# Biodiversity Status and Knowledge Summary - Sydvaranger Mine

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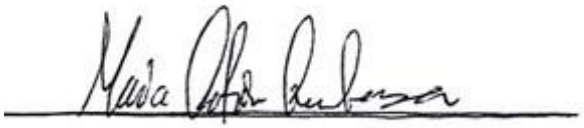
## PREFACE

In connection with Sydvaranger iron mine's plans to resume and develop mining operations, Ecofact AS has been tasked by Sydvaranger Drift AS to review and summarize the environment status within and surrounding the concession area. This report is a desktop study with a systematic review of relevant studies and reports to identify possible knowledge and data gaps. The review encompasses analyses of previous studies by Rambøll, NIVA, Åkerblå, and other contributors.

Ecofact commend all parties for a great collaboration!

Sandnes
26.03.2025

Maia Catrin Gundersen



Ragnhild Svensen Stokka

# SUMMARY


## Description of assignment

Ecofact has been tasked with reviewing and summarizing existing environmental data and identify possible knowledge and data gaps in areas that may be affected by Sydvaranger iron mine's plans to resume and develop mining operations.

## Data

The report is based on existing reports by Rambøll (Burgess, Haukø, Donali & Gaskell (2022); Gaskell (2019); Koivulehto (2020); Laitinen (2020); Mäkinen (2019a); Mäkinen (2019b); Oliver (2020); Reppe (2022); SC (2019); SC (2020a); SC (2020b); Sopanen, Lintinen, Roikonen, Laaksonen & Oliver (2020); Vollan, Sundsdal, Marcussen & Rask-Jensen (2020)), Akvaplan (Christensen, Jensen & Fagard (2014)), Ecofact (Larsen (2024)) and Miljødirektoratet (2023).

## Result

Numerous environmental surveys have been conducted in the Sydvaranger Iron Mine area in recent years. The knowledge base for the topics of birds, mammals, invertebrates, reptiles and amphibians, and groundwater is comprehensive and considered sufficient. However, the knowledge base for terrestrial vegetation, freshwater, and landscape is still insufficient. A proposal for additional surveys is presented in this report.

## Conclusion

We recommend conducting in-person field surveys to assess terrestrial vegetation for valuable terrestrial nature across much of the mine concession area and its influence zone. This is also recommended for landscape assessments, as the current data in this topic is insufficient. Additionally, for freshwater ecology and biology, there is a lack of adequate knowledge regarding several water bodies, particularly in terms of both fauna and water quality.

# 1 Introduction

In connection with Sydvaranger iron mine's plans to resume and develop mining operations, Ecofact has been tasked to review existing terrestrial and fresh water environmental baseline data and to prepare a report that summarizes the status of biodiversity in areas that may be affected by future mining activities. This includes a systematic review of relevant studies, reports and new information from public databases to assess the available baseline data and identify any data gaps. The aim is to support a potential upcoming Environmental Impact Assessment (EIA). The review therefore also includes recommendations for future surveys to fill these data gaps where necessary. The review encompasses analyses of previous studies by Rambøll, NIVA, Akvaplan, and others.

The report includes:

- A comprehensive evaluation of the existing environmental knowledge base, integrating new data from public sources to establish a baseline status.

- Identification of critical data gaps based on the impact assessment guidelines (Miljødirektoratet 2024, M-1941) that must be addressed to ensure a robust and well-founded EIA.

- Recommendations for targeted studies to close identified knowledge gaps and improve the overall understanding of environmental conditions in the area.

The marine environment was not included in this scope.

## 1.1 The project

Sydvaranger mine is located 10 km south of Kirkenes in Finnmark county, Northern Norway, and has been closed since 2015. In addition to the open pit mine, iron ore is processed in the processing plant located in Kirkenes. The mine concession area is connected to the processing plant via an 8 km railway.

## 1.2 The influence zone

The extent of the influence zone varies by topic, depending on the standards used in previous reports and the nature of potential impacts. For terrestrial vegetation, the influence zone covers the mine concession area and extends approximately 3 km around it, which includes surrounding ecosystems but does not account for the pit to port route. For birds, the influence zone encompasses the entire potential impact area, including areas outside the mine concession area that may be affected by noise, dust, or habitat disturbance. For mammals, the influence zone extends to 10 km around the mine concession area due to their larger territories and sensitivity to disturbance, while for other terrestrial animals the range is 1 to 5 km, depending on species mobility and habitat needs. The freshwater influence zone is based on the catchment

areas to the water bodies mentioned in Burgess, Haukø, Donali & Gaskell (2022). The landscape influence zone is broader, covering up to 10 km from the mining site, considering the visual and physical impact on the natural scenery.

## 2 Method

All previous documentation on biodiversity, wildlife, aquatic environment, and landscape related to the mine concession area, along with relevant databases containing additional information, has been reviewed in a desktop study. Different standards, handbooks and databases are used for the review process based on the specific field and is shown in Table 2-1.

*Table 2-1: Guidelines, handbooks and databases assessed in this review in addition to the reports and documents provided by Sydvaranger Mine.*

| Category | Guidelines, handbooks, databases |
|---|---|
| Terrestrial vegetation | Handbook M-1941, The Norwegian Red List for Species (2021), The Norwegian Red List of Ecosystem Types, The Norwegian Alien Species List (2023), Naturbase, Artskart |
| Terrestrial wildlife | Handbook M-1941, The Norwegian Red List for Species, The Norwegian Red List of Ecosystem Types, Sensitive Artsdata |
| Freshwater ecology and biodiversity | Handbook M-1941, The Norwegian Red List for Species, The Norwegian Red List of Ecosystem Types, Alien Species List, guideline 02:2018, Guideline M-608 |
| Landscape | Handbook M-1941 |

Handbook M-1941, "Impact Assessment of Climate and Environment", is a Norwegian guide used to assess the potential impacts and consequences of a project. The handbook provides the methodological framework applied across all fields in this report. In 2023, freshwater ecology and biology were given their own dedicated chapter, in accordance with regulations set forth by the Water Framework Directive and the corresponding Norwegian regulation.

The Norwegian Red List for Species, a database used in this review, identifies species at risk of extinction in Norway. The list was most recently updated in 2021, and the red list status of species plays a key role in the valuation methodology outlined in Handbook M-1941. The list includes seven categories, of which five classifies as red-listed (**Feil! Fant ikke referansekilden.**).

The Norwegian Red List of Ecosystem Types (Nature types) of 2018 is also used in the terrestrial vegetation assessment. This Red List uses the same categories as mentioned in **Feil! Fant ikke referansekilden.**, but with some adaptation (Collapsed (CO) is used instead of Regionally extinct (RE) and Not Applicable (NA) is not used).

