

Environmental Impact Assessment Plan for nuclear installations in Norrundet, Gävle Municipality

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Client: Blykalla AB

Consultancy firm: The Environmental Impact Assessment has been compiled by Structor Miljöbyrå Stockholm AB. Blykalla AB has provided the description of reactors, technology, and waste management, as well as the choice of location, design of preparedness zones, and data regarding emissions of radioactive substances. Modelling of discharged cooling water has been carried out by DHI. Initial assessments of the impact on aquatic organisms from the discharge of heated cooling water have been conducted by Pelagia. Ekologigruppen has provided data regarding the occurrence and assessment of the impact on natural values. Geological conditions have been investigated by Structor Geoteknik. Environmental risks have been assessed in an overview by Structor Riskbyrå.

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Summary

According to the new review process for nuclear installations, the Government may, upon application, decide on the approval of an installation. The Government is responsible for preparing an installation plan (*anläggningsplan*), which needs to be adopted before an approval decision can be made, as well as for conducting a strategic environmental assessment of the installation plan. The party applying for the Government's approval has the opportunity to contribute data to the strategic assessment.

The current document constitutes the environmental impact assessment within the framework of the strategic environmental assessment that the Government has commissioned the County Administrative Board of Gävleborg (*Länsstyrelsen i Gävleborg*) to carry out. Blykalla has previously submitted data for the strategic environmental assessment to the Government together with the application for approval of a nuclear installation. This data served as the basis for the scoping consultation (*avgränsningssamråd*) held by the County Administrative Board, after which the present environmental impact assessment was developed in collaboration between the County Administrative Board, Blykalla, and Structor.

The environmental impact assessment highlights the environmental impact that may arise as a result of the installation enabled by the plan proposal. At this stage, the assessment is made at an overall level in order to highlight whether conditions exist for the planned land use based on the management provisions in Chapters 3 and 4 of the Environmental Code (*miljöbalken*).

The plan proposal aims to enable the establishment of nuclear activities in Norrsundet, Gävle Municipality, in the form of the construction and operation of a park with six lead-cooled small modular reactors (SEALER reactors) developed by Blykalla AB. The main part of the proposed installation plan area includes the planned area for nuclear activities. The remaining part of the plan area will be used for ancillary activities such as warehousing, research and development, and other related functions.

Norrsundet is a coastal community with a history closely linked to industrial development. Today, industrial and port activities are conducted within the Norrsundet industrial area just southeast of the plan area. There are good road connections around the area, and the nearest residences are located approximately one kilometer south of the current area in Norrsundet.

The plan proposal may give rise to impacts through the taking up of land (*ianspråktagande av mark*), noise, intake and discharge of water, groundwater drainage (*grundvattenbortledning*), consumption of raw materials and chemicals, generation of waste, energy consumption, and emissions to air.

A risk identification has been performed where various risk sources linked to the plan proposal have been identified with regard to conventional risks. Radiological risks encompass potential unplanned events where acceptance criteria are applied as the requirement framework for radiation doses to the general public. The nuclear installations will need to be constructed such that the dose to a representative person from the general public is lower than the acceptance criterion for the respective event class. For extremely improbable events (serious accidents), preparedness measures (*beredskapsåtgärder*) are planned within the preparedness zones (*beredskapszoner*) established around nuclear installations. Estimated maximum preparedness zones for the SEALER park with six SEALER reactors are stated to be one-fifth of the radius of existing nuclear power plants, i.e., an inner preparedness zone of approximately 1 kilometer and an outer preparedness zone of approximately 5 kilometers. It is not improbable that the final

preparedness zones will be smaller than this; however, this is dependent on the results of forthcoming detailed analyses and the position of the authorities regarding these.

The assessment of the plan proposal's potential environmental impact is based on early investigations of relevant environmental aspects and has been adapted and delimited based on current knowledge data and the purpose of the installation plan at this early stage.

The plan proposal entails the taking up of natural land in close proximity to existing industrial activities, which entails an expansion of the existing industrial area. The proposed establishment does not affect any protected areas. The land taken up consists of managed forest land with generally lower natural values and limited values linked to habitats for protected species, with the exception of the southwestern corner of the plan area where there are higher natural values. Certain species occurrences exist and require further inventory and investigation.

In the vicinity of the area and within the estimated maximum preparedness zones, there is an area of national interest (*riksintresse*) for commercial fishing. In the event that the intake and discharge of cooling water becomes relevant, the impact on fishing needs to be considered. The sediments off the coast along the Norrsundet industrial areas are affected by pollution from previous industry. Therefore, the placement of any cooling water pipelines needs to occur in such a way that decided environmental quality standards (*miljökvalitetsnormer*) are not at risk of deterioration. Within the outer preparedness zone, there are areas of national interest (*riksintresse*) for nature conservation, shipping-fairway, commercial fishing, and railway.

Otherwise, no protected natural or cultural values or other national interests occur. No known recreational values occur, and the plan proposal is assessed to be able to be integrated into the nearby industrial environment.

Overall, the assessment is that conditions exist for the proposed establishment based on the general interests specified in Chapters 3 and 4 of the Environmental Code (*miljöbalken*). Adaptations and protective measures are needed for any intake and discharge of cooling water to limit the impact on aquatic organisms and environmental quality standards for water, as well as likely for protected species.

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1. INTRODUCTION

Sweden aims to achieve net-zero greenhouse gas emissions by 2045 (Swedish Environmental Protection Agency [Naturvårdsverket], 2026). To reach this goal, more fossil-free electricity production is required. Nuclear power has the capacity to generate significant amounts of electricity on a limited area and is expected to play a central role in the expansion of Sweden's future electricity system.

Against this background, Blykalla plans to establish small modular lead-cooled reactors (SMR) in Norrsundet, Gävle Municipality. These reactors are substantially smaller than traditional nuclear power plants, and the technology is more flexible and scalable, making it possible to adapt production to future needs and contribute dispatchable power to the electricity grid.

According to the new review process for nuclear installations, which enters into force on 17 June 2026, the Government may, upon application, approve a nuclear installation. Such approval presupposes that the Government has previously adopted an installation plan (*anläggningsplan*) for nuclear installations covering the area and the installations to which the application refers. A decision to adopt a plan for nuclear installations shall be preceded by a strategic environmental assessment according to Chapter 6 of the Environmental Code (*miljöbalken*). The Government is responsible for conducting the strategic environmental assessment, but the party applying for the Government's approval has the opportunity to contribute data to it.

The County Administrative Board of Gävleborg County (*Länsstyrelsen i Gävleborgs län*) is responsible for conducting the strategic environmental assessment through a commission from the Government. Blykalla has submitted data for the strategic environmental assessment to the Government together with the application for approval of a nuclear installation. This data served as the basis for the scoping consultation (*avgränsningssamråd*) conducted by the County Administrative Board, after which the present environmental impact assessment was developed in collaboration between the County Administrative Board, Blykalla, and Structor.

The environmental impact assessment highlights the environmental impact that may arise as a result of the installation that the plan proposal is intended to enable. At this early stage, the assessment is made at an overall level in order to highlight whether conditions exist for the planned land use based on the management provisions in Chapters 3 and 4 of the Environmental Code (*miljöbalken*).

2. STRATEGIC ENVIRONMENTAL ASSESSMENT

2.1. Process

An environmental assessment aims to integrate environmental considerations early in the decision-making processes for plans, programs, and activities or measures subject to permit requirements. The goal of the environmental assessment is to prevent negative environmental impact and contribute to sustainable development.

The present document constitutes the environmental impact assessment within the framework of a strategic environmental assessment (SEA) according to Chapter 6 of the Environmental Code (*miljöbalken*). The strategic environmental assessment shall be conducted within the framework of the process regarding the Government's adoption of an installation plan for a nuclear installation according to, among other things, Section 12 of the Act (2026:585) on the Government's Approval of Nuclear Installations (*lagen (2026:585) om regeringens godkännande av kärntekniska anläggningar*). Section 10 of the same Act states that the Government, following an application for the approval of a nuclear installation, may adopt an installation plan to guide the decision on how land and water areas shall be used. Upon the adoption of the installation plan, the basic and the special management provisions in the Environmental Code shall be applied, and an assessment shall be made as to whether the construction of the installation is compatible with the national general interests (national interests) (*riksintressen*) specified in Chapters 3 and 4 of the Environmental Code (*miljöbalken*).

The strategic environmental assessment for the installation plan follows these main steps according to Chapter 6, Section 9 of the Environmental Code (*miljöbalken*):

- Scoping consultation according to Chapter 6, Sections 9–10
- Preparation of an environmental impact assessment (EIA)
- Opportunity to submit comments on the plan proposal and the EIA
- Consideration of the EIA and submitted comments
- Decision on plan and location. The Government decides on the suitability of the location, and the installation plan is approved as a basis for the forthcoming permit review according to the Environmental Code and the Nuclear Activities Act (*kärntekniklagen*), and if necessary, also for the forthcoming planning process according to the Planning and Building Act (*plan- och bygglagen*).

The content of the environmental impact assessment within the strategic environmental assessment is regulated in Chapter 6 of the Environmental Code (*miljöbalken*). The level of detail shall be adapted based on the purpose of the plan and concentrated on the issues concerning the assessment of the site's suitability for the establishment of a nuclear installation, as well as a balancing of interests according to the management provisions for the use of land and water areas according to Chapters 3 and 4 of the Environmental Code (*miljöbalken*). The assessment shall ensure that the plan proposal is compatible with the long-term suitable use of the area and does not cause significant harm to national interests or other values according to the Environmental Code (*miljöbalken*). Issues of a more detailed nature, such as the exact placement of buildings or technical solutions, will be handled in forthcoming review processes.

2.2. Scoping Consultation

The planned activity is assumed to entail significant environmental impact. Since the planned activity is assumed to entail significant environmental impact, no screening consultation (*undersökningssamråd*) has been conducted. The scoping consultation was conducted by the

County Administrative Board of Gävleborg County and took place in writing with the affected authorities and municipalities during the period from 10 July up to and including 4 September 2026. The documents sent out for consultation were Blykalla AB's submitted application to the Government for the approval of a nuclear installation.

The scoping consultation aimed to identify which environmental aspects need to be addressed within the framework of the environmental impact assessment, as well as what scope and level of detail are appropriate given the purpose of the installation plan. The scoping covered the question of which environmental effects can be assessed at the strategic level at which the installation plan is situated and which issues need to be handled at later stages, for example, during detailed design or forthcoming permit reviews.

A compilation of submitted comments and how they have been handled will be presented in a consultation report (*samrådsredogörelse*). The supplements and clarifications made in the environmental impact assessment after the completed scoping consultation primarily concern:

- Surface and groundwater occurrences (Section 6.3.5)
- Intake and discharge of cooling water (Section 8.4.2)
- Interim storage of waste (Section 3.1.2)
- Geographical delimitation and transboundary environmental impact (Section 4.2.1)
- Environmental quality standards for water (Sections 5.4 and 8.4)
- National interest for nature conservation (Sections 6.2.1 and 8.3)
- National interest for valuable substances and minerals (Section 6.2.1)
- Surface and groundwater occurrences (Section 6.3.5)
- Environmental quality standards for air, emissions to air (Sections 6.3.6 and 8.1.2)
- Future climate (Sections 6.3.7 and 8.2)
- Contaminated sediments (Sections 6.3.8 and 8.4.2)
- Noise (Sections 7.2 and 8.1.1)
- Stormwater (*dagvatten*) (Sections 7.3 and 8.4.1)
- Radiological events and impact on infrastructure (Sections 7.10.2 and 8.1.5)
- Groundwater drawdown (*grundvattenavsänkning*) (Section 8.2)
- National interest for commercial fishing (Section 8.5)
- Cultural environment (Section 8.6)

3. DESCRIPTION OF THE PLAN PROPOSAL AND ALTERNATIVES

This section summarizes the plan proposal that is the subject of the installation plan. According to Section 11 of the Act on the Approval of Nuclear Installations, an installation plan shall specify:

1. Which types of and how many nuclear installations may be constructed and where these may be located, and
2. which area needs to be taken up (*tas i anspråk*) so that the nuclear installations can be constructed and operated.

3.1. Plan Proposal

The plan proposal aims to enable the establishment of nuclear activities in the form of the construction and operation of a park with six lead-cooled small modular reactors (SMR) as well as interim storage for nuclear waste. The reactor park is planned to have an electrical output of approximately 330 MWe.

An SMR (Small Modular Reactor) is a small nuclear reactor based on the same basic principle as today's large reactors, but in a smaller and more standardized format (prefabricated modules). In the reactor, uranium is fissioned, which releases heat. The heat is used to boil water and create steam that drives a turbine and a generator to produce electricity. An SMR is small and compact and is built in modules at a factory, which makes it faster and simpler to construct. Once the land and buildings are prepared, the reactor can be transported and installed at the facility. The reactors, developed by Blykalla AB, are called SEALER and have built-in safety systems and are cooled with lead. The reactors shall be used for electrical power production and, if necessary, industrial heat production.

The planned facility consists of reactor buildings with control rooms, changing rooms, loading/unloading areas, a turbine hall, a generator hall, and other support functions. In connection with the reactor buildings, a steam cell is constructed where the steam from the reactor is converted into kinetic energy in a turbine, which drives a generator where electricity is produced. Within the area, spaces and buildings are also planned for the interim storage of radioactive waste and spent nuclear fuel resulting from the facility's operation, as well as, if necessary, spaces for the examination and research of radioactive materials and fuels.

The proposed installation plan covers an area totaling approximately 40 hectares at Norrsundet in Gävle Municipality; see Figure 2-1 for a preliminary map of the area. The main part of the area includes the area for nuclear installations (approximately 35 hectares). The remaining part of the area will be used for ancillary activities such as warehousing, research and development, and other related functions.

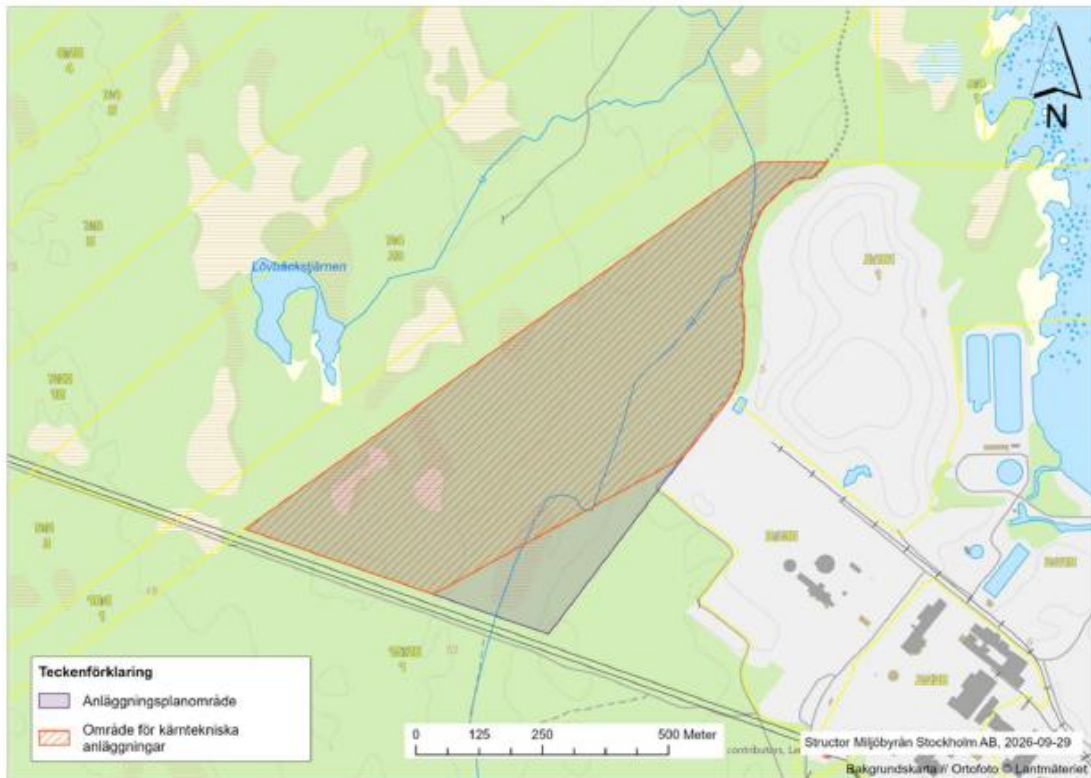


Figure 2-1. Map of the area for the installation plan including the area for nuclear installations.

The planned activities within the area are described in more detail in the sections below.

3.1.1. Design and Operation of the Reactors



Figure 3-1. Visualization of a park with six reactor buildings. The image is generic and illustrates an example of how the facility may be designed.

SEALER is an SMR of the fast lead-cooled reactor type (LFR, Lead-cooled Fast Reactor). "Fast" here means that the reactor utilizes non-moderated neutrons, unlike, for example, today's light water reactors (LWR, Light Water Reactor) where neutrons are moderated, i.e., slowed down. The reactor core is cooled with liquid lead in a closed system. The lead circulates in the so-called primary circuit, and the heat from the lead is transferred in steam generators to water (steam) in the so-called secondary circuit, which is also a closed system. The steam is used for the generation of electricity using a steam turbine and generator.

Various alternatives are being investigated for the cooling of the secondary circuit. One alternative is air cooling, where the water/steam circulates in a closed system that is cooled against air. The second alternative entails that the cooling instead occurs against seawater. The seawater does not come into contact with any material in the process, and therefore no contamination of the water occurs before it is returned to the recipient.

For the primary circuit, there is also a passive safety system for air cooling, which, in a potential accident scenario (where the normal cooling in the secondary circuit would not function as intended), will cool the primary system so that core damage can be avoided. The fact that the air cooling is passive means that it functions independently of electricity and operator actions.

The SEALER park consists of reactor buildings and ancillary buildings (storage, etc.). The reactors themselves will be recessed below ground level. The highest building parts are expected to reach approximately 40 meters above ground level in the event of air cooling; otherwise, approximately 20 meters above ground level.

The fuel consists of low-enriched uranium of the type called HALEU (High-Assay Low-Enriched Uranium), here with enrichment between approx. 12% and approx. 19% U-235, in the form of uranium nitride or uranium dioxide. Uranium dioxide will primarily be used for the facility. Uranium nitride is being evaluated as a future alternative fuel and may be used provided that the fuel can, among other things, be approved in the continued stepwise review according to the Nuclear Activities Act (*kärntekniklagen*).

Safety

Safety for SEALER reactors is achieved through the use of general principles of barriers and defense-in-depth, which are proven for nuclear reactors.

Barriers

Nuclear reactors have several physical barriers, one after another. If one barrier fails, the next takes over. The barriers shall delay or prevent radioactive substances from spreading in the event of an accident. For SEALER, the following barriers exist:

1. Fuel pellets

The majority of the radioactive material produced in a nuclear reactor occurs in the fuel itself; this is where nuclear fission takes place, giving rise to a variety of different radioactive substances. The fuel consists of hard pellets, where a large part of these radioactive substances remain once they are created.

2. Fuel cladding

The fuel pellets are collected in metal fuel rods. This metal cladding prevents radioactive substances leaving the fuel pellets from spreading to the coolant in the reactor core.

3. Primary system

The reactor core and the coolant lead are enclosed by the reactor vessel, pipes, and steam generators made of metal. If the fuel cladding is damaged, radioactive substances thus remain in the primary circuit.

