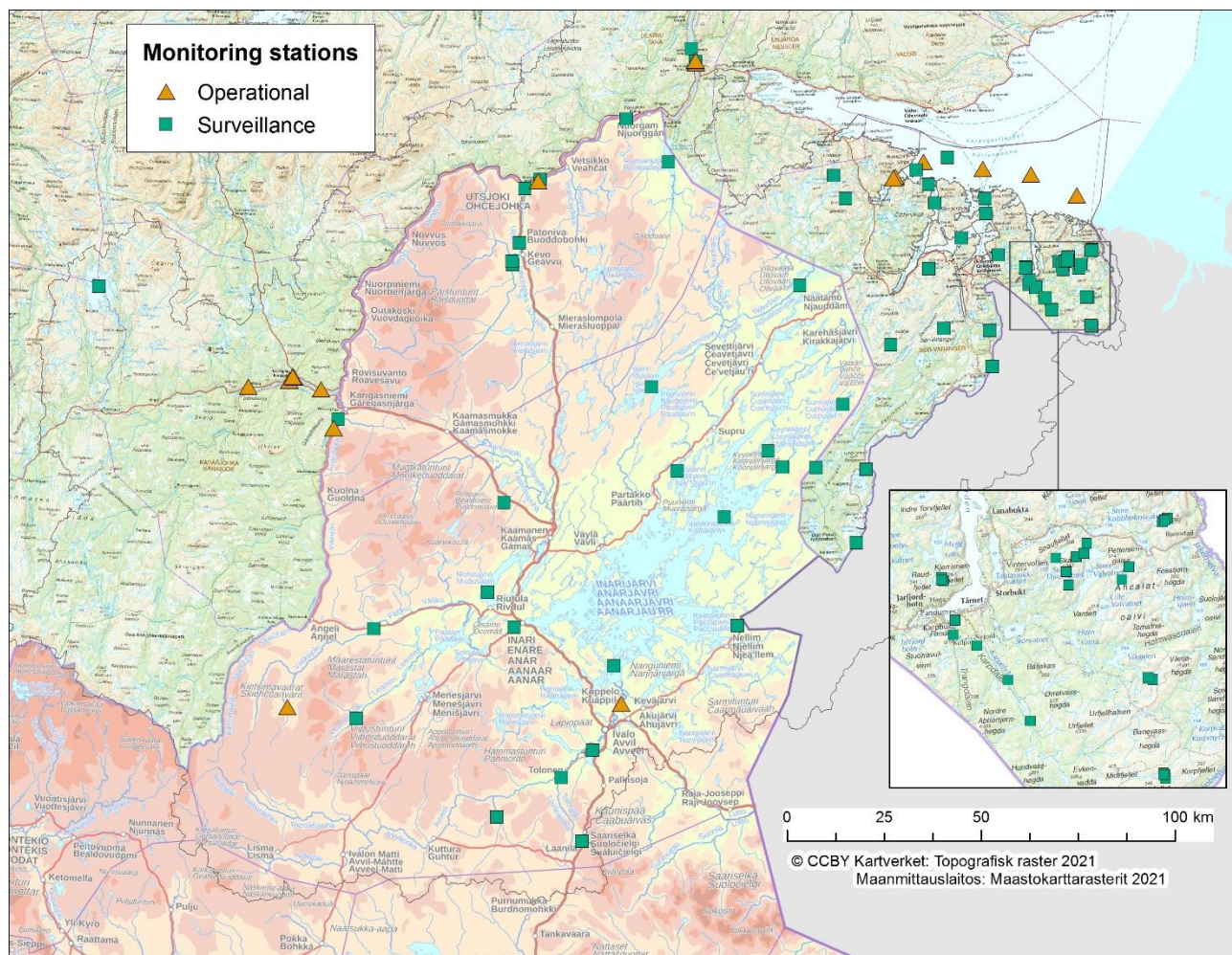


Figure 6. Operational and surveillance monitoring stations in the river basin district. As of May 2021.

6. Assessment of water bodies

Typology and reference condition

Surface waters are divided into different “water types” based on the geographical and physio-chemical characteristics of the waters. Waterbodies with similar physio-chemical characteristics also have similar ecology. When comparing to reference conditions, the water type of a water body can tell us what the water body would be like in its natural state, without the impact of human activities. Reference condition refers to a state that is mostly unaffected by anthropogenic pressures. Chemical and biological data from such pristine reference water bodies forms the type-specific reference data that is used in assessing the status of water bodies in the same type. In some cases natural state of waters cannot be found for reference. In such cases the reference conditions are based on the historical data, modelling, expert reviews or the best suitable waters with low human activity. Some surface water types still lack reliable reference condition.

The water type of surface waters is decided by different factors for rivers, lakes and coastal waters. Factors used to decide the water type of rivers and lakes would for example be the amount of calcium and organic material in the water. An example of a water type for a lake would be “highland, medium surface area, deep, low alkalinity, clear water”, as opposed to for example “lowland, large surface area, shallow, medium alkalinity, humic”. When determining the water type of a river, depth would not be a factor. Factors used to decide the water type of coastal waters would be for example salinity and wave exposure.

Delineation

There are some differences between Finland and Norway in the delineation of water bodies, where Norway has delineated smaller water bodies than Finland. Norway has delineated rivers or stretches of river with a catchment area larger than 10 km², and lakes that are larger than 0.5 km². Smaller lakes are included in river water bodies. In Finland, rivers with catchments larger than 100 km², as well as 60 smaller rivers with catchments ranging between less than 10 km² and up to 100 km² have been delineated. All lakes larger than 1 km² have been fully characterised, and lakes between 0.5 km² and 1 km² have been typified and preliminarily classified. This results in some rivers being delineated on the Norwegian side of the border but not on the Finnish side. The differences in delineation are illustrated by figure 7. The bigger water bodies, however, are delineated in the same way.