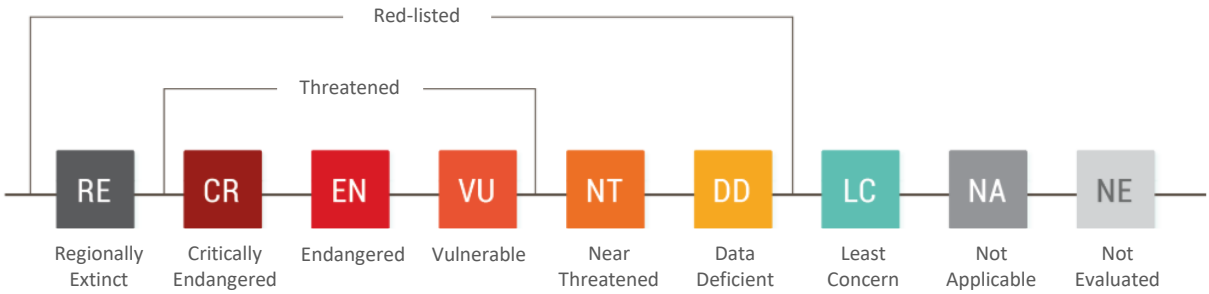



*Figure 2-1: The categories Regionally Extinct (RE), Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT) and Data Deficient (DD) comprise the Red List categories for species. Among these, Critically Endangered (CR), Endangered (EN), and Vulnerable (VU) make up the threatened categories (Artsdatabanken, 2021). Collapsed CO is used in the Norwegian Red List of Ecosystem Types instead of Regionally Extinct (RE) and Not Applicable (NA) is not used.*

The Alien Species List, updated in 2023, is a database used throughput this report to assess the potential impacts of non-native species in various fields. In Norway, alien species are defined as species introduced after 1800, and they can pose significant threats to local biodiversity by outcompeting native species, altering ecosystems, or introducing diseases. Species on the Alien Species List are classified into one of six categories based on their ecological risk (Figure 2). This list helps to evaluate ecological risks in line with the methodologies outlined in Handbook M-1941 and helps guide management decisions aimed at preserving Norway's natural habitats.


*Figure 2-2: The categories Severe risk (SE), High risk (HI), Potentially high risk (PH), Low risk (LO), No known risk (NN) and Not assessed (NR) on the Norwegian alien species list (Artsdatabanken, 2023).*

Sensitive Artsdata is a collective term for a database of selected species of birds, mammals and lichen. Localized information for these species is shielded because open access could lead to exposure to unfortunate negative influence, for example disturbance, pursuit or destruction. This database is managed by the Norwegian Environment Agency (Miljødirektoratet, 2025b).

There are two main guidelines used to assess freshwater ecology and biology, guideline 02:2018 "Classification of the environmental condition of water" and guideline M-608 "Limit values for classification of water, sediment and biota – revised 30.10.2020". Guideline 02:2018 is a classification guideline with methodology for classifying the biological, ecological and chemical freshwater status. The guideline includes updated limit values for classification and guidelines for monitoring. Guideline M-608 is a classification guideline for prioritized environmental toxins with limit values and classes for environmental conditions.

A summary of the reviewed information is presented in this report and organized into appropriate categories.

# 3 RESULTS

## 3.1 Terrestrial vegetation

### *3.1.1 Knowledge base*

The mine concession area was surveyed for terrestrial nature types, and red-listed and invasive species in 2019. This was a combination of fieldwork and desktop studies, where remote sensing was used to map out areas of woodland and open water within the mine concession area. The areas of woodland and open water surveyed remotely were not considered to be of local or regional importance during the field survey. The results from the vegetation study are presented in Vollan, et al. (2020). A smaller area south in the concession area was also surveyed in 2024. The result from this survey is presented in a report from Ecofact (2024). Records from these two reports in addition to available information in public databases is presented below.

Several valuable nature types have been identified within the mine concession area. The nature types reported in the 2019 vegetation survey (Vollan, et al., 2020) are not listed in Naturbase, the national database of valuable nature types and protected areas (Miljødirektoratet, 2025a). For example, one location of rich bog in the northern part of the mine concession area is registered in the report but is not listed in Naturbase.

The 2024 survey thoroughly examined a smaller area in the southern part of the concession area. While no nature types of major importance were recorded, the area serves as a habitat for two red-listed moss species that had not been previously registered in the region. Both species are classified as vulnerable (VU) in the red-list and are found inhabiting the bogs registered during the survey.

The 2019 survey recorded one red-listed species within the mine concession area: *Myricaria germanica* (NT) (Vollan, et al., 2020). In addition, there are a number of registered red-listed species in Artskart, the national map for species registrations (Artsdatabanken, 2025), in and near the mine concession area. Most of these are in the red-list category near threatened (NT), except one that is listed as vulnerable (VU).

During the 2019 vegetation survey, no alien species were recorded. However, several alien species have been registered within and near the mine concession area, as documented in Artskart (Artsdatabanken, 2025). The report from 2020 (Vollan, et al., 2020) highlights all these registrations, which include two species listed as having a severe ecological impact (SE) and several species categorized as having potentially high impact (PH) or low impact (LO) according to the Alien Species List (Artsdatabanken, 2023).