4. Reactor containment

Should the primary system also be damaged, further leakage of radioactive substances is prevented by a metal reactor containment.

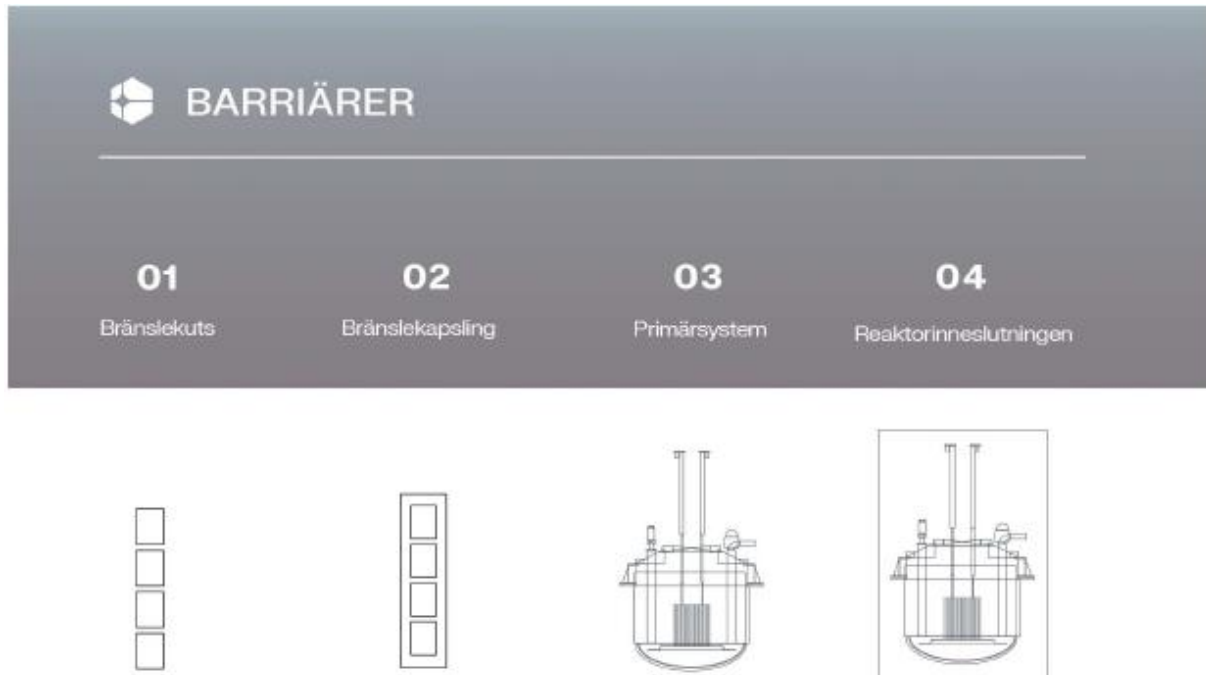


Figure 3-2. Schematic diagram illustrating the physical barrier stages.

Defense-in-Depth

For SEALER, safety is structured according to the so-called defense-in-depth principle. Defense-in-depth encompasses all aspects that build up safety and, for SEALER (as for today's light water reactors), consists of five levels (note that these defense-in-depth levels are not the same as the barriers mentioned above):

1. Quality in design, operation, and maintenance, to prevent operational disruptions and other faults.
2. Detecting and controlling operational disruptions so that they do not lead to accidents and so that the nuclear reactor can be returned to normal operation.
3. Minimizing the consequences of accidents and countering extensive fuel damage.
4. Ensuring that radioactive releases caused by accidents with extensive fuel damage are as low as reasonably achievable.
5. Mitigating consequences in the event of radioactive releases.

In the SEALER reactors, the unique properties of lead as a coolant are utilized to enhance safety. A SEALER operates at near atmospheric pressure, which means that the reactor system is not dependent on high pressure to function. Lead has a very high boiling point of +1749°C, which prevents boiling during a temperature increase that deviates from normal operation. Lead circulates in a closed system in the reactor and cools the core. In the event of a coolant leak, lead solidifies when its temperature drops below the melting point of +328°C.

Lead also functions as radiation protection since lead is a strong radiation-shielding material and is often used as radiation shielding in various applications. It also has a strong ability to bind volatile fission products (such as cesium and iodine), which reduces a potential release of radioactive substances in the event of an accident.

SEALER uses a passive safety system for air cooling to cool the primary system in the event of an accident. The fact that the air cooling is passive means that it functions independently of electricity and operator actions. This is a difference from existing reactors, which are dependent on electrical power (external power or local backup power) to cool the core.

To manage scenarios where, despite all high safety measures, the worst kind of accident should nevertheless occur for some reason, preparedness zones (*beredskapszoner*) are established (Blykalla, 2026).

Physical Protection

The facility's physical protection will be designed according to requirements and principles for nuclear reactors. SEALER's inherent safety characteristics—including operation at atmospheric pressure, passive cooling, and lead's ability to bind volatile fission products, together with its placement below ground level—mean that the possibilities for an antagonist to cause significant radiological harm are limited.

3.1.2. Interim Storage of Radioactive Waste and Spent Nuclear Fuel

Within the area for nuclear installations, spaces are planned for the interim storage of radioactive waste resulting from the facility's operation, including spent nuclear fuel. The interim storage within the facility constitutes an intermediate step pending final disposal. The interim storage is planned to take place in spaces designed to safely shield the waste and prevent radiation or the spread of contamination to the surroundings.

The waste is stored in interim storage until it can be cleared (*friklassas*) and sent for external waste treatment, external interim storage, or directly to final disposal. The fuel will be stored in dry storage within the facility in licensed containers or in dedicated spaces.

Dry storage is a passive storage method. All safety functions—namely containment, radiation shielding, criticality safety, and removal of decay heat (*resteffekt*)—are provided by the licensed container or the space adapted for that purpose. Decay heat is removed through natural convection of the surrounding air, which is why the method is not dependent on power supply, pumps, or coolants. The method is proven through more than four decades of commercial use in a large number of countries. The characteristics of the site therefore have less significance for the radiation safety of the interim storage, and dry storage can be applied safely regardless of location in principle. The site, however, is significant in the following respects, all of which are assessed as favorable:

- the passive cooling is dimensioned against the surrounding air temperature, and the Swedish climate provides a significant margin to the temperatures for which commercially available container systems are licensed.

- low seismic activity results in low design loads for the storage area, which must support heavily loaded containers.
- a secluded and contiguous operational area enables joint physical protection for reactors and interim storage.
- the technology is modular, meaning that capacity can be expanded as fuel is generated.

The estimated amount of spent nuclear fuel from the facility amounts to approximately 260 tonnes of uranium during the planned operating period of 50 years. The amount is an approximate estimate and may be adjusted as the design of the facility is specified and the enrichment level of the fuel is finally determined. The accumulated amount in the interim storage is expected to correspond to the spent nuclear fuel expected to be generated during the entire operating period of the activity. The amount increases successively during the operating period as fuel is removed from the reactors, and the interim storage capacity is dimensioned accordingly.

Spent nuclear fuel from a nuclear power plant is high-level waste. All safety functions required for this will be provided by the dry storage system described above.

The spent nuclear fuel will be stored in interim storage until a new final repository for spent nuclear fuel from new reactors has been completed. The spaces for interim storage will meet applicable requirements for physical protection according to the Nuclear Activities Act (*kärntekniklagen*) and the regulations of the Swedish Radiation Safety Authority (*SSM:s föreskrifter*), including measures to prevent unauthorized access, sabotage, and unauthorized handling of nuclear material. The spaces for interim storage of radioactive waste and spent fuel will be equipped with radiation protection, physical protection, ventilation, and monitoring systems to ensure that the waste does not pose a risk to personnel or the surrounding environment. The interim-stored radioactive waste and spent fuel will be inspected regularly, and radiation levels will be monitored.

The starting point is that the waste will need to be stored in interim storage until suitable final disposal solutions have been commissioned and made available to new operators. The interim storage capacity within the area will be dimensioned accordingly. In parallel, the possibility of storing spent nuclear fuel in a central interim storage facility is also being investigated. Such a solution could offer economies of scale regarding radiation protection, safety, and cost-effectiveness, but presupposes separate permits and infrastructure agreements. The long-term interim storage strategy will be specified within the framework of the forthcoming stepwise permit review.

3.1.3. Preparedness Zone

The area around nuclear power plants is divided into two preparedness zones, an inner and an outer preparedness zone. For the different zones, there are a number of planned urgent protective actions (see Section 7.10.2).

3.1.4. Infrastructure and Transport

The activity may entail a need for new or adapted infrastructure solutions. To ensure accessibility during the transport of personnel and facility components, new access roads and reinforcement of existing roads leading to the existing public road will be needed. Transport via the nearby port will, if possible, be utilized for the transport of both facility components and fuel. The port's capacity may need to be expanded.

The operational phase generally entails relatively few transports. These transports primarily comprise deliveries of consumables, transport of conventional and radioactive waste, as well as personnel transport to and from the facility. It is assessed that these transports will mainly be carried out by road vehicles.

During construction, transports of modules and other facility components, soil and rock material, as well as building materials to and from the operational area will be added.

In the event of any intake of cooling water for secondary cooling, pipelines will be laid from the intake point to the facility. Furthermore, a dedicated facility for the production and treatment of water and sewage may need to be constructed, depending on the availability and capacity of the existing water and sewage (VA) network.

The facility also needs to be connected to the overlying electricity grid, which means that power lines need to be laid to a suitable connection point and that reinforcements of the grid capacity may become necessary.

3.1.5. Decommissioning

The lifespan of the SEALER reactors is estimated to be 50 years. Decommissioning entails that the area is restored, which includes the shutdown of the reactors, removal of spent fuel, demolition, cleaning, and transport away of demolition material and radioactive waste.

It is subject to permit requirements under the Environmental Code (*miljöbalken*) to decommission a nuclear reactor, and the decommissioning will therefore be handled according to a special procedure at the relevant time. A plan will be developed for the decommissioning and restoration of the site. This will be further developed in the forthcoming application for an environmental permit.

3.2. Alternative Location

The choice of location in Norrsundet has been preceded by a site selection process. In this section, Blykalla's starting points for the initial assessment of the site's suitability, the selection process, and the reasons for the chosen site are described.

3.2.1. Legal Starting Points

Upon the Government's adoption of an installation plan for a nuclear installation, a review shall be conducted to determine whether an installation entails a suitable use of land and water areas (Chapters 3 and 4 of the Environmental Code [*miljöbalken*]).

In the basic management provisions in Chapter 3 of the Environmental Code, it is stated that land and water areas shall be used for the purpose or purposes for which the areas are most suitable. There are also provisions regarding special land-use interests, some of which are areas of national interest (*riksintresse*).

Chapter 4 of the Environmental Code contains the special management provisions. There, geographical areas of national interest are specified with regard to the natural and cultural values present in the areas. The purpose of these provisions is to protect these values against development projects and other interventions in the environment that could significantly harm the conservation values of the areas.

The Government must also be able to determine whether the site is suitable from a preparedness perspective based on data regarding the need for inner and outer preparedness zones (*beredskapszoner*) for the facility.

The site for the planned facility has been chosen through a systematic process based on IAEA's guiding documents, particularly SSG-35 and SSR-1, relevant requirements in the regulations of the Swedish Radiation Safety Authority (*Strålsäkerhetsmyndigheten*), including the authority's regulations and general advice (SSMFS 2021:4) on the construction of nuclear reactors.

Nuclear reactors are constructed according to strict safety requirements, which include ensuring that even improbable events cannot lead to serious radiological consequences for the surroundings. To enable society to protect people from extremely improbable events, preparedness zones are established with prepared protective measures. The decision to establish preparedness zones rests with the authorities, as does the planning of protective measures. Thus, it is not the operator of the nuclear power plant (the permit holder) who decides on the type or size of the preparedness zones. However, it is the responsibility of the permit holder to analyze the maximum radioactive releases that such an extremely improbable event could entail, and such analysis (together with the authority's verifying analysis) then serves as the basis for the decision on the type and size of the preparedness zones around the facility.

3.2.2. National Mapping of Potential Areas

The Swedish Energy Agency (*Energimyndigheten*) is responsible for designating areas of national interest for energy production (Chapter 3 of the Environmental Code). Today, there are eight areas of national interest for energy production—thermal power:

- Barsebäck, Kävlinge
- Brofjorden, Lysekil
- Forsmark, Östhammar
- Malmö harbor (Öresundsverket), Malmö
- Oskarshamn, Oskarshamn
- Ringhals-Värö peninsula, Varberg
- Stenungsund, Stenungsund
- Sternö-Stilleryd harbor, Karlshamn

In March 2024, the Government commissioned the Swedish Energy Agency to map areas that have potential for fossil-free energy production and distribution, and to review designated national interests for fossil-free energy.

In an interim report, the Swedish Energy Agency has detailed the physical resources or limitations for the establishment of new nuclear power (Swedish Energy Agency [Energimyndigheten], 2024). According to the Swedish Energy Agency's interim report, nuclear power plants are generally extensive facilities and therefore require a large available area. The large electricity production provided by nuclear power plants presupposes that there is a significant regional electricity demand and the possibility to connect the facility to the transmission grid (*stamnätet*). Furthermore, the reactors are dependent on efficient cooling. The technologies used today are usually water-cooled, and in Sweden, all reactors are cooled with seawater. Therefore, existing nuclear power plants are located on the coast and in connection with a harbor, which also enables sea transport of the spent nuclear fuel.

The current Government has taken a number of steps aimed at removing obstacles and creating conditions for an expansion of new nuclear power in Sweden. The Government has removed the previous limitation on location and number in the Environmental Code, which makes it permissible to have new reactors in locations other than where the existing nuclear power plants at Forsmark, Ringhals, and Oskarshamn are located, and allows more than ten reactors to be in operation simultaneously.

The Swedish Energy Agency's interim report further indicates that the location of new reactors can become more flexible with SMR technology. Due to the smaller size and lower output, such technology may be suitable for installation in more potential locations than large-scale conventional reactors. It may also be possible to have lower requirements for access to cooling water or accessibility for large transports. Preparedness zones for SMRs could also be smaller, which may facilitate location closer to, for example, energy-intensive industry. Local acceptance is highlighted as an important issue if reactors are to be placed near residential areas.

Overall, Blykalla has considered but assessed that a location within the designated areas of national interest for energy production—thermal power is not a reasonable alternative, as Blykalla does not have control over any of these sites. At the same time, the flexible SMR technology has created conditions for investigating and reviewing other locations that have not been relevant for nuclear establishment until now.

3.2.3. Basic Requirements for the Location of Lead-Cooled SMRs

Blykalla has proceeded from the following overall selection criteria when locating reactor parks:

- Benefit to the electricity system
- An area that with a margin accommodates the reactor park with necessary ancillary activities
- Sufficient distance to protected areas (distance to protected nature, conflicting national interests, and similar)
- Sufficient distance to contiguous residential development
- Local acceptance
- Geological conditions for the establishment of a reactor park
- Suitable distance to the regional grid
- Required infrastructure
- Access to cooling water
- Land availability

Estimated maximum preparedness zones for the reactor park are stated to be one-fifth of the radius of existing nuclear power plants, i.e., an inner preparedness zone of approximately 1 kilometer and an outer preparedness zone of approximately 5 kilometers (Blykalla, 2026). It is not improbable that the final preparedness zones will be smaller than this; however, this is dependent on the results of forthcoming detailed analyses and the position of the authorities regarding these.

3.2.4. Method Description for the Siting Process

The siting process is carried out in a stepwise manner, where Step 1 involves an initial selection of sites that meet Blykalla's basic requirements and where the relevant municipality is interested in an establishment. The sites that meet the basic requirements in a comprehensive assessment proceed to Step 2.

In Step 2, a simplified mapping is conducted using map analyses, desktop studies, and other methods to investigate whether conditions exist to meet the requirements and criteria. The sites that remain interesting after a comprehensive assessment of the criteria proceed to Step 3.

In Step 3, a siting study is conducted where investigations and modelling are initiated as needed, for example, geotechnical investigations and cooling water modelling.

In Step 4, an application for the Government's approval of a nuclear installation is prepared for the establishment of the activity at the chosen site.

3.2.5. Considered Alternatives

Blykalla's strategy for the siting work has been to identify a number of potential sites and drive different siting alternatives in parallel. This is to find possible locations in the most efficient way possible and contribute to achieving Sweden's climate goal of having no net emissions of greenhouse gases to the atmosphere by 2045 at the latest.

Blykalla's objective has been to evaluate different locations from a broad approach and to conduct analyses and investigations stepwise to identify sites in Sweden that have the conditions for the establishment of small modular nuclear power plants. For business reasons, the sites are not mentioned by name, but the siting work has resulted in a number of potential sites in Sweden. A large number of areas were initially identified as interesting, and after more detailed assessments of these areas' conditions for the establishment of nuclear power plants, a number of areas were studied further. The areas assessed as suitable may all be relevant for future establishments of Blykalla's reactors.

3.2.6. Reasons for the Choice of Site

Blykalla has assessed Norrsundet, located on the coast approximately 40 kilometers north of Gävle, as a suitable site for a reactor park (see Figure 3-3). Norrsundet has a long industrial history and well-developed existing infrastructure, including port facilities, road connections, and regional grid connection, which together provide excellent logistical conditions for a project of this scale. Preliminary on-site investigations covering, among other things, geology, hydrology, and natural values have demonstrated the site's suitability. The immediate area is sparsely populated while remaining relatively close to a larger city, offering a favorable balance between distance and accessibility.



Figure 3-3. Overview map of the location of the installation plan area.

Regarding the demand for electricity and connection to the electricity grid, Norrsundet is well-positioned. A regional 70 kV grid connection is available, and the transmission grid is less than 20 kilometers away. There is a significant and growing demand for electricity in the region, primarily driven by data center developers and green industry. The grid owner has expressed a strongly positive attitude toward the location of new electricity production in the region, and a preliminary positive response has been received for a connection capacity of 330 MW with a target in the first half of the 2030s. Gävle Municipality's roadmap for business development indicates that one of the municipality's focus areas is the manufacturing industry with energy-intensive activities, and that the transition to fossil-free energy supply creates new business opportunities when the energy needs for industry and the vehicle fleet can be met locally. It is also noted that Gävle is in a good situation regarding electricity infrastructure (Gävle Municipality, 2022).

To meet the reactor park's needs for drinking water and sewage, capacity in the area needs to be reinforced. The issue is under investigation in dialogue with the municipality.

Regarding local acceptance, Blykalla has been actively engaged in the municipality for nearly three years, and the response has so far been predominantly positive. Blykalla will continue to inform and maintain an open dialogue with politicians, the municipality, and the broader local community as the project progresses.

Overview geotechnical investigations show that there is primarily near-surface bedrock and a thin soil cover within the area. Based on the geotechnical conditions, the site is assessed to be suitable for the planned establishment.

From a preparedness perspective, the site is well-suited. Even with estimated maximum preparedness zones, only a limited number of residents and businesses are affected, which facilitates the planning and implementation of urgent protective actions. The location offers good connections with access to port, railway, and road, which facilitates both short- and long-term management of a potential preparedness event.

The site offers good conditions for the physical protection of the facility in terms of available areas and suitable seclusion.