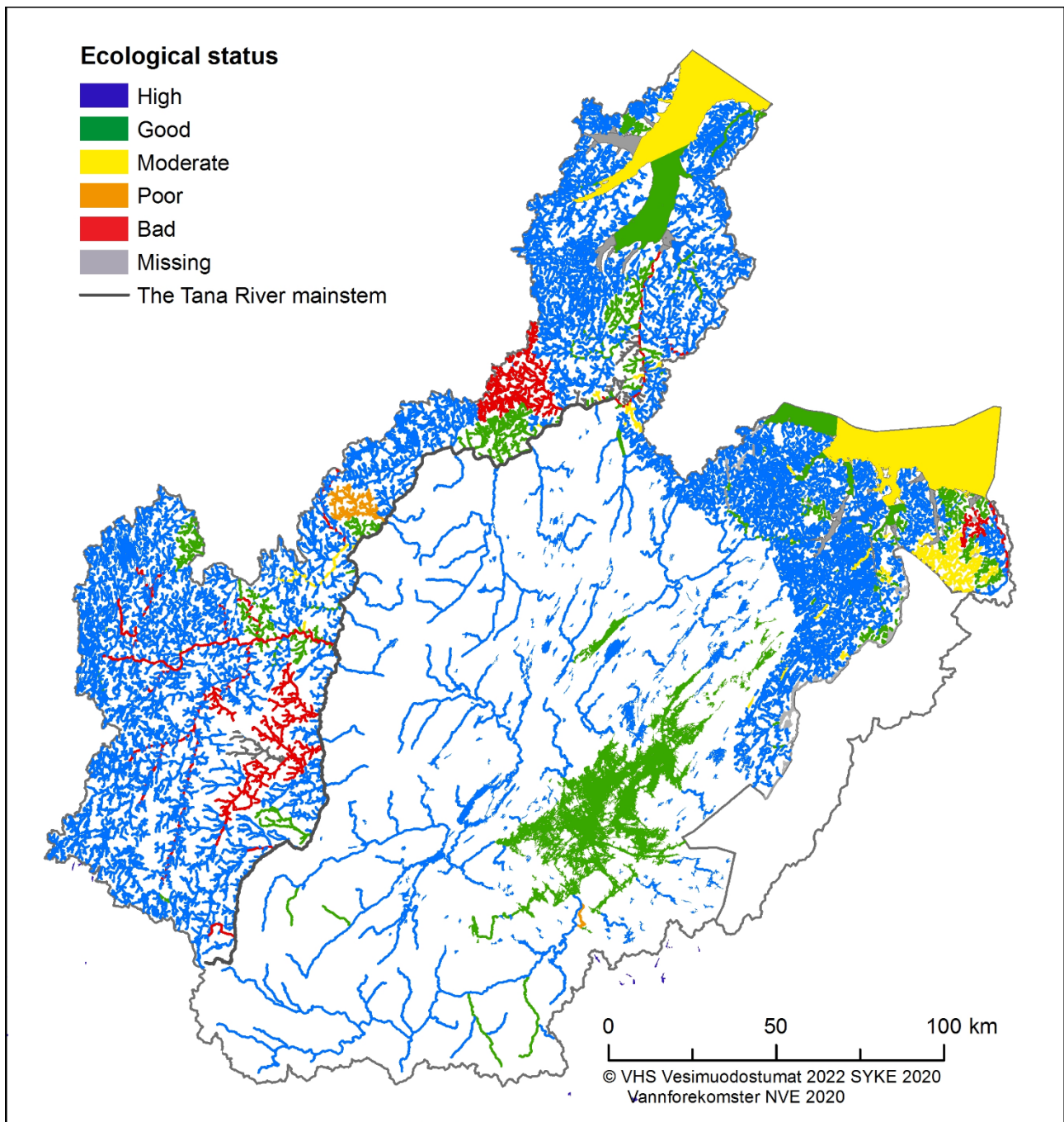


Figure 7. The ecological status of water bodies in the river basin district. The map also shows the difference in delineation on the Norwegian and Finnish side of the border.

Ecological classification

The general objective of the Water Framework Directive is to achieve “good” status for all surface waters. The WFD gives a definition of what constitutes good water status, and the classification scheme for water quality includes five status classes: high, good, moderate, poor and bad. Ecological and chemical status together decide the status of the water body. High status, also called “reference condition”, is the best status achievable. It is defined as the biological, chemical and morphological conditions associated with no to very low anthropogenic pressure. Good ecological and chemical status would be if a water body was affected by human activity, but there was still a healthily

functioning ecosystem and low pollution levels. Figure 8 illustrates the five different ecological status classes.

Ecological Status	Environmental Objective Status
High	Environmental Objectives achieved
Good	
Moderate	Measures are necessary in order to achieve environmental objectives
Poor	
Bad	

Figure 8. Ecological status classes.

The ecological classification of surface waters is based primarily on biological quality elements. The classification takes into account phytoplankton (including chlorophyll), periphyton, aquatic vegetation, benthic invertebrates and fish. The biological material and data used in classification consists of samples taken from rivers and lakes (littoral, pelagic and profundal zones).

Ecological classification also takes into account the other effects of human activity on the water quality, such as the physical-chemical quality of the water, the loading, as well as various man-made hydrological or structural changes, such as dams and dredging. An overall expert evaluation of the water body is necessary, because of the biological material is often available only to a limited extent or only in certain places.

The classification has been carried out mainly based on recent monitoring data. The level of classification is divided into five categories on the basis of the data used in the classification: extensive data, limited data, water quality assessments, classification on the basis of the other water bodies, and expert judgement.

In the Norwegian part of the international river basin, there are over 1000 waterbodies. Few of these have been studied according to the requirements, and a complete classification can therefore rarely be carried out. At the same time, the area is sparsely populated, both according to Norwegian and European standards. Most industrial activity in the river basin is located along the coast. There are large areas unaffected by human activity, with the exception of transboundary pollution and climate change. Many of the water bodies have no recorded impacts on the aquatic environment, and it is therefore assumed that the ecological condition of these is very good. Moreover, it is often the case that even if one is missing data for the complete classification, there are measurements for some parameters that are considered sensitive for registered impacts. In this case the quality element with the poorest result/condition will control the outcome (one-out, all-out principle), and the ecological status can be assessed even with little data.

There are transboundary or border rivers that are in lower ecological status in Norway compared to the Finnish side (table 2). The difference in the Tana district stems from the approach to salmon spawning stocks. Norway has adopted a new 'Salmon stock' status assessment as part of the fish quality element, and it results in bad ecological status with the spawning stock sizes observed in the Tana and the upper tributaries (table 3). Finland is using only its fish community index based on

electrofishing data. However, as described earlier, the pressure from fishing causing decreased salmon stock is recognized as a significant pressure in the upper tributaries of the Tana River. The Neiden River does not meet the high status' criteria in Norway because of the occurrence of pink salmon as alien species.

Table 2. An overview of the transboundary rivers that have different ecological statuses in the two countries (as of February 2020) and the primary reason for the difference.

Name in Norway	Name in Finland	Status in Norway	Status in Finland	Difference in classification of
Skiehččanjohka	Kietsimäjoki yläosa	Bad (at risk)	Good (at risk)	Fish stocks
	Kietsimäjoki alaosa		Good (at risk)	
Anárjohka (lower and middle parts)	Inarijoki	Bad (at risk)	High (at risk)	Fish stocks
Tanaelva Utsjok til Hillagurra/Polmak	Teno alaosa	Bad (at risk)	High	Fish stocks
Tanaelva Karasjok til Utsjok	Teno yläosa	Bad (at risk)	High	Fish stocks
Neiden	Näätämöjoki	Good	High	Alien species
Munkelva	Uutuanjoki	Good	High	Alien species

Table 3. Overview of the ecological status of fish as a quality element (QE) in rivers with anadromous salmonids in the Norwegian areas of the Finnish-Norwegian river basin district.