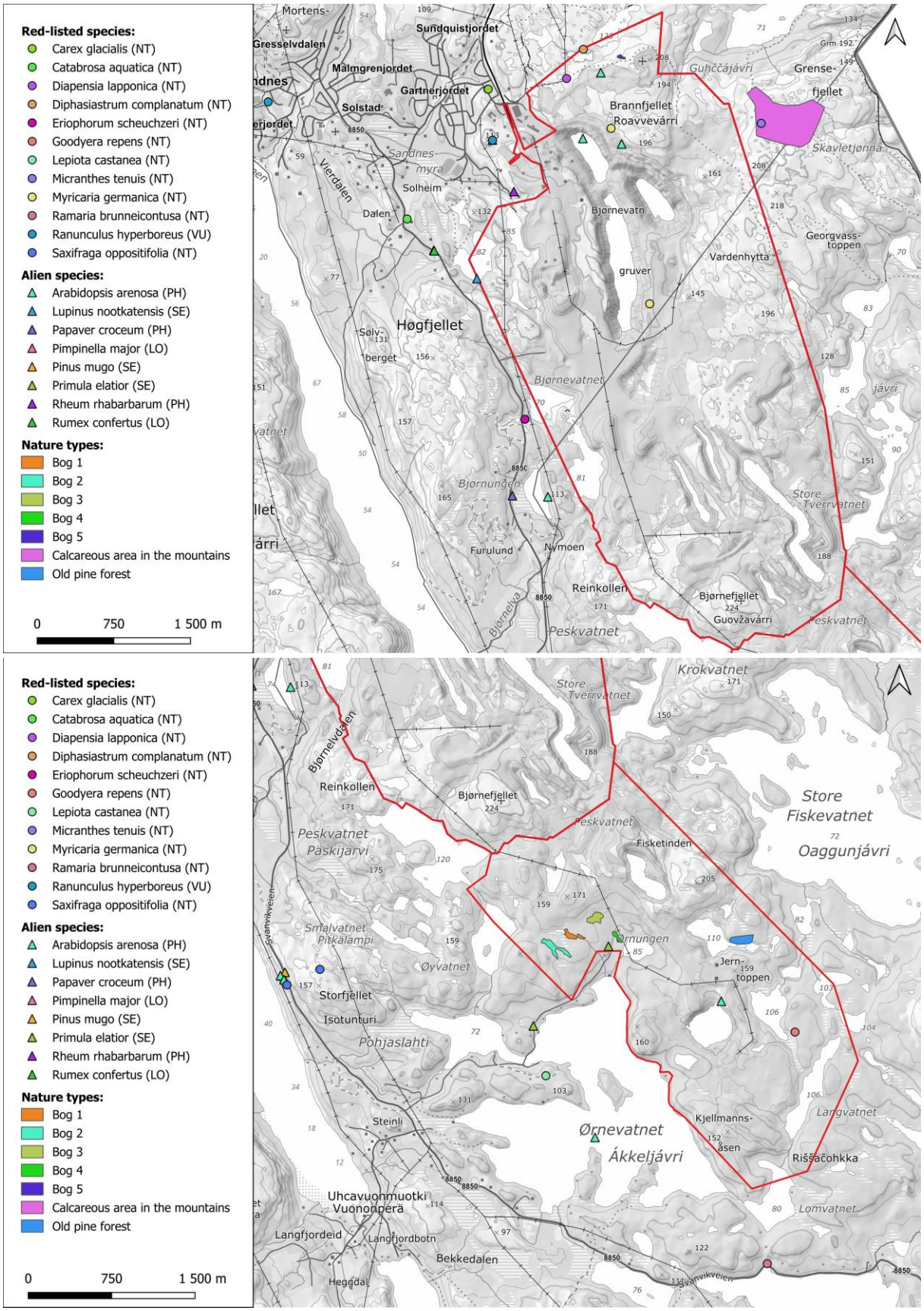



*Figure 3-1: Overview of key vegetation, including red-listed species, invasive species, and valuable natural types. The map highlights important vegetation within and around the mine concession area, with the northern section at the top and the southern section at the bottom (Artsdatabanken, 2025; Miljødirektoratet, 2025; Larsen, 2024; Vollan, et al., 2020; Oliver, 2020).*

### *3.1.2 Assessment*

Parts of the mine concession area have been thoroughly surveyed for valuable species and nature types, while other areas have only been surveyed remotely. During the 2019 field survey, it was determined that these areas did not contain nature of particular interest, and thus, no detailed on-site surveys were conducted. However, these remote surveys covered fairly large areas, including some of the area around Langvatnet, which poses the risk that smaller, valuable habitats or species of interest may have been overlooked. To comply with the Nature Diversity Act and the guidelines from the Norwegian Environment Agency, the entire area should be surveyed using the Nature in Norway (NiN) system to ensure that all relevant habitats and species are adequately surveyed.

The nature types identified in the previous survey reports have not been registered in the national database for valuable nature types, Naturbase (Miljødirektoratet, 2025a). For nature types to be included in this database, the survey must be conducted by qualified personnel following the standards set by the Norwegian Environment Agency (Miljødirektoratet), such as using Nature in Norway (NiN) system. Before being added to Naturbase, the identified habitat types must undergo a quality assurance process overseen by the Norwegian Environment Agency to ensure data reliability. The fact that the nature types from these reports have not undergone this quality assurance process somewhat reduces the reliability of the data and represents a weakness in the terrestrial biodiversity assessment. Additionally, it will be challenging to accurately classify the value of these nature types in an Environmental Impact Assessment when information regarding their condition (tilstand) and biodiversity (naturmangfold) is lacking. This information is essential for determining the quality of the localities and, consequently, their ecological value (verdi).

A further issue is that the red-listed species recorded during the 2024 survey have not been uploaded to Artskart, the national map for species registrations. Without precise location data for these species, it will be more challenging to accurately assess the potential impacts of the project in an Environmental Impact Assessment.

### *3.1.3 Recommendations*

It is recommended that the entire area undergoes a detailed on-site survey to verify the accuracy of the registered nature types and to assess the area that were only remotely surveyed during the 2019 fieldwork. The on-site survey should take place during the growing season (June – August) to ensure that relevant species can be identified during their peak growing time.

Particular attention should be given to the area around Langvatnet. This body of water may be partly drained (lowered by 3 meters) to facilitate continued mining in Kjellmannsåsen, and the surrounding area may be impacted by the expansion of mining activities. This area has the potential for old-growth forest, a valuable nature habitat type, but only parts of it have been thoroughly surveyed through field studies. Therefore, it is critical that the remaining parts are assessed in person to avoid overlooking valuable species and/or nature types.

There is raw data available with GPS coordinates and descriptions of the registered nature types and red-listed species from the 2019 fieldwork. It is recommended that the raw data related to nature types should be quality assured prior to new fieldwork and used as a basis for the upcoming surveys. The results of the surveys should be uploaded to public databases, such as Naturbase and Artskart, following the guidelines in Handbook M-1941 (Miljødirektoratet, 2024). Uploading the records of red-listed species from the 2019 surveys to Artskart is also recommended and these registrations should be included in an Environmental Impact Assessment. Together, this will provide a solid foundation for conducting the Environmental Impact Assessment and will make it possible to assess the consequences that mining activities will have on the terrestrial ecosystem within the mine concession area and the surrounding influence zone.