There are no designated areas of national interest (*riksintresseområdet*) or protected areas within the plan area, see Figure 6-2 and Figure 6-3 in Section 6.2. A small part of the inner preparedness zone (1 kilometer) is covered by a national interest for commercial fishing. Within the outer preparedness zone (5 kilometers), there are areas of national interest for nature conservation, shipping-fairway, commercial fishing, and railway. There is also a Natura 2000 area, Hådells gammelskog, within the outer preparedness zone at a distance of approximately 3 kilometers from the area. The Näset nature reserve is also located within the outer preparedness zone, as are the Lössenåsen and Hamrångefjärden water protection areas, located at a distance of approximately 3 kilometers.

The land taken up (*tas i anspråk*) consists of managed forest land with generally low natural values and limited values linked to habitats for protected species, with the exception of the southwestern corner of the plan area where there are higher natural values. Certain species occurrences exist and require further inventory and investigation.

Table 3-1. Initial assessment of the site's suitability. Green marking indicates that the site is assessed as suitable with no or limited obstacles. A yellow marking indicates that the conditions

on site may entail challenges, but that the challenges/impact are assessed to be manageable. A red marking indicates that the conditions constitute obstacles that make it unsuitable/difficult for the activity to be established.

Table 3-1

Assessment Criterion	Assessment	Justification
Blykalla's basic requirements		
Benefit to the electricity system	●	There is a demand for additional electricity in the region and a good situation regarding electricity infrastructure.
Area size	●	The proposed plan area covers approximately 40 hectares and is therefore a sufficiently large area for the planned reactor park.
Protected areas (distance from protected nature, conflicting national interests, and similar)	●	Within 1 kilometer, there is only a national interest for commercial fishing and shore protection (<i>strandskydd</i>) (however, outside the plan area). Otherwise, national interests and protected areas are absent within 1 kilometer. The nearest national interest for nature conservation is located approximately 2 kilometers away, and a Natura 2000 area and nature reserve are located approximately 3 kilometers away.
Natural values and species	●	Managed forest land with generally low natural values, with the exception of the southwestern corner where there are higher natural values. Certain species occurrences exist and require further inventory and investigation.
Distance to residents	●	Just over 1 kilometer southeast of the area is the urban area (<i>tätorten</i>) of Norrsundet, and just over 3 kilometers to the west is the urban area (<i>tätorten</i>) of Bergby. Otherwise, the area is sparsely populated.
Local acceptance	●	Blykalla has been actively engaged in the municipality for nearly three years, and the response has so far been predominantly positive.

Assessment Criterion	Assessment	Justification
Geology	●	The area primarily consists of near-surface bedrock and a thin soil cover. Based on the geotechnical conditions, the site is assessed to be suitable for the proposed establishment.
Access to regional grid	●	A regional 70 kV grid connection is available at the site, and the transmission grid is less than 20 kilometers away. Reinforced capacity is required.
Infrastructure	●	Well-developed existing infrastructure with port, road connections, and railway connection. Reinforced capacity for water and sewage is required.
Access to cooling water	●	It is assessed that there are no obstacles to the intake or discharge of cooling water. Further investigations will be required.
Land availability	●	Agreements exist with landowners.
Overall requirements		
Suitability based on Chapter 3 Environmental Code (MB)	●	There are no designated areas of national interest according to Chapter 3 of the Environmental Code within the plan area. A small part of the inner preparedness zone is covered by a national interest for commercial fishing; additionally, there are national interests for shipping-fairway, railway, and nature conservation in the outer preparedness zone.
Suitability based on Chapter 4 Environmental Code (MB)	●	There are no designated areas of national interest according to Chapter 4 of the Environmental Code within the plan area or within the inner preparedness zone.
Suitability from a preparedness perspective	●	Estimated maximum preparedness zones encompass a limited number of residents and businesses. Good connections with access to port, railway, and road, which facilitates the management of a potential preparedness event.

3.3. Zero Alternative

The zero alternative entails that the Government does not decide to adopt an installation plan in

Norrsundet and that the nuclear activity is not constructed. Land use within the area continues to be characterized by forestry, and the environmental conditions prevailing at present remain. At the same time, the zero alternative means that the energy the activity intends to produce is not supplied to the electricity grid, and the contribution to the expansion of Sweden's fossil-free electricity system is absent at the current site.

4. METHODOLOGY

4.1. Assessment of the Plan's Compatibility with General Interests

The environmental impact assessment details the installation plan's compatibility with the general interests specified in Chapters 3 and 4 of the Environmental Code (*miljöbalken*), its impact on environmental quality standards, and its alignment with relevant plans and goals at the national level.

The assessment is conducted through a comprehensive assessment of the site's conditions and values in relation to the impact of the plan proposal. Established assessment criteria are used to support this balancing of interests. In cases where negative impact is identified, the need for protective measures is considered in order to avoid, reduce, or compensate for the impact.

The overall assessment is made based on a three-point scale (see Table 4-1), where the suitability of the plan is valued based on identified interests, impact, and the possibility of managing said impact.

Table 4-1. Assessment Scale

Scale	Description
	The plan proposal is assessed as suitable based on the site's conditions and the installation plan's foreseen impact, with no or limited obstacles.
	The plan proposal may entail challenges based on the site's conditions and the installation plan's foreseen impact, but the challenges are assessed to be manageable through certain measures.
	Based on the site's conditions and the installation plan's foreseen impact, there are obstacles that make it unsuitable/difficult to implement the plan proposal.

4.2. Delimitations

4.2.1. Geographical Delimitation

The environmental impact assessment covers the geographical area that may be affected by the implementation of the plan proposal. This includes both the direct impact area within the area where land use is changed, as well as surrounding areas where environmental effects could arise—for example, nearby recipients affected by any intake and discharge of cooling water (extent of temperature impact), as well as residential development and natural areas adjacent to the plan area. The geographical delimitation is also adapted to include the area for the estimated maximum inner and outer preparedness zones.

The installation plan area is located approximately 130 kilometers from the nearest foreign land territory (the outer skerries at Åland). Based on the distance and the extent of the impact area, the plan proposal is assessed not to cause any significant transboundary environmental impact during normal operation. The distance between the estimated maximum outer preparedness zone and the nearest national border is also significant. Accident scenarios with associated release calculations will be handled in forthcoming permit reviews.

- Figure 4-1. Map showing the geographical delimitation with the area for nuclear installations and the installation plan area, as well as the estimated maximum inner and outer preparedness zones.

4.2.2. Temporal Delimitation

The environmental impact assessment includes an assessment of the consequences of a full expansion in accordance with the current plan proposal. Environmental consequences during the construction phase are also described at an overall level for those environmental aspects where it is assessed to be relevant.

The nuclear activity planned to be conducted within the installation plan is foreseen to have an operating period of approximately 50 years.

Issues concerning the development of the area after the activity has been decommissioned are described very briefly in this data for the strategic environmental assessment, as a special review is required prior to the decommissioning of nuclear installations.

4.2.3. Substantive Delimitation

The environmental impact assessment is designed to describe, stepwise, the impact and environmental consequences of the plan proposal based on its purpose. The impact from the planned activity within the plan area is described based on a number of identified impact factors; see Table 4-2.

The environmental consequences are described in Section 8 through a comprehensive assessment of the site's values (Section 6) and the impact factors (Section 7).

In Section 11, an overall assessment of the installation plan's environmental consequences is made based on the special land-use interests specified in Chapters 3 and 4 of the Environmental Code (*miljöbalken*), based on environmental quality standards, as well as other national environmental goals and the comprehensive plan (*översiktsplan*).

The environmental aspects/interests described in the respective sections are summarized in Table 4-2 below.

Table 4-2

Impact Factor	Environmental Consequence	Special Land-Use Interests according to Ch. 3 and 4 Environmental Code (MB)
● Taking up of land and visual impact ● Noise and vibrations ● Water intake and discharge ● Groundwater drainage ● Raw materials and chemicals ● Waste ● Energy use and	● Human health (sound environment, air, radioactive releases, recreation and outdoor life, as well as risk and safety) ● Natural environment and species ● Cultural environment and landscape image ● Soil contamination and groundwater ● Water environment and impact	● Taking up of land ● Ecology and biological diversity ● Agriculture and forestry ● Reindeer husbandry, commercial fishing, water supply ● Cultural environment, outdoor life, recreation, and natural environment ● Valuable substances or

Impact Factor	Environmental Consequence	Special Land-Use Interests according to Ch. 3 and 4 Environmental Code (MB)
energy recovery ● Emissions to air ● Release of radioactive substances during normal operation ● Risk and safety	on environmental quality standards ● Management of land and water	materials ● Other industrial or supply interests ● Total Defence (<i>Totalförsvaret</i>) ● National interests according to Chapter 4 of the Environmental Code ● Environmental quality standards according to Chapter 5 of the Environmental Code ● Other plans, programs, and decisions

Table 4-2. Delimitation of impact factors, environmental consequences, and general interests considered in this data for the strategic environmental assessment.

4.3. Uncertainties in Assessment

The preparation of the installation plan and the Government's approval is the first step in a stepwise decision process. Subsequent permit review according to the Environmental Code and the Nuclear Activities Act, and any planning process according to the Planning and Building Act, will take place before the activity can commence. The strategic environmental assessment to be produced shall be adapted based on the content and level of detail of the decision, where in the decision process the decision is made, and to what extent certain issues are assessed to be better handled at other levels in the decision process to avoid the assessment being performed twice.

The assessments in the environmental impact assessment are based on investigations of relevant environmental aspects, which have been adapted and delimited based on knowledge data and the purpose of the installation plan at this early stage. Currently, investigations have been conducted regarding the site's geotechnical, hydrological, and ecological conditions. An overview geotechnical investigation of the site has been performed, as well as an overview environmental technical soil investigation. Initial hydro-modelling has been conducted to assess the activity's potential intake and discharge of cooling water, together with an assessment of the consequences for marine species of a discharge of heated cooling water from the facility. Additionally, a natural value inventory has been conducted on site.

In the models and simulations used in the investigations, there is always a certain degree of uncertainty. Uncertainties with calculations and models stem from the models' limitations and simplifications of reality. There are also certain uncertainties in the assessment methodology and the assessment scales used. The existing uncertainties are managed by making conservative assumptions in calculations and assessments.

5. ASSESSMENT CRITERIA

The assessment of environmental aspects in this data has been adapted to be able to assess whether conditions exist for the current activity based on the land-use interests specified in Chapters 3 and 4 of the Environmental Code (*miljöbalken*), as well as based on environmental quality standards and national environmental goals.

The assessment criteria are used as a starting point to assess whether, based on known conditions, it is possible to meet applicable requirements, including through reasonable protective or adaptation measures where such are assessed to be relevant.

If it is assessed that conditions exist for the planned land use based on the respective environmental aspect, it means that the issue is not assessed to constitute a decisive obstacle to the site's suitability, even if more detailed investigations and potential measures may be required at later stages.

5.1. Human Health

5.1.1. Noise

The assessment of noise impact is based on applicable guideline values and guidance for different types of noise. At this stage, the assessment aims to determine in an overview whether conditions exist for the planned land use from a noise perspective—that is, whether applicable guideline values are assessed to be maintainable through reasonable protective and adaptation measures.

Construction Noise

Assessment of noise from construction and civil engineering works is based on the Swedish Environmental Protection Agency's general advice NFS 2004:15 on noise from construction sites. The advice contains guideline values for equivalent and maximum sound levels, depending on the sensitivity of the site (e.g., residences, schools) and the scheduling of working hours (day, evening, night). The assessment takes into account the nature of the work, its duration, and possibilities for noise-reducing measures.

Traffic Noise

For traffic noise, guideline values are applied according to the Ordinance (2015:216) on traffic noise at residential buildings, as well as practice in the assessment of new or altered development and infrastructure.

Industrial Noise

The assessment of noise from industrial activities, facilities, and other sound-producing activities is based on the Swedish Environmental Protection Agency's guidance in report 6538. The guideline values applied vary depending on the type of area exposed (residences, schools, healthcare facilities, etc.) and at what time of day the noise occurs.

5.1.2. Air Pollution

Environmental Quality Standards for Outdoor Air

The Air Quality Ordinance (2010:477) specifies the Swedish environmental quality standards for outdoor air. The standards specify the highest permitted levels of various pollutants in the air to protect human health and the environment. Environmental quality standards are legally binding regulations developed in connection with the Environmental Code. Environmental quality standards currently exist for nitrogen dioxide, particles (PM10 and PM2.5), benzene, carbon monoxide, sulfur dioxide, ozone, benzo(a)pyrene, arsenic, cadmium, nickel, and lead.

Planning may not contribute to an environmental quality standard being exceeded.

Environmental quality standards specify guideline values for levels of air pollutants for both long and short exposure times. From a health protection perspective, it is important to have both a low average exposure to air pollutants (corresponding to the annual average value) and to minimize the number of occasions with high levels over shorter periods (daily and hourly average values). For an environmental quality standard to be met, none of the standard values may be exceeded.

5.1.3. Recreation and Outdoor Life

The assessment of the impact on recreation and outdoor life is based on the Environmental Code's provisions on the management of land and water and the protection of areas of importance for outdoor life (Chapter 3, Section 6). The purpose of the assessment is to clarify whether the plan affects people's opportunity for recreation and outdoor life in the current area. The following aspects are weighed in:

- Occurrence of national interest for outdoor life or other protected/promoted outdoor areas such as nature close to urban areas or nature reserves.
- Areas with local use for leisure activities.

5.1.4. Radiological Releases

Radiation dose to a representative person from the general public

According to regulations from the Swedish Radiation Safety Authority (SSMFS 2018:1), the radiation dose to the general public shall be calculated for a hypothetical person who represents the group or groups of persons in the general public expected to receive the highest radiation doses from the activity (representative person). The calculation of the radiation dose shall be performed for the age categories 0–5 years, 6–15 years, and 16–70 years.

For nuclear installations, there are requirements that the total radiation dose to a representative person from the general public from installations within the same geographical area must not exceed 0.1 mSv per year. The dose requirement shall therefore be applied jointly for all nuclear installations within an area. The dose shall also be limited as far as is possible and reasonable.

5.1.5. Risk and Safety

Conventional risks

Conventional risks refer to risks that are not radiological. It follows from the Environmental Code that accident risks shall be considered in the balancing of interests conducted prior to the construction and operation of the current type of installation, and that these shall be reported in the data. The requirements entail that human health and the environment shall be protected against damage and nuisances, and that the party conducting or intending to conduct an activity or take a measure shall implement the protective measures, observe the limitations, and take other precautionary measures necessary to prevent, hinder, or counteract the activity or measure from causing damage or nuisance to human health or the environment. The perspectives on the accident risks to be addressed are summarized in Figure 5-1.

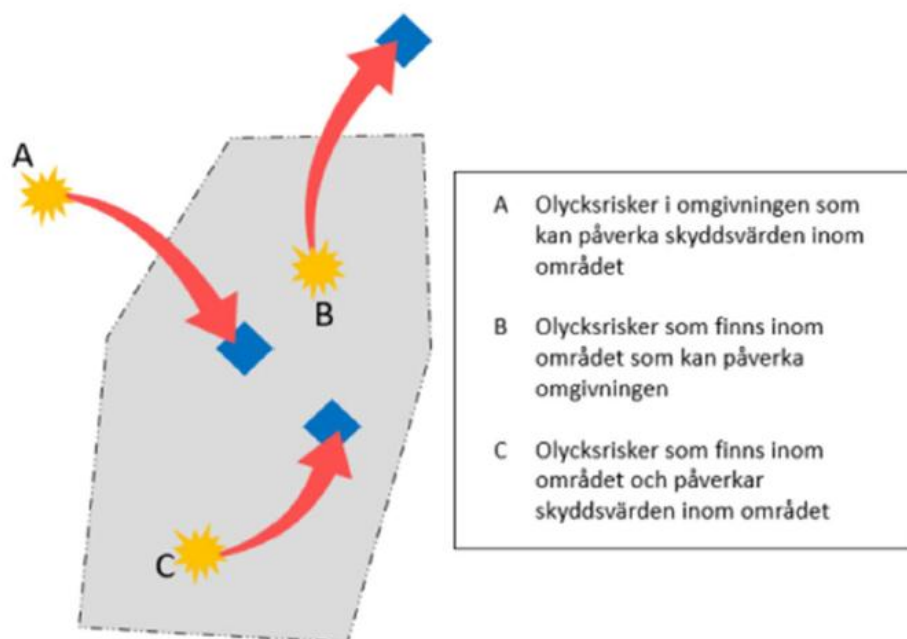


Figure 5-1. Perspectives on accident risks to be considered (MSB, 2012).

Figure 5-1

A. Accident risks in the surroundings that may affect protected values within the area.

B. Accident risks existing within the area that may affect the surroundings.

C. Accident risks existing within the area that affect protected values within the area.

Several other pieces of legislation with associated ordinances and regulations also set requirements for the management and consideration of accident risks, such as the Act (1999:381) on measures to prevent and limit the consequences of serious chemical accidents (the Seveso Act), the Planning and Building Act (2010:900), the Act (2003:778) on protection against accidents, and the Act (2010:1011) on flammable and explosive goods.

Radiological risks

In a safety analysis for a nuclear reactor, unplanned events that could be thought to occur are identified, how often these can be expected to occur (occurrence frequency), and what effects they would have. The events are categorized according to occurrence frequency (categories called H2, H3, H4A/B, and H5), and for each category, an acceptance criterion applies regarding the resulting maximum dose to a representative person from the general public. If the analysis shows a dose exceeding this acceptance criterion, the reactor design must be improved; even if the acceptance criterion is not exceeded, the design needs to be optimized so that the dose is as low as reasonably possible.

The acceptance criteria are higher for more improbable events and lower for more probable ones. For extremely improbable events (major accident), no acceptance criterion is given; instead, these are managed through preparedness zones with prepared preparedness measures.

For new nuclear reactors that are not of the light-water type, such as SEALER, acceptance criteria have not yet been established. However, the Swedish Radiation Safety Authority (SSM) has developed proposed acceptance criteria, which are presented in SSM2023-3711-11 *Investigation Report - Radiological Acceptance Criteria for New Nuclear Reactors*. The design

work for SEALER is currently being conducted with regard to these proposed acceptance criteria.

5.2. Soil Contamination and Groundwater

The Swedish Environmental Protection Agency has developed general guideline values for contaminated land. Guideline values are used to estimate the extent of a contamination and the risks it may entail. The guideline values distinguish between sensitive and less sensitive land use. Less sensitive land use refers to land for offices, industry, roads, etc. The stricter guideline value (sensitive land use) means that the soil quality shall not limit the choice of land or groundwater use. This guideline value is generally used for the construction of residences. The guideline values are not legally binding.

- **Sensitive land use (KM)**, where the soil quality does not limit the choice of land use. All groups of people (children, adults, elderly) can stay permanently within the area for a lifetime. Most soil ecosystems as well as groundwater and surface water are protected.

- **Less sensitive land use (MKM)**, where the soil quality limits the choice of land use to, for example, offices, industries, or roads. The exposed groups are assumed to be persons who stay in the area during their professional working time, as well as children and elderly persons who stay in the area temporarily. The soil quality provides conditions for land functions that are significant for less sensitive land use; for example, vegetation can be established and animals can stay in the area temporarily. Groundwater at a distance of approximately 200 meters as well as surface water are protected.