REGINE	Water district	Norwegian name	Finnish name	Ecological status for fish as a QE
234.Z	Tana	Tana river (entire watercourse)	Teno	Bad
234.ZY3	Tana	Karasjohka (Tana river tributary)	Karasjoki	Bad
234.ZY4	Tana	Iešjohka (Tana river tributary)	Iesjoki	Bad
234.ZY5	Tana	Máskejohka/Masjok (Tana river tributary)	-	Good
234.ZY7	Tana	Lakšjohka (Tana river tributary)	-	Bad
243.Z	Neiden	Klokkerelva	-	Good
244.4Z	Neiden	Munkelva	Uutuanjoki	Good
247.3Z	Pasvik/Paats	Karpelva	-	Moderate
247.Z	Pasvik/Paats	Grense Jakobselv	Vuoremijoki	Bad

Chemical classification

Water bodies are also classified according to their chemical state. Chemical status in a water body is decided through measurements of selected pollutants in water and biota. These substances, called priority substances, include both metals such as cadmium, mercury, nickel and lead, as well as organic

pollutants like pesticides. In addition, nationally identified harmful substances are noted as a part of the ecological state. There are only two status classes for chemical status: Good or not good. Good chemical status of a water body is reached when concentrations of all the priority substances are below the Environmental Quality Standard (EQS) limit values outlined in the Directive on Environmental Quality Standards (2008/105/EC). The concentration of a single substance exceeding a limit value will lead to the water body failing to achieve good chemical status. Data for classification of chemical status in the Tana-Neiden-Pasvik river basin area consists mainly of heavy metal water monitoring and mercury surveys in fish.

Chemical status on the Finnish side of the river basin district area is now not good in terms of PBDE due to the new lower environmental quality standard. No other priority substances exceed their EQS in the area.

In Norway, nearly 90 % of waterbodies lack an assessment of chemical status. This is due to a lack of data, as expert judgement is not used for assessing chemical status. Monitoring stations for priority substances are few and far between in Troms and Finnmark, with the exemption of Jarfjordfjellet, which are included in the trilateral monitoring of the Pasvik programme, as well as national monitoring stations on transboundary air pollution.

Status in rivers

Overall, the river water bodies in the river basin area are very nutrient poor. The amount of nutrients and suspended solid load coming from diffuse and point sources is very small in almost all of the area. River basin waters generally do not suffer from acidification and the noteworthy acidity spikes do not occur during the spring time.

Most watercourses in the river basin district have a high or good chemical and ecological status (table 4). In total, 123 river water bodies were reclassified on the Finnish side. Only one watercourse, the Akujoki River near Ivalo, is classified with lower than good ecological status on the Finnish side. Because of nitrogen loading from the Ivalo and Saariselkä common sewage water treatment plant and slow discharge, water quality in the river is in poor ecological status. No heavily modified rivers or lakes are registered on the Finnish side of the Tana-Neiden-Pasvik river basin area. In addition, the water quality of three rivers in the Finnish part of the river basin area were considered to be at risk due to the pressure caused by a gold prospecting: Sotajoki (Inari), Maddib-Ravadas and Postijoki.

Several river courses are classified as having moderate and bad status in the Norwegian side of the river basin area, mainly due to overexploitation of Atlantic salmon, hydropower regulation, run-off and emissions from land-based activities and airborne pollution from the Kola GMK nickel smelter.

Another serious risk for the ecology of the rivers is the parasite *Gyrodactylus salaris*. Atlantic salmon has no resistance to the parasite. Fish disease carried with roe is also a risk in the area.

Table 4. The ecological status for rivers in the river basin (amount and percentage) as of 11.02.2021

Ecological status*		High	Good	Moderate	Poor	Bad	Unclassified
Norway	Tana	399 (78.2 %)	56 (11 %)	15 (2.9 %)	2 (0.4%)	33 (6.5%)	5 (1 %)
	Pasvik	58 (50%)	31 (26.7%)	24 (20.7%)	-	3 (2.6%)	-

	Neiden	59 (74.7%)	15 (19%)	5 (6.3%)	-	-	-
Finland	Tana	37 (94.9%)	2 (5.1%)	-	-	-	-
	Pasvik	59 (89.4%)	6 (9,1%)	-	-	1 (1.5%)	-
	Neiden	18 (100%)	-	-	-	-	-

*For Norway, a majority of the waterbodies are classified with assumed status as there is little data – ecological status must be confirmed for these waterbodies with investigative monitoring and study samples.

Status in lakes

A majority of the lakes in the river basin district have high or good chemical and ecological status (table 5). The status was assessed for 306 lakes in Tana-Neiden-Pasvik river basin area on the Finnish side. All lakes larger than 0,5 km² (50 ha) were classified. As a result, most of the lakes on the Finnish side (93 %) have high ecological status. The largest lake in the river basin area, Lake Inari, was assessed as having only good ecological status due to pressures from hydro power regulation.

In Finland there are two lakes regulated for hydropower production, but they are not named as heavily modified water bodies. Lake Inari is regulated with Kaitakoski dam on the Russian side. The most significant harmful effects of the regulation are bank erosion and a decrease of vegetation in the littoral zone. Building construction has also caused migration barriers in small rivers. However, the ecological status of the lake is good.

On the Norwegian side of the river basin area, there are a few lakes with moderate status, mostly due to pollution from mining activity in Russia.

Table 5. The ecological status for lakes in the river basin (amount and percentage) as of 11.02.2021

Ecological status*		High	Good	Moderate	Poor	Bad	Unclassified
Norway	Tana	142 (91.6%)	9 (5.8%)	1 (0.6%)	-	-	3 (1.9%)
	Pasvik	43 (55.1%)	19 (24.4%)	16 (20.5%)	-	-	2 (3%)
	Neiden	41 (80.4%)	7 (13.7%)	3 (5.9%)	-	-	-
Finland	Tana	45 (97.8%)	1 (2.2%)	-	-	-	-
	Pasvik	156 (84.8%)	28 (15.2%)	-	-	-	-
	Neiden	75 (98.7%)	1 (1.3%)	-	-	-	-

*For Norway a majority of the waterbodies are classified with assumed status as there is little data – ecological status must be confirmed for these waterbodies with investigative monitoring and study samples.

Status of groundwater

During the previous planning period in Norway, there was very little knowledge of the groundwater's chemical state and many groundwater bodies were put at risk. Since 2015, we have monitored 14 bodies of groundwater nationally, with a high impact from intensive agriculture and/or various other influences, such as industry, roads, polluted ground and more. The preliminary results indicate that some groundwater bodies in the most intensive agricultural areas in Norway may have too high values for nitrate and pesticides. None of these groundwater bodies are in Troms and Finnmark. In groundwater's with more mixed influence there has not been measured high values of substances

included in the chemical classification. Consideration must be given to how the results can be used in other groundwater bodies with similar or minor impact, but which do not have monitoring data.

In the Pasvik and Jarfjord border area in Norway, additional ground water monitoring has been accomplished over the years 2017-2019 to follow the effects of the heavy metal pollution from the metallurgical industry in Russia. Classification for the relevant water bodies based on these data is not complete.