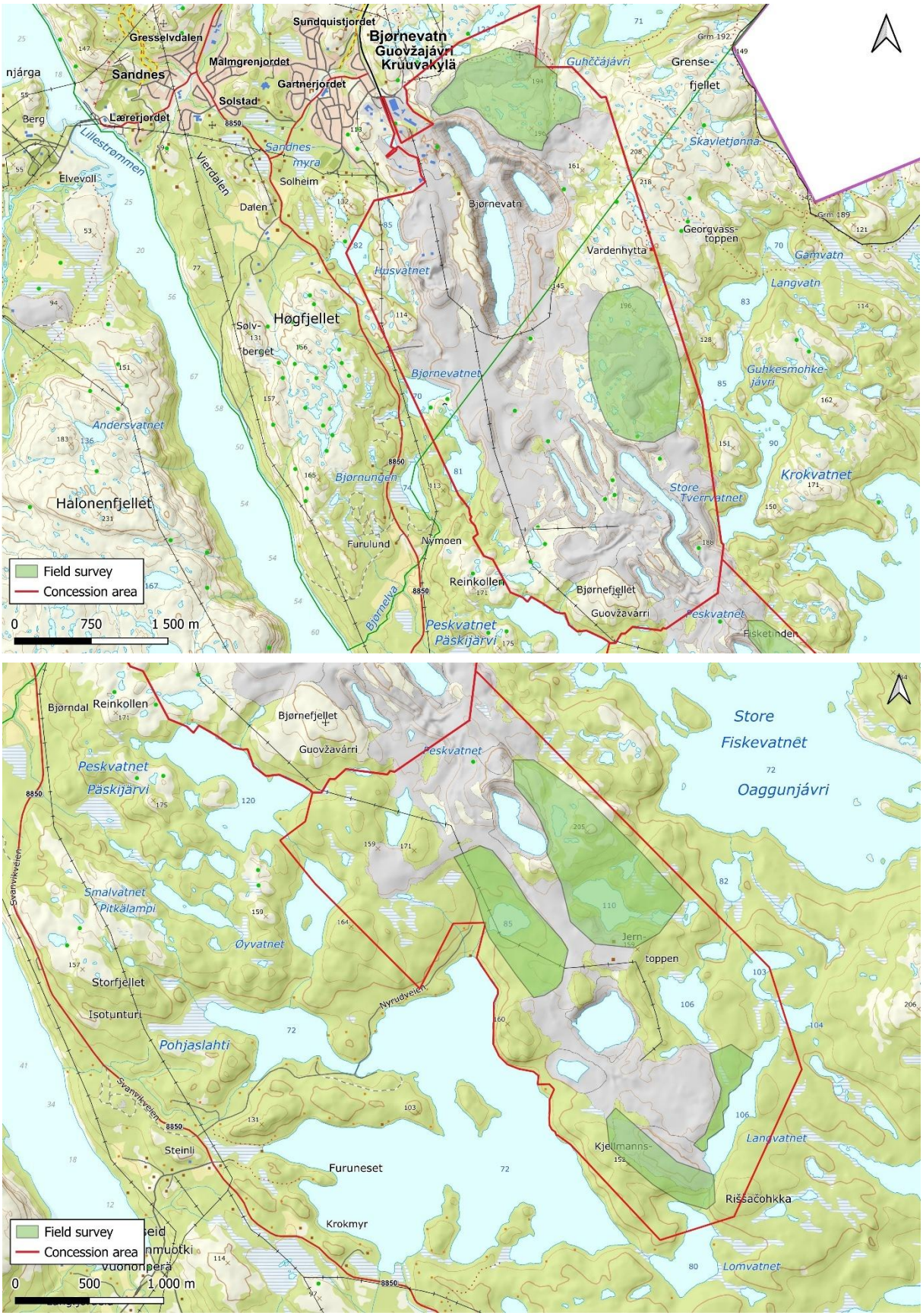



*Figure 3-2: Overview over earlier in-person surveyed areas within the concession area, with the northern section at the top and the southern section at the bottom.*

## 3.2 Terrestrial wildlife

### *3.2.1 Birds*

#### *3.2.1.1 Knowledge base*

In connection with Sydvaranger's plans to resume mining operations, baseline studies of birds were conducted by Rambøll in 2019 (Mäkinen, 2019a; Mäkinen, 2019b) and 2021 (Reppe, 2022) within and near the concession area. In both years, breeding birds were surveyed during breeding season, and migrating birds were surveyed in the autumn. In 2019, the breeding bird survey was carried out in June, while in 2021, breeding bird surveys were conducted in April, May, and June. Migration surveys were carried out in August and September both years.

The following threatened bird species were located in a potential impact area: Common Eider (VU), Smew (VU), Black-headed gull (CR), Common gull (VU), Black-legged kittiwake (EN), Herring gull (VU), Lesser gull (VU), Common scoter (VU), Greenfinch (VU), Willow tit (VU), Parasitic jaeger (VU), Hen harrier (EN) and Sand martin (VU).

The surveys related to the mine concession area focused on the planned construction areas, in and near the mine, along the railway, and at the processing and shipping area by the fjord. Potential impact areas located relatively far from the project areas were also surveyed. The studies were conducted in both a peak year and a low year for small rodents. By surveying the area during a peak year for rodents (2019), it was possible to detect whether there were breeding birds of prey specialized in hunting these animals. For example, in 2019, several breeding rough-legged buzzards were recorded, whereas in the low rodent year of 2021, no rough-legged buzzards nested within the area.

The surveys conducted were based on a fairly consistent methodology. Fixed vantage points and routes were used in the harbour area, mining area and near the three small lakes. For all fixed surveys the main observation period was early morning. In addition, there was more flexible mapping within the impact areas, with a focus on red-listed species and other important species. These are more free surveys where potential important areas for birds are visited. Lakes and mires were visited, alongside potential breeding areas for raptors and grouse.

The database for sensitive species data, Sensitive Artsdata, was also checked for species that are sensitive due to conservation concerns (Oliver, 2020). Most of these species are birds of prey.

The three reports (Mäkinen, 2019a; Mäkinen, 2019b; Reppe, 2022), along with the information in the Terrestrial Biodiversity Baseline report (Oliver, 2020), present many important habitats and species that have been recorded in the impact area. Important areas for birds that were identified include Langfjorden (“Slambanken”), the harbour area, the Kirkenes lakes (just south of Kirkenes), the process plant area. In addition, several breeding areas for birds in the influence area for the mines were identified.

#### *3.2.1.2 Assessment*

The surveys have mapped many important functional areas, including both breeding and resting areas. The surveys were conducted over two years, with relatively long coverage periods spanning several months. They were carried out by experienced ornithologists with strong knowledge of relevant species and their biology.

The existing knowledge base for preliminary investigation is considered to be sufficient and further data collection is not necessary.

One identified weakness is the lack of coverage in the month of July. This is a period when the main migration of adult waders occurs, and many non-breeding wetland birds gather. However, the absence of July coverage is unlikely to change the assessment of which functional areas are important for birds.

Another limitation is that the recorded ecological functional areas for birds are not directly related to Handbook M-1941, "Impact Assessment of Climate and Environment" (Miljødirektoratet, 2024). Despite this, the surveys provide a strong foundation for evaluating the potential consequences of new mining activities on the ecological functional areas for birds in an EIA.

### *3.2.2 Mammals*

#### *3.2.2.1 Knowledge base*

In May 2020, a desktop study was carried out to survey terrestrial mammals within the mine concession area and a 10 km buffer around it (SC, 2020a). Ten different mammals have been recorded close to the concession area. Five are red-listed in categories from near threatened (NT) to critically endangered (CR). These species include the Brown bear (EN), Lynx (EN), Hare (NT), Wolf (CR), and Wolverine (EN). Additionally, one of the recorded species, the Muskrat (PH), is listed as a potentially high impact alien species. The remaining species fall under the least concern (LC) category. For more detailed information regarding the proximity of these registrations of mammal species to the mine concession area, see SC (2020a).

The area has been surveyed for sensitive species, and the results are presented in the report Terrestrial Biodiversity Baseline (Oliver, 2020).

Additionally, Artskart shows several newer records of mountain hare (*Lepus timidus*, NT, 2022) and one record of wolverine (*Gulo gulo*, EN, 2024) in and around the mine concession area.