In addition to the general guideline values, there are also levels for the classification of "less than negligible risk" (MRR) developed by the Swedish Environmental Protection Agency for the assessment of waste recycling in civil engineering works¹, as well as Avfall Sverige's criteria for hazardous waste (FA)² which are significant for mass handling.

5.3. Natural Environment and Species

The assessment of the impact on the natural environment is based on the Environmental Code's general rules of consideration (Chapter 2), Chapter 3 on the management of land and water, and the protection provisions in the Species Protection Ordinance (*artskyddsförordningen*) (2007:845). Additionally, nature reserves, biotope protection, Natura 2000, and other forms of protection are considered.

There is a Swedish standard for natural value inventory (SS 199000). In connection with a natural value inventory, a classification is made according to the following four levels:

- **Highest natural value** – Objects in this class are assessed to be of particular significance for biological diversity at a national or international level.

- **High natural value** – The objects are assessed to be of particular significance for maintaining biological diversity at a regional or national level and should, as far as possible, be protected against measures that could harm the natural environment.

- **Significant natural value** – The objects do not need to be of significance for biological diversity at a regional, national, or global level, but are instead of particular significance so that the total area of such areas can be maintained and their ecological qualities maintained or improved.

- **Certain natural value** – The objects do not need to be of significance for maintaining biological diversity at a regional, national, or global level. However, it is significant to maintain or expand the total area of these areas and that their ecological quality is maintained or improved.

Species Protection Ordinance

The Species Protection Ordinance incorporates the EU Birds Directive and Habitats Directive into Swedish legislation. The ordinance aims to preserve biological diversity by protecting all wild birds as well as a number of animals and plants listed in the annexes of the Species Protection Ordinance. Impact is assessed in relation to the occurrence of the species, requirements for habitat and protection status, and whether the plan may entail a risk of disturbance or damage to breeding areas or resting sites.

5.4. Water Environment and Impact on Environmental Quality Standards

The assessment of the impact on the water environment and environmental quality standards is based on the extent to which the plan proposal affects the status of water bodies, contributes to deterioration, or hinders the possibility of achieving applicable environmental quality standards. The management of the quality of water bodies is governed by the Water Management Ordinance (*vattenförvaltningsförordningen*) (2004:660).

Environmental quality standards for water specify the status that each water body shall have at a certain point in time. The standard specifies the lowest level that is permitted, which means that a water body may not be affected by an activity in such a way that the quality becomes worse than the status specified in the standard.

For surface water, there are environmental quality standards for chemical status (environmental toxins and pollutants) and ecological status (biological, physico-chemical, and hydromorphological quality factors). For groundwater, there are environmental quality standards for chemical status and quantitative status (that is, that there is a balance between the extraction and renewal of groundwater). The goal is for all water bodies to achieve good status.

The management of the quality of the marine environment is governed by the Marine Environment Ordinance (*havsmiljöförordningen*) (2010:1341). In this ordinance, the marine areas (water and seabed) have been divided into geographical areas, so-called assessment areas. To be able to assess the environmental status in the assessment areas, a number of indicators in the marine environment are monitored continuously, the results of which are then compared against established criteria. The environmental status for each assessment area is then produced by comprehensively assessing and weighting the results in an overall assessment. The environmental quality standard is that the assessment areas shall achieve good status. The environmental quality standard is a standard according to Chapter 5, Section 2, Paragraph 4, not Chapter 5, Section 4 of the Environmental Code, which according to practice means that it shall be considered in the application of Chapter 2 of the Environmental Code.

To follow up on which levels of radioactive substances of artificial origin exist in the seas, cesium-137 is monitored in flatfish, herring, and seawater. The monitoring is performed annually, and data from water samples and fish are compiled as annual average values and compared with threshold values. The threshold value for herring and flatfish is 20 Bq/kg wet weight and 40 Bq/m³ for surface water. For an assessment area to be considered to achieve good status, the threshold values for cesium-137 must be maintained.

5.5. Management of Natural Resources

The assessment of the plan proposal's impact on the management of natural resources is based on the provisions in Chapters 3 and 4 of the Environmental Code as well as the general rules of consideration in Chapter 2. The assessment aims to highlight the extent to which the plan contributes to or counteracts a long-term sustainable use of natural resources. This includes identifying whether the installation plan affects resources of limited availability. The assessment

also weighs in how the installation plan relates to national goals for good management and resource efficiency.

5.6. Cultural Environment and Landscape Image

The assessment criteria regarding the cultural environment and landscape image include:

- Occurrence of national interest for the conservation of the cultural environment (Environmental Code, Chapter 3, Section 6).
- Protected buildings or environments according to the Cultural Environment Act (*kulturmiljölagen*).
- Areas with particular cultural-historical value according to the comprehensive plan or cultural environment program.
- Visual impact on the landscape image. Changes in sightlines, topography, scale or placement of buildings are assessed based on the sensitivity and character of the landscape.

The assessment of the impact on the cultural environment and landscape image is based on the extent to which the plan proposal affects cultural-historical values, the visual experience of the landscape, and the historical character of the site.

6. SITE CONDITIONS

6.1. Area Description

Norrundet is a coastal community located north of Gävle in Gävleborg County, with a history closely linked to industrial development and coastal industries. The Norrsundet industrial area began to emerge during the late 19th century in connection with the establishment of the sawmill and pulp industry, which attracted labor and contributed to the growth of a community with housing, services, and infrastructure. During the 20th century, the industry was primarily focused on wood and paper production. A sulfate plant was also constructed during the 1920s for the manufacture of paper pulp. Today, industrial and port activities continue within the Norrsundet industrial area.

The area current for siting is approximately 40 hectares in size and is located directly northwest of the Norrsundet industrial area, approximately one kilometer north of the community of Norrsundet and 40 kilometers north of Gävle, within the property Gävle Norrsundet 15:28 (1). The area consists of production forest. To the east of the area lies a landfill, and to the southwest of the area runs a utility corridor (*ledningsgata*).

There are good road connections. Approximately 9 kilometers' travel distance from the area is the E4, which is reached via roads 575, 583, and 303. There is also an industrial siding that connects to the East Coast Line (*Ostkustbanan*) and a port in the immediate area. The nearest residences are located approximately one kilometer south of the area, in Norrsundet. The area is not designated in the comprehensive plan (*översiktsplan*) or the detailed development plan (*detaljplan*).



Figure 6-1. Proposed plan area north of the community of Norrsundet.

6.2. National Interests and Other Protected Areas and Objects

According to Chapters 3 and 4 of the Environmental Code (*miljöbalken*), land and water areas shall

be used for the purpose or purposes for which the areas are most suitable, taking into account, among other things, the conservation of natural and cultural values as well as the long-term management of natural resources. Areas that are of particular significance for one or more general interests may be designated as national interests (*riksintressen*). These have national significance and shall be protected against measures that could significantly harm their values.

National interests may refer, for example, to nature conservation, the cultural environment, outdoor life, communications, energy production, and the defence.

This section details which national interests affect the area or the inner and outer preparedness zones, respectively.

6.2.1. National Interests according to Chapter 3 of the Environmental Code

Commercial fishing (Environmental Code, Ch. 3, Sec. 5)

A national interest for commercial fishing, coast, according to Chapter 3, Section 6 of the Environmental Code, extends over the surface water bodies Norrsundet and Fårholmen on the eastern side of the operational area and is located within the inner preparedness zone; see Figure 6-2.

Nature conservation (Environmental Code, Ch. 3, Sec. 6)

Within the outer preparedness zone, there are two national interests for nature conservation: Lindön-Björnön-Iggösundet at a distance of approximately 2 kilometers and Hamrångeån at a distance of approximately 5 kilometers from the installation plan area. Lindön-Björnön-Iggösundet is characterized by water areas ranging from brackish water to nutrient-poor freshwater, as well as a variation of mire lands showing land-uplift-based mire development. In Lindön-Björnön-Iggösundet, there is also botanically and ornithologically valuable coastal forest. The swamp forest vegetation that occurs constitutes a decisive ecological niche for certain woodpeckers and is of great value also for other bird species. The water area between Lindön and Iggön is exceptionally valuable as a spawning and nursery area for fish (Swedish Environmental Protection Agency register sheet, n.d.).

Valuable substances and minerals (Environmental Code, Ch. 3, Sec. 7)

According to Chapter 3, Section 7, land and water areas containing valuable substances or materials shall, as far as possible, be protected against measures that could significantly hinder the extraction of these.

Outside the installation plan area, approximately 1.7 km to the northwest, there is a designated national interest for valuable substances and minerals, named Bergby, referring to lithium; see Figure 6-2. The national interest is assessed not to be affected by the installation plan.

Communications (Environmental Code, Ch. 3, Sec. 8)

There is a national interest for shipping—fairway (Välkommen - Norrsundet) including buffer zones according to Chapter 3, Section 8 of the Environmental Code east of the port area; see Figure 6-2. The fairway is located within the outer preparedness zone. The existing railway and the E4, as well as the planned East Coast Line Gävle-Kringlan and Kringlan-Dingersjö, are located within the estimated maximum outer preparedness zone.

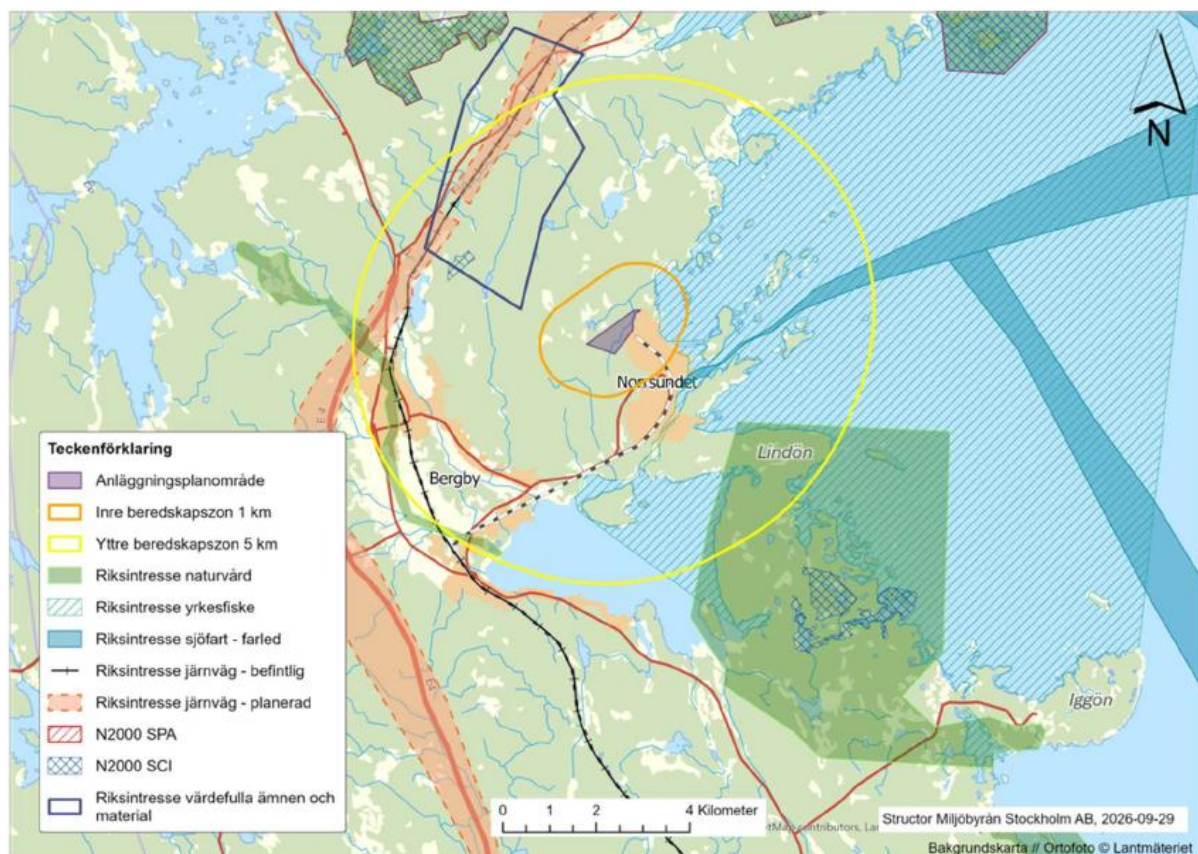


Figure 6-2. Current area with estimated maximum inner and outer preparedness zones in relation to nearby national interests (Source: Swedish Environmental Protection Agency 2022, Swedish Environmental Protection Agency 2025, Swedish Transport Administration 2024, Swedish Agency for Marine and Water Management 2025).

6.2.2. National Interests according to Chapter 4 of the Environmental Code

Natura 2000 areas (Environmental Code, Ch. 4, Sec. 8)

A Natura 2000 area, Hådelles gammelskog, is located within the outer preparedness zone at a distance of approximately 3 kilometers.

6.2.3. Areas protected according to Chapter 7 of the Environmental Code

Generally, a shore protection (*strandskydd*) of 100 meters applies in the area; the current area is at its closest just over 300 meters from the shoreline and therefore does not affect the shore protection. Within the Norrsundet industrial area, the shore protection has been lifted.

Within the outer preparedness zone, the Lössenåsen and Hamrångfjärden water protection areas are located at a distance of approximately 3 kilometers. The nature reserves Hådelles gammelskog and Näset are also located within the preparedness zone; see Figure 6-3.

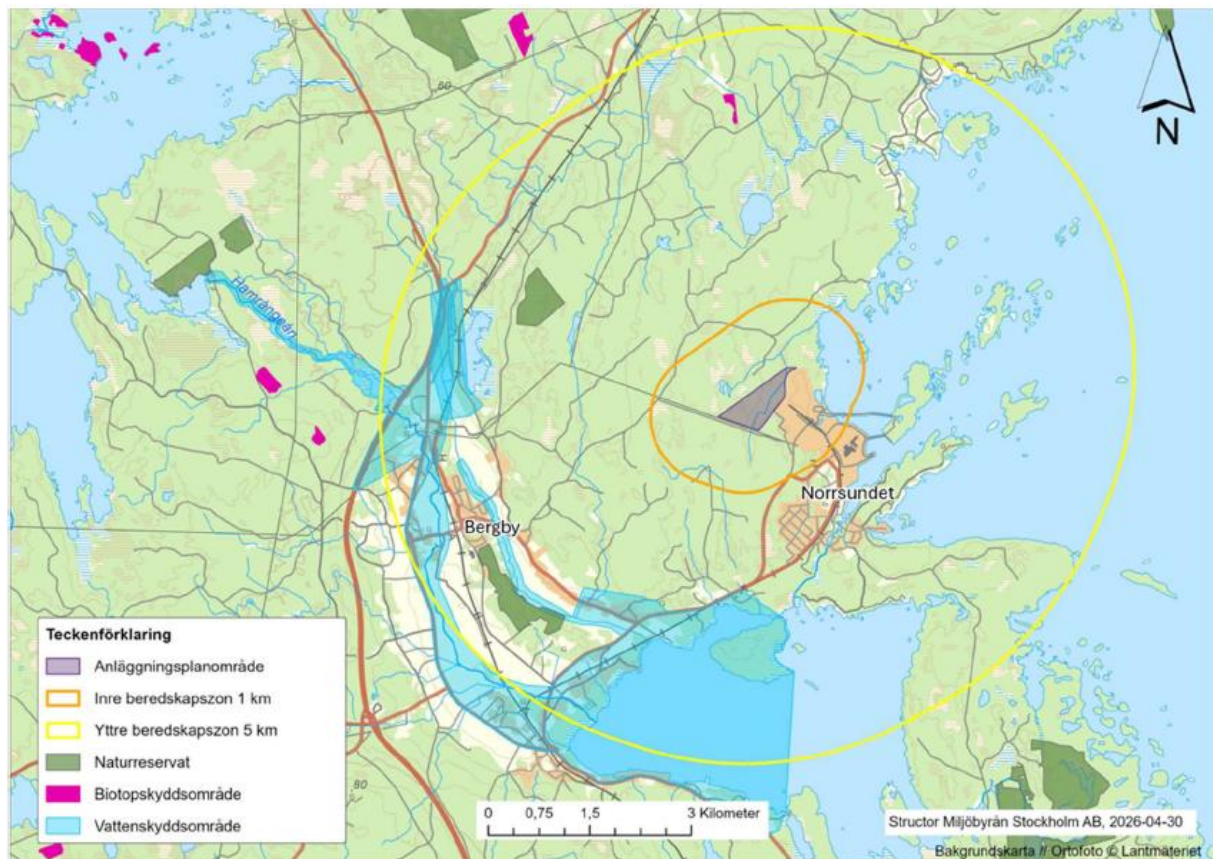


Figure 6-3. Protected areas in the vicinity of the current area (Source: Swedish Environmental Protection Agency 2025, Swedish Forest Agency 2025).

6.3. Ground Conditions

6.3.1. Geology and Topography

The general ground level within the investigation area varies between approximately +10.8 and +7.5 according to the geotechnical investigations performed by Structor Geoteknik Stockholm AB during February 2026. The investigations showed that the ground within the area consists of near-surface bedrock with a thin till cover. The thickness of the till is assessed to vary between approximately 0–6.3 meters. Peat occurs in parts of the area, and the thickness is assessed to vary between approximately 0.5–1 meter. Till occurs beneath the peat layers. Figure 6-4 shows the occurring soil types in the area at an overview level.

The level of the bedrock surface varies between approximately -1.1 and +11.1 at investigated points, which corresponds to approximately 6.8–0.2 meters below the ground surface.

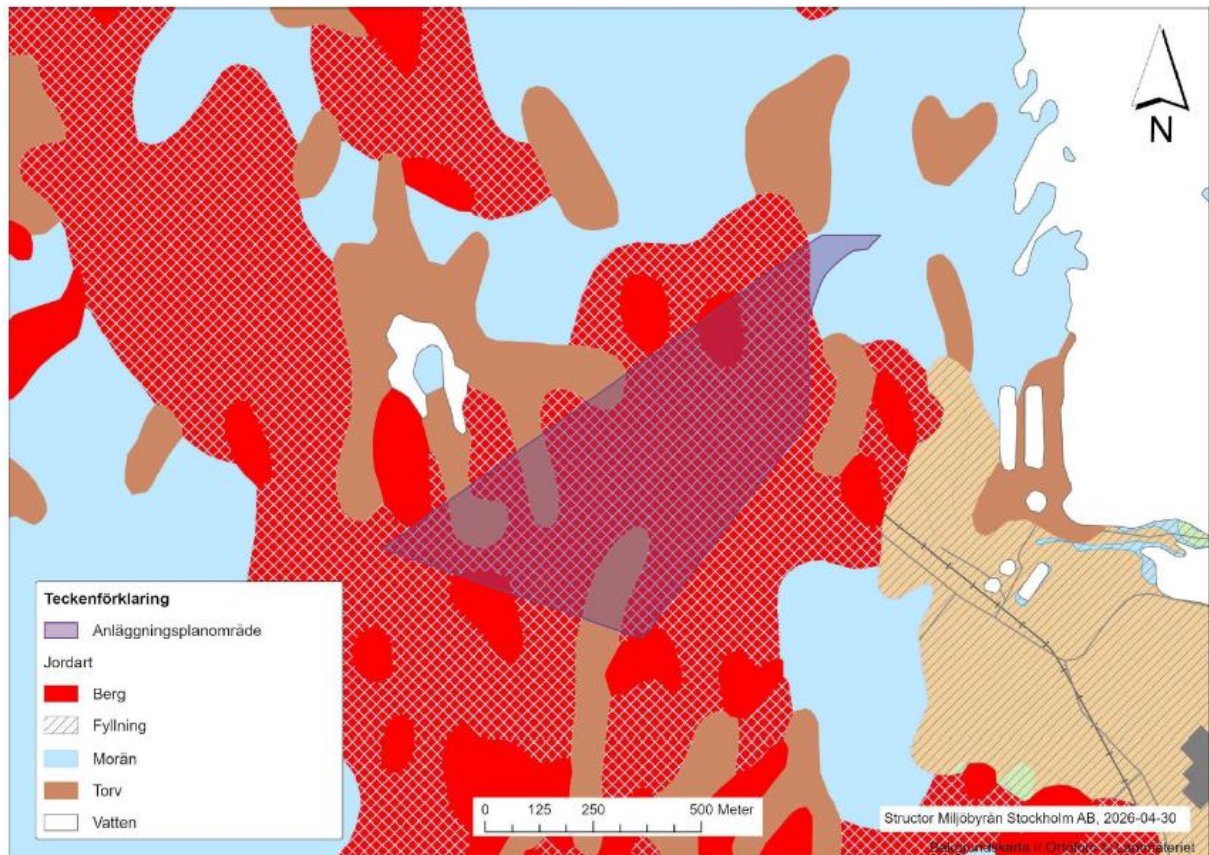


Figure 6-4. Soil types in the area (SGU, 2025).

