Environmental Impact Assessment (EIA) of the Facility Plan for a Nuclear Installation, Valdemarsvik

Translated excerpts

Important Information

The original document on which this text is based was written in Swedish. The translation has been carried out using AI tools.

Table of contents

NON-TECHNICAL SUMMARY **4**

7. SIGNIFICANT ENVIRONMENTAL ASPECTS **6**

7.1 Built Environment, Cultural Environment, and Landscape Character 6

7.1.1 Assessment Criteria, Indicators, Requirements, and Guidelines 6

7.1.2 Methodology and Uncertainties 7

7.1.3 Current Situation 8

7.1.4 Impact, Effects, and Consequences 12

7.1.5 Assessment of the Zero Alternative 17

7.1.6 Proposed Measures 18

7.2 Natural Environment 18

7.2.1 Assessment Criteria, Indicators, Requirements, and Guidelines 19

7.2.2 Methodology and Uncertainties 19

7.2.3 Current Situation 20

7.2.4 Impact, Effects, and Consequences 27

7.2.5 Assessment of the Zero Alternative 30

7.2.6 Proposed Measures 30

7.3 Health and Living Environment 31

7.3.1 Assessment Criteria, Indicators, Requirements, and Guidelines 31

7.3.2 Methodology and Uncertainties 32

7.3.3 Current Situation 33

7.3.4 Impact, Effects, and Consequences 34

7.3.5 Assessment of the Zero Alternative 38

7.3.6 Proposed Measures 38

7.4 Climate Impact 38

7.4.1 Assessment Criteria, Indicators, Requirements, and Guidelines 39

7.4.2 Methodology and Uncertainty 39

7.4.3 Current Situation 40

7.4.4 Impact, Effects, and Consequences 40

7.4.5 Assessment of the Zero Alternative 42

7.4.6 Proposed Measures 42
7.5 Climate Adaptation 43
7.5.1 Assessment Criteria 43
7.5.2 Methodology and uncertainty 43
7.5.3 Current situation 44
7.5.4 Impact, effect, and consequence 46
7.5.5 Assessment of the zero alternative 48
7.5.6 Proposals for measures 49
7.6 Water environment 49
7.6.1 Assessment criteria 50
7.6.2 Methodology and uncertainties 52
7.6.3 Current situation 52
7.6.4 Impact, Effect, and Consequence 53
7.6.5 Assessment of the Zero Alternative 56
7.6.6 Proposals for Measures 57
7.7 Resource Management and Energy 57
7.7.1 Assessment Criteria 58
7.7.2 Methodology and Uncertainties 58
7.7.3 Current Situation 59
7.7.4 Impact, Effect, and Consequence 61
7.7.5 Assessment of the Zero Alternative 64
7.7.6 Proposals for Measures 65
7.8 Risk and Safety 65
7.8.1 Assessment Criteria 66
7.8.2 Methodology and Uncertainties 67
7.8.3 Current Situation 68
7.8.4 Impact, Effect, and Consequence 68
7.8.5 Assessment of the Zero Alternative 72
7.8.6 Proposals for Measures 72

Non-Technical Summary

The County Administrative Board of Östergötland (*Länsstyrelsen i Östergötlands län*) has, on behalf of the Swedish Government, developed a facility plan (*anläggningsplan*) for the establishment of new nuclear power in Valdemarsvik. The plan covers two geographically separate areas: the northern and southern plan areas. The southern plan area is connected to the coast, enabling functions that require proximity to water, such as cooling water facilities and a port. The northern plan area is located further from the shoreline, resulting in less intrusion into the coastal environment, but it does not include a port within the plan area. The plan outlines overarching conditions for further planning but does not determine the final localisation, scope, or technical design of the nuclear power plant.

This Environmental Impact Assessment (*miljökonsekvensbeskrivning*, MKB) has been prepared within the framework of the strategic environmental assessment (*strategisk miljöbedömning*) of the facility plan. The purpose is to integrate environmental aspects into the planning process and to identify, describe, and assess the significant environmental impacts that implementing the plan may entail. The assessments are based on the plan's overarching level and the time horizons of 2050 and 2100. Since the precise design of the facility is not yet known, several consequences are presented as possible risks or ranges of impacts. More detailed assessments will be required in subsequent site selection, planning, and permit processes.

The MKB compares the plan proposal with a zero alternative (*nollalternativ*), which describes the area's likely development if the facility plan is not implemented. The zero alternative means that the land and water areas will not be taken into use for the nuclear power establishment enabled by the plan. Existing land and water uses can then largely continue, while the area will also remain affected by, among other things, other planning, changes within the framework of current land use, and climate change.

Implementation of the plan may lead to extensive changes in the land and water environments. The most significant negative environmental effects are assessed to potentially impact:

- Natural environments,
- Aquatic environments,
- Landscape,
- Cultural environments, and
- The management of land, water, and natural resources.

Within and adjacent to the plan areas, there are natural values and ecological connections that may be affected through land use (*markanspråk*), fragmentation, disturbances, and altered hydrology. In coastal and aquatic environments, facilities for cooling water and ports may cause physical impacts on seabeds and shoreline environments, as well as changes in temperature, flow, and habitat conditions. The impact on the aquatic environment needs to be assessed specifically in relation to the environmental quality standards for water (*miljökvalitetsnormer för vatten*).

The establishment may also entail the taking into use of forest and agricultural land, as well as other natural resources. Large building volumes, technical installations, pipelines, and new transport infrastructure may alter the landscape and impact cultural environment values, as well as the conditions for recreation (*friluftsliv*). The construction phase may involve noise, emissions to air and water, extensive mass handling, and increased transport. Additionally, risks related to climate change, flooding, extreme weather events, and accidents need to be considered in the continued planning. Nuclear safety, radiation protection, and the management of nuclear fuel will primarily be examined in subsequent processes under the Environmental Code (*miljöbalken*) and nuclear technology legislation.

At the same time, the plan creates conditions for new fossil-free electricity production and can thereby contribute to the energy and climate transition and a strengthened power supply. However, the potential climate benefits need to be weighed against emissions and the loss of carbon sinks during the facility's lifecycle, as well as against the local and regional environmental consequences that the establishment may entail.

The MKB's overall assessment is that the facility plan enables an activity that can result in significant environmental impacts, primarily due to the facility's extensive land and water use and its effects on areas with high environmental values. The final level of impact will largely depend on the localisation, technical design, and the protective measures implemented. In further planning, special emphasis must be placed on avoiding the most sensitive environments, limiting land and water use, maintaining ecological connections, and investigating cooling water management, port facilities, transport, and cumulative effects. The plan's environmental impacts and identified uncertainties need to be followed up and progressively refined in upcoming planning and permit stages.

7. Significant Environmental Aspects

7.1 Built Environment, Cultural Environment, and Landscape Character

The cultural environment consists of environments shaped by humans over time, thus bearing witness to historical and geographical contexts. This may include anything from individual objects to large landscape sections. Temporally, cultural environments can range from prehistoric remains to today's built environments.

The cultural environment is an important part of our cultural heritage, which we consciously or unconsciously convey in the form of traditions, ideas, and values between generations. The cultural heritage contributes to a stimulating living environment and is an important resource for recreation, outdoor activities, tourism, and the visitor industry.

To ensure that cultural environment values endure, it is important that continuity in the environment is maintained, for example by ensuring that the origins of cultural environments remain clear and that connections between different periods are preserved.

Landscape character is the visual experience of a landscape, based on human interpretation of the landscape's physical conditions. Landscape character is strongly linked to both current and historical land use, as well as natural geographical conditions in the form of natural habitats, topography, and soil properties. Landscape character can be seen as a summary of all components in the landscape, both physical and perceived.

7.1.1 Assessment Criteria, Indicators, Requirements, and Guidelines

The assessment criteria for cultural environment, landscape, and the built environment are based on (Note: Preposition "från" in Swedish can correspond to either "from" or "under" in English; "on" aligns better with the sense of "guided by" the policy objectives) the cultural policy objectives for the cultural heritage, as well as provisions in the Cultural Environment Act (kulturmiljölagen), the Environmental Code (miljöbalken), and the Planning and Building Act (plan- och bygglagen).

Cultural environment values include both individual buildings, ancient remains (fornlämningar), and other cultural-historical objects, as well as larger cultural-historical contexts and landscapes where historical connections remain legible. Under the Environmental Code, areas of significance from a general perspective due to their cultural heritage values shall be protected against measures that may cause considerable harm. For areas classified as national interests (riksintresse) for cultural environment conservation, the legibility of the cultural environment is an important assessment criterion.

The character and experience of the landscape are influenced by its structure, scale, and diversity. Changes in land use or built structures can affect landscape spaces (landskapsrum), important views, and historical connections, and may alter how the landscape's form, function, and development can be interpreted. New elements may also introduce new landmarks and reinforce or alter the landscape's character.

Under the Planning and Building Act, planning shall take into account cultural heritage values, as well as urban and landscape character. Specifically designated historical, cultural-historical, environmental, and artistic values shall be protected, and existing character-defining features preserved. The assessment therefore focuses on how the proposed plan affects cultural-historical values, landscape character and legibility, and the distinctive features and identity of the built environment.

7.1.2 Methodology and Uncertainties

No cultural environment or landscape investigation has been carried out as a basis for the facility plan (*anläggningsplan*). The description of the current situation and the assessment of the plan's consequences are therefore based on existing available data from open sources, descriptions of national interests (*riksintresse*), a viewshed analysis (*vyanalys*) developed for the proposed plan (*planförslaget*), and a cultural environment programme (*kulturmiljöprogram*).

The absence of field inventories and in-depth analysis introduces uncertainty regarding the area's cultural environment values, landscape character, and visual relationships. The assessments should therefore be regarded as strategic and need (*or "should"*) to be supplemented by further investigations in subsequent planning stages.

A viewshed analysis has been conducted to visualize the facility's visibility in the landscape. The analysis is based on a maximum facility height of 30 metres and an elevation above sea level of five metres; see Appendix 1. Twelve viewpoints (*vypunkter*) were analysed (see Figure 9). This is a preliminary estimate that will be adjusted during the work on the proposed plan.



Figure 8. Viewpoints used in the analysis (*Vypunkter använda i analysen*). (Appendix 1)

The County Administrative Board of Östergötland (*Länsstyrelsen för Östergötland*) has a cultural environment programme that was drawn up in 1983. Since the data is relatively old, there is a risk that the values described may have changed. Further investigations are therefore needed in subsequent planning stages.

7.1.3 Current Situation

The planned areas (*planområdena*) are located within the national interest (*riksintresse*) for unbroken coastline (*obruten kust*) for Östergötland's coastal and archipelago areas (see Figure 9), and in the surroundings there are three national interests (*riksintresse*) for cultural environment conservation: Fågelvik [E75], Gryt Archipelago [E77-82], and Björkskär [E76] (see Figure 10; Swedish National Heritage Board (*Riksantikvarieämbetet*), 2016). There is no landscape character protection (*landskapsbildsskydd*) in or near the planned areas.

The landscape around the planned areas is characterised by archipelago and agricultural land. In the vicinity of the planned areas, there are cultural environments that have been identified in the County Administrative Board's cultural environment programme.

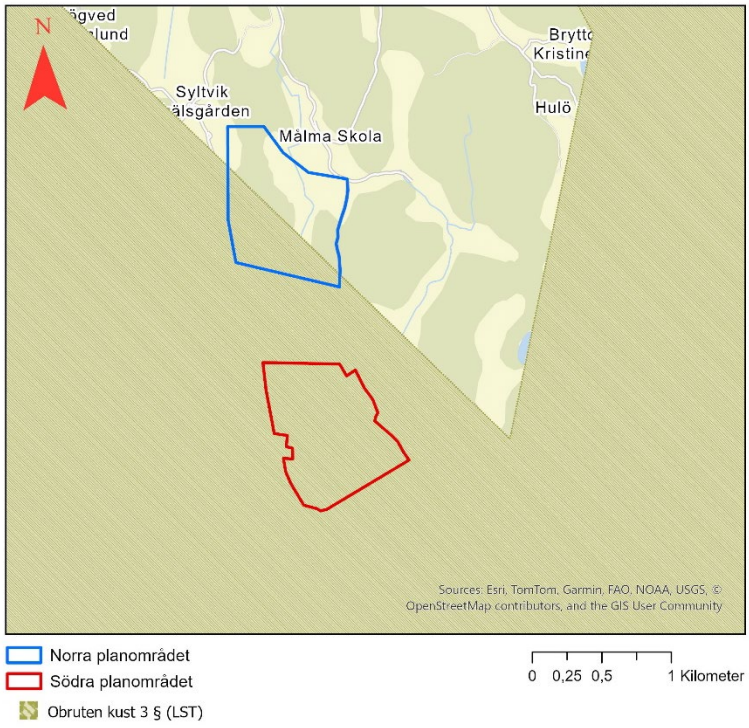


Figure 9. National interest (*riksintresse*) for unbroken coastline (*Obruten kust*): Östergötland's coastal and archipelago areas, and the planned areas (*planområdena*).

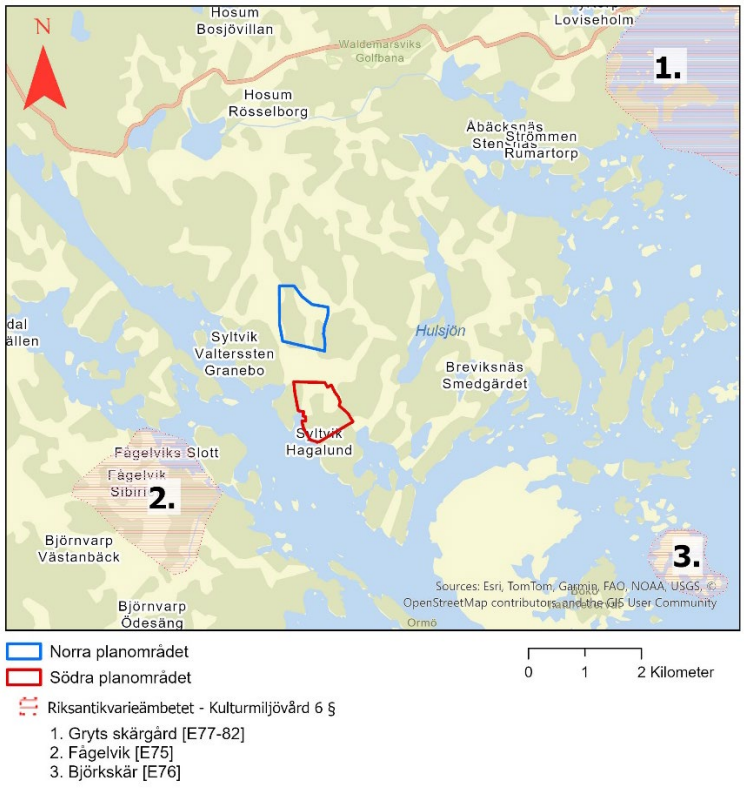


Figure 10. National interest (*riksintresse*) for cultural environment.

The values within the national interest for unbroken coastline are linked to the area's natural and cultural heritage values. These values shall not be considerably harmed. Within the area, the interests of tourism and outdoor recreation, particularly mobile outdoor recreation (*det rörliga friluftslivet*), shall be particularly considered in the assessment of the permissibility of exploitation projects or other interventions in the environment.

According to an amendment to the law that entered into force on 15 July 2026, it is now possible to assess sites for nuclear facilities (*kärnteknisk anläggning*) within, among other areas, the region between Simpevarp and Arkösund. The planned areas are located within this region.

The national interest Fågelvik [E75] (see Figure 10) constitutes a national interest for cultural environment conservation (*riksintresse för kulturmiljövården*) and comprises a culturally and historically valuable manor environment, forming a prominent feature in the coastal landscape on the southern shore of Valdemarsviken. The northern planned area is located approximately 3 kilometres from the national interest, and the southern approximately 2 kilometres away.

The values of the national interest include, among other things, the medieval castle ruin in Fågelvik and the manor complex from the late 18th century, with associated outbuildings. The manor is also designated a listed building (*byggnadsminne*) by the County Administrative Board (*Länsstyrelsen*). The manor environment is situated on the opposite side of Valdemarsviken relative to the area where the planned nuclear facility is intended to be located.

The national interest Björkskär [E76] is an island in the outer archipelago, located just north of the inlet to Valdemarsviken (see Figure 10). Björkskär lies approximately 6 kilometres from the southern planned area and approximately 8 kilometres from the northern planned area. The national interest comprises a well-preserved fishing village with clustered settlement from the 18th and 19th centuries, including, among other structures, ridge-roofed cottages (*ryggåsstugor*), loft stores (*loftbod*), and boathouses (*sjöbodar*) (Valdemarsvik Municipality, 2018). Björkskär is one of the oldest known fishing villages in the archipelago and reflects the historical importance of fishing and archipelago industries in the area (Valdemarsvik Municipality, n.d.). The cultural environment constitutes a valuable element in the archipelago landscape.

Gryt Archipelago forms a larger, contiguous coastal and archipelago environment that constitutes a national interest for cultural environment conservation (*riksintresse för kulturmiljövården*) (Gryt

Archipelago [E77-82]; see Figure 10). The national interest is located approximately 8 kilometres from the northern planned area and approximately 9 kilometres from the southern planned area. The values of the national interest lie in a long continuity of settlement, fishing, maritime trade, and other activities associated with the coastal landscape, where the distinctive archipelago culture remains clearly legible in the landscape. The area includes, among other things, older fishing villages, archipelago hamlets, pilot and lighthouse environments, port facilities, remains of mining operations, and ancient remains (*fornlämningar*) from various time periods, as well as a well-preserved coastal cultural landscape. The area reflects the longstanding importance of fishing, maritime trade, and settlement in Östergötland's archipelago.

The village of Stora Syltvik and its surrounding cultivated landscape are included in the regional cultural environment programme (*regionalt kulturmiljöprogram*; County Administrative Board of Östergötland, Planning Department, 1983). The village lies along the western and northern borders of the northern planned area. Stora Syltvik is a well-preserved village of wooden houses. Breviksnäs and Högved are two other villages designated as cultural environments in the regional cultural environment programme. These locations lie a few kilometres away from the planned areas. For both villages, the design of the buildings is described. In Högved, the surrounding cultivated landscape is also described as part of the cultural environment.

Within both planned areas, the landscape varies between forest, open agricultural areas, and coastal landscape. The landscape is hilly, with farmland lying in the valleys and forest covering the heights. In the agricultural areas, there are field islands (*åkerholmar*), which contribute to the spatiality of the landscape. In the northern planned area, the landscape is characterised by forest and agriculture. In the southern planned area, in addition to an agricultural and forested landscape, there is a shoreline environment along Valdemarsviken.

The landscape within both planned areas forms part of the contiguous coastal landscape around Valdemarsviken, where the interplay between water, forested highlands, and cultivated land creates long vistas and visual connections over large distances. The water space (*vattenrummet*) in particular is significant for the landscape experience, as it enables views between different parts of the coastal and archipelago landscape.

The landscape's character is currently shaped by natural, agricultural, and archipelago environments. No registered ancient remains have been identified within the planned areas. However, there is one possible ancient remain, L2009:7509. Further investigations are needed to determine the status of the remain. The remain is described as a former

crofter's cottage (*backstuga*), where the visible trace of the remain likely consists of a hearth rubble mound (*spismursröse*) (*Note: Tentative translation; specific Swedish term retained in parentheses as below*). As several ancient remains, mainly stone settings (*stensättningar*), have been registered in the vicinity, the presence of additional unknown ancient remains within the planned areas cannot be ruled out (*kan inte uteslutas*). (Swedish National Heritage Board, 2026)

Within the two planned areas, there are no buildings. However, there are 14 adjoining properties (*angränsande fastigheter*) with buildings in close proximity (National Land Survey of Sweden (*Lantmäteriet*), 2026). Table 1 lists the properties. There are also more properties in the vicinity. Whether these properties are used as permanent residences or holiday homes needs further investigation.

Table 1. Property designations (*fastighetsbeteckning*) for properties with buildings in the vicinity of the two planned areas.

Area	Property designation
Northern planned area	• Målma 4:9 (2)
	• Målma 4:12
	• Lilla Målma 4:11
Southern planned area	• Målma 4:9 (2)
	• Syltvik 11:3
	• Syltvik 11:13
	• Syltvik 11:14
	• Syltvik 11:15
	• Syltvik 11:18

7.1.4 Impact, Effects, and Consequences

Northern Planned Area

As no cultural environment and landscape character investigation (*kulturmiljö- och landskapsbildsutredning*) has been carried out for the planned areas, it is uncertain which values exist in and around the planned areas today. The nuclear facility (*kärnteknisk anläggning*) and its

environmental impacts, as well as associated infrastructure, will entail a major transformation of the landscape and the qualities related to outdoor recreation. An agricultural and archipelago environment will be converted into industrial land. This will significantly affect the national interest for unbroken coastline (*riksintresse obruten kust*). However, pursuant to the legislative amendment that entered into force in 2026, it shall be possible to assess the feasibility of a nuclear facility within this national interest.

Depending on the final design of the facility, the northern planned area may become visible from the national interest for cultural environment conservation (*riksintresse för kulturmiljövården*) Fågelvik [E75]. The tallest buildings in the planned area are expected to be approximately 20–30 metres high, but the ground will also need to be raised. Based on the viewshed analysis (*vyanalys*, Appendix 1), the facility will not be visible from any of the analysed viewpoints. This suggests that the facility is unlikely to be perceived from the national interest. However, light from the planned area may be visible. The value-bearing objects, such as the manor environment and the castle ruin, will not be directly affected, and the understanding of the national interest's cultural-historical development is assessed to remain intact. Any potential impact is primarily assessed to concern the experience of landscape continuity and the visual connections within the national interest. Given the distance, the screening vegetation, and the fact that the impact depends on the facility's design, the impact on the national interest's cultural environment values is assessed to be minor.

The establishment of a nuclear facility in the planned area is likely to have a minor to negligible impact on the national interests for cultural environment conservation Björkskär [E76] and Gryt Archipelago [E77-82]. The values of these national interests are primarily linked to the historical archipelago culture and its long-standing connection to fishing, maritime activities, and settlement. These values are legible in well-preserved fishing villages, older built environments, ancient remains (*fornlämningar*), and the coastal cultural landscape, which collectively narrate the archipelago's historical development and use. According to the viewshed analysis, the facility's buildings will not be visible. However, illumination of the night sky may render the facility visible from the national interests, which could result in some impact. Such an assessment should be conducted in subsequent planning phases in order to implement appropriate measures to avoid affecting the national interests.

The nuclear facility is assessed to have a major impact on landscape character and landscape continuity. The establishment will also negatively affect the village of Stora Syltvik and its associated

agricultural landscape. Through felling, excavation, filling, and surfacing, the area will be transformed from a nature-dominated coastal landscape into an environment characterised by large-scale technical structures. In addition to the building volumes, security fencing, technical installations, service buildings, and other associated infrastructure, such as power lines, will contribute to giving the area a distinctly industrial character. The absence of vegetation within the security area may also enhance the facility's visual presence in the landscape. The facility will constitute a new and visually prominent element that affects both nearby landscape spaces (*landskapsrum*) and long-distance vistas. As a result, the experience of the landscape's natural and cultural environment values will be reduced. Measures will be required to mitigate the impact.

The environments of Breviksnäs and Högved may be visually affected by the facility, depending on how much the facility rises above the horizon and how illuminated it is at night. Additionally, Breviksnäs and Högved may be affected by increased traffic in the area. However, the buildings in the villages described in the cultural environment programme (*kulturmiljöprogrammet*) are unlikely to be affected by the establishment of the nuclear facility.

Given that registered ancient remains exist in the vicinity and that the area has not undergone an archaeological investigation, the presence of currently unknown ancient remains cannot be ruled out. Extensive earthworks therefore pose a risk of impacting hitherto unknown cultural-historical remains (*lämningar*). An archaeological and a maritime archaeological investigation will be required in subsequent planning phases.

Depending on the facility's design, adjoining properties will be affected to varying degrees, with the greatest impact assessed for those properties located closest to the planned area. The facility will introduce a new large-scale, fenced, and illuminated element into the landscape, representing a clear change from the current conditions. Even properties at greater distances may be affected by altered vistas and landscape experiences. Illumination of buildings, roads, and security systems may also render the facility perceptible over greater distances, which may be particularly noticeable in the currently relatively dark coastal and archipelago landscape.

The effects of the nuclear facility will result in a markedly altered landscape where a large-scale establishment will dominate instead of the agricultural and coastal landscape. Despite mitigation measures, the facility's dominance will likely remain perceptible (*påtaglig*) in the landscape. This will affect nearby properties and the cultural environment around Stora Syltvik. Light from the facility also risks being visible from within the national interests Fågelvik [E75], Björkskär [E76],

and Gryt Archipelago [E77-82]. Adjustments to the height of buildings, as well as an architecture and design adapted to the surrounding landscape, could mitigate the facility's impact. Without an archaeological investigation, there is a risk that unknown ancient remains may be impacted or destroyed. Overall, the proposed plan for the northern planned area is assessed to entail moderately negative consequences for the cultural environment and landscape character.

Southern Planned Area

The southern planned area will result in a more visible facility, as it will be located adjacent to the shoreline, opposite the national interest for cultural environment conservation Fågelvik [E75]. From the viewpoints (*vypunkter*) at Kroksö, Arnö, and Stora Granholmen, the planned area with its buildings will be visible (see Figure 11, Figure 12, and Figure 13). The facility will introduce visual impact by introducing a modern and large-scale element into the landscape, which may reduce the experience of the historical character and legibility of the manor and archipelago environment. This will also reduce the legibility and experience of the national interest's cultural-historical context, even though the physical value-bearing objects will not be directly impacted. Measures related to design in terms of materials, colours, height, and screening may be necessary to mitigate the impact. Further investigation will be required to fully understand the impact on the national interest.



Figure 11. Viewpoint from Kroksö. (Appendix 1)



Figure 12. Viewpoint from Arnö. (Appendix 1)



Figure 13. Viewpoint from Stora Granholmen. (Appendix 1)

The establishment of a nuclear facility in the planned area is likely to have the same impact on the national interests Björkskär [E76] and Gryt Archipelago [E77-82] as the northern planned area.

The nuclear facility will have a major impact on landscape character and landscape continuity. Similar to the northern planned area, the facility will introduce a new large-scale and technical element, altering the landscape's character and affecting the experience of natural and cultural environment values. However, the facility will be located further

away from the village of Stora Syltvik, which may mean that the experience of the agricultural landscape remains somewhat intact. Measures will be required to mitigate the impact.

For the villages of Breviksnäs and Högved, the impact is assessed to be the same as for the northern planned area.

The southern planned area will impact the coastal stretch with a large-scale technical element that disrupts the archipelago environment. Unlike the northern alternative, the facility will be more exposed to the water space (*vattenrummet*) and may thus be visible from more viewpoints, water areas, and shipping routes. This means that the area of influence on the landscape character will be larger, and the facility will have a more pronounced impact on the experience of the coastal landscape around Valdemarsviken.

As with the northern planned area, an archaeological investigation and a maritime archaeological investigation will be required in subsequent planning phases, since it **cannot be ruled out* that ancient remains may exist within the area.

Similarly to the northern planned area, properties near the planned area will be affected by the introduction of a new large-scale, fenced, and illuminated element into the landscape. The impact is assessed to be greatest for nearby properties but may also be noticeable at greater distances.

The effects of the nuclear facility will result in a markedly altered landscape where a large-scale establishment will dominate instead of the agricultural and coastal landscape. Despite mitigation measures, the facility's dominance will likely remain perceptible in the landscape, affecting properties in the vicinity. The facility also risks being visible from within the national interest Fågelvik [E75]. Several measures may be needed in relation to design. The facility may also become visible from within the other two national interests, Björkskär [E76] and Gryt Archipelago [E77-82]. Adjustments to building heights and an architecture and design adapted to the surrounding landscape could mitigate the facility's impact. Without an archaeological investigation, there is a risk that unknown ancient remains may be impacted or destroyed. Overall, the proposed plan for the southern planned area is assessed to entail moderate to major negative consequences for the cultural environment and landscape character.

7.1.5 Assessment of the Zero Alternative

No changes to the landscape are expected in the zero alternative (*nollalternativet*). As a result, the values related to landscape character and cultural environment within the planned areas will be preserved.

No impact on national interests for cultural environment conservation (*riksintressen för kulturmiljövård*) will occur.
Any potential ancient remains (*fornlämningar*) will remain, and the risk of damage will not arise in the zero alternative.
Properties in the vicinity will remain unaffected.
Overall, the zero alternative is assessed not to entail any consequences for the cultural environment and landscape character.

7.1.6 Proposed Measures

- Buildings within the planned areas should be kept sufficiently low to minimise the visibility of the facility from within national interests for cultural environment conservation.
- To limit the impact on landscape character and cultural environment values, design guidelines should be applied when shaping the facility. Buildings and building components exposed to open landscape spaces (*landskapsrum*) and national interests (*riksintressen*) should be designed with adapted colour schemes and materials to reduce their visual prominence. Lighting should be designed and screened to limit light dispersion and minimise the impact on the surrounding landscape and cultural environments.
- An archaeological and maritime archaeological investigation should be conducted.
- A cultural environment and landscape character investigation should be carried out to examine, among other things, the impact on national interests.
- The plan description (*planbeskrivningen*) may be usefully supplemented with a consolidated account of the investigations, analyses, and background documents that need to be produced during the continued planning process. Such requirements are described in several different parts of the proposed plan, but a compiled list would provide clearer guidance for further planning and offer a better overview of the investigative efforts required in later stages.

7.2 Natural Environment

The natural environment is a broad and multifaceted concept. The values of the natural environment consist of both entire habitat types—natural as well as those shaped by human activity—and individual plant and animal species. The protection and conservation of natural environments is a prerequisite for preserving biological diversity and, by extension, all biological life, as well as the functions and processes essential for ecosystems and habitats to endure and evolve. Biodiversity enhances the resilience of ecosystems and their ability to adapt to

changes.

Green infrastructure can be briefly described as networks of nature. The concept refers to natural structures, species, and processes that are necessary for animals, plants, and fungi to persist in the future. Robust ecosystems are a prerequisite for the services and products—the so-called ecosystem services—that nature provides.

7.2.1 Assessment Criteria, Indicators, Requirements, and Guidelines

The assessment criteria for the natural environment are based on the Planning and Building Act (*plan- och bygglagen*), the Environmental Code (*miljöbalken*), and the Species Protection Ordinance (*artskyddsförordningen*). The Planning and Building Act stipulates that consideration shall be given to natural values in planning. According to Chapter 3, Section 6 of the Environmental Code, land and water areas that are of significance from a general perspective due to their natural values shall, to the greatest extent possible, be protected against measures that could cause considerable harm. The assessment also considers the impact on biodiversity, ecological relationships, and green infrastructure.

Natura 2000 is the EU network of protected natural areas, aiming to preserve biodiversity by ensuring a favourable conservation status for protected species and habitats. Projects that may significantly affect a Natura 2000 area are subject to special provisions under the Environmental Code.

The Species Protection Ordinance (2007:845), most recently amended by (2026:1504), contains provisions on the protection of protected species and species covered by the EU's Birds Directive and Habitats Directive. The assessment therefore includes the impact on protected species and their habitats, breeding areas, and ecological functions.

7.2.2 Methodology and Uncertainties

No environmental investigations or species inventories have been conducted for the two planned areas. The description of the current situation and the assessment of the plan's consequences, effects, and impacts are therefore based on existing available data from open sources, government reports, and other available material. The absence of field inventories and in-depth analysis introduces uncertainty regarding the area's natural environment values, local conditions, and the impact on regional ecological relationships. The assessments should therefore be regarded as strategic and should be supplemented with investigations and inventories in subsequent stages.

7.2.3 Current Situation

The planned area is located in the coastal part of Valdemarsvik Municipality, within a landscape that includes forest, arable land, and agricultural land, as well as proximity to the archipelago of the Baltic Sea. The forest environments are dominated by coniferous forest, while the open areas consist of cultivated farmland and pasture. The combination of forest and agricultural landscapes creates conditions for a varied natural environment and contributes to the area's biodiversity.

The coastal and archipelago environments are described in the municipality's comprehensive plan (2018) as unique from a national perspective, hosting a wide range of natural environments, as well as several rare and threatened species. The shallow sea bays are highlighted as biologically valuable environments and important parts of the Baltic Sea ecosystem.

Within and in connection with the planned areas, identified natural values exist in the form of, among other things, key habitats (*nyckelbiotoper*), habitat protection areas (*biotopskyddsområden*), and areas with documented natural values (see Figure 15). The forest and agricultural lands of the planned areas may serve as habitats that could be significant as dispersal corridors and habitats for protected and valuable species. A few hundred metres northeast of the northern planned area, there is also an area covered by a nature conservation agreement (*naturvårdsavtal*) with the Swedish Forest Agency (*Skogsstyrelsen*).

Within or adjacent to the northern planned area, registered occurrences of the red-listed species *Scorzonera humilis* (viper's grass), *Helianthemum nummularium* (common rockrose), *Polygala vulgaris* (common milkwort), which are found in natural grasslands, and *Lathyrus heterophyllus* (Whippoor-will pea), which is a forest-edge and woodland plant in southern Sweden, have been recorded. All species are classified as NT (Near Threatened) according to the 2025 Red List (SLU Swedish Species Information Centre, 2026). Within the area, there are also registered occurrences of *Phellinus pini* (pine fire fungus), an indicator species associated with older pine environments and the presence of old pines (SLU Swedish Species Information Centre, 2026). Near the planned area, observations of the house martin (*Delichon urbicum*) have also been made, suggesting that the area is used by the species. The house martin is listed as Vulnerable (VU) on the Swedish 2025 Red List (SLU Swedish Species Information Centre, 2026).

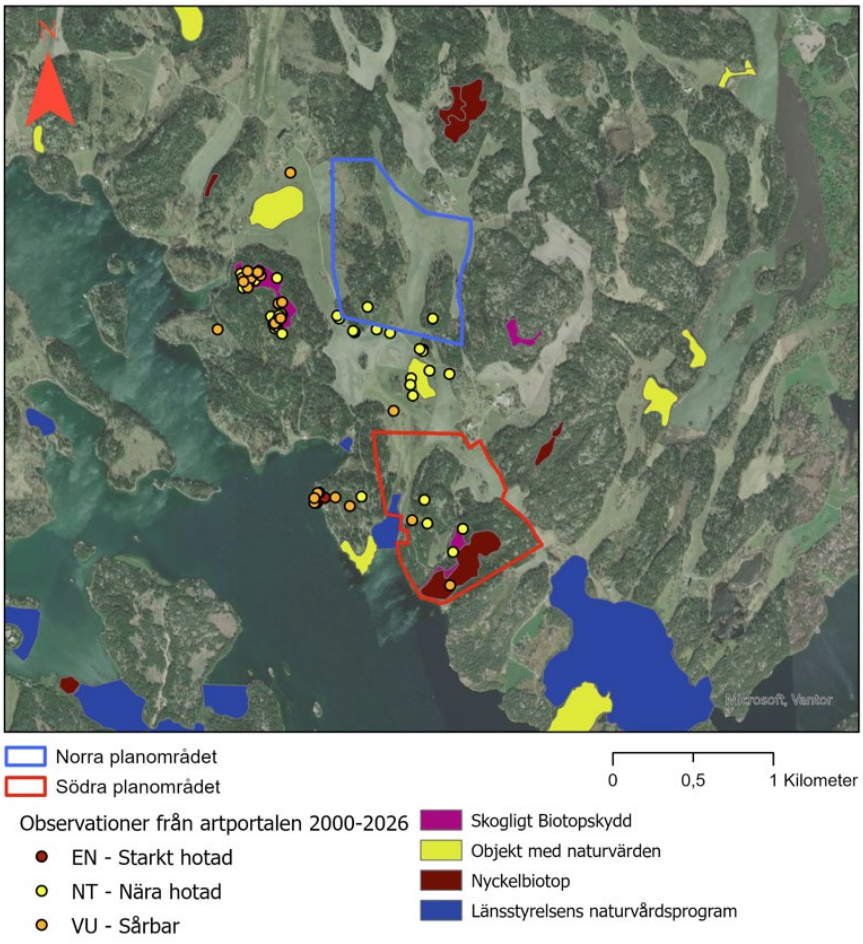


Figure 15. Habitat protection area adjacent to the planned area. The northern planned area is shown in blue; the southern planned area is shown in red.

The southern planned area consists of more than half of a forested habitat protection area (*skogligt biotopskyddsområde*) in the form of mature, natural forest-like pine forest, with a total area of 9.4 hectares. Within the planned area and surrounding regions, several observations of the adder (*hasselsnok*) have been recorded. This species is protected under the EU Habitats Directive and is also protected in Sweden. Its occurrence indicates that the area may constitute a habitat for the species (SLU Swedish Species Information Centre, 2026).

The area also borders the northern shore of Valdemarsviken. Along the coastal stretch within the planned area, there are core values, value networks, and value tracts (*värdekärnor*, *värdenätverk och värdetrakter*) for bladderwrack (*blåstång*), tall vascular plants, and pine (County Administrative Board of Östergötland, 2025) (see Figure 16, Figure 17, Figure 18). These core values have been identified in the work on the Regional Action Plan for Green Infrastructure (*regionala handlingsplanen*

för grön infrastruktur) and constitute areas with particularly high natural values linked to certain habitat types. They serve as crucial habitats for many species and are of significant importance for biodiversity in the landscape (County Administrative Board of Östergötland, 2025). Bladderwrack is a structure-forming species that creates habitats for many other species. Bladderwrack communities have therefore been identified as one of the particularly valuable marine habitat types analysed in the work on marine green infrastructure in Östergötland (County Administrative Board of Östergötland, 2025).

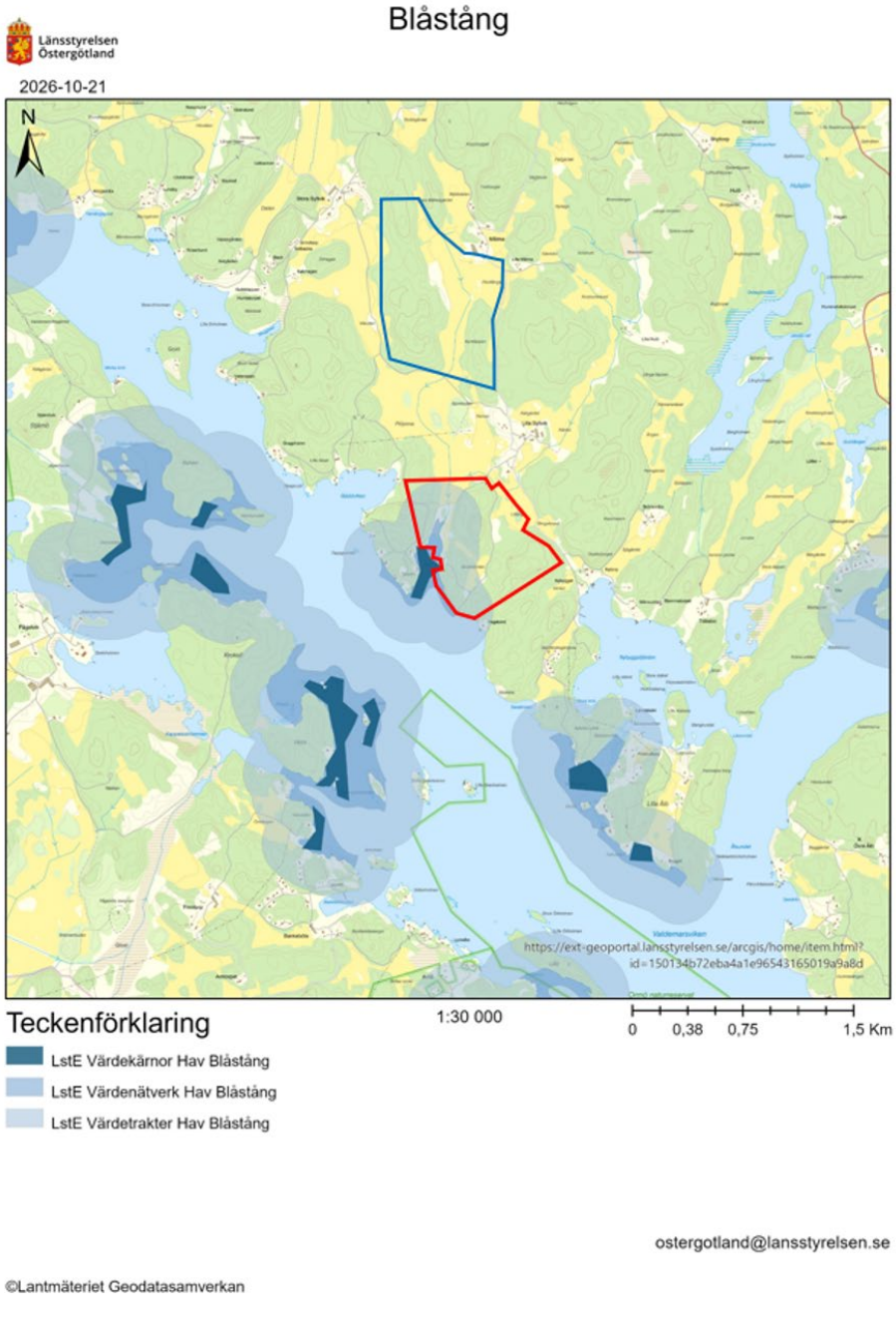


Figure 16. Core values (*värdekärnor*), value networks (*värdenätverk*), and value tracts (*värdetrakter*) for bladderwrack (*blåstång*). The northern planned area is shown in blue; the southern planned area is shown in red.

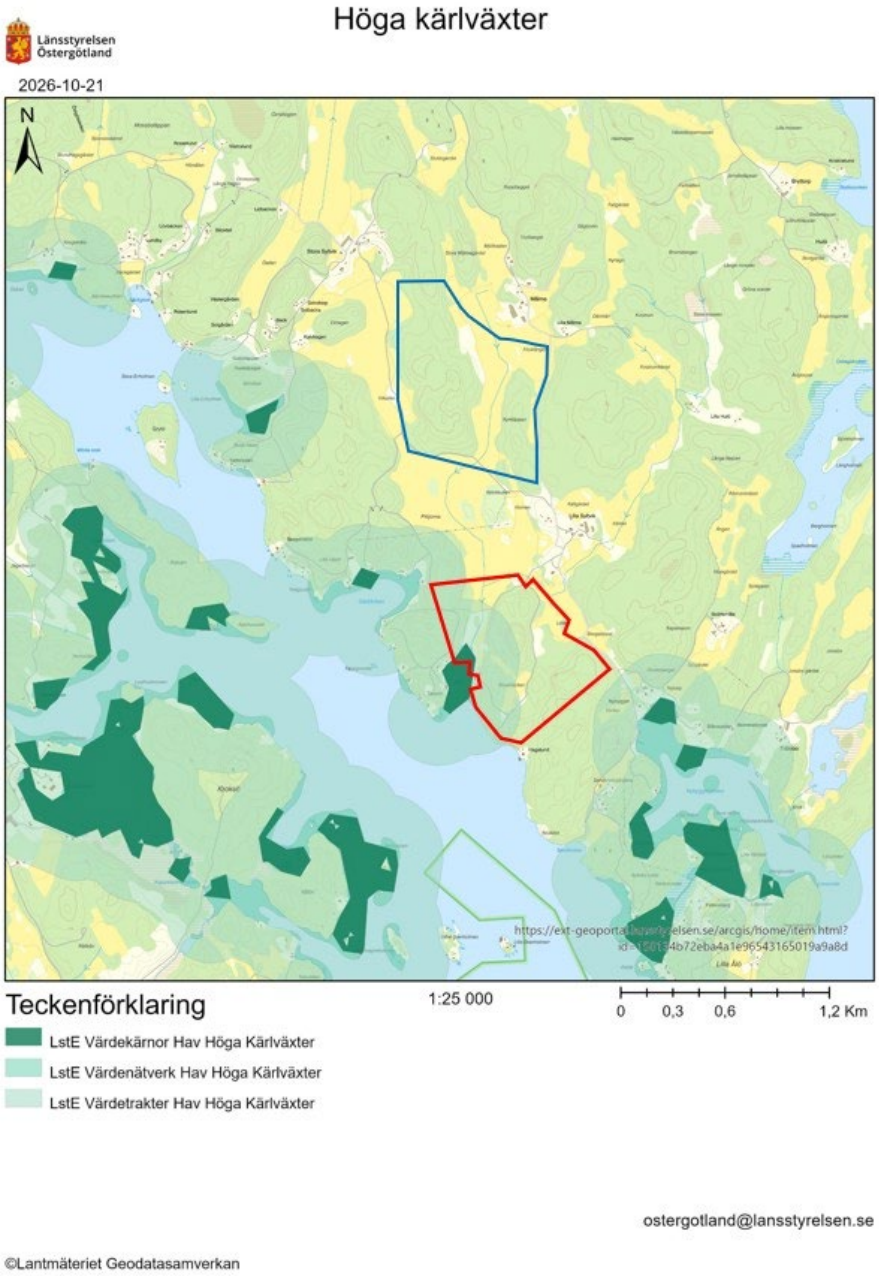


Figure 17. Core values, value networks, and value tracts for tall vascular plants. The northern planned area is shown in blue; the southern planned area is shown in red.

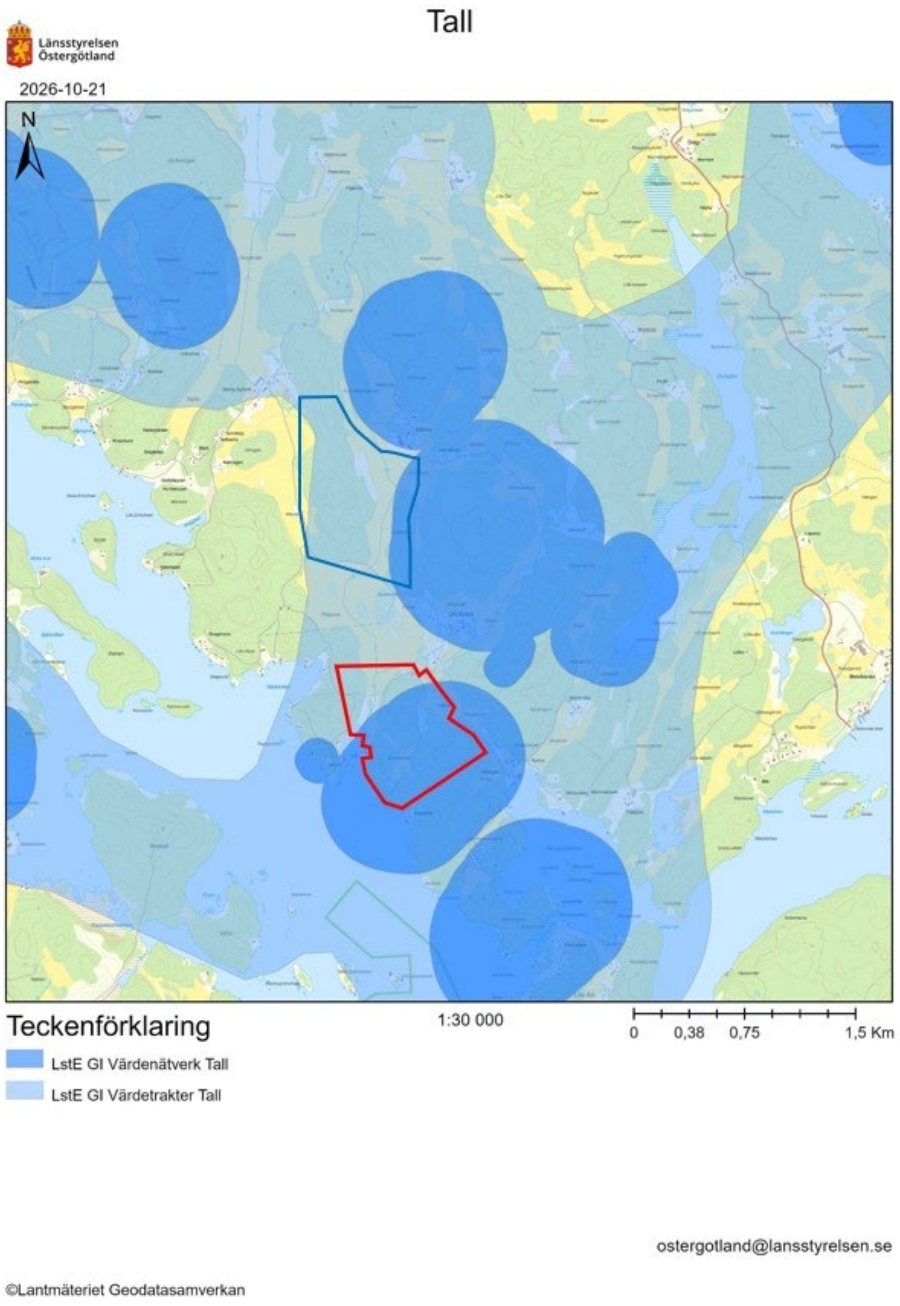


Figure 18. Core values, value networks, and value tracts for pine. The northern planned area is shown in blue; the southern planned area is shown in red.

Currently, extended shoreline protection (*utvidgat strandskydd*) applies along the municipality's coastal and archipelago areas. This protection falls within the extent of the southern planned area, primarily covering land areas up to 150 metres from the shoreline and water areas up to 300 metres from the shoreline. The extended shoreline protection aims to long-term secure public access to shoreline areas and preserve favourable living conditions for plant and animal life on land and in water

(County Administrative Board of Östergötland, 2015).

The area of influence also includes surrounding coastal and marine environments outside the planned area, including Valdemarsviken and adjacent parts of the Gryt Archipelago. These areas fall within the national interest for nature conservation, Östergötland Archipelago (NRO05068), which is described as a unique and highly valuable natural environment with a great variety of habitats and high natural values. The Gryt Archipelago is characterised, among other things, by forested islands and islets with both coniferous and deciduous forest, shallow sea bays, spawning and nursery areas for fish, fishing protection areas, and marine environments of significance for biodiversity. The area also includes designated reproduction areas for species such as pike (*Esox lucius*), whitefish (*Coregonus lavaretus*), Baltic herring (*Clupea harengus*), and zander (*Sander lucioperca*). At the inlet to Valdemarsviken and the surrounding coastline, there are also core values, value networks, and value tracts for blue mussel (*Mytilus edulis*). Blue mussels occur on both hard and soft bottoms and can form continuous mussel beds with high species diversity. The mussels' shells create habitats for algae and attached animals, while their filtration contributes to the nutrient circulation of the ecosystem. Blue mussel beds are therefore of great importance as habitats and food sources for several species. Older mussel beds with a well-developed fauna are particularly valuable, and beds on soft bottoms are sensitive, as re-establishment can take a long time (County Administrative Board of Östergötland, n.d.). The southern planned area partially overlaps with the national interest for nature conservation, Östergötland Archipelago (NRO05068).

Within the area of influence, but outside the planned area, several nature reserves with high or very high natural values exist (Swedish Environmental Protection Agency, 2026). In the vicinity, there are also Natura 2000 areas, which constitute national interests under Chapter 4 of the Environmental Code and are included in the EU Birds Directive as well as the Habitats Directive (Valdemarsvik Municipality, 2018) (see Table 2, and Figure 19).

Table 2. Natura 2000 areas in the vicinity of the planned area. (Application by ReFirm Målma AB for government approval)

Name	Designation	Directive
Åsvikelandet-Kvädö	SE0230138	Birds Directive
Dannskären	SE0230139	Birds Directive
Högved	SE0230358	Habitats Directive

Name	Designation	Directive
Kattedal	SE0230199	Habitats Directive
Arnö	SE0230395	Habitats Directive
Åsvikelandet-Kvädö	SE0230138	Habitats Directive
Bokö	SE0230142	Habitats Directive
Stjärnö-Fågelvik	SE0230192	Habitats Directive



Figure 19. Natura 2000 areas in the vicinity of the planned areas.

The Natura 2000 areas located closest to the planned areas are Högved (approximately 1.4 kilometres north of the northern planned area), Stjärnö-Fågelvik (approximately 1.6 kilometres southwest of the southern planned area), and Arnö (approximately 2.2 kilometres south of the southern planned area). The Natura 2000 area Högved aims to preserve and develop species-rich siliceous grasslands and the natural

values associated with traditionally managed pastures. The area has particularly high values related to a species-rich flora, including several red-listed vascular plants, and a rich insect fauna, including threatened butterflies (County Administrative Board of Östergötland, 2016).

The Natura 2000 area Stjärnö-Fågelvik aims to preserve valuable coastal and pasture landscapes with tree-covered grazing lands, shore meadows, and shallow marine environments. The area also has high natural values associated with old broad-leaved trees and protected species, including the stag beetle (*Lucanus cervus*) (County Administrative Board of Östergötland, 2016).

The Natura 2000 area Arnö aims to preserve a traditionally managed archipelago landscape with species-rich pastures, shore meadows, tree-covered grazing lands, and older coniferous forest environments. The area also comprises marine natural values linked to reefs and coastal water environments (County Administrative Board of Östergötland, 2018).

In addition to the designated Natura 2000 values, the area of influence also includes significant bird values linked to the coastal and archipelago environments. The Natura 2000 area Åsvikelandet-Kvädö is one of the most important bird areas in the southern Östergötland Archipelago. The area includes bird protection zones and is designated under the Birds Directive for a large number of coastal, seabird, and forest-associated species, including osprey (*Pandion haliaetus*), Arctic tern (*Sterna paradisaea*), common tern (*Sterna hirundo*), Sandwich tern (*Thalasseus sandvicensis*), whooper swan (*Cygnus cygnus*), capercaillie (*Tetrao urogallus*), hazel grouse (*Tetrastes bonasia*), and pygmy owl (*Glaucidium passerinum*) (County Administrative Board of Östergötland, 2018).

The nature reserves affected are Kattedals gammelskog (2023549), Stjärnö (2001707), Arnö (2001711), Bokö (2001728), Ormö (2001710), Kvädöfjärden (SE0230395), and Gryt (2001741). The nature reserve Kvädöfjärden hosts a rich birdlife with both breeding and resting birds, and parts of the island world are subject to bird protection in order to preserve sensitive bird habitats (County Administrative Board of Östergötland, n.d.).

7.2.4 Impact, Effects, and Consequences

Northern Planned Area

The establishment will entail that land currently consisting of agricultural land, forest land, and to some extent pasture land will be utilised and converted into hardened surfaces for buildings, roads, and other infrastructure. This may result in the loss of existing habitats for

protected species and may lead to landscape fragmentation and enclosure, which could impair dispersal patterns and the conditions for species dependent on contiguous natural environments. The construction of roads and other connecting infrastructure may also result in additional natural land being utilised outside the actual planned area. Development, earthworks, and felling may affect or eliminate the growth sites and habitats of the red-listed species *Scorzonera humilis* (viper's grass), *Helianthemum nummularium* (common rockrose), *Polygala vulgaris* (common milkwort), and *Lathyrus heterophyllus* (Whippoor-will pea) within and adjacent to the planned area. Further inventories and mitigation measures may therefore be necessary to clarify their occurrence and to assess the need for protective actions.

The operation may also cause impacts through increased lighting during the operational phase. Light disturbance may affect, among other species, birds and bats by altering their movement patterns, foraging behaviours, and reproductive conditions. Further investigation is required to examine the distribution of other bird species and bats within and adjacent to the planned area, where the facility may negatively affect their habitats. This is to enable adaptation of the design to minimise disturbances.

A few hundred metres northeast of the planned area, there is a forested habitat protection area (*biotopskyddsområde*), and near the area, there is also land covered by a nature conservation agreement (*naturvårdsavtal*). If these areas are impacted through direct encroachment or indirect effects, such as altered hydrological conditions, barrier effects, or increased disturbance, there is a risk that natural values associated with the mature, natural-like coniferous forest may deteriorate. The continued delimitation and design of the planned area should therefore be adapted to avoid impacting these areas as far as possible.

A location in the northern part of the planned area will also require the installation of buried cooling water pipelines between the facility and the recipient, as well as the establishment of intake and discharge points in the aquatic environment.

Overall, the proposed plan is assessed to potentially result in moderate to major negative consequences for the natural environment through the permanent utilisation of natural land, loss of habitats, increased fragmentation, impaired ecological relationships, and the risk of impacts on protected and valuable species. Major negative consequences may in particular arise if areas with high natural values or valuable species are affected. Marine environments may also be impacted due to the installation of cooling water pipelines. However, the extent of the impact is uncertain, as detailed inventories and technical solutions have not yet been developed.

Southern Planned Area

The establishment in the southern planned area will entail that forest land and coastal natural environments will be utilised for buildings, roads, and other infrastructure. The area includes a forested habitat protection area (*skogligt biotopskyddsområde*) comprising mature, natural-like pine forest, as well as core values (*värdekärnor*) and value networks (*värdenätverk*) identified in the work on the Regional Action Plan for Green Infrastructure. Utilisation of these environments could result in the loss and fragmentation of habitats with high natural values and may impair the conditions for ecological relationships in the landscape. Development and earthworks may affect both habitats and important functions for the observed species *Coronella austriaca* (smooth snake, *hasselsnok*), thereby impacting its survival, including overwintering sites and reproduction areas (SLU Swedish Species Information Centre, 2026).

The facility may also lead to increased disturbance through lighting, noise, enclosure, and increased human activity. Such disturbances may affect birds, bats, and other disturbance-sensitive species that use the area. Since the area adjoins coastal and marine environments with high natural values, there is also a risk of indirect impacts on species and natural environments outside the actual planned area.

Establishment within the southern planned area is also expected to require a port or quay facility for the transport of larger components and materials, as well as pipelines for cooling water intake and discharge. Potentially, spent nuclear fuel may also be transported via the port. Shipping traffic can lead to turbidity, underwater noise, wave impacts, erosion, increased dispersal of sediments and pollutants, and disturbances to fish, marine habitats, and birdlife associated with coastal and archipelago environments.

The southern planned area is also covered by extended shoreline protection (*utvidgat strandskydd*) and is located in proximity to several Natura 2000 areas and other valuable coastal environments. The operation of the facility and associated secondary activities, such as port operations, shipping, and cooling water management, may result in impacts through, for example, noise, lighting, increased human activity, and changes in the aquatic environment. Such impacts may affect both marine natural habitats and species, as well as bird species associated with coastal, archipelago, and forest environments. It cannot be ruled out that the conservation objectives and purposes of nearby Natura 2000 areas may be impacted, which will need to be further investigated in subsequent stages.

Overall, the proposed plan is assessed to potentially result in moderate to major negative consequences for the natural environment. This

assessment is based on the presence of protected and valuable natural environments within and directly adjacent to the area, the risk of impacts on ecological relationships, and potential impacts on both terrestrial and marine natural values, as well as the fact that parts of the area fall within the scope of the national interest for nature conservation, Östergötland Archipelago (NRO05068). The presence of protected species may also trigger the prohibitions stipulated in the Species Protection Ordinance (*artskyddsförordningen*), which could necessitate adjustments to the design of the plan, as well as protective, precautionary, or compensatory measures. However, the uncertainties are substantial since detailed natural value inventories and species-specific investigations have not yet been conducted.

7.2.5 Assessment of the Zero Alternative

In the zero alternative (*nollalternativet*), the natural environment of the southern and northern planned areas is assessed to predominantly remain in its current extent and character. Agricultural land, pastures, and forest land will continue to be used, and no major changes to land use are expected. This will prevent the habitat loss, fragmentation, and disturbance that development could entail. Natural values associated with the cultivated landscape, forest environments, and coastal and aquatic environments are therefore assessed to largely persist over time. Similarly, the natural values underpinning the area's national interests and other protected areas are assessed to be maintained. Overall, the consequences for the natural environment in the zero alternative are assessed to be negligible.

7.2.6 Proposed Measures

- A natural value inventory (*naturvärdesinventering*) and targeted species inventories should be conducted prior to continued planning to map the occurrence of protected and valuable species and to identify the need for adaptations and protective measures.
- The delimitation of the planned area and the design of the facility should be adapted to avoid or minimise encroachment on areas with high natural values, habitat protection areas (*biotopskyddsområden*), nature conservation agreements (*naturvårdsavtal*), and core values (*värdekärnor*) and value networks (*värdenätverk*) within the regional green infrastructure.
- Lighting should be designed with directional luminaires, shielding, and limited light dispersion to reduce impacts on birds, bats, and other light-sensitive species.
- When installing cooling water pipelines, port facilities, or other water infrastructure, pipeline routes and locations should be adapted to avoid areas with high marine natural values, such as core values

for bladderwrack (*blåstång*) and blue mussel (*blåmussla*), as well as fish breeding areas.

- Turbidity-inducing activities in water should be conducted with appropriate protective measures to limit the dispersal of sediment and turbidity to surrounding aquatic environments. Such measures need to be adapted to the conditions prevailing at the specific worksite.
- If natural environments are temporarily utilised during the construction phase, the land should be restored after the completion of works to promote the re-establishment of vegetation and ecological functions.
- If protected species or their breeding areas and resting sites are affected, the possibility of avoiding or limiting impacts through alternative designs, adapted working methods, protective measures, and other precautionary actions should be investigated as a priority. In subsequent stages, such alternative solutions need to be evaluated. If impacts cannot be avoided despite the implemented measures, the need for exemptions under the Species Protection Ordinance (*artskyddsförordningen*) should also be investigated.

7.3 Health and Living Environment

Health and living environment encompass people's opportunities for recreation, outdoor activities, and residence in a good and healthy environment. Recreation can take place in many different types of environments, but in this **Environmental Impact Assessment (EIA)**, the focus is primarily on natural and outdoor areas, coastal environments, and other areas used for nature experiences and recovery. The accessibility, experiential values, and conditions for outdoor activities in the area are thus important aspects of the assessment.

People's health and perception of their surroundings are also influenced by factors such as air quality, noise, vibrations, and structure-borne sound. Air pollution can give rise to negative effects on both human health and the environment, while noise and vibrations can impact well-being, recovery, and the opportunities to use and reside in an area for recreation. These factors must therefore be considered when planning new activities and when assessing the consequences of the proposed plan for people's health and living environment.

7.3.1 Assessment Criteria, Indicators, Requirements, and Guidelines

Recreation and Outdoor Activities

The assessment of recreation and outdoor activities is based on the

provisions of the Environmental Code (*miljöbalken*) on outdoor life, the Planning and Building Act's (*plan- och bygglagen*) requirements for a good living environment, and relevant national objectives for outdoor recreation. Special consideration is given to areas used for outdoor activities, nature experiences, recreation, and other stays in natural environments. The assessment also includes the impact on accessibility, experiential values, and any national interests for outdoor recreation (*riksintressen för friluftsliv*).

Air Quality

For air quality, the environmental quality standards (*miljökvalitetsnormer*) serve as the primary assessment criterion. The environmental quality standards aim to protect human health and the environment from harmful air pollutants and constitute legally binding requirements for achieving this. The assessment includes the impact from the activity and associated transport, as well as any impact on nearby residences, recreational areas, and other areas where people spend time.

Noise

Noise, vibrations, and structure-borne sound are assessed based on national guideline values and knowledge of how disturbances can affect human health, well-being, and the perception of the surroundings. Consideration is given to the impact on residences, recreational areas, outdoor activities, and other environments where people regularly spend time. For vibrations, established guideline values for comfort vibrations are also considered, while the assessment of structure-borne sound is based on the risk of disturbances in buildings and recreational environments.

7.3.2 Methodology and Uncertainties

No noise investigations or studies on air quality have been conducted for the two planned areas. The description of the current situation and the assessment of the plan's consequences, effects, and impacts are therefore based on existing available data from open sources, government reports, and other available materials. The lack of field inventories and in-depth analyses introduces uncertainty regarding the area's values for health and living environment. The assessments should therefore be seen as strategic and should be supplemented with investigations and inventories in subsequent stages.

The two alternative road routes between the planned areas and County Road 212 (*länsväg 212*) pass a few properties in their proposed alignments, which means that the overall impact on residents and the living environment is assessed to be low. The proposed locations for the roads are on forest and agricultural land.

7.3.3 Current Situation

The planned areas are located in an archipelago environment where people reside and spend time for recreation and outdoor activities. Currently, there are no properties within the planned areas, but several are located immediately adjacent to the area. It has not yet been established whether the residences are permanent homes or holiday homes. This means that the planned area currently includes locations of significance for recreation and outdoor activities.

The entire southern and parts of the northern planned area are covered by the national interest for outdoor recreation (*riksintresse för friluftsliv*), Östergötland Archipelago [FE07]. The values of the national interest are linked to the accessibility, biodiversity, and recreational opportunities of the archipelago landscape. Designated activities within the national interest include, among others, boating, sailing, kayaking, swimming, fishing, birdwatching, and hiking. The most significant recreational environments within the national interest are primarily found north of the northern planned area around Gryt, Fyrudden, and Tyrislöt, as well as to the south towards Kvädöfjärden and Torrö.

Both the northern and southern planned areas are included in the national interest for unbroken coastline (*riksintresse för obruten kust*) for Östergötland's coastal and archipelago areas under Chapter 4 of the Environmental Code. The purpose of the national interest is to preserve the combined natural and cultural values associated with the coastal landscape, as well as to safeguard the conditions for outdoor activities and recreation. The provisions aim to ensure that the character and values of the area are considered in planning and the assessment of new activities (County Administrative Boards, n.d.).

The Gryt Bicycle Loop (*Rundslingan Cykeltur i Gryt*) currently passes through the northern planned area. The Östgötaleden hiking trail does not pass directly adjacent to the planned areas. The nearest section is located at Kattedalsfjärden, approximately four kilometres away in a straight line. Fågelvik constitutes a local recreational area adjacent to the planned areas. The living environment values of the area are currently largely linked to the experience of the coastal and archipelago landscape, proximity to water, and opportunities for outdoor activities and recreation.

No noise investigations have been conducted for the planned areas. The nearest major road, County Road 212 (*länsväg 212*), is located at its closest approximately five kilometres from the planned areas. The impact of noise from the road is assessed to be low, and the planned areas are generally considered to be quiet, as there are no larger activities or ports in the vicinity. No other major continuous sources of

noise have been identified within or immediately adjacent to the planned area.

The air quality in the area is assessed to be good. Calculations for Valdemarsvik Municipality show that the annual mean concentration of nitrogen oxides in the area is 1.5 µg/m³. This level is well below the current environmental quality standard for nitrogen dioxide of 40 µg/m³ as an annual mean value, and also below the upcoming limit of 20 µg/m³ to be applied under the EU's revised Air Quality Directive from 2030.

Currently, there are no nuclear facilities within the planned areas, and thus no emissions of radioactive substances from the area. In Sweden, small emissions of radioactive substances into the air occur from, among others, nuclear facilities and other activities handling radioactive materials. However, these emissions are regulated and controlled through extensive supervision and monitoring. No investigations have examined the levels of radioactivity in the planned area, but they can be assumed to be very low at present.

7.3.4 Impact, Effects, and Consequences

Northern Planned Area

Establishing a nuclear facility within the northern planned area entails the conversion of a currently undeveloped area into a large-scale technical operation. For nearby residences and holiday homes, a facility represents an altered local environment compared to the current situation. The facility's buildings, associated traffic, and lighting may impact residents' perception of their living environment. The establishment may also affect the experiential values underlying the national interest for outdoor recreation (*riksintresse för friluftsliv*), Östergötland Archipelago [FE07], by altering the natural character of the area. The extent of these consequences depends on the facility's final design, particularly regarding height and location within the area.

The establishment may also affect opportunities for recreation and outdoor activities within and adjacent to the planned area. The cooling water facility may entail restrictions that could limit access to the waterfront environment. Areas around water intake and discharge may be subject to restrictions and technical installations, which could affect opportunities for recreation and access to the coastal environment. This may have an impact on the national interest for outdoor recreation for the Östergötland Archipelago [FE07], as well as the national interest for unbroken coastline for Östergötland's coastal and archipelago areas. Safety requirements may result in certain areas having limited accessibility or regulated access. The impact is primarily assessed to be local and connected to the areas within or immediately adjacent to the northern planned area. No direct impact on Östgötaleden is expected.

The Gryt Bicycle Loop may be affected by the northern planned area and may need to be relocated. The northern planned area is primarily surrounded by forest, which means that certain parts of the facility may be screened off by vegetation and the area's topography. However, the experience of the landscape is altered by the introduction of a large-scale technical operation into a natural environment. This change may affect the perception of the area and thus potentially people's access to recreation and outdoor activities. This could result from the access to and quality of nature experiences being limited.

The operation may also impact people's perceived security and living environment in the area. A nuclear facility is a new type of operation in the area, and its establishment may influence how people perceive their local environment. Even if the actual risk to people and the environment is limited by extensive safety and protection system requirements, the location of a nuclear facility at the site may affect the perception of residents and others spending time in the area. The impact may vary between individuals and is therefore difficult to quantify and assess. The consequences for health and living environment depend on the facility's final design, location, and scope, as well as the results of investigations showing, for example, noise levels. Further investigations are required to fully assess the extent to which a nuclear facility would impact health and living environment in the planned area.

A facility entails the need for transport in the form of heavy, medium-heavy, and light vehicles. This contributes to increased noise levels along the intended roads. Additionally, there may be a risk of increased vibration disturbances. It also contributes to increased emissions and impacts on air quality, which may have consequences for those living or spending time along the roads. A facility involves operational noise, and even higher noise levels occur when backup power is used. This may affect people living or spending time nearby and may necessitate measures to reduce the impact. During normal operation, small amounts of radioactive substances may be released into the air. However, emissions are expected to be limited through safety systems and the application of the best available technology. The extent of the consequences depends on the size of the emissions and the protection systems implemented in the facility.

Compared to the southern planned area, the northern planned area is surrounded to a greater extent by vegetation and topography that can limit the visual exposure of the facility. The impact on recreational values is therefore assessed to be more limited than for the southern alternative.

Southern Planned Area

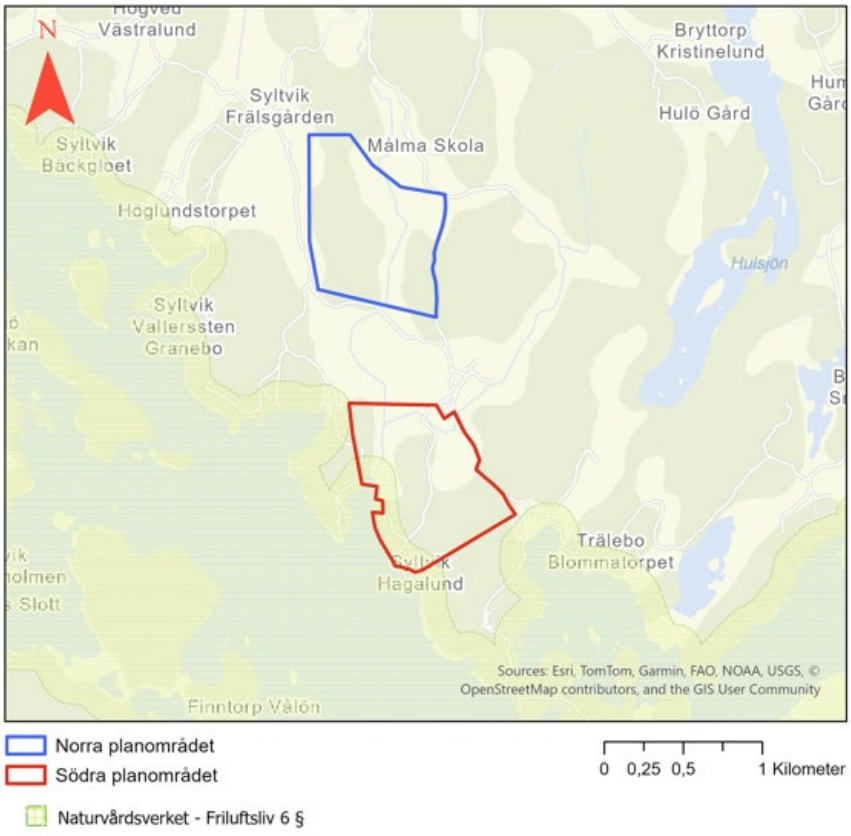


Figure 20. National interest for outdoor recreation (riksintresse för friluftsliv).

The establishment of a nuclear facility (*kärnteknisk anläggning*) within the planned area could lead to a significant transformation of the area's character. This would entail a shift from a small-scale archipelago landscape to buildings—including associated roads, fencing, and lighting—that alter the site's visual character. The southern planned area has a more pronounced connection to the coastal environment of Yttre Valdemarsviken. The area forms part of the national interest for unbroken coastline (*riksintresse för obruten kust*) and constitutes an important resource for recreation and outdoor activities. Based on the viewshed analysis conducted, buildings will be clearly visible from the water. A change in land use could lead to reduced accessibility to parts of the shoreline due to both the harbour and cooling water discharges, thereby negatively impacting recreational values. This would also result in a negative impact on the national interest for outdoor recreation (see Figure 20).

The most substantial change resulting from the establishment of a

facility is assessed to be related to the experience of the landscape, nature, and the area's character. Since the southern area is located closer to the shoreline and a harbour may potentially be constructed, it is more exposed to the surrounding water areas and the associated archipelago. The facility may thus become a prominent and visually striking element in the landscape. This could affect the perception of the site and people's experience of the living environment to a greater extent than in the northern area, as the southern planned area will be visible from the nearby archipelago and waterways. A harbour with associated boat traffic could also impact and limit the use of recreational boats in the area.

The operation may also influence people's perceived security and living environment in the area. A nuclear facility represents a new type of operation in the area, and its establishment could affect how people perceive their local surroundings. Although the actual risk to people and the environment is limited through extensive safety and protection system requirements, the fact that a nuclear facility is located at the site may influence the perception of residents and others present in the area. The impact may vary between individuals and is therefore challenging to quantify and assess. The consequences for health and living environment depend on the facility's final design, location, and scale, as well as the results of investigations concerning factors such as noise levels. Further investigations are required to fully assess the extent to which a nuclear facility would impact health and living environment in the planned area. With regard to noise and air quality, the same conditions are assessed to apply to the southern planned area as those described for the northern planned area.

The southern planned area is more strongly connected to the coastal landscape and the areas used for recreation. The establishment is therefore assessed to potentially result in greater impacts on experiential values and accessibility. This impact is amplified by the fact that the area is part of the national interest for unbroken coastline and that the facility is likely to be more exposed in the landscape when viewed from the surrounding archipelago.

Both the northern and southern planned areas are currently relatively sparsely populated environments with values related to recreation, outdoor activities, and the archipelago environment. The establishment of nuclear facilities would mean that areas currently used for recreational purposes acquire a more technical and developed character. The consequences for health and living environment are primarily assessed to relate to changes in opportunities for recreation and encroachment on the national interest for outdoor recreation. Overall, the northern planned area is assessed to result in minor negative

consequences, and the southern planned area is assessed to result in moderate negative consequences for health and living environment.

7.3.5 Assessment of the Zero Alternative

In a scenario where the facility plan (*anläggningsplan*) is not implemented, the area's current character as an archipelago landscape is assessed to remain. Opportunities for recreation and outdoor activities within and adjacent to the planned areas are assessed to persist at their current level. Nor will any impact arise due to new development or security areas that could restrict accessibility or alter the experience of the landscape. The zero alternative also means that disturbances such as increased traffic and emissions of noise and air pollutants will not occur.

No impact on people's perceived security due to the establishment of a nuclear operation will arise. Overall, the zero alternative is assessed to entail negligible consequences for health and living environment.

7.3.6 Proposed Measures

- The design and location of the facility should be adapted to reduce visual impact on those living in and using areas of significance for recreation and outdoor activities.
- Lighting should be designed to limit disturbance to nearby residences and recreational environments.
- The construction phase should be planned to minimise noise and other disturbances for those in proximity to the planned area.
- The possibility of maintaining access to recreational and outdoor environments should be considered in the future planning process.
- Further investigations on noise and traffic should be conducted to identify and specify necessary protective measures.

7.4 Climate Impact

The Intergovernmental Panel on Climate Change (IPCC) has established that the climate is changing beyond natural variation, and that this change is due to human influence. This involves humans intensifying the natural greenhouse effect through emissions of greenhouse gases, primarily carbon dioxide. This is expected to lead to an increase in the Earth's average temperature, resulting in a changed climate with drastic consequences for humans, animals, and plants.

In spatial planning, the climate issue involves both reducing the emissions that affect the climate and adapting society to a changing climate. Climate adaptation in planning is addressed in Section 7.5.

7.4.1 Assessment Criteria, Indicators, Requirements, and Guidelines

Climate Act and National Objectives

Sweden's Climate Act (2017:720) entered into force on 1 January 2018. It binds the government to pursue a policy ensuring that Sweden's net greenhouse gas emissions are zero by 2045 at the latest. The national targets are set in line with the objectives established by the EU for 2030. The Union's collective emissions **shall** be reduced by 55 per cent by that year compared to 1990 levels (European Commission, 2024).

Guidance from the Swedish Environmental Protection Agency

To limit the climate impact of the **facility plan**, the proposed plan will also be assessed against the guidelines provided by the Swedish Environmental Protection Agency (*Naturvårdsverket*) in evaluating the climate impact of plans (Swedish Environmental Protection Agency, 2019):

- An increase or decrease in the demand for products, services, raw materials, or input commodities leading to indirect changes in greenhouse gas emissions.
- Changes in greenhouse gas emissions due to increased or decreased energy use, for example in material production and transport, during both the construction phase and when the facility is in operation.
- Loss or creation of environments that act as carbon sinks, for instance if forest land is developed or if a wetland is restored.
- Indirect impact through climate adaptation measures leading to changes in emissions.

The assessment encompasses both direct and indirect climate-impacting emissions associated with material production, transport, energy use, and land use. Consideration is also given to how the proposed plan affects areas functioning as carbon sinks, as well as the plan's significance for the transition to a long-term fossil-free energy system.

7.4.2 Methodology and Uncertainty

No calculations have been conducted of the carbon dioxide emissions resulting from the implementation of the proposed plan. The assessments of the plan's climate impact are qualitative and primarily comprise descriptions of the impact. There is consequently no accounting of emission quantities, and the effects cannot be quantified. Since the assessments are based on descriptions rather than numerical calculations, uncertainties regarding the magnitude of the climate impact are significant. Further analyses and quantitative studies are

required for a comprehensive understanding of the plan's climate impact.

7.4.3 Current Situation

All new construction entails greenhouse gas emissions that impact the climate. In 2024, Valdemarsvik Municipality emitted 57,906 tonnes of carbon dioxide equivalents (tCO_2e; SMHI, 2026). The majority of the municipality's greenhouse gas emissions derive from transport and agriculture. While emissions in the municipality had previously shown a declining trend, they increased by 7 percent between 2023 and 2024. This may be attributable to increased emissions from transport, working machinery, and product use.

The planned area consists predominantly of undeveloped natural land and includes forested areas. The forest stands within the planned areas are relatively young, having primarily regenerated following logging operations in the 21st century. Natural land contributes to the area's function as a carbon sink through the uptake and storage of carbon in biomass and soil. Wetlands, in particular, are highly effective carbon sinks. Further inventory work is required to determine whether the planned areas contain wetlands.

Hydropower followed by nuclear power constitute the largest shares of Swedish electricity production (Government Offices of Sweden, 2026). To achieve the climate transition, Sweden needs to electrify using fossil-free electricity. Between September 2025 and September 2026, only 1 percent of the electricity generated came from non-renewable sources (Statistics Sweden [SCB], 2026). Demand for electricity is anticipated to rise, and to reach the national net-zero emissions target, the supply of fossil-free electricity must increase.

7.4.4 Impact, Effects, and Consequences

Northern Planned Area

The proposed plan entails the development and surface hardening (*hårdgöring*) of natural land. The conversion of natural land to built and hardened surfaces results in the release of carbon stored in vegetation and soil, while simultaneously reducing the land's future carbon sequestration capacity. Studies indicate that emissions from land-use changes can be of the same order of magnitude as, or in some cases exceed, the emissions produced by the construction process itself—particularly when developing forest land and other carbon-rich natural environments (Greenhouse Gas Protocol, 2026). The scale of emissions generated by development depends on the carbon content of the soil and vegetation. Given that knowledge of the area's actual carbon storage remains limited, the assessment is subject to uncertainties that should

be addressed in future investigations.

The operational phase of the nuclear facility will result in increased transport in the area and an overall rise in transport volumes within the municipality. This risks further increasing Valdemarsvik Municipality's transport-related emissions, counteracting Sweden's environmental quality objectives and interim target of reducing carbon dioxide emissions from transport.

The facility's energy demand during operation will also affect climate impact. However, the assessment is subject to uncertainties, as the scale and origin of the energy supply have yet to be determined. Since the majority of Sweden's electricity production is fossil-free, emissions from energy use are expected to be limited.

Furthermore, the nuclear fuel cycle entails indirect greenhouse gas emissions. Uranium mining, enrichment, fuel fabrication, and the transport of nuclear fuel require energy and generate emissions, even though these processes take place outside the planned area. The total climate impact of the activity therefore requires assessment from a lifecycle perspective, accounting for both direct and indirect emissions.

The proposed plan enables the establishment of a nuclear facility for the production of fossil-free electricity. Nuclear power results in very low greenhouse gas emissions during operation and also has a low climate impact from a lifecycle perspective compared to fossil-fuel-based energy production (UNECE, 2021). The activity can thus contribute to the transition towards an energy system with lower climate impact and greater access to fossil-free electricity.

The primary climate impact originating from the proposed plan is the conversion of natural land into hardened surfaces. However, the implementation of the plan will enable an increased production of fossil-free electricity in Sweden, thereby contributing to the national target of net-zero emissions. The contribution to the national transition to fossil-free energy is likely greater than the loss of the carbon sink. Overall, the proposed plan is assessed to result in positive consequences for climate impact.

Southern Planned Area

The southern planned area is assessed to have the same impact as the northern planned area, as this area also entails the development of natural land with a consequent loss of carbon sequestration, increased transport volumes, and emissions during the construction and operational phases. However, a port within the southern planned area would facilitate the maritime transport of large goods volumes, which is frequently more energy-efficient than equivalent road transport. The

actual climate impact will, however, depend on the design of the transport system and the choice of fuel.

Similar to the northern planned area, the southern planned area will enable the establishment of a nuclear facility for the production of fossil-free electricity, contributing to the net-zero emissions climate target.

Overall, the proposed plan is assessed to result in positive consequences for climate impact.

7.4.5 Assessment of the Zero Alternative

As no changes to land use or development are anticipated in the zero alternative, existing natural land will be preserved. The forested areas within the planned areas will thus continue to function as a carbon sink, storing carbon in both biomass and soil. By the target year of 2050, large parts of the forest are expected to remain in a growth phase, leading to a progressive increase in stored carbon. According to current forest management planning, only one regeneration felling is expected to take place within the southern planned area, while the remaining forest is assessed to remain standing.

Greenhouse gas emissions that may arise in the area at present—for example, as a result of forestry operations—are assessed to largely persist at similar levels in the zero alternative. Overall, the zero alternative implies that the area's capacity to store carbon in soil and vegetation is largely maintained.

At the same time, the zero alternative means that the planned nuclear facility will not be realised. Consequently, the contribution to the energy system that the facility is intended to provide also does not materialise. The zero alternative therefore does not provide the conditions for increased production of fossil-free electricity or the potential climate benefits that such a contribution could deliver at the regional and national levels.

Overall, the zero alternative is assessed to result in positive consequences for climate impact by allowing the natural land to continue growing and increasing its carbon sequestration capacity.

7.4.6 Proposed Measures

- By adopting a clear focus on climate emissions during the construction phase—including through a comprehensive climate calculation (*klimatkalkyl*), sustainable material choices, and ensuring energy efficiency in new construction—greenhouse gas emissions can be limited.
- Fossil-free transport to and from the facility should be enabled.

- Efforts should be made to implement energy-efficient and energy-saving measures to reduce the climate impact of energy consumption.
- A lifecycle analysis (LCA) of the nuclear facility's establishment should be conducted.

7.5 Climate Adaptation

The climate of the future will differ from today's. Increased precipitation and higher average temperatures are expected, among other changes. Heatwaves and heavy rainfall events are assessed to become more frequent. Climate adaptation involves minimising vulnerability and preventing damage caused by climate change. Both current and future buildings, public spaces, and infrastructure need to be adapted to the effects of climate change.

7.5.1 Assessment Criteria

In accordance with Chapter 2, Section 5 of the Planning and Building Act (2010:900), the suitability of land and water areas shall be assessed with regard to risks such as flooding, landslides, erosion, and other natural hazards. Given ongoing climate change, these risks must be considered early in the planning process to ensure a long-term sustainable and safe land use.

Sweden's new National Climate Adaptation Strategy was presented by the government in March 2024. The National Strategy for Climate Adaptation (2023/24:97) outlines the direction of Sweden's work to reduce society's vulnerability to the effects of climate change and enhance its capacity to manage a changing climate. The strategy particularly emphasises the need to address risks associated with flooding, high temperatures, water shortages, landslides, erosion, fires, and impacts on biodiversity. In physical planning, this means that land and water use must be designed to mitigate future climate-related risks and to create robust, long-term sustainable living environments.

7.5.2 Methodology and uncertainty

The current situation and assessments are partly based on knowledge from publicly available map analyses.

The County Administrative Board of Östergötland (*Länsstyrelsen Östergötland*) has calculated extreme sea level rise for the entire county. The calculations indicate a sea level 270 centimetres above the current mean level under extreme conditions in the year 2100.

The National Climate and Vulnerability Assessment (*Nationella klimat- och sårbarhetsanalysen*) has used two climate scenarios, RCP4.5 and

RCP8.5, covering the time period 2070–2100. The climate scenarios RCP4.5 and RCP8.5 are used to model future climate change. The application of these scenarios aims to provide information on climate change under varying atmospheric concentrations of greenhouse gases.

The assessments of the plan's need for climate adaptation are qualitative and primarily consist of descriptions of risks.

7.5.3 Current situation

Sweden's climate is expected to become warmer and wetter, while extreme weather events such as cloudbursts (*skyfall*), heatwaves, and periods of drought are anticipated to increase in both frequency and intensity. Climate change also leads to rising sea levels, which particularly affect coastal areas. Flooding in coastal environments can occur both due to temporarily elevated water levels caused by strong winds and long-term sea level rise.

The plan areas are located in a coastal environment at Valdemarsviken and primarily consist of agricultural and forest land. The landscape is hilly, with low-lying valleys and shoreline-adjacent areas that may be sensitive to cloudbursts, standing water, and future sea level rise. Further investigations are required to identify any low points and assess the need for climate adaptation measures.

Based on the County Administrative Board of Östergötland's calculated sea level at extreme conditions, the sea level is projected to rise to 270 centimetres by the year 2100 (*Länsstyrelsen Östergötland*, 2026). This means that parts of the plan areas may become submerged, as shown in Figure 21. The primary impact of future sea level rise is expected to affect agricultural land, as well as the shoreline.

Climate change also results in higher temperatures and an increased risk of drought. According to the Agency for Civil Protection and Emergency Planning's (*Myndigheten för civilt försvar*, MCF) mapping of maximum temperatures, the plan areas are currently relatively cool, with the highest temperatures recorded on arable land (*åkermarken*) (*MCF*, 2026). This may be due to the presence of forests and open water, which have a cooling effect. However, future temperature increases may cause drought. Combined with higher temperatures, this could lead to forest and grass fires, which have become more frequent in Sweden.

Another consequence of increased temperatures and drought is water scarcity.

Within and adjacent to the plan areas, there are several precautionary areas for landslides in fine-grained soil types (*aktsamhetsområden för skred i finkorniga jordarter*) according to the Geological Survey of

Sweden (SGU) (SGU, 2026). In the southern plan area, there are also shoreline-adjacent areas with increased landslide sensitivity and shoreline erodibility (*landslide sensitivity* and *erodibility* used descriptively, as no direct English equivalents exist for the Swedish terms *förhöjd skredkänslighet* and *strandnära eroderbarhet*) (SGU, 2026; *Swedish Geotechnical Institute [SGI]*, 2026). Changes in precipitation patterns, high water levels, and other climate-related processes may affect ground stability over time, meaning that geotechnical conditions require further investigation.

Climate change and biodiversity loss are closely interconnected. Changes in temperature and precipitation conditions may affect natural environments and ecosystems, while the ability of natural environments to store carbon (see Section 7.4) and manage water plays a role in societal climate adaptation. However, climate change may also lead to an increased presence of aquatic organisms, such as algae, mussels, and other species.

Climate change is expected to alter the conditions in the area by increasing the risk of flooding, landslides, drought, and fire. Climate adaptation therefore needs to constitute an important part of the continued planning to ensure long-term sustainable land use.

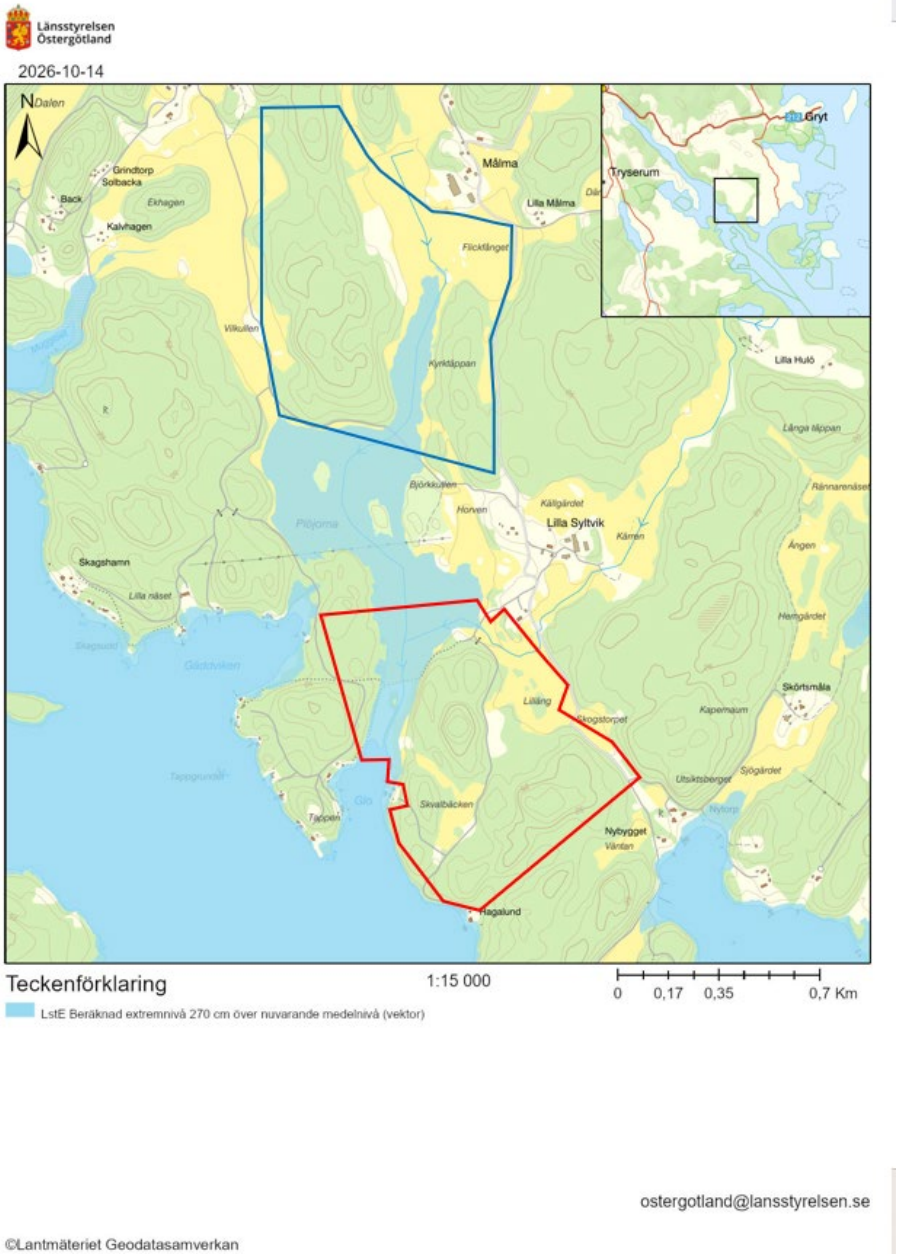


Figure 21. Map of the plan areas and surrounding area, illustrating the County Administrative Board's calculated extreme sea level rise of 270 centimetres in blue.

7.5.4 Impact, effect, and consequence

Northern plan area

A key climate-related risk for the proposed plan is future changes in cooling water supply. Higher water temperatures and longer periods of drought may affect the function of cooling systems and reduce the possibility of using the receiving body of water (*recipienten*) for cooling.

According to the National Climate and Vulnerability Assessment, risks associated with increased sea temperatures are expected to rise over the century (*SMHI, 2026*). Further investigations are required to assess the local conditions in Valdemarsviken and the need for climate adaptation measures.

The coastal location of the plan area entails a risk of impact from high water levels, cloudbursts, and future sea level rise. Hardened surfaces may also increase runoff and the risk of local flooding if cloudburst management is not adapted. According to the National Climate and Vulnerability Assessment, sea level rise represents a significant future risk for coastal nuclear facilities (*SMHI, 2026*). The proposal states that the establishment area (*etableringsytan*) within the plan area shall be located at least 3.2 metres above the current mean sea level. This is intended to provide protection against future sea level rise but shall also take into account the possibility of even higher water levels in extreme conditions. The plan description also states that the facility needs to be designed to manage high flows and cloudbursts; however, the intended design specifications are not described. Climate adaptation measures require further investigation and integration into the continued planning. Without adequate measures, there is a significant risk of damage to the nuclear facility (*SMHI, 2026*).

The increased presence of aquatic organisms due to climate change may also affect the function of cooling water systems. Organisms that cause fouling or blockage of cooling water intakes, pipelines, and technical installations may reduce cooling capacity and increase the need for maintenance measures.

Rising water temperatures may affect facility operations, as cooling water is essential for the cooling system's function. If the water becomes too warm, its cooling capacity decreases, which may limit production or cause operational disruptions. Climate change is expected to result in higher water temperatures, meaning that cooling water supply needs to be considered in the continued planning and climate adaptation of the facility. Further investigations are required to assess future temperature conditions in Valdemarsviken. Additional studies are also needed to assess the risk of fire in and around the plan area, which may be caused by a changing climate.

Given the geotechnical conditions for landslides, this needs to be addressed in the plan proposal. Due to land uplift, climate change, and the impact of the establishment on nature, ground stability may change over time. Over the years, even previously stable ground may become unstable. Geotechnical investigations are needed to assess the risks and identify any need for reinforcement or protective measures.

Nuclear facilities are generally at high risk of impact on cooling water availability due to climate change and flooding. The plan proposal is dependent on climate adaptation measures being integrated into the continued planning to manage risks related to cooling water supply, flooding, sea level rise, cloudbursts, fire, and ground stability. Without sufficient climate adaptation measures, significant risks to operations may arise. While certain climate adaptation measures are described in the plan description, thereby mitigating the risks to some extent, it is currently not possible to determine whether the intended measures will be sufficient without further investigation. Overall, the plan proposal is considered to entail unacceptable risks without such measures. With adequate measures, the risks can be minimised.

Southern plan area

The southern plan area is affected by the same climate-related risks as the northern plan area. However, the southern plan area may be more exposed to extreme weather related to wind and wind-driven surge (*uppstuvning*, a Swedish term referring to wind-generated temporary elevation of sea levels), as it is located close to the shoreline. The shoreline is also at risk of landslides, which needs to be addressed in the continued planning.

Nuclear facilities are generally at high risk of impact on cooling water availability due to climate change and flooding. The plan proposal is dependent on climate adaptation measures being integrated into the continued planning to manage risks related to cooling water supply, flooding, sea level rise, cloudbursts, fire, and ground stability. Without sufficient climate adaptation measures, significant risks to operations may arise. While certain climate adaptation measures are described in the plan description, thereby mitigating the risks to some extent, it is currently not possible to determine whether the intended measures will be sufficient without further investigation. Overall, the plan proposal is considered to entail unacceptable risks without measures. With adequate measures, the risks can be minimised.

7.5.5 Assessment of the zero alternative

As no surface hardening (*hårdgöring*) of the plan areas will take place, the ground's capacity to manage precipitation will be preserved. However, the risks described in the current situation are assumed to materialise, as no climate adaptation measures are expected to be implemented in the area. The landscape will therefore have changed in character. The new shoreline will be positioned further inland where agricultural land previously existed, as shown in Figure 21. This will affect properties surrounding the plan areas.

7.5.6 Proposals for measures

- The following measures are proposed to address climate-related risks:
- Societally critical infrastructure (*samhällsviktig verksamhet*) should be designed to withstand a 500-year rainfall event (500-*årsregn*).
- Cloudburst pathways (*skyfallsstråk*) should be planned to redirect water away from sensitive functions.
- The facility should be elevated above projected future high-water levels.
- Further investigation should be conducted into risks related to climate change that may affect the availability of cooling water or impact the nuclear facility (*kärnteknisk anläggning*). Necessary measures should be identified.
- Landslide, rockfall, and erosion risks in and around the plan areas, linked to a changing climate, should be investigated. Sites for any necessary stabilization measures should be identified.
- The placement of buildings within risk areas should be avoided.
- Risks related to fire in and around the plan areas, linked to a drier climate, should be investigated, and any necessary measures should be studied.
- An investigation should be conducted to assess future water temperatures in the receiving body of water (*recipienten*) and identify the technical measures that best ensure cooling water supply throughout the facility's lifespan in a changing climate.
- Cooling water systems should be designed to minimize the risk of blockage from vegetation, algae, and other aquatic organisms, and to enable management through operational and maintenance measures.
- An action plan for climate adaptation should be developed, covering both the construction and operational phases.
- The preservation of vegetation, wetlands, and natural drainage pathways can help reduce flooding risks, strengthen ecosystem resilience, and improve the area's climate adaptation.

7.6 Water environment

Surface water refers to water collected in seas, lakes, and watercourses (*vattendrag*). Stormwater (*dagvatten*) is water that temporarily accumulates on the ground surface as a result of precipitation, ice/snowmelt, or upward-flowing groundwater. Through surface runoff or stormwater systems, stormwater can reach surface waters.

Surface water and groundwater are integrated parts of the hydrological

cycle, with continuous exchange between the two. The quality of different water bodies is determined by their natural properties and the environmental impacts they are, or have been, exposed to.

The impact on surface water is strongly dependent on adjacent land use. An increased proportion of hardened surfaces (*hårdgjorda ytor*), such as asphalt, raises the volume of stormwater, while the level of pollutants in stormwater depends on the activities within the catchment area and whether the stormwater is treated before reaching the receiving body of water (*recipienten*).

7.6.1 Assessment criteria

Environmental quality standards for surface water
Environmental Quality Standards (EQS) for water (*miljökvalitetsnormer*, MKN) are legally binding under Chapter 5 of the Environmental Code (5 *kap. miljöbalken*) and are based on the EU Water Framework Directive (*vattendirektivet*). The standards specify the quality that a water body (*vattenförekomst*) must achieve by a certain time. Lakes, watercourses, coastal waters, and groundwater covered by water management are referred to as water bodies. For surface water, environmental quality standards include both ecological status and chemical status.

- The ecological status is assessed based on several quality factors and classified on a five-point scale ranging from high to poor.
- The chemical status is classified as either good or fails to achieve good.

The environmental quality standards guide the review and planning processes of authorities and municipalities. Permits for a project or activity, as well as the adoption of a detailed development plan (*detaljplan*), may not be granted if the measure risks causing a deterioration in a water body's status or jeopardizes the possibility of achieving applicable environmental quality standards.

Water bodies are subject to a no-deterioration requirement (*icke-försämringskrav*), meaning that human activities may not degrade the status of a water body. This requirement also applies at the level of individual quality factors, meaning that the deterioration of a single quality factor may be prohibited even if the overall status classification of the water body remains unchanged. For quality factors already in the lowest status class, any further negative impact may constitute a prohibited deterioration.

In line with the Water Framework Directive, member states must also protect, improve, and restore water bodies. In addition to the no-deterioration requirement, there is therefore a requirement for improvement (*förbättringskrav*), meaning that measures and decisions

shall contribute to enabling water bodies to achieve good status in the long term. In planning and review processes, it must therefore be demonstrated whether a plan proposal or project risks deteriorating the status of a water body or complicating the achievement of applicable environmental quality standards.

Marine Environment Ordinance
The Marine Environment Ordinance (*Havsmiljöförordningen*, SFS 2010:1341) is based on the EU Marine Strategy Framework Directive (*havsmiljödirektivet*) and aims to maintain or achieve good environmental status (*god miljöstatus*) in the marine environment through ecosystem-based management. The ordinance covers Sweden's marine areas in the Baltic and North Seas and regulates, among other things, the assessment of the marine environment's status, environmental quality standards for the marine environment, monitoring, and action programmes to improve or preserve the marine environment.

Good environmental status is assessed based on several quality aspects, including biodiversity, marine habitats, nutrient loads, hazardous substances, underwater noise, and impacts on marine ecosystems. Within marine environmental management, environmental quality standards have been established to ensure that the marine environment's structure, function, and ecological processes are preserved or improved.

In the planning and review of activities that may affect the marine environment, regard shall be taken to applicable environmental quality standards and the objective of good environmental status. When planning activities that may affect the marine environment, potential effects on the marine environment and the possibilities of maintaining or achieving good environmental status must be identified and assessed.

Municipal guidelines for water environment according to the Comprehensive Plan (ÖP)
Below are Valdemarsvik Municipality's guidelines for stormwater management within the municipality:

- Stormwater shall be managed and treated in a sustainable manner. In new construction and redevelopment, it is important to allocate areas for stormwater management.
- In connection with detailed development planning (*detaljplaneläggning*), areas should be reserved to create better conditions for local stormwater management and the construction of detention basins (*fördröjningsmagasin*).
- In detailed planning and other localization decisions under the Planning and Building Act (*Plan- och bygglagen*, PBL), the

municipality shall ensure that plans or decisions do not result in the exceeding of environmental quality standards for water.

- Valdemarsvik Municipality strives to actively implement the measures recommended by the Water Authority (*Vattenmyndigheten*).
- The municipality shall strive to fulfil the prioritized measures in the water and sanitation plan (VA-*plan*).

7.6.2 Methodology and uncertainties

No project-specific water investigations have been conducted for the plan areas. The description of the current situation and the assessment of the plan's consequences, effects, and impact on the water environment are therefore based on existing publicly available data from open sources, government reports, and other available materials. The lack of recipient studies (*recipientutredningar*), sediment investigations, and detailed information on the facility's design introduces uncertainties regarding the activity's impact on the water environment, aquatic organisms, environmental quality standards for water, and adjacent Natura 2000 areas. The assessments should therefore be considered strategic and will require supplementation with in-depth investigations in subsequent stages.

7.6.3 Current situation

Valdemarsvik Municipality is characterized by its location along the Baltic Sea coast and its extensive archipelago environments. Coastal waters provide important habitats for flora and fauna and are of significant value for recreation, fishing, and ecosystem functions. At the same time, the water environment is affected by human activities, particularly through eutrophication and historical emissions of hazardous substances. To protect and improve the water environment, coastal waters are covered by environmental quality standards under water management.

The plan area is located adjacent to Valdemarsviken and the Baltic Sea coast. The coastal water environments thus form a central part of the area's natural conditions. Valdemarsviken is part of a larger coastal and archipelago system where water quality, ecological interactions, and marine natural values are important aspects to consider.

The inner part of Valdemarsviken has historically been affected by hazardous substances and contaminated sediments. Remediation measures have been implemented, but knowledge of sediment conditions outside the remediated area, which borders the water adjacent to the plan area, is limited. According to the VISS (*Vatteninformationssystem Sverige*), the water body Inner

Valdemarsviken has unsatisfactory ecological status and does not achieve good chemical status (VISS, *n.d.*). Outer Valdemarsviken, within which the plan area lies, has moderate ecological status and does not achieve good chemical status (VISS, *n.d.*). The water environment is affected by eutrophication and the presence of hazardous substances. The adjacent water bodies Kvädöfjärden and Halsöfjärden also both have moderate ecological status and do not achieve good chemical status.

Östergötland generally has limited access to large groundwater reservoirs. During dry periods, problems with water supply may arise, and several consecutive dry summers can also affect larger drinking water reservoirs. In the longer term, a changing climate with increased evaporation and longer growing seasons may lead to reduced groundwater recharge (*grundvattenbildning*) (*County Administrative Board of Östergötland [Länsstyrelsen Östergötland]*, 2020).

7.6.4 Impact, Effect, and Consequence

Northern plan area

The facility will require cooling for the removal of excess heat. Once-through cooling (*genomströmningskylning*) generally entails a larger cooling water intake, while recirculating cooling systems with cooling towers result in significantly lower water abstraction. The water is then returned to the receiving body of water (*recipienten*) with an elevated temperature. Depending on the cooling technology selected, the extent of water abstraction and temperature impact on the receiving body of water may vary.

For a reactor with a thermal output of 1200–1600 MW, the estimated cooling water intake for once-through cooling is approximately 90 m^3 per second. After being used to cool the reactor, the water is discharged back into the receiving body of water at an elevated temperature. The temperature increase is estimated at approximately 10°C, which may affect temperature conditions in the affected surface water body (*ytvattenförekomst*) and thereby the biological and ecological conditions in the aquatic environment. The cooling water intake and discharge of heated water may impact fish, benthic fauna (*bottenlevande djur*), and plankton through altered temperature conditions, as well as through the risk that eggs, larvae, and other small organisms may be drawn into the cooling water intake. The local warming may also affect species composition and alter competitive relationships between different species, potentially favouring thermophilic (*värmekrävande*) species and even invasive alien species. Experience from Swedish nuclear power plants demonstrates that such effects may occur and should be further investigated in upcoming licensing processes.

The construction of cooling water intakes, discharge points, and

associated pipelines may also affect hydromorphological quality factors (*hydromorfologiska kvalitetsfaktorer*) through changes to benthic environments, shoreline zones, and local flow conditions. Such measures may impact the physical structure of the aquatic environment and ecological connectivity (*ekologiska konnektivitet*). The extent of this impact will depend on the final location and design of the facility and requires further investigation.

If cooling water intakes, discharge points, or associated pipelines are located in areas with contaminated sediments, there is a risk that construction activities or the altered flow conditions resulting from the abstraction and discharge of cooling water may cause turbidity (*grumling*) and the spread of sediment-bound pollutants. This could affect water quality and the chemical status of the affected water bodies. Adjacent coastal water bodies may also be impacted, depending on the discharge point and prevailing currents. If necessary, protective measures and adapted working methods may be implemented to limit such impacts and reduce the risk of erosion, turbidity, and the spread of contaminated sediments.

The inner part of Valdemarsviken has historically been affected by sediment contamination and has been subject to remediation measures. If cooling water intakes are located further into the bay, the risk of impact on and spread of remaining contaminants must be considered. Since knowledge of the extent of sediments outside the remediated areas is limited, uncertainties exist regarding the potential scale of such impacts.

The facility will entail the replacement of natural land with buildings, roads, and other hardened surfaces (*hårdgjorda ytor*). If stormwater is not managed and treated appropriately, this may lead to increased runoff and the transport of pollutants to nearby water bodies. Pollutant loads may include metals, oil contaminants, nutrients, and suspended solids (*suspenderat material*). Stormwater management must therefore be designed to minimise the impact on the aquatic environment and affected water bodies.

The facility may also result in long-term changes to groundwater conditions. Deep structural elements, foundations, and potential permanent abstraction of groundwater may affect groundwater levels across a wider area than the plan area itself. Such changes may impact soil water conditions and the prerequisites for nearby agricultural land, forest land, surface water environments, and other groundwater-dependent environments. The extent of the impact will depend on the final design of the facility, foundation requirements, and local hydrogeological conditions, and therefore requires further investigation in upcoming stages.

Overall, the plan proposal is assessed to entail moderate negative consequences for the aquatic environment. This assessment is based on the risk of impact from cooling water abstraction and the discharge of heated water, altered groundwater conditions, effects on aquatic organisms, changes to the physical structure of the aquatic environment, and the risk of spreading sediment-bound pollutants and contaminated stormwater. The construction of cooling water intakes, discharge points, and associated pipelines may also affect hydromorphological quality factors through changes to benthic environments, shoreline zones, and local flow conditions. However, the extent of these consequences will depend on the final design of the facility, the choice of cooling technology, the location of intakes and discharges, and the protective and precautionary measures implemented. Further investigations are needed to assess the impact of cooling water abstraction and discharge, and to optimise the location and design of intakes and discharges. Flow conditions play a significant role in the spread of heat, nutrients, and any discharges, and therefore must be considered in the continued design process. SMHI's coastal zone models and other data on water turnover can be used to assess the impact and the extent of the area of influence.

Southern plan area

For the southern plan area, it is assumed that the cooling water intake and discharge points will be the same as for the northern plan area; thus, the impact will be identical (see the Northern plan area section).

The establishment of a nuclear facility will entail the conversion of natural land into hardened surfaces for buildings, roads, and other infrastructure. This may result in stormwater containing metals, petroleum products, and other operational pollutants being discharged into nearby recipients during heavy precipitation. Pollutants in stormwater often constitute a significant source of pollution for nearby aquatic environments in developed areas. Stormwater management must therefore be designed to limit the impact on the aquatic environment and to ensure compliance with applicable environmental quality standards for water.

At present, there is insufficient data to assess future stormwater flows and pollutant concentrations. In upcoming licensing and design phases, stormwater investigations will therefore be required, covering flows, pollutant content, and the need for detention, treatment, and other protective measures.

The facility may also result in long-term changes to groundwater conditions. Deep structural elements, foundations, and potential permanent abstraction of groundwater may affect groundwater levels across a wider area than the plan area itself. Such changes may impact soil water conditions and the prerequisites for nearby agricultural land,

forest land, surface water environments, and other groundwater-dependent environments. In coastal areas, altered groundwater conditions may also affect the interaction between groundwater and surface water. The extent of the impact will depend on the final design of the facility, foundation requirements, and local hydrogeological conditions, and therefore requires further investigation in upcoming stages.

A port will be established within the plan area to enable maritime transport of large components, construction materials, and other equipment required for the facility's construction. Port operations are not expected to be relevant solely during the construction phase but may also be necessary during the operational phase for transport related to the facility's operation, maintenance, and waste management. Increased shipping may affect the aquatic environment through waves, erosion, altered flow conditions, and disturbances to aquatic organisms. The construction and operation of port facilities may also impact hydromorphological quality factors through changes to shoreline zones, benthic environments, and the physical structure of the aquatic environment, as well as affect ecological connectivity.

The proposed activities may potentially entail moderate to significant negative consequences for the aquatic environment, primarily related to cooling water management, in-water construction activities, port operations, changes to the physical structure and function of the aquatic environment, and potential impacts on contaminated sediments and stormwater runoff. However, the extent of these consequences will largely depend on the final design of the facility, the choice of cooling technology, the location of cooling water intakes, discharge points, and port facilities, as well as the protective and precautionary measures implemented. At present, significant uncertainties exist in this assessment. Since the affected water bodies already exhibit impacts and do not achieve good ecological and/or chemical status, it must be ensured that the facility does not result in a deterioration of the status of any water body or any individual quality factor, in accordance with the no-deterioration requirement in water management. The facility's impact on the possibility of achieving applicable environmental quality standards for water must therefore be further investigated.

7.6.5 Assessment of the Zero Alternative

If the planned activity is not carried out, no new impacts on the aquatic environment will arise due to cooling water abstraction, discharges of heated cooling water, port operations, shipping, or in-water construction works. This eliminates the risk of turbidity, sediment disturbance, and the spread of any potential contaminants associated with the construction of cooling water facilities, pipelines, or the port.

However, the aquatic environment in the area is assessed to remain affected by existing pressures in the future. Neither Inner nor Outer Valdemarsviken currently achieves good chemical status, and both are impacted by, among other things, historical contamination and eutrophication. Without the planned activity, these sources of impact are expected to persist and continue to influence the development of the aquatic environment. Any future improvements in water quality are therefore presumed to depend primarily on measures targeting existing sources of pollution and nutrient loads within the catchment area.

7.6.6 Proposals for Measures

The following measures are proposed to minimise impacts on the water environment:

- The cooling system should be designed to minimise water abstraction and thermal impact on the receiving body of water.
- The localisation of cooling water intakes and discharges should be adapted to avoid sensitive aquatic environments.
- Any in-water works should be planned to limit turbidity and sediment spread.
- The design and foundation of the facility should be adapted to minimise impacts on groundwater levels and groundwater-dependent environments.
- Stormwater management should be designed to limit stormwater flows and pollutant loads to the receiving body of water, for example through appropriate detention and treatment.
- The activity's impact on environmental quality standards for water and adjacent Natura 2000 areas should be further investigated in subsequent stages.
- Port and water facilities should be localised and designed to minimise impacts from shipping, waves, and erosion.

7.7 Resource Management and Energy

Natural resources are economic assets that exist in nature without human intervention. From certain natural resources, raw materials or primary energy can be extracted. Natural resources can be equated with land use that generates economic value. These resources may be finite or renewable. However, it is always important that they are utilised efficiently and in an environmentally sound manner to ensure their availability for future generations.

Examples of natural resources include agriculture, forestry, drinking water, fisheries, sand and gravel, minerals, energy extraction (solar,

wind, hydropower, or from fossil sources), and peat.

7.7.1 Assessment Criteria

Assessments of natural resources primarily consider their current status, the conditions for continued use, and any changes in resource quality.

Principles for sound management of land and water are based, among other things, on the resource management provisions (*hushållningsbestämmelser*) of the Environmental Code (*miljöbalken*), Chapters 3–4. According to Chapter 3, Section 1 of the Environmental Code, priority should be given to land use that promotes resource management that is sound from a public interest perspective. These provisions cover, among other things, land areas that hold value or significance for agriculture and forestry, as well as the extraction of valuable substances and materials.

Agriculture and forestry are of national significance according to Chapter 3, Section 4 of the Environmental Code. The provisions emphasise the cultivation value (*brukningsvärde*) of the land as central to conservation interests. Thus, it is the agricultural and forestry sectors that are of national interest, not merely the land itself. Cultivation-worthy agricultural land may only be taken into use for facilities that serve essential public interests, where this need cannot be satisfactorily met on other land. Forest land should, as far as possible, be protected from measures that hinder rational forestry.

Land and water areas containing valuable substances or materials should, as far as possible, be protected against measures that could significantly hinder their extraction. Such areas are to be designated as national interests (*riksintressen*) according to Chapter 3, Section 7 of the Environmental Code.

In the assessment, areas designated as national interests under Chapter 3 of the Environmental Code are also taken into account. Land and water areas of significance for commercial fishing, communications infrastructure, or total defence (*totalförsvaret*) should, as far as possible, be protected against measures that could significantly hinder the establishment, utilisation, or development of these interests. Where multiple national interests concern the same area, a balancing of interests shall be carried out in accordance with the resource management provisions of the Environmental Code.

7.7.2 Methodology and Uncertainties

No detailed investigations have yet been conducted into the cultivation value of agricultural land and forest land, or the impact on commercial fishing, within the plan areas. The description of the current situation

and the assessment of the plan's impacts, effects, and consequences are therefore based on existing data from authorities, publicly available sources, and other available materials. This means that uncertainties exist regarding the plan proposal's impact on agriculture, forestry, and other natural resources. The assessments should thus be viewed as strategic and should be supplemented with further investigations and inventories in subsequent stages.

7.7.3 Current Situation

The plan areas consist of agricultural and forest land. Agricultural land is a finite resource of great importance for food supply and preparedness (*beredskap*). According to the Swedish Board of Agriculture (*Jordbruksverket*), cultivation-worthy agricultural land should be safeguarded and only used where the need cannot be met on other land (*Jordbruksverket*, 2026). Within the municipality, the proportion of agricultural land in relation to forest land is comparatively small. Nevertheless, agriculture has traditionally contributed to creating the unique values present today in nature, culture, and recreation. Valdemarsvik Municipality emphasises the importance of creating conditions for the continued practice of primary industries (*areella näringar*) both in the archipelago and on the mainland in its comprehensive plan (ÖP) (*Valdemarsvik Municipality*, 2018). The primary industries in the municipality have declined significantly in scope, particularly in the archipelago. This decline poses a risk that these industries cannot be maintained in the long term.

The agricultural land within the plan area and surrounding land consists of arable land (*åker*) and permanent grassland. In the vicinity of the plan areas, there are two active agricultural enterprises. Both operate cattle herds with suckler cows, grazing, and crop cultivation. The agricultural land located within and closest to the facility's plan areas is primarily cultivated by one of these enterprises. These areas consist almost exclusively of arable land (*Länsstyrelsen Östergötland*, 2026).

Approximately 75 per cent of Valdemarsvik Municipality's land area consists of forest land, primarily coniferous and mixed forests. Forest land of significance for the forestry sector should, as far as possible, be protected against measures that could hinder rational forestry, in accordance with the Environmental Code (1998:808).

In the marine area adjacent to the plan area, there are three national interest areas for commercial fishing (see Figure 22), located both further out to sea (Västervik Outer Sea Area [RI YF 05 HP] and Gustaf Dalén [RI YF 04 HP]) and along the coastline past the mouth of Valdemarsviken and further south towards Västervik (Kvädö Västervik and Misterhult Archipelagos [RI YF 46 KZ]). In the southern parts of the

municipality, this national interest overlaps with national interests for nature conservation and recreation. These are not considered to conflict with each other but are dependent on the ecological status of the Baltic Sea (*Valdemarsvik Municipality*, 2018). Commercial fishing in the area is conducted primarily as small-scale coastal fishing and, despite its limited extent, constitutes a natural resource that contributes to local food production and the utilisation of ecosystem services in coastal and marine areas. The fishing targets species such as pike, perch, zander, Baltic herring, as well as whitefish, salmon, and sea trout. There is value in enabling commercial fishing to continue.

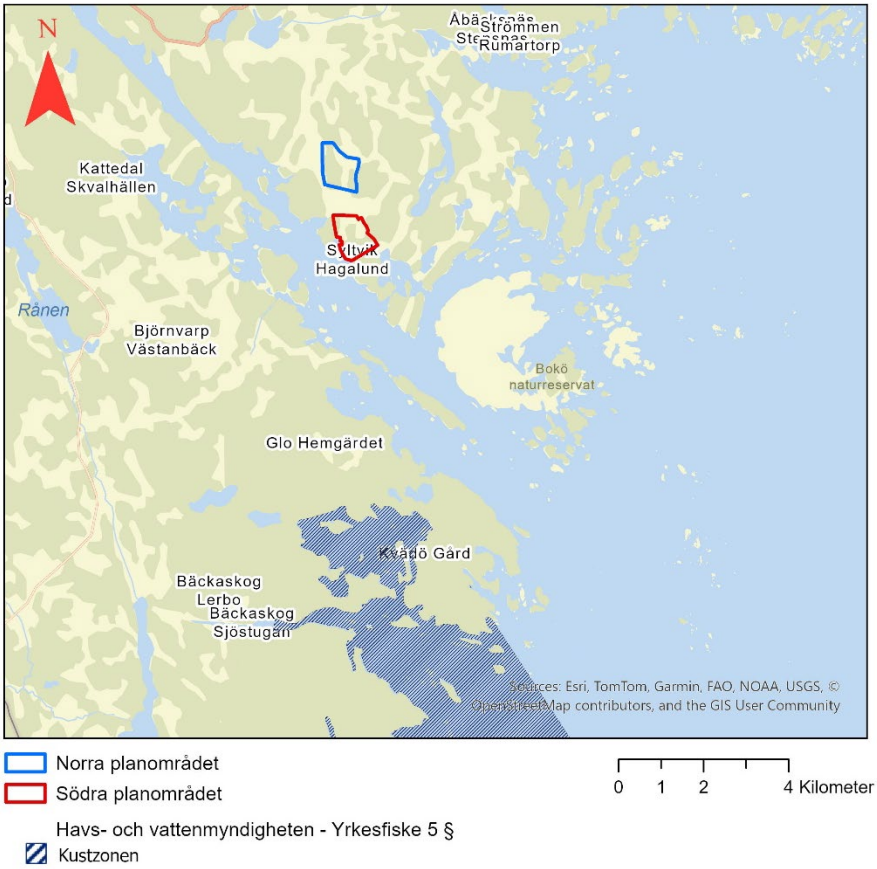


Figure 22. National interest for commercial fishing – Kvädö Västervik and Misterhult Archipelagos [RI YF 46 KZ], with the two plan areas indicated.

The two plan areas are located within and in proximity to areas associated with the national interest for total defence (Weather Radar Vilebo [TM0090] and Impact Area [TM0509]) (see Figure 23).

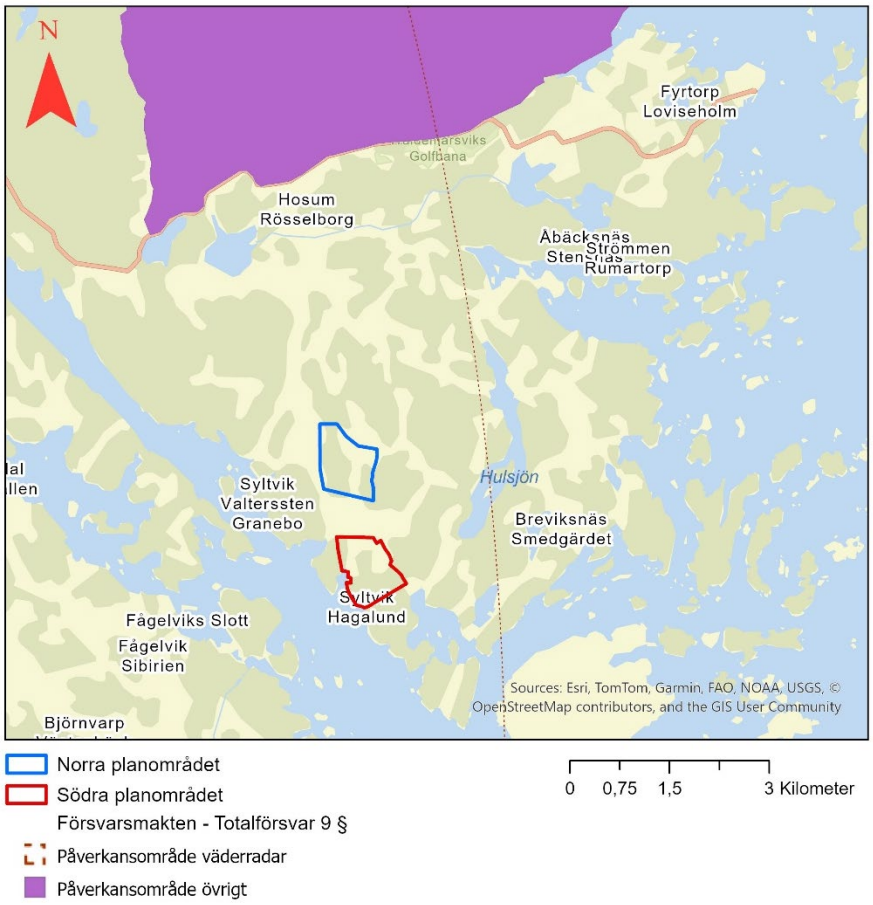


Figure 23. National interest for total defence ([TM0090] and [TM0509]), with the two plan areas indicated.

7.7.4 Impact, Effect, and Consequence

Northern plan area

The establishment of a nuclear facility in the northern plan area entails the permanent taking into use (*permanent ianspråktagande*) of all agricultural land within the plan area, totalling approximately 24 hectares. This will reduce opportunities for food production and diminish the availability of land for local agriculture. The planning of the area will also impact surrounding agricultural land, as it fragments larger arable fields. The extent to which accessibility for agricultural machinery to the remaining farmland will be affected depends on the design of access roads and the fencing of the area. This is not currently specified and cannot therefore be assessed at this stage. Whether rational agriculture (*rationellt jordbruk*) can continue after the plan area has been developed requires further investigation to fully understand the total impact on agriculture in the area. Given that primary industries (*areella näringar*) in the municipality have already declined, further loss of agricultural land may have a significant impact on the municipality's

capacity for food production.

Cultivation-worthy agricultural land (*brukningsvärd jordbruksmark*) may only be taken into use for facilities that serve essential public interests and where this need cannot be satisfactorily met on other land. The production of fossil-free electricity and a strengthened national power supply may constitute an essential public interest under the resource management provisions (*hushållningsbestämmelserna*) of the Environmental Code. In the plan proposal, the taking into use of agricultural land is justified on the grounds that the facility is of such significant public interest that other interests must yield. It is also stated in the plan proposal that it is not possible to avoid the intrusion by using other land. However, without a site investigation (*lokaliseringsutredning*), it is not possible to assess whether the chosen location is the most suitable or whether alternative sites would result in less impact on agricultural land and other public interests.

The loss of agricultural land will also affect the potential for livestock farming, as pastureland is developed.

In addition to the impact on existing agricultural land, the northern plan area will also permanently take into use approximately 46 hectares of forest land. While this reduces a larger forest area, only minor fragmentation is expected to occur. The decline in primary forestry industries in the municipality means that the impact of the facility's establishment on forest land is assessed to have a negligible impact on forestry in the municipality. However, the accessibility for forestry machinery to remaining forest areas requires further investigation.

The northern plan area has no direct connection to the coastline. The impact on commercial fishing (*yrkesfiske*) is therefore assessed to be primarily indirect and dependent on the final design of the cooling water system and discharge points. Sections 7.2.4 and 7.6.4 describe the impact on aquatic species due to increased water temperature. If fish stocks or important habitats are affected, this may, over time, impact the conditions for coastal commercial fishing. The extent of such an impact requires further investigation. Additionally, potential fishing bans or other restrictions near cooling water discharge points may affect the ability to conduct commercial fishing.

The nuclear facility and its operations will require large amounts of electricity to operate. However, the facility is also expected to produce fossil-free electricity for approximately 60 years. Studies generally show that nuclear power generates significantly more energy over its lifecycle than it consumes. The facility will contribute to the national power supply, which is considered positive for resource management.

The potential impact of establishing the nuclear facility on the national

interest for total defence ([TM0090] and [TM0509]) requires further investigation.

The northern plan area entails a larger permanent taking into use and fragmentation of agricultural land, but a smaller taking into use of forest land. Agricultural land in the municipality, particularly in archipelago areas, is already decreasing. Without a site investigation, it is not possible to assess whether the chosen location is the most suitable in relation to agricultural land. There is a risk that the national interest for commercial fishing may be indirectly impacted due to the cooling water that the facility will generate. At the same time, the plan proposal enables an increase in national energy production, which may constitute a public interest under the resource management provisions of the Environmental Code. Overall, the plan proposal is assessed to result in significant negative consequences for the agricultural sector. However, the plan proposal also enables the long-term production of fossil-free electricity, which entails positive consequences for energy resource management and Sweden's power supply.

Southern plan area

Establishing a nuclear facility in the southern plan area entails the taking into use of approximately 16.5 hectares of agricultural land and 53.5 hectares of forest land. In the southern plan area, forestry will be primarily impacted, as a larger area of forest land is lost and forest areas are fragmented. The question of whether rational forestry (*rationellt skogsbruk*) can be conducted on the remaining forest patches is unanswered and requires further investigation. The loss of forest land for production forestry may therefore be greater than just within the plan area.

The planning of the southern plan area entails the taking into use of agricultural land, leading to both a reduction in agricultural area and some fragmentation of remaining land. Although the conditions for rational agriculture are assessed to be better here than in the northern plan area, the loss of land will have a negative impact on the agricultural sector. Given that primary industries in the municipality have already declined, further loss of agricultural land may significantly affect the local capacity for food production.

As with the northern plan area, the establishment of the nuclear facility may be considered an essential public interest, given the planned production of large amounts of energy for Sweden's power grid. However, without a site investigation, it remains unclear whether this need could be met on other land.

Unlike the northern plan area, the southern plan area is located directly adjacent to the shoreline. The impacts described in Sections 7.2.4 and

7.6.4, related to the location and cooling water discharge, may indirectly affect the national interest for commercial fishing. Impacts on fish stocks and broader biodiversity may significantly affect the ability to continue commercial fishing. Additionally, the port and the planned transport to and from the plan area may impose limitations on fishing through indirect impacts. Further investigation is required to determine the full extent of the effects. Furthermore, potential fishing bans or other restrictions near cooling water discharge points may affect the ability to conduct commercial fishing.

Like other renewable energy sources such as wind, hydro, and solar power, nuclear power constitutes a fossil-free energy source with low greenhouse gas emissions over its entire lifecycle. While the facility will require significant resources and energy during construction and operation, it is expected to produce large quantities of fossil-free electricity over the long term. The long-term electricity production is assessed to contribute positively to energy resource management and the national power supply.

The Swedish Armed Forces (*Försvarsmakten*) raised no objections to the establishment during the scoping consultation (*avgränsningssamråd*). Consequently, the national interest for total defence ([TM0090] and [TM0509]) is assessed not to be impacted.

Similar to the assessment of the northern plan area, the southern plan area entails the permanent taking into use of agricultural and forest land. The southern plan area results in a smaller taking into use of agricultural land, but a larger taking into use and greater fragmentation of forest land. There is also a risk of indirect impact on the national interest for commercial fishing due to cooling water discharges from the facility and impacts on the coastal environment. At the same time, the plan proposal enables an increased national production of fossil-free electricity, which constitutes a significant public interest. Overall, the plan proposal is assessed to result in moderate negative consequences for the management of agricultural and forest land. However, the plan proposal enables the long-term production of fossil-free electricity, which entails positive consequences for energy resource management and Sweden's power supply.

7.7.5 Assessment of the Zero Alternative

The zero alternative means that the facility plan is not implemented and no nuclear activity is established in either the northern or southern plan area. This entails that agricultural land, forest land, and the natural resources associated with the coastal environment are assessed to continue to be used for food production and the extraction of raw materials.

However, with the zero alternative, no energy will be produced in the plan area that could contribute to Sweden's national energy supply. Nevertheless, it is assumed that the electricity demand will be met elsewhere in Sweden.

No impact on the national interest for commercial fishing (*riksintresse för yrkesfiske*) or other industries connected to the aquatic environment is expected.

The natural resources currently used in the plan areas are assessed to remain available under the zero alternative. Overall, the zero alternative is assessed not to entail any consequences for the management of natural resources.

7.7.6 Proposals for Measures

The following measures are proposed to minimise impacts on natural resources:

- The location and design of the facility should be adapted to have as little impact on agricultural land as possible.
- The intrusion into productive forest land should be limited as far as possible, through efficient land use and the siting of new infrastructure.
- In cases where agricultural land or forest land is taken into use, the extent should be reported and justified in accordance with the resource management provisions (*hushållningsbestämmelserna*) of the Environmental Code (*miljöbalken*).
- The design of cooling water systems should be adapted to minimise impacts on commercial fishing and other industries connected to the aquatic environment.
- Further investigations should be conducted to assess the plan proposal's impact on agriculture, forestry, and fishing.

7.8 Risk and Safety

Risk and safety are central aspects of spatial planning and encompass a range of events with varying probability and consequence. In this context, risk is defined as a combination of the probability of an unwanted event occurring and the consequences it may entail. Additionally, the vulnerability of the plan areas and other risks that may arise during the operational phase are assessed. Through risk assessments, the risk exposure present at a specific location can be identified and evaluated.

When assessing risk, measures such as individual risk and societal risk

(*samhällsrisk*) are often used.

- Individual risk describes the probability that a single person may lose their life due to an accident at a specific location, for example near an industrial facility or transport route.
- Societal risk, on the other hand, considers the consequences for a larger number of people, taking into account population density and how many people may be affected in different accident scenarios.

Within the framework of risk and safety, exposure to electromagnetic fields is also considered.

Preparedness (*beredskap*) is another aspect addressed under risk and safety. Preparedness encompasses society's ability to prevent, manage, and recover from disruptions, accidents, and other events that may impact human health, the environment, or critical societal functions. For nuclear facilities, the issue of preparedness is particularly important due to the stringent safety requirements and the need to manage both normal operating conditions and extraordinary events.

7.8.1 Assessment Criteria

In addition to the general provisions in the Planning and Building Act (*plan- och bygglagen*) and the Environmental Code (*miljöbalken*) regarding the siting of buildings on land suitable in terms of environment and health, there are several laws, regulations, and guidelines related to risk management, protective distances, and the handling of flammable and explosive materials.

In Sweden, there is no national decision on which methodology or criteria should be applied for risk evaluation, but common practice is to use Det Norske Veritas' risk criteria for individual and societal risk. The criteria are designed with an upper and a lower limit, as shown in Figure 24.

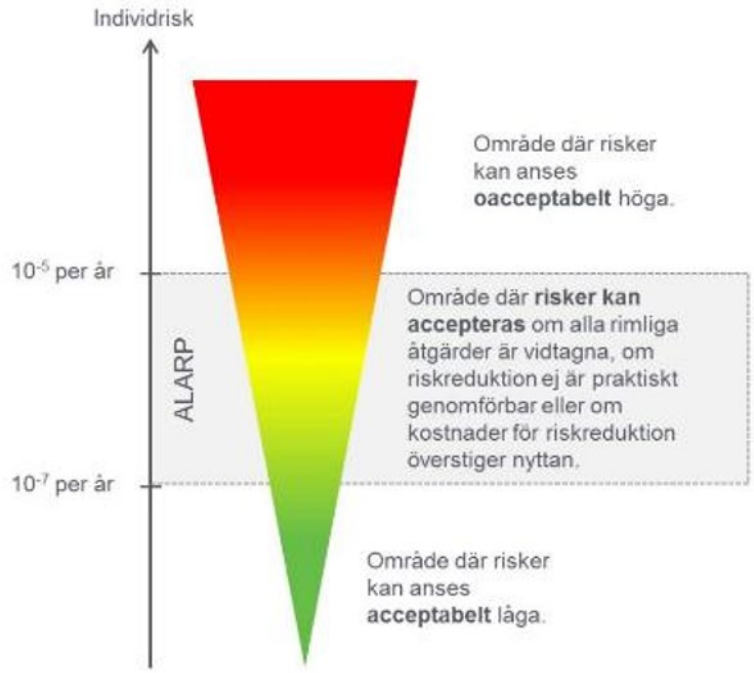


Figure 24. Principle for risk evaluation in physical planning (Swedish Civil Contingencies Agency [SRV], Det Norske Veritas, 1997).

Preparedness

The assessment of preparedness is based on the plan's impact on society's ability to prevent, withstand, and manage accidents, disruptions, and crises. Particular consideration is given to the impact on:

- Societally critical infrastructure (*samhällsviktig verksamhet*),
- Critical infrastructure (*kritisk infrastruktur*),
- Accessibility for emergency response operations (*räddningsinsatser*),
- Supply systems, and
- Conditions for civil preparedness (*civil beredskap*) and total defence (*totalförsvaret*).

7.8.2 Methodology and Uncertainties

No in-depth investigations into risk, safety, or preparedness have yet been conducted for the plan areas. The description of the current situation and the assessment of the plan's impact, effects, and consequences are therefore based on existing publicly available data from authorities, open data sources, and other available materials. This means there are uncertainties regarding the plan proposal's impact on risk and safety, particularly concerning radioactive waste and transport solutions. The assessments should therefore be seen as strategic and should be supplemented with further investigations and inventories in

subsequent stages.

7.8.3 Current Situation

The plan areas are located in a sparsely populated environment near Valdemarsviken and consist primarily of forest and agricultural land. Currently, there are no activities within the plan areas that pose extensive risks to the surrounding area. The areas are therefore not subject to any special safety zones (*säkerhetszoner*) or protective distances (*skyddsavstånd*) associated with hazardous activities.

However, the presence of homes and holiday cottages adjacent to the plan areas means there are people who may be exposed to disruptions and risk situations due to future establishment activities. The current population in the area is, however, low compared to urban environments.

Accessibility to the area currently depends on the local road network, which mainly consists of private gravel roads. None of the roads near the plan areas serve as primary or secondary routes for the transport of dangerous goods.

The plan areas are situated within an area where the interests of total defence (*totalförsvaret*) constitute an important planning condition. Risk and safety issues are also influenced by access to road networks, technical infrastructure, and the ability to conduct emergency response operations.

Currently, there is no nuclear activity in the area, and consequently, no emergency planning zones (*beredskapszoner*) or emergency measures (*beredskapsåtgärder*) related to radioactive substances or radioactive waste exist in the region.

7.8.4 Impact, Effect, and Consequence

Northern Plan Area

The establishment of nuclear facilities (*kärntekniska anläggningar*) in the northern area introduces new risk and safety issues in a region currently lacking activities with a comparable risk profile. The presence of residential and holiday homes adjacent to the area means that people may be affected by risks and disruptions associated with nuclear activities, even though such activities are subject to stringent safety requirements and protective systems.

A nuclear facility places high demands on functional infrastructure and good accessibility for emergency services (*räddningstjänst*). The quality of the road network thus plays a central role. The facility plan (*anläggningsplanen*) presents two alternative road routes to and from

the plan areas. During the operational phase, the application estimates that 250–300 passenger cars, a couple of buses, and a limited number of freight transports will traverse these routes daily. Transports of dangerous goods (*farligt gods*) may also affect locations along the road in the event of a spill or accident.

No port is proposed for the northern plan area, meaning all transport will occur via the road network. The application proposes two alternative routes to the plan areas, both of which require extensive reconstruction measures due to their current insufficient width and lack of the structural capacity needed for heavy traffic. As only one of the two alternative roads is planned to be constructed, accessibility to and from the facility is expected to be vulnerable. Should only one road lead in and out of the plan area, accessibility risks becoming restricted, posing a threat to safety. Additionally, certain reinforcement measures will be required on County Road 212 (*länsväg 212*) to achieve sufficient road capacity. The conditions for implementing protective measures must be ensured to safeguard people and the environment in the event of an accident.

The preliminary emergency planning zones (*beredskapszoner*) presented for the plan areas cover a relatively small number of people compared to, for example, Ringhals. The inner emergency planning zone (*inre beredskapszonen*) primarily consists of rural and archipelago environments with low population density. The nearest settlement is Gryt, and no facilities of particular significance for healthcare or social care have been identified within the zone. Within the outer emergency planning zone (*yttre beredskapszonen*), Valdemarsvik urban area (*Valdemarsviks tätort*) and several schools, preschools, and healthcare facilities are located. These facilities constitute important assets for preparedness in the event of an accident. At the same time, the number of sensitive facilities within the zone is limited compared to several existing nuclear facilities in Sweden. The conditions for emergency planning (*beredskapsplanering*) are considered good, but a more detailed mapping of societally critical infrastructure (*samhällsviktig verksamhet*), such as schools, healthcare services, and other infrastructure, is required.

During the operational phase, the area will host nuclear activities involving the handling of radioactive materials (*radioaktiva ämnen*). Despite extensive safety systems, a severe accident cannot be entirely ruled out. Such an event could lead to the release of radioactive substances over a wider area and require the implementation of protective measures and emergency response efforts.

The handling and storage of chemicals represent a risk factor during the operational phase. Accidents, leaks, fires, or explosions in connection

with chemical handling may impact people and the environment. To limit these risks, preventive safety measures and preparedness for rapid response to any accidents are necessary. Given that the northern plan area will be primarily surrounded by forest, the effect of a fire at the facility could have major consequences for the nearby area if the forest were to catch fire. Additionally, the location of the northern plan area in a forested landscape means that forest fires must be considered as an external risk factor for the facility. In the event of a large-scale forest fire, there is a risk that critical infrastructure and the safety of the facility could be affected, placing heightened demands on preventive fire protection and preparedness.

The facility will also generate radioactive waste (*radioaktivt avfall*) and spent nuclear fuel (*förbrukat kärnbränsle*), which must be managed and stored safely on an interim basis. To limit the release of radioactive substances, the activities must be designed in accordance with applicable requirements and radiation protection regulations (*strålskyddsregelverket*). In the event of an accident, the facility is expected to implement protective measures to minimise consequences for people and the environment. These measures are based on current legislation and the regulations of the Swedish Radiation Safety Authority (*Strålsäkerhetsmyndigheten*) and include systems for immediate public warning both outdoors and indoors. In addition, preparedness includes the pre-distribution of iodine tablets (*förhandsutdelning av jodtabletter*) to households and individuals within the affected areas and the preparation of evacuation routes.

The facility is planned to be classified as a protected area (*skyddat område*), which will include parts of buildings containing vital equipment for the safe operation of the facility or where nuclear materials and nuclear waste are handled and stored. The protected area is located within the monitored area (*bevakade området*).

A comparison with the conditions surrounding the existing nuclear facilities in Oskarshamn shows that the Målma area has relatively low population density and fewer societally critical activities within the proposed emergency planning zones. The conditions for implementing protective measures are thus assessed to be comparable to, and in some respects better suited than, those in the vicinity of Oskarshamn. The comparison indicates that the area's demographic conditions and built environment do not pose an obvious obstacle to risk and safety. However, this must be verified through an investigation into whether the buildings adjacent to the plan area are primarily holiday homes or permanent residences.

Both inner and outer emergency planning zones are planned, where different types of protective measures may be applied depending on the

extent and nature of the event. Within the inner emergency planning zone, priority is given to measures that can rapidly protect people from exposure to radioactive substances, while the outer emergency planning zone aims to enable the early dissemination of information and the implementation of protective measures over a larger geographic area. These aspects are assessed to provide good conditions for implementing protective measures and maintaining effective preparedness in the event of an accident. At the same time, further planning must ensure that the road network and other critical infrastructure have sufficient capacity to support emergency services and the dissemination of information.

Southern Plan Area

Similarly, the establishment of nuclear facilities in the southern plan area introduces new risk and safety issues. However, the proximity of the area to the coast and archipelago means that the activities will have a clearer connection to the receiving water body (*recipienten*) and the water required for the facility's operation.

Like the northern plan area, the southern plan area places high demands on accessibility for emergency services and infrastructure. Unlike the northern alternative, the southern plan area includes a potential port facility (*hamn*), in addition to one of the road alternatives also proposed for the northern plan area. This is assessed to reduce the facility's vulnerability by creating alternative transport routes for personnel, materials, service, and emergency services. The possibility of combining transport routes by land and water enhances the robustness of the facility's preparedness. The facility will also be classified as a protected area in the southern plan area. However, a port means that several vessels will operate in the area, which may increase the risk of collisions between ships or groundings.

During the operational phase, radioactive materials will be handled within the facility. During normal operation, minor releases to air and water may occur. These releases are expected to be limited through technical safety systems and purification measures, but the radiological consequences for people and the environment need to be further investigated. As with the northern area, a serious accident cannot be entirely ruled out, meaning that conditions for protective measures and preparedness must be ensured in the same way as described for the northern plan area. The consequences of a fire are assessed to be somewhat smaller in the southern plan area, as it is located close to water and the surrounding area is not forested to the same extent as in the northern plan area.

Both the northern and southern plan areas mean that new risk and safety aspects need to be considered compared to the current situation. The main consequences are related to the handling of radioactive

materials and waste, chemical management, the need for preparedness in the event of an accident, and requirements for stable infrastructure with a particular focus on the road network. The differences between the alternative plan areas are, at this stage, considered limited in terms of risk and safety. However, the southern area has a clearer connection to the coastal environment, which may impact risks at sea, whereas the northern area is located inland.

Overall, the risk of an accident is considered small due to the protective measures planned. Despite these measures, the effects of a potential release of radioactive substances are nonetheless considered sufficiently harmful that the facility proposal is assessed to result in an elevated risk level in both the northern and southern plan areas. The final assessment, however, depends on the facility's design and the results of investigations examining radiation protection and preparedness.

7.8.5 Assessment of the Zero Alternative

The zero alternative means that the facility plan is not implemented in the area. Consequently, the site is assessed to continue to consist of forest and agricultural land, without the risks and safety issues associated with nuclear activities.

The zero alternative means that releases of radioactive substances during normal operation or in the event of an accident cannot occur in the area. Furthermore, there will be no need for interim storage of spent nuclear fuel (*mellanlagring av använt kärnbränsle*) or the management and final disposal of radioactive waste. Finally, the transports and construction activities that may entail risks and impacts on the surrounding area during both the construction and operational phases will not arise. Under the assumption that the land is not exploited for any other purpose, the zero alternative is assessed to entail no risk level.

7.8.6 Proposals for Measures

The following measures are proposed to enhance safety and preparedness:

- Review the vulnerability associated with only one planned access and exit road to the facility in the northern plan area. A concrete plan should be developed to manage obstacles on the road. Consider constructing both roads proposed in the draft plan.
- Investigate whether it is possible to design a road network that ensures accessibility for emergency services and is suitable for heavy traffic.

- Conduct further risk and preparedness investigations to ensure that the site is suitable for the planned activities and that protective measures can be implemented.
- Design the handling, interim storage, and transport of radioactive waste to minimise exposure to people and the environment as far as possible.
- Conduct further investigations to assess radiological consequences during normal operation and in the event of an accident.
- Consider emergency planning zones and other protective measures in further planning to ensure that people and the environment can be protected in the event of an accident.
- Collaborate with relevant authorities concerning safety, radiation protection, and aspects related to **total defence** (*totalförsvaret*) during the continued planning process.