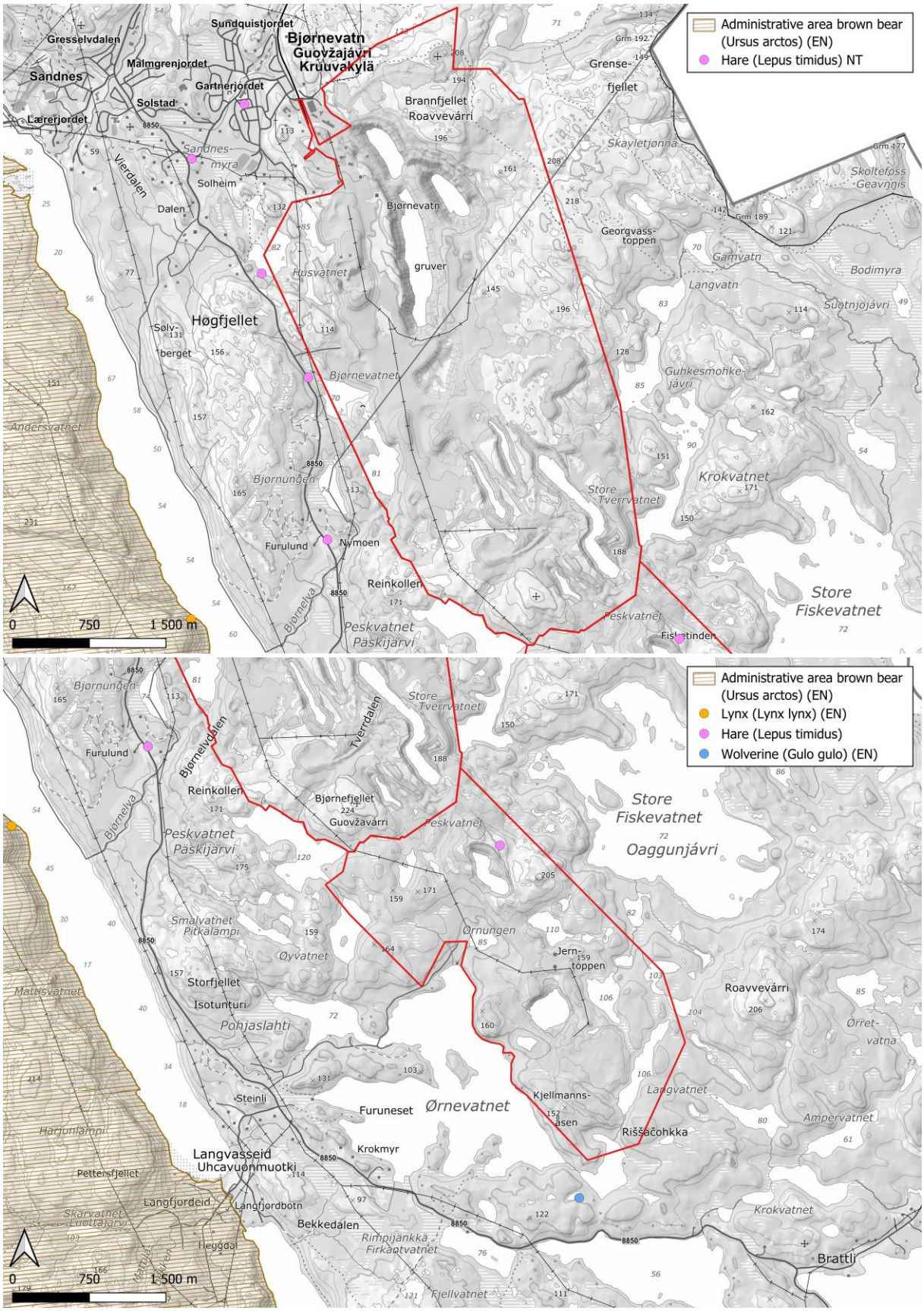



*Figure 3-3: Overview of red-listed mammals registered within the concession area. Grey wolves have been observed within an 8 km radius of the concession area, which is not shown in the figure.*

#### *3.2.2.2 Assessment*

The existing knowledge base for the preliminary investigation of terrestrial mammals is considered sufficient and does not require further data collection.

### *3.2.3 Other terrestrial animals*

#### *3.2.3.1 Knowledge base*

In October 2019, a desktop study was carried out to survey terrestrial invertebrates within the mine concession area and a 5 km buffer around it (SC, 2019). No terrestrial invertebrates were recorded within the concession area itself. However, a vulnerable (VU) red-listed invertebrate species, *Eristalis gomojunovae*, was found 2 km from the concession area. The report concluded that no further surveys of terrestrial invertebrates were necessary. Additionally, another red-listed fly, *Sialis sibirica* (DD), has later been recorded just outside the mine concession area (Artsdatabanken, 2025).

A similar desktop study was conducted in May 2020 to survey the area for reptiles and amphibians (SC, 2020b), using a 1 km buffer around the mine concession area. Both the viviparous lizard (*Zootoca vivipara*, LC) and the common frog (*Rana temporaria*, LC) are potentially present within the mine concession area.

The presence of the mentioned species should be reported and assessed in an EIA, in accordance with the M-1941 Handbook (Miljødirektoratet, 2024).

#### *3.2.3.2 Assessment*

The existing knowledge base for the preliminary investigation for other terrestrial animals is considered sufficient and does not require further data collection.

## 3.3 Freshwater ecology and biology

### *3.3.1 Knowledge base*

Sydvaranger holds an environmental permit granted by the Norwegian Environment Agency. Included in this permission are measures to limit runoff from the area that can negatively impact the aquatic environment including systematically map all emissions to waters, as well as monitor the effects the pollution has on the waters by a monitor program. Potential events that can lead to acute pollution to water have to be mapped. The permission allows draining the pits of accumulated water in 3 km long tunnel westwards to the Langfjorden and pumping the water on land eastwards towards the Pasvik river, as long as it does not cause negative effects on the recipients.

There are several reports assessing the conditions of surrounding waters and rivers, as well as freshwater organisms. The ecological and chemical status for most lakes has been presented in

the report by Rambøll (Burgess, Haukø, Donali & Gaskell, 2022). The classification in the report is based on the Water Framework Directive (WFD). A status of "High" means that the conditions deviate very little from the reference conditions, whereas a "Bad" status means that the conditions deviate a lot from the reference conditions (Burgess, Haukø, Donali & Gaskell, 2022). The chemical status is either "good" or "bad", based on requirements from WFD where parameters with status "moderate" or lower is considered to have bad chemical status. A summary of the results is presented in the table below. The ecological status for some of the lakes could not be classified since the biological indices that were sampled does not directly apply to the water body type. In these cases, the Swedish WFD-classification system was used as a reference and the conditions were described.

*Table 3-1: Ecological and chemical status for examined water bodies in Burgess, Haukø, Donali & Gaskell (2022).*

| Lake | Indicated ecological status | Indicated chemical status |
|---|---|---|
| Nordvatnet | High | Good |
| Valpvatnet | Good | Good |
| Langvatnet | Moderate | Bad |
| Lomvatnet | Good | Bad |
| Andevatn | Undefined | Good |
| Ørnungen | Moderate | Good |
| Langtjern | Undefined | Good |
| Peskvatnene (Store and lille) | Good | Bad |
| Ørnevatnet | Good | Bad |
| Rognmobukta | Undefined | Good |
| Bjørnevatnet | Undefined | Good |
| Sandbotnvatn | Undefined | Good |
| Krokvatnet and Gotmagavatnet | Good | Good |
| Reitanvatn | Moderate | Bad |
| Store fiskevatnet | Moderate | Bad |
| Pasvik river | Moderate to bad* | Undefined |

* Is a heavily modified water body and has a different goal for ecological status (ecological potential)

When resuming the mining operations each of the pits must be drained, and a water balance model was used by Gaskell (2019) to predict discharge to the Pasvik river catchment area. The model also predicted the mean average annual volume discharged to the catchment area. Data on discharge and runoff amounts is essential for dispersion calculations, which is necessary for an impact assessment of climate and environment, in accordance with the M-1941 Handbook (Miljødirektoratet, 2024). The available discharge and runoff data is considered sufficient.

The presence of freshwater pearl mussel (*Margaritifera margaritifera*), European eel (*Anguilla anguilla*) and fish was examined in 2019 by Sopanen, Lintinen, Roikonen, Laaksonen & Oliver (2020). A standard method of electro fishing and visual examination (from land or diving) for freshwater pearl mussel was used. In the study 10 sites were mapped and freshwater pearl

mussel was found in one site Ørnevassbekken. Ørnevassbekken, was considered to have a clear protection value based on this finding.