6.3.2. Landslide and Slump Risk

The investigation area consists of a firm ground area with limited thicknesses of peat, which entails a low risk of landslides and slumps. Consequently, there are no designated risk areas within the investigation area; see Figure 6-5. Precautionary areas (*aktsamhetsområden*) for slumps occur in shore-adjacent areas around Lövbäckstjärnen, which is located northwest of the area, and along the coastal strip west of the investigation area.



Figure 6-5. Precautionary areas for slumps around the area (Source: SGU 2024).

6.3.3. Groundwater

Conducted geotechnical investigations (February 2026) showed that the pressure level varies between approximately +10 and +6. This corresponds to a groundwater level approximately 0.2 meters below the ground surface at the respective groundwater pipes where measurements were performed. In two pipes, the pressure level was above ground level.

The flow direction of the groundwater largely follows the topography and runs in the direction of the ditch that passes through the plan area. The thin soil cover means that the groundwater reservoir in the soil is limited (Structor Geoteknik Stockholm AB, 2026).

6.3.4. Surface Water

A watercourse runs through the area, which primarily consists of a furrow with the character of a ditch that has been excavated in many places. The watercourse is mostly slow-flowing, but there are a few shorter sections with weakly flowing water, primarily in the northern part. The catchment area for the watercourse is limited, which means that the furrow likely dries up during the summer period.

Northwest of the area lies Lövbäckstjärnen. To the east lies the Baltic Sea with its surface water bodies; see Section 6.3.5.

6.3.5. Surface and Groundwater Bodies

In close proximity to the eastern part of the operational area is the surface water body for coastal waters, Norrsundet (WA87973988), and southeast of the area is the surface water body for coastal waters, Fårholmen (WA77566993). The Hamrånge river empties into the Fårholmen water body.

Southeast of the Fårholmen peninsula is the surface water body for coastal waters, S S M Bottenhavets kustvatten (WA34434970).

Both water bodies, Norrsundet and Fårholmen, are classified with moderate ecological status and do not achieve good chemical status. The risk assessment shows that the environmental quality standards are at risk of not being achieved during the next management period.

Norrsundet does not achieve good ecological status primarily due to elevated levels of the specific pollutant non-dioxin-like PCBs. The water body also has deteriorated status regarding flow changes, morphological changes, and continuity, but for these factors, the risk assessment is uncertain due to uncertain classifications and a lack of biological data.

Good chemical status is not achieved because the levels of anthracene, cadmium and cadmium compounds, and benzo(a)pyrene exceed applicable limit values. Good chemical status is also not achieved due to the ubiquitous pollutants brominated diphenyl ethers, mercury, as well as dioxins and dioxin-like compounds, which are assessed to exceed limit values throughout the Gulf of Bothnia.

Fårholmen does not achieve good good ecological status primarily due to morphological changes and lack of continuity. Flow changes, certain specific pollutants, and eutrophication also affect the status, but the risk assessment is uncertain due to a lack of data. Good chemical status is not achieved due to the ubiquitous pollutants brominated diphenyl ethers, mercury, as well as dioxins and dioxin-like compounds, which are assessed to exceed limit values throughout the Gulf of Bothnia.

S S M Bottenhavets kustvatten is classified with good ecological status but does not achieve good chemical status. Good chemical status is not achieved due to the ubiquitous pollutants brominated diphenyl ethers, mercury, as well as dioxins and dioxin-like compounds, which are assessed to exceed limit values throughout the Gulf of Bothnia.

The assessment area for marine environment standards that is adjacent to the installation plan area is the Bothnian Sea (MarineUnitID: BAL-SE-AA-B_Bottenhavet). All three mentioned water bodies—Norrsundet, Fårholmen, and S S M Bottenhavets kustvatten—are contained within this assessment area. During the 2024 assessment of the indicator for radionuclide levels, where the annual average levels of Cesium-137 were measured in flatfish, herring, and surface water, it was established that the indicator was met. The criterion status for the indicator is therefore good (HaV, 2026).

The nearest groundwater body is the Totra groundwater body, approximately three km from the plan area.

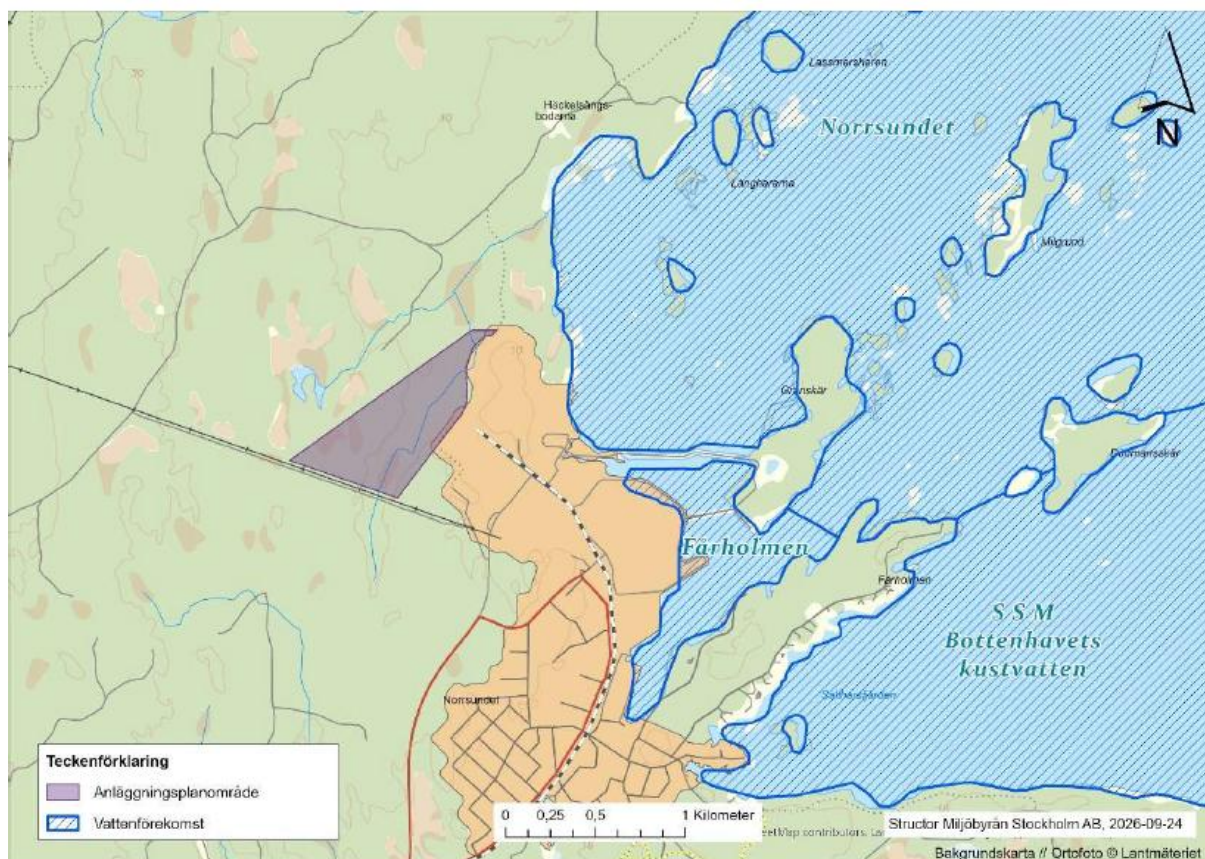


Figure 6-6. Surface water bodies in the vicinity of the installation plan area (Source: VISS 2024).

6.3.6. Environmental Quality Standards for Air, Emissions to Air

Within the Eastern Sweden Air Quality Association (Östra Sveriges Luftvårdsförbund), air pollutants are monitored, including within Gävleborg County. It appears from the available regional concentration maps (SLB-analysis | Environmental Department) for nitrogen dioxide and PM10 that the concentrations of these are well below the environmental quality standard at the site.

Regional concentration maps are lacking for other air pollutants. However, based on the measurements that formed the basis for the air quality association's 2025 annual report, it is assessed that these other air pollutants also do not exceed any environmental quality standard. The majority of air pollutants are rarely measured by the air quality association due to low expected concentrations.

6.3.7. Low Points, Cloudbursts, and Future Climate

Due to its coastal location, the area is potentially exposed to flood risks due to sea-level rise, as well as as a result of heavy cloudbursts in a future altered climate. The area is at its closest just over 300 meters from the coast, and the elevation level is between +10.8 and +7.5. The future mean water level in Gävle in the year 2100 is, according to a high-emission scenario SSP5-8.5, +27 centimeters (RH2000). This corresponds to an increase of 13 centimeters compared to the reference period 1995–2014 (SMHI, 2026).

Future climate changes will lead to increased temperatures in the Baltic Sea. The average summer temperature in the surface water will increase by 3.3°C in a scenario with continued high carbon dioxide emissions (RCP 8.5) (Gröger et al, 2019). The average temperature during

the summer months of June, July, and August between the years 2022-2026 was 15.1°C in Saltharsfjärden, which is located approximately three kilometers southeast of the installation plan area (HaV, 2026b).

6.3.8. Soil Environment and Contamination

An overview environmental technical investigation has been performed by Structor Miljöbyrån Stockholm AB. The result of the investigation does not indicate the occurrence of contamination in the soil or groundwater within the area (Structor Miljöbyrån Stockholm AB, 2026).

Just east of the area, in the Norrsundet industrial area, there is an old industrial landfill. Within that area, concentrations in the soil exceed the Swedish Environmental Protection Agency's guideline values. Along the coast outside the Norrsundet industrial area, contaminated and fiber-rich sediments occur, originating from the two larger forest industries (a sawmill and a sulfate pulp mill) that previously existed on site. The sulfate pulp mill, which started in 1925, discharged its wastewater untreated into the sea until 1964. Pulp fibers have therefore spread northeast from the discharge point at the shoreline north of the pulp mill, and further out into the sea. The Geological Survey of Sweden (SGU) has mapped the areas where fiber-rich sediments exist and conducted sediment sampling; see Figure 6–7. The mapping showed that fiber-rich sediments primarily occur in a contiguous area in the western and northern parts of the Norrsundet water body. In the adjacent water body, Fårholmen, southeast of the pulp mill's outlet, fiber-rich sediments are absent except at the quay edge in Norrsundet harbor. The water body S S M Bottenhavets kustvatten is located far from the pulp mill, and no mapping has been performed there. A map of the water bodies is shown in Figure 6–6. Since SGU's mapping was conducted by boat, the shallowest parts around the discharge point could not be investigated; the fiber-rich sediments present there are therefore missing from Figure 6–7.

The area with fiber-rich sediments is a relatively open and shallow coastal area with variable bottom topography and covers a total area of 520,000 m². Over time, the fiber-rich sediments have accumulated in depressions and deep holes in the bottom, where sediment transport is slower. Even though the discharge of pulp fibers ceased about 60 years ago, some transport likely still occurs from the shallow areas out toward deeper water. Sediment sampling in the fiber-rich sediments shows that the levels of organic environmental pollutants are very high in several of the sampling points, particularly dioxins, hexachlorobenzene, PAHs, and DDTs, and certain metals also stand out (SGU, 2016).

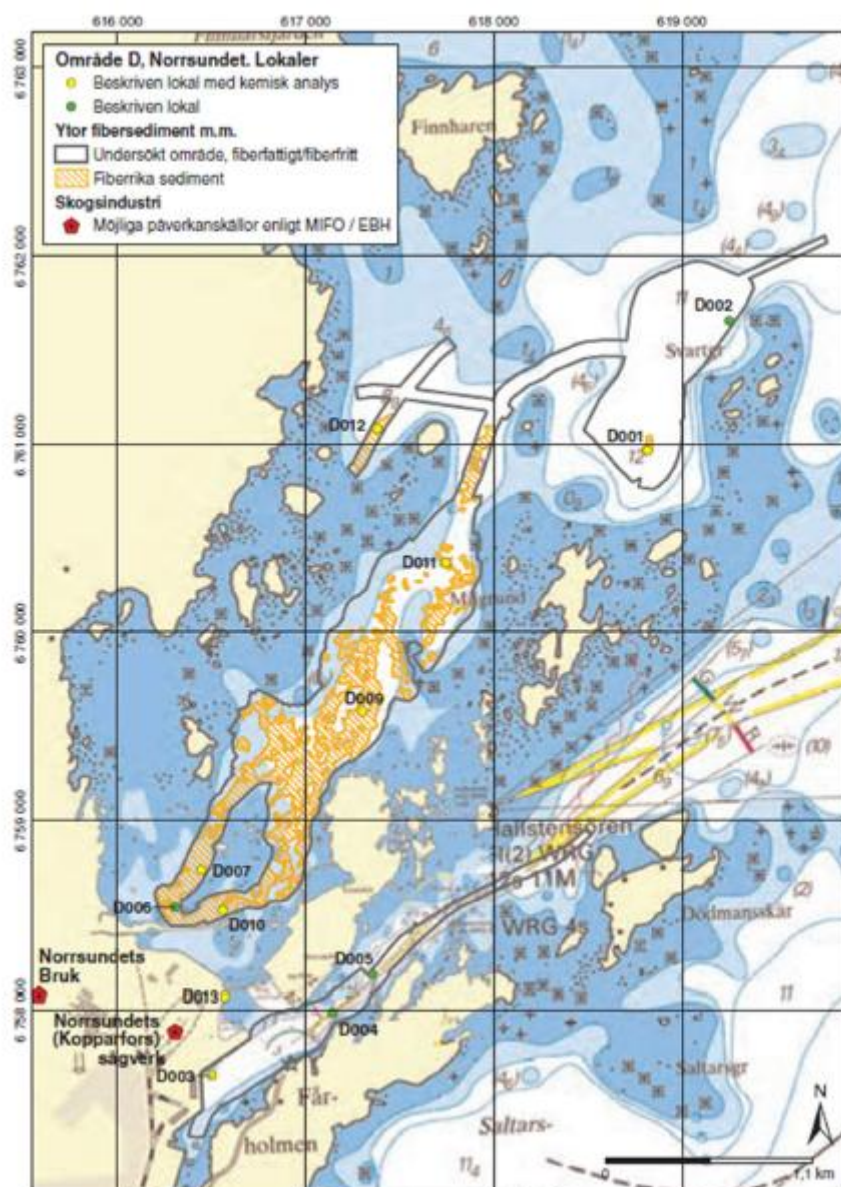


Figure 6–7. Distribution of fiber-rich sediments around Norrsundet. Points mark locations where sediment sampling was performed; at yellow points, fiber was detected and chemical analysis was conducted (SGU, 2016).

The fiber discharges ceased in the mid-60s when the wastewater was instead routed via a sedimentation basin. However, it was not until 2002 that an expanded biological treatment system was put in place (SGU, 2016) (Malmaeus, 2012).

6.4. Natural Values

On 10 April 2026, Ekologigruppen conducted a natural value inventory in the plan area as well as an in-depth inventory of habitats for birds, amphibians, and bats (report is under preparation).

The natural value inventory showed that the area primarily consists of managed forest land with generally lower natural values and limited values linked to habitats for protected species, with the exception of the southwestern corner of the area where there are higher natural values; see Figure 6.7. There are two areas with natural value class 2, high natural value, consisting of pine-covered bog as well as older coniferous mixed forest. Two areas with pine forest and bedrock

pine forest, respectively, are assessed to have significant natural value, class 3, while other areas with young, even-aged, and impacted forests constitute class 4 (certain or lower natural values).

Value species are primarily found in the southwestern parts of the inventory area, in areas with longer continuity, but a few scattered finds also occur in the production forest. Seven protected species occur, of which four are birds. Seven species are red-listed, of which the lungwort lichen (*garmlav*) and the European greenfinch are threatened in the category of vulnerable species (VU), and the others consist of near-threatened species (NT) linked to dead wood: the shield lichen (*vedskivlav*), the hoof fungus (*ullticka*), the black nail lichen (*blanksvart spiklav*), the charcoal lichen (*kolflarnlav*), and the short-stemmed nail lichen (*kortskaftad ärgspik*).

No particularly protectable trees or invasive species were noted in the area.

During the inventory of habitats for birds, the largest part of the area was assessed to be possible environments for common bird species with low requirements for their habitats. Only smaller areas constitute very suitable habitats for the capercaillie (Birds Directive - BD) (droppings were found), and suitable habitats for, for example, the spruce grouse (BD), the yellowhammer, the lesser spotted woodpecker, and the willow tit (all NT).

According to the inventory of habitats for bats, the area was assessed to have low values for bats due to a lack of valuable structures and environments that enable colony formation and overwintering environments. Suitable bat environments primarily consist of possible foraging environments in moist deciduous forest, at a bog, and along forest roads. The coastal location means that the area could harbor certain values for migrating bats.