In Finland there are 15 groundwater areas which are important for water supply (class-1) and 20 groundwater areas which are suitable for water supply (class-2) in the river basin district. Quantity of groundwater on class 1 and 2 areas is estimated to be around 32 500 m³/d. All water supply systems on the Finnish side are from groundwater sources. A significant amount of groundwater areas in the river basin district are classified in class III (338 waterbodies). The suitability for water supply of these class III groundwater areas has not yet been studied. In these class III areas, the estimated quantity of groundwater is about 200 000 m³/d. The quantitative and chemical status of the groundwater is good.

Status of coastal waters

An overview of coastal waterbodies is not included here, as there are no common waterbodies. For more information on coastal waterbodies in the Finnish-Norwegian river basin district, please see the Norwegian River Basin Management Plan for the Norwegian-Finnish river basin district.

7. Environmental objectives and exemptions

The most important element in the river basin management plans are the environmental objectives, which are determined by criteria defined in the WFD and agreed upon by all involved parties. Member states are committed to reaching these objectives within 15 years after the WFD enters into force.

The Water Framework Directive sets the goal of achieving at least good status for all of Europe's surface waters and groundwater. "Good status" means both good ecological and good chemical status. The current river basin management plans aim to initially achieve this goal by 2027. In addition, water bodies that already have a high or good ecological status must maintain it. There are some exceptions to these standard environmental objectives.

Heavily modified water bodies

There are separate environmental objectives for heavily modified water bodies (HMWB), which take into account altered ecosystems which may never reach their full potential, while also considering the value of the alteration to society, e.g. water reservoirs, hydropower dams, etc. The environmental objectives set for HMWB are defined as maximum, good or moderate ecological potential. The objective of good chemical status is the same regardless of if the water body is heavily modified or not. For HMWB, the environmental objective must be defined specifically for each water body, as this depends on the type and level of hydromorphological changes that have been made. In Norway, HMWB are identified using the "measure method". This entails investigating the ecological status, determining which measures are necessary to obtain at least good ecological status, and then evaluating whether those measure can realistically be implemented. The highest ecological status which can be attained is then set at the environmental objective of the water body, and is defined as the *ecological potential*. HMWB must be reviewed for every new planning period, and are thus only defined for 6 years at a time.

In Norway it is the River Basin District Board who decides which waterbodies should be defined as heavily modified. It should be noted that to define a waterbody as heavily modified, one needs data on ecological status. For many waterbodies in Troms and Finnmark, ecological status is unknown and assumed, and this is a major challenge. The Office of the Finnmark County Governor and the Norwegian Water Resources and Energy Directorate have in cooperation reviewed all waterbodies affected by hydropower production, and attempted to set an ecological status, define HMWB-status and define an appropriate environmental objective. This has been done based on expert judgement and various reports on waterbodies. The preliminary classification based on expert judgments will have to be updated later when new knowledge (problem mapping) is available. A full explanation is available in the Norwegian River Basin Management Plan for the Norwegian-Finnish River Basin District.

In the Norwegian part of the river basin there are 41 waterbodies defined as heavily modified (table 6). For most of the HMWB, the measures suggested are problem mapping and/or investigative monitoring, and to a lesser extent biotope measures and suggestions for minimum water flow to secure better conditions for fish. Problem mapping and investigative monitoring is widely suggested to gain data on ecological status, which will give a better starting point for considering mitigating measures.

Table 6. Number of HMWB in the Norwegian areas of the Norwegian-Finnish River Basin District, with environmental objectives GEP (good ecological potential) and less stringent objective. As of 01.09.2021.

	Rivers		Lakes		Coast		Total HMWB
	GEP 2027	Less stringent	GEP 2027	Less stringent	GEP 2027	Less stringent	
Tana	4	1	1	-	1	-	7
Pasvik	3	8	7	8	-	-	26
Neiden	3	3	3	-	-	-	9

On the Finnish side of the river basin district Lake Inarijärvi and Rahajärvi are regulated for hydropower production, but their environmental status does not meet the criteria for the designation of a heavily modified water body.

Exemptions

Extended deadlines

In some cases the deadlines for achieving the environmental objectives may be extended, as long as certain conditions are met. Deadlines can be extended due to technical feasibility, high costs of completing the measures during a short timeframe, or natural conditions that prevent improvement. Extensions of deadlines must be summarised and justified, and are limited to two further updates of the river basin management plans (2027 or 2033 in Norway, 2021 or 2027 in Finland). Measures and a timetable must also be supplied. Extensions must be reconsidered during each planning period. It must be emphasised that in Finland, as opposed to in Norway, all environmental objectives have 2027 as a deadline, and any waterbody that achieves its deadline after this is considered an exemption. In Norway, that deadline is 2027.

In the Norwegian part of the international river basin there are some water bodies that have received extended deadlines in achieving their environmental objectives – among them Bøkfjorden midtre in Pasvik, where pressures are from multiple sources. However, contamination from the smelter in Nikel is the main reason for extended deadlines in the Pasvik water district. The main reason for extended deadline for rivers in the Tana water district is due to bad status for salmon stocks. For all of these, the environmental objectives should be achieved by 2033.

For full information about which waterbodies have been granted an exemption, please refer to the Norwegian River Basin Management Plan for the Norwegian-Finnish River Basin District.

In the Finnish part there are no extended timetables applied.

Less stringent objectives

It is possible to give water bodies less stringent environmental objectives than the standard objectives required by the WFD, if the water body is greatly affected by human activity or natural conditions which make the achievement of the objective disproportionately expensive or infeasible. In Norway, one may only suggest less stringent environmental objectives based on national authorities' guidelines, which stipulate that for the planning period 2022-2027. The main reason for less stringent environmental objectives is mainly related to water bodies regulated for hydropower (table 7).

The Finnish river Akujoki is proposed less stringent objective of moderate ecological status. At current level of loading it cannot achieve good ecological status, but there also are no socially nor ecologically sustainable options for waste water recipient outside Akujoki.

Table 7. Use of less stringent objectives in the Finnish-Norwegian river basin district. As of 01.09.2021.

Water district	Rivers	Lakes	Coastal waters	Total
Tana	1			1
Pasvik	8	8		16
Neiden	3			3

8. Protected areas in the river basin district

According to the WFD legislation, information on the following protected areas is to be collected for the WFD work:

- All water bodies used for the abstraction of water intended for human consumption, where more than on average 10 m³ water, or water for more than fifty PE (person equivalents), is abstracted per day. This also includes water bodies intended for such use in future
- Bathing areas based on EU legislation (Bathing Water Directive)
- Natura 2000 network areas, which are important for maintaining or improving the state of water bodies for the protection of rare or threatened habitats or species. (The Natura 2000 network is formed by the areas protected under the EU's Habitats Directive and Bird Directive, which have not been implemented in Norway)

Objectives for the environmental status of waterbodies in the specific areas are determined according to the same principles as in other water bodies. Furthermore, the specific criteria from relevant legislation have to be taken into account in these areas, which can result in different requirements or objectives. The parameters used in the classification are not necessarily the same as those normally used with the WFD.