Anadromous river stretches in the area was examined by Christensen, Jensen & Fagard (2014). The report also looked at the movement of the anadromous species Atlantic salmon (*Salmo salar*), Sea trout (*Salmo trutta*) and Arctic char (*Salvelinus alpinus*). The fish was marked by acoustic transmitters and registered on 63 acoustic loggers that were placed in different locations. The rivers closest to the mining area containing anadromous fish include Pasvik river, Sandnes River and Langfjord river. The knowledge of anadromous river stretches is considered sufficient.

A report by Ecofact from 2024 looked at the consequences on biodiversity by developing a new open pit mine at Ørnungen, which includes draining the lake and the outlet stream. The consequences on freshwater organisms were determined by the impact assessment in accordance with the M-1941 Handbook (Miljødirektoratet, 2024). The data regarding impacts on freshwater biodiversity resulting from the draining of Ørnungen is deemed sufficient.

In 2020 a desktop study on mammals near the mine was published by Rambøll (SC, 2020). It was found in the study that grey seal (*Halichoerus grypus*) (LC) and beluga (*Delphinapterus leucas*) (EN) are occasionally seen in the estuaries of the Pasvik river. The data on freshwater mammals near the mine is considered sufficient.

The hydrological baseline investigations by Koivulehto (2020) and Gaskell (2019) provided no indication of an impact on the ecological aquatic environment.

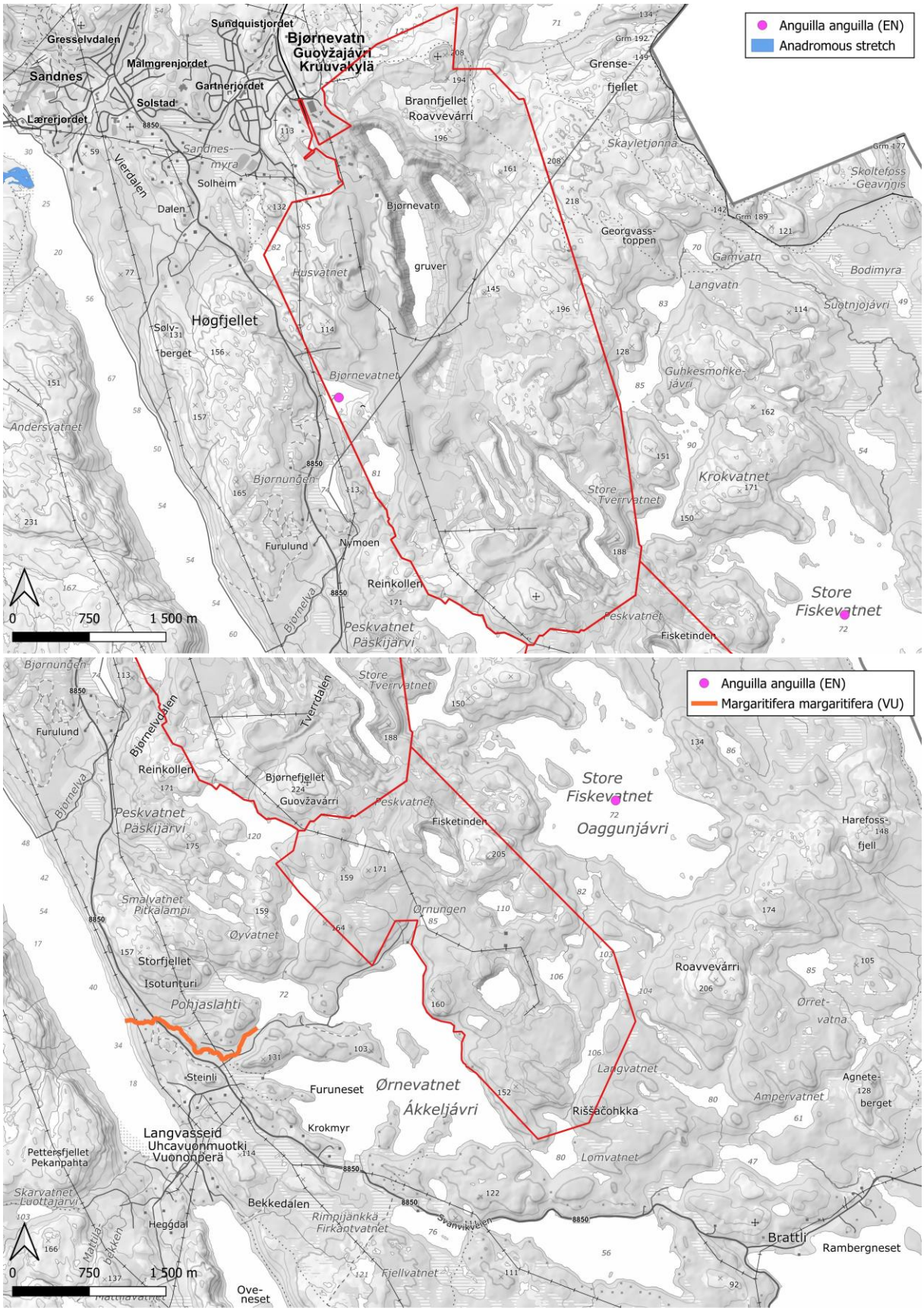



*Figure 3-4: An overview of red listed freshwater species within and surrounding the mine concession area.*

### *3.3.2 Assessment*

Most of the water bodies within and surrounding the concession area have been examined and given an ecological and chemical status (Figure 3-5). There are water bodies within the mine concession area and catchment area that have not been examined. This includes Husvatnet, Langvatn, Gamvatn and Sundtjernan lakes. There is no information about the ecological or chemical condition of these water bodies (vann-nett, 2025), and further examinations is recommended.