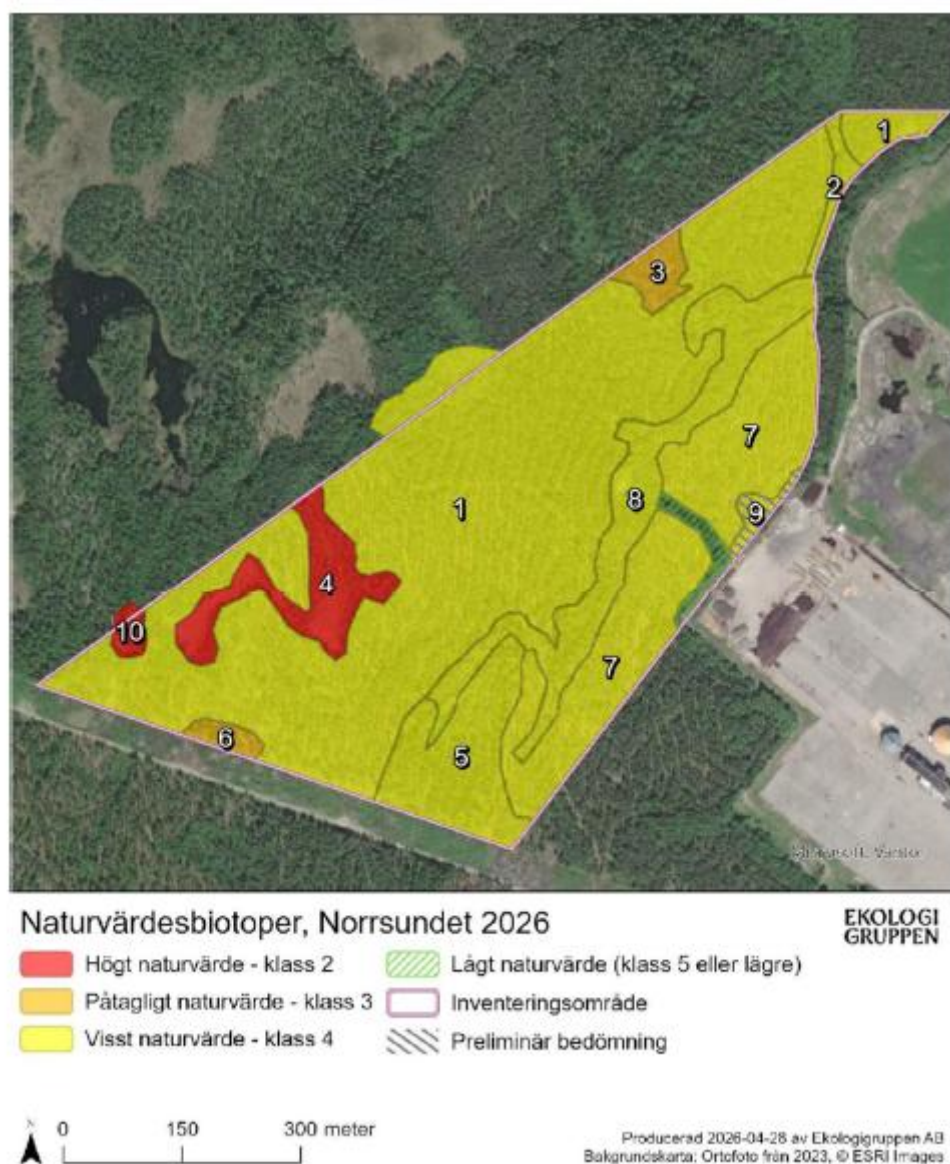


Figure 6.7. Results from the natural value inventory conducted by Ekologigruppen in April 2026.

For amphibians, the most important habitats in the form of potential spawning waters are largely absent. A few small water bodies that could constitute spawning waters exist, but generally, the water collections have too high a water flow, are shaded, lack suitable vegetation, and/or are too acidic to be very suitable. During the field visit, no amphibians were found, neither adult animals nor egg clusters.

6.5. Cultural-Historical Values

According to information from the Swedish National Heritage Board (*Riksantikvarieämbetet*), there are no registered cultural-historical remains within the area (see Figure 6-8). Nor are there any cultural environments with general or special consideration requirements within or around the area. Along the coast outside Norrsundet harbor, there are registered boat and ship remains without an antiquarian assessment.

In Gävle Municipality's cultural environment program, the buildings in Norrsundet are designated as cultural-historical buildings of high value. The area is described as an industrial

community by the coast built at the turn of the century 1900 around sawmills and a sulfate plant (Gävle Municipality's cultural environment program, 2017).

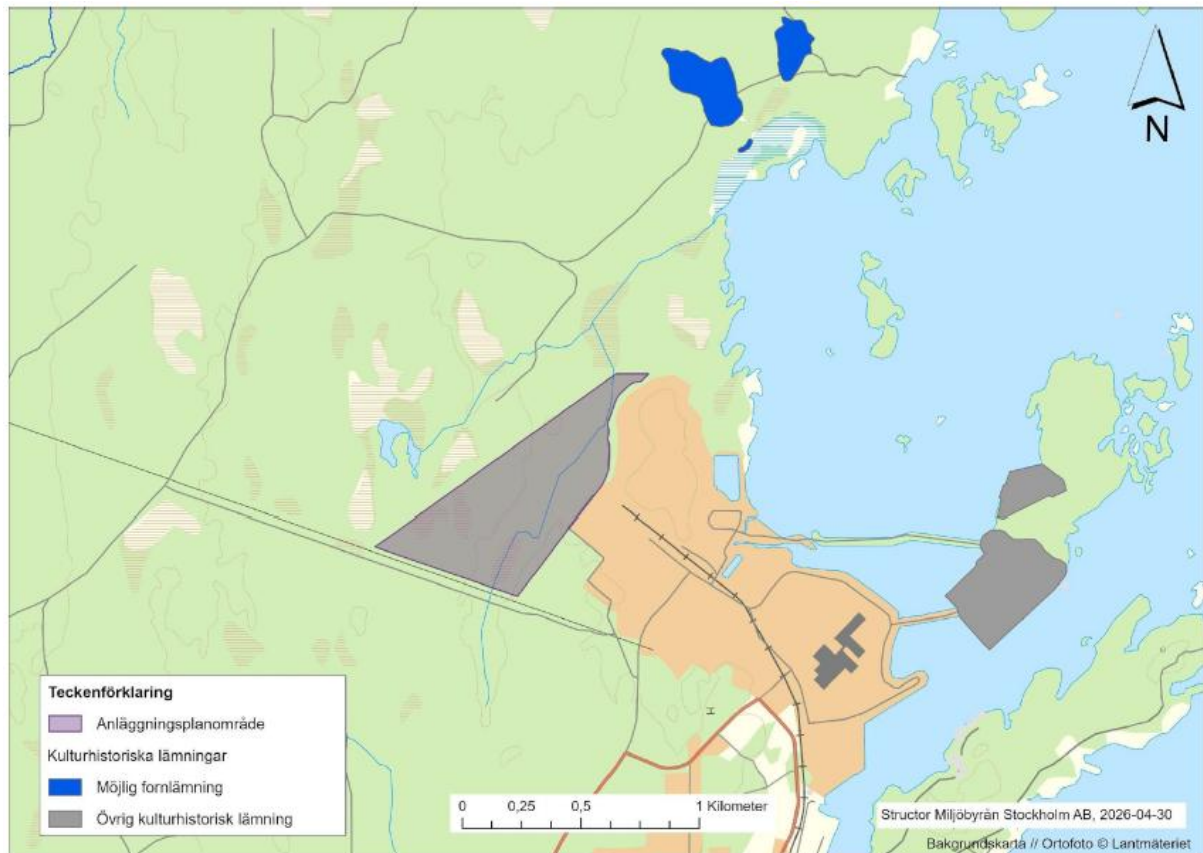


Figure 6-8. Cultural-historical remains in the vicinity of the area. The map only shows the occurrence of registered possible ancient remains and other cultural-historical remains. Other objects in the cultural environment register are not reported (Source: Swedish National Heritage Board 2025).

6.6. Nearby Ongoing/Planned Projects

Within the Norrsundet industrial area, there are currently a metal refinery, port and logistics activities, and a capped landfill. Various types of goods such as wood products, coke, and waste are handled at the quay. Within the port area, storage (both indoor and outdoor) of the handled products, as well as paints, soil masses, and sludge, occurs, along with the parking of machinery.

The Norrsundet industrial area with the associated port, south of the area, is designated as an investigation area for activities in the comprehensive plan (*översiktsplanen*). The northern part of the Norrsundet industrial area is detailed-planned for industrial purposes. In the northern part of the plan area, permission for a Seveso facility in the form of a biorefinery has been enabled. The detailed plan entered into force on 25 March 2022. The application for a permit according to the Environmental Code for the construction and operation of the biorefinery was granted in December 2024, but the plans have not yet been realized.

7. IMPACT FACTORS

This chapter describes the environmental effects that the plan proposal and the associated nuclear activity may give rise to, and the impact factors and conditions that form the basis for the consequence assessment. Chapter 8 describes how the changes that the plan proposal may give rise to affect the surrounding environment.

7.1. Taking up of Land and Visual Impact

Taking up of land (*ianspråktagande av mark*) refers to the land utilized by the facility during the operational phase. The land requirement for the installation plan covers approximately 40 hectares. The land requirement entails that existing land surface may be taken up for buildings and paved surfaces. The reactors are planned to be recessed approximately 15 meters below the ground surface, where components such as steam generators and cooling systems are also placed. The excavation work will generate masses that will, as far as possible, be reused within the area. Any surplus masses will need to be transported away.

The above-ground parts of the facility are planned to consist of reactor buildings and associated operation and service buildings. The reactor buildings are planned to have chimneys that protrude above the buildings (approximately 20 meters above ground level), and in the event of air cooling of the secondary circuit, the cooling plant may reach a height of approximately 40 meters above ground level. The visual impact that the building volumes entail for the experience of a landscape and cultural environments depends on the character, scale, and use of the landscape. Landscapes that are built-up and utilized are more changeable and resilient to impact than untouched nature, where changes are few and slow. In unaffected natural and cultural environment areas, a large-scale change in the landscape may entail a risk of impact on the landscape image and the cultural environment compared to an already built-up and utilized landscape. The natural environment and human health, through outdoor life and recreation, will be affected by the facility. The consequences are described in Sections 8.1 and 8.3. The landscape image and cultural environment are also affected by the facility, which is described in Section 8.6.

7.2. Noise and Vibrations

Noise resulting from the implementation of the plan proposal may occur in both the construction phase and the operational phase.

During operation, noise will arise from moving facility parts, for example, ventilation systems and generators. The facility will be constructed based on the requirements of the Environmental Code, and sound requirements will be stipulated during the procurement of various facility components. There is also the possibility of implementing noise-reducing protective measures if necessary to ensure that guideline values are maintained.

External transports outside the operational area are assessed to be relatively few in number. Noise will also occur during the construction phase. To limit the impact of noise on the surroundings, the Swedish Environmental Protection Agency's general advice (NFS 2004:15) on noise from construction sites shall be applied to works and transports within the construction area. In the event that any work step risks exceeding the guideline values specified in NFS 2004:15, protective measures will be taken.

Local vibrations may occur during blasting, piling, compaction, as well as from heavy transports. An investigation regarding the environmental impact of vibrations will be conducted and followed up during the construction phase.

Consequences resulting from noise are assessed for human health in Section 8.1.

7.3. Water Intake and Discharge

Paving of surfaces and construction of buildings generate stormwater (*dagvatten*), the pollutant content of which is affected by the activity within the plan area. Stormwater is rain or meltwater that runs off from roofs, roads, and other paved surfaces. During heavy rain or rapid snowmelt, the water can collect pollutants from these surfaces, such as oils, metals, chemicals, and debris. The pollutants then travel with the stormwater to the recipient. Paving of surfaces and construction of buildings within the plan area generate stormwater whose pollutant content is also affected by the activity that will be conducted. There are no nationally adopted guideline or limit values for stormwater. However, stormwater management must be carried out in such a way that discharges to the recipient do not risk compromising environmental quality standards; see 5.4. Later in the review process, a stormwater investigation will be produced where flows and pollutant content are calculated, and the need for stormwater detention and treatment is investigated.

The reactors' cooling systems are primarily based on lead cooling. This means that liquid lead is used to transport heat from the reactor, instead of water as used in conventional light-water reactors. Heat from the primary cooling system is diverted through air cooling. From the primary circuit, the heat will be transferred to water in the closed secondary circuit, where the steam created is used to produce electricity. The secondary circuit's condenser is cooled with seawater or in a closed cooling plant that is cooled against air. The seawater does not come into contact with any material in the process, and therefore no contamination of the water occurs before it is returned to the recipient.

Water cooling for the secondary circuit entails a water requirement during operation, where seawater cooling can be expected to entail the greatest water requirement. The facility also has a need for water for steam production (circulating water) as well as needs for drinking water and other water and sewage (VA) functions within the operational area. The exact water requirement depends on which cooling method is chosen for the final design of the facility. The water used in the process may need to be pre-treated (purified) depending on the area of use.

In the event that seawater is used for cooling the secondary circuit (instead of air cooling), the need for cooling water is assessed to be approximately 18 m³/s during the operation of six SEALER reactors. Upon return, the water will have a temperature increase of a maximum of 10 °C compared to the intake. The discharge point needs to be located and designed so that good mixing with the surrounding seawater is achieved, so that the thermal impact on the recipient can be limited.

Within the facility, there is process water that may contain radioactivity. Various alternatives for handling the process water are being investigated, and after treatment, it may be discharged to the recipient.

7.4. Groundwater Drainage

The reactors are planned to be constructed approximately 15 meters below the ground surface, which means that parts of the facility will be located below the groundwater pressure level. The amount of water that may need to be drained during the operational phase depends on the groundwater flow in the surrounding ground and the extent to which sealing can be implemented. Groundwater drainage can lead to settlements in the surrounding ground, drying out of wetlands, and, in coastal areas, a risk of saltwater intrusion.

During the construction phase, groundwater will need to be drained temporarily. The groundwater drawdown will be monitored regularly, and a control program for both groundwater drainage and (if necessary) control and treatment of sump water (*länshållningsvatten*) will be developed prior to the start of construction. Protected objects will be mapped, and necessary preventive measures will be taken prior to the start of construction.

Consequences from groundwater drainage are described in 8.2.

7.5. Raw Materials and Chemicals

In the SEALER reactors, liquid lead will be used as a cooling medium. The molten lead will be part of a closed circuit. The amount of lead amounts to 1,000–1,500 tonnes of lead per reactor.

During operation, chemicals such as nitrogen, argon, and oxygen, as well as chemicals for the treatment of incoming cooling water, will be used. Examples of maintenance chemicals include lubricating oils, greases, solvents, and cleaning agents. All handling of chemical products will follow applicable legal requirements, and all liquid chemicals will be stored in a secure manner using bunds (*invallningar*) or similar. Absorbent materials will be available for the handling of spills.

7.6. Waste

7.6.1. Radioactive Waste and Spent Fuel

The objective is to apply the waste hierarchy and actively work to prevent the generation of radioactive waste, as well as to reuse, recycle, and treat waste as far as possible in order to minimize environmental impact and to reduce the volume of waste and its complexity. This, in turn, facilitates safe handling, transport, and final disposal. This approach shall permeate the entire life cycle of the facility—from design and construction to operation and decommissioning. Already in the design phase, the choice of materials, technology, and processes affects the type and volume of radioactive waste generated. During operation, controlled operating conditions, planned maintenance, and thorough documentation of operating history enable the minimization of waste production and correct characterization of waste. The largest waste volumes are expected to occur during decommissioning, primarily as a result of the demolition of buildings, systems, and components.

Spent nuclear fuel and radioactive waste will be treated to create stable and well-characterized waste forms that meet regulatory requirements and are compatible with systems for storage, transport, and final disposal.

The radioactive waste and spent fuel expected to be generated in the activity will be handled and classified according to established routines, based on material type and activity content.

Radioactive waste, including solid, liquid, and gaseous fractions, as well as spent fuel, will be stored within the area in adapted spaces for interim storage. These will be equipped with the required radiation protection, physical protection, ventilation, and monitoring systems to ensure that the waste does not pose a risk to personnel or the surrounding environment. The interim-stored radioactive waste and spent fuel will be inspected regularly, and radiation levels will be continuously monitored.

Uranium dioxide constitutes the primary fuel for the facility. It is a well-established fuel with high technical maturity and extensive operational experience globally. Uranium dioxide as a fuel form is compatible with the basic principles of the KBS-3 method³, and there are no identified technical obstacles for disposal according to this or similar future final disposal solutions. The

higher enrichment level required by SEALER, together with the fuel's properties after operation—such as decay heat, isotope composition, and potentially different burn-up rates—may differ from today's light-water reactor fuel, which means that certain adaptations may be needed to meet the acceptance criteria of the final repository. This will be handled in the continued technical development and review process.

Uranium nitride is being evaluated as a possible future alternative fuel. Any use presupposes that the fuel can be approved in the continued stepwise review according to the Nuclear Activities Act (*kärntekniklagen*) and that it is assessed to be economically justified.

SEALER is a so-called breeder reactor, which enables the recycling of spent fuel and a closed fuel cycle. If the fuel is recycled, both the waste volume and the amount of long-lived radionuclides can be significantly reduced, with positive effects for long-term environmental and radiation safety. However, fuel recycling constitutes a long-term possibility.

7.6.2. Conventional Waste

The activity will give rise to conventional waste in the form of, for example, combustible residual waste, packaging, office waste, as well as waste from maintenance and operation.

Waste management will be carried out in accordance with applicable legislation, the municipality's waste regulations, and the principle of the waste hierarchy according to Chapter 15 of the Environmental Code (*miljöbalken*).

The waste will be handled by an approved waste contractor with the required permits for transport and treatment. Any changes in waste flows or the occurrence of special waste types are documented and followed up within the framework of the activity's self-monitoring (*egenkontroll*).

The consequences of the activity linked to waste are assessed in Section 8.5.

7.7. Energy Use and Energy Recovery

To operate a SEALER reactor, a total electrical power of approximately 2.5 MW is required. For the operation of six reactors, a total electrical power of approximately 15 MW is required. The power supply is needed to drive pumps and circulation systems, control and safety systems, as well as ventilation. To secure the power supply in the event of an interruption in the electricity grid, a backup power facility will be available in the form of diesel generators or batteries. The SEALER reactors use entirely passive air cooling to cool the primary system (and thus the lead and the core) in the event of an accident. The air cooling is entirely independent of electricity or operator actions.

In Norrsundet, the facility will primarily produce electrical energy and, if necessary, industrial heat production.

7.8. Emissions to Air

During the construction phase, road transports will increase noticeably, which entails increased emissions to air from transports as well as increased dusting as a result of construction works.

The operational phase generally entails relatively few transports. Transports primarily comprise deliveries of consumables, waste transports, and personnel transports to and from the facility.

Air cooling may be used to divert excess heat from the secondary circuit's condenser in the reactors. The overall principle is that water is cooled via evaporation. This process entails some water consumption, and the evaporation that occurs may give rise to visible steam.

Consequences resulting from emissions to air are assessed for human health in Section 8.1.

7.9. Release of Radioactive Substances during Normal Operation

During the operational phase, air containing very small amounts of radioactive substances will be vented from the reactors via ventilation ducts. Process water is also generated, which may contain radioactivity and may be released to the recipient after treatment. The rules and requirements imposed on a nuclear installation will need to be followed, and verifying calculations will need to be performed to show that the applicable dose restriction for the general public can be followed, and that the releases are as low as reasonably achievable.

Consequences for human health resulting from the release of radioactive substances during normal operation are assessed in Section 8.1.4.

7.10. Risk and Safety

7.10.1. Conventional Risks

In a risk identification, a number of risk sources have been identified for the activity in the operational phase:

- Handling of environmentally or health-hazardous substances
- Handling of flammable or explosive substances
- Handling of certain hazardous substances that can cause a serious chemical accident
- Storage of large quantities of combustible or organic material
- Substances handled under high pressure or high temperature
- Cooling plants and/or substances handled at low temperatures
- Vehicle movements during deliveries or maintenance measures
- Dusting environments or other risk of explosive atmospheres (ATEX)

Possible dispersion processes for lead in accident events have been analyzed for SEALER-E, Blykalla's electrical test reactor. The investigation focused on under what conditions a leak of liquid lead from the cooling circuit could occur and whether there are scenarios that could lead to the spread of lead, for example, in connection with a fire in the equipment or in adjacent spaces. The investigation could not identify any physical conditions for scenarios where health-hazardous amounts of lead are spread to the surroundings.