In Natura 2000 areas, the determination of the environmental objectives of water bodies has to be examined in relation to the protection of the aquatic habitats and/or species. The environmental state of the surface water and groundwater must be such that it satisfies the demands as given by the protection status of the area. The conservation of aquatic habitats and the species dependent on them are a priority when planning water management objectives and measures in these areas. In those cases where, for example, the protection of the aquatic habitat or species is dependent on the natural state of the water body (e.g. nutrient-poor and clear water quality), good environmental status in accordance with the objectives of the WFD is not necessarily enough. In particular, the living conditions of some protected species can require better water quality than in the good ecological status as described by the WFD. In most cases, the WFD and the Habitats and Bird Directives complement each other in terms of water management demands.

Finland has pointed out 10 Natura 2000 areas and 14 Class I groundwater areas in the Finnish-Norwegian river basin district area. There are no EU bathing water areas in the river basin district on the Finnish side.

In Norway, the national environmental authority, the Environment Agency, is responsible for creating a register of protected areas as defined by the national Water Management Regulation. The register provides an overview of any other eventual environmental objectives besides those defined in the regulation, although this will not result in additional objectives. Rather, environmental objectives that are grounded in other legislation will be safeguarded. The register contains five categories:

1. Drinking water sources
2. Aquatic species of economic importance
3. Areas of recreation (bathing areas)
4. Areas sensitive to nutrient loading

5. Areas chosen for the protection of habitats and species

A register with digital maps for each category is available at www.miljodirektoratet.no and www.vannportalen.no.

Protection of drinking water sources

Norway

In Norway, the Norwegian Drinking Water Regulations (NDWR) sets the framework for drinking water quality guidelines. The regulation has the objective of ensuring that water supply systems in the country, provide drinking water in adequate quantities and of a satisfactory quality, including ensuring that drinking water does not contain contaminants of any kind. Specific minimum values for microbial and chemical substances in drinking water are set out. To meet the criteria in the NDWR, requirements are set for many different tasks, including purification, sampling plan, risk identification, protective measures and more. Water supply systems dimensioned to produce at least 10 m³ of water intended for human consumption per day, or to supply one or more vulnerable subscribers, are subject to plan approval by the Norwegian Food Safety Authority. The water supplier must also notify the Norwegian Food Safety Authority upon suspicion of deviation from requirements.

Finland

Groundwater areas are classified in two categories; important for water supply (class-1) and suitable for water supply (class-2). The main purpose of mapping and classifying groundwater areas is water supply management and groundwater protection. The information can also be used to support land use planning. As of February 2015 the legislation on protecting groundwater was updated and groundwater dependant ecosystems (both terrestrial and surface water) were acknowledged.

Ground water extraction for household water supply requires a permit based on the Water Act (27.5.2011/587) from the Regional State Administrative Agency (Avi). The permit sets limits for sustainable level of extraction and monitoring of the water quality and quantity. In addition, a special safeguard zone may be ordered in areas with high risk activity. Otherwise safeguarding is managed via municipal ground water protection plans.

The municipal health official supervises the water quality. The act on household water quality (17.11.2015/1352), which sets the chemical quality criteria for most common substances that are not to be exceeded in drinking water.

Figure 9 shows a map of protected areas in the Finnish-Norwegian river basin district. Of the national salmon fjords and rivers in Norway, two cross the border to Finland (the rivers Tana and Neiden).

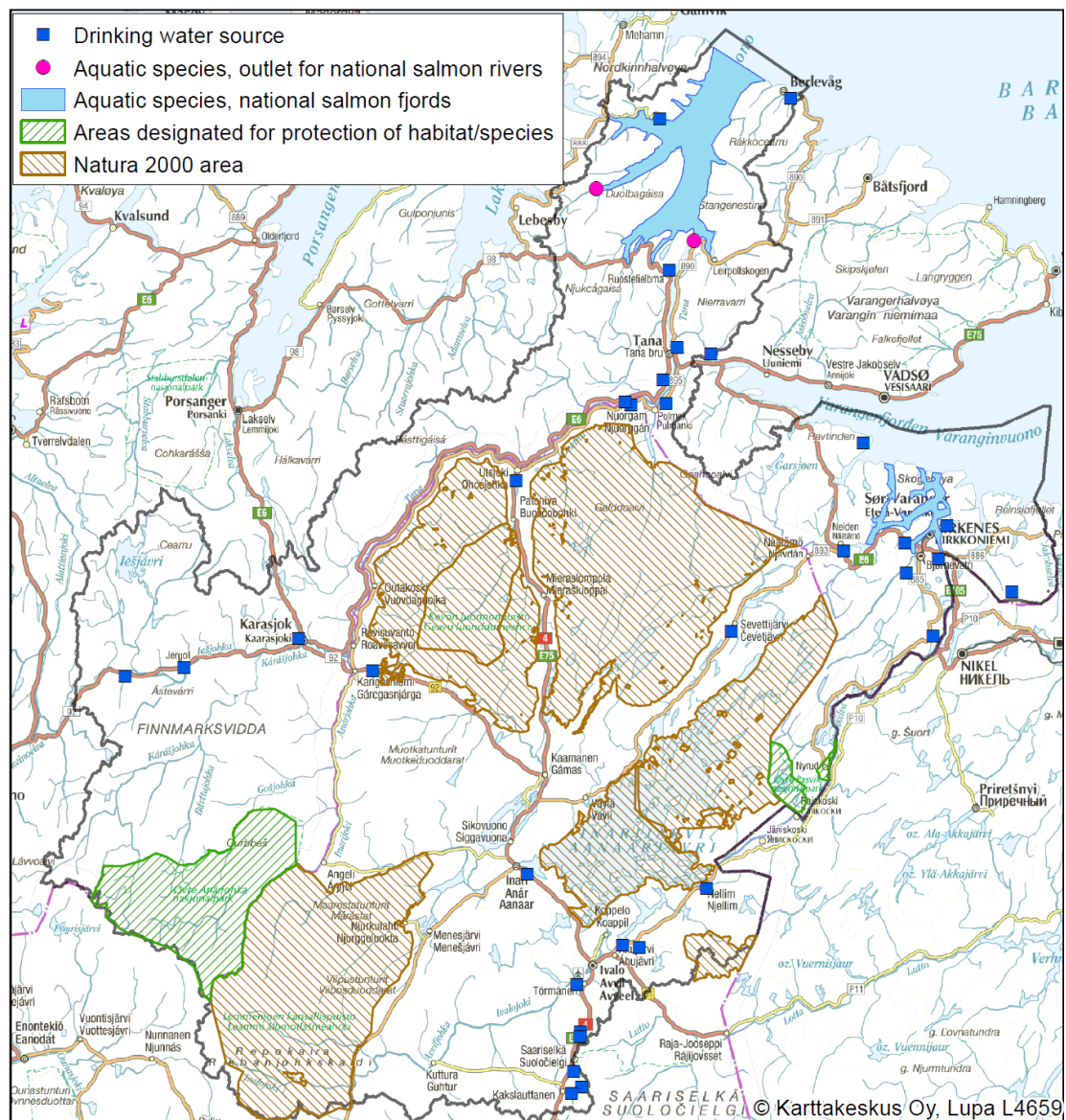


Figure 9. Map of protected areas in the Finnish-Norwegian river basin district.