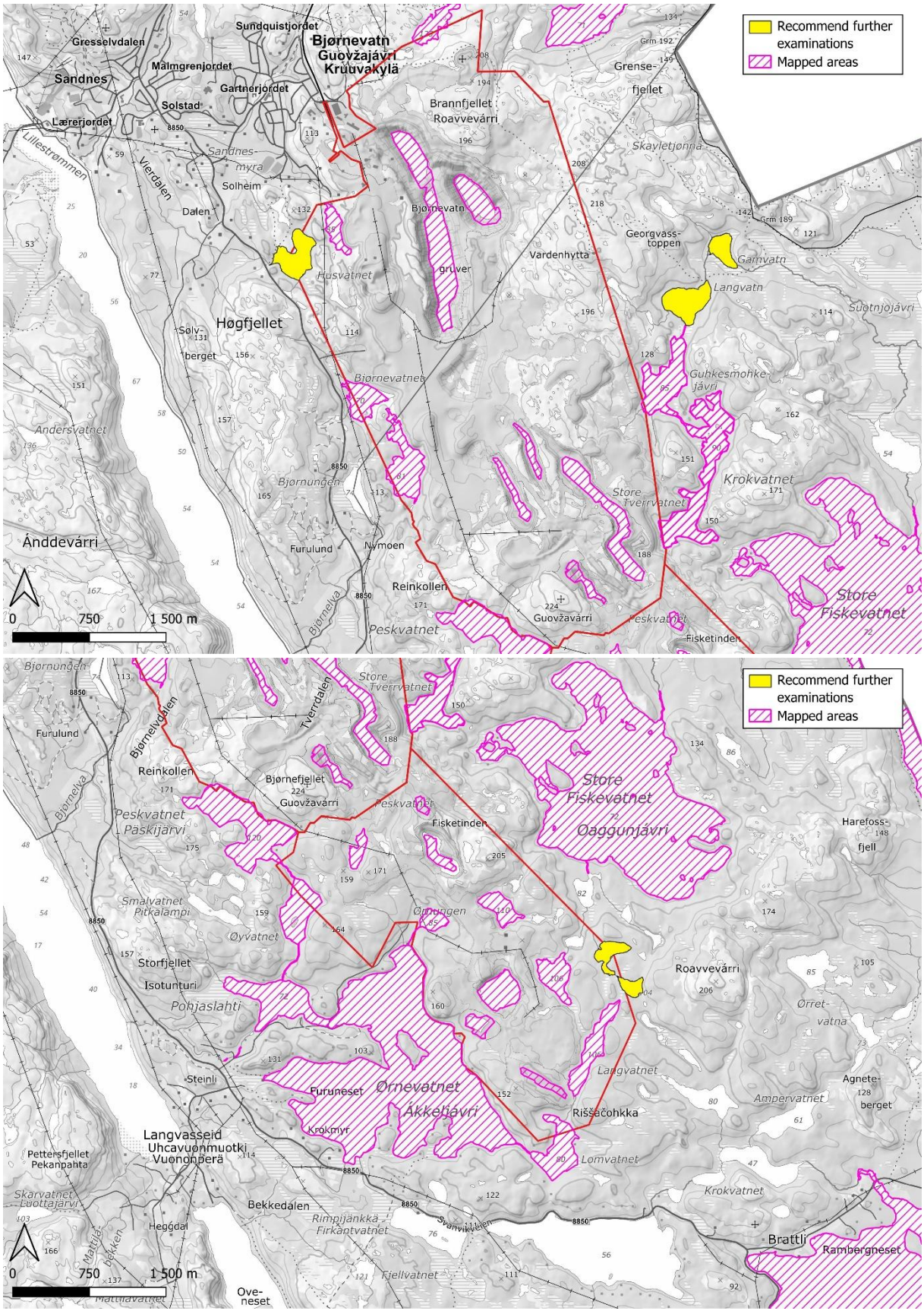



*Figure 3-5: Overview of mapped water bodies from previous reports between 2019 – 2021. The water bodies marked in yellow are recommended for further examination as they have not been looked at or classified previously. The water bodies within or partly within the mine concession area are given the highest priority for further examination.*

Even though no European eel (*Anguilla anguilla*, EN) were found in the study by Sopanen, Lintinen, Roikonen, Laaksonen & Oliver (2020), there is uncertainty regarding the population in the vicinity of the mine. This is due to the previous surveys exclusively focusing on streams, excluding lakes and smaller water bodies. There are four European eel sightings on public databases (Artskart, 2025; Naturbase, 2025a), with the newest from 2008 in Pasvik river. The rest of the sightings date back to 1918 (Sandnesvatn, Bjørnevatnet and Store Fiskevatnet), making them irrelevant. It is recommended to conduct further surveys to determine whether there is eel present.

Depending on the final mine plan, Langvatnet may be partially lowered by three meters to facilitate pit development at Kjellmannsåsen. This would affect the outlet stream and change the drainage pattern between Langvatnet and Lomvatnet. The ecological and chemical conditions of Langvatnet and its outlet have already been examined by Burgess, Haukø, Donali & Gaskell (2022). The indicated ecological status is "moderate" for the lake and the outlet, while the indicated chemical status is "bad". Langvatnet was the only lake with a chromium sample in class V (Bad). The ecological knowledge of lake Langvatnet is considered sufficient. The biodiversity in the Langvatnet outlet stream is unknown as it was not included in the study by Sopanen, Lintinen, Roikonen, Laaksonen & Oliver (2020). It is recommended to conduct further examinations in the stream to determine whether there are freshwater pearl mussels or freshwater fish in the stream.

To evaluate the overall impact of mining activities on the aquatic environment, it is essential to conduct an impact assessment that examines the effects of these activities on the whole aquatic ecosystem within and surrounding the concession area.

### *3.3.3 Recommendation*

The water bodies that are recommended to be examined to classify ecological and chemical status are presented in the table below. Biological quality elements are used to classify ecological status, such as benthic and algae fauna and water plants.

*Tabell 3-2: Recommended water bodies for further examinations to classify ecological and chemical status.*

| Water body | Code vann-nett | Location | Priority |
|---|---|---|---|
| Husvatnet | 246-64433-L | Partly within mine concession area | 1 |
| Langvatn | 246-64484-L | Within catchment area 5 | 2 |
| Gamvatn | 246-64471-L | Within catchment area 5 | 2 |
| Sundtjernan lakes north | 246-65234-L | Partly within mine concession area | 1 |
| Sundtjernan lakes south | 246-65235-L | Partly within mine concession area | 1 |

To classify benthic fauna the ASPT index (Average Score Per Taxon) is common, although it is only used for running waters in the Norwegian system. It is recommended to sample benthic fauna in the littoral zone, inlet and outlet of the lakes. The benthic fauna can also be used to

classify acidification by using the MC (MultiClear) or LAMI (Lake Acidification Macroinvertebrate Index) indexes. In the lakes where there are no clear inlet or outlet benthic fauna can be sampled in the littoral sone, although they cannot be classified in the Norwegian system. The benthic fauna is sampled twice a year, in the spring (April – July) and in the autumn September – November). The sampling must be conducted in accordance with Guideline 02:2018 "Classification of the environmental condition of water". In addition to biological quality elements, nutrients (phosphorous and nitrogen) and "water region specific substances" classified from water samples act as supporting elements for ecological status. Zinc, arsenic, copper and chromium are some "water region specific substances" and are included in the monitoring program in Table 3-3. It is also recommended compare the results from the benthic fauna sampling to the Norwegian red list to look for threatened species.

Water samples are recommended to classify chemical status in the five water bodies, focusing on the parameters mentioned in Table 3-3. Each parameter is compared to its limit value in the Guideline M-608 "Limit values for classification of water, sediment and biota – revised 30.10.2020". One round of water sampling is recommended for Langvatn and Gamvatn, while Husvatnet and Sundtjernan lakes are included in the monitoring program outlined below, as they are partly located within the mine concession area.

In addition, a monitoring program should be implemented before mining operations begin to ensure sufficient data on the status of water bodies and establish a reliable reference value. This approach is more accurate than relying on one-time measurements. Monthly water sampling is recommended. However, if that is not feasible, the program should include at least three rounds of sampling. Sampling must be carried out by personnel with competence in water sampling. It is recommended that the monitoring program include the water bodies and parameters in Table 3-3. Several water bodies within the concession area are not included in the monitoring program as they are heavily modified and affected, thus the biological indices do not directly apply to them.

*Table 3-3: The monitoring program should include recommended water bodies and parameters. Zinc, arsenic, copper, and chromium are "water region-specific substances" and serve as ecological supporting elements.*

| **Water bodies** | **Chemical and ecological parameters** | |
|---|---|---|
| Husvatnet | Aluminium (Al) | Nickel (Ni) |
| Krokvatnet | Arsenic (As) | pH |
| Gotmagavatnan | Boron (B) | Suspended matter* |
| Store peskvatn | Cadmium (Cd) | Total hydrocarbons (THC) |
| Lille peskvatn | Chromium (Cr) | Turbidity |
| Store fiskevatnet | Copper (Cu) | Zinc (Zn) |
| Ørnevatnet | Conductivity | |
| Langvatnet | Iron (Fe) | |
| Lomvatnet | Lead (Pb) | |
| Sundtjernan lakes | Mercury (Hg) | |

* Must be analysed within 24 hours. If this is difficult to attain, turbidity can be monitored instead.