A corresponding analysis for the nuclear reactor, SEALER, is being performed within the framework of the continued permit work.

During the construction phase, there will be construction work steps that entail accident risks, for example, in connection with heavy transports, heavy lifts, excavation, blasting, hot works (*hetarbeten*), and so on.

7.10.2. Radiological Risks

In a safety analysis for a nuclear reactor, potential unplanned events, their estimated occurrence frequency, and possible consequences are identified. The events are classified based on frequency, and for each category, acceptance criteria are applied regarding the maximum radiation dose to a representative person from the general public.

For new nuclear power that is not of the light-water type, established acceptance criteria are currently lacking. The design work for the SEALER reactors therefore proceeds from proposed criteria (see Section 5.1.5). A detailed safety analysis will be conducted at a later stage, when a more detailed design has been developed.

The requirement framework entails that radiation doses to the general public during identified events shall be below the applicable acceptance criteria, and even if the acceptance criterion is not exceeded, the design needs to be optimized so that the dose is as low as reasonably possible.

For extremely improbable events (serious accidents), specific dose criteria are not applied; instead, these are managed through the planning of preparedness measures.

Inner and outer preparedness zones are defined around nuclear installations. For existing light-water reactors, these amount to approximately 5 kilometers (inner zone) and 25 kilometers (outer zone). For the SEALER reactors, which have lower output and use different technology, the corresponding zones are preliminarily assessed to be substantially smaller, estimated at approximately 1 kilometer (inner zone) and 5 kilometers (outer zone). The extent of the final zones will be determined at a later stage.

The inner preparedness zone aims to enable rapid evacuation during an accident to avoid direct radiation damage. The outer preparedness zone aims to reduce the risk of long-term health effects through planned protective measures.

Within the preparedness zones, the pre-distribution of iodine tablets may become relevant as part of the preparedness measures.

Communication infrastructure (roads, railways, port, etc.) in the facility's surroundings is not affected by the facility during normal operation or during minor events.

Preparedness planning around nuclear installations also encompasses extremely improbable events. In such an event, the evacuation of the general public from the inner preparedness zone and at least parts of the outer preparedness zone is expected to be carried out, which are then cordoned off from the general public. In an event with the release of radioactive substances, the communication infrastructure can continue to be utilized by actors working on the management of the event, with the implementation of appropriate radiation protection measures. Exactly which measures are implemented is decided based on the specific event that occurred and circumstances such as weather, etc.

8. ENVIRONMENTAL IMPACTS

This section describes the environmental effects and impacts that the proposed plan is assessed to give rise to. Primarily, the impacts following the implementation of the plan (during the operation of the nuclear activities) are described, but aspects during the construction phase are also described where relevant for the assessment of the site's suitability. The assessment of environmental impacts has been made in relation to the zero alternative.

8.1. Human Health

8.1.1. Noise

The activities will generate noise during both the installation and operational phases. As the nearest residents are located approximately one kilometer away, the conditions are assessed to be favorable for applicable noise guideline values to be maintained during the installation and operational phases. External transports outside the activity area will be relatively few in number. This means they are not assessed to cause any significant increase in traffic noise levels along the public road network.

The assessment is that the proposed plan will not cause any nuisance to human health based on noise. It is assessed that applicable guideline values can be achieved. The facility will be constructed based on the requirements of the Environmental Code (miljöbalken), and the possibility for noise-reducing protective measures is assessed as favorable. Based on this, it is assessed that conditions exist for the proposed establishment.

8.1.2. Air

The primary emissions to air are linked to transports and potentially to an air-cooling system (water vapor).

During the installation phase, the number of transports will increase, which may lead to increased emissions to air. Installation works may increase dusting at the site. The operational phase generally involves relatively few transports to the area. Transports during the installation and operational phases involve, among other things, emissions of particles and nitrogen dioxide. However, based on current knowledge, the addition of these, both regionally and locally, during both the installation and operational phases is assessed to be negligible.

In the event that air cooling is used to dissipate excess heat from the secondary circuit's condenser in the reactors, cooling occurs via evaporation, which may give rise to visible steam. Pre-treatment of the water before use may be required, and chemicals may be added to avoid biological growth and also to minimize the risk of spreading legionella via aerosols.

No other air emissions are expected from the activities during normal operation. Radiological emissions are described in section 8.1.4.

Based on existing knowledge, the proposed plan is not assessed to cause any nuisance to human health or the environment due to emissions of air pollutants. It is also assessed that the proposed plan will not result in any environmental quality standard (miljökvalitetsnorm) according to the Air Quality Ordinance (2010:477) being exceeded. Based on this, it is assessed that conditions exist for the proposed establishment.

8.1.3. Recreation and Outdoor Life

No national interest (riksintresse) for outdoor life exists within the area or in its immediate

vicinity. The area will be fenced in, thereby limiting public access to the area. Recreation and outdoor life can continue in the forest area outside.

The proposed plan is not assessed to result in recreation and outdoor life being affected to a greater extent. Against this background, it is assessed that conditions exist for the proposed establishment.

8.1.4. Radiological Emissions during Normal Operation

The rules and requirements imposed on a nuclear facility shall be followed, and verifying calculations shall be carried out. For normal operation, according to the Radiation Protection Ordinance, a dose restriction for the public from emissions of a maximum of 0.1 mSv/year applies. This dose restriction applies to the emissions from an entire nuclear power plant, which may comprise several nuclear reactors. The dose from emissions is calculated for a hypothetical person from the public living in the immediate vicinity of the nuclear power plant, while the dose decreases sharply with increasing distance from the nuclear power plant.

For comparison, an inhabitant in Sweden receives, on average, a completely natural radiation dose of 1–2 mSv/year (Swedish Radiation Safety Authority, 2025).

The nearest residences are in Norrsundet, approximately 1 kilometer from the plan area.

Against the background of available knowledge about the area, the proposed plan is not assessed to cause any nuisance to human health based on radiological emissions during normal operation. Against this background, it is assessed that conditions exist for the proposed establishment.

8.1.5. Risk and Safety

Conventional Risks

Within the proposed activities, accident risks have been identified based on the perspectives usually considered according to the Environmental Code (miljöbalken). In the reactors, lead will be used as a cooling medium in a closed circuit, in quantities that exceed the higher requirement level according to the Seveso Act (Sevesolagen), which means that the facility becomes a so-called Seveso establishment. Within the activities, smaller quantities of other hazardous substances will also be handled for, for example, water treatment, operation and maintenance, and potentially as fuel for backup power. Accident risks associated with this are not assessed to be so significant that they affect the conditions for the overall siting of the facility, but they need to be considered in future stages.

Accident risks in the surroundings that have been assessed as relevant have been identified as follows:

- **Transports of dangerous goods**

The recommended road network for the transport of dangerous goods consists of county road 575 Norrsundsvägen (approximately 800 meters) and the E4 (just over four kilometers).

Rail transports of dangerous goods may occur on the industrial track that connects to Norrsundet from the south and is located closest approximately 150 meters from the proposed location of the nuclear facilities. The risk impact from accidents involving the transport of dangerous goods is not assessed to be so significant that it affects the conditions for the proposed siting.

- **Accident risks within the Norrsundet port area**

Various types of goods, such as wood products, coke, and waste, are handled at the quay. Within the port area, storage (both indoors and outdoors) of the handled products, as well as paints, soil masses, and sludge, occurs, along with the positioning of machinery. Typical accident risk impact on the surroundings from such activities may include fires causing heat radiation (in the immediate area) and disturbances through smoke. However, the current distance to the proposed location of the nuclear facility means that no significant accident risk impact is assessed to exist.

- **Accident risks at a potential future establishment of a biorefinery**

A company has been granted a permit (Land and Environment Court at Östersund District Court, case no. M 2154-23 through partial judgment on November 28, 2024) to establish a biorefinery within the Norrsundet industrial area (not yet taken up [ianspråktaget], the commencement period is 7 years). If constructed, the biorefinery would comprise the production and storage of green fuels such as aviation fuel, diesel, or gasoline to such an extent that it becomes a Seveso establishment at the higher requirement level. The process involves flammable goods which, in the event of an accident, may cause an impact on the surroundings and parts of the plan area in the form of heat radiation, fragments, shockwaves, and combustion gases. Cooling systems may contain ammonia (up to 25 tonnes), a toxic gas that entails a risk impact on the surroundings. Overall, the activity (if constructed) is assessed to entail an accident risk impact on the plan area that will need to be considered, among other things based on the fact that two nearby Seveso establishments need to collaborate. It is assessed that conditions exist to manage this potential risk impact on the plan area with various appropriate protective measures. The permitted activity is therefore not assessed to make the overall siting of the nuclear facility impossible.

Through systematic occupational health and safety work according to current practice that considers relevant risks for employees and impact within the work area, accident risks in both the operational and installation phases are assessed to be manageable without any significant risk of impact on human health and the environment in the facility's surroundings.

Risks linked to a changed climate with more extreme weather will be handled in future planning and permitting processes.

Radiological Risks

For unplanned events, there are event classes, and for each event class, there is an acceptance criterion regarding the resulting maximum dose to a representative person from the public. The nuclear facilities shall be designed so that the radiation dose to a representative person from the public during events becomes lower than the acceptance criterion for the respective event category; even if the acceptance criterion is undershot, the construction shall be optimized so that the dose is as low as reasonably achievable.

To handle extremely improbable events, preparedness zones (beredskapszoner) shall be established. A basis regarding preparedness zones for the facility planned in Norrsundet has been developed and is summarized below (Blykalla, 2026). Within the preparedness zones, there are pre-distributed warning receivers, iodine tablets, and information to the public. There are also evacuation plans to quickly evacuate both the inner and outer preparedness zones in the event of an accident. The maximum inner and outer preparedness zones have been estimated. The inner preparedness zone mainly comprises the Norrsundet industrial area and

forest land. Within the inner preparedness zone, there are no permanently residing persons or other sensitive activities such as schools or healthcare facilities.

The outer preparedness zone mainly includes forest land and agricultural land. Just over 1 kilometer southeast of the area for nuclear facilities lies the urban area (tätorten) Norrsundet, and just over 3 kilometers west of the activity area lies the urban area (tätorten) Bergby, which are also included in the outer preparedness zone. Otherwise, the area is sparsely populated. Approximately 2,500 people are permanently residing within the outer preparedness zone. Within the outer preparedness zone, there is a health center and a care and nursing home in Bergby. There is also a primary school and a preschool. In Norrsundet, there is a primary school, a preschool, and a music school.

See Figure 8-1 for the estimated maximum extent of the inner and outer preparedness zones, one and five kilometers respectively from the outer boundary of the area for nuclear facilities. The exact routing of zone boundaries shall be decided by authorities at a later stage and will, where possible, also take into account appropriate physically visible boundaries in the terrain for maximum clarity. Given these aspects, it is not currently known whether the E4 or the East Coast Line (Ostkustbanan) will be included in the outer preparedness zone or not.

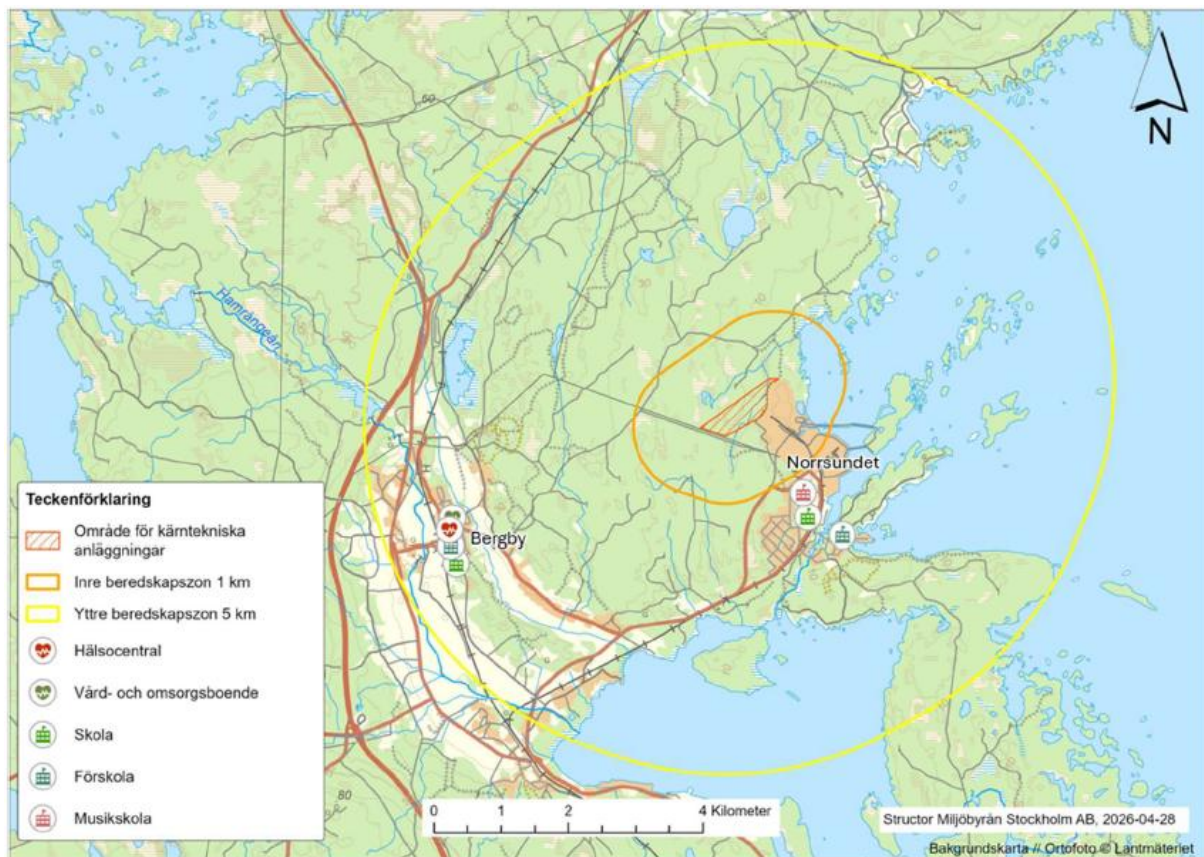


Figure 8-1. Extent of estimated maximum inner and outer preparedness zones one and five kilometers respectively from the outer boundary of the area for nuclear facilities.

The siting of the proposed area for nuclear facilities is well-suited from a preparedness perspective. The estimated maximum preparedness zones comprise a limited number of residents and sensitive activities, which facilitates planning and the implementation of urgent protective measures.

8.2. Ground Conditions

The proposed plan shall enable facilities that require foundation on bedrock approximately 15 meters below the ground surface. The ground in the plan area consists mainly of till soil over bedrock. The bedrock is located relatively close to the surface, including areas of exposed bedrock in some places, which means that the plan area offers conditions for foundation where the bedrock is shallow. Some small peat areas occur, but the largest investigated thickness has been less than one meter.

The thin soil cover means that the groundwater reservoir in the soil is limited. At the same time, the bottom of the excavation will be located below the water level of the Baltic Sea. The distance between the plan area and the Baltic Sea shoreline is at its closest just over 300 meters, which is favorable for reducing the risk of water ingress since bedrock will remain between the excavation and the Baltic Sea. The facility that the plan intends to enable needs to be executed with a watertight foundation construction, and the bedrock needs to be sealed to prevent the ingress of groundwater.

The groundwater level will temporarily need to be lowered in connection with the installation phase and potentially also during the operational phase. In the event of groundwater lowering, there are generally risks of ground settlement, which can cause damage to buildings, pipelines, and other infrastructure. When lowering the groundwater reservoir, there is also a risk of impact on groundwater-dependent vegetation. To counteract such effects, protective infiltration may be applied during the installation phase, which means that water is added to the groundwater reservoir to avoid harmfully low groundwater levels. Another possible protective measure could be, for example, an adapted working method, such as limiting the duration of the groundwater drainage (grundvattenbortledning).

The distance to state infrastructure such as roads and railways is approximately 3–4 kilometers, which is why these are not assessed to be affected by any potential groundwater lowering.

The extent of the groundwater lowering, the risk of impact on the surroundings, and the need for protective measures will be investigated further in the upcoming permitting process.

The facility that the proposed plan intends to enable will be adapted with regard to future climate changes. This includes the management and diversion of flows resulting from extreme rain and floods. The installation plan area consists of undeveloped land, and the elevation of the ground can therefore be designed to withstand more extreme rain and floods. The facility will be adapted so that surface-running stormwater (dagvatten) flows away from buildings and other sensitive infrastructure.

Furthermore, the stormwater management will be designed so that precipitation can be delayed and treated within the property. Climate factors will be considered in a stormwater investigation in the upcoming planning and permitting process.

The changed climate will mean that the sea level in the Bothnian Sea will rise. An increase in the mean water level at Gävle to +27 cm is not assessed to entail any unmanageable risk. The level of the installation plan area varies between +7.5 and +10.8 (levels in RH2000).

Based on the available knowledge, it is assessed that conditions exist for the proposed establishment.

8.3. Natural Environment and Species

The proposed plan entails the taking up of land (ianspråktagande) of natural land consisting of

managed forest land with generally low natural values and limited values linked to habitats for protected species, with the exception of the southwestern corner of the plan area where there are higher natural values. Since there is some occurrence of suitable habitats and protected species, further inventory and investigation are assessed to be needed in future steps of the permitting process. Adaptations and protective measures may be needed, but against the background of available knowledge about the character of the area, the proposed plan is not assessed to cause any significant negative impact on the natural environment. Based on the available knowledge, it is therefore assessed that conditions exist for the proposed establishment from a natural environment perspective.

Approximately two kilometers east of the installation plan area is the designated national interest (riksintresse) area for nature conservation Lindön-Björnön-Iggösundet. The area is located in the water body (vattenförekost) S S M Bothnian Sea coastal waters and a couple of kilometers southeast of the points being studied as possible for the intake and discharge of cooling water in other water bodies in the area. The water area between Lindön and Iggön, which is located another kilometer away, is particularly valuable as a spawning and nursery area for fish. Should it become relevant to place a cooling water intake in the water body S S M Bothnian Sea coastal waters, the intake point would be placed closer to the national interest Lindön-Björnön-Iggösundet. However, the intake point and associated pipeline will continue to be placed outside and at a distance from the national interest area. Good opportunities are assessed to exist for adaptations of placement and design to avoid the risk of significant impact on the national interest. This will be investigated further during upcoming permitting processes. Discharge of cooling water is not relevant in the water body S S M Bothnian Sea coastal waters.

Initial modelings show that the temperature impact from the discharge of cooling water spreads in a northeasterly direction, i.e., away from the national interest area. The values of the national interest are found in land and water environments located outside the area where temperature impact was demonstrated in the model. Protective measures will be taken in connection with the installation of the pipelines so that the impact of turbidity in connection with the works is avoided. The assessment is that the intake and discharge of cooling water do not entail a risk of significant damage to the national interest for nature conservation Lindön-Björnön-Iggösundet.

8.4. Water Environment and Impact on Environmental Quality Standards

The assessment of the impact on the water environment and environmental quality standards (miljökvalitetsnormer) is based on the extent to which the proposed plan affects the status of water bodies, contributes to deterioration, or hinders the possibility of achieving applicable environmental quality standards.