9. Joint programme of measures

Measures in river basin management direct to the relevant significant pressures for each water body or district. The measures aim to improve the ecological status when below good and to prevent high or good status from deteriorating.

Basic measures are based on EU directives and are therefore the same across the border. Supplementary measures are covered in national environmental legislation. Moreover, a set of policy measures are drawn to guide management in the future, these may include strategies, financial programs and research objects.

The Finnish PoM is targeted at sectors (agriculture, forestry, industry etc.). This covers all actions from policy and strategy work to land use planning. The primary responsibility for implementing the measures lies on private actors (eg operators, citizens, organizations etc), whose activities affect the status of the waters.

The Norwegian PoM are quite similar as Finnish, but the responsibility for implementing the measures is more on a government and municipal level. In some cases, a type of activity and pressure may be managed by another sector authority and legislation. In these cases, it is the managing authority of that specific legislation who has the responsibility to suggest and implement measures.

Jointly coordinated measures have been carried out in bilateral projects for wastewater and migration barriers during the last 20 years. Also, the Finnish-Norwegian Border Water Commission has prompted resolving of waste water treatment and alien species issues in its annual recommendations. Official Programs of Measures are still separate in both countries for the river basin district.

Alien and invasive species

Pink salmon

The Norwegian Environmental Agency in collaboration with other authorities have prepared a draft action plan concerning the invasion of the pink salmon. The main objective of the action plan is to promote the development of coordinated efforts and to implement concrete measures to reduce the abundance of pink salmon in rivers. Eastern parts of river basin district from the Tana/Teno river to Grense Jakobselv will be prioritized first. Pink salmon occurs in several bordering river bodies, and the action plan addresses the need to enhance the cooperation concerning measures and surveillance of pink salmon between Norway, Finland, and Russia².

Vendace

The invasion of vendace has resulted in extensive ecological changes in the Pasvik River, but it is not considered realistic to implement measures to remove this species from the watercourse.

King crab

For the coastal areas in the Norwegian-Finnish river basin district King crab is managed as an important economic fishing resource with quota restrictions. Restrictions are used to keep the population and harvest at maximum economical yield. However, in the western parts of Troms and Finnmark, harvest is unregulated, and the goal is to minimize the spread and abundance of king crab.

European bullhead

The European bullhead is an alien species for northern Norway. The species are found in the Tana river. The effect of European bullhead on the aquatic environment and native fish species are uncertain, and measures have been proposed to increase the knowledge and further actions.

Contamination from metallurgy in Russia

The smelting plant in Nikel was closed in December 2020. Closure of smelter facilities is an important measure to reduce the pressure on water bodies on the Norwegian side of the river basin district. However, long time effects on aquatic ecosystems are anticipated. Heavy metals are accumulated in soils in the Pasvik area and possible leaching to ground water resources and surface waters need to be monitored in a long-term perspective.

² <https://www.miljodirektoratet.no/publikasjoner/2021/april-2021/forslag-til-handlingsplan-mot-pukkellaks/>

Monitoring and bilateral contracts/collaboration are proposed as measures in water bodies that are affected by contamination from metallurgy in Russia. Further information on monitoring and collaboration is described in the Multiuse plan for Pasvik and Grense Jakobselv.

Hydropower regulation

Lake Inarijärvi regulation is based on treaty between Finland, Norway and Russia. Practical reinforcement takes place in trilateral delegation, which may adjust the regulation practice. In 1999 the delegation imposed so called ecological regulation practice with smaller regulation height.

Adjustment of Lake Inarijärvi regulation is a continuous process. Climate change has been altering the temporal rainfall patterns and so the need for adaptation to the changing hydrology has been recognized in the regulation delegation. There also remains a possibility to amend ecological regulation practice towards more natural water level variation.

For many of the water bodies affected by hydropower regulations on the Norwegian side, there is a need for more knowledge to assess realistic measures. Such measures were proposed for the planning period 2016-2021, but a majority of the measures have been postponed or delayed due to lack of resources. Increased knowledge of piscivorous trout in the Pasvik river is suggested as a new measure for the planning period 2022-2027 (table 8).

Table 8. Suggested measures in river bodies affected by hydropower regulations Norwegian side.

	Plan 2016-2021				Plan 2022-2027				
Type of measure	Planned	Complete	Rejected	Total 2016-2021	Started	Exposed	Delayed	New measure	Total 2022-2027
Mapping/ knowledge	19	0	1	20	5	3	11	1	20
Fishing measure	0	0	3	3	0	0	0	0	0
Total	19	0	4	23	5	3	11	1	20

Over-exploitation of anadromous fish

Sustainable Atlantic salmon spawning stocks in the Tana River are a joint goal across the border. The Working Group on Salmon Monitoring and Research is the shared knowledge base of the salmon stocks. Bilateral fishing agreement based on monitoring data is the key the measure in salmon stock conservation. The current Fishing Agreement has been enforced from 2017. For 2021, Finland and Norway have agreed not to allow salmon fishing in the Tana river.

Pressures from mining in Norway and Finland

Measures for gold prospecting in the Pasvik River tributaries are mainly based on the Finnish environmental protection law and its requirements for water protection and monitoring. Machine prospecting ended in Lemmenjoki national park in 2020, when machine work was forbidden in the park area. Closed prospecting areas will be landscaped and altered stream beds restored. Elsewhere, where machine gold prospecting continues it is managed by the environmental permits. There is

also recognized a need to develop good water protection practises for the whole gold prospecting sector including small scale shovel work. It is proposed to be organised as policy measure by interest group cooperation.

Syd Varanger mines was closed in 2014 and water bodies are no longer affected by active operations. A reopening of the he mines is being planned and a revision of the environmental permit is being processed. The Norwegian Environment Directorate will make necessary requirements to reduce the impact. These may be requirements such as stricter regulation of chemical use, reduced discharge of particles as well as surveillance.

Pollution in harbors and coastal areas

There is suggested two measures to remove contaminated sediments in coastal waterbodies on the Norwegian side of the river basin. The measures are related to pollution from land-based industry in the Pasvik sub-district, including some areas affected by previous runoff from Syd Varanger mines (table 9). In several areas with contaminated sediments, however, no measures have been proposed. Monitoring and concrete measures should be assessed further.

Norway has implemented a national strategy on remediation of contaminates sediments in coastal water bodies. In several areas, measures to remove and reduce contaminates sediments have either been implemented or planned. Hence, none of the priority areas are within the Norwegian-Finnish river basin district.

Table 9: Suggested measurers to remove contaminated sediments in coastal waterbodies

Type of measure	River bodies	River basin sub district
Removal/dredging of contaminated sediments	Bøkfjorden-Midtre	Pasvik (NOR)
Removal/dredging of contaminated sediments	Langfjorden Ytre	Pasvik (NOR)

Fish migration barriers

Road culvert migration barriers in the Tana tributary have been mapped and repaired in several bilateral Interreg projects, previously in Tana Interreg 2018-2020. There remain few barricading road culverts in small streams, that would able fish pass in their natural state.

The hydropower dam in the Finnish Kirakkajoki below Lake Rahajärvi does not have functional fish pass. Road culvert migration barrier mapping and repairing is started in the Finnish Pasvik tributaries with the ReArc-ENI project 2019-2022 (table 10).

Table 10. Suggested measures to remove or restore migration barriers.

Type of measure	River bodies	River basin sub district
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Remove/restore migration barriers due to road culverts	Ytre hopsfjord bekkefelt	Tana (NOR)
	Golgotjohka – Gulbjok	
	Basávžžejohka nedre	
	Čáhppesjohka	
	Ráitejohka	
	Rastevannsbekken/Mattisbekken	Pasvik (NOR)
	Stalvannsbekken ved Fagermo	
Facilitation of fish passage	Nordmannsbekken og Norskebekken	Neiden (NOR)
	Kirakkajoki	Pasvik (FI)
	Basávžžejohka øvre	Tana (NOR)

Sewage wastewater

Measures for communal sewage networks promote sewer separation, good maintenance practices and improvements in treatment efficiency (table 11). Mainly this is achieved through obligations from national environmental legislation and stricter voluntary goals. Treatment efficiency is pivotal in the whole region, where recipient waters are sensitive to eutrophication.

Table 11. Suggested measures for communal sewage networks.

Type of measure	Number of measures	River bodies	River basin sub district
Upgrade sewage network	3	Tana river/Teno (Tana bru and Rustefjelbma)	Tana (NOR)
		Karašjohka/Karasjoki	
Improve treatment efficiency	4	Neidenelva/Näätämöjoki	Neiden (NOR)
		Karašjohka/Karasjoki	Tana (NOR)
		Rássejohka/Rasjok	
		Berlevåg ytre havn	
Water and sewerage plan	1	Tana river/Teno	Tana (NOR)
Sewage plant maintenance	1	Akujoki	Pasvik (FI)

Diffuse source nutrient loading

The EU nitrate directive (91/676/ EY) and legislation on plant protection products (2009/1107/EY) are the basic measures applied to all farming in the district. In addition, the EU Common Agricultural Policy includes agri-environmental measures have great impact on environment friendly farming practices. These measure work against diffuse loading and harmful plant protection substances.

Wastewater treatment in scattered settlements is managed according to national legal demands aiming to decrease nutrient run-off into the waters.

On the Norwegian side of the river basin district there is suggested 25 measures for wastewater treatment in scattered settlements. The two Finnish measures are directed to properties within the sub districts (table 12).

Forestry is practised in the southern part of Pasvik sub basin. There forestry measures are protective buffer zones to the waters in forestry management and restrict tilling depth in ground water areas.

Table 12. Suggested measures for wastewater treatment in scattered settlements.

Type of measure	Number of measures	River bodies	River basin sub district
Connect scattered drains to municipal treatment plant	1	Berlevåg ytre havn	Tana (NOR)
Supervision and control of scattered wastewater	24	Pasvikelva	Pasvik (NOR)
		Bøkfjorden	
		Jarfjorden	
		Neidenelva/Näätämsjoki	Neiden (NOR)
		Bugøyfjorden	
Improvement and maintenance of wastewater treatment in scattered settlements	2		Pasvik, Tana, Neiden (FI)

Fish farming and parasites

Fishfarming activities is not extensive in Norwegian coastal areas of the Norwegian- Finnish river basin district compared to other Norwegian districts. The main reason for this is that the Tana fjord is a National Salmon Fjord where fish farming is not permitted. Pressures from fish farming in the Neiden and Pasvik sub-districts are classified as small. However, preventive measures and surveillance have been proposed to prevent increased impacts on aquatic environment.

The prevention of *Gyrodactylus salaris* from spreading relies on monitoring and active information dissemination. The fishing gear and boats are required to be completely dry or disinfected when transferred from another river basin. Chemical disinfection is obligatory in Norway. Parasite prevention is coordinated by national food safety authorities Mattilsynet and Ruokavirasto.

The Veterinary Institute in collaboration with Mattilsynet monitors the parasite *Gyrodactylus salaris* in Norwegian rivers. Annual reports and an overview of which rivers are monitored are available on the veterinary institute's website³.

A spread of *gyrodactulus salaris* to river bodies with Atlantic salmon will have major consequences on ecological status and many societal interests. Preventive measures are therefore noted as a very high priority.

Other investigative monitoring

Many of the measures suggested for the Norwegian part of the international river basin are problem mapping and investigative monitoring to determine ecological status and suggest more concrete measures if necessary. This includes pressures from many different sources and is not necessarily

³ <https://www.vetinst.no/overvaking/gyrodactylus-salaris-overv%C3%A5kningsprogram>

included in the description of measures and map in chapter five about monitoring networks. For more information on such measures, please see the Norwegian River Basin Management Plan for the Norwegian-Finnish river basin district.

Flood protection

The EU Flood risk management directive has not been adopted in Norway, but has been implemented in Finland. The focus of the directive is for all Member States to assess flood risk along all watercourses and coastlines, map the flood extent and areas at risk, and to produce flood risk management plans including measures to reduce flood risk.

Ivalo village was named as a significant flood risk area first time in 2011 and again in 2018. Therefore a Flood Risk Management Plan (FRMP) has been prepared for the Ivalo River basin. Current FRMP is for years 2016-2021 and FRMP for years 2022-2027 is under preparation. In total 29 measures have been suggested to reduce flood risks and to improve the preparedness and the protection against floods. As constructional flood protection measures new flood banks and raising of the existing ones have been suggested. The flood bank protecting the centre of the Ivalo village and Ivalo healthcare centre has already been raised to protect against 250-years flood. The need for new flood banks concerns only some individual buildings or structures and for some existing flood banks raising might be still needed to ensure their protection ability. Using temporary flood protection structures is also an important measure, that is suggested in the FRMP. In addition several non-constructional measures like flood mapping, flood forecasting, informing inhabitants about floods and documenting flood events are included in the FRMP. Due to implementation of flood risk management measures the flood protection of Ivalo village has been improved.

The Norwegian Water Resources and Energy Directorate (NVE) have had a 24-hour flood forecasting and monitoring system since 1989. A similar system is also used in Finland by the Finnish Environment Institute (FEI). This system consists of an analysis of the present situation, a calculation of stream flow and water levels and the issuing of stream flow forecasts and flood warnings. NVE and FEI also map risk-areas and perform risk assessments to prioritise various safeguard measures. NVE, FEI and other sectorial authorities support municipalities with mapping local danger- and risk-areas and detailed investigations, as well as contributing to spatial planning processes by ensuring that flood risk is sufficiently addressed. The effects on flood risk management are carefully considered by NVE when suggesting measures as part of the Norwegian river basin management plans. Some flood barriers have been removed in Julelva in Norway, as these barriers have altered the ecosystem, and have been considered safe to remove. This measure has proven to be positive for fish and the ecological status of the water body. Similar measures have also been proposed for this planning period. Other measures have also been suggested to reduce the probability of negative effects on aquatic environment due to floods and climate change.

Marine protection

The EU Marine Directive aims to protect the marine environment in Europe and ensure good environmental status. All Member States must develop a marine strategy for their coastal waters. The directive has not been adopted in Norway, yet extensive marine management plans, marine protection plans, and protected areas under the OSPAR convention are in place. The marine management plans

regulate the Norwegian seas (Barents and Lofoten, the Norwegian Sea, and the North Sea). Marine protection plans regulate specific areas with different characteristics of ecological interest and importance. As a part of the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR), Norway has submitted several areas to form part of an international network. Parts of the marine areas surrounding Svalbard, Bjørnøya, Jan Mayen, as well as various coral reef areas and Ytre Hvaler national park now form part of this network, which aims to protect the marine environment of the Northern Atlantic Ocean. The three first marine protected areas in Troms and Finnmark were established in 2020, but neither of these are located within the Norwegian- Finnish river basin district. The EU Marine Directive is implemented by the national legislation in Finland. There are no marine areas located on the Finnish side of the river basin.

10. Economic analysis of water uses

In Norway it is mainly the municipalities or municipally-owned companies which are in charge of supplying water and wastewater services for the general population and industry. An average Norwegian household pays roughly 7000 NOK/year for these services. This number may increase to secure necessary investments and maintenance, but municipalities may not price these services higher than a strictly necessary level (full cost level). The replacement costs for water supply and wastewater management in Norway is estimated to be NOK 332 billion over the next twenty years. Some improvements have already been made, but increasingly strict quality requirements mean that costs will continue to be high in the future.

On the Finnish side of the river basin district, one household water plant has been included in the calculations. The plant had a total turnover of 2,3 million euros in 2018. The cost of coverage (the income/expenses) was 101 % Subsidies have not been paid for the plants in Finland in the year 2018. Use of water is estimated to slightly decline in the future, mainly due to the reduction in the population number in the region and the increasing prevalence of the modern water saving equipment in the households.

11. Effects of climate change in relation to the water framework directive

Climate change impacts on water resources in many ways. The effects are already partly visible, but they are estimated to increase by the end of the century. Information on the effects of climate change is still incomplete, and in the short term many other factors are more significant in relation to the water management.

According to the latest climate change scenarios, Finland's average temperature will be 1.6-2.1° C higher for the period 2020 – 2049 than for the reference period 1981 - 2010. At the same time precipitation is estimated to grow 5-7 % and extreme events of rainfall to become more abundant. The increase in precipitation is the most prominent in winter.

In Norway, there is an expected increase in precipitation of 7 - 23 % and an expected increase in temperature of 3.3 – 6.4 ° C by 2100⁴.

⁴ https://www.met.no/kss/_/attachment/download/e1d26477-1c7c-4912-8af9-a2b20a0c084f:c615e5a9799582b64d52542878edf0d607d515dc/klimarapport-2100-engelsk-web-0160517.pdf

The most important effect of the climate change is connected to hydrological conditions (runoff, flow and water level) of the inland waters. The annual runoff is estimated to change by the middle of the century from up to + 12 %. The winter time runoff will increase due to an increase in snow melting and rainfall. Based on the current climate change scenarios, floods in Northern Lapland will remain at current levels until the end of the century. In Norway, flood risk is expected to rise in certain areas.

Increased precipitation can cause more erosion, which in turn may lead to increased nutrient loading. This can be reinforced by increased flooding. The runoff will grow, causing the diffusion load to increase. Shortened ground frost season is likely to increase the nutrient loading into waterways from fields and forests. If the surface water temperature rises, the growth of blue-green algae in lakes and coastal waters will be increased. Also, the abundance of bacteria in water may increase. On the other hand, a shorter ice covered period can improve the oxygen levels in the waters.

Changes in temperature and precipitation can result in changes in flood patterns and the risk of landslides. The Norwegian Water Resources and Energy Directorate (NVE) have published several reports concerning future challenges. In Troms and Finnmark there is a risk of increased winter- and autumn floods, and surface floods in populated areas. Increased precipitation will require an investment and maintenance in wastewater and drainage infrastructure. A warmer climate may also affect the ecology in watercourses and affect the survival rate of fish species. New species may arrive and change the ecosystems. In areas where barriers are to be established to prevent erosion and flooding, it will be important to also assess how the ecological status can be affected and possibly avoided.

12. Future challenges

The future challenges of the river basin are many, and require national level participation in order to be resolved. National differences in ecological status assessment remains an important issue (see chapter 6). Multiple reasons account for the differences, including: parameters and limit values in assessing water quality, approach towards alien species and fishing pressure, and most all variable methods for determination of the final status class. Delineation of water bodies is also in need of harmonisation. In addition, the three-month gap in our deadlines creates a challenge if we are to coordinate our management plans on both sides of the border, and especially if we aim to create a common document. The issue of a common monitoring programme and databases also needs to be addressed, so a shared knowledge base can be built up.

All these elements play a part in achieving our goal of a common river basin management plan for the Norwegian-Finnish River Basin district and will facilitate common environmental objectives for our transboundary water bodies.

13. Related documents

Bilateral documents:

The agreement concerning The Finnish-Norwegian Transboundary Water Commission is available at:

www.finlex.fi/fi/sopimukset/sopsteksti/1981/19810032/19810032_2 (in Finnish)

The agreement concerning the Finnish-Norwegian river basin district is available at:

<http://www.finlex.fi/fi/sopimukset/sopsteksti/2014/20140050> (in Finnish)

<https://www.vannportalen.no/vannregioner/norsk-finsk/om-vannregionen2/> (in Norwegian and English)

Norwegian documents:

- River Basin Management Plan for the Norwegian-Finnish River Basin District (2022-2027)
- Programme of Measures for the Norwegian-Finnish River Basin District (2022-2027)

All documents are accessible at www.vannportalen.no/norsk-finsk. The River Basin Management Plan and Programme of Measures are translated to Finnish.

Finnish documents:

- Water Management Plan for Tana-Neiden-Paatsjoki River Basin District (2022-2027) (in Finnish including Sami summary)
- Programme of Measures for Tana-Neiden-Paatsjoki River Basin District (2022-2027) (in Finnish)

All documents are accessible at www.ymparisto.fi/vaikutavesiin

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Appendix I. Coordination meetings between national authorities

The regional authorities in water management, Troms and Finnmark County Council, the Office of the Finnmark County Governor and Lapland ELY-centre, have had bilateral meetings concerning water management in the Finnish-Norwegian River Basin District:

- 2019 Rovaniemi: planning the common roof-report and incorporating databases
- 2020 – 2021: Writing the roof-report, produce common maps, etc

In the annual Finnish-Norwegian Transboundary Water commission meetings listed below, the authorities mentioned above have shared updates of the current situation in water management planning process:

- 2018 Utsjok, Finland
- 2019 Tana, Norway

Northern Calotte water authority meetings where Swedish, Norwegian and Finnish authorities introduced the progress in water management for the second planning period are listed below:

- 2018 Luleå, Sweden