It is important to include the water bodies affected by dewatering the pits (Store Fiskevatnet and Krokvatnet) in the monitoring program before, during, and after the dewatering period. This ensures adequate monitoring of the water quality during the dewatering period and its impact on freshwater biota.

There are uncertainties to the presence of European eels surrounding the mining area. It is therefore recommended to map possible presence of European eels by electro fishing, eel traps or by using environmental DNA (eDNA). It is recommended to do this in the waters where eel has previously been registered (Bjørnevatnet and Store Fiskevatnet) as well as Ørnevatnet, Peskvatnet and Langvatnet. Sampling can be conducted throughout most of the year, but it is advisable to complete it before autumn when eels may begin their migration to the sea.

Further biological examinations are recommended in Langvatnet, with an assessment of the outlet stream for freshwater pearl mussels and fish. Mapping freshwater pearl mussels involves wading upstream with an aquascope or snorkelling in deeper areas. While there is no specific timing for mussel mapping, good visibility is essential. The mapping must be done after the Norwegian standard, NS-EN 16859:2017. The eDNA method can also be used to detect the presence of freshwater pearl mussels.

For fish mapping electro fishing is used as a survey method (standard NS-EN 14011:2003). The stream between Langvatnet and Lomvatnet (outlet stream) is the recommended area to survey. Electro fishing should preferably be carried out in the period between May – September, under conditions of low water flow and water temperatures below 16 degrees Celsius.

*Table 3-4: The ecological parameters that are recommended to examine in the suggested water bodies*

| **Water bodies** | **Ecological parameters** |
|---|---|
| Husvatnet | Benthic fauna, nutrients, water region specific substances (monitoring program) |
| Langvatn | Benthic fauna, nutrients, water region specific substances (one-time measurement) |
| Gamvatn | Benthic fauna, nutrients, water region specific substances (one-time measurement) |
| Sundtjernan lakes north | Benthic fauna, nutrients, water region specific substances (monitoring program) |
| Sundtjernan lakes south | Benthic fauna, nutrients, water region specific substances (monitoring program) |
| Bjørnevatnet | European eel |
| Store Fiskevatnet | European eel |
| Ørnevatnet | European eel |
| Peskvatnet | European eel |
| Langvatnet | European eel, freshwater pearl mussel, electro fishing |
| Lomvatnet | Freshwater pearl mussel, electro fishing |

## 3.4 Landscape

### *3.4.1 Knowledge base*

In connection with Sydvaranger's plans to resume mining operations, a baseline study of landscape was conducted by Rambøll in 2020 (Laitinen, 2020). The influence area was determined to be approximately 10 km around the mine concession area. Puschmann´s Reference System for Landscape was used for the baseline conditions assessment. Three different landscape regions were described within this 10 km radius: Pasvik (sub-region Pasvik), Fjordene i Finnmark (sub-region Sørvarangerfjordene) and Finnmarksvidda (sub-region Gallot). However, the Natur i Norge (NiN) landscape types are not described. Visibility from nearby communities and roads were identified using Google StreetView. Visualizations of the mining area has been made from several vantage points, using Google StreetView (bar bakke 2018).

### *3.4.2 Assessment*

The area in a 10 km radius is described in general. The baseline study does not contain enough information or pictures to assess the value of the landscape areas. The visualizations received offer a good preliminary understanding of the project's potential impact on the landscape.

### *3.4.3 Recommendations*

The visualizations are helpful in illustrating general features and possible changes in the landscape, but they are not sufficient on their own to form the basis for a comprehensive environmental impact assessment. A field survey is still necessary to assess the landscape values on site, including elements that may not be fully captured or accurately represented in the visualizations. It is also necessary to refine the boundary of the influence area. According to Handbook M-1941 (Miljødirektoratet, 2024), field surveys are necessary to prepare a comprehensive impact assessment.

# 4 CONCLUSION

The review highlights several important findings related to terrestrial and freshwater biodiversity that should be given special attention as the resumption of mining activities at Sydvaranger progress. In terms of terrestrial vegetation, the presence of the two red-listed moss species and the bogs that serve as their functional habitat should be of particular concern. These areas require careful consideration during planning and execution of mining operations.

For birds, several important functional areas have been identified. These include Langfjorden ("Slambanken"), the harbour area, the Kirkenes lakes (just south of Kirkenes), and the process plant area. Additionally, breeding areas for birds have been found within the influence zone of the mine concession area, which could be impacted by habitat disturbance, noise, or pollution from the mining activities.

For freshwater ecology, one particular important finding is the presence of the Freshwater pearl mussel in Ørnevassbekken, which gives Ørnevassbekken a clear protection value. However, there is still significant information missing regarding the overall biodiversity status of freshwater systems in the area.

Further assessment of what is considered of high biodiversity value will be carried out more thoroughly in an Environmental Impact Assessment (EIA).

The review also highlights several data gaps and provides recommendations for further surveys. An overview of the recommended surveys for each topic is summarized in Table 4-1.

*Table 4-1: Overview of recommended surveys that need to be done in order to write an Environmental Impact Assessment.*

| Topic | Reference | EIA sufficient | Recommendation |
|---|---|---|---|
| Terrestrial Vegetation | Artsdatabanken, 2025; Artsdatabanken, 2023; Artsdatabanken, 2021; Larsen, 2024; Oliver, 2020; Miljødirektoraatet, 2025; Vollan, et al., 2020 | No | NiN mapping of terrestrial vegetation should be conducted following the guidelines in Handbook M-1941 for the entire mine concession area. The green areas in Figure 3-2: Overview over earlier in-person surveyed areas within the concession area, with the northern section at the top and the southern section at the bottom.Figure 3-2, which have been surveyed in the field previously, require localization of the previously registered nature types and in-field quality assurance. |

| | | | |
|---|---|---|---|
| Birds | Mäkinen, 2019a, 2019b; Reppe, 2022 | Yes | |
| Mammals | Rambøll, 2020a; Artsdatabanken. 2025 | Yes | |
| Other terrestrial animals | SC, 2019; SC, 2020b | Yes | |
| Freshwater biology and ecology | Burgess, Haukø, Donali & Gaskell (2022); Christensen, Jensen & Fagard (2014); Gaskell (2019); Koivulehto (2020); Larsen (2024); Sopanen, Lintinen, Roikonen, Laaksonen & Oliver (2020); Vann-nett (2025); Vannmiljo (2025) | No | Benthic fauna and water samples in Husvatnet, Langvatn, Gamvatn, Sundtjernan lake, implementing monitoring programs, mapping European eel in the easter side of the mine, mapping fish and freshwater pearl mussels in the outlet stream from Langvatnet. |
| Landscape | Bar bakke, 2018; Laitinen, 2020 | No | The influence area should undergo a field survey to better evaluate the subareas and their value, and to refine the boundary of the influence area. |

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