Both the discharge of stormwater and the intake and discharge of cooling water can affect the concerned surface water bodies. Based on the distance and groundwater flows in the immediate area, no groundwater body will be affected by the proposed plan.

8.4.1. Stormwater

Pollutants in stormwater normally constitute a significant contribution to the pollutant load in lakes and watercourses adjacent to developed areas. Stormwater management must therefore be carried out in such a way that the discharges to the recipient do not risk compromising environmental quality standards. In preparation for future permitting processes (detailed plan and permit according to the Environmental Code), a stormwater investigation will therefore be produced where flows and pollutant content are calculated, and the need for delay and treatment of the stormwater is investigated. No other pollutants in the stormwater than those

commonly occurring in stormwater from equivalent industrial activities are expected to arise due to the proposed plan.

Regarding stormwater, the proposed plan is not assessed to affect the possibility of achieving good chemical and ecological status for the concerned water bodies. The possibility is assessed as good to collect and, if necessary, install systems for the delay and treatment of stormwater before diversion to the recipient.

8.4.2. Intake and Discharge of Cooling Water

The amount of cooling water that will be needed for the reactor park depends on many factors, but in the current case, the assessments are based on the need for approximately 18 m³/s of cooling water during the operation of six SEALER reactors. Investigations of various solutions for the intake and discharge of cooling water are ongoing. Hydrodynamic modelings of temperature impact are being carried out as a basis for assessing whether a cooling water intake of this size is feasible without unauthorized impact in the water area.

Annual recipient controls carried out at existing nuclear power plants in Sweden show a negative effect of cooling water intakes, as fish die as a result of being sucked in at the cooling water intake. However, existing nuclear power plants require significantly larger amounts of cooling water than SEALER reactors. There are also various protective measures to be taken to reduce the impact, such as the design of the cooling water intake.

In the modelings performed, the discharge water is assumed to be approximately 10 degrees warmer than the intake water. The intake of cooling water and the discharge of heated water can affect the aquatic animals and plants found in the immediate area. The impact could, for example, be a higher metabolism which can lead to food shortage problems, problems with recruitment as eggs, larvae, and fry are lost in the intake or affected by temperature shocks. Problems with invasive species may also arise as a result of local heating.

The results of the initial hydrodynamic modelings show a geographical distribution of heated water in the shallow areas around the discharge point. Future pelagic investigations (plankton, benthos, fish, etc.) will form the basis for further modelings and assessment of how the pipeline routing is appropriately placed to avoid negative impact or, in any case, limit any potential impact as far as reasonably possible. The intake and discharge of cooling water will be located in either the water bodies Norrsundet and Fårholmen, or alternatively, the intake may be located in S S M Bothnian Sea coastal waters.

In the event that intake and discharge points for cooling water and associated pipelines in water are placed adjacent to contaminated sediments in the water body Norrsundet (WA87973988), protective measures must be taken with regard to the occurrence of contaminated and fiber-rich sediments from previous industrial activities. This is because works in water and currents during the intake and discharge of cooling water can cause bottom sediments to be stirred up and spread, which, among other things, could further deteriorate the chemical status of the water body. If there is a risk of such impact, it is assessed that appropriate protective measures can be taken to avoid the spread of environmental toxins in the bottom sediments during both the operational and installation phases. For example, the contaminated sediments can be encased with covering and erosion-protecting material, such as concrete mattresses, geotextiles, or isolation capping with, for example, sand and stone. Examples of protective measures that can be used during potential work in contaminated bottom sediments are protective turbidity screens (for example, silt curtains) that limit particulate spread. In addition, there are several specially designed dredging methods for work in contaminated sediments that minimize the risk

of spread, for example, dredging with an environmental bucket or low-flow dredging (Åtgärdsportalen, 2026) (Teknikmarknad, 2020).

Regarding the quality factors that cause the water bodies Norrsundet and Fårholmen not to achieve good ecological status, both the intake and discharge points need to be placed with regard to these, and particularly the discharge point. The discharge point needs to be placed in a location with sufficient depth to mitigate the effects linked to the temperature increase that occurs, primarily linked to biological quality factors. Regarding flow changes (the quality factor hydrographic conditions) and morphological changes and continuity (the quality factors connectivity in coastal waters and morphological condition in coastal waters), these are also assessed to potentially be affected by the intake and discharge of cooling water, but to a lesser extent than the biological quality factors.

Further modeling, pelagic investigations, and sediment sampling need to be carried out within the framework of the subsequent permit review to more accurately adapt the placement of the intake and discharge points so that the impact can be limited, sensitive areas protected, and environmental quality standards are not deteriorated or compromised.

Against the background of the above, the proposed plan, in the event that seawater is used for cooling, is not assessed to deteriorate the possibility of achieving good chemical and ecological status in the concerned water bodies. Intake and discharge points and pipelines should be able to be placed within the current water bodies. There are good conditions for performing protective measures in the event of impact on contaminated sediments, and the intake and discharge points can be placed and technically designed so that the environmental impact is as limited as possible.

Based on current knowledge, future climate changes are not assessed to affect the possibilities for effective cooling; this will be further investigated in upcoming permitting processes.

8.5. Land and Water Management

The proposed plan entails the taking up of land (ianspråktagande) of forest land for the establishment of nuclear facilities, which results in a change to the ongoing land use of forestry. In accordance with the management provisions in Chapter 3 of the Environmental Code (miljöbalken), land and water areas shall be used for the purpose or purposes for which they are most suitable, taking into account their nature, location, and need.

The proposed area is located in direct connection to the Norrsundet industrial area, which means that the proposed plan constitutes an extension of existing land use. This also means that the need to take up more undisturbed areas in other locations is limited.

No arable agricultural land is taken up within the plan area. Agricultural land occurs within the outer preparedness zone surrounding the area for nuclear facilities.

Within both the inner and outer preparedness zones, there is a national interest (riksintresse) for commercial fishing. The national interest area extends to the shoreline and is therefore affected by the planned pipelines for the intake and discharge of cooling water. During the installation phase, works in water may cause turbidity and temporary limitations on the possibility of conducting fishing where the works are performed. The impact is assessed to be temporary and limited to a small part of the national interest area.

During the operational phase, the discharge of cooling water entails an increased water temperature of a maximum of 10 degrees at the discharge point. Performed modelings show

that the temperature impact has an extent of approximately 2 km in a northeasterly direction. The water area between Lindön and Iggön, which is designated as a particularly valuable spawning and nursery area for fish within the national interest for nature conservation Lindön-Björnön-Iggösundet, is located approximately 3 km southeast of the discharge points and thus outside the area where temperature impact was demonstrated in the modeling performed. Overall, the installation of the pipelines is not assessed to significantly hinder the conduct of commercial fishing. The design and operation of any cooling water system will need to be further investigated to more closely assess the impact and the need for adaptations.

Based on existing knowledge, the overall assessment is that the proposed plan is compatible with a land and water management that is good from a general point of view.

8.6. Cultural Environment and Landscape

There are no registered ancient monuments or other known cultural-historical remains within the area. The plan area is located at a relatively low altitude above sea level, varying between 10–15 meters. Due to the area's low altitude above sea level, prehistoric remains are not expected to occur in the area. However, it cannot be ruled out that unregistered cultural-historical remains exist within the area. This is indicated by the shieling remains (fäbodslämningar) registered north of the area (see, for example, L1951:5501 and L1951:5502), and by the fact that studies of maps with terrain shading have identified several possible unregistered charcoal pits (kolbottnar) within the current area.

Since it cannot be ruled out that unregistered cultural-historical remains exist within the area, the need for an archaeological investigation may become relevant in later stages (development of the detailed plan and/or permit according to the Environmental Code). The proposed plan is, however, not assessed to be affected by the results of an archaeological investigation. The possibility for adaptations is assessed as good.

In connection with the installation of any cooling water pipelines, marine archaeological values may also be affected, which may need to be further investigated. The possibility for adaptations to marine archaeological values is, however, assessed as good.

The proposed plan comprises a facility occupying an area of approximately 35 hectares, as well as building components in the form of chimneys and potential cooling systems that may cause a visual change to the landscape.

Against the background of the area being located adjacent to existing industrial land in Norrsundet, and the fact that the town's cultural-historical values are largely linked to its industrial development, the additional buildings are assessed to be able to be integrated into the existing landscape and industrial environment.

The siting adjacent to an existing industrial environment, combined with the absence of known remains within the area, means that the establishment is assessed to be suitable from a cultural environment perspective.

9. CUMULATIVE EFFECTS

The cumulative effects that could arise due to the impact of the planned activities together with other environmental impacts in the area from other activities are assessed to arise primarily due to traffic to and from the plan area as well as the nearby industrial activities within the Norrsundet industrial area.

The adjacent industrial and port area may cause cumulative noise, emissions to air, and discharges to the recipient in conjunction with the planned activities. Furthermore, cumulative effects may arise regarding risks in the event that the planned biorefinery is realized (see section 8.1.5). If constructed, the biorefinery would comprise the production and storage of green fuels to such an extent that it becomes a Seveso establishment at the higher requirement level. Overall, the activity (if constructed) is assessed to entail an accident risk impact that will need to be considered, among other things based on the fact that two nearby Seveso establishments need to collaborate. It is assessed that conditions exist to manage this situation with various appropriate protective measures, which is why cumulative effects are not assessed to make the siting of the nuclear facility impossible.

Cumulative effects will be investigated further in the next stage.

10. ENVIRONMENTAL IMPACTS OF THE ZERO ALTERNATIVE

The zero alternative entails that the proposed plan is not implemented and that the area continues to be used for forestry. No establishment of the nuclear facilities that the proposed plan intends to enable will then take place. Consequently, both its positive effects, such as the contribution to Sweden's future electricity supply, and negative effects, such as the taking up of land and impact on the surrounding environment, will not occur.

11. OVERALL IMPACT ASSESSMENT

In this section, an overall assessment is made of the proposed plan's compatibility with the general interests specified in Chapters 3 and 4 of the Environmental Code, the impact on environmental quality standards, and the proposed plan's compatibility with other plans, programs, decisions, and other decided goals at local, regional, and national levels. Conclusions regarding preparedness are also raised in this section.

11.1. Alignment with National Interests and Other General Interests

The table below summarizes the assessment of the proposed plan's compatibility with general interests based on the three-level scale specified in section 4, which is also shown below.

Scale	Description
	The plan proposal is assessed as suitable based on the site's conditions and the installation plan's foreseen impact, with no or limited obstacles.
	The plan proposal may entail challenges based on the site's conditions and the installation plan's foreseen impact, but the challenges are assessed to be manageable through certain measures.
	Based on the site's conditions and the installation plan's foreseen impact, there are obstacles that make it unsuitable/difficult to implement the plan proposal.

Yellow marking is used both in cases where an identified challenge is assessed to be resolvable through known technical or planning solutions, and in cases where the full extent of the impact has not yet been clarified, but where it is not assessed that there are obstacles to the establishment based on current knowledge. In the latter case, the issue will be further investigated in subsequent planning and permitting processes, and adaptations and protective measures will be taken if necessary.

Chapter 11.1

General Interest	Description	The Proposed Plan
Taking up of land	Section 2. Large land and water areas that are not at all or only insignificantly affected by development projects or other interventions in the environment shall, as far as possible, be protected against measures that can significantly affect the character of the areas.	Forest land is taken up, but the area is affected by nearby industry and constitutes an extension of an existing activity area. An establishment is assessed as possible based on current knowledge.

General Interest	Description	The Proposed Plan
Ecology and Biological Diversity	Section 3. Land and water areas that are particularly sensitive from an ecological point of view shall, as far as possible, be protected against measures that can damage the natural environment.	No protected areas are affected. Some species occurrence exists and requires further inventory. An establishment is assessed as possible based on current knowledge.
Agriculture and Forestry	Section 4. Agriculture and forestry are of national importance. Arable agricultural land may be taken up for buildings or facilities only if it is necessary to meet essential societal interests and this need cannot be met in a way that is satisfactory from a general point of view by taking up other land. Forest land that is of importance to the forestry industry shall, as far as possible, be protected against measures that can significantly hinder rational forestry.	The area does not include agricultural land. Managed forest land is taken up, but an establishment at the site is not assessed to significantly hinder rational forestry of the forest outside the area.
Reindeer Husbandry, Commercial Fishing, Water Supply	Section 5. Land and water areas that are of importance for reindeer husbandry or commercial fishing or for aquaculture shall, as far as possible, be protected against measures that can significantly hinder the conduct of these industries. Areas that are of national interest (riksintresse) for reindeer husbandry or commercial fishing shall be protected against the measures referred to in the first paragraph.	Reindeer husbandry interests are not relevant in the present case. A national interest for commercial fishing exists near the area and within planned preparedness zones. Potential intake and discharge of cooling water need to consider the impact on fishing. Based on current knowledge, an establishment in the area is assessed to be possible.
Cultural Environment, Outdoor Life/Recreation	Section 6. Land and water areas and the physical environment in general that are of importance from a general point of view due to their natural values or cultural	No known cultural values are affected. The national interest for nature conservation Lindön-Björnön-Iggösundet is not assessed to be at risk of significant damage. If

General Interest	Description	The Proposed Plan
and Natural Environment	values or with regard to outdoor life shall, as far as possible, be protected against measures that can significantly damage the natural or cultural environment. The need for green spaces in urban areas and in the vicinity of urban areas shall be particularly considered. Areas that are of national interest (riksintresse) for nature conservation, cultural environment conservation, or outdoor life shall be protected against the measures referred to in the first paragraph.	the intake of cooling water becomes relevant in the water body S S M Bothnian Sea coastal waters, this will be adapted so that the risk of significant impact on the national interest can be avoided. This will be investigated further during upcoming permitting processes. The proposed plan is assessed to be able to be integrated adjacent to the existing industrial environment, and known recreational values do not occur in the area. An establishment is assessed as possible based on current knowledge.
Valuable Substances or Materials	Section 7. Land and water areas containing valuable substances or materials shall, as far as possible, be protected against measures that can significantly hinder the extraction of these. Areas containing deposits of substances or materials that are of national interest (riksintresse) shall be protected against the measures referred to in the first paragraph.	No known valuable substances or mineral deposits within the plan area are affected.
Other Industrial or Supply Interests	Section 8. Land and water areas that are particularly suitable for facilities for industrial production, energy production, energy distribution, communications, water supply, or waste management shall, as far as possible, be protected against measures that can significantly hinder the creation or utilization of such facilities. Areas that are of national interest (riksintresse) for facilities referred to in the first paragraph shall be protected	National interest for communications (shipping, road, and railway) passes through the outer preparedness zone. Otherwise, no national interests for industrial or supply facilities are affected. The area is located adjacent to existing industry and is assessed to be suitable for the purpose. An establishment is assessed as possible based on current knowledge.

General Interest	Description	The Proposed Plan
	against measures that can significantly hinder the creation or utilization of the facilities.	
Total Defense	Section 9. Land and water areas that are of importance for the total defense shall, as far as possible, be protected against measures that can significantly counteract the interests of the total defense. Areas that are of national interest (riksintresse) because they are needed for total defense facilities shall be protected against measures that can significantly hinder the creation or utilization of the facilities.	No openly disclosed land or water areas of importance for the total defense are affected. The area will become a protected object (skyddsobjekt).
Other Programs, Plans and Decisions	Compatibility of the proposed plan with other applicable plans, programs, or decisions.	The area is not covered by any applicable detailed plan and is not designated in the comprehensive plan (översiktsplan).
Environmental Quality Standards	Overall assessment of the proposed plan's impact on environmental quality standards.	The sediments off the coast along the Norrsundet industrial area are affected by pollutants from previous industry. The routing of any cooling water pipelines needs to be carried out in an adapted manner so that decided environmental quality standards (miljökvalitetsnormer) are not at risk of being deteriorated.

11.2. Alignment with the Global Goals for Sustainable Development

In September 2015, the UN General Assembly decided on 17 Global Goals for Sustainable Development, Agenda 2030. Agenda 2030 also includes 169 targets.

The Global Goals assessed as relevant for the present plan for the nuclear facility are as follows:

Goal 7 – Affordable and Clean Energy

"Ensure access to affordable, reliable, sustainable and modern energy for all"

The proposed plan aims to enable fossil-free electricity production, which can contribute to

increased access to a sustainable and reliable energy supply. The establishment is assessed to be compatible with Goal 7.

Goal 9 – Industry, Innovation and Infrastructure

"Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation"

The proposed plan enables the development of new technology in connection with existing infrastructure. This contributes to resource-efficient and long-term sustainable industrialization. The measure is assessed to be compatible with Goal 9.

Goal 11 – Sustainable Cities and Communities

"Make cities and human settlements inclusive, safe, resilient and sustainable"

The proposed plan enables development in connection with the Norrsundet industrial area, which contributes to consolidated and efficient land use. The measure is assessed to be compatible with Goal 11.

Goal 13 – Climate Action

"Take urgent action to combat climate change and its impacts"

The proposed plan enables fossil-free energy production and thereby contributes to reduced climate emissions. The measure is assessed to be compatible with Goal 13.

Goal 14 – Life Below Water

"Conserve and sustainably use the oceans, seas and marine resources for sustainable development"

The proposed plan entails water intake and discharge that may affect marine environments. The routing of planned cooling water pipelines will need to be adapted so that decided environmental quality standards (miljökvalitetsnormer) are not at risk of being deteriorated.

Goal 15 – Life on Land

"Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss"

The proposed plan entails the taking up of land (ianspråktagande) of natural land and may affect certain habitats linked to the site, which will be further investigated. However, based on current knowledge, the establishment is assessed to be in line with Goal 15.

11.3. Alignment with Sweden's Environmental Objectives

The Parliament (Riksdagen) has decided on 16 national environmental quality objectives that describe the condition to be achieved from a generational perspective. For the plan for the nuclear facility, a number of the national environmental quality objectives have been assessed as relevant to evaluate, see Table 11-1.

Table 11-1

Environmental Objective	Impact of the Installation Plan on Goal Achievement
Limited Climate Impact	The proposed plan enables fossil-free electricity production, which contributes to reduced greenhouse gas emissions. The proposed plan is assessed to contribute positively to goal achievement.

Environmental Objective	Impact of the Installation Plan on Goal Achievement
Safe Radiation Environment	The rules and requirements imposed on nuclear facilities shall be complied with.
Good Quality Groundwater	The overview soil environment investigation performed shows low pollutant levels in the groundwater. In connection with the construction of the facility, groundwater will need to be drained and, if necessary, treated.
Balanced Seas, and Living Coasts and Archipelagoes	The proposed plan entails potential water intake and discharge of heated cooling water that may affect the water environment in the immediate area. The installation of any cooling water pipelines needs to be adapted so that decided environmental quality standards (miljökvalitetsnormer) are not at risk of being deteriorated.
Living Forests	The proposed plan entails the taking up of land (ianspråktagande) of forest land, which results in a local impact.
A Rich Agricultural Landscape	The proposed plan does not entail the taking up of agricultural land.
Good Built Environment	The proposed plan enables development in connection with the Norrsundet industrial area, which contributes to efficient land use. The nearest residential building is located approximately 1 kilometer south of the plan area. The proposed plan is assessed to be compatible with the goal.
Rich Plant and Animal Life	The proposed plan may affect the natural environment and species. Further inventories are required, but based on current knowledge of the area's character, the proposed plan is not assessed to cause any significant negative impact on the natural environment.

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