

Environmental impact assessment for a nuclear power plant

Environmental impact assessment programme

September 2026

Copyright © Helen Nuclear Ltd

All rights are reserved. This document, or any part of it, may not be copied or reproduced in any form without the written permission of AFRY Finland Oy.

AFRY Finland Oy's project number is 101032682-001.

Cover image: Helen Ltd

Base maps and aerial imagery: Base map data from the National Land Survey of Finland, open data 2026, unless otherwise stated.

The original language of the environmental impact assessment is Finnish. Versions in other languages are translations of the original document which is the document Helen Nuclear Ltd is committed to.

CONTACT DETAILS AND PUBLIC DISPLAY

Party responsible for the project:

Helen Nuclear Ltd

Melina Laine, Nuclear Siting Manager

+358 40 334 6617

firstname.lastname@helen.fi

www.helen.fi

Competent authority:

Ministry of Economic Affairs and Employment

Venla Liljeström, Specialist

+358 295 16001

eos.tem@gov.fi

www.tem.fi

International consultation:

Finnish Environment Institute

Latokartanonkaari 11, 00790 Helsinki

transboundaryEIA.SEA@syke.fi, kirjaamo@syke.fi

www.syke.fi

EIA consultant:

AFRY Finland Oy

Liisa Kopisto, EIA Project Manager

+358 50 327 3817

firstname.lastname@afry.com

www.afry.com

The EIA programme is available electronically at:

https://tem.fi/en/helen-eia-programme

Copyright © Helen Nuclear Ltd

CONTENTS

ABSTRACT 12

EIA TEAM 29

TERMS AND ABBREVIATIONS 32

1 INTRODUCTION 37

2 DESCRIPTION OF THE PROJECT 37
2.1 Party responsible for the project 37
2.2 Purpose of the project and its grounds 37
2.3 The project and options to be assessed in the EIA procedure 38
2.3.1 Limitation of the project package 47
2.4 Project location 49
2.4.1 Salmisaari 50
2.4.2 Vuosaari 51
2.4.3 Norrberget 52
2.5 Plant site selection 53
2.6 Background and objectives of the project 53
2.6.1 International and national objectives 53
2.6.2 Regional and municipal targets 54
2.6.3 The objectives of the party responsible for the project and the schedule of the project 54
2.7 Implemented or studied district heat production solutions that are not based on combustion 55
2.8 The project's connection to other projects 57

3 TECHNICAL DESCRIPTION OF THE PROJECT 58
3.1 General description of the nuclear power plant 58
3.1.1 Safety 58
3.1.2 Heating plant 58
3.1.3 Combined heat and power plant 59
3.1.4 Nuclear power plant site, buildings and structures 61
3.1.5 Construction 62
3.2 Procurement and use of nuclear fuel 66
3.2.1 Refuelling maintenance 67
3.3 Nuclear waste management and other waste management 67
3.3.1 Spent nuclear fuel 67
3.3.2 Very low level, low level and intermediate level waste 68
3.3.3 Conventional waste 70

Copyright © Helen Nuclear Ltd

3.3.4 Waste cleared from regulatory control 70
3.4 Backup generators 70
3.5 District heat transmission connection 70
3.5.1 Tunnel option KL1 73
3.5.2 Combination of a tunnel and a pipe dug into the ground KL2 74
3.6 Electricity transmission connection and electricity demand 76
3.6.1 Vuosaari CHP plant 78
3.6.2 Norrberget heating plant 83
3.6.3 Norrberget CHP plant 84
3.6.4 Backup power connections 85
3.7 Cooling solutions for the CHP plant 86
3.7.1 Seawater cooling 86
3.7.2 Air cooling 96
3.8 Road connections 97
3.9 Excavation during construction 98
3.9.1 Drilling and blasting method 99
3.9.2 TBM method 99
3.9.3 Excavation volumes and use of excavated rock material 100
3.10 Water demand and supply 102
3.10.1 Service water demand and supply 102
3.10.2 Cooling water demand and supply 102
3.11 Loading on the water system 102
3.11.1 Construction site waters 102
3.11.2 Cooling water 103
3.11.3 Conventional wastewater 103
3.11.4 Stormwater and firefighting wastewater 104
3.12 Conventional emissions to air 104
3.13 Radioactive releases 104
3.13.1 Releases into the air and water 104
3.13.2 Treatment of radioactive waters 105
3.13.3 Treatment of radioactive releases into the air 105
3.13.4 Accident situation 105
3.14 Traffic 105
3.14.1 During construction 105
3.14.2 During operation 106
3.15 Noise and vibration 107
3.15.1 Noise and vibration during construction 107
3.15.2 Noise and vibration during operation 107

Copyright © Helen Nuclear Ltd

3.16 Use and storage of chemicals 107
3.17 Energy efficiency of the plant 108
3.18 Decommissioning 109

4 NUCLEAR AND RADIATION SAFETY 111
4.1 Nuclear energy legislation and regulatory control 111
4.2 Nuclear safety 111
4.3 Radiation and its monitoring 112
4.4 Emergency preparedness 114
4.5 Precautionary action zone and emergency planning zone 114
4.6 Security arrangements and preparing for external threats 115

5 PERMITS, PLANS AND DECISIONS REQUIRED FOR THE PROJECT 117
5.1 General 117
5.2 Environmental impact assessment 117
5.3 International consultation procedure 117
5.4 Decisions and licences under the Nuclear Energy Act 118
5.4.1 Decision in principle 118
5.4.2 Construction licence 119
5.4.3 Operating licence 120
5.4.4 Decommissioning licence 120
5.4.5 Other permits 120
5.5 Permits required for the transport of radioactive substances 120
5.6 Permits under the Radiation Act 120
5.7 Building Act and Land Use Act 120
5.7.1 Local detailed plan required for the project 120
5.7.2 Building permit 121
5.8 Environmental permit 121
5.9 A permit under the Water Act 122
5.10 Permits and documents in accordance with the Chemicals Act 123
5.11 Permits and agreements required for connection to and building of district heating, water and sewerage network 124
5.12 Other permits and notifications 124
5.12.1 Special transport permit 124
5.12.2 Aviation obstacle permission 124
5.12.3 Project permit 125
5.12.4 Crossing statement 125
5.12.5 A crossing permit 125
5.12.6 Expropriation permit 125

Copyright © Helen Nuclear Ltd

5.12.7 Deviation permits under the Nature Conservation Act and the Water Act 125
5.12.8 Natura assessment 126
5.12.9 A permit to interfere with a fixed relic 127
5.12.10 Research permit 127
5.12.11 Registration notification 127
5.12.12 Notification of contaminated soil 128
5.12.13 Landscaping permit 128

6 EIA PROCEDURE 129
6.1 The need for the EIA procedure and the parties 129
6.2 The objective, content and phases of the EIA procedure 130
6.2.1 General 130
6.2.2 Preliminary consultation 131
6.2.3 EIA programme 132
6.2.4 EIA report 133
6.2.5 Reasoned conclusion 133
6.3 Time schedule of the EIA procedure 133
6.4 Participation, interaction and communication 134
6.4.1 Public notice and display 134
6.4.2 Communication and participation 134
6.4.3 Other communication and interaction 137

7 DESCRIPTION OF THE ASSESSMENT WORK 138
7.1 Assessed impacts 138
7.2 Preliminary assessment of the significance of the impacts 138
7.2.1 The EIA programme phase proposal for environmental impacts at which the assessment will be targeted during the EIA reporting phase in order to assess the likely significant environmental impacts 138
7.3 Limitations of the assessment and impact areas 140
7.4 Available input data and project-specific surveys 141
7.5 Comparison of the options and assessment of the significance of impacts 143

8 URBAN STRUCTURE AND LAND USE 146
8.1 Current status 146
8.1.1 Salmisaari 146
8.1.2 Vuosaari 147
8.1.3 Norrberget 148
8.1.4 National land use objectives 150

Copyright © Helen Nuclear Ltd

8.1.5 Regional plans 151
8.1.6 Master plans 153
8.1.7 Local detailed plans 173
8.1.8 Ongoing planning projects in the project area and its vicinity 185
8.2 Impact assessment and methodology 191

9 LANDSCAPE AND CULTURAL ENVIRONMENT 194
9.1 Current status 194
9.1.1 Regional landscape 194
9.1.2 Salmisaari 194
9.1.3 Vuosaari 201
9.1.4 Norrberget 208
9.1.5 Archaeological cultural heritage 215
9.2 Impact assessment and methodology 227
9.2.1 Landscape and cultural environment 227
9.2.2 Archaeological cultural heritage 228

10 NOISE AND VIBRATION 230
10.1 Current status 230
10.1.1 Salmisaari 230
10.1.2 Vuosaari 231
10.1.3 Norrberget 232
10.2 Impact assessment and methodology 233

11 TRAFFIC 236
11.1 Current status 236
11.1.1 Salmisaari 236
11.1.2 Vuosaari 238
11.1.3 Norrberget 240
11.2 Impact assessment and methodology 242

12 AIR QUALITY 245
12.1 Current status 245
12.2 Impact assessment and methodology 246

13 PEOPLE'S HEALTH, LIVING CONDITIONS AND COMFORT 248
13.1 Current status 248
13.1.1 Salmisaari 248
13.1.2 Vuosaari 253
13.1.3 Norrberget 264
13.2 Key stakeholder feedback during the EIA programme phase 277

Copyright © Helen Nuclear Ltd

13.2.1 Topics brought up by theme 277
13.2.2 Wishes for interaction and communication 279
13.2.3 Other considerations for the future 280
13.3 Impact assessment and methodology 280

14 SOIL, BEDROCK AND GROUNDWATER 282
14.1 Current status 282
14.1.1 Soil 282
14.1.2 Seabed soil types 290
14.1.3 Bedrock 294
14.1.4 Groundwater 300
14.1.5 Seismicity 304
14.2 Impact assessment and methodology 306

15 SURFACE WATERS 308
15.1 Current status 308
15.1.1 Overview of the water system 308
15.1.2 Water and marine management 315
15.1.3 Water quality 320
15.1.4 Aquatic life and underwater nature 324
15.1.5 Stormwater 335
15.2 Impact assessment and methodology 335
15.2.1 Heat discharge modelling 336
15.2.2 Separate surveys in the marine area 337
15.2.3 Stormwater 338

16 FISH STOCK AND FISHING 340
16.1 Current status 340
16.1.1 Fish stocks and fish stock structure 340
16.1.2 Fishing 346
16.2 Impact assessment and methodology 349

17 VEGETATION AND HABITAT TYPES 352
17.1 Current status 352
17.1.1 Salmisaari 352
17.1.2 Vuosaari 353
17.1.3 Norrberget 354
17.2 Impact assessment and methodology 358

18 FAUNA AND BIRDS 360
18.1 Current status 360

Copyright © Helen Nuclear Ltd

18.1.1 Species listed in Annex IV (a) of the EU Habitats Directive 360
18.1.2 Birds 361
18.2 Ecological corridors 368
18.3 Impact assessment and methodology 371
18.3.1 Materials and studies 371
18.3.2 Impact assessment 373

19 PROTECTED AREAS 374
19.1 Current status 374
19.1.1 Salmisaari 374
19.1.2 Vuosaari 377
19.1.3 Norrberget 384
19.2 Need for Natura assessment 391
19.2.1 Mustavuori grove and Östersundom waterfowl habitats F10100065 391
19.2.2 Kallahti ridge, meadow and water areas FI0100063 393
19.2.3 Sipoonkorpi FI0100066 393
19.3 Impact assessment and methodology 394

20 CLIMATE 396
20.1 Current status 396
20.1.1 Climate 396
20.1.2 Flood risks 398
20.1.3 Greenhouse gas emissions 406
20.2 Impact assessment and methodology 408

21 USE OF NATURAL RESOURCES AND CONVENTIONAL WASTE 411
21.1 Current status 411
21.1.1 Salmisaari 411
21.1.2 Vuosaari 411
21.1.3 Norrberget 411
21.2 Impact assessment and methodology 412
21.2.1 Study on the utilization and temporary storage of excavated rock material 413

22 NUCLEAR AND RADIOACTIVE WASTE 415
22.1 Impact assessment and methodology 415

23 EXCEPTIONAL AND EMERGENCY SITUATIONS 417
23.1 Impact assessment and methodology 417
23.1.1 Methods used for modelling severe accidents 417

Copyright © Helen Nuclear Ltd

24 IMPACTS ON SAFETY AND ENVIRONMENTAL RISKS 419

25 CUMULATIVE IMPACTS WITH OTHER PROJECTS 420
25.1 Other projects 420
25.2 Cumulative impact assessment 420

26 ASSESSMENT OF TRANSBOUNDARY IMPACTS 421

27 IMPACTS OF DECOMMISSIONING 422

28 IMPACTS OF THE ZERO OPTION 422

29 EXAMINING ALTERNATIVES TO NUCLEAR POWER 422

30 UNCERTAINTIES IN THE IMPACT ASSESSMENT 423

31 HARM PREVENTION, MITIGATION AND IMPACT MONITORING 424

32 REFERENCES 425

Appendices

Appendix 1. International consultation document

Appendix 2. Markings and regulations of the valid regional land use plans in Uusimaa (in Finnish)

Appendix 3. Designations and planning provisions in Uusimaa’s 5th phase regional land use plan (VISIO) (in Finnish)

Copyright © Helen Nuclear Ltd

ABSTRACT

Party responsible for the project and purpose of the project

Helen Nuclear Ltd is planning to build a nuclear power plant in Helsinki. The purpose of the planned nuclear power plant, or SMR (Small Modular Reactor) plant, is to produce either district heat or both district heat and electricity. There are three alternative sites for the nuclear power plant: Salmisaari, Vuosaari and Norrberget (Figure 1).

The project is managed by Helen Nuclear Ltd, a nuclear energy project development company owned by Helen Ltd, whose task is to find out the prerequisites for the construction of nuclear energy production in Helsinki. Helen Ltd, owned by the City of Helsinki, is one of the largest energy companies in Finland. Helen Ltd produces electricity, district heat and district cooling, for example, in power and heating plants in different parts of Helsinki. The production palette also includes hydro, wind, solar and nuclear power.

The aim is for the nuclear power plant to start operating during the 2030s. The project is an important part of Helen Ltd's aim to move away from combustion-based energy production by 2040, in addition to other projects already implemented and planned.

A heat-only heating plant would reduce other forms of heating based on combustion or electricity needed for heating in Helsinki, which would contribute to increasing self-sufficiency and help to move away from combustion-based energy production. The impact of a combined heat and power plant, or a CHP plant, producing both heat and electricity on the self-sufficiency of electricity in Finland as a whole would be significant, as the need for power in Helsinki is estimated to double from the current 800 megawatts to about 1,600 megawatts by the beginning of the next decade at the latest. This requires either a heavy increase in transmission connections or a significant increase in electricity production in the Helsinki area, as at the moment, electricity is mostly produced on the west coast, and it may not be possible in all respects to transfer it to the extent required in Helsinki. Helen aims to secure the growing city's energy needs with nuclear power while reducing emissions and easing cost pressures on energy.

Copyright © Helen Nuclear Ltd



Figure 1. Alternative locations for the nuclear power plant in Helsinki.

Description of the project

The plant options examined in Helen's nuclear power project are based on light water reactor technology, which is the most widely used nuclear power technology in the world and is also used in all of Finland's current nuclear power plants.

This project looks only at small modular reactors (SMRs) as alternatives. There is no official or established definition for a small modular reactor, or SMR. Small modular reactors are characterised by a relatively compact structure, modularity and design based on passive safety solutions. Unlike traditional large nuclear power plants implemented in recent decades, small modular reactors are comparable in size to medium-sized industrial plants, which means that they can be placed closer to consumption. This reduces construction needs for transmission infrastructure and transmission losses, as well as supports the regional balance of the energy system.

Copyright © Helen Nuclear Ltd

The modular approach means that the plant's components can be manufactured as ready-made modules in factories, and these modules are then assembled on site. The degree of modularity varies depending on the type and supplier of the plant. The modularity is designed to shorten the construction time of the plant compared to a traditional nuclear power plant.

The energy production of a nuclear power plant is based on fission in a nuclear reactor, where heavy atomic nuclei split, releasing thermal energy. This heat is used either directly in the production of district heat or in the production of electricity through the turbine–generator chain. The plant options examined are either pressurised water or boiling water reactors. Both reactor types operate on the same basic principle, where the heat generated in the reactor is transferred to water, but they differ in whether steam is produced directly in the reactor or in a separate heat exchanger (vaporiser).

The nuclear power plant's plant options are a heating plant that produces only district heat (HOP, Heat-Only Plant) and a combined heat and power plant (CHP, Combined Heat and Power) that produces electricity and district heat. The planned operating life of the nuclear power plant is at least 60 years.

Heating plant

The process of a heating plant producing only district heat is simpler and the need for space is smaller than that of a combined heat and power plant. It produces only hot water, the energy of which is transferred in full to the district heating network, instead of also producing electricity. A heat-only nuclear power plant used for district heat production does not require cooling water from a water system, and therefore does not discharge heat into the aquatic environment.

Combined heat and power plant

A combined heat and power plant, a CHP plant, produces both electricity and district heat. A CHP plant requires seawater cooling. Part of the heat produced at the CHP plant is directed to the district heating network, part of the heat is transferred to the sea with cooling water due to the technical constraints of the plant or fluctuations in the need for district heating.

Table 1 shows the preliminary technical data of the heating plant and the CHP plant examined in the EIA procedure.

Copyright © Helen Nuclear Ltd

Table 1. Preliminary technical data of the heating plant and CHP plant.

	Heating plant	Combined heat and power plant
Energy generated	District heat	District heat and electricity
Number of reactors (max.)	18	1
Heat output (max.)	630 MW	1,400 MW
District heat output	600 MW	700 MW
Electric power	–	500 MW
Efficiency	about 95%	65–75% (35% in condensing mode)
Heat output discharged to the water system, maximum	–	about 1,000 MW
Cooling water requirements	–	about 25 m^3/s
Space requirements of the plant area	about 12 ha	about 20 ha

Assessed options

The EIA procedure examines a heating plant that produces only district heat and a CHP plant that produces electricity and district heat as plant alternatives for the nuclear power plant. The heating plant is considered for the Salmisaari, Vuosaari and Norrberget plant sites. The CHP plant is considered for the Vuosaari and Norrberget plant sites.

The project includes new connections to be built (electricity transmission connections, district heating connection, cooling water connections, and road connections). The new connections required depend on the project option.

For nuclear waste generated during the operation of the nuclear power plant, the processing and interim storage of spent nuclear fuel at the nuclear power plant site are included in this EIA procedure. The final disposal of spent nuclear fuel is not included in this EIA procedure. The processing, interim storage and final disposal for very low-level, low level and intermediate level waste at the nuclear power plant site are included in this EIA procedure. Final disposal at a site other than the plant site is not included in the EIA procedure. A separate EIA procedure for this will be undertaken, if required, at a later stage.

The project options examined in the EIA procedure are presented in Table 2.

Copyright © Helen Nuclear Ltd

Table 2. Project options and necessary new connections.

Project option	Nuclear power plant	New connections
VE1 Heating plant in Salmisaari	Up to 18 reactors, total heat output up to 630 MWth and district heat output up to 600 MW.	–
VE2a Heating plant in Vuosaari	Up to 18 reactors, total heat output up to 630 MWth and district heat output up to 600 MW.	–
VE2b CHP plant in Vuosaari	One reactor with heat output up to 1,400 MWth, electric power up to 500 MWe and district heat output up to 700 MW.	Electricity transmission connection of 400 kV to Fingrid's new Itäsalmi substation. Cooling water tunnel connection to the sea, including an assessment of expanding the existing tunnels of the Vuosaari power plant and constructing entirely new cooling water intake and discharge tunnels.
VE3a Heating plant in Norrberget	Up to 18 reactors, total heat output up to 630 MWth and district heat output up to 600 MW.	The district heat transmission connection is carried out either entirely in a tunnel excavated in the bedrock or as a combination of a tunnel and a pipe excavated in the ground. Electricity transmission connection of 110 kV to Fingrid's current Länsisalmi substation. Backup power connection of 110 kV to the district heat transmission line. New road connections and utilities.
VE3b CHP plant in Norrberget	One reactor, heat output up to 1,400 MWth, electric power up to 500 MWe and district heat output up to 700 MW.	The district heat transmission connection is carried out either entirely in a tunnel excavated in the bedrock or as a combination of a tunnel and a pipe excavated in the ground. Electricity transmission connection of 400 kV to Fingrid's new Itäsalmi substation. Backup power connection of 110 kV to the district heat transmission line. Cooling water tunnel connection to the sea, construction of new cooling water intake and discharge tunnels. New road connections and utilities.

Copyright © Helen Nuclear Ltd

In addition, the EIA procedure examines the zero option (VE0), that is, a situation in which a nuclear power plant is not built. In this case, the positive and negative environmental impacts of the project will not materialise. Helen will not move away from combustion-based energy production, but energy production in Helsinki will continue at the current production facilities. In addition, the production investments already decided at Helen will be implemented.

The project options and the necessary new connections are shown in the following figures.

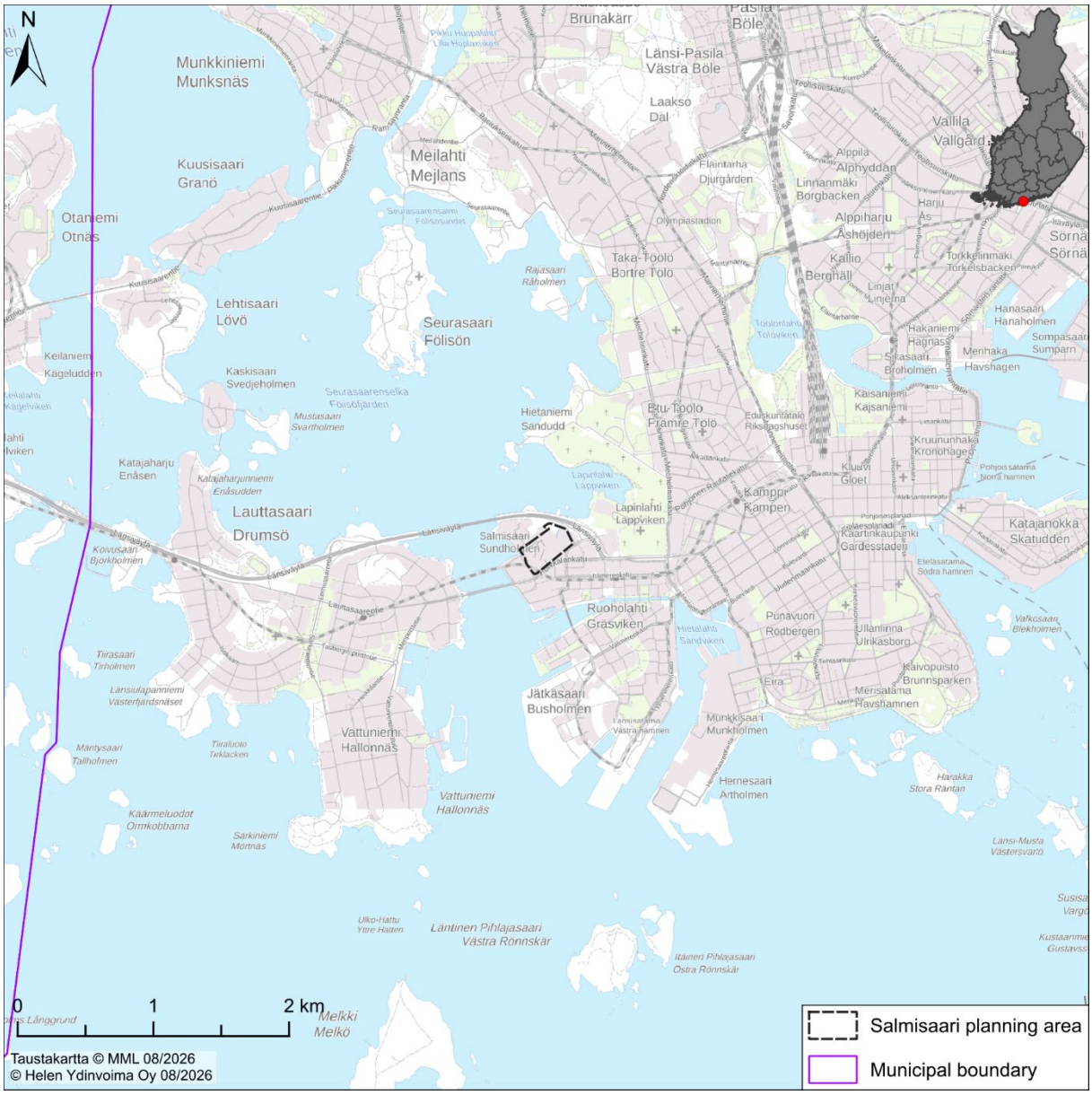


Figure 2. Location of the planning area of the Salmisaari heating plant (project option VE1).

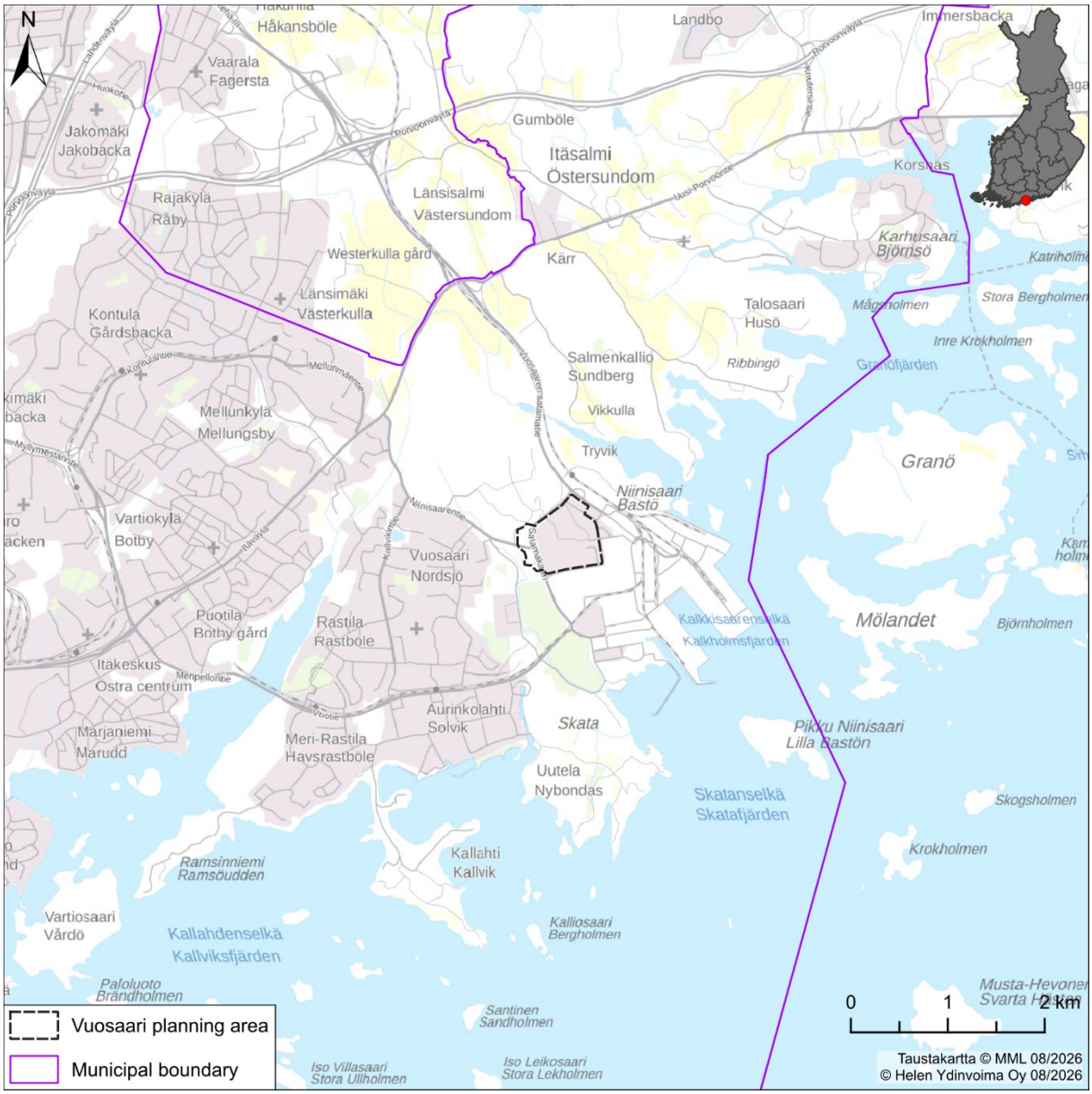


Figure 3. Location of the planning area of the Vuosaari heating plant (project option VE2a).

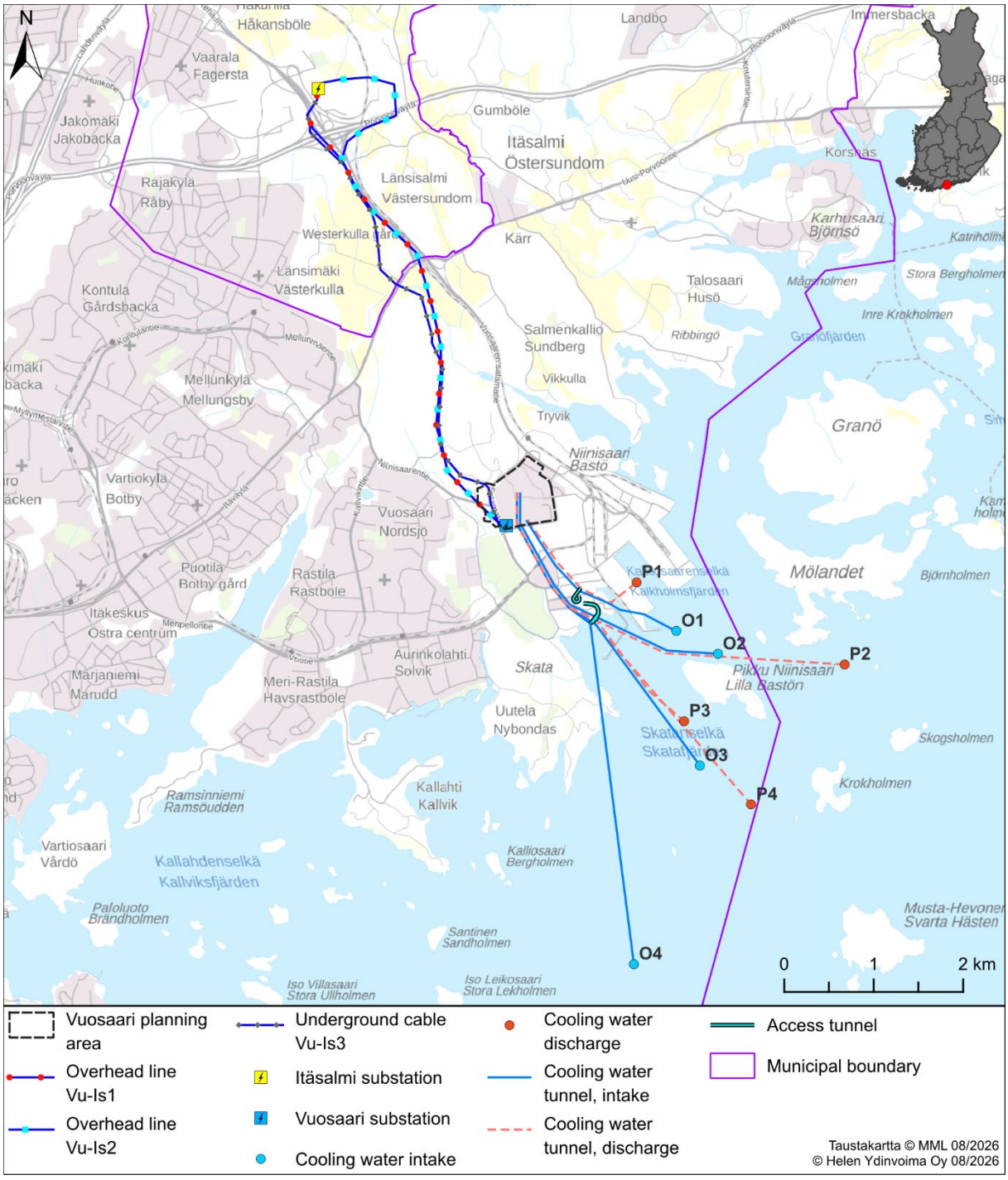


Figure 4. Location of the planning area of the Vuosaari CHP plant and the location of the necessary connections to the project area (project option VE2b).

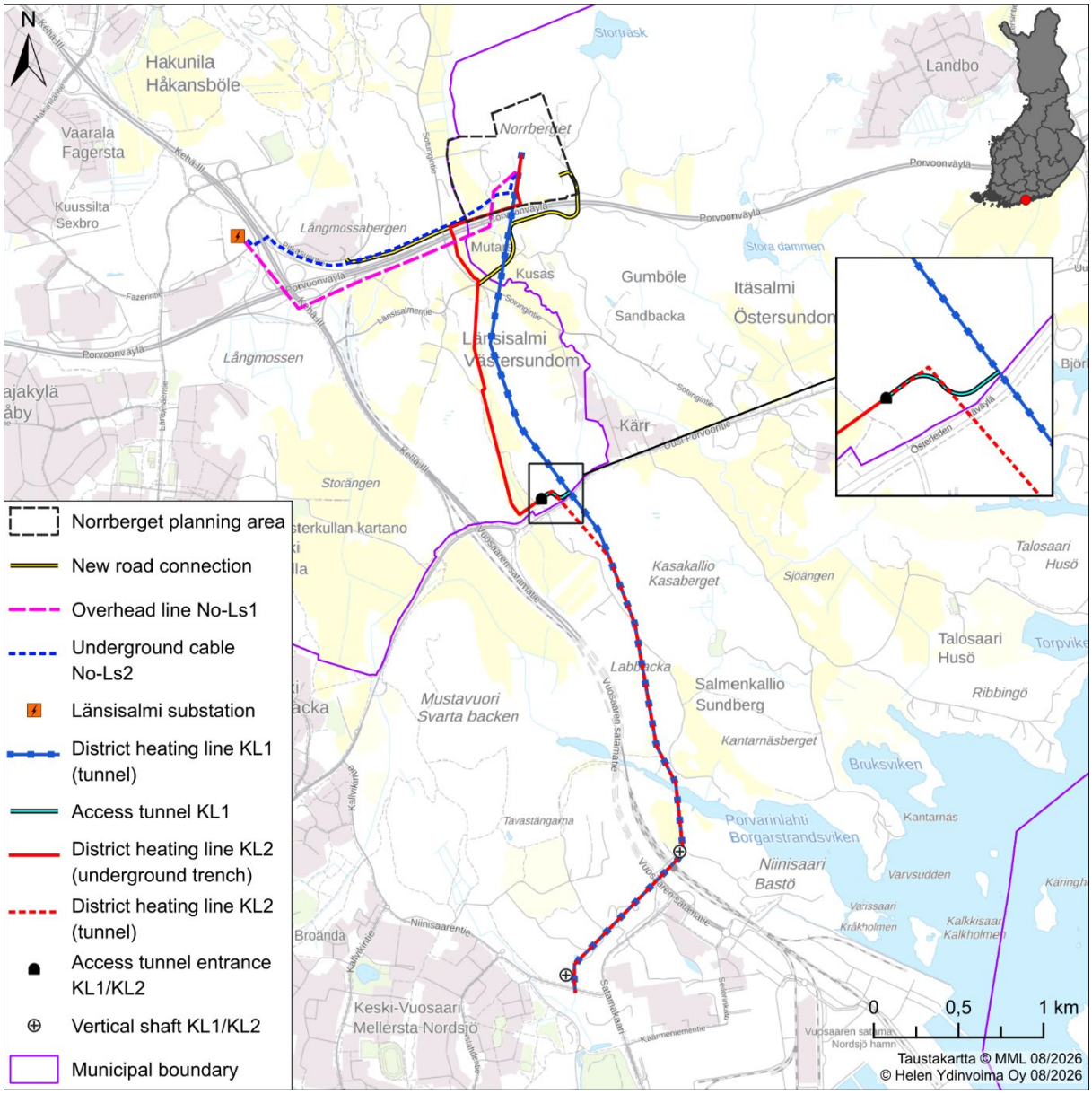


Figure 5. Location of the planning area of the Norrberget heating plant and the location of the necessary connections to the project area (project option VE3a).

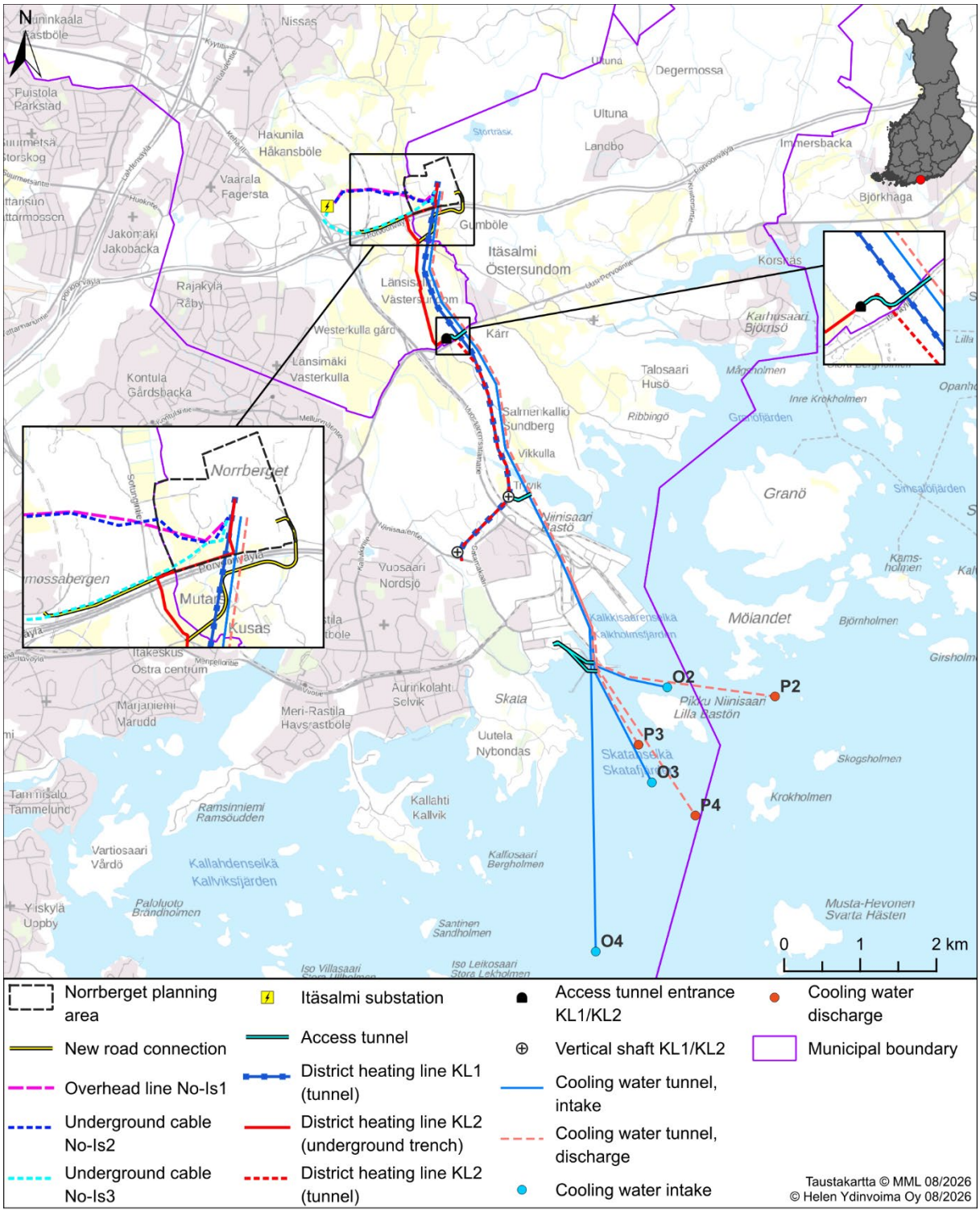


Figure 6. Location of the planning area of the Norrberget CHP plant and the location of the necessary connections to the project area (project option VE3b).

EIA procedure

The purpose of the EIA procedure is to assess the environmental impacts of the project and to promote their consideration in its planning. At the same time, the objective is to improve access to information and participation opportunities for all stakeholders. The EIA procedure does not make any implementation decisions concerning the project, but it is a prerequisite for subsequent permit decisions and decision-making concerning the project.

Copyright © Helen Nuclear Ltd

The environmental impact assessment procedure (EIA procedure) is regulated by the EIA Act (252/2017) and Decree (277/2017). The planned activity corresponds to item 7(b) of the project list in Annex 1 of the Environmental Impact Assessment Act: Nuclear power stations and other nuclear reactors. This project is subject to the Espoo Convention on Environmental Impact Assessment in a Transboundary Context.

The EIA procedure is a two-step process. In the first phase of the EIA procedure, an environmental impact assessment programme (EIA programme) is drawn up, which is a plan for the organisation of the EIA procedure and the surveys required for it. The EIA programme is submitted to the Ministry of Economic Affairs and Employment, which acts as the competent authority, and the Ministry announces the EIA programme by publishing a public notice on its website. In this EIA procedure, the EIA programme is made available for public review for a period of 60 days. During the public notice period, the authorities, local residents and other parties concerned may submit statements and opinions on the EIA programme to the competent authority. An international consultation is being carried out at the same time. The competent authority compiles all the statements and opinions submitted on the EIA programme and issues its own statement on the basis of them.

In the next phase of the EIA procedure, an environmental impact assessment report (EIA report) is prepared on the basis of the EIA programme and the competent authority's statement on it. The results of the assessment are compiled in the EIA report, which is submitted to the competent authority. The EIA report is announced in due course in the same way as the assessment programme, and during the public display period (60 days), an international consultation is carried out at the same time as the national consultation. On the basis of the EIA report and the statements and opinions submitted, the competent authority prepares its reasoned conclusion on the significant environmental impacts of the project. The permit applications for the project must include the EIA report and the reasoned conclusion.

Time schedule of the project and the EIA procedure

The EIA programme was completed in September 2026, and the competent authority's statement on it is expected to be issued in January 2027. The preparation of the EIA report begins immediately after the programme phase. The EIA procedure is expected to be completed by the end of 2027. After the EIA procedure, the following permit processes and planning phases will be carried out. The aim is for the nuclear power plant to start operating during the 2030s.

Project location

The plant site options examined in the EIA procedure are located in Helen Ltd's current power plant areas in Salmisaari and Vuosaari, as well as in the Norrberget area in Östersundom.

The project options examined in the EIA procedure are located in the Helsinki, Vantaa and Sipoo regions. The planning areas as well as most of the new connections to be built in different project options are located in the City of Helsinki. The electricity transmission connection options for project option VE2b are partly located in Vantaa, as well as electricity and district heat transmission connection options for project options VE3a and VE3b. Also parts of the new road connections are located in Vantaa. In project options VE2b and VE3b, one of the alternative cooling water discharge points (P2) under consideration is located in the Sipoo marine area. According to preliminary estimates, the utilization, temporary storage and placement of excavated rock material generated in the project may take place in the

Copyright © Helen Nuclear Ltd

Uusimaa region. As a rule, the rock material generated from construction is used as close as possible to the project area.

The planning area refers to an area the suitability of which for small-scale nuclear power generation or as support areas during construction is examined in the EIA procedure. The planning area has been designed as wide as possible, as the plant technology or plant supplier has not yet been selected. Different technologies and suppliers have different requirements for the size and characteristics of the plant site. The entire area may not become the final plant site of the nuclear power plant. The project area refers to the area where all the activities of the project are located. In the EIA procedure, the project area of the different project options includes the planning area of the nuclear power plant, as well as various connections related to the project option (such as electricity transmission connection, cooling water connection, district heat transmission connection, road connections).

Salmisaari

The Salmisaari planning area is located in the inner city of Helsinki in the West Harbour district, in the Ruoholahti area. The planning area is located in the current Salmisaari power plant area. The Salmisaari planning area is surrounded by many commercial and office buildings, as well as densely populated areas such as Ruoholahti, Lauttasaari, Jätkäsaari, Kamppi and Etu-Töölö.

In the Salmisaari planning area, the above-ground construction of the nuclear power plant would be located, according to preliminary plans, in the area of the decommissioned Salmisaari B power plant.

Vuosaari

The Vuosaari planning area is located in the Vuosaari district of Helsinki, mainly in the Vuosaari power plant area. The area is located near Vuosaari Harbour. The western part of the planning area is traversed by the busy Satamakaari road, which is connected from the west by the Niinisaarentie road. On the west side of Satamakaari, there is a soil dumping area and a snow disposal site. In addition, there are, among other things, a gas station, a parking area and logistics companies in the planning area.

According to preliminary plans, the construction of the nuclear power plant requires the dismantling of the Vuosaari A combined cycle gas turbine and the backup heating plant from the planning area before construction work begins. The structures of the nuclear power plant are located in the area of the coal storage facility to be decommissioned in Vuosaari and the still used interim storage for bottom ash.

In the vicinity of the Vuosaari planning area are the port operations of the Port of Helsinki Ltd, as well as logistics companies among others. The nearest residential area is located about 300 metres west of the planning area boundary. To the west of the Vuosaari planning area is the Central Vuosaari residential area and to the southwest of the planning area is the Aurinkolahti residential area.

Norrberget

The Norrberget planning area is located in Östersundom in Helsinki, on the border of the City of Vantaa. Currently, the area is mostly undeveloped, with mixed forest and patches of exposed bedrock. In the southern and western parts of the area, there is arable land. In the northwestern part of the planning area, there are four residential buildings and one holiday

Copyright © Helen Nuclear Ltd

building, and in the southeastern part of the planning area, there is one residential building. Fingrid Oyj's 400 kilovolt power line (Länsisalmi–Anttila) and Sipoon Energia Oy's 110 kilovolt power line (Anttila–Vaarala) are located in the southern part of the area. The area is bordered from its southern part by the Porvoonväylä road and from its northern part by the Sipoonkorpi National Park.

To the west of the planning area, the Långmossebergen area in Vantaa has industrial activities, such as Remeo Oy's recycling plant and Vantaan Energia Oy's waste-to-energy plant. The nearest residential buildings outside the planning area are located approximately 130 metres south of the planning area boundary and about 150 metres to the west. The nearest more densely populated areas around the Norrberget planning area are Hakunila and Länsimäki in Vantaa.

Assessed environmental impacts and assessment methods

Urban structure and land use

For the purpose of the impact assessment, information on the project area and its surrounding area is examined regarding the current land use, existing and pending plans and planned land use.

When assessing the impacts on urban structure and land use, the project options' impacts at different regional levels are examined: whether the implementation of the project has an impact on the urban structure of the area, the land use of the area in the vicinity of the project area, or individual sites in the immediate impact area. In addition, the suitability of the land use required by the project options for the existing and pending plans, other land use plans, as well as national land use objectives will be assessed.

Landscape and cultural environment

The assessment of the landscape impacts describes the project's relationship to the wider landscape and local environment, as well as to the national and regional values of the landscape and the built cultural environment. In addition, changes to the current state of the area, the nature and significance of the change, as well as the principles of mitigation of adverse impacts are evaluated. The assessment of impacts on the landscape and built cultural environment is based on existing data, project planning information, map and aerial image reviews, and visualisations of the nuclear power plant.

The impacts of the project on archaeological cultural heritage are assessed by examining the relationship of the location of the construction measures to known archaeological cultural heritage sites, both on land and in the water area. A detailed inventory will be conducted on the archaeological site located within the Norrberget planning area.

Noise and vibration

Noise impacts are evaluated as expert work using noise modelling prepared for the project, and the modelling is prepared for all project options. Using noise modelling, the environmental noise levels caused by the plant are calculated for construction and the operating condition in a situation where the plants have been implemented according to plans. Noise modelling takes into account the loudest work phases during construction (e.g. excavation operations and transports) and, in the modelling during operations, the noise emissions caused by the plants' equipment, as well as the noise caused by transports within the assessment area.

Copyright © Helen Nuclear Ltd

In terms of vibration, the assessment examines the vibration and structure-borne noise impacts during construction and operation. The intensity of the vibration is estimated based on the magnitude of the operation causing vibration, taking into account existing information and experience from similar projects carried out previously.

Traffic

The assessment describes the current situation of the traffic network in the project areas (road connections, current status of the routes, traffic volumes and the number of traffic accidents) on the basis of existing data and information. Traffic impacts are assessed on the basis of operational planning data by comparing the current state of the area with the planned activities and the changes to traffic caused by them. The impacts of excavated rock material transports during construction are assessed on the basis of a report on the utilization and temporary storage of rock material. The traffic impact assessments examine the project's effects on traffic volumes on the road network and on traffic flow and safety. Particular attention is paid to the transport of hazardous goods (such as nuclear fuels), as well as to sites vulnerable to road safety impacts (for example, schools and densely populated areas).

Air quality

Air quality impacts of the project are evaluated as an expert assessment, based on the current state of air quality in the project area and the airborne release generated by the operations. The impact assessment takes into account emissions from the nuclear plant's emergency diesel generators, exhaust gas emissions of traffic and the impacts of dust generated during construction on air quality.

People's health, living conditions and comfort

The impact of the project on people's health, living conditions and comfort is assessed by using computational and qualitative estimates generated in other impact assessment sections, such as noise impacts and impacts on water systems and traffic. In addition, the assessment uses other relevant information produced during the planning process concerning the project's characteristics. The assessment emphasises both impacts assessed as significant and those people perceive as such and which give rise to concerns.

The attitudes of residents and other stakeholders to the project will be explored, for example, by using the stakeholder feedback already collected, the views presented at the public event at the EIA programme phase and in the project monitoring group, and by taking into account the opinions to be given on the assessment programme. In addition, a resident survey and, if necessary, other stakeholder consultations will be carried out.

The impacts on health are assessed by comparing the estimated impacts of the project with the health-based guideline value or recommendation for each impact. Estimates of the quantities of radioactive emissions from the normal operation of the nuclear plant is compared with the emission limits and actual emissions from the normal operation of Finland's current nuclear power plants.

Soil, bedrock and groundwater

The impacts of the project on the soil, bedrock and groundwater are assessed in terms of the changes caused by the planned activities (extraction and construction) by comparing it with the current situation. The impacts during construction and operation are assessed separately.

Copyright © Helen Nuclear Ltd

The assessment uses surveys carried out in the areas of the project's activities and possible other surveys. Issues related to seismic events are taken into account as required by the requirements.

Surface waters

The impacts on water systems are assessed by experts, based on the project's planning information and information about the area's current state. The thermal load of the cooling water related to the CHP plant, i.e. project options VE2b and VE3b, is directed to the marine area off Vuosaari. The dispersal and mixing of the heat discharge from the CHP plant's cooling water in the coastal area off Helsinki is assessed using a 3D flow calculation model. The impacts of heat discharge on the aquatic ecosystem are evaluated as an expert estimate based on the modelling results.

During the EIA procedure, surveys are carried out in the marine area to support the impact assessment, such as sediment sampling and contaminant surveys, a benthic animal survey and an aquatic vegetation survey.

Fish stock and fishing

The impacts on fish and fishing activities are assessed with a focus on the marine area off Vuosaari and the CHP plant project options. The impact assessment is carried out as an expert assessment based on existing material, research literature, project description and separate fisheries studies produced in connection with the EIA procedure. The impact assessment also uses an assessment of the impacts on water systems, as well as a cooling water thermal load dispersion model drawn up to support it.

Vegetation, fauna, and protected sites

An expert assessment is carried out of the impact of the construction and operation of the project on vegetation, habitats, fauna and protected sites. Other impact assessments and modelling carried out during the EIA reporting phase will be used in the assessment. To support the impact assessment, nature surveys will be carried out during the 2026 field season, including vegetation and habitat surveys, breeding bird surveys, bat surveys, and Siberian flying squirrel surveys. In accordance with Section 35 of the Nature Conservation Act, Natura assessments of the project's impacts on the Natura 2000 area of the Mustavuori grove and the Östersundom waterfowl habitat, and on the Natura 2000 area of Kallahti ridge, meadow and water areas, will be prepared as annexes to the EIA report.

Climate

The climate impacts of the project are assessed by calculating the carbon footprint during the project's life cycle. The climate impacts of the project are assessed by comparing the emission intensity of the energy produced in the project with the emission intensity of the district heat and/or electrical energy produced in other ways due to the non-implementation of the project. The impacts of climate change on the project are assessed by examining the risks caused by extreme weather events and the adaptation measures required by them.

Use of natural resources and conventional waste

The impact assessment describes the impacts on natural resources that may arise from enabling or restricting their use. The project is based on the utilization of a natural resource, uranium, the need for and procurement of which are described in general terms based on the

Copyright © Helen Nuclear Ltd

project's technical description and on information from other similar projects. Other materials required by the project and the materials released by it, such as aggregate and soil materials, and their quantities are also examined at a general level. For the purpose of the impact assessment, a study is carried out on the utilization and temporary storage of excavated rock material, which identifies potential end use sites and available landfill sites subject to a permit. In addition, the conventional waste resulting from the project and their treatment are examined.

Nuclear and radioactive waste

The formation, quality and quantity of nuclear waste and other radioactive waste arising during the operation of the nuclear power plant, and its treatment and storage, are described, taking into account the waste's activity levels (very low-level, low level, intermediate level and high level nuclear waste). The impacts of the disposal of very low, low and intermediate level waste at the plant site are assessed, taking into account alternatives to disposal, based on the requirements set for the disposal of waste in laws, decrees and regulations. The impact assessment of the final disposal of spent nuclear fuel is not part of this EIA procedure.

The impacts are assessed based on the properties of the waste and the treatment methods. The assessment is carried out as an expert assessment on the basis of the technical design of the project, as well as existing information about the projects and studies that have already been carried out.

Impacts on safety and environmental risks

The EIA procedure initially identifies the environmental risks related to the project and its various project options and assesses their potential impacts on the environment and public health. The environmental risk assessment examines the risks posed by major process disruptions and abnormal situations, fires and chemicals, as well as those related to weather conditions and traffic. The assessment also takes into account the possible risks to the project caused by activities near the project and, correspondingly, the risks from the project to other nearby activities.

Conventional accidents and disturbances, their effects and likelihood are assessed during construction and operation. The review includes all activities of the entire project, including road traffic. Accident risks caused by extreme weather phenomena that increase with climate change are also taken into account.

Exceptional and emergency situations

As part of the environmental impact assessment, a highly unlikely severe reactor accident at the nuclear power plant and the resulting radioactive release are modelled. The impacts of the accident are assessed up to a distance of 1,000 kilometres. The modelling is done separately for the CHP plant and heating plant options. The results of the modelling are presented as radiation doses, fallout, and possible restrictions on the use of foodstuffs, the environment and areas.

Cumulative impacts

The impact assessment examines the potential cumulative impacts of the nuclear power plant project in conjunction with other projects in the vicinity. In the assessment of cumulative impacts, consideration is given to activities planned for the area that the project may interact with and for which sufficient information is available for the assessment.

Copyright © Helen Nuclear Ltd

Assessment of transboundary impacts

Within the EIA procedure, the assessment covers both the impacts occurring within Finland and any potentially harmful transboundary impacts caused by the project. Preliminary assessment indicates that the project is not likely to cause significant transboundary impacts. A severe reactor accident and the resulting radioactive release could potentially have harmful transboundary impacts. The radius of the assessment area for radioactive release dispersion modelling in the event of an accident, carried out during the EIA reporting phase, is 1,000 kilometres. The transboundary impact assessment presents country-specific maximum results for radiation doses.

Copyright © Helen Nuclear Ltd

EIA TEAM

The preparation of the environmental impact assessment programme has been carried out by AFRY Finland Oy as a consultant. The experts of the EIA team are presented in the table below (Table 1-1).

Table 1-1. The team of the EIA consultant and their qualifications.

Name	Education, role and experience
Liisa Kopisto	MA, environmental biology M.Sc. (Eng), environmental engineering
	Project Manager, general sections of the EIA programme
	Leading expert, environmental consulting. Over 10 years of work experience, including project manager positions for EIA procedures and coordinating impact monitoring and permit processes. Approximately 10 years of work experience in the nuclear power sector.
Juha Niemistö	PhD, aquatic sciences
	Project coordinator
	Leading expert, environmental consulting. 15 years of experience in research on nutrient cycling in Finland's inland waters and the coastal areas of the Baltic Sea. Has worked for about six years as a project coordinator and water system expert in environmental impact assessments and permit applications for projects in the infrastructure, industry and energy sectors.
Karoliina Jaatinen	M.Sc. (Agr. & For.), limnology
	Project manager's deputy, quality assurance
	Leading expert, environmental consulting. More than 15 years of work experience, several EIA projects and impact assessments in the role of a project manager, project coordinator, expert and quality assurance officer.
Ilkka Suntio	M.Sc. (Eng), energy technology
	Nuclear engineering, nuclear waste
	10 years of experience as an expert and project manager in nuclear energy projects, including 5 years in SMR surveys.
Pekka Lähde	Environmental planner, UAS, sustainable development
	Quality assurance
	Over 15 years of work experience in EIA projects and in the environmental sector. Has worked as a quality assurance officer, project manager and expert in several EIA procedures.
Marja Pelo	Landscape architect, construction architect
	Landscape and built cultural environment, urban structure and land use
	About 15 years of experience in planning processes and land use planning. Has acted as an expert on the landscape and the built cultural environment, as well as on urban structure and land use in several EIA procedures. In addition, has prepared landscape surveys.
Tommi Toikkanen	MA, urban studies
	Urban structure and land use
	Approximately three years of work experience in EIA procedures and planning projects. Has been involved in several EIA projects and focused especially on land use, planning and thematic maps.
Maarit Suomenkorpi	Landscape architect
	Urban structure and land use
	Over 20 years of experience in planning processes and land use planning. Experience in managing multidisciplinary planning projects and expert tasks, especially

Copyright © Helen Nuclear Ltd

	in the field of urban planning. Has acted as an expert in urban structure and land use in several EIA procedures.
Anna Taskinen	MA, biology, ecology
	Archaeological cultural heritage
	Environmental expert. Almost three years of experience in coordinating and expert tasks of EIA procedures for several energy production and transmission projects (including wind and solar power, power lines, hydrogen). In expert assignments, the focus has been on assessing the impacts on archaeological cultural heritage. Also has five years of previous project experience.
Tapio Lukkari	M.Sc. (Eng), mechanical engineering
	Noise and vibration
	About 9 years of experience. Extensive experience of noise issues in various industrial, road and railway projects. Has worked on several EIA and planning projects and carried out environmental noise modelling.
Juho Peltoniemi	M.Sc. (Eng), industrial engineering
	Traffic
	About 4 years of experience in various EIA procedures, and he works as an expert in investigating traffic-related impacts of various projects.
Jatta Salmi	MA, environmental sciences
	Air quality
	Altogether, more than 20 years of experience in the environmental sector, especially in air quality studies, airborne release dispersion model surveys and impact assessments.
Stella Selinheimo	MA, geography
	Impact on people, health
	About 9 years of work experience in various social impact assessment projects. Has worked as an expert in several EIA procedures in different sectors (energy, industry, infrastructure). Has worked as a social impacts expert in an SMR survey.
Pekka Keränen	MA, soil geology
	Soil, bedrock and groundwater; sediments
	Leading expert. More than 25 years of experience in various soil and groundwater surveys and expert tasks related to EIA procedures in terms of soil, bedrock and groundwater.
Marianne Malm	MA, geophysics
	Seismology
	Over 15 years of work experience in the field of seismology (e.g. seismic hazard, risk and monitoring) as an expert and project manager.
Lotta Lehtinen	M.Sc. (Agr. & For.), limnology
	Surface waters: Water system and aquatic ecosystem
	Over 15 years of work experience in observing and assessing surface water impacts extensively in inland waters and marine areas in EIA and permit projects related to different industries.
Anna Väisänen	MA, aquatic sciences and fish biology
	Surface waters: benthic animals
	More than 15 years of work experience in monitoring and studying water systems across various industries, especially in the fields of aquatic ecology and fisheries. Has worked in numerous EIA and permitting procedures, as well as in water system restoration, and has prepared several Natura assessments and aquatic species surveys, including EU directive species.
Joni Nyyssönen	M.Sc. (Eng), environmental engineering
	Stormwater, flood risks

Copyright © Helen Nuclear Ltd

	Over 10 years of experience in the environmental field. Has worked both as a project manager and as an expert. Expertise in network and stormwater planning for industrial sites.
Soile Turkulainen	MA, biology
	Vegetation and habitat types, protected areas, Natura
	Over 20 years of experience in compiling and organising nature surveys related to different land use plans and projects, as well as in environmental impact assessments and monitoring. Participated as a nature expert in numerous Natura assessments and EIA projects.
Petri Lampila	MA, biology
	Birds and other fauna
	Over 15 years of experience in the environmental field in research and teaching, nature conservation and environmental consulting.
Juha Kiiski	MA, biology
	Birds, Natura
	Approximately 20 years of work experience in preparing nature surveys related to land use planning and working on several EIA projects and Natura assessments.
Tuukka Nissilä	D.Tech., environmental engineering
	Climate
	Approximately three years of experience in climate impact assessments related to EIA procedures, carbon balance and carbon footprint calculation of projects. Further experience includes research related to the circular economy of materials.
Mira Pikkujämsä	M.Sc. (Eng), environmental engineering M.Sc. (Econ), environmental management
	Exploitation of natural resources, conventional waste
	Five years of experience in various projects related to the conservation and sustainable use of natural resources. Experience of several EIA procedures as an expert and project coordinator.
Anna-Liisa Koskinen	MA, environmental hygiene
	Conventional accidents and disturbances
	Approximately 30 years of experience in risk assessments, environmental, chemical and occupational safety legislation, and audits.
Eemeli Hurmerinta	Bachelor of Engineering (UAS), electronics
	Spatial data sets, maps
	15 years of experience in various environmental studies, reporting and tasks related to spatial data.
Subconsultants involved in the preparation of the EIA programme:	
Sauli Vatanen (Kala- ja vesitutkimus Oy)	M.Sc. (Agr. & For.), fisheries sciences
	Fish stock and fisheries
	More than 20 years of extensive work experience in aquatic and fishery biology studies, fisheries surveys and impact assessment covering a wide range of infrastructural and energy projects and their EIA and permit procedures.

Copyright © Helen Nuclear Ltd

TERMS AND ABBREVIATIONS

The following terms and abbreviations have been used in the EIA programme:

Term	Description
Aerogeophysics	Geophysical measurements by aeroplane or helicopter to map soil and bedrock characteristics.
Becquerel (Bq)	Unit of radioactive activity. One becquerel means that one nuclear disintegration (decay of an excited nucleus) occurs per second in a radioactive substance. The more nuclear decays take place, the more radiation is generated.
CHP plant	Combined Heat and Power plant, a cogeneration plant.
Civil protection measure	In the event of a radiation hazard arising from a serious nuclear accident, the key protective measures to limit the radiation dose to population are sheltering indoors, taking iodine tablets and evacuating.
CO_2	Carbon dioxide.
Combined heat and power plant	In this EIA procedure, a nuclear power plant that produces both electricity and district heat has been designated as a CHP plant and is planned for the Vuosaari and Norrberget planning areas.
Controlled area	Controlled area refers to a work area where special safety instructions must be followed to protect against radiation and access to which is controlled.
Conventional waste	Conventional or hazardous waste that is not radioactive.
dB(A), decibel	Unit of sound volume. An increase of ten decibels in the noise level means that the sound energy increases tenfold. In noise measurements, filters that emphasise different frequencies in different ways are used. The most common is the so-called A filter, which aims to describe more accurately the effect of sound on people.
Decision in principle	The use of nuclear energy requires a decision in principle made by the Government and confirmed by the Parliament. A prerequisite for the decision in principle is the overall benefit to society, the positive attitude of the municipality where the plant is located towards the project, and the Radiation and Nuclear Safety Authority's positive preliminary safety assessment. With the ongoing legislative amendment, changes to the content of the decision in principle are expected.
Dual-use product	A product, technology, service or other commodity that, in addition to its normal civilian use or application, can be used for the development or manufacture of weapons of mass destruction or their delivery missile systems, or that can contribute to general military operability.
Economic Development Centre	Economic Development Centres handle the diverse tasks of the state's regional administration related, among others, to livelihoods, employment, transport and road maintenance, land-use planning, water management, the promotion of biodiversity, maintaining good status of waters and the sea, climate action, and fisheries.
Efficiency (η)	The ratio between the electrical energy generated by a power plant and the thermal energy of a reactor.
EIA	Environmental impact assessment.
EIA procedure	The environmental impact assessment (EIA) procedure means a process in accordance with EIA legislation to identify, assess and describe the likely significant environmental impacts of specific projects and to consult public authorities and those whose circumstances or interests may be affected by the project, as well as communities and foundations whose field of activity may be affected by the project.
EIA programme	The EIA programme presents a plan drawn up by the party responsible for the project, covering the necessary surveys and the organisation of the assessment procedure.
EIA report	The EIA report refers to a document prepared by the party responsible for the project, which presents information about the project and its options, as well as a uniform assessment of their likely significant environmental impacts.
Emergency planning zone	An area where, in the event of an accident, it may be necessary to implement urgent protective measures directed at the population in order to limit the radiation effects and for which the authority must draw up an external rescue plan in accordance with the Rescue Act. The precautionary action zone is included in the emergency planning zone.

Copyright © Helen Nuclear Ltd

Equivalent continuous sound level (LAeq)	The A-weighted sound level is used to assess the annoyance of environmental noise. The A-weighting is intended for the assessment of noise disturbance experienced by people. When noise that varies over a long period of time and any resulting harm to a person's health or comfort are expressed as a single value, the equivalent continuous sound level is used. Other names for the equivalent continuous sound level are the A-weighted equivalent sound level and the equivalent level, and its symbol is LAeq. The equivalent continuous sound level is not just a regular average of the noise level. The squaring included in the definition means that sound pressures above the average receive an emphasised weight in the final result.
FENCAT	The Earthquake Catalogue of Northern Europe maintained by the Institute of Seismology of the University of Helsinki.
Final disposal	Placing radioactive waste permanently in the soil or bedrock so that the site does not need to be supervised and the radioactivity of the waste does not pose a danger to the environment.
FINIBA area	A nationally important bird area (Finnish Important Bird Area).
Fission	The splitting of a heavy atomic nucleus into two or more new nuclei releasing a large amount of energy, neutrons and neutrinos.
Fuel bundle	A bundle of more than 200 fuel rods to be placed in a reactor. The reactor core of an SMR plant has about 30–40 fuel bundles, depending on the technology.
Fuel pellet	A fuel tablet pressed from uranium dioxide powder (UO_2).
Fuel rod	A rod assembled from fuel pellets with a gas-tight cladding typically made of zirconium.
GTK	Geological Survey of Finland.
GWh	Gigawatt-hour.
Heating plant	In this EIA procedure, a nuclear power plant that produces only district heat has been designated as a heating plant and is planned for the Salmisaari, Vuosaari and Norrberget planning areas.
High level waste	Radioactive waste with a very high activity concentration, usually above 10 GBq/kg. High level waste requires very effective radiological protection arrangements and usually also cooldown. In Finland, spent fuel from nuclear reactors is classified as high level waste.
HOP plant	Heat Only Plant, a heating plant.
HSY	Helsinki Region Environmental Services Authority
IBA area	A nationally important bird area (Important Bird and Biodiversity Area).
INES	INES (International Nuclear Event Scale) is an international severity scale of nuclear facility events and it classifies nuclear safety incidents and accidents into eight categories (categories INES 0–INES 7).
Infrastructure route	New power lines, underground cables, cooling water tunnels, district heat transmission connections, vertical shafts and road connections related to project options VE2b, VE3a and VE3b.
Intermediate level waste	Intermediate level and low level wastes are operational waste from a power plant. In addition, it is produced during the decommissioning of a power plant. Effective radiological protection arrangements (activity usually between 1 and 10,000 MBq/kg) are required for the treatment of intermediate level waste.
International consultation	Consultation procedure on transboundary environmental impact assessment under the Espoo Convention, in which the affected states may participate and which is carried out for activities that are likely to have significant transboundary adverse effects.
Ion	An electrically charged atom or molecule. Radiation that generates ions when it hits a medium is called ionising radiation.
Ionising radiation	Electromagnetic radiation or particle radiation that generates free electrons and ions upon contact with a medium. It is able to break internal chemical bonds of molecules, for example, the DNA molecule that carries the cell genome. For this reason, ionising radiation is harmful to health.
Isotope	Isotopes are different forms of the same element. They differ in the number of neutrons in the nucleus and the properties of the nucleus. Almost all elements occur in

Copyright © Helen Nuclear Ltd

	nature as several isotopes. For example, hydrogen has three isotopes: protium (hydrogen), deuterium and tritium, of which tritium is radioactive.
ISUH	Institute of Seismology, University of Helsinki.
Kilovolt (kV)	Kilovolt, a unit of voltage.
Light water reactor	A type of reactor where ordinary water is used in the reactor core as coolant and moderator. Most nuclear reactors worldwide, and every reactor in use in Finland, are light water reactors.
Low level waste	Low level and intermediate level wastes are operational waste from a power plant. In addition, it is produced during the decommissioning of a power plant. Low level waste can be processed without radiological protection arrangements, as its radioactivity is low (usually up to 1 MBq/kg).
MAALI area	A regionally important bird area.
Magnitude (M)	Magnitude (M) is a way of measuring the size and intensity of an earthquake or a seismic event at the source of the seismic waves themselves. Magnitude readings are objective scales, that is, they do not depend on the location of the observation point or the observer.
masl	Metres above sea level.
MEAE	Ministry of Economic Affairs and Employment. Competent authority for the EIA procedure and the supreme authority for the use of nuclear energy.
Modularity	The modular approach means that the SMR plant's components can be manufactured as ready-made modules in factories, and these modules are then assembled on site. The degree of modularity varies depending on the type and supplier of the plant.
MW	Megawatt, a unit of power (1 MW = 1,000 kW). MWth means megawatt of heat and MWe means megawatt of electricity.
MWh (GWh, TWh)	Megawatt-hour (gigawatt-hour, terawatt-hour), a unit of energy (1 GWh = 1,000 MWh, 1 TWh = 1,000 GWh).
Natural circulation	Systems based on natural circulation do not require external power sources to operate, so their use can enhance the safety of nuclear power.
Nuclear facility	A nuclear facility refers to installations used for the generation of nuclear energy, including research reactors, facilities for the large-scale disposal of nuclear waste, and facilities for the large-scale manufacture, use, processing or storage of nuclear material and nuclear waste.
Nuclear fuel	A uranium-containing compound intended for use in reactors of nuclear power plants, packaged in such a way that it can be assembled into a reactor core inducing a chain reaction based on nuclear fission.
Nuclear power plant	A nuclear facility designed to generate electricity or heat by means of a nuclear reactor based on fission.
Nuclear waste	A general term for radioactive waste arising from the operation of a nuclear facility. Nuclear waste is very low level, low level or intermediate level waste or high level fuel waste.
Passive safety solutions	Safety systems and structures that operate by means of natural laws (such as gravity, natural circulation or conduction) without external electricity, human activity or control of automation systems.
PIMA	Means contaminated soil or detection of contaminated areas.
Planning area	In this EIA programme, the planning area refers to the area for which the nuclear power plant is planned. In addition to the nuclear power plant, the planning area includes support areas during construction and areas of existing plants in Salmisaari and Vuosaari. The planning area is part of the project area. The boundaries of the planning area in Salmisaari, Vuosaari and Norrberget are presented in chapter 2.3. The actual nuclear power plant site is smaller than the planning area. See the project area and plant area.
Plant area	The plant area in the EIA programme refers to the area where the nuclear power plant is located and around which double fences are being built. The plant area is located in the planning area. See the planning area.
Precautionary action zone	An area where, in the event of an accident, it may be necessary to take protective measures to prevent or limit severe radiation effects on the population. The area is subject to land use restrictions.

Copyright © Helen Nuclear Ltd

Pressurised water reactor	A type of light water reactor in which the pressure of the water used as coolant and moderator is kept so high that it does not boil despite the high temperature. Water that has passed through the reactor core releases its heat in separate heat exchangers to the water in the secondary circuit.
Project area	The project area in the EIA programme refers to the area where all the project activities are located. In this EIA programme, the project area of the different project options includes the planning area of the nuclear power plant, as well as various connections related to the project option (such as electricity transmission connection, cooling water connection, district heat transmission connection, road connections).
Radioactivity	Radioactive substances spontaneously decay into lighter elements or isotopes of the same element with lower energy. The process releases ionising radiation, which is either electromagnetic radiation or particle radiation.
Radiation	Radiation is either electromagnetic wave motion or particle radiation.
Radionuclide	A radionuclide is a nucleus of an atom that is unstable due to additional neutrons or protons. This instability causes extra energy to be released through radioactive decay. Radionuclides can emit radiation such as alpha, beta or gamma radiation.
Right-of-way	The part of the transmission line area where the power lines and transmission towers are located. The rights-of-way are cleared selectively so that low-growing trees and shrubs that do not compromise reliability may be left to grow. The main rule is that the trees and shrubs left after clearing are no more than three metres high.
SAC area	Special Areas of Conservation selected for the Natura 2000 network on the basis of the Habitats Directive.
Safety principle of defence-in-depth	Ensuring safety to prevent reactor damage and harmful effects of radiation takes place on several consecutive operational and structural levels, all backing up each other. In ensuring safety, preventive (design and operation of the plant), protective (plant systems tasked with detecting disturbances and preventing them from developing into severe accidents) and mitigating (maintaining the integrity of the containment and ensuring the functioning of the containment-related systems) levels can be distinguished.
Scaling	Removal of loose stones and boulders from an excavated rock face.
Scope 1, 2 and 3 emissions	Scope 1, 2 and 3 emissions represent the company's greenhouse gas emissions according to the Greenhouse Gas Protocol. Scope 1 includes all direct greenhouse gas emissions generated as a result of the company's operations. Scope 2 includes greenhouse gas emissions from the production of purchased and consumed energy. Scope 3 includes all other indirect greenhouse gas emissions generated as a result of the company's activities, but the emission sources themselves are not owned or controlled by the company.
Seismicity	The incidence or frequency of seismic events in the area.
Sievert (Sv)	The unit of radiation dose. The higher the radiation dose, the more likely it is to cause harm to health. The unit millisievert (mSv) or microsievert (µSv) is often used (1 µSv = 0.001 mSv = 0.000001 Sv).
Small Modular Reactor, SMR	SMR = small modular reactor. There is no official or established definition for a small modular reactor, or SMR. They are significantly smaller in terms of reactor heat output than the conventional nuclear power plants implemented in recent decades. A small modular reactor plant may have one or more reactors, and they are characterised by a relatively compact structure, modularity and design based on passive safety solutions. Heat, electricity or both can be produced in a small modular reactor plant.
SPA area	An area selected for the Natura 2000 network on the basis of the Birds Directive.
Spent nuclear fuel	Nuclear fuel is considered spent when it has been in the reactor for power generation and has been removed from the reactor. Spent nuclear fuel contains uranium fission products such as caesium and is highly radioactive.
SSP	Climatic scenarios SSP, Shared Socioeconomic Pathway SSP2-4.5: reasonably successful climate policy scenario, emissions are expected to remain at their current level until 2050, after which they will start decreasing but will not reach net zero by 2100. SSP4-7.0: high emissions scenario, assuming that greenhouse gas emissions will continue to rise or remain very high well into the 21st century, due to insufficient climate action.

Copyright © Helen Nuclear Ltd

	SSP5-8.5: high emission scenario model representing so-called “business-as-usual” or “fossil-based” development.
Stormwater	In built-up areas, rainwater or meltwater that accumulates on the ground, on the roof of a building, or on other surfaces.
STUK	Radiation and Nuclear Safety Authority. An independent authority and expert whose task is to promote and supervise radiation safety and the safe use of nuclear energy in Finland.
Thermal power (W)	The power at which the plant generates thermal energy (reactor thermal power).
Transmission line area	Ground area under a power line. The transmission line area consists of the right-of-way and the border zones on both sides.
Tukes	The Finnish Safety and Chemicals Agency, which, among other things, monitors and promotes the safety and reliability of products, chemicals, mines, the chemical and explosives industry, equipment and services. In addition, large-scale storage and handling of chemicals requires a permit issued by Tukes.
Uranium (U)	A chemical element with the symbol U. Uranium makes up 0.0004% of all substances (four grams per tonne) in the Earth’s crust. All uranium isotopes are radioactive. The majority of natural uranium is the isotope U-238, which has a half life of 4.5 billion years. Approximately 0.71% of natural uranium is U-235, which is suitable as a fuel for nuclear power plants.
VAMA	Nationally valuable landscape areas.
VARK	Archaeological sites of national significance.
Water system	In the Water Act, a water system means a lake, pond, river, stream and other natural water bodies, as well as a reservoir, canal and other similar artificial water bodies.
VKSZ	VKSZ (Vuosaari–Korso Shear Zone). Over 50 km long north–south shear zone / gouge.

Copyright © Helen Nuclear Ltd

1 INTRODUCTION

Helen Nuclear Ltd is planning to build a nuclear power plant in Helsinki. The purpose of the planned nuclear power plant, or SMR (Small Modular Reactor) plant, is to produce either district heat or both district heat and electricity. There are three alternative sites for the nuclear power plant: Salmisaari, Vuosaari and Norrberget.

The planned activity corresponds to item 7(b) of the project list in Annex 1 of the Environmental Impact Assessment Act (252/2017), or the EIA Act: nuclear power stations and other nuclear reactors.

The aim is for the nuclear power plant to start operating during the 2030s. The project is an important part of Helen Ltd's aim to move away from combustion-based energy production by 2040, in addition to other projects already implemented and planned.

2 DESCRIPTION OF THE PROJECT

2.1 Party responsible for the project

The project is managed by Helen Nuclear Ltd, a nuclear energy project development company owned by Helen Ltd, whose task is to find out the prerequisites for the construction of nuclear energy production in Helsinki. At the moment, the company is conducting studies with selected plant site options, competitive tendering among plant suppliers, as well as exploring possible alternative business models. The project preparation phase is supported by experienced nuclear energy partners.

Helen Ltd, owned by the City of Helsinki, is one of the largest energy companies in Finland. Helen Ltd has approximately 600,000 customers across Finland, and the Helen Group employs over 700 energy specialists. Helen Ltd produces electricity, district heat and district cooling, for example, in power and heating plants in different parts of Helsinki. The production palette also includes hydro, wind, solar and nuclear power. The company's head office is located in Ruoholahti, Helsinki.

Helen has been one of the owners of Finnish nuclear power since its early stages. A significant part (2024: 45%) of Helen's electricity is produced at the Olkiluoto nuclear power plants. Helen has more than 100 years of experience in energy production and power plant operation, and the company is well placed to build an organisation for the construction and production of nuclear power.

2.2 Purpose of the project and its grounds

Helen's goal is to move away from combustion-based energy production by 2040. Helen has reviewed and already implemented several options for achieving the targets, and based on the results of these studies, Helen is now investigating the construction of a nuclear power plant that produces either heat only or both heat and electricity as part of Helen's wider low-emission energy production. The Helsinki City Strategy also provides for the possible location of a small modular reactor plant in Helsinki, if the changes in the regulation make it possible (City of Helsinki 2025c). Alongside this, Helen is exploring other options for achieving the goals (see chapter 2.7 and 29).

When considering the options, it must be taken into account that district heat production is a critical sector in terms of security of supply, and therefore its production must be sufficiently ensured and decentralised. The last few years have shown that energy availability and prices

Copyright © Helen Nuclear Ltd

can fluctuate significantly. District heating should have several supporting pillars, and the nuclear power plant project would introduce nuclear energy as a new supporting pillar.

Finland's climate and energy targets require low-emission baseload power. Nuclear power is suitable as part of the energy system, where the share of weather-dependent wind and solar power increases, but where consumption is high and constant, especially during winter. If realised, nuclear power could provide weather-independent, stable, predictable and low-emission energy production for Helsinki and, with the CHP plant, for the entire Finland.

Helen is studying plant options that produce only heat and options that produce both electricity and heat. A heat-only heating plant would reduce other forms of heating based on combustion or electricity needed for heating in Helsinki, which would contribute to increasing self-sufficiency and help to move away from combustion-based energy production. The impact of the CHP plant producing both heat and electricity on the self-sufficiency of electricity in Finland as a whole would be significant, as the need for power in Helsinki is estimated to double from the current 800 megawatts to 1,600 megawatts by the beginning of the next decade at the latest. This requires either a heavy increase in transmission connections or a significant increase in electricity production in the Helsinki area, as at the moment, electricity is mostly produced on the west coast, and it may not be possible in all respects to transfer it to the extent required in Helsinki. Helen aims to secure the growing city's energy needs with nuclear power while reducing emissions and easing cost pressures on energy.

The carbon dioxide emissions produced by nuclear power during its entire life cycle in relation to the amount of energy produced may be lower than those of solar and wind power (UNECE 2022), so as part of the energy system it would also support Helsinki's emission targets. Due to its minimal surface area requirements compared to other low-emission forms of production, it is estimated to be suitable for Helsinki, where there is a shortage of land.

There is no official or established definition for a small modular reactor, or SMR. Small modular reactors are characterised by a relatively compact structure, modularity and design based on passive safety solutions. Unlike traditional large nuclear power plants implemented in recent decades, small modular reactors are comparable in size to medium-sized industrial plants, which means that they can be placed closer to consumption. This reduces construction needs for transmission infrastructure and transmission losses, as well as supports the regional balance of the energy system.

Finland's strong nuclear expertise and well-functioning regulatory environment create good conditions for the controlled and safe deployment of an SMR plant.

2.3 The project and options to be assessed in the EIA procedure

Helen Nuclear Ltd is planning to build a nuclear power plant in Helsinki. There are three alternative locations for the nuclear power plant: Salmisaari, Vuosaari and Norrberget. The nuclear power plant's plant options are a heating plant that produces only district heat and a CHP plant that produces electricity and district heat.

The project includes new connections to be built (electricity transmission connections, district heating connection, cooling water connections, and road connections). The new connections required depend on the project option.

For nuclear waste generated during the operation of the nuclear power plant, the processing and interim storage of spent nuclear fuel at the nuclear power plant site are included in this

Copyright © Helen Nuclear Ltd

EIA procedure. The final disposal of spent nuclear fuel is not included in this EIA procedure, but a separate EIA procedure will be implemented in due course. The processing, interim storage and final disposal for very low-level, low level and intermediate level waste at the nuclear power plant site are included in this EIA procedure. Final disposal at a site other than the plant site is not included in the EIA procedure.

In addition, the EIA procedure examines the zero option (VE0), that is, a situation in which a nuclear power plant is not built.

VE0

The nuclear power plant will not be implemented and the positive and negative environmental impacts of the project will not materialise. Helen will not move away from combustion-based energy production, but energy production in Helsinki will continue at the current production facilities. In addition, the production investments already decided at Helen will be implemented.

Project options to be examined in the EIA procedure are as follows:

VE1 Heating plant in Salmisaari

The heating plant will be built in the Salmisaari planning area, where Helen Ltd's Salmisaari power plant area is currently located. The heating plant consists of a maximum of 18 small reactors and the reactors have a maximum total heat output of 630 MWth and a maximum district heat output of 600 MW. No new district heat or road connections are required for the plant. The plant may require new electrical cables in existing tunnels.

VE2a Heating plant in Vuosaari

The heating plant will be built in the Vuosaari planning area, where Helen Ltd's Vuosaari power plant area is currently located. The heating plant consists of a maximum of 18 small reactors and the reactors have a maximum total heat output of 630 MWth and a maximum district heat output of 600 MW. No new electrical, district heat or road connections are required for the plant.

VE2b CHP plant in Vuosaari

The CHP plant will be built in the Vuosaari planning area, where Helen Ltd's Vuosaari power plant area is currently located. The CHP plant has one reactor with heat output up to 1,400 MWth, electric power up to 500 MWe and district heat output up to 700 MW. No new district heat or road connections are required for the plant.

For electricity transmission, the CHP plant requires the construction of a new 400 kV power line from Vuosaari to Fingrid Oyj's new Itäsalmi substation in Vantaa. The electricity transmission connection from Vuosaari to Itäsalmi substation has three options, two of which are overhead line options (options Vu-Is1 and Vu-Is2) and one is an underground cable option (option Vu-Is3). In addition, a new substation by Helen Electricity Network Ltd is needed in the southwestern part of the Vuosaari planning area.

For cooling, a cooling water tunnel connection is required in the marine area off the Vuosaari Harbour. The EIA examines the use of the current cooling water tunnels of the Vuosaari power plant as the cooling water intake and discharge tunnels of the nuclear power plant (option Vuosaari O1P1). In addition, the extraction of completely new cooling water intake and discharge tunnels is examined, and there are a total of nine options (Vuosaari O2P2, Vuosaari

Copyright © Helen Nuclear Ltd

O2P3, Vuosaari O2P4, Vuosaari O3P2, Vuosaari O3P3, Vuosaari O3P4, Vuosaari O4P2, Vuosaari O4P3 and Vuosaari O4P4). In addition, it is possible that part of the cooling is carried out as air cooling.

VE3a Heating plant in Norrberget

The heating plant will be built in Östersundom in the Norrberget planning area. The heating plant consists of a maximum of 18 small reactors and the reactors have a maximum total heat output of 630 MWth and a maximum district heat output of 600 MW.

For district heat transmission, a heat transmission connection will be built between Norrberget and Vuosaari. The heat transmission connection can be carried out either entirely in a tunnel excavated in the bedrock (option KL1) or as a combination of a tunnel and a pipe excavated in the ground (option KL2). In Vuosaari, the district heat transmission connection is connected to the existing district heating network.

The heating plant requires the construction of a new 110 kV power line and a 110 kV backup power connection for electricity transmission. The new 110 kV power line will be built from Norrberget to Fingrid Oyj's existing Länsisalmi substation. The power line has two options, one overhead line option (No-Ls1) and one underground cable option (No-Ls2). The backup power connection will be built in connection with the district heat transmission line.

New road connections and municipal infrastructure connections will be built in the area.

VE3b CHP plant in Norrberget

The CHP plant will be built in Östersundom in the Norrberget planning area. The CHP plant has one reactor with heat output up to 1,400 MWth, electric power up to 500 MWe and district heat output up to 700 MW.

For district heat transmission, a heat transmission connection will be built between Norrberget and Vuosaari. The heat transmission connection can be carried out either entirely in a tunnel excavated in the bedrock (option KL1) or as a combination of a tunnel and a pipe excavated in the ground (option KL2). In Vuosaari, the district heat transmission connection is connected to the existing district heating network.

The CHP plant requires the construction of a new 400 kV power line and a 110 kV backup power connection for electricity transmission. The new 400 kV power line will be built from Norrberget to Fingrid Oyj's new Itäsalmi substation in Vantaa. The power line has three options, one overhead line option (No-Is1) and two underground cable options (No-Is2 and No-Is3). The backup power connection will be built in connection with the district heat transmission line.

For cooling, new cooling water intake and discharge tunnels are excavated from Norrberget to the marine area off Vuosaari, and there are a total of nine intake and discharge tunnel options (Norrberget O2P2, Norrberget O2P3, Norrberget O2P4, Norrberget O3P2, Norrberget O3P3, Norrberget O3P4, Norrberget O4P2, Norrberget O4P3 and Norrberget O4P4). In addition, it is possible that part of the cooling is carried out as air cooling.

New road connections and municipal infrastructure connections will be built in the area.

Copyright © Helen Nuclear Ltd

The EIA procedure assesses the impact of all project options and the options for new connections to be built for the project options. The options are compared between the project options.

The project options and the necessary new connections are shown in the following figures (Figure 2-1–Figure 2-5) and table (Table 2-1).

Copyright © Helen Nuclear Ltd

Table 2-1. Project options and necessary new connections.

Project option	Nuclear power plant	New connections
VE1 Heating plant in Salmisaari	Up to 18 reactors, total heat output up to 630 MWth and district heat output up to 600 MW.	–
VE2a Heating plant in Vuosaari	Up to 18 reactors, total heat output up to 630 MWth and district heat output up to 600 MW.	–
VE2b CHP plant in Vuosaari	One reactor, heat output up to 1,400 MWth, electric power up to 500 MWe and district heat output up to 700 MW.	Electricity transmission connection of 400 kV to Fingrid's new Itäsalmi substation. Cooling water tunnel connection to the sea, including an assessment of expanding the existing tunnels of the Vuosaari power plant and constructing entirely new cooling water intake and discharge tunnels.
VE3a Heating plant in Norrberget	Up to 18 reactors, total heat output up to 630 MWth and district heat output up to 600 MW.	The district heat transmission connection is carried out either entirely in a tunnel excavated in the bedrock or as a combination of a tunnel and a pipe excavated in the ground. Electricity transmission connection of 110 kV to Fingrid's current Länsisalmi substation. Backup power connection of 110 kV to the district heat transmission line. New road connections and utilities.
VE3b CHP plant in Norrberget	One reactor, heat output up to 1,400 MWth, electric power up to 500 MWe and district heat output up to 700 MW.	The district heat transmission connection is carried out either entirely in a tunnel excavated in the bedrock or as a combination of a tunnel and a pipe excavated in the ground. Electricity transmission connection of 400 kV to Fingrid's new Itäsalmi substation. Backup power connection of 110 kV to the district heat transmission line. Cooling water tunnel connection to the sea, construction of new cooling water intake and discharge tunnels. New road connections and utilities.

Copyright © Helen Nuclear Ltd

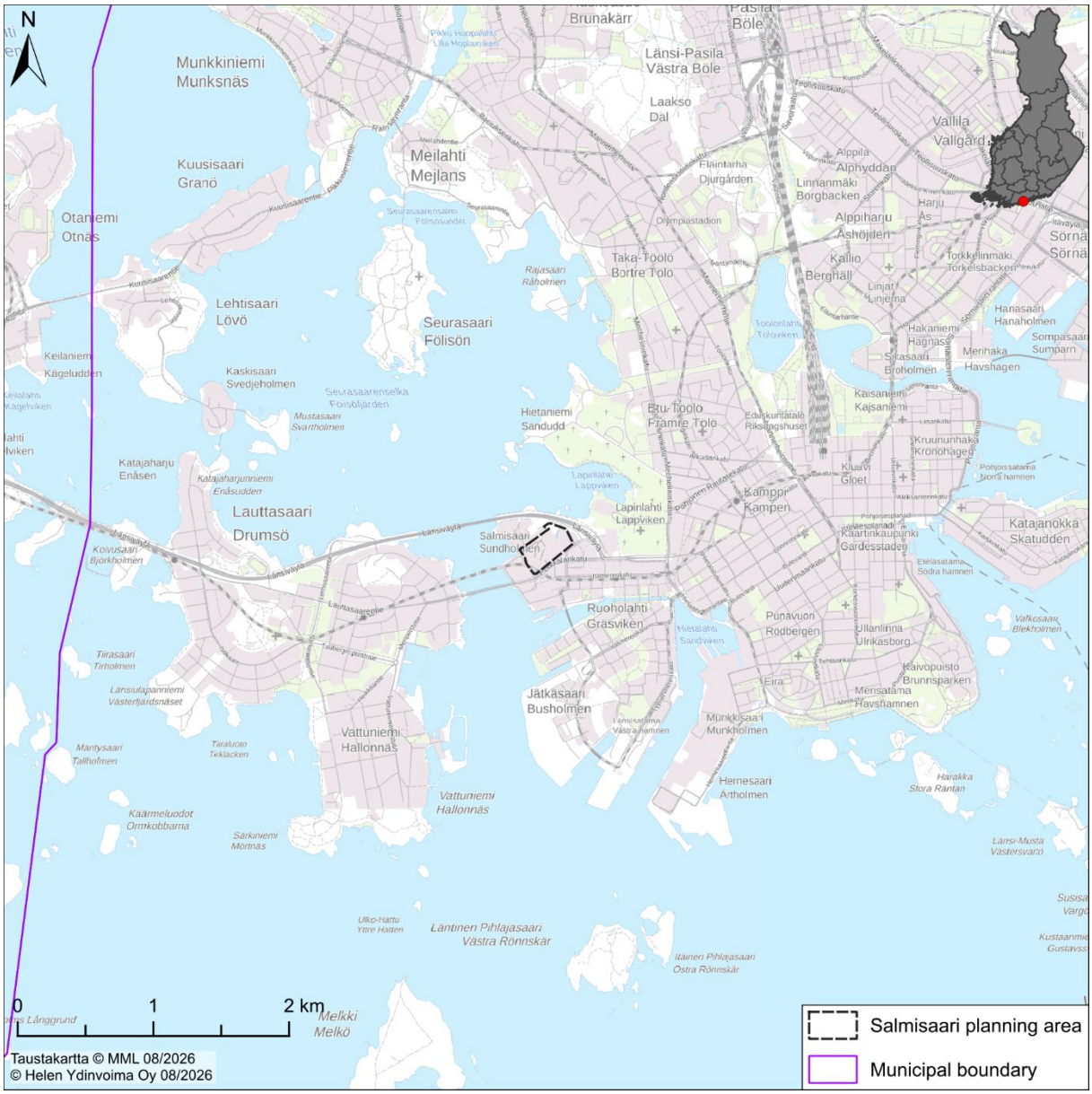


Figure 2-1. Location of the planning area of the Salmisaari heating plant (project option VE1).

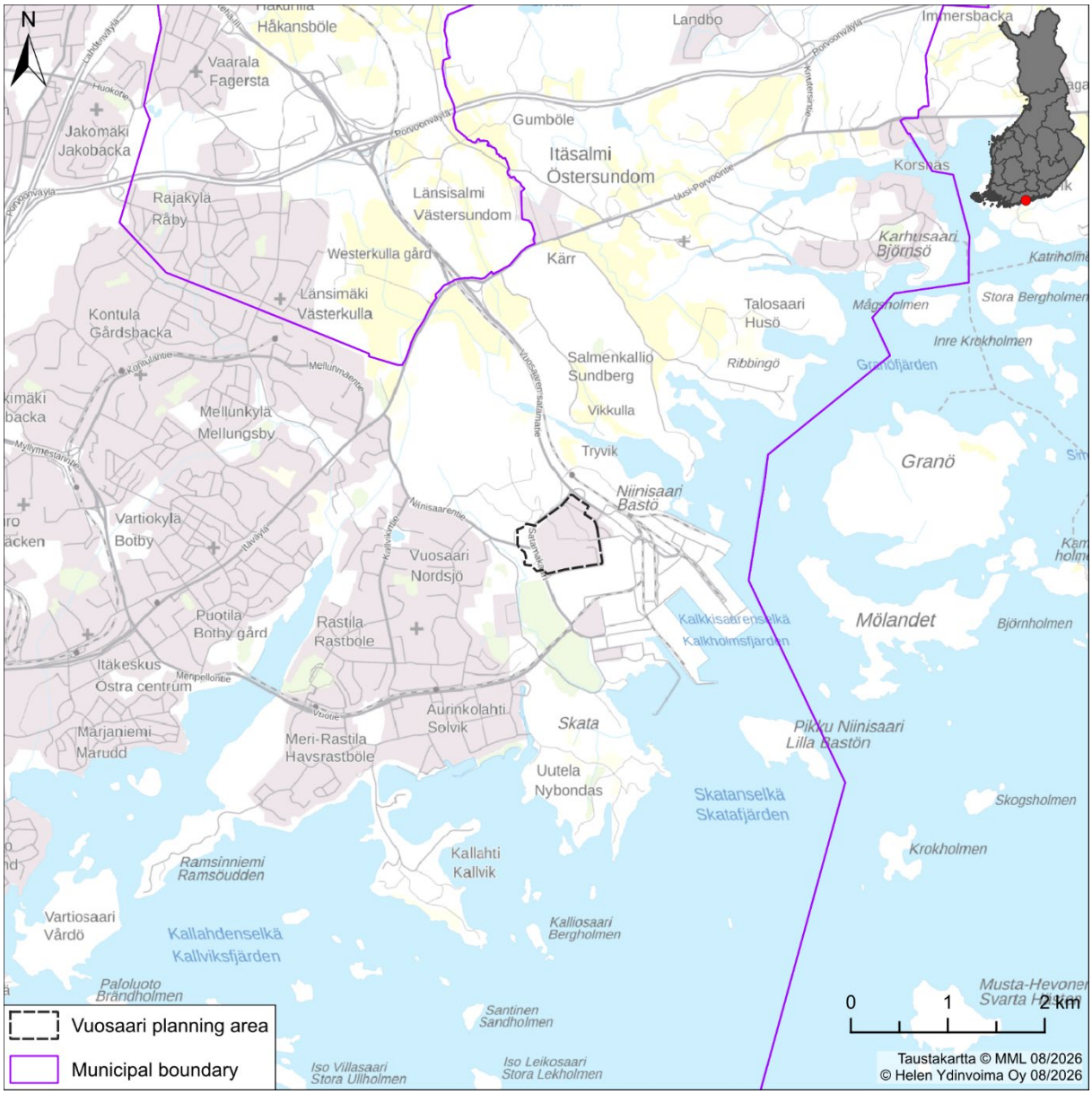


Figure 2-2. Location of the planning area of the Vuosaari heating plant (project option VE2a).

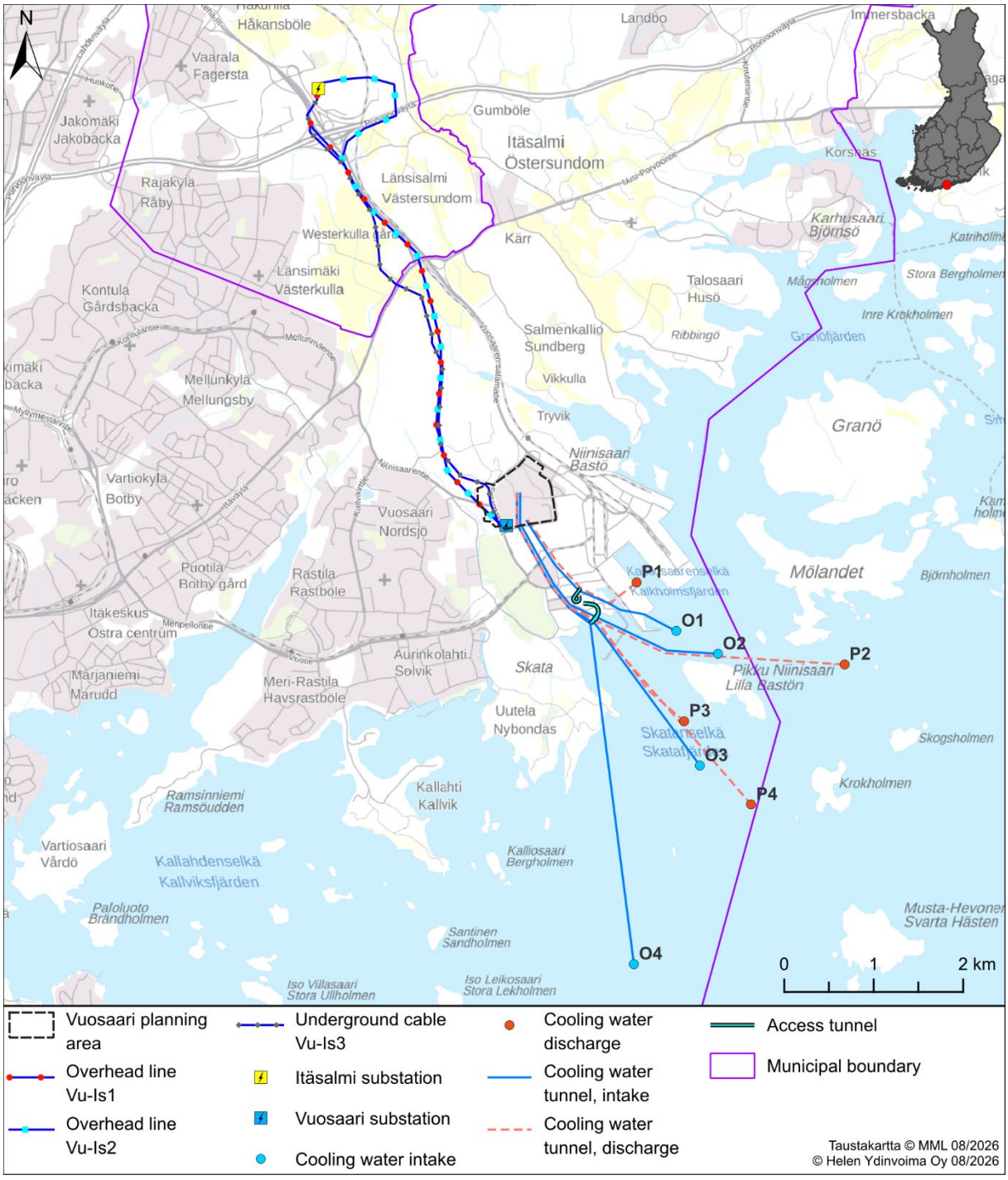


Figure 2-3. Location of the planning area of the Vuosaari CHP plant and the location of the necessary connections to the project area (project option VE2b).

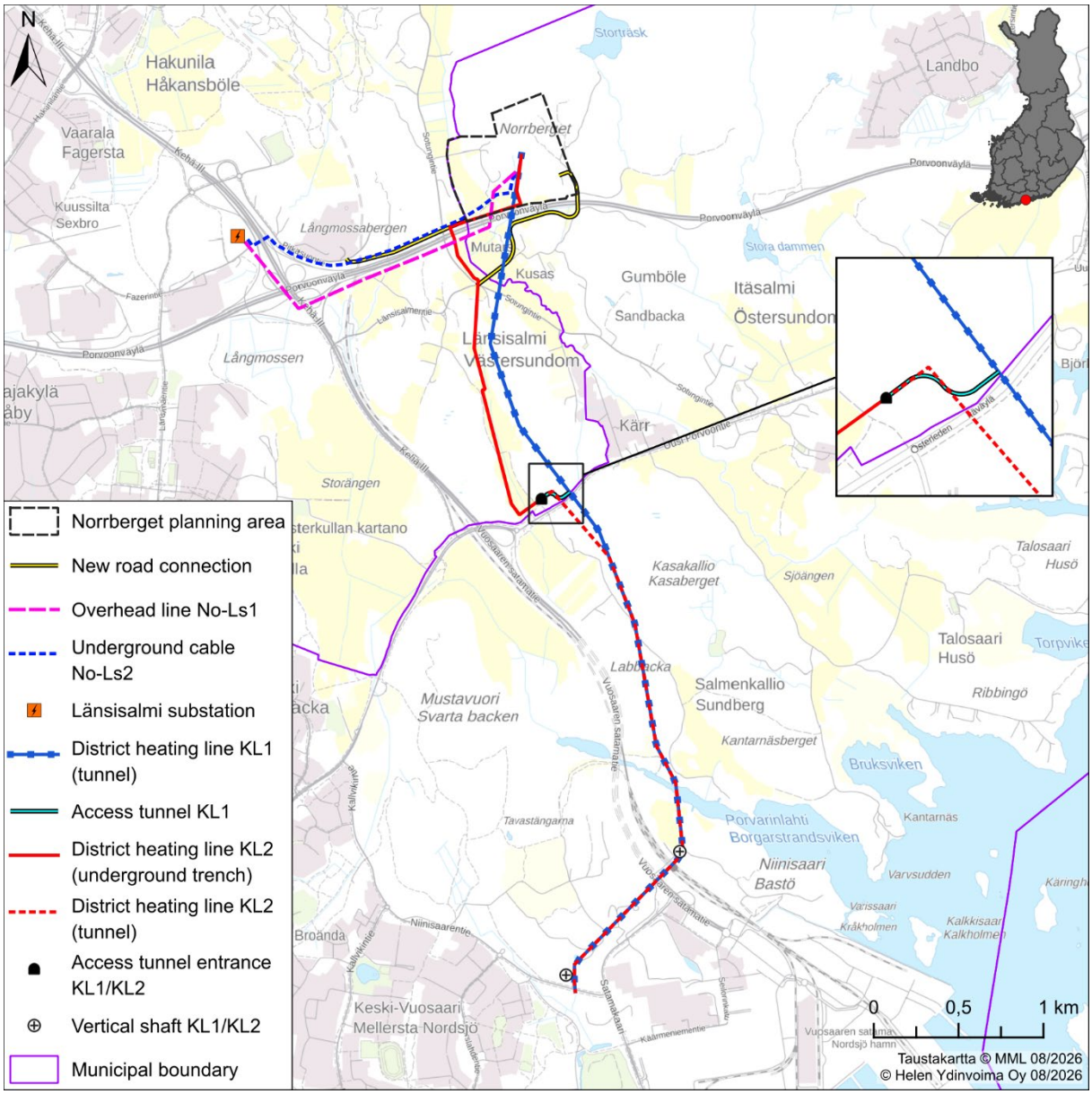


Figure 2-4. Location of the planning area of the Norrberget heating plant and the location of the necessary connections to the project area (project option VE3a).

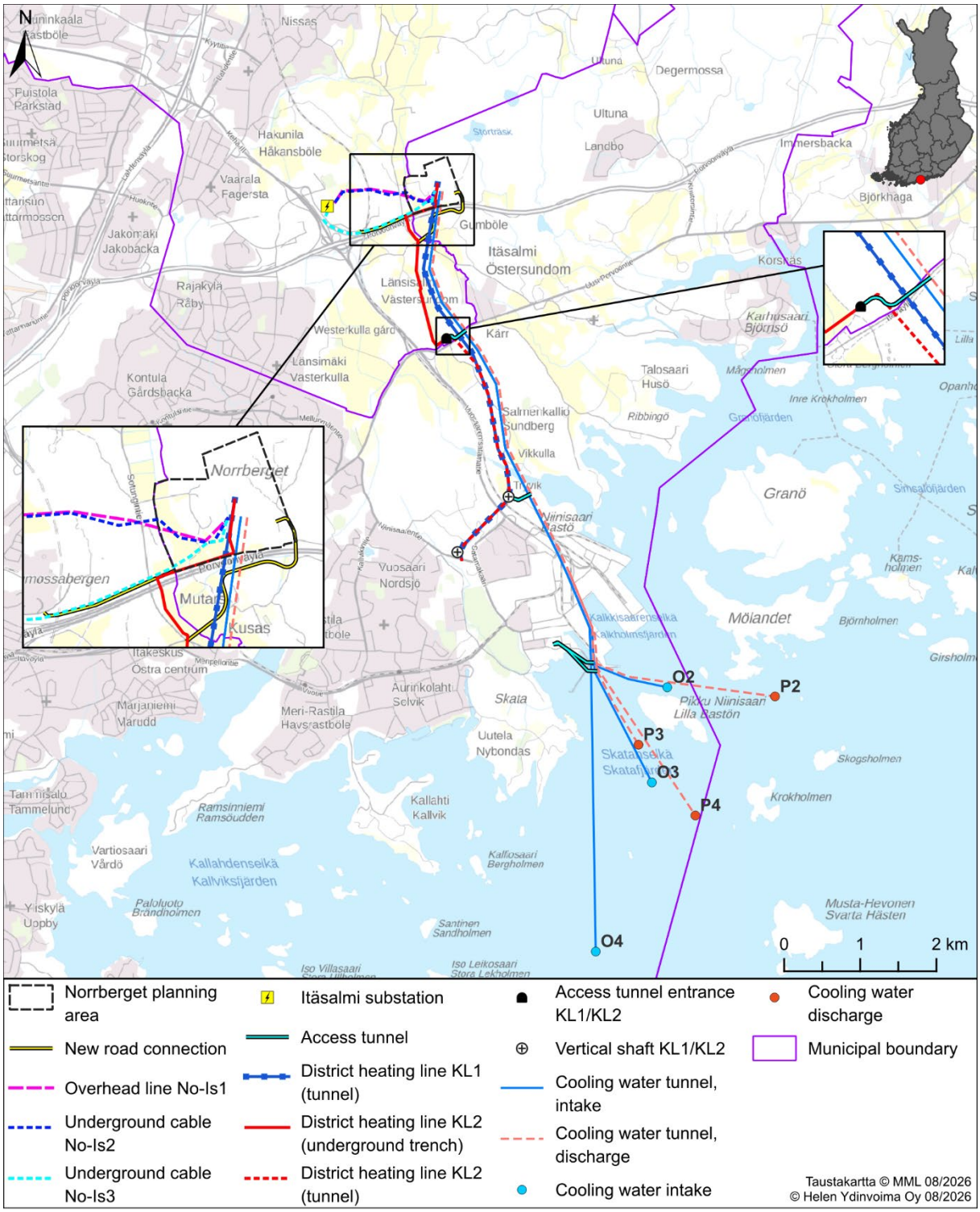


Figure 2-5. Location of the planning area of the Norrberget CHP plant and the location of the necessary connections to the project area (project option VE3b).

2.3.1 Limitation of the project package

The project package examined in this EIA procedure includes the impacts during the construction and operation of the nuclear power plant and the connections related to it in different project options (electricity transmission connections, district heat transmission connection, cooling water connections and road connections). Nuclear waste management is an integral part of the operation of the nuclear power plant. The attached table (Table 2-2) shows the parts of the

project included in this EIA procedure, as well as those parts of the project for which separate EIA procedures will be implemented in due course, if needed.

For nuclear waste generated during the operation of the nuclear power plant, the processing and interim storage of spent nuclear fuel at the nuclear power plant site are included in this EIA procedure. The final disposal of spent nuclear fuel is not included in this EIA procedure, but a separate EIA procedure will be implemented in due course. The processing, interim storage and final disposal for very low-level, low level and intermediate level waste at the nuclear power plant site are included in this EIA procedure. Final disposal at a site other than the plant site is not included in the EIA procedure. Possible alternatives to the final disposal of low and intermediate level waste may include, for example, existing low and intermediate level waste final disposal facilities in Finland, as well as possible new final disposal facilities to be built elsewhere.

Table 2-2. The limitation of the project package to be examined in the EIA procedure.

Part of the project	Part of this EIA procedure	Separate EIA procedure
Nuclear power plant and related connections in different project options (including excavation required for their construction)	x	
On-site treatment and interim storage of spent nuclear fuel	x	
Off-site treatment and interim storage of spent nuclear fuel		x
Final disposal for spent nuclear fuel		x
On-site treatment and interim storage of very low, low and intermediate level waste	x	
Off-site treatment and interim storage of very low, low and intermediate level waste		x
On-site final disposal of very low, low and intermediate level waste	x	
Off-site disposal of very low, low and intermediate level waste		x
Decommissioning of the nuclear power plant		x

Nuclear waste management is an integral part of the operation of a nuclear power plant and its impact assessment is included in all chapters of the EIA programme, although it is not always separately mentioned in each impact section. The entire life cycle of a nuclear power plant project is very long. The final disposal of nuclear waste is topical only when the operation of the nuclear power plant has started. In practice, the final disposal of very low, low and

Copyright © Helen Nuclear Ltd

intermediate level waste can be started some decades after the start of operation of the nuclear power plant. The final disposal of spent nuclear fuel can be started at the earliest when the fuel removed from the reactor has cooled for decades.

The decommissioning of the nuclear power plant is even further in the future, so it is not included in this EIA procedure.

2.4 Project location

As a result of Helen's studies, three different plant site options have been selected in Helsinki, where more detailed investigations have begun, including the environmental impact assessment procedure. The sites are located in Helen Ltd's current power plant areas in Salmisaari and Vuosaari, as well as in the Norrberget area in Östersundom. A decision on the site of the nuclear power plant has not yet been made (see chapter 2.5).

The planned nuclear power plant will produce district heat, the production of which must be located close to consumption. This reduces heat losses and the need for electricity for pumping. Long heat transmission connections would increase the impacts of the project on land use, as well as environmental impacts during construction.

The planning area refers to an area the suitability of which for small-scale nuclear power generation or as support areas during construction is examined in the EIA procedure. The planning area has been designed as wide as possible, as the plant technology or plant supplier has not yet been selected. Different technologies and suppliers have different requirements for the size and characteristics of the plant site. The entire area may not become the final plant site of the nuclear power plant.

The project options examined in the EIA procedure are located in the Helsinki, Vantaa and Sipoo regions. The planning areas as well as most of the new connections to be built in different project options are located in the City of Helsinki. The electricity transmission connection options for project option VE2b are partly located in Vantaa, as well as electricity and district heat transmission connection options for project options VE3a and VE3b. Also parts of the new road connections are located in Vantaa. In project options VE2b and VE3b, one of the alternative cooling water discharge points (P2) under consideration is located in the Sipoo marine area. According to preliminary estimates, the utilization, temporary storage and placement of excavated rock material generated in the project may take place in the Uusimaa region. As a rule, the rock material generated from construction is used as close as possible to the project area.

Copyright © Helen Nuclear Ltd



Figure 2-6. Alternative locations for the nuclear power plant in Helsinki.

2.4.1 Salmisaari

The Salmisaari planning area covers the Salmisaari power plant area, which is Helen Ltd's existing energy production area. The area is located in Ruoholahti, near the inner city of Helsinki (Figure 2-1). The planning area of the nuclear power plant examined in the EIA procedure is located in the Salmisaari power plant area, in properties 91-20-786-6 and 91-20-9908-9, which are under Helen Ltd's control. The size of the planning area is about 7.6 hectares.

In the Salmisaari power plant area, district heat is produced with the help of biomass, in addition to which there are plants representing a new generation of heat production, which consist of two electric boilers and an industrial-sized air-to-water heat pump plant. The power plant area also has cooling centres, a heat accumulator and a substation. In addition to district heating, district cooling is produced in the power plant area.

There are many office buildings around the Salmisaari planning area, as well as residential buildings in areas such as Ruoholahti, Jätkäsaari and Lauttasaari.

Copyright © Helen Nuclear Ltd

2.4.2 Vuosaari

The Vuosaari planning area covers the Vuosaari power plant area, which is Helen Ltd's existing energy production area. The area is located in the vicinity of Vuosaari Harbour (Figure 2-2). The planning area examined in the EIA procedure is located in a wider area than the Vuosaari power plant area, in properties 91-54-152-20, 91-54-152-21, 91-54-152-22, 91-54-152-13, 91-54-152-14, 91-54-152-15, 91-54-152-19, 91-54-152-24, 91-417-1-64, 91-54-318-3, 91-417-4-31, 91-435-4-59 and 91-435-2-122. The properties are owned by the City of Helsinki. Those within the current Vuosaari power plant site are managed by Helen Ltd. The planning area covers approximately 46.8 hectares.

The two combined cycle power plants at the Vuosaari power plant produce electricity and heat from natural gas. There is also a bioenergy heating plant, a heat pump plant and a heat accumulator in the power plant area. In addition, there are other Helen Ltd activities in the planning area, such as a backup heating plant, coal storage, bottom ash storage, substation and underground oil caves, as well as a green hydrogen production plant to be completed during this year.

The western part of the planning area is traversed by the busy Satamakaari road, which is connected from the west by the Niinisaarentie road. On the west side of Satamakaari, there is a soil dumping area and a snow disposal site. In addition, there are, among other things, a gas station, a parking area and logistics companies in the planning area.

In the vicinity of the Vuosaari planning area are the port operations of the Port of Helsinki Ltd, as well as logistics companies among others. Paulig Oy's factory is also located in the port area. In addition, there is passenger traffic in the Vuosaari Harbour.

To the west of the Vuosaari planning area is the Central Vuosaari residential area and to the southwest of the planning area is the Aurinkolahti residential area. The nearest residential buildings are about 300 metres from the boundary of the planning area.

The CHP plant (project option VE2b) requires the construction of a new 400 kV electricity transmission connection from Vuosaari to Fingrid's new Itäsalmi substation in Vantaa (Figure 2-3). The overhead line options (Vu-Is1 and Vu-Is2) largely correspond to the existing Vaarala–Länsisalmi 2x110 kV power line of Helen Electricity Network Ltd. The underground cable option (Vu-Is3) is also mainly located on the route of the existing power line, but departs from the route in the Vuosaari planning area in both the Mustavuori and Westerkulla areas. In the Mustavuori area, the underground cable route goes around an archaeological cultural heritage site, and therefore departs from the power line route. Fingrid is implementing the Itäsalmi substation regardless of Helen's nuclear power project.

The alternative cooling water intake and discharge points required by the CHP plant are located in the marine area off Vuosaari, including Skatanselkä (Figure 2-3). One of the discharge points under review is located on the Sipoo side (discharge point P2), the intake points and other discharge points are located in the Helsinki marine area. Cooling water intake and discharge tunnels are built as tunnels excavated in rock, and only the intake and discharge structures are located at the bottom of the sea. An access tunnel is located in the Vuosaari Harbour area as the above-ground structure of the cooling water tunnels.

Copyright © Helen Nuclear Ltd

2.4.3 Norrberget

The Norrberget planning area is located in Östersundom in Helsinki, on the border of the City of Vantaa (Figure 2-4). Currently, the area is mostly undeveloped, with mixed forest and patches of exposed bedrock. In the southern and western parts of the area, there is arable land. In the northwestern part of the planning area, there are four residential buildings and one holiday building, and in the southeastern part of the planning area, there is one residential building. Fingrid Oyj's 400 kilovolt power line (Länsisalmi–Anttila) and Sipoon Energia Oy's 110 kilovolt power line (Anttila–Vaarala) are located in the southern part of the area. The area is bordered from its southern part by the Porvoonväylä road and from its northern part by the Sipoonkorpi National Park. The nearest residential buildings outside the planning area are about 130 metres south of the Porvoonväylä road and about 150 metres west of the Sotungintie road. The planning area covers approximately 35.4 hectares.

To the west of the planning area, the Långmossebergen area in Vantaa has industrial activities, such as Remeo Oy's recycling plant and Vantaan Energia Oy's waste-to-energy plant. HSY's wastewater treatment plant is planned to be built later in the eastern part of the planning area. According to current information, the wastewater treatment plant will be built only after the nuclear power plant is in operation. The planning of the area is carried out in cooperation with HSY.

The district heat transmission connection will be built from the Norrberget planning area to Vuosaari, where it will link to Helen's existing district heating network. The district heat transmission connection will be carried out either entirely in a tunnel excavated in the bedrock (option KL1) or as a combination of a tunnel and a pipe excavated in the ground (option KL2). The section running in an underground trench in option KL2 crosses Krapuoja and passes under Porvoonväylä, after which the route continues southwards through the arable land area in Länsisalmi. In Länsisalmi, north of Itäväylä, the pipe running in the underground trench enters the rock tunnel through the tunnel entrance. In addition to the entrance to the Länsisalmi tunnel (the access tunnel entrance in option KL1), the above-ground parts of the district heat transmission connection tunnel are the vertical shafts located in Niinisaari and Vuosaari.

To the west of the planning area is Fingrid's existing Länsisalmi substation and the planned Itäsalmi substation. The 110 kV power lines of the heating plant (project option VE3a) from Norrberget to Fingrid's existing Länsisalmi substation will be built either as an overhead line (No-Ls1) or as an underground cable (No-Ls2). Both power line options are located south of the Långmossebergen industrial area near the Porvoonväylä road (Figure 2-4). The 400 kV power line of the CHP plant (project option VE3b) will be built from Norrberget to Fingrid's new Itäsalmi substation in Vantaa, as either an overhead line (No-Is1) or an underground cable (No-Is2 and No-Is3). The overhead line option No-Is1 and the underground cable option No-Is2 are located north of the Långmossebergen industrial area in connection with the existing power line corridor. The underground cable option No-Is3 is located south of the Långmossebergen industrial area, north of the Porvoonväylä road (Figure 2-5). Fingrid is implementing the Itäsalmi substation regardless of Helen's nuclear power project.

The alternative cooling water intake and discharge points required by the CHP plant are located in the marine area off Vuosaari, including Skatanselkä (Figure 2-5). One of the discharge points under review is located on the Sipoo side (discharge point P2), the intake points and other discharge points are located in the Helsinki marine area. Cooling water intake and discharge tunnels are built as tunnels excavated in rock, and only the intake and discharge

Copyright © Helen Nuclear Ltd

structures are located at the bottom of the sea. The above-ground parts of the cooling water tunnels are the access tunnels located in Länsisalmi, Niinisaari and the Vuosaari Harbour area. In addition, a vertical shaft is located in Niinisaari.

The road connection to the planning area will be built as an extension of Vantaa's Pitkäsuontie to the north of Porvoonväylä, and it will cross the Sotungintie road on a new bridge. The alternative road connection to the planning area approaches from the south, from the south side of the Porvoonväylä road.

2.5 Plant site selection

The selection of the plant site is carried out in phases. The first screening phase was carried out mainly as a public source-based review, aimed at seeking suitable areas for the site, which were initially assessed to meet the required criteria.

A more detailed suitability assessment was carried out for several alternative locations in Helsinki and nearby areas. When reviewing this phase, Salmisaari, Vuosaari and Norrberget were identified as the locations that best met the criteria. In these areas, more detailed studies are carried out for each segment, such as this environmental impact assessment.

In the next phase, the goal is to select one site after the completion of the environmental impact assessment and other studies in this phase, estimated for early 2028. The selection is made on the basis of more detailed information on all segments. The licence process required by the project would be started for this location and the planning process would continue.

The suitability assessment is divided into five segments:

- Acceptability and land ownership: This segment examines local acceptability, the prerequisites for planning, and the availability of area management rights.
- Protection of the population and the environment: In this segment, the conditions for the protection of people and the environment throughout the life cycle of the plant are assessed. The readiness for emergency planning and the environmental impacts during construction and operation will be examined.
- Plant safety: In this segment, it is assessed whether the external conditions of the site allow for the safe operation of the plant. It covers natural hazards such as floods, earthquakes and extreme weather events, as well as risks caused by human activity such as nearby industrial or transportation activities and intentional damage.
- Constructability: In this segment, the practical feasibility and cost-effectiveness of the construction of the plant is assessed, taking into account the soil conditions, space needs during operation and construction, as well as the feasibility of logistics during construction.
- Connections: In this segment, the prerequisites and costs of implementing connections related to district heat, road connections, electricity and cooling water are assessed.

2.6 Background and objectives of the project

2.6.1 International and national objectives

The European Parliament has adopted the European Climate Law, which increases the EU's emissions reduction target for 2030 from the previous 40% to 55% (base year 1990) and makes climate neutrality a legally binding target by 1990.

Copyright © Helen Nuclear Ltd

EU's Climate Law is part of the European Green Deal, the EU's roadmap towards climate neutrality. To achieve its objectives, the European Union is working on an ambitious legislative package known as Fit for 55. It includes a number of new climate and energy bills and an update of existing legislation.

Small modular reactors (SMRs) are part of achieving the EU's climate targets by 2040. According to the European Commission, the goal is that the first reactors can be commissioned commercially by 2030. (European Commission 2024).

According to the Commission, the climate target for 2040 means that the EU must reduce its greenhouse gas emissions by 90% compared to 1990 levels. To achieve this, the Union's dependence on fossil fuels needs to be reduced by 80% by 2040 compared to 2021 levels. (European Commission 2024)

The European Commission recognises the potential of small-scale nuclear power to support energy and climate targets in line with the European Green Deal.

In accordance with the target outlined in the Finnish Climate Act (423/2022), Finland must be carbon neutral by 2035. This requires accelerated emission reductions in all sectors as well as reinforcement of carbon sinks. Finland's electricity and heat production must be nearly emission-free by the end of the 2030s. As a low-emission form of electricity and heat production, nuclear power plays a significant role in achieving this goal.

The national energy and climate strategy will accelerate the clean transition, reduce greenhouse gas emissions and strengthen carbon sinks in accordance with the Finnish Government Programme. Policy measures will improve the prerequisites for clean transition investments, economic growth and employment, and strengthen Finland's position as a forerunner of clean energy in Europe. According to the national climate and energy strategy, the government considers the construction of additional nuclear power to be very important and sees the piloting and use of new small modular reactor technology solutions as an opportunity to ensure an affordable supply of electricity and heat. (Ministry of Economic Affairs and Employment, 2026)

2.6.2 Regional and municipal targets

Uusimaa's goal is to be carbon neutral by 2030. This target is achieved by reducing greenhouse gas emissions by 80% compared to 2005 levels and by capturing or compensating for the remaining emissions. (Helsinki–Uusimaa Regional Council 2020).

Helsinki's target is to reduce emissions by 85% from 1990 levels by 2030. The target concerns direct emissions (so-called Scope 1 and 2). A net zero target has been set for 2040, which means that the city's emissions and sinks are in balance: greenhouse gases can only be produced to the extent that natural sinks or other removals – such as technical and biological decarbonisation solutions – can absorb. (City of Helsinki 2026d)

2.6.3 The objectives of the party responsible for the project and the schedule of the project

Helen's goal is net zero emissions and to move away from combustion-based energy production by 2040. In addition, Helen's goal is a 95% reduction in direct climate emissions from district heat by 2030 (compared to 1990 levels).

Copyright © Helen Nuclear Ltd

The construction of the nuclear power plant would begin approximately in the middle of the 2030s and the goal is to commission the nuclear power plant by 2040. The following figure illustrates the various phases in the project (Figure 2-7).

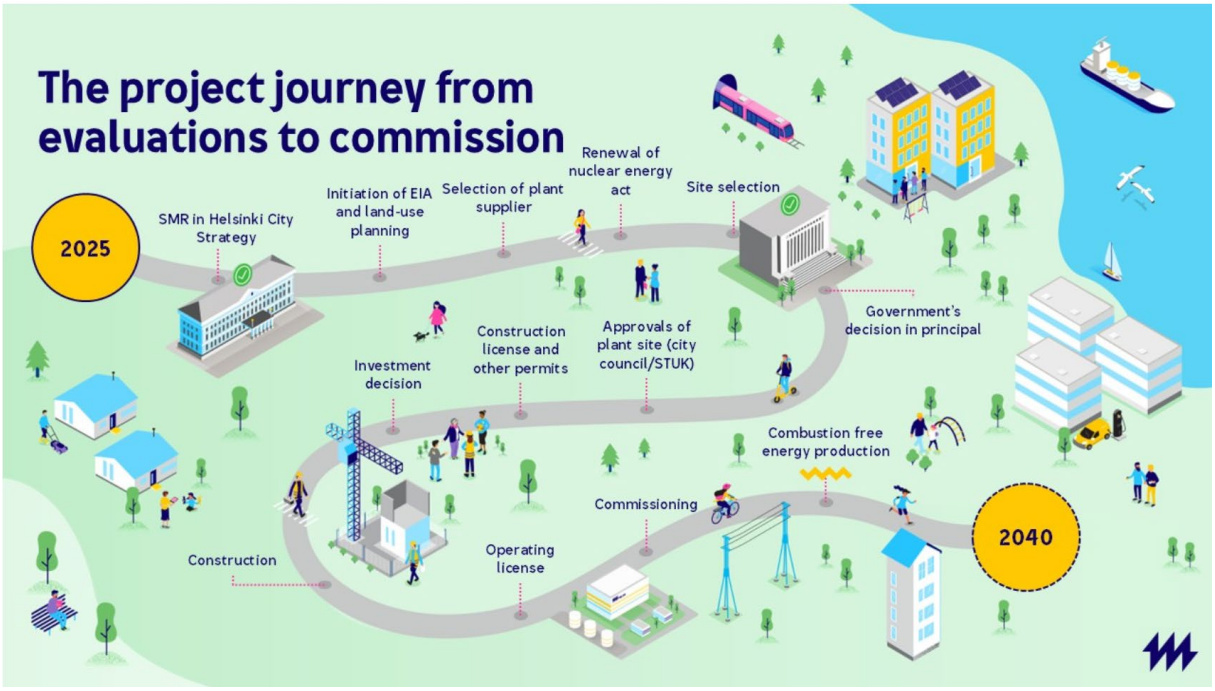


Figure 2-7. Description of the various phases of the project.

2.7 Implemented or studied district heat production solutions that are not based on combustion

The use of coal has been completely ended at Helen's production plants, as the Salmisaari B power plant ceased operations in 2025 and the Hanasaari power plant in 2023. As a result, Helen has shifted to more electric and decentralised heat production, focusing on the use of waste and environmental heat through heat pumps, electric boilers, bioenergy, and heat storage. The change currently taking place in heat production will increase Helen's electricity consumption, as an increasing share of district heat is produced with electricity-based solutions.

Between 2025 and 2029, Helen will commission new electric boiler plants totalling 430 MW in Helsinki. Additionally, Helen has built a heat pump plant in Eiranranta, South Helsinki, producing district heat and cooling by using exceptionally low-temperature wastewater that was previously used for district heat production at Helen's Katri Vala heat pump plant. The district heat output of the new heat pump plant is about 90 megawatts and the district cooling output is about 60 megawatts.

Helen is implementing the first green hydrogen production plant in Vuosaari, Helsinki. The pilot plant will create the necessary expertise for the needs of large-scale hydrogen production and increase the flexibility of the entire energy system. The primary use of the hydrogen produced is a hydrogen refuelling station to be built in connection with the plant. In addition, hydrogen can be delivered in containers to customers. The waste heat generated as a by-product of the production process is used in Helen's district heating network. The goal is to start hydrogen production in 2026.

Copyright © Helen Nuclear Ltd

In Helsinki, the change in heat production is the most significant single factor that increases electricity consumption and the need for electricity transmission in a high-voltage distribution network. Changes in Helen's district heat production play a key role. The closures of coal power plants have reduced Helsinki's electricity and heat production capacity. The closure of the power plants has eliminated about 400 MW of electricity production in Helsinki. Replacement electricity production capacity is located outside Helsinki, while district heat must be produced relatively close to consumption. Electricity-based district heat production, for example with electric boilers and heat pumps, increases the need to strengthen the capacity of the electricity network so that there is enough electricity in all situations. The electrification of transport also significantly increases the use of electricity in Helsinki. According to Helen Electricity Network Ltd's long-term plan, investments in network assets in 2026–2035 will amount to more than EUR 500 million. These investments address the growing electricity demand and include significant investments to upgrade the network's capacity.

In the medium term, Helen will focus on using the waste heat from data centres. Renewable energy projects, such as further construction of wind and solar power, are also possible if the electricity market situation supports their implementation.

In the long term, Helen aims to move away from combustion-based energy production by 2040. This target is supported by the above-mentioned actions in the short and medium term. Long-term goals also include projects related to data centres and nuclear power.

Helen has also investigated moving away from combustion-based energy production without nuclear power. There is still an opportunity to electrify district heat production, for example, with the help of electric boilers. The EIA report assesses the environmental impact of district heat produced using electric boilers at a general level. This is described in more detail in chapter 29.

Helen has previously carried out numerous studies of different production options, on the basis of which it has been decided to start investigating the nuclear power plant project in more detail. Helen has also investigated other non-combustion-based heat production solutions, which, however, have not been implemented for various reasons. These have included:

- A large-scale seawater heat pump plant in Salmisaari, where seawater heat is used to produce district heating
- Use of waste heat from Kilpilahti industrial area in the production of district heat in Helsinki
- Use of waste heat from the Loviisa nuclear power plant in the production of district heat in Helsinki
- Use of shallow, medium and deep (EGS) geothermal wells for district heat production
- Construction of large seasonal storage facilities for district heat in the sea off Helsinki
- Use of waste heat from large-scale local hydrogen production in Helsinki's district heat production
- Biogenic carbon dioxide recovery from Vuosaari C plant and geological final disposal of biogenic carbon dioxide
- In addition, smaller-scale solutions have been investigated, such as the use of groundwater energy and phase change solutions for seawater heat.

Copyright © Helen Nuclear Ltd

2.8 The project's connection to other projects

The project involves the final disposal of spent nuclear fuel formed from the operation of the nuclear power plant in Finland in accordance with the requirements of the Nuclear Energy Act. The final disposal of spent nuclear fuel requires an EIA procedure and a government resolution. Alternatives to final disposal of spent nuclear fuel are final disposal by the company itself or the purchase of services from an industrial final disposal company. The final disposal is subject to its own EIA procedure, either by Helen or another operator.

Copyright © Helen Nuclear Ltd

3 TECHNICAL DESCRIPTION OF THE PROJECT

3.1 General description of the nuclear power plant

Nuclear power has been produced in the world since the 1950s, and in Finland for almost half a century. The plant options examined in Helen's nuclear power project are based on light water reactor technology, which is the most widely used nuclear power technology in the world and is also used in all of Finland's current nuclear power plants.

This project considers only small modular reactors (SMRs) as alternatives. These are the smaller modular nuclear power plants that have been deployed in recent decades. The plant options examined are either pressurised water or boiling water reactors. Both reactor types operate on the same basic principle, where the heat generated in the reactor is transferred to water, but they differ in whether steam is produced directly in the reactor or in a separate heat exchanger (vaporiser).

The modular approach means that the plant's components can be manufactured as ready-made modules in factories, and these modules are then assembled on site. The degree of modularity varies depending on the type and supplier of the plant. The modularity is designed to shorten the construction time of the plant compared to a traditional nuclear power plant.

The energy production of a nuclear power plant is based on fission in a nuclear reactor, where heavy atomic nuclei split, releasing thermal energy. This heat is used either directly in the production of district heat or in the production of electricity through the turbine–generator chain.

3.1.1 Safety

Modern nuclear power plants are designed, implemented and maintained according to strict quality standards to ensure that operational incidents are rare. However, in case of operational incidents and accidents, the plant is equipped with multiple, independent safety systems in accordance with the so-called safety principle of defence-in-depth. In addition, the plant and safety systems are protected and scaled for very abnormal situations, such as a direct collision of a large commercial aircraft.

Nuclear and radiation safety is discussed in more detail in chapter 4.

3.1.2 Heating plant

The heating plant (HOP, Heat-Only Plant) is examined for the Salmisaari (project option VE1), Vuosaari (project option VE2a) and Norrberget (project option VE3a) plant sites. The process of a heating plant producing only district heat is simpler and the need for space is smaller than that of a combined heat and power plant. It produces only hot water, the energy of which is transferred in full to the district heating network, instead of also producing electricity.

In a nuclear reactor, the fission of nuclear fuel (enriched uranium) generates heat. In fission, atomic nuclei disintegrate in a controlled manner, releasing a large amount of energy. The heat generated in the reactor is transferred to the water that acts as the coolant for the fuel.

The water heated in the reactor is led to heat exchangers, where heat is transferred to circulating water in the district heating network, which heats buildings and domestic water. A heat-only nuclear power plant used for district heat production does not require cooling water from a water system, and therefore does not discharge heat into the aquatic environment.

Copyright © Helen Nuclear Ltd

The heating plant is used for supplying the district heating base load, meaning it is operated mainly at a steady full output. When necessary, the heating plant can also be operated for more flexible production at varying power levels in accordance with the plant's operating conditions and heat demand. In summer, for example, when the need for district heat is lower, the plant can be operated at a lower capacity.

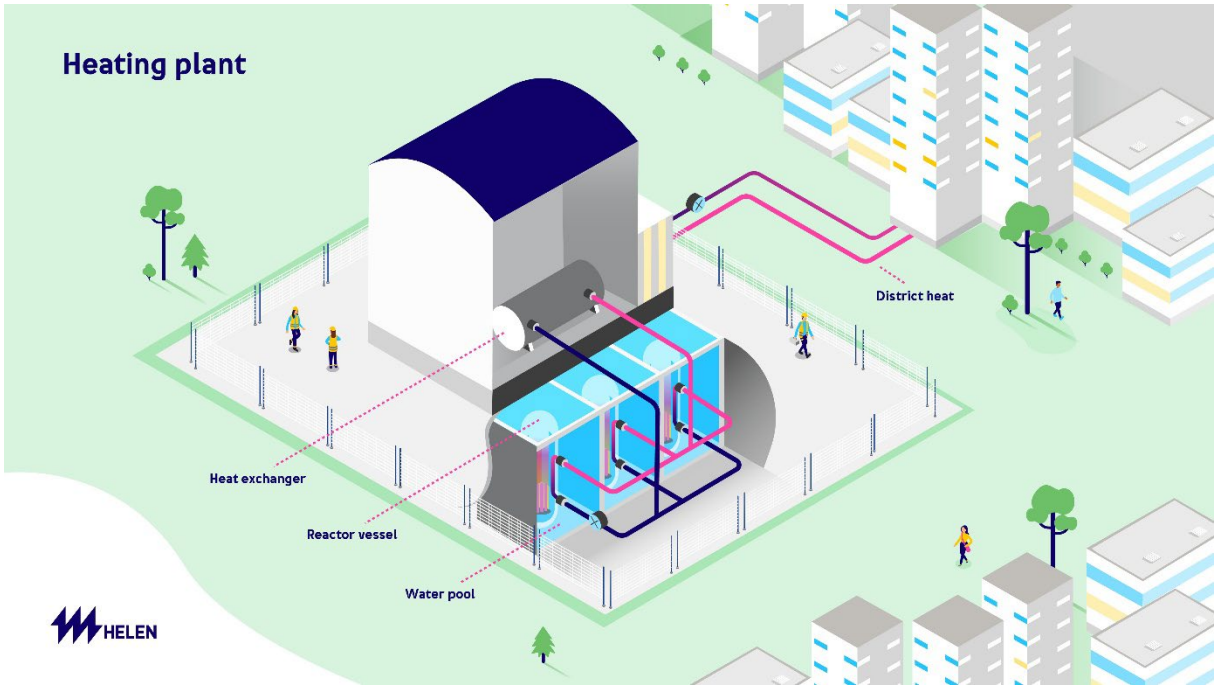


Figure 3-1. General process diagram of the heating plant (HOP).

The heating plant consists of several plant units. The plant unit consists of reactors (4–6 reactors) located in the same building and the same pool. In the EIA procedure, the heating plant under consideration has a maximum of 18 reactors. The heat output of the heating plant's reactors is a maximum of approximately 630 MWth and the district heat output is approximately 600 MW. The preliminary technical data of the heating plant are presented in table (Table 3-1).

3.1.3 Combined heat and power plant

A CHP (Combined Heat and Power) plant is examined for the Vuosaari (project option VE2b) and Norrberget (project option VE3b) plant sites. A combined heat and power plant, a CHP plant, produces both electricity and district heat. A CHP plant differs from the nuclear power plants currently in use in Finland in that part of the heat produced in the reactor is used for the production of district heat. In Finland's current nuclear power plants, heat that cannot be used for electricity production is discharged into the sea with cooling water.

In a nuclear reactor, the fission of nuclear fuel (enriched uranium) generates heat. In fission, atomic nuclei disintegrate in a controlled manner, releasing a large amount of energy. The heat generated in the reactor is transferred to the water that cools the fuel, which heats up and turns into steam, or vaporises water in large evaporators. Steam generated in the CHP plant flows to the steam turbine at high speed. The speed is achieved with a post-turbine condenser with a high vacuum due to the rapid condensation of steam. In the turbine, the momentum of the steam acts on the turbine blades and makes the turbine to rotate. The turbine drives a generator that converts mechanical energy into electricity.

Copyright © Helen Nuclear Ltd

A part of the steam from the turbine is directed to district heat exchangers, where heat is transferred to the water of the district heating network. The district heating network transmits the transferred energy to the heating of buildings and domestic water.

Condensation in the condenser is achieved by cooling the condenser on the other side with sea water. The heat released in condensation is discharged into the sea with warm sea water. The condensed steam is returned as water in the recirculation process back for evaporation. The EIA procedure also considers implementing part of the cooling as air cooling (see chapter 3.7.2).

The CHP plant is used for supplying the district heating base load, meaning it is operated mainly at a steady full output. When necessary, the plant can also be operated for more flexible district heat production in accordance with the plant's operating conditions and heat demand. If less district heat is produced, the corresponding energy is mainly used for electricity production. In summer, for example, when the need for district heat and possibly electricity is lower, the plant can also be operated at a lower capacity.

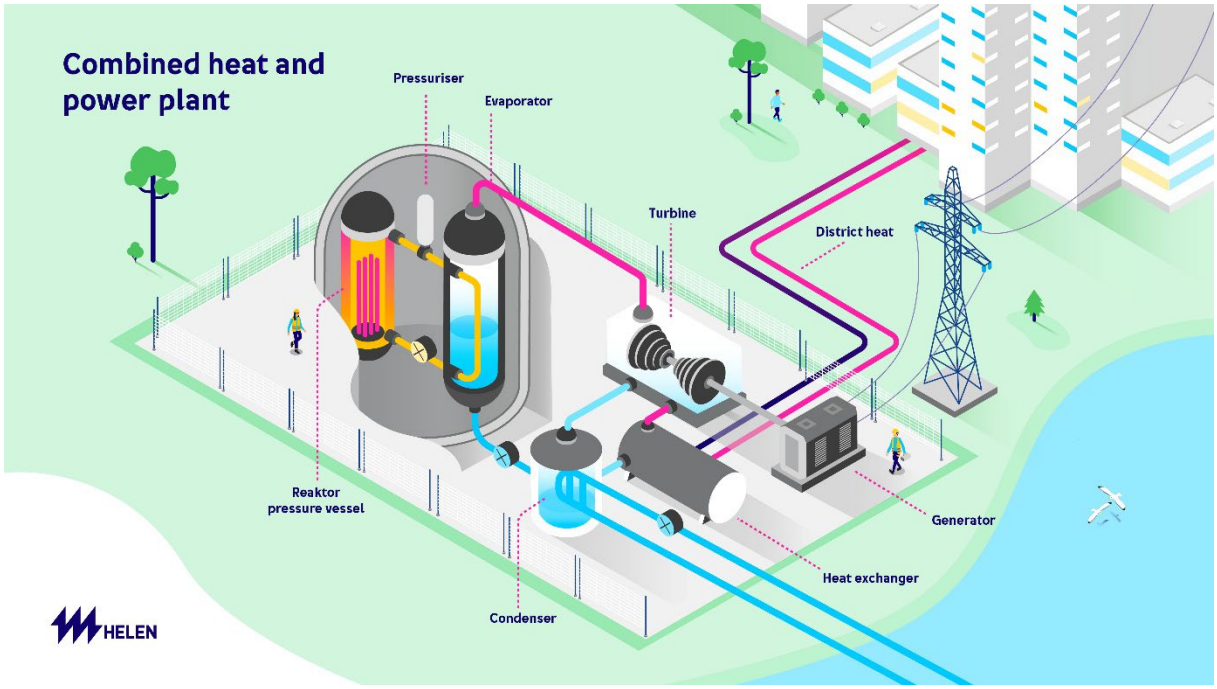


Figure 3-2. General process diagram of the CHP plant.

In the EIA procedure, the CHP plant under consideration has one reactor. The heat output of the reactor is about 1,400 MWth, the electric power about 500 MWe and the district heat output about 700 MW. The table below (Table 3-1) shows the preliminary technical data of the CHP plant examined in the EIA procedure.

The heat output of the reactor describes the amount of heat that the reactor generates with the help of a nuclear reactor and is the actual energy output of the reactor. The heat output can be used for electricity production, district heat and process heat (industry). The electric power indicates how much electricity is produced from the heat produced by the reactor. The district heat output depends on how much of the heat generated in the reactor can be used in the production of district heat after the turbine. The amount of radioactivity contained in the reactor is approximately proportional to the heat output of the reactor.

Copyright © Helen Nuclear Ltd

Table 3-1. Preliminary technical data of the heating plant and CHP plant.

	Heating plant	Combined heat and power plant
Energy generated	District heat	District heat and electricity
Number of reactors (max.)	18	1
Heat output (max.)	630 MW	1,400 MW
District heat output	600 MW	700 MW
Electric power	–	500 MW
Efficiency	about 95%	65–75% (35% in condensing mode)
Heat output discharged to the water system, maximum	–	about 1,000 MW
Cooling water requirements	–	about 25 m^3/s
Space requirements of the plant area	about 12 ha	about 20 ha

3.1.4 Nuclear power plant site, buildings and structures

The plant area of the nuclear power plant is surrounded by double fences. The plant area has a movement restriction, and it also includes Helen's existing plants (in Salmisaari and Vuosaari) to the extent that the existing plants have not been dismantled due to the construction of the nuclear power plant. In addition, a precautionary action zone and emergency planning zone are defined around the nuclear power plant site (see chapter 4.5). Land use restrictions apply to the precautionary action zone.

3.1.4.1 Heating plant

The reactors of the heating plant can be built either in a cave to be excavated in the bedrock or in a trench below the ground level. In both cases, other plant structures are also above ground. The underground heating plant excavated in the rock includes the reactor hall, maintenance facilities, access tunnel and shaft connections to the ground. The hall is approximately 35 metres wide, 160–260 metres long, and about 33 metres high in total, including the reactor level.

Without more detailed bedrock data, it can be estimated that there must rock above the rock facility and its thickness must be at least half the width of the rock facility. In this case, it means at least 18 metres. It is estimated that one access tunnel connection and at least five vertical shaft connections from the ground will be made to the underground facility. The above-ground buildings are placed directly above the underground heating plant.

In the above-ground heating plant option, the size of the plant area influences the layout of the buildings. At least the reactor pit will be largely excavated in all options.

In the plant area of the heating plant, there are much fewer above-ground buildings than in the CHP plant and they are smaller. There is only one fairly large building for the reactor plant and district heat production. The height of the ventilation stack of the heating plant is about

Copyright © Helen Nuclear Ltd

40 metres, and the height of the building is about 20 metres. In addition, a variety of other buildings are required, as is the case with the CHP plant (see chapter 3.1.4.2).

According to the preliminary assessment, the space requirement of the heating plant area is no more than approximately 12 hectares and less than that of the CHP plant (see chapter 3.1.4.2). The above-ground buildings associated with the underground heating plant require about 6 hectares of space. The need for space at the plant area will be specified as the planning progresses.

3.1.4.2 Combined heat and power plant

The CHP plant will be built on the ground except that the reactor may be partially or fully below ground level.

The CHP plant area houses reactor and turbine buildings, control room and utility buildings, as well as possibly other buildings for diesel generators, workshops, access control and other needs. A building will be constructed for the interim storage of spent nuclear fuel. For very low, low and intermediate level waste, treatment and interim storage facilities as well as a final disposal facility may be built (see chapter 3.3). In addition, there are some containers for liquids and gases in the area. The reactor building is usually near the centre of the site, with the other buildings around it. The height of the ventilation stack of the CHP plant is about 80–100 metres, and the height of the building is about 60 metres.

According to a preliminary estimate, the space requirement of the CHP plant area is no more than approximately 20 hectares. The need for space at the plant area will be specified as the planning progresses.

3.1.5 Construction

3.1.5.1 Salmisaari

In the Salmisaari planning area, the above-ground construction of the nuclear power plant would be located, according to preliminary plans, in the area of the decommissioned Salmisaari B power plant (Figure 3-3). The Salmisaari B power plant is to be dismantled at least partially, regardless of this project.

The current pellet boilers at the Salmisaari power plant area will remain in operation at least until the nuclear power plant is commissioned. The construction does not affect the protected office building or the protected Salmisaari A power plant building, but it is possible that vertical shaft buildings required by underground facilities, for example, would be located in its vicinity. The planning area is also home to the Salmisaari C power plant, including an air-water heat pump and electric boiler plant.

There are underground oil caves in the planning area where light fuel oil is stored. Heavy fuel oil storage caves are currently empty. The bedrock in the area of the oil caves exhibits an exceptionally high horizontal stress state. A mining prohibition has been imposed (by Tukes) on the area.

The suitability of the proposed planning area as the plant area of the nuclear power plant and as support areas during construction will be investigated. Support areas during construction refer to areas required for storage and construction site operations. The scope of the required areas will be specified as the planning progresses. The usability of the buildings and structures

Copyright © Helen Nuclear Ltd

in the planning area and the possible need for demolition will be specified as the planning progresses.



Figure 3-3. The current operations and buildings of Helen Ltd in the Salmisaari planning area.

3.1.5.2 Vuosaari

According to preliminary plans, the construction of the nuclear power plant requires the dismantling of the Vuosaari A combined cycle gas turbine and the backup heating plant from the planning area before construction work begins. Figure 3-4 The current Vuosaari B power plant and Vuosaari C bioenergy heating plant would be in operation at least until the nuclear power plant is commissioned. The usability of other buildings and structures in the planning area and the need for demolition will be specified as the planning progresses.

The structures of the nuclear power plant are located in the area of the coal storage facility to be decommissioned in Vuosaari and the still used interim storage for bottom ash (Figure 3-4). The interim storage field of bottom ash currently operates as an interim storage area for bed sand from the Vuosaari C bioenergy heating plant and Salmisaari pellet boilers. If, as a result

Copyright © Helen Nuclear Ltd

of the construction of the nuclear power plant, the interim storage facility no longer fits in the area, a new location must be found for it and a permit must be issued. This is not included in the scope of this EIA.

The base structure of the coal storage has used about 45,000 tonnes of bottom ash from coal combustion, about 90,000 tonnes of fly ash and about 54,000 tonnes of the end product of desulphurisation, so a total of about 189,000 tonnes of by-products has been used. The base structure of the coal storage is intended to prevent rainwater that leaks through the coal storage heap from being absorbed into the soil and direct the water to the settling basin (the volume of the basin is 5,000 m^3). A total of 50,000 tonnes of by-products of the then Helsingin Energia coal power plant were used as the base structure materials of the bottom ash storage field located to the west of the coal storage. The structures contain, for example, bottom ash, fly ash and a mixture of fly ash and the final product from desulphurisation (80/20). It is likely that the base structure of the coal storage will be partially or completely removed from the area before the construction of the nuclear power plant. In that case, the aim is to use the masses of the ash structure in the construction of the power plant area or in other reuse applications. The matter requires further investigation, including ground surveys and detailed studies of the ash structure.

Copyright © Helen Nuclear Ltd

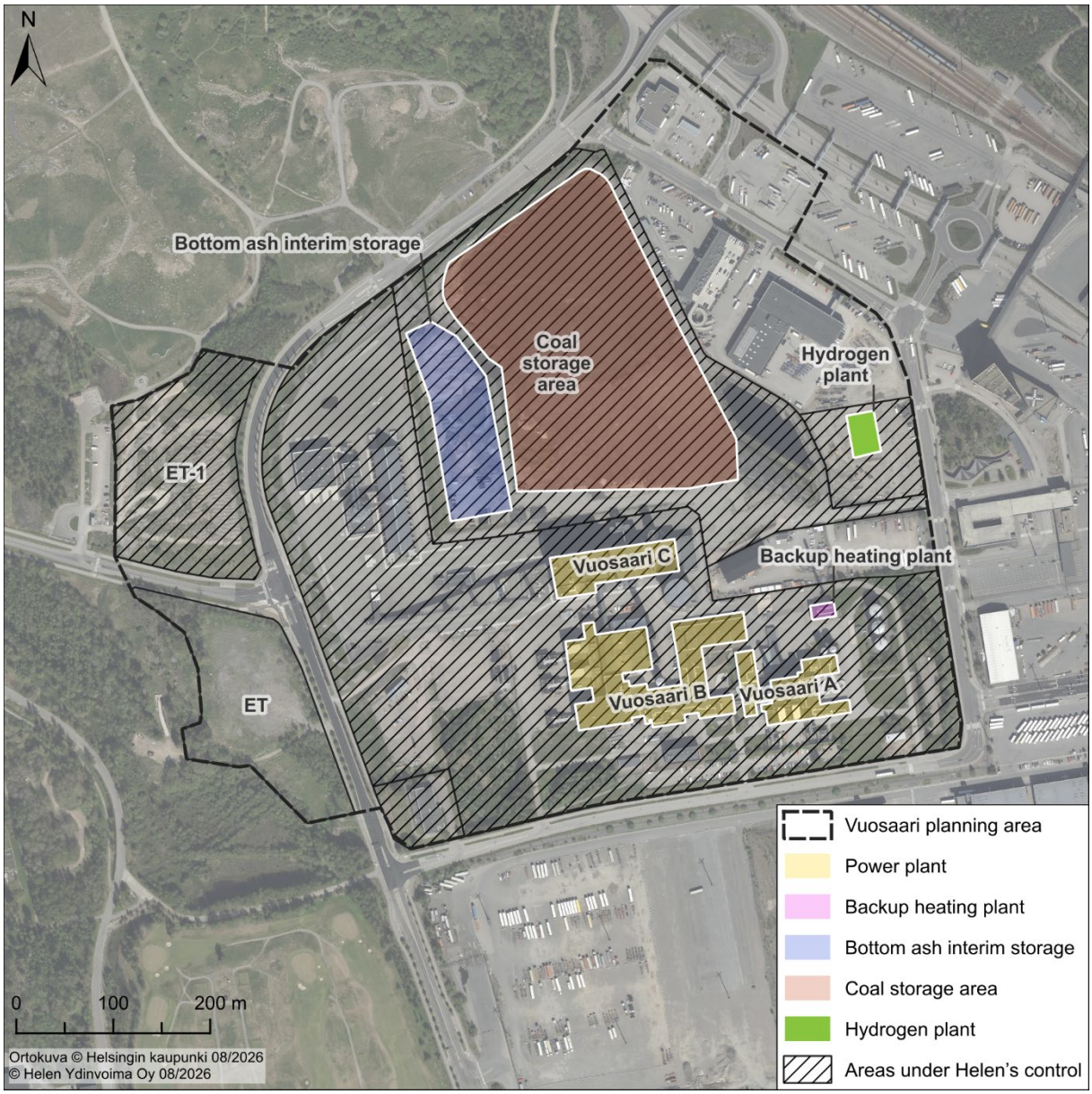


Figure 3-4. The current operations and buildings of Helen Ltd in the Vuosaari planning area, as well as the areas under the control of Helen Ltd.

The use of the ET1 area designated in the local detailed plan west of Satamakaari as a support area during construction is being considered (Figure 3-4). Similarly, the use of the ET area in the local detailed plan south of the ET-1 area as an interim storage area for soil and excavation material is being investigated. The use of the area north of the Rahtarinkatu road for the nuclear power plant project is also being investigated.

The suitability of the proposed planning area as the plant area of the nuclear power plant and as support areas will be investigated. The planning area includes properties that are not under Helen's control and whose inclusion in the final plant area or support area is not yet certain. The scope of the required areas will be specified as the planning progresses. The usability of the buildings and structures in the planning area and the possible need for demolition will be specified as the planning progresses.

Copyright © Helen Nuclear Ltd

3.1.5.3 Norrberget

The Norrberget planning area is mainly an undeveloped area, and construction in the area requires the removal of topsoil and felling of trees. In addition, excavation must be carried out in the area. The suitability of the proposed planning area as the plant area of the nuclear power plant will be investigated. The planning area includes private properties whose inclusion in the final plant area or support area is not yet certain. The scope of the required areas will be specified as the planning progresses.

3.1.5.4 Space requirements during construction

The space requirements during the construction of the heating plant is about 16 hectares, including the plant area. The space requirements during the construction of the CHP plant is no more than 45 hectares, including the plant area.

The space required for construction site operations may be significant, depending on the nuclear power plant supplier selected. Due to the limited size of the examined planning areas, a preliminary study has been carried out on the availability of the still undeveloped areas of the City of Helsinki's regional construction projects to contractors for the duration of the construction work. Possible support areas could be found in the West Harbour, Jätkäsaari, Malmi and Östersundom areas. Since the need will only arise in the long term, and the exact timing of construction is not yet known, the matter can be agreed in more detail at a later stage.

3.2 Procurement and use of nuclear fuel

The nuclear power plant uses uranium dioxide (UO_2) enriched in the isotope U-235 as fuel. The use of uranium as a fuel is based on the heat generated in the fission reaction of atomic nuclei. The fuel is enriched to contain 3–5% of the U-235 isotope. Natural uranium contains only 0.71% of this easily fissile isotope.

The fuel is in the form of ceramic tablets in gas tight and sealed pipes, i.e. fuel rods. The fuel rods are assembled into fuel bundles. In the fuel rods, fresh fuel can be handled and transported safely without separate radiation shielding. Fresh nuclear fuel bundles are transported from the fuel plant to the nuclear power plant in specially constructed packages that protect the fuel bundles during transport. Due to low radioactivity, no special radiation shielding is required.

The CHP plant uses up to 15 tonnes of enriched uranium annually as fuel. An estimated up to 150 tonnes of natural uranium is required to produce this amount of fuel. Instead of natural uranium, reprocessed uranium can also be used to make fuel. Uranium is purchased on the global market.

The nuclear power plant usually has a fuel storage that corresponds to approximately one year of operation. If necessary, nuclear fuel can also be stored for longer operating times for reasons related to the security of supply.

When using natural uranium, the phases in procuring nuclear fuel are the mining and enrichment of raw uranium, conversion, isotope enrichment (i.e. concentration), and the manufacture of fuel bundles. Helen may procure the services included in these phases from the market through long-term contracts with producers. When other than natural uranium is used as fuel, Helen obtains the fuel from the manufacturer of fuel bundles. In this case, the mining and enrichment of raw uranium are excluded from the supply chain.

Copyright © Helen Nuclear Ltd

The Radiation and Nuclear Safety Authority (STUK) supervises that nuclear fuel is designed, manufactured, transported, stored, handled and used in accordance with applicable rules and regulations.

Helen uses only responsible and reliable parties in all its procurements. In Western countries, there are several fuel suppliers that make it possible to decentralise fuel purchases. The conclusion of a fuel supply contract becomes topical in the later phases of the project.

3.2.1 Refuelling maintenance

The reactors of the nuclear power plant are shut down at regular intervals during refuelling and plant maintenance and inspections. In short maintenance shutdowns, part of the fuel is replaced, while longer maintenance includes more extensive inspection and maintenance work in addition to refuelling. The timing and frequency of maintenance depend on how the plant is used, and these matters will be specified as the project progresses. According to a preliminary estimate, refuelling maintenance is carried out every one and a half to two years.

3.3 Nuclear waste management and other waste management

In Finland, responsibility for nuclear waste management lies with the nuclear power companies, which must take care of the measures related to the management of the nuclear waste they produce. According to the Nuclear Energy Act (990/1987), nuclear waste must be processed, stored and disposed of within Finland's own territory. Nuclear power companies are also responsible for the costs of nuclear waste management. During operation, the nuclear power plant also produces conventional waste.

3.3.1 Spent nuclear fuel

The estimated amount of spent nuclear fuel accumulated during 60 years of operation of the nuclear power plant is up to 900 tonnes of enriched uranium. The amount of spent nuclear fuel depends, among other things, on the type of plant, technology and output of the nuclear power plant.

Spent nuclear fuel is highly radioactive immediately after use. The radioactive decay process generates radiation and heat, which decreases rapidly during the first decades after the fuel has been removed from the reactor. Spent nuclear fuel accumulated during the operation of a nuclear power plant is initially stored in the reactor building and then transferred to an interim storage for spent nuclear fuel to cool down and await final disposal. Interim storage usually takes decades. After interim storage, spent nuclear fuel is finally disposed of at a final disposal facility.

In the interim storage of spent nuclear fuel, possible exceptional and accident situations as well as their long-term impacts are taken into account. The operation of the interim storage and the cooling of spent fuel shall not be compromised during storage. The safety systems of the interim storage are designed with multiple layers, and they are often comparable to those of the nuclear power plant unit itself.

Technically, the interim storage of spent nuclear fuel can take place either in dry storage or wet storage. The cooling of spent nuclear fuel in dry storage is based on passive air cooling and active water cooling in wet storage. In dry storage, spent nuclear fuel is enclosed in purpose-built containers. In wet storage, fuel bundles are placed in water basins so that on top of them is a water mattress of several metres insulating radiation and cooling spent nuclear fuel.

Copyright © Helen Nuclear Ltd

The interim storage facilities for spent nuclear fuel in Loviisa and Olkiluoto in Finland are wet storage facilities. The space requirement for an interim storage for spent nuclear fuel is initially about 2,000 m^2.

An interim storage for spent nuclear fuel at a nuclear power plant may be located on site, at the final disposal facility for spent nuclear fuel or elsewhere. On-site treatment and interim storage of spent nuclear fuel are included in this EIA procedure. Spent nuclear fuel will be finally disposed of at a licensed final disposal facility located in the Finnish bedrock. The final disposal is not included in this EIA procedure, but a separate EIA procedure will be implemented either by Helen or another operator. Alternatives to final disposal are final disposal by the company itself or the purchase of services from an industrial final disposal company.

3.3.2 Very low level, low level and intermediate level waste

The estimated amount of very low, low and intermediate level waste accumulated during 60 years of operation of the nuclear power plant is approximately 6,000 m^3.

Very low-level waste is typically mixed waste that has been contaminated with radioactive substances. Although the activity is low, the waste cannot be classified as inactive waste. Very low-level waste can be, for example, paper overalls and disposable respirators. The processing, interim storage and disposal of very low-level nuclear waste takes place as part of other nuclear waste management, but it can also be separated from it. Very low-level waste contains very little radioactive waste (< 0.1 MBq) and it is suitable for disposal close to the ground surface in near-surface final disposal facilities. In January 2026, STUK granted TVO an operating licence for a near-surface final disposal facility for very low-level nuclear waste in Olkiluoto (Teollisuuden Voima Oyj 2026).

Low-level waste refers to nuclear waste that has such a low level of activity that it can be treated without special radiation protection arrangements. The activity concentration of the waste is usually up to 1 MBq/kg. Low-level waste includes, for example, protective equipment used in maintenance work and machine parts removed from the nuclear power plant.

Intermediate-level waste refers to nuclear waste that has such a high level of activity that effective radiation protection arrangements are needed when it is processed. The activity concentration of the waste is usually between 1 MBq/kg and 10 GBq/kg. Intermediate-level waste includes, for example, ion-exchange resins used in the purification of the primary circuit.

The amount of waste generated is minimised by paying attention to this during the design of the plant and its operation. Systems containing radioactive substances are located within the controlled area, where specific safety instructions are followed to ensure protection against radiation. The size of the controlled area and the material brought into it should be minimised. Work areas are delimited and protected so that contamination does not spread. The resulting waste is classified and sorted already as it is generated. Based on sorting, part of the waste can also be cleared from regulatory control and recycled or treated as non-hazardous waste (see chapter 3.3.4).

The very low-level, low level and intermediate level waste generated at the nuclear power plant is stored and processed in an interim storage built on site. The space requirement for the storage and treatment plant is initially approximately 2,000 m^2. Technically, the waste is stored in an industrial hall, which also has the machinery and equipment needed for waste treatment and packaging. After minimising the amount of waste generated, the waste is treated before

Copyright © Helen Nuclear Ltd

final disposal. Liquid waste is solidified. Before disposal, waste is compacted, if possible, e.g. by compression, so that the volume of waste to be finally disposed of is as small as possible. Typically, waste is packaged for final disposal in metal drums, metal boxes and/or concrete boxes.

Very low-level, low level and intermediate level waste is disposed of in a final disposal facility, which is built either on site or elsewhere in Finland. The final disposal facility for low and intermediate level waste is mainly built in an underground space in the bedrock. The facilities in use in Finland in Loviisa and Olkiluoto are located in the rock, at a depth of about 100 metres. In other countries, solutions have also been implemented in which the final disposal facility is built, for example, in a trench above ground. Very low-level waste can be disposed of in a final disposal facility built on the ground.

An underground final disposal facility typically consists of underground final disposal spaces excavated for waste, an access tunnel, a personnel shaft and a ventilation shaft. The final disposal facility usually has separate facilities for low and intermediate level waste. Waste is packed so that final disposal can be carried out safely. Waste is packaged in a building on the ground, for example, in metal drums, metal boxes or concrete boxes, and transferred to underground facilities. The control of radioactive substances is carried out for the final disposal facility in accordance with the requirements, and it will include the control of the activity of exhaust air and water, for example.

The final disposal facility will undergo its own licence process, and this nuclear facility will be operated under an operating licence in accordance with the Nuclear Energy Act. In due course, when all waste has been placed in the final disposal facility, the facilities will be filled and closed permanently.

The construction of an underground final disposal facility for low and intermediate level waste requires excavation. Depending on the design solution, the space requirement for the underground facility is about 1 ha. An above-ground facility is required only for buildings made in connection with shafts and the upper parts of the access tunnel. The estimated space requirement is 5,000 m^2. The use of underground facilities for the final disposal of nuclear waste requires careful investigation of bedrock and groundwater conditions and in-depth long-term safety analyses. The selection and planning of the exact location of the facilities also requires site surveys over multiple years.

A possible separate final disposal facility for very low-level waste would be located near the ground surface, usually built above ground and protected by containment barriers. The final disposal facility consists of the waste filling and various structural layers at the bottom and on top of the waste filling. The waste is sealed in waste packages and placed on top of the base structure. The surface structure consists of several layers and is intended to isolate waste from the rest of the environment.

The processing, interim storage and final disposal for very low-level, low level and intermediate level waste at the plant site are included in this EIA procedure. Final disposal at a site other than the plant site is not included in the EIA procedure. Possible alternatives to the final disposal of low and intermediate level waste may include, for example, existing low and intermediate level waste final disposal facilities in Finland, as well as possible new final disposal facilities to be built elsewhere. The EIA report describes in more detail the processing, storage and final disposal of very low, low and intermediate level waste at the plant site.

Copyright © Helen Nuclear Ltd

3.3.3 Conventional waste

During operation, conventional waste (e.g. paper, plastic and food waste) and hazardous waste (e.g. waste oils) are generated in the nuclear power plant site. The waste is taken care of as required by the environmental permit for the nuclear power plant.

In accordance with the principles of the Waste Act, the operation of a nuclear power plant ensures that as little waste is generated as possible. As much of non-hazardous waste as possible is delivered for recovery.

The variation of waste volumes from year to year depends, among other things, on the maintenance operations carried out at the plant. The amount of non-hazardous waste at the CHP plant is estimated to be around 400 tonnes and the amount of hazardous waste is estimated to be around 50 tonnes per year. At the heating plant, the quantities are smaller.

Most of the waste generated can be recovered through recycling or in energy production. Sorted waste is delivered for proper treatment.

During construction, larger amounts of conventional waste are generated, including packaging and surplus materials. Waste is sorted and delivered for proper treatment.

3.3.4 Waste cleared from regulatory control

Waste generated in the radiation controlled and supervised areas of the nuclear power plant is treated as radioactive because of its origin. When the amount of radioactive substances in the waste is sufficiently low and it is below the activity limits, the waste can be cleared from regulatory control and managed as non-hazardous waste. Radioactivity is determined by measurements that verify the waste does not require special measures because of its radioactivity. Waste cleared from regulatory control falls within the scope of the Waste Act, after which it is managed using the methods described in chapter 3.3.3. For example, Teollisuuden Voima Oyj's maintenance waste cleared from regulatory control is currently used by incinerating it to produce energy (Teollisuuden Voima Oyj 2025).

The Radiation and Nuclear Safety Authority (STUK) supervises the waste clearance procedures, and waste must not be intentionally diluted to clear it from regulatory control. (Radiation and Nuclear Safety Authority 2023)

3.4 Backup generators

The CHP plant has fixed diesel generators to provide power in the event of a power loss. There are several generators and they range in power from a few megawatts to ten megawatts. Fuel tanks are located on the plant area and their capacity must be sufficient for at least seven days.

The plant may also have other backup generators for limited uses, fixed or movable, mounted in a truck, for example.

Heating plants also have smaller diesel generators in the event of a power loss.

Diesel generators are tested approximately once a month.

3.5 District heat transmission connection

The project options of Salmisaari and Vuosaari do not require the construction of new district heat transmission connections. A new district heat transmission connection is required for the Norrberget plant site both in the case of the heating plant (VE3a) and the CHP plant (VE3b).

Copyright © Helen Nuclear Ltd

The district heat transmission connection will be built from the Norrberget plant site to Vuosaari, the connection point of the existing district heat transmission network. The heat transmission connection will be carried out either entirely in a tunnel excavated in the bedrock (option KL1) or as a combination of a tunnel and a pipe excavated in the ground (option KL2) (Table 3-2 and Figure 3-5). The new district heat transmission connection is located in the cities of Helsinki and Vantaa.

Table 3-2. Information on the district heat transmission connection options for the Norrberget project options (VE3a and VE3b).

District heat transmission connection	Length	Space requirement	Excavation quantity (solid m^3)	Other observations
KL1: tunnel completely excavated in bedrock	5.5 km	Tunnel width approx. 8.4 m and height approx. 7 m	390,000	On the ground: access tunnel / tunnel entrance (Länsisalmi), vertical shafts (Niinisaari and Vuosaari) The total width of the precautionary action zone of the district heat tunnel is about 27 m (10 m +7 m +10 m) and the total height is about 27 m (10 m +7 m +10 m).
KL2: combination of a tunnel and a pipe dug into the ground	A total of 6.2 km. Ground pipe section 2.7 km, tunnel section 3.5 km	Tunnel width approx. 8.4 m and height approx. 7 m The total space requirement in the area of the pipe dug into the ground is 19–24 m. A 110 kV backup power connection will be built alongside the district heat transmission line. The total width of the area for the pipe dug into the ground and the power cable is about 30 m.	250,000	

Copyright © Helen Nuclear Ltd

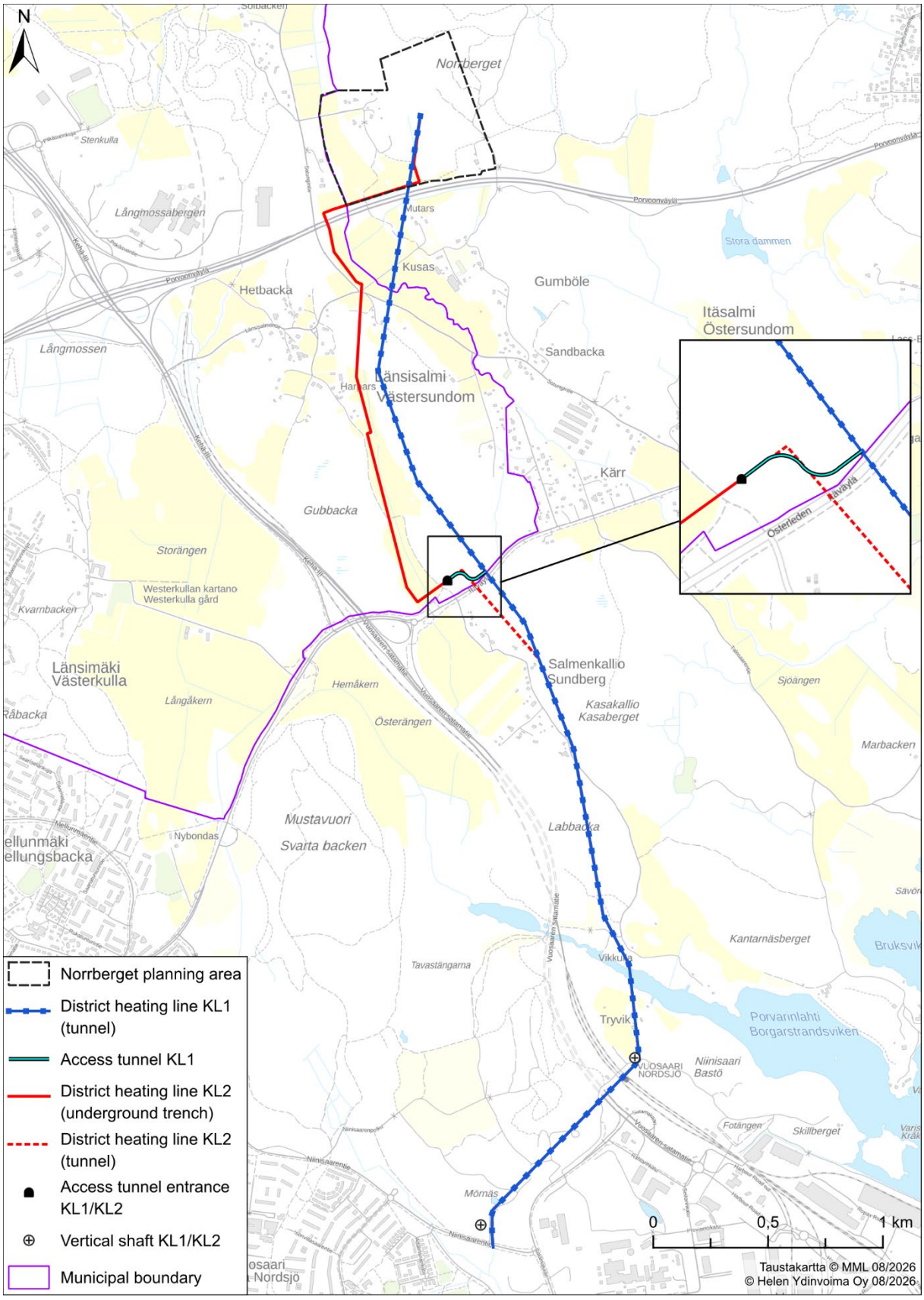


Figure 3-5. Alternative district heat transmission connections KL1 and KL2 from the Norrberget planning area to Vuosaari.

3.5.1 Tunnel option KL1

The district heat transmission connection option KL1 is located entirely in the tunnel between Norrberget and Vuosaari. The length of the route is about 5.5 kilometres. In Vuosaari, the tunnel is connected to existing rock facilities. The tunnel structures consist of a district heat tunnel, pipe link tunnels, access tunnels, as well as vertical shafts and vertical shaft buildings. Drainage water pumping stations are designed for the lowest points in the tunnels. The tunnels and shafts have a rock structure.

According to current information, the tunnel will be located in the bedrock, at a depth of about 20–50 metres. The tunnel crosses the bay of Porvarinlahti at a depth of about 50 metres. On the tunnel sections, most of the structures are underground. For construction, servicing and maintenance, an access tunnel and two vertical shafts will be built in the district heat tunnel. The access tunnel entrance and vertical shaft buildings are located above ground. The access tunnel will be located in Länsisalmi, Vantaa. The tunnel's vertical shafts are located in Vuosaari and Niinisaari. A pumping station hall will be built underground in connection with the Vuosaari vertical shaft.

The access tunnel entrance and, if necessary, a reinforced concrete entrance building to landscape the entrance into the environment are planned to be implemented above ground as visible structures. Outside the access tunnel, a courtyard area and an access road to the existing road network have been planned. For operations during the construction, a construction site with an area of approximately 5,000 m^2 has been planned outside the access tunnel.

At the top end of the rock-structured vertical shafts, a shaft building with ventilation grilles and entrance doors is designed above ground. The vertical shaft building has an area of about 100 m^2. Outside the vertical shaft building, a courtyard area and an access road to the existing road network have been planned. For operations during the construction, a construction site with an area of approximately 1,300 m^2 has been planned outside the vertical shaft.

The construction of the district heat transmission tunnel requires clearing trees and other vegetation at the tunnel entrances, the upper ends of the vertical shafts, and along the construction access roads. It may also be necessary to clear trees or vegetation from the construction sites, depending on their location.

The excavation of rock facilities is planned to be carried out using the drilling and blasting method (see chapter 3.9). After excavation, the rock facilities are systematically reinforced with rock bolts and shotcrete. Before excavation, the bedrock is sealed with pre-injections as necessary. During the work, the rock is reinforced as necessary. The estimate of the excavation volume of the rock tunnel, vertical shafts and pumping station in option KL1 is a total of about 390,000 solid cubic metres (solid m^3). The amount of excavation corresponds to approximately 630,000 loose cubic metres.

Two district heat pipes are installed in the district heat tunnel, alongside the tunnel's opposite wall, stacked one above the other in pipe support structures. The district heat pipes are plastic-coated, steel-structured pipes insulated with polyurethane. In addition, it is possible to use mineral wool for insulation and steel for the outer casing in the tunnel option. The structures come as elements from the factory and are connected by welding at the construction site. The size of the pipeline of the district heat transmission connection is DN1200. The design temperature of the pipeline of the district heat transmission connection is 120 °C and the design pressure is 25 bar.

Copyright © Helen Nuclear Ltd

Also, 110 kV power lines will be placed in the district heat tunnel, which will serve as a backup connection for the power transmission of the nuclear power plant. The width of the excavation cross-section of the district heat tunnel is about 8.4 metres and the height is about 7 metres (Figure 3-6). The area of the excavation cross-section is about 55.9 m^2 and the free cross-section of the district heat tunnel is about 44.5 m^2.

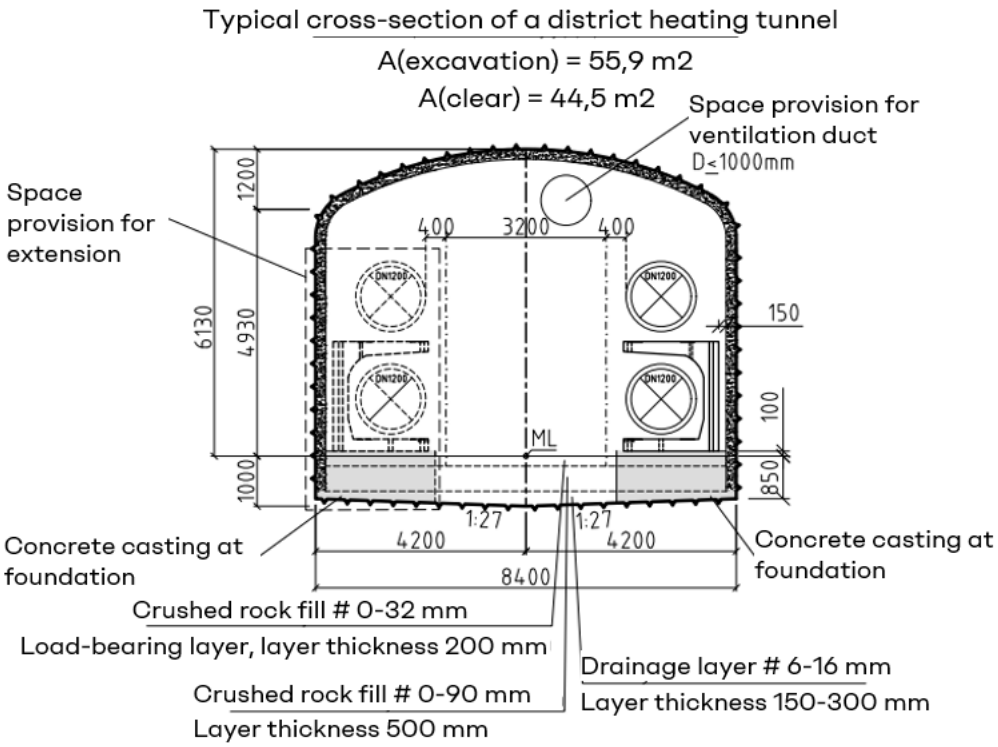


Figure 3-6. Typical cross-section of the tunnel of the district heat transmission connection.

Planned underground facilities cause construction restrictions in their immediate surroundings. In the immediate vicinity of the facilities, rock excavation and drilling holes in the bedrock are not allowed without a separate permit, and the impacts of foundation loads on the tunnels must be investigated. According to the current information, a geotechnical precautionary action zone is formed around the rock facilities, and its size is initially about 10 metres outward from the outline of the tunnel and shaft. Thus, the total width of the precautionary action zone for the district heat tunnel is initially about 27 metres (10 m + 7 m + 10 m) and the total height is initially about 27 metres (10 m + 7 m + 10 m). Construction work within the precautionary action zone should be avoided. Construction restrictions will be specified in further planning phases.

3.5.2 Combination of a tunnel and a pipe dug into the ground KL2

Option KL2 of the district heat transmission connection consists of a tunnel section and a pipe section dug into the ground, the total length of the route is 6.2 km. The length of the tunnel section between Vuosaari and Länsisalmi is about 3.5 km. The length of the ground pipe section between Länsisalmi and Norrberget is about 2.7 km.

The tunnel section of option KL2 is the same as the tunnel from Vuosaari to the Salmenkallio area in option KL1. Thus, the tunnel section's vertical shafts are located in Vuosaari and Niinisaari. Instead of an access tunnel, the northern entrance of the tunnel section of option KL2 is located in Länsisalmi, north of Itäväylä. The tunnel entrance is located at the edge of the hill. If necessary, an entrance building will be constructed at the district heat tunnel entrance. A

Copyright © Helen Nuclear Ltd

construction site has been planned to the west of the entrance, which will be landscaped after the project is completed. The estimate of the excavation volume of the rock tunnel, vertical shafts and pumping station in option KL2 is a total of about 250,000 solid cubic metres (solid m^3). The amount of excavation corresponds to approximately 390,000 loose cubic metres.

The pipeline dug into the ground on the western edge of Länsisalmi is located in a field adjacent to Gubbacka, running northwards towards Porvoonväylä. The routing is located south of the Porvoonväylä underpass in the field opening between road 11633 and Krapuoja. The routing has been placed as far away as possible from Krapuoja.

With a pipe line dug into the ground, two DN1200 district heat pipes are placed next to each other in the trench. The width of the trench is 4.3 metres. A construction site road will be built alongside the district heating line for pipe installation and maintenance, and the construction site road is about 7 metres wide. The total width of the district heating line, taking into account working margins, etc., is approximately 19–24 metres, depending on foundation conditions. In principle, there is no need for the construction site road after the heat transmission line has been commissioned, but at those points of the routing where service points such as shut-off valves are located, a permanent service road is required during operation. There are different options for the placement of the road, and in the more detailed design of the project, the need for a permanent road is considered. If necessary, the road can be adapted to the environment.

The construction of the district heat transmission pipe dug into the ground requires the clearing of trees and other vegetation from the district heating line and the construction site road. Depending on the soil in the area, base reinforcements or support structures are made for the pipeline, if necessary. The cross-section of the pipeline in the rock and the load-bearing silt and clay soil is shown in the attached figures.

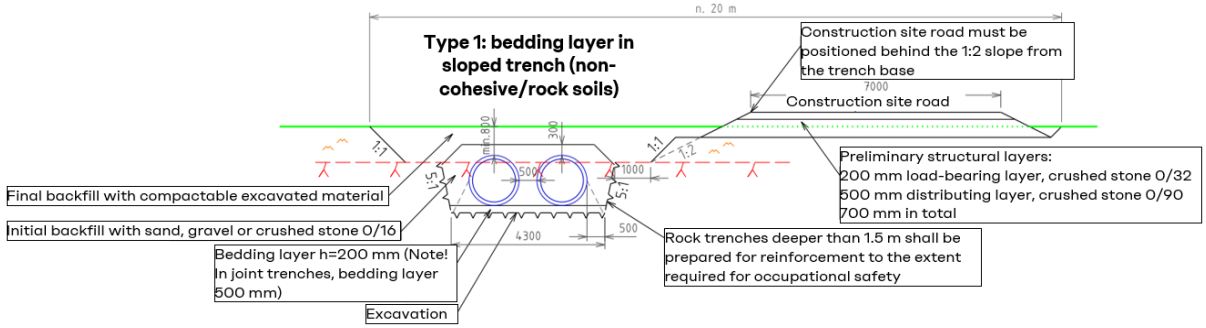


Figure 3-7. Preliminary cross-section of the district heat transmission line on rock/non-cohesive soils.

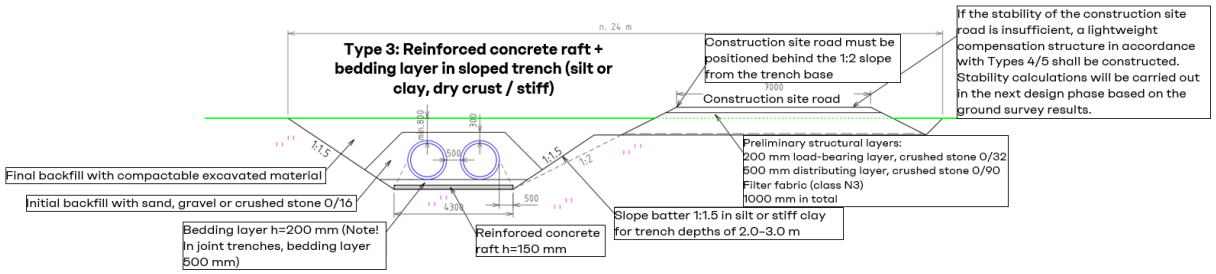


Figure 3-8. Preliminary cross-section of the district heat transmission line on load-bearing silt and clay soil.

Copyright © Helen Nuclear Ltd

The Porvoonväylä underpass is planned to be constructed, for example, by directional drilling. The Porvoonväylä road is located on a high embankment at this point. Directional drilling requires the construction of inlet and outlet chambers at the start and end points. Due to the large size of the pipes, they may need to be divided into several smaller pipes in the directional drilling section. Alternatively, the Porvoonväylä underpass can be constructed by excavation or by placing the pipes beneath the existing underpass in the road structure. To the north of the Porvoonväylä underpass, the pipeline runs alongside the Porvoonväylä embankment, from where it turns north towards the planned Norrberget plant site.

After completion of the district heat transmission line, agriculture can be carried out on the excavation site, but forestry cannot. Future land use must be taken into account, for example, in the protection of the pipes. Crossing roads, streets, and, for example, tram lines with the district heating line in an underground trench is possible. It is possible to build pedestrian and cycle paths and, for example, parking areas on top of the underground trench line. Implementation of tram lines along the district heating line is not possible.

In this option, the 110 kV backup electricity transmission connection would run along the tunnel floor in the tunnel section, rise to the surface via a vertical shaft, and continue above ground alongside the district heat pipes to the plant area.

3.6 Electricity transmission connection and electricity demand

The electric power required at the heating plant is about 25 MWe.

The CHP plant’s own operating power is about 40 MWe. In order to supply the electricity produced, the nuclear power plant must be connected to an external electricity network. In addition, a separate backup connection independent of this connection is required. Electrical connections are designed in such a way that it is unlikely that both connections will fail simultaneously and for the same reason.

The Salmisaari and Vuosaari heating plants (VE1 and VE2a) do not require the construction of new electricity transmission connections. Other project options, i.e. the Vuosaari CHP plant (VE2b) and the Norrberget plant options (VE3a and VE3b), require the construction of new electricity transmission connections and backup connections. The table below contains information on the new electricity transmission connections required by the project options (Table 3-3). In the following chapters, new electricity transmission connections have been examined in more detail.

Copyright © Helen Nuclear Ltd

Table 3-3. Preliminary information on electricity transmission connections required by project options VE2b, VE3a and VE3b.

Electricity transmission connection	Options	Length	Space requirement
VE2b Electricity transmission connection of 400 kV to Fingrid's new Itäsalmi substation	Overhead line Vu-Is1 and Vu-Is2 Underground cable Vu-Is3	Vu-Is1: 5.6 km Vu-Is2: 6.7 km Vu-Is3: 5.8 km	Overhead line: It is located largely on the route of the existing power line. On this section, the existing right-of-way and transmission line area widen by about 12 m. Overall, the right-of-way is 42 m wide and the transmission line area is 62 m wide. Underground cable: The trench is about 3–5 metres wide. An area approximately 10 m wide should be left treeless.
VE3a Electricity transmission connection of 110 kV to Fingrid's current Länsisalmi substation Backup power connection of 110 kV to the district heat transmission line	Overhead line No-Ls1 Underground cable No-Ls2	No-Ls1: 2.1 km No-Ls2: 1.8 km	Overhead line: The right-of-way is 26 m wide and the transmission line area is 46 m wide Underground cable: The trench is about 3–5 metres wide. An area approximately 10 m wide should be left treeless. Backup power connection: Cable trench width approx. 4 m. A gap of at least 2 m must be left between the high-voltage cable and the district heat pipe. In this case, the total width of the district heat transmission line to be constructed is approximately 30 m.
VE3b Electricity transmission connection of 400 kV to Fingrid's new Itäsalmi substation Backup power connection of	Overhead line No-Is1 Underground cable No-Is2 and No-Is3	No-Is1: 1.5 km No-Is2: 1.5 km No-Is3: 1.8 km	Overhead line: located alongside Fingrid's existing Länsisalmi–Anttila transmission lines Underground cable: The trench is about 3–5 metres wide. An area approximately 10 m wide should be left treeless.

Copyright © Helen Nuclear Ltd

110 kV to the district heat transmission line			Backup power connection: Cable trench width approx. 4 m. A gap of at least 2 m must be left between the high-voltage cable and the district heat pipe. In this case, the total width of the district heat transmission line to be constructed is approximately 30 m.

3.6.1 Vuosaari CHP plant

The Vuosaari CHP plant (VE2b) requires a new 400 kV power line from the Vuosaari planning area to Fingrid's new Itäsalmi substation for electricity transmission. Fingrid has initially planned the location of the new substation at Ojanko in Vantaa. The Itäsalmi substation will be located in the place marked in the attached figure (Figure 3-9) or in its vicinity. In addition, a new substation by Helen Electricity Network Ltd is needed for electrical connections in the southwestern part of the Vuosaari planning area. A new 400 kV electricity transmission connection from Vuosaari to Fingrid's substation may be needed in the future, regardless of whether or not the nuclear power project is implemented. In addition, Fingrid is implementing the Itäsalmi substation regardless of Helen's nuclear power project.

A new 400 kV connection from Vuosaari to Itäsalmi substation would be implemented either as an overhead line or as an underground cable. The routes are located in the area of the cities of Helsinki and Vantaa. The figure below (Figure 3-9) shows the location of alternative electricity transmission routes between Vuosaari–Itäsalmi substation.

Copyright © Helen Nuclear Ltd

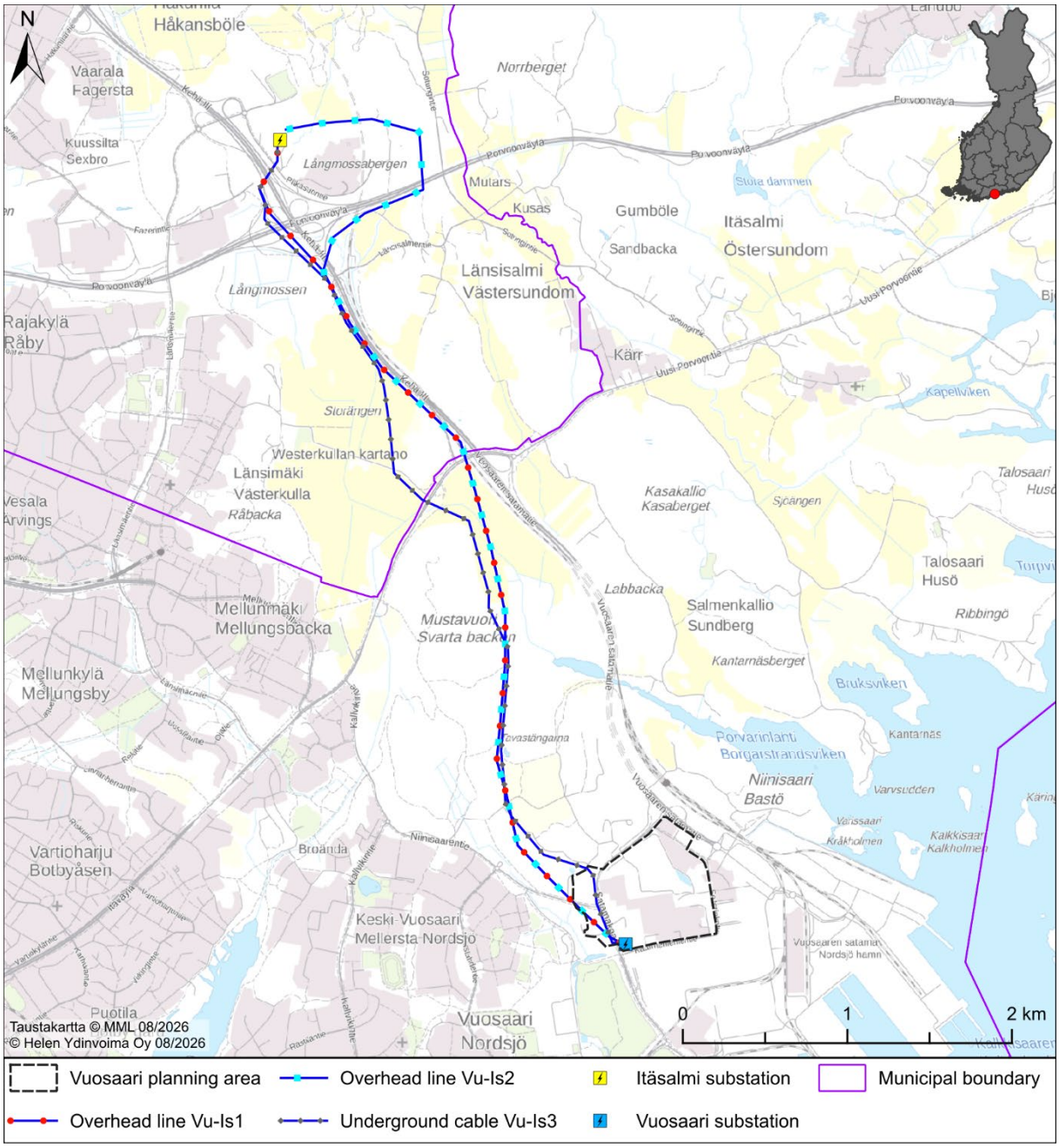


Figure 3-9. Alternative routing of the new 400 kV power line of the Vuosaari CHP plant (VE2b) to Fingrid's new substation.

3.6.1.1 Overhead line options Vu-Is1 and Vu-Is2

With regard to overhead lines, two alternative routes are examined, which largely follow the existing Vaarala–Vuosaari 2x110 kV power line of Helen Electricity Network Ltd. Option Vu-Is1 is located alongside the Vaarala–Vuosaari 110 kV power line, and just before Fingrid Oyj's current Länsisalmi substation, the route intersects the 110 kV Rekola–Vaarala, Anttila–Vaarala and Vaarala–Waste-to-Energy Plant 1 power lines and continues to Fingrid's new Itäsalmi substation planned on the opposite side of Ring Road III. The total length of the route is about 5.6 kilometres, of which the power line corridor shared with the Vaarala–Vuosaari power line is about 5.2 kilometres. Option Vu-Is2 is largely located on the routing of the existing Vaarala–Vuosaari 2x110 kV power line, and the shared power line corridor is about 4.7 kilometres long. The route crosses Ring Road III and turns towards the east. After this, the route crosses the

Porvoonväylä road and goes around Remeo Oy's recycling plant and Vantaan Energia Oy's waste-to-energy plant. To the north of the recycling plant and the waste-to-energy plant, the route runs alongside Fingrid Oyj's Länsisalmi–Anttila 400 kV power line for approximately 800 metres. The total length of the route is about 6.7 kilometres.

The shared section of the Vaarala–Vuosaari 2x110 kV route would be implemented as multi-circuit poles (Figure 3-10). At present, the 2x110 kV Vaarala–Vuosaari power line has a 30-metre right-of-way, with 10-metre border zones on both sides (30 m + 2×10 m). The right-of-way of the multi-circuit pole is preliminarily estimated at 42 metres, with 10-metre border zones on both sides (42 m + 2×10 m). Thus, the right-of-way and the transmission line area will widen by about 12 metres. The multi-circuit pole is about 7–15 metres higher than the existing power line, depending on the chosen pole structure.

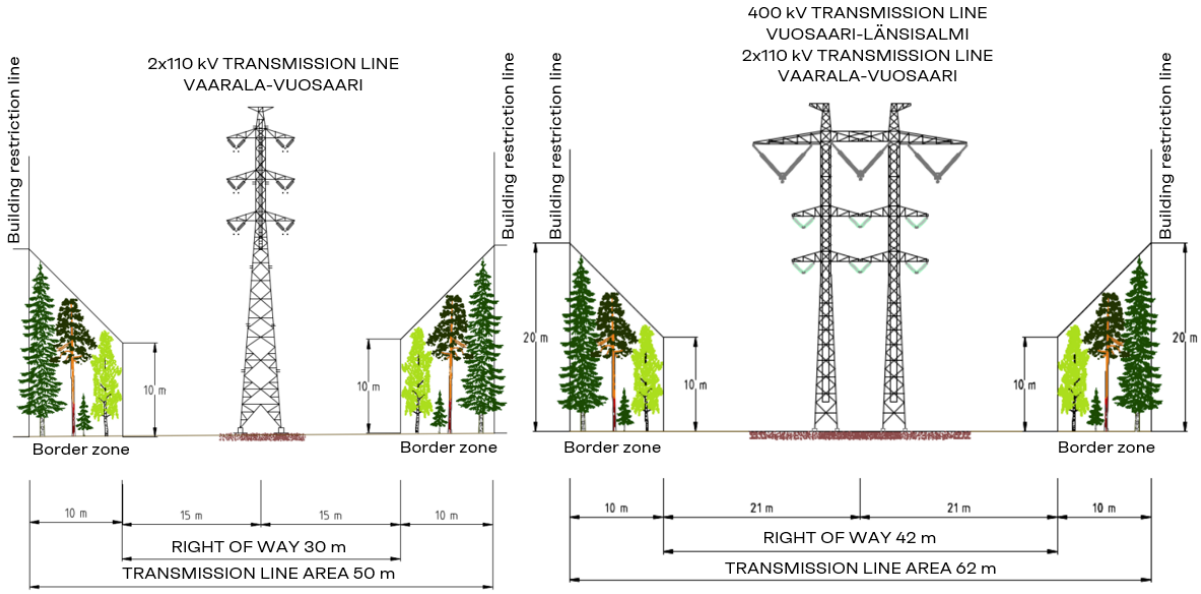


Figure 3-10. On the left, the existing 2x110 kV Vaarala–Vuosaari power line; on the right, the 2x110 kV and 400 kV power lines implemented as a multi-circuit pole.

When the new 400 kV power line separates from the existing Vaarala–Vuosaari power line, a new power line corridor will be built for the 400 kV power line. The width of the right-of-way of the new 400 kV power line is 42 metres, and the transmission line area is 62 metres wide. A schematic illustration of the new 400 kV power line is shown in the figure below (Figure 3-11).

Copyright © Helen Nuclear Ltd

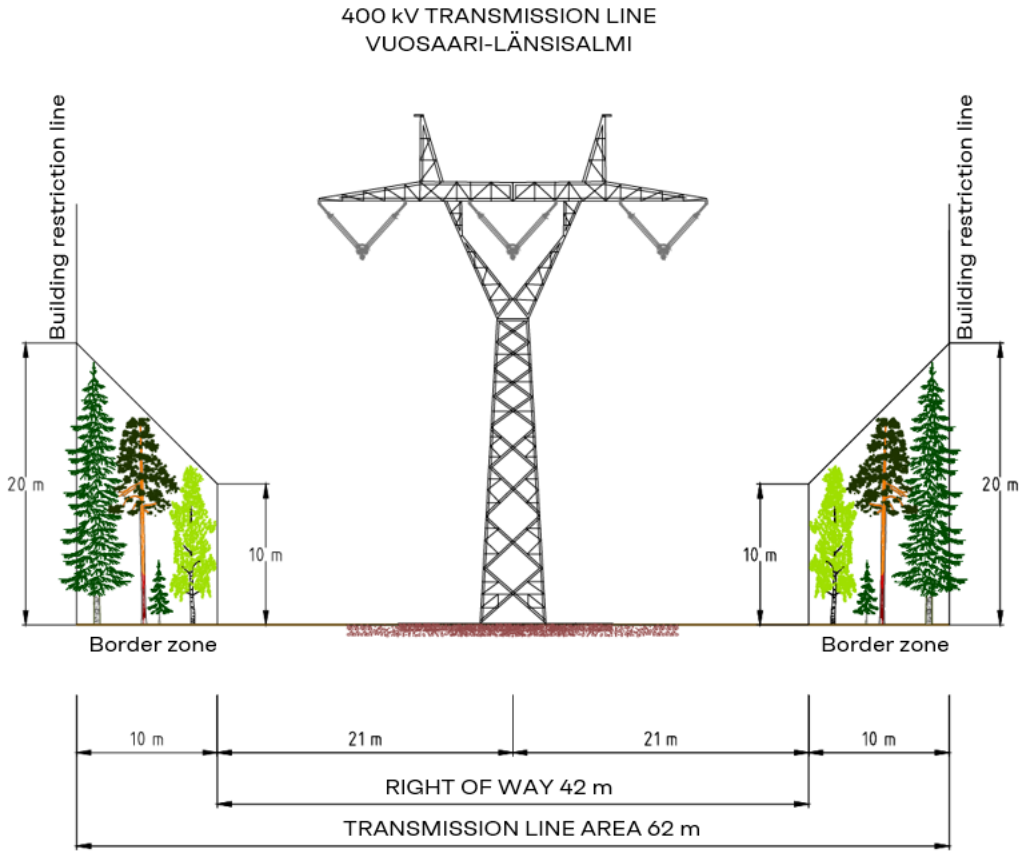


Figure 3-11. Schematic illustration of the 400 kV power line in a completely new power line corridor.

A schematic illustration showing the placement of the new 400 kV power line in option Vu-Is2 alongside Fingrid's Länsisalmi–Anttila 400 kV line is shown in the following figure (Figure 3-12).

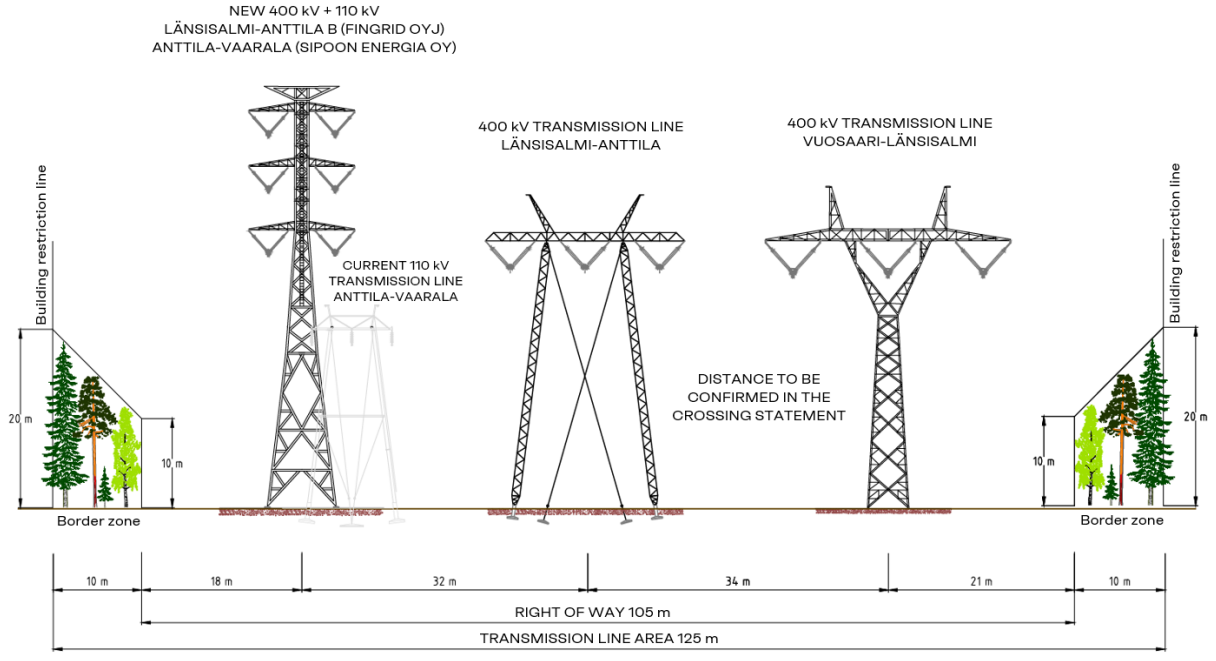


Figure 3-12. Schematic illustration showing the placement of the new 400 kV power line alongside Fingrid' existing Länsisalmi–Anttila transmission line.

Copyright © Helen Nuclear Ltd

The transmission line area is a building restriction area where construction is not permitted. The width of the building restriction area varies by power line. An expropriation permit is applied for the transmission line area, which grants a right of use while the land remains with the landowner.

3.6.1.2 Underground cable option Vu-Is3

The route of the underground cable option Vu-Is3 also follows the existing Vaarala–Vuosaari 2x110 kV power line routing (Figure 3-9). However, the route differs from the power line at the end of Vuosaari, as well as in the Mustavuori and Westerkulla areas. The underground cable route is located for a total distance of about 1.8 kilometres in connection with the Vaarala–Vuosaari power line. The underground cable route crosses power lines (Vaarala–Vuosaari, Rekola–Vaarala, Anttila–Vaarala, Vaarala–Waste-to-Energy Plant 1), a gas pipeline and the underpasses beneath Itäväylä, Ring Road III and Porvoonväylä, for example. The route intersects with the Westerkulla stream. The total length of the route is about 5.8 kilometres.

The underground cables are placed at a depth of about 1.5 metres in a trench. The width of the trench is about 3–5 metres. An area about 10 metres wide above the trench should be left free of trees, but other vegetation may be present. The installation methods for the underground cable, the space requirements and the necessary protections will be specified at a later stage of the planning process, taking into account load capacity assessments and existing infrastructure. No above-ground structures are planned for the cable.

The crossing under the stream could be carried out by directional drilling, as could road underpasses. Directional drilling requires only the launching and receiving pits, where drilling and the laying of underground cables take place. On rocky sections where the desired installation depth cannot be reached, the rock must be blasted. The choice of excavation method depends, among other things, on the amount of excavation required, as well as the location.

The underground cable restricts construction within the cable corridor. On arable land, fields can still be used for agricultural activities after construction is completed.

3.6.1.3 Other options considered

Preliminary examination was also made of other route options for the electricity transmission connection, which would have been located to the west of the Mustavuori region. However, these options were abandoned for reasons related to land use or technical challenges. Route options were not planned west of Mustavuori for the following reasons:

- The planned extension of the Mustavuori nature reserve and the already existing nature reserves.
- Restrictions on the electricity transmission connection caused by the planned tram line project parallel to Itäväylä.
- Restrictions caused by the existing natural gas pipeline north of the Niinisaarentie road and the Kallvikintie road. To the south side of the roads, residential areas are close by.
- Westerkulla manor area is a valuable cultural environment.

Copyright © Helen Nuclear Ltd

3.6.2 Norrberget heating plant

The heating plant in Norrberget (VE3a) requires a new 110 kV power line and backup power connection for electricity transmission. The new 110 kV power line will be built from Norrberget to Fingrid's existing Länsisalmi substation. The power line has two options, one overhead line option (No-Ls1) and one underground cable option (No-Ls2) (Figure 3-13).

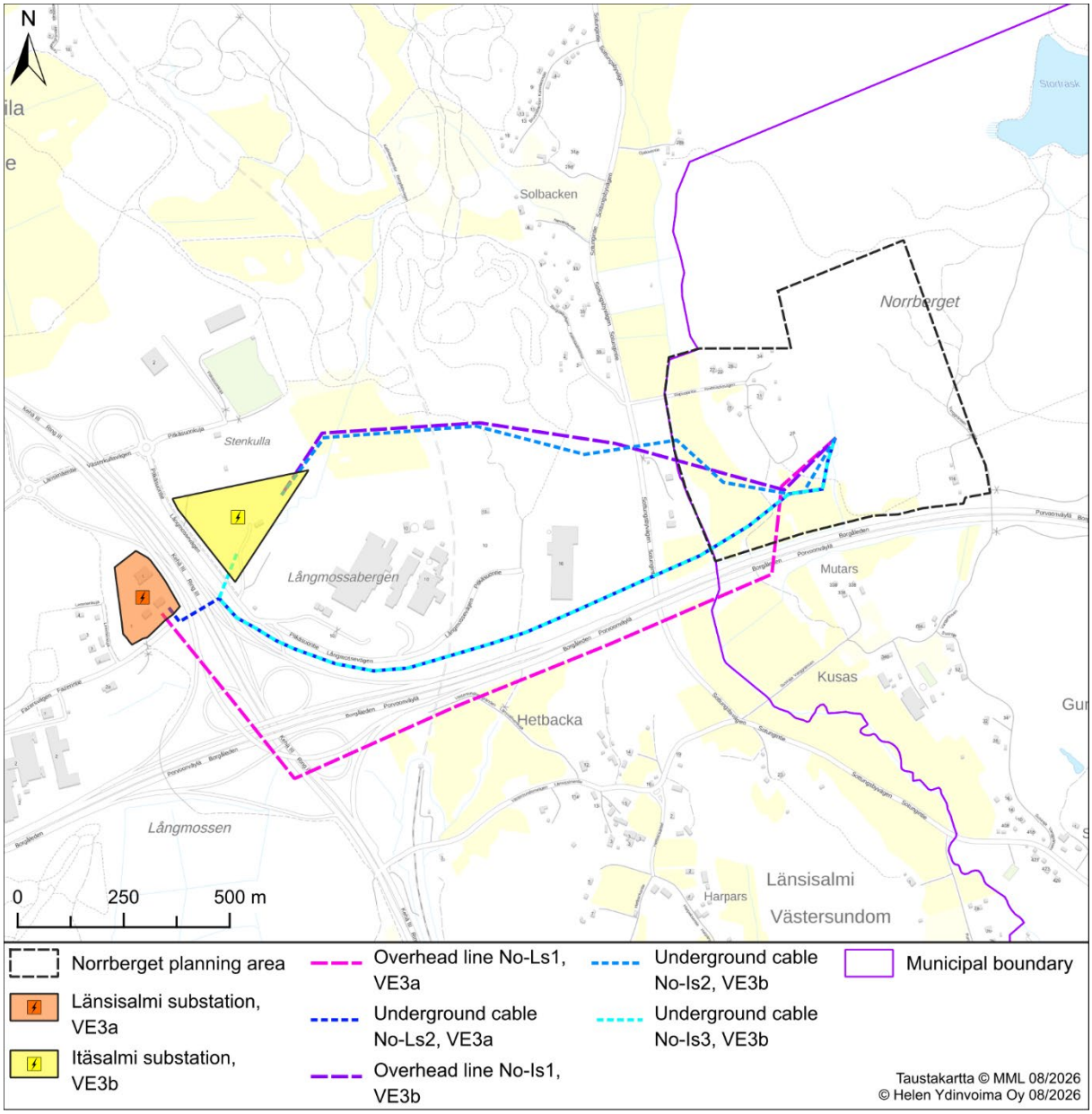


Figure 3-13. The 110 kV power line options of the Norrberget heating plant (project option VE3a) to the existing Länsisalmi substation and the 400 kV power line options of the Norrberget CHP plant (project option VE3b) to the new Itäsalmi substation.

3.6.2.1 Overhead line option No-Ls1

The overhead line option No-Ls1 is mainly located in a new power line corridor south of Porvoonväylä (Figure 3-13). The width of the right-of-way is initially 26 metres and the width of the transmission line area is 46 metres (Figure 3-14). The power line crosses with, for example, Porvoonväylä and Ring Road III, and also with several existing power lines in the vicinity of the Länsisalmi substation. The length of the route is about 2.1 kilometres.

Copyright © Helen Nuclear Ltd

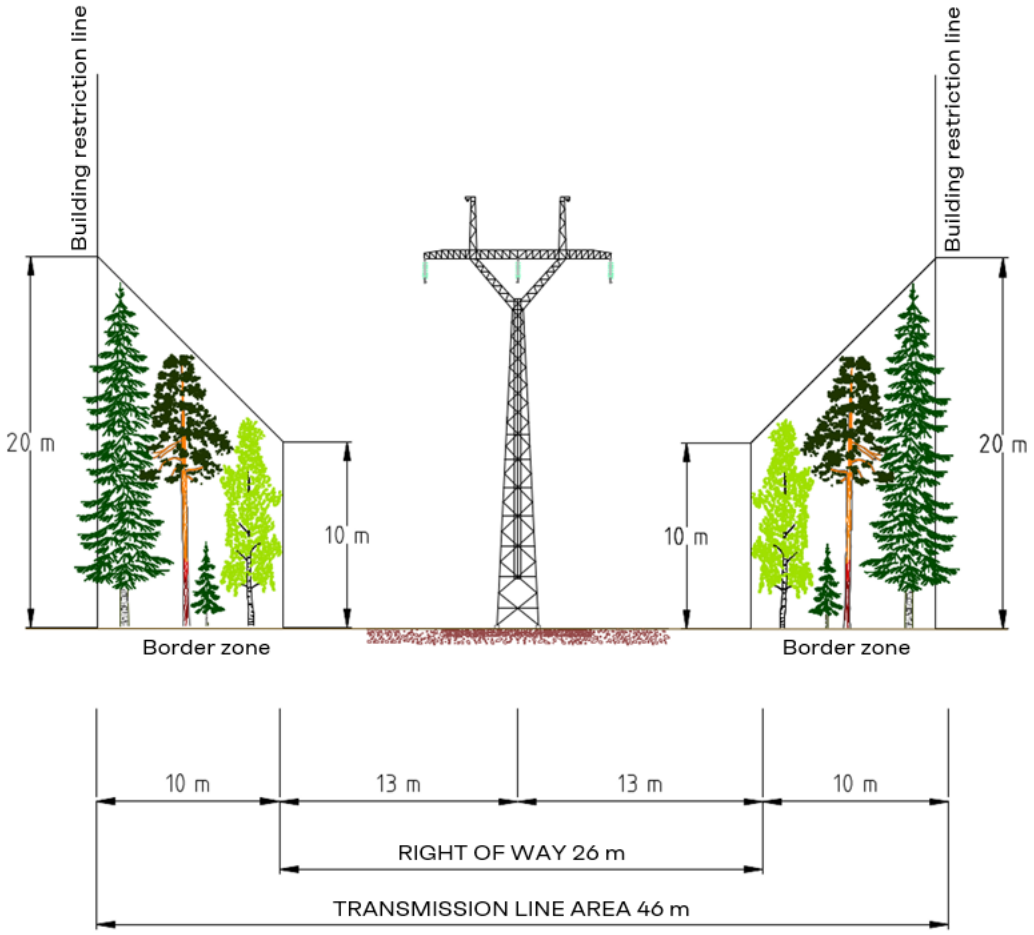


Figure 3-14. Schematic illustration of the new 110 kV power line.

3.6.2.2 Underground cable option No-Ls2

The underground cable option No-Ls2 is located on the north side of the Porvoonväylä road (Figure 3-13). The starting point for the route is to be located under the new road connection leading to the Norrberget planning area. The placement of the underground cable will be specified in more detail later, for example, as the road plans progress. On the route, it is necessary to excavate rock over a distance of about 260 metres. The underground cable crosses Ring Road III, a railway tunnel and a gas pipeline, and it also passes under the Krapuoja stream. The length of the route is about 1.8 kilometres.

The underground cable is built as described in chapter 3.6.1.2.

3.6.3 Norrberget CHP plant

The CHP plant in Norrberget (VE3b) requires a new 400 kV power line and a backup power connection for electricity transmission. A new 400 kV power line will be built from Norrberget to Fingrid's new Itäsalmi substation. The power line has three options, one overhead line option (No-Is1) and two underground cable options (No-Is2 and No-Is3) (Figure 3-13).

3.6.3.1 Overhead line option No-Is1

The overhead line option No-Is1 is located alongside Fingrid's existing Länsisalmi–Anttila transmission lines, to the north of the existing power lines (Figure 3-13 and Figure 3-15). Near

Copyright © Helen Nuclear Ltd

the substation, the power line intersects with existing power lines. The length of the route is about 1.5 kilometres.

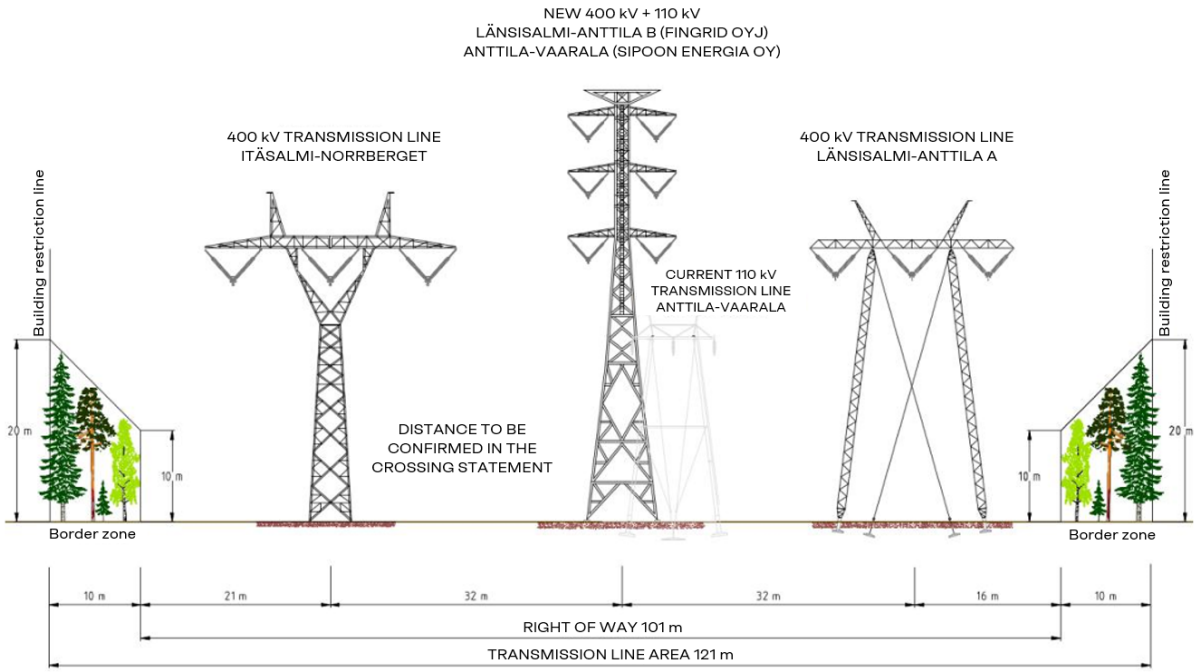


Figure 3-15. Schematic illustration of the transmission line area, the section running alongside existing lines.

3.6.3.2 Underground cable options No-Is2 and No-Is3

The underground cable option No-Is2 is located alongside Fingrid's existing Länsisalmi–Anttila transmission lines (Figure 3-13). The distance to existing power lines is specified in the requested crossing statement. Implementation as an underground cable would reduce the width of the transmission line area, so the amount of trees to be removed would be smaller. On the route, it is necessary to excavate rock over a distance of about 500 metres. The underground cable crosses a railway tunnel and a gas pipeline, and it also passes under the Krapuoja and Ojangonoja streams. The length of the route is about 1.5 kilometres.

The underground cable option No-Is3 is located on the north side of the Porvoonväylä road (Figure 3-13). The starting point for the route is to be located under the new road connection leading to the Norrberget planning area. The placement of the underground cable will be specified in more detail later, for example, as the road plans progress. On the route, it is necessary to excavate rock over a distance of about 260 metres. The underground cable crosses a railway tunnel and a gas pipeline, and it also passes under the Krapuoja stream. The length of the route is about 1.8 kilometres.

The underground cable is built as described in chapter 3.6.1.2.

3.6.4 Backup power connections

In addition to the power transmission connection, the nuclear power plant must have a backup power transmission connection. The Salmisaari plant site will receive two separate 110 kV power supplies from the Salmisaari substation and one from Kamppi through existing tunnel connections.

Copyright © Helen Nuclear Ltd

In Vuosaari, the 110 kV connections currently coming to the area serve as a backup connection. Additionally, a smaller tap-off substation will be built in the Vuosaari planning area for the 110 kV backup power connection in option VE2a.

The backup power connection from the Norrberget nuclear power plant to Vuosaari will be implemented in the tunnel of the district heat transmission connection to be built. If the combination of a tunnel and an underground trench is chosen as the district heat transmission connection, a backup power connection is placed with the part of the underground trench section of the district heat transmission pipe next to the district heat pipes. The 110 kV underground cable will be installed at a depth of 1.5–2.2 metres. The width of the cable trench is 4 metres. There should be a minimum distance of 2 metres between the high-voltage cable and the district heat pipe. In this case, the total width of the district heat transmission line to be constructed is approximately 30 metres.

3.7 Cooling solutions for the CHP plant

A CHP plant requires seawater cooling. Part of the heat produced at the CHP plant is directed to the district heating network, part of the heat is transferred to the sea with cooling water due to the technical constraints of the plant or fluctuations in the need for district heating. With regard to the Vuosaari CHP plant (VE2b), the use of the existing cooling water tunnels of the Vuosaari power plant as well as the construction of completely new cooling water tunnels in the marine area off Vuosaari are examined. The Norrberget CHP plant (VE3b) requires the construction of new cooling water tunnels in the marine area off Vuosaari.

Seawater cooling is the primary cooling solution for the CHP plant. The EIA procedure also considers implementing part of the cooling as air cooling. In this case, the necessary equipment for air cooling is built in the planning area.

The heating plant options (VE1, VE2a and VE3a) do not require seawater or air cooling, all the heat produced at the heating plant is transferred to the district heating network.

3.7.1 Seawater cooling

3.7.1.1 Cooling water intake and discharge points

The EIA procedure examines four cooling water intake points (O1–O4) and four cooling water discharge points (P1–P4) for the Vuosaari CHP plant (VE2b). The intake point O1 is the intake of the current cooling water tunnel of the Vuosaari power plant, and the discharge point P1 is the discharge of the current cooling water tunnel of the Vuosaari power plant. The EIA procedure examines the expansion of existing cooling water tunnels as well as the construction of completely new tunnels. For the Norrberget CHP plant (VE3b), three cooling water intake points (O2–O4) and three cooling water discharge points (O2–O4) are considered. The intake and discharge points are located in the Helsinki marine area, except for discharge point P2, which is located in the Sipoo marine area. The cooling water intake and discharge points to be considered are shown in the following figure (Figure 3-16).

Copyright © Helen Nuclear Ltd

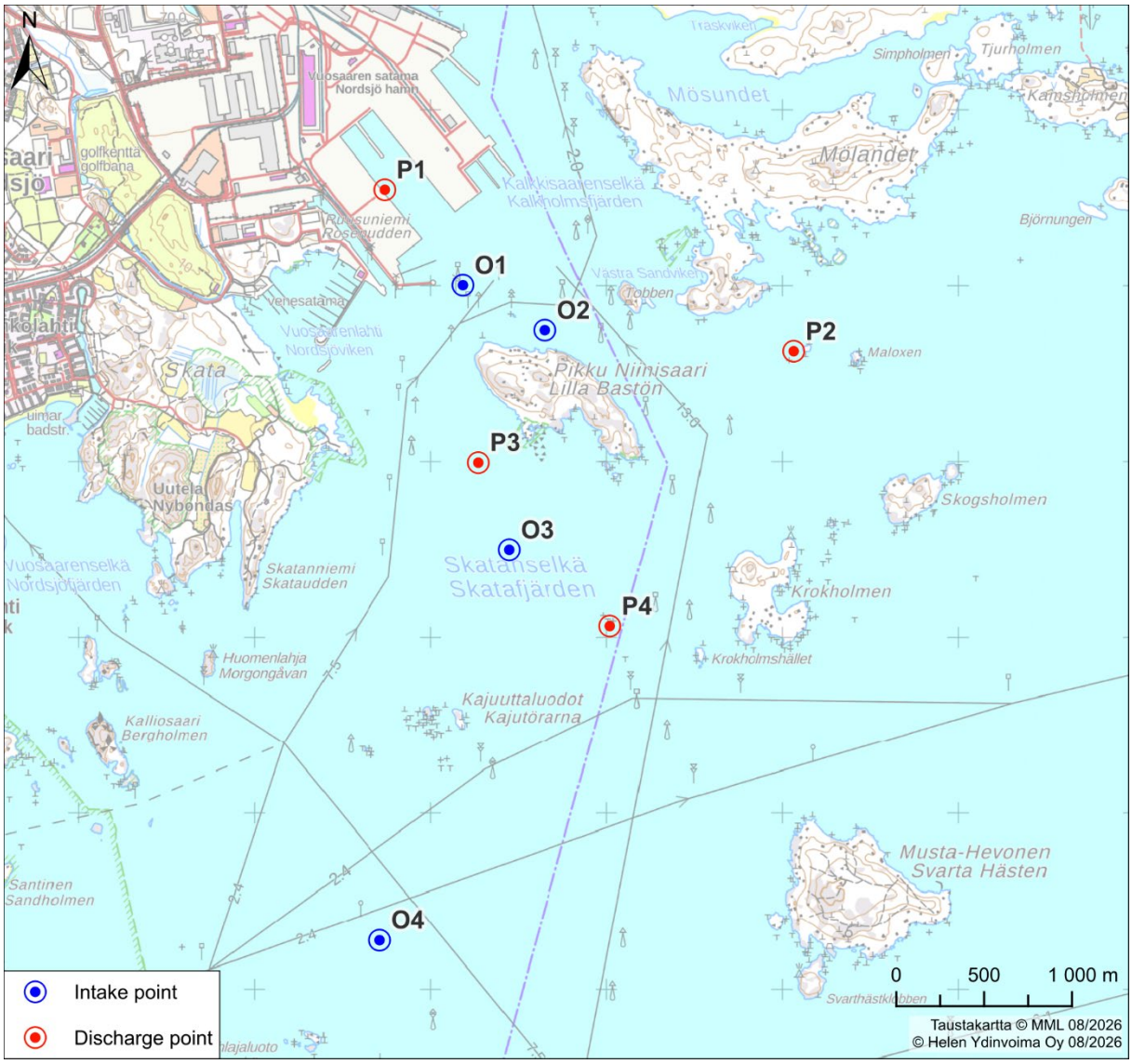


Figure 3-16. Alternative cooling water intake and discharge points to be considered in the EIA procedure. Discharge point P2 is located in the Sipoo marine area, other points in the Helsinki marine area.

3.7.1.2 Vuosaari cooling water tunnel routes

For the Vuosaari CHP plant, a total of ten different combinations of cooling water intake and discharge tunnels are examined: O1P1, O2P2, O2P3, O2P4, O3P2, O3P3, O3P4, O4P2, O4P3 and O4P4 (Figure 3-17, Figure 3-18 and Figure 3-19). Of these, the combination O1P1 represent the current cooling water intake and discharge tunnels of the Vuosaari power plant (Figure 3-17). The access tunnel of the cooling water tunnels of the Vuosaari CHP plant is located on the west side of the Vuosaari Harbour, near the marina. No vertical shafts are required for cooling water tunnels. The lengths of completely new cooling water tunnels and the excavation volumes required for construction are shown in the table (Table 3-4). The length of the current cooling water intake tunnel of the Vuosaari power plant is about 2.2 kilometres, and the length of the discharge tunnel is about 1.3 kilometres.

Copyright © Helen Nuclear Ltd

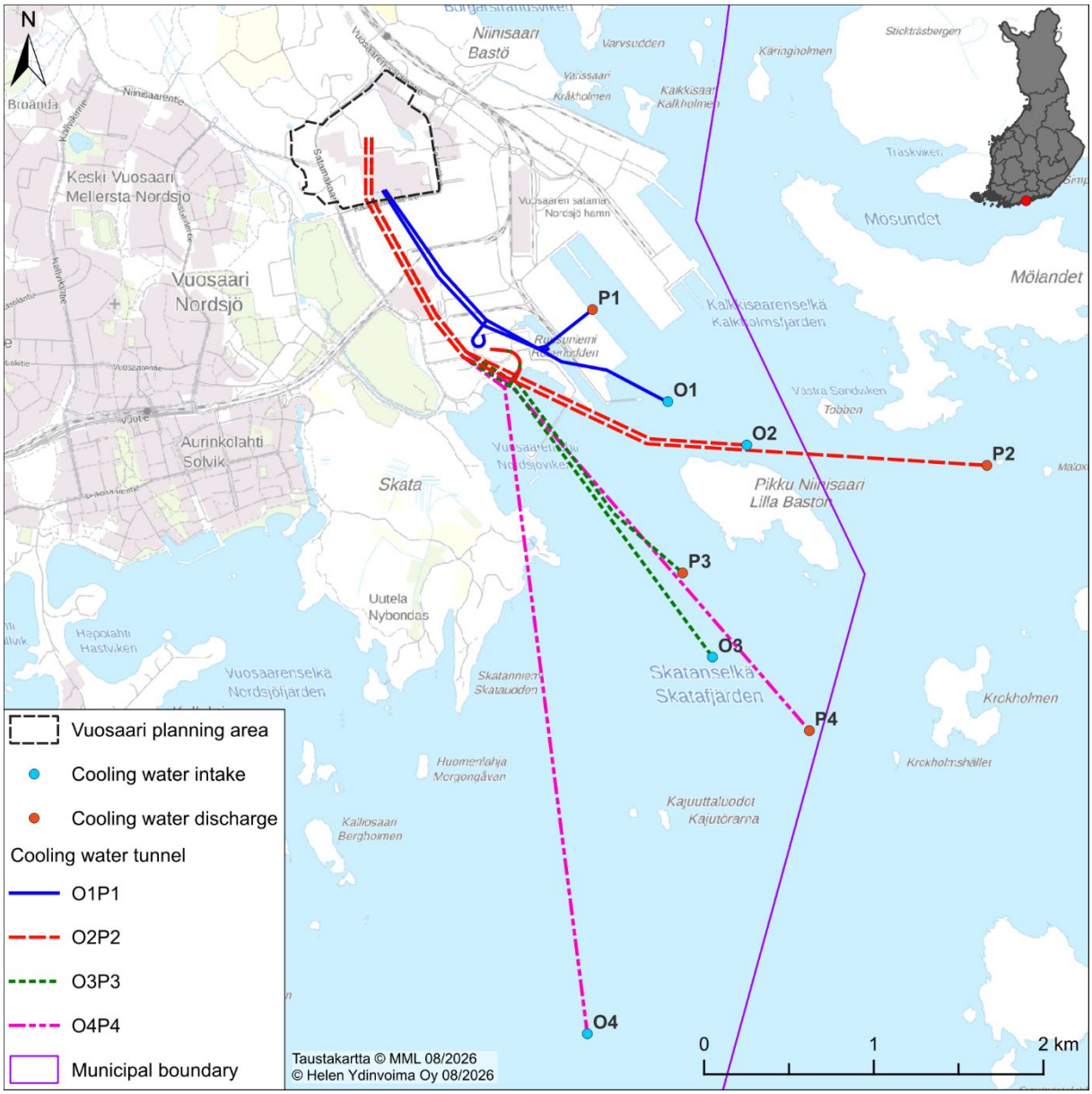


Figure 3-17. Alternative cooling water tunnel routes O1P1, O2P2, O3P3 and O4P4 of the Vuosaari CHP plant (project option VE2b).

Copyright © Helen Nuclear Ltd

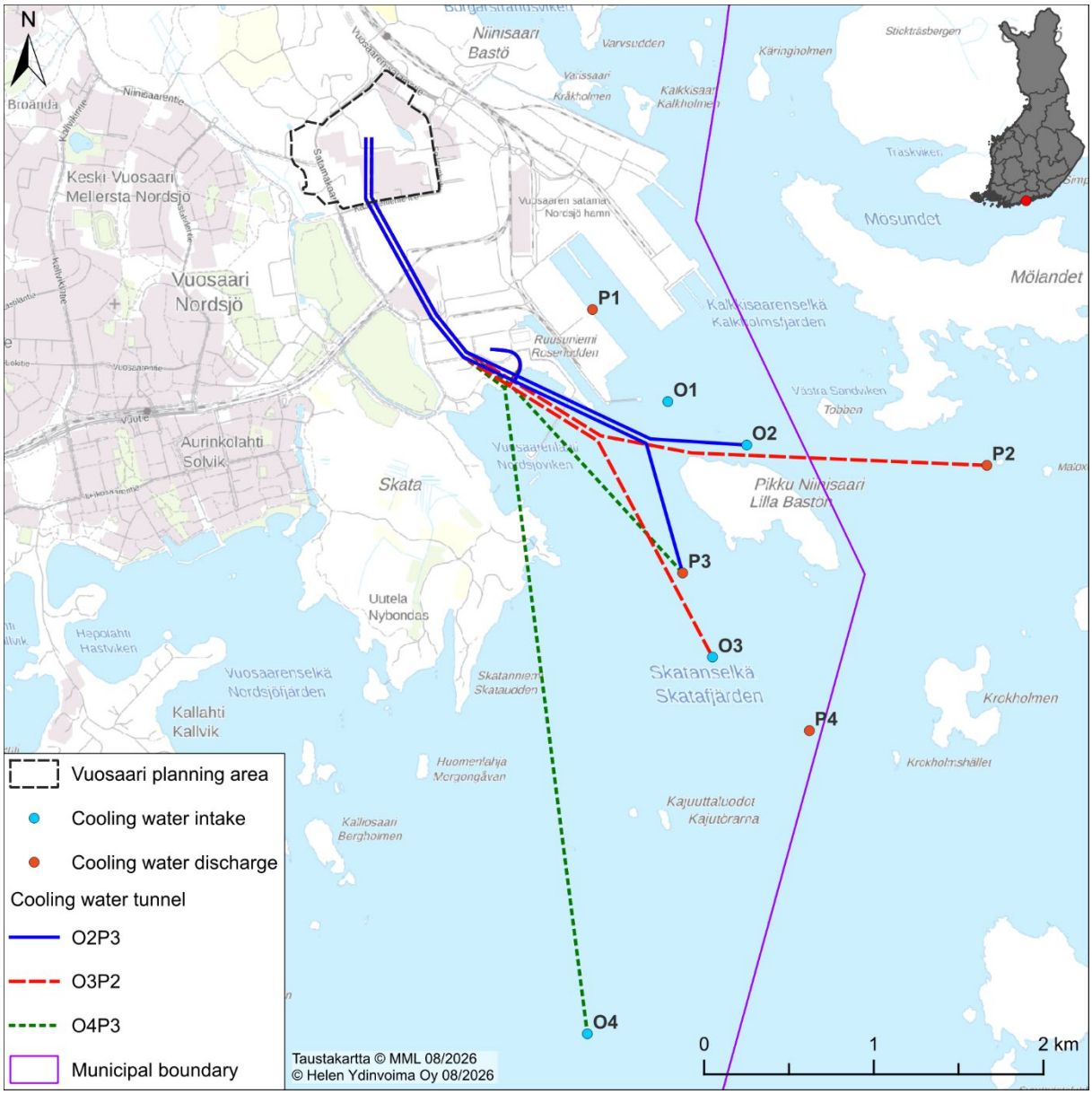


Figure 3-18. Alternative cooling water tunnel routes O2P3, O3P2 and O4P3 of the Vuosaari CHP plant (project option VE2b).

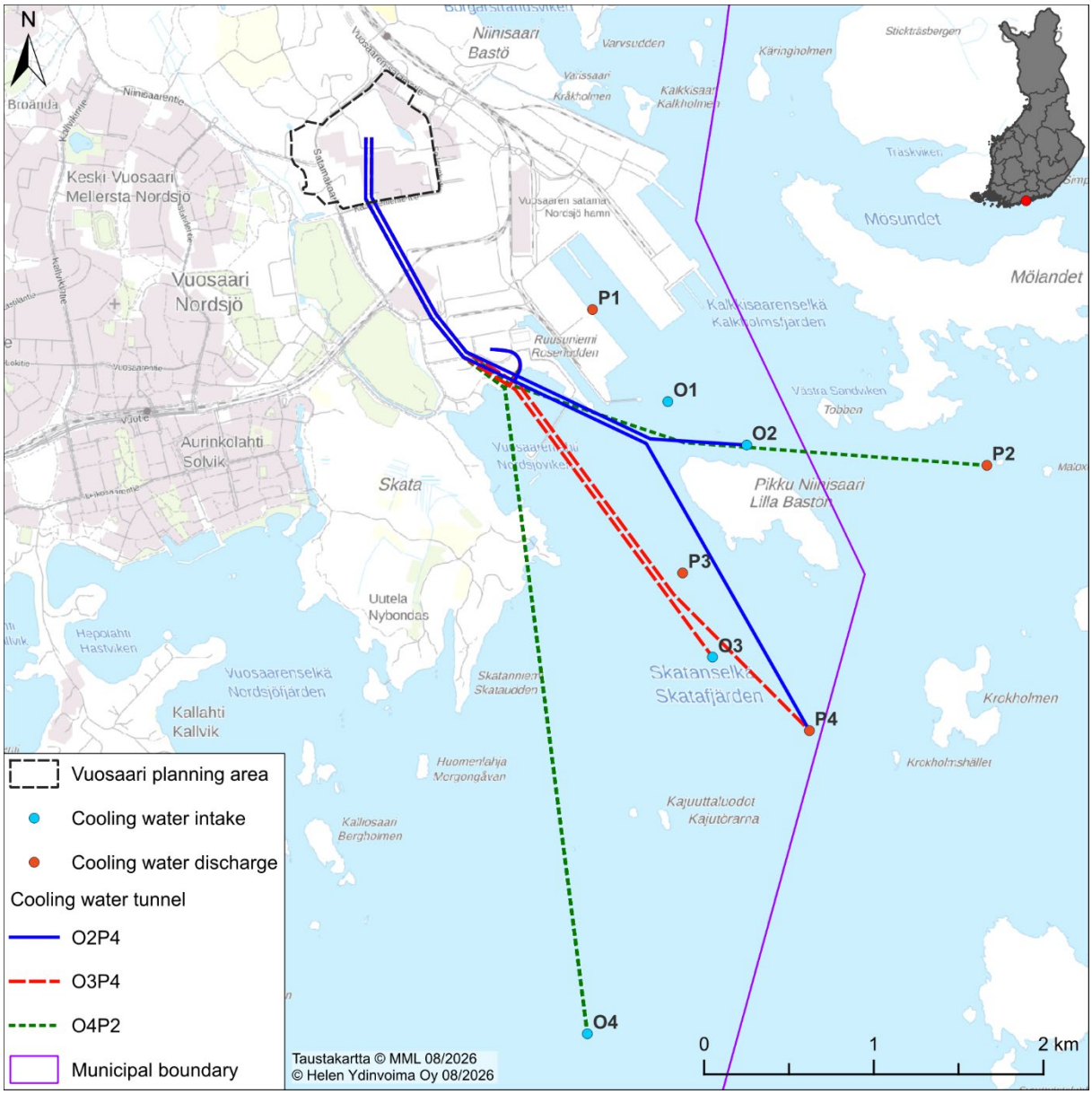


Figure 3-19. Alternative cooling water tunnel routes O2P4, O3P4 and O4P2 of the Vuosaari CHP plant (project option VE2b).

Table 3-4. Cooling water tunnel options, tunnel lengths and extraction volumes of the Vuosaari CHP plant (project option VE2b).

Option	Length (km)	Excavation quantity/volume (m^3)	
		solid cubic metre	loose cubic metre
Vuosaari O1P1	2.2 + 1.3 = 3.5		
Vuosaari O2P2	3.2 + 4.7 = 7.9	410,000	650,000
Vuosaari O2P3	3.2 + 3.4 = 6.6	350,000	550,000
Vuosaari O2P4	3.2 + 4.6 = 7.8	400,000	640,000
Vuosaari O3P2	3.8 + 4.6 = 8.4	440,000	700,000
Vuosaari O3P3	3.8 + 3.3 = 7.1	370,000	590,000
Vuosaari O3P4	3.8 + 4.5 = 8.3	430,000	680,000
Vuosaari O4P2	5.6 + 4.6 = 10.2	520,000	840,000
Vuosaari O4P3	5.6 + 3.2 = 8.8	460,000	730,000
Vuosaari O4P4	5.6 + 4.4 = 10.0	520,000	840,000

3.7.1.3 Norrberget cooling water tunnel routes

For the Norrberget CHP plant, a total of nine different combinations of cooling water intake and discharge tunnels are examined: O2P2, O2P3, O2P4, O3P2, O3P3, O3P4, O4P2, O4P3 and O4P4 (Figure 3-20, Figure 3-21 and Figure 3-22). The access tunnels for the Norrberget CHP plant are located in Länsisalmi, Niinisaari and Vuosaari. In addition, there is a vertical shaft in Niinisaari. The lengths of the cooling water tunnels and the excavation volumes required for construction are shown in the table (Table 3-5).

Copyright © Helen Nuclear Ltd



Figure 3-20. Alternative cooling water tunnel routes O2P2, O3P3 and O4P4 of the Norrberget CHP plant (project option VE3b).



Figure 3-21. Alternative cooling water tunnel routes O2P3, O3P4 and O4P2 of the Norrberget CHP plant (project option VE3b).



Figure 3-22. Alternative cooling water tunnel routes O2P4, O3P2 and O4P3 of the Norrberget CHP plant (project option VE3b).

Table 3-5. Cooling water tunnel options, tunnel lengths and excavation volumes of the Norrberget CHP plant (project option VE3b).

Option	Length (km)	Excavation quantity/volume (m^3)	
		solid cubic metre	loose cubic metre
Norrberget O2P2	7.8 + 9.1 = 16.9	880,000	1,410,000
Norrberget O2P3	7.7 + 8.0 = 15.7	820,000	1,310,000
Norrberget O2P4	7.7 + 9.1 = 16.8	880,000	1,410,000
Norrberget O3P2	8.5 + 9.2 = 17.7	920,000	1,470,000
Norrberget O3P3	8.5 + 7.9 = 16.4	860,000	1,370,000
Norrberget O3P4	8.5 + 9.1 = 17.6	920,000	1,470,000
Norrberget O4P2	10.5 + 9.2 = 19.7	1,020,000	1,630,000
Norrberget O4P3	10.5 + 7.9 = 18.4	960,000	1,530,000
Norrberget O4P4	10.5 + 9.1 = 19.6	1,020,000	1,630,000

3.7.1.4 Implementation of cooling water tunnels

The new cooling water tunnels will be constructed as rock tunnels, meaning they will be excavated deep into the bedrock. Only the cooling water intake and discharge structures located at the end of the tunnels will be built on the seabed. The area of the rock tunnel cross-section is about 45 m^2.

Cooling water tunnels are excavated using either the drilling and blasting method or the TBM (Tunnel Boring Machine) method (see chapter 3.9). The more likely method is the drilling and blasting method, which is more commonly used and well suited to the conditions of the Finnish bedrock.

The above-ground structures of the cooling water tunnels include access tunnels and vertical shafts. These are constructed in the same way as the access tunnels and vertical shafts required for the district heat transmission connection (see chapter 3.5). Preliminary planning has considered both the district heat transmission tunnels and the cooling water tunnels, and the aim has been to design the tunnels so that the same access tunnel and vertical shaft connections can be used for both.

All new cooling water tunnels are excavated from land to sea. Excavated rock will be transported out of the tunnels via the access tunnels. Rock material will not be transported by sea. The cooling water intake and discharge structures will be built at the bottom of the sea. The structures are built either as underwater work or as dry work, if the water depth is low enough. The construction of the intake and discharge structures requires dredging and possibly levelling excavation only at the location of the structure. In preliminary assessments, the dredging and excavation volumes are small, but the volumes will be specified at the EIA reporting phase. The aim is to primarily place the dredging masses in marine dumping areas owned by the City of Helsinki.

The use of the existing cooling water tunnels of the Vuosaari power plant for the needs of the Vuosaari CHP plant (project option VE2b, O1P1) requires the expansion of the existing tunnels. In order to obtain a larger amount of cooling water for the nuclear power plant, the cross-

Copyright © Helen Nuclear Ltd

sectional area of the cooling water tunnels must be expanded by excavation. The excavation is carried out using the drilling and blasting method.

The intake and discharge structures of the cooling water tunnels are closable, and the intake structure is equipped with a coarse screen that prevents fish and other organic matter (screenings) from ending up in the cooling water intake. There is a cover plate on top of the structure and the coarse screens are located on the sides of the intake structure. The water intake structure is dimensioned so that the water flow rate is low enough to prevent fish from being sucked into the intake structure. Fish repellents can also be placed in the intake structure, which can potentially reduce the amount of fish ending up in the cooling water intake. Placing the water intake structure on the seabed reduces the possibility of freezing in winter. A schematic illustration of the cooling water intake and discharge structure on the seabed is shown in the following figure (Figure 3-23).

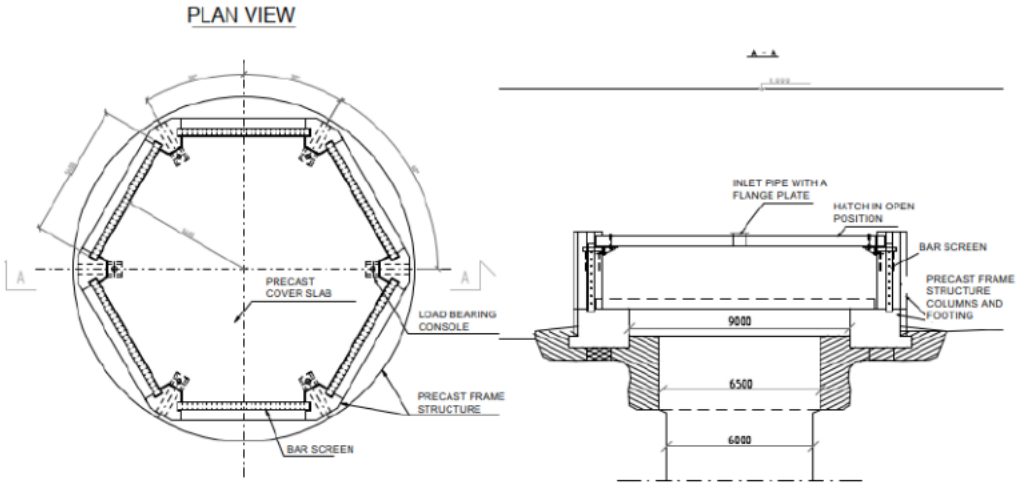


Figure 3-23. Intake and discharge structure.

The pumping station and the collection building for screenings is located on the nuclear power plant site. The fine screen is located a few metres before the seawater pumps. The fine screen filters material from the water that has entered the seawater tunnel from the intake structure. The fine screen is typically either a chain rake screen or a drum filter. Material that has entered the cooling water intake is collected and treated as waste.

3.7.2 Air cooling

The primary cooling solution for the CHP plants under consideration is seawater cooling. The project also explores the use of air cooling as a way to reduce the thermal load transferred to the sea, especially in summer. In air cooling, the heat is transferred to the atmosphere, for example, by means of cooling towers. Evaporative cooling towers are the most commonly used closed cooling solution, in which heat is removed by evaporating part of the circulating water (1–3%). Environmental conditions, such as air temperature and relative humidity, affect the evaporation rate.

A schematic cross-sectional view of a single cooling tower unit is shown in the figure below (Figure 3-24). There are several cooling tower units arranged in one or more rows, and the length of the building can exceed 100 metres, depending on the design solution and the plant site.

Copyright © Helen Nuclear Ltd

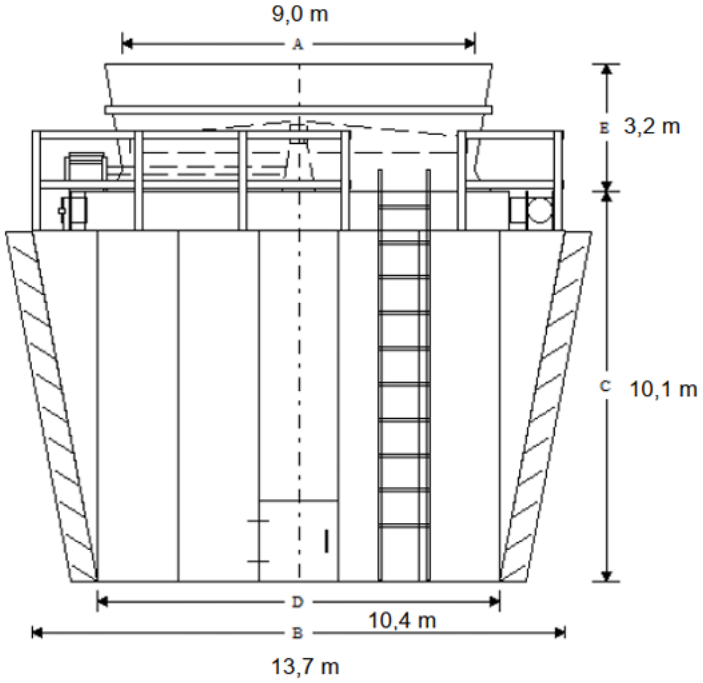


Figure 3-24. Cross-sectional view of the cooling tower unit, the dimensions of the structure are indicative.

Cooling tower fans make noise, and in the vicinity of the fans (at a distance of 10 metres) the noise level can reach 80 dB(A). In addition, cooling towers generate steam, which can be seen especially in cold weather conditions. Wet cooling towers carry a risk of spreading Legionella bacteria to the nearby area of the plant if the water circulation is not properly managed and the measures to prevent bacterial growth are inadequate. In addition, the air cooling system uses different chemicals to prevent biological growth and corrosion. Therefore, the chemicals used in the process should be taken into account in the treatment of the effluent.

Compared to seawater cooling, the use of air cooling reduces the energy efficiency of the plant, as it can significantly increase the self-consumption of electricity and reduce the production capacity of the plant. Therefore, seawater cooling is the project's primary cooling solution. Limited space in the planning areas can also affect the feasibility of air cooling solutions. This information will be specified as the planning progresses.

3.8 Road connections

There is a need to build new road connections to the Norrberget planning area. The new main road connection from the west to the planning area follows the traffic connection indicated in the Vantaa master plan 2020 and the road traffic connection need indication in Östersundom's component master plan. The road connection will be built as an extension of Vantaa's Pitkäsuontie to the north of Porvoonväylä, and it will cross the Sotungintie road on a new bridge. A backup road connection is also required for the nuclear power plant. The alternative road connection to the planning area approaches from the south, from the south side of the Porvoonväylä road. The backup road connection would only be used in exceptional situations. The road connection will be built as an extension of Länsisalmentie (connecting road 11633), from the Sotungintie intersection, across Porvoonväylä on a bridge. The current road (Susiraja) in the area crosses Krapuoja, and there is a bridge at Porvoonväylä. The current bridge is in a condition suitable for demolition, and further project planning will consider constructing a new

Copyright © Helen Nuclear Ltd

bridge across Porvoonväylä. The road connection and the backup road connection are shown in the figure below (Figure 3-25).

The Vuosaari and Salmisaari plant sites do not require the construction of new road connections.

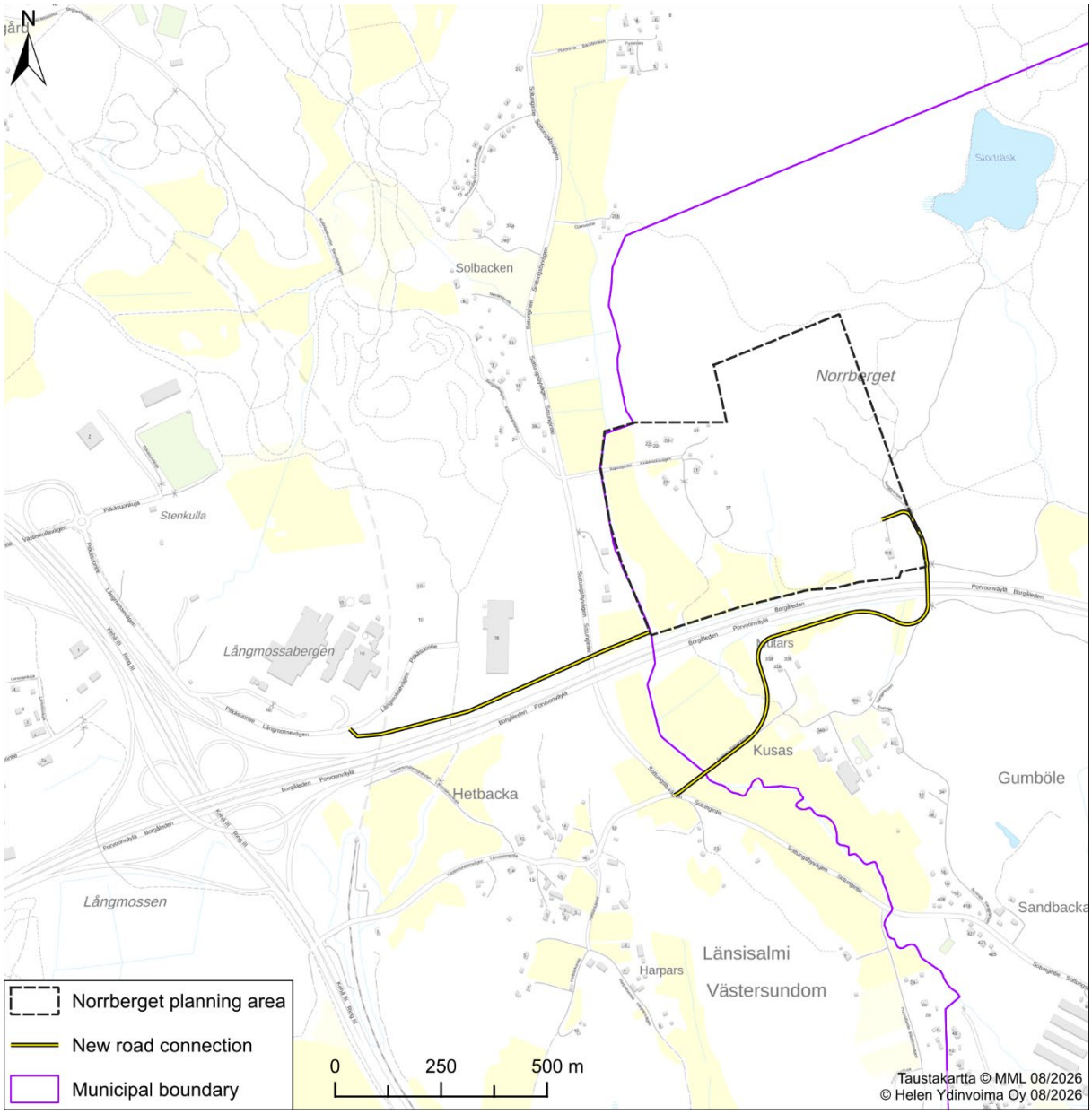


Figure 3-25. A new road connection and a backup road connection to the Norrberget planning area.

3.9 Excavation during construction

The construction of the nuclear power plant requires excavation both in the planning area and in connection with the district heat transmission connection tunnels (project options VE3a and VE3b) and cooling water tunnels (project options VE2b and VE3b).

The method of excavation in the planning area is the drilling and blasting method. The tunnels of the district heat transmission connection are planned to be implemented using the drilling

and blasting method. Cooling water tunnels are implemented using either the drilling and blasting method or the TBM method.

In the tunnel sections, the noise and vibration restrictions defined for each area are complied with. Environmental surveys and risk analyses are carried out for the excavation, in which noise and vibration sensitive sites are determined and different limit values are set.

The vertical shafts associated with the tunnels are excavated by long-hole drilling, with rock material generally dropped to the tunnel level, from where it is transported away. Additionally, some open excavation is carried out at the top of the shafts and on the surface in the courtyard areas. Disturbances to the environment are mainly limited to vibration and noise from drilling and blasting, as well as dust, during the excavation phase.

The following chapters describe the drilling and blasting method and the TBM method, focusing on the description of tunnel excavation.

3.9.1 Drilling and blasting method

The drilling and blasting method is a common and traditional excavation method in Finland. In the drilling and blasting method, holes are drilled in the rock wall and explosive is put into these holes. The charged field is then blasted, after which rock material is transported away. On a typical working day, two blasts are carried out at the work site.

Equipment used in the drilling and blasting method includes a drilling jumbo, excavators, trucks for transporting rock material, scaling equipment, bolting and grouting equipment and shotcrete equipment. The equipment is mainly diesel driven, but the drilling jumbo uses electricity for drilling. The same equipment is also used, for example, for the excavation of tunnel entrances and access tunnels.

Drilling and blasting cause noise and vibration. In tunnel excavation, excavation noise can be heard from a single property for about two months, after which the tunnel work site has progressed away from the scope of the property.

The drilling and blasting method must take tunnel ventilation into account. Blasting produces explosion gases and harmful substances that must be removed from the tunnel. For this purpose, temporary ventilation fans are placed at each tunnel entrance during work, and clean air is fed into the tunnel through temporary fabric ducts. When clean air reaches the tunnel face, it carries polluted explosion gases to the surface. This ventilation phase lasts about 2–3 hours after each blast. In addition, these ventilation fans used during the work may also be employed for other tasks.

Excavation causes rock breakage and cracking. The roof and wall surfaces of the tunnel are reinforced with shotcrete and rock bolts. The tunnel is not completely sealed, but leakages from the bedrock seep into it in certain places. The leakages from the rock are prevented by pressure grouting of the rock both before and after excavation. Grouting volumes and sealing targets are defined according to bedrock characteristics and environmental requirements. For example, in developed environment or groundwater areas, the requirements for sealing are stricter.

3.9.2 TBM method

The TBM method (Tunnel Boring Machine) refers to full-face tunnelling, where a tunnel covering the entire tunnel profile is excavated at once. At the same time, the necessary rock supports

Copyright © Helen Nuclear Ltd

and reinforcements are installed. Therefore, the method is only suitable for tunnel excavation. Traditionally, the TBM method has been used mainly in sedimentary rocks, but in recent years, the use of machines developed for hard rocks has also become more common. The method has been used in hard crystalline bedrock in countries such as China, Canada, Switzerland, Norway and Sweden. So far, no hard rock TBM tunnels have been built in Finland.

The TBM method differs from drilling and blasting excavation particularly in that, instead of the traditional excavation cycle, the tunnel spaces are created by continuous drilling. In the TBM method, the tunnel is drilled with carbide rollers that form the drill bit. The drill bits located at the front of the drilling machine break the rock and remove crushed rock from the tunnel face, which is directed via screens and chutes to the belt conveyor. When drilling using the TBM method, a circular tunnel profile is created. In general, TBM tunnels are 3 to 15 metres in diameter. In principle, the TBM equipment is built in accordance with project-specific conditions and the dimensions of the tunnel.

A key advantage of the TBM method is that it enables the economical construction of longer tunnel sections, as the TBM's excavation cycle is simpler. In addition, especially in long tunnels, it is significant that the method does not generate explosive gases.

Preparing and designing the TBM implementation requires significantly more work than starting drilling and blasting excavation. After implementation planning, it usually takes about 6–15 months for the equipment to be delivered and about 2 months for the assembly. The advantage of the TBM method is the speed of excavation, which is generally many times higher than in the drilling and blasting method. However, the final speed of progress is significantly influenced by local conditions and the size of the tunnel to be created.

The material produced by the TBM method is more uniform and consists of smaller crushed aggregate particles than that produced by the drilling and blasting method. Rock material in the TBM method generally contains a higher proportion of fines. A high fines content may require screening or treatment before rock material can be used.

3.9.3 Excavation volumes and use of excavated rock material

During the construction of the nuclear power plant, excavated rock material will be generated within the planning area from the excavation work required for the nuclear power plant, as well as, depending on the option, from the construction of the cooling water tunnels and the district heat transmission connection. The table below shows the estimated maximum excavation volumes by project option (Table 3-6). The excavation volumes are given in solid cubic metres (i.e. the volume to be excavated in the rock).

In the planning area of the heating plant, the required volume for the underground heating plant excavated in the bedrock is estimated to be about 230,000 m^3. In the above-ground heating plant option, at least the reactor pit will largely need to be excavated. The volume of the excavation for the reactor building of the above-ground plant option is about 100,000 m^3. The excavation volume of the Salmisaari and Vuosaari planning areas has been estimated at a maximum of approximately 230,000 m^3. The excavation volume of the Norrberget heating plant is higher, as levelling is required in the area. The estimated excavation volume of the Norrberget planning area is approximately 400,000 m^3. The duration of the excavation works of the underground heating plant is estimated to be about 2 years, the above-ground heating plant about 1–2 years. In addition, pre-construction works, such as area levelling excavation, must

Copyright © Helen Nuclear Ltd

be carried out at Norrberget for the construction of the heating plant, and the estimated duration of this is about 2 years.

The amount of excavation in the planning area of the CHP plant largely depends on the depth of the bedrock surface. In Norrberget, the area is largely bare rock. At the plant site of the CHP plant in Norrberget, it is estimated that there will be a maximum of approximately 1.4 million m^3 to be extracted and excavated. The cubic volumes also include the excavation of the reactor area, which is done in the Norrberget option entirely by excavation. The estimated duration of the excavation works at the Norrberget CHP plant is approximately 3.5 years. In Vuosaari, the excavation volumes are smaller than in Norrberget, with an estimated maximum of about 500,000 m^3. The estimated duration of the excavation works at the Vuosaari CHP plant is about 1–2 years.

Rock material from the excavation of the cooling water tunnels at the Vuosaari CHP plant will amount to about 520,000 solid m^3 (820,000 loose m^3) at the most (see chapter 3.7.1.2). Rock material from the excavation of the cooling water tunnels at the Norrberget CHP plant will amount to about 1,020,000 solid m^3 (1,630,000 loose m^3) at the most (see chapter 3.7.1.3). The estimated duration of the excavation work of the cooling water tunnels is about 2.5–3.5 years.

The construction of the Norrberget district heat transmission connection will produce approximately 390,000 solid m^3 (630,000 loose m^3) of rock material in option KL1 and approximately 250,000 solid m^3 (390,000 loose-m^3) in option KL2. The attached table (Table 3-6) takes into account the larger excavation volume of option KL1. The estimated duration of the excavation of the district heat transmission connection is approximately 2 years.

Table 3-6. Excavation volumes (solid m^3) in different project options, estimates are the maximum amounts.

	VE1	VE2a	VE2b	VE3a	VE3b
Planning area	230,000	230,000	500,000	400,000	1,400,000
Cooling water tunnels	–	–	520,000	–	1,020,000
District heating transmission connection	–	–	–	390,000	390,000
Total (max)	230,000 m^3	230,000 m^3	1,020,000 m^3	790,000 m^3	2,810,000 m^3

The construction and excavation of the project will take place in the 2030s. During the construction period, excavated rock material will be used in other infrastructure projects in the nearby area that are ongoing at the same time, if possible. Transporting the rock material out of the construction site is the responsibility of the contractor. The contractor transports the rock material either directly to the intended reuse site or to a landfill area with the appropriate permits. Any crushing of the rock material near the access tunnels will be planned in the later phases of the project.

It may also be necessary to store the rock material in a temporary storage. The needs for temporary storage of crushed rock material, as well as possible locations, will be clarified as

Copyright © Helen Nuclear Ltd

the technical planning progresses. For the purpose of the impact assessment, a study is carried out on the utilization and temporary storage of rock material, which identifies potential end use sites and available landfill areas subject to a permit (see chapter 21.2.1).

3.10 Water demand and supply

3.10.1 Service water demand and supply

The need for fresh service water during construction of the nuclear power plant is estimated to be 400–500 m^3/d, depending on the construction phase of the plant and the number of employees on site. During the operation of the CHP plant, the need for service water is estimated to be 300–400 m^3/d. Less water is needed in the heating plant, and the amount is estimated to be less than 100 m^3/d.

Most of the service water of the CHP plant, about 250–320 m^3/d, is used for the production of process water required by the plant. Process water is prepared by removing all salts from it with ion exchangers and/or reverse osmosis filters.

The above process water needs are for a plant with direct seawater cooling. If the plant uses air cooling, i.e. some type of cooling towers, the required process water demand multiplies depending on the air cooling solution chosen.

Fresh service water is primarily obtained from HSY's network.

3.10.2 Cooling water demand and supply

In a CHP plant, about 25 m^3/s of cooling water is required. Sea water is used as cooling water.

Part of the cooling need can be covered by air cooling, for example, by using cooling towers. The use of air cooling reduces the need for sea water for cooling.

Heating plants do not need cooling water.

3.11 Loading on the water system

3.11.1 Construction site waters

During construction, blasting, excavation and rock crushing works are carried out in the area. These works generate wastewater containing solids and possibly oil and nitrogen compounds. Wastewater is treated appropriately and monitored in terms of quantity and quality.

During construction, site waters mainly consist of surface runoff from the site, dewatering from excavations, and waters produced by rock excavation. Suspended matter is washed into site waters during earthworks. Soil replacement and groundworks can also cause elevated electrical conductivity in site water. In exceptional situations, the water generated on the site may also become contaminated with oil from broken equipment. The discharge routes and arrangements for site waters are agreed with the authorities, and the stormwater systems are implemented before commencing actual construction work. Stormwater during blasting, possible crushing of excavated rock material and temporary storage may contain elevated nitrogen concentrations due to explosive residues in the rock material.

Construction site water is treated using qualitative management methods before being discharged into the environment. If necessary, preparations are made to direct the most heavily loaded runoff from the construction site (e.g. nutrients, pH level, oil residues from work

Copyright © Helen Nuclear Ltd

machinery) into the wastewater sewer. Site water management will be specified at a preliminary level during the EIA reporting phase. The qualitative and quantitative management and treatment of construction site waters will be planned in more detail in the later implementation planning phases of the project and will be dealt with in connection with the project's permit process in accordance with the Building Act. Stormwater can also be used for dust control during rock material crushing, which increases evaporation and reduces the amount of stormwater to some extent.

Preparations for flooding situations that may be caused by heavy rains during construction are made by designing the sites in accordance with the minimum planning requirements that take climate change into account (Hulevesirakenteet [Stormwater structures] RT 103006; Hulevesien hallinta [Stormwater management] RT 89-11196; Rakennustyömaan hulevesien hallinta [Stormwater management at construction sites], RTS 16:23 instruction; RT 103169, Ilmasto. Perustietoa suunnittelijalle [Climate. Basic information for a planner] and RT 103170, Ilmastonmuutos. Hillintä ja sopeutuminen rakennetussa ympäristössä [Climate change. Mitigation and adaptation in a developed environment]). The management and treatment (both qualitative and quantitative) of stormwater causing turbidity during construction will be planned in more detail in the later design phases of the project.

3.11.2 Cooling water

The CHP plant uses seawater for cooling. Part of the heat produced at the nuclear power plant is directed to the district heating network and part of the heat is released into the sea with cooling water. At certain moments, it is possible that the CHP plant will only produce electricity, and all the heat will be discharged into the sea. Such situations can arise especially in summer, when the district heating network is not able to receive the heat produced at the plant due to low heat demand, and at the same time there is a need for electricity.

According to the information currently available, cooling water at the nuclear power plant heats up to about 10–12 degrees. The heat discharge of cooling water to the sea is at its highest at about 1,000 MW. The estimated theoretical annual heat discharge is at its highest at approximately 22,000 TJ, assuming that the plant runs at full capacity throughout the year, so that the amount of district heat produced varies according to the heat demand of the district heating network and electricity is produced continuously at maximum capacity. The heat discharge to the sea varies according to the seasons and the need for district heat. The heat discharge is at its highest in summer when there is no need for district heat. The heat discharge is at its lowest in winter, when a large part of the heat is directed to the district heating network.

3.11.3 Conventional wastewater

Wastewater generated during operation consists of domestic wastewater and process wastewater. Domestic wastewater is discharged to HSY's treatment plant. Process wastewater includes various washing waters and wastewater from the production and use of process water. Wastewater is appropriately treated with different purification methods before it is discharged into the sea or sewage network.

Wastewater is generated in the CHP plant during operation at about 250–350 m^3/d, of which about one fifth is domestic wastewater, the rest is process wastewater. In the heating plant, the amount of wastewater is lower, estimated to be less than 100 m^3/d.

Copyright © Helen Nuclear Ltd

3.11.4 Stormwater and firefighting wastewater

Stormwaters from the plant area are led to the sea or the municipal stormwater system through the necessary solid separation and oil separation wells. Clean stormwater generated on the plant area is discharged into the environment. If necessary, the discharge flow of stormwater is regulated by detaining it. Stormwater management will be specified further as planning progresses.

At the plant, preparations are made for the collection and on-site retention of potential firefighting wastewater generated during accident situations. Firefighting wastewater is collected primarily through the stormwater system and by directing it over surfaces. Firefighting water is prevented from entering the environment. The stormwater systems are equipped with a shut-off system, and in the event of an accident, the water is retained in a separate reservoir or pool. The firefighting water collection system is dimensioned on the basis of fire scenarios, taking into account heavy rain situations. The drainage of potentially radioactive firefighting water is planned separately from the treatment of other firefighting water. The preliminary technical description of firefighting wastewater collection will be clarified as the planning progresses.

3.12 Conventional emissions to air

During the test run of the diesel generators used as a backup power source for the CHP plant and the heating plant, some emissions of carbon dioxide, nitrogen oxide, sulphur dioxide and particulate matter are generated. During operation, traffic and transport cause exhaust emissions.

During construction, air emissions arise from exhaust gases of heavy vehicles transporting rock material and soil, as well as from possible dust generated during construction. In addition, drilling and blasting excavation produces locally exhaust gases and dust from the machines.

3.13 Radioactive releases

3.13.1 Releases into the air and water

Minor amounts of radioactive substances are released from the nuclear power plant in a controlled manner, including ventilation and exhaust water, into air and water. During normal operation, small amounts of radioactive substances, such as inert gases (xenon and krypton), gaseous activation products (carbon-14), halogens (iodines) and radioactive substances in aerosol form, are released from the nuclear power plant in a controlled manner into the air and water.

Water and gases containing radioactive substances are purified and delayed so that their radiation levels are low. Purified gases are released through the power plant’s ventilation stack, and purified waters are discharged into the sea along with the cooling water or sewage network. Activity and releases are monitored through measurements and sampling. The activity limits of radioactive waters discharged into the sewage network will be planned and indicated during the licence process of the plant, also taking into account exceptional situations.

Releases are measured to ensure that they are below the set emission limits. The impact of releases in the environment is very small compared to the impact of radioactive substances that are normally present in nature.

Copyright © Helen Nuclear Ltd

Helen's nuclear power plant is designed so that its releases and radiation doses caused by releases are below all the limits set for radioactive releases. The limit values for radiation doses to the public arising from the operation of a nuclear power plant are defined in the Nuclear Energy Decree (161/1988, Section 22b). The limit on the annual dose received by an individual of the population from the normal operation of a nuclear power plant is 0.1 millisieverts (mSv). The radiation dose caused by Finland's operating nuclear power plants to the surrounding population has been less than one percent of the set annual dose limit (Radiation and Nuclear Safety Authority 2026a).

3.13.2 Treatment of radioactive waters

Radioactive waters (washing plant wastewater, laboratory wastewater, decontamination wastewater, etc.) are purified at the plant's liquid waste treatment plant. Decontamination refers to the cleaning of equipment, structures or rooms from radioactive substances. Purified wastewater is discharged either into the sea or into the sewage network.

Activity and releases are monitored through measurements and sampling.

3.13.3 Treatment of radioactive releases into the air

At the power plant, radioactive gases are collected in the purification system, where they are filtered and delayed to reduce activity. After cleaning, the gases are led through the ventilation stack to the atmosphere, where they mix and dilute.

3.13.4 Accident situation

In the design of nuclear power plants, preparations are made for all kinds of situations, including accidents. In the worst case scenario, the nuclear fuel will melt. Although such a severe reactor accident is highly unlikely, the plants are designed in such a way that no significant environmental impacts occur. Preventing accidents and limiting the consequences of possible accidents are key objectives in all nuclear energy use and plant design.

In the extremely unlikely event of a serious accident, the release of radioactivity into the environment is limited by various nested barriers and safety systems. The magnitude of the potential release is affected by how much radioactivity is released from the reactor core and how the release occurs from the plant.

In principle, releases are led in a controlled manner to the ventilation stack, the height of which is about 40–100 metres. In the highly unlikely event, the release can also occur directly from the reactor building, in which case the height of the reactor building (20–60 metres) can be assumed as the height of the release.

The dispersion of radioactive substances in an accident is modelled with a dispersion model (see chapter 23).

3.14 Traffic

3.14.1 During construction

During construction, heavy vehicle traffic is caused, among other things, by excavation in the planning area, the transport of rock material generated during tunnel excavations and the transport of landmasses. In addition, the transport of building materials and components causes heavy vehicle traffic.

Copyright © Helen Nuclear Ltd

The reactors of the heating plant (VE1, VE2a and VE3a) are placed either completely or partially underground, so excavation work is needed in the area. According to a preliminary estimate, the excavation volumes in Salmisaari and Vuosaari are approximately 230,000 solid m^3 (368 000 loose m^3), most of which must be transported away from the planning area for use in other infrastructure projects nearby or to an agreed disposal area. It is estimated that transporting this extraction volume will require at least 37,000 truck loads. The excavation volumes required for the Norrberget heating plant are greater, as the site will need to be levelled. A preliminary estimate of the excavation volume in the Norrberget planning area is approximately 400,000 solid m^3 (640 000 loose m^3), and the transportation of the rock material volume requires approximately 64,000 truck loads.

In the Vuosaari and Norrberget CHP plant options (VE2b and VE3b), cooling water tunnels are built from the planning area to the marine area off Vuosaari. According to a preliminary estimate, the excavation of the planning area for the Vuosaari CHP plant (VE2b) and cooling water tunnels could generate a maximum of approximately 1,020,000 solid m^3 (1 632 000 loose m^3) of rock material to be transported, which corresponds to an estimated 163,000 truck loads.

In the Norrberget options (VE3a and VE3b), the district heat transmission connection is either fully or partially built in a tunnel. The extraction of the planning area in the Norrberget heating plant (VE3a) and the district heat transmission connection as a whole could, according to preliminary estimates, generate up to about 790,000 solid m^3 (1 264 000 loose m^3) of rock material to be transported, which corresponds to an estimated 126,000 truck loads.

According to preliminary estimates, the excavation of the planning area for the Norrberget CHP plant (VE3b), the excavation of the district heating tunnel and the cooling water tunnels could generate a maximum of about 2,810,000 solid m^3 (4 496 000 loose m^3) of rock material to be transported, which corresponds to an estimated 450,000 truck loads.

If the foundations of the Vuosaari coal storage need to be completely removed before construction, this requires the transport of approximately 189,000 tonnes of masses. If the interim storage area for bottom ash is built, its foundations must be removed and the 50,000 tonnes of masses transported away. According to a preliminary estimate, this would result in approximately 15,000 truck loads of masses being transported.

In addition, the demolition of existing power plants in Salmisaari and Vuosaari will generate significant transport volumes when demolition waste is taken out of the area.

The number of workers peaks in the fourth year of the power plant’s construction, when there may be over a thousand employees.

In addition to commuting, the plant will receive approximately 30 heavy transports per day. For example, building materials, equipment and parts are transported by road.

Traffic volumes during construction are detailed in the EIA report, particularly concerning the transport of excavated rock.

3.14.2 During operation

During operation, the CHP plant is estimated to employ approximately 150–300 people. At the heating plant, the number of personnel is smaller, about 60–70 people. Approximately three quarters of employees are expected to arrive at the workplace by car. Based on this, the amount of commuting is estimated to be at most about 230 vehicles per day.

Copyright © Helen Nuclear Ltd

In addition, the plant receives maintenance and goods deliveries, which generate an estimated traffic volume of about 10 vehicles per day. The amount of goods and passenger traffic within the plant area is low in normal operating situations.

During annual maintenance, the number of personnel working at the plant temporarily increases by about 500, which briefly increases commuting traffic.

In the Vuosaari and Salmisaari areas, the volumes of heavy traffic are estimated to decrease significantly as the biofuel transports cease.

3.15 Noise and vibration

3.15.1 Noise and vibration during construction

The phase generating the most noise occurs in the first years of construction, when blasting, excavation work and rock crushing are carried out in cooling water and district heating tunnels and in the underground facilities of the reactor pit or heating plant. In addition, noise is caused by traffic from and to the construction site.

The excavation of the tunnel of the district heat transmission connection and the cooling water tunnels occasionally causes noise and vibration. Vibration can cause structure-borne noise impacts near the tunnels during drilling and blasting. The excavation is carried out in such a way that noise and vibration remain at an acceptable level. On the pipe sections to be dug into the ground, soil support and ground reinforcements cause noise and vibration. Excavation of tunnels under the sea may cause underwater noise.

3.15.2 Noise and vibration during operation

The most significant noise sources in the CHP plant area are the plant's large pumps, turbo-generator set, generator transformers, seawater pumping station, diesel engines and traffic to the plant area. Various equipment at the nuclear power plant causes vibration and structure-borne noise in the immediate vicinity of the equipment. If air cooling is used at the plant, it is a significant source of noise, as the cooling tower fans generate noise. In addition, noise is occasionally caused by blowdowns, tests and possible disturbances.

At the heating plant, the most significant sources of noise are large pumps and site traffic.

No operational noise or vibration is generated from the pipeline or tunnel of the district heat transmission connection. The ventilation of the tunnel causes noise in the vicinity of the air intakes and exhausts. Test running the tunnel's smoke extraction fans may cause intermittent noise. The building technology of the tunnel section, pumping stations, etc., causes noise in the interior of the tunnel. Minor noise and vibration may be caused by maintenance traffic.

With the commissioning of the nuclear power plant, combustion-based energy production will end in Vuosaari and Salmisaari and fuel transports will be significantly reduced. Thus, the noise caused by transports will also be reduced.

The nuclear power plant is designed and implemented in such a way that its noise level falls below any guideline noise values.

3.16 Use and storage of chemicals

Chemicals are used in the nuclear power plant, for example, to control reactor power and water chemistry, for cleaning and as fuel for emergency diesel generators. The chemicals used and

Copyright © Helen Nuclear Ltd

their quantities depend on the type of the plant and the information will be specified as the planning progresses.

Most of the chemicals are different acids and bases that are used in the nuclear power plant's process water production and to regulate the acidity and chemical reactions of the plant's water cycles. In addition, chemicals are used, among other things, to clean closed-cycle steam devices and pipelines and prevent corrosion. The chemicals most used are probably sodium hydroxide, sulfuric acid and boric acid, which are stored in containers. Less commonly used chemicals are stored either in small tanks or in various containers or vessels within facilities designed for chemical storage.

Oxygen is removed from the process water with a deoxidation chemical. Water treatment chemicals, such as ammonia water and sodium phosphate, are also needed to regulate the acidity and chemical reactions of the plant's water cycles.

In a pressurised water reactor, boric acid is used to regulate the reactor's power output.

Flammable liquids and gases are also used in the processes of the nuclear power plant. For example, hydrogen is used to cool the turbine plant generator of the CHP plant. Other flammable liquids and gases such as gaseous oxygen, acetone and acetylene are stored as needed.

Nitrogen gas is used to power certain equipment and can also be used to pressurise the primary circuit and emergency cooling water tanks.

Emergency diesel generators used as emergency power units are fuelled with light fuel oil, which would be stored in tanks in the area. In Vuosaari, it is possible to study the use of existing fuel tanks.

Air cooling requires water treatment chemicals to prevent corrosion and biological contamination (biofouling). Chemicals free of phosphorus, zinc or other heavy metals can be used as anti-corrosives. Sodium hypochlorite, for example, can be used to prevent biological contamination.

3.17 Energy efficiency of the plant

Helen Ltd is committed to continuous improvement of energy efficiency by joining the energy efficiency agreement between the business sector and the Ministry of Economic Affairs and Employment.

The nuclear power plant is designed to be as energy efficient as possible, with the objectives of the most efficient energy production and the lowest possible energy consumption in plant operations, as well as the lowest possible removal of waste heat from the CHP plant with cooling water into the sea.

Safety is the starting point for planning, and therefore solutions or efficiency measures that improve energy efficiency are considered on a case-by-case basis.

In the CHP plant, it is not possible to fully convert the heat produced by the reactor into electricity and district heat. Therefore, some of the heat generated is removed from the power plant by condensing it into seawater or into the air. The efficiency ratio of the CHP plant is about 65–75%, which is higher than that of current nuclear power plants. For example, the total efficiency ratio of Loviisa's power plant units is about 34%. A CHP plant differs from the nuclear power

Copyright © Helen Nuclear Ltd

plants currently in use in Finland in that part of the heat produced in the reactor is used for the production of district heat. In Finland's current nuclear power plants, heat that cannot be used for electricity production is discharged into the sea with cooling water.

The project also explores the use of air cooling as a way to reduce the thermal load transferred to the sea, especially in summer. Compared to seawater cooling, the use of air cooling reduces the energy efficiency of the plant, as it can significantly increase the self-consumption of electricity and reduce the production capacity of the plant. Therefore, seawater cooling is the project's primary cooling solution. Limited space in the planning areas can also affect the feasibility of air cooling solutions. This information will be specified as the planning progresses.

3.18 Decommissioning

The estimated operating life of the nuclear power plant is at least 60 years, after which the plant will be closed and dismantled, or decommissioned. Decommissioning ensures the safety of the plant environment after closure.

Decommissioning waste is waste accumulated during the closure and dismantling of the nuclear power plant. At the end of the operation of the nuclear power plant, radioactive substances remain in its structures, systems and equipment, and these substances originate either from the passage of radioactive contamination or from the activation of the materials of components in the vicinity of the nuclear reactor.

The objective of the decommissioning of the plant is to dismantle the radioactive systems, clean the nuclear power plant of all radioactivity and free the buildings and areas from regulatory control. However, some buildings may be left undemolished and, after cleaning, put to use for a new power plant or entirely different activities, for example.

There are methods for treating waste generated during decommissioning, but since the decommissioning of the nuclear power plant and the treatment of its waste are still several decades away, they will eventually be carried out using the best available technology at that time.

According to the Nuclear Energy Act, the licence-holder of the nuclear power plant is responsible for the planning and implementation of the decommissioning of the power plant. For the first time, the plant's decommissioning plan and the associated costs must be presented in the application for the construction licence for the nuclear power plant.

The decommissioning plan and cost estimate are specified in the operating licence application for the nuclear power plant, after which the plan must be updated every six years. The Radiation and Nuclear Safety Authority (STUK) must approve the plan and its amendments. The purpose of the plan is to ensure that the radioactive parts to be dismantled do not pose a danger to the environment.

For example, the so-called delayed dismantling strategy can be applied in decommissioning. Delayed dismantling uses the half-life of radionuclides over time, making dismantling easier as the radiation level decreases. Thus, the entire decommissioning phase can take tens of years.

Even during decommissioning, low and intermediate level waste is generated, which have the same properties as waste generated during operation. The same principles as for low and intermediate level power plant waste can be applied to their classification, treatment and packaging. Where possible, decommissioning waste is decontaminated from radioactive substances in order to be exempted from control and treated like conventional waste. The amount

Copyright © Helen Nuclear Ltd

of decommissioning waste from the nuclear power plant is estimated to be approximately 6,000 m^3.

In due course, a separate EIA procedure will be implemented for the decommissioning of the nuclear power plant.

Copyright © Helen Nuclear Ltd

4 NUCLEAR AND RADIATION SAFETY

4.1 Nuclear energy legislation and regulatory control

In Finland, the use of nuclear energy must be safe under the Nuclear Energy Act (990/1987) and must not pose a risk to people, the environment or property. The nuclear safety requirements applicable to a nuclear facility are based on the Nuclear Energy Act (990/1987) and the Nuclear Energy Decree (161/1988), supplemented by the regulations issued by the Radiation and Nuclear Safety Authority (STUK) and by the detailed requirements set out in the Regulatory Guides on nuclear safety (YVL Guides) and Regulatory Guides on preparedness (VAL Guides). The Radiation Act (859/2018) and the Government Decree on Ionizing Radiation (1034/2018) lay down requirements for radiation safety. In addition to STUK's regulations and YVL Guides, requirements and limit values are set in the plant's operational limits and conditions (OLC), which STUK approves. STUK monitors the safe use of nuclear power.

The comprehensive reform of the Nuclear Energy Act is currently underway in the Ministry of Economic Affairs and Employment. The goal for the entry into force of the new Nuclear Energy Act being discussed in Parliament is in 2027. In addition to the comprehensive reform of the Nuclear Energy Act, STUK's regulatory reform is also underway. The new regulations will enter into force following the new Nuclear Energy Act. The objective of the comprehensive reform of the Nuclear Energy Act is, among other things, to promote the introduction of new nuclear energy solutions (e.g. SMRs) and the placement of facilities close to points of consumption. It is also intended to improve the investment environment for nuclear installations by reforming the licencing system, reducing regulatory project risks and enhancing predictability. The aim is to take into account the different types of operating and cooperation models, the diversity of SMR plants and other nuclear facilities, as well as the proportionality of the requirements at the different phases of the projects and the licencing system.

4.2 Nuclear safety

Nuclear power plants are designed, implemented and maintained according to strict quality standards to ensure that operational incidents are rare. However, in case of operational incidents and accidents, the plant will be equipped with effective safety systems that will be able to handle the situations in such a way that there will be no consequences for the environment. The safety systems include parallel subsystems which operate independently of each other. This prevents a single fault from stopping the system from operating. In addition, the plant has systems that operate on different principles but share the same function, ensuring that if several subsystems fail for the same reason, another system with a different operating principle can still perform the task. Furthermore, the subsystems are physically separated from each other so that they are not exposed to a common hazard, such as a fire.

The plant and safety systems are protected and scaled for very abnormal situations, such as a direct collision of a large commercial aircraft, earthquakes and extreme flooding (see chapter 4.6). These scaling principles ensure that the plant is able to operate even in challenging conditions.

Safety solutions primarily rely on inherent safety features. For example, the reactor core is designed so that the reactor power naturally decreases if the temperature rises. If a leak of cooling water occurs in the reactor, the reactor will naturally shut down as the chain reaction stops. In addition, the cooling of all reactor options of the nuclear power plants examined in the project is based on passive safety systems. Passive safety systems are based on gravity,

Copyright © Helen Nuclear Ltd

pressure differences and natural circulation, and therefore do not require power supply or user intervention for their operation. Plants must be able to cool the reactor for several days without external power supply or other supplementary material.

The safety of nuclear power plants is based on compliance with the safety principle of defence-in-depth. Several independent levels of protection are applied simultaneously in the design and operation of the plant. For example, the release of radioactivity from the fuel into the environment is prevented by several nested technical barriers. These technical barriers include a ceramic fuel pellet, metal cladding of the fuel rods, and a cooling circuit that can withstand the pressure of the reactor. The outer barrier is a gas-tight containment around the reactor. Each of these barriers alone must be sufficient to prevent the release of radioactive substances into the environment.

The design of the nuclear power plant also prepares for the worst possible accident, which in a light water reactor is the meltdown of the reactor core. Although such a severe reactor accident is very unlikely, plants must be designed to withstand the effects of a severe reactor accident in such a way that no significant environmental impacts occur.

The reliability and safety of the plant's operation is also maintained through continuous training of staff and an excellent safety culture. In addition, the nuclear power plants in operation and their operating organisations are continuously developed in terms of safety and reliability of operation, taking into account operating experience, the results of safety studies and scientific and technical progress.

4.3 Radiation and its monitoring

In a nuclear power plant, radioactive substances are generated as fission products when the atomic nuclei of the fuel split, through neutron activation in or near the reactor, and as products of the radioactive decay of the substances described above.

Systems containing radioactive substances are located within the controlled area, where specific safety instructions are followed to ensure protection against radiation. In the design of a nuclear power plant, the ALARA (As Low As Reasonably Achievable) principle is applied, meaning that all radiation exposures are kept as low as possible through practical measures, taking economic and societal factors into account.

Before a nuclear power plant is commissioned, a baseline environmental survey will be carried out within the plant area and its surroundings to determine the prevailing radiation conditions prior to the start of operation. During operation, radiation and releases of radioactive substances are monitored in accordance with the radiation monitoring programme approved by STUK.

The limit values for radiation doses to the public arising from the operation of a nuclear power plant are defined in the Nuclear Energy Decree (161/1988, Section 22b). The limit on the annual dose received by an individual of the population from the normal operation of a nuclear power plant is 0.1 millisieverts, which is less than 2% of the average annual radiation dose (5.9 mSv) of Finns. The majority of the annual radiation dose to Finns is caused by indoor radon (4 mSv). (Radiation and Nuclear Safety Authority 2026b)

Radiation from soil and building materials causes an annual dose of about 0.5 mSv. In addition, natural background radiation includes radiation from space, which causes a radiation dose of about 0.33 mSv annually. Radiation dose from the soil varies by location between

Copyright © Helen Nuclear Ltd

0.17–1 mSv/yr. External radiation is highest in the rapakivi granite area of southeastern Finland. (Radiation and Nuclear Safety Authority 2026c)

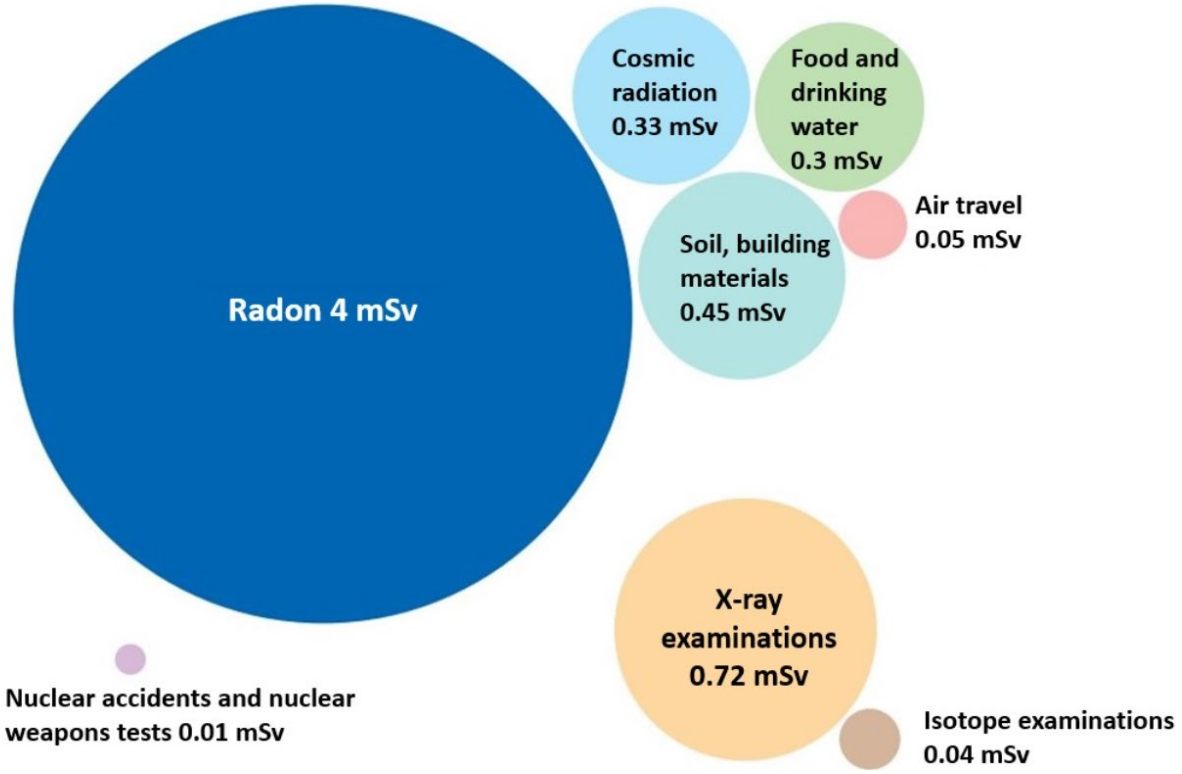


Figure 4-1. Sources of an average annual radiation dose of 5.9 millisieverts received by a Finn. Source: Radiation and Nuclear Safety Authority 2026b

For events deviating from the normal operation of a nuclear power plant, the Nuclear Energy Decree (161/1988, Section 22b) defines the limit values for radiation doses to the public as follows:

- Anticipated operational occurrences – 0.1 mSv
    - The expected occurrence of the incident is one or more times over a period of 100 years of operation
- Class 1 anticipated accidents – 1 mSv
    - The expected occurrence of the incident is less than one time over a period of 100 years of operation, but at least one time over a period of 1,000 years of operation
- Class 2 anticipated accidents – 5 mSv
    - The expected occurrence of the incident is less than one time over a period of 1,000 years of operation
- Extension of an anticipated accident – 20 mSv
    - An anticipated operational occurrence or a Class 1 anticipated accident is accompanied by a common cause failure in the system required to perform the safety function, or

Copyright © Helen Nuclear Ltd

- A combination of defects identified as significant based on probabilistic risk analysis, or
- A rare external event that the plant is required to withstand without severe fuel damage.

4.4 Emergency preparedness

The purpose of emergency arrangements is to prepare for a highly unlikely accident situation in which it is necessary to take measures to protect the population around the nuclear power plant. As the last level, emergency preparedness is part of the defence-in-depth principle, which aims to mitigate the consequences of the release of radioactive substances.

Emergency preparedness planning is carried out in accordance with the requirements set by the current Nuclear Energy Act and STUK's regulations. In addition, STUK's instructions related to emergency preparedness are taken into account.

4.5 Precautionary action zone and emergency planning zone

In 2024, STUK published an updated regulation on the emergency arrangements of a nuclear power plant (Y/2/2024), in which the determination of the precautionary action zone and emergency planning zone was changed from fixed kilometre boundaries to a case-by-case assessment. This enables new nuclear projects to be zoned closer to the point of use in the same manner as in district heat production.

The precautionary action zone refers to the area around the nuclear power plant where, in the event of an accident, it must be possible to carry out the necessary evacuation measures effectively in order to prevent or limit serious direct adverse effects on the population, which is why the area is subject to land use restrictions. The precautionary action zone is determined so that the radiation dose to an unprotected person outside it does not exceed 1 Sv within 10 hours from the start of exposure. The precautionary action zone is part of the emergency planning zone.

Operations that do not complicate rescue measures or the protection of the population may be located in the precautionary action zone. Thus, the precautionary action zone may include, for example, residential buildings, ordinary business activities, recreational and natural sites, as well as agricultural and forestry areas. The precautionary action zone should not include sites that are difficult to evacuate, such as densely populated areas or so-called sensitive sites (hospitals, nursing homes). For example, the precautionary action zone of the Loviisa nuclear power plant has permanent housing and especially holiday homes.

The emergency planning zone refers to the area where, in the event of an accident, it may be necessary to implement urgent protective measures (such as sheltering) directed at the population in order to limit the occasional adverse effects of ionising radiation, and an external rescue plan in accordance with the Rescue Act must be drawn up for the area by the authority. In the event of an accident, it is highly likely that sheltering of the people located outside the emergency planning zone will not be necessary. The emergency planning zone is defined so that the radiation dose to an unprotected person outside it does not exceed 10 mSv within 48 hours of the start of exposure. In addition, the emergency planning zone extends up to about 20 kilometres from the power plant. There are no restrictions on land use in the emergency planning zone.

Copyright © Helen Nuclear Ltd

The licence applicant must demonstrate through analyses that even a highly unlikely severe accident does not cause the need for large-scale evacuations or permanent land use restrictions in the plant environment. Based on the analyses, the licence applicant makes a proposal on the extent of the necessary preparedness arrangements, including the size of the emergency planning zone. STUK reviews and evaluates the safety analyses and reports provided by the licence applicant and issues its own safety assessment regarding the plant's safety and the adequacy of the preparedness arrangements.

Determination of the precautionary action zone and the emergency planning zone of Helen's nuclear power plant is currently underway. According to the current estimate, the radius of the precautionary action zone of the CHP plant is estimated to be 500–1,000 metres, measured from theoretical emission points, such as the ventilation stack or reactor building. The radius of the emergency planning zone is estimated to be less than 5 kilometres. The radius of the precautionary action zone of the heating plant is estimated to be less than 200 metres, measured from theoretical emission points, such as the ventilation stack or reactor building. When the calculations are refined, it is possible that the dose limit used for defining the precautionary action zone is, however, only estimated to be exceeded at the plant site, and it is also possible that the radiation dose limit is not exceeded at all. The radius of the emergency planning zone is estimated to be less than 800 metres.

The size of the precautionary action zone depends, among other things, on the reactor's safety characteristics and the amount and composition of radioactive substances in the reactor. These depend quite directly on the amount of fuel and how long the fuel has been used in the reactor. The final delimitation of the precautionary action zone can also be affected by the location and environment of the plant. More detailed definitions of the precautionary action zone and the emergency planning zone are presented at the EIA reporting phase. The EIA report presents preliminary precautionary action zones and emergency planning zones for each plant site option. The extent of the precautionary action zone is defined in the nuclear power plant's construction licence in accordance with the Nuclear Energy Act.

4.6 Security arrangements and preparing for external threats

The nuclear power plant is designed to withstand the loads caused by various external threats. These include extreme weather conditions, sea and ice phenomena, earthquakes, various flying objects, explosions, fires, flammable and toxic gases, and intentional damage.

The design of the nuclear power plant takes into account weather-related phenomena such as low and high temperatures, rain and snowfall, snow load, strong winds, whirlwinds, downbursts, air humidity and lightning. With regard to extreme natural phenomena, the design values of safety systems are selected in accordance with official regulations so that they are estimated to be exceeded less often than once every 100,000 years. Even rarer conditions have been prepared for so that the most important safety functions can also be implemented if the design values are exceeded.

The design accounts for both low and high sea levels. The plant is designed so that it is not endangered even in very exceptional flood situations.

The design of the cooling systems for the CHP plant takes into account factors that may affect seawater intake, including oil spills in the marine area, formation of ice ridges, slush ice (ice crystals formed in supercooled water), high seawater temperatures, and abundant algae deposits and fish stocks. Different impurities are removed from seawater with the help of valves

Copyright © Helen Nuclear Ltd

and filters. Despite these design solutions, preparations are also being made for a situation where seawater cooling is completely lost.

In the design of the plant, possible power supply interruptions are taken into account, for example, in connection with various extreme natural phenomena. Passive systems ensure the safety of the plant even in possible power loss situations.

Other issues to take into account in the planning are the possible effects of climate change, such as the increase in extreme phenomena, the warming of seawater and the rise in the average seawater level.

The nuclear power plant is also designed to withstand earthquakes, although Finland is located within the interior of the Eurasian tectonic plate, making strong earthquakes extremely rare and unlikely.

Various crisis and exceptional situations, as well as cyber threats, are prepared for already at the planning and development stage of operations. Safety is taken into account comprehensively in technical solutions, operating models and the organisation’s readiness. The nuclear power plant will be built in such a way that it can withstand, among other things, a collision of a large commercial aircraft without significant releases to the environment.

The nuclear power plant and the nuclear materials used are protected against illegal activities such as vandalism and sabotage. Threats arising from terrorism, cyber threats, other illegal activities or societal emergencies and crises are prepared for with thorough and continuous security arrangements. They complement the protection provided by the robust structure and the protection of sensitive parts required by the basic safety design of the plant. The current global situation in terms of safety requires both power companies and authorities to continuously develop their operation in possible crisis conditions.

Copyright © Helen Nuclear Ltd

5 PERMITS, PLANS AND DECISIONS REQUIRED FOR THE PROJECT

5.1 General

Once the environmental impact assessment procedure has been completed, the project proceeds to the permit phase. The EIA report and the reasoned conclusion issued by the competent authority are attached to the project-specific permit applications. The following chapters briefly describe what procedures, licences, permits and decisions may be required to implement the project.

5.2 Environmental impact assessment

The need and phases of the EIA procedure are described in chapter 6.

The EIA procedure of the project includes the preparation of the EIA programme and the EIA report. The EIA report and the reasoned conclusion issued by the competent authority (in this project, the Ministry of Economic Affairs and Employment) are a prerequisite for obtaining permits for the project.

5.3 International consultation procedure

This project is subject to the Espoo Convention on Environmental Impact Assessment in a Transboundary Context (see chapter 26 and Appendix 1). The application of the Espoo Convention is recorded in Chapter 5, Sections 28 and 29 of the EIA Act.

The assessment of environmental impacts in a transboundary context is governed by the Espoo Convention (*Convention on Environmental Impact Assessment in a Transboundary Context*). Finland ratified this United Nations Economic Commission for Europe convention in 1995. The Espoo Convention entered into force in 1997. In Finland, the obligations of the Espoo Convention have been implemented through the Environmental Impact Assessment Act and the Decree on the entry into force of the Convention on Environmental Impact Assessment in a Transboundary Context (SopS 67/1997). Internationally, public participation and rights of appeal are regulated in the Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (SopS 121–122/2004, the Aarhus Convention). The Aarhus Convention aims, among other objectives, to enable the public to participate in decision-making in environmental matters. The Aarhus Convention has been implemented in the EU through a number of directives, including the EIA Directive.

The parties to the Espoo Convention have the right to participate in an environmental impact assessment procedure carried out in another country if the harmful and likely significant environmental impacts of the project under assessment may affect their country (“the affected party”). The international consultation procedure is necessary if a proposed project listed in Annex 1 to the Espoo Convention is likely to have significant adverse transboundary effects. This list of projects includes nuclear power plants and other nuclear reactors. Accordingly, the transboundary environmental impact assessment procedure under the Espoo Convention is applied to nuclear power plant projects.

The Point of Contact of the party (country) of origin notifies the Points of Contact of those parties (countries) considered likely to be affected by the project of the commencement of the EIA procedure and offers them the opportunity to participate in the procedure. If the affected party (country) decides to participate in the assessment procedure, it will make the project

Copyright © Helen Nuclear Ltd

documentation provided by the party (country) of origin publicly available in the affected country for comments and opinions from its authorities and the public. The Point of Contact of the affected Party (country) compiles the comments and opinions received and then submits them to the Point of Contact of the Party (country) of origin. The Point of Contact of the Party (country) of origin submits the comments and opinions received to the competent authority for consideration in its own statement.

In the transboundary consultation procedure under the Espoo Convention, the competent authority for Finland (Party of origin) is the Finnish Environment Institute (Syke). The Finnish Point of Contact (Syke) submits the comments and opinions received from the affected parties to the national EIA authority, which takes the comments and opinions/feedback into account in its own statement.

Possible transboundary impacts are described in more detail in Appendix 1 to the EIA programme.

5.4 Decisions and licences under the Nuclear Energy Act

In Finland, the use of nuclear energy is based on the Nuclear Energy Act (990/1987) and the Nuclear Energy Decree (161/1988). In addition to the Nuclear Energy Act and Decree, the licences and their information requirements presented in this chapter are also based on the Regulatory oversight of safety in the use of nuclear energy (YVL A.1) and the information published by the Ministry of Economic Affairs and Employment (MEAE) and the Radiation and Nuclear Safety Authority (STUK). Currently, a comprehensive reform of nuclear energy legislation is underway, and as a result, changes in licence procedures are expected in the future, which will also be taken into account in this project.

The current licence and decision-making process related to the use of nuclear energy is briefly described in chapters 5.4.1–5.4.4 and in the following figure (Figure 5-1).

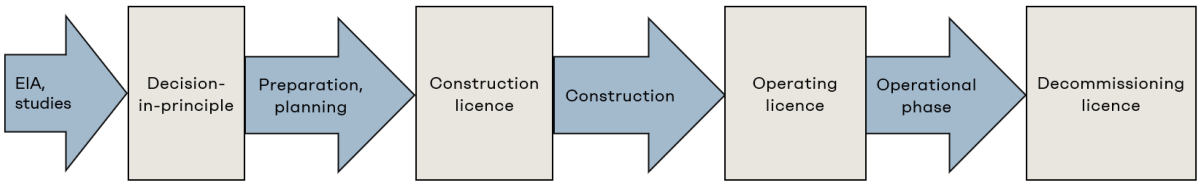


Figure 5-1. The current licence process related to the use of nuclear energy in Finland. The figure shows the different phases of the licence process as well as the phases to be completed between them.

5.4.1 Decision in principle

According to the Nuclear Energy Act, the construction of a nuclear facility requires a Government decision in principle that the construction of the nuclear facility is in line with the overall interest of society. When making a decision in principle, the Government pays particular attention to the following factors:

- the need for the nuclear facility project in relation to the country's energy supply;
- the suitability of the intended location of the nuclear facility and its effects on the nuclear facility and on the environment;
- arrangements for nuclear fuel and waste.

The decision in principle requires the approval of the Parliament.

Copyright © Helen Nuclear Ltd

At the application phase for the decision in principle, STUK will conduct a preliminary safety assessment of the project, and will provide its views on the prerequisites for the construction of the nuclear facility in its statement. In its safety assessment, STUK states whether the prerequisites for the construction of the nuclear facility are met as required by the Nuclear Energy Act. In this phase, the technology and safety of the future nuclear facility are not yet being assessed on a detailed level.

The decision in principle also requires a statement from the Ministry of the Environment and the municipality where the plant will be located, as well as from neighbouring municipalities. Support from the host municipality is a prerequisite for the decision in principle.

Alternatives for the plant supplier and the technology to be used may be proposed in the application for the decision in principle, and different location options may also be suggested for the plant.

The documents and information to be submitted to STUK in connection with the application phase of the decision in principle are specified in Guide YVL.A1 (Regulatory oversight of safety in the use of nuclear energy). Other more specific requirements are presented in the YVL for different topics.

The information submitted to STUK at the application phase of the decision in principle must provide sufficient grounds for STUK to prepare a preliminary safety assessment for the nuclear facility project.

An environmental impact assessment (EIA) in accordance with environmental legislation must be carried out for new nuclear facility projects before applying for the decision in principle.

With the comprehensive reform of the Nuclear Energy Act, the procedure related to the decision in principle is changing.

5.4.2 Construction licence

Under the Nuclear Energy Act, a construction licence for a nuclear facility is applied for by submitting a written application to the Government. STUK issues a statement on the construction licence application and carries out a safety assessment. The safety assessment includes a statement on the fulfilment of the requirements that fall within STUK’s area of responsibility. The documents and information to be submitted to STUK in connection with the construction licence application are specified in Guide YVL.A1 (Regulatory oversight of safety in the use of nuclear energy). Other more specific requirements are presented in the YVL for different topics.

As part of processing the application for a construction licence for a nuclear facility, STUK also carries out inspections and assessments related to the activities of the licence applicant, the plant supplier and all organisations participating in the project, whose work is considered to have a significant impact on safety. Audits and evaluations focus on the management systems of the organisation concerned, in particular the operation of the organisation and resource management, competence management, quality management procedures, management of deviations and the security of information systems.

With the comprehensive reform of the Nuclear Energy Act, the procedure related to the construction licence is changing.

Copyright © Helen Nuclear Ltd

5.4.3 Operating licence

Once the nuclear facility has been completed, an operating licence in accordance with the Nuclear Energy Act must be applied for. The operating licence is granted for a fixed period of time. The operating licence for a nuclear facility is applied for from the Government by means of a written application.

YVL A.1 contains more detailed information about the documents to be submitted to STUK in connection with the operating licence application.

5.4.4 Decommissioning licence

As the end of the operating life of the nuclear facility approaches, the operating licence holder must initiate measures for the decommissioning of the facility and apply for a licence for it. The licence must be applied for early enough to allow the authorities time to assess the application before the nuclear facility's operating licence expires.

5.4.5 Other permits

The operation of a nuclear power plant may also require other permits in accordance with the Nuclear Energy Act, which STUK issues upon application. Such permits include, for example, those related to the possession, manufacture, production, transfer, handling, use, storage, transport and import of nuclear materials and nuclear waste, as provided for in the Nuclear Energy Decree 161/1988.

The project may possibly also require an application for an export licence for dual-use products from the Ministry for Foreign Affairs.

The Nuclear Energy Act also requires that the applicant has control of the area required for the use of nuclear energy.

5.5 Permits required for the transport of radioactive substances

The Act on the Transport of Dangerous Goods (541/2023), the Nuclear Energy Act (990/1987) and the Radiation Act (859/2018) regulate the transport of radioactive waste. An approval in accordance with the Nuclear Energy Act is required for the transport of nuclear fuel and nuclear waste. The permit authority is STUK.

5.6 Permits under the Radiation Act

In accordance with the Radiation Act (859/2018), radiation operations other than the use of nuclear energy require a safety authorisation issued by STUK. This may apply, for example, to radiation sources and X-ray equipment used in radiochemical analyses carried out in the plant's laboratory, in the inspection of materials and structures, and in the calibration of equipment.

5.7 Building Act and Land Use Act

5.7.1 Local detailed plan required for the project

An SMR is, in principle, a matter at a more detailed planning level than the regional plan. Uusimaa is currently working on an innovative green transition phased regional plan, where one of the themes to be addressed is nuclear power. The construction of a nuclear power plant requires at least master planning and a local detailed plan based on it. The master planning is intended to begin after the consultation on the EIA programme phase, and local detailed

Copyright © Helen Nuclear Ltd

planning will then be prepared for a single area once the plant site has been selected. The City of Helsinki is responsible for the planning process within its area, and the City of Vantaa is responsible for planning within its area where necessary. Regional planning is the responsibility of the Helsinki–Uusimaa Regional Council.

The connections and related structures required by the project may require land use planning. Land use planning needs will become clear as planning progresses.

Helen has submitted a land use planning initiative to the City of Helsinki in early 2026 to launch the necessary land use planning required for nuclear power.

5.7.2 Building permit

According to the Building Act (RakL 751/2023), a building permit is required, among other things, for the buildings of the nuclear power plant, as well as for the above-ground buildings of the district heat transmission connection tunnel and cooling water tunnel (vertical shaft buildings, tunnel entrance building). The building permit is applied for from the municipal (Helsinki in this case) building supervision authority.

5.8 Environmental permit

The operation of a nuclear power plant requires an environmental permit under the Environmental Protection Act (527/2014) (Annex 1, Activities subject to a permit, Table 2, Other installations, point 3, Energy production, b) nuclear power plants).

In addition, emergency diesel generators at a nuclear power plant may also require an environmental permit, with the permit requirement based on their total fuel power. If the fuel power is 50 MW or more, the operation requires an environmental permit (Annex 1, Activities subject to a permit, Table 1, Installations covered by the directive, point 3 Energy production, a) Combustion of fuels in plants with a thermal input of 50 megawatts or more; in the determination of the thermal input of a combustion plant, all energy production units located on the site shall be included in the calculation).

The permit authority is the Finnish Supervisory Agency.

During the construction phase of the project, an environmental permit is likely to be required for the following activities:

- Excavating and crushing of rock material: According to Annex 1, Table 2, Section 7c of the Environmental Protection Act 527/2014, if the excavated rock material is crushed in the same area for at least 50 days, the crushing operation requires an environmental permit. The permit is usually applied for from the municipal environmental protection authority. If the crushing lasts less than 50 days, this can be done with a notification in accordance with Section 118 of the Environmental Protection Act (temporary activity causing noise and vibration).
- Noise and vibration: According to Section 118 of the Environmental Protection Act 527/2014, the operator must submit a written notification (so-called noise notification) to the municipal environmental protection authority for temporary activities that cause noise and vibration (e.g. excavation work in the construction phase).
- Concrete batching plant: It is possible that a fixed concrete station is needed during the construction of the project. A fixed concrete batching plant is an installation located permanently, or for at least two months, at a particular site. Fixed concrete

Copyright © Helen Nuclear Ltd

manufacturing plants and concrete products plants are activities to be registered in accordance with Annex 2, Section 8 of the Environmental Protection Act. A registration notification of the operation must be submitted to the municipal environmental protection authority. The concrete plant and the concrete products plant to be registered must meet the requirements of the Government Decree (858/2018). A new concrete plant may require an application for a building permit.

- Soil placement: If the soil resulting from construction activities is placed in a landfill area, it requires an environmental permit for a new landfill site or a change of permit for an existing landfill site. According to Environmental Protection Decree 713/2014, an environmental permit is required for a landfill designed for an annual waste volume of less than 50,000 tonnes (Section 2, item 12 a). The permit authority is the municipal environmental protection authority. If the amount of soil to be placed on a landfill exceeds 50,000 tonnes per year, the permit authority is the Finnish Supervisory Agency (Environmental Protection Decree, Section 1, items 13(e) and 13(f)). It should be noted that if the annual amount of soil to be deposited exceeds 50,000 tonnes, the EIA procedure must be carried out in the soil filling area (Act on the Environmental Impact Assessment Procedure 252/2017, Annex 1, Section 11, item b).
- Removal of the base structures of the coal storage and the bottom ash interim storage: In the Vuosaari project options VE2a and VE2b, the possible removal of the coal storage and bottom ash interim storage base structures (bottom ash, fly ash and the end product of desulphurisation) in the planning area and the possible use of the masses require a permit. Obligations related to ending operations in accordance with current environmental permits must be fulfilled. The use of the desulphurisation end product to be removed from the coal storage structure, as well as the mixture of fly ash and desulphurisation product in the earthworks site, requires an environmental permit in accordance with the Environmental Protection Act. Possibly also the use of bottom ash and fly ash may require an environmental permit.
- Environmental permit for site water management: Activities that may cause water pollution (e.g. a long-term construction site from which environmentally harmful site water is discharged into a stormwater drain or directly into the water system) require an environmental permit on the basis of Section 27(2), Subsection 1 of the Environmental Protection Act. During construction work, wastewaters are formed, which are intended to be discharged into the terrain/water system. The management, treatment, possible monitoring and emission limit values of the discharged waters are laid down in the environmental permit decision. The permit authority is the Finnish Supervisory Agency.

5.9 A permit under the Water Act

The Water Act (587/2011) provides for whether or not water resources management projects are subject to a permit or not. In addition, the Water Act protects certain types of aquatic habitats such as springs, small streams, small ponds and coastal formations (flads, gloe lakes). A water resources management project means an operation or the use of a structure on water or land areas that may affect surface water or groundwater, the aquatic environment, water management or the use of a water area. The operations described in Chapter 3 (Sections 2 and 3) of the Water Act require a water permit. The permit authority for permits under the Water Act is the Finnish Supervisory Agency.

A permit in accordance with the Water Act is always required for dredging when the quantity of dredged material exceeds 500 m^3. The extraction of water from the sea and its use as

Copyright © Helen Nuclear Ltd

cooling water also requires a permit in accordance with the Water Act. A permit under the Water Act is required for the installation of water, sewerage, power or other pipelines beneath a public waterway (Chapter 3, Section 3, Subsection 5 of the Water Act) or if the project endangers the preservation of the natural state of a stream channel (Chapter 3, Section 2, Subsection 8 of the Water Act). The installation of water, sewerage or power lines, telecommunications cables or other similarly affected lines beneath major waterways (e.g. rivers, narrows, straits) and streams must be reported to the Finnish Supervisory Agency. Under the Water Act, the party responsible for the project has the right to place the above-mentioned line or cable in another water area if its placement does not require a permit under Chapter 3, Section 2, is not regulated by the Environmental Protection Act and does not cause more than minor harm to the owner of the area. The Finnish Supervisory Agency will review the notification and assess whether a permit is required for each crossing. If the undercutting does not have the impacts provided for in Chapter 3, Section 2 of the Water Act and does not result in a loss of benefit to the public or private interest, the undercutting does not require a separate permit.

A water permit is also required for a project that may change the quality or quantity of groundwater, and this change causes a deterioration in the status of the groundwater body or substantially reduces the yield of an important or other groundwater body suitable for water supply or otherwise degrades its usefulness, or otherwise causes damage or inconvenience to water abstraction or the use of water for domestic purposes.

In this project, a water permit is required for the water construction works of the CHP plant (project options VE2b and VE3b) (cooling water intake and discharge structure) and the extraction of water from the sea. In addition, a water permit may be required for the dredging of the areas of the cooling water intake and discharge structures of the CHP plant, as well as for the disposal of dredged material at the marine dumping area. If the dredged material is not suitable for disposal at sea, it must be placed on an appropriate land area and handled properly in accordance with the Ministry of the Environment’s dredging and dumping guidelines (2015).

The construction of district heat and cooling water tunnels may require a water permit due to a decrease in the groundwater level. In connection with lines constructed as trenches, there may be a need to interfere with channels classified as water systems. If excavation of a channel classified as a water system is used as a working method, a water permit under the Water Act may be required. In addition, a permit in accordance with the Water Act is required if a channel (water system) is moved or taken into a pipe. The need for a permit is case-specific, for example, in the case of undercutting of streams, and an inquiry is made about the need for a permit to the Finnish Supervisory Agency, which is used to find out whether the permitting must be done using the notification procedure or the permit procedure. The need for a water permit for project option VE3a and VE3b for the construction of the district heat pipeline located in the underground trench of the district heat transmission connection KL2 and the underground cable options of the electricity transmission connection will be decided on a site-by-site basis by the Finnish Supervisory Agency after a notification made by the project operator.

5.10 Permits and documents in accordance with the Chemicals Act

Plants engaged in the large-scale industrial processing and storage of chemicals require a permit issued by Tukes. The extent of industrial processing and storage of chemicals is determined on the basis of the amount and hazard of chemicals stored at the plant. In smaller-scale operations, the processing of the chemical safety permit is the responsibility of the local fire

Copyright © Helen Nuclear Ltd

and rescue service. Conditions are set in the permit for the operation and a commissioning inspection is carried out at the plant after the permit has been issued.

The following laws and regulations may apply to the project:

- Act on the Safe Handling and Storage of Dangerous Chemicals and Explosives (390/2005, the so-called Chemical Safety Act)
- Government Decree on the Monitoring of the Handling and Storage of Dangerous Chemicals (685/2015)
- Government Decree on Safety Requirements for Industrial Handling and Storage of Dangerous Chemicals (856/2012)
- Chemicals Act (599/2013).

5.11 Permits and agreements required for connection to and building of district heating, water and sewerage network

Installation of district heating, water and sewer pipes in the ground generally requires permission from the property owner. The municipal building supervision authority is entitled to decide on the placement if the matter has not been agreed with the owner or holder of the property. When deciding on placement, attention must be paid to not causing significant inconvenience to the use of the property (Section 131 of the Building Act). The placement of a cable, pipe, power line or other similar structure on the road area of a public road requires a permit issued by the Economic Development Centre of Inland Finland.

The discharge of wastewater into the sewage network must be covered by an industrial wastewater agreement with HSY. The agreement defines the conditions for wastewater management and quality monitoring, and its purpose is to prevent damage caused by wastewater to the wastewater treatment plant, the quality of wastewater and sludge, and the environment.

5.12 Other permits and notifications

5.12.1 Special transport permit

Road transport requires a special transport permit if it exceeds the dimensional or mass limits allowed for normal traffic. A special transport permit is applied for either through the e-service or by sending an application for a permit (or a free-form application) to the Economic Development Centre of Inland Finland. During the construction phase of a nuclear power plant, the transport of equipment or components to the area may require an application for a special transport permit.

5.12.2 Aviation obstacle permission

According to Section 158 of the Aviation Act (864/2014), a permission from the Finnish Transport and Communications Agency Traficom is required for erecting a device, building, structure or marker of a specified height (30 metres or more), if the obstacle is located within 45 kilometres of the airport reference point referred to in Section 75.

Buildings or structures over 30 metres high are planned at the CHP plant and the heating plant, in which case an aviation obstacle permission is likely to be required.

The potential need for a no-fly zone is investigated and presented in the assessment report.

Copyright © Helen Nuclear Ltd

5.12.3 Project permit

For the construction of a high-voltage, or at least 110 kV, power line, a project permit must be applied for from the Energy Authority. A project permit is required for lines belonging to the main grid or high-voltage distribution network, interconnectors and connection lines with a nominal voltage of at least 110 kV. The new 110 kV and 400 kV power lines to be built in the project require a project permit from the Energy Authority.

5.12.4 Crossing statement

A crossing statement must be requested from Fingrid for construction in or near the transmission line area. The crossing of the transmission line area can be, for example, a pedestrian or cycle path, an overhead line, a road or street, or a structure or building, including underground structures, located near the power line. The crossing statement must also take into account the excavation work in the area. A crossing statement is required at least for the construction work of the Norrberget project options, as Fingrid's Anttila–Länsisalmi transmission lines are located within the planning area. In addition, the crossing of new power lines (overhead line or underground cable) between the Vuosaari CHP plant and the two Norrberget project options with existing power lines requires a crossing permit.

5.12.5 A crossing permit

A crossing permit applies to placements under a railway track, alongside the track, or otherwise in an area owned by the Finnish Transport Infrastructure Agency. Crossing refers to wires, pipes or cables located in a railway area. The crossing goes over or under a track, or runs through a railway area or other structures (such as road bridges or underpasses, cable ducts, etc.). The permit is granted by the Finnish Transport Infrastructure Agency.

5.12.6 Expropriation permit

An expropriation permit is usually applied for the transmission line area. Expropriation is regulated by the Act on the Redemption of Immovable Property and Special Rights (603/1977). The Ministry of Economic Affairs and Employment (MEAE) prepares the expropriation permit case, and the permit is granted by the Government. By expropriation, a right to use the transmission line area is obtained, allowing the power line to be constructed, used and maintained. According to the Expropriation Permit Act (Act on Expropriation Permits for Certain Projects with Environmental Impacts, 768/2004), all above-ground electrical lines and all types of transmission pipelines for the transport of gas, oil or chemicals require an expropriation permit, if the line or pipe is part of a project that is subject to the EIA procedure. Therefore, in this project, an expropriation permit must be applied for in respect of the transmission line area of the above-ground power lines.

5.12.7 Deviation permits under the Nature Conservation Act and the Water Act

The Nature Conservation Act (9/2023) contains several prohibitions related to the protection of areas, species or habitats, to which exceptions can be applied in some cases. If the implementation of the project adversely affects Natura 2000 areas, natural habitats protected by the Nature Conservation Act, species under strict protection, protected species or species listed in Annex IV(a) of the Habitats Directive (92/43/EEC), an application for a deviation permit under the Nature Conservation Act must be submitted. The possibility to deviate from conservation provisions governing private nature conservation areas is provided for in Section 54 of the

Copyright © Helen Nuclear Ltd

Nature Conservation Act, the prohibition on the destruction and deterioration of natural habitats in Section 66 and the provisions on the protection of species in Section 83.

The presence of the habitat types listed in Section 64 of the Nature Conservation Act that are in a natural state or comparable to a natural state must not be destroyed or degraded. The prohibition is in force after the Finnish Supervisory Agency has made and notified a decision on the boundaries of the area.

Under Section 74 of the Nature Conservation Act, species whose existence has been threatened or where protection has otherwise proved necessary are protected. Picking or destroying protected plants or parts thereof is prohibited.

Under Section 77 of the Nature Conservation Act, it is forbidden to destroy or otherwise impair a site that is important for the survival of a species under strict protection. The prohibition is in force after the Finnish Supervisory Agency has made and notified a decision on the boundaries of the area. Species under strict protection are those endangered species where there is an obvious threat of their extinction. The species can be found in Annex 6 of the Nature Conservation Decree. The Finnish Supervisory Agency may grant a permit to deviate from the conservation provisions concerning a plant species or a prohibition related to a species under strict protection, provided that the species' conservation status remains favourable.

Under Section 78 of the Nature Conservation Act, the destruction and deterioration of breeding sites and resting places for animal species listed in Annex IV (a) of the Habitats Directive is prohibited. The prohibition applies to all breeding sites and resting places without a separate decision being made. The Finnish Supervisory Agency may grant an exemption from the prohibition only on strictly defined grounds as set out in Article 16 (1) of the Habitats Directive.

According to Chapter 2, Section 11 of the Water Act, it is forbidden to endanger the natural state of a flad, a gloe lake or a spring of up to ten hectares, or of a streamlet or a pond or lake of up to one hectare located outside the province of Lapland. The permit authority may, upon application, grant an exemption from this prohibition in an individual case, if the conservation objectives of the aquatic habitat type are not significantly compromised. In the Norrberget planning area, there is a streamlet protected under the Water Act, for which it is likely that an exemption under the Act will need to be sought. The streamlet is located in the central part of the Norrberget planning area, so implementation of project options VE3a and VE3b will likely require its removal from the area. A deviation permit in accordance with the Water Act is applied for from the Finnish Supervisory Agency.

5.12.8 Natura assessment

Section 35 of the Nature Conservation Act (9/2023) provides that if a project or plan, alone or in combination with others, is likely to significantly deteriorate the natural values of an area included in the Natura 2000 network for the protection of which the area was included in the network, the project implementer or the plan author must assess these impacts in an appropriate manner.

In the EIA programme phase, the need for Natura assessment has been assessed (see chapter 19.2). For the Vuosaari CHP plant (project option VE2b), a Natura assessment of the impacts of the project on the Natura area of the Mustavuori grove and the Östersundom waterfowl habitat will be prepared as an appendix to the EIA report in accordance with Section 35 of the Nature Conservation Act, as the electricity transmission connection of the plant is located in

Copyright © Helen Nuclear Ltd

the Natura area. In addition, for the Vuosaari heating plant (project option VE2a), a Natura assessment will be carried out on the impacts of the project on the Natura area of the Mustavuori grove and the Östersundom waterfowl habitat, as, for example, noise impacts during construction cannot be excluded at the EIA programme phase. A Natura assessment will also be prepared on the impacts of Norrberget project options VE3a and VE3b on the Natura area of the Mustavuori grove and the Östersundom waterfowl habitats, as the planned construction partly lies within a forest area identified as a critical ecological corridor, particularly for the hazel grouse, which is one of the bird species forming the grounds for protection of the Natura site. In project options VE2b and VE3b for CHP plants, a Natura assessment is carried out of the impacts of the project on the Natura area of Kallahti ridge, meadow and water areas, as the impacts of the cooling water heat discharge of the CHP plant cannot be excluded at the EIA programme phase.

5.12.9 A permit to interfere with a fixed relic

Fixed relics are protected by the Antiquities Act (295/1963) and the act also protects underwater relics. Without the permission granted under the Antiquities Act (Section 11), any interference with a fixed relic, such as digging, covering, altering, damaging and removing, is prohibited. The Finnish Heritage Agency may grant a permit to interfere with a fixed relic if the relic causes unreasonable harm or detriment relative to its significance. The permit to interfere must be applied for from the Finnish Heritage Agency by submitting a written application.

It is likely that a permit to interfere has to be applied for at least for the ancient relics located in the Norrberget planning area in project options VE3a and VE3b, and possibly if the power line in project option VE2b is located in the VARK area.

5.12.10 Research permit

As a rule, a research permit is always required for studies carried out in the field (for example, ground or soil surveys). Research permits are not regulated collectively in a specific act or decree, but are processed as permit procedures under various regulations. When requesting a research permit, it is advisable to agree on compensation with the property owner.

A research permit can be applied for from the Finnish Supervisory Agency, for example, in projects governed by the Water Act, either together with the water permit or as a separate application. The research must be carried out in such a way that it causes as little harm as possible to the owner of the area and the use of the area (587/2011, Chapter 18, Section 7, Subsection 2).

Research permits for ancient relics are granted by the Finnish Heritage Agency. A permit must be applied for whenever methods interfering with the ancient relic are used in the research (295/63, Section 10).

5.12.11 Registration notification

If the combined fuel power of the nuclear power plant’s emergency diesel generators is less than 50 MW, a registration notification in accordance with the Environmental Protection Act is likely to be required. The registration notification is provided for in more detail in the Government Decree on Environmental Protection Requirements for Medium-sized Energy Production Units (1065/2017).

Copyright © Helen Nuclear Ltd

5.12.12 Notification of contaminated soil

The decontamination of contaminated soil and groundwater must be reported to the Finnish Supervisory Agency if the decontamination does not require an environmental permit. The notification must also be made about the use of the soil excavated in connection with the decontamination in the excavation area or about its processing elsewhere. In Helsinki, the notification is made to the municipal environmental protection authority.

5.12.13 Landscaping permit

A landscaping permit in accordance with the Building Act (751/2023, Section 53) is required for landscaping that changes the landscape in an area covered by a local detailed plan. Landscaping that changes the landscape refer to digging, excavating, levelling and filling, as well as felling trees or other comparable work. The permit is not required for the performance of works necessary for the implementation of the master plan or local detailed plan or in accordance with the granted building permit, or for operations with minimal impact. In addition, the permit is not required for necessary preparatory measures for a construction project that are related to the implementation of a legally valid local plan.

Copyright © Helen Nuclear Ltd

6 EIA PROCEDURE

6.1 The need for the EIA procedure and the parties

The environmental impact assessment procedure (EIA procedure) is regulated by the EIA Act (252/2017) and Decree (277/2017). The EIA procedure is applied to projects and their modifications that are likely to have significant environmental impacts.

Depending on the type and size of the project, the EIA procedure is applied either directly, based on projects listed in the EIA Decree, or a decision on a case-by-case basis. In this project, the EIA procedure is applied on the basis of Section 3(1) of the EIA Act and Annex 1, item 7 b (nuclear power plants).

The key parties in the EIA procedure are the **party responsible for the project**, which is Helen Nuclear Ltd in this project, and the **competent authority**, in this case the Ministry of Economic Affairs and Employment.

The other parties to the EIA procedure are:

- other authorities
- those whose circumstances or interests may be affected by the project, and
- communities and foundations whose fields of activity may be affected by the project's impacts.

The parties to this EIA procedure are listed in the figure below (Figure 6-1). The group entitled to participate is wide, and practically everyone interested in the project and the EIA procedure can do so by giving opinions and attending public events (Pölönen and Perho 2018).

One of the parties is AFRY Finland Oy, which prepared the EIA programme as a consultant. Its EIA team is presented in the table (Table 1-1).

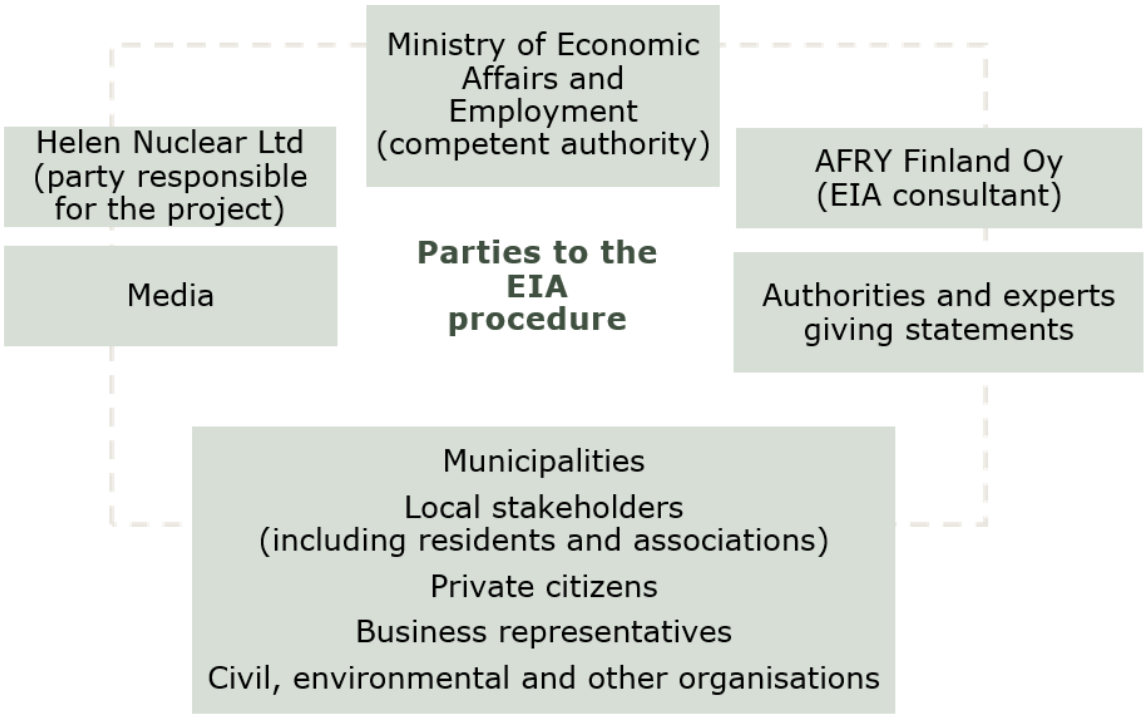


Figure 6-1. Participants in the EIA procedure.

Copyright © Helen Nuclear Ltd

6.2 The objective, content and phases of the EIA procedure

6.2.1 General

The objective of the EIA Act is to promote environmental impact assessment and the uniform consideration of the assessment in planning and decision-making. At the same time, the objective is to improve access to information and participation opportunities for all stakeholders.

The environmental impacts of the project must be assessed in the statutory EIA procedure at the earliest possible phase of project planning, when the options are still open. The EIA procedure does not make any implementation decisions concerning the project, but it is a prerequisite for subsequent permit decisions and decision-making concerning the project. It is therefore provided that the authorities may not grant permits for the implementation of the project, or make other comparable decisions, before the EIA procedure has been completed.

The EIA procedure is an open process, and one of its objectives is to improve access to information and participation opportunities for all stakeholders. Participation in the EIA procedure refers to the interaction between the different parties involved in the EIA procedure (Figure 6-1) in the environmental impact assessment. Participation includes, for example, providing information, consulting, expressing opinions and positions, and giving statements during the procedure (Pölönen and Perho 2018).

The key phases of the EIA procedure are shown in the figure below (Figure 6-2) and in the following chapters 6.2.2–6.2.5.

Copyright © Helen Nuclear Ltd

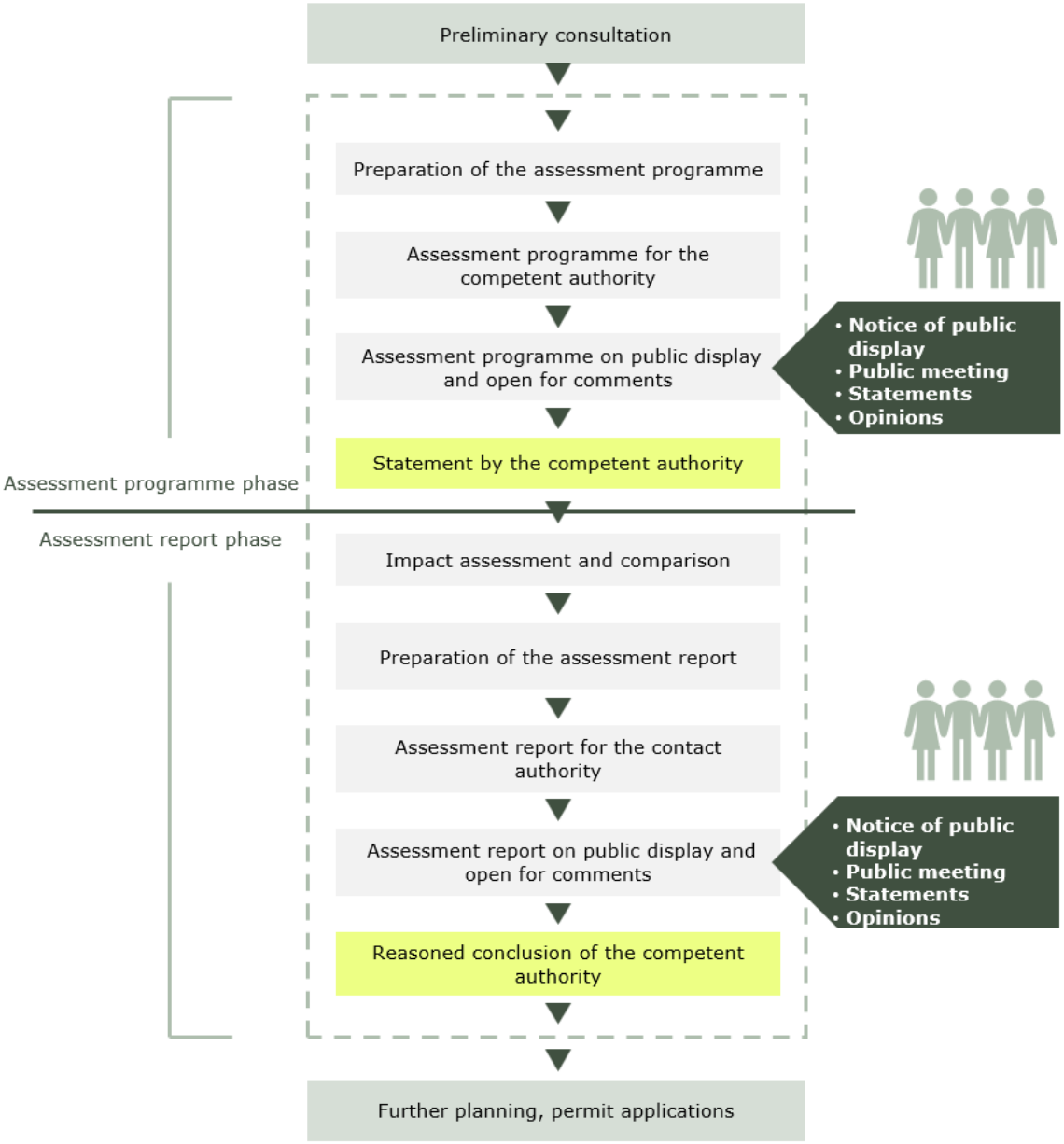


Figure 6-2. Phases of the EIA procedure.

6.2.2 Preliminary consultation

Prior to the start of the EIA procedure or during the procedure, a preliminary consultation can be arranged in cooperation with the party responsible for the project and key authorities. The aim of the preliminary consultation is to promote the overall management of the evaluation, planning and permit procedures required by the project, to facilitate the exchange of information between the party responsible for the project and the authorities, and to improve the quality and usability of surveys and documents, as well as to streamline these procedures.

In this project, the preliminary consultation was held on 3 February 2026. In addition to the competent authority, the project manager and the EIA consultant, representatives of the authorities from the Finnish Supervisory Agency, the City of Helsinki (planning and environmental protection), the City of Vantaa (planning and environmental protection), the Municipality of Sipoo (planning and environmental protection), the Finnish Environment Institute, the

Copyright © Helen Nuclear Ltd

Radiation and Nuclear Safety Authority, the Helsinki–Uusimaa Regional Council, the Helsinki City Museum, the Finnish Heritage Agency, the Helsinki Rescue Department, the Central Uusimaa Rescue Department, the Helsinki Police Department and the Eastern Uusimaa Police Department participated in the preliminary negotiations. Representatives from the Port of Helsinki Ltd, HSY, Fingrid Oyj, Helen Ltd and Helen Electricity Network Ltd also participated in the preliminary negotiations. The preliminary negotiations covered, among other things, the delimitation of the EIA procedure, the need for Natura assessment, nuclear waste, the project's health impacts, impacts on water systems, the identification of the nuclear power plant's precautionary action zone and emergency planning zone and their impacts on land use, local planning required by the project, the project's impact on other existing and planned activities in the project areas, and the impact on archaeological and other cultural heritage.

6.2.3 EIA programme

In the first phase of the EIA procedure, an environmental impact assessment programme (EIA programme) is drawn up, which is a plan (work programme) for the organisation of the EIA procedure and the surveys required for it.

This EIA programme provides the following information:

- Description of the project, its purpose, design phase, location, size, land-use needs and the project's connection to other projects.
- Information on the person responsible for the project, as well as an assessment of the project's planning and implementation schedule.
- Project implementation options and the zero option. In principle, solutions that would cause as little disruption as possible, while being operationally and economically viable and feasible based on preliminary assessments, have been sought as the implementation options for this project.
- Information on the plans and permits required for the implementation of the project.
- Description of the current state and development of the environment in the likely impact area.
- A reasoned proposal for the environmental impacts to which the assessment is likely to be directed in order to identify and assess significant environmental impacts, as well as information on the surveys prepared and planned for the assessment of environmental impacts, and the methods to be used.
- Information on identified transboundary environmental impacts.
- Information on the prepared and planned surveys on environmental impacts, as well as on the methods used in the acquisition and evaluation of the material and the related assumptions.
- Information on the competence of the authors of the assessment programme.
- A plan for organising the assessment procedure and related participation, as well as their connection to the planning of the project.
- An estimate of the time of completion of the assessment report.

The EIA procedure is officially started when the EIA programme is submitted to the competent authority. The competent authority informs about the start of the EIA procedure and the public display of the EIA programme electronically on its own website and in the municipalities likely to be affected by the project.

The public display period starts on the date of publication of the notice and lasts for 30 days (for a special reason, up to 60 days). In this EIA procedure, the duration of the EIA programme is likely to be 60 days, as the project is subject to an international consultation in accordance with the Espoo Convention (see chapter 5.3).

During the public notice period, the authorities, local residents and other parties concerned may submit statements and opinions on the EIA programme to the competent authority. The competent authority requests statements on the programme from various authorities. An

Copyright © Helen Nuclear Ltd

international consultation will take place in parallel with the national consultation procedure. The competent authority compiles all the statements and opinions submitted on the EIA programme and issues its own statement on the basis of them to the person responsible for the project within one month of the end of the public display period.

6.2.4 EIA report

In the next phase of the EIA procedure, an environmental impact assessment report (EIA report) is prepared on the basis of the EIA programme and the competent authority's statement on it. The EIA report must describe how the competent authority's statement on the EIA programme has been taken into account in the report. The EIA report presents, among other things, a description of the project, the current state of the environment, the likely significant environmental impacts of the project and its options, mitigation of the impacts, monitoring and comparison of the options, as well as information on the implementation of the EIA procedure and a simplified summary.

A public notice of the EIA report will be issued in the same manner as for the EIA programme, and during the public display period of the EIA report, an international consultation will be carried out in parallel with the national consultation with those Parties to the Espoo Convention that have announced their participation in the assessment procedure. The assessment report is available for viewing for 60 days. On the basis of the EIA report and the statements and opinions submitted during both the national and international consultation procedures, the competent authority prepares its reasoned conclusion on the significant environmental impacts of the project.

6.2.5 Reasoned conclusion

The competent authority reviews the appropriateness of the environmental impact assessment report and then draws up its reasoned conclusion on the significant environmental impacts of the project on the basis of the EIA report within two months of the end of the public notice period. The reasoned conclusion summarises the other statements and opinions given on the EIA report.

The competent authority is responsible for communicating the conclusion.

The permit applications for the project must include the EIA report and the reasoned conclusion.

6.3 Time schedule of the EIA procedure

The preliminary schedule for the EIA procedure is shown in the figure below (Figure 6-3). The EIA programme was completed in September 2026, and the competent authority's statement on it is expected to be issued in January 2027. The preparation of the EIA report begins immediately after the programme phase. The aim is to complete the EIA report during 2027 and the EIA procedure by the end of 2027. The schedule may change, for example, due to the consultation procedure.

Copyright © Helen Nuclear Ltd

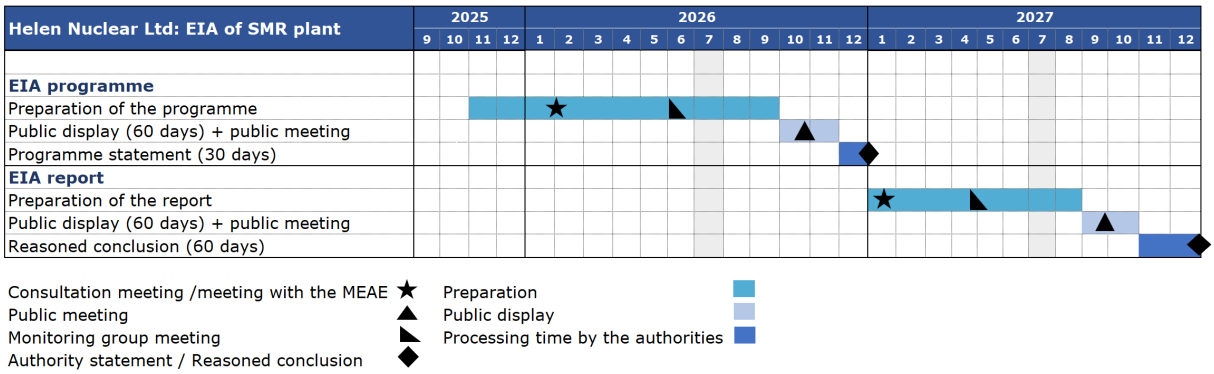


Figure 6-3. A preliminary estimate of the schedule of the project's EIA procedure.

6.4 Participation, interaction and communication

6.4.1 Public notice and display

The EIA programme is submitted to the Ministry of Economic Affairs and Employment, which acts as the competent authority, and the Ministry announces the EIA programme by publishing a public notice on its website (see chapter 6.2.3). The public notice states where the EIA programme can be viewed in municipalities and by when the statements and opinions concerning the programme must be submitted.

During the public notice period, local residents and other parties concerned may give their opinions on the EIA programme to the competent authority. Opinions may concern, for example, the need for a survey of the project's impact assessment and whether the information and plans presented in the EIA programme are sufficient. In addition, the competent authority requests statements on the EIA programme from various authorities. The competent authority compiles the opinions and statements given on the EIA programme and issues its own statement on the basis of them to the person responsible for the project within one month of the end of the public display period.

In due course, a public notice will be given of the EIA report in the same way as of the EIA programme, and during the public notice period, local residents and other interested parties may give their opinions on the EIA report to the competent authority (see chapter 6.2.4).

6.4.2 Communication and participation

6.4.2.1 Steering group for the EIA procedure

For the EIA procedure of the project, a steering group has been assembled, which includes, in addition to the party responsible for the project and the EIA consultant, representatives of the City of Helsinki's planning and environmental protection, as well as Helen Ltd. The steering group meets approximately once a month during the EIA procedure. The steering group monitors the progress of the EIA procedure and reviews issues related to, among other things, the EIA procedure of the project and local planning.

6.4.2.2 Monitoring group work

A monitoring group consisting of public authorities and non-profit associations has been set up to monitor and guide the EIA procedure. The composition of the monitoring group is presented below. AFRY Finland Oy acts as convener of the monitoring group.

Copyright © Helen Nuclear Ltd

The purpose of the monitoring group is, among other things, to obtain information and views from various parties and to ensure that the information used during the work is up-to-date and as comprehensive as possible. The monitoring group oversees the progress of the environmental impact assessment and provides opinions on the preparation of the environmental impact assessment programme and report and supporting surveys.

Parties invited to the monitoring group:

Ministry of Economic Affairs and Employment (MEAE)

Finnish Supervisory Agency

Radiation and Nuclear Safety Authority (STUK)

Finnish Environment Institute (Syke)

City of Helsinki: local planning, environmental protection and health protection

City of Vantaa: local planning, environmental protection and health protection

City of Espoo: local planning, environmental protection and health protection

Municipality of Sipoo: local planning, environmental protection and health protection

Economic Development Centre of Uusimaa (ELY)

Economic Development Centre of Southwest Finland (ELY)

Economic Development Centre of Southeast Finland (ELY)

Rescue Department of Helsinki

Rescue Department of Central Uusimaa

Rescue Department of Eastern Uusimaa

Helsinki Police Department

Eastern Uusimaa Police Department

Finnish Safety and Chemicals Agency (Tukes)

Traficom

Finnish Transport Infrastructure Agency

Finnish Defence Forces

Natural Resources Institute Finland

National Emergency Supply Agency

Finnish Heritage Agency

Helsinki City Museum

Vantaa City Museum

Helsinki–Uusimaa Regional Council

Uusimaa Region of Finnish Association for Nature Conservation

Helsinki Association for Nature Conservation

Finnish Association for Nature Conservation (Vantaa branch)

Tringa ry

Vantaan Omakotiyhdistysten Keskusjärjestö ry

Vaarala-Rajakylä Asukasyhdistys ry

Vuosaari-Seura

Vuosaari-Säätiö

Vuosaaren Pienkiinteistöt ry

Sotungin kyläyhdistys

Mellunmäki-Seura ry

Östersundom-seura

Vuosaaren Urheilukalastajat

Lauttasaari-seura

Jätkäsaari-seura

Pro Uutela

Kallahti-Kallvik-seura

Vantaan Energia Oy

Copyright © Helen Nuclear Ltd

Remeo Oy	HSY
Port of Helsinki	Helen Ltd
Paulig	Helen Electricity Network Ltd
Bertchi	GTK
Sipoon Vesi	Kuopion Energia Oy
Keravan Energia	Fortum Power and Heat Oy
Fingrid Oyj	Teollisuuden Voima Oyj
Gasgrid	Posiva Oy

The monitoring group met for the first time on 3 June 2026. In the meeting, the matters discussed included the social impacts and acceptability of the project, the current activities in the project areas and their inclusion in the impact assessment, as well as any future projects. In addition, nuclear waste, alternatives to the nuclear power project and the impacts of the CHP plant's cooling water on the marine environment and fish were discussed.

The monitoring group will meet for the second time during the EIA reporting phase.

6.4.2.3 Presentations to the public

During the EIA procedure, two presentations are organised, which are open to all interested parties. The presentations are convened by the Ministry of Economic Affairs and Employment, the competent authority, and they will be announced on the competent authority's website. The party responsible for the project takes care of organising the event.

The first presentation will be held during the public display period of the EIA programme. The project and the EIA programme will be presented at the meeting, and the public will have the opportunity to express their views and ask questions.

A presentation on the environmental impact assessment report will be held after the assessment report has been completed. The results of the environmental impact assessment will be presented at the event. The public will have the opportunity to express their views on the environmental impact assessment work carried out and whether or not it is adequate.

6.4.2.4 Information, resident and other stakeholder events

A nuclear energy project is a matter of social significance, and its social acceptability is a prerequisite for the implementation of the project. Helen has wanted to secure the public's and stakeholders' access to information and opportunities to participate already from the first phase of the project through open and interactive communication.

The aim of the early interaction has been to raise awareness of the project among Helsinki residents, start discussions on the topic, present the upcoming decision-making process and its schedule, and find out the residents' interests and concerns.

In November 2025, the City of Helsinki and Helen held a press conference after the announcement of location options, at which the prerequisites for nuclear power in Helsinki were reviewed. The event was also streamed.

Copyright © Helen Nuclear Ltd

During spring 2026, Helen organised three resident events in the project's planning areas, aiming for open and inclusive dialogue from the very first phase of the project. The aim of the events was to communicate about the project and its preparation, as well as the launch of the EIA procedure. Above all, Helen wanted to invite residents to participate in the discussion, survey residents' concerns, answer questions and gather views on the potential impacts of the project. Time was also reserved for informal discussions at the end of the events.

In addition to the official presentations of the EIA procedure, Helen develops other ways of inclusion to ensure understandable communication and interaction. In addition, the company's experts actively participate in events organised by other parties. The aim is to increase understanding of the project, enable dialogue and bring out the views of stakeholders in support of project preparation.

6.4.3 Other communication and interaction

The project and its environmental impact assessment are communicated on the Ministry of Economic Affairs and Employment's internet pages at [https://tem.fi/en/frontpage].

Helen Ltd informs about the progress of the project and its environmental impact assessment on the project's own website at helen.fi/en/about-us/ydinvoima/about-nuclear-energy-program. The website provides background information on the project and information on the EIA and permit process. Through the website, it is possible to provide Helen with feedback and ask questions about the project.

However, official feedback on the EIA procedure must be submitted directly to the competent authority.

Information about the project and its environmental impacts will be communicated regularly as the project progresses. Press releases, resident newsletters, the project website, Helen's social media channels and an email newsletter are used as communication channels. The project can also be viewed on the City of Helsinki's website at hel.fi/en/urban-environment-and-traffic/urban-planning-and-construction/plans-and-building-projects/small-scale-nuclear-power.

Copyright © Helen Nuclear Ltd

7 DESCRIPTION OF THE ASSESSMENT WORK

7.1 Assessed impacts

Environmental impacts refer to the direct and indirect impacts of the project on the environment. In accordance with Section 2 of the EIA Act, the assessment examines the environmental impacts caused by the project on:

- The population and people's health, living conditions and comfort
- Land, soil, water, air, climate, vegetation, organisms and biodiversity
- Urban structure, material assets, landscape, cityscape and cultural heritage
- Exploitation of natural resources, and
- Interactions between these factors.

The assessment considers impacts during construction and operation, as well as impacts arising after the end of operations. Methodological descriptions of the impact assessment concerning decommissioning are summarised in chapter 27. The impacts of the non-implementation of the project are also assessed (zero option). The assessment also highlights the uncertainties related to the assessment and the measures to prevent and mitigate adverse impacts.

The impact assessment is carried out in the form of expert assessments. The assessment work is based on existing and publicly available materials, as well as on terrain and marine area surveys and models carried out as part of the assessment work (see chapter 7.4).

7.2 Preliminary assessment of the significance of the impacts

Based on preliminary assessments and the project option, the main impact categories identified for this project are:

- Water system impacts of the CHP plant during operation (intake and discharge of cooling water, heat discharge to the sea)
- Impacts on nature during construction
    - Norrberget: plant site and new connections needed
    - Vuosaari: electricity transmission connection
- Impacts on nature during operations
    - Norrberget: plant site and electricity transmission connection
    - Vuosaari: electricity transmission connection
- Impacts on land use
- Impacts on people's health, living conditions and comfort
    - Social impacts (acceptability of the project)
    - Spread of release after a severe reactor accident
- Climate impacts (changes in the way energy is produced).

7.2.1 The EIA programme phase proposal for environmental impacts at which the assessment will be targeted during the EIA reporting phase in order to assess the likely significant environmental impacts

At the EIA reporting phase, the environmental impacts of the project will be assessed in accordance with Section 2 of the EIA Act (see chapter 7.1). The environmental impact assessment is especially targeted at the likely significant environmental impacts of the project. The Government Decree on amending Sections 1 and 3 of the Government Decree on the Environmental Impact Assessment Procedure (1253/2025) took effect on 1 January 2026. With the

Copyright © Helen Nuclear Ltd

amendment to the Decree, the EIA programme must include a reasoned proposal for the environmental impacts on which the assessment will focus in order to identify and assess the likely significant environmental impacts. A preliminary view, with justifications, of the environmental impacts of this project on which the impact assessment will specifically focus at the EIA reporting phase to assess the likely significant environmental impacts is presented by project option for each impact area in chapters 8–24. A summary of the environmental impacts on which the assessment is specifically focused is presented in the following table (Table 7-1).

Table 7-1. The EIA programme phase proposal for environmental impacts by project option at which the impact assessment will be specifically targeted during the EIA reporting phase in order to assess the likely significant environmental impacts.

	VE1	VE2a	VE2b	VE3a	VE3b
Urban structure and land use	x	x	x	x	x
Landscape and cultural environment	x			x	x
Archaeological cultural heritage			x	x	x
Noise and vibration	x	x	x	x	x
Traffic	x		x	x	x
Air quality					
People's health, living conditions and comfort	x	x	x	x	x
Soil, bedrock and groundwater			x	x	x
Surface waters			x	x	x
Fish stock and fishing			x	x	x
Vegetation and habitat types			x	x	x
Fauna and birds		x	x	x	x
Protected areas		x	x	x	x
Climate	x	x	x	x	x
Exploitation of natural resources and conventional waste			x	x	x
Radioactive waste	x	x	x	x	x
Exceptional and emergency situations	x	x	x	x	x
Conventional accidents and disturbances	x	x	x	x	x

During the EIA procedure, all impacts will be assessed, but the assessment will be targeted at significant environmental impacts. The EIA report also examines measures to mitigate adverse environmental impacts.

Copyright © Helen Nuclear Ltd

7.3 Limitations of the assessment and impact areas

The environmental impact assessment examines impacts both within the project area and beyond it. The assessment area refers to the area defined for each type of impact, where the relevant environmental impact is investigated and assessed. It is defined to be so large that no significant environmental impacts can be expected to occur outside the area. The impact area refers to the area where environmental impacts are expected to occur. If it becomes evident during the assessment work that an environmental impact has a wider impact area than previously estimated, the scope of the assessment and impact areas for that impact will be redefined. Thus, the actual determination of the impact areas takes place as a result of the assessment work in the environmental impact assessment report.

Initially, the following assessment areas have been determined for environmental impacts:

- The impacts on **urban structure and land use** are mainly considered from a distance of about one kilometre, but taking into account the extent of the precautionary action zones related to the project options. In addition, the impact on existing and pending local plans and national land use objectives will be examined. The land use impacts of the project options mainly concern the planning area as well as the areas where land use is limited by the infrastructure routes related to the project options. For example, the impact area for power lines where land use is directly limited is the transmission line area.
- The extent of the assessment area for **landscape and cultural environment** is based on the project's estimated visual impact area. The assessment area for the planning areas is about 3–4 kilometres, the power lines about 2 kilometres and the underground cables about 500 metres. The assessment area will be expanded if the assessment identifies significant impacts on sites that are located further away.
- The impacts on the **archaeological cultural heritage** will be assessed in the areas where the land use of the project extends and impacts on archaeological sites may arise. The impacts are examined in the area of the nuclear power plant's planning areas and above-ground transmission connections, as well as in their vicinity up to a distance of about 100 metres. Possible underwater cultural heritage sites are also taken into account in the vicinity of cooling water intake and discharge points.
- **Noise impacts** are considered to the extent that they are estimated to result from the project based on noise modelling. The assessment area for noise modelling extends to about two kilometres from the plant area. If necessary, the impact up to the identified sensitive sites or nature reserves will be considered.
- **Vibration impacts** are examined within an estimated radius of one kilometre around the project area. The vibration and structure-borne noise impacts during the construction and operation of the transmission connections are examined at a distance of about 500 metres from the vibration source.
- **Traffic impacts** are examined by estimating the transport volumes and primary routes leading to the area related to both construction and operation. The transport impacts of the transport of excavated rock are initially assessed in the region of Uusimaa.
- The **air quality impacts** of the project are assessed in the project area and its vicinity.
- **Impacts on people** are assessed using computational and qualitative estimates generated during other parts of the impact assessment process. The impacts on living conditions and comfort (e.g. noise, landscape, traffic) are examined regionally to the extent

Copyright © Helen Nuclear Ltd

indicated by the project's impact assessments. In addition, the results of stakeholder cooperation are used in the impact assessment.

- **Impacts on soil, bedrock and groundwater** are examined in the planning area, the areas of the new connections to be built and in their immediate vicinity, in areas to which the impacts of construction work and operations extend. Impacts on groundwater are assessed at a distance of about 500 metres.
- The project's **impacts on water systems** will be examined for water bodies and small waters, such as streams, that are in the vicinity of or in the planning area and transmission connections, as well as for water bodies in cooling water intake and discharge areas. The impacts on water systems are also assessed for stormwater from the planning area.
- The project's impacts on **fish and fishing** are assessed for water bodies and small waters, such as streams, that are in the vicinity of or in the planning area and transmission connections, as well as for water bodies in cooling water intake and discharge areas.
- Impacts on **flora, fauna and birds** are assessed in the planning area and in the area of the transmission connections and in the vicinity of these areas. The vegetation impacts are assessed within a radius of about 100–500 metres. The impacts on fauna and birds are examined more extensively. The impacts on **protected areas** located within approximately one kilometre of the project's activities and whose conservation criteria may be affected by the project are assessed.
- The assessment area of **climate impacts** ranges from municipal-level climate targets to global targets and the progression of climate change. The project area is examined from the perspective of climate change adaptation. The climate impacts are assessed computationally, taking into account the greenhouse gas emissions generated during the project's life cycle.
- The impacts on the **use of natural resources** will be examined with a focus on the natural resources present in the project area, the exploitation of which may be limited. The reuse potential of the rock material formed during construction is examined in the Uusimaa region. For conventional waste, the end of the life cycle of the material after waste generation is considered.
- The assessment area of the impacts of a **severe reactor accident** is 1,000 kilometres.
- The impacts of **accidents and incidents** are assessed to the extent that they are estimated to arise from the project based on any risk assessments that may be prepared.

7.4 Available input data and project-specific surveys

The environmental impact assessment is based on existing data, publicly available material and information generated during the plant's preliminary design. As part of the environmental impact assessment work related to this project, the following surveys are carried out to support the existing material:

- Terrain surveys
  - Salmisaari planning area
  - Vuosaari planning area, east of Satamakaari
- Vegetation and habitat type surveys
  - Vuosaari planning area, west of Satamakaari
  - Norrberget planning area

Copyright © Helen Nuclear Ltd

    - The area of the route of all electricity transmission connections (approx. 100 m corridors)
    - Above-ground parts of cooling water tunnels and district heat transmission connection
- Breeding bird surveys
    - Vuosaari planning area, west of Satamakaari
    - Norrberget planning area
    - The area of the route of all electricity transmission connections
    - Above-ground parts of cooling water tunnels and district heat transmission connection
    - Norrberget road connection area
- White-backed woodpecker survey, Mustavuori Natura area
- European nightjar survey, Norrberget planning area and Länsisalmi (tunnel entrance)
- Capercaillie mating area survey, Norrberget planning area
- Bat survey, Norrberget planning area
- Scarce fritillary survey, Norrberget planning area
- Siberian flying squirrel survey, Norrberget planning area
- Natura assessment of the impacts of the project on the Natura 2000 area of the Mustavuori grove and the waterfowl habitat in Östersundom, and on the Natura 2000 area of Kallahti ridge, meadow and water areas
- High-precision archaeological survey at the archaeological site in the Norrberget planning area
- Multibeam echosounding (MBES) in the marine area at cooling water intake and discharge points
- Sediment sampling and contaminant analysis at the cooling water intake and discharge points
- Benthic fauna survey at cooling water intake and discharge points
- Studies related to fish stocks and fisheries in the marine area off Vuosaari
    - Commercial and recreational fishing surveys
    - Juvenile fish survey using Gulf Olympia
    - Sounding survey of fish schools at cooling water intake areas
    - Fish survey of cooling water discharge areas
    - Habitat surveys at water intake and discharge areas
- Aquatic vegetation survey in the Vuosaari marine area
- Dispersion modelling of heat discharge of cooling water
- Study on the utilization and temporary storage of excavated rock material
- Noise modelling for the construction and operational phases
- Illustrative images of the nuclear power plant
- Severe accident modelling
- Resident survey

The results of the above-mentioned surveys are presented in the EIA report.

A survey on the regional economic impacts of the project will be conducted in connection with the project. The results of the survey are presented in the EIA report.

Copyright © Helen Nuclear Ltd

7.5 Comparison of the options and assessment of the significance of impacts

The significance of environmental impacts is assessed by comparing the resilience of the environment in relation to each environmental load, taking into account the current environmental load of the area. The impact assessment uses, where applicable, the practices and tools of the so-called multi-criteria decision analysis developed in the EU's LIFE+ IMPERIA project (Marttunen et al. 2015) to evaluate the significance of impacts.

The significance of the impacts is affected by the sensitivity of the area or site, as well as the magnitude of the changes caused by the project (Figure 7-1). The sensitivity of the affected site describes the characteristics of the affected site or area. Its components include legislative guidance related to the impact (laws, programmes, guidelines, local plans), the social significance of the area or aspect, and the site's susceptibility to change. Factors affecting societal significance include, among other things, the area's recreational use and natural values, the number of people affected and the possibility of conflicts. In turn, susceptibility to change is influenced by the ability to tolerate changes and the number of sensitive sites. The magnitude of the change describes the characteristics of the change caused by the project, where the direction can be either negative or positive. The magnitude consists of the intensity and direction of the change, its regional scope and duration.

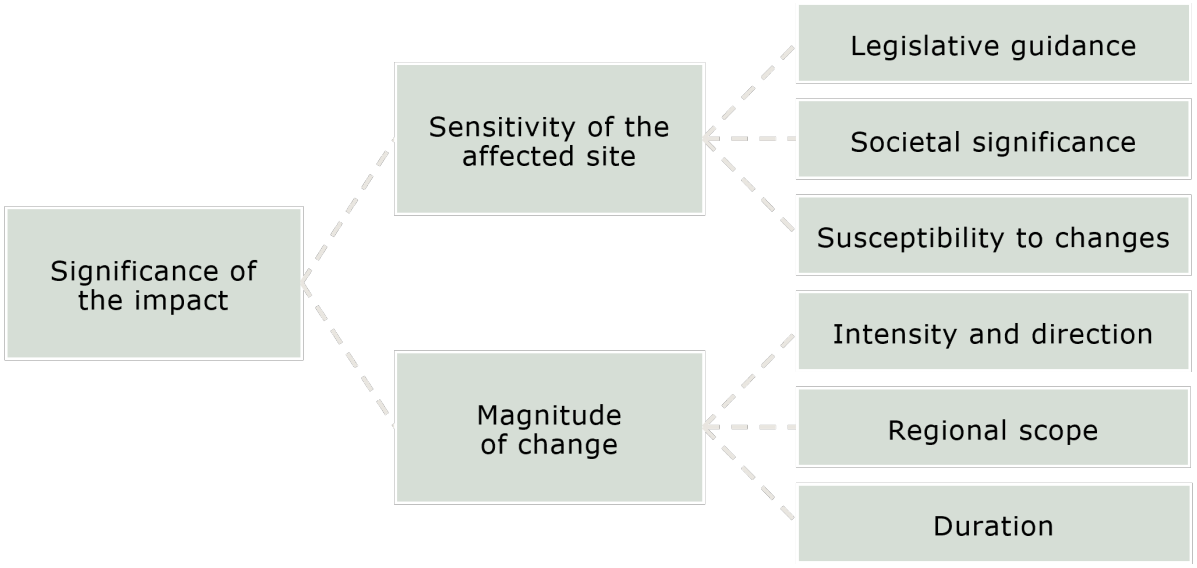


Figure 7-1. The method of assessing the significance of impacts used in the IMPERIA project (Marttunen et al. 2015).

The assessment of the significance of the impacts of the project takes into account the magnitude of the change and the sensitivity of the affected site described above, applying the assessment framework developed in the IMPERIA project (Table 7-2). The significance of the environmental impacts of the project is summarised in summary tables, which are presented in each impact assessment section in the EIA report. The table describes the negative impact in shades of red and the positive impact in shades of green.

Copyright © Helen Nuclear Ltd

Table 7-2. Table describing the overall significance of the impacts used in the assessment (adapted from the table developed in the IMPERIA project).

Significance of the impact		Negative				Magnitude of change			Positive	
		Very high	High	Moderate	Low	No change	Low	Moderate	High	Very high
Sensitivity of the affected object	Low	High	Moderate	Low	Low	No impact	Low	Low	Moderate	High
	Moderate	High	High	Moderate	Low	No impact	Low	Moderate	High	High
	High	Very high	High	High	Moderate	No impact	Moderate	High	High	Very high
	Very high	Very high	Very high	High	High	No impact	High	High	Very high	Very high

The criteria presented in the table (Table 7-3) are used to assess the significance of the impacts.

Copyright © Helen Nuclear Ltd

Table 7-3. Criteria used to assess the significance for the options.

	Very high ++++	The project will cause a very clearly noticeable positive and long-term change that will have a regional impact on people's daily lives and the surrounding nature.
Significance of impacts	High +++	The project will cause a clearly noticeable positive and long-term change that will have a regional impact on people's daily lives or the surrounding nature.
	Moderate ++	The project will cause a clearly noticeable positive change that will have a local impact on people's daily lives or the surrounding nature.
	Low +	The positive change caused by the project is noticeable, but does not significantly impact people's daily activities or the surrounding nature.
	No impact	The change is so small that it is practically not noticeable and does not cause any harm or create any benefit.
	Low -	The negative change caused by the project is noticeable, but does not significantly impact people's daily activities or the surrounding nature.
	Moderate --	The project will cause a clearly noticeable negative change that will have a local impact on people's daily lives or the surrounding nature.
	High ---	The project will cause a clearly noticeable negative and long-term change that will have a regional impact on people's daily lives or the surrounding nature.
	Very high ----	The project will cause a very clearly noticeable negative and long-term change that will have a regional impact on people's daily lives or the surrounding nature.

The positive, negative and neutral environmental impacts of the project are compiled in the table for comparison. All options included in the EIA procedure are compared so that their main environmental impacts are taken into account. At the same time, the feasibility of the project is assessed on the basis of the results after the environmental impact assessment.

Copyright © Helen Nuclear Ltd

8 URBAN STRUCTURE AND LAND USE

8.1 Current status

8.1.1 Salmisaari

The Salmisaari planning area (project option VE1) is located in the inner city of Helsinki in the West Harbour district, in the Ruoholahti area (Figure 8-1). The planning area is located in the current Salmisaari power plant area. There are commercial and office buildings as well as public and private services and housing in the surroundings. The area is located in a busy traffic environment. To the north of the planning area is Länsiväylä and to the south is Porkkalankatu. The metro line is located underground in the southern part of the planning area. West Harbour is located approximately 1.5 kilometres from the planning area. Other operators in the area are described in chapter 2.4.1.

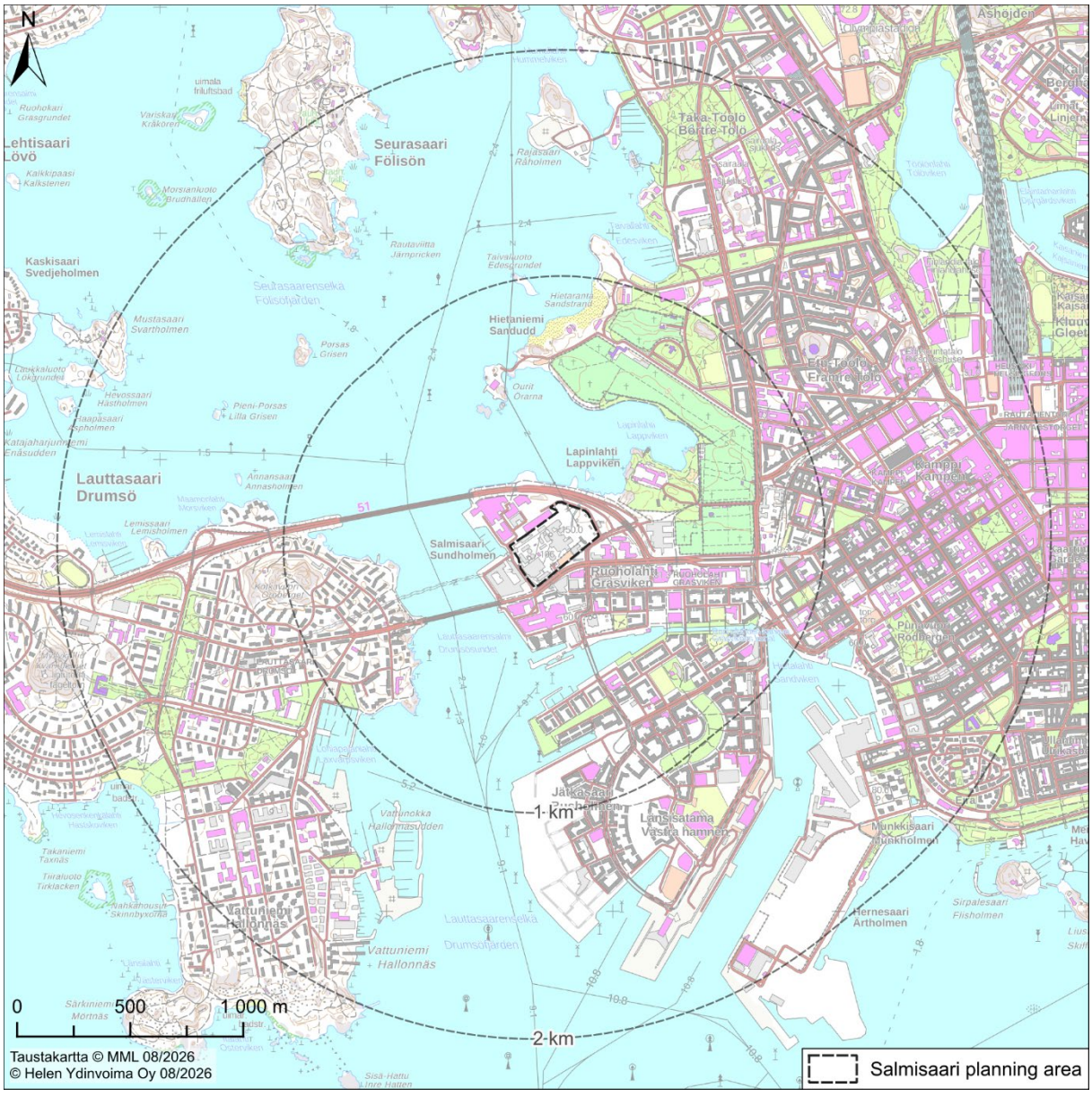


Figure 8-1. Extract of the topographic map and the Salmisaari planning area (VE1).

8.1.2 Vuosaari

The Vuosaari planning area (project options VE2a and VE2b) is located in the Vuosaari district of Helsinki, mainly in the Vuosaari power plant area. Vuosaari Harbour and the associated freight traffic hub (Figure 8-2) are located in the east. Other operators in the area are described in chapter 2.4.2.

In terms of land use, the planning area is a modified and developed industrial and warehouse area. The current 110 kilovolt power lines of Helen Electricity Network Ltd (Vaarala–Vuosaari 1 and 2, Mellunkylä–Vuosaari and Herttoniemi–Vuosaari) start from the southwestern part of the planning area.

The electricity transmission routes related to option VE2b, as well as the underground cable between Itäsalmi substation and Vuosaari, are located in connection with the current power line, mainly in a recreational area and an agricultural and forestry area, near Ring Road III. The Itäsalmi substation area is situated in a storage site bordered by the existing power lines and Pitkäsuontie, which is currently Rudus Oy's rock material area. The cooling water tunnels are located under Vuosaari Harbour and the adjacent block area with industrial and commercial buildings.

On the west side of the planning area, there are areas reserved for recreation, as well as the Vuosaari residential area. The Central Vuosaari residential area is situated approximately 300 metres from the planning area at its nearest point. The former Vuosaari dumping ground, which now serves as a recreational area, is located in the immediate vicinity of the planning area to the north. The Vuosaari golf course is located at a distance of about 100 metres to the southwest of the planning area.

To the northeast and east of the planning area, there is a small amount of holiday housing and sparse population about one kilometre away.

Copyright © Helen Nuclear Ltd



Figure 8-2. Extract of the topographic map and the Vuosaari planning area with the infrastructure routes of project option VE2b.

8.1.3 Norrberget

The Norrberget planning area (project options VE3a and VE3b) is located in Helsinki's Ultuna district, approximately 1.5 kilometres from the Landbo residential area. The area is bordered from its southern part by the Porvoonväylä road and from its northern part by the Sipoonkorpi National Park. To the south of the Porvoonväylä road, there are village-like settlements stretching from the area around Länsisalmi towards Söderkulla. The Kärr residential area is located about a kilometre to the south. The industrial site of Långmossebergen is located about half a kilometre to the west. The area is located approximately one kilometre east of the intersection

Copyright © Helen Nuclear Ltd

of Porvoonväylä and Ring Road III (Figure 8-3). Other operators in the area are described in chapter 2.4.3.

The district heating connections KL1 and KL2 related to options VE3a and VE3b, as well as the cooling water tunnels related to option VE3b, are located in the residential area of Vuosaari, and elsewhere mainly in the surrounding agricultural and forestry areas.

The eastern part of the planning area is undeveloped and consists of mixed forest with exposed bedrock in places, while the south and west parts are farmland. There are five residential buildings and one holiday home within the planning area. Fingrid Oyj's 400 kilovolt power line (Länsisalmi–Anttila) and Sipoon Energia Oy's 110 kilovolt power line (Anttila–Vaarala) are located in the southern part of the area. Telia's mast is located in the middle of the area.

The project does not consider changes in the land use of the current Länsisalmi substation.

Copyright © Helen Nuclear Ltd

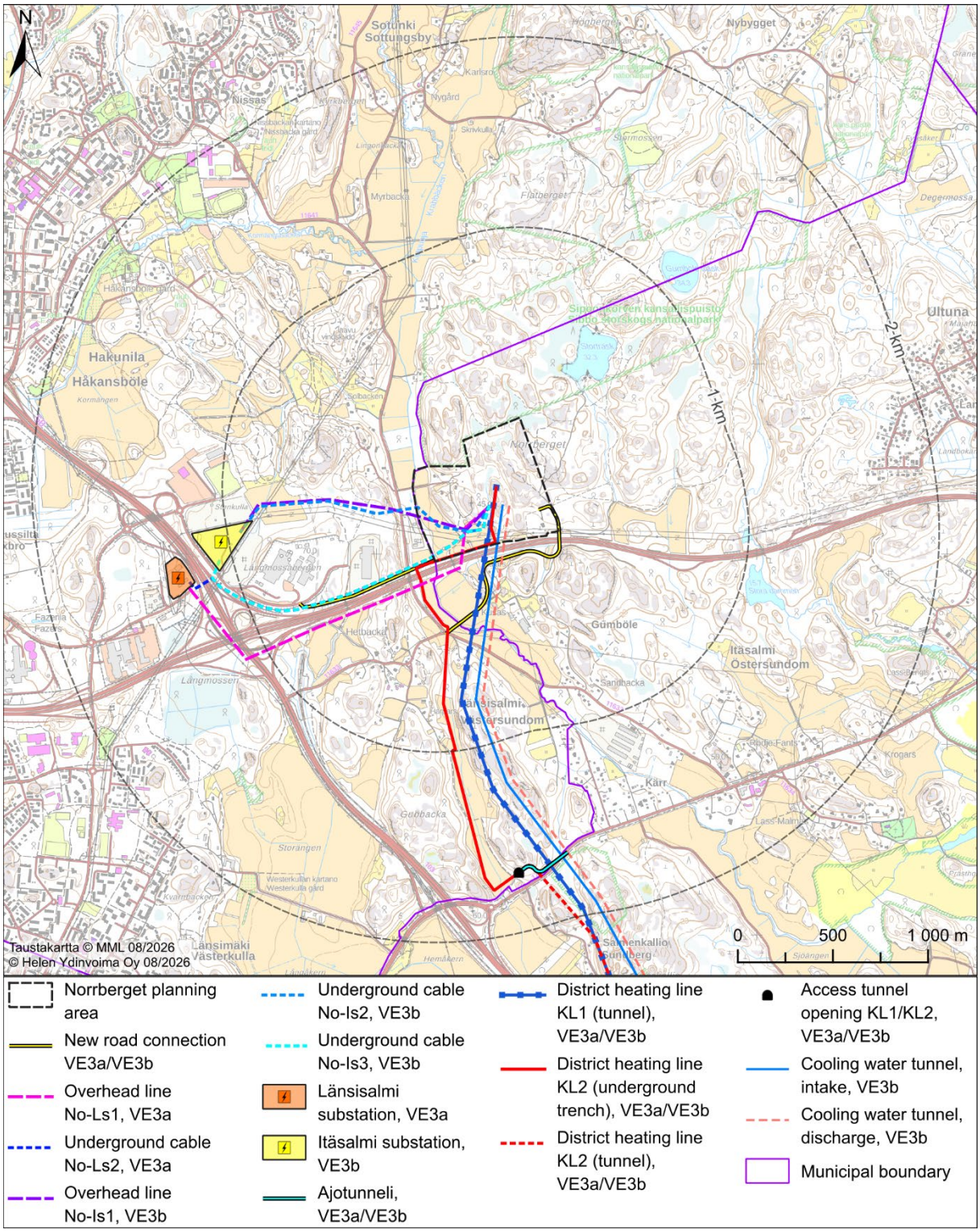


Figure 8-3. Extract of the topographic map and the Norrberget planning area with the infrastructure routes related to project options VE3a and VE3b.

8.1.4 National land use objectives

National land use objectives are part of the land use planning system in accordance with the Land Use Act. The Government decided on the currently valid national land use objectives on 14 December 2017. The purpose of the national land use objectives is, among other things, to help achieve the objectives of the Land Use Act and land use planning, the most important of

which are good living environment and sustainable development. The national land use objectives also contribute to the implementation of international obligations and agreements, such as the Paris Agreement and the United Nations (UN) Sustainable Development Goals (2030 Agenda).

The national land use objectives apply to projects that have significance beyond the regional level in terms of regional structure, land use, the transport network, or the energy network.

The national land use objectives are divided into five sections, which are:

- functional communities and sustainable mobility
- an efficient transport system
- a healthy and safe living environment
- a vibrant natural and cultural environment, as well as natural resources
- renewable energy supply.

According to Section 24 of the Land Use Act (132/1999), the planning of land use must take into account national land use objectives in such a way as to promote their implementation. For example, according to the national land use objective related to *functional communities and sustainable mobility*, the aim is to create prerequisites for low-carbon and resource-efficient urban development, which primarily relies on the existing structure. According to the national land use objective related to *a healthy and safe living environment*, a sufficiently long distance is left between activities that cause adverse health impacts or accident risks and activities that are sensitive to the impacts, or the risks are otherwise managed.

The relationship of the project to the national land use objectives is described in more detail at the reporting phase of the environmental impact assessment.

8.1.5 Regional plans

The approved regional plans in Uusimaa are the Uusimaa 2050 plan as a whole, the Östersundom regional plan and the wind power solution of the fourth phase regional plan. The Uusimaa plan 2050 includes the phased regional plans of the Helsinki region, Eastern Uusimaa and Western Uusimaa, which aim to steer the growth of the region in a sustainable manner. The Uusimaa plan 2050 covers almost the whole of Uusimaa, with the exception of the Östersundom area, and the plan package is legally valid. (Helsinki–Uusimaa Regional Council 2025a). The project's operations are located in the Helsinki region's phased regional plan (part of the Uusimaa regional plan 2050) and the areas of the Östersundom regional plan.

The Östersundom region has a valid Östersundom regional plan, which includes all key land use themes. The plan covers the area from Östersundom in Helsinki to the Sipoonjoki river, as well as part of Vantaa's Länsisalmi. In the legally valid fourth phase regional plan for wind power, no wind power reservations have been designated for the survey area. (Helsinki–Uusimaa Regional Council 2025a)

In the approved regional plans for the alternative planning areas VE1, VE2a/VE2b and VE3a/VE3b, as well as for the related infrastructure routes, the designations in the plan and the planning provisions are presented in Appendix 2. An extract of the approved regional plans is shown in Figure 8-4.

Copyright © Helen Nuclear Ltd

In the Helsinki region's phased regional plan, the Salmisaari planning area has been designated as the core zone of the Helsinki Metropolitan Area (dark brown waffle pattern) and as a development zone for urban activities (light brown vertical hatching). An important area in terms of preserving the cultural environment or landscape (Salmisaari industrial area) has also been designated to the area. In addition, a power line, metro and a road or street significant for public and/or freight transport have been designated to the surroundings of the planning area. According to the general planning provisions of the Helsinki region's phased regional plan, the operational opportunities and development needs of community management networks and facilities must be taken into account in more detailed planning.

A traffic area/port and recreational area have been designated to the Vuosaari planning area in the Helsinki region's phased regional plan. In addition, a main natural gas pipeline, power line, metro and a nationally significant two-lane road have been designated to the vicinity of the planning area.

In the regional plans, a workplace area (TP1), a 110 kilovolt power line and a 400 kilovolt power line have been designated to the area of the Itäsalmi substation.

In the Östersundom regional plan, a community management area (ET), a workplace area (TP1), a recreational area and a 400 kilovolt power line have been designated to the Norrberget planning area. A nature reserve and a main natural gas pipeline (k) have been designated in the immediate vicinity of the planning area.

Copyright © Helen Nuclear Ltd

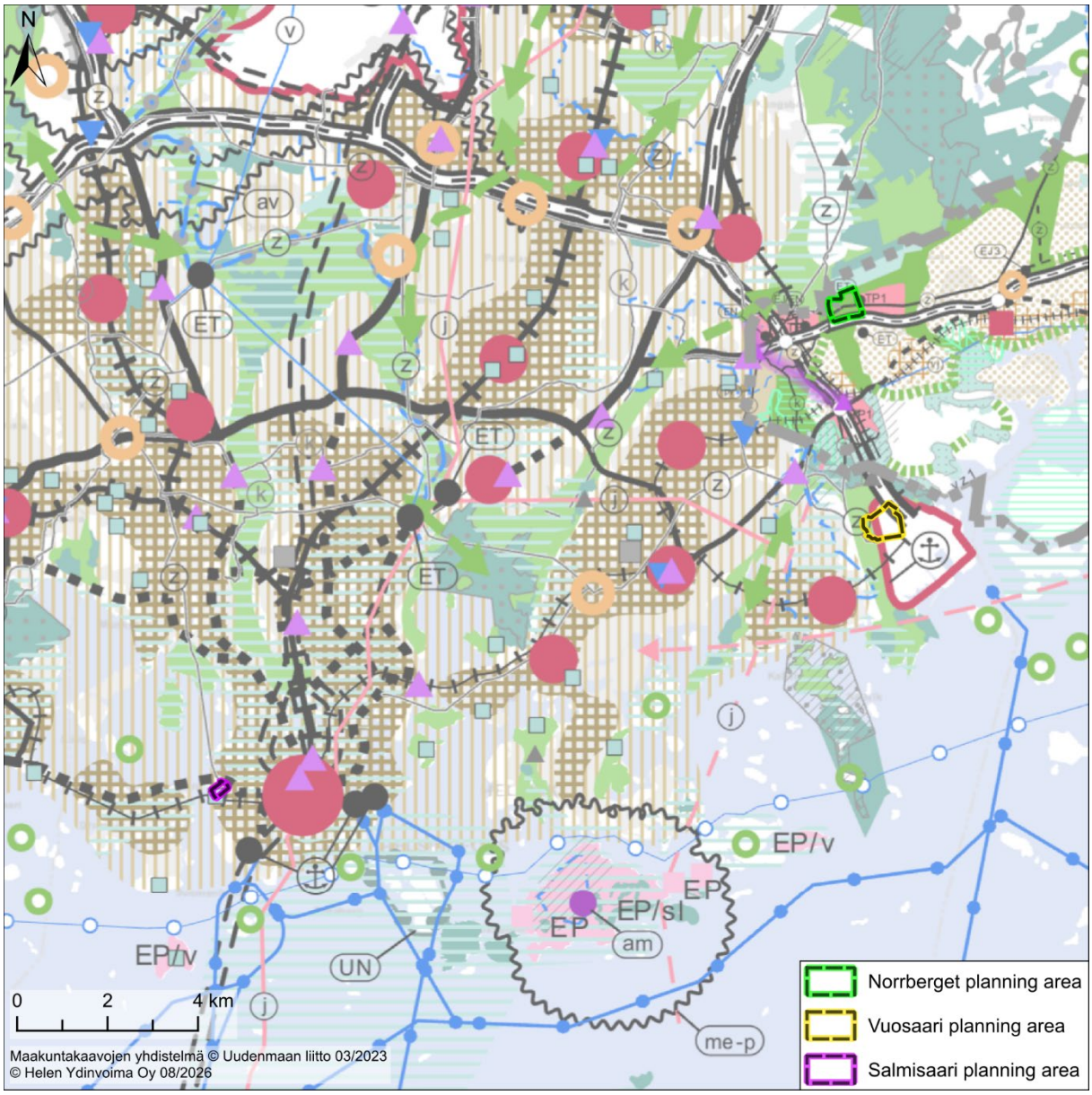


Figure 8-4. Extract of the combined map of regional plans valid in Uusimaa, as well as the planning areas related to project options.

8.1.6 Master plans

In the alternative planning areas as well as in the area of the associated infrastructure routes, the following master plans are in force:

- Helsinki Master Plan 2016, entry into force on 5 December 2018
- Helsinki Underground Master Plan 2021, entry into force on 19 August 2021
- Helsinki Master Plan 2002, entry into force on 19 January 2007
- Vantaa Master Plan 2007, entry into force on 25 February 2009, 3 June 2009 and 13 January 2010
- Vantaa Master Plan 2020, entry into force on 11 January 2023.

Copyright © Helen Nuclear Ltd

8.1.6.1 Salmisaari

The Salmisaari planning area (VE1) is covered by the Helsinki Master Plan 2016, where the planning area and its surroundings have been designated as the inner city area (C2), and a metro line has been designated to the southwest corner of the area (Figure 8-5). In the Helsinki Master Plan 2016, the city boulevard and the inner city C2 designations have been removed from the north side of the project area. The removed blocks are shown with a yellow diagonal hatch, and the city boulevard with black crosses. Helsinki Master Plan 2002 is in force in this area.

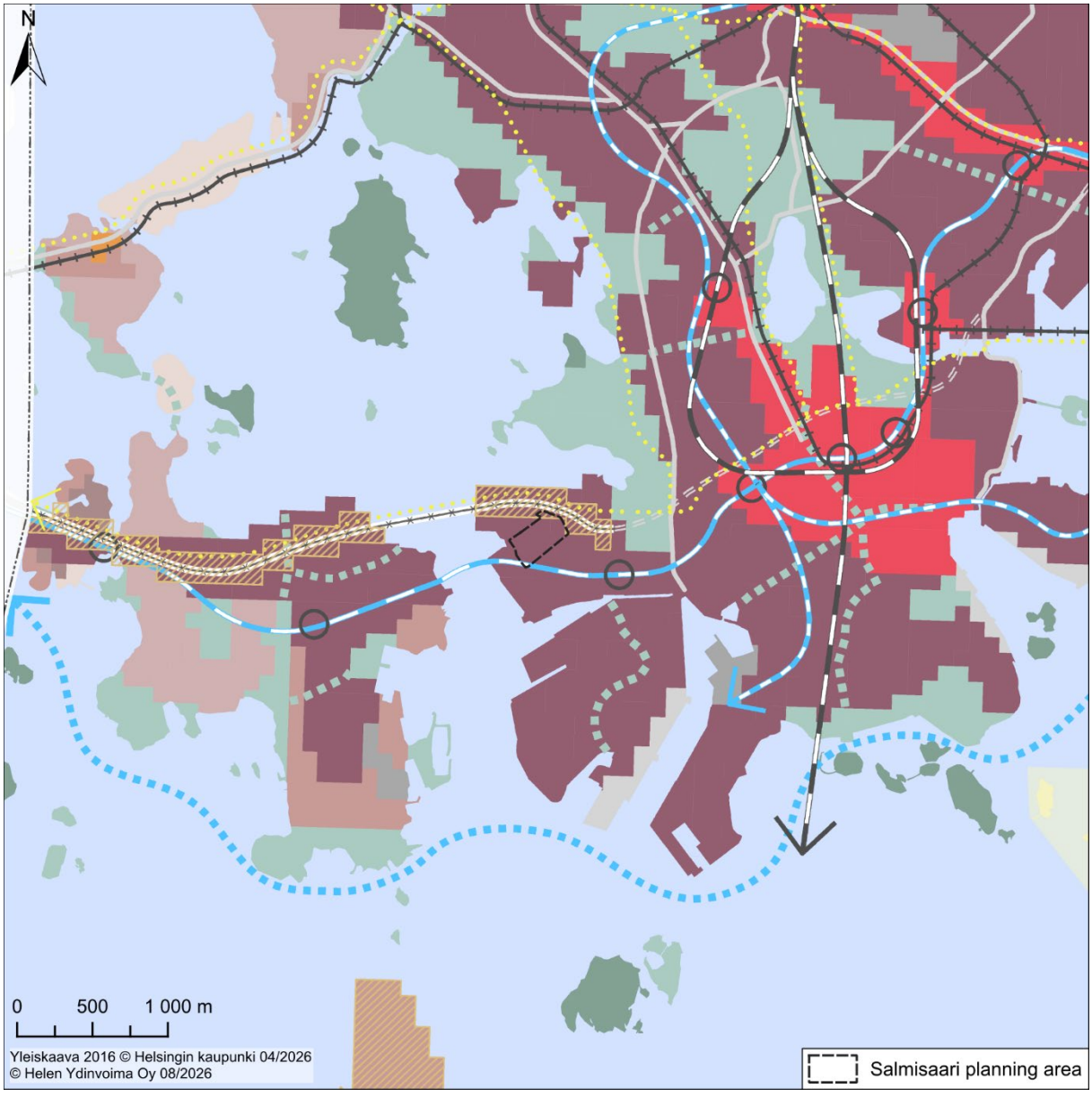


Figure 8-5. Extract of the Helsinki Master Plan 2016 and the Salmisaari planning area (VE1).

The Cultural Environment Theme Map related to the Helsinki Master Plan 2016 indicates legally binding designations, with nationally significant built cultural environment (RKY 2009 area) designated in the Salmisaari planning area (black diagonal hatching in Figure 8-6). According to the planning provision (see Figure 8-6), nationwide inventories are taken into account in planning in nationally significant landscape and cultural environment areas. The

Copyright © Helen Nuclear Ltd

planning must reconcile the land use indicated in the plan with the landscape and cultural environmental values. In addition, detailed planning must clarify the current decision situation.

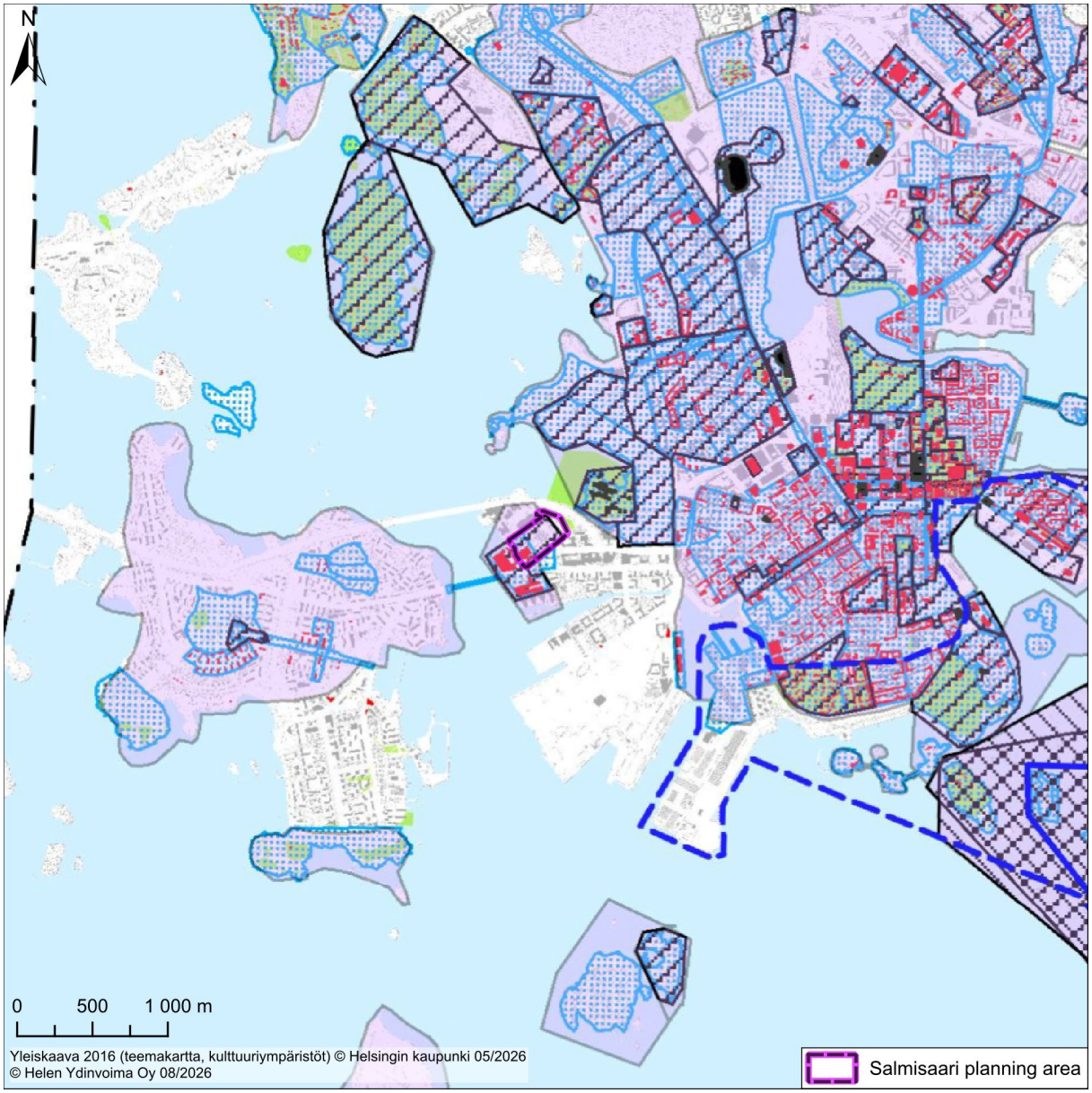


Figure 8-6. Extract of the Cultural Environments Theme Map of the Helsinki Master Plan 2016 and the Salmisaari planning area (VE1).

No legally effective designations (Figure 8-7) have been assigned to the Salmisaari planning area in the Urban Nature Theme Map related to the Helsinki Master Plan 2016.

Copyright © Helen Nuclear Ltd

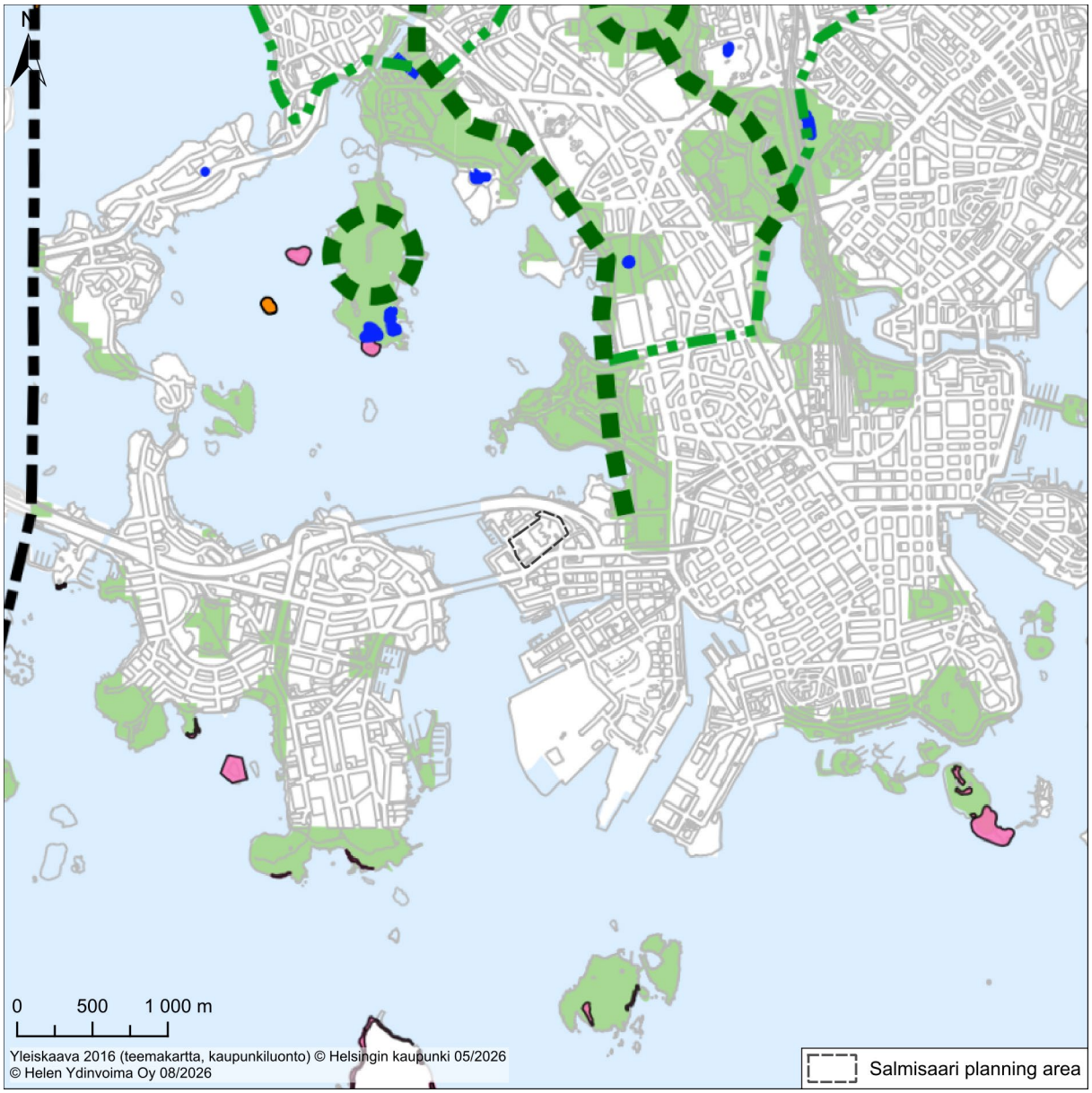


Figure 8-7. Extract of the Urban Nature Theme Map of the Helsinki Master Plan 2016 and the Salmisaari planning area (VE1).

The **Helsinki Master Plan 2002** is valid for the yellow diagonal hatching shown in the Helsinki Master Plan 2016 (Figure 8-5). In the Helsinki Master Plan 2002, an area dominated by apartment blocks for housing and offices (T), as well as a motorway (Länsiväylä, purple double line) has been designated to the north of the planning area. A technical maintenance area (grey) (Figure 8-8) has been designated to the planning area.

Copyright © Helen Nuclear Ltd

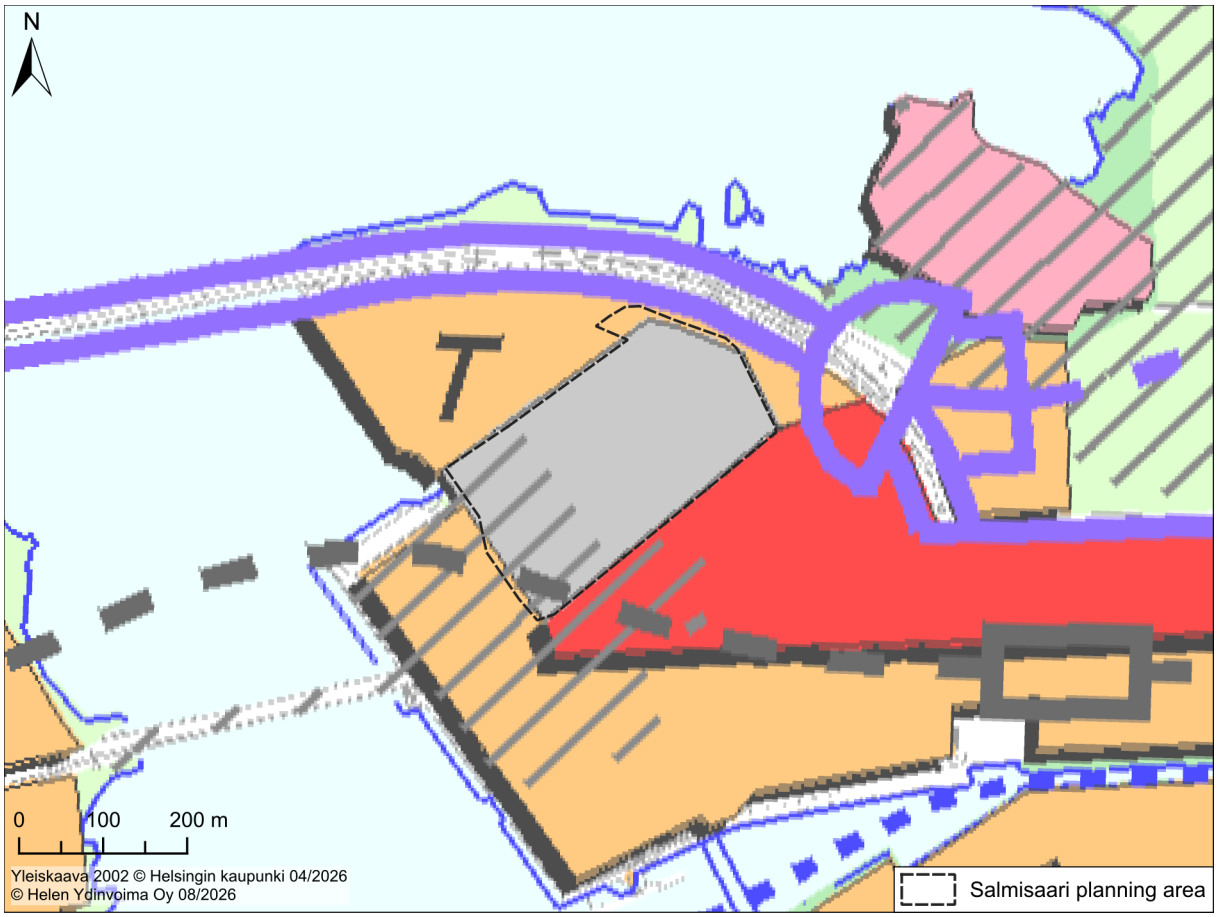


Figure 8-8. Extract of the Helsinki Master Plan 2002, valid in the northern part of the Salmisaari planning area. The Salmisaari planning area (VE1) has been added to the map.

Helsinki Underground Master Plan 2021 is in force in the planning area, the objective of which is to reconcile the needs of above-ground and underground land use. The designations in the plan are indicative and general in nature.

The entire Salmisaari planning area is located in the city centre underground development target area indicated in the plan. Existing built underground facilities and tunnels have been designated to the Salmisaari planning area. Spaces reserved for planned underground facilities and technical maintenance tunnels have been designated to the central and southern parts of the planning area. According to the planning provision, the prerequisites for the implementation of the planned underground facilities and tunnels must be secured.

To the south of the planning area, the need for a technical maintenance connection has been designated. To the north of the planning area, indicative planned underground facilities and technical maintenance tunnels have been designated in an east–west direction. The plan designation indicates the space to be reserved for planned underground facilities and technical maintenance tunnels, the locations of which are indicative. According to the planning provision, the prerequisites for the implementation of the indicatively planned underground facilities and tunnels must be secured. An extract of the plan map has not been presented due to restricted visibility of information related to underground arrangements.

Copyright © Helen Nuclear Ltd

8.1.6.2 Vuosaari

The Helsinki Master Plan 2016 applies in the Vuosaari planning area, which designates mainly community management areas and a main road to the area (Figure 8-9). Bordering the planning area are business premises and recreational and green areas. The planning area borders a light rail line to the east and, to the north, a nationally/regionally important road/street and a nationally/regionally important underground or covered road/street. The plan shows a coastal path to the west of the planning area.

The electricity transmission lines related to option VE2b (Vu-Is1, Vu-Is2 and Vu-Is3) are partly located in the recreational and green area of the Helsinki Master Plan 2016 and in the area of community management, and they intersect with the designated coastal path. The cooling water tunnels are located in the business premises area and the port area.

Copyright © Helen Nuclear Ltd

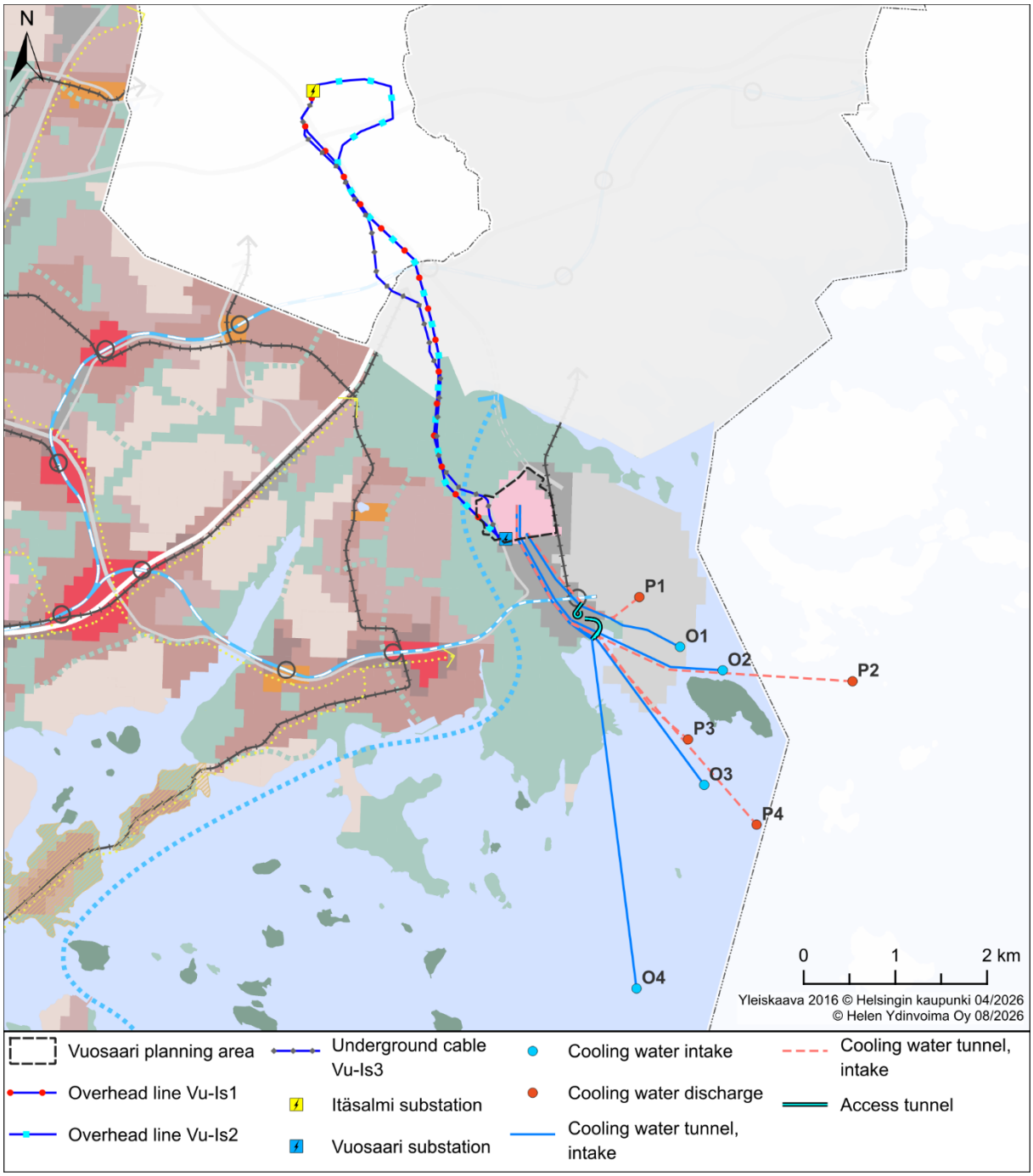


Figure 8-9. Extract of the Helsinki Master Plan 2016 and the Vuosaari planning area with the infrastructure routes related to project option VE2b.

In the Cultural Environments Theme Map related to the Helsinki Master Plan 2016, no legally effective plan designations have been assigned to the Vuosaari planning area. A nationally significant built cultural environment (black diagonal hatching) in the Mustavuori area has been designated to the location of the electricity transmission routes Vu-Is1, Vu-Is2 and Vu-Is3 (Figure 8-10).

Copyright © Helen Nuclear Ltd

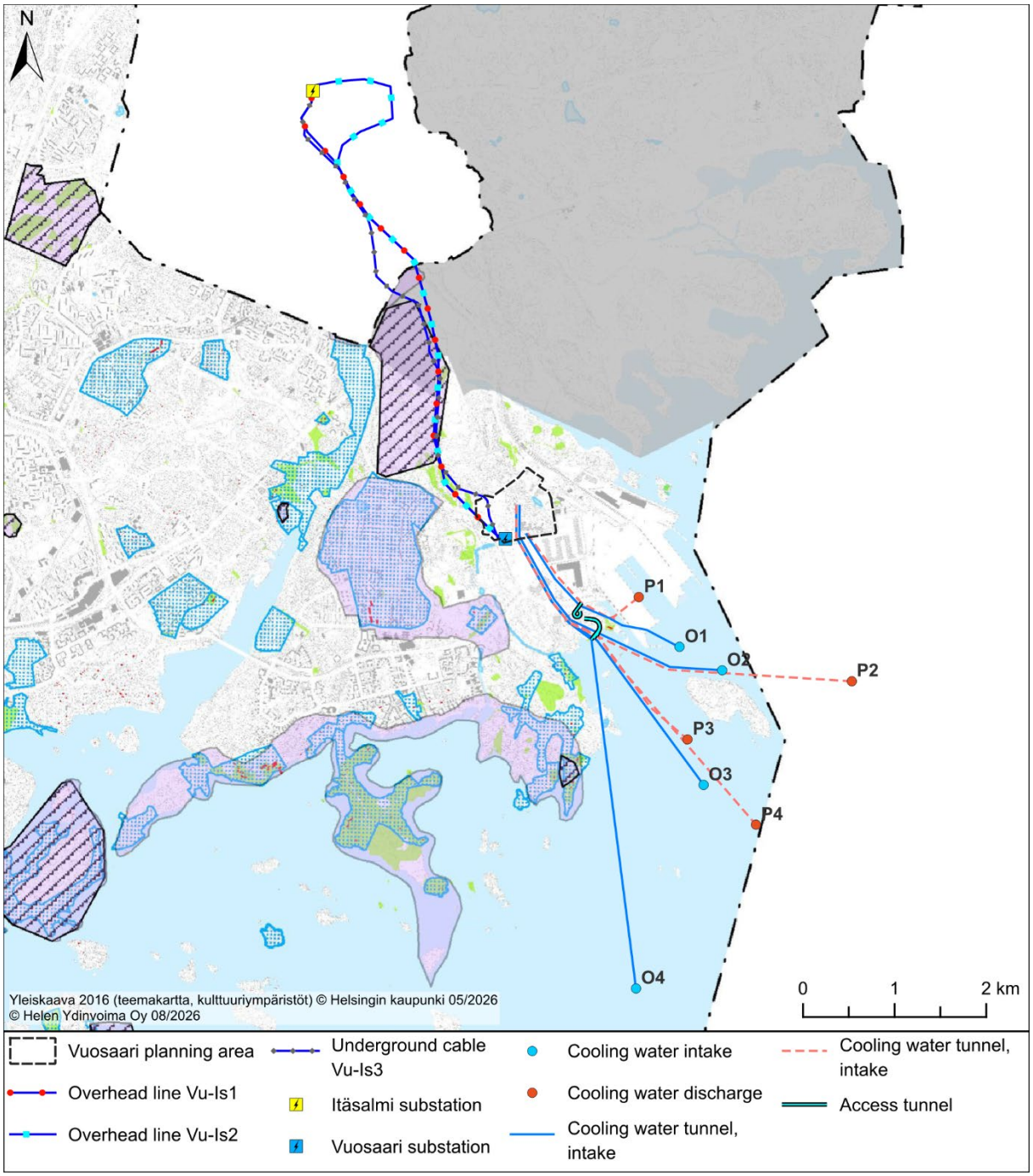


Figure 8-10. Extract of the Cultural Environments Theme map of the Helsinki Master Plan 2016 with the Vuosaari planning area (VE2a and VE2b) and the infrastructure routes related to project option VE2b.

In the Urban Nature Theme Map related to the Helsinki Master Plan 2016, no legally effective plan designations have been assigned to the Vuosaari planning area. The electricity transmission routes Vu-Is1, Vu-Is2 and Vu-Is3 pass through a nature reserve and natural habitats protected under the Nature Conservation Act (pink area), an area included in the Natura 2000 network (black diagonal hatching) and an area designated for protection (orange area) in the Mustavuori area (Figure 8-11). In addition, nature conservation areas and natural habitats protected under the Nature Conservation Act are indicated along the cooling water tunnel intake route O4, east of Uutela, in the Särkkäniemi area.

Copyright © Helen Nuclear Ltd

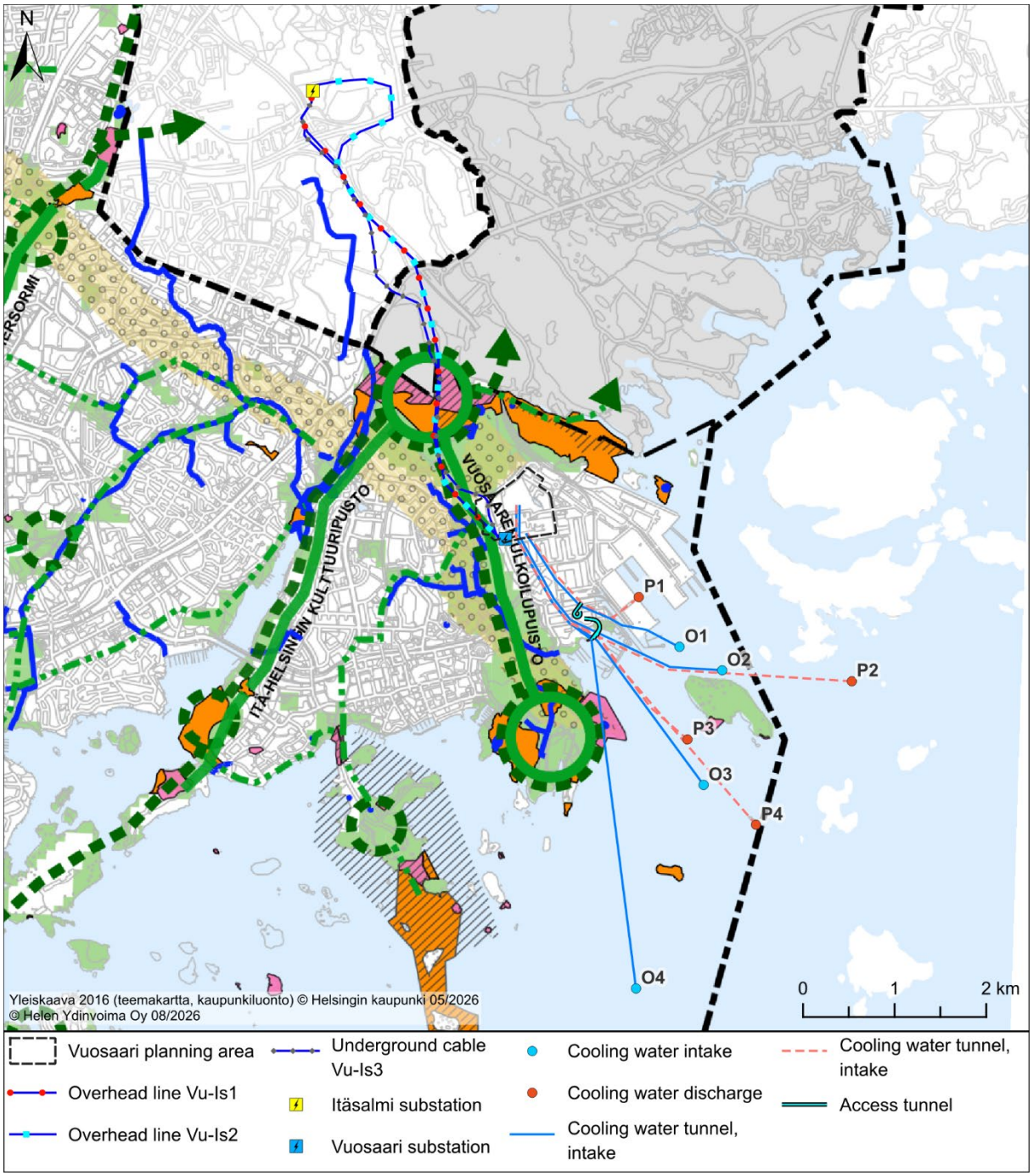


Figure 8-11. Extract of the Urban Nature Theme Map of the Helsinki Master Plan 2016 with the Vuosaari planning area (VE2a and VE2b) and the infrastructure routes related to project option VE2b.

The Helsinki Underground Master Plan 2021 is also in force in the planning area. An extract of the plan map has not been presented due to restricted visibility of information related to underground arrangements.

In the area of the electricity transmission routes related to option VE2b (Vu-Is1, Vu-Is2 and Vu-Is3), the Underground Master Plan of Helsinki from 2021 has designated the existing built underground facilities and tunnels crossing the southern part of the lines around the Niinisaarentie road, as well as the planned underground facilities and technical maintenance tunnels to the area between the planning area and Mustavuori and the Itäväylä area.

Copyright © Helen Nuclear Ltd

For the existing cooling water tunnel O1P1 related to option VE2b, the Helsinki Underground Master Plan indicates the existing built underground facilities and tunnels. Route O4 intersects the existing built underground facility and tunnel in the Uutela area.

The electricity transmission lines related to project option VE2b (Vu-Is1, Vu-Is2 and Vu-Is3) are also located within the City of Vantaa, all of which fall within the area covered by the Vantaa Master Plan 2020 (Figure 8-12). Power line options Vu-Is1 and Vu-Is2 cover areas where a power line (z), traffic area (L), metro (wide black dashed line), ecological corridor (wide green dashed line), green connection development site (green boundary), local recreational area (VL), agricultural area (MT), valuable cultural environment (black diagonal hatching), culturally and scenically significant village landscape (blue horizontal hatching), scenically valuable area or other valuable cultural environment (brown vertical hatching), indicative outdoor route, transport connection and residential area (A) are designated. In addition, in the immediate vicinity of the routes near Westerkulla Manor, an area of particular importance for biodiversity has been designated (luo).

In the Vantaa Master Plan 2020, a community management area (ET) as well as a power line (z) have been designated to the area of route options Vu-Is1, Vu-Is2 and Vu-Is3 and the Itäsalmi substation. The power line Vu-Is1 and the underground cable Vu-Is3 are partly located within the groundwater area (pv). In the Långmossebergen area, an indicative riding route, a natural gas trunk line (k), as well as a tunnel section for heavy traffic, have been designated to the area of the power line Vu-Is2.

The underground cable route Vu-Is3 in the Westerkulla manor area is located further west than the power line options alongside Ring Road III, circling the area of particular importance for biodiversity (luo) on its western side and running for a longer stretch through agricultural land (MT).

In Länsisalmi, the power line route Vu-Is-2 is bordered with the valid Vantaa Master Plan 2007 (Figure 8-12), where the power line route borders the protected green area (EV), the railway traffic area (LR) and the hiking and recreational area (VR). In addition, a natural gas trunk line (K), an indicative outdoor route and the tunnel section of the transport route (black dotted line) have been designated to the south side.

8.1.6.3 Norrberget

In the Norrberget planning area (VE3a and VE3b), in addition to the Östersundom regional plan, only Helsinki Underground Master Plan 2021 applies, which designates the planned underground facilities, technical maintenance tunnels (Östersundom wastewater treatment plant) and a technical maintenance connection need to the eastern part of the area. In the Helsinki Underground Master Plan 2021, the Östersundom area is designated as part of the region where underground land use has not been resolved, except for the Östersundom wastewater treatment plant, the utility tunnel and the Kilpilahti–Vuosaari tunnel. An extract of the plan map has not been presented due to restricted visibility of information related to underground arrangements.

The electricity transmission lines related to options VE3a and VE3b are located on the west side of the Östersundom wastewater treatment plant indicated in the Helsinki Underground Master Plan. To the southwest of the area, lies the new road connection for options VE3a and VE3b.

Copyright © Helen Nuclear Ltd

The district heating connections related to options VE3a and VE3b intersect with the existing built underground facility and tunnel marked in their southern part in the southern section of the Vuosaari tunnel and around Niinisaarentie, where they also intersect with the planned underground facility and the technical maintenance tunnel. To the south of the district heating connections, a technical maintenance connection need has been designated at a distance of less than 200 metres at its nearest point.

The route options for the cooling water tunnel related to option VE3b intersect with the technical maintenance connection need indicated in the Helsinki Underground Master Plan north of Vuosaari Harbour, as well as with the existing built underground facility and tunnel in the southern part of Vuosaari Harbour. The access tunnel of options VE3a/VE3b is also located near the existing tunnel in the southern part of the harbour.

The planning area borders the Vantaa Master Plan 2020 (Figure 8-12), which is in force in Vantaa, on its western side. At the western edge of the planning area, a local recreational area (VL), an ecological corridor (wide green dashed line), and a power line (z) have been designated. Near the planning area, a natural gas trunk line (k), an indicative outdoor route (black dotted line) and a traffic connection (black line) have also been designated. The village area (AT) has been designated at a distance of approximately 100 metres to the northwest side of the planning area at its nearest point.

In the Vantaa Master Plan 2020, a nature conservation area (SL) has been designated at a distance of approximately 360 metres to the north of the planning area at its nearest point and a community management area (ET) at a distance of approximately 220 metres to the west at its nearest point.

The pipe section of the district heating connection KL2 related to options VE3a and VE3b lies to a small extent within the area covered by the Vantaa Master Plan 2020, where a traffic area (L), a local recreational area (VL) and an ecological corridor have been designated along the route. A natural gas trunk line (k) and a traffic connection are also designated to the immediate vicinity. The district heating connection KL1 is not located in the area of the Vantaa Master Plan 2020.

The electricity transmission lines No-Ls1 (power line) and No-Ls2 (underground cable) related to option VE3a are located around the traffic area (L) shown in the Vantaa Master Plan 2020. A community management area (ET) has been designated to the area at the upstream end of the route No-Ls1 in the Länsisalmi substation. Route No-Ls2 is located in the community management area (ET) around the Länsisalmi substation and Pitkäsuontie. The Länsisalmi substation and partly the routes No-Ls1 and No-Ls2 are also situated within the groundwater area (pv). In addition, a power line (z), a traffic connection, a tunnel section for heavy rail traffic, ecological corridors, a green corridor development site, a local recreational area (VL), an indicative outdoor route, an indicative riding route and a natural gas trunk line (k) are designated to the route No-Ls2. The western new road connection ending at Pitkäsuontie, related to options VE3a and VE3b, follows the traffic connection indicated in the Vantaa Master Plan 2020, but it also intersects with, among other things, the green corridor development site (green border), two ecological corridors (thick green dashed line) and the natural gas trunk line (K).

The electricity transmission lines No-Is1 (power line) and No-Is2 (underground cable) related to option VE3b are located north of Långmossebergen in the local recreational area (VL) indicated in the Vantaa Master Plan 2020 near the power line (z). In addition, a community

Copyright © Helen Nuclear Ltd

management area (ET), a heavy traffic tunnel section (thick dotted line), an indicative riding route (brown dashed line), two ecological corridors (thick green dashed line), indicative outdoor routes (dotted line), a traffic connection (thick black line) and a natural gas trunk line (k) have been designated to the area of the routes No-Is1 and No-Is2. There is also a power line (z) intersecting with the routes near the Itäsalmi substation.

A power line (z), a traffic connection, a tunnel section for heavy rail traffic, ecological corridors, a green connection development site, a local recreational area (VL), an indicative outdoor route, an indicative riding route and a natural gas trunk line (k) have been designated to the area of the underground cable option No-Is3 located further south next to the traffic area (L).

Copyright © Helen Nuclear Ltd

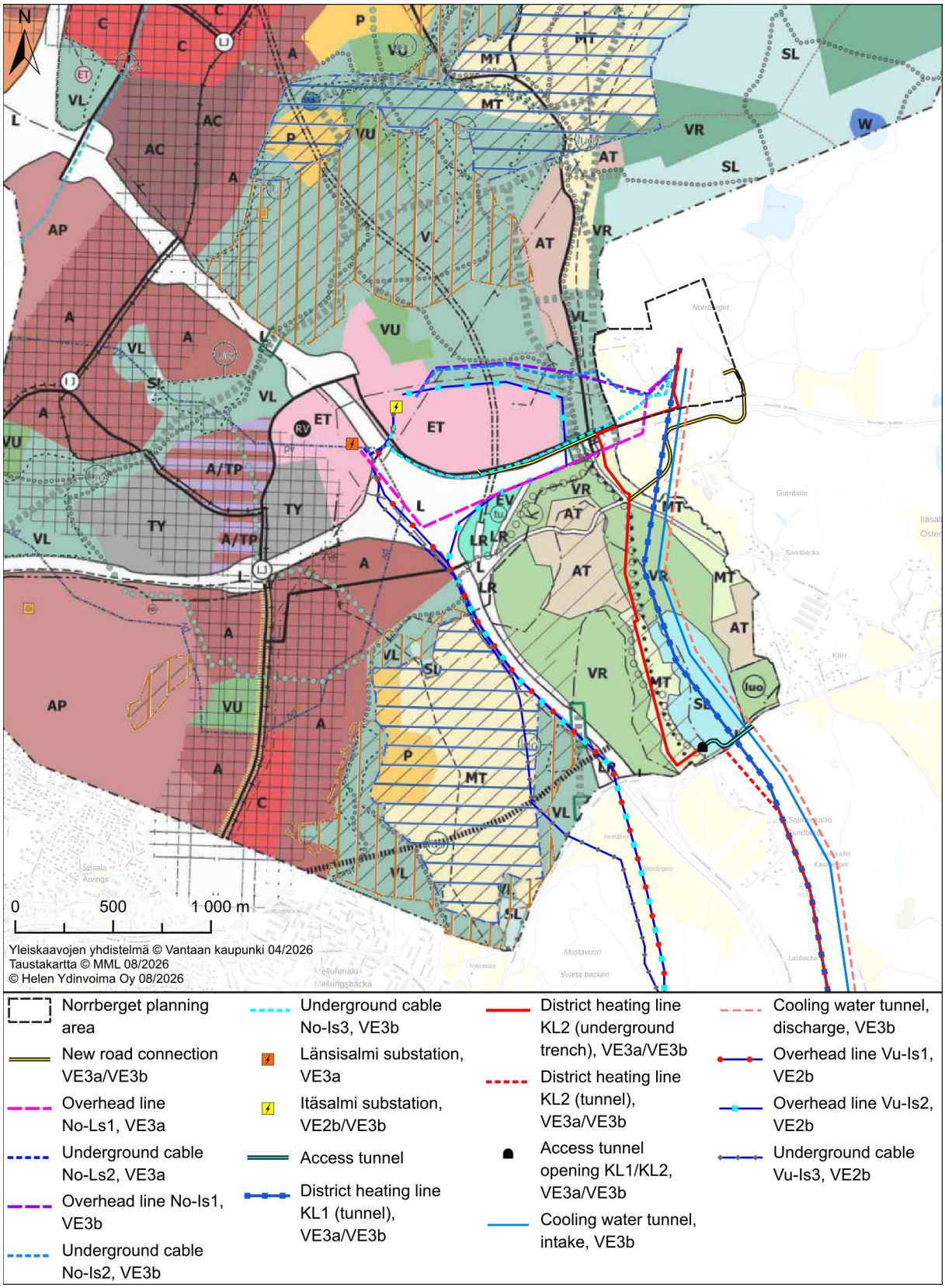


Figure 8-12. Extract of the Vantaa Master Plan 2020 and Vantaa Master Plan 2007 with the infrastructure routes related to project options VE2b, VE3a and VE3b.

To the southeast of the Porvoonväylä and Ring Road III intersection, the Vantaa Master Plan 2007 (Figure 8-12) is in force, in which an agricultural area (MT), natural gas trunk line (k),

road traffic area and hiking and outdoor area (VR) have been designated nearest to the planning area. The plan designates a village area (AT) at a distance of approximately 400 metres to the southwest of the planning area at its nearest point.

The district heating connection KL1 (tunnel) for options VE3a and VE3b runs through the area covered by the valid Vantaa Master Plan 2007 in Länsisalmi for approximately 1.4 kilometres. District heating connection KL2 (tunnel and pipeline) is located in the Vantaa Master Plan area for about two kilometres. An agricultural area (MT), as well as hiking and outdoor area (VR), area of scenic value (black diagonal hatching) and road traffic area are designated to the routes KL1 and KL2. There is also a nature conservation area (SL) at the section of the routes KL1 and KL2 located in a tunnel. The access tunnel is situated in the southern part of this area. In addition, an indicative outdoor route and an indicative riding route have been designated to the route KL2 (underground trench), and the route is immediately adjacent to the village area (AT) and the natural gas trunk line (K).

The power line related to option VE3a is located to a small extent in the protective green area (EV), the hiking and outdoor area (VR) and the agricultural area (MT) designated in the Vantaa Master Plan 2007. It also crosses the tunnel section of the traffic route (black double-dotted line), the railway area (LR), the natural gas trunk line (K), the indicative outdoor route (dotted line) and the road traffic area.

The new road connection, located more to the east, of options VE3a and VE3b is partly located in the agricultural area (MT) and road traffic area of the Vantaa Master Plan 2007.

In the area of district heating lines KL1 and KL2 and cooling water tunnels related to the Norrberget planning area, the Helsinki Master Plan 2016 is valid in the Helsinki area, except for the Östersundom major district (Figure 8-13). At the location of the district heating lines northwest of Vuosaari Harbour, recreational and green areas (green), community management areas (pink) and an underground or covered section of a nationally or regionally important road or street, city boulevard or main street (grey double dashed line) have been designated. A recreational and green area has been designated at the locations of the vertical shafts.

In the Helsinki Master Plan 2016, a harbour (light grey), a business premises area (dark grey), a bordering recreational and green area (green) and a water area (blue) have been designated to area of the cooling water tunnels. Additionally, a light rail line crossing the routes of the cooling water tunnels and the access tunnel of the Niinisaari vertical shaft has been designated at Niinisaari. A harbour (light grey), a business premises area (dark grey) and a water area (blue) have been designated to the area of the access tunnel located on the south side of the Vuosaari Harbour.

Copyright © Helen Nuclear Ltd

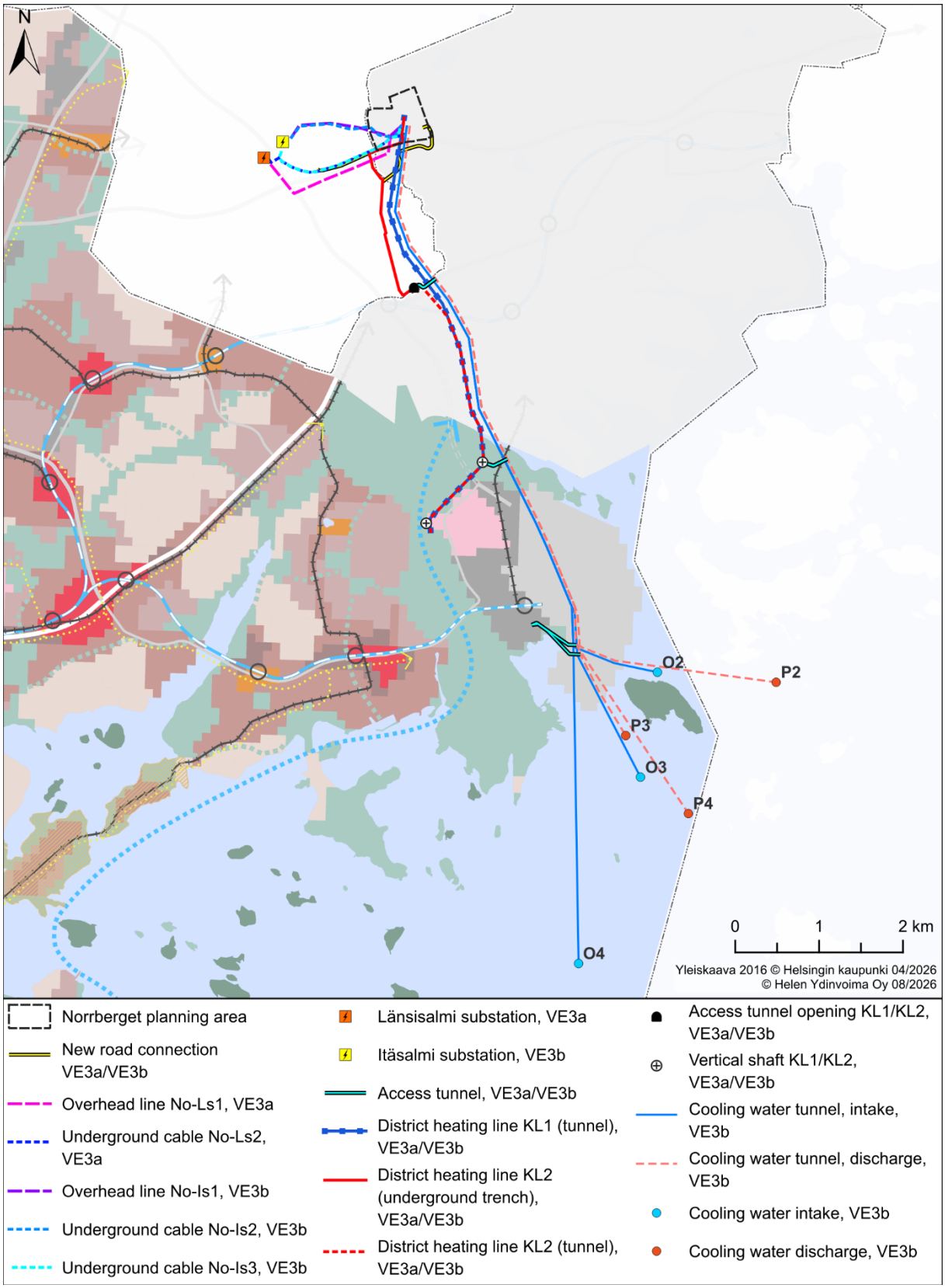


Figure 8-13. Extract of the Helsinki Master Plan 2016 and the infrastructure routes related to the Norrberget planning area VE3a and VE3b.

No legally effective designations have been assigned to the surroundings of the infrastructure routes related to the Norrberget project options VE3a and VE3b in the Cultural Environments Theme Map (Figure 8-14).

Legally effective designations have been assigned to the routes of the district heating lines related to project options VE3a and VE3b and the cooling water tunnels of project option VE3b in the Urban Nature Theme Map related to the Helsinki Master Plan 2016. Areas belonging to the Natura 2000 network (black diagonal hatching), as well as areas designated for protection (orange), have been designated to the area (Figure 8-15).

Copyright © Helen Nuclear Ltd

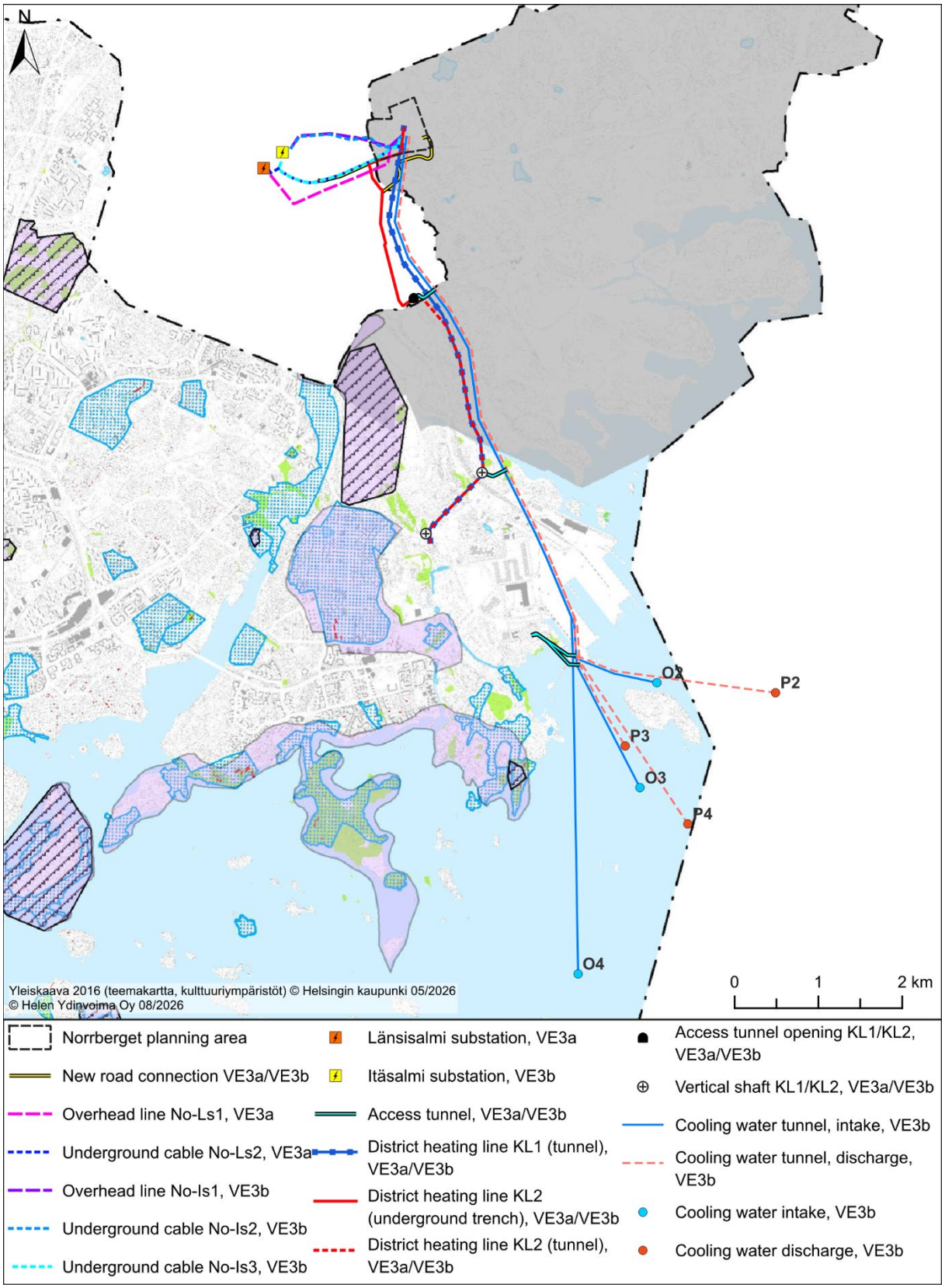


Figure 8-14. Extract of the Cultural Environments Theme Map of the Helsinki Master Plan 2016 and the infrastructure routes related to the Norrberget planning area (VE3a and VE3b).

Copyright © Helen Nuclear Ltd

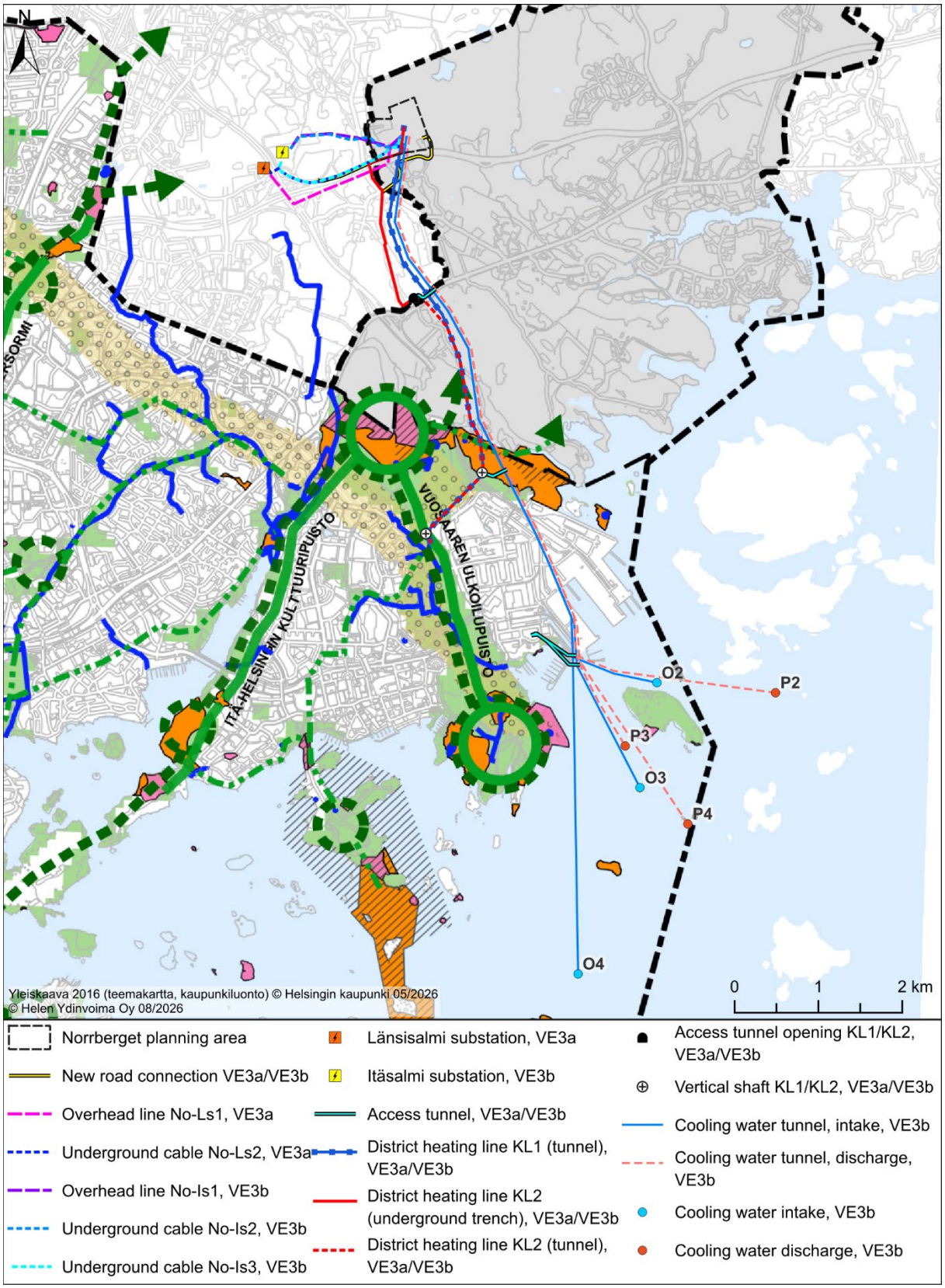


Figure 8-15. Extract of the Urban Nature Theme Map of the Helsinki Master Plan 2016 and the infrastructure routes related to the Norrberget planning area (VE3a and VE3b).

Copyright © Helen Nuclear Ltd

8.1.6.4 General provisions of master plans

Of the general provisions concerning the entire Helsinki Master Plan 2016 area, the most important for the project are the following:

- Areas formed by squares describe the main purpose of land use. Areas do not have a precise boundary. Land use in adjacent areas subject to different planning provisions is coordinated so that a functional urban structure is created. The continuity of green fingers and other regional green areas as well as the local green area network must be ensured.
- The master plan area is planned everywhere, taking into account functionality, economy and ecological sustainability, as well as health and safety, the needs of housing and business, as well as the accessibility of services, using the existing urban structure.
- Nationally significant landscape and cultural environments must be taken into account as legally binding on the Cultural Environments Theme Map. In addition, the planning must take into account the regionally and locally significant landscape areas and cultural environments and their characteristics, as well as sites protected under the Antiquities Act. The planning must reconcile the land use indicated in the plan with the landscape and cultural environmental values.
- Areas belonging to the Natura 2000 network, nature conservation areas and areas protected under the Helsinki Nature Conservation Programme 2015–2024 must be taken into account with legal effect on the Urban Nature Theme Map. Recreational services and ecosystem services will be developed. Areas of value for nature conservation and biodiversity must be taken into account in planning and the preservation of values must be ensured.
- Facilities and equipment serving community management may be located in all areas. Large energy production facilities may also be located in the inner city. Regional energy and water supply networks and facilities, along with their protection zones, are included in the area reservations for areas to be developed and for currently developed areas.
- The shoreline is indicative. Beaches in new development areas are planned as public.
- Flood preparedness must be taken into account when planning close to the sea and water systems. In planning, attention should be paid to stormwater management. In connection with land use changes that cause significant impacts, a stormwater management plan must be prepared.

Of the general provisions concerning the entire Helsinki Underground Master Plan 2021 area, the most important for the project are the following:

- The Underground Master Plan guides underground planning and the drafting of underground and above-ground local detailed plans.
- In addition to the area reservations presented in the Underground Master Plan, other underground construction indicated in the underground local detailed plan is allowed, if it does not cause significant harm to the main underground operation or the above-ground use of the area.

Copyright © Helen Nuclear Ltd

- When designing and building an underground facility, the health, safety and comfort aspects of the environment must be taken into account. In the vicinity of traffic tunnel entrances, air quality must meet the requirements of housing and residential buildings. Tunnel entrances and ventilation openings must be designed and implemented in such a way that the traffic emissions generated in the tunnel do not endanger the health of the residents and do not prevent building of housing or other construction in the vicinity of the tunnel entrances or ventilation openings. In addition, special attention must be paid to groundwater and water supply of the properties, as well as to noise and air emissions.
- In connection with the planning and construction of new projects, care must be taken to ensure that the prerequisites for the implementation of long-term projects of general interest, such as technical maintenance and area reservations for tunnels of different modes of transport, are maintained.
- The use of geothermal heat is promoted and can be used at sites where the drilling of geothermal wells does not cause significant inconvenience to existing underground facilities and tunnels, planned and indicatively planned underground area reservations, above-ground land use, groundwater areas important for water supply, cultural environment, recreation or nature conservation values.
- When designing and implementing underground facilities, recreational use, scenic values, cityscape, cultural environmental values, natural values and geological values must be taken into account.
- The planning and placement of underground facilities and their above-ground structures, including exits, ventilation equipment, rescue connections and smoke extraction, as well as their coordination with above-ground facilities, must take into account the cityscape, landscape, valuable cultural environment, conservation objectives and adaptation to the space, as well as the possibilities for joint solutions. In the first place, the integration of structures into buildings and, in the second place, the placement of structures in public areas should be studied, taking into account functional aspects as well as those related to cityscape and the environment.
- The safety of underground facilities must be ensured. Fire and rescue safety must be taken into account in the design of underground facilities. When designing an underground facility, in addition to the main purpose of use, the need for use of the facility as a civil defence shelter must be assessed.
- When designing underground facilities, the constructability of the bedrock with precautionary action zones and safety impacts must be ensured.
- When designing connections to the ground or to other underground facilities and structures from underground facilities, the risk of flooding caused by high sea level, stormwater and technical maintenance networks must be taken into account in the design and implementation.
- Underground facilities must be developed in a versatile and systematic manner, combining different functions.

Copyright © Helen Nuclear Ltd

- In addition to the underground facilities and area reservations shown in the master plan, the state administration's underground facilities and plans must also be considered when planning underground facilities.

Of the general and timing provisions concerning the Vantaa General Plan 2020 area, the most important for the project are the following:

- Local detailed planning and permit processing must take into account significant heritage buildings in accordance with the cultural environment database maintained by the museum authority, as well as fixed ancient relics and other cultural heritage sites in accordance with the Ancient Relics Register maintained by the Finnish Heritage Agency, and identify their protection needs and conditions.
- Energy efficiency and the use of renewable energy must be promoted in local detailed planning.
- In addition to the main purpose of the area, facilities and equipment serving community management may be located without disturbing it.
- Potential risks of sites involving major accident hazard must be adequately identified and taken into account in further planning.

Of the general provisions concerning the Vantaa Master Plan 2007 area, the most important for the project are the following:

- In addition to area-specific provisions, the following construction may be permitted, provided that it does not adversely affect the main purpose of the area:
    - 6 construction of technical maintenance equipment and noise barriers
    - 7 construction of civil defence shelters and underground facilities
- The local detailed planning and permit processing must take into account the sites protected by the Antiquities Act as mentioned in the appendices to the master plan report, as well as sites of architectural and cultural historical value, and find out their protection needs and conditions.

8.1.7 Local detailed plans

8.1.7.1 Salmisaari

Plan no. 11890 applies to the Salmisaari planning area (VE1). It was approved on 25 November 2009 and came into force on 8 January 2010. In the local detailed plan, a block area (ET) for buildings and facilities serving community management, a protective green area (EV) and architecturally valuable buildings (sr-2) are designated, among others, to the planning area (Figure 8-16). According to the sr-2 notation, "*the building cannot be demolished, nor can it be repaired or altered in a way that spoil the townscape value of the façade or the roofing. If such measures have been taken in the building in the past, in connection with repair or alteration work, the building must be repaired in a way that is well suited to the building's style.*" An approximate part of the area reserved for the underground line as well as the area reserved for the overhead line (z) has also been designated to the planning area.

Copyright © Helen Nuclear Ltd

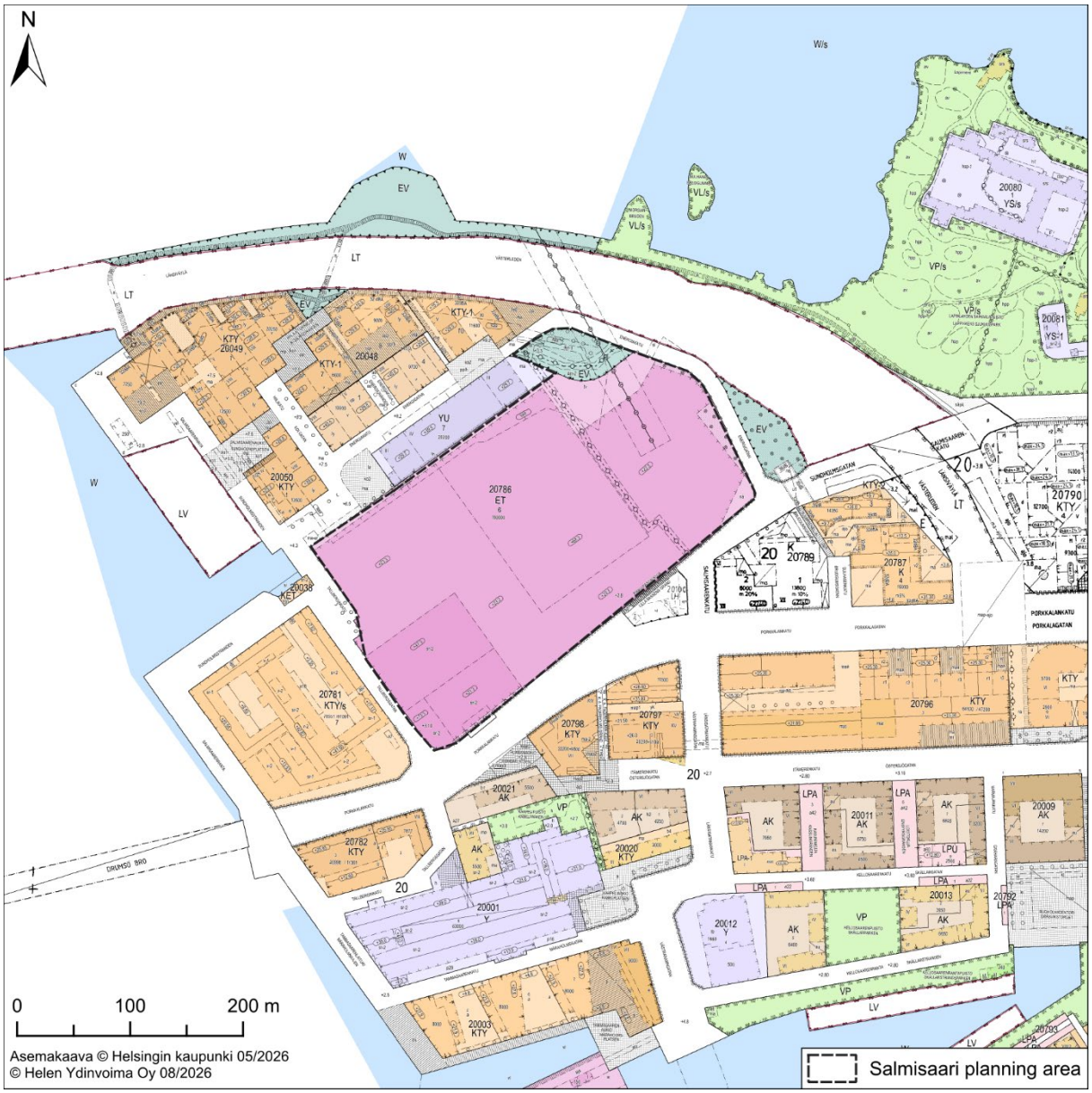


Figure 8-16. Extract of the City of Helsinki's valid consolidated local detailed plans (City of Helsinki 2026f) and the Salmisaari planning area.

Plan no. 10894 (underground local detailed plan) is also valid in the planning area. It was approved on 17 January 2001 and came into force on 9 March 2001. In the plan, an underground facility for energy supply below level -16.0 (ma-1), the part of the area where an exhaust air shaft and staircase connection leading to the ground may be located (mahi-1) and underground facilities for a metro tunnel (mam), for example, are designated to the planning area. An extract of the plan map has not been presented due to restricted visibility of information related to underground arrangements.

8.1.7.2 Vuosaari

Five local detailed plans (Figure 8-17) are valid in the Vuosaari planning area.

Plan no. 12248 was approved on 10 December 2014 and came into force on 28 October 2016. In the plan, a block area for buildings and facilities serving community management (ET), an area for community management (ET-1), a block area for commercial buildings (KTY), a block

area for retail premises (KL-1), street areas and underground facilities for a metro tunnel (mam-1), for example, are designated to the planning area.

Plan no. 11730 was approved on 26 August 2009 and came into force on 9 October 2009. In the plan, street areas and underground facilities for a metro tunnel (mam-1), as well as a local recreational area (VL) bordering on the western side, for example, are designated to the planning area. In the east and south, there is a port area for the needs of the municipality (LS-k).

Plan no. 10640 was approved on 8 December 1999 and came into effect on 2 August 2002. The plan is valid in the planning area only at the eastern end of the Niinisaarentie road, where a street area has been designated. Near the planning area, part of the area is reserved for a power line, as well as an underground cable tunnel, where the bedrock must not be excavated in a way that would damage the tunnel.

Plan no. 12783 was approved on 31 January 2023 and came into effect on 12 April 2023. In the plan, community management areas (ET) and parts of the area reserved for overhead power lines are designated to the planning area. The planning area borders a protected green area (EV), which includes a protected/conserved section (s) containing a breeding site for the moor frog.

Plan no. 11668 was approved on 12 December 2007 and came into effect on 25 January 2008. In the planning area, the plan applies to the Satamakaari street area, which includes, among other things, street areas and parts reserved for power lines.

Copyright © Helen Nuclear Ltd

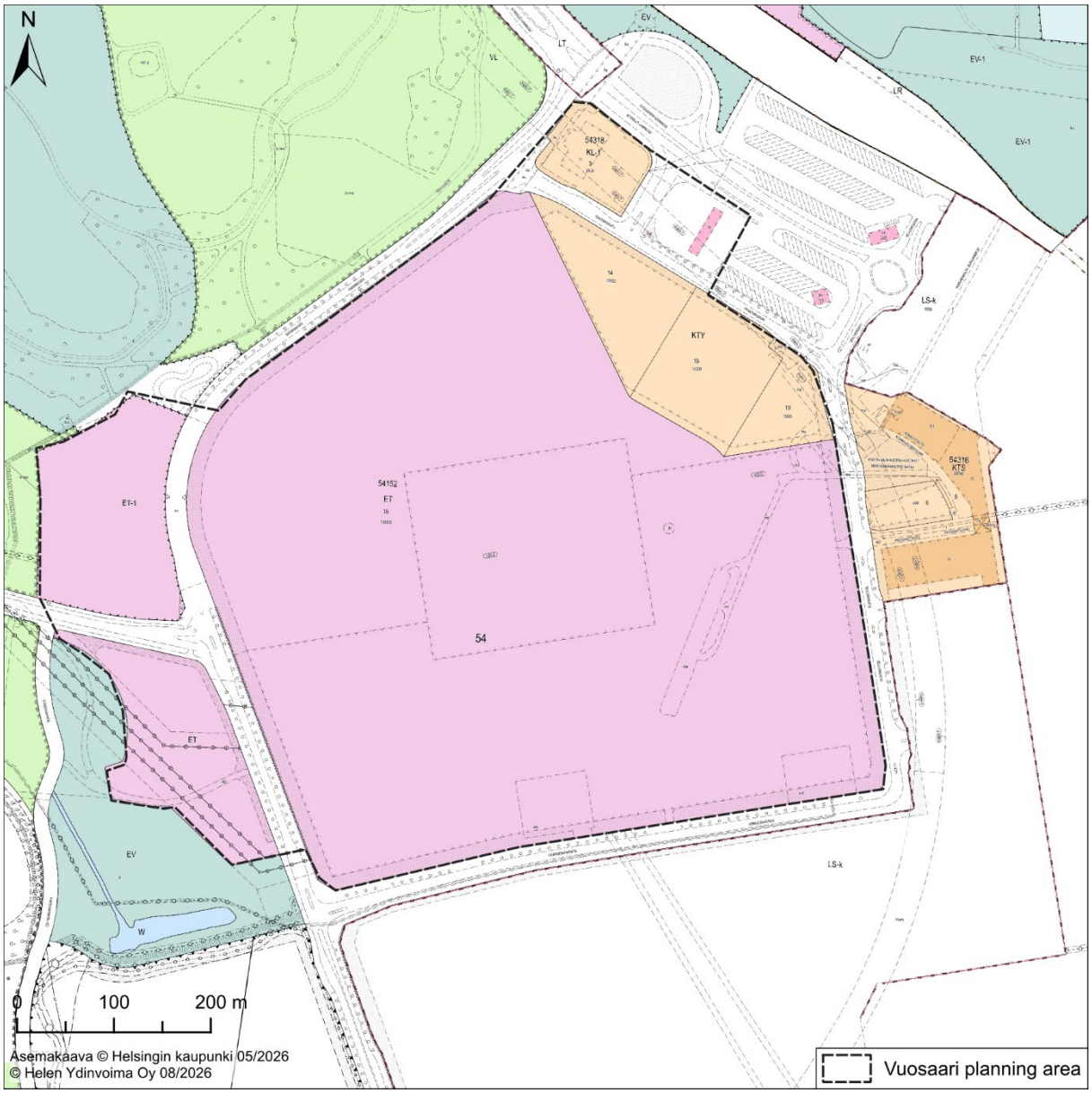


Figure 8-17. Extract of the City of Helsinki's valid consolidated local detailed plans (City of Helsinki 2026f) and the Vuosaari planning area.

In Helsinki, the southern sections of the electricity transmission routes Vu-Is1, Vu-Is2 and Vu-Is3 related to project option VE2b lie in areas covered by local detailed plans (Figure 8-18).

In the local detailed plans valid for the area of the overhead line options Vu-Is1 and Vu-Is2, block areas for buildings and facilities serving community management (ET), street areas, protected green areas (EV) and a part of the area with trees of scenic value (s) are designated. In addition, an underground cable tunnel has been designated to the area of the routes Vu-Is1 and Vu-Is2. In this area, rock must not be excavated in a way that would harm the tunnel (e). The area also includes a parking area (p), an indicative riding area (ra), a landscape management area reserved for research, teaching and nature monitoring (EM), a part of the area containing a historical relic protected under the Antiquities Act (sm), a local recreational area (VL), a nature reserve (SL) and an area intended for protection under the Nature Conservation Act (SL-1). In the southern part of the route options, the routes are located in places in the area reserved for the power line (z).

Copyright © Helen Nuclear Ltd

The underground cable Vu-Is3 is located at the southern end of the route further north of the overhead lines, but in the Mustavuori area, is runs alongside the routes Vu-Is1 and Vu-Is2. A community management area (ET and ET-1) has been designated to the location of the underground cable, of which the area marked ET-1 north of the Niinisaarentie road can be used for fuel storage. In the area of the underground cable, there is also a landscape management area, reserved for research, teaching and nature monitoring (EM), an indicative outdoor path (ut), an indicative riding path (rt), a street reserved for walking and cycling (pp), a part of the area with trees of scenic value (s), an indicative riding area which may be fenced (ra), as well as a part of the area containing a historical relic protected under the Antiquities Act (sm).

Routes Vu-Is1, Vu-Is2 and Vu-Is3 also intersect with the delimitation indicated by the sl-n notation, which is related to the Government's decision on Finland's proposal for a site to be included in the European Community's Natura 2000 network.

The route options of the cooling water tunnels related to project option VE2b are located in the local detailed plan area, with the exception of the water area south of the Vuosaari Harbour.

A block area (T) of industrial and warehouse buildings has been designated to the area of the cooling water tunnels, where a coffee roastery may be placed. In connection with the designation of the block area T, no more than one underground basement floor may be constructed within the block for parking, maintenance, storage, technical facilities, dressing rooms, washing facilities and similar facilities. A port area for municipal needs (LS-k) has been designated at the location of the cooling water tunnels, where port facilities may be built. A block area (KTY) for business premises has been designated at the location of the tunnels, where no more than one underground basement floor may be built for parking, maintenance, storage, technical facilities and similar facilities. In addition, block areas for public buildings as well as commercial and office buildings (KY), a park (VP) and a part of the area containing a rare habitat type (slt) protected under the Nature Conservation Act have been designated.

In the local detailed plans valid in the marine area, a nature conservation area (SL), a marina (LV) and a water area (W) have been designated to the area of the route options of the cooling water tunnels related to project option VE2b. In addition, the route of the cooling water intake point O4 intersects with the shipping lane and boat lane indicated in the local detailed plans.

In addition, in the immediate vicinity of the route options for the cooling water tunnels related to project option VE2b, a marina (LV) has been designated in the local detailed plan.

Copyright © Helen Nuclear Ltd

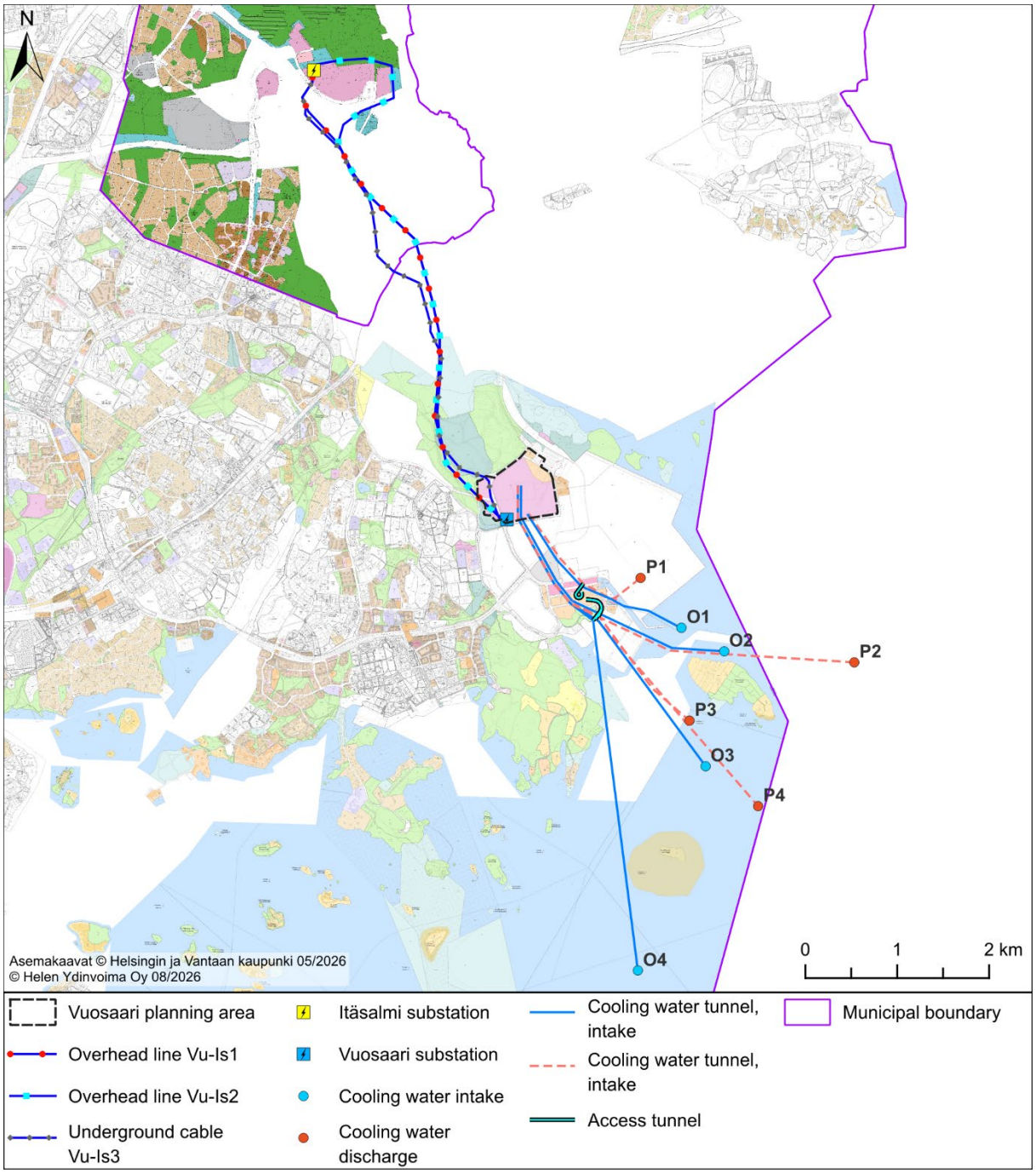


Figure 8-18. Extract of the City of Helsinki's valid consolidated local detailed plans (City of Helsinki 2026f) and the City of Vantaa's valid consolidated local detailed plans (City of Vantaa 2026c) with the Vuosaari planning area and the infrastructure routes related to project option VE2b.

In the City of Vantaa's area, the electricity transmission routes related to project option VE2b are mainly located in an unplanned area (Figure 8-18 and Figure 8-19), with the exception of the northern part of the routes.

In the vicinity of the substation, special functions block area (E), a road area (LT) and a street have been designated to the area of the overhead line Vu-Is1 and the underground cable Vu-Is3. A concrete product plant, ready-mixed concrete plant and asphalt plant as well as recycling plants may be located in the special functions block area. The routes also intersect with the part of the area reserved for the underground line.

Copyright © Helen Nuclear Ltd

In the area of the overhead line Vu-Is2, a protective green area (EV), a street, as well as a part of the area where no measures may be carried out that change its natural state (s-3) are designated. In addition, the transmission line area of the route Vu-Is2 is also located in the block area (ET) for buildings and facilities serving community management. A local recreational area (VL) has also been designated to the area of the overhead line Vu-Is2, within which the route intersects with the part of the area reserved for a natural gas line (k).

Routes Vu-Is1 and Vu-Is3 are located west of the danger area (va) shown in the local detailed plan near the Pitkäsuontie road, and route Vu-Is2 lies south of the danger area north of Långmossebergen, where, according to the related provision, a separate crossing statement must be requested from the power line owner for any activities within the transmission line area marked as a danger area or for construction or other infrastructure nearby (e.g. streets, traffic arrangements, cables, dumping, stormwater management, crushing, water and sewer systems, etc.).

In the area of the Itäsalmi substation in Vantaa, the local detailed plan has assigned a special functions block area (E) for a concrete plant, ready-mixed concrete plant, asphalt plant and recycling facilities, as well as a special area for a snow reception point (EL). According to the provision related to the designation EL, a separate crossing statement must be requested from the owner of each power line for construction located in or near the designated transmission line area. The part of the area reserved for the underground line has been assigned to the western part of the substation area.

Copyright © Helen Nuclear Ltd

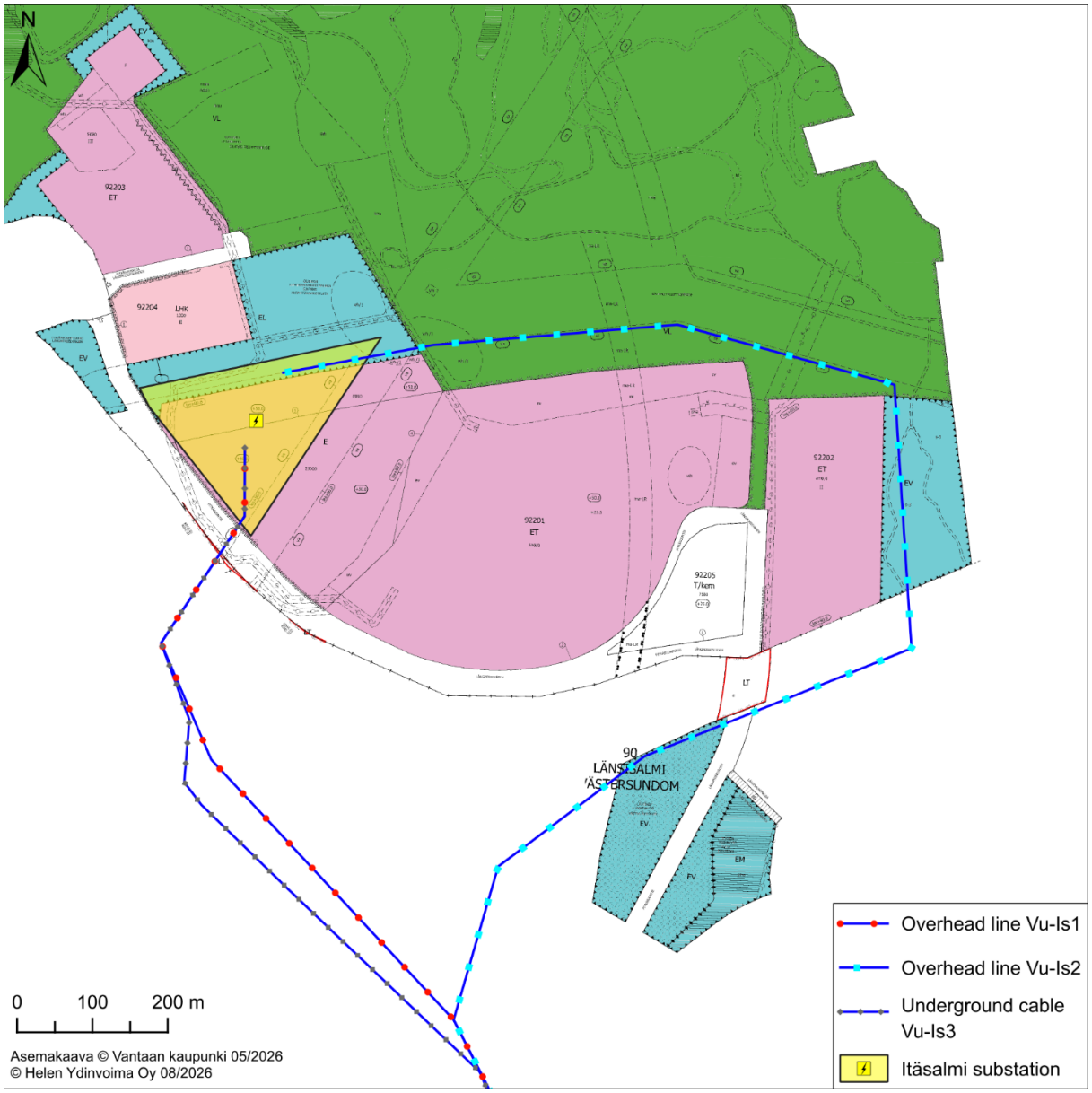


Figure 8-19. Extract of the City of Vantaa's valid consolidated local detailed plans (City of Vantaa 2026c) covering the surroundings of Porvoonväylä and Ring Road 3, as well as the electricity transmission route options related to project option VE2b and the Itäsalmi substation area.

8.1.7.3 Norrberget

There are no valid local detailed plans in the Norrberget planning area.

The nearest valid local detailed plans are located in Vantaa, on the west side of the planning area. About 100 metres away, in the currently valid plans no. 920100 (approved 27 March 2000) and no. 002175 (approved 18 November 2013), the closest designation is a local recreational area (VL). In plan no. 002175, a danger area (va) related to the transmission line area is designated, for example. About 140 metres away, in the currently valid plan no. 920200 (approved 29 March 1999), the closest designation is a protected green area (EV) and a part of the area where no measures may be carried out that change its natural state (s-3).

Copyright © Helen Nuclear Ltd

The electricity transmission route options related to the planning area (110 kV in option VE3a and 400 kV in option VE3b) are mainly located in the local detailed plan area in Vantaa (Figure 8-20). No-Ls1 is located entirely in an unplanned area.

In the areas for electricity transmission routes No-Ls1, No-Ls2 and No-Is3, a block area for buildings and facilities serving community management (ET), a protective green area (EV), a through-traffic or access roads with protection areas and areas of unobstructed visibility (LT) and a part of the area reserved for a natural gas line (k) are designated. The areas for electricity transmission routes No-Is1 and No-Is2 include a special area for a snow reception point (EL), parts reserved for underground lines and an indicative stormwater area where a bioretention basin may be constructed (wh/1).

The areas for electricity transmission routes No-Is1, No-Is2, No-Is3 and No-Ls2 include a special functions block area (E), a block area for buildings and facilities serving community management (ET), a local recreational area (VL), a road area (LT), an underground railway tunnel (ma-LR) and a danger area (va). In the vicinity of the electricity transmission routes No-Is1 and No-Is2, a local recreational area (VL) has also been designated.

In the area of electricity transmission routes No-Is3 and No-Ls2, a block area of industrial and warehouse buildings has been designated, on which a major plant for the manufacture or storage of dangerous chemicals (T/kem), an underground railway tunnel (ma-LR) and a street area may be located. The underground plan 920400 valid in the area of the routes is not public.

There are no valid local detail plans in the area of the district heating lines KL1 and KL2 in the Vantaa area.

The new road connection to the west of the planning area related to options VE3a and VE3b is located within the local detailed plan area north of the Porvoonväylä road. In the local detailed plans, a protected green area (EV), a part of the area where no measures may be carried out that change its natural state (s-3), a block area of buildings and facilities serving community management (ET) and a street area have been designated to the location of the road connection. The underground plan 920400 valid in the area is not public. There are no valid local detailed plans in the area of the new road connection south of the planning area.

The Länsisalmi substation does not have a valid local detailed plan. In the area of the Itäsalmi substation, the local detailed plan has assigned a special functions block area (E) for a concrete plant, ready-mixed concrete plant, asphalt plant and recycling facilities, as well as a special area for a snow reception point (EL). According to the provision related to the designation EL, a separate crossing statement must be requested from the owner of each power line for construction located in or near the designated transmission line area. The part of the area reserved for the underground line has been assigned to the western part of the substation area.

Copyright © Helen Nuclear Ltd

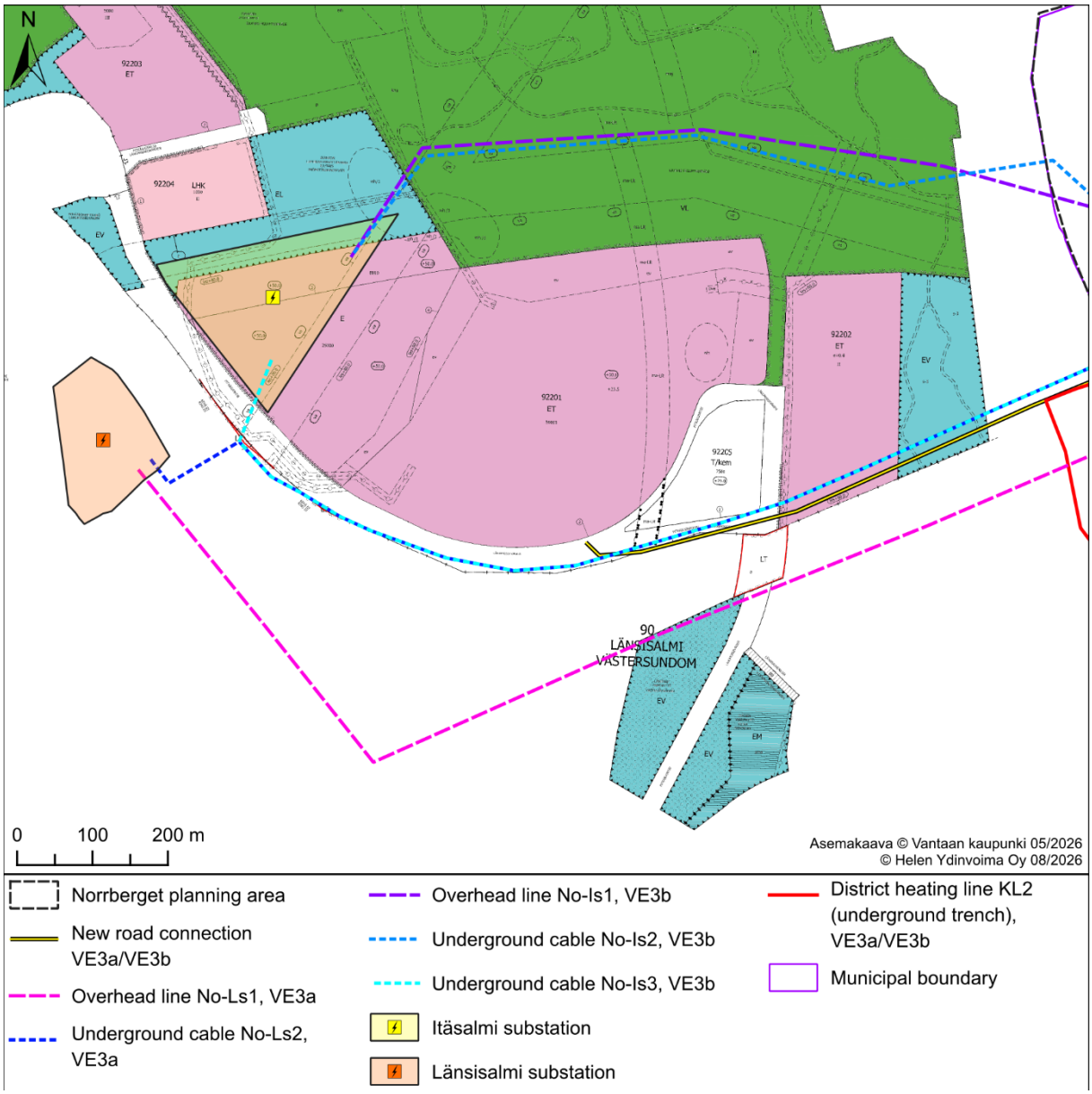


Figure 8-20. Extract of the City of Vantaa's valid consolidated local detailed plans (City of Vantaa 2026c) covering the surroundings of Porvoonväylä and Ring Road 3, as well as electricity transmission routes related to project options VE3a and VE3b, substation areas and the new road connection located to the west.

In the Helsinki area, district heating lines KL1 and KL2 are located in a tunnel. There is no valid local detailed plan (Figure 8-21) in the northern part of the lines. In the southern part of the local detailed plans, the area includes areas designated for protection under the Nature Conservation Act (SL-1) and an area included in the European Community Natura 2000 network (sl-n) by Government's decision on Finland's proposal. It also includes construction zones where a farm's economic centre (mt) may be located, a section near the line containing an artillery road (sm-t), belonging to First World War fortification equipment and protected under the Antiquities Act, and an area containing a historical relic (sm) protected by the Antiquities Act. In addition, the area of district heating lines KL1 and KL2 includes a protective green area where a noise barrier must be built (EV-1), a railway area (LR), a local recreational area (VL), a part of the area where an underground public road (ma-lt) may be located, a part of the area where solidified contaminated soil masses (e-mm) may be placed, a landscape management

Copyright © Helen Nuclear Ltd

area reserved for research, teaching and nature monitoring (EM), a pumping station construction area (et-ma), a utility tunnel where excavation is allowed only in a way that will not harm the tunnel (e) and a part of the area reserved for the power line (z).

In the Niinisaari area, the vertical shaft related to district heating lines KL1 and KL2 is located within an area designated for protection under the Nature Conservation Act (SL-1). The vertical shaft near Niinisaarentie is situated in an area with a designated local recreational area (VL), a utility tunnel in its vicinity (e) where excavation is allowed only in a way that will not harm the tunnel and a part of the area reserved for the power line (z).

In the Niinisaari area, an area intended for protection under the Nature Conservation Act (SL-1) has been designated to the location of the underground access tunnel in the Niinisaari area. In addition, the area to the east includes a part of the area where an ancient relic (sm) protected by the Antiquities Act is located. It intersects with the part of the area where an artillery road (sm-t), belonging to First World War fortification equipment and protected under the Antiquities Act, is located. The area of the underground access tunnel located in the southern part of Vuosaari Harbour includes a block area of business premises buildings (KTY), a block area of parking spaces (LPA), a block area of commercial buildings (KL-1), a marina (VL), a street area and a water area (W).

Regarding the cooling water tunnels related to project options VE3a and VE3b, the local detailed plan for the Niinisaari area designates an area protected under the Nature Conservation Act (SL-1) to the area of the cooling water tunnels. Other designated areas are an area included in the European Community Natura 2000 network (sl-n) by Government’s decision on Finland’s proposal, a part of the area where a historical relic protected under the Antiquities Act (sm) is located and a protected green area where a noise barrier must be built (EV-1). The area intersects a part of the area where an artillery road (sm-t), belonging to First World War fortification equipment and protected under the Antiquities Act, is located. The Vuosaari Harbour area has a designated port area (LS-k) reserved for the needs of the municipality, a marina (LV) and a water area.

Copyright © Helen Nuclear Ltd

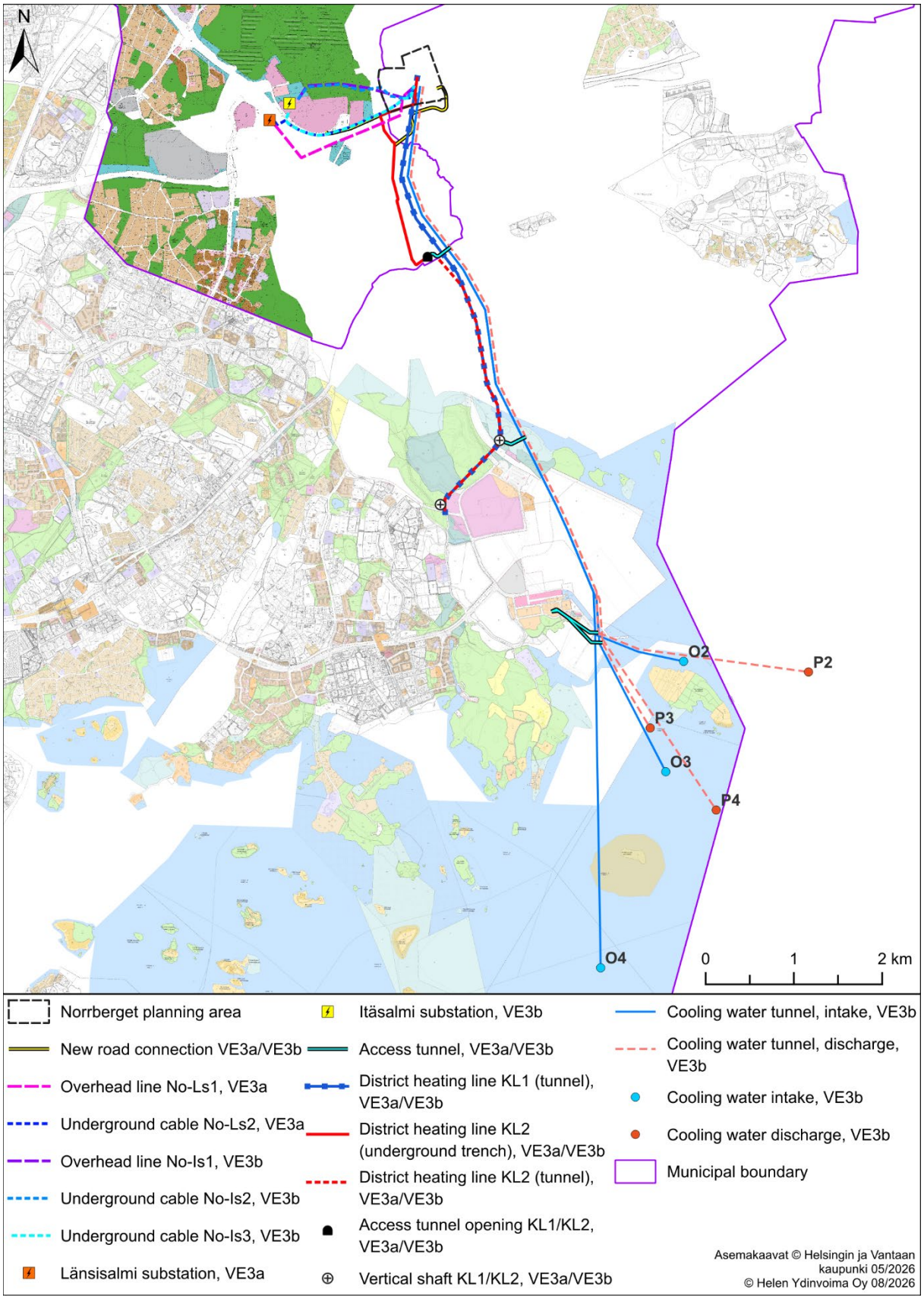


Figure 8-21. Extract of the City of Helsinki's valid consolidated local detailed plans (City of Helsinki 2026f) and the City of Vantaa's valid consolidated local detailed plans (City of Vantaa 2026c) with the Norrberget planning area and the infrastructure routes related to project options VE3a and VE3b.

Copyright © Helen Nuclear Ltd

8.1.8 Ongoing planning projects in the project area and its vicinity

8.1.8.1 Regional plan

The entire region of Uusimaa is currently working on Uusimaa's 5th phase regional land use plan, the *Innovative Green Transition* plan, or the VISIO Plan, which complements the current land use plan package. One of the five themes in the VISIO Plan is energy. The target year for the phased regional plan is 2050.

The VISIO Plan draft has been on display from 11 March to 8 May 2026. According to the participation and assessment plan for the phased regional plan, the plan proposal phase will run from spring 2026 to spring 2027, with the approval phase scheduled for 2027. (Helsinki–Uusimaa Regional Council 2025b)

In the VISIO Plan draft (Helsinki–Uusimaa Regional Council 2026a), an energy supply area (EN/h) has been designated to the Salmisaari planning area (VE1) which indicates the need for and the indicative location of a new 400 kV substation, necessary for the security of supply of electricity transmission, as well as an area important for the preservation of the cultural environment or landscape, and a power line (z).

In the VISIO Plan draft, a traffic area / port, an energy supply area site designation (EN/h), which indicates the need for and the indicative location of a new 400 kV substation, necessary for the security of supply of electricity transmission, a main gas pipeline and a power line (z) have been designated to the Vuosaari planning area (VE2a and VE2b). To the surrounding area in the north, a protected area has been designated, as well as the need for a power line connection (z) to the substation.

The VISIO Plan draft, an energy supply area (EN/h), an area of community management (ET), the indicative alignment of community management (ET) and a power line (z) have been designated to the Norrberget planning area (VE3a and VE3b). A main gas pipeline (k) has also been designated to the west.

The VISIO Plan draft also designates distribution and resting points for alternative fuels for heavy traffic in the vicinity of the Vuosaari and Norrberget planning areas.

According to the general provisions of the phased regional land use plan draft, small modular reactor plants (SMRs) intended for energy production can be placed within an urban structure or its immediate vicinity, relying on existing infrastructure. The placement requires more detailed planning in the local detailed plan.

The designations and planning provisions of the draft regional plan as well as the planning provisions and general planning provisions (Helsinki–Uusimaa Regional Council 2026b) designated to the area of the infrastructure routes of alternative planning areas are presented in Appendix 3.

Copyright © Helen Nuclear Ltd

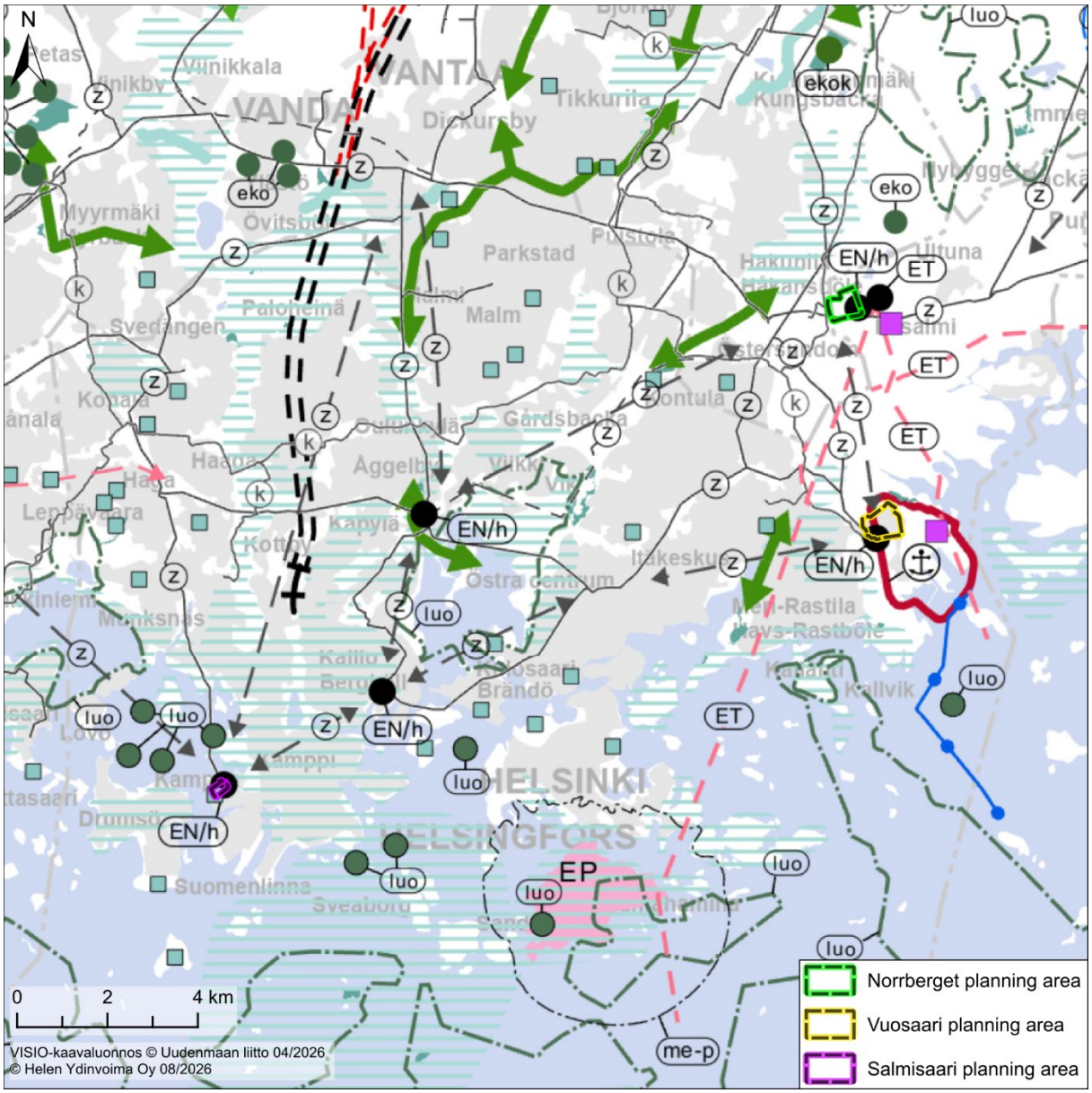


Figure 8-22. Extract of the draft of the pending VISIO plan and the planning areas related to the project options.

8.1.8.2 Master plans

In the planning areas and their surroundings, the Östersundom component master plan in its proposal phase is pending, and in Salmisaari, the component master plan covering the Länsiväylä area is in its preparation phase. The implementation of the project in these areas requires the preparation of a separate component master plan or a phased local master plan, allowing for the construction of a nuclear power plant, covering the planning area and the precautionary action zone of the plant. In connection with the above-mentioned pending plans, the prerequisites for the placement of a nuclear power plant will not be addressed, but these plans may have a steering effect, for example, regarding infrastructure routes and ecological corridors.

In the Salmisaari planning area (VE1), the component master plan for the Länsiväylä area is pending, for which the Urban Environment Committee has approved the planning principles. The aim of the plan is to explore the possibilities of planning new business premises,

Copyright © Helen Nuclear Ltd

apartments and other urban structures in the area, as well as to reduce the adverse impacts of a road-like traffic environment on residential areas. (City of Helsinki 2023a) It has been decided to put the planning on hold until other plans, surveys and decision-making concerning Koivusaari, Länsiväylä and the harbour tunnel, among others, have progressed (City of Helsinki 2026a).

There are no pending master plans in the Vuosaari planning area (VE2a and VE2b). However, the electricity transmission routes related to project option VE2b are located in the Östersundom component master plan area, for which a draft plan was published on 28 January 2025 (City of Helsinki 2025a). In the draft plan, the area of the electricity transmission routes Vu-Is1, Vu-Is2 and Vu-Is3 includes designations for a 110 kilovolt power line (z-1), a nature reserve (SL), an area belonging to the Natura 2000 network (nat), a nationally significant built cultural environment (RKY), an agricultural area (MT), as well as the intersecting water pipeline Helsinki–Östersundom (V), a light rail line, a street or other street important for the urban structure and a regional bike route. In addition, the power line routes Vu-Is1 and Vu-Is2 include designations for workplace areas (TP), a grade-separated intersection and a railway in the vicinity of Itäväylä and Ring Road III.

In the Norrberget planning area (VE3a and VE3b), the Östersundom component master plan is pending (Figure 8-23). In the component master plan draft, the planning area includes designations for workplace areas (TP), residential areas (A-4), hiking and outdoor areas (VR) and an underground area for community management (et). Across the planning area in the east–west direction, the need for road traffic connection as well as a 400 kilovolt power line, a 110 kilovolt power line and the route of the 400 kilovolt transmission line project have been designated. The southeastern corner of the planning area includes designations for an ecological corridor in the north–south direction, as well as a wildlife crossing or underpass (ecological corridor). The planning area is bordered from its northern part by a nature reserve (SL) designated in the plan draft, and from its southern part by a motorway or other main roadway.

In the Östersundom component master plan, a traffic area (L-1) has been designated at a distance of about 270 metres to the east of the planning area. The L-1 notation indicates a heavy traffic service area that serves freight logistics. At a distance of approximately 70 metres to the south of Finnish national road 7 (Porvoonväylä), a residential area has been designated where the environment is preserved (A/s). To the south of Finnish national road 7, the draft also designates, among other things, a farmland area of scenic value (MA). Other residential areas designated as nearest in the plan draft are Kärr (A-4) about 700 metres away, Östersundom (A-2 and A-1) about one kilometre away and Landbo (A-4) and Sakarinmäki (A-3, A-2 and A-1) about 1.5 kilometres away.

For the district heating connections KL1 (entirely in a tunnel) and KL2 (a combination of a tunnel and a pipe) related to project options VE3a and VE3b in the Norrberget area, the Östersundom component master plan draft designates a hiking and outdoor area (VR), workplace area (TP), road traffic connection need, a 110 kilovolt power line (z-1) and a 400 kilovolt power line project route (z-4). District heating connections KL1 and KL2 intersect with a motorway or other main road transport route. The area of the tunnel section of the district heating connections include designations for a residential area where the environment is preserved (A/s), a residential area (A-4), a farmland area with scenic value (MA), a nature reserve area (SL), a hiking and outdoor area (VR), a water area (W), an area belonging to the Natura 2000 network, an intersecting regional water pipeline (Helsinki–Porvoo) and a regional sewage pipeline

Copyright © Helen Nuclear Ltd

(Helsinki–Porvoo) (VJ), a water pipeline (Helsinki–Östersundom), a light rail line (PR) and a regional coastal route.

The pipeline section of the district heating connection KL2 is mainly located in the City of Vantaa, which is not part of the Östersundom component master plan area. Near the Uusi Porvoontie/Itäväylä, south of the pipeline section, there is a regional bike route, a light rail line (PR), a light rail stop,a workplace area (TP) and a residential area (A-4) designated in the plan draft. The entrance to the access tunnel related to district heating connections KL1 and KL2 is located near Itäväylä / Uusi Porvoontie.

To the area of the electricity transmission routes No-Ls1, No-Ls2, No-Is1, No-Is2 and No-Is3 related to project options VE3a and VE3b, a workplace area (TP), a 110 kilovolt power line (z-1), a 400 kilovolt power line project route (z-4) and road traffic connection need have been designated in the component master plan draft. Option No-Ls1 (i.e. a 110 kilovolt power line) crosses with a motorway or other main road transport route. In addition, No-Is1 (i.e. a 400 kilovolt power line) and No-Is2 (i.e. a 400 kilovolt underground cable) fall slightly within the hiking and outdoor area (VR).

The eastern new road connection of project options VE3a and VE3b is located in an area where the Östersundom component master plan drafts designates a hiking and outdoor area (VR), a residential area where the environment is preserved (A/s), a farmland area with scenic value (MA), an underground area for community management (et), an ecological corridor, a wildlife crossing or underpass related to the ecological corridor, a 110 kilovolt power line (z-1), a 400 kilovolt power line project route (z-4), a motorway or other main road transport route, as well as a need for road traffic connection.

Copyright © Helen Nuclear Ltd

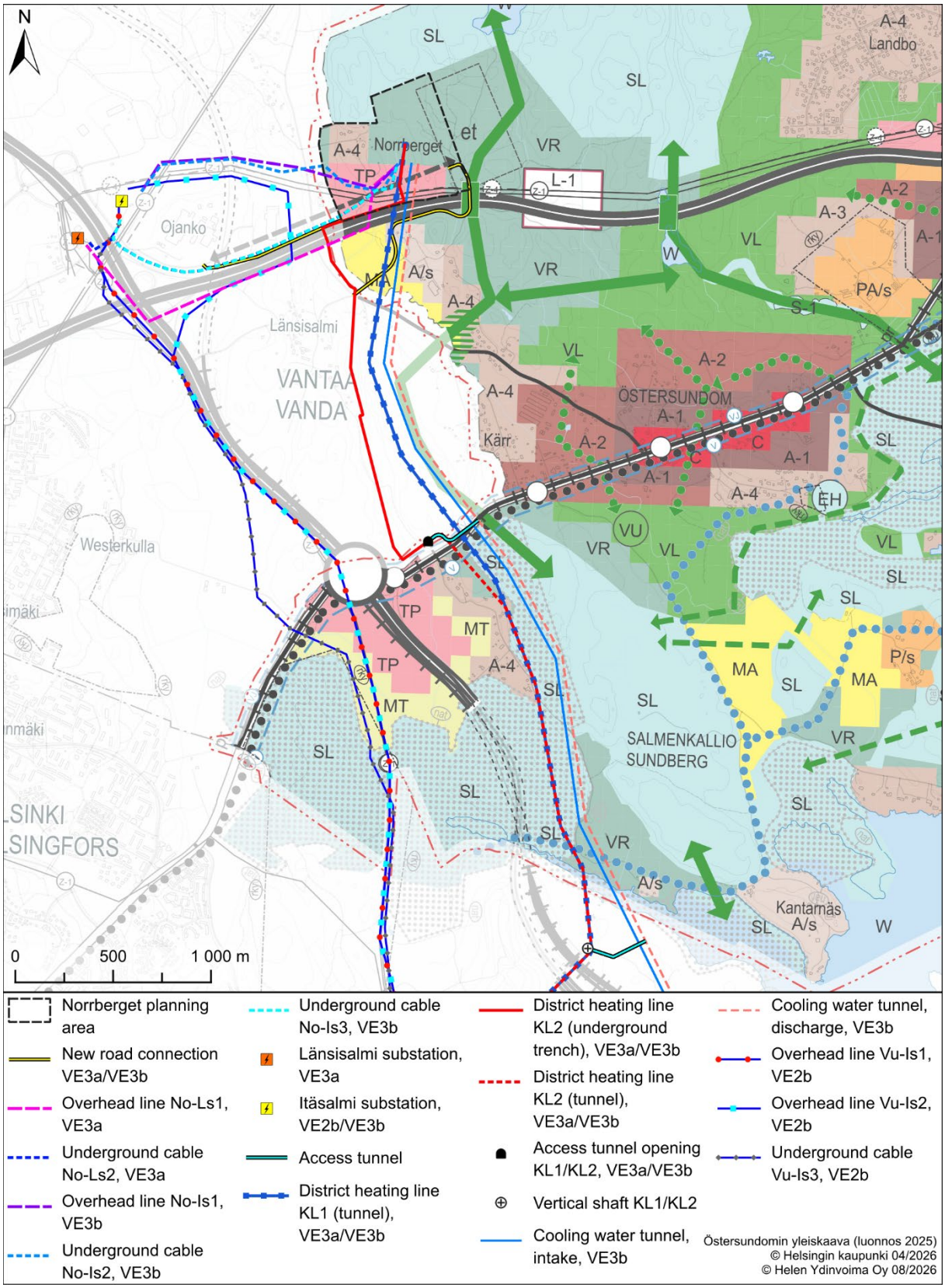


Figure 8-23. Extract of Östersundom's draft master plan (28 January 2025) with the Norrberget planning area and the infrastructure routes related to project options VE2b, VE3a and VE3b.

8.1.8.3 Local detailed plans

Bordering on the northern edge of the Salmisaari planning area (VE1), the local detailed plan “Ruoholahti, Itämerenkatu and Lepakonaukio” is underway. Tall office development is planned in the area at Itämerentori, Lepakonaukio and Porkkalankatu 5.

To the south of Porkkalankatu, there is a pending local detailed plan, “Ruoholahti, Tammasaarenlaituri’s floating block”, which is at the initial phase. A floating residential area is planned to the west of Tammasaarenlaituri. In addition, the local detailed plan “Länsisatama, Kellosaarenranta” is pending and at its plan proposal phase. A residential block is planned between the Ruoholahti Canal and the Kellosaari reserve power plant.

There are no pending local detailed plans in the Vuosaari planning area (VE2a and VE2b). The nearest pending local detailed plan is the initial phase of the “Vuosaari Sports Park Environment” located about 300 metres to the southwest, which aims to enable the placement of a new ball sports hall, recreational services, business premises and a children’s home in the area.

There are no pending local detailed plans for the electricity transmission routes Vu-Is1, Vu-Is2, and Vu-Is3 or the Itäsalmi substation areas related to project option VE2b. The nearest local detailed plan is 920600 and 920500ma Pitkäsuontie 10 in the Långmossebergen area of Vantaa, which is connected to the Pitkäsuontie carbon capture and storage project in the Ojanko area.

There are no pending local detailed plans in the Norrberget planning area (VE3a and VE3b). The nearest pending local detailed plan at a distance of about 400 metres to the west is 920600 and 920500ma Pitkäsuontie 10, whose plan proposal has been available for viewing from 11 February to 12 March 2026. The aim of the plan is to enable the construction of a carbon capture plant and a mixed waste sorting plant in the area (City of Vantaa 2026a). The second closest pending local detailed plan is the “Östersundom, Kärr” local detailed plan, located about 500 metres south of the planning area in Helsinki, which is in its initial phase. The purpose of the local detailed plan is to enable complementary building in the area with detached houses.

The 110 kV underground cable No-Ls2 related to project option VE3a, the 400 kV underground cable No-Is3 related to project option VE3b and the new road connection, located more to the west, of options VE3a and VE3b are located in the Pitkäsuontie 10 area of the pending local detailed plan 920600 and 920500ma in the Långmossebergen area of Vantaa. In the local detailed plan and its amendment, the areas of the routes include designations for a block area for buildings and facilities serving community management (ET) and street areas.

In the area of the route for the district heating lines related to project options VE3a and VE3b, the Salmenkallio, Vikkullantie local detailed plan is pending and currently in its initial phase. Opportunities for complementary building are being explored in the area. The cooling water tunnel options route related to project option VE3b also intersects with the Vikkullantie local detailed plan area. In addition, less than 200 metres east of the cooling water tunnel, there is a pending local detailed plan, Östersundom, Kärr, which is in its initial phase. The aim of the local detailed plan is to enable complementary building in the area with detached houses.

There are no pending local detailed plans in the Länsisalmi substation area.

Copyright © Helen Nuclear Ltd

8.2 Impact assessment and methodology

When assessing impacts on urban structure and land use, information on the project area and its surrounding area is examined regarding the current land use, existing and pending plans and planned land use.

When assessing the impacts on urban structure and land use, the project options' impacts at different regional levels are examined: whether the implementation of the project has an impact on the urban structure of the area, the land use of the area in the vicinity of the project area, or individual sites in the immediate impact area. In addition, the suitability of the land use required by the project options for the existing and pending plans, other land use plans, as well as national land use objectives will be assessed.

The land use impacts of the project can be either direct or indirect. The project may cause changes in the environment that affect current land use or change the starting points or limiting conditions related to future land use planning. Direct impacts are project operations that directly alter land use or urban structure. Indirect impacts may arise, for example, from changes in environmental distractions, such as noise caused by increased traffic volumes. In addition, precautionary action zones related to the project options may also cause land use planning restrictions outside the planning areas related to the project. Possible land use conflicts and need for changes in plans are indicated and described.

The impact assessment is conducted during the reporting phase of the environmental impact assessment, during which it is verified whether or not the description of the planning status is up to date. The description of the current situation and planning status will be updated if necessary, based on feedback received from the assessment programme. Illustrative map material is prepared for the assessment. The significance of the project options' impacts on urban structures and land use is determined by the sensitivity of the affected site and the magnitude of the change in land use or urban structures (see chapter 7.5).

The impacts are examined as an expert assessment carried out by an experienced land use planner.

Table 8-1 presents the justification for targeting the environmental impact assessment by project option for urban structure and land use (for background on targeting, see chapter 7.2.1). The impacts on urban structure and land use caused by the project options, as well as the comparison between the options, will be implemented at the EIA reporting phase.

Copyright © Helen Nuclear Ltd

Table 8-1. Justification for targeting the environmental impact assessment by project option in terms of urban structure and land use. x = the project option for which the assessment is specifically targeted.

	Urban structure and land use	Justification
VE1	x	The planning area is currently an energy production area, so the change in land use in the plant area relates to operational and production changes. Construction of a nuclear power plant restricts land use in its precautionary action zone. The precautionary action zone of the heating plant is estimated to be less than 100 metres from the emission source and will likely remain within the planning area. The project option does not require the construction of new connections that would have impacts or impose restrictions on land use.
VE2a	x	The planning area is currently mainly an energy production area, so the change in land use in the plant area relates to operational and production changes. Construction of a nuclear power plant restricts land use in its precautionary action zone. The precautionary action zone of the heating plant is estimated to be less than 100 metres from the emission source and will likely remain within the planning area. The project option does not require the construction of new connections that would have impacts or impose restrictions on land use.
VE2b	x	The planning area is currently mainly an energy production area, so the change in land use in the plant area relates to operational and production changes. The construction of a nuclear power plant will restrict land use within its precautionary action zone, which is likely to be wider than in option VE2a and extends beyond the planning area. This project option requires new overhead lines or underground cables and cooling water tunnels, which will have impacts or impose restrictions on the use of the surrounding land.
VE3a	x	The planning area is not subject to local detailed planning and is mostly undeveloped, so the impact directly concerns changes in land use within the planning area, as well as impacts and restrictions in the surrounding environment. Construction of a nuclear power plant restricts land use in its precautionary action zone. The precautionary action zone of the heating plant is estimated to be less than 100 metres from the emission source and will likely remain within the planning area. This project option requires new overhead lines or underground cables, road connections, as well as district heat pipes,

Copyright © Helen Nuclear Ltd

		which will have impacts or impose restrictions on the use of the surrounding land.
VE3b	x	The planning area is not subject to local detailed planning and is mostly undeveloped, so the impact directly concerns changes in land use within the planning area, as well as impacts and restrictions in the surrounding environment. The construction of a nuclear power plant will restrict land use within its precautionary action zone, which is likely to be wider than in option VE3a and extends beyond the planning area. This project option requires new overhead lines or underground cables, road connections, as well as district heat pipes and cooling water tunnels, which will have impacts or impose restrictions on the use of the surrounding land.

Copyright © Helen Nuclear Ltd

9 LANDSCAPE AND CULTURAL ENVIRONMENT

9.1 Current status

9.1.1 Regional landscape

According to Finland's regional landscape division, all the project's location options are situated in the Southern Coast. The Salmisaari and Norrberget location options are in its southern agricultural area, and the Vuosaari option is on the coastal area of the Gulf of Finland.

The Southern Coast is mainly low-lying in terms of elevation, but very varied in its small features. The area is an ancient seabed. The landscape is characterised by river valleys running north to south and their clay plains, with undulating wooded and rocky areas between them. Lakes are small and scarce. The landscape reflects a long agricultural tradition, but the effects of rapid development are also visible, as economic and administrative activities concentrate and the population moves towards the Helsinki Metropolitan Area. Historical features are represented by mansions and various ironworks areas. The settlement has traditionally focused on the coast and riverside, as well as later on important transport routes, roads and railways. (Ministry of the Environment 1992)

The southern cultivation area is varied in terrain, typically covered by fields and small patches of forest. Clay soil is everywhere, but in some places there are rougher rocky and moraine soils. The overall appearance of vegetation is lush in almost the entire region, with the exception of rocky areas that are rougher than their surroundings. The building stock of rural settlements shows the influence of mansion culture and ironworks communities. (Ministry of the Environment 1992)

Bare and wooded rocks alternate in the landscape of the coastal area of the Gulf of Finland. Different island regions are perhaps the most important characteristic of the region. Despite the harsh weather conditions, the vegetation is relatively lush. On the mainland, settlements are concentrated near rivers. In the inner archipelago, there are clustered settlements, and in the outer archipelago, compact villages. The Finnish-Swedish cultural traditions are visible in the old building stock of the area as well as in the gardens. (Ministry of the Environment 1992)

As part of the preparation of Uusimaa's 2nd phase regional land use plan, the Uusimaa Cultural Environment Survey specifies the division of regional landscapes at the provincial level. All location options of the project are on the archipelago coast between Porkkala and Sipoo according to the survey. This central coast of Uusimaa has extensive, open seas and a small-scale broken coastline. The area is characterised by small, steep-edged rocky islands and outcrops, as well as the coast's rugged capes of glaciated rock. There is only a very narrow archipelago zone in front of Helsinki, to the south of which is the open sea. (Helsinki–Uusimaa Regional Council 2022)

9.1.2 Salmisaari

9.1.2.1 Overview of the landscape

The Salmisaari planning area is located in the developed environment of the City of Helsinki, right next to the seashore.

The Salmisaari planning area is part of the developed environment, and the area and its immediate surroundings have changed dramatically during its history. The planning area is

Copyright © Helen Nuclear Ltd

currently developed and forms part of a power plant site. The planning area and its immediate surroundings consist of flat terrain, with ground elevation varying between approximately +3 and +6 masl. The busy Länsiväylä road runs to the north of the planning area, with Porkkalankatu to the south. The surroundings feature intensive office development. The Ruoholahti apartment block areas begin south of Porkkalankatu and continue southwards to Jätkäsaari. The wooded Hietaniemi cemetery lies to the east of Länsiväylä and bends to the north along the seashore.

Salmisaari is surrounded by marine areas to the north and somewhat further south, while to the west, the Lauttasaarensalmi strait connects the Seurasaarenselkä bay to the open sea. The landscape is characterised by the surrounding sea bay and its numerous islands, such as Lauttasaari and Seurasaari, as well as the heavily developed environments of the City of Helsinki. The shores vary from undeveloped, vegetated or rocky areas to developed shores with predominantly residential buildings. To the south, via the Lauttasaarensalmi strait, there are expansive sea views, and islands off Helsinki such as Melkki and the Pihlajasaaret are visible. The landscape is shaped by human activity, and there are a number of sites in the environment that can be identified as landmarks, such as bridges crossing straits and significant buildings. In the archipelago views, large islands in particular stand out. The landscape is characterised by the layering of construction and the cityscape that has been formed in the long term. Wide and extensive views open over the open marine areas, and from the shores surrounding the sea bay, views open towards the inner city of Helsinki and the planning area.

Copyright © Helen Nuclear Ltd

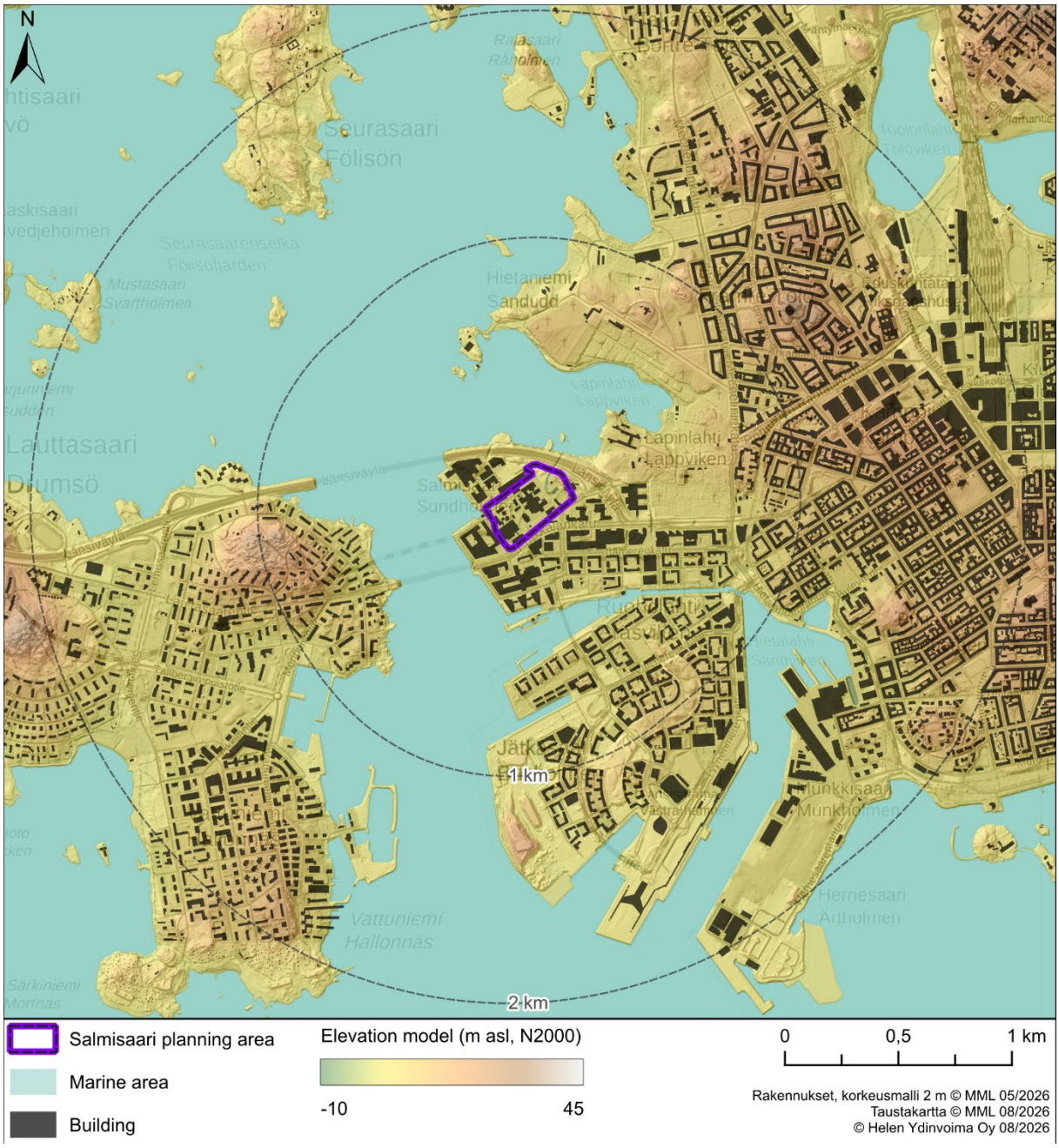


Figure 9-1. Topography, buildings and marine areas of the Salmisaari project area.

9.1.2.2 Value areas and sites of the landscape and cultural environment

To the southeast of the Salmisaari planning area, lies the UNESCO World Heritage Site *Suomenlinna Sea Fortress* and the nationally valuable landscape area (VAMA) *Helsinki offshore seascape*. The Suomenlinna World Heritage Site covers the islands of the actual Suomenlinna Sea Fortress, but its designated precautionary action zone, the “buffer zone”, extends to the mainland, reaching as close as approximately 1.3 kilometres from the planning area (Figure 9-2 and Table 9-1). (Finnish Heritage Agency 2026a, Unesco 1991)

The national landscape of *Maritime Helsinki* includes views between Suomenlinna and the Helsinki Market Square. There are no precise boundaries for national landscapes, but they have a strong symbolic value and generally recognised importance in national culture, history and nature photography. National landscapes are also popular destinations for hiking and

Copyright © Helen Nuclear Ltd

tourism. Many of them are attractions where changes are kept to a minimum. (Environmental Administration 2026)

The Salmisaari planning area is surrounded by several nationally valuable built cultural environment sites (RKY) and those marked in the Protected Buildings Register, as well as regionally valuable landscape areas or cultural environments. *Salmisaari industrial area* (RKY) covers almost the entire Salmisaari planning area. The red-brick power plants in the Salmisaari industrial area consist of buildings from two different eras; the power plant building A from the 1950s and Salmisaari B, which has been the main heat production unit of Salmisaari since 1984. (Finnish Heritage Agency 2026a, Helsinki–Uusimaa Regional Council 2023) The Salmisaari B power plant has undergone a building history survey (Okulus Oy 2025), according to which the demolition of the building is possible when new construction follows the instructions of the transformation plan.

The Cultural Environments Theme Map of the Helsinki Master Plan 2016 shows the areas that are significant for Helsinki's cultural history, architectural art and landscape culture. In the surroundings of the Salmisaari planning area, there are several areas that are significant from the point of view of cultural history, architectural art and landscape culture, in accordance with the Theme Map. Salmisaari power plant building A and the office building are protected by the local detailed plan. (City of Helsinki 2016)

The valued sites of the landscape and the built cultural environment around the Salmisaari planning area are shown in the below figure (Figure 9-2) and table (Table 9-1).

Copyright © Helen Nuclear Ltd

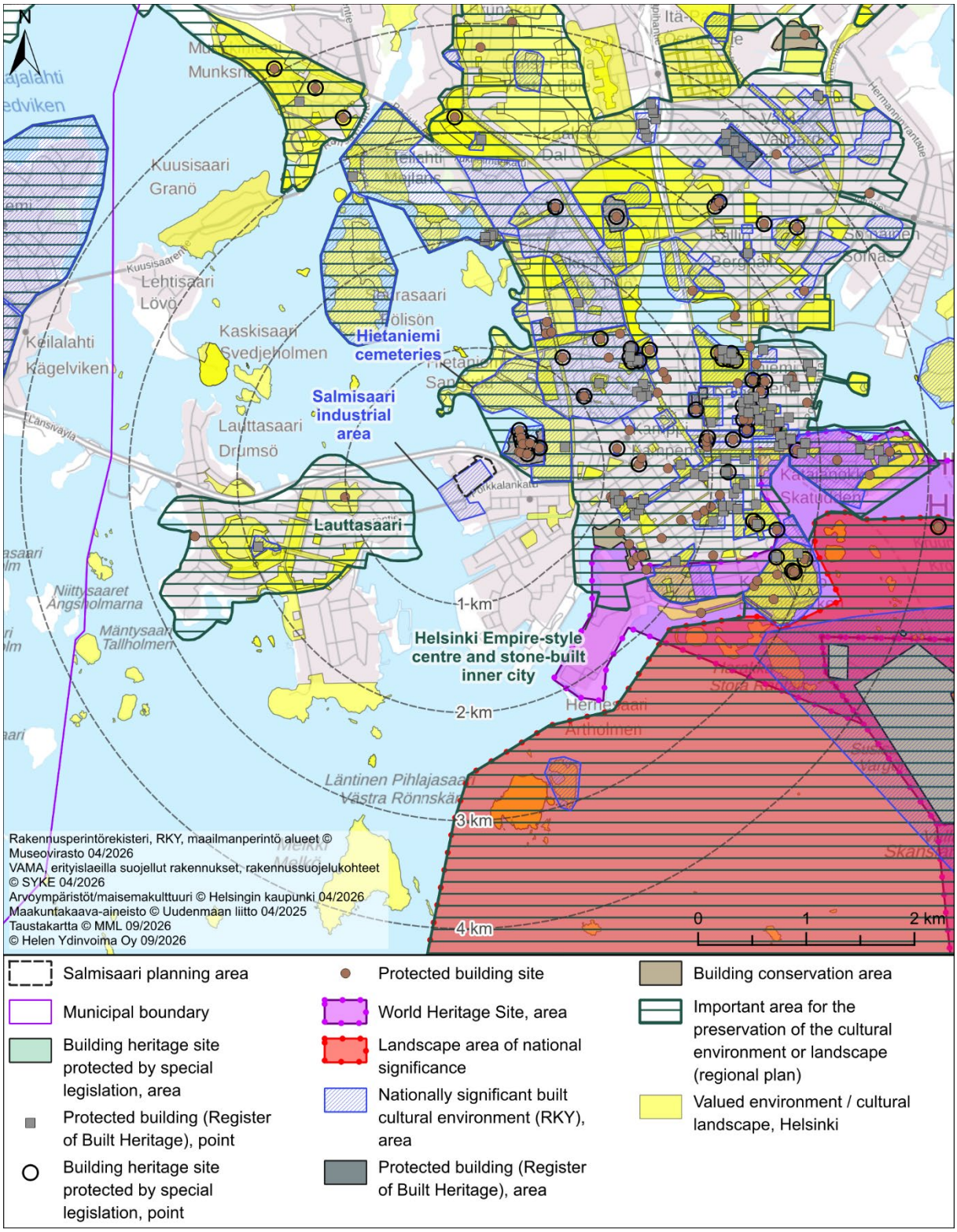


Figure 9-2. Valued sites of the landscape and the built cultural environment around the Salmisaari planning area.

Copyright © Helen Nuclear Ltd

Table 9-1. Valued sites of the landscape and the built cultural environment around the Salmisaari planning area and their distance to the planning area.

Site	Distance to the planning area (km)
World Heritage Site (UNESCO)	
Suomenlinna Sea Fortress	1.3
National landscape	
Maritime Helsinki	3.0
Nationally valuable landscape area (VAMA)	
Helsinki offshore seascape	2.3
Nationally significant built cultural environment (RKY)	
Salmisaari industrial area	0
Lauttasaari Church	1.8
Seurasaari	1.5
Meilahti Villa Area	2.2
Meilahti Church and School	2.9
Meilahti Hospital Area	2.3
Taka-Töölö apartment building area	1.6
Olympic buildings	1.3–2.8
Etu-Töölö district	1.0
1930s architecture of the Finnish Defence Forces in Helsinki	1.3
Helsinki Synagogue	1.1
Pohjola Insurance building, Lasipalatsi and Rautatalo	1.6–2.3
Helsinki’s Rautatientori square	2.0
Eläintarha Villas and public institutions	2.4
Kaisaniemi Park and Botanical Garden	2.2
University of Helsinki buildings (downtown campus)	2.4–2.7
Bank of Finland, National Archives and House of the Estates	2.5
Senate Square and its surroundings	2.5
Aleksanterinkatu, Helsinki	2.0
Esplanadi – Bulevardi	1.3 – 2.4
Helsinki Market Square and its buildings	2.5
Old part of Katajanokka	3.0
Kaartin kasarmi military barracks	2.3
St. John’s Church with its surroundings	2.0
Tähtitorninmäki Observatory and Park	2.4

Copyright © Helen Nuclear Ltd

Site	Distance to the planning area (km)
Surgical Hospital	2.3
Kaivopuisto	2.8
Eira district, Huvilakatu blocks and Mikael Agricola Church	1.9
Suomenlinna Sea Fortress	3.2
World War I Fortresses in the Helsinki Metropolitan Area – Itäinen Pihlajasaari	2.8
Lapinlahti Hospital Area	0.2
Hietaniemi Cemeteries	0.6
Finlandia Hall, Helsinki City Theatre and House of Culture	1.8–2.6
Building heritage	
Lauttasaari Church	2.0
Lapinlahti Hospital (several buildings)	0.3–0.7
Kaartin lasaretti block (several buildings)	1.2–1.4
Helsinki University of Technology	1.3
Alexander Theatre (old part)	1.4
State building, Bulevardi 29	1.4
Museum building	1.4
Wooden building	1.4
St. John’s Church	2.0
Mikael Agricola Church	1.9
Swedish Girls’ Lyceum	1.7
Helsinki Old Church	1.7
Yrjönkatu 18 – Bulevardi 8, former girls’ school in Kirkkopuistikko	1.9
Erottajankatu 2 – Uudenmaankatu 1–5 – Yrjönkatu 5	1.9
Joutsen Pharmacy	1.4
Helsinki Synagogue	1.2
Kallio Church	1.3
Parliament House (several buildings)	1.5–1.6
National Museum (several buildings)	1.6–1.7
Lallukka Artists’ Home	1.5
Finlandia Hall	1.8
Regionally valuable landscape or cultural environment	
Salmisaari industrial area	0
Lauttasaari	0.6
Fortifications and summerhouses in Lauttasaari’s southern tip	2.4

Copyright © Helen Nuclear Ltd

Site	Distance to the planning area (km)
Helsinki City Center, Central Park, Maritime Area and Vantaa River Landscape Area	0.3
Laajalahti cultural landscape	3.1
World War I Fortresses – Melkki	3.7
Locally valuable landscape or cultural environment	
Cultural environments of Helsinki – City Centre	0.5
Cultural environments of Helsinki – Taka-Töölö, Meilahti	1.5
Cultural environments of Helsinki – Lauttasaari	1.0
Cultural environments of Helsinki – Seurasaari	1.8
Cultural environments of Helsinki – Mustasaari	2.1
Cultural environments of Helsinki – Läntinen Pihlajasaari and Itäinen Pihlajasaari	2.9
Cultural environments of Helsinki – Islands off Helsinki, Suomenlinna Sea Fortress	>3.2

9.1.3 Vuosaari

9.1.3.1 Overview of the landscape

The Vuosaari planning area is part of the extensive industrial environment of the Vuosaari Harbour, and the landscape of the area and its surroundings has been heavily modified during its history. The industrial operations of the Vuosaari Harbour, such as the Vuosaari power plant, have had an impact on the landscape for a long time. The area has large-scale power plant and port buildings, structures and port cranes. The planning area and its immediate surroundings are mostly fairly flat and low-lying, with the ground level varying around + 5–20 masl. The now landscaped coal storage in the planning area, which formed a mound over +30 masl high, has been levelled to the ground.

To the north of the planning area is the former landfill site, Vuosaarenhuippu, which rises to over +60 masl. Views of the planning area open up from Vuosaarenhuippu. The highest peaks of the outdoor area are mostly open, but the area is bordered by more wooded zones. To the east and south, the marine area begins, and the archipelago off Vuosaari and Sipoo is visible in the landscape, with views opening far out to sea in places. In the south is located the Vuosaari golf course, the northern part of which is about +10 masl, the southern part rises in places +20 masl. The course appears in the landscape as an elongated open area between the industrial area and the residential areas of Vuosaari. The golf course is bordered to the south by the forest areas of Uutela. The terrain of Uutela outdoor park's recreational area is small-scale but varied. The highest mounds rise to about +20 masl. The area is mainly wooded, but in places in the central parts of the cape, more open bog and pasture areas, as well as allotment gardens, open up.

The nearest residential areas are located to the west, about 300 metres from the boundary of the planning area. In some places, more wooded zones remain between the residential areas

Copyright © Helen Nuclear Ltd

and Vuosaari industrial areas. In the northeast, forest zones border the narrow water area of the bay of Porvarinlahti. From the north of the bay, Salmenkallio's extensive forested zones and cultivation areas continue.

Power lines run north from the Vuosaari planning area. At the top of Vuosaari, power lines run at the western edge of the open landscape area. In Mustavuori, power lines pass through a wooded rocky ridge. North of Mustavuori, there is an open agricultural landscape, located south of Ring Road III and the Itäväylä intersection area. The intersection area is surrounded by small open fields that border clearly defined forest areas, and the landscape is quite enclosed. On the west side of Ring Road III, behind the narrow forest zone bordering the open field landscape, the residential areas of Länsimäki begin. The east side of the road is bounded by forest zones. The continuous forest ridge extends from Länsisalmi along Kasakallio and Salmenkallio all the way to the bay. West of the forest ridge, the agricultural landscape is fragmented; the open vistas formed by the fields have been interrupted. Ring Road III and Itäväylä cut through the landscape and break the integrity of the open fields.

The surroundings of Ring Road III and the Porvoonväylä intersection area are strongly shaped by human activity, and the landscape is characterised by power lines, industrial construction and traffic routes. To the east of Ring Road III, the landscape is characterised by broken fields, and they are bordered by patches of forest and forest zones. The landscape is more enclosed, sparsely populated and rural, as urban, densely developed residential areas begin in the north and west.

Copyright © Helen Nuclear Ltd

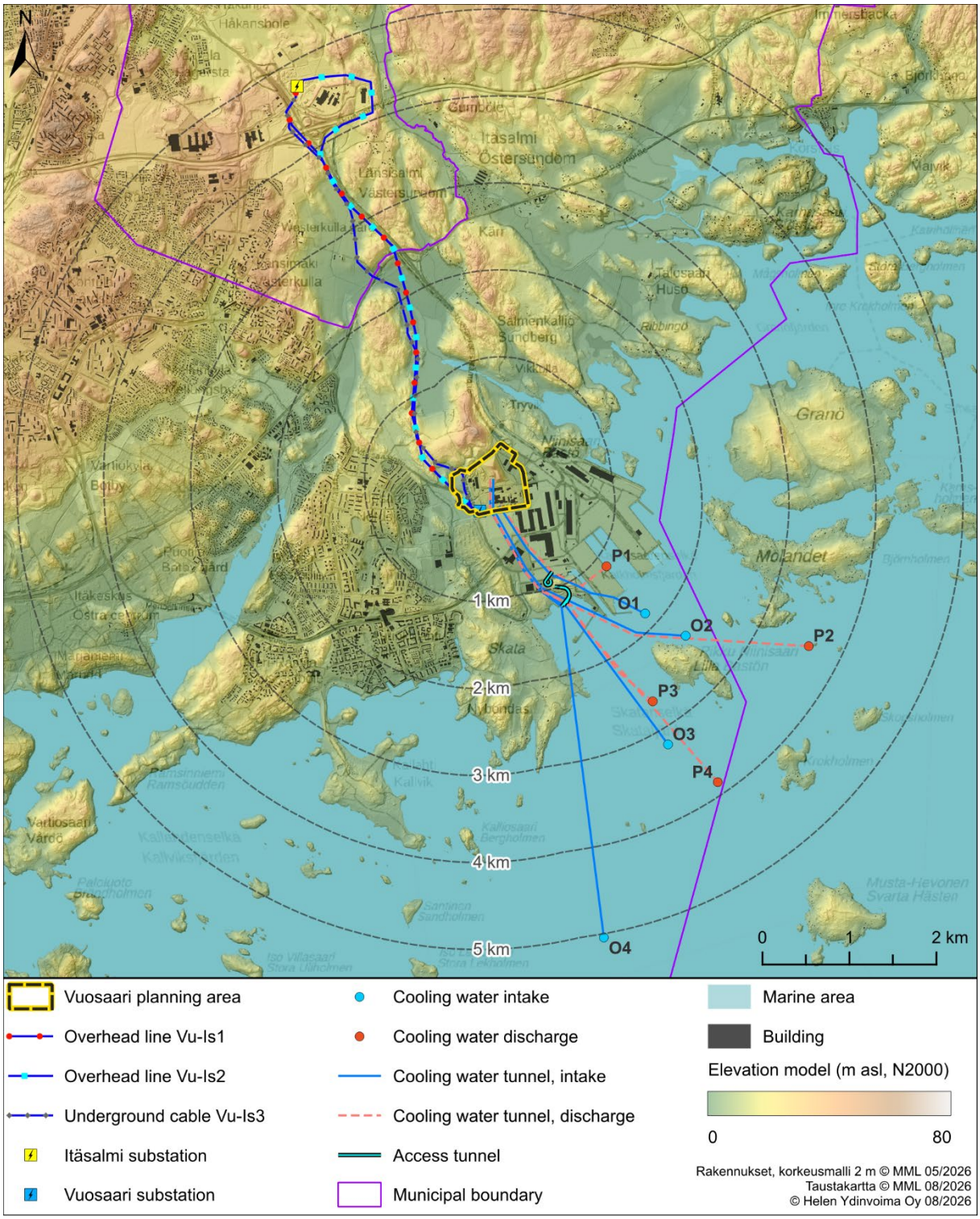


Figure 9-3. Topography, buildings and marine areas of the Vuosaari project area. Operations of project option VE2b are shown in the figure.

9.1.3.2 Value areas and sites of the landscape and cultural environment

There are no World Heritage Sites (UNESCO), landscape areas of national significance (VAMA) or national landscapes in the vicinity of the Vuosaari project area. (Finnish Heritage Agency 2026a)

In the vicinity of the Vuosaari project area, there are nationally significant built cultural environments (RKY), regionally valuable landscape areas or cultural environments and one building heritage site (Figure 9-4, Figure 9-5 and Table 9-2). (Finnish Heritage Agency 2026a, Helsinki–Uusimaa Regional Council 2023)

In the vicinity of the Vuosaari project area, there are areas that are significant from the point of view of cultural history, architectural art and landscape culture, in accordance with the Cultural Environments Theme Map of the Helsinki Master Plan 2016, as well as valuable landscape areas or cultural environments according to the Vantaa Master Plan (Figure 9-4, Figure 9-5 and Table 9-2). (City of Helsinki 2016, City of Vantaa 2007, City of Vantaa 2023)

Copyright © Helen Nuclear Ltd

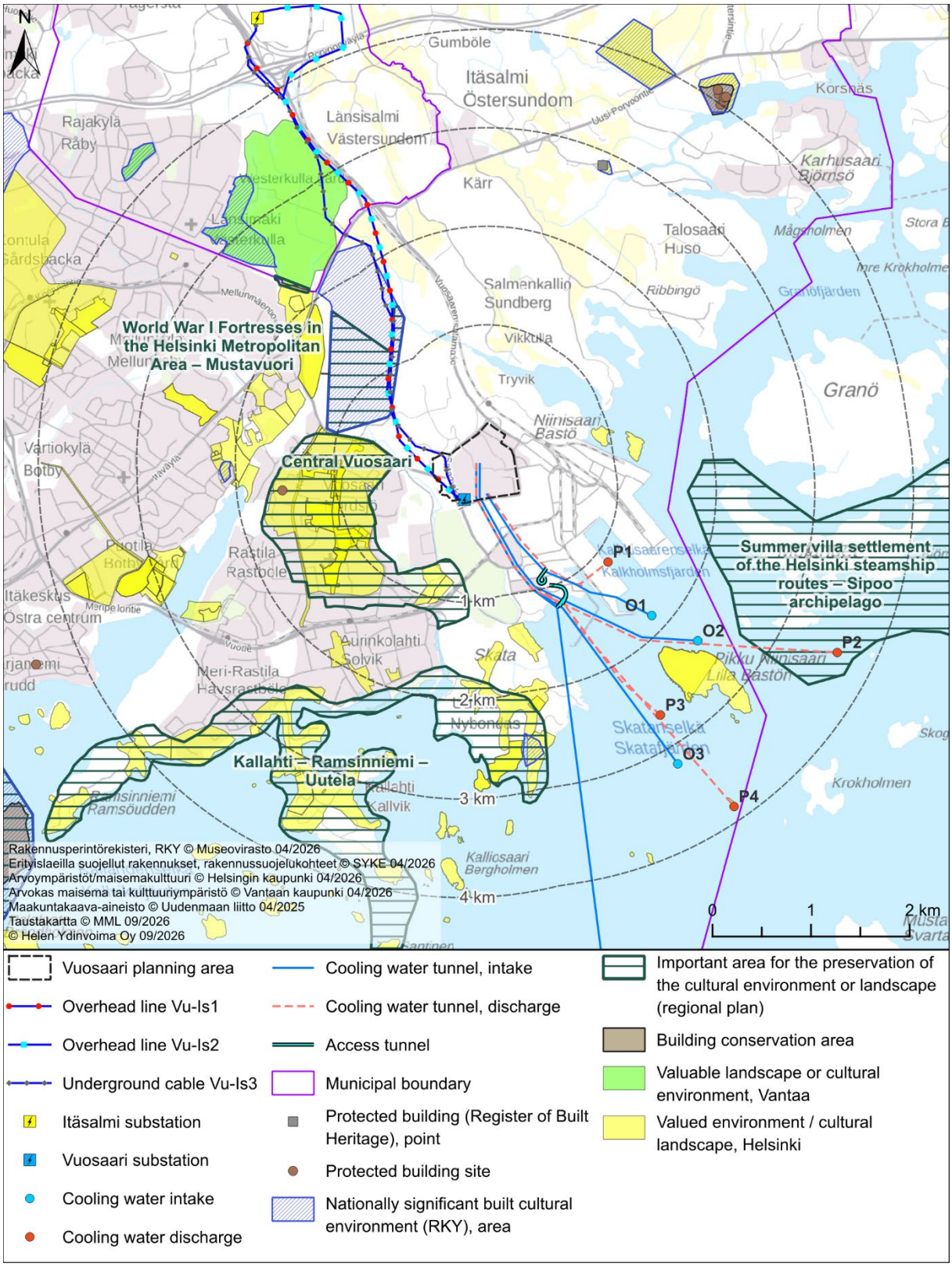


Figure 9-4. Valued sites of the landscape and the built cultural environment around the Vuosaari planning area.

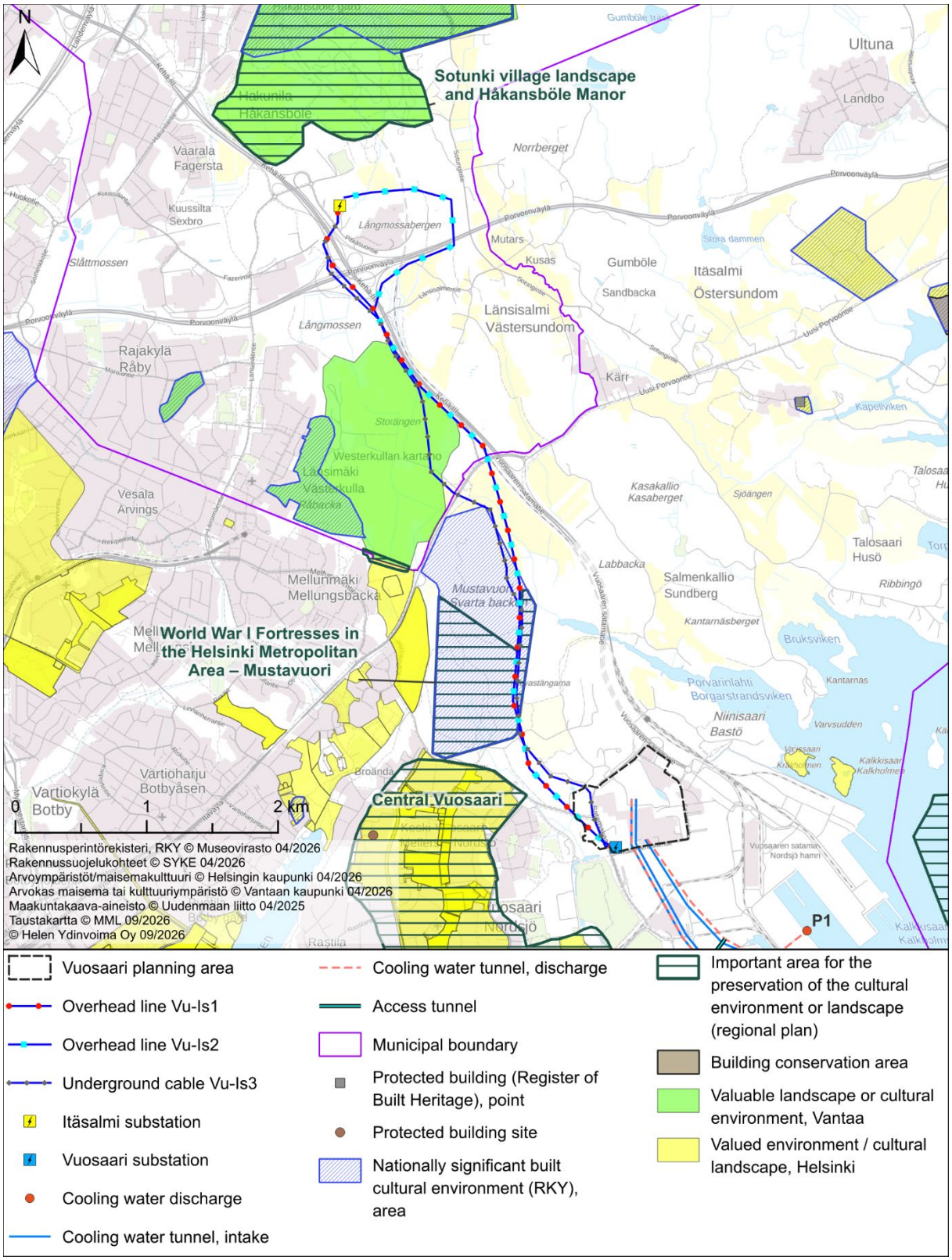


Figure 9-5. Valued sites of the landscape and the built cultural environment around the electricity transmission route options for project option VE2b.

Table 9-2. Valued sites of the landscape and the built cultural environment around the Vuosaari project area and their distance to the project operations.

Site	Distance (km) to the planning area	Distance (km) to power line option Vu-ls1	Distance (km) to power line option Vu-ls2	Distance (km) to power line option Vu-ls3
Nationally significant built cultural environment (RKY)				
World War I Fortresses in the Helsinki Metropolitan Area – Mustavuori	1.0	0	0	0
World War I Fortresses in the Helsinki Metropolitan Area – Vartioharju	2.2	1.8	1.8	1.8
World War I Fortresses in the Helsinki Metropolitan Area – Uutela	2.5	2.7	2.7	2.7
World War I Fortresses in the Helsinki Metropolitan Area – Länsimäki	2.8	0.8	0.8	0.7
World War I Fortresses in the Helsinki Metropolitan Area – Rajakylä	4.4	1.4	1.5	1.3
Östersundom Manor, Chapel and Björkudden Villa	3.0	2.4	2.4	2.5
Sotunki village and Håkansböle	5.8	1.4	1.2	1.5
Building heritage				
Östersundom Church	3.0	2.4	2.4	2.5
Regionally valuable landscape or cultural environment				
Summer Villa Settlement of the Helsinki Steamship Routes – Sipoo archipelago	2.0	3.0	3.0	2.9
Kallahti – Ramsinniemi – Uutela	1.9	1.9	1.9	1.9
Central Vuosaari	0.6	0.3	0.3	0.4
World War I Fortresses in the Helsinki Metropolitan Area – Vartiokylä Hill Fort	2.2	1.8	1.8	1.8
World War I Fortresses in the Helsinki Metropolitan Area – Mustavuori	0.8	0	0	0
Länsisalmi cultural landscape	2.5	0	0	0
World War I Fortresses in the Helsinki Metropolitan Area – Maratonpuisto	4.4	1.5	1.6	1.5
Sotunki village landscape and Håkansböle Manor	5.4	0.7	0.5	0.7
Locally valuable landscape or cultural environment				
Cultural environments of Helsinki – Mellunmäki	1.5	0.7	0.7	0.7
Cultural environments of Helsinki – Central Vuosaari	0.7	0.3	0.3	0.4

Copyright © Helen Nuclear Ltd

Site	Distance (km) to the planning area	Distance (km) to power line option Vu-ls1	Distance (km) to power line option Vu-ls2	Distance (km) to power line option Vu-ls3
Cultural environments of Helsinki – Nordsjö Manor	0.9	0.9	0.9	0.9
Cultural environments of Helsinki – Skata, Uutela	1.5	1.6	1.6	1.6
Sotunki village and Håkansböle Manor	5.5	0.8	0.7	0.8
Länsisalmi (Västersundom village and Westerkulla Manor)	2.5	0	0	0

9.1.4 Norrberget

9.1.4.1 Overview of the landscape

The Norrberget planning area is largely undeveloped forest, but there are residential buildings at the end of the Rapuojantie road in the western part. In addition, there is a residential building in the southeast corner. There is a field area in the southwestern part of the area, which is zigzagged by existing power lines. The planning area is bordered on its southern edge by the busy Porvoonväylä road. In the west, there is a large intersection area of Porvoonväylä and Ring Road III, and Ring Road III runs from the north towards Vuosaari Harbour. The surroundings of Ring Road III and the Porvoonväylä intersection area are strongly shaped by human activity, and the landscape is characterised by power lines, industrial construction and traffic routes. To the east of Ring Road III, the landscape is characterised by broken fields, and they are bordered by patches of forest and forest zones. The landscape is more enclosed, sparsely populated and rural.

The planning area has varied, hilly terrain. The terrain falls from about +40 masl in the north-east to about +10 masl on the cultivated areas in the south-west. Large undeveloped forest zones continue to the north and east. About 2 kilometres to the east is the dense residential area of Landbo, in the northeast the settlement is more scattered in the middle of forest zones. In the northwest, the terrain is slightly hilly and fields are dotted with forest areas and patches of different sizes. From a distance of about 2 kilometres, the residential areas of Hakunila and Vaarala begin.

The narrow cultivated valley continues from the northern outskirts of Sotunki to the south of Porvoonväylä, bordering the western edge of the planning area. Sotungintie runs along the edge of the cultivation area. To the south of Porvoonväylä, in the Länsisalmi area, the open field continues southwards towards the sea bay. The narrow cultivation valley is bordered by wooded ridges, and the highest hills rise over +40 masl. Located between the ridges, the Västersundom village centre is located approximately 600 metres southwest of the planning area. On the west side of the planning area, there are residential buildings at a distance of about 150 metres from the edge of the planning area. To the south, in the Gumböle forest areas, there are scattered settlements, with the nearest residential buildings located just south of the Porvoonväylä road, about 130 metres from the edge of the planning area. About 1.5 kilometres

Copyright © Helen Nuclear Ltd

to the south is Kärr, where development is concentrated along the Uusi Porvoontie road. Heading southeast, the forest zone gives way to cultivated fields along Uusi Porvoontie, and the varied landscape of forest and farmland continues all the way to the bay. A continuous forest ridge extends from Länsisalmi along Kasakallio and Salmenkallio to the bay, forming a well-defined feature that borders the open landscape areas and separates the eastern and western areas. On the west side, the open landscape formed by fields has been interrupted, with Ring Road III and Itäväylä cutting through the landscape and fragmenting the continuity of the open fields. The connection of open landscape areas to the sea has been interrupted by the overgrowth of coastal meadows. Approximately 1.6 kilometres southwest, the Länsimäki open field is bordered by forest ridges, as well as by Ring Road III and Itäväylä. From the west side of the field landscape, the residential areas of Länsimäki and Mellunmäki begin.

Copyright © Helen Nuclear Ltd

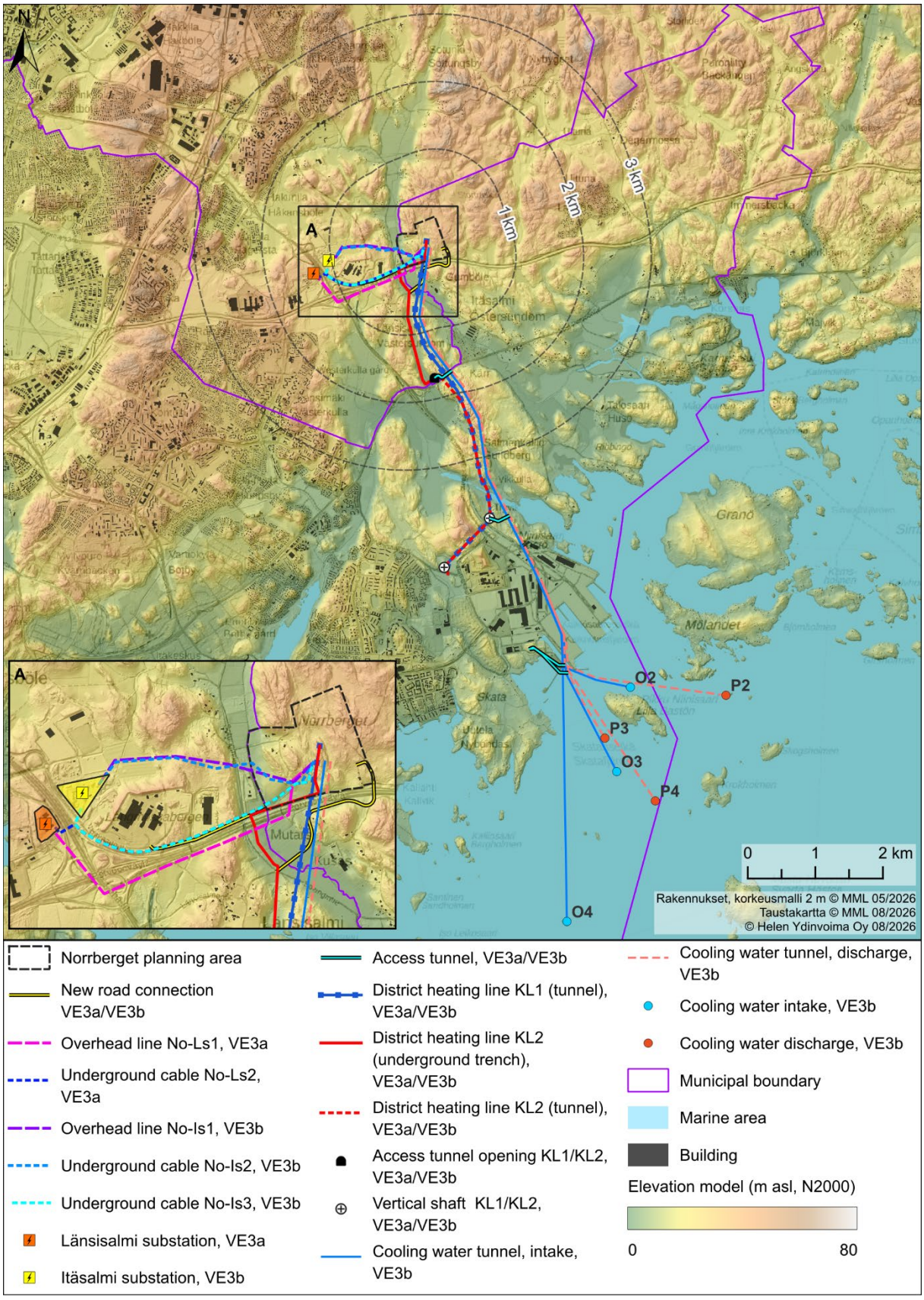


Figure 9-6. Topography, buildings and marine areas of the Norrberget project area. The figure shows the operations of project options VE3a and VE3b.

Copyright © Helen Nuclear Ltd

9.1.4.2 Value areas and sites of the landscape and cultural environment

There are no World Heritage Sites (UNESCO), landscape areas of national significance (VAMA) or national landscapes in the vicinity of the Norrberget project area. (Finnish Heritage Agency 2026a)

In the vicinity of the Norrberget project area, at their closest about 500 metres away from the project operations, there are nationally significant built cultural environments (RKY), regionally valuable landscape areas or cultural environments and one building heritage site (Figure 9-7, Figure 9-8 and Table 9-3). (Finnish Heritage Agency 2026a, Helsinki–Uusimaa Regional Council 2023)

In the vicinity of the Norrberget project area, valuable landscape areas or cultural environments according to the Vantaa Master Plan are located at their closest about 500 metres away from the project operations (Figure 9-7, Figure 9-8 and Table 9-3). (City of Vantaa 2007, City of Vantaa 2023)

Copyright © Helen Nuclear Ltd

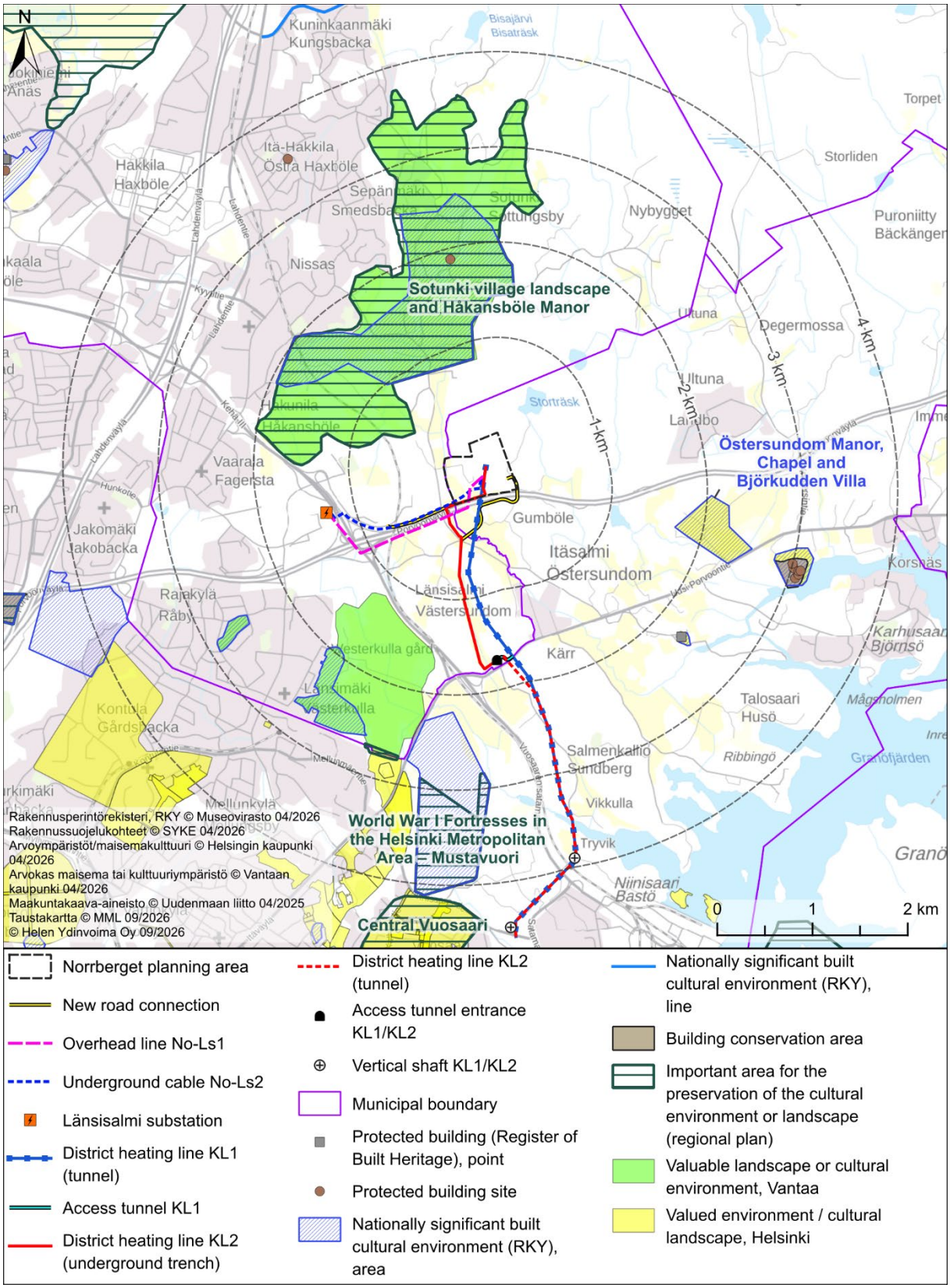


Figure 9-7. Valued sites of the landscape and the built cultural environment around the Norrberget project area (VE3a).

Copyright © Helen Nuclear Ltd



Figure 9-8. Valued sites of the landscape and the built cultural environment around the Norrberget project area (VE3b).

Copyright © Helen Nuclear Ltd

Table 9-3. Valued sites of the landscape and the built cultural environment around the Norrberget project area and their distance to the project operations, with the exception of the cooling water tunnels.

	Distance (km)							
Site	**From the planning area**	**No-Is1**	**No-Is2**	**No-Is3**	**No-Ls1**	**No-Ls2**	**KL1**	**KL2**
Nationally significant built cultural environment (RKY)								
Sotunki village and Håkansböle	1.0	1.0	1.0	1.5	1.6	1.5	1.5	1.5
Östersundom Manor, Chapel and Björkudden Villa	2.0–3.0	2.5	2.5	2.5	2.4	2.5	1.6	1.6
World War I Fortresses in the Helsinki Metropolitan Area – Rajakylä	2.6	1.9	1.9	1.5	1.4	1.5	2.4	2.3
World War I Fortresses in the Helsinki Metropolitan Area – Länsimäki	2.1	1.9	1.9	1.4	1.2	1.4	1.6	1.4
World War I Fortresses in the Helsinki Metropolitan Area – Mustavuori	2.4	2.6	2.6	2.2	2.0	2.2	0.7	0.7
Building heritage								
Östersundom Church	2.4	2.8	2.8	2.7	2.6	2.7	1.6	1.6
Regionally valuable landscape or cultural environment								
Sotunki village landscape and Håkansböle Manor	0.7	0.5	0.5	0.7	0.8	0.7	1.2	1.0
World War I Fortresses in the Helsinki Metropolitan Area – Maratonpuisto	2.8	2.1	2.1	1.7	1.6	1.7	2.6	2.4
Cultural landscape of Östersundom	2.0	2.7	2.7	2.5	2.4	2.5	2.2	2.3
Länsisalmi cultural landscape	1.5	1.5	1.5	1.0	0.7	1.0	0.8	0.7
World War I Fortresses in the Helsinki Metropolitan Area – Mustavuori	3.0	3.2	3.2	2.9	2.7	2.9	1.4	1.2
Locally valuable landscape or cultural environment								
Sotunki village and Håkansböle Manor	0.9	0.5	0.5	0.7	0.9	0.8	1.1	1.2
Länsisalmi (Västersundom village and Westerkulla Manor)	1.5	1.3	1.3	0.7	0.5	0.7	0.7	0.5

Copyright © Helen Nuclear Ltd

9.1.5 Archaeological cultural heritage

Archaeological cultural heritage refers to the remnants, structures, layers and finds of human activity in prehistoric and historical times that have survived on land or water. Fixed relics are a central part of the archaeological cultural heritage and are protected in Finland by the Antiquities Act (295/1963), which prohibits measures that may endanger the preservation of a relic (e.g. excavation, covering or other interference). The Antiquities Act protects underwater relics in the same way as those on land. A shipwreck or a part of a wreck is comparable to a fixed relic if it can be assumed to have sunk more than a hundred years ago. Other sites belonging to the archaeological cultural heritage are not fixed relics protected by the Antiquities Act, but their preservation is often justified by their historical significance and cultural heritage values. Human-made structures underwater, such as fairway barriers and the remains of bridges and piers, are protected as memories of our country's previous settlements and history. Such sites are automatically protected regardless of age and may not be tampered with without the permission from the Finnish Heritage Agency.

9.1.5.1 Salmisaari

A heating plant (VE1) is planned to be built in the Salmisaari planning area. Helen Ltd's Salmisaari power plant area is located in the planning area. The plant is planned for an already well-built area, and there are no known archaeological sites in its vicinity (Figure 9-9). The closest fixed relic, Lohiapajalahti 3 (registry code 1000034152), is located in Lohiapajalahti almost a kilometre away. Two underwater sites classified as other sites are located near the Lauttasaari bridge and in Lapinlahti just under 340 metres away: Lapinlahti (shipwreck, 1000019736) and Lauttasaarensalmi 2 (remnant of a wooden bridge, 1000036821).

Copyright © Helen Nuclear Ltd

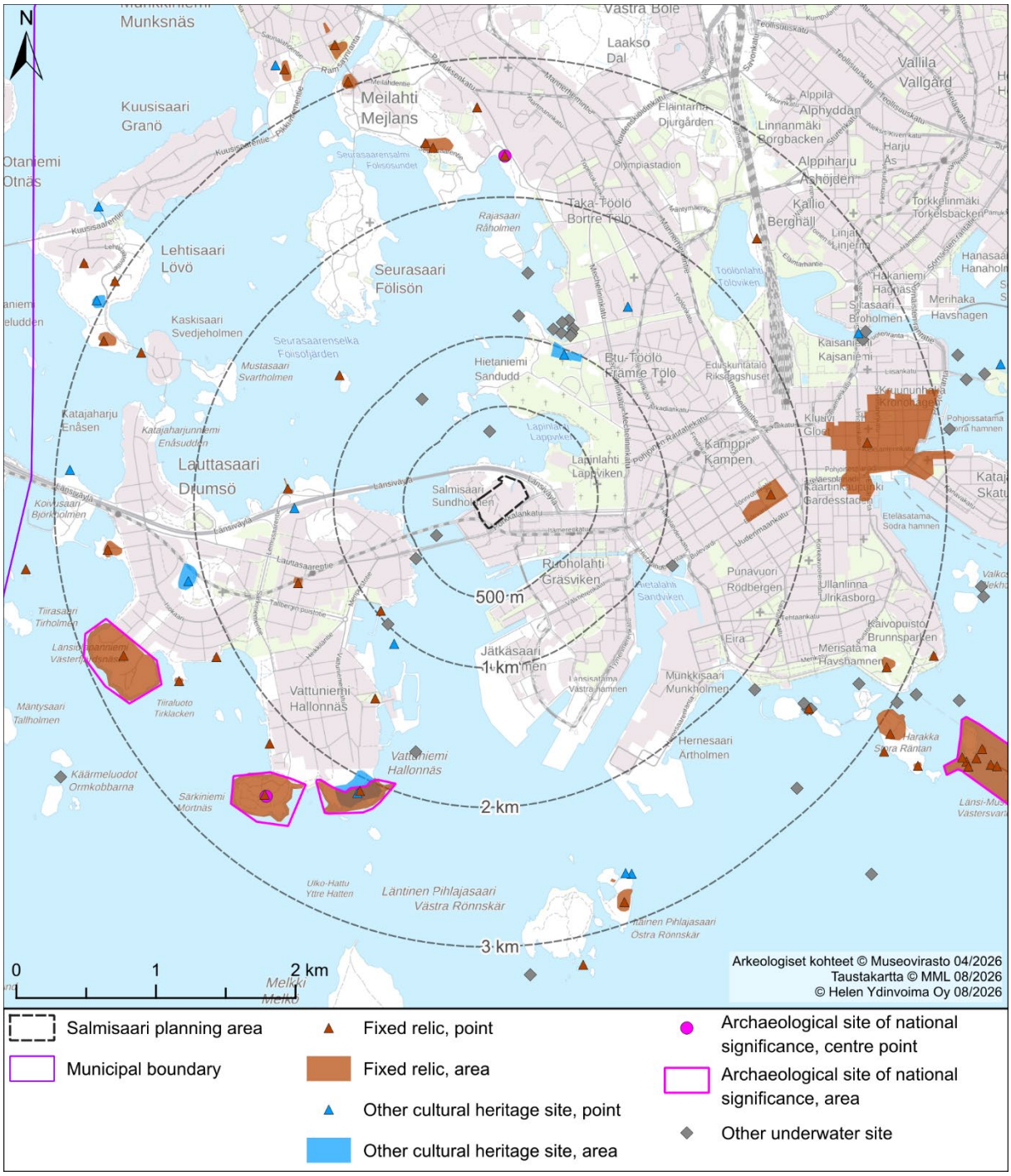


Figure 9-9. Known archaeological cultural heritage sites in the vicinity of project option VE1. (Finnish Heritage Agency 2026b)

9.1.5.2 Vuosaari

Either a heating plant (VE2a) or a CHP plant (VE2b) will be built in the Vuosaari planning area. The planning area currently houses Helen Ltd's Vuosaari power plant area. The planning area of the Vuosaari nuclear power plant is an already built-up area and there are no known archaeological sites in the planning area (Figure 9-10). In the vicinity of the planning area, on its west side, about 30 metres away, is the area delimitation of the connection road during the World War I (Base 1: road 1 (Mustavuori), 1000007642). The other five sites closest to the planning area are located at a distance of about 200–465 metres to the north and northeast of

Copyright © Helen Nuclear Ltd

the area. Sites (1000094729, 1000007626, 1000007627, 1000007625 and 1000094727) belong to Base 1, and its defence stations are located in Niinisaari.

In the area of the planned electricity transmission routes of project option VE2b, there is a nationally significant archaeological site (VARK), Mustavuori fortifications (100309), which forms the best-preserved fortification complex of the World War I-era Helsinki in the Helsinki Metropolitan Area. The VARK area delimitation and some of its ancient relics intersect with all overhead line and underground cable options (Table 9-4). Another VARK area in the vicinity of the electricity transmission routes is the village plots of Gubbacka and Labbas (100435), the sites of which are located at their closest at a distance of about 30 metres from the overhead line options Vu-ls1 and Vu-ls2.

Other fixed relics located on the electricity transmission routes of project option VE2b outside the VARK area are the Nordsjö quarry (1000001622) in all overhead line and underground cable options and the residence Västersundom (Länsisalmi) Måsbrot hem åkern (1000007051) in overhead line option Vu-ls2 (Table 9-4).

The cooling water intake and discharge tunnels required in project option VE2b are excavated deep into the rock, so they do not have an impact on archaeological sites. However, underwater archaeological sites may be affected if they are located near the cooling water intake and discharge points. Known sites are located in the vicinity of the current intake point O1 and discharge point P1. About 150 metres from intake point O1 is the wreck site Pikku Niinisaari (1000028290), and about 360 metres from discharge point P1 in Vuosaari Harbour are three wreck sites: Niinisaari 1 (2225), Niinisaari 2 (2226) and Niinisaari 3 (2227).

Copyright © Helen Nuclear Ltd

Table 9-4. Archaeological sites located within 100 metres of the planned project structures of project option VE2b. The distances have been measured from the area delimitation of archaeological sites to the centre line of the planned electricity transmission connection or to the boundary of the planning area of the nuclear power plant. (Finnish Heritage Agency 2026b)

Site (Ancient Relics Register, site ID)	Type of the site	Status of the site	Distance from the nearest project structure
Base 1: road 1 (Mustavuori) (1000007642) Part of the VARK area of Mustavuori fortifications (100309)	Defence equipment, artillery roads	Fixed relic VARK	About 30 metres from the Vuosaari planning area 0 metres from overhead line Vu-ls1, Vu-ls2 and underground cable Vu-ls3
Base 1: well 1 (Mustavuori) (1000094810)	Defence equipment	Fixed relic	About 90 metres from underground cable Vu-ls3
Artillery battery 61 (Mustavuori) (1000007628) Part of the VARK area of Mustavuori fortifications (100309)	Defence equipment, artillery stations	Fixed relic VARK	About 35 metres from underground cable Vu-ls3
Nordsjö quarry (1000001622)	Raw material sourcing sites, quarries	Fixed relic	0 metres from overhead line Vu-ls1, Vu-ls2 and underground cable Vu-ls3
Base 1: barracks area (Mustavuori) (1000040133) Part of the VARK area of Mustavuori fortifications (100309)	Residences, military camps	Fixed relic VARK	About 33 metres from overhead line Vu-ls1, Vu-ls2 About 52 metres from underground cable Vu-ls3
Base 1:9 (Niinisaari) (1000007629) Part of the VARK area of Mustavuori fortifications (100309)	Defence equipment, trenches	Fixed relic VARK	0 metres from underground cable Vu-ls3 About 20 metres from overhead line Vu-ls1, Vu-ls2
Rasböle quarry (1000001623)	Raw material sourcing sites, quarries	Fixed relic	About 15 metres from underground cable Vu-ls3 About 25 metres from overhead line Vu-ls1, Vu-ls2

Copyright © Helen Nuclear Ltd

Site (Ancient Relics Register, site ID)	Type of the site	Status of the site	Distance from the nearest project structure
Base 1: barrier1 (Niinisaari) (1000015039) Part of the VARK area of Mustavuori fortifications (100309)	Defence equipment, barbed wire barriers	Fixed relic VARK	About 11 metres from overhead line Vu-ls1, Vu-ls2 About 60 metres from underground cable Vu-ls3
Base 1:10 (Mustavuori) (1000007630) Part of the VARK area of Mustavuori fortifications (100309)	Defence equipment, trenches	Fixed relic VARK	About 7 metres from underground cable Vu-ls3 About 15 metres from overhead line Vu-ls1, Vu-ls2
Base 1:11 (Mustavuori) (1000007631) Part of the VARK area of Mustavuori fortifications (100309)	Defence equipment, trenches	Fixed relic VARK	About 62 metres from underground cable Vu-ls3
Base 1:17 (Mustavuori) (1000007638) Part of the VARK area of Mustavuori fortifications (100309)	Defence equipment, trenches	Fixed relic VARK	About 43 metres from underground cable Vu-ls3
Base 1:18 (Mustavuori) (1000007639) Part of the VARK area of Mustavuori fortifications (100309)	Defence equipment, trenches	Fixed relic VARK	About 39 metres from underground cable Vu-ls3
Västersundom (Länsisalmi), Gubbacka (1000001658) Part of the VARK area of Gubbacka and Labbas village plots (100435)	Settlements, village locations; work and manufacturing places, workshops	Fixed relic VARK	About 45 metres from underground cable Vu-ls3 About 68 metres from overhead line Vu-ls1 and Vu-ls2

Copyright © Helen Nuclear Ltd

Site (Ancient Relics Register, site ID)	Type of the site	Status of the site	Distance from the nearest project structure
Västersundom (Länsisalmi), Gubbacka–Labben (1000010767)	Passageways, roadbeds	Fixed relic	About 33 metres from underground cable Vu-ls3 About 90 metres from overhead line Vu-ls1 and Vu-ls2
Västersundom (Länsisalmi), Labbas (1000001659) Part of the VARK area of Gubbacka and Labbas village plots (100435)	Settlements, village locations; settlements, crofts	Fixed relic VARK	About 30 metres from overhead line Vu-ls1 and Vu-ls2
Västersundom (Länsisalmi), Heikbacka–Labben (1000010768)	Passageways, roadbeds	Fixed relic	About 93 metres from overhead line Vu-ls1 and Vu-ls2
Västersundom (Länsisalmi), Måsbrot hem åkern (1000007051)	Settlements, village locations	Fixed relic	0 metres from overhead line Vu-ls2

Copyright © Helen Nuclear Ltd

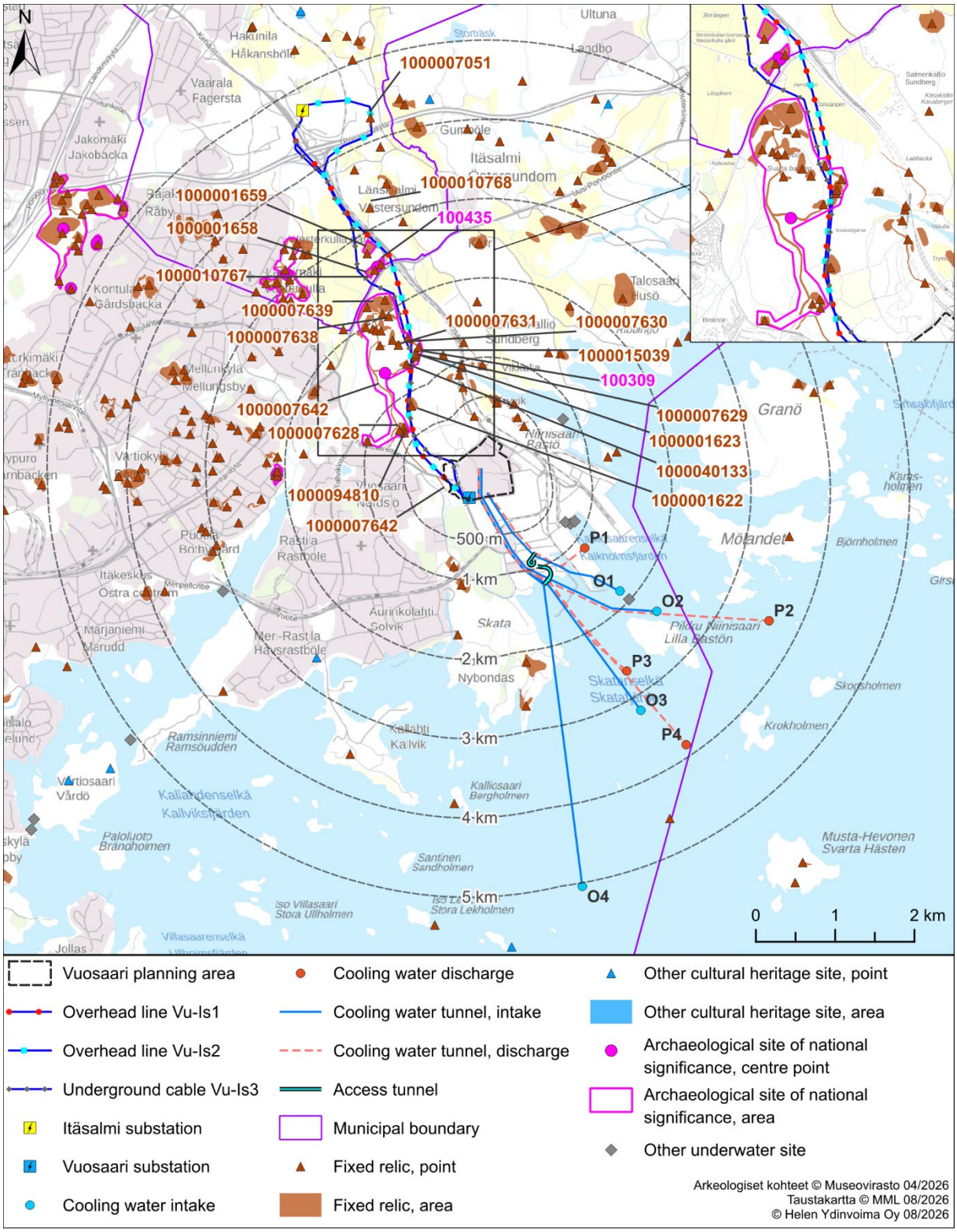


Figure 9-10. Known archaeological cultural heritage sites in the vicinity of project option VE2a and VE2b. Project option VE2a includes only the planning area of the Vuosaari nuclear power plant shown on the map, the new transmission connections are part of project option VE2b. The map names sites located less than 100 metres from above-ground or open-pit structures. (Finnish Heritage Agency 2026b)

Copyright © Helen Nuclear Ltd

9.1.5.3 Norrberget

Either a heating plant (VE3a) or a CHP plant (VE3b) will be built in the Norrberget planning area. The planning area of Norrberget in Östersundom is currently mostly undeveloped.

The Norrberget planning area houses two fixed relics, the Stone Age settlement Gumböle Norrberget (1000030614) and the Gumböle Norrberget stone structure (1000050376), as well as one other cultural heritage site Gumböle–Storträsket forest road (1000050377) (Figure 9-11 and Figure 9-12). In project option VE3a for the underground cable route No-Ls2 and in option VE3b for the underground cable route No-ls3, one fixed relic is located (Västersundom (Länsisalmi) Måsbrot hem åkern, 1000007051). One site (Gumböle 1000010822) is located on the new road connection common to both project options, and two sites are located on the excavated section of the district heating line KL2 that is partly implemented as an underground trench: Västersundom (Länsisalmi), Heikbacka–Vikkula (1000010772) and – Heikbacka (1000001661) (Table 9-5). Sites located in the tunnel section of the district heating line KL2 and at the tunnel section of the district heating line KL1 will not be affected, as the soil is not interfered with, which is why these sites have not been taken into account. The above-ground access tunnel/tunnel entrance and vertical shafts of the district heating line have been taken into account in the review.

The cooling water intake and discharge tunnels required in project option VE3b are excavated deep into the rock, so they do not have an impact on archaeological sites. Therefore, the archaeological sites along their route above ground have not been taken into account. Cooling water intake and discharge points are the same as in project option VE2b, and similarly, underwater archaeological sites may be affected if they are located in the vicinity of the intake and discharge points.

Copyright © Helen Nuclear Ltd

Table 9-5. Archaeological sites located within 100 metres of the planned project structures of project options VE3a and VE3b. If a project option is not mentioned in connection with the separately indicated distance, the information applies to both project options VE3a and VE3b. The distances have been measured from the area delimitation of archaeological sites to the centre line of the planned transmission connection or to the boundary of the planning area. (Finnish Heritage Agency 2026b)

Site (Ancient Relics Register, site ID)	Type of the site	Status of the site	Distance from the nearest project structure (project option)
Gumböle Norrberget (1000030614)	Settlements	Fixed relic	In the Norrberget planning area 0 metres from district heating line KL2 (underground trench) 0 metres from underground cable No-Ls2, overhead line No-Ls1 (VE3a) 0 metres from overhead line No-ls1, underground cable No-ls2, No-ls3 (VE3b)
Gumböle Norrberget stone structure (1000050376)	Stone structures, cellars	Fixed relic	In the Norrberget planning area
Gumböle–Storträsket forest road (1000050377)	Passageways, roadbeds	Other cultural heritage site	In the Norrberget planning area
Västersundom (Länsisalmi), Måsbrot hem åkern (1000007051)	Settlements, village locations	Fixed relic	0 metres from underground cable No-Ls2 (VE3a) 0 metres from underground cable No-ls3 (VE3b) 2 metres from the new road connection
Gumböle (1000010822)	Settlements, village locations	Fixed relic	0 metres from the new road connection About 58 metres from district heating line KL2 (underground trench) About 27 metres from overhead line No-Ls1 (VE3a)
Västersundom (Länsisalmi), Heikbacka–Vikkula (1000010772)	Passageways, roadbeds	Fixed relic	0 metres from district heating line KL2 (underground trench) About 33 metres from district heating line KL1/KL2 (access tunnel/tunnel entrance)
Västersundom (Länsisalmi), Heikbacka (1000001661)	Settlements, village locations	Fixed relic	About 10 metres from district heating line KL2 (underground trench)

Copyright © Helen Nuclear Ltd

Site (Ancient Relics Register, site ID)	Type of the site	Status of the site	Distance from the nearest project structure (project option)
Base I:5 (Niinisaari) (1000007627)	Defence equipment, trenches	Fixed relic	About 86 metres from district heating line KL1/KL2 (vertical shaft of the tunnel)
Base I: road 1 (Mustavuori) (1000007642)	Defence equipment, artillery roads	Fixed relic	About 83 metres from district heating line KL1/KL2 (vertical shaft of the tunnel)

Copyright © Helen Nuclear Ltd

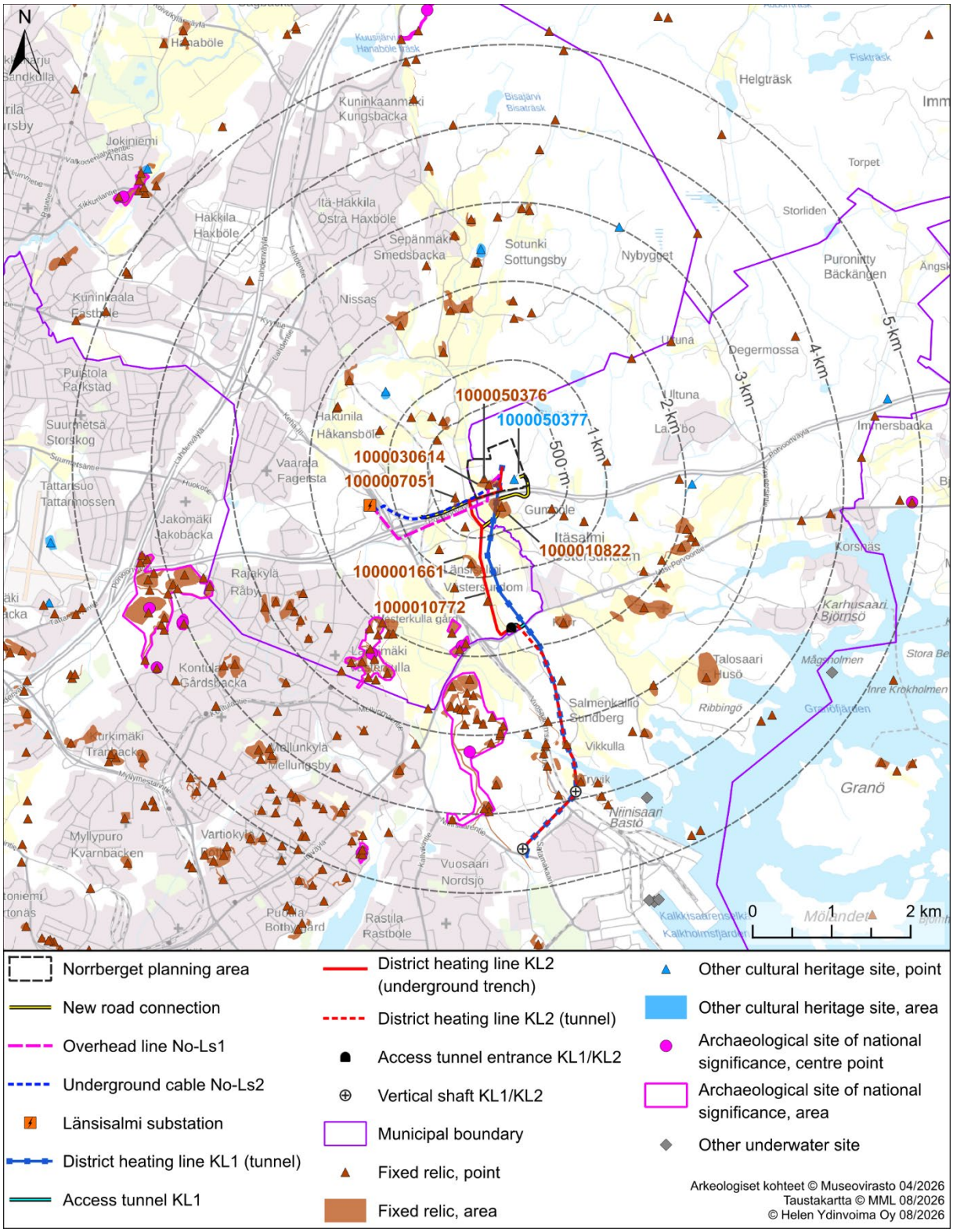


Figure 9-11. Known archaeological cultural heritage sites in the vicinity of project option VE3a. The map names sites located less than 100 metres from above-ground or open-pit structures. (Finnish Heritage Agency 2026b)

Copyright © Helen Nuclear Ltd

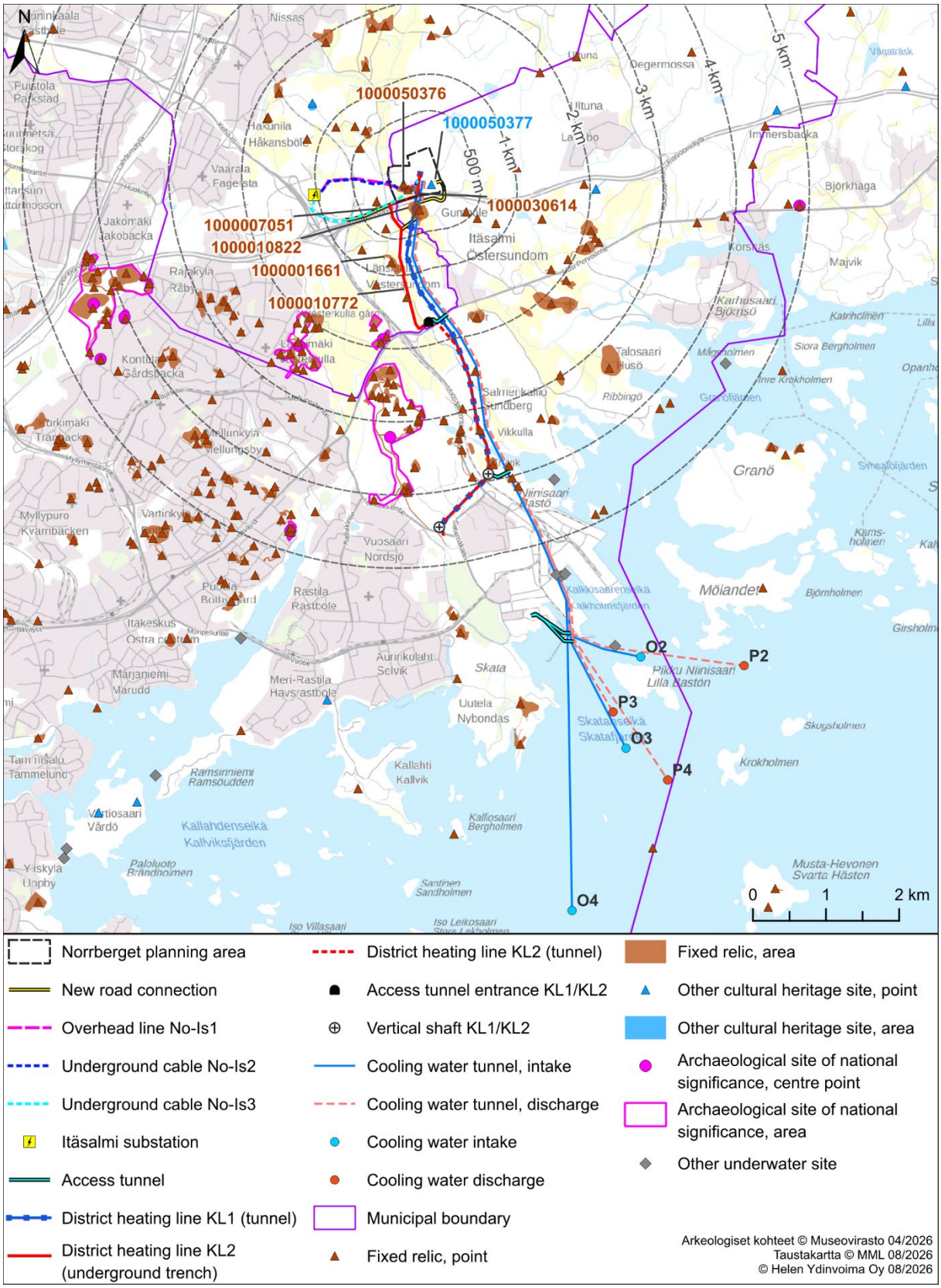


Figure 9-12. Known archaeological cultural heritage sites in the vicinity of project option VE3b. The map names sites located less than 100 metres from above-ground or open-pit structures. (Finnish Heritage Agency 2026b)

9.2 Impact assessment and methodology

9.2.1 Landscape and cultural environment

The effects of the project and related operations on the landscape and cultural environment arise from constructing buildings and structures in the area, as well as from their visibility and prominence in the landscape.

In the plant area, landscape impacts are caused mainly by tall buildings and structures that stand out in the landscape. The impacts on the landscape and cultural environment are concentrated in the vicinity of the plant structures, at a distance of about two kilometres, but especially tall plant structures can also be seen further away, if vegetation, landscape forms or other construction do not obscure the view.

The landscape impacts of the power line consist of the open right-of-way, as well as power line poles and conductors.

The landscape impacts of the underground cable and district heat pipe consist of an underground cable/pipe route that is cleared and kept free of trees. The underground cable and district heat pipe are located underground, so landscape impacts mainly occur where trees and other vegetation are removed and the terrain is modified along the cable/pipe route.

Landscape impacts due to the tunnel to be excavated in the rock consist of above-ground structures at most, such as vertical shafts and the access tunnel entrance.

The cooling water tunnels are not estimated to have any landscape impacts during the operation when they are located inside the rock and on the seabed.

The assessment of the landscape impacts describes the project's relationship to the wider landscape and local environment, as well as to the national and regional values of the landscape and the built cultural environment. In addition, changes to the current state of the area, the nature and significance of the change, as well as the principles of mitigation of adverse impacts are evaluated.

The assessment of the impacts on the landscape and built cultural environment is based on prepared inventories and surveys, initial data collected from official registers (e.g. the Environmental Administration, the Finnish Heritage Agency, the Regional Council), project's planning information, as well as map and aerial photo reviews and illustrative images of the nuclear power plant.

The impacts on the landscape and cultural environment are evaluated as an expert assessment based on the above-mentioned material. The assessment is carried out by a specialist in impacts on the landscape and cultural environment.

The table (Table 9-6) below presents the justification for targeting the environmental impact assessment by project option for landscape and cultural environment (for background on targeting, see chapter 7.2.1).

Copyright © Helen Nuclear Ltd

Table 9-6. Justification for targeting the environmental impact assessment by project option in terms of landscape and cultural environment. x = the project option for which the assessment is specifically targeted.

	Landscape and cultural environment	Justification
VE1	x	The project area is located in a heavily developed environment marked by human activity, and the area is in the current state characterised by industrial construction. The RKY area covers almost the entire planning area.
VE2a		The project area is located in a heavily developed industrial environment. Industrial operations have had an impact on the surrounding landscape for a long time.
VE2b		The project area is located in a heavily developed industrial environment. Industrial operations have had an impact on the surrounding landscape for a long time. The new power lines mainly run alongside the existing ones or along busy traffic routes.
VE3a	x	The planning area is located in an undeveloped environment. The project operations are located both in the undeveloped area and in the landscape marked by human activity. Industrial operations and human activities have had an impact on the surrounding landscape for a long time.
VE3b	x	The planning area is located in an undeveloped environment. The project operations are located both in the undeveloped area and in the landscape marked by human activity. Industrial operations and human activities have had an impact on the surrounding landscape for a long time.

9.2.2 Archaeological cultural heritage

The impacts of the project are assessed by examining the relationship of the location of the construction measures to known archaeological cultural heritage sites, both on land and in the water area.

During the EIA procedure, a detailed inventory will be carried out on the archaeological site (Gumböle Norrberget) located in the Norrberget planning area on the mainland. Archaeological inventories (e.g. detailed inventories) are also needed in other areas of the project, but these are made only after the project planning has progressed and the project location has been selected.

Multibeam echosounding (MBES) is carried out in the marine areas related to the project. Multibeam echosounding data can also be used in underwater inventories, as potential archaeological sites on the seabed can be identified from the data. If possible archaeological sites are discovered on the basis of the data, a more accurate underwater inventory is made by diving during the project's permitting phase. In echosounding, the instructions of the Finnish Heritage Agency (2020) "Vedenpohjan luotaus arkeologisen inventoinnin osana" (Underwater seabed surveying as part of archaeological inventory) are followed.

Copyright © Helen Nuclear Ltd

The table (Table 9-7) below presents the justification for targeting the environmental impact assessment for archaeological cultural heritage (for background on targeting, see chapter 7.2.1). Based on current information, archaeological cultural heritage sites are located in the areas of project options VE2b, VE3a and VE3b. The estimation is uncertain, for example, because archaeological field surveys have not yet been carried out. The impact assessment is carried out at the EIA reporting phase as an expert assessment on the basis of the archaeological survey report, results from echosounding and the register material of the Finnish Heritage Agency.

Table 9-7. Justification for targeting the environmental impact assessment by project option in terms of archaeological cultural heritage. x = the project option for which the assessment is specifically targeted.

	Archaeological cultural heritage	Justification
VE1		There are no archaeological sites in or near the Salmisaari planning area.
VE2a		There are no archaeological sites in the Vuosaari planning area or in its immediate vicinity.
VE2b	x	The electricity transmission routes of the project option intersect the VARK area and several fixed relics.
VE3a	x	Archaeological sites are located in the Norrberget planning area and along the planned route of the underground cable, road and district heating connections (underground trench).
VE3b	x	Archaeological sites are located in the Norrberget planning area and along the planned route of the underground cable, road and district heating connections (underground trench).

Copyright © Helen Nuclear Ltd

10 NOISE AND VIBRATION

10.1 Current status

10.1.1 Salmisaari

The noise of the planning area and its surrounding areas mainly consists of traffic noise from Länsiväylä, Porkkalankatu and smaller road sections, as well as noise from the power plant area. The figure (Figure 10-1) below shows the City of Helsinki's 2022 noise survey (City of Helsinki 2022a) average daytime (07–22) sound level of traffic noise. The yellow range describes the average sound level of 55–60 dB. The results take into account road, tram and above-ground metro traffic.

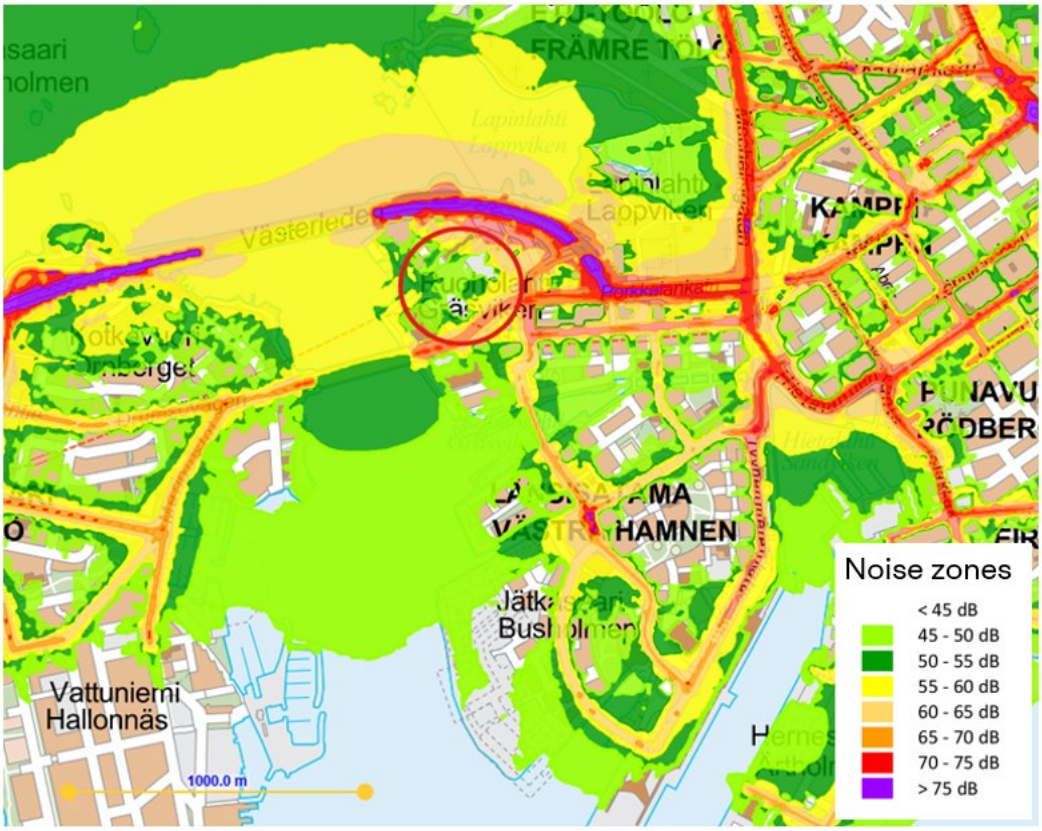


Figure 10-1. An excerpt from the Helsinki Map Service's noise modelling (City of Helsinki 2022a) of the average daytime sound results for the Salmisaari area. The approximate location of the planning area is shown in a red circle.

According to the noise survey, environmental noise from road and tram traffic near the planning area exceeds the daytime guideline value of 55 dB at the residential buildings within and close to the planning area. Similarly, the nighttime guideline value of 50 dB is exceeded in the same areas.

The current Salmisaari power plant causes industrial noise in the environment of the planning area. The power plant generally produces a steady humming sound around the clock. The noise level is regularly monitored through modelling and environmental noise measurements. The noise levels of the plant do not exceed the nighttime limit of 50 dB at the nearest residential buildings (Helen Ltd 2026a). Industrial noise is detectable at night when there is less road traffic noise.

Copyright © Helen Nuclear Ltd

The only source of vibration in the area is road traffic, but the vibration reduces to an undetectable level in the immediate vicinity of the roads.

10.1.2 Vuosaari

Noise in the planning area and its surroundings consists mainly of noise from the Satamakaari and Vuosaaren Satamatie roads, from the Vuosaari power plants (Helen Ltd) and from Vuosaari Harbour. The figure (Figure 10-2) below shows the City of Helsinki's 2022 noise survey (City of Helsinki 2022a) average daytime (07–22) sound level of traffic noise. The yellow range describes the average sound level of 55–60 dB. The results take into account road, tram and above-ground metro traffic.

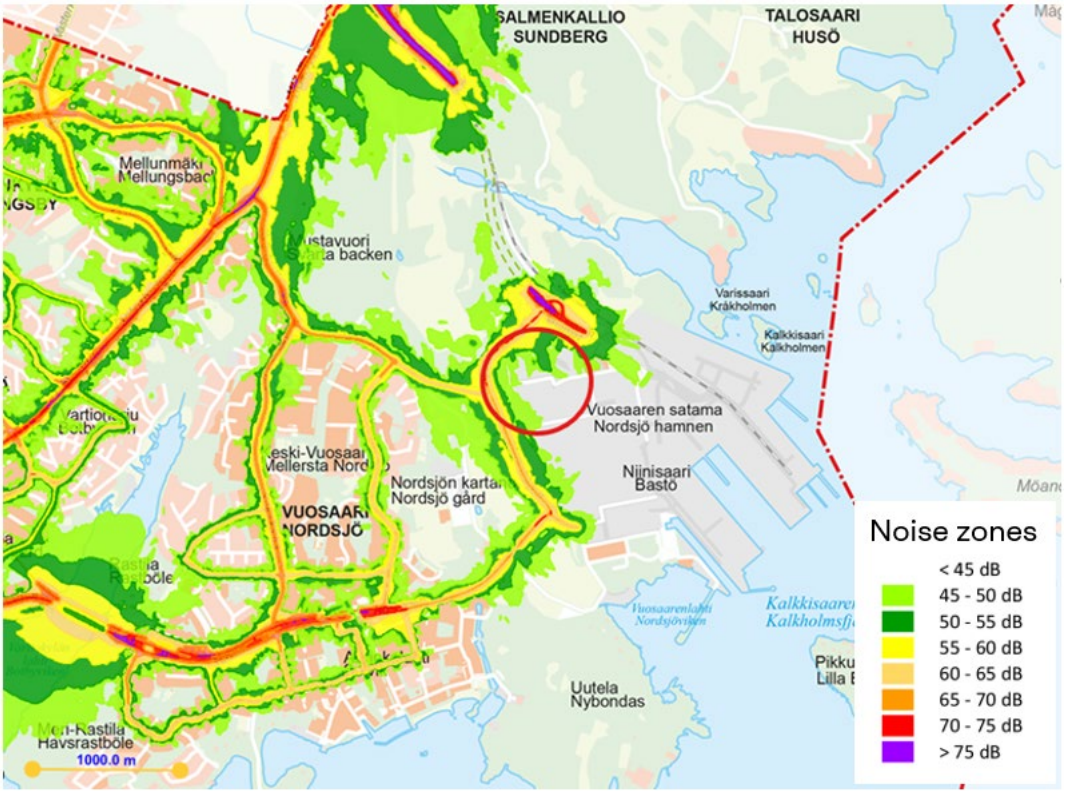


Figure 10-2. An excerpt from the Helsinki Map Service's noise modelling (City of Helsinki 2022a) of the average daytime sound results for the Vuosaari area. The approximate location of the planning area is shown in a red circle.

According to the noise survey, environmental noise caused by road traffic near the planning area is mainly below the daytime guideline value of 55 dB for the planning area. Nearby residential buildings are located at a distance of about 300 metres from the boundary of the planning area to the west of the Satamakaari, where noise is at a level of about 45 dB during the day. At night, road traffic noise levels are clearly lower.

Vuosaari has two power plants, a heat pump plant, a bioheating plant and a backup heating plant. The noise generated by the plants has been monitored through noise modelling and environmental noise measurements. The noise of the heat pump plant is insignificant. The noise of other plants is constant, even and mostly at the same level during the day and night. The nearest affected sites are located at a distance of about 500 metres to the west of the power plant area. The noise caused by the plants at the residential buildings is 43–45 dB, depending on the receiver location. (Helen Ltd 2024, Helen Ltd 2025)

Copyright © Helen Nuclear Ltd

Vuosaari Harbour is located on the east side of the planning area. The harbour's most significant sources of noise are the loading and unloading of containers, crane and machine operations and the operation of heavy equipment. Harbour noise is monitored through noise modelling and environmental noise measurements. The nearest affected sites close to the harbour are located on islands, and the noise level in these locations is 49–50 dB during the day. For the nearest affected sites of this project, the noise level caused by the harbour has not been determined, but the noise level is likely to be well below 45 dB. (Vantaan Energia Oy 2025)

Vibration in the area can be caused by road traffic and heavy industrial mobile machinery, but it reduces to an undetectable level in the immediate vicinity of the sources.

10.1.3 Norrberget

Noise in the planning area and its surroundings consists of that caused by the Porvoonväylä road (Finnish national road 7). The figure (Figure 10-3) below shows the City of Helsinki's 2022 noise survey (City of Helsinki 2022a) average daytime (07–22) sound level. The yellow range describes the average sound level of 55–60 dB. The results take into account road, tram and above-ground metro traffic.

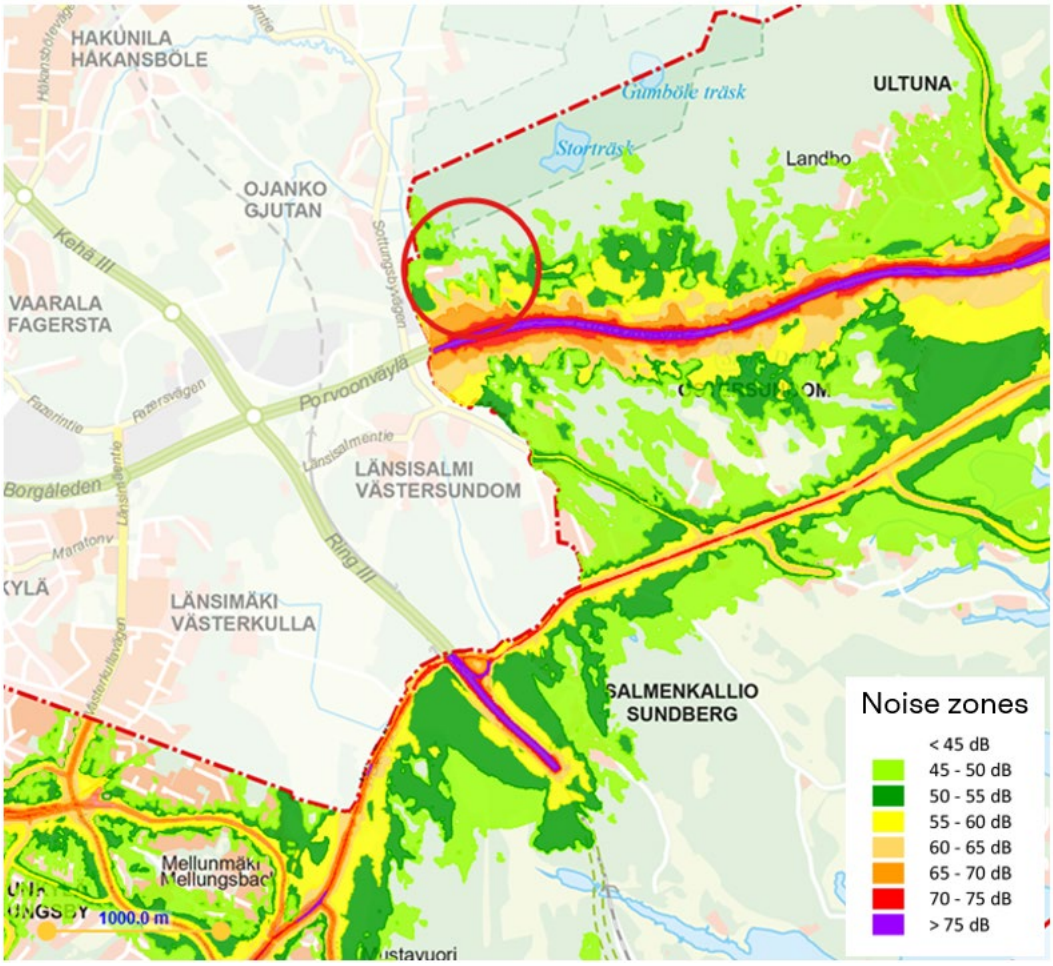


Figure 10-3. An excerpt from the Helsinki Map Service's noise modelling (City of Helsinki 2022a) of the average daytime sound results for the Norrberget area. The approximate location of the planning area is shown in a red circle.

According to the noise survey, environmental noise caused by road traffic near the planning area exceeds the daytime guideline value of 55 dB for some sections of the planning area. The

Copyright © Helen Nuclear Ltd

area where the noise exceeds the guideline value extends from the Porvoonväylä road to a maximum distance of about 350 metres. Nearby residential buildings are located approximately 130 metres south of the Porvoonväylä road and about 150 metres to the west of the planning area. At night, road traffic noise levels are clearly lower.

The operations of Vantaan Energia Oy and Remeo Oy, located in Ojanko to the west of the planning area, generate environmental noise. The noise generated by the operations has been monitored through noise modelling and environmental noise measurements. The modelled environmental noise level during the day has ranged from 39 to 47 dB near the residential buildings within the planning area and its surroundings, as well as in Sipoonkorpi National Park. At night, the results are 2 dB lower. Road traffic has a significant impact on the area. When road traffic is taken into account in the results, the average sound level modelled at the same receiver points is about 6–11 dB higher. The noise impact of the operations is clearly noticeable in the planning area, especially at night, but noise from the Porvoonväylä road is the most significant in terms of the average noise level in the area. (Vantaan Energia Oy 2025)

The only source of vibration in the area is road traffic, but the vibration reduces to an undetectable level in the immediate vicinity of the roads.

10.2 Impact assessment and methodology

The assessment of the industrial noise impacts of the project is based on its planning data, the volumes of transport related to the activity, experience with the noise of other similar plants and activities, as well as the current noise surveys of the site environment in terms of the total industrial noise of the area.

Noise impacts are assessed as expert work with the help of a noise modelling prepared for the project. Noise modelling is prepared for all project options VE1, VE2a, VE2b, VE3a and VE3b. Using noise modelling, the environmental noise levels caused by the plant are calculated for construction and the operating condition in a situation where the plants have been implemented according to plans. The noise modelling of the CHP plant (VE2b, VE3b) takes into account the situation where part of the cooling demand is met by air cooling. The situation is more significant from the point of view of noise compared to the situation of sea water cooling alone. The average environmental noise levels caused by the plants are assessed using Nordic industrial and road traffic noise calculation models.

Noise modelling takes into account the loudest work phases during construction (e.g. excavation operations and transports) and, in the modelling during operations, the noise emissions caused by the plants' equipment, as well as the noise caused by transports within the assessment area. Noise calculations are used to assess the daytime and nighttime equivalent continuous sound levels (LAeq) caused by the above activities, taking into account the daily operating times of construction and the normal running times of the equipment during the day.

The modelling is carried out in accordance with the noise modelling guideline 20/2007 of the Ministry of the Environment (Ministry of the Environment 2007). The results of the modelling are presented with illustrative noise maps. The impacts of noise on health, comfort and annoyance (maximum sound level, narrowbandness, impulsiveness) are assessed by comparing the situation with health-based noise level guideline values (VnP 993/1992) and the current state of noise. Estimates are based on noise data from similar processes or work phases.

Copyright © Helen Nuclear Ltd

The combined noise level of each plant area with current and future operations is examined as an expert assessment. The assessment is based on the studies carried out on the current operations causing noise in each area. The purpose of the assessment is to find out the change in the environmental noise level brought by the new functions to the areas close to the planning area.

The assessment of underwater noise caused by the construction of cooling water tunnels (VE2b and VE3b) and district heat transmission connection tunnels (VE3a and VE3b) is carried out as an expert assessment based on similar projects and information from the literature.

In project options VE2b, VE3a and VE3b, new power lines are built. Power lines can cause corona noise, which means noise generated by high-voltage power lines resulting from the so-called corona discharge phenomenon. The impacts of corona noise are assessed as an expert assessment based on information from similar projects and literature.

In terms of vibration, the assessment examines the vibration and structure-borne noise impacts during construction and operation. The intensity of the vibration is estimated based on the magnitude of the operation causing vibration, taking into account existing information and experience from similar projects carried out previously. With regard to tunnel construction, particular attention is paid to the structure-borne noise impacts caused by construction near the tunnel routes. The assessment takes into account the buildings and structures located in the vicinity of the project area, as well as the progression of the vibration and structure-borne noise to different distances. In addition, the possible disturbance experienced by people is assessed. Measures to prevent and mitigate vibration impacts are presented.

The table (Table 10-1) below presents the justification for targeting the environmental impact assessment by project option for noise and vibration (for background on targeting, see chapter 7.2.1).

Copyright © Helen Nuclear Ltd

Table 10-1. Justification for targeting the environmental impact assessment by project option in terms of noise and vibration. x = the project option for which the assessment is specifically targeted.

	Noise and vibration	Justification
VE1	x	The operation is located within the existing urban structure. Particular attention should be paid to the impacts during construction and, if necessary, mitigation measures should be determined.
VE2a	x	The operation is located close to the existing residential area. Particular attention should be paid to the impacts during construction and, if necessary, mitigation measures should be determined.
VE2b	x	The operation is located close to the existing residential area. Particular attention should be paid to the impacts during construction and, if necessary, mitigation measures should be determined.
VE3a	x	The operations are located relatively close to the existing residential area and the national park. Particular attention should be paid to the impacts during construction and, if necessary, mitigation measures (e.g structure-borne noise in tunnel construction) should be determined.
VE3b	x	The operations are located relatively close to the existing residential area and the national park. Particular attention should be paid to the impacts during construction and, if necessary, mitigation measures (e.g structure-borne noise in tunnel construction) should be determined.

Copyright © Helen Nuclear Ltd

11 TRAFFIC

11.1 Current status

11.1.1 Salmisaari

The nuclear power plant is planned in Salmisaari for Helen Ltd's power plant area (VE1), which is located in the middle of a lively urban structure and next to the Länsiväylä (Finnish national road 51) road, an important entryway to Helsinki. Länsiväylä is one of the most important transport routes for the Salmisaari planning area. According to the traffic volume data of the Finnish Transport Infrastructure Agency, the average daily traffic volume (ADT) of Länsiväylä is 45,686 vehicles at the Lapinlahti bridge, of which 1,744 vehicles are heavy traffic (4% of the total traffic volume). The traffic volume on the ramp from Länsiväylä to Salmisaarenkatu is 5,461 vehicles/day, of which 132 (2%) vehicles are heavy traffic, and on the ramp from Salmisaarenkatu to Länsiväylä is 5,193 vehicles/day, of which 125 (2%) vehicles are heavy traffic. (Finnish Transport Infrastructure Agency 2026)

Unlike on the state-owned public road network, ADT traffic volumes are not available for the City of Helsinki's street network. Instead, the city's traffic volume data is reported as the average autumn weekday daily traffic (AWDT). According to the latest data, the average (autumn) daily traffic volume on Salmisaarenkatu is 8,400 vehicles, of which 351 vehicles (4%) are heavy traffic. On Porkkalankatu, in front of the Salmisaari power plant, the traffic volume is 10,700 vehicles on an average weekday, of which 627 (6%) vehicles are heavy traffic. The traffic volume on Porkkalankatu between Länsiväylä and Mechelininkatu is 57,500 vehicles on an average weekday, of which 1,366 (2%) vehicles are heavy traffic. (City of Helsinki 2026b) Thus, there is a lot of vehicle traffic in the area and traffic is often congested during the morning and afternoon peak hours, as well as sometimes during the departure and arrival times of the West Harbour ferry traffic. The City of Helsinki has made a decision on the construction of a harbour tunnel to be used for heavy traffic between Länsiväylä and West Harbour, which will reduce heavy traffic to the harbour on the street network in the future (Port of Helsinki Ltd 2026a).

Traffic volumes on roads and streets near the Salmisaari planning area are shown in the figure (Figure 11-1).

Copyright © Helen Nuclear Ltd



Figure 11-1. Traffic volumes of roads and streets near the Salmisaari planning area (AWDT). The amount of heavy traffic in brackets.

Over the past five years (2021–2025), a total of 17 traffic accidents that have led to injuries and were reported to the police have occurred in the vicinity of the Salmisaari power plant area (Länsiväylä, Salmisaarentie, Porkkalankatu). Of these, eight were rear-end collisions, five were bicycle accidents and the other individual accident types were a turning accident, an overtaking accident, an individual accident and a light electric vehicle accident. No fatal accidents occurred during this period. There were a total of 25 accidents that did not lead to personal injury. (Ramboll Finland Oy 2026) In addition to vehicle traffic, the area also has a lot of pedestrian and cycle traffic, which can also be noted in accident statistics. Traffic-sensitive destinations include, for example, Crusell Comprehensive School in the Ruoholahti area and several other schools in the inner city area.

Copyright © Helen Nuclear Ltd

11.1.2 Vuosaari

In the Vuosaari area of Helsinki, the nuclear power plant is being planned for the Helen Ltd's power plant area next to the Vuosaari Harbour. The project's planning area will contain either a heating plant (VE2a) or, alternatively, a CHP plant (VE2b). The area's traffic connections are good, and it can be reached via the Vuosaari road tunnel from Ring Road III (Finnish regional road 103). The alternative route runs along Itäväylä (Finnish regional road 170) and the City of Helsinki's street network. The traffic volumes in the area are also not as high as in the inner city area. There are currently substantial transports of dangerous goods in the Vuosaari Harbour area.

According to the traffic volume data of the Finnish Transport Infrastructure Agency, the average daily traffic volume (ADT) of the Vuosaari road tunnel is 9,874 vehicles, of which 2,356 vehicles are heavy traffic (24% of the total traffic volume). On Itäväylä, from Kallvikintie towards Ring Road III, the traffic volume is 11,903 vehicles per day, of which 481 (4%) vehicles are heavy traffic. (Finnish Transport Infrastructure Agency 2026) On the City of Helsinki's street network, the average (autumn) weekday traffic volume (AWDT) on Satamakaari, adjacent to the power plant area, is 6,300 vehicles per weekday, of which 726 (12%) vehicles are heavy traffic. The traffic volume on Niinisaarentie, leading from Satamakaari towards Itäväylä, is 6,000 vehicles per weekday, of which 994 (17%) vehicles are heavy traffic, and on Kallvikintie, it is 11,500 vehicles per weekday, of which 709 (6%) vehicles are heavy traffic. (City of Helsink 2026b)

Traffic volumes on roads and streets near the Vuosaari planning area are shown in the figure (Figure 11-2).

Copyright © Helen Nuclear Ltd

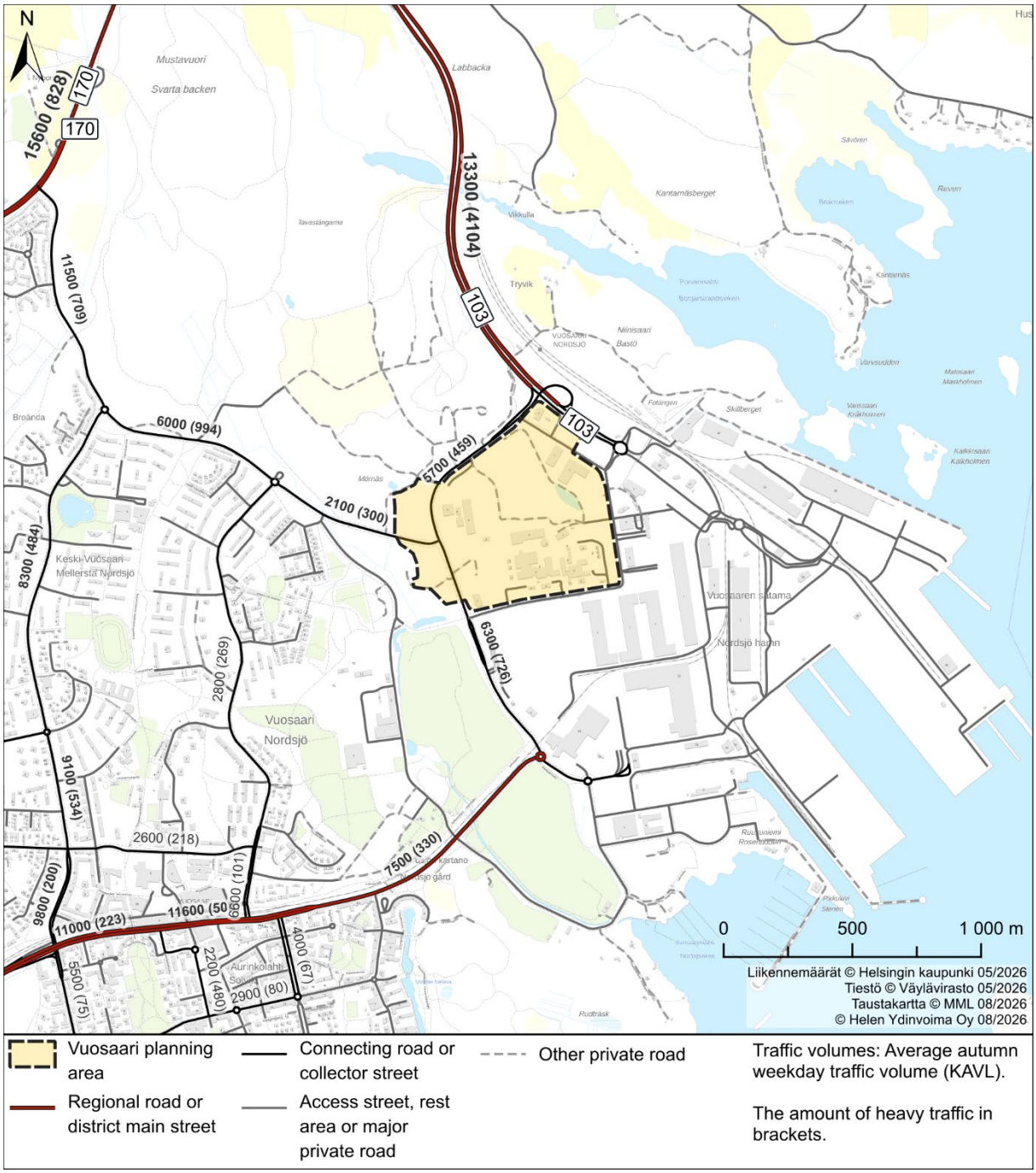


Figure 11-2. Traffic volumes of roads and streets near the Vuosaari planning area (AWDT). The amount of heavy traffic in brackets.

Over the past five years (2021–2025), a total of 10 traffic accidents that have led to injuries and were reported to the police have occurred in the vicinity of the Vuosaari power plant (Vuosaari harbour tunnel, Satamakaari, Niinisaarentie, Kallvikintie and Itäväylä). Of these, five were individual accidents, two were turning accidents, two were intersection accidents and one was an overtaking accident. No fatal accidents occurred during this period, but there were 19 accidents that did not result in personal injury. (Ramboll Finland Oy 2026). Traffic-sensitive sites include, for example, schools located in the Vuosaari and Mellunmäki areas.

In the CHP plant project option, a new 400 kV power line will be constructed to the Itäsalmi substation, built on the Vantaa side. Alternative power line routes (overhead line or

Copyright © Helen Nuclear Ltd

underground cable) intersect with Itäväylä, Ring Road III and Porvoonväylä. The CHP plant project option also requires a cooling water tunnel connection to the sea off Vuosaari Harbour. The Vuosaari Harbour mainly serves unitised freight traffic. The harbour serves as a freight harbour, where container and roll-on/roll-off traffic is handled (i.e. loading takes place through the bow or stern gate of the ship using power or traction units), as well as project cargoes. In addition, there is a Hansa Terminal in Vuosaari Harbour, which serves the passenger traffic of Travemünde and Muuga. (Port of Helsinki Ltd 2026b) Vuosaari Harbour's maritime traffic is served by the Vuosaari fairway, which belongs to fairway category 1, i.e. the main fairways of merchant shipping, with a design draught of 13 metres. Other shallower sea routes in the area are the Vuosaari shipyard fairway (fairway class 2), the Vuosaari–Kalkkiranta local boating fairway (fairway class 5) and the Jollas–Sipoonselkä main recreational boating fairway (fairway class 4). (Finnish Transport Infrastructure Agency 2026) In the construction of cooling water tunnels, the transport of rock material is carried out along the tunnels to shore. However, construction may have temporary, short-term impacts on the use of sea routes.

11.1.3 Norrberget

A nuclear power plant is planned in the Norrberget area of Helsinki, which would be either a heating plant (VE3a) or, alternatively, a CHP plant (VE3b). The nuclear power plant is mainly located in an undeveloped area on the border of Vantaa, next to Porvoonväylä (Finnish national road 7) and Sotungintie (connecting road 11645), and the project will implement new road connections to the area. According to the preliminary plan, the main route in the area will be a new road connection to the west of the plant, built as an extension of Vantaa's Pitkäsuontie, which will cross Sotungintie via a bridge. Pitkäsuontie is accessible from Ring Road III and Porvoonväylä via grade-separated intersections, which form the main access routes to the nuclear power plant. On the east side of the area, a backup access road will also be constructed as an extension of Länsisalmentie (connecting road 11633) from the Sotungintie intersection, crossing Porvoonväylä by a bridge. Länsisalmentie connects to Ring Road III via a traffic light intersection. The traffic connections to the nuclear power plant are therefore reasonably good.

According to traffic volume data from the Finnish Transport Infrastructure Agency, the average daily traffic volume (ADT) on Ring Road III north of the area's grade-separated intersections is 37,674 vehicles, of which 3,866 (10% of the total) vehicles are heavy traffic. At the Länsisalmentie traffic light intersection, the volume is 17,001 vehicles, of which 3,145 (18%) vehicles are heavy traffic. On the Porvoonväylä road, the volume of traffic in the east direction is 30,656 vehicles, of which 2,285 vehicles (7%) are heavy traffic, and 16,959 vehicles in the west direction, of which 812 (5%) are heavy traffic. The traffic volume on Länsisalmitie is 650 vehicles/day, of which 26 (4%) vehicles are heavy traffic (Finnish Transport Infrastructure Agency 2026). There are no traffic volume data available for Pitkäsuontie, as it belongs to the street network of the City of Vantaa. Currently, it is home to Vantaan Energia's waste-to-energy plant, Remeo's recycling plant and the Rudus recycling point, meaning there is a lot of traffic and many transportation operations.

Traffic volumes on roads near the Norrberget planning area (VE3a and VE3b) are shown in the figure (Figure 11-3).

Copyright © Helen Nuclear Ltd

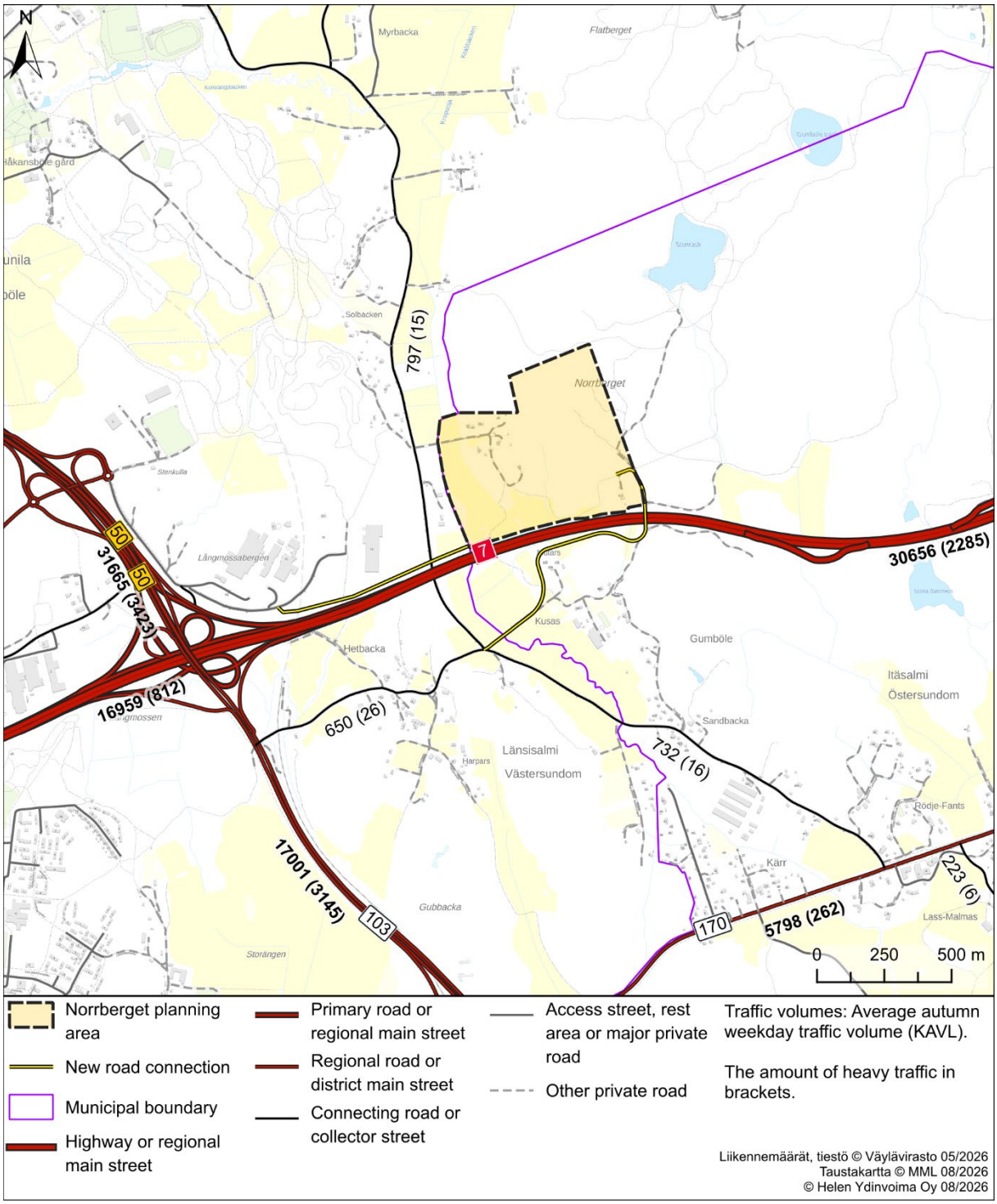


Figure 11-3. Traffic volumes (ADT) on roads and streets near the Norrberget planning area. The amount of heavy traffic in brackets.

During the past five years (2021–2025), a total of five traffic accidents that resulted in an injury and were reported to the police have occurred in the vicinity of the planned Norrberget planning area (Pitkäsuontie, Länsisalmentie and the intersection areas of Ring Road III and Porvoonväylä). Three of these accidents were individual accidents, and there was also a rear-end collision and a collision involving a deer. No fatal accidents occurred during this period, but there were 16 accidents that did not result in personal injury. (Ramboll Finland Oy 2026). Traffic-sensitive sites include, for example, the small Swedish-language primary school in

Västersundom, located on the emergency route along the Länsisalmentie road. Länsisalmentie (speed limit 40 km/h) is narrow and winding, and there is no separate pedestrian and cycle path along it. (Finnish Transport Infrastructure Agency 2026).

In the project option of the heating plant, a new 110 kV power line will be constructed to the current Länsisalmi substation on the Vantaa side, west of Ring Road III. The overhead line option runs from the planning area to the substation from the south side of the Porvoonväylä road and the underground cable option from its north side. In the CHP plant project option, a new 400 kV power line will be constructed to the new Itäsalmi substation on the Vantaa side, east of Ring Road III. The overhead line option and both underground cable options run from the planning area to the substation from the north side of the Porvoonväylä road. In both project options, a new transmission connection from the planning area to the existing district heating network in Vuosaari will also be implemented for district heat transmission, either in a tunnel excavated entirely in the rock, or as a combination of a tunnel and an underground pipe. In the CHP plant project option, a cooling water tunnel running from the planning area to the sea off Vuosaari Harbour must also be constructed for cooling, and its construction may have temporary impacts on the area's sea routes, as is the case with the Vuosaari CHP plant. In addition to several roads, the Vuosaari Harbour railway, which mainly runs in a tunnel from Kerava to Vuosaari Harbour, intersects Norrberget's electricity transmission, district heat and cooling water transmission lines.

11.2 Impact assessment and methodology

The traffic effects caused by the new nuclear power plant will be especially focused on the construction period of the project, as the traffic volumes generated during construction are very large. The traffic volumes generated during the operation of the plant are significantly lower.

In the planning areas, heavy traffic during the project's construction is mainly caused by excavation work and the transport of rock material. During construction, there is also plenty of passenger traffic. In the Vuosaari project options (VE2a and VE2b), heavy traffic during construction is also caused in the planning areas by the possible removal of the base structures of the coal storage and the interim storage of bottom ash, as well as possibly by the demolition of existing power plant buildings. In the Norrberget project options (VE3a and VE3b), also preparatory works (such as felling trees, removing topsoil, building roads) in the planning area cause heavy traffic.

The excavation work for the cooling water tunnels of the CHP plant options (VE2b and VE3b) and the transport of rock material cause significant heavy traffic. The Norrberget project options (VE3a and VE3b) require the construction of a district heat transmission connection from Norrberget to the Vuosaari connection point, and the transport of rock material from the construction works will cause heavy traffic.

The construction of the 400 kV power line for the Vuosaari CHP plant (VE2b) will increase traffic volumes along the route. The new 110 kV power line for the Norrberget heating plant crosses busy roads (Ring Road III, Porvoonväylä), and the construction may cause temporary traffic arrangements on those roads. The new 400 kV electricity transmission connection for the Norrberget CHP plant (VE3b) crosses only Sotungintie which is a road with low traffic.

The table (Table 11-1) below presents the justification for targeting the environmental impact assessment by project option for traffic (for background on targeting, see chapter 7.2.1).

Copyright © Helen Nuclear Ltd

Table 11-1. Justification for targeting the environmental impact assessment by project option in terms of traffic. x = the project option for which the assessment is specifically targeted.

	Traffic	Justification
VE1	x	During construction, traffic volumes are high and the area's traffic network is already under stress in the current situation. In addition, the area is sensitive to traffic safety impacts. However, the road connections in the area are good. During operation, traffic volumes are lower.
VE2a		During construction, traffic volumes are high, but the area's traffic network is functional and enables even large projects. During operation, traffic volumes are lower.
VE2b	x	During construction, traffic volumes are high, but the area's traffic network is functional and enables even large projects. The temporarily large traffic volumes during the construction phase are spread over a wide area. During operation, traffic volumes are lower.
VE3a	x	The planning area is undeveloped and, during construction, traffic volumes are high. The traffic network in the project area is busy in the current situation, which may affect traffic flow and safety, but traffic connections are nevertheless good. During operation, traffic volumes are lower.
VE3b	x	The planning area is undeveloped and, during construction, traffic volumes are high. The traffic network in the project area is busy in the current situation, which may affect traffic flow and safety, but traffic connections are nevertheless good. During operation, traffic volumes are lower.

Traffic during the construction and operation of the project is mainly by road, so in the assessment of the traffic impacts, special emphasis is placed on the assessment of the road traffic impacts. The impacts on water traffic, rail traffic and air traffic (an aviation obstacle permission is required for the project) in different project options are also taken into account in the assessment. The assessment describes the current situation of the traffic network in the project areas (road connections, current status of the routes, traffic volumes and the number of traffic accidents) on the basis of existing data and information (for example, data from the Finnish Transport Infrastructure Agency and the City of Helsinki). Traffic impacts are assessed on the basis of operational planning data by comparing the current state of the area with the planned activities and the changes to traffic caused by them. The impacts of excavated rock transports during construction are assessed on the basis of a report on the utilization and temporary storage of rock material (see chapter 21.2.1). The traffic impact assessments examine the project's effects on traffic volumes on the road network and on traffic flow and safety. Particular attention is paid to the transport of hazardous goods (such as nuclear fuels), as well as to sites vulnerable to road safety impacts (for example, schools and densely populated areas). The impacts are assessed in more detail in the vicinity of the traffic routes leading to the project area and in relation to the current traffic and condition of the

Copyright © Helen Nuclear Ltd

routes. The traffic impact assessment also takes into account the cumulative impacts with other relevant projects and proposes ways to mitigate the impacts. The traffic impacts of the project are evaluated as expert assessments and carried out by an expert who is familiar with the traffic impacts.

Copyright © Helen Nuclear Ltd

12 AIR QUALITY

12.1 Current status

Most of the time, air quality in Helsinki and throughout the Helsinki Metropolitan Area is generally good. In the urban area, air quality is most significantly affected by road traffic emissions and the highest concentrations of air pollutants occur on busy traffic routes and intersections, as well as in their immediate vicinity. Concentrations decrease rapidly as the distance from the traffic routes increases, as emissions are mixed with the surrounding air. In areas of detached housing, emissions from fireplaces can occasionally significantly weaken local air quality. The impact of emissions from energy production plants on air quality in the Helsinki Metropolitan Area is mainly minor, as emissions from energy production plants are released from high chimneys, in which case they spread and dilute efficiently and do not reduce air quality at breathing altitude. Emissions from shipping and port operations, as well as road traffic within ports, can occasionally cause short-term spikes in pollutant concentrations near the ports. The impact of emissions from air traffic and airport operations on air quality is mainly limited to the airport area and its immediate vicinity. Air pollution, mainly fine particles, also reaches the area as long-range transboundary air pollution. For most of the year, concentrations of air pollutants are well below the limit values set by legislation, and air quality does not cause significant harm to the health of the population.

HSY (Helsinki Region Environmental Services Authority) is responsible for monitoring the air quality in the capital. Concentrations in the planning areas in 2024–2025 in accordance with HSY's indicative annual air quality map are presented in the following table (Table 12-1; https://www.hsy.fi/en/air-quality-and-climate/information-for-urban-planning/annualairqualitymap/). Long-term concentrations are well below the current health-based air quality limit values (79/2017) in all planning areas, as well as the EU's stricter air quality limit values (2881/2024), which must be reached by 1 January 2030. Air quality in all planning areas is very similar. In all areas, air quality is good on average, but in winter, nitrogen oxide concentrations can sometimes reach high levels under poor mixing conditions (e.g. inversion), and in the spring, street dust (inhalable particles) weakens air quality like everywhere in traffic environments and urban areas.

The Salmisaari planning area is located right next to the busy Länsiväylä road and close to the inner city of Helsinki, which is reflected in the area's air quality at slightly higher concentration levels on average than in the other two planning areas. The Vuosaari planning area is located further away from the busy main roads and the inner city, but the area's air quality is affected by the area's harbour operations and heavy traffic to the harbour, as well as emissions related to energy production and industry. The Norrberget planning area's environment is sparsely built, but the busy Porvoonväylä road runs south of the area and the busy Ring Road III runs some distance to the west, so car traffic and nearby energy production and industrial emissions have the most significant impact on the air quality in the area.

The intensity of the air quality impacts caused by traffic is clearly related to the traffic volume, the flow of traffic and the characteristics of the vehicle pool. In the long term, advances in vehicle technology and electrification of transport will reduce tailpipe emissions, and this is likely to be reflected in the future in the traffic environment and in urban areas as reductions in nitrogen dioxide and fine particulate matter concentrations. However, there is significant uncertainty in the development of concentrations. Street dust will still remain a significant local air quality challenge in the future, as street dust is mainly generated by road surface wear

Copyright © Helen Nuclear Ltd

caused by studded tyres, sanding material and brake and tire wear, and it does not depend on the propulsion power of vehicles.

Table 12-1. Annual concentration levels in the planning areas in 2024–2025 according to HSY's annual air quality map, as well as the corresponding valid air quality limit values (79/2017) and future limit values (2881/2024, to be achieved by 1 January 2030).

Annual concentration level (µg/m³)	Salmisaari	Vuosaari	Norrberget	Limit value: current/future
Particulate matter ($PM_{2.5}$)	4–7	4–6	4–6	25/10
Inhalable particles (PM_{10})	12–14	<12	<12	40/20
Nitrogen dioxide (NO_2)	5–15	5–10	5–10	40/20

12.2 Impact assessment and methodology

Air quality impacts of the project are evaluated as an expert assessment, based on the current state of air quality in the project area and the airborne release generated by the operations. Conventional airborne discharges that impair air quality are not released from the nuclear power plant and are therefore not modelled separately. There are up to six backup generators and they range in power from a few megawatts to ten megawatts. They are fuelled with light fuel oil. The backup generators at the nuclear power plant are not used continuously. Instead, they are operated approximately once a month for testing. They cause emissions into the air only during testing and in possible situations where the generators are used during power failures. The nitrogen oxide, sulphur dioxide and particulate emissions into the air generated by the generators are assessed on the basis of design data (technical data, estimated use, etc.). The exhaust emissions caused by the nuclear power plant's traffic are estimated on the basis of traffic volumes. District heat transmission connections, power lines or cooling water tunnels do not cause impacts on air quality during their operation.

All major construction projects cause air quality impacts during construction. The main impacts arise from excavation, earthworks, machinery and transport traffic. The most significant air pollutant during construction is inhalable particles, i.e. dust, which mainly consists of rock and soil dust. These particles are relatively large in size and typically only spread in the air for short distances, which is why the impacts are mainly local and specifically focused on the immediate surroundings of the construction site. In the reporting phase, the air quality impacts of dust emissions from the project's construction work and from traffic during the construction period, and the measures to mitigate them, are assessed.

Radioactive releases into the air are described in more detail in chapter 3.13. In principle, the nuclear power plant is designed so that its radioactive releases and radiation doses caused by releases are below all the limits set for radioactive releases, and do not have adverse impacts on the environment or humans. Radioactive releases into the air during operation are assessed by experts by comparing preliminary data from the nuclear power plant with emission limits for existing nuclear power plants and with actual emissions. Exceptional and emergency situations involving radioactive substances and their modelling are described in chapter 23.

Copyright © Helen Nuclear Ltd

According to a preliminary assessment, the project will not cause any significant air quality impacts. During operation, the use of backup generators is occasional, and no other air quality effects are caused by normal operation. Dust impacts during construction are typical for all construction projects and can be effectively influenced by dust control measures. Thus, an air quality impact assessment will be carried out during the EIA reporting phase, but the project's air quality impacts are considered to be those for which the impact assessment is not specifically targeted (for background on the targeting of impacts, see chapter 7.2.1).

Copyright © Helen Nuclear Ltd

13 PEOPLE'S HEALTH, LIVING CONDITIONS AND COMFORT

13.1 Current status

13.1.1 Salmisaari

13.1.1.1 Settlement

The Salmisaari planning area is surrounded by densely populated areas such as Ruoholahti, Lauttasaari, Jätkäsaari, Kamppi and Etu-Töölö (Figure 13-1).

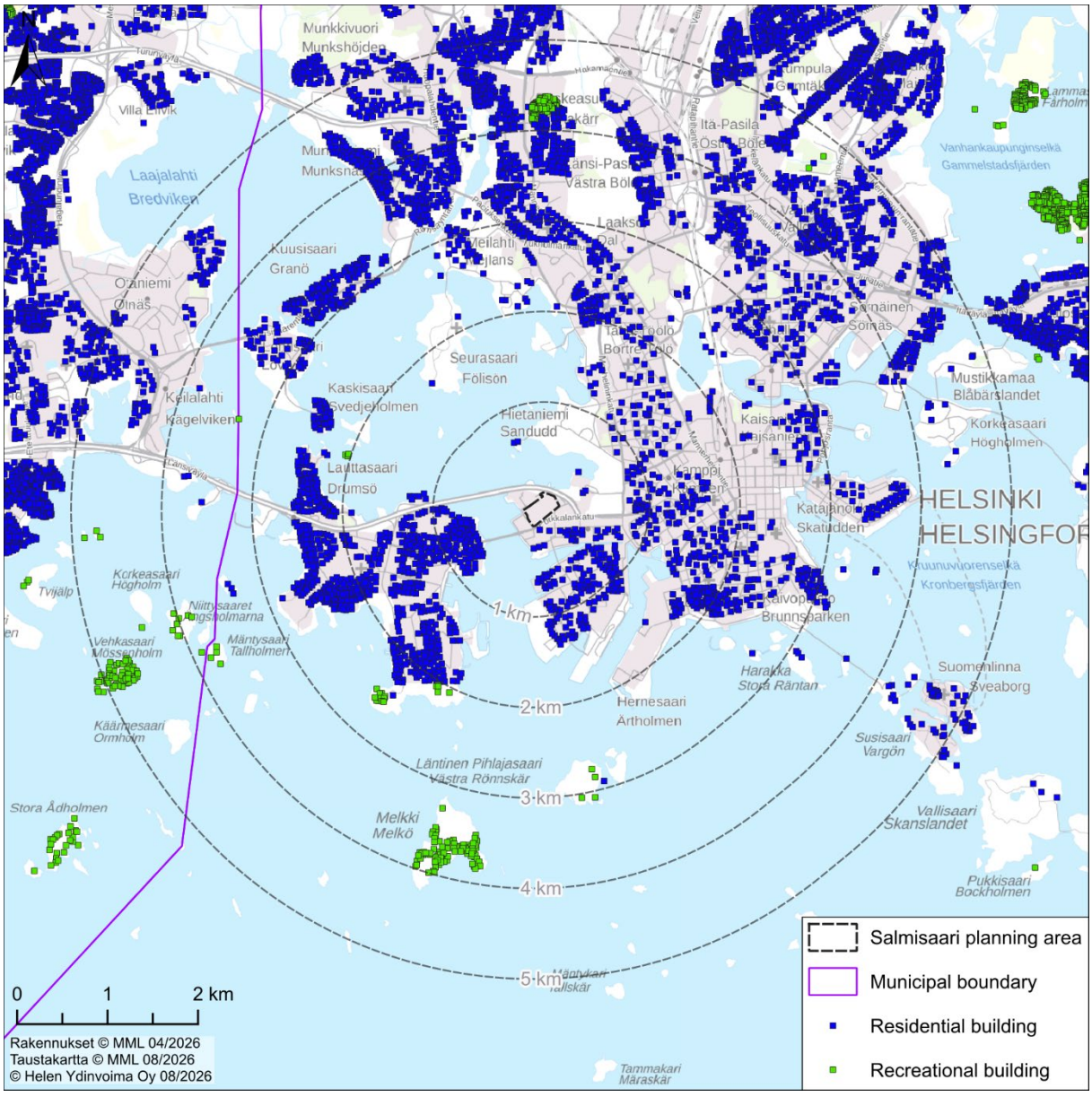


Figure 13-1. Residential and leisure buildings around the Salmisaari planning area. The map shows the distance zones 1, 2, 3, 4 and 5 kilometres from the boundary of the planning area.

The most densely populated areas near the planning area are Kamppi, Ruoholahti, Lauttasaari, Töölö and Kallio (Figure 13-2).

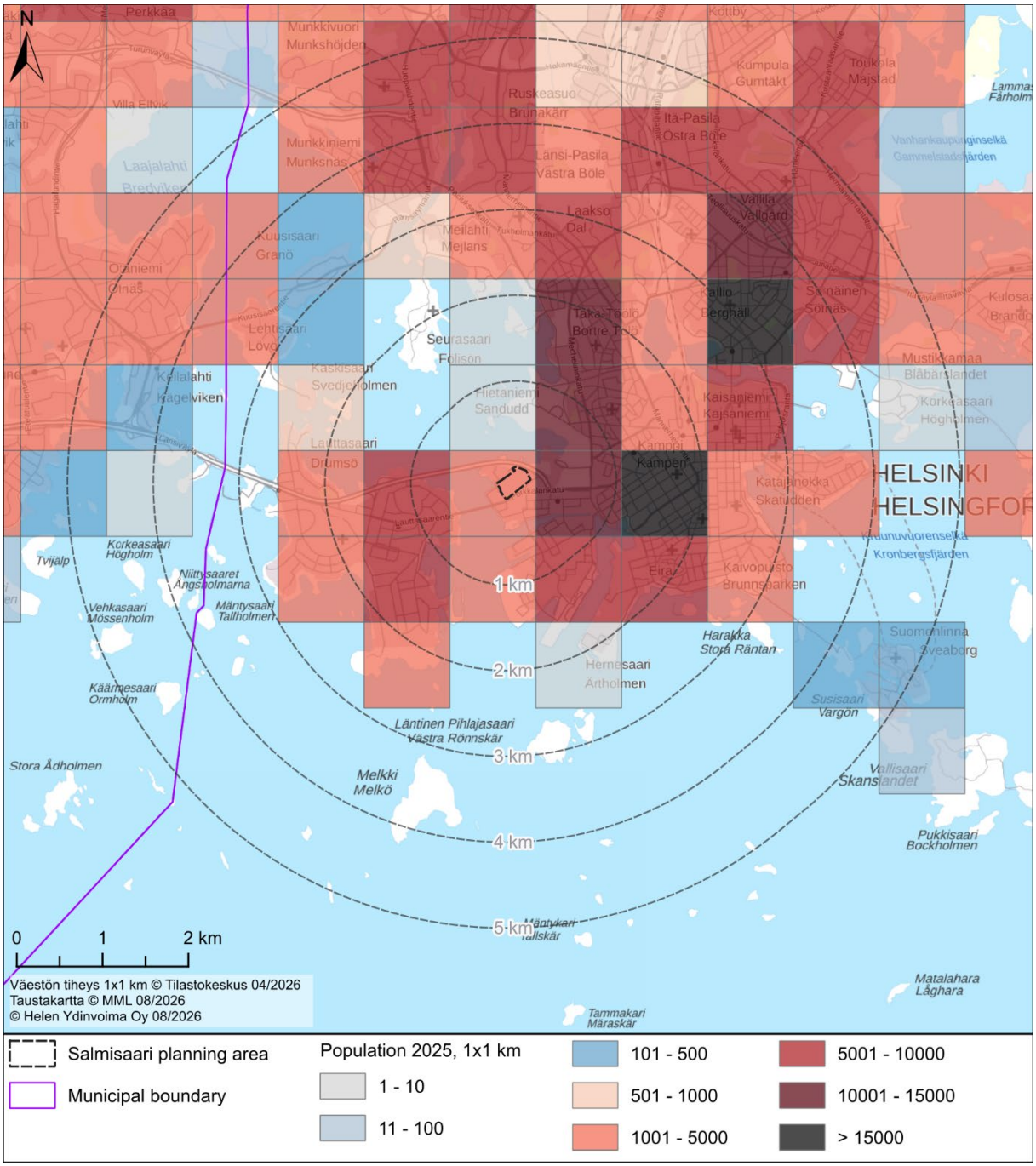


Figure 13-2. Population density around the Salmisaari planning area.

About 23,000 people live within a kilometre of the planning area and about 245,000 people within a distance of five kilometres (Table 13-1).

Copyright © Helen Nuclear Ltd

Table 13-1. Population within 1, 5, 20 and 100 kilometres of the Salmisaari planning area. Within a radius of 100 km from the planning area, only the population of Finland has been taken into account.

Distance from the Salmisaari planning area	Number of inhabitants (persons)
1 km	about 23,000
5 km	about 245,000
20 km	about 1,218,000
100 km	about 2,003,000

13.1.1.2 Other sensitive sites

The nearest daycare centres are located north of the planning area on Energiakatu, south of the area on Porkkalankatu and about 300 metres to the south-east of the planning area (Figure 13-3). There are plenty of other daycare centres in the Ruoholahti area and Lauttasaari. The health centre is located on the southwest side of the planning area at a distance of about 50 metres. The nearest school is located in Ruoholahti, about 600 metres from the planning area. The nearest residential care home and retirement home are located in Lauttasaari, about 700 metres from the planning area.

Copyright © Helen Nuclear Ltd



Figure 13-3. Sensitive sites in the vicinity of the Salmisaari planning area. The map shows distance lines from the boundary of the planning area at 500 metres, 1 kilometre and 2 kilometres.

13.1.1.3 Recreation

In the Salmisaari and West Harbour area, several boat berths are located close to the project area, along with the Salmisaari Sports Center, the Selkämerenpuisto outdoor gym and the nearby sports facilities of Jätkäsaari and Ruoholahti schools (Figure 13-4). There are outdoor trails around the project area, such as the Seurasaarenselkä coastal route and the cycling route.

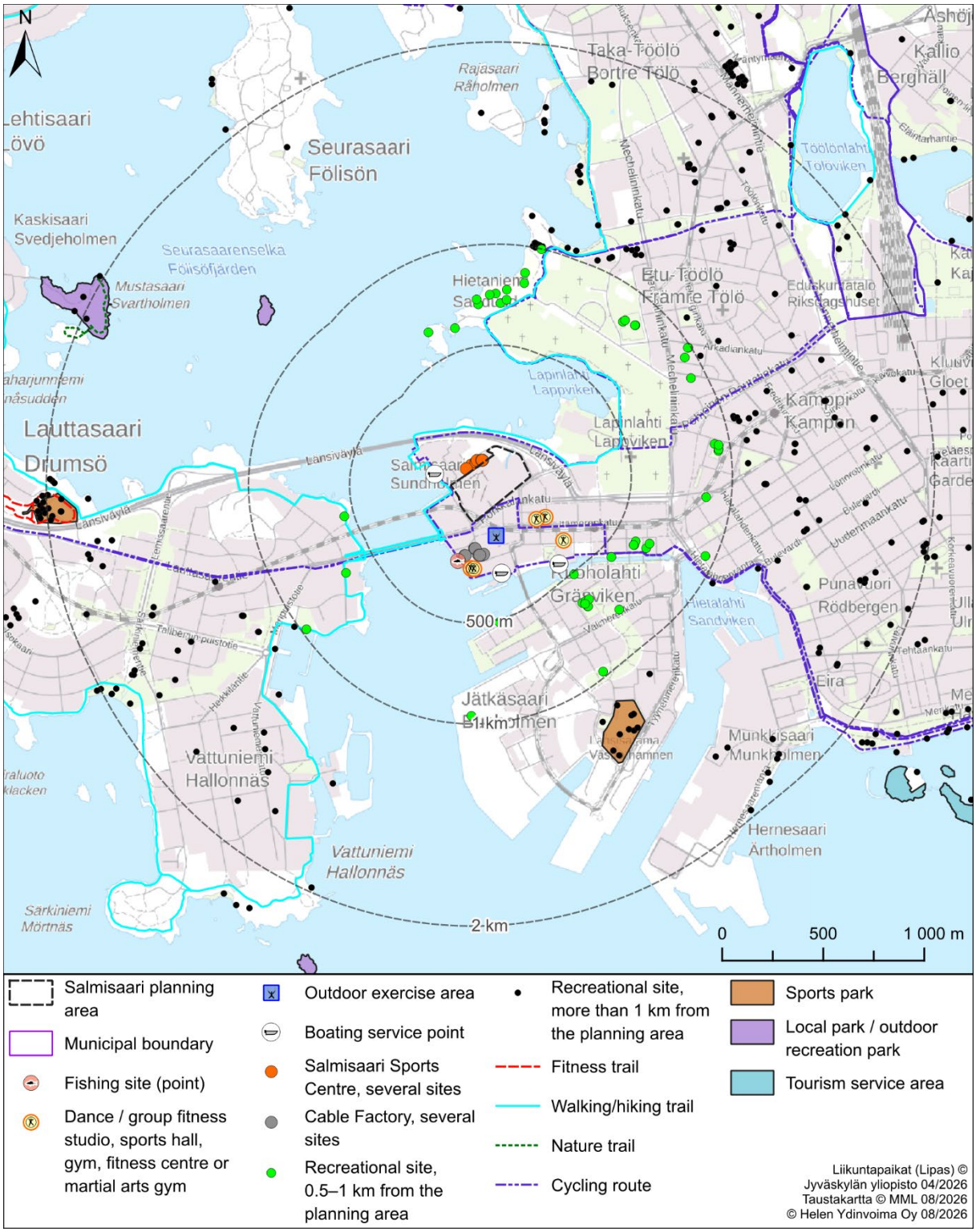


Figure 13-4. Recreational sites and routes around the Salmisaari planning area, shown at approximately two kilometres distance. The map shows distance lines from the planning area at 500 metres, 1 kilometre and 2 kilometres.

13.1.2 Vuosaari

13.1.2.1 Settlement

The nearest residential area is located about 300 metres west of the planning area boundary (Figure 13-5). To the west of the planning area is the Central Vuosaari residential area and to the southwest of the planning area is the Aurinkolahti residential area. The area adjacent to the planning area on the east and north sides is mostly uninhabited, except for a few individual holiday buildings. On the south side of Vuosaari Harbour, there are holiday homes on the islands of Pikku Niinisaari and Mölandet, for example.

Copyright © Helen Nuclear Ltd

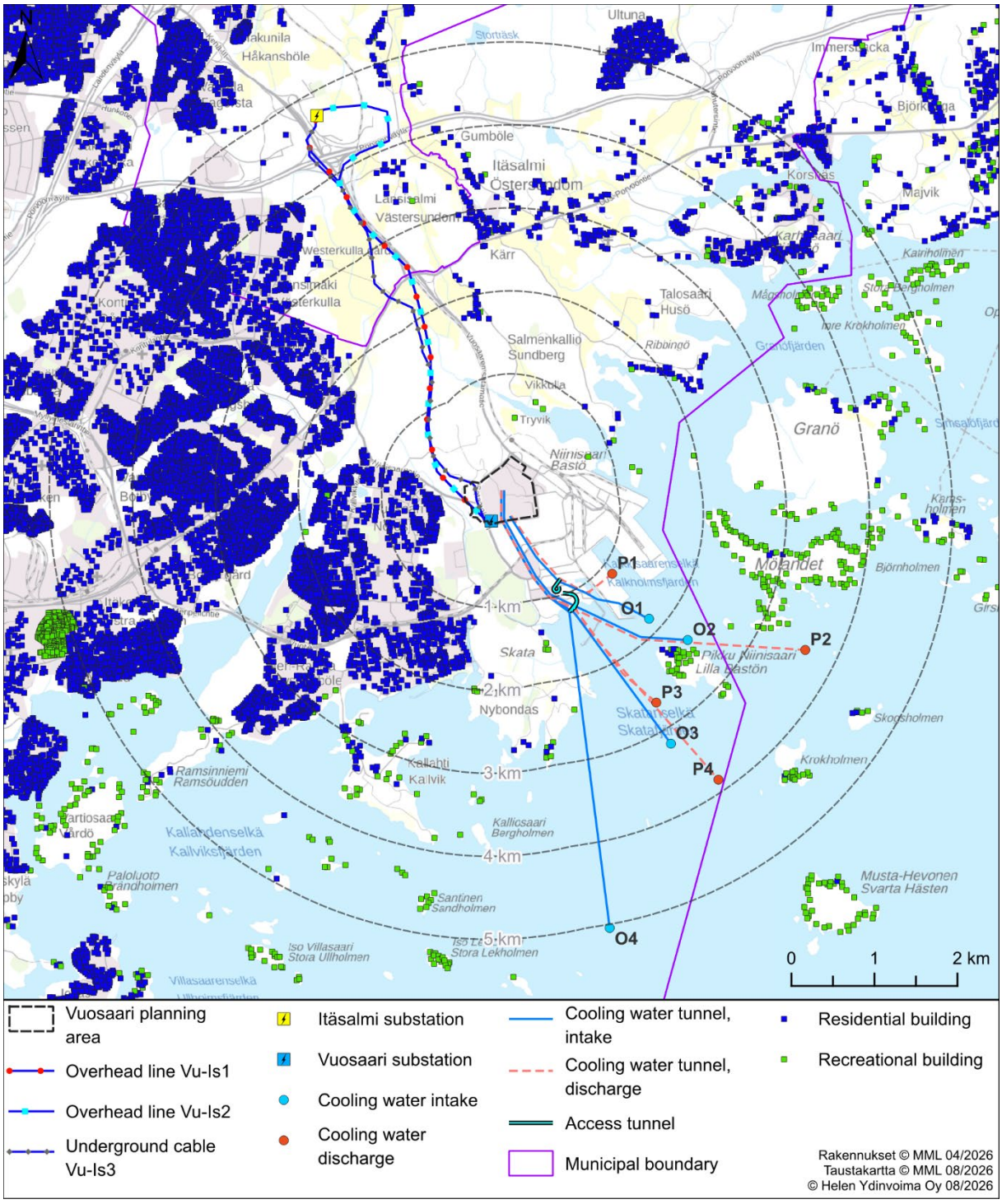


Figure 13-5. Residential and leisure buildings in the Vuosaari project area. The map shows the distance zones 1, 2, 3, 4 and 5 kilometres from the boundary of the planning area.

The overhead line options (options Vu-Is1 and Vu-Is2) are located alongside the existing Vaarala–Vuosaari 2x110 kV power line (project option VE2b) (Figure 13-5 and Figure 13-6). Residential or holiday buildings are not located in the immediate vicinity of the route. Residential buildings located at a distance of less than 300 metres are located in Vuosaari at a distance of approximately 215 metres from the overhead line. In the Hetbacka area, the nearest residential buildings are located approximately 230 metres from the overhead line Vu-Is2. In the vicinity of the Itäsalmi substation, a single residential building is located approximately

240 metres from the overhead line Vu-Is1 and the underground cable option Vu-Is3. The route of the underground cable option Vu-Is3 largely follows the route of the Vaarala–Vuosaari 2x110 kV power line, but the route diverges from the power line at the Vuosaari end, as well as in the Mustavuori and Westerkulla areas. Residential or holiday buildings are not located in the immediate vicinity of the underground cable option.

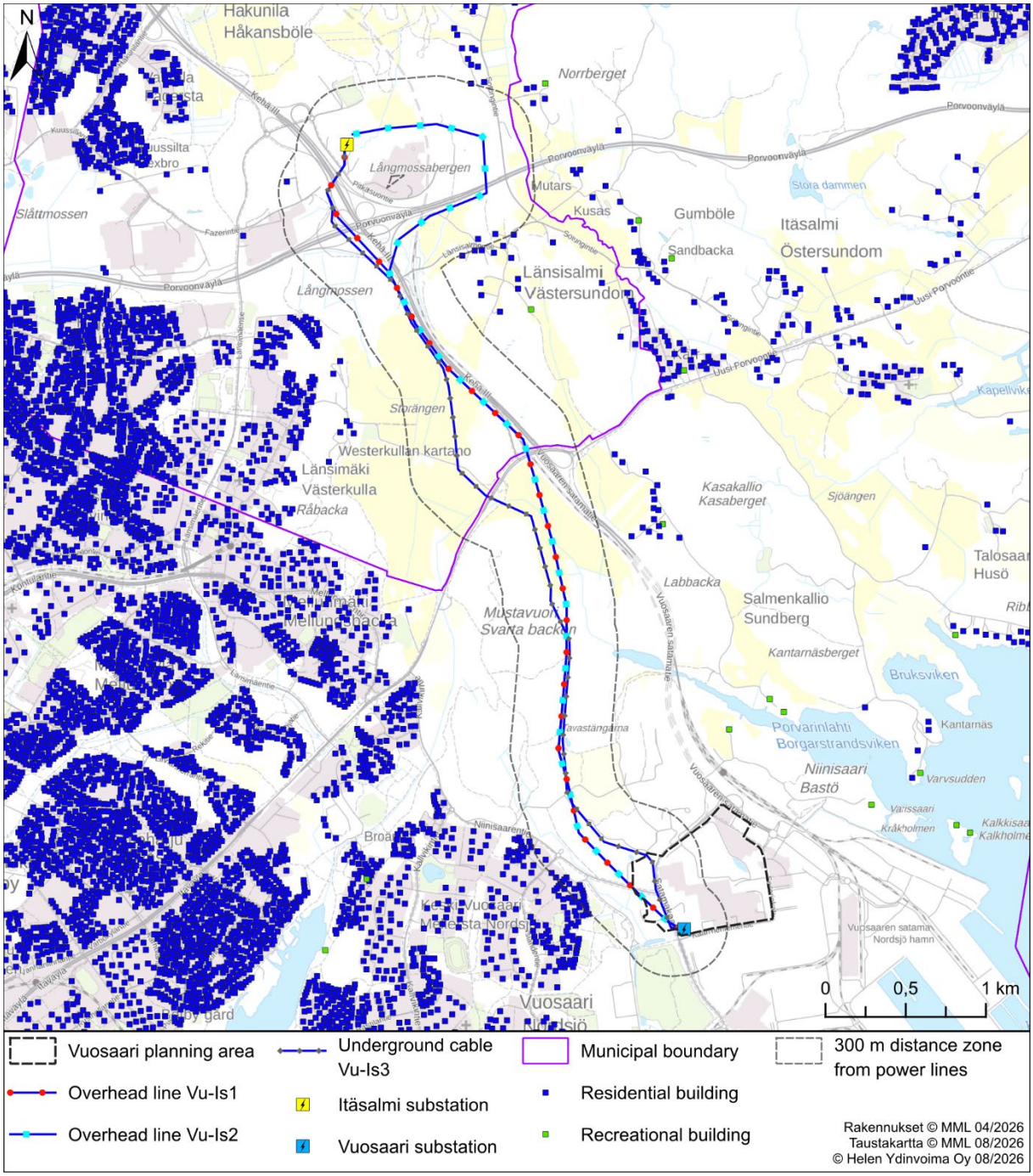


Figure 13-6. Residential areas near the Vuosaari electricity transmission route options in project option VE2b.

The nearest more densely populated areas in the vicinity of the Vuosaari planning area are Aurinkolahti, Rastila and Meri-Rastila (Figure 13-7). The east and north sides of the Vuosaari planning area are sparsely populated.

Copyright © Helen Nuclear Ltd

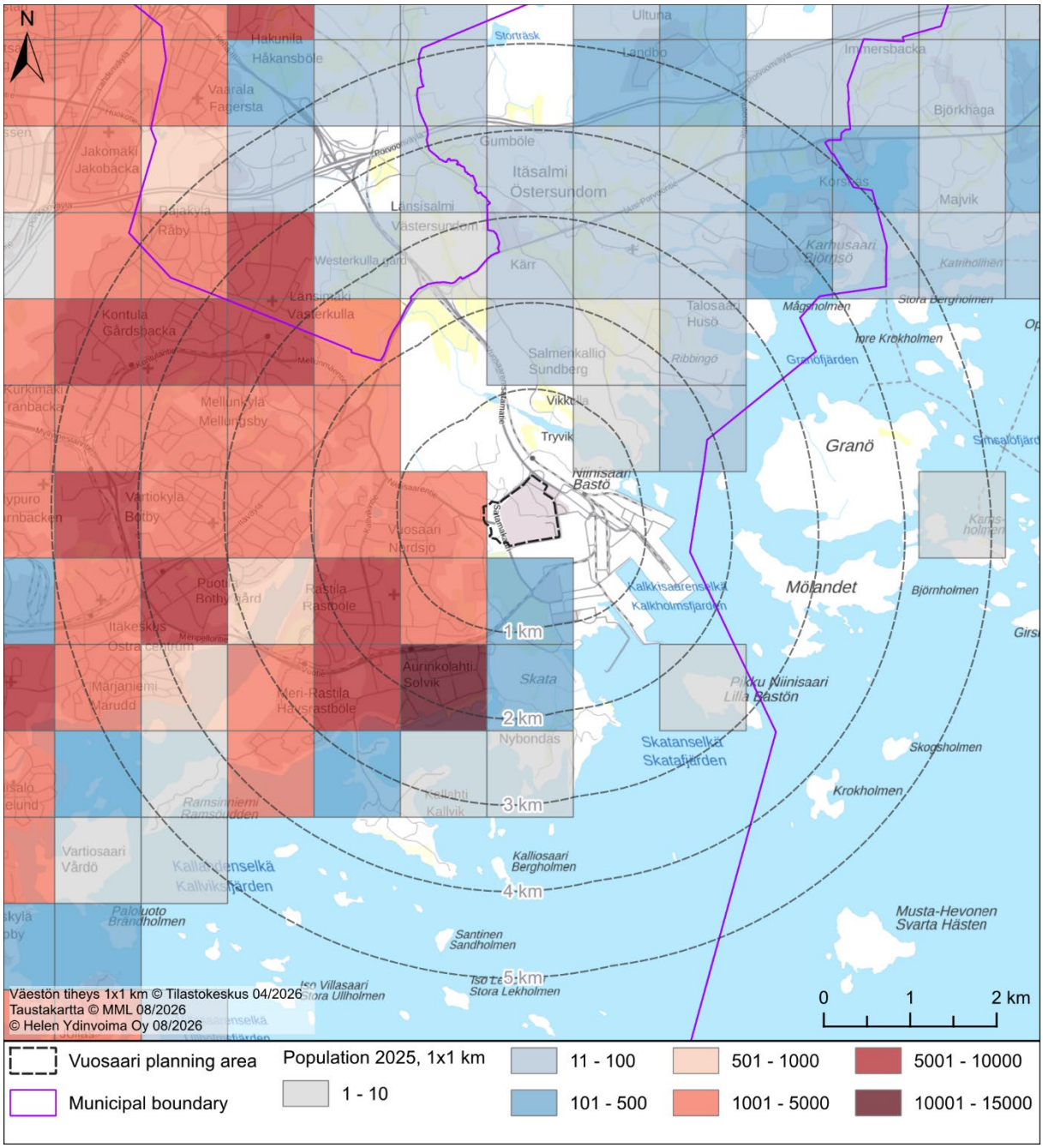


Figure 13-7. Population density around the Vuosaari planning area.

About 5,000 people live within a kilometre of the planning area and about 109,000 people within a distance of 5 kilometres (Table 13-2).

Table 13-2. Population within 1, 5, 20 and 100 kilometres of the Vuosaari planning area. Within a radius of 100 km from the planning area, only the population of Finland has been taken into account.

Distance from the Vuosaari planning area	Number of inhabitants (persons)
1 km	about 5,000
5 km	about 109,000
20 km	about 1,007,000
100 km	about 2,077,000

13.1.2.2 Other sensitive sites

The nearest daycare centre is located just over 600 metres west of the Vuosaari planning area (Figure 13-8). In the city districts of Central Vuosaari and Aurinkolahti, there are several schools and a residential care home. A health centre is located in Aurinkolahti, approximately 1.4 kilometres from the planning area. The school in Länsisalmi is about 500 metres from the electricity transmission route options.

Copyright © Helen Nuclear Ltd



Figure 13-8. Sensitive sites in the vicinity of the Vuosaari planning area and the Vuosaari project operations (project options VE2a and VE2b).

13.1.2.3 Recreation

There are recreational sites around the Vuosaari planning area, such as the Vuosaarenhuippu viewpoint and an outdoor area, located about 170 metres north of the planning area, and the Mustavuori nature reserve with hiking trails (Figure 13-9). A cycling route runs north–south on the west side of the planning area, about 700 metres away. On the southwest side of the planning area is the Vuosaari golf course and the Vuosaari sports park. Porvarinlahti, northeast of the planning area, is a Natura area. A nature tower is located approximately 900 metres north of the planning area in the bay of Porvarinlahti.

Copyright © Helen Nuclear Ltd

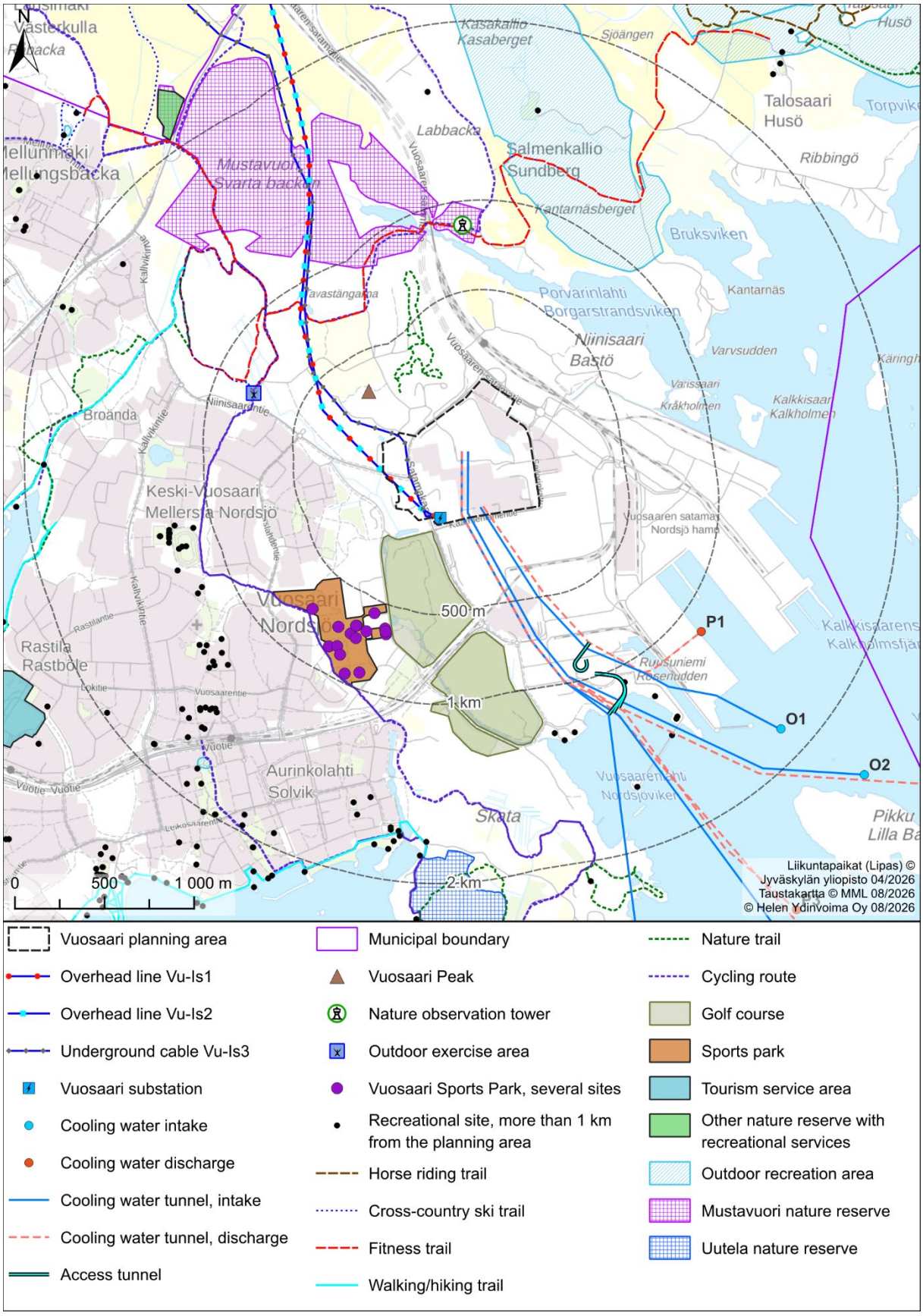


Figure 13-9. Recreational sites and routes in the vicinity of the Vuosaari planning area.

The electricity transmission route options intersect with a fitness trail and cycling route in the Mustavuori area (Figure 13-10). The cycling route frequently crosses the electricity transmission route options west of Ring Road III and runs alongside them. A cross-country ski trail intersects with all electricity transmission route options in the vicinity of Porvoonväylä.

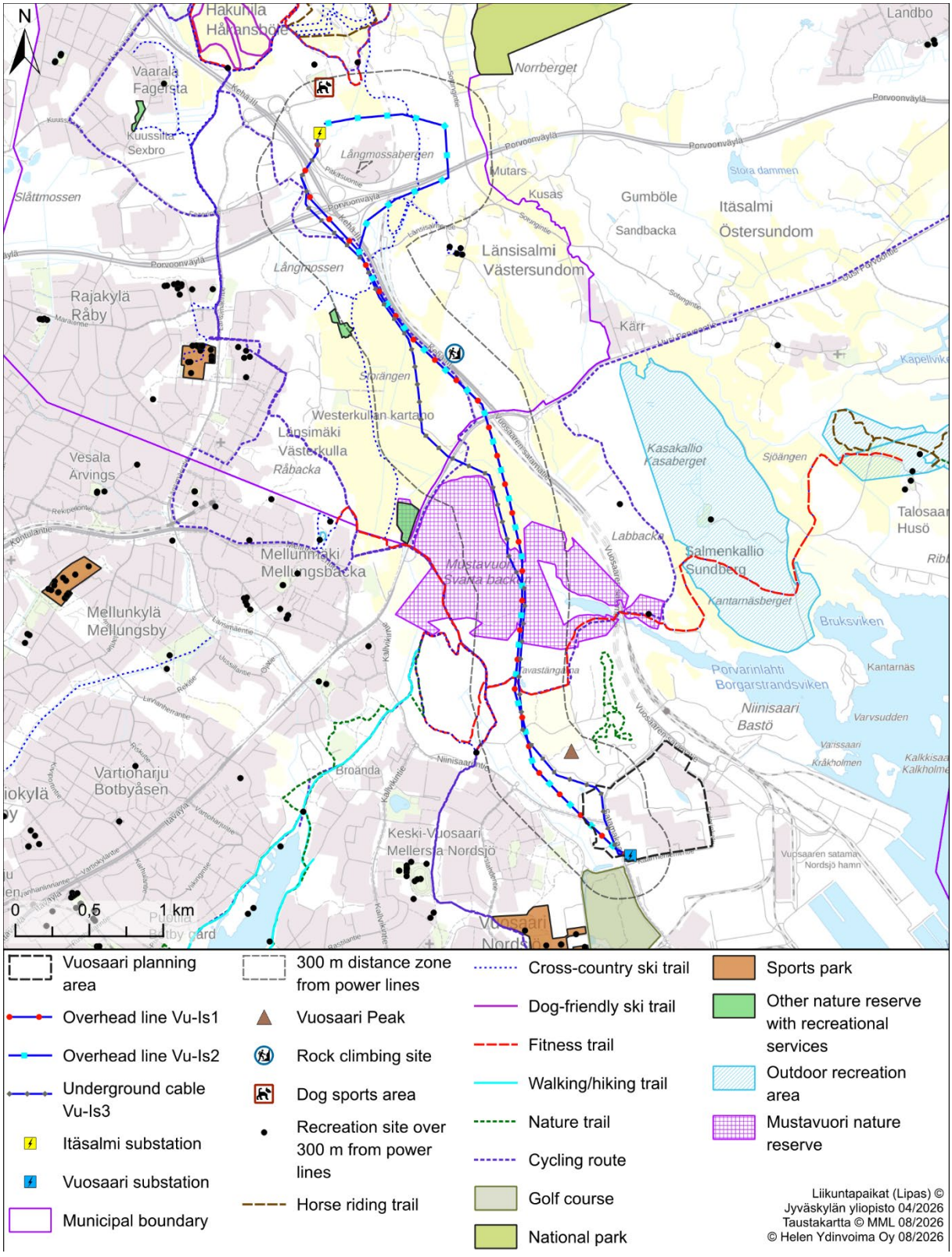


Figure 13-10. Recreation routes and sites near the electricity transmission route options in project option VE2b.

Copyright © Helen Nuclear Ltd

The recreational routes and locations near the cooling water tunnels are shown on the map (Figure 13-11). The map also shows the alternative cooling water tunnels of the Norrberget project option VE3b in the vicinity of Vuosaari Harbour. Two marinas are located in the southern part of Vuosaari Harbour. One route for the cooling water tunnel options in project option VE2b is below the outdoor area of Uutela. The marine area is used for independent recreation, such as boating.

Copyright © Helen Nuclear Ltd

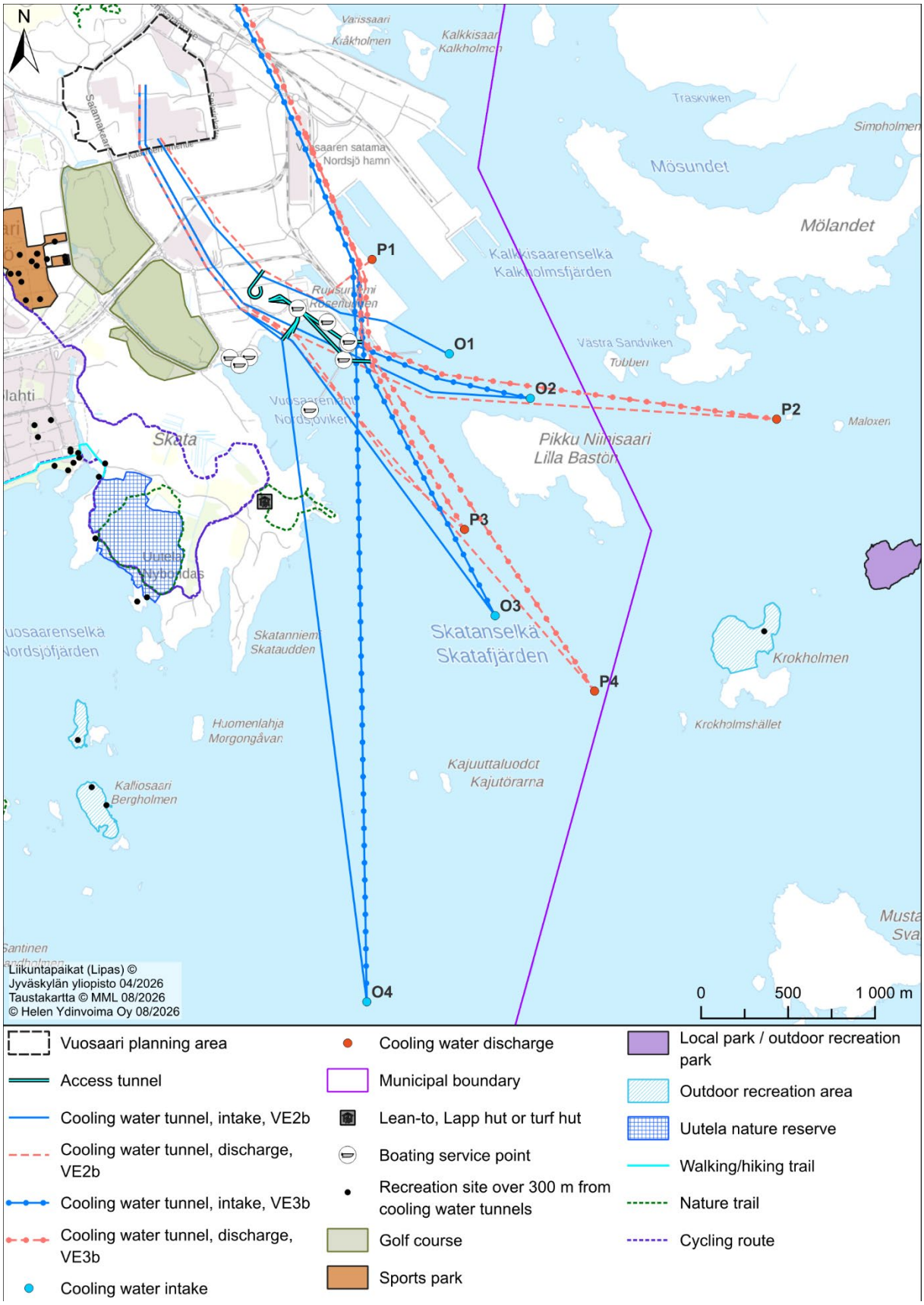


Figure 13-11. Close-up of the location for the cooling water tunnel options in project options VE2b and VE3b (Norrberget) in the southern part of Vuosaari Harbour.

Copyright © Helen Nuclear Ltd

13.1.3 Norrberget

13.1.3.1 Settlement

There are five residential buildings with their outbuildings and one holiday building in the Norrberget planning area (Figure 13-12, Figure 13-14). The nearest residential buildings outside the planning area are located approximately 130 metres south of the planning area boundary and about 150 metres to the west.

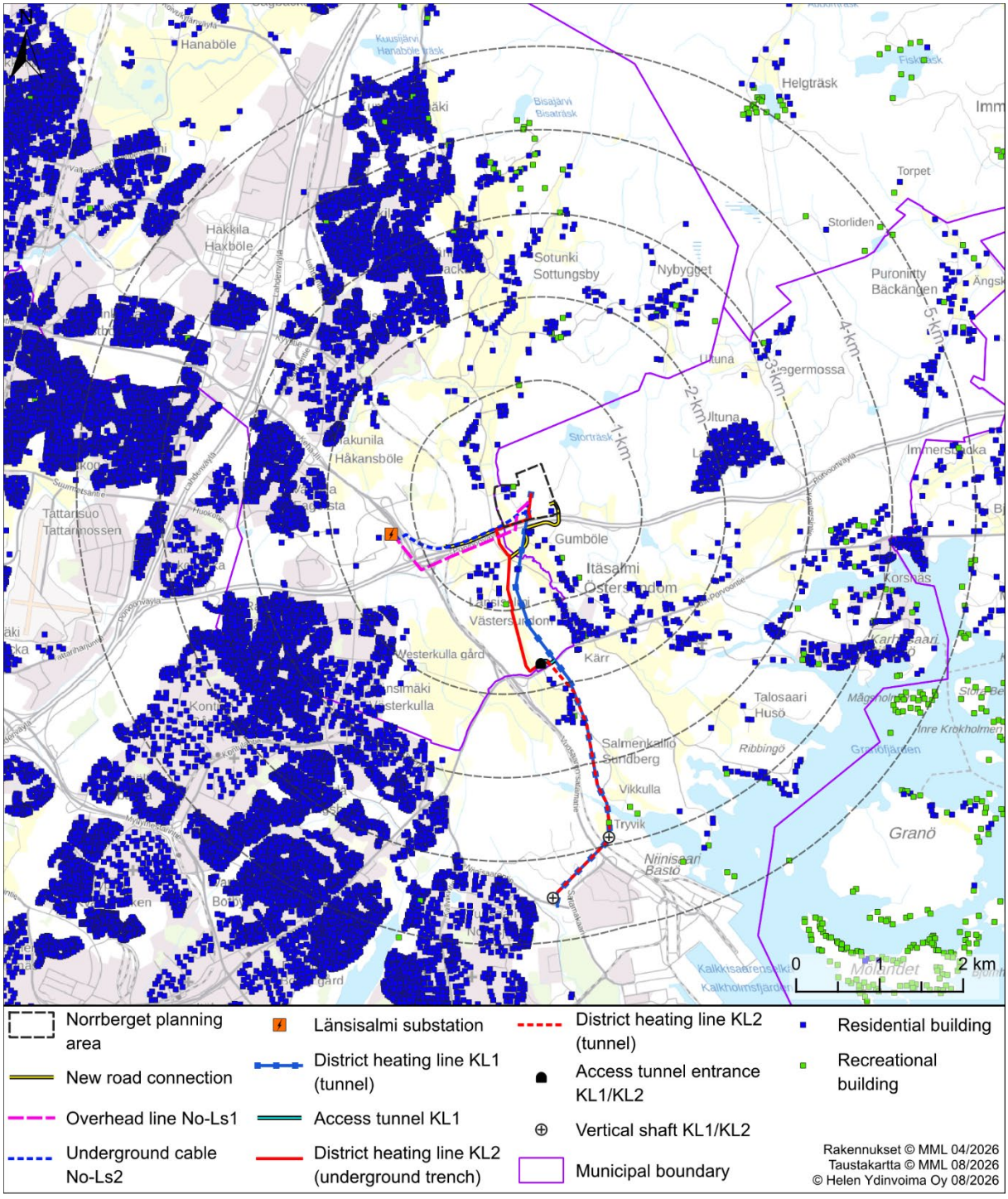


Figure 13-12. Residential and leisure buildings in and around the Norrberget project area. The map shows the operations of project option VE3a. The map shows the distance zones 1, 2, 3, 4 and 5 kilometres from the boundary of the planning area.

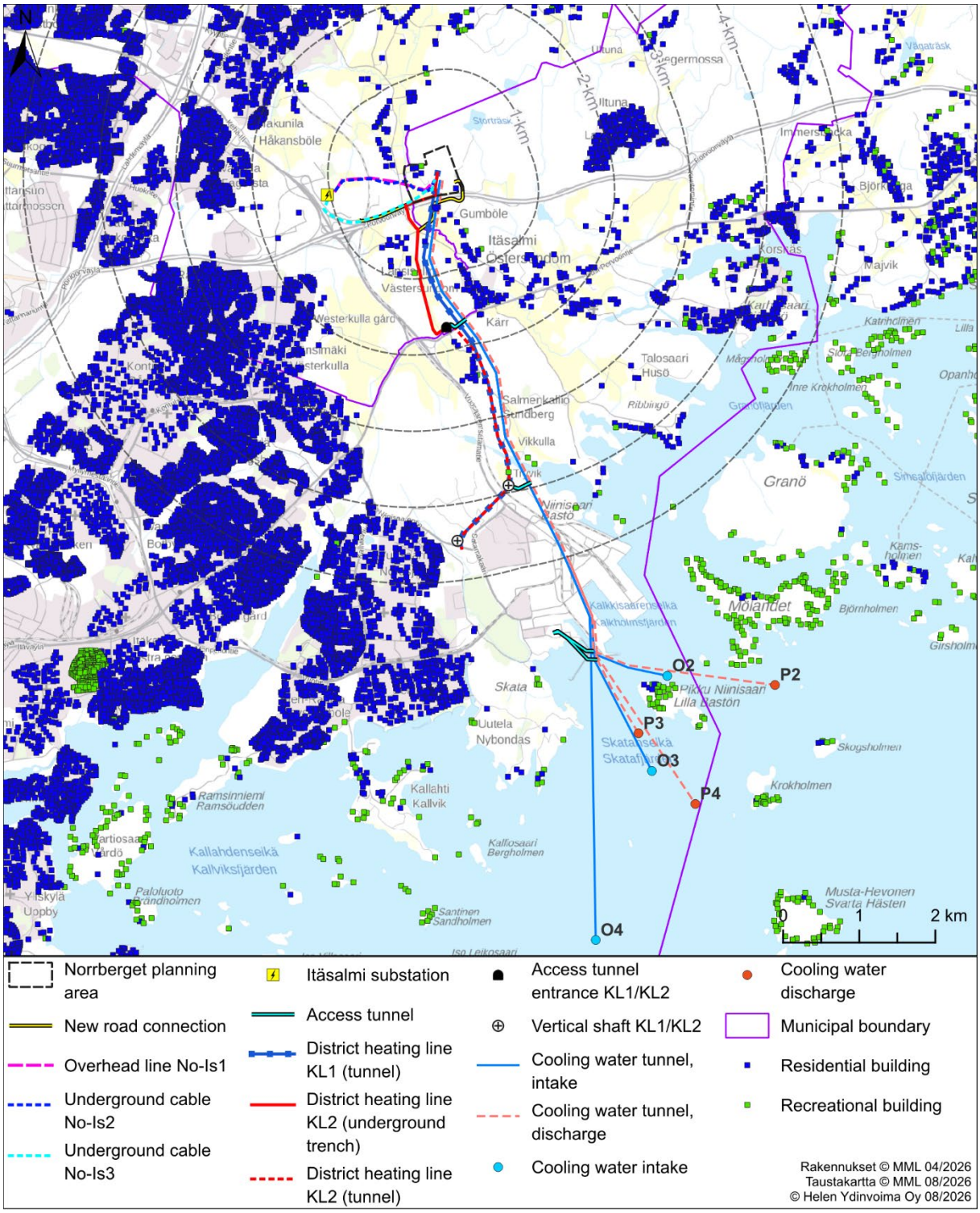


Figure 13-13. Residential and leisure buildings in and around the Norrberget project area. The map shows the operations of project option VE3b. The map shows the distance zones 1, 2, 3, 4 and 5 kilometres from the boundary of the planning area.

In project option VE3a, the nearest residential building to the overhead line No-Ls1 is located about 145 metres east in the Mutars area (Figure 13-14). In project option VE3b, the nearest residential building is located to the north of the power line connections, about 180 metres from the overhead line No-Is1.

Copyright © Helen Nuclear Ltd

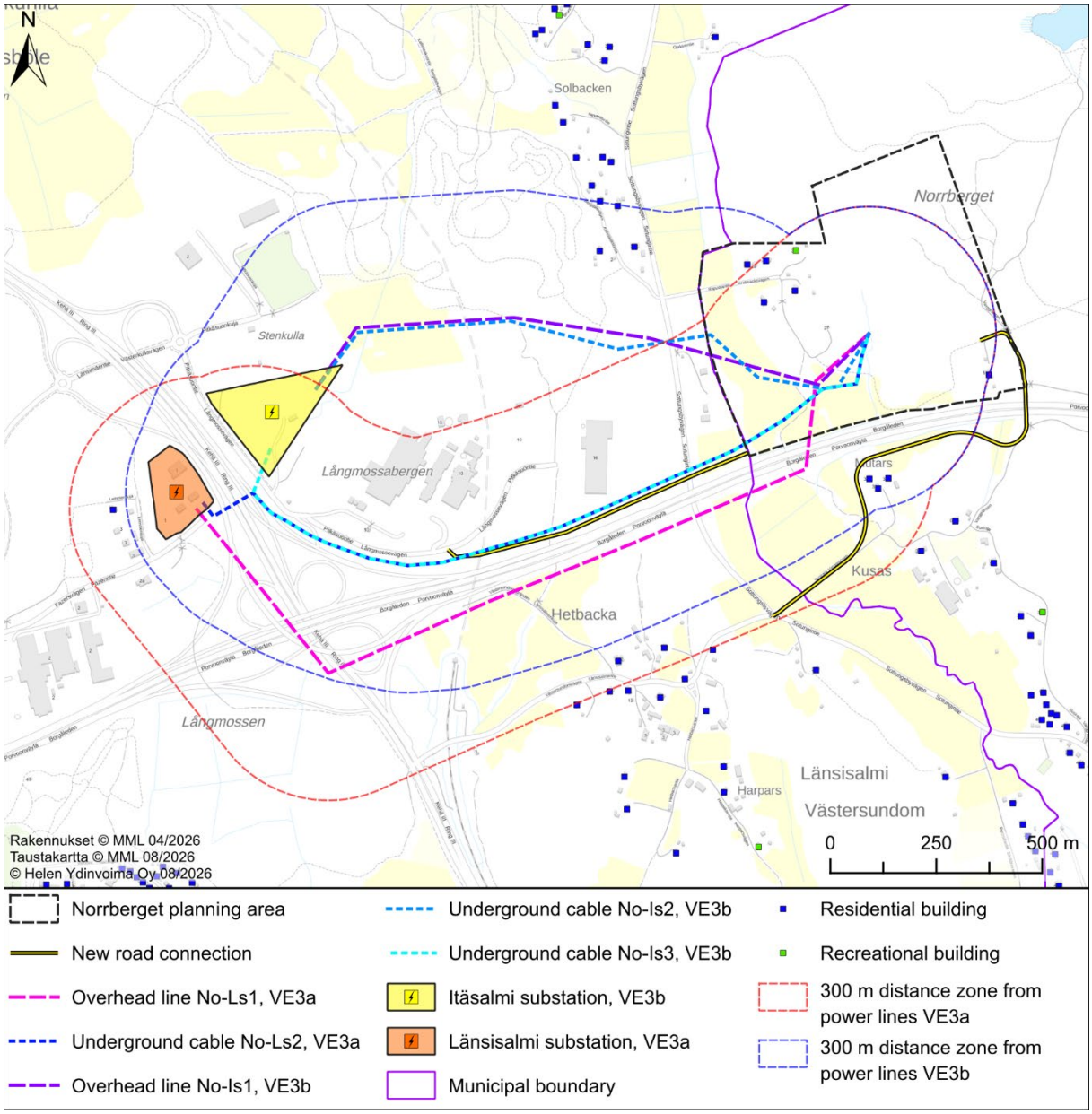


Figure 13-14. Close-up of the Norrberget planning area and the electricity transmission route options in project options VE3a and VE3b.

District heating line KL1 runs towards south from the planning area (Figure 13-15). The nearest residential building is located 30 metres south of Porvoontie to the east of the district heating line. In Länsisalmi, a residential building is located approximately nine metres from the district heating line KL1. In Salmenkallio, the district heating lines KL1 and KL2 merge. The nearest residential building is located approximately 37 metres from the district heating line tunnel. The district heating line continues south. In Tryvik, the district heating line runs under one holiday building (Figure 13-12, Figure 13-13).

There are no residential areas (Figure 13-15) near the Norrberget planning area along the district heating line KL2. The nearest residential building is located about 90 metres away, and the nearest holiday building about 60 metres from the district heating line in the Länsisalmi area. To the south of Itäväylä, the nearest residential building is located approximately 42 metres from the district heating line KL2.

Copyright © Helen Nuclear Ltd

Norrberget's cooling water tunnels (project option VE3b) are located south of the planning area in the Mutars area, where three residential buildings lie in their immediate vicinity (Figure 13-15). To the south of Sotungintie, a residential building is located at a distance of about 80–110 metres from the cooling water tunnels (intake and discharge tunnel). In the Salmenkallio area, residential buildings are located on the west side of the tunnels at a distance of about 140 metres at its closest. In Porvarinlahti, there are two holiday buildings located at their closest about 100 metres from the cooling water tunnels (Figure 13-13). The distances are measured above the ground, and the perpendicular distance in depth has not been taken into account when describing the distances.

Copyright © Helen Nuclear Ltd

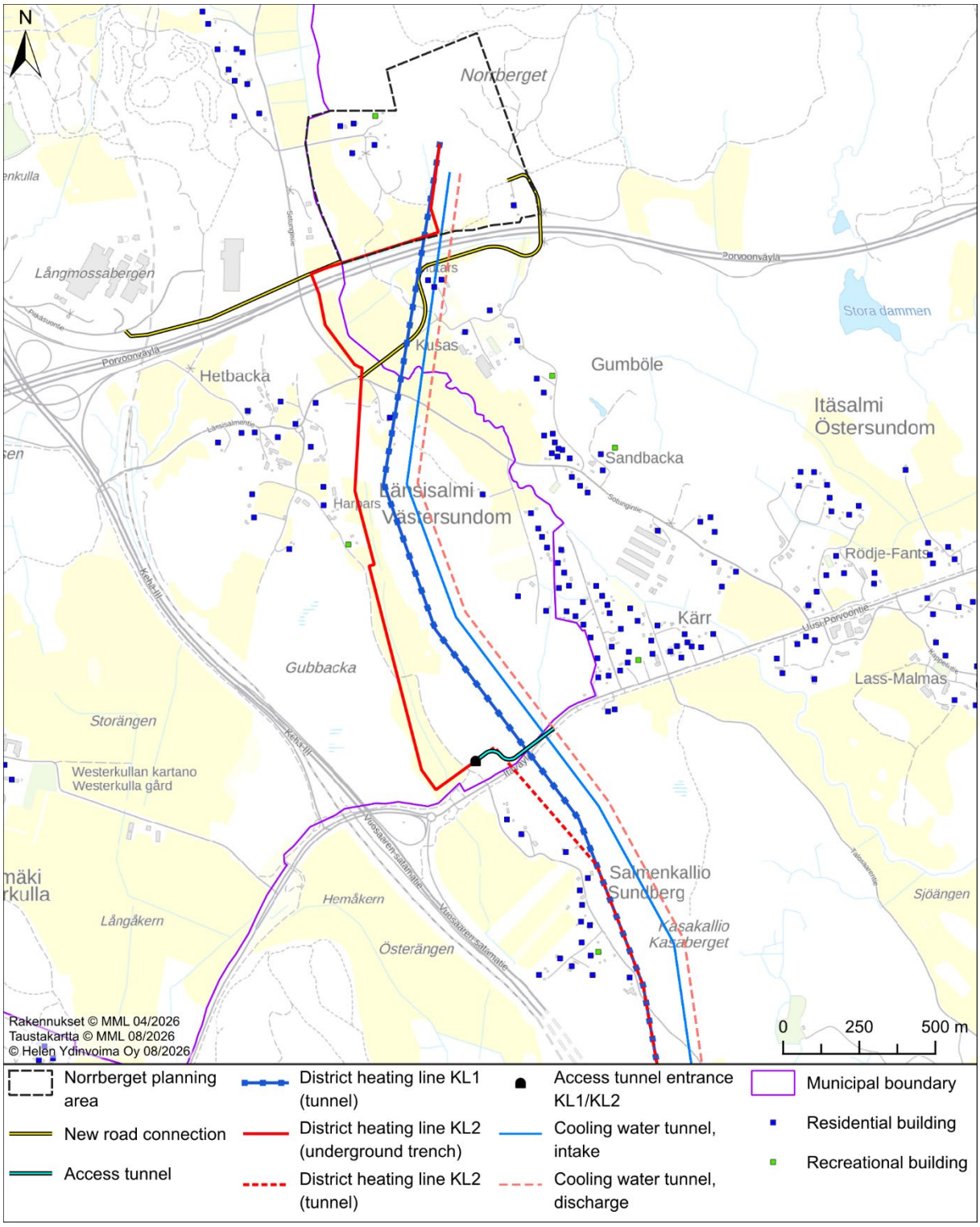


Figure 13-15. The district heating lines of project options VE3a and VE3b, as well as the cooling water tunnels of project option VE3b, are located south of the Norrberget planning area, where residential buildings are situated close to the project operations.

The nearest more densely populated areas around the Norrberget planning area are Hakunila and Länsimäki in Vantaa (Figure 13-16).

Copyright © Helen Nuclear Ltd

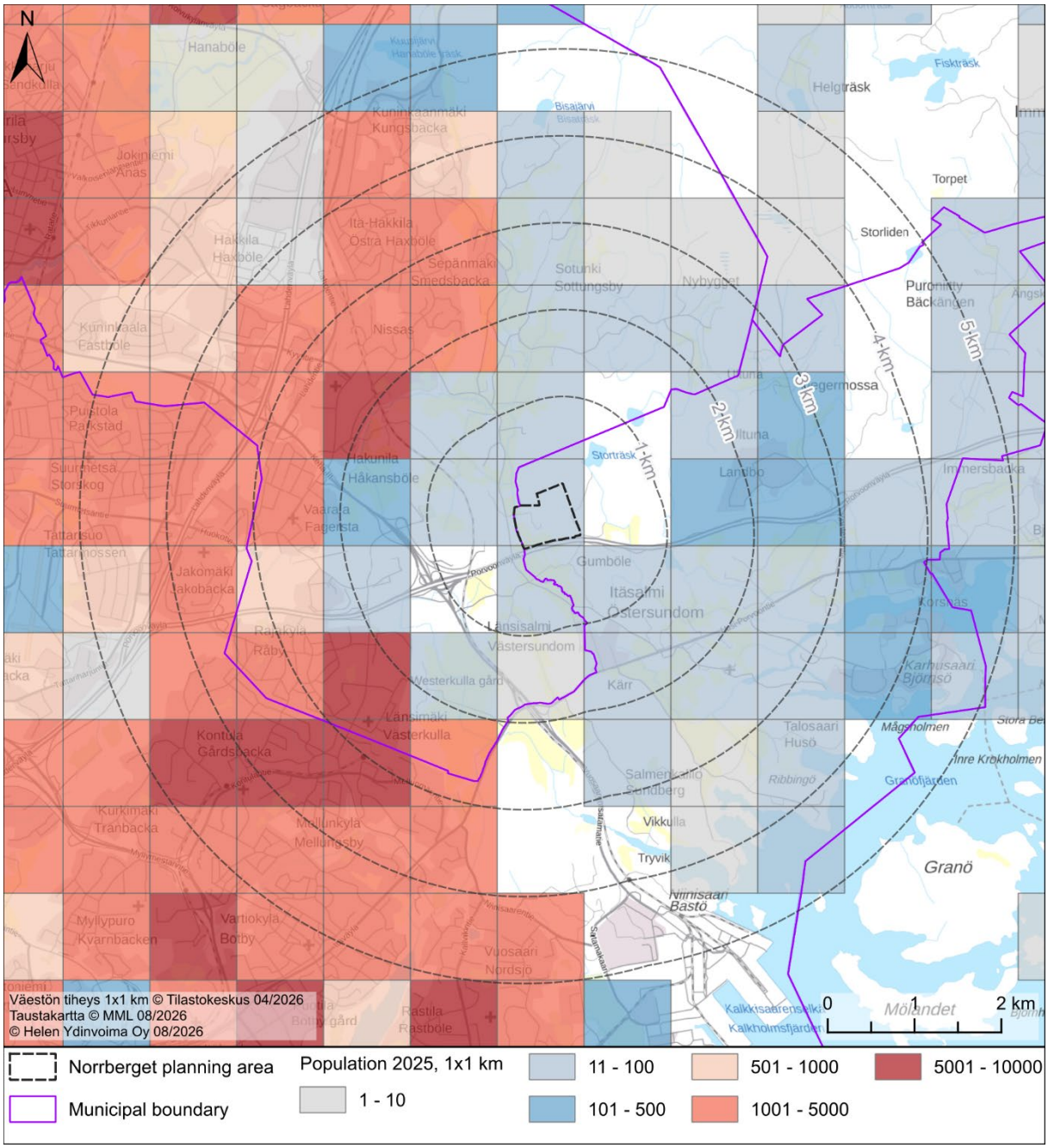


Figure 13-16. Population density around the Norrberget planning area.

About 120 people live within a kilometre of the planning area and about 92,000 people within a distance of five kilometres (Table 13-3).

Table 13-3. Population within 1, 5, 20 and 100 kilometres of the Norrberget planning area. Within a radius of 100 km from the planning area, only the population of Finland has been taken into account.

Distance from the Norrberget planning area	Number of inhabitants (persons)
1 km	about 120
5 km	about 92,000
20 km	about 1,066,000
100 km	about 2,095,000

13.1.3.2 Other sensitive sites

There are no daycare centres or health services in the immediate vicinity of the Norrberget planning area (Figure 13-17). The nearest school is located approximately 670 metres from the boundary of the planning area to the southwest, in the Länsisalmi area. Sensitive sites are not located in the immediate vicinity of electricity transmission route options, district heating lines or cooling water tunnels (VE3b). The school in the Länsisalmi area is approximately 210 metres from the district heating line KL2.

Copyright © Helen Nuclear Ltd

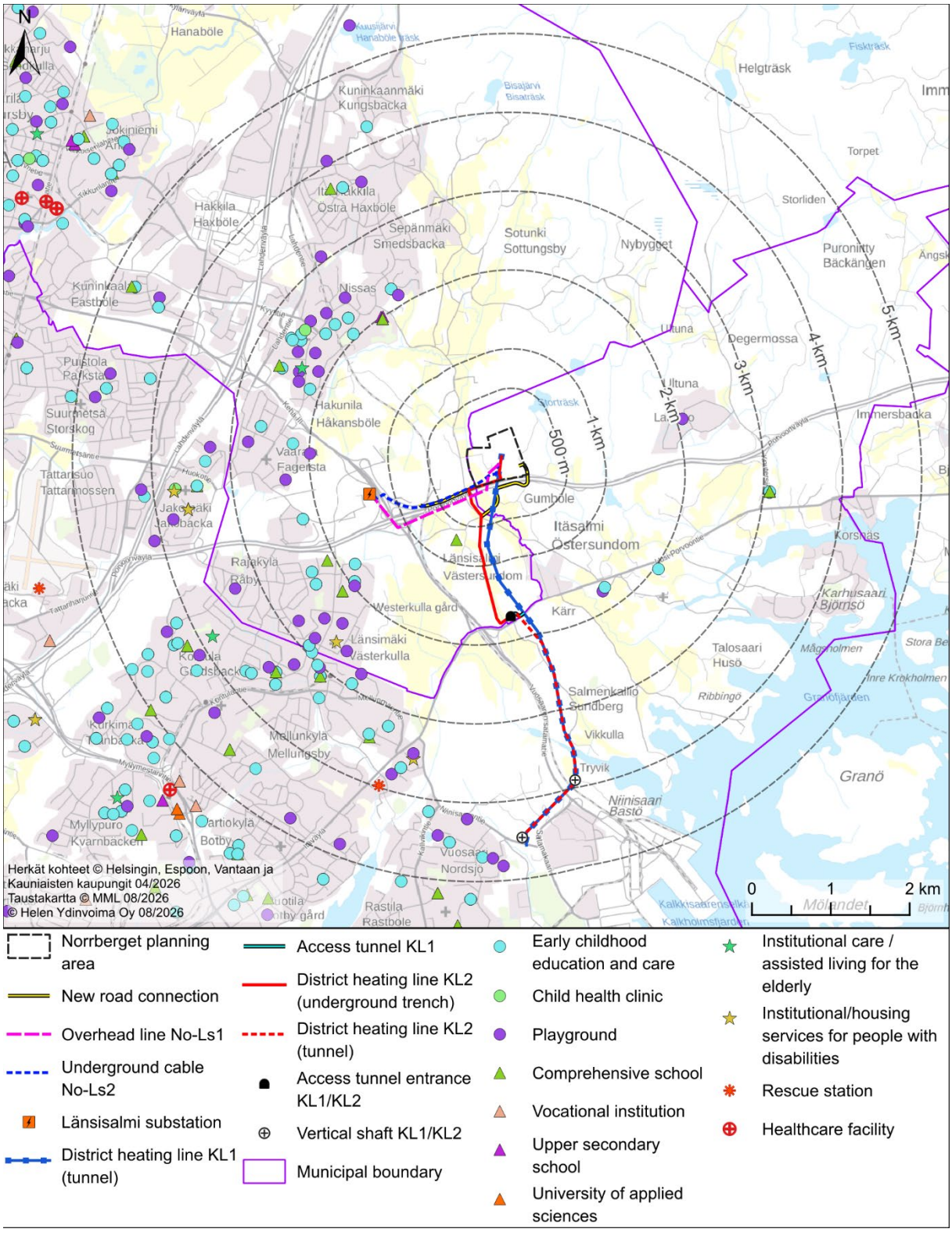


Figure 13-17. Sensitive sites around the Norrberget project area. The map shows the operations of project option VE3a.

13.1.3.3 Recreation

To the north of the Norrberget planning area lies Sipoonkorpi National Park (Figure 13-18, Figure 13-19). About 700 metres northwest of the planning area is the Hakunila sports area. On the west side of the planning area, a cross-country ski trail runs at its closest about

400 metres away. A school's sports facility is located in Länsisalmi about 700 metres away. A cross-country ski trail and cycling route (Figure 13-18) are located near the electricity transmission routes of option VE3a.

Sports facilities of the Länsisalmi school are located approximately 220 metres from the district heating line KL2 (Figure 13-18, Figure 13-19, Figure 13-20). District heating lines intersect with a cycling route at Itäväylä. The district heating lines are located about 90 metres east of a riding arena in Salmenkallio (Figure 13-20). They pass through the Mustavuori nature reserve about 40 metres from the nature tower. In the Vuosaari area, a nature trail is located near the district heating lines.

Copyright © Helen Nuclear Ltd

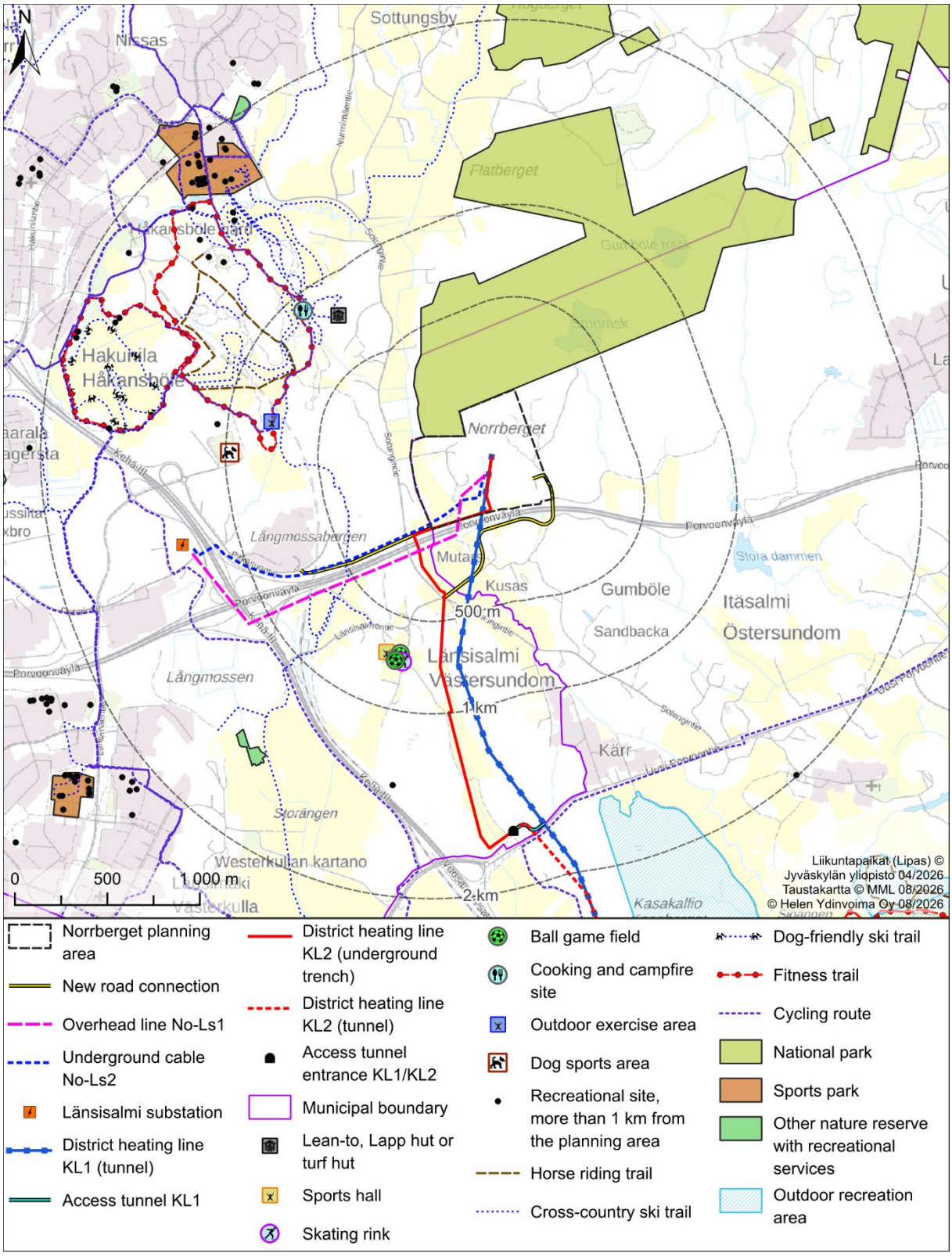


Figure 13-18. Recreational sites and routes in the vicinity of the Norrberget planning area in project option VE3a.

The Hakunila sports area is located just over 120 metres from the overhead line No-Is1 and the underground cable No-Is2 in option VE3b (Figure 13-19). There is also a cross-country ski trail in the area, which intersects with all electricity transmission options in project option VE3b.

Copyright © Helen Nuclear Ltd

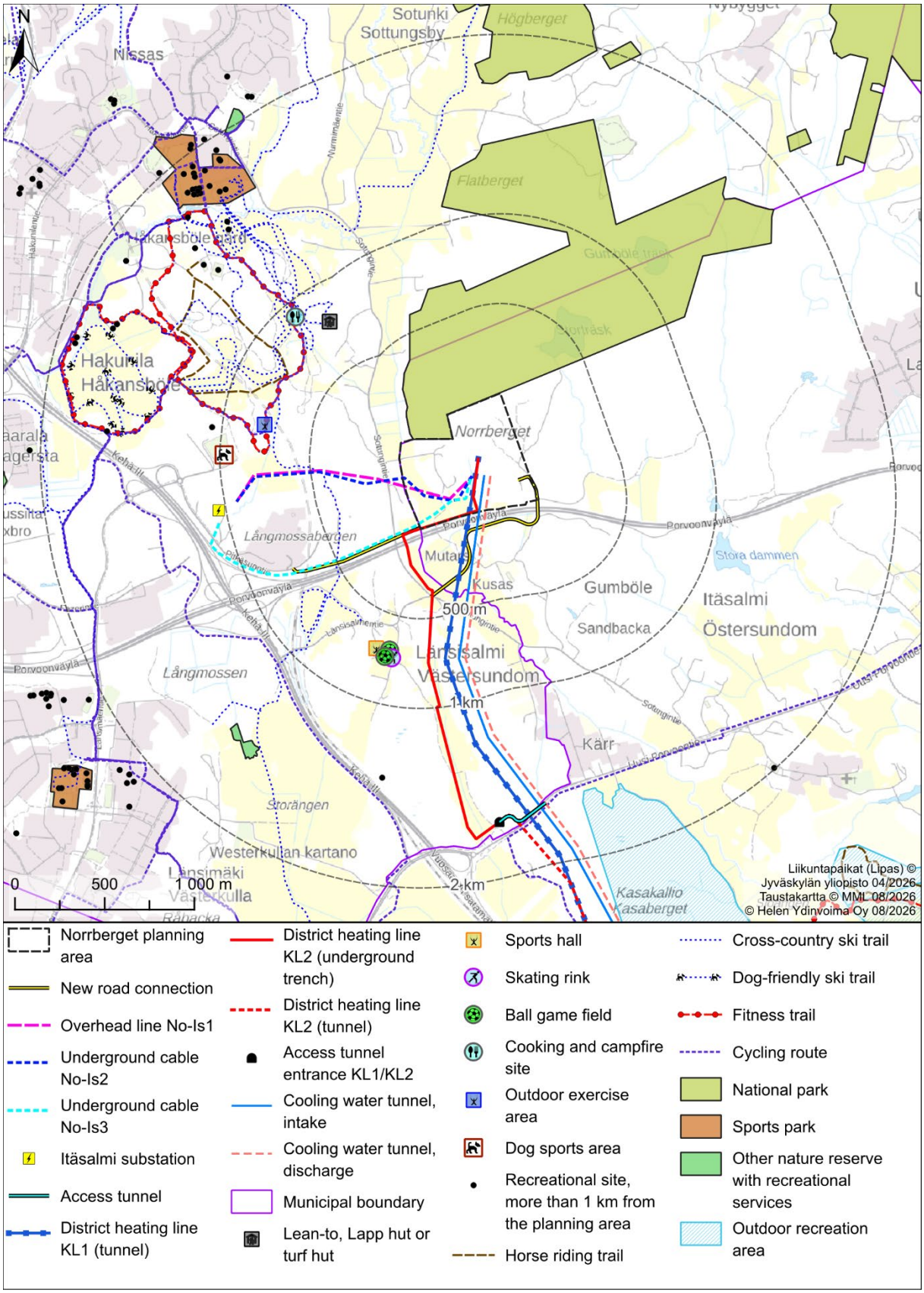


Figure 13-19. Recreational sites and routes in the vicinity of the Norrberget planning area in project option VE3b.

Cooling water tunnels (option VE3b) intersect with a cycling route at Itäväylä (Figure 13-20). They are located on the west side of the Talosaari outdoor and recreational area. On the north side of the Porvarinlahti bay, cooling water tunnels intersect with a fitness trail and a cross-country ski trail. Recreational sites in the southern part of Vuosaari Harbour are presented in chapter 13.1.2.3, Figure 13-11.

Copyright © Helen Nuclear Ltd

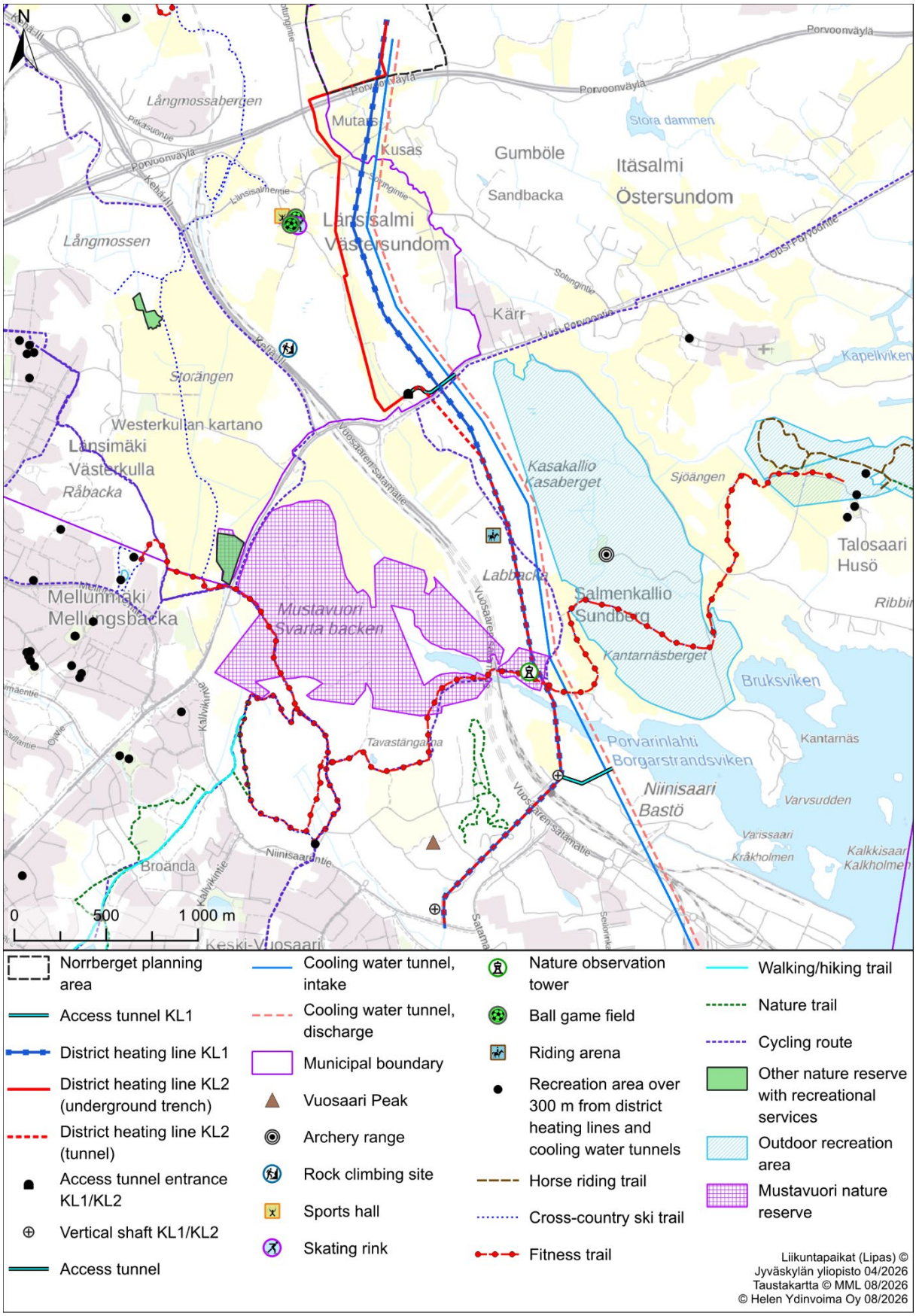


Figure 13-20. Recreational sites and routes for the Norrberget project options north of Vuosaari Harbour.

13.2 Key stakeholder feedback during the EIA programme phase

In this EIA programme, key themes and concerns raised in the stakeholder feedback collected so far have been gathered. The material reveals the views and concerns of residents about the impacts of the project on everyday life, the living environment and the community.

Stakeholder feedback on the project has been collected at three resident events organised by Helen Nuclear Ltd in the project planning areas during the spring of 2026. Feedback on the project has also been gathered through the City of Helsinki's open feedback channel (the Voice your opinion) and Helen's own feedback channel. The replies were used as background information for this EIA programme. This section particularly analyses the views gathered at the spring 2026 resident events (survey forms and discussions), the discussion on the Voice your opinion service and Helen's own feedback channel. The processed material consists of responses as free text, which have been analysed using qualitative content analysis and thematic analysis.

In connection with the resident events, the participants had the opportunity to fill in a short survey form that mapped the perceived impacts of the project, the concerns related to the project, as well as the views of the residents on the preferred methods of inclusion and information. In addition, the respondents were able to highlight other factors that, in their opinion, would be important to take into account when planning the project. A total of 42 people filled in the survey form at three resident events. A total of 512 comments were collected through the open feedback channel (the Voice your opinion service) during the commenting period. The feedback channel was open for about a month (from 6 November to 7 December 2025). Helen's own feedback system received just over twenty comments between November 2025 and April 2026.

13.2.1 Topics brought up by theme

Safety and risk management

By far the most significant theme in the feedback was safety. Some of the respondents expressed concern about the risks of accidents and radiation associated with the nuclear power plant, as well as their possible consequences, especially in the densely populated Helsinki Metropolitan Area. Although several comments identified the probabilities as low, the potential consequences of the risks were considered serious and difficult to manage in an urban environment.

A significant part of the feedback also covered external threats, such as intentional harm, terrorism, sabotage and military threats. Helsinki's status as the administrative and logistical centre of the country was seen as a factor that increases the significance of the risks faced by the plant. In particular, the proximity of Vuosaari Harbour to the Vuosaari planning area was considered problematic from the point of view of security of supply and safety. With regard to the harbour, it was also highlighted that the hazardous substances handled in the harbour pose a risk to the nuclear power plant.

The treatment, storage and disposal of nuclear waste were raised as a recurring concern. In particular, the feedback raised concerns about the interim storage of spent nuclear fuel in the plant area, the duration of the interim storage in an urban environment and its final disposal.

Copyright © Helen Nuclear Ltd

Living environment and comfort

Another key theme was related to the location of the plant and its impact on the urban structure. Several responses expressed the view that a small modular reactor plant is not suitable for a densely populated urban area, and that such activities should be located further away from residential areas.

The impacts related to the living environment and well-being particularly concerned the comfort, image and attractiveness of the area as a residential environment. Respondents raised concerns about the deterioration of the value of housing and possible migration away from the proximity of the planning areas. In the long term, some respondents saw a risk of regional segregation if the project negatively affects the area's attractiveness**.**

Nature impacts

Concerning undeveloped areas or areas of significant natural value, the impacts on biodiversity and natural values, as well as recreational use, raised concerns. In the responses, it was emphasised that natural values should be carefully investigated. The discharge of cooling water into the sea raised concerns among some of the respondents.

A few responses also highlighted the impacts of climate change and the risks caused by extreme weather phenomena for the project, such as rising sea levels and forest fires.

Technological uncertainty and the experimental nature of the project

The feedback highlighted concerns about the novelty of the planned solution. In many comments, a small modular reactor was considered to be a technology for which there is not yet sufficient operating experience, especially in urban environments. Several respondents found it problematic that a possible pilot or one of the first projects to be implemented would be located in a densely populated area.

In connection with financial profitability, the risk of exceeding costs and delays in construction and permitting was raised. Urban location was estimated to increase the costs of construction, safety and infrastructure.

Part of the feedback emphasised alternative ways of producing district heat and electricity. Solutions based on renewable energy sources, such as heat pumps, wind and solar energy, were highlighted. In addition, various energy storage solutions and the use of hydrogen as part of the energy system were mentioned. Several comments stated that these options should be considered equally with nuclear solutions.

At the same time, the concept of a "small modular reactor plant" was questioned. Part of the feedback pointed out that the power of the plants can be considerable and comparable to conventional nuclear power plants, which increases the perceived risks and concerns about safety distances.

Positive views

Although the feedback focused on critical views, some respondents welcomed the project. Positive comments highlighted the zero-emission nature of nuclear energy, steady and weather-independent energy production, improved security of supply and the possibility to abandon fossil fuel and biomass combustion. Some respondents considered that a small modular reactor placed underground could be a safe and efficient solution for district heat

Copyright © Helen Nuclear Ltd

production. Helen's own feedback channel received comments related to the technology and contact requests concerning possible cooperation.

13.2.2 Wishes for interaction and communication

The survey form, which could be filled in at the spring 2026 resident events, asked for the desired methods, how interaction and communication will be carried out during the project's EIA procedure and in the project's further planning.

Respondents considered resident surveys to be the most important form of participation. Primarily, electronic surveys were hoped, but some respondents also suggested distributing survey forms directly to the mailboxes to ensure accessibility. It was hoped that the surveys would be directed not only at the residents of the affected area, but also more broadly at the residents of the city.

Alongside surveys, resident events and information sessions emerged as a key form of interaction. It was hoped that the events would be public and that they would be held in sufficient numbers and at different times to allow as many people as possible to participate. Several responses highlighted the need for transparent and fact-based information, in particular on safety, risks and project progress.

Many respondents expressed the hope that the opinions of the residents would have a real impact on the project plans. Some respondents suggested organising citizen panels, interviews, polls or even a referendum, especially for residents living in the vicinity of the project's planned location. It was seen that these means would increase the credibility of participation and reinforce the experience that citizens' opinions matter.

The key communication channels mentioned were websites, particularly those of the project operator and the City of Helsinki. Respondents hoped the websites would provide up-to-date information on the project's progress, as well as the opportunity to ask questions or view frequently asked questions.

Direct communication to households was also highlighted. Communication methods mentioned include information letters or newsletters sent to email addresses or by post for those wishing to follow how the project proceeds.

Traditional media was also mentioned as a key information channel. The proposals included national news media, such as Yle and Helsingin Sanomat, as well as local media and local newspapers, which were considered important in providing regionally targeted information. Radio was also mentioned as part of the desired means of communication.

A few of the respondents mentioned social media channels such as Facebook, Instagram, TikTok and Threads. Local social media groups, such as regional Facebook groups, were mentioned as channels for discussion and information sharing.

In addition, some respondents stressed the need to use "all possible" or very accessible public channels, so that information about the project is openly and widely available. With regard to the content of communications, particular emphasis was placed on transparency, honesty and fact-based communication, regardless of the channel used.

Copyright © Helen Nuclear Ltd

13.2.3 Other considerations for the future

Based on the data, the information needs of residents that emerged were the comparison criteria for different locations, safety of small modular reactor plants, discussion of safety plans and contingency planning, the concept of small modular reactor plants, and an open discussion of small modular reactor plant technology. In particular, the clarity and comprehensibility of information related to safety and risks were emphasised in terms of building trust. Some respondents also wanted a study on the possibilities of using alternative forms of energy for district heat and electricity production in Helsinki.

A wide range of views, concerns and opinions were presented in the feedback on the project. The amount of feedback was abundant and the content was quite polarised. On the one hand, the project was opposed and, on the other hand, some respondents were very positive about the project. This polarisation should be taken into account in project communication and interaction, so that discussion can take place in a way that allows everyone who wishes to express their opinions to do so.

During the project's EIA procedure and further development of the project, new information needs and new ways of implementing project interaction may arise. These should be met as the project progresses.

13.3 Impact assessment and methodology

The impact of the project on people's health, living conditions and comfort is assessed by using computational and qualitative estimates generated in other impact assessment sections, such as noise impacts and impacts on water systems and traffic. In addition, the assessment uses other relevant information produced during the planning process concerning the project's characteristics. The assessment emphasises both impacts assessed as significant and those people perceive as such and which give rise to concerns.

The assessment considers the area's current use and examines the project-related changes to its present condition. Background material is used to describe the planning area, including the locations of settlements and recreational areas, as well as the so-called sensitive sites such as daycare centres and schools. The attitudes of residents and other stakeholders to the project will be explored, for example, by using the stakeholder feedback already collected (see chapter 13.2), the views presented at the public event at the EIA programme phase and in the project monitoring group, and by taking into account the opinions to be given on the assessment programme. In addition, a resident survey and, if necessary, other stakeholder consultations will be carried out.

The resident survey will be conducted using the browser-based Maptionnaire survey programme. The survey is open to everyone. In connection with the survey, the respondents are given information about the project, its alternatives, the potential impacts of the project and the EIA procedure. The survey investigates how the project areas are currently used, which sensitive areas the respondent identifies near the project areas, what impacts the respondent anticipates from the project and their views on the project.

The impacts on health are assessed by comparing the estimated impacts of the project with the health-based guideline value or recommendation for each impact. Impacts on health may be caused, for example, by traffic, noise, dust, vibration and other emissions into the air. Electric and magnetic fields caused by power lines are also taken into account in the impact assessment.

Copyright © Helen Nuclear Ltd

In the normal operation of a nuclear power plant, the radiation exposure limit for an individual is 0.1 millisievert (161/1988, Section 22b), and the undercutting of the limit value is taken into account in the design of the nuclear power plant. The radiation dose caused by Finland's operating nuclear power plants to the surrounding population has been less than one percent of the set annual dose limit (Radiation and Nuclear Safety Authority 2026). Estimates of the quantities of radioactive emissions from the normal operation of the nuclear plant is compared with the emission limits and actual emissions from the normal operation of Finland's current nuclear power plants.

Radiation exposure related to emergency and accident situations will be modelled taking into account the impacts of a severe accident, which is described in chapter 23.

The impact assessment takes into account the impacts of the project on material assets. The impact assessment of the EIA procedure does not make a separate assessment of changes in the market value of the properties, but focuses on the environmental impacts of the project and their possible impacts on the use of the properties, property management, housing conditions and the quality of the environment.

The assessment area of the impacts on people is determined by the spatial extent of the impacts. The main focus of the assessment is on the immediate environment of the project area, as the most significant impacts are expected to be on the immediate area of the project during construction and operation.

The table (Table 13-4) below presents the justification for targeting the environmental impact assessment by project option for people's living conditions and comfort (for background on targeting, see chapter 7.2.1).

Table 13-4. Justification for targeting the environmental impact assessment by project option in terms of people's health, living conditions and comfort. x = the project option for which the assessment is specifically targeted.

	People's health, living conditions and comfort	Justification
VE1	x	Location close to residential buildings, workplaces, recreational areas and other sensitive areas.
VE2a	x	
VE2b	x	
VE3a	x	
VE3b	x	

Copyright © Helen Nuclear Ltd

14 SOIL, BEDROCK AND GROUNDWATER

14.1 Current status

14.1.1 Soil

The soil in the project areas is diverse due to its location and land use history. It has been greatly influenced not only by the Ice Age, but also by subsequent maritime phases. Since the retreat of the continental glacier, the project areas have been covered by the water stages of the ancient Baltic Sea. Land revealed due to land uplift was shaped by the actions of the coastal processes. In the project areas, especially in the Salmisaari and Vuosaari planning areas, the impact of human activity has also been great.

The soil of the Helsinki Metropolitan Area and Helsinki is dominated by clay deposits of varying thickness and bedrock areas covered by a thin, less than one metre thick moraine layer. Moraine covers the bedrock and evens out its surface. Coarse-grained sand and gravel formations are most common in the eastern part of the Helsinki Metropolitan Area. The soil of the Helsinki Metropolitan Area and its surroundings, as well as its development, are described in more detail in the background concentration report for the municipalities surrounding the Helsinki Metropolitan Area (Tarvainen 2006, Tarvainen et al. 2013).

14.1.1.1 Salmisaari

At present, the planning area is almost entirely built-up, with the exception of the northeast section. The area is flat, the ground level is between +2.6 and +3.1 (masl). At the northeastern edge of the area, the ground level rises to about +6.8 (masl) at its highest.

A large number of geotechnical surveys have been carried out in the Salmisaari area over the decades. The southwest side of the area lies on the site of the old island, where natural soil and rock lie beneath the infill layers of the power plant yard. In addition, a small island has been located on the northern corner of the area and the northeast end is located on the mainland side. About half of the area is on land reclaimed from the sea. The attached figure (Figure 14-1) shows the general soil characteristics of the Salmisaari planning area.

Copyright © Helen Nuclear Ltd

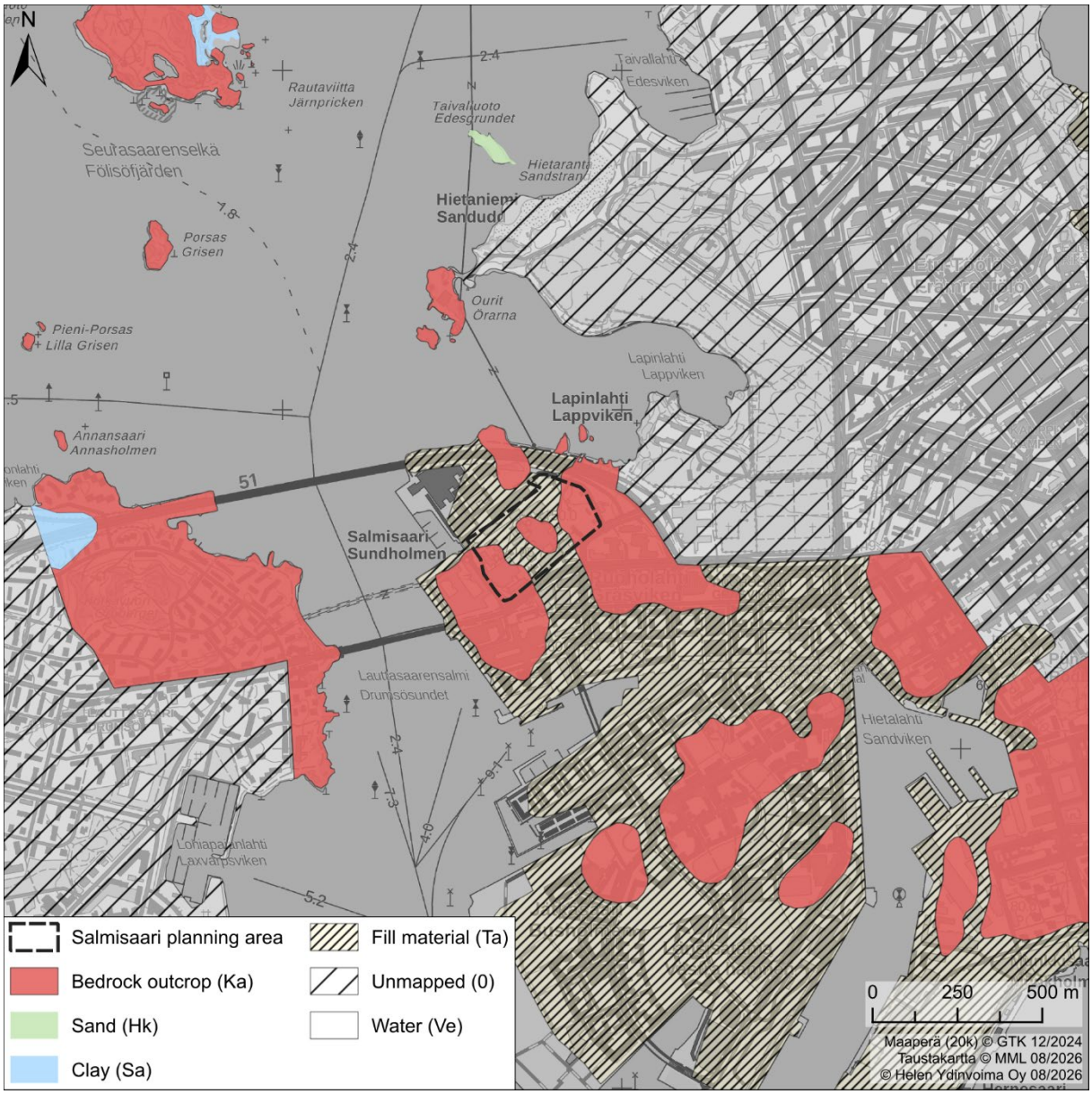


Figure 14-1. General characteristics of the soil of the Salmisaari planning area.

Based on the current use of the area and the history of use, it is possible that there are soils containing harmful substances in the planning area. In the Salmisaari area, there is one site marked in the National Soil Database System (MATTI) maintained by the Finnish Environment Institute under the code 383674,6671637. The database system contains information on potentially contaminated areas, areas confirmed as contaminated, cleaned areas and areas confirmed as clean. The database system contains information on potentially contaminated areas, areas confirmed as contaminated, cleaned areas and areas confirmed as clean. The information is constantly updated, but may not be fully up to date. The Finnish Supervisory Agency is responsible for updating the information regarding the system. System data is not public data.

The Helsinki Metropolitan Area belongs to the arsenic province of Southern Finland, which is characterised by higher than average natural arsenic concentrations. In addition to arsenic, the maximum recommended background concentrations of mercury, lead and zinc are in some places higher than the threshold values set in PIMA (Government Decree on the Assessment

Copyright © Helen Nuclear Ltd

of Soil Contamination and Remediation, 214/2007) in urban parks and filling areas. A threshold value means the soil contaminant concentration value above which (based on representative sampling) the soil contamination and the need for remediation must be assessed. Outside urban areas, the maximum recommended background concentrations of cobalt, chromium, nickel and vanadium are above the threshold value in clay soils. In the humus layer, the maximum recommended background concentrations for lead and antimony are above the threshold value. (Tarvainen et al. 2013)

Based on the Geological Survey of Finland's Surveys on Acid Sulfate Soils material (2026b), the likelihood of acid sulphate soils in the project area is very low. The bedrock does not contain black shale.

There are no nationally valuable moraine formations or wind and shore deposits in the vicinity of the project's activities (Finnish Environment Institute 2026d).

14.1.1.2 Vuosaari

The planning area is located on a northwest–southeast-oriented moraine ridge, which is bordered to the east and west by clay and rock areas. In the middle of the moraine ridge, the ground level is at its highest at about +15 (masl). From the moraine ridge, the ground level falls to the west and east and is in clay areas at level ranging from +2 to +4. (Ramboll Finland Oy 2013). The attached figure (Figure 14-2) shows the general soil characteristics of the planning area.

Copyright © Helen Nuclear Ltd

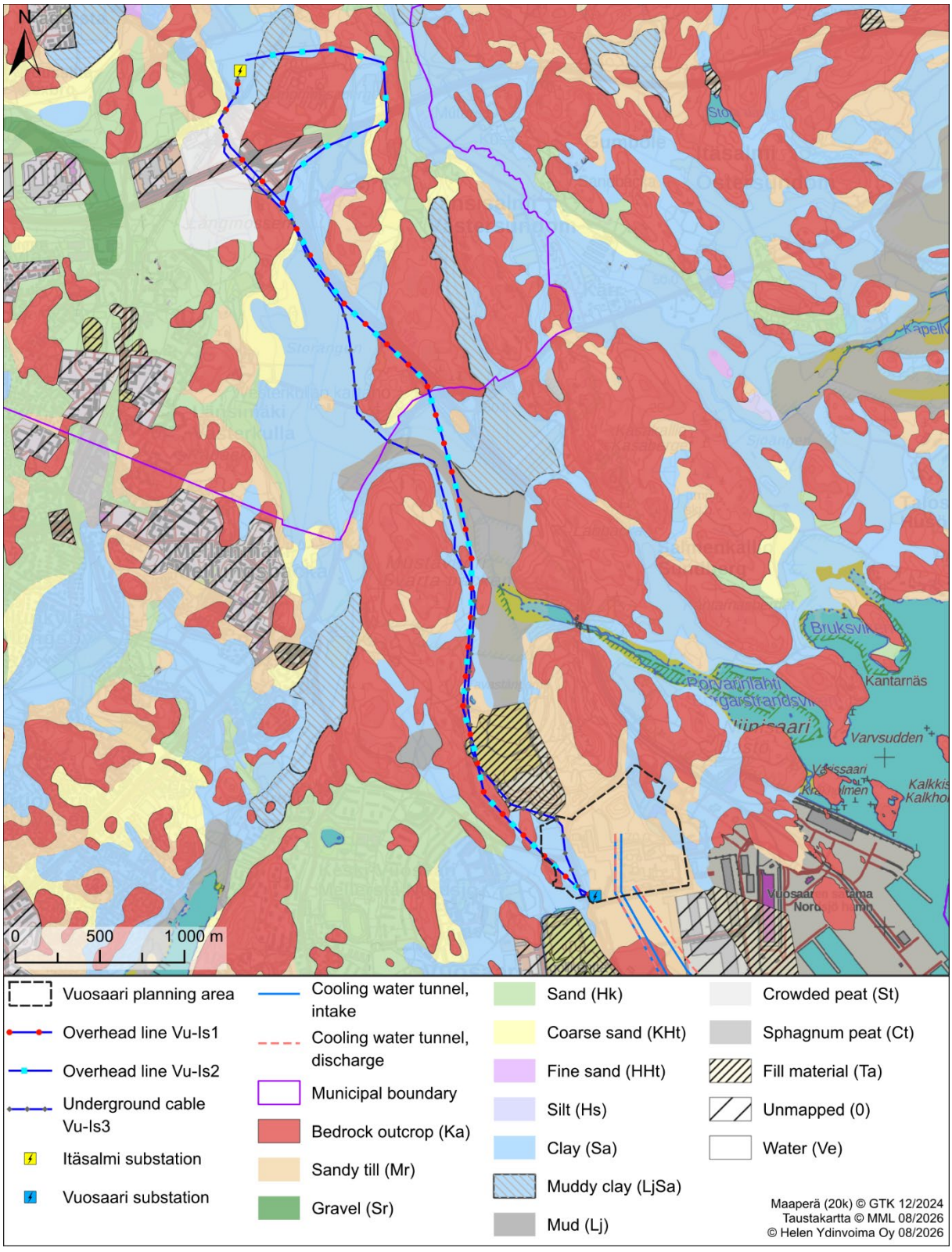


Figure 14-2. General soil characteristics of the Vuosaari project area.

In the 1980s, many ground surveys have been carried out in the Vuosaari area. The area mainly has a 1.5–3 m thick infill layer, under which there is a sand moraine of varying compactness. The rock surface observations from the area are at a level ranging from -7 to +1, that is, at a depth of about 8–15 metres from the ground, but the rock surface may also be deeper than this in the area. (A-Insinöörit Suunnittelu Oy 2025b)

Copyright © Helen Nuclear Ltd

At present, the planning area is mostly used for operations related to energy production. Because of this, natural topsoil has been removed from the area and replaced with different structural layers. Based on the current use of the area and the history of operation, it is possible that there may be soils containing harmful substances in the planning area. There are four sites marked in the National Soil Database System (MATTI) maintained by the Finnish Environment Institute.

In the 2013 surveys (Ramboll Finland Oy), soil samples taken from the planning area did not indicate concentrations of harmful substances exceeding the upper guideline values set out in Government Decree 214/2007. Based on this, there was no need to clean the soil in the area.

No contaminant investigations have been conducted on the pavement structure of the coal storage or the soil beneath it.

In connection with further planning, soil, groundwater, test pit and contamination surveys must be carried out in the area in order to gain a more accurate understanding of the area's constructability and cost impacts. (A-Insinöörit Suunnittelu Oy 2025b)

There are no nationally valuable moraine formations or wind and shore deposits in the vicinity of the project's activities (Finnish Environment Institute 2026d).

Based on the Geological Survey of Finland's Surveys on Acid Sulfate Soils (2026b) material, the likelihood of acid sulphate soils in the planning area is very low. The likelihood is partly moderate and high along the electricity transmission routes (Figure 14-3). The bedrock does not contain black shale.

Copyright © Helen Nuclear Ltd

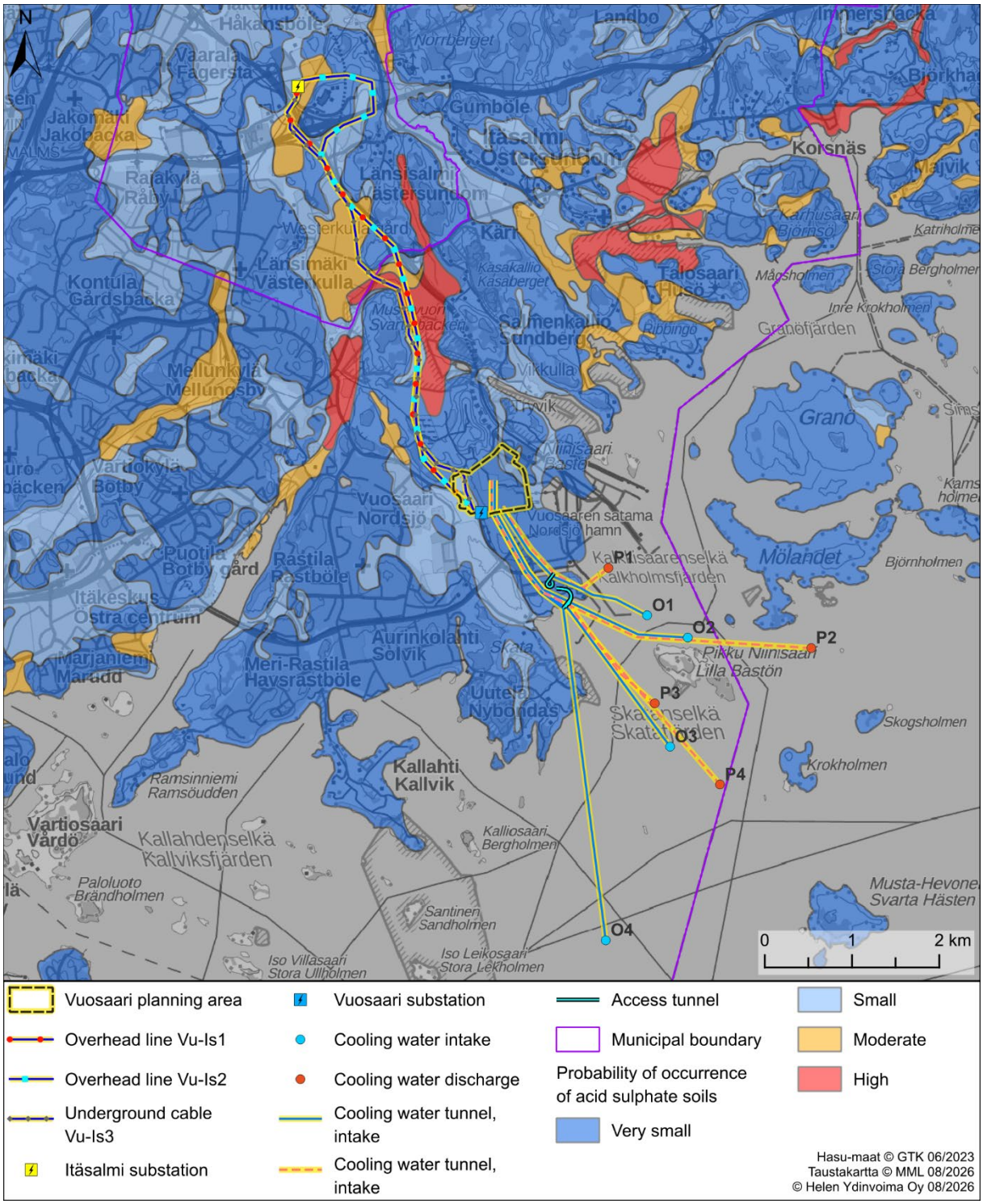


Figure 14-3. Acid sulfate soils in the Vuosaari project area.

14.1.1.3 Norrberget

The Norrberget planning area is located north of the Porvoonväylä road, close to the Vantaa border. The ground surface of the area is very varied and hilly. The ground level is at its lowest at the southwestern edge of the area at level +10 (masl) and at its highest at the northern edge of the area at +40 (masl). Correspondingly, the height of the rock surface also varies. The hills are rocky and the soil cover layer thickens in between the hills. There are boggy areas in the

hollows to the north. The attached figure (Figure 14-4) shows the general characteristics of the soil in the Norrberget planning area.

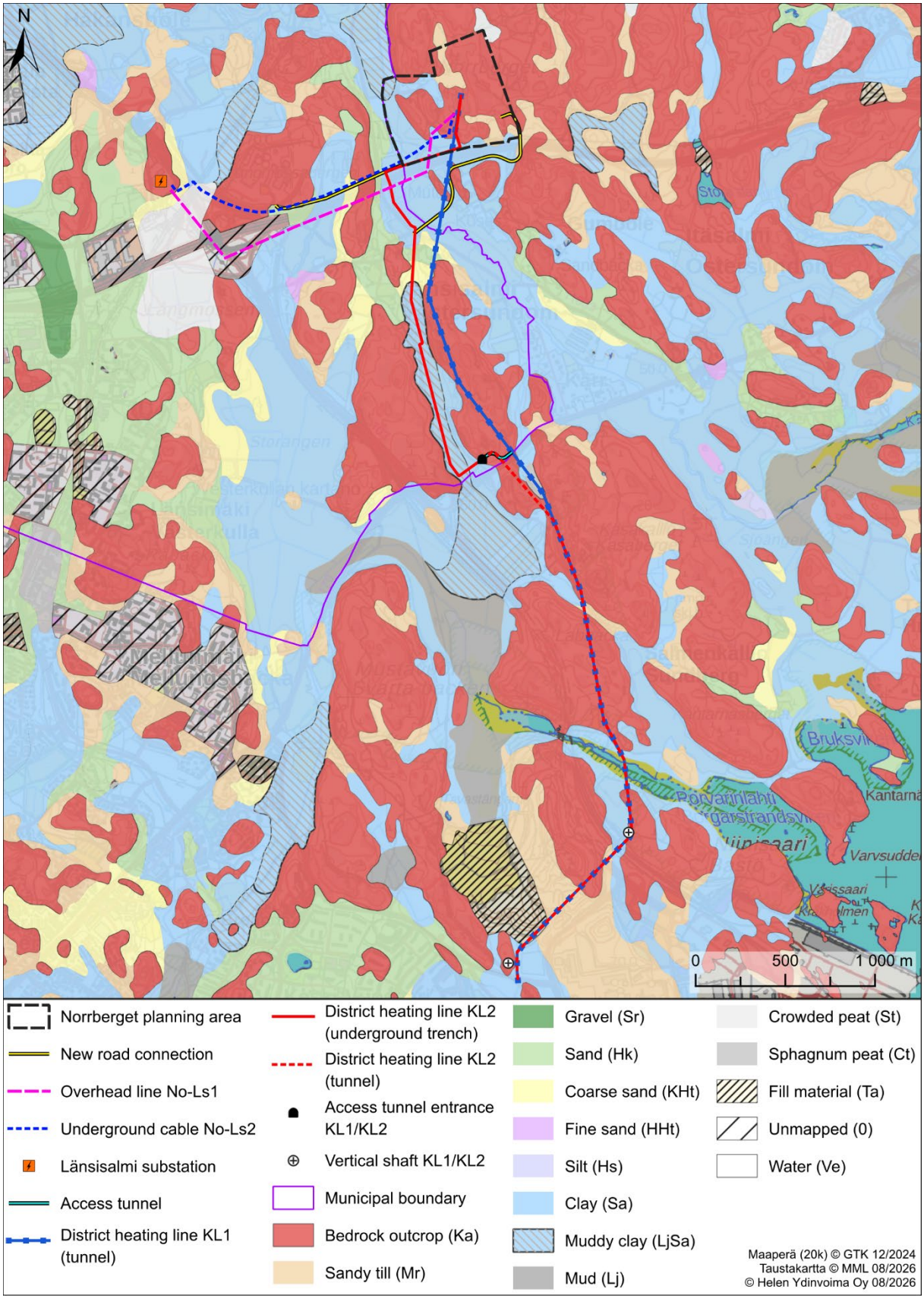


Figure 14-4. General soil characteristics of the Norrberget project area.

Copyright © Helen Nuclear Ltd

According to the constructability survey (A-Insinöörit Suunnittelu Oy 2025c), drilling that extends to the rock surface has not been done in areas other than open rock areas, so the deepest level of the rock surface in the area is not known. However, the deepest drillings have reached -9 (masl) in the field in the southwest corner of the area. In the Norrberget area and its vicinity, the most significant structures affecting the geotechnical constructability of the bedrock are the zones of weakness of the rock, running approximately from north to south. Based on preliminary data, there are no significant risk factors in the area from the perspective of foundation construction. Only for construction in the banks of Krapuoja, regional stability should be considered.

The National Soil Database System (MATTI) maintained by the Finnish Environment Institute has no entries in the site area. The area is mainly undeveloped forest and arable land, and on the basis of old aerial photographs, the area has not had any special activities that cause soil contamination.

There are no nationally valuable moraine formations or wind and shore deposits in the vicinity of the project's activities (Finnish Environment Institute 2026d).

Based on the Geological Survey of Finland's Surveys on Acid Sulfate Soils (2026b) material, the likelihood of acid sulphate soils in the location area is mainly very low. The likelihood is moderate in minor parts in the west and high in parts along the electricity transmission route (KL2) to the south (Figure 14-5). The bedrock does not contain black shale.

Copyright © Helen Nuclear Ltd

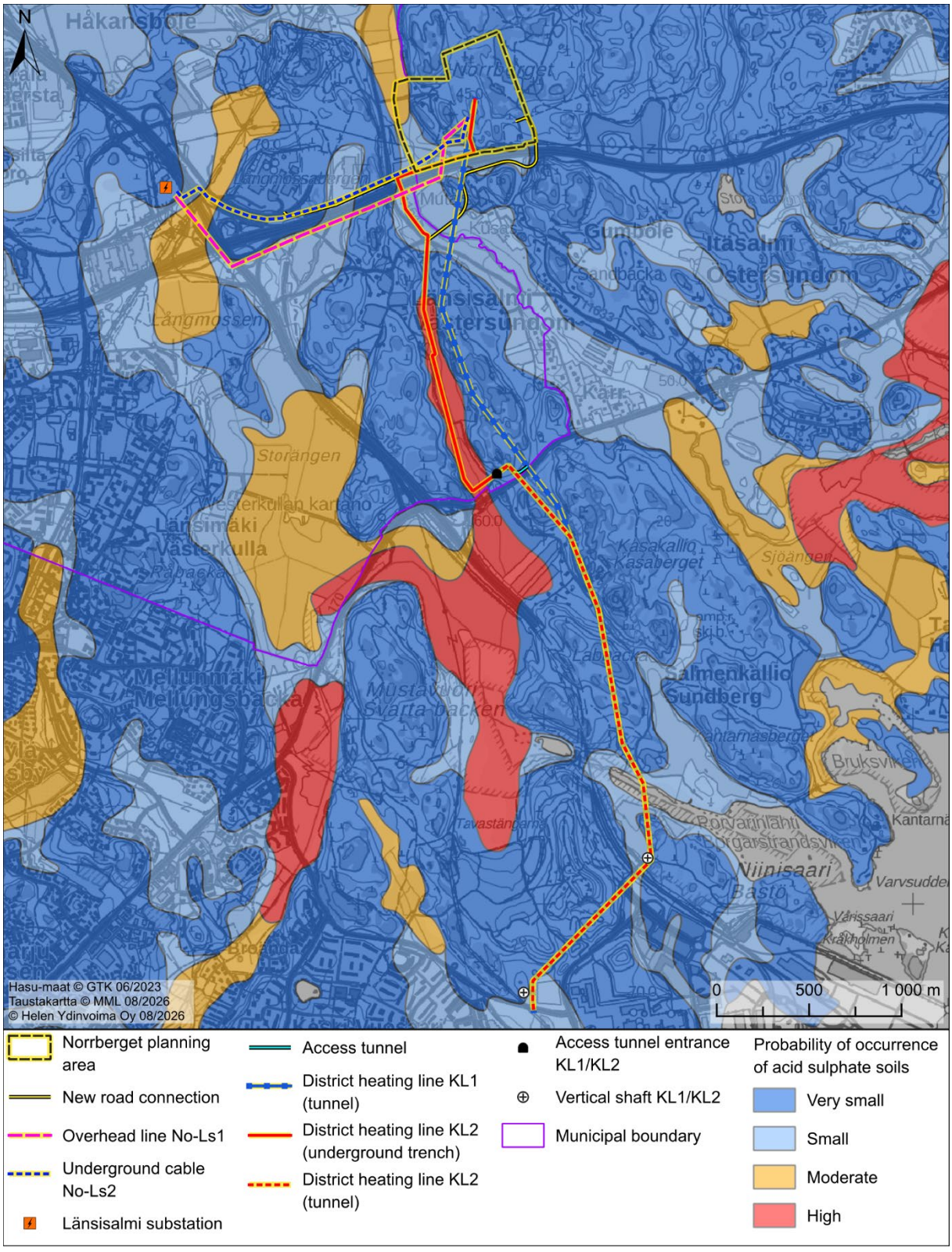


Figure 14-5. Acid sulfate soils in the Norrberget project area.

14.1.2 Seabed soil types

This description of the current state has been made on the basis of the available material. These include a 1:100,000 map from the Geological Survey of Finland's electronic service (GTK 2026b). In addition, other electronic materials (e.g. https://www.ostersjon.fi/fi-FI/,

https://paikkatieto.ymparisto.fi/velmuviewers/, https://julkinen.traficom.fi/oskari/) and publicly available surveys have been used. It should also be mentioned that sediment studies will be carried out in connection with this project at cooling water intake and discharge sites in spring/summer 2026. Their results are not yet available at the EIA programme phase.

As a result of varying processes, layers of different ages may be exposed on the seabed, ranging from sediments of the Ice Age or earlier to young, recently deposited muds or layers of erosion sand. For this reason, the regional distribution of different seabed types is very uneven. The erosion, transport and deposition of the material on the seabed vary both in time and place. Layering is rarely continuous even in oceanic trenches, and it is nowhere exactly the same (Leppänen et al. 2012).

The water area off Vuosaari is relatively shallow all the way to the outer archipelago area, and the quality of the seabed is diverse. The seabed consists mainly of clay and clay sand, but mixed sediment (moraine), rock and coarse-grained sediments are also common. Map of the seabed soil type 1:100,000 off Vuosaari is shown in the figure below (Figure 14-6).

Copyright © Helen Nuclear Ltd

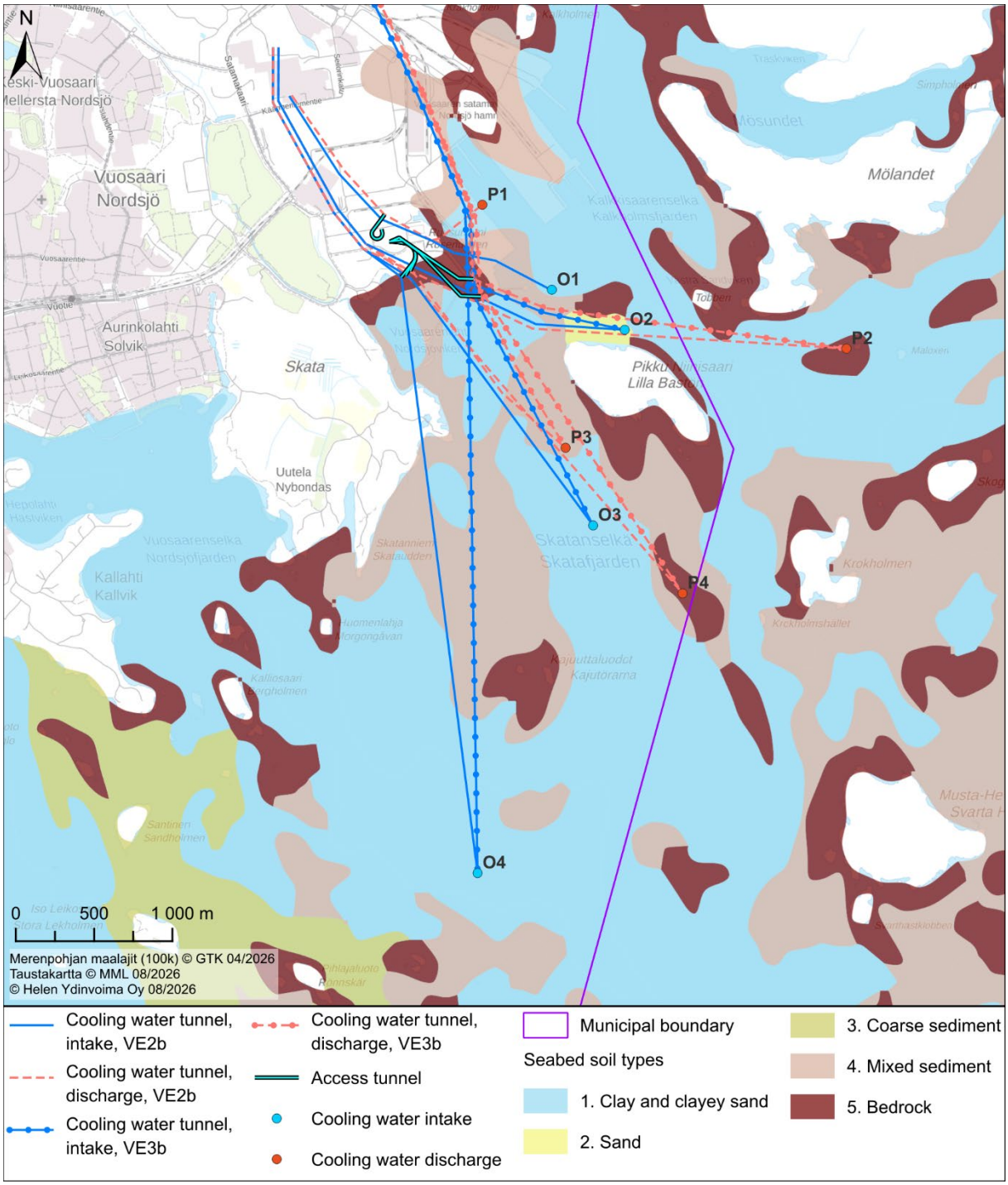


Figure 14-6. Seabed soil types in the Vuosaari project area. The figure also shows the intake and discharge options for cooling water tunnels in project options VE2b and VE3b.

14.1.2.1 Sediment contaminants

In the sedimentation areas of the seabed, the uppermost layers consist of muddy clay and mud deposited during the current Baltic Sea period, that is, over the last few hundred years. Organic deposits play a significant role in the geochemistry of sediments, influencing the accumulation of harmful substances transported to the seabed as well as the internal loading of the sea. The activity of benthic organisms, such as digging, may mix the sediment deposited on the seabed (Leppänen et al. 2012).

Copyright © Helen Nuclear Ltd

The marine area is burdened by municipal wastewater treatment plants, industrial plants, power plants and harbour areas. In addition to point sources, coastal waters are burdened by river waters, run-off from shore areas directly into the sea and ambient fallout.

The marine area off the Helsinki Metropolitan Area has long received nutrient loads from urban wastewater and diffuse pollution. Nutrient loads have led to eutrophication of coastal waters, which in many places has resulted in low-oxygen conditions at the bottom of the sea or even the death of benthic organisms. According to studies (Vahtera and Lukkari 2015), there are several small oxygen-starved or low-oxygen areas off the Helsinki Metropolitan Area, as well as one fairly uniform oxygen-starved or low-oxygen open sea area connected to the basins of the Gulf of Finland. The area covered by the low-oxygen water near the seabed was estimated at a total of approximately 141 km^2, which is about 12% of the studied seabed area. The phosphorus flux from the sediment to the water is at its highest when the water is heavily stratified in late summer, when the distribution of low-oxygen or oxygen-starved water near the bottom is also at its highest.

Hazardous substances have been investigated off Helsinki, for example, in connection with transport infrastructure and harbour construction.

In 2005, the concentrations of pollutants in the surface layer of the sediment in the Helsinki water area were investigated with the help of three lines extending from the bay areas to the outer sea. The TBT concentrations (tributyltin) of the sediment, with the exception of the offshore area, exceeded the concentration of 3 µg/kg, and the concentrations were in large areas at the level of 20–100 µg/kg, which means that, according to the dredging and dumping guide (Ministry of the Environment 2015), they were at the 1A–1C level. This means that the materials could also be dumped at the 1C level in a so-called good dumping site. Concentrations of PCBs were quite high in wide areas, and heavy metals were present in many places. (Kala- ja vesitutkimus Oy 2005)

The seabed conditions of the Vuosaari fairway and harbour front have been investigated several times. The surface sediments of the planned dredging sites of the Vuosaari fairway had low concentrations of pollutants (FCG Suunnittelu ja Tekniikka Oy 2016). The highest concentrations observed occurred only in one sub-sample and were classified at the contaminant level 1A of the dredging and dumping guide (Ministry of the Environment 2015). At dredging sites RK1 and RK2 in the waterway traffic area, harmful substances were found only occasionally and unsystematically. As a whole, the pollutant concentrations of the dredged masses were low, which was partly due to the fact that these areas had been dredged earlier in connection with the implementation of the Vuosaari Harbour project. The cessation of the use of TBT and TPhT (triphenyltin) and the gradual decomposition of organic compounds, likely accelerated by vessel traffic, also partly explain the current situation.

In its decision no. 149/2017/2 of 26 June 2017, the Regional State Administrative Agency for Southern Finland considered that all the dredging masses from the deepening project of the Vuosaari Harbour and the fairways are suitable for dumping into the sea (no. 417/2019 Dnr. ESAVI/180/2018 of 25 October 2019).

Copyright © Helen Nuclear Ltd

In the guide of the Ministry of the Environment (Ministry of the Environment 2015), sediment is considered harmless if the concentrations remain at level 1 of the dredging and dumping guide. Such sediments are suitable as such, for example, for dumping in water systems and are harmless to the marine environment. The sediment corresponding to level 2 is heavily spoiled or contaminated and requires separate treatment in dumping operations. The area between levels 1 and 2, the so-called grey area, is divided into sub-areas (1A, 1B, 1C) in the guide, on the basis of which it is possible to assess more accurately the harmfulness of the sludge and the possible need for separate treatment, as well as to determine the requirements of a potential marine dumping site.

The composition of the seabed soil types in the project area and the concentration levels of harmful substances will be specified in the sediment surveys to be carried out in spring/summer 2026 (see chapter 15.2.2). Their results are available at the EIA reporting phase.

14.1.3 Bedrock

The Helsinki Metropolitan Area is located in the southern part of the Fennoscandian Shield in a very geologically diverse area. The rock types in the area belong to Finland's Precambrian bedrock and are 1.9–1.8 billion years old. The bedrock consists of supracrustal rocks and plutonic rocks. In connection with folding, the sedimentary rocks have metamorphosed into various micaceous and acidic gneisses, with interlayers of limestone and skarn rocks. Of the volcanic rock types, alkaline tuffs, tuffites and certain lava types have metamorphosed into amphibolites and gneissic amphibolite. Plutonic rocks form plutons that follow the orientations and structures of the supracrustal rock zones. Granites are widely mixed with other rock types over large areas, forming various veined gneisses, migmatites and, together with alkaline rock, also breccias. (Laitala 1991)

The supracrustal gneisses and shales (Kimito suite) in the Helsinki Metropolitan Area bedrock map update (Elminen 2020) are the oldest rocks. At several stages, plutonic rocks of varying composition (Southern Finland plutonic suite) have intruded into them. These have been involved in Svecofennian deformation and are mostly foliated. Late-stage microcline granites and pegmatites (Southern Finland granite suite) cut other rock types. Migmatisation and granitisation are locally intense.

Shear zones and faults formed in the bedrock at different times after orogenesis have also influenced the topography. They form zones of weakness, where erosion and wear have been more strongly targeted when compared to healthy bedrock.

This description of the current state has been prepared based on the information currently available.

14.1.3.1 Salmisaari

According to the Geological Survey of Finland's overall 1:200,000 bedrock map, the bedrock mainly consists of amphibolite, microcline granite and partly biotite paragneiss (Figure 14-7).

Amphibolite is a metamorphic, foliated rock whose main minerals are amphibole and plagioclase. Biotite paragneiss is a structurally foliated, sedimentary, medium- to coarse-grained metamorphic rock whose main minerals are quartz, feldspar and micas. As its additional name suggests, it contains a lot of biotite. The majority of granites in Southern Finland are microcline

Copyright © Helen Nuclear Ltd

granites. Granite is the most common plutonic rock, whose main minerals are potash feldspar, albitic plagioclase, quartz, mica and sometimes amphibole. Microcline is the triclinic crystalline form of potash feldspar ($KAlSi_3O_8$). (Lehtinen 1998)

There are no nationally valuable rock areas in or near the project's activities (Finnish Environment Institute 2026d).

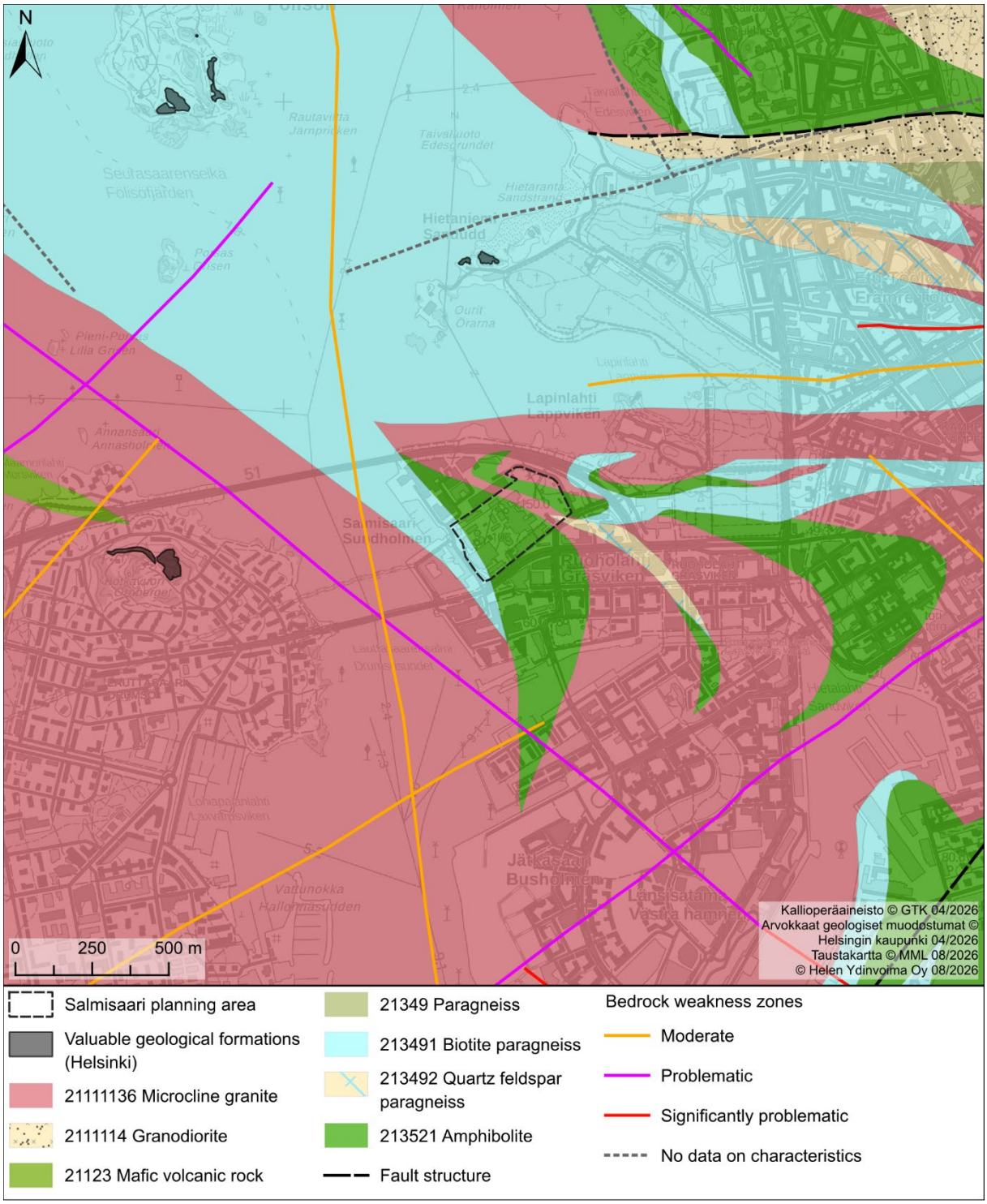


Figure 14-7. General characteristics of the bedrock of the Salmisaari planning area.

The Geological Survey of Finland has carried out a preliminary survey (confidential) on the geological suitability of the planning sites (Nordbäck et al. 2026). The geological characteristics of the sites in the survey are described on the basis of currently available data. The bedrock of Salmisaari is migmatitic and has significant lithological variation, including amphibolite, granite, pegmatite and gneiss compositions. Aerogeophysical and topographical data show fragile structures over several kilometres in offshore areas with northeastern, northwestern and western orientations; one northeastern and one northwestern structure may be bordered by the site. These characteristics can pose geotechnical challenges and increase groundwater flow. Tunnel observations and Rockplan's geological coordination model (Rockplan 2023) confirm smaller, similar zones of weakness that run through the area. Based on GTK's observations, the fracture intensity is highest in the northernmost parts of the tunnel, while the other areas are relatively intact or moderately fractured.

14.1.3.2 Vuosaari

According to the Geological Survey of Finland's overall 1:200,000 bedrock map, the bedrock in the planning area mainly consists of mafic vulcanite, arkosic gneiss and biotite paragneiss (Figure 14-8).

Mafic vulcanic rock is a supracrustal rock rich in magnesium and iron minerals. Gneisses are very common in the Finnish bedrock. The mineral composition of gneisses determines which additional attributes are added to the name of the gneiss. Arkose is a sandstone rich in feldspar (more than 25%) with less than 15% matrix.

There are no nationally valuable rock areas in the area of the project's activities. The nearest valuable rock areas are located north of the planning area, at a distance of approximately 400–800 metres (Labbacka KAO010033, Mustavuori KAO010035, Kasberget KAO0110031) (Finnish Environment Institute 2026d).

Copyright © Helen Nuclear Ltd

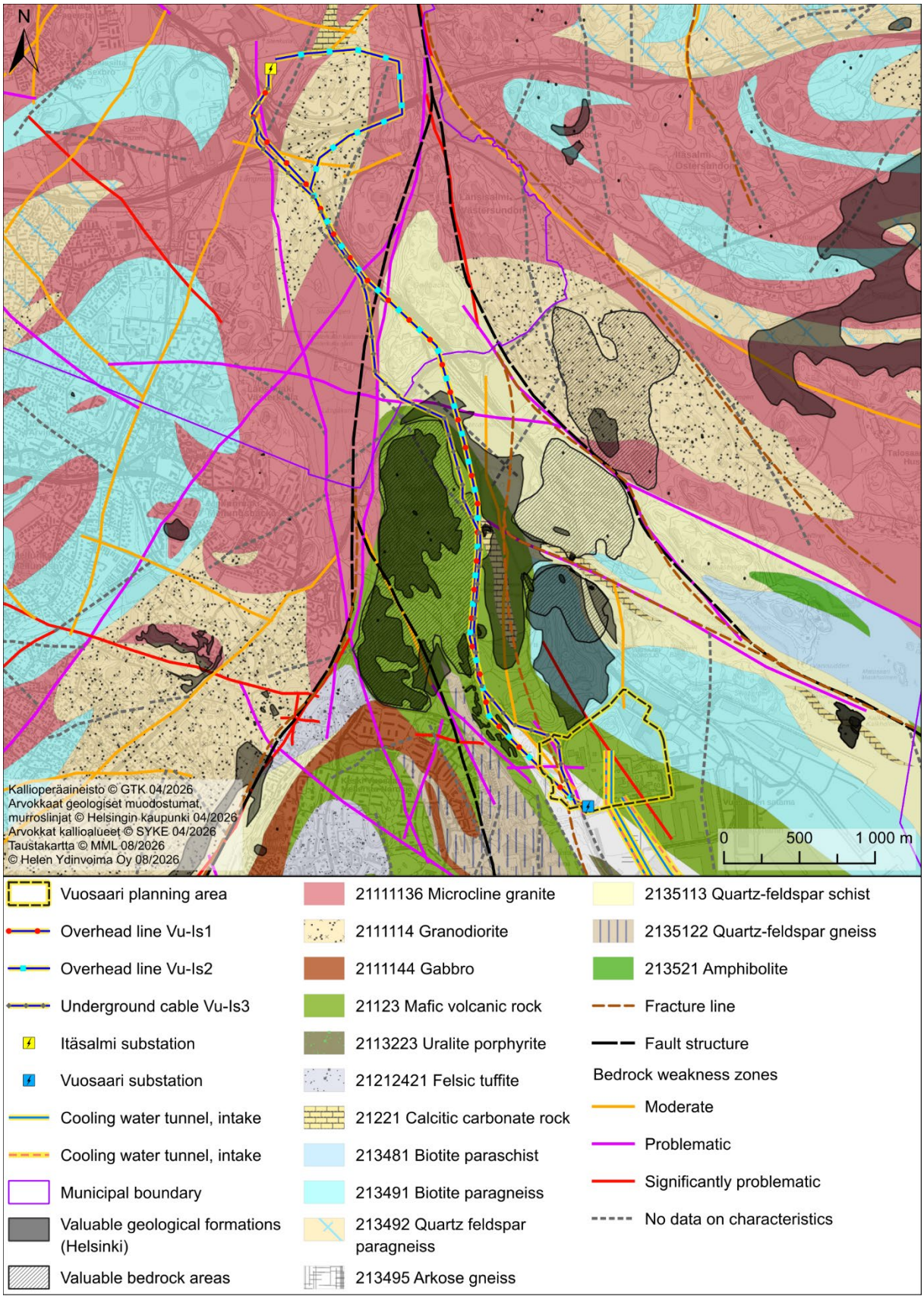


Figure 14-8. General bedrock characteristics of the Vuosaari project area.

Copyright © Helen Nuclear Ltd

According to a preliminary survey by the Geological Survey of Finland (Nordbäck et al. 2026), sedimentary and volcanic bedrock in the Vuosaari area is less migmatised than typical in the Helsinki region and volcanic layers can still be distinguished locally. Limestone (marble) and heavily modified rocks are also found. The bedrock is heterogeneous, due to which there are zones of weakness in the area. The main VKSZ (Vuosaari–Korso Shear Zone) observed north of Vuosaari is a continuous north–south shear zone/zone of weakness over 50 km long, which appears to be divided into several fault segments oriented in different directions within the Vuosaari area. Structural interpretations indicate several possible northeast–southwest and northwest–southeast lineaments (straight or gently curved linear features interpreted from topographic or geophysical data). Tunnel observations confirm zones of weakness near the planning area, including a 5.2 m wide northwest–southeast zone that may intersect the western edge of the planning area. Zones of weakness are shown on the bedrock map (Figure 14-8).

14.1.3.3 Norrberget

According to the Geological Survey of Finland's overall 1:200,000 bedrock map, the bedrock of the planning area is microcline granite (Figure 14-9). As already mentioned for Salmisaari, the majority of granites in Southern Finland are microcline granite. Granite is the most common plutonic rock, whose main minerals are potash feldspar, albitic plagioclase, quartz, mica and sometimes amphibole. Microcline is the triclinic crystalline form of potash feldspar ($KAlSi_3O_8$). (Lehtinen 1998)

Copyright © Helen Nuclear Ltd

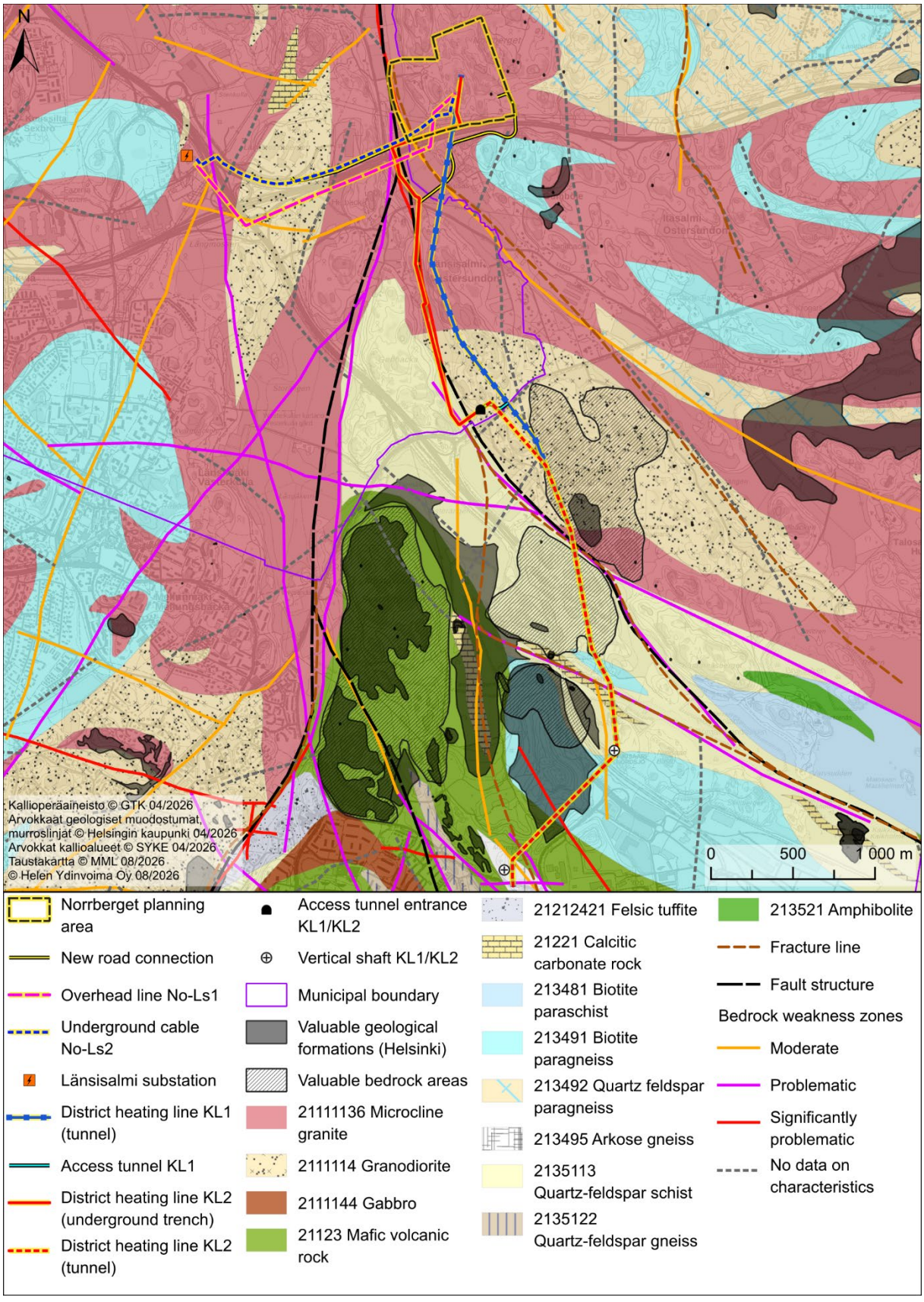


Figure 14-9. General bedrock characteristics of the Norrberget project area.

Copyright © Helen Nuclear Ltd

There are no nationally valuable rock areas in the area of the planning area. The nearest valuable rock areas are located to the north of the project area at a distance of about two kilometres (Sotunki's Högberget KAO010030) and to the south at a distance of about 1.8 kilometres (Kasberget KAO0110031) (Finnish Environment Institute 2026d).

According to a preliminary survey by the Geological Survey of Finland (Nordbäck et al. 2026), the bedrock is mainly granite, coarse-grained and pegmatite, with local gneissic inclusions and weak schistosity. The area is edged by the VKSZ deformation zone (Vuosaari–Korso Shear Zone), which is more than 50 km long and involves fractures and probably high groundwater conductivity. Norrberget's field data show typical regional fracture patterns consisting of north-eastern and northwestern vertical fractures with normal or lower fracture intensity. The quality of the bedrock looks high, the rock is intact and the fracturing is regular. All in all, Norrberget's bedrock conditions are favourable for construction. However, bedrock depressions require further investigation for possible local zones of weakness and the proximity of the VKSZ requires seismic risk assessments.

According to the constructability study (A-Insinöörit Suunnittelu Oy 2025c), the most significant structures affecting the geotechnical constructability of the bedrock in the Norrberget area and its vicinity are the zones of weakness of the rock, running approximately from north to south. These repeat in an east–west direction at intervals of approximately 200–400 metres. The most significant zone of weakness in the bedrock is the fracture zone that follows the Krapuoja valley and the border of Helsinki and Vantaa. Based on the initial data, the frequency of the aforementioned structures is relatively low, so it is assumed that there are no bedrock structures in the location area that would significantly impair the geotechnical constructability. Based on preliminary data, there are no significant risk factors in the area from the perspective of foundation construction. Only for construction in the banks of Krapuoja, regional stability should be considered.

14.1.4 Groundwater

14.1.4.1 Salmisaari

There are no groundwater areas in or near the planning area. There are a few groundwater observation wells in the area. In the well located in the northeast corner of the planning area, the groundwater level was observed between 14 September 2023 and 25 February 2025 at levels ranging from -3.56 to -0.17 (masl). In the groundwater observation well installed on the southeast side of the area in 2017 along the Porkkalankatu road, the water surface has been detected at a level ranging from -1.06 to +2.75 (masl). (A-Insinöörit Suunnittelu Oy 2025a) The infill layers in the area, as well as the land reclamations, are water-bearing. The area is almost entirely built-up and asphalted, so natural groundwater recharge is minimal. At the Salmisaari power plant, heavy fuel oil may have transported outside the rock cavern system decades ago, when the oil level in the rock cavern has been higher than the groundwater level. Samples are regularly taken from the groundwater observation wells around the rock cavern.

According to the constructability survey (A-Insinöörit Suunnittelu Oy 2025a), deep trenches and permanent structures that extend below the groundwater surface must, in principle, be made waterproof.

Copyright © Helen Nuclear Ltd

14.1.4.2 Vuosaari

The planning area is not located in a groundwater area. The nearest groundwater area, Vuosaari (0101101, category 1), is located on the west side of the planning area at a distance of less than one kilometre (Figure 14-10). The electricity transmission route options Vu-Is1 and Vu-Is3 are partly located in Fazerila's groundwater area (see chapter 14.1.4.3).

In water management, the Vuosaari groundwater area has been defined as a risk groundwater area in good condition due to the presence of chloride. There are two water intake plants in the area. The Huvilamäki water intake plant has been in operation from 1966 to 1981. Water intake has been stopped in 1981 and it is now a reserve water intake plant in times of crisis (intake permit 400 m^3/day, 184/1965). The Hautala water intake plant has previously been located in the area (intake permit 1,200 m^3/day, 184/1965). The intake plant was dismantled in 1992. Lohjan Kalkkitehdas Oy's Saseka water intake plant, which operated in the area in the 1980s, was located adjacent to the Hautala intake plant and was dismantled in 1995. Protection zones have been defined for the intake plants, but these have not been confirmed by a decision of the water rights court. (Finnish Environment Institute 2026e)

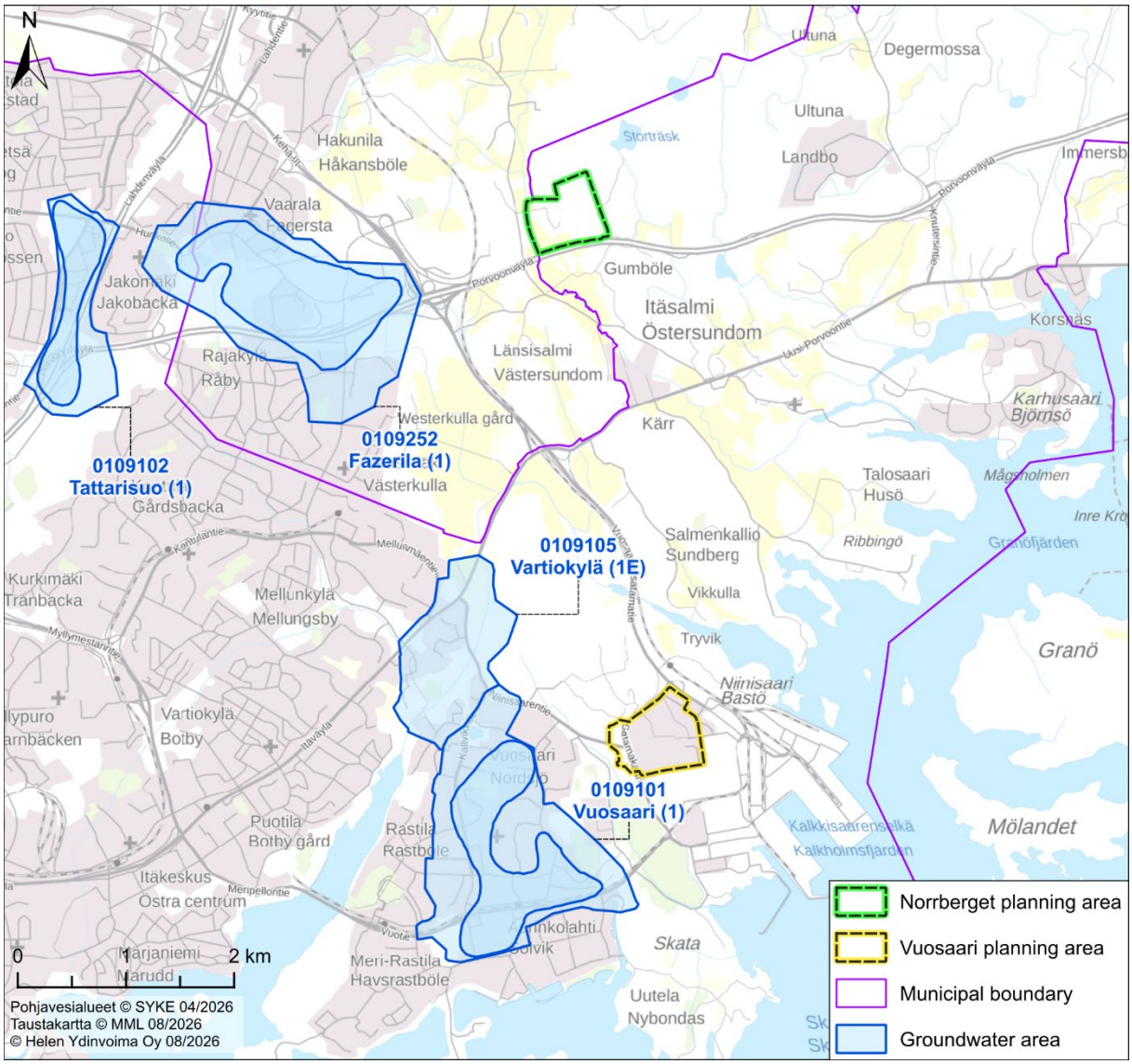


Figure 14-10. The Vuosaari and Norrberget planning areas and the nearest groundwater areas.

The planning area is located on a moraine ridge bounded by rocky ridges, where the groundwater that forms flows mainly towards the east/southeast, i.e. towards the former Niinilahti Bay. Niinilahti has been filled in connection with the construction works of Vuosaari Harbour and is currently located under the harbour's pavement structures. Based on the drilling performed in the area, the bottom moraine in the planning area is very dense, so the groundwater flow is slow. Groundwater levels and flow directions have also presumably been affected by the construction of the Vuosaari power plant area and its surroundings, as well as the construction of the underground facilities since the early 1990s.

To the west of the moraine ridge lies a very large zone of weakness of the bedrock, which runs in the northwest–southeast direction below the Porslahti dumping ground and Vuosaari landfill. Another large zone of weakness of the bedrock, parallel to the previously mentioned one, is on the east side of the coal storage. Rock fractures can direct groundwater flow. Groundwater may be connected to bedrock groundwater that flows through bedrock fracture zones. In the three groundwater observation wells (MV8A06, G14_2008 and G15) located west of the Laivanrakentajantie road, i.e. in the rock shear zone, the water level varied between −0.3 and +1.5 m, while in the groundwater observation wells (H14, H13 and H10_2010) located in the planning area, the water level varied between +9.6 and +13.6 (at a depth of 1–3 m below ground level) during 2009–2011. On the other hand, the ground level falls towards the west of the project area and the soil changes from moraine to clay at the Laivanrakentajantie road, which is why groundwater can naturally occur at a lower level below the clay layer, in the thin moraine layer near the bedrock surface. Groundwater below the clay layer can also be pressurised, and therefore the water pressure level is close to the ground. In the clay area east of the coal storage and in the observation wells (VV2 and VV3B) at the second fracture zone, the water level has varied from +2.2 to +3.5 in 2009–2011. (Ramboll Finland Oy 2013)

According to the constructability survey (A-Insinöörit Suunnittelu Oy 2025b), the soil layer on top of the rock in the area consists partly of higly water-bearing sand moraine. Thus, deep trenches and permanent structures that extend below the groundwater surface must, in principle, be made waterproof.

Groundwater quality

In Helsinki, the Vuosaari area has implemented the monitoring of the quality of seepage water, groundwater and surface water as joint monitoring since 1999. There are several points of observation: Vuosaari coal storage (Helen Ltd), Vuosaari interim storage field for bottom ash (Helen Ltd), Vuosaari dumping ground extension (City of Helsinki), interim storage field (City of Helsinki), final disposal area of contaminated soil (City of Helsinki), the closed Vuosaari landfill (City of Helsinki), Porslahti dumping ground (Vuosaari Golf Oy), Melumäki (City of Helsinki), TBT reuse areas (City of Helsinki), snow disposal site and the technical maintenance area of Satamakaari (City of Helsinki).

The observation points of the Vuosaari coal storage and interim storage field of bottom ash are shown in the figure below (Figure 14-11). The results for 2019–2022 are summarised below. The results are described in more detail in the summary report (AFRY Finland Oy 2023, Ramboll Finland Oy 2026).

Copyright © Helen Nuclear Ltd

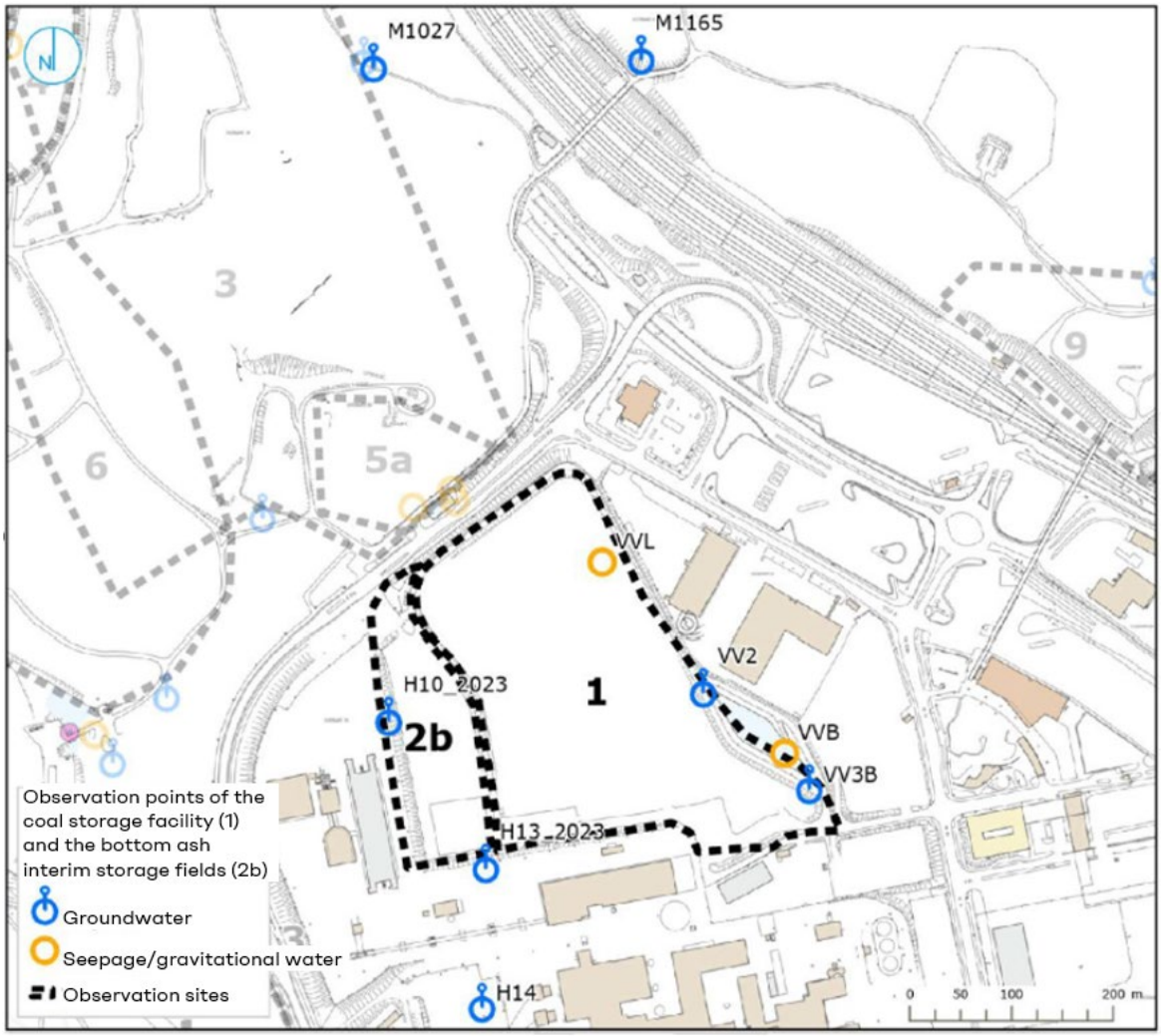


Figure 14-11. The location of the observation points of Vuosaari coal storage (1) and the interim storage field of bottom ash (2b) (Ramboll Finland Oy 2026).

Total nitrogen concentrations have been high at times, especially at points H10_2010, H13 and H14. Chloride concentrations exceeded the environmental quality standard for groundwater (25 µg/l) and/or the quality requirements and targets for domestic water (250 µg/l) in several samples taken from the site's groundwater points. Sulfate concentrations exceeded the quality requirements and targets for domestic water (250 µg/l) in all samples taken at points H10_2010, VV2 and VV3B. The conductivity exceeded the quality requirements and targets for domestic water (250 mS/m) in all samples taken from groundwater points VV2 (541–970 mS/m) and VV3B (322–520 mS/m), as well as in a single sample taken from point H10_2010 (267 mS/m). Metal concentrations were generally at normal levels for the sampling points. No PAH concentrations exceeding the reference values were found in the groundwater of the areas. For petroleum hydrocarbons C10-C40, individual slightly elevated concentrations (79 µg/l and 83 µg/l) were found in samples taken from H14 in October 2021 and 2022. Concentrations of petroleum hydrocarbons above the limit of quantification were not detected at other groundwater points in the area. (AFRY Finland Oy 2023).

Copyright © Helen Nuclear Ltd

The general reference values for groundwater quality are determined by the general need for protection of groundwater, as well as the use and potential for use of groundwater. The determination of hazards and risks and the application of the reference values are also affected by other environmental and health risks caused by groundwater pollutants, the location of the source of the pollutant in relation to the groundwater level, the time of pollution and any migration into groundwater that has already occurred (Ministry of the Environment 2014). In the basic assessment of contamination, the Ministry of Social Affairs and Health's Decree on domestic water quality (STM 1352/2015 and amendments) is generally applied also in areas where groundwater is not used as domestic water. Environmental quality standards for groundwater (Government Decree 1022/2006, 341/2009) are only intended for classifying the chemical status of groundwater in aquifers (classified significant groundwater areas), while these values have also been used in other areas to assess the quality of groundwater.

14.1.4.3 Norrberget

The planning area is not located in a groundwater area. The nearest groundwater area is the Fazerila groundwater area in Vantaa (0109252, class 1), located approximately 1.3 km west of the planning area (Figure 14-10). The electricity transmission route options No-Ls1 and No-Ls2 are partly located in the Fazerila groundwater area. In water management, The Fazerila groundwater area has been defined as a risk groundwater area in poor condition due to the presence of petroleum products, solvents and chloride. Concentrations are stable. There are several water intake plants in the groundwater area. The protection plan was drawn up in 1996 and updated in 2015. A more detailed description of the groundwater area is available from Environmental Administration's Hertta service (https://wwwp2.ymparisto.fi/scripts/povetarea/povetarea.asp)

There are no groundwater level or quality data from the area.

14.1.5 Seismicity

The geological assessment of potential nuclear power plant sites produced by the Geological Survey of Finland for Helen Ltd (Nordbäck et al. 2026) has also briefly covered regional seismic data. The information presented here is based only on the document mentioned. Other surveys related to seismicity have not been carried out at the EIA programme phase.

The bedrock of the Salmisaari, Vuosaari and Norrberget planning areas is part of the Fennoscandian Shield, where the local stress field and the occurrence of earthquakes are affected by, for example, the spread of the Mid-Atlantic Ridge and land uplift as a result of the melting of the continental ice sheet. According to the FENCAT earthquake catalogue (Uski et al. 2025), seismicity in Southern Finland is at a low level of activity (Figure 14-12 and Figure 14-13). There does not appear to be any elevated seismic activity (Figure 14-13) associated with the observed or interpreted zones of weakness of the bedrock around Helsinki. In addition, the seismic risk in Southern Finland has been estimated to be low (Korja & Kosonen 2015). According to a preliminary assessment, seismicity does not affect the site selection for the planning area.

Copyright © Helen Nuclear Ltd

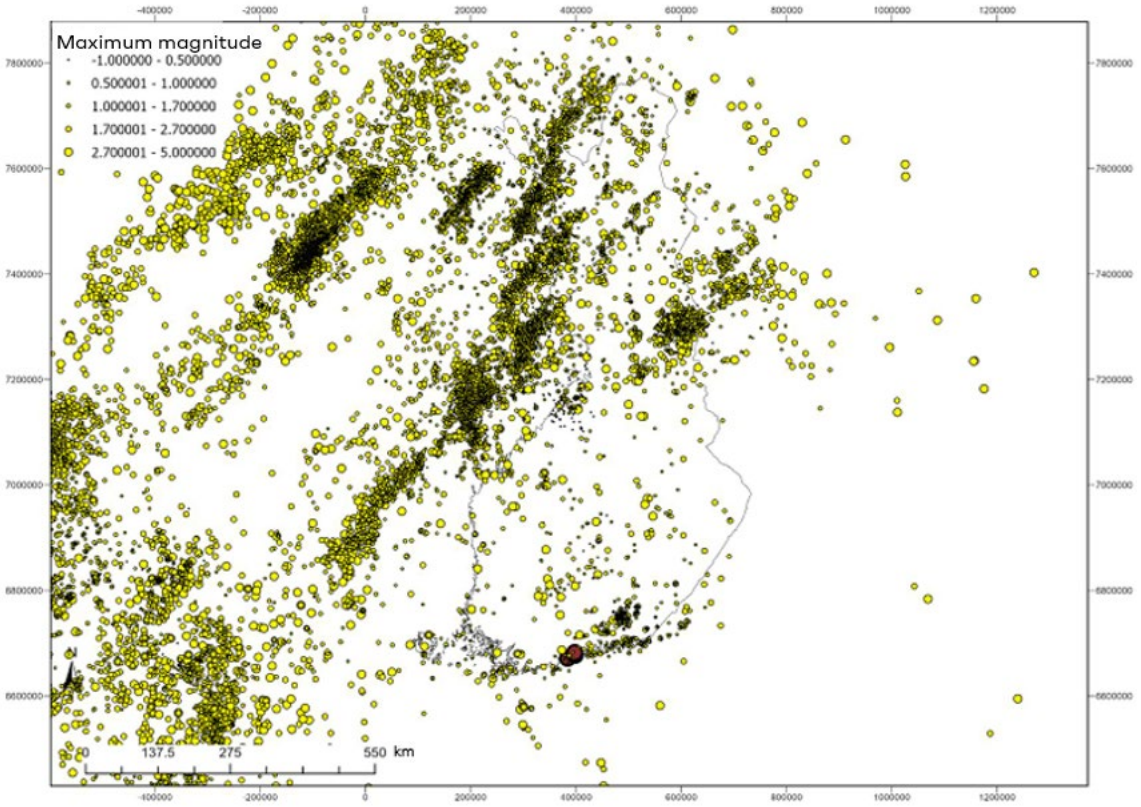


Figure 14-12. The Fennoscandia earthquake catalogue FENCAT's data for years 1467–2021 (modified from the original figure Nordbäck et al. 2026, original earthquake data Uski et al. 2025). The locations of the planning areas are marked in the picture with brown circles and earthquakes with yellow circles. The size of the circles describing the earthquakes is proportional to the maximum magnitude of the events.

Copyright © Helen Nuclear Ltd

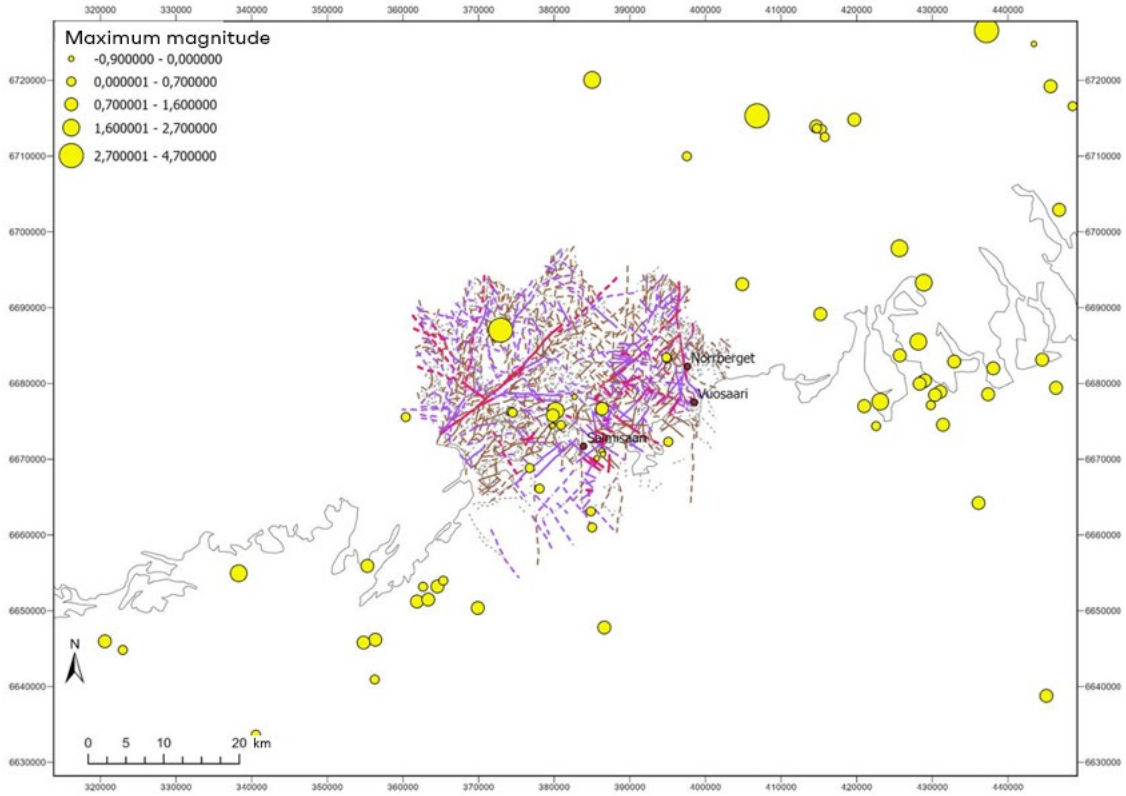


Figure 14-13. Earthquakes based on the FENCAT data in and around the Helsinki Metropolitan Area (modified from the original figure Nordbäck et al. 2026, original earthquake data Uski et al. 2025). The locations of the planning areas are marked in the picture with brown circles and earthquakes with yellow circles. The size of the circles describing the earthquakes is proportional to the maximum magnitude of the events. In addition, the figure shows the zones of weakness of the bedrock according to Pajunen et al. (2002). Significantly problematic structures are presented in fuchsia, problematic in purple and moderate in brown. The structures presented in grey do not have an assessment of the bedrock quality or its characteristics. Continuous line markings are observations and dashed line markings are interpretations.

14.2 Impact assessment and methodology

The project's impacts on the soil and bedrock are direct consequences of construction. Groundwater is particularly affected during construction, but excavation and construction can also permanently change local groundwater conditions. In assessing the significance of environmental impacts on soil, bedrock and groundwater, the spatial extent of the impacts, the affected site's sensitivity to change and the reversibility or persistence of the impacts are essential.

The impacts are assessed in terms of the changes caused by the planned operation by comparing it with the current situation. The impacts during construction and operation are assessed separately. The impacts are also assessed separately for all project options, and based on this, the project options are compared with each other. The impacts on the soil and bedrock are assessed in the project areas (planning area and new connections to be built) and in their immediate vicinity, to which the impacts of the construction work and operations extend. Impacts on groundwater are assessed at a distance of about 500 metres. The assessment uses surveys carried out in the areas of the project's activities and possible other surveys. In addition, the significance of the adverse effects is assessed and measures are presented to prevent or mitigate them. Issues related to seismic events are taken into account as required by the requirements.

Copyright © Helen Nuclear Ltd

Environmental impacts are assessed through expert work and based on accumulated experience and knowledge of similar activities. The assessment is carried out by specialists in soil, bedrock, seismology and groundwater. Initially, the most significant impact mechanisms during construction are removal of topsoil, covering of the ground and excavation. The impacts are initially estimated to be similar to conventional earthworks and excavation work, and the nuclear power plant will not have any impacts on soil, bedrock or groundwater during operation. The magnitude of the impacts is influenced by the extent and depth of the replacement of soil, and especially the excavation, required for construction, all of which are specified as the planning progresses. As these aspects are specified, the need to map the private wells (their type and purpose) near the project areas will be assessed.

Constructability surveys will be carried out in the Vuosaari coal and bottom ash storage area in 2026. In connection with these, soil and groundwater samples are also taken, the results of which are used in the EIA reporting phase in the impact assessment.

The table (Table 14-1) below presents the justification for targeting the environmental impact assessment by project option for soil, bedrock and groundwater (for background on targeting, see chapter 7.2.1).

Table 14-1. Justification for targeting the environmental impact assessment by project option in terms of soil, bedrock and groundwater. x = the project option for which the assessment is specifically targeted.

	Soil, bedrock and groundwater	Justification
VE1		The area is currently a built-up industrial area, no new electricity or district heating connections.
VE2a		The area is currently a built-up industrial area, no new electricity or district heating connections.
VE2b	x	The area is currently a built-up industrial area, new electricity and cooling water connections. The implementation of the project requires extensive excavation.
VE3a	x	The area is undeveloped and largely in its natural state, new district heat and electrical connections, new roads and municipal infrastructure required. The implementation of the project requires extensive excavation.
VE3b	x	The area is undeveloped and largely in its natural state, new district heat and electrical connections, cooling water connections, new roads and municipal infrastructure required. The implementation of the project requires extensive excavation.

Copyright © Helen Nuclear Ltd

15 SURFACE WATERS

15.1 Current status

The affected area of the Salmisaari marine area is described below to a lesser extent than the Vuosaari area, because for Salmisaari, the project option (VE1) is a heating plant that produces only district heat (HOP) and it does not require seawater cooling or the intake or discharge of cooling water into the sea. The Salmisaari project option also relies on the existing power plant environment and current structures and does not require new marine construction works. Thus, the Salmisaari project option would not create new heat discharges to the marine area or any other impact on the physical conditions of the coastal area. Therefore, the description of the current state of the Salmisaari marine area and the impact assessment methods can be clearly narrowed down further compared to the Vuosaari area.

In the Vuosaari project option (VE2b), on the other hand, also the CHP plant option is examined. This plant requires the intake and discharge of cooling water into the marine area, as well as the expansion of cooling water tunnels or the excavation of entirely new tunnels. These activities may cause impacts on a wider marine area, which is why the review of the affected Vuosaari marine area has been made more extensive and detailed compared to that of the Salmisaari area. In the Norrberget CHP plant option VE3b, the water impacts are primarily related, as in option VE2b, to the intake and discharge of cooling water and the construction of new cooling water tunnels in the marine area off Vuosaari. Option VE2b also requires a new electricity transmission connection from Vuosaari to Itäsalmi substation, the location option in Norrberget requiers electricity and district heat transmission connection from Norrberget to Vuosaari and, in addition to these requirements, option VE3b also requires a cooling water tunnel from Norrberget to the sea off Vuosaari. The above-mentioned operations extend the affected area during the construction phase in particular to the catchment areas of the shoreline.

15.1.1 Overview of the water system

The marine area off Helsinki is located in the inner and middle archipelago zones of the Gulf of Finland, characterised by an alternation of shallow, sheltered areas and more open sea areas, varying flow conditions and strong mixing of fresh and salt water. Sea water movements are mainly driven by wind, and wind conditions regulate surface water flow, mixing and water exchange. The main flow along the coast is typically from east to west, but its direction and intensity vary significantly depending on wind and weather conditions. The impact of the wind is particularly pronounced in the inner archipelago and sheltered areas, where it controls local water exchange and causes considerable temporal and regional variation in water quality.

The archipelago zone is divided into bay areas as well as the inner and outer archipelago. Bay areas are generally shallow, lush and have a low rate of water exchange. In particular, the bay areas are subject to significant freshwater influence through rivers and streams discharging into the area, lowering the salinity of the surface layer and increasing the content of nutrients and suspended solids. The most significant river that discharges into the area is the Vantaanjoki river, in addition to the Espoonjoki river in the west and the Sipoonjoki river in the east. The river water impact is emphasised in the spring and during periods of heavy rainfall, when the runoff of fresh water forms a salinity transitional zone across a wide coastal area (Vantaanjoen ja Helsingin seudun vesiensuojeluyhdistys ry 2024, City of Helsinki 2024b).

Copyright © Helen Nuclear Ltd

The level of water exchange and depth increase when moving towards the open sea. In the middle archipelago, exchange is already quite good and depth typically ranges from 10 to 20 m, while in the open sea it exceeds 30 m. Intermittent thermal and salinity stratification occur in the inner archipelago, which may weaken oxygen conditions in the water close to the bottom and increase the significance of the internal load, due to the release of nutrients previously accumulated in the sediment back into the water. The southeast–northwest-oriented oceanic trenches typical of the area allow water to flow from time to time further into the archipelago.

The condition of the marine area is affected by both the load caused by the use of the marine area, such as dredging and other hydraulic engineering activities that increase water turbidity and can release substances bound to the bottom sediment, as well as diffuse pollution from the catchment area through rivers, streams and stormwaters. Point sources of pollution are the discharge of purified wastewater and cooling seawater into the sea. The discharge of wastewater into the outer archipelago has reduced the direct point load of the inner archipelago, shifting the focus of the load to river flow and other diffuse loads. The wastewater treated at the Viikinmäki wastewater treatment plant in Helsinki is discharged through a discharge tunnel to the open sea to the south of Katajaluoto, and the purified wastewater from the Espoo Blominmäki wastewater treatment plant is discharged to the southeast of Gåsgrundet island. The discharge of wastewater takes place near the bottom, from where the wastewater mixes with and dilutes to seawater under the influence of salinity and temperature difference. In addition, sea water used for cooling power plants are also led to the marine area. (City of Helsinki 2024b).

In terms of morphology, the marine area off the coast of Helsinki has been significantly modified by human activity. Shoreline modification, fairway structures, dredging and sea dumping of the dredged material have changed the topography and flow conditions of the seabed and increased turbidity locally, especially during construction and work phases.

The temperature and ice conditions of the marine area vary according to the seasons. The inner archipelago is often covered in ice in winter, and the stratification during summer is typically weak or short-lived (City of Helsinki 2023b and 2024b).

15.1.1.1 Salmisaari

The Salmisaari project area is located in the Gulf of Finland coastal intermediate area 81V050. In SYKE's latest catchment division, the project area is located in the 4th division areas FI1-81.01.098 and 099 (Figure 15-1).

The marine area off Salmisaari is located in the inner archipelago, west of the inner city of Helsinki, in the coastal water body of Seurasaari. The Seurasaarenselkä marine area is bordered in the west by the chain of islands between Lauttasaari and Munkkiniemi, which separates it partly from more open marine areas, and in the east by the inner city's coastal zone. The Seurasaarenselkä marine area is connected to the open sea mainly via the Lauttasaarensalmi strait, while on the west side the connection continues via narrow straits to Laajalahti. Due to the protective nature of the archipelago, bridges and narrow connections, water exchange is limited. Depth conditions in the area vary. In shallow bays, the depths remain at few metres, while in the more open sea area, the depth can be about 10 metres. South of the Lauttasaarensalmi strait is the Suvisaaristo–Lauttasaari coastal water body, which is clearly more open and the depth also increases when going further towards the sea.

Copyright © Helen Nuclear Ltd

The area receives local diffuse pollution from the urban area through stormwaters and also thermal load from Helen's Salmisaari power plant area (thermal load from district heating auxiliary cooling and cooling water of cooling centres). Cooling waters are discharged to the southern part of Seurasaarenselkä. The area is also affected by waterfront construction, as well as maritime traffic and transport routes.

15.1.1.2 Vuosaari

The Vuosaari planning area is located in the Gulf of Finland coastal intermediate area 81V049, i.e. in the 4th division area FI1.81.01.102 in SYKE's latest catchment area division (Figure 15-2). There are no water systems in the planning area under the Water Act. On the west side of the planning area flows the Vuosaarenpuro stream, along which there are wetland pools in the northern part of the golf course. The bed of the Vuosaarenpuro channel has been modified and its environment has been affected by abundant construction in the area, but the stream is important for recreational use (City of Helsinki 2022b).

The marine area off Vuosaari belongs to the Sipoo archipelago water body, which is an open and relatively shallow marine area. The archipelago zone is short and becomes open sea south of Länsitonttu, about 13 km south of Vuosaari Harbour. The entire coastal area is relatively shallow and the depth zone of more than 20 metres actually begins in the outer archipelago area. Kalkkisaarenselkä off Vuosaari Harbour represents a relatively shallow inner archipelago, the depth of which is mainly about 10–15 m, except for the coastal zones. Kalkkisaarenselkä borders Mölandet to the east and Pikku Niinisaari to the south. To the northeast of Kalkkisaarenselkä lies the shallow Granönselkä, and to the south is Skatanselkä, where the water depth is also mainly around 10–15 metres.

The variation in water quality in the marine area is particularly affected by nutrient and solid matter loads from the catchment area, water flows, ice conditions and the use of the area, such as Vuosaari Harbour operations and other coastal infrastructure. In the vicinity of the harbour, there is also Helen Ltd's Vuosaari power plant, whose cooling waters are directed to the harbour basin.

In the Vuosaari project option VE2b, the power line and underground cable lines planned for Itäsalmi substation run mainly in the Gulf of Finland coastal intermediate area 81V049 and partly also in the Krapuoja catchment area 81.048, i.e. in the 4th division sub-catchments FI1.81.01.102 and FI1.01.032 in SYKE's latest catchment area division (Figure 15-2). Electricity transmission routes intersect with Westerkullanoja, which flows into the Porvarinlahti bay. Further north, the overhead line option Vu-Is2 is located at its closest about 300 m from Krapuoja, which flows into the Kapellviken bay (Figure 15-2). The land use of the streams' catchment areas (Westerkullanoja 7.3 km^2 and Krapuoja 32.3 km^2) is diverse, including fields, forests, residential areas, industry and major transport routes. Westerkullanoja runs south of the Itäväylä and Ring Road III intersection. Its channel is in a degraded natural state and especially its upper reaches have been heavily modified and straightened (City of Helsinki 2022b). Krapuoja is somewhat larger channel than the other streams in the area. The average width of the stream channel is 3–4 metres, and the stream structure shows initial meandering. The bed of Krapuoja is clay, and the water is fairly turbid (City of Helsinki 2022b). According to the Purohelmi modelling dataset (Aroviita et al. 2022) on the changed natural state of flowing water habitats, the upper part of Krapuoja is only slightly altered (class 4).

Copyright © Helen Nuclear Ltd

15.1.1.3 Norrberget

In the Norrberget project options, the planning area is located within the Krapuoja catchment area, 81.048 (SYKE's latest catchment area division, 4th division, FI1.01.032), and the electricity transmission and district heating lines run partly within the Krapuoja catchment area and mainly in the Gulf of Finland coastal intermediate area 81V049 (catchment area, 4th division, FI1.81.01.102) (Figure 15-3). The Norrberget planning area is located at its closest about 300 metres from the upper course of the Gumbölenpuro stream, or a streamlet flowing south from Storträsk, which is one of the most natural sections of the stream channel (based on the Purohelmi dataset, class 4, Aroviita et al. 2022). However, none of the project operations are situated within the stream's catchment area (Figure 15-3). There is a natural streamlet in the planning area, which is discussed in more detail in chapter 17.1.3.

In the case of the project option of the Norrberget CHP plant (VE3b), the route of the cooling water tunnels is also located in the above-mentioned catchment areas of Krapuoja and the intermediate area. At sea, the locations of both the discharge and intake points of the cooling water tunnels are the same as in project option VE2b (excluding the intake and discharge point 1), i.e. in the Sipoo archipelago water body off Vuosaari (Figure 15-3).

In options VE3a and VE3b, electricity and district heat transmission routes, as well as in option VE3b, the cooling water tunnel between Norrberget and Vuosaari intersect with the bottom of the Porvarinlahti bay and, further north, with Krapuoja (Figure 15-3). Porvarinlahti is a shallow and sheltered inner bay in the eastern part of Helsinki. The bay is only about 1–3 metres deep, partly overgrown and covered with extensive reed beds (City of Helsinki 2022b).

Copyright © Helen Nuclear Ltd



Figure 15-1. Coastal catchment areas in the Salmisaari project option VE1.



Figure 15-2. Coastal catchment areas and electricity transmission, district heating and cooling water routes in the Vuosaari project option VE2b. In project option VE2a, the planning area is the same, but the option does not include new electricity, district heating, road or cooling water connections.



Figure 15-3. Coastal catchment areas and electricity transmission, district heating and cooling water routes in the Norrberget project option VE3b. The project operations presented are similar in project option VE3a, with the exception of cooling water connections. The electricity transmission connections for project option VE3a (overhead line/underground cable) to the Länsisalmi substation differ slightly from those to Itäsalmi substation in project option VE3b, but they also intersect Krapuoja on the western edge of the planning area.

Copyright © Helen Nuclear Ltd

15.1.2 Water and marine management

The marine area off Salmisaari and Vuosaari belongs to the water management area of the Gulf of Finland and the Kymijoki river, and it is subject to the objectives of the EU Water Framework Directive (2000/60/EC). The key principle of water management is that the ecological status of the water body must not deteriorate, and the goal is to achieve at least good ecological status. Water management plans for the third management period 2022–2027 (Mäntykoski et al. 2022) have been approved in 2021, and the next period (2028–2033) is currently being prepared. The water management plans and related operational programmes contain information on the status of water bodies, loads and the necessary water protection measures.

In water management planning, the ecological status of coastal waters is classified into five categories: high – good – satisfactory – poor – bad. The classification is primarily based on biological quality factors, supported by physical-chemical and hydro-morphological factors (Aroviita et al. 2019). Biological quality factors used in the Gulf of Finland are phytoplankton (chlorophyll a in the inner archipelago), benthic fauna (BBI-ELS index) and aquatic vegetation (macrophytes), particularly the depth distribution of bladder wrack (*Fucus vesiculosus*). Physical-chemical factors include total nutrients (nitrogen and phosphorus) and visibility (Secchi) depth. Classification is based on late summer (7 July–7 September) averages. The current 3rd period status classification is based on monitoring data from the period between 2012 and 2017. The classification is currently being updated. In the fourth period, in accordance with the requirements of EU reporting, the so-called one-out, all-out principle is introduced in the definition of the ecological status class of a water body, which means that the ecological status class is determined by the quality factor in the weakest status. The classification also includes some new quality factors, such as red algae in marine areas (Aroviita et al. 2025), which may contribute to the classification of the site.

In front of Vuosaari, the marine area close to the operations of project options VE2 and VE3 belongs to the coastal water body of the Sipoo archipelago and more broadly to the surface water type of the Gulf of Finland inner archipelago. The surface area of the water body is approximately 94 km². During the third planning period of water management, the ecological status of the coastal water body of the Sipoo archipelago has been classified as satisfactory (Table 15-1, Figure 15-4). Several biological quality elements, such as the chlorophyll a concentration describing phytoplankton and the benthic fauna BBI-ELS index, indicate a satisfactory status. However, the overall classification was nevertheless assessed as satisfactory because some physical-chemical quality elements, particularly total phosphorus concentration and visibility (Secchi) depth, are close to the borderline values between satisfactory and poor. Pressures on the water body are caused by diffuse pollution (agriculture, wastewater from dispersed and holiday settlements) and eutrophication, especially in relation to internal loading.

In the classification of the chemical status of surface waters, the concentrations of hazardous and harmful substances to the aquatic environment are examined. There are only two classification levels: good or worse than good. The chemical status in the water body of the Sipoo archipelago is worse than good, based on the exceedance of the environmental quality standard for polybrominated diphenyl ethers (PBDEs), according to an expert assessment by SYKE. The strict environmental quality standard for polybrominated diphenyl ethers (PBDEs) used as flame retardant causes a worse than good chemical status in all surface waters in Finland.

According to the classification of the third water management period, the ecological status of the Seurasaari water body, which covers the area off Salmisaari, is also classified as poor

Copyright © Helen Nuclear Ltd

(Table 15-2, Figure 15-5). In the classification, the biological status has been assessed as poor overall and the physical-chemical conditions as bad, especially based on nutrient concentrations and oxygen levels. The hydro-morphological conditions of the Seurasaari water body are in the poor category, which is related to the morphological changes and accessibility of the area. Pressures on the water body are caused by eutrophication due to diffuse pollution (agriculture, storm water) and external loading. The chemical status, classified based on harmful substances, is worse than good in the Seurasaari water body due to certain harmful substances (e.g. brominated diphenyl ethers and tributyltin compounds), whose environmental quality standards are exceeded according to measurements. The status of the outer Suvisaari–Lauttasaari water body south-southwest of Salmisaari has been classified as satisfactory.

According to the water management plan, the status of coastal waters in the Gulf of Finland is strongly dependent on the load coming from the catchment area, and the nutrient loads brought by rivers in particular weaken the status of coastal waters. Eutrophication is a key problem and it manifests itself, among others, in increased phytoplankton production, changes in aquatic vegetation and oxygen depletion in the water near the sea bed. The extent of the archipelago zone and the low threshold areas that limit the flow of water between water areas reduce water exchange and increase the sensitivity to load.

The Kymijoki–Gulf of Finland water management plan deals with energy production and industry in general as part of pressures on water systems, such as emissions and hydro-morphological changes. In the plan, measures targeting industry are mainly related to controlling emissions, reducing harmful substances and improving wastewater treatment as part of the environmental permit system, and their role is part of the broader water load reduction in different sectors.

Table 15-1. The ecological status of the Sipoo archipelago (2_Ss_025) water body by quality factors in the classification of the 3rd period (Finnish Environment Institute 2026a).

	3rd period classification		
Sipoo archipelago 2_Ss_025	Value	Computational / impact score	Assessment
Biological parameters		Satisfactory	Poor
Phytoplankton	0.57	Satisfactory	Poor
Chlorophyll a	4 µg/l	Satisfactory	
Benthic animals	0.46	Satisfactory	Poor
BBI index	0.4 ELS	Satisfactory	
Physical-chemical parameters			Poor
Total phosphorus	33.92 µg/l	Poor	
Total nitrogen	396.67 µg/l	Satisfactory	
Secchi depth	1.93 m	Poor	
Hydrologic-morphological parameters		1	Excellent
Accessibility		0	Excellent
Morphology		1	Good
Hydrology		0	Excellent
Overall classification: Poor			

Copyright © Helen Nuclear Ltd

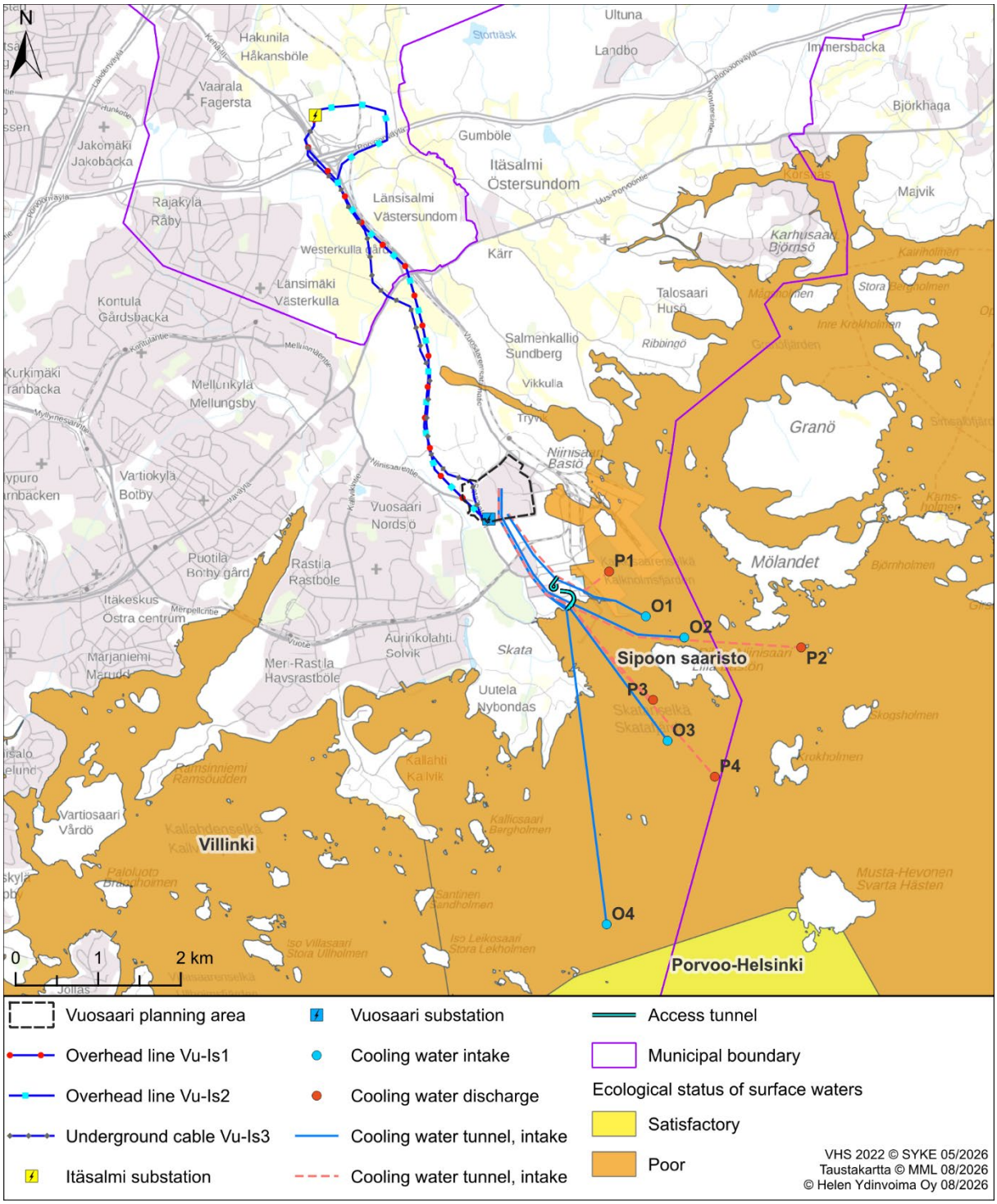


Figure 15-4. The ecological status of the water bodies off Vuosaari in the classification of the 3rd period (in the figure, the operations of project options VE2a and VE2b, the operations in the marine area related to the cooling water of option VE3b are equivalent, excluding the intake and discharge point 1) (Finnish Environment Institute 2026a).

Copyright © Helen Nuclear Ltd

Table 15-2. The ecological status of the Seurasaari (2_Ss_028) water body by quality factors in the classification of the 3rd period (Finnish Environment Institute 2026a).

	3rd period classification		
Sipoo archipelago 2_Ss_025	Value	Computational / impact score	Assessment
Biological parameters		Satisfactory	Poor
Phytoplankton	0.26	Poor	Poor
Chlorophyll a	14.29 µg/l	Poor	
Benthic animals	0.79	Good	Poor
BBI index	0.85 ELS	Good	
Physical-chemical parameters			Poor
Total phosphorus	50.71 µg/l	Bad	
Total nitrogen	589.21 µg/l	Bad	
Secchi depth	0.9 m	Bad	
Hydrologic-morphological parameters		1	Excellent
Accessibility		2	Satisfactory
Morphology		7	Bad
Hydrology		0	Excellent
Overall classification: Poor			

Copyright © Helen Nuclear Ltd

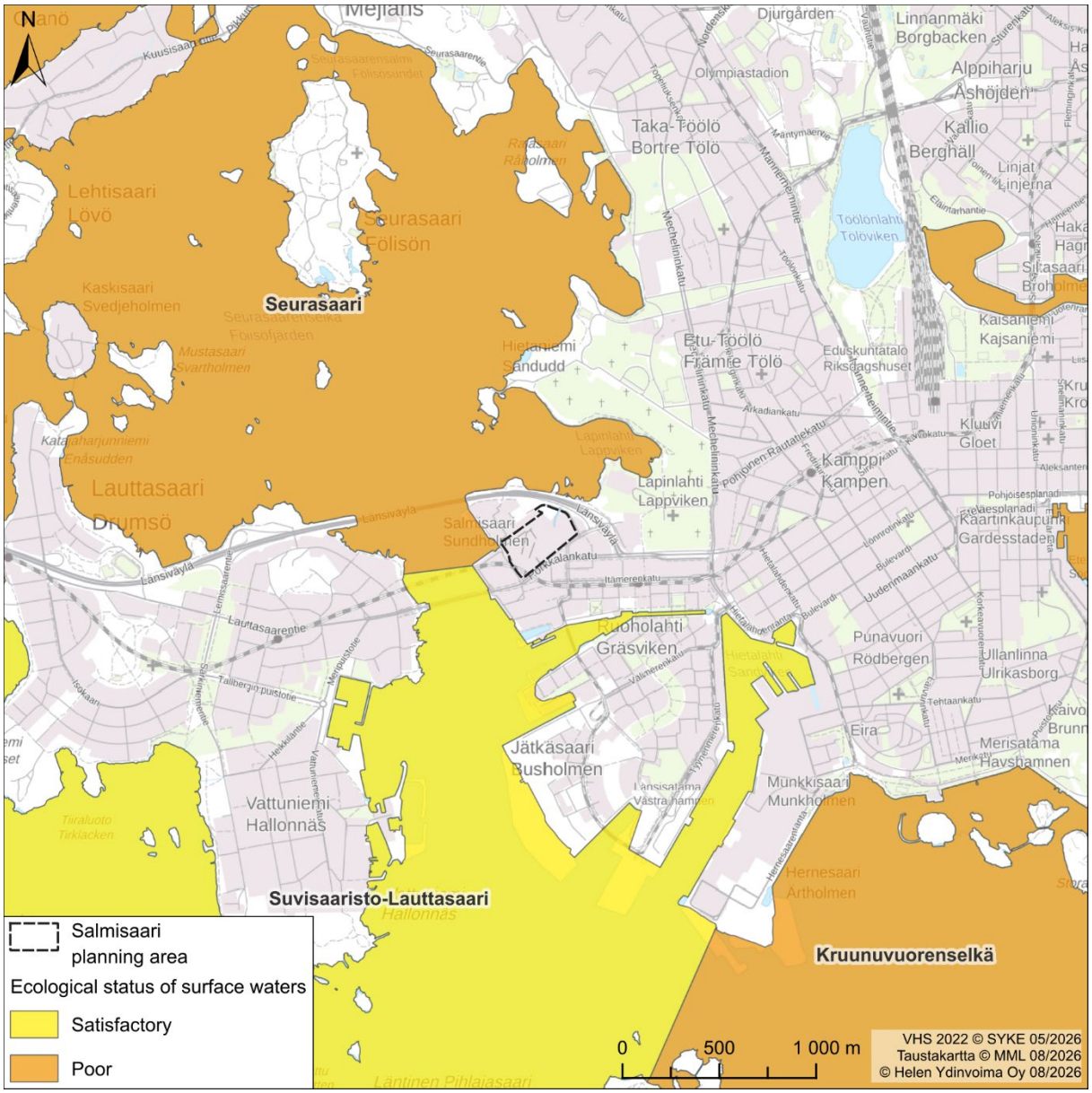


Figure 15-5. The ecological status of the water bodies off Salmisaari in the classification of the 3rd period (Finnish Environment Institute 2026a).

The marine area that may be affected by the project is also covered by Finland's marine management plan as a whole and the good status objective set out in the plan. The main themes of the environmental objectives of the marine management plan include: reducing nutrient loads, reducing the load of harmful substances, reducing litter, preventing the spread of invasive alien species, the sustainability of the use of marine resources and nature conservation and restoration (Korpinen et al. 2018 and 2024). The measures necessary to achieve the objectives are described in the programme of measures of Finland's marine management plan for 2022–2027 (Ministry of the Environment 2021). The programme of measures will be updated in 2027.

In marine management planning, the good status of the marine environment is assessed using 11 descriptors and related indicators. Among the objectives and measures of the water and marine management plan, the most relevant areas to be considered in this impact assessment are the items described in the following table (Table 15-3) (Korpinen et al. 2018 and 2024).

Copyright © Helen Nuclear Ltd

Table 15-3. Descriptors of the good status of marine management planning to be taken into account in the assessment of the impacts on water systems (Korpinen et al. 2018 and 2024, Merenhoidon ympäristötavoitteiden tarkistaminen 2024).

Descriptors of the good status of marine environment	
Descriptor	**Objective**
Marine biodiversity	Maintain biodiversity. The quality and occurrence of habitats and the distribution and abundance of species correspond to the prevailing physiographic, geographical and climatic conditions.
Invasive species	The number of species spreading via vessel traffic is decreasing. The introduction of new species spreading through vessel traffic, via the water and sediment in ballast water tanks and attached to the hulls of vessels will decrease in 2024–2030 compared to previous introduction rate. The number of invasive species deliberately released by humans into the wild is reduced. Invasive species do not continue to spread to new marine areas in Finland as a result of human activity.
Commercial fish species	Populations are viable and within safe biological limits so that the age and size distribution of the population reflects the good condition of the stock. The natural reproductive capacity of fish stocks is intact, and there are sufficient spawning broodstock to ensure normal stock reproduction.
Food webs	The load of phosphorus and nitrogen as well as suspended solids and organic matter is reduced. Fishing guidance and regulation safeguard the sustainability and biodiversity of the fisheries of the most important coastal species and contribute to the achievement of good status. Bycatch quantities in fishing are known and do not threaten the status of species or stocks, nor do they hinder achieving or maintaining their set target conditions. Concentrate additional protection to the most valuable/key areas in terms of marine biodiversity, with the aim of moving towards 30% coverage of the Finnish marine area (including OECM areas that meet the criteria). The efficiency of the management of protected marine areas improves. Archipelago breeding islets are free of invasive predators. The status/favourable conservation status of the Baltic ringed seal stocks in the Finnish Archipelago Sea and the Eastern Gulf of Finland improves by conservation measures. Areas of strict conservation include the most valuable/sensitive areas for marine biodiversity, with the aim of moving towards 10% coverage of the marine area. 30% of degraded habitats are subject to restoration measures.
Eutrophication	The maximum allowed load for phosphorus and nitrogen is not reached, and the suspended solids load is reduced. The load of nutrients, organic matter and suspended solids in agriculture, forestry and peat production is reduced. The nutrient load caused by aquaculture does not threaten the achievement of good status or the already achieved good status. Airborne nitrogen pollution caused by shipping and water traffic is reduced. The load caused by wastewater decreases in 2018–2024. Opportunities for managing internal nutrient stocks in the Baltic Sea improve.

15.1.3 Water quality

The description of the water quality of the Vuosaari marine area is mainly based on the joint monitoring of the Helsinki Metropolitan Area (Savela et al. 2024). Joint monitoring regularly assesses the physical-chemical quality of seawater, such as salinity, turbidity, oxygen levels and nutrient concentrations, at several long-term observation sites. The data covers different seasons as well as inner and outer marine areas, which enables the examination of temporal

Copyright © Helen Nuclear Ltd

and spatial variation in water quality. Regular water quality observation sites off Vuosaari include Skatanselkä and Musta Hevonen. Table 15-4 presents a summary of water quality from 2018 to 2025 at the monitoring sites with the most extensive data, and all water quality observation sites according to local Environmental Administration's VESLA register are shown on the map in Figure 15-6.

The physical-chemical water quality of the marine area off Vuosaari is characterised by seasonal and regional variation, which is typical of the coastal waters of the Gulf of Finland. Salinity decreases especially in the surface layer in the spring and during periods of heavy rainfall due to the influence of fresh water. On average, the salinity of seawater in the area is at the level of 4–6 per mille. There is moderate turbidity in the Vuosaari marine area, influenced by factors such as loads from rivers and the wind and flow conditions in the marine area. Turbidity in the marine area is also occasionally increased by algae production and human activity, such as vessel traffic, dredging and dumping. Further out, as in the Musta Hevonen area, the water is on average brighter and the visibility (Secchi) depth is higher than closer inshore.

Oxygen conditions in the area under review are on average good, and the actual anoxia has not been measured in near-bottom water on the basis of the data. Still, in the Musta Hevonen area, for example, benthic animal and sediment observations have identified indications of oxygen depletion, such as sulphide sludge. Oxygen problems are usually concentrated in late summer and early autumn, when the decomposition of organic matter increases oxygen consumption and the stratification of water weakens the mixing conditions.

Nutrient concentrations (total phosphorus and total nitrogen) are typically slightly elevated in the marine area off Vuosaari, indicating mild eutrophication. Phosphorus concentrations are on average about 40 µg/l and nitrogen concentrations vary on either side of 400 µg/l. Based on the ecological status classification thresholds, the nutrient concentrations during the summer indicate a satisfactory or poor condition. In the surface layer, the maximum temperatures of the water during summer time have been approximately 21–22 C.

Copyright © Helen Nuclear Ltd

Table 15-4. Average and extreme values of water quality from 2018 to 2025 off Vuosaari in the Sipoo archipelago (n = number of observations). The location of the observation sites is shown on the map in Figure 15-6.

	Depth	Tempera-ture	Oxygen, dis-solved	pH	Salinity	Turbidity	Total P	Total N	Chloro-phyll a	Solid matters	Sec-chi depth
	m	°C	mg/l		‰	FNU	µg/l	µg/l	µg/l	mg/l	m
Kalkkisaarenselkä 106											
avg.	**1.9**	**13**	**9.3**	**7.9**	**5.3**	**4.8**	**40**	**387**	**7.6**	**7.0**	
min	0	7.3	7.1	7.5	4.8	1.1	23	310	2.5	0.5	
max	5	20.5	11.4	8.4	5.8	14	60	560	22	29	
n	23	18	21	21	21	19	21	26	13	14	
avg.	**13**	**12**	**8.5**	**7.8**	**5.5**	**5.3**	**43**	**361**		**9.8**	
min	12	8.1	5.9	7.5	4.8	2.2	37	300		5.2	
max	14.5	17.4	10.9	8.1	6.1	18	54	410		17	
n	11	8	11	11	11	10	11	11		4	
Kalkkisaarenselkä 174											
avg.	**0.74**	**14**	**9.4**	**7.9**	**5.3**	**4.0**	**43**	**400**	**6.9**	**5.4**	**1.6**
min	0	7.5	7.3	7.5	4.9	1.1	27	270	2.5	2.5	0.9
max	1	22.4	12.3	8.3	5.8	8.8	100	630	16	9.1	3.1
n	19	16	16	16	16	15	16	21	14	8	10
avg.	**12**	**12**	**8.1**	**7.8**	**5.4**	**6.1**	**47**	**369**		**14**	
min	10.4	8.8	6.0	7.5	4.9	1.3	34	270		6.8	
max	14.2	17.4	9.8	8	6.1	20	69	430		19	
n	12	9	12	12	12	11	12	12		4	
Musta Hevonen 181											
avg.	**0.45**	**10.0**	**11**	**8.02**	**5.3**	**1.9**	**38**	**408**	**9.2**		**3.2**
min	0	0.0	7.8	7.7	4.5	0.05	15	100	0.4		1.5
max	1	21.6	18.4	8.8	6.1	6.8	80	1,000	50		5.2
n	62	69	69	69	68	69	69	69	67		69
avg.	**14**	**8.7**	**11**	**7.9**	**5.4**	**1.8**	**39**	**389**			
min	13	0.3	5.9	7.5	4.4	0.82	18	250			
max	14	20	19.7	8.4	6.0	6.1	55	510			
n	69	69	69	69	68	69	69	69			
Skatanselkä 111											
avg.	**0.47**	**11**	**11**	**8.0**	**5.3**	**2.6**	**40**	**415**	**9.4**	**2.9**	**2.6**
min	0	0.3	7.8	7.5	4.5	0.05	20	230	0.4	1.5	1
max	1	21.6	18.5	8.8	6.1	7.1	110	840	94	6	4.9
n	70	71	75	75	74	74	75	75	73	8	74
avg.	**12**	**9.4**	**11**	**7.9**	**5.4**	**2.3**	**39**	**388**		**3.8**	
min	11.8	0.4	6.7	7.4	4.5	0.05	19	230		0.5	
max	12.2	21.3	15.6	8.5	6.1	9.7	76	610		8.4	
n	71	68	71	71	70	70	71	71		4	

Copyright © Helen Nuclear Ltd

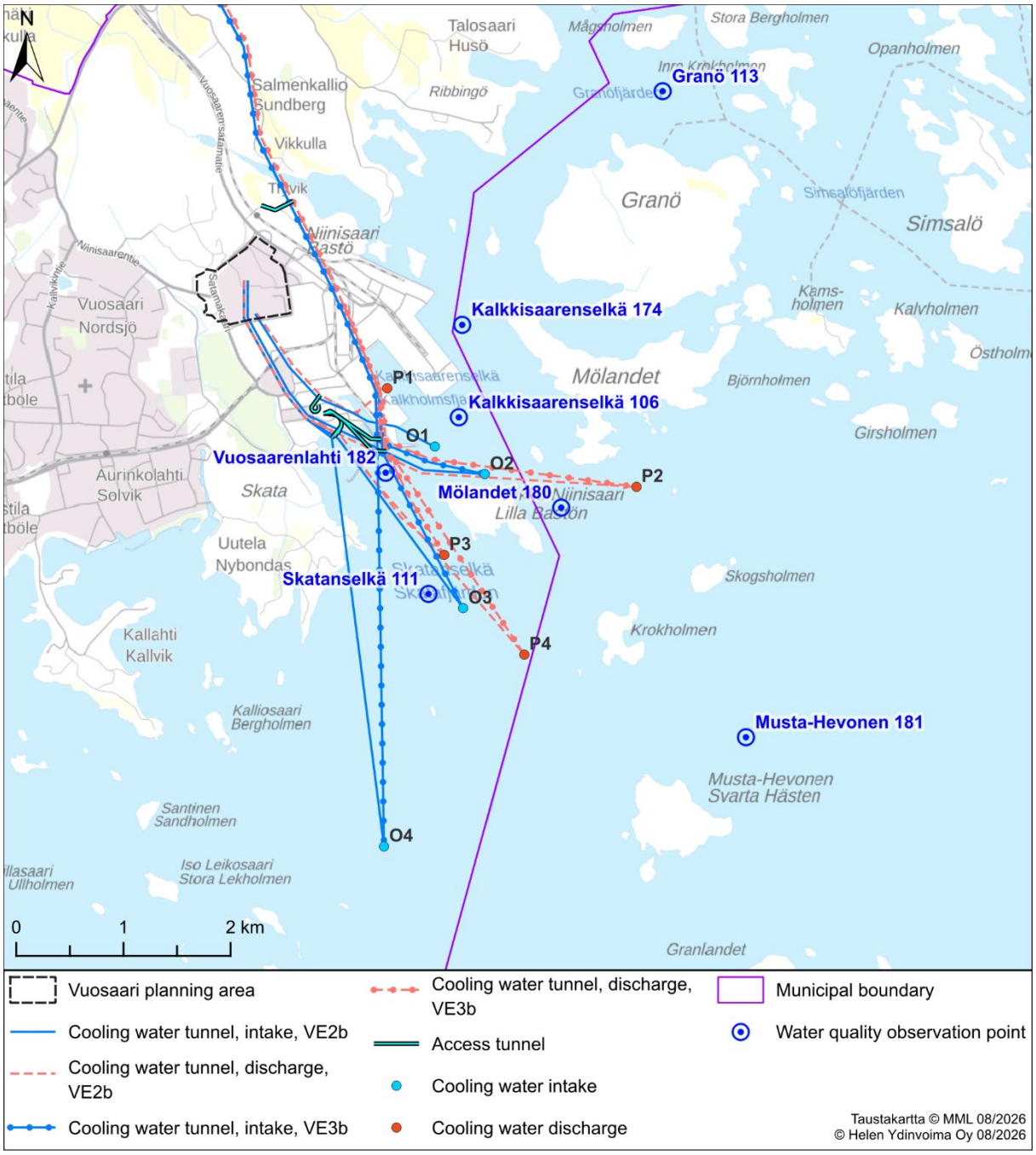


Figure 15-6. Sample points for water quality and phytoplankton off Vuosaari (Finnish Environment Institute 2026b, Vesla register). The figure also shows the different intake and discharge options for cooling water for project options VE2b and VE3b. Intake and discharge points O1 and P1 apply only to project option VE2b.

Off Salmisaari and more widely in the Seurasaari marine area, the water exchange in the inner archipelago of Helsinki is relatively poor. The water quality in the marine area is moderately eutrophic, and nutrient concentrations are classified even as bad according to the ecological status classification. The chlorophyll a concentrations indirectly describing the amount of phytoplankton are also elevated. Eutrophication is also manifested in the area as increased turbidity of water and deterioration of visibility (Secchi) depth, as well as intermittent algal blooms. The oxygen situation in the area has been moderate, although in late summer, concentrations decrease which is typical in the inner archipelago.

Copyright © Helen Nuclear Ltd

The quality of sediment in the marine area is described in chapter 14.1.2.1.

15.1.4 Aquatic life and underwater nature

15.1.4.1 Phytoplankton

As part of the joint monitoring of the marine area, phytoplankton surveys are also carried out off Helsinki, in which species and biomass are determined, but the monitoring focuses on the outer area and bays. In addition, the basic production capacity of phytoplankton is measured as well as nutrient limitation (City of Helsinki 2025b). The nutrient limitation of the marine area was most recently assessed on the basis of phytoplankton nutrient-enrichment experiments carried out in 2024. Typically, the production of phytoplankton in the coastal waters of the Gulf of Finland is mainly limited by nitrogen in the spring, while nutrient limitation in the summer season vary depending on time and place and is not unambiguous throughout the growing season. During the summer and autumn seasons, there were most often co-limitation of nitrogen and phosphorus. Situations were also observed in the vicinity of wastewater discharges where growth was not at all limited by the availability of nutrients.

In the coastal waters of the Gulf of Finland, the increase in phytoplankton usually occurs between April and May, mainly consisting of diatoms. The diatom bloom in the spring appears as elevated chlorophyll a concentrations, especially in the outer regions. After the spring bloom, the amount of plankton usually decreases in the early summer after the nutrients in the surface layer have been depleted. Between the midsummer and late summer, the structure of the phytoplankton community changes. The proportion of blue-green algae increases in July–August, with the most abundant species off Helsinki being *Aphanizomenon flos-aquae* and *Nodularia spumigena.* Phytoplankton biomass can sometimes increase also due to higher abundances of euglenophytes and dinoflagellates, but their significance varies from year to year. (City of Helsinki 2025b)

More detailed phytoplankton surveys have not been carried out in the Sipoo archipelago in recent years. According to the Environmental Administration's phytoplankton register, the latest survey was conducted in 2011 at the Skatanselkä observation point. The amount of phytoplankton can also be estimated indirectly from the concentration of chlorophyll a, which is monitored throughout the Sipoo archipelago water body. In the ecological status classification, chlorophyll results are the results used to classify inland coastal waters (Aroviita et al. 2025). Off Vuosaari, chlorophyll a concentrations have been 7–9 µg/l on average (Table 15-4). The values in the table include results from the spring diatom bloom, which causes large variation, especially at the outer observation points. The averages used in the ecological status classification for mid and late summer (from 1 July to 7 September, Aroviita et al. 2025) in the Sipoo archipelago area fluctuate around the threshold between satisfactory and poor status (threshold 7.5 µg/l, Aroviita et al. 2025). The occurrence of blue-green algae off Vuosaari has been sporadic based on monitoring data and the algae monitoring results from Järvi-meriwiki (2026). However, from time to time in the late summer, a large amount of algae is detected in the wider Sipoo archipelago area. For example, in connection with surveys of the Vuosaari Harbour's dumping area, heavy blue-green algae blooms and oxygen supersaturation were reported in July 2020 off Vuosaari in the areas of Skatanselkä, Granö, Kalkkisaarenselkä and Mölandet, among others, but not in front of the harbour (Luode Consulting Oy 2021).

Further out from Helsinki, chlorophyll a concentrations have been higher on average near treated wastewater discharge areas than in the reference areas, when examined in the long

Copyright © Helen Nuclear Ltd

term. However, the difference has not been consistently large, and in some individual years the reference areas have recorded equally high or higher concentrations, for example, due to drifting algal masses from the outer marine area (City of Helsinki 2024b and 2020). In the long term, basic production has increased off Helsinki from the 1970s to the 2010s, which reflects the development of eutrophication, but in the early 2020s, the level has slightly decreased after the peak years (City of Helsinki 2025b).

15.1.4.2 Aquatic habitats

Habitats are protected by legislation and through various international agreements. Of the protected Natura habitats under Annex I of the Habitats Directive, six are underwater marine habitats: coastal lagoons (1150), large shallow inlets and bays (1160), Boreal Baltic narrow inlets (1650), reefs (1170), sandbanks (1110) and estuaries (1130). The Baltic esker islands (1610) and the Boreal Baltic islets and small islands (1620) also have underwater parts. Of the Natura habitat types protected under the Habitats Directive, coastal lagoons are a priority natural habitat type. They are diverse habitats and important, for example, for the endangered charophyte population, living in sheltered bottoms, as well as for spring spawners. Habitats under the Habitats Directive are habitats with a very small natural range or at risk of disappearing from the territory of the European Union. Habitat data outside Natura areas can be used to describe the state of the area's underwater nature, and areas outside the network can be used, for example, to significantly improve the ecological coherence of the network and the functional connections between Natura 2000 areas.

Vuosaari

The marine area off Vuosaari does not include EMMA areas, i.e. ecologically significant marine underwater areas in Finland, where diverse biota or natural habitats are present and which are of key importance for the preservation of marine biodiversity (Lappalainen et al. 2020). However, several areas classified as locally ecologically significant marine areas (PEMMA) are located in the area, especially around the Kallahti Natura area and Skata, as well as in the coastal area north of the harbour (Figure 15-7).

Of the habitats in the Habitats Directive, reefs and coastal lagoons in particular are present in the marine area off Vuosaari (Figure 15-7). In addition, sandbanks are also present in the Kallahti area and its vicinity. The distribution data of VELMU's habitats under the Habitats Directive are mainly based on statistical modelling, underpinned by various environmental variables and collected field observation data. Located north of Vuosaari Harbour, the Porvarinlahti bay is both a large shallow bay and a coastal lagoon. Westerkullanoja flows into the Porvarinlahti bay, and slightly further north, Krapuoja flows into Kapellviken.

Copyright © Helen Nuclear Ltd

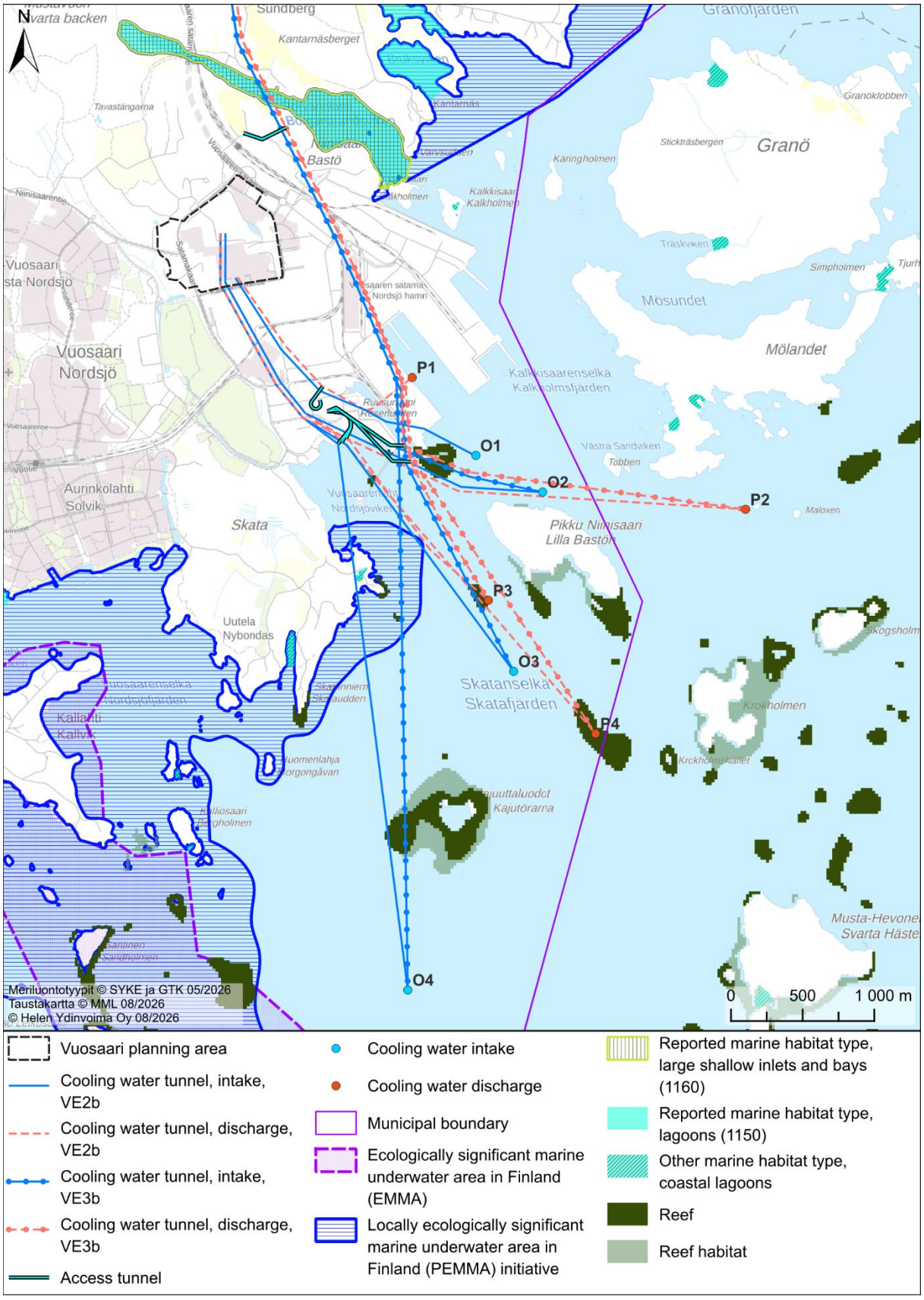


Figure 15-7. The habitats under the Habitats Directive (VELMU map service 2026) are located in the marine area off Vuosaari. The information is based on the modelling of habitats. The figure also shows the different intake and discharge options for cooling water for project options VE2b and VE3b. Intake and discharge points O1 and P1 apply only to project option VE2b.

Copyright © Helen Nuclear Ltd

In the assessment of the endangered status of habitats in Finland, the Baltic Sea habitats assessed as vulnerable (VU) include sheltered charophyte bottoms, eelgrass bottoms, flads and gloe lakes (Kontula & Raunio 2018). Habitats assessed as highly endangered (EN) include *Fucus*-dominated bottoms, red algae bottoms, river mussel bottoms, bottoms dominated by *Monoporeia affinis* and *Pontoporeia femorata* and river estuaries (also a habitat under the Habitats Directive). In the new Nature Conservation Act (9/2023), the protected underwater habitats include eelgrass bottoms and sheltered charophyte bottoms.

Based on the probability of occurrence model conducted in the VELMU project, there is a large area favourable for bladder wrack within the project's impact area, especially along the coastal zones of Kallahti, Skata and the islands in the area (Figure 15-8). The coastal zones of Skata and the islands have also been assessed as possible red algae bottoms (Figure 15-9). Charophyte bottoms occur, according to modelling, mainly near Kallahti on its southwest side (Figure 15-10).

Copyright © Helen Nuclear Ltd

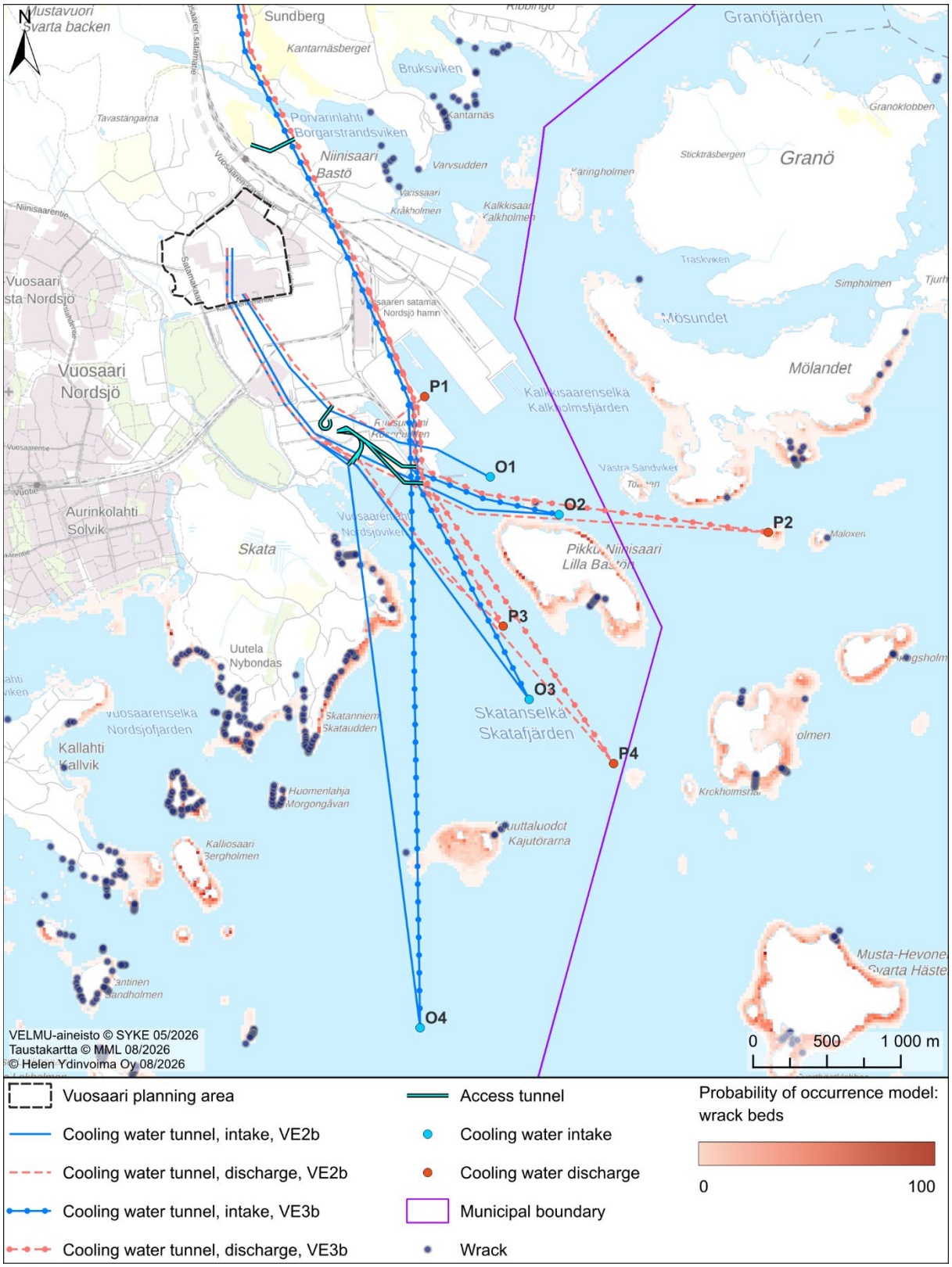


Figure 15-8. Modelled *Fucus*-dominated bottoms and field observations off Vuosaari. The figure also shows the different intake and discharge options for cooling water for project options VE2b and VE3b. Intake and discharge points O1 and P1 apply only to project option VE2b.

Copyright © Helen Nuclear Ltd

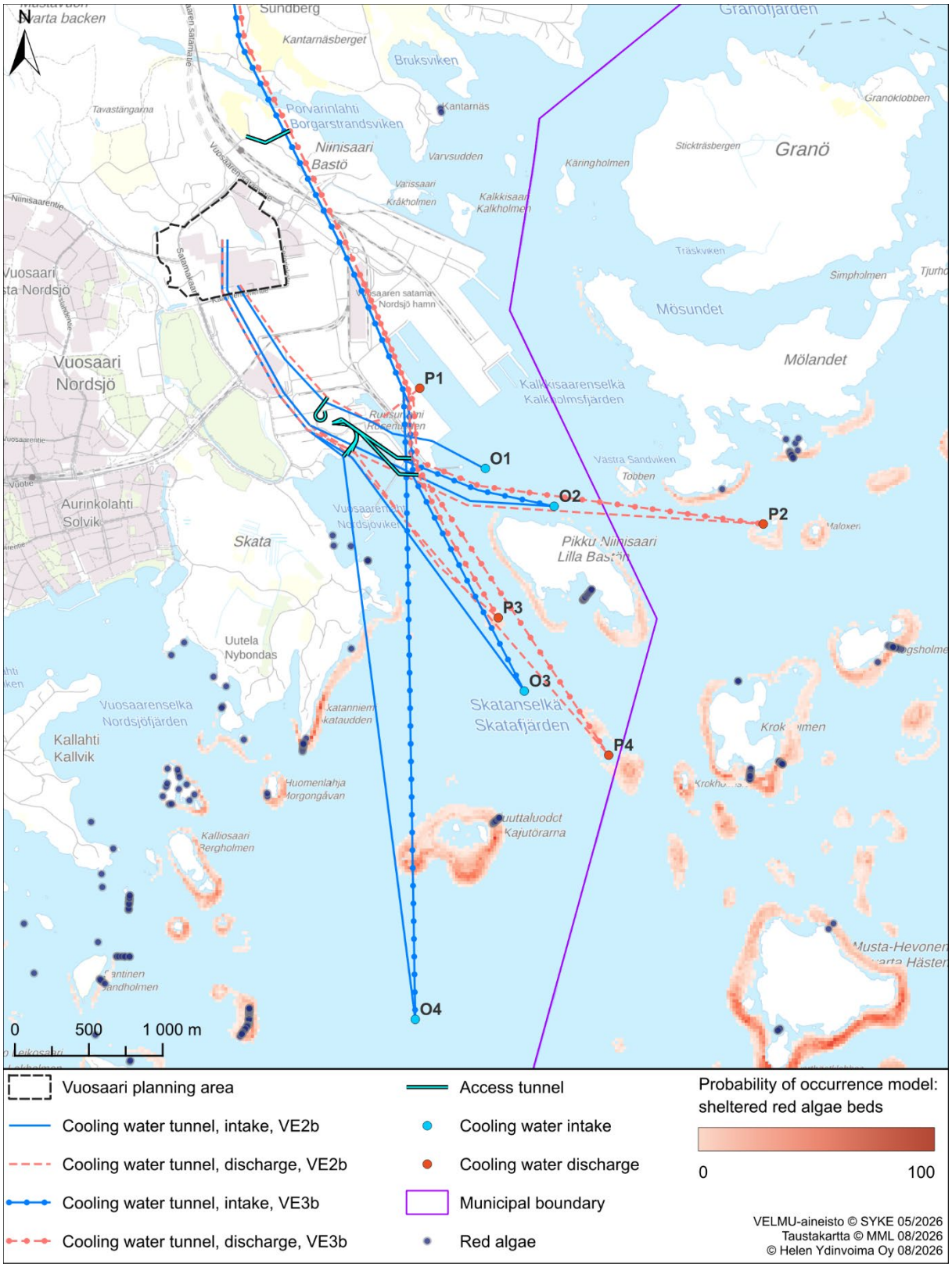


Figure 15-9. Modelled red algae bottoms and field observations off Vuosaari (VELMU map service 2026). The figure also shows the different intake and discharge options for cooling water for project options VE2b and VE3b. Intake and discharge points O1 and P1 apply only to project option VE2b.

Copyright © Helen Nuclear Ltd



Figure 15-10. Modelled charophyte bottoms and field observations off Vuosaari (VELMU map service 2026). The figure also shows the different intake and discharge options for cooling water for project options VE2b and VE3b. Intake and discharge points O1 and P1 apply only to project option VE2b.

Salmisaari

The marine area of Salmisaari–Seurasaari does not include EMMA areas, i.e. ecologically significant marine underwater areas in Finland or areas classified as locally ecologically significant marine areas (PEMMA) (VELMU map service 2026). Of the habitats under the Habitats Directive, only the coastal lagoons habitat is located in the area, which is how the entire Seurasaarenselkä with its bay area is classified.

15.1.4.3 Aquatic flora and endangered species

The areas of the Kallahti Natura area, Skata, Porvarinlahti and Bruksviken off Vuosaari have plenty of underwater nature mapping observations (Figure 15-11), and these are the most diverse areas in terms of aquatic flora based on the Velmu data. Some surveys have also been carried out on the islands in the area, but clearly less than in the coastal area. There are hardly any mapping points in front of the harbour and, on the other hand, the area is largely a dredged harbour and fairway area.

The most commonly encountered algae species in the area are the near threatened (NT) bladder wreck (*Fucus vesiculosus*) (Figure 15-8), rough stonewort (*Chara aspera*) (Figure 15-10), green mermaid's hair (*Cladophora glomerata*), mermaid's tresses (*Chorda filum*) and sea lettuces (*Ulva* spp.), brown algae (*Stictyosiphon* spp.) and brown seaweed (*Dictyosiphon* spp.). Various submerged vascular plants (including pondweeds, spike-rushes, charophytes, tasselweeds and water milfoils) are mainly found in the same areas. There are no endangered algae or vascular plant species in the planned construction areas or in the cooling water discharge area or in their immediate vicinity (Finnish Biodiversity Information Facility 2026).

In the framework of joint monitoring in the Helsinki Metropolitan Area, the state of aquatic vegetation was assessed in 2019 by mapping several coastal zone research lines across the marine area. Based on the results, there is a clear regional variation in the condition of aquatic vegetation: it is poorest in shallow, sheltered inner bays and better in the more open and sheltered habitats of the middle and outer archipelago. (City of Helsinki 2020).

Based on the VELMU surveys in the marine area near Salmisaari, vegetation is scarce, and there are no endangered vascular plant species in the marine area near the project area or in its immediate vicinity (Finnish Biodiversity Information Facility 2026).

Copyright © Helen Nuclear Ltd

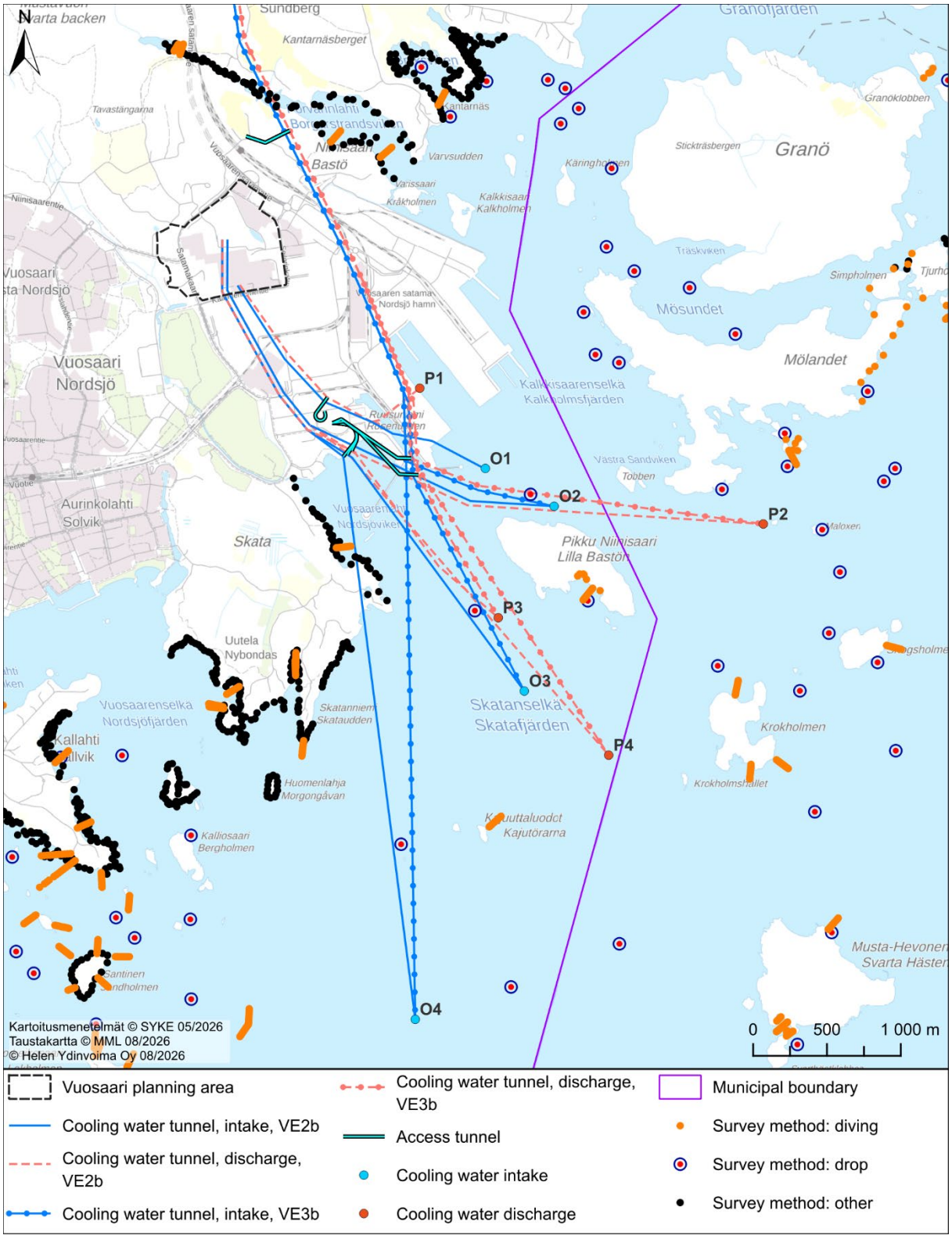


Figure 15-11. Mapping of underwater nature in the marine area off Vuosaari (VELMU map service 2026). The figure also shows the different intake and discharge options for cooling water for project options VE2b and VE3b. Intake and discharge points O1 and P1 apply only to project option VE2b.

Copyright © Helen Nuclear Ltd

15.1.4.4 Benthic animals

Vuosaari

The nearest benthic fauna stations to the Vuosaari Harbour area are Vuosaari marina (Wp190) and Uutela_1743 (Figure 15-12). Sampling at Uutela is from 2009, and samples from the Vuosaari marina station are from 2014. In 2014, the following taxa were observed off Vuosaari: nematodes (*Nematoda*), the invasive spionid worm (*Boccardiella ligerica*), hypoxia-tolerant spionid polychaetes (*Marenzelleria*), oligochaetes (*Oligochaeta*), mud snails (*Ecrobia/Peringia*), the invasive New Zealand mud snail (*Potamopyrgus antipodarum*), the lagoon cockle (*Cerastoderma glaucum*), Baltic macoma (*Macoma balthica*) and ostracods (Ostracoda). (Finnish Environment Institute 2026c, POHJE register).

The benthic fauna station Skatanselkä (111), located off Vuosaari, is included in the continuous monitoring required under the mandatory monitoring programme. The benthic fauna at Skatanselkä have been dominated by Baltic macoma in recent years. Oxygen conditions in the area have been good, and consequently the numbers of benthic animals have been relatively high; in 2019 and 2020, up to 6,000 individuals/m^2. However, the number of individuals in the area has decreased, although biomass has increased. Minor amounts of spionid polychaetes, oligochaetes, as well as individual feather-duster worms and a tanaid have been detected in the sample. A total of 11 taxa were detected, which is in the same order of magnitude as what is usually found in the area. (City of Helsinki 2024b).

Littoral samples from the shallow zone have been collected in the VELMU project in the inter-reef area. The samples have included, among others, spionid polychaetes and Baltic macomas (Finnish Environment Institute 2026c, POHJE register) (Figure 15-12).

Copyright © Helen Nuclear Ltd

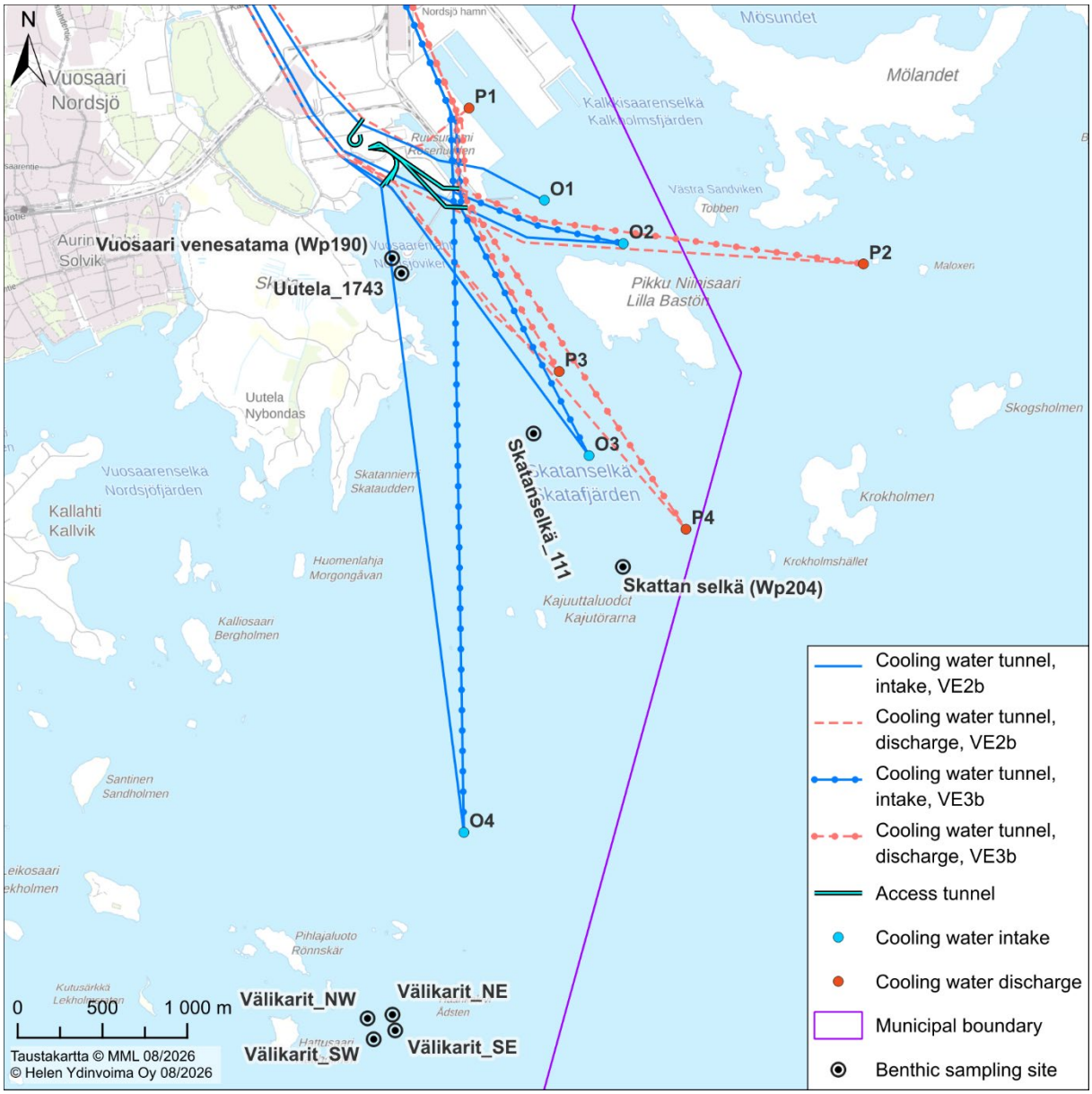


Figure 15-12. Benthic sampling points off Vuosaari (Finnish Environment Institute 2026c, POHJE register). The figure also shows the different intake and discharge options for cooling water for project options VE2b and VE3b. Intake and discharge points O1 and P1 apply only to project option VE2b.

Salmisaari

The closest benthic sampling stations monitored in recent years in front of the Salmisaari power plant are Helsinki_meri_Salmisaari_63 and Lauttasaarenselkä_62. The benthic fauna at the Lauttasaarenselkä_62 station consisted mainly of spionid polychaetes, oligochaetes, zebra mussels and Baltic macomas. The species list at the Salmisaari_63 station was similarly sparse (Finnish Environment Institute 2026c, POHJE register).

The ecological status estimates of the benthic fauna of the water bodies in front of Vuosaari and Salmisaari are presented in chapter 15.1.2.

Copyright © Helen Nuclear Ltd

15.1.5 Stormwater

The Salmisaari planning area (VE1) is a power plant area fully built in its current state (Helen Ltd's Salmisaari power plant). In the current state, stormwater from the area is discharged into the sea through stormwater management systems. The area is almost completely paved and built.

The Vuosaari planning area (VE2) is mainly located on the eastern side of Satamankaari within Helen Ltd's Vuosaari power plant area. In the current state, stormwater from the area is discharged into the sea through stormwater management systems. Other business buildings are located in the northeastern part of the planning area, whose built yard areas are covered by stormwater drainage. The eastern part of the planning area is mainly built. The part of the planning area west of Satamankaari is, in its current state, mostly land that has been altered in terms of land use but remains unpaved.

The Norrberget planning area (VE3) is mainly located on undeveloped wooded land, as well as partly on farmland and residential areas. Currently, stormwaters in the area partly seep into the ground and partly drain into the area's drainage network.

15.2 Impact assessment and methodology

The impacts of the construction phase of the project are mainly limited in time, but they can be significant locally. In the construction phase, impacts are especially caused by blasting and excavation work carried out in the planning areas as well as in connection with possible district heating and cooling water tunnels. Wastewater generated during construction may contain solids as well as small amounts of oil and nitrogen compounds, and it is treated before being discharged into the sea. In options VE2b, VE3a and VE3b, excavation and construction work related to electricity and district heat transmission lines may cause washout of suspended solids also in coastal catchment areas. Deterioration of water quality, increased sedimentation and siltation in channels may further affect aquatic fauna and flora in water systems with low flow rates. In the area of the transmission lines, the acidity risk caused by sulphate soils is mainly small, but the risk may also be high locally, which should be taken into account in more detailed planning, especially for work in the vicinity of streams. During construction of the intake and discharge structures for cooling water tunnels, disturbances to marine sediment and local turbidity, as well as impacts on aquatic life, are likely due to small-scale dredging and possible levelling excavation. Concentrations of sediment contaminants have been low in studies in the fairway areas off Vuosaari, but additional information on sediment quality will be collected in the project for the EIA reporting phase (see chapter 15.2.2).

The thermal load of the cooling water related to the CHP plant, i.e. options VE2b and VE3b, will have a significant impact on the water system in the project. The thermal load can indirectly increase the eutrophication of the marine area and further affect the stratification of the water column, oxygen conditions and the biota. In both project options, the impact would be on the marine area off Vuosaari. The impacts related to the construction of cooling water tunnels also affect the hydro-morphological and bottom conditions of the marine area, as well as possibly biota, in the vicinity of the intake and discharge area. Other impacts on the water system are estimated to be minor, as process and sanitary wastewaters are discharged into the sewage network after treatment. Rainwaters and stormwaters are discharged into the sea through oil and sand separation systems. The EIA report describes the impacts of the thermal load of the CHP plant in the marine area off Vuosaari. Preliminary information on the thermal load and other load is presented in chapter 3.7.1 of the EIA programme. The dispersal and mixing of

Copyright © Helen Nuclear Ltd

the heat discharge in the coastal area off Helsinki is assessed using a 3D flow calculation model. A separate modelling plan is presented in chapter 15.2.1. The impacts of heat discharge on the aquatic ecosystem are evaluated as an expert estimate based on the modelling results.

Small amounts of radioactive substances are generated during normal operation of the nuclear power plant. Water and gases containing radioactive substances are purified and delayed so that their radiation levels are low. Purified gases are released through the power plant's ventilation stack, and purified waters are discharged into the sea along with the cooling water or into the sewage network. Radioactive water is purified before being discharged into the sewage system or the sea, ensuring that emissions remain below all limit values set for them. The impacts on water systems related to radioactive discharges are assessed as part of the EIA procedure.

The assessment of impacts on water systems examines, in particular, how the project affects the ecological status of the coastal water body of the Sipoo archipelago and whether the project could prevent or delay achieving good status in the marine area.

Impacts on aquatic organisms and underwater nature and habitats are also assessed. In the case of benthic fauna and aquatic flora, additional surveys will also be carried out in connection with the project to support the impact assessment (see chapter 15.2.2).

15.2.1 Heat discharge modelling

The modelling calculates the mixing of the cooling water load under the prevailing flow, temperature, salinity and stratification conditions in the target water system (climate change is also taken into account; see the last paragraph of this chapter). The aim is to estimate how much the heat discharge will increase the water temperature and which area the warming affects. The parameters calculated with the model are flow, water temperature and water salinity, as well as the behaviour of the ice cover for winter periods.

The modelling is done as a dynamic calculation for the realised summer and winter periods of recent history, using measurements and/or reanalysis data of weather and Baltic Sea models as the boundary conditions and weather conditions for the calculation. The periods to be modelled are chosen to represent typical conditions and a more difficult than average condition in terms of environmental impact (1/10 a recurrence). The calculation is first performed without the planned nuclear power plant, that is, the current state of the area is calculated. Then, the same time period is recalculated so that the planned nuclear power plant is included in the calculation. The impact of the planned nuclear power plant is estimated as the difference between the current state calculation and the calculation with the planned nuclear power plant. To ensure the functioning of the model, the results of the current state calculation are compared with the temperature, salinity and flow measurements available in the area, taking into account coastal monitoring data and remote sounding data.

Close to the planned water intake and discharge points, the calculation model must have sufficient horizontal and depth resolution. It is estimated here that the sufficient horizontal resolution in the area near the discharge site measured as the surface area of the grid cell is around 4,000 m^2 (corresponding to a square area of about 60x60 m), and the depth resolution of 1 m or more up to a depth level of 10 m. The model accounts for the influence of the outer sea area of the Gulf of Finland on the target area either through boundary conditions or by including the entire Gulf of Finland in the model at a coarse resolution. The model boundaries are placed

Copyright © Helen Nuclear Ltd

sufficiently far from the target area so that the temperature rise caused by the heat discharge can mix and/or cool to the level of the ambient water temperature under all conditions before reaching the model boundary.

As a result of the model, an estimate of the change in water temperature caused by the heat discharge is produced as map images under different conditions. The change in temperature is presented on the map template as monthly averages of the increase in temperature over the calculation periods for those depths where there is an increase in temperature. Map layers can also display durations of exceedance for selected temperature thresholds, illustrating, for example, areas where the surface temperature of the sea exceeds a chosen limit both currently and with the nuclear power plant in operation. In addition to the map illustrations, temperature time series graphs are presented in the model results for points to be selected later. Various statistical quantities can be calculated from time series data.

Climate change must be taken into account when assessing the impact of long-term heat discharges. In addition to the current state, the model calculates two climate scenarios so that one represents intermediate greenhouse gas emissions scenario (SSP2-4.5) and the other high greenhouse gas emissions scenario (SSP4-7.0). The scenarios are initially calculated for 2080, i.e. the current state plus 50 years (from 2030), and only for a single cooling water intake/discharge location combination to be selected later. Due to the data requirements of the flow calculation, the climate scenario is incorporated into the current weather data by raising the air temperature values of the weather data monthly by the difference between the monthly averages of the climate scenario and the current temperature, that is, using the so-called delta change method for air temperature. Wind speeds, air humidity, incoming radiation and cloudiness can be corrected accordingly, if information from the climate scenario data are obtained for these.

15.2.2 Separate surveys in the marine area

The current status information of the project area will be supplemented with studies on benthic fauna, sediment and aquatic flora for the EIA reporting phase, and these data will be used in the impact assessment. The surveys also serve for later monitoring and detecting possible changes caused by the project.

Sediment studies are carried out in the cooling water intake and discharge areas at a total of eight sampling points. Samples are taken from soft bottoms selected on the basis of the material from the multibeam echosounding to be carried out in 2026. The samples are primarily taken with a Gemax twin core sediment sampler or using an equivalent method, allowing the vertical distribution of the sediment. From each sample area, a series of three samples is collected at intervals of approximately 50–100 metres, and the samples are analysed and reported separately. If the samples can be taken from the target depth, they are divided into layers (0–10 cm, 10–30 cm and 30–60 cm), which are analysed separately. If the bottom is too hard for sampling, a Van Veen grab sampler is used, in which case the surface sediment is analysed. Samples are delivered to an accredited laboratory, where key contaminants, nutrients and parameters describing sediment properties are analysed. The results are normalised in accordance with the guidelines of the Ministry of the Environment (Ministry of the Environment 2015) and reported as tables and maps, showing the location and degree of contamination of any potentially contaminated sediments.

Copyright © Helen Nuclear Ltd

Benthic animal samples are taken from eight stations off Vuosaari (cooling water intake and discharge points). Sampling, sample processing and analysis are carried out in accordance with the HELCOM COMBINE guidelines. Three replicate benthic animal samples are taken at each sampling site. Benthic animals are picked from the sifted raw samples preserved in ethanol in the laboratory and transferred to sample jars containing 70–80% ethanol, to wait for species identification and biomass determination, which must be performed by a qualified expert. Benthic animals are identified to species level, and their abundance and biomass are calculated. In addition, the length of the shell of Baltic macomas is measured and they are divided into length classes. From the benthic animal data, the BBI (Brackish Water Benthic Index) and BBI-ELS (ecological quality ratio) are calculated. These indices have been developed to describe the ecological status of benthic animal communities on the soft bottoms along the Baltic Sea coast.

Aquatic vegetation surveys are carried out in July–August 2026 on a total of 18 diving lines, one of which (east of Gränö) serves as a reference area. Three dive lines are in the Kallahdenniemi Natura 2000 area. Species, biovolume (coverage × height) and the occurrence depths of perennial bladder wrack (*Fucus vesiculosus*) and red algae (*Rhodophyta*) are surveyed along the lines. In addition, the growth in length of mermaid's hair (*Cladophora glomerata*) is monitored. The monitored variables reflect eutrophication potentially caused by rising temperatures. The depths of algal zones also indicate water clarity during the growing season and are used directly as quality elements in ecological classification. The dive lines are placed near the sites of previous monitoring surveys in the area, so that longer-term changes can also be assessed.

15.2.3 Stormwater

As part of the assessment of the project's impacts on the water system, the impact of stormwater management on surface waters is assessed. To support the impact assessment, the EIA report phase will clarify the preliminary stormwater discharge sites and the preliminary need for, and implementation of, qualitative and quantitative control measures.

The water system impacts caused by construction site water or stormwater during construction consist mainly of water generated during the treatment of soil and excavations. The assessment of impacts on water systems during construction also takes into account the construction of pipelines and power lines. The EIA report describes the expected quality, treatment and discharge of construction site waters and other stormwaters/excavation waters generated during the excavation of the rock facilities, as well as the estimated environmental impacts caused by their discharge. The preliminary amount of construction site water, discharge routes and treatment will be specified during the EIA reporting phase. Possible contaminated areas are also taken into account in the assessment of surface water impacts during construction. The impact on water systems caused by the project's stormwater and construction site runoff is assessed on the basis of load data.

The assessment of impacts on water systems from stormwater and construction site runoff is carried out by a water system specialist specialising in surface waters and a stormwater specialist.

Copyright © Helen Nuclear Ltd

The table (Table 15-5) below presents the justification for targeting the environmental impact assessment by project option for surface waters (for background on targeting, see chapter 7.2.1).

Table 15-5. Justification for targeting the environmental impact assessment by project option in terms of surface waters. x = the project option for which the assessment is specifically targeted.

	Surface waters	Justification
VE1		No cooling water impacts, but impacts of site waters possible during construction
VE2a		No cooling water impacts, but impacts of site waters possible during construction
VE2b	x	Impacts of cooling water on the marine area and impacts of site water during construction for the plant, as well as for electricity transmission and cooling water routes
VE3a	x	No cooling water impacts, but possible impacts of site waters during construction for the plant and electricity transmission and district heating routes
VE3b	x	Impacts of cooling water on the marine area and impacts of site water during construction for the plant, as well as for electricity transmission, district heating and cooling water routes

Copyright © Helen Nuclear Ltd

16 FISH STOCK AND FISHING

16.1 Current status

16.1.1 Fish stocks and fish stock structure

Fish stock and fish stock structure have been surveyed in the marine area off Helsinki using coastal gillnetting. There are gillnetting sites near the project options, for example, in Seurasaarenselkä and Vuosaari (Vatanen et al. 2019, Happo et al. 2022, Happo et al. 2024). The fish stock has been addressed more extensively in the management plan for the Helsinki-Espoo Fisheries Region (Happo & Janatuinen 2023). More than 60 species of fish have been observed in the marine area off Helsinki and Espoo (Kangas 2007).

The fish spawning and nursery areas have been examined in numerous habitat, spawning and juvenile fish surveys in both the Salmisaari and Vuosaari areas (e.g. Happo & Janatuinen 2023, Vatanen & Haikonen 2012, Happo et al. 2022, 2023, 2024, Vatanen et al. 2012, 2019).

With regard to the Krapuoja water system, the fish stock and fish migration routes have been discussed in the reports on stream waters and in the management plans for fisheries areas (e.g. Happo & Janatuinen 2023, Vantaajoki Fisheries Area 2022, Janatuinen 2011, 2013, Närhi 2011).

16.1.1.1 Salmisaari

Salmisaari is located on the eastern edge of the Lauttasaarensalmi strait and on the south-eastern edge of Seurasaarenselkä in the Lapinlahti estuary. From the point of view of fish stock, the Lauttasaarensalmi strait is a significant route to the spawning areas of Seurasaarenselkä, Lehtisaarenselkä and Laajalahti, as well as to the small streams draining into them (Monikonpuro, Mätäjoki and Haaganpuro). In all the aforementioned streams, the critically endangered sea trout (*Salmo trutta*) spawns (Happo & Janatuinen 2023). The Lauttasaarensalmi strait is also known as an important area for the spring spawning of the Baltic herring (Happo et al. 2023).

The average catch per unit in Seurasaarenselkä gillnetting surveys for 2012–2022 was 2.9–6.2 kg, which can be considered fairly typical for the marine area of the Helsinki Metropolitan Area. The fish species have been dominated by cyprinids, which accounted for 50–72% of the biomass catch. The most abundant cyprinids in biomass were silver bream (*Blicca bjoerkna*) and roach (*Rutilus rutilus*), but bream (*Abramis brama*) and bleak (*Alburnus alburnus*) have also occasionally been abundant. In particular, the share of silver bream has increased in recent years, reflecting the eutrophication of the area. (Happo et al. 2024)

Perciformes have accounted for 27–46% of the biomass catch. The most abundant perciform species have been perch (*Perca fluviatilis*) and occasionally pike-perch (*Sander lucioperca*). Ruffe (*Gymnocephalus cernua*) is also abundant in the catch. Predatory perch (≥ 20 cm) have accounted for 9–21% of the catch. (Happo et al. 2024)

Of other fish species, Baltic herring (*Clupea harengus membras*) is commonly found in catches, while flounder (*Platichthys flesus*) is rare. An invasive species, the round goby (*Neogobius melanostomus*), has been rare in catches since 2018. (Happo et al. 2024)

Copyright © Helen Nuclear Ltd

Fish spawning and nursery areas

Based on the regional boundaries of the modelled juvenile production areas produced in the Velmu project by the Natural Resources Institute Finland, the shores of the Lauttasaarensalmi strait and the southern edge of Seurasaarenselkä are favourable areas for Baltic herring, smelt (*Osmerus eperlanus*), perch and pike-perch, and very favourable for gobies (VELMU map service 2026, juvenile production areas). Based on juvenile fish surveys carried out using the Gulf Olympia method in 2013, 2016, 2019, 2022 and 2023, Baltic herring sac fry and juvenile Baltic herring occasionally occur quite abundantly in the Lauttasaarensalmi strait and the southern part of Seurasaarenselkä (Happo et al. 2023, 2024). In contrast, the occurrence of age-0 perch (hatched during the current year) is low, and no pike-perch juveniles have been recorded. Based on the information provided by commercial fishermen and juvenile fish surveys, the significant spawning areas of spring spawning fish species are located in Laajalahti, Lehtisaarenselkä and the inner Seurasaarenselkä (Happo et al. 2024, Vatanen & Haikonen 2012). Laajalahti has been assessed as an ecologically significant marine underwater area (EMMA) due to, for example, fish spawning areas (Lappalainen et al. 2020).

16.1.1.2 Vuosaari

When considering fish, various types of areas can be found in the Vuosaari marine area. There are shallow and rapidly warming bays in the inner archipelago, where fish migrate to spawn in the spring. There are natural stone/gravel beaches near the coast and further out. The area also has plenty of built-up beaches (Vuosaari Harbour and Vuosaarenlahti marina) and holiday homes.

In 2012, 2014, 2020 and 2022, the average unit biomass catch in the Vuosaari area gillnetting was 4.3–9.2 kg. The catch has been dominated by roach and perch. Of the biomass catches, roach has accounted for 37–47% and perch for 29–39%. Together, roach and perch have accounted for 74–81% of the total catch. The average biomass share of predator perch over 20 cm in length has been 19–30% in the fishing years. (Happo et al. 2022)

Other species commonly caught in the test net catch include the cyprinids silver bream and bleak, and the perciformes pike-perch and ruffe. Among saltwater fish species, Baltic herring has been present in the catch in all fishing years, while flounder has occurred in low numbers. Of invasive species, the round goby has become established in the area's fish stock between 2014 and 2020. (Happo et al. 2022)

When the waters are cool, whitefish (*Coregonus lavaretus*) and sea trout move near the coast and are quite commonly found in the catches of fishermen in the area (e.g. Happo et al. 2024, Mattila et al. 2023). Returns from stocked and marked sea trout are also occasionally recorded in the area (e.g. Happo et al. 2024). Individual sea trout may migrate to the Krapuoja water system that drains into the spawning area (see chapter 16.1.1.3).

Fish spawning and nursery areas

Based on the models of the Natural Resources Institute Finland, the bay areas between Vuosaari Harbour and Sipoonranta are spawning and/or nursery areas favourable or very favourable for pike (*Esox lucius*), perch and pike-perch (VELMU map service 2026, juvenile production areas). In addition to the bay areas, the inner archipelago east of Vuosaari Harbour has been modelled almost entirely as favourable nursery areas for perch and pike-perch. In

Copyright © Helen Nuclear Ltd

terms of Baltic herring juvenile production, the area has been modelled as favourable overall. (VELMU map service 2026, juvenile production areas)

Small streams also flow into the area's bays, and some spring spawners migrate there to spawn. For example, roach have been observed moving up into the Krapuoja water system (Janatuinen 2013). The area contains spawning sites well suited to pike, but surveys show their condition varies considerably, with silting and overgrowth observed in several locations (Karppinen et al. 2016, Happo et al. 2022). Based on an expert assessment of existing data, the spawning areas of spring-spawners are concentrated in shallow, vegetation-rich spawning bays or their estuaries (Figure 16-1). Some of the spawning bays are located in nature reserves (Porvarinlahti and Östersundom nature reserve) and are protected from fishing.

Baltic herring spawns in the archipelago typically in the vegetation zones of hard-bottomed beaches and shallows. In the spring, the spawning begins in April–May when the seawater temperature rises by about 7–10 ºC and continues until the turn of June–July (Ilmarinen & Oulasvirta 2012). Baltic herring typically show fluctuations in stock abundance. There are also changes in spawning areas between the years, but significant spawning areas often remain the same. A total of 51 spawning areas for Baltic herring (Figure 16-1, Ilmarinen & Oulasvirta 2012) were found in surveys conducted in the Vuosaari marine area from 1989 to 2010, extending from the coast to the outer islets. There has been a lot of variation in the use of the spawning areas between the years. In the central and outer archipelago, spawning was low for several years, especially towards the end of the monitoring (Ilmarinen & Oulasvirta 2012). In the middle archipelago, the area where spawn was found quite regularly was the monitoring site of Tiirapaade (B22, Figure 16-1, Ilmarinen & Oulasvirta 2012). In the inner archipelago, similar areas were Matosaari (B6, Figure 16-1) and Käringholmen (B8, Figure 16-1) monitoring sites located less than a kilometre northeast of Vuosaari Harbour, as well as Lingholmstratet and Bässen (C5 and C6, Figure 16-1, Ilmarinen & Oulasvirta 2012) located northeast of Granö in Simsalöfjärden. In the areas east of Vuosaari Harbour, the construction of the harbour (2003–2008) and ship traffic since 2008 have had a negative impact on spawning areas, and no spawning of Baltic herring was observed at the monitoring sites of Matosaari and Käringholmen in 2010 (Ilmarinen & Oulasvirta 2011).

Copyright © Helen Nuclear Ltd

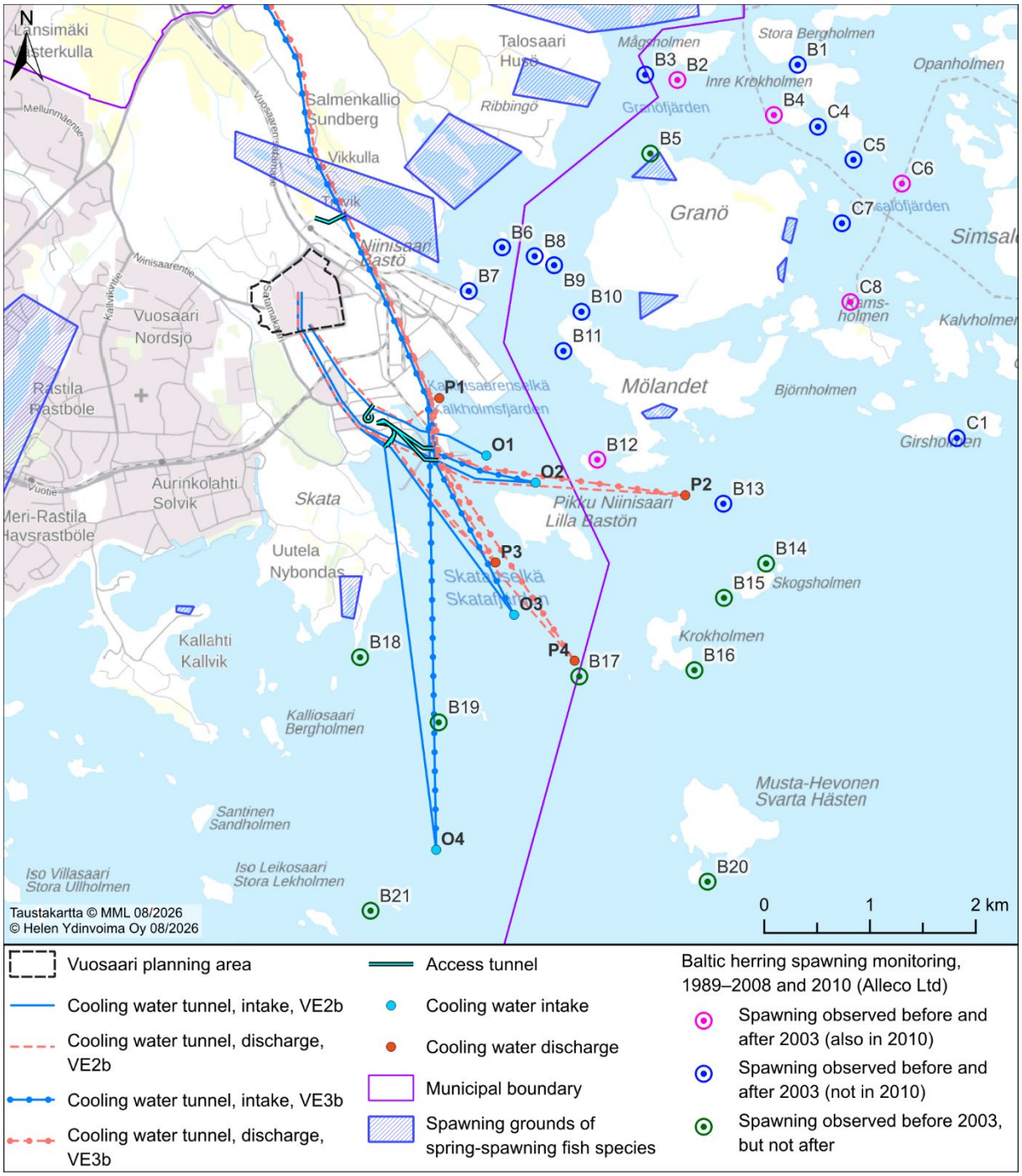


Figure 16-1. The spawning areas of spring spawners on the basis of expert assessment, as well as the spawning areas of Baltic herring on the basis of spawning monitoring carried out in 1989–2008 and 2010 (Ilmarinen & Oulasvirta 2011, Ilmarinen & Oulasvirta 2012). Spawning areas are also located in the outer archipelago and in the outer sea. The figure also shows the different intake and discharge options for cooling water for project options VE2b and VE3b.

Based on the information provided by commercial fishermen, there are several spawning areas of whitefish in the Vuosaari marine area (e.g. Haikonen et al. 2013). However, surveys carried out at the places indicated by fishermen as spawning areas have not found eggs or sac fry, although habitats suitable for spawning can be found in the areas (e.g. Niinimäki et al. 2004, Vatanen & Niinimäki 2005, Vatanen & Haikonen 2007, Happo et al. 2022). In the area of the Gulf of Finland west of Loviisa, the occurrence of marine spawning whitefish sac fry hatched from natural spawning is very rare (Vatanen & Haikonen 2007; VELMU map service 2026,

Copyright © Helen Nuclear Ltd

juvenile production areas). Each year, a large number of 1-year-old migratory whitefish juveniles are stocked into the Helsinki marine area. In the East Helsinki area, fish stocking is made in Aurinkolahti, located on the west side of Uutela. Spawn-ready fish, which fishermen get, for example, from the coast of Uutela in the autumn during the spawning period of whitefish, are likely to originate from stockings.

In the fry seining carried out in the Vuosaari area between 2003 and 2010 (Figure 16-2), a total of 18 juveniles of different fish species hatched in the same summer were observed. In the fry seining catches, gobies, bleak, three-spined stickleback (*Gasterosteus aculeatus*), roach and nine-spined stickleback (*Pungitius pungitius*) were present in abundance. Some juveniles of Baltic herring and perch were present. Juveniles of minnow (*Phoxinus phoxinus*) and lesser sand eel (*Ammodytes tobianus*) were temporarily abundant. The numbers of juveniles of other species have been low. Areas where perch juveniles regularly occurred were, in particular, Vuosaarenlahti (P1), the Granönselkä periphery (P8) and Porvarinlahti estuary (P10), but also areas P2, P4, P5, P7 and P9. Individual pike-perch juveniles were also obtained from the Granönselkä periphery (P4, P5 and P8) and the Porvarinlahti estuary (P10). (Vatanen et al. 2012, Vatanen & Haikonen 2010, 2011)

In the Gulf Olympia catches (Figure 16-2) carried out in 2013 and 2016, the catch mainly consisted of Baltic herring and three-spined stickleback juveniles. Baltic herring sac fry were obtained from all lines, while juveniles over 10 mm long concentrated near the coast in more sheltered and warmer areas. Only a few perch juveniles were caught during the monitoring, and no pike-perch juveniles appeared in the catch at all. (Vatanen et al. 2019)

Copyright © Helen Nuclear Ltd

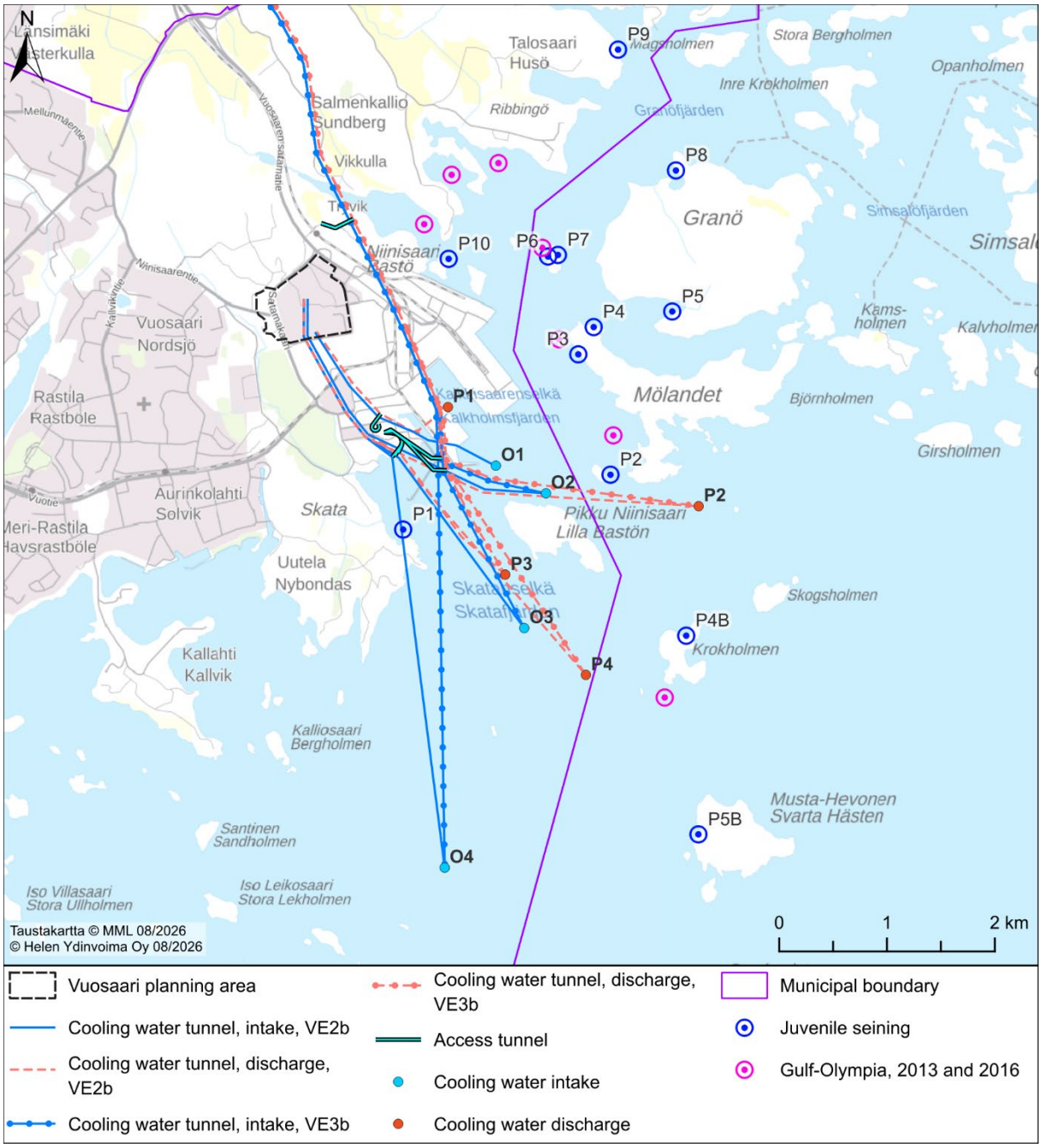


Figure 16-2. Fry seining sites from 2003–2010 and the Gulf-Olympia line in 2013 and 2016 (Vatanen et al. 2012, 2019) (note: discharge points P1, P2, and P4 are marked with a red dot and the fry seining sites with the same labels P1, P2, and P4 but with a circled blue dot). The figure also shows the different intake and discharge options for cooling water for project options VE2b and VE3b.

16.1.1.3 Norrberget

The Krapuoja water system includes several small channels. Krapuoja originates from the Sipoonkorpi area. Several side channels flow into the main channel, such as Roxinoja, Sotunginoja, Kormuniitynoja and Ojangonoja. Krapuoja flows into the sea in Kapellviken on the east side of Vuosaari. (Närhi 2011)

In Krapuoja, observed fish species include trout, river lamprey (*Lampetra fluviatilis*), roach, bleak, three-spined stickleback, perch and pike (Närhi 2011; Janatuinen 2011, 2013). Signal

Copyright © Helen Nuclear Ltd

crayfish (*Pacifastacus leniusculus*), an invasive species (e.g. Haikonen 2008), also occurs in the Krapuoja water system. Krapuoja is an important spawning area for spring spawners. Especially cyprinids migrate from the sea to spawn in the Krapuoja water system (Janatuinen 2011, 2013).

Sea trout has been introduced to the Krapuoja water system at least between 1998 and 2018 (Happo & Janatuinen 2023). The current state of the trout population is not known, as there is no regular monitoring of the area (Happo & Janatuinen 2023). At least on the Kormuniitynoja side, trout sac fry were observed in 2024 and 2025, and in autumn 2025 a possible sea trout redd was observed (Tiusanen, M., personal communication 30 April 2026).

16.1.2 Fishing

Fishing in the Helsinki marine area is monitored with fishing inquiries, and fishing has also been discussed in detail in the management plan for the Helsinki-Espoo fisheries region (Happo et al. 2024, Happo & Janatuinen 2023). Separate surveys have also been conducted in the Vuosaari area (e.g. Mattila et al. 2023).

The Krapuoja water system is classified as migratory fish water system, where angling, ice fishing and lure fishing are prohibited in both the Helsinki-Espoo and Vantaanjoki fisheries region (Kalastusrajoitus.fi, referenced on 29 April 2026).

16.1.2.1 Commercial fishing

Salmisaari

Gillnet and fyke net fishing in the Lauttasaarensalmi strait is prohibited during the open water period (Kalastusrajoitus.fi 2026). Commercial fishermen engage in gillnet fishing in the inner Seurasaarenselkä, Lehtisaarenselkä and Laajalahti (Happo et al. 2024, Happo & Janatuinen 2023).

Vuosaari

In 2022, four fishermen were engaged in commercial fishing in the Vuosaari marine area (Mattila et al. 2023). Of the above-mentioned fishermen, one was a category 1 fisherman (the average turnover of fishing activities over the last three years exceeded 10,000 euros) and three were category 2 fishermen.

Gillnet and fyke net fishing took place in the survey area. The net locations were mainly located near the coast in Granönselkä (Figure 16-3). Baltic herring were caught south of Pikku-Niinisaari and in the outer archipelago using nets. The nearest fyke net sites were located in the traditional areas in Granönselkä and Uutela. There have been relatively few changes in fishing locations over the last 10 years.

The catches of commercial fishermen in the marine area off Vuosaari consist of whitefish, Baltic herring, trout, salmon, perch, pike-perch, pike and cyprinids (Happo et al. 2024, Mattila et al. 2023).

Copyright © Helen Nuclear Ltd



Figure 16-3. Fishing grounds for commercial fishermen in 2022 and 2023 (Mattila et al. 2023, Happo et al. 2024). The figure also shows the different intake and discharge options for cooling water for project options VE2b and VE3b.

16.1.2.2 Recreational fishing

Salmisaari

Based on a recreational fishing survey aimed at fishermen in the marine area off Helsinki and Espoo, both Laajalahti–Seurasaarenselkä and Lauttasaari are popular fishing areas. In the Laajalahti–Seurasaarenselkä area, fishing for pike-perch and perch plays a significant role. In the Lauttasaari area, on the other hand, fishing for Baltic herring, whitefish and perch is important. The fishing methods used are both active rod fishing and passive gillnet fishing.

Copyright © Helen Nuclear Ltd

Fishing for Baltic herring with a herring rig is typical in the Lauttasaarensalmi strait. (Happo et al. 2024, 2023; Happo & Janatuinen 2023)

Vuosaari

Based on a recreational fishing survey aimed at fishermen in the marine area off Helsinki and Espoo, the Kallahdenselkä–Skatanselkä area is a popular fishing area. In the area, a lot of Baltic herring, whitefish, perch and pike-perch are caught. In addition, the second highest number of sea trout is caught in the area, after the outer archipelago of Helsinki and Espoo. (Happo et al. 2024)

Based on a recreational fishing survey targeted at owners of seaside properties, 51% of households in the area engaged in fishing in 2022. Responding households reported that they fished on average about 20 days per household. Most recreational fishing took place between May and September. In contrast, winter fishing in the survey area was very limited. (Mattila et al. 2023)

The most common form of fishing in the survey area was gillnet fishing, but rod fishing, angling and wire fish-trap fishing were also widely practised. Survey respondents' recreational fishing was concentrated mainly around the islands of Granö and Mölandet (Figure 16-4). (Mattila et al. 2023)

Copyright © Helen Nuclear Ltd

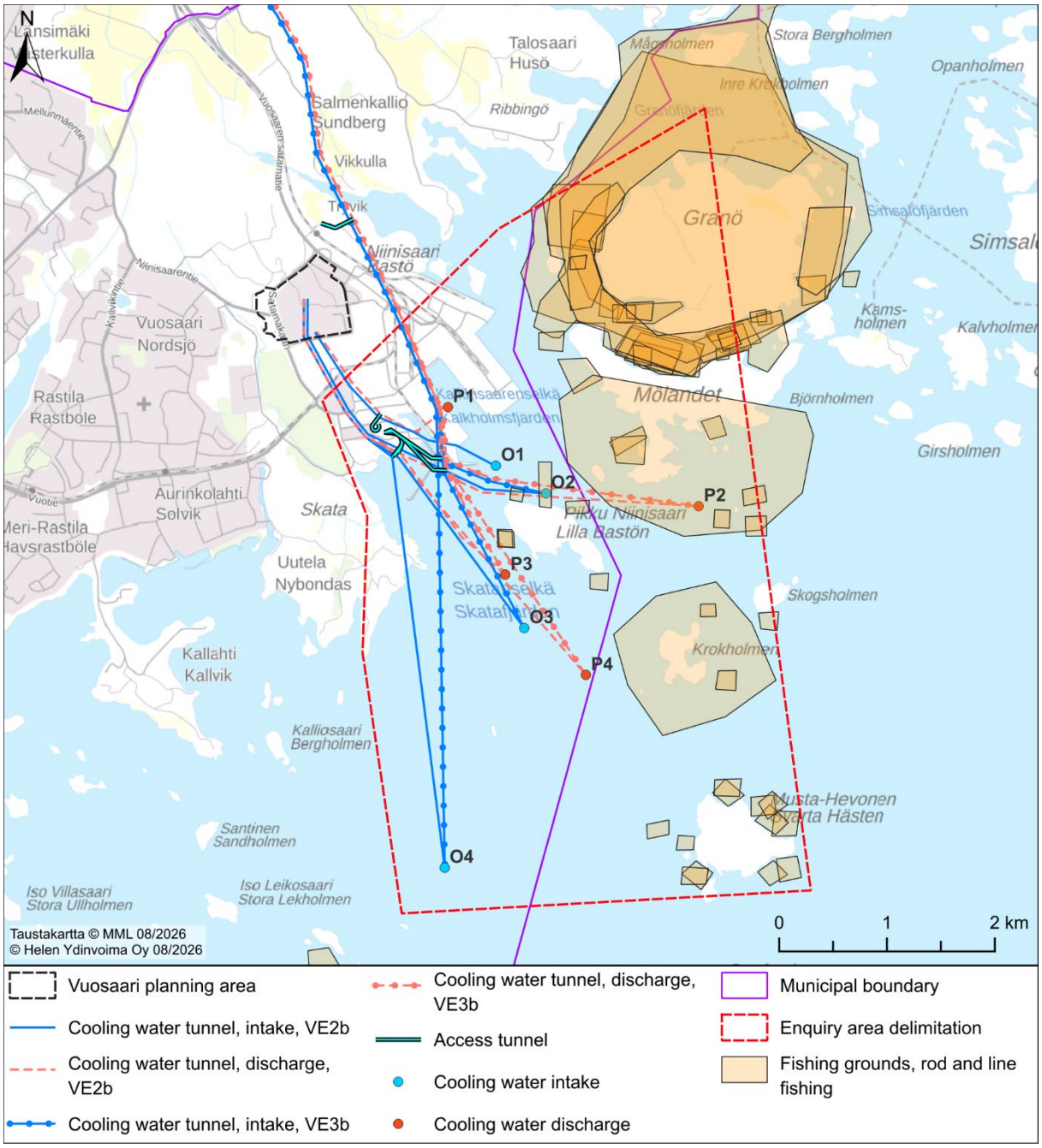


Figure 16-4. Rod fishing areas used by recreational fishers in the Vuosaari marine area in 2022 (Mattila et al. 2023). The figure also shows the different intake and discharge options for cooling water for project options VE2b and VE3b.

16.2 Impact assessment and methodology

The impact assessment is carried out as an expert assessment based on existing material, research literature, project description and separate fisheries studies produced in this project. The impact assessment also uses an assessment of the impacts on surface waters, as well as a cooling water thermal load dispersion model drawn up to support it.

Project options VE2b and VE3b cause fisheries impacts on the marine area off Vuosaari during both construction and operation (Table 16-1). Impacts arise during construction, for example, from extensive excavations, construction site waters and water construction. During operation,

Copyright © Helen Nuclear Ltd

the intake and discharge of cooling water affect the marine area off Vuosaari. In addition, possible underground cable connections intersect with the Krapuoja water system in both options.

Project option VE3a also has potential fisheries impacts (Table 16-1). In this option, the impacts are related to the intersection of the district heating line and underground cable routes with the Krapuoja water system.

In project options VE1 and VE2a, no measures affect the marine areas or flowing waters, and therefore no fisheries impacts occur (Table 16-1).

The table (Table 16-1) below presents the justification for targeting the environmental impact assessment by project option for fish stock and fishing (for background on targeting, see chapter 7.2.1).

Table 16-1. Justification for targeting the environmental impact assessment by project option in terms of fish stock and fishing. x = the project option for which the assessment is specifically targeted.

	Fish stock and fishing	Justification
VE1		No measures are directed at the marine areas or flowing waters.
VE2a		No measures are directed at the marine areas or flowing waters.
VE2b	x	The marine area off Vuosaari is subject to fisheries impacts both during construction (e.g. excavation, intake and discharge structures, site waters) and during operation (intake and discharge of cooling water). In addition, there may be possible impacts on the Krapuoja water system.
VE3a	x	Possible impacts on the Krapuoja water system.
VE3b	x	The marine area off Vuosaari is subject to fisheries impacts both during construction (e.g. excavation, intake and discharge structures, site waters) and during operation (intake and discharge of cooling water). In addition, there may be possible impacts on the Krapuoja water system.

Several fisheries surveys will be carried out in the Vuosaari marine area during 2026 as background material for the impact assessment of the EIA procedure.

The following surveys are carried out in connection with water construction:

- Commercial fishermen are interviewed.
- A recreational fishing survey is carried out for owners of seaside properties.
- The habitats of water intake and discharge areas and their vicinity are mapped from the point of view of fish spawning and juvenile production. Side-scan sonar and underwater imaging are used as mapping methods.

The following surveys are carried out as background material for the assessment of the impacts during operation:

Copyright © Helen Nuclear Ltd

- Echosounding survey of Baltic herring schools in water intake areas in the spring and autumn
- Gulf Olympia juvenile fish survey in water intake areas
- Surveys of the fish community structure around the cooling water discharge areas at three different times
    - 45 gillnet nights in May during the cool water period
    - 45 gillnet nights in August during the warm water period
    - 45 gillnet nights in October–November during the cool water period

In addition, a field inspection is carried out at stream sites that intersect district heating and underground cable lines. If a suitable flowing water habitat for juvenile trout is located in intersecting areas or their immediate vicinity, an electrofishing survey is carried out there.

The impact assessment is carried out by a biologist specialised in fish and fisheries or a fish and fisheries expert with equivalent training.

Copyright © Helen Nuclear Ltd

17 VEGETATION AND HABITAT TYPES

17.1 Current status

17.1.1 Salmisaari

The Salmisaari planning area is located within the built environment of the Salmisaari power plant area. Based on the aerial photo review, there is only very little vegetation in the area. From the edges of the planning area (outside the fenced power plant area), observations have been recorded of plant species common in urban environments (Finnish Biodiversity Information Facility 2026). The closest known valuable plant sites and endangered habitats are located approximately 100 metres away, on the other side of Länsiväylä in the Lapinlahti park area (City of Helsinki 2026c) (Figure 17-1).



Figure 17-1. Helsinki's valuable plant and forest sites located in the surroundings of the Salmisaari planning area.

17.1.2 Vuosaari

The Vuosaari planning area is located in the built environment of the Vuosaari power plant area and the harbour area and, to a small extent, outside it to the west of Satamakaari, on a dumping area of surplus soil and a snow reception point. Based on the aerial photo review, there is only very little vegetation in the planning area.

A nature survey was carried out at the coal storage area in the northern part of the planning area in 2024 (AFRY Finland Oy 2024). In the survey, large hop trefoil was found in a few habitats, which is a species that has been assessed as near threatened (NT) (Hyvärinen et al. 2019). Of the invasive species determined as harmful, garden lupin and Canadian golden-rod were observed (Vieraslajit.fi 2026). In the part of the planning area located west of Satamakaari, the harmful regulated invasive species observed include garden lupin, Himalayan balsam, ramanas roses, goldenrods, Sakhalin knotweed and willow spiraea (City of Helsinki 2026c, Finnish Biodiversity Information Facility 2026). From the planning area (mainly outside the fenced harbour and power plant area), observations have been recorded of plant species common in urban environments (Finnish Biodiversity Information Facility 2026).

The closest known valuable plant sites are located immediately west of the planning area (City of Helsinki 2026c). These include the rock southeast of Mörnäs, south of Niinisaarentie, and the central section of the Niinisaarentie rock formation north of Niinisaarentie. An endangered habitat, acid rock meadows, is present in both areas (Figure 17-2).

In project option VE2b, the planned electricity transmission connection is located partly in forest areas and partly in fields between Vuosaari and Itäsalmi substation. For the main part of the planned route, both the overhead lines (options Vu-Is1 and Vu-Is2) and the underground cable (option Vu-Is3) are located on the current power line route. In the southern part, north of Niinisaarentie, the overhead line would be located about 500 metres within the valuable plant site in the central part of the Niinisaarentie rock section, where the endangered habitat, acid rock meadows, occurs, and which is part of the Mustavuori set of habitats of high ecological value (City of Helsinki 2026c) (Figure 17-2). Plenty of plant observations have been recorded in the area (Finnish Biodiversity Information Facility 2026). Of the endangered vascular plants, the vulnerable (VU) yellow bedstraw and the near threatened (NT) cat’s foot and maiden pink have been observed. To the north, the electricity transmission connection is located in nature reserves and the Natura 2000 area of the Mustavuori grove and the waterfowl habitat in Östersundom, which are discussed in chapter 19.

Vegetation sites in the northern part of the planned electricity transmission connection within the City of Vantaa include the grove on Västerkulla rock hill immediately east of the underground cable route, as well as the heath forest east of the Långmossen bog and the core area of the green shield moss, near which on the eastern side both the overhead line and the underground cable are located (City of Vantaa 2026b). (Figure 17-2). The overhead line option Vu-Is2 is also located north of the Vantaa Energia’s power plant area, near the core area of the green shield moss at Långmossebergen.

In project option VE2b, valuable coastal plant sites are located around the planned cooling water intake and discharge points, e.g. in Pikku Niinisaari, the Uutela area and east and south of Kallahdenniemi (City of Helsinki 2026c) (Figure 17-2). They are mainly located in nature reserves and areas of the City of Helsinki Nature Conservation Programme.

Copyright © Helen Nuclear Ltd

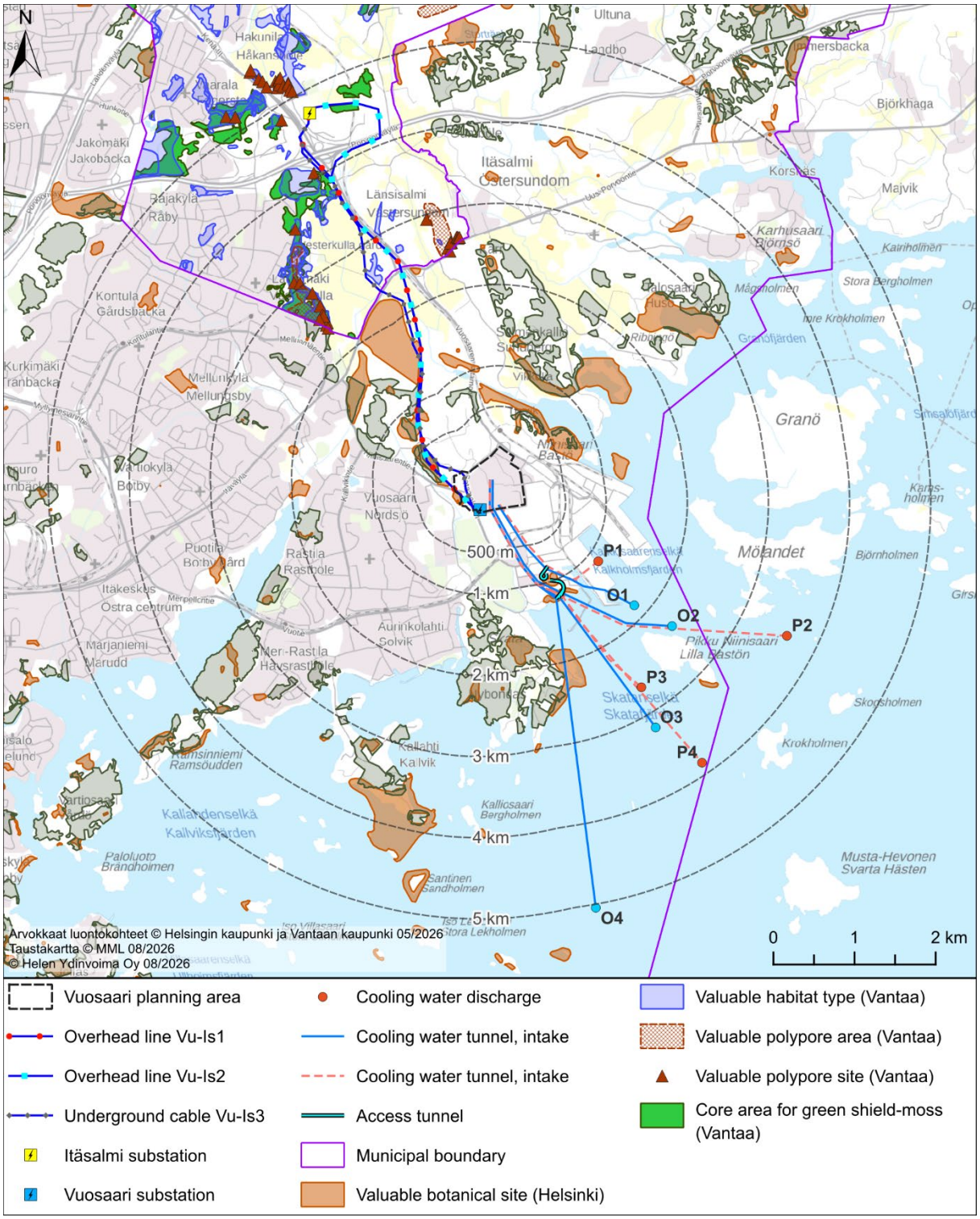


Figure 17-2. Helsinki's valuable plant and forest sites, as well as Vantaa's valuable habitat and polypore sites and core areas of green shield moss located in the vicinity of the Vuosaari planning area in options VE2a and VE2b.

17.1.3 Norrberget

The Norrberget planning area is located in rocky forest terrain, a field and in an area with a few detached houses north of the Porvoonväylä road. Valuable plant sites partly located in the planning area are the Norrberget bog and the western hillside of Norrberget (City of Helsinki 2026c) (Figure 17-3 and Figure 17-4). In the forested part of the planning area, there are small-

scale bogs and a streamlet, which represent endangered habitats and whose representativeness has been assessed mainly as good (City of Helsinki 2026c). The streamlet has been assessed as a streamlet depression in its natural state, surrounded by herb-rich heath forest and bordered by a stream grove a few metres wide (City of Helsinki 2017). In addition, the endangered habitats are represented by the maple forest located on the southern edge of the planning area and the Krapuoja stream with its grove located on the western edge, but their representativeness has been assessed as poor. The Finnish Forest Centre (2026) has delimited two small-scale bogs with slight forest cover as particularly important habitats under the Forest Act (Section 10) in the northern edge of the planning area.

The forest area within the planning area is part of Norrberget's polypore area, which covers just under 80 hectares, with its boundary extending about one kilometre northeast of the survey area (City of Helsinki 2026c). The boundary is based on a 2018 survey, which found the area to be of significant importance for polypore and corticioid species favouring pine deadwood and both main conifer species. Polypore species assessed as near threatened (NT) and recorded in the planning area at that time (Hyvärinen et al. 2019) included *Sidera vulgaris*, *Antrodiella citrinella*, *Dichomitus squalens* and *Poriella subacida*. The eastern part of the forest area of the planning area is included in the delimitation of a valuable forest site north of the motorway (City of Helsinki 2026c) (Figure 17-3 and Figure 17-4).

Plenty of plant observations have been recorded in the planning area (Finnish Biodiversity Information Facility 2026). Of the endangered vascular plants, the vulnerable (VU) yellow bedstraw and the near threatened (NT) maiden pink have been observed. Of the invasive species (Vieraslajit.fi 2026), garden lupin has been observed along roads in the western part, and Himalayan balsam along the banks of the Krapuoja stream.

The overhead line option No-Is1 and the underground cable option No-Is2 for electricity transmission in project option VE3b are located near the core area of the green shield moss in the southern part of the Ojanko area (City of Vantaa 2026b) (Figure 17-4). The southern road connection planned for the Norrberget area is located south of Porvoonväylä, close to the valuable plant sites, Kusas and Mutars rock meadows, and passes briefly through the valuable polypore area of the Gumbölen forest, also bordering the boundary of a valuable forest site (Figure 17-4). The underground pipe section of the planned district heat transmission option KL2 crosses Krapuoja at the border of Vantaa and Helsinki (City of Helsinki 2026c). The tunnel entrance of option KL2 and the access tunnel of option KL1 are located in the southern part of the Länsisalmi forest, close to a valuable polypore site (City of Vantaa 2026b) (Figure 17-4).

In project option VE3b, valuable coastal plant sites are located around the planned cooling water intake and discharge points, e.g. in Pikku Niinisaari, the Uutela area and east and south of Kallahdenniemi (City of Helsinki 2026c) (Figure 17-4). They are mainly located in nature reserves and areas of the City of Helsinki Nature Conservation Programme.

Copyright © Helen Nuclear Ltd

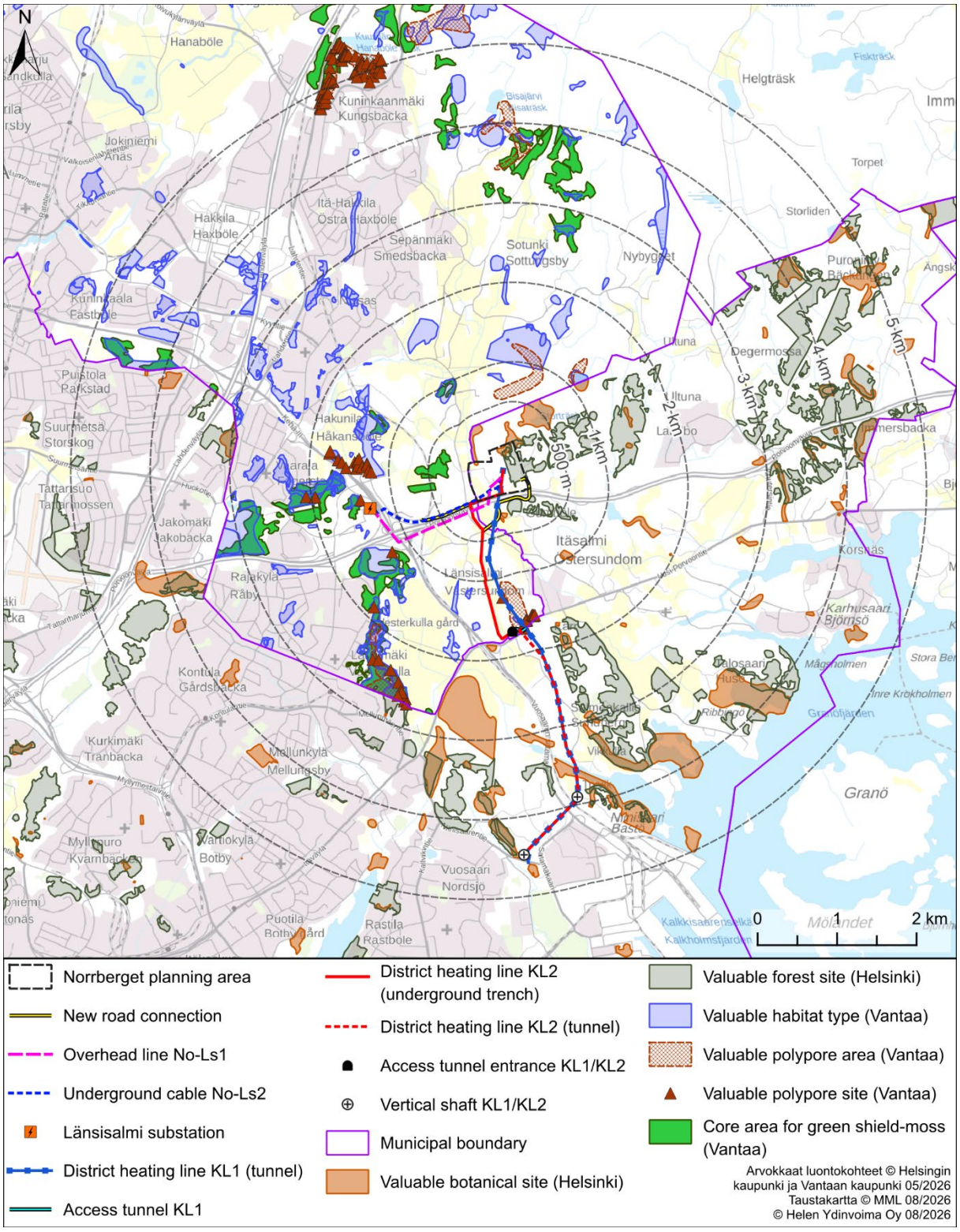


Figure 17-3. In the Norrberget planning area in option VE3a and in its vicinity, there are Helsinki's valuable plant and forest sites, as well as Vantaa's valuable habitat and polypore sites and core areas of green shield moss.

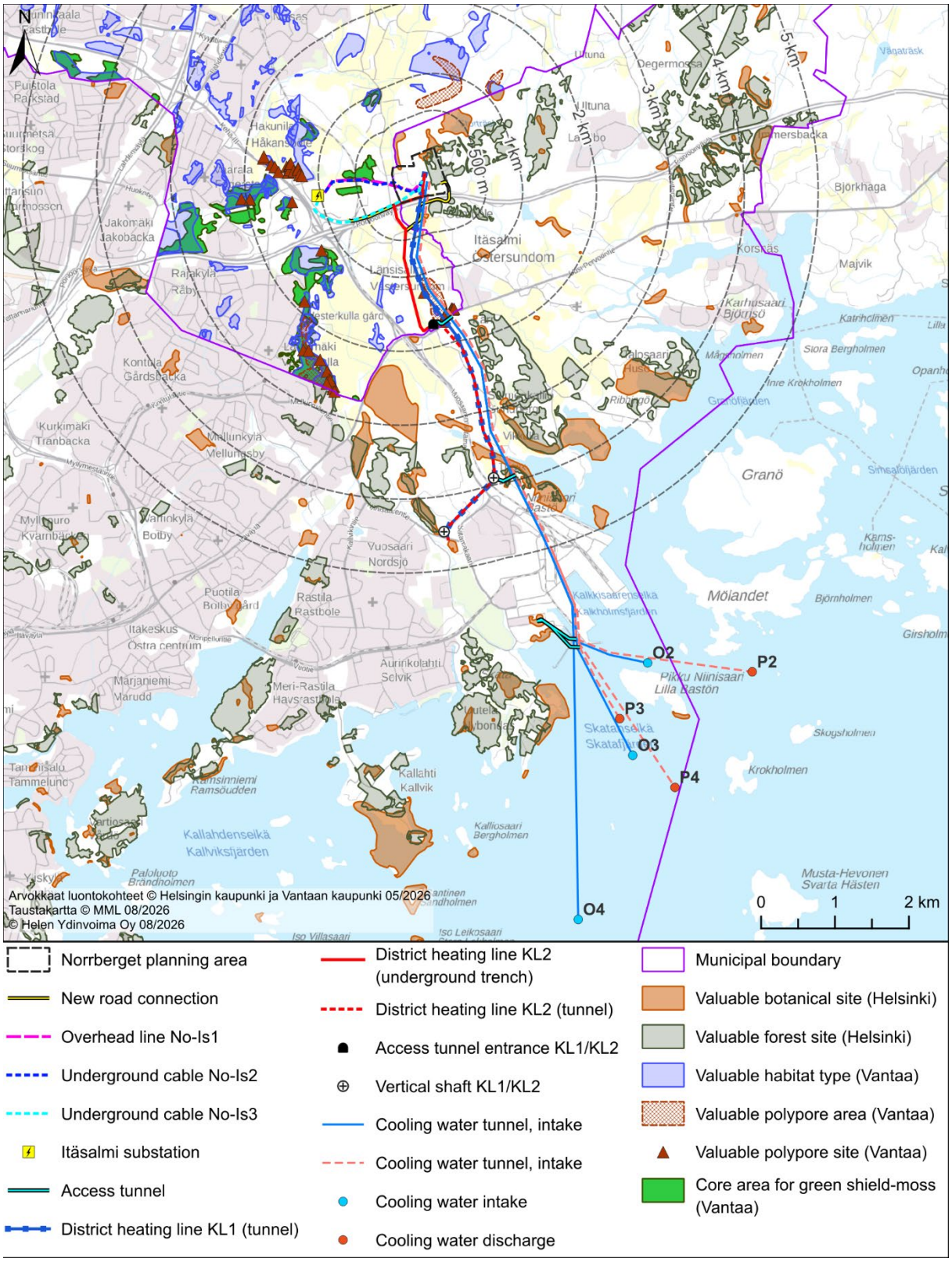


Figure 17-4. In the Norrberget planning area in option VE3b and in its vicinity, there are Helsinki's valuable plant and forest sites, as well as Vantaa's valuable habitat and polypore sites and core areas of green shield moss.

Copyright © Helen Nuclear Ltd

17.2 Impact assessment and methodology

The impacts of the project on vegetation and habitats are likely to be mainly direct impacts due to construction in the planning area and in the areas of any associated transmission connections. The Salmisaari and Vuosaari planning areas are located in the built-up power plant areas and, in the Vuosaari option, also in an area that has otherwise changed its natural state, so the impacts are minimal.

The electricity transmission connection of the Vuosaari project option VE2b, as well as the Norrberget planning area and related transmission connections are located in partially forested areas, so the direct impacts of construction are greater, as it is necessary to clear trees and other vegetation from the construction areas, as well as to carry out earthmoving work and excavation. The strongest and most permanent impacts are likely to affect the Norrberget planning area, where the current forested land will be transformed into a built-up area.

For the electricity transmission connection and the possible district heat transmission connection section implemented as an underground pipe in Norrberget, trees will be cleared from the forested sections, but other vegetation will be partially preserved and partially restored after construction. In the case of arable land, the vegetation will primarily remain unchanged. At this stage, the heat transmission and cooling water tunnels of Vuosaari and Norrberget are not estimated to have an impact on overhead vegetation and habitats other than at the entrances and vertical shafts. The impacts of cooling water discharge on the vegetation of the beaches are likely to be minor, but the impacts are examined in the EIA report based on dispersion modelling. Impacts on underwater vegetation and habitats are assessed in connection with the impacts on water systems.

The EIA programme mentions in the text and maps the valuable vegetation sites of the City of Helsinki (2025) and the City of Vantaa (2025) in the planning areas and their surroundings, as well as the particularly important habitat patterns delimited by the Finnish Forest Centre (2026) and the most significant species observations (Finnish Biodiversity Information Facility2026). The information is reviewed in the EIA report, and, if necessary, the assessment area is expanded to correspond to the project's impact area. More detailed descriptions are provided for the affected sites. In addition, nature surveys have been carried out in connection with recent EIA projects, concerning parts of the project areas and their environments (e.g. Vantaan Energia Oy 2025, Sitowise Oy 2025). At the EIA reporting stage, any nature surveys carried out for land use planning purposes are also reviewed.

During the summer of 2026, vegetation and habitat surveys will be carried out for the various electricity transmission options of the Vuosaari option VE2b, as well as for the Norrberget planning area and the related electricity transmission options and the underground pipe option for heat transmission. In addition, the locations of the tunnel entrances and vertical shafts are examined. In the Salmisaari and Vuosaari planning areas, it is only examined whether there are notable plant species or invasive species. The results are reported in the EIA report.

The vegetation and habitat survey maps the protected habitats under the Nature Conservation Act (Sections 64 and 65) and the Water Act (Chapter 2, Section 11), as well as the habitats assessed as endangered and near threatened in the latest assessment of threatened habitat types in Finland (Kontula & Raunio 2018). The habitats under the Habitats Directive and the protected habitats under the Nature Conservation Act are identified and their natural state is assessed in accordance with the inventory instructions (Airaksinen & Karttunen 2001, Keskinen et al. 2024). For the transmission lines planned in the area of the City of Vantaa, the

Copyright © Helen Nuclear Ltd

city has requested that the natural habitats of the built environment are also mapped (Jalkanen et al. 2026) and the ecological status of the habitats is assessed for ecological compensation (Jalkanen et al. 2025).

In addition, the vegetation and habitat survey carried out in the summer of 2026 records observations on plant species assessed in the latest assessment of threatened species in Finland (Hyvärinen et al. 2019) as endangered or near threatened or regionally endangered (Ministry of the Environment & Finnish Environment Institute 2021), on plant species protected by the Nature Conservation Act and on invasive species (Vieraslajit.fi 2026). In addition, the habitats under the Habitats Directive will be mapped from the edges of the current power line at the Mustavuori grove and at the electricity transmission connection located in the Natura 2000 area of the Östersundom waterfowl habitat.

The EIA report assesses the impacts that the implementation of the project and its different options will have on vegetation and habitats. Nature surveys and impact assessment are carried out in accordance with the *Ecological Surveys and Ecological Impact Assessment* (Luopas) guide (Mäkelä & Salo 2024). The assessment takes into account both direct and indirect impacts and assesses their significance. Other impact assessments and modelling carried out during the EIA reporting phase will be used in the assessment. Recommendations are made to prevent and mitigate adverse impacts.

The impact assessment is carried out by biologists with experience of similar impact assessments and who have previously participated in impact assessments for projects in the same area.

The table (Table 17-1) below presents the justification for targeting the environmental impact assessment by project option for vegetation and habitats (for background on targeting, see chapter 7.2.1).

Table 17-1. Justification for targeting the environmental impact assessment by project option in terms of vegetation and habitats. x = the project option for which the assessment is specifically targeted.

	Vegetation and habitat types	Justification
VE1		The planning area is located in the built-up power plant area.
VE2a		The planning area is located in a built or modified area.
VE2b	x	The planning area is located in a developed or modified area, but it is necessary to clear vegetation along the electricity transmission lines.
VE3a	x	The planning area is located in a forested area, and it is necessary to clear vegetation along the transmission lines.
VE3b	x	The planning area is located in a forested area, and it is necessary to clear vegetation along the transmission lines.

Copyright © Helen Nuclear Ltd

18 FAUNA AND BIRDS

18.1 Current status

18.1.1 Species listed in Annex IV (a) of the EU Habitats Directive

Several species listed in Annex IV (a) of the Habitats Directive can be encountered in the project area. The planning areas of Salmisaari and Vuosaari (possibly excluding the part west of Satamakaari) are unlikely to have habitats suitable for any of the species listed in the Annex. In contrast, the Norrberget planning area, as well as the electricity and heat transmission connections related to the Vuosaari and Norrberget options, include habitats assessed as suitable for several species listed in the Annex. The nearest sites delineated in the datasets of the cities of Helsinki and Vantaa are shown in the figures in the following chapter (Figure 18-1, Figure 18-2, Figure 18-3 and Figure 18-4).

Siberian flying squirrel

From eastern Helsinki, at least as far east as Porvoo, there is an area close to the coast where little or no Siberian flying squirrel sightings are known, despite suitable habitats. About two kilometres west of Norrberget, there are known Siberian flying squirrel sightings (Finnish Biodiversity Information Facility 2026), so the occurrence of the species in Norrberget is possible.

Bats

Almost all bat species that regularly occur in Finland can be seen in the Helsinki and Vantaa regions. In the Norrberget planning area and around the electricity and heat transmission routes related to the Vuosaari and Norrberget options, there are several bat areas assessed as significant (Figure 18-3, Figure 18-4). In the eastern and western parts of the Norrberget planning area, there are three foraging habitats or ecological corridors important for bats (category II bats), as well as two other areas used by bats (category III bats) (City of Helsinki 2026c). The pond located north of the Vuosaari golf course near the Vuosaari planning area was classified as a class II bat area in the 2025 report (Vantaan Energia Oy 2025). Of the other bat areas, the most noteworthy are the Vartiokylänlahti and Uutela areas to the south and southwest of Vuosaari, as well as small bat areas in the Länsisalmi and Porvarinlahti areas.

Scarce fritillary

In the survey area, especially in Norrberget, there are sunny heath forests suitable for the species, which may be well suited to the main food plant of the species' larvae, common cow wheat. There are also observations from the Norrberget area in the laji.fi database of adult specimens (Finnish Biodiversity Information Facility 2026).

Moor frog and other amphibians and reptiles

Moor frogs have been observed in the area under investigation, at least in the area north of the Vuosaari golf course (City of Helsinki 2026c, Vantaan Energia Oy 2025 and Finnish Biodiversity Information Facility 2026). In addition, the electricity and heat transmission lines are connected to the reptile and amphibian sites of Mustavuori, Porvarinlahti and Kalkkisaari in the City of Helsinki's nature information system (Figure 18-2). The area is an important wintering area for vipers and also hosts sparse populations of blindworm.

Copyright © Helen Nuclear Ltd

18.1.2 Birds

The survey area includes several delimitations of significant bird areas. Protected areas are discussed in chapter 19. Here, only the internationally, nationally and regionally important bird areas (IBA, FINIBA, MAALI; BirdLife Finland ry 2026 a–c) as defined by BirdLife, as well as bird area delineations from the information systems of the cities of Helsinki and Vantaa (2026), are addressed. The value of the areas consists mainly of the nesting woodland bird species and archipelago bird sites (near the planning areas). In addition, the Porvarinlahti area has regional value as a resting and feeding area during bird migration. Several of the delimitations overlap with protected areas and Natura areas.

The IBA, FINIBA and MAALI areas are listed in the following table (Table 18-1). They, along with the important bird areas in the cities, are shown on maps in the following figures (Figure 18-1, Figure 18-2, Figure 18-3 and Figure 18-4).

Copyright © Helen Nuclear Ltd

Table 18-1. Important Bird and Biodiversity Areas (IBA) located within a ten-kilometre radius of the planning areas or electricity and heat transmission routes, and nationally (FINIBA) or regionally important (MAALI) bird areas located within a five-kilometre radius.

Name	Designator	Type	Nearest site	Distance and direction
Helsinki–Espoo wetlands	FI1302	IBA	Salmisaari	4.2 km NW
Shallows off Helsinki	FI45169	IBA	Salmisaari	3.7 km SSE
The Sipoonkorpi area	210231	FINIBA	Norrberget	2.7 km NE
Islets off Helsinki	210265	FINIBA	Salmisaari	1 km N
Östersundom waterfowl habitats	210315	MAALI	Electricity transmission tunnel in Vuosaari and the heat transmission and cooling water tunnels in Norrberget.	in the area / pass beneath
Forests of East Helsinki	211236	MAALI	Electricity transmission tunnel in Vuosaari and the heat transmission and cooling water tunnels in Norrberget.	in the area / pass beneath
The Sipoonkorpi region	210328	MAALI	Norrberget	in the area
East Helsinki Archipelago	211214	MAALI	Vuosaari	4.6 km SW
The Kallahdenniemi archipelago area	210089	MAALI	Vuosaari	2.7 km SSW
Sipoo inner archipelago	211219	MAALI	Vuosaari	1.9 km E
Sipoo middle archipelago	211221	MAALI	Vuosaari	2.6 km SE
Espoo–Helsinki border area archipelago	211209	MAALI	Salmisaari	400 m NW
Helsinki Central Park	211239	MAALI	Salmisaari	2.9 km NNE
Ourit	210087	MAALI	Salmisaari	3.6 km SE
Espoo–Helsinki shallows	210793	MAALI	Salmisaari	4.9 km SW
Laajalahti	210103	MAALI	Salmisaari	4.5 km NW

Copyright © Helen Nuclear Ltd

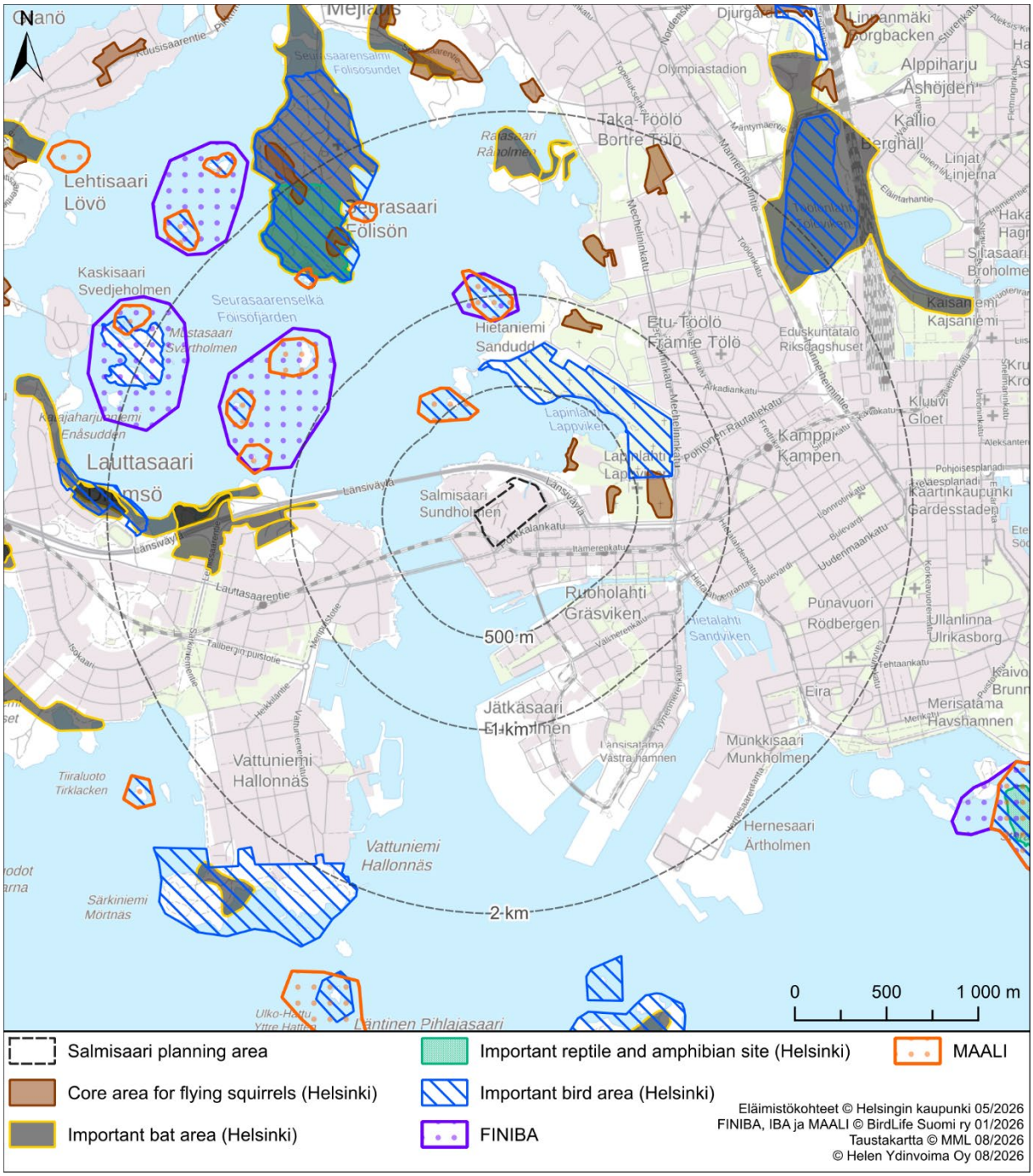


Figure 18-1. Important bird areas and other areas important for fauna around the Salmisaari planning area.

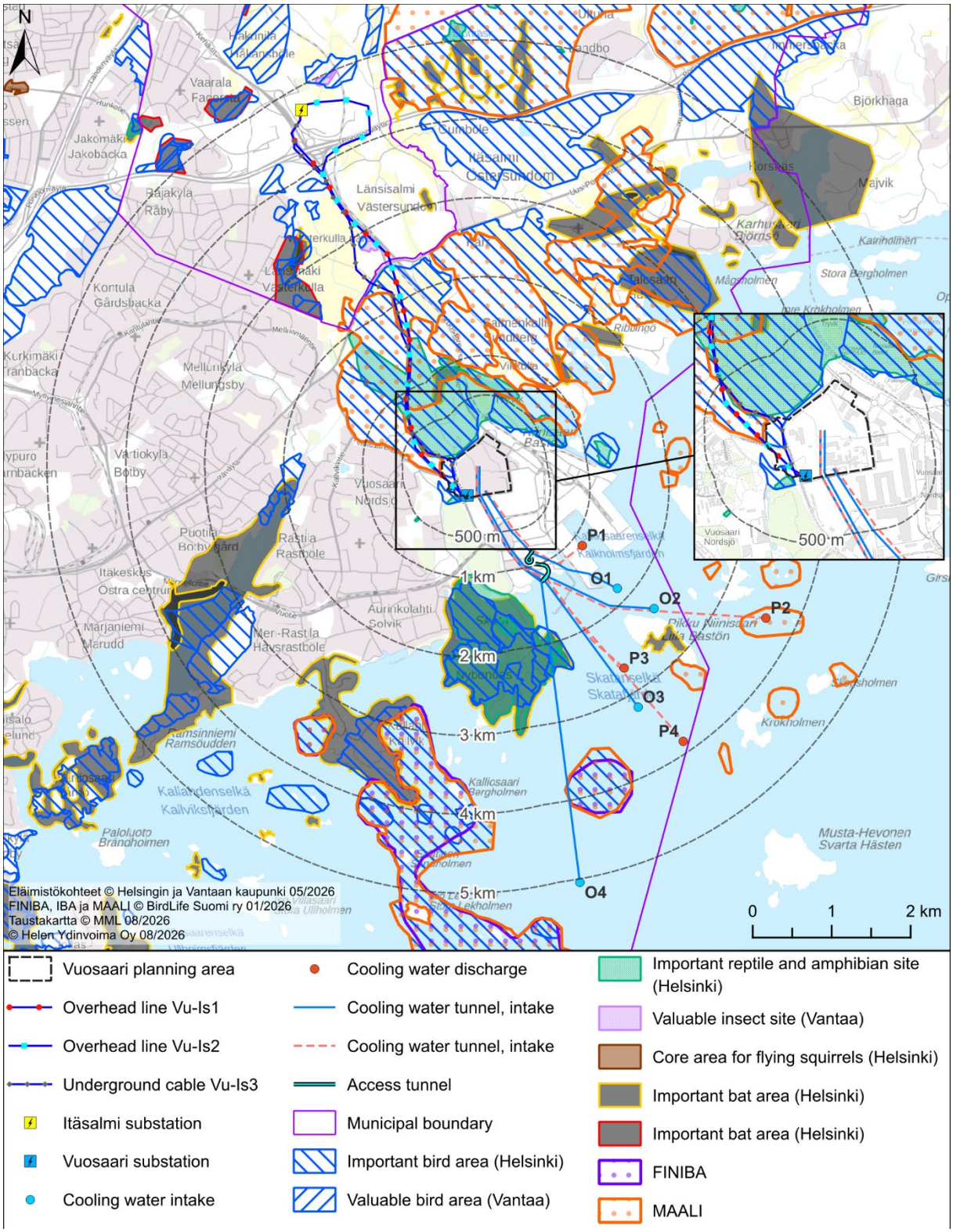


Figure 18-2. Important bird areas and other areas important for fauna in the vicinity of the Vuosaari project area options VE2a and VE2b.

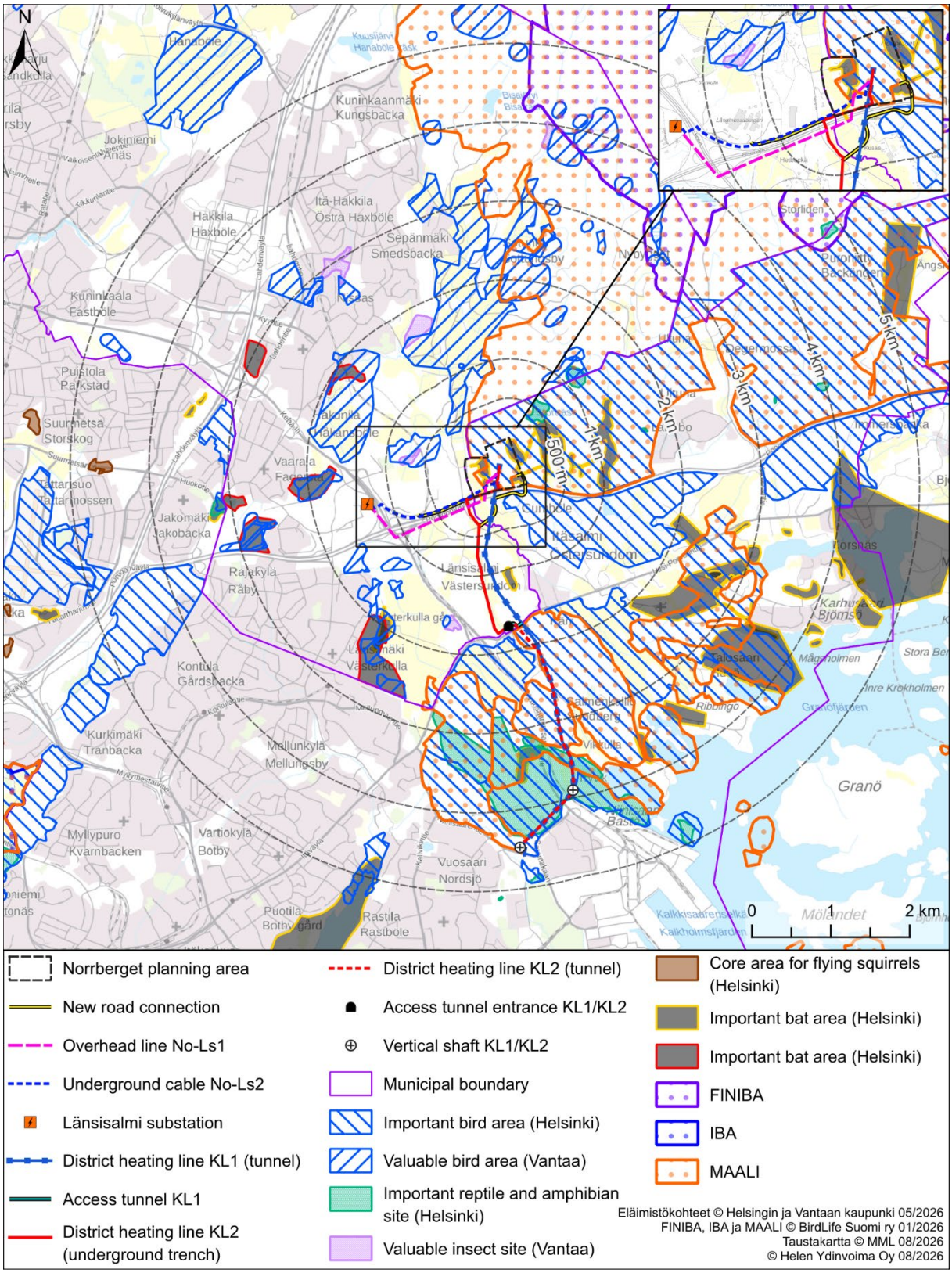


Figure 18-3. Important bird areas and other areas important for fauna in the vicinity of the Norrberget project area option VE3a.

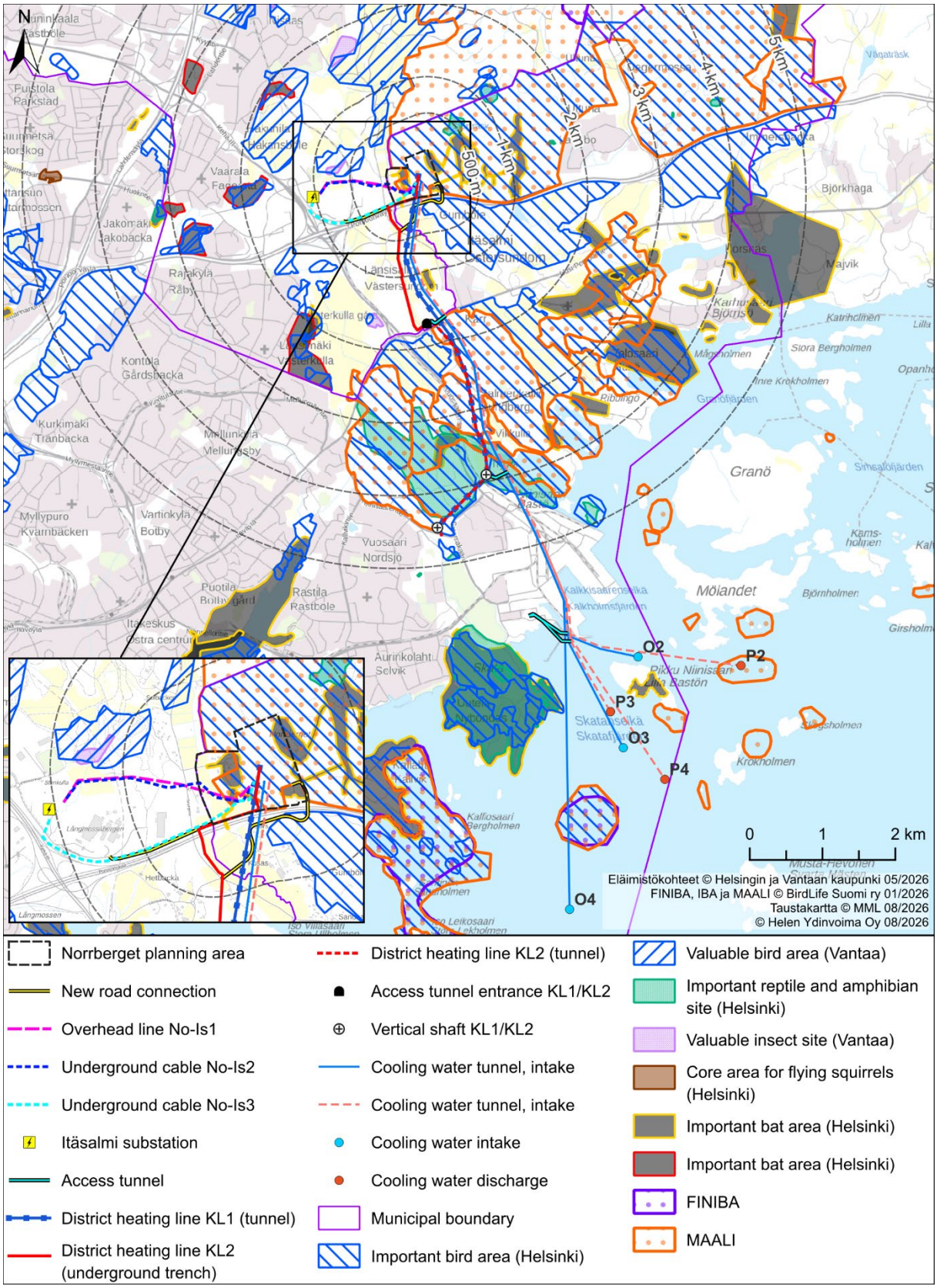


Figure 18-4. Important bird areas and other areas important for fauna in the vicinity of the Norrberget project area option VE3b.

Important Bird and Biodiversity Areas (IBA)

The IBA bird areas closest to the project areas are the shallows off Helsinki and the Helsinki–Espoo wetlands (BirdLife Finland ry 2026a). The shallows off Helsinki consists of multiple areas, one of which is located less than four kilometres south of the Salmisaari planning area. The second area is located on the south side of Vuosaari, so that the distance from the southernmost cooling water intake and discharge point planned in the Vuosaari and Norrberget options is about a kilometre. The Laajalahti area of the Helsinki–Espoo wetlands is located about four kilometres northwest of the Salmisaari planning area and the Vanhankaupunginlahti–Viikki area about five kilometres west of the Vuosaari and Norrberget project areas.

Finnish Important Bird Areas (FINIBA)

The FINIBA bird areas closest to the project areas are the multi-part coastal islets with bird colonies off Helsinki, Sipoonkorpi and Laajalahti–Huopalahti–Vanhankaupunginlahti, which is largely part of the Helsinki–Espoo wetlands IBA area (BirdLife Finland ry 2026b). Coastal islets with bird colonies off Helsinki are located at their closest about one kilometre from the Salmisaari planning area and 2.7 kilometres from the Vuosaari planning area. The southernmost cooling water intake and discharge points planned in the Vuosaari and Norrberget options are located less than a kilometre away from two sites. The Sipoonkorpi FINIBA area is located 2.7 km from the Norrberget planning area. The distances to the Laajalahti–Huopalahti–Vanhankaupunginlahti FINIBA area are the same as mentioned above for the IBA areas.

Regionally Important Bird Areas (MAALI)

Several regionally important MAALI areas of the Helsinki region are located in and around the project areas (BirdLife Finland ry 2026c). The Norrberget planning area is partly located within the MAALI area of the Sipoonkorpi region. The electricity transmission connections planned in the Vuosaari option are located at Mustavuori within the MAALI areas of the forests of Eastern Helsinki and the waterfowl habitats of Östersundom, and the district heating and cooling water tunnel planned in the Norrberget option runs beneath them. The cooling water intake and discharge points examined in the Vuosaari and Norrberget options are located close to the MAALI areas of the Sipoo middle archipelago and the Kallahdenniemi marine area, with the easternmost point situated within the Sipoo middle archipelago site (Maloxratan and Maloxen). The MAALI area of the Sipoo middle archipelago consists of approximately 25 island and islet sites arranged in zones. In addition, several other MAALI sites in the archipelago, forests and wetlands lie within a five-kilometre radius of the project areas.

Other bird values

Important bird areas of the City of Helsinki (2026c) are not located in the Salmisaari planning area or its immediate vicinity. The Salmisaari area is a built-up industrial area that is unlikely to have significant bird values. However, swallows or common swifts, for example, may nest in the buildings. This will be verified during a field survey in the summer of 2026.

The Vuosaari planning area also mainly consists of an industrial zone but extends slightly into undeveloped areas. In 2025, among other species, little ringed plover, assessed as near threatened (NT), nested here (Vantaan Energia 2025). The western part of the Vuosaari planning area partly overlaps the City of Helsinki's (2026c) important bird areas: Vuosaari dumping ground and the Nordsjö Manor flooded forest. The electricity transmission connections planned in the Vuosaari option VE2b are located within important bird areas delineated in the

Copyright © Helen Nuclear Ltd

Mustavuori–Porvarinlahti area. Hemåkern's field north of Mustavuori is also one of the city's important bird areas. In the Vantaa region, on the edges of the Storängen field area, there are a few small valuable woodland bird areas near the planned electricity transmission connections (City of Vantaa 2026b).

The Norrberget area is currently mostly undeveloped and contains partly rocky, pine-dominated forest, but also more lush areas where bird density is likely to be higher. The Norrberget planning area is mainly located in the Southern Sipoonkorpi area, which is one of the important bird areas of the City of Helsinki (2026c), and the forests of Itäsalmi, located south of Porvoonväylä, have also been designated as important bird areas. Important bird areas are also located at the tunnel sections of the heat transmission routes planned in the Norrberget option and at the cooling water tunnel. To the south of Porvoonväylä, from Gumböle via Norrberget, the forested connection to Sipoonkorpi has been found to be very important for the hazer grouse, which belongs to the protected bird species of the Natura 2000 area of the Mustavuori grove and the Östersundom waterfowl habitat, and whose preservation in the area depends on ecological corridors to the extensive forest areas in the direction of Sipoonkorpi (e.g. Erävuori et al. 2024).

Important bird areas of the City of Helsinki (2026c) are also located near the cooling water intake and discharge points examined in the Vuosaari and Norrberget options. In the marine area, these are mainly the same sites included in the MAALI bird areas.

18.2 Ecological corridors

There are no corridors of Helsinki's forest and tree-stand network in the Salmisaari planning area (City of Helsinki 2026c). The closest local corridor ends/begins in the northeast of the Lapinlahti park area.

The closest corridors of Helsinki's forest and tree-stand network to the Vuosaari planning area are located north and west of the Porvarinlahti and Mustavuori areas (Figure 18-5). In the Vuosaari option VE2b, the planned electricity transmission connection crosses at Mustavuori with the eastern corridor of the network and the local corridor. Additionally, it intersects with the local corridor marked in Helsinki's forest and tree-stand network south of Porvoonväylä, within the City of Vantaa area. In the material of the City of Vantaa (2026), the corridor is marked as a local ecological corridor (Figure 18-5).

The closest corridors of Helsinki's forest and tree-stand network to the Norrberget planning area are the corridor west of Sotungintie within the City of Vantaa, and another corridor to the north along the edge of Sipoonkorpi National Park (Figure 18-6). In addition, a local corridor crossing Porvoonväylä is located on the east side. In the material of the City of Vantaa (2026), the regional corridor between Sipoonkorpi National Park and Mustavuori (Natura 2000 area) is marked on the west side of Sotungintie, which is also indicated in the regional plan. To the east, at Krapuoja, the master plan designates a corridor (flowing water corridor). The planned electricity transmission connection crosses in all options with the corridor to the west of Sotungintie and the corridor or Krapuoja, as do the northern road connection and the underground pipe section of the heat transmission connection KL2.

Copyright © Helen Nuclear Ltd

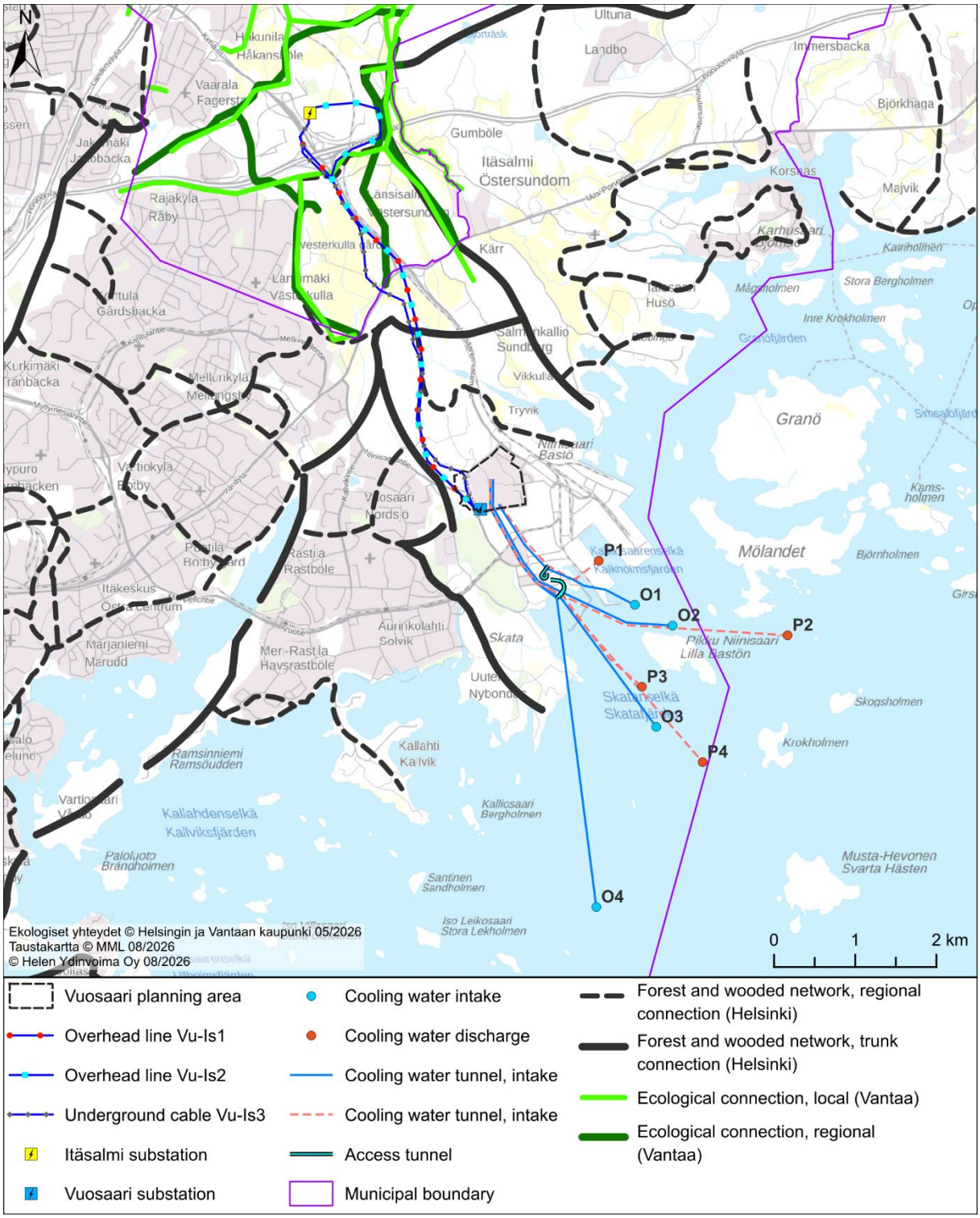


Figure 18-5. Ecological corridors in the vicinity of the Vuosaari project area.

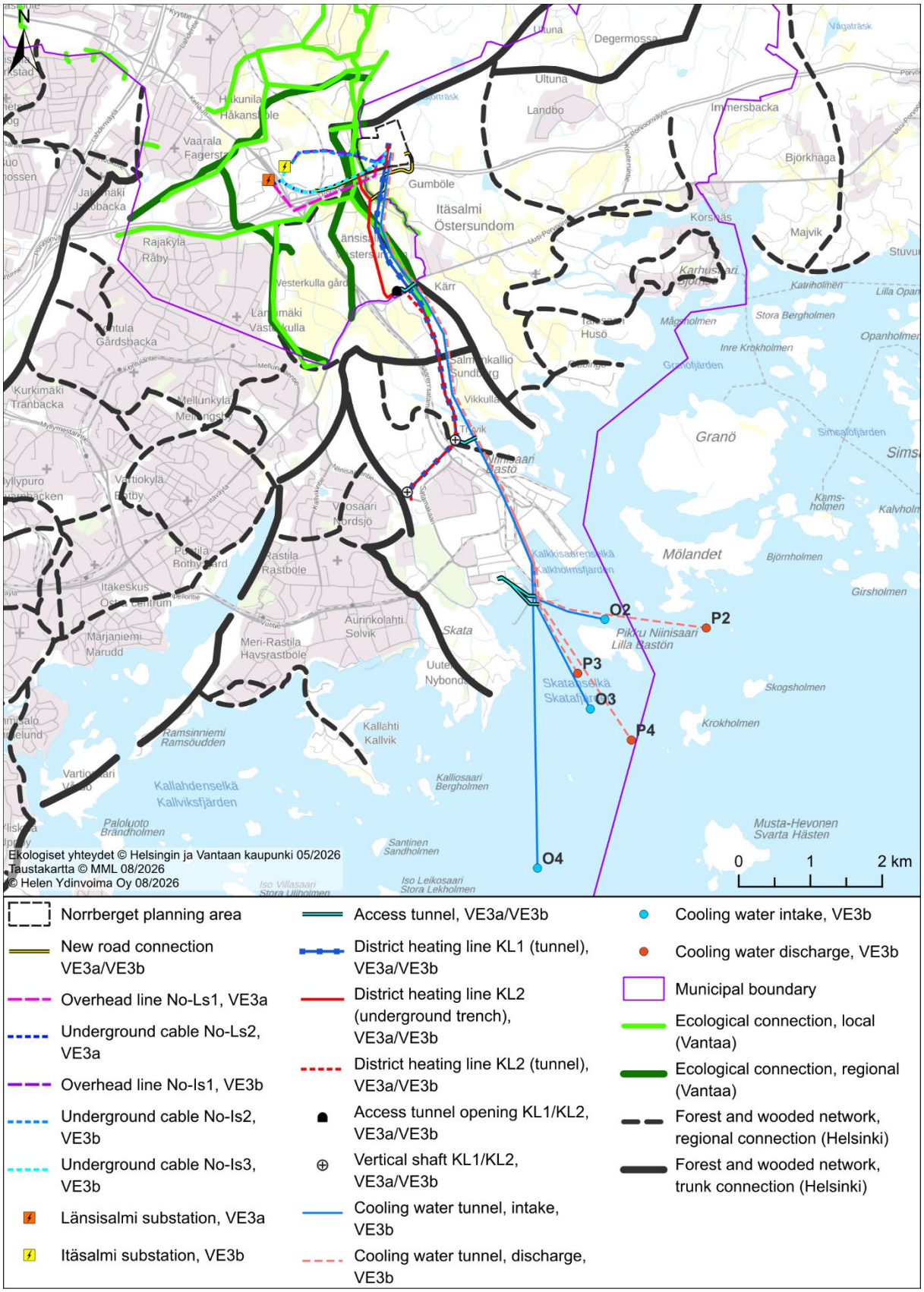


Figure 18-6. Ecological corridors in the vicinity of the Norrberget project area.

18.3 Impact assessment and methodology

18.3.1 Materials and studies

The description of the current status presented in the EIA programme is based on public sources, such as the nature data of Helsinki's Nature Information System (City of Helsinki 2026c) and Vantaa Map Service (City of Vantaa 2026), and the public observations of the Finnish Biodiversity Information Facility (2026). Nature surveys have been carried out in the area, for example, in connection with EIA projects (e.g. Sitowise Oy 2025, Vantaan Energia Oy 2025). The description of the current state will be specified in the EIA report through database requests from the Finnish Biodiversity Information Facility and possibly from the Tiira bird observation database managed by BirdLife Finland.

In addition, the following surveys will be carried out for the project during the spring and summer of 2026. The surveys follow the guidelines for species surveys (e.g. Nieminen & Ahola 2017) and the *Ecological Surveys and Ecological Impact Assessment* (Luopas) guide (Mäkelä & Salo 2024).

Birds

The planning areas in Salmisaari and Vuosaari east of Satamakaari will undergo a one-day field survey for bird inventories, during which birdlife will also be observed. At the same time, attention will be paid to any nesting swallows and common swifts. The broader breeding bird survey covers the parts of the planning areas west of Satamakaari in Vuosaari, the Norrberget planning area, as well as all electricity transmission connections and the above-ground sections of the district heat transmission connection and cooling water tunnel.

The breeding bird survey includes white-backed woodpecker survey and a fowl survey conducted in early spring, as well as a survey of other breeding birds conducted in the spring/early summer.

A separate white-backed woodpecker survey will be carried out in the Mustavuori Natura area, approximately 500 metres from the planned electricity transmission connection, during March and April. Two field days have been allocated for the work.

A capercaillie mating area survey is targeted only at the Norrberget planning area and its surrounding area (e.g. the Sipoonkorpi National Park area). The field survey is carried out during the peak of the species's mating period in April. The work is carried out over two visits, the first of which coincides with the Siberian flying squirrel survey. Two mapping mornings have been allocated for the work.

An European nightjar survey is conducted in the Norrberget area and in Länsisalmi near the tunnel entrance, in habitats suitable for European nightjar. European nightjars are surveyed by listening for the males' mating calls at night in June. Three mapping nights have been allocated for the work.

Other breeding birds are surveyed by systematically walking through the survey areas at a distance of about 100–200 metres from the power lines. In representative habitats, the area will be surveyed more extensively if necessary. For example, in the Norrberget area, the survey area will be expanded to about 300 metres from the planning area, especially towards Sipoonkorpi National Park. The survey is carried out using the ground-dwelling bird territory mapping in the morning and before the noon in good weather, when the birds are most vocally

Copyright © Helen Nuclear Ltd

active. There are three mapping rounds: the first in April, the second in May and the third in (May–)June. Observations of endangered bird species and bird species in Annex I to the Birds Directive, as well as other noteworthy bird species, are recorded and any areas of bird value are delimited on the map. A list of common species is drawn up. A total of eighteen mapping mornings have been allocated for the work.

Bats

Bats are inventoried in the Norrberget planning area. The occurrence of bats is surveyed in two nightly mapping rounds, the first in June and the second in July. The survey is conducted by walking through habitats assessed as potentially suitable for bats, while simultaneously observing them using a bat detector with the heterodyne method, as well as visually. Based on the observations, possible bat areas and sites referred to in the guideline of Suomen lepakkotieteellinen yhdistys ry (2023) will be delimited on the map. A total of four field nights have been allocated for the work.

Siberian flying squirrel

The Siberian flying-squirrel survey is carried out only in the Norrberget planning area. During the same field visit, an early-morning survey of capercaillie mating sites is conducted. Suitable habitats are searched for Siberian flying squirrel droppings, especially under large spruce and deciduous trees. Based on the observations and the structure of the forest, the habitats of the Siberian flying squirrel are defined on the map, and movement corridors are also assessed if necessary. The survey will be carried out in April–May. At the same time, preliminary mapping of the area's vegetation and other species is carried out. One field day is allocated for the work.

Scarce fritillary

The survey is only carried out if necessary in the Norrberget planning area. In order to determine the presence of the species, the most reliable way is to search for larval cases in the late summer/early autumn. Larval cases, on the other hand, appear on the cow wheat crops used as food crops by the species. The need for a scarce fritillary survey will be determined during the summer vegetation survey of the Norrberget area, which will establish whether there are abundant cow wheat areas suitable as habitats for the species. On the basis of observations, habitats suitable for the species are delimited as necessary. If the vegetation survey records cow wheat stands suitable as habitats for the species, these stands will be searched in the late summer (August–September) for larval cases, in which the species winters. Unlike midsummer observations of flying adult specimens, the presence of larval cases is a sure sign of the species' breeding and resting place. One field day has been allocated for mapping suitable habitats. The workload of mapping the silk cocoons is determined after mapping the habitats.

Moor frog and dragonflies

Separate moor frog and dragonfly surveys are not considered necessary because there are few habitats suitable for these species within the plants' planning areas and along the electricity and heat transmission routes, and sufficient information on species occurrences is already available. The nearest species occurrence is the pond north of the golf course near the Vuosaari planning area, which was last surveyed in 2025 (Vantaan Energia Oy 2025).

Copyright © Helen Nuclear Ltd

18.3.2 Impact assessment

The EIA report assesses the impacts that the implementation of the project and its different options will have on fauna and birds. Nature surveys and impact assessment are carried out in accordance with the *Ecological Surveys and Ecological Impact Assessment* (Luopas) guide (Mäkelä & Salo 2024). The assessment takes into account both direct and indirect impacts and assesses their significance. Other impact assessments and modelling carried out during the EIA reporting phase will be used in the assessment. Recommendations are made to prevent and mitigate adverse impacts.

The impact assessment is carried out by biologists with experience of similar impact assessments and who have previously participated in impact assessments for projects in the same area.

The table (Table 18-2) below presents the justification for targeting the environmental impact assessment by project option for fauna and birds (for background on targeting, see chapter 7.2.1).

Table 18-2. Justification for targeting the environmental impact assessment by project option in terms of fauna and birds. x = the project option for which the assessment is specifically targeted.

	Fauna and birds	Justification
VE1		The planning area is located in the built-up power plant area.
VE2a	x	The planning area is mainly located in the built-up power plant area. However, an area extending beyond it may contain bird and other wildlife values.
VE2b	x	The planning area is mainly located in the built-up power plant area. However, an area extending beyond it may contain bird and other wildlife values. Along the electricity transmission lines, the habitats of birds and other animals may change, and disturbances may occur.
VE3a	x	The planning area is located in a forest valuable for birdlife, and along electricity transmission and district heating lines, the habitats of birds and other fauna may change and disturbances may occur.
VE3b	x	The planning area is located in a forest valuable for birdlife, and along electricity transmission and district heating lines, the habitats of birds and other fauna may change and disturbances may occur.

Copyright © Helen Nuclear Ltd

19 PROTECTED AREAS

19.1 Current status

19.1.1 Salmisaari

The nature reserves and Natura 2000 areas in and around the Salmisaari planning area are shown in the table and figure below (Table 19-1, Figure 19-1).

The nature reserves closest to the Salmisaari planning area are located 1.5–2.2 kilometres northwest of Seurasaari and around Seurasaari, and 2.3–2.9 kilometres southwest and west of Lauttasaari and around Lauttasaari. Almost all nature reserves in the vicinity of the Salmisaari planning area are small, and among them are several sites (seashore meadows, sandy beaches and hazel scrubs) protected under the Nature Conservation Act. The widest area is the Laajalahti Nature Reserve (ESA010002), located 4.7 km to the northwest.

The Natura 2000 area closest to the Salmisaari planning area is the Laajalahti waterfowl habitat (FI0100028, SAC/SPA, 192 ha), located 4.7 kilometres to the northwest. The Vanhankaupunginlahti waterfowl habitat (FI0100062, SAC/SPA, 316 ha) is located 6.3 km to the northeast, and the Vantaanjoki river (FI0100104, SAC, 146 ha) is 6.7 km to the northeast. Other Natura areas are more than 10 kilometres away.

In the vicinity of the Salmisaari planning area, sites marked in the City of Helsinki's Nature Conservation Programmes are not located within a two-kilometre radius (City of Helsinki 2026c).

Copyright © Helen Nuclear Ltd

Table 19-1. Nature reserves and Natura 2000 areas located within a five-kilometre radius of the Salmisaari planning area.

Name	Designator	Type	Distance and direction from the planning area
Nature reserve of the islets south of Seurasaari	YSA014112	nature conservation area on private land	1.5 km northwest
Seurasaari seashore meadow	LTA010140	protected habitat	1.5 km northwest
Morsianluoto nature reserve	YSA246116	nature conservation area on private land	2.1 km northwest
Variskari nature reserve	YSA014111	nature conservation area on private land	2.2 km to the northwest
Tiirakari nature reserve	YSA010109	nature conservation area on private land	2.3 km southwest
Vattuniemi seashore meadow	LTA010143	protected habitat	2.3 km southwest
Ulko-Hattu nature reserve	YSA251228	nature conservation area on private land	2.5 km south
Särkiniemi seashore meadow (Lauttasaari)	LTA010252	protected habitat	2.6 km southwest
Takaniemi seashore meadow	LTA010142	protected habitat	2.9 km southwest
Koivusaari seashore meadow	LTA010231	protected habitat	2.9 km west
Seafront meadow in Läntinen Pihlajasaari	LTA010234	protected habitat	2.9 km south
Nature reserve for the grove in Läntinen Pihlajasaari	YSA014113	nature conservation area on private land	2.9 km south
Harakkasaari nature reserve	YSA013476	nature conservation area on private land	3.0 km southeast
Melkki seashore meadow	LTA010233	protected habitat	3.1 km southwest
Melkki sandy beaches 1/3–3/3	LTA010245	protected habitat	3.1 km south
Puolimatkansaari and Pormestarinhepo nature reserve	YSA013473	nature conservation area on private land	3.6 km southeast
Bakugrund (nature reserve)	YSA014171	nature conservation area on private land	3.7 km west
Rajakupu nature reserve	YSA014110	nature conservation area on private land	3.8 km southwest
Korkeasaarenluoto	YSA243884	nature conservation area on private land	3.9 km east
Tiirakari nature reserve	YSA251488	nature conservation area on private land	4.0 km south
Pormestarinluoto nature reserve	YSA246115	nature conservation area on private land	4.1 km southeast
Koirapaasi nature reserve	YSA014114	nature conservation area on private land	4.3 km south
Pasila hazel scrub	LTA267816	protected habitat	4.4 km northeast
Pasila hazel grove	LTA010225	protected habitat	4.6 km northeast

Copyright © Helen Nuclear Ltd

Laajalahti nature reserve	ESA010002	nature conservation area on state-owned land	4.7 km northwest
Laajalahti waterfowl habitat	FI0100028 (SAC/SPA)	Natura 2000 area	4.7 km northwest
Madeluoto nature reserve	YSA246117, YSA250971	nature conservation area on private land	4.7 km northwest

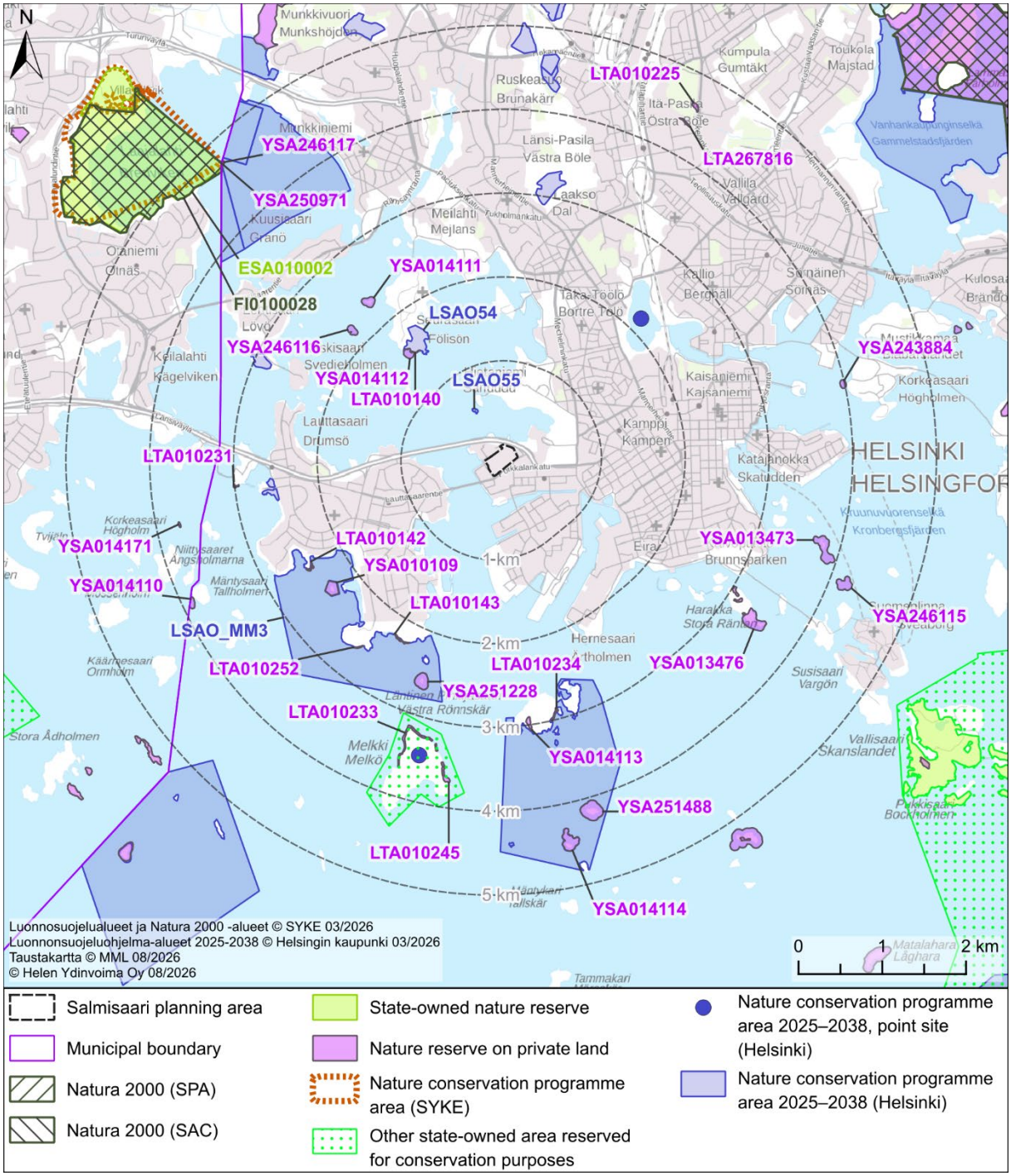


Figure 19-1. Nature reserves, Natura 2000 sites and areas designated to nature conservation in the surroundings of the Salmisaari planning area.

Copyright © Helen Nuclear Ltd

19.1.2 Vuosaari

The nature reserves and Natura 2000 areas in and around the Vuosaari planning area and in the vicinity of the transmission lines planned in project option VE2b are shown in the table and figure below (Table 19-2, Figure 19-2).

The nature reserves closest to the Vuosaari planning area are located 0.2–1.4 kilometres to the northwest, north and northeast of the Porvarinlahti, Mustavuori, Salmenkallio and Bruksviken areas, 1.2–1.8 kilometres to the south of the Vuosaarenlahti, Skata and Uutela areas and 1.8 kilometres to the west of the Varjakanpuisto area. One of them is a protected habitat (seashore meadow) and the others are nature conservation areas on private land.

The Natura 2000 area closest to the Vuosaari planning area is the four-part Mustavuori grove and Östersundom waterfowl habitats (F10100065, SAC/SPA, 355 ha), which lies about 500 metres to the north at its closest point. The Kallahti ridge, meadow and water areas (FI0100063, SAC, 251 ha) are located approximately 2.6 kilometres to the southwest. Also located within 10 kilometres are Sipoonkorpi (FI0100066, SAC, 1,267 ha), 6.6 kilometres to the north, and the Vanhankaupunginlahti waterfowl habitat (FI0100062, SAC/SPA, 316 ha), 7.3 kilometres to the west.

In the Vuosaari project option VE2b, the 400 kV electricity transmission connection lies east of Mustavuori along the existing power line route, so that both the overhead lines (options Vu-Is1 and Vu-Is2) and the underground cable (option Vu-Is3) are located within the Natura area of the Mustavuori grove and Östersundom waterfowl habitats, as well as in two or three nature conservation areas on private land. The cooling water tunnel in option VE2b runs below one or two nature reserves, and the intake and discharge points are located less than one kilometre from some beach and islet nature reserves. The Natura area of the Kallahti ridge, meadow and water areas and the nature reserve of the Kallahti shallows, as well as a few small nature reserves on the islands, are located 1–1.5 kilometres from the southernmost intake and discharge point.

In addition, the environment of the Vuosaari planning area and the planned transmission lines and cooling water intake and discharge points in project option VE2b include several sites of the City of Helsinki’s nature conservation programmes, as well as one of the nature conservation area reservations of the Vantaa Master Plan and the nature conservation areas designated as nature reserves in the component master plan of the Sipoo archipelago and coastal areas (Table 19-3, Figure 19-2).

Copyright © Helen Nuclear Ltd

Table 19-2. Nature reserves and Natura 2000 areas within a radius of five kilometres from the Vuosaari planning area, within a radius of one kilometre from the electricity transmission connections in option VE2b and at the cooling water tunnels and within a radius of one kilometre from the intake and discharge sites.

Name	Designator	Type	Distance and direction from the planning area	Distance and direction from the transmission lines in VE2b
Nature reserve on the south bank of Porvarinlahti	YSA270280	nature conservation area on private land	200 m north	Electricity transmission: 700 m east
Mustavuori grove and Östersundom waterfowl habitats	F10100065	Natura 2000 site (SAC/SPA)	500 m northeast	Electricity transmission: Vu-Is1 and Vu-Is2: located in the area for about 560 m Vu-Is3: located in the area for about 850 m
Vikkulla–Kasaberget nature reserve	YSA200253	nature conservation area on private land	700 m north	Electricity transmission: 700 m east
Southern Mustavuori nature reserve	YSA272342	nature conservation area on private land	700 m northwest	Electricity transmission: Vu-Is1 and Vu-Is2: located in the area for 500 m Vu-Is3: located in the area for 450 m
Porvarinlahti nature reserve	YSA013642	nature conservation area on private land	800 m northeast	–
Mustavuori–Porvarinlahti nature reserve	YSA012663	nature conservation area on private land	800 m northwest	Electricity transmission: Vu-Is1 and Vu-Is2: located in the area for 430 m Vu-Ls3: located in the area/on the boundary for 450 m
Mustavuori grove	YSA240584	nature conservation area on private land	900 m north	Electricity transmission: Vu-Is1 and Vu-Is2: 10–30 m west Vu-Is3: located in the area for 240 m
Östersundom waterfowl habitats	YSA200140	nature conservation area on private land	1.2 km northeast	–
Vuosaarenlahti seashore meadow	LTA010141	protected habitat	1.2 km south	Cooling water: all tunnel options pass under the area; intake and discharge points less than 1 km away
Kasaberget–Kasakallio nature reserve	YSA013643	nature conservation area on private land	1,4 m north	Electricity transmission: Vu-Is1: 600 m east Vu-Is2: 600 m east Vu-Is3: 900 m east
Mellunmäki swanp nature reserve	YSA272341	nature conservation area on private land	1.4 km northwest	Electricity transmission: 700 m west
Rudträsk nature reserve	YSA257309	nature conservation area on private land	1.6 km south	–

Copyright © Helen Nuclear Ltd

Särkkäniemi nature reserve	YSA013303	nature conservation area on private land	1.7 km south	Cooling water: one tunnel option passes under the area; intake and discharge points less than 1 km away
Uutela forest nature reserve	YSA256427	nature conservation area on private land	1.8 km south	–
Varjakanpuisto nature reserve	YSA265438	nature conservation area on private land	1.8 km west	–
Linnavuorenpuisto bee meadow	ERA267818	habitat of a specially protected species	2.0 km west	–
Nature reserve for the meadows in Uussillanpuisto	YSA261236	nature conservation area on private land	2.2 km west	–
Kapellviken nature reserve	ESA300581	nature conservation area on state-owned land	2.3 km north	–
Kallahdenharju nature reserve	YSA012910, YSA011543	nature conservation area on private land	2.6 km southwest	–
Kallahti ridge, meadow and water areas	FI0100063	Natura 2000 area (SAC)	2.6 km southwest	–
Pikku Niinisaari coastal meadow	YSA013474	nature conservation area on private land	2.6 km southeast	Cooling water: intake and discharge points less than 1 kilometre away
Meri-Rastila nature reserve	YSA271918	nature conservation area on private land	3.0 km southwest	–
Kallahdenniemi	ERA202309	habitat of a specially protected species	3.1 km southwest	–
Pikku Niinisaari seashore meadow	LTA010242	protected habitat	3.2 km southeast	Cooling water: intake and discharge points less than 1 kilometre away
Rastila open bog	YSA013517	nature conservation area on private land	3.3 km southwest	–
Neitsytsaaret coastal islets with bird colonies	YSA207768	nature conservation area on private land	3.4 km south	–
Mölandet islets	YSA011627	nature conservation area on private land	3.4 km west	Cooling water: an intake and discharge point less than 1 kilometre away
Kallahti shallows	YSA243067	nature conservation area on private land	3.5 km southwest	–
Kallahti coastal meadow	YSA013227	nature conservation area on private land	3.5 km southwest	–
Länsimäki broad-leaved deciduous forest	LTA200865	protected habitat	3.5 km northwest	Electricity transmission: 300 m west
Östersundom broad-leaved deciduous forest	LTA202928	protected habitat	3.7 km north	–
Topeliusviken	YSA202946	nature conservation area on private land	3.8 km northeast	–

Copyright © Helen Nuclear Ltd

Kallioluoto nature reserve	YSA014173	nature conservation area on private land	3.9 km south	–
Prinsessa nature reserve	YSA014116	nature conservation area on private land	3.9 km south	–
Kalliosaarenluoto nature reserve	YSA014174	nature conservation area on private land	4.2 km south	–
Nature reserve for the grove in Ramsinniemi	YSA012911	nature conservation area on private land	4.2 km southwest	–
Korsnäs broad-leaved deciduous forest	LTA202928	protected habitat	4.3 km northeast	–
Loppikari nature reserve	YSA014172	nature conservation area on private land	4.5 km southwest	–
Sandy beaches in Santinen	LTA010229	protected habitat	4.6 km south	–
Sipoonkorpi National Park	KPU010036	national park	4.6 km north	Electricity transmission: Vu-Ls1: – Vu-Ls2: 400 m west Vu-Ls3: –
Myllypuro	ERA202307	habitat of a specially protected species	5.0 km west	–

Copyright © Helen Nuclear Ltd

Table 19-3. The sites of the nature conservation programmes and plans of Helsinki, Vantaa and Sipoo within a radius of two kilometres from the Vuosaari planning area, within a radius of one kilometre from the electricity transmission connections of option VE2b, as well as at the cooling water tunnels and within a radius of one kilometre from the intake and discharge sites.

Name	Conservation programme or plan	Distance and direction from the planning area	Distance and direction from the transmission lines in VE2b
Extension of the southern Mustavuori nature reserve	Helsinki Nature Conservation Programme 2025–2038	600 m northwest	Electricity transmission: Vu-Is1 and Vu-Is2: 60 m west Vu-Is3: 70 m west
Granöfjärden nature reserve	Helsinki Nature Conservation Programme 2025–2038	700 m northeast	–
Labbacka nature reserve	Helsinki Nature Conservation Programme 2025–2038	800 m north	Electricity transmission: Vu-Is1 and Vu-Is2: 100 m east Vu-Is3: 150 m east
Salmenkallio nature reserve	Helsinki Nature Conservation Programme 2025–2038	800 m northeast	Electricity transmission: Vu-Is1 and Vu-Is2: 700 m east Vu-Is3: 800 m east
Broändanpuro nature reserve	Helsinki Nature Conservation Programme 2025–2038	1.4 km west	Electricity transmission: 800 m west
Nature reserve for the northern forest in Uutela	Helsinki Nature Conservation Programme 2025–2038	1.3 km south	–
Tankovainio nature reserve	Helsinki Nature Conservation Programme 2025–2038	1.6 km west	–
Talosaari nature reserve	Helsinki Nature Conservation Programme 2025–2038	1.8 km northeast	–
Vartiokylänlahti nature reserve	Helsinki Nature Conservation Programme 2025–2038	1.9 km west	–
Linnavuori nature reserve	Helsinki Nature Conservation Programme 2025–2038	2.0 km west	–
Skata nature reserve	Helsinki Nature Conservation Programme 2025–2038	2.0 km south	–
Uutela Nuottaniemi nature reserve	Helsinki Nature Conservation Programme 2025–2038	2.0 km south	–
Uutela marine area nature reserve	Helsinki Nature Conservation Programme 2025–2038	2.0 km south	Cooling water: one tunnel option passes under the area, intake and discharge points less than 1 km away
Länsimetsä	nature conservation area reservation of the Vantaa Master Plan	–	Electricity transmission: Vu-Is1 and Vu-Is2: 400 m east Vu-Is3: 700 m east
Kajuuttaluodot marine area nature reserve	Helsinki Nature Conservation Programme 2025–2038	–	Cooling water: intake and discharge points less than 1 kilometre away
Nature reserve for the eastern marine area in Kallahdenniemi	Helsinki Nature Conservation Programme 2025–2038	–	Cooling water:

Copyright © Helen Nuclear Ltd

			intake and discharge points less than 1 kilometre away
Nature reserve for the eastern marine area in Kallahdenniemi	Helsinki Nature Conservation Programme 2025–2038	–	Cooling water: an intake and discharge point less than 1 kilometre away
Kuminapää nature reserve	Helsinki Nature Conservation Programme 2025–2038	–	Cooling water: an intake and discharge point less than 1 kilometre away
Maloxratan and Maloxen	nature reserve in the component master plan of the Sipoo archipelago and coastal areas		Cooling water: intake and discharge point in the immediate vicinity
Krokholmshället	nature reserve in the component master plan of the Sipoo archipelago and coastal areas		Cooling water: an intake and discharge point less than 1 kilometre away

Copyright © Helen Nuclear Ltd

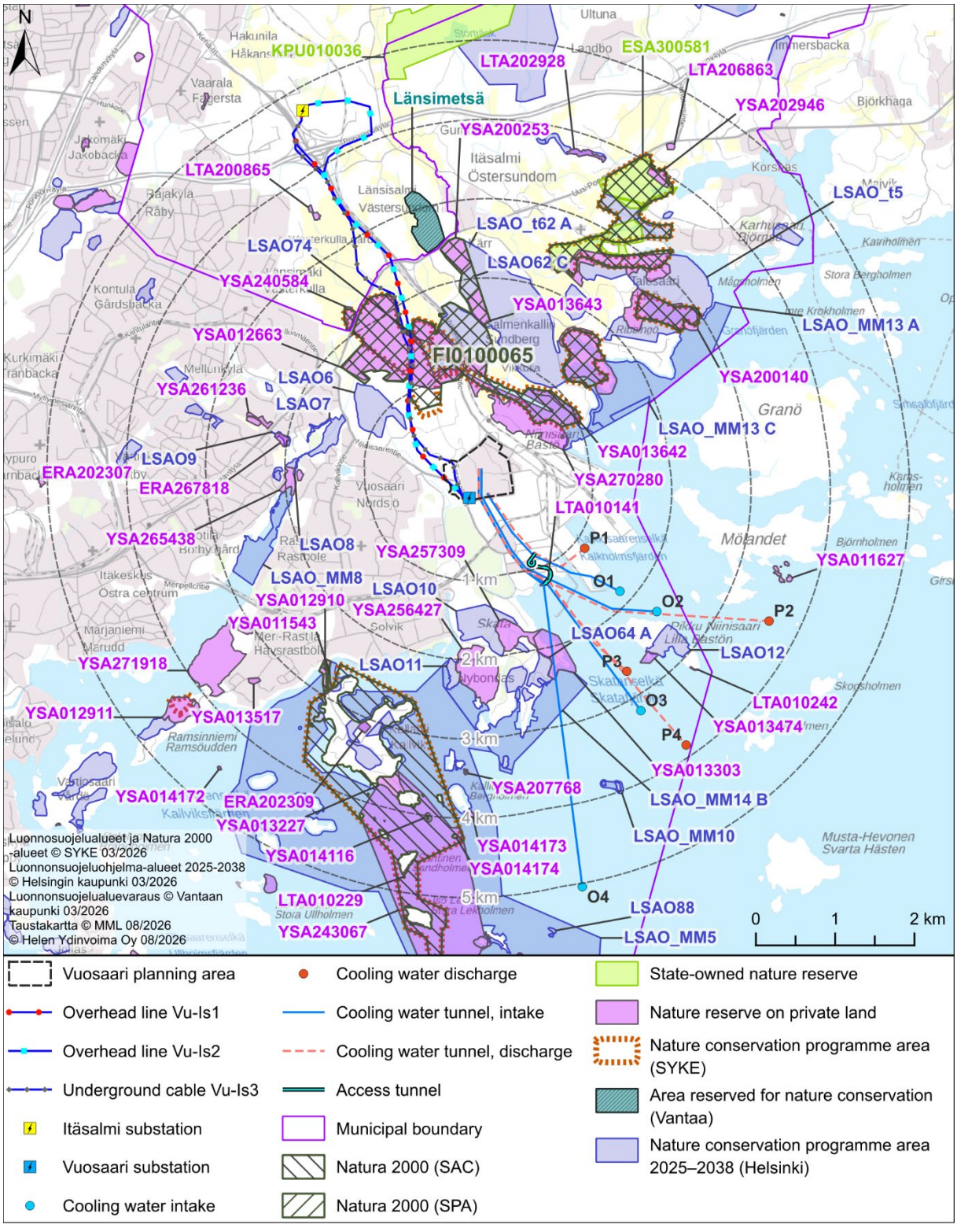


Figure 19-2. In the environment of the Vuosaari planning area, options VE2a and VE2b include nature conservation areas, Natura 2000 areas and the areas of the Helsinki Nature Conservation Programme 2025–2038 and the Länsimetsä nature conservation area reservation in the Vantaa Master Plan.

Copyright © Helen Nuclear Ltd

19.1.3 Norrberget

The nature reserves and Natura 2000 areas in and around the Norrberget planning area and in the vicinity of the planned transmission lines are shown in the table and figures below (Table 19-4, Figure 19-3 and Figure 19-4).

The Norrberget planning area borders Sipoonkorpi National Park along approximately 670 metres on its northern edge. The next closest nature reserves are small-scale protected habitats (broad-leaved deciduous forests) 1.5 and 1.7 kilometres to the southwest and southeast, as well as a nature conservation on private land on Kasakallio 1.6 kilometres to the south.

The Natura 2000 area closest to the Norrberget planning area is the four-part Mustavuori grove and Östersundom waterfowl habitats (F10100065, SAC/SPA, 355 ha), which lies about 1,6 metres to the north at its closest point. Sipoonkorpi (FI0100066, SAC, 1,267 ha) is located 2.6 kilometres to the northeast. Also located within 10 kilometres are Sipoonjoki (FI0100086, SAC, 53 ha) 5.3 kilometres to the northeast, the Kallahti ridge, meadow and water areas (FI0100063, SAC, 251 ha) 6.9 kilometres to the south, the Vanhankaupunginlahti waterfowl habitat (FI0100062, SAC/SPA, 316 ha) 8.1 kilometres to the southwest, the Vantaanjoki river (FI0100104, SAC, 146 ha) 8.9 kilometres to the west and Gästerby lakes and bogs (FI0100067, SAC, 199 ha) 9.1 kilometres to the east.

Of the planned electricity transmission connections in the Norrberget project option VE3b, the 400 kV overhead line (No-Is1) and the northern underground cable option (No-Is2) are located closer to Sipoonkorpi National Park than other options. The tunnels of both options for heat transmission connections, as well as cooling water tunnels, pass under the Natura area of the Mustavuori grove and Östersundom waterfowl habitats, as well as three nature conservation areas. The cooling water intake and discharge points are located less than a kilometre from several beach and islet nature reserves. The Natura area of the Kallahti ridge, meadow and water areas and the nature reserve of the Kallahti shallows, as well as a few small nature reserves on the islands, are located 1–1.5 kilometres from the southernmost intake and discharge point.

In addition, the environment of the Norrberget planning area and the planned transmission lines and cooling water intake and discharge points include several sites of the City of Helsinki’s nature conservation programmes, as well as one of the nature conservation area reservations of the Vantaa Master Plan and the nature conservation areas designated as nature reserves in the component master plan of the Sipoo archipelago and coastal areas (Table 19-5, Figure 19-3 and Figure 19-4).

Copyright © Helen Nuclear Ltd

Table 19-4. Nature reserves and Natura 2000 areas within a radius of five kilometres from the Norrberget planning area, within a radius of one kilometre from the electricity transmission connections and at the heat transmission connections and cooling water tunnels and within a radius of one kilometre from the intake and discharge sites.

Name	Designator	Type	Distance and direction from the planning area	Distance and direction from transmission lines
Sipoonkorpi National Park	KPU010036	national park	borders on the northern edge	Electricity transmission: 200 m north for all options
Länsimäki broad-leaved deciduous forest	LTA200865	protected habitat	1.5 km southwest	Electricity transmission VE3a: No-Ls1: 600 m southwest No-Ls2: 800 m southwest Electricity transmission VE3b: No-Is1: – No-Is2: – No-Is3: 800 m southwest
Vikkulla–Kasaberget nature reserve	YSA200253	nature conservation area on private land	1.6 km south	Heat transmission KL1 and KL2: the tunnel passes under the area in both options; 100 m southeast of the underground pipe/tunnel entrance in option KL2 Cooling water: all tunnel options pass under the area
Mustavuori grove and Östersundom waterfowl habitats	F10100065	Natura 2000 site (SAC/SPA)	1.6 km south	Heat transmission KL1 and KL2: the tunnel passes under the area in both options Cooling water: all tunnel options pass under the area
Östersundom broad-leaved deciduous forest	LTA202928	protected habitat	1.7 km southeast	–
Nissbacka nature reserve	YSA014190	nature conservation area on private land	2.0 km north	–
Kapellviken nature reserve	ESA300581	nature conservation area on state-owned land	2.2 km southeast	–
Koivumäki herb-rich forest with lime trees	LTA010156	protected habitat	2.2 km west	–
Mustavuori grove	YSA240584	nature conservation area on private land	2.2 km south	–
Kasaberget–Kasakallio nature reserve	YSA013643	nature conservation area on private land	2.3 km south	Heat transmission KL1 and KL2: the tunnel passes under the area in both options Cooling water: all tunnel options pass under the area
Östersundom waterfowl habitats	YSA200140	nature conservation area on private land	2.5 km southeast	–

Copyright © Helen Nuclear Ltd

Sipoonkorpi	FI0100066	Natura 2000 area (SAC)	2.6 km northeast	–
Topeliusviken	YSA202946	nature conservation area on private land	2.7 km southeast	–
Mustavuori–Porvarinlahti nature reserve	YSA012663	nature conservation area on private land	2.8 km south	–
Korsnäs broad-leaved deciduous forest	LTA202928	protected habitat	2.9 km southeast	–
Jakomäki hazel grove	LTA010221	protected habitat	3.0 km west	–
Slåttmossen nature reserve	YSA013516	nature conservation area on private land	3.2 km west	–
Kivikko fortification nature reserve	YSA261794	nature conservation area on private land	3.6 km west	–
Jakomäki boulder field of raised beaches inland (ancient)	YSA206460	nature conservation area on private land	3.7 km west	–
Nature reserve on the south bank of Porvarinlahti	YSA270280	nature conservation area on private land	3.7 km south	Heat transmission KL1 and KL2: the tunnel passes under the area in both options Cooling water (VE3b): all tunnel options pass under the area
Porvarinlahti nature reserve	YSA013642	nature conservation area on private land	3.7 km south	–
Roosinmäki nature reserve	YSA205256	nature conservation area on private land	3.8 km northwest	–
Roosinmäki	ERA202304	habitat of a specially protected species	3.9 km northwest	–
Kalkkikallio nature reserve	YSA019902	nature conservation area on private land	3.9 km northwest	–
Nature reserve for the meadows in Uussillanpuisto	YSA261236	nature conservation area on private land	4.1 km southwest	–
Linnavuorenpuisto bee meadow	ERA267818	habitat of a specially protected species	4.2 km southwest	–
Hältingberget broad-leaved deciduous forest	LTA202296	protected habitat	4.5 km east	–
Varjakanpuisto nature reserve	YSA265438	nature conservation area on private land	4.6 km southwest	–
Palokallio nature reserve	YSA019901	nature conservation area on private land	4.9 km north	–
Forsskogskärr	YSA270917	nature conservation area on private land	4.9 km northeast	–
Vuosaarenlahti seashore meadow	LTA010141	protected habitat	–	Cooling water: intake and discharge points less than 1 kilometre away
Särkkäniemi nature reserve	YSA013303	nature conservation area on private land	–	Cooling water: intake and discharge points less than 1 kilometre away

Copyright © Helen Nuclear Ltd

Pikku Niinisaari coastal meadow	YSA013474	nature conservation area on private land	–	Cooling water: intake and discharge points less than 1 kilometre away
Pikku Niinisaari sea-shore meadow	LTA010242	protected habitat	–	Cooling water: intake and discharge points less than 1 kilometre away
Mölandet islets	YSA011627	nature conservation area on private land	–	Cooling water: an intake and discharge point less than 1 kilometre away

Copyright © Helen Nuclear Ltd

Table 19-5. The sites of the nature conservation programmes and plans of Helsinki and Vantaa within a radius of two kilometres from the Norrberget planning area, within a radius of one kilometre from the electricity transmission connections of option VE2b, as well as at the cooling water tunnels and within a radius of one kilometre from the intake and discharge sites.

Name	Conservation programme or plan	Distance and direction from the planning area	Distance and direction from transmission lines
Landbo nature reserve	Helsinki Nature Conservation Programme 2025–2038	400 m east	Electricity transmission: 800 m east for all options
Länsimetsä	nature conservation area reservation of the Vantaa Master Plan	900 m south	Heat transmission: KL1: 50 m east of the underground pipe, the tunnel entrance and the tunnel are located in the southern corner of the area KL2: the tunnel passes under the area Cooling water: all tunnel options pass under the area
Östersundominpuro nature reserve	Helsinki Nature Conservation Programme 2025–2038	1.2 km southeast	–
Salmenkallio nature reserve	Helsinki Nature Conservation Programme 2025–2038	1.7 km south	Heat transmission: The KL1 and KL2 tunnels pass under the area Cooling water: all tunnel options pass under the area
Labbacka nature reserve	Helsinki Nature Conservation Programme 2025–2038	–	Heat transmission KL1 and KL2: the tunnel passes under the area in both options Cooling water: all tunnel options pass under the area
Uutela marine area nature reserve	Helsinki Nature Conservation Programme 2025–2038		Cooling water: one tunnel option passes under the area, intake and discharge points less than 1 km away
Kajuuttaluodot marine area nature reserve	Helsinki Nature Conservation Programme 2025–2038	–	Cooling water: intake and discharge points less than 1 kilometre away
Nature reserve for the eastern marine area in Kallahdenniemi	Helsinki Nature Conservation Programme 2025–2038	–	Cooling water: intake and discharge points less than 1 kilometre away
Nature reserve for the eastern marine area in Kallahdenniemi	Helsinki Nature Conservation Programme 2025–2038	–	Cooling water: an intake and discharge point less than 1 kilometre away
Kuminapää nature reserve	Helsinki Nature Conservation Programme 2025–2038	–	Cooling water: an intake and discharge point less than 1 kilometre away

Copyright © Helen Nuclear Ltd

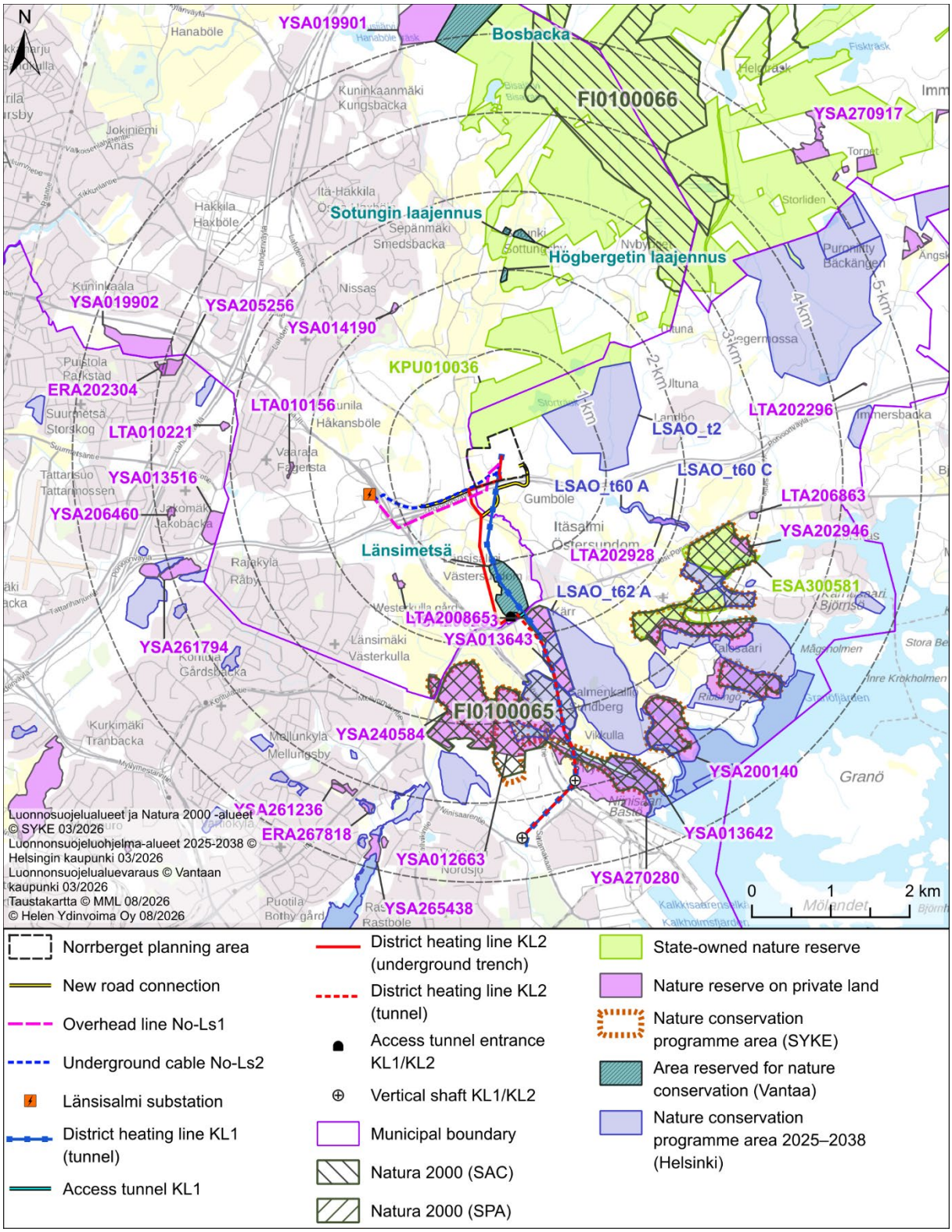


Figure 19-3. Nature reserves, Natura 2000 sites and areas designated to nature conservation in the surroundings of the Norrberget planning area in option VE3a.

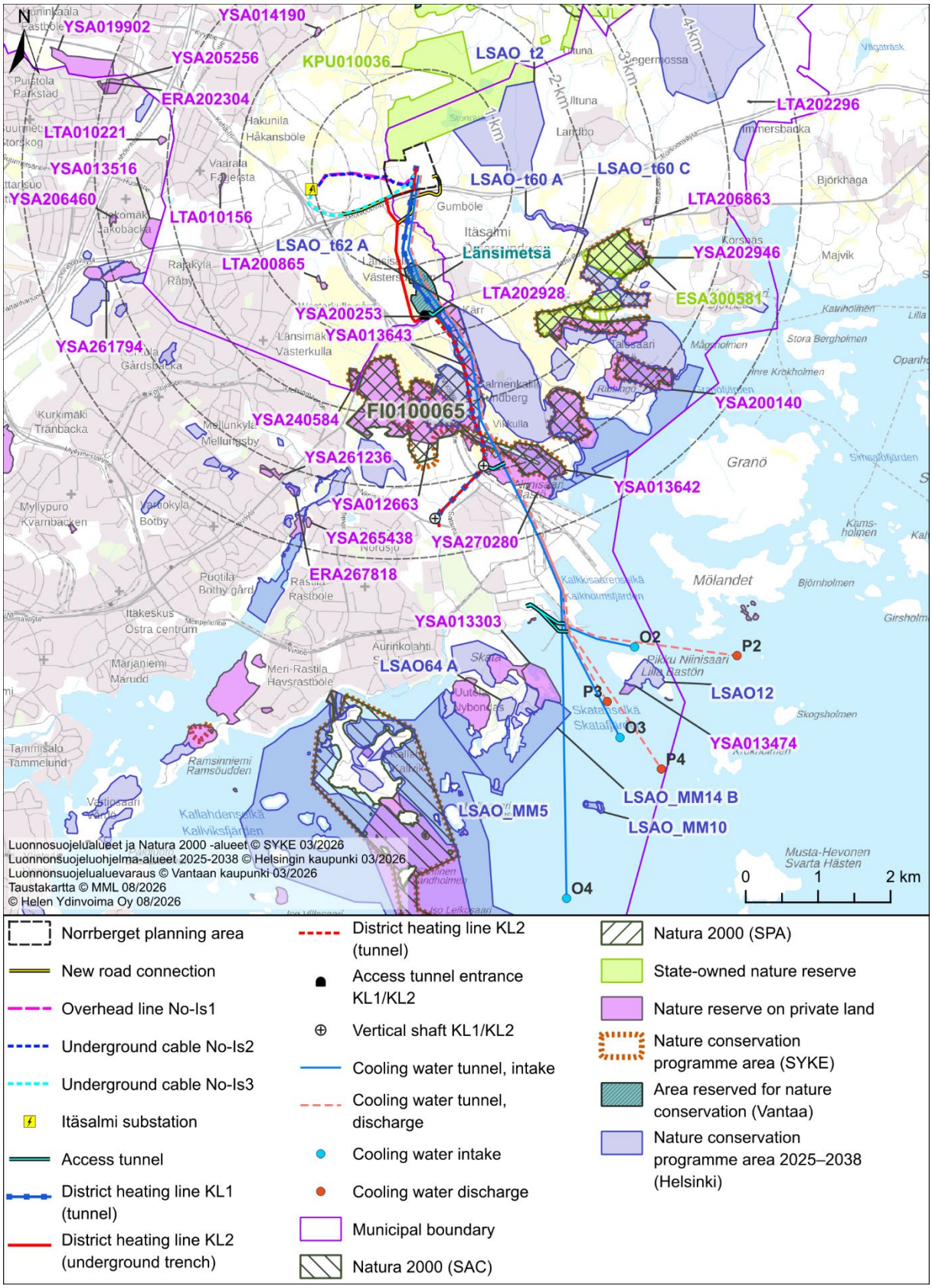


Figure 19-4. Nature reserves, Natura 2000 sites and areas designated to nature conservation in the surroundings of the Norrberget planning area in option VE3b.

19.2 Need for Natura assessment

Natura assessment is considered necessary in both Vuosaari (VE2a, VE2b) and Norrberget project options (VE3a, VE3b). The grounds for this are presented in more detail for each Natura area.

19.2.1 Mustavuori grove and Östersundom waterfowl habitats F10100065

The grounds for the protection of the Natura area are 13 habitat types listed in the Habitats Directive, and, of the species listed in Annex II of the Habitats Directive, *Herzogiella turfacea* and 32 bird species, three of which are so-called sensitive species kept confidential. The bird species forming the grounds for protection are mainly the nesting species in wetlands and forests, as well as the migratory species found in wetlands.

In the Salmisaari project option VE1, all land use is located at a distance of more than 10 kilometres and impacts on the Natura area are ruled out.

The Vuosaari project option VE2a includes only the construction of the heating plant in the Vuosaari planning area without new electricity, district heating or road connections. At its closest, the Vuosaari planning area is located at a distance of 500 metres from the Natura area (Porvarinlahti areas, Figure 19-2). Depending on the method and timing of construction, significant impacts (disturbance and noise impacts) on the nesting birds that form the grounds for the protection of the area cannot be ruled out.

The Vuosaari project option VE2b includes the construction of the CHP plant in the Vuosaari planning area and the related electricity and cooling water connections. At its closest, the planning area of the plant is located at a distance of 500 metres from the Natura area (Porvarinlahti areas). All three electricity transmission options of the CHP plant are located in the Mustavuori part of the Natura area (Figure 19-2). The overhead line options Vu-Is1 and Vu-Is2 do not differ from each other in the Natura area. Both options would be located on a shared pole for about 560 metres within the Natura area along the existing Vaarala–Vuosaari 110 kV power line route. Both electricity transmission route options would require widening the power line corridor and the bedding beyond their current width. According to the biotope patch data of Metsähallitus, of the habitat types that form the grounds for the protection, herb-rich forests and deciduous swamp woods are present at the edges of the current power line corridor or in its immediate vicinity. The option Vu-Is3, which is implemented as an underground cable in the Natura area, would be located mainly alongside the current power line, but the option also includes a new terrain corridor in the Natura area. In total, the option Vu-Is3 would be located within the Natura area for about 850 metres. According to the biotope patch data of Metsähallitus, of the habitat types that form the grounds for the protection, the new terrain corridor contains herb-rich forests. Significant adverse impacts on the habitat types that form the grounds for the protection of the area cannot be ruled out.

A new district heat transmission connection is required for the Norrberget plant site both in the case of the heating plant (VE3a) and the CHP plant (VE3b). The heat transmission connection will be carried out either entirely in a tunnel excavated in the bedrock (option KL1) or as a combination of a tunnel and a pipe excavated in the ground (option KL2). In addition, the CHP plant requires the construction of new cooling water tunnel connections from the Norrberget plant site to the marine area off Vuosaari. Both project options include vertical shafts in the Niinisaari and Vuosaari areas. At its closest, the Niinisaari vertical shaft is located at a distance of 250 metres from the Natura area (Porvarinlahti areas, Figure 19-3 and Figure 19-4).

Copyright © Helen Nuclear Ltd

Depending on the method and timing of construction, significant adverse impacts (disturbance and noise impacts) on the nesting birds that form the grounds for the protection of the area cannot be ruled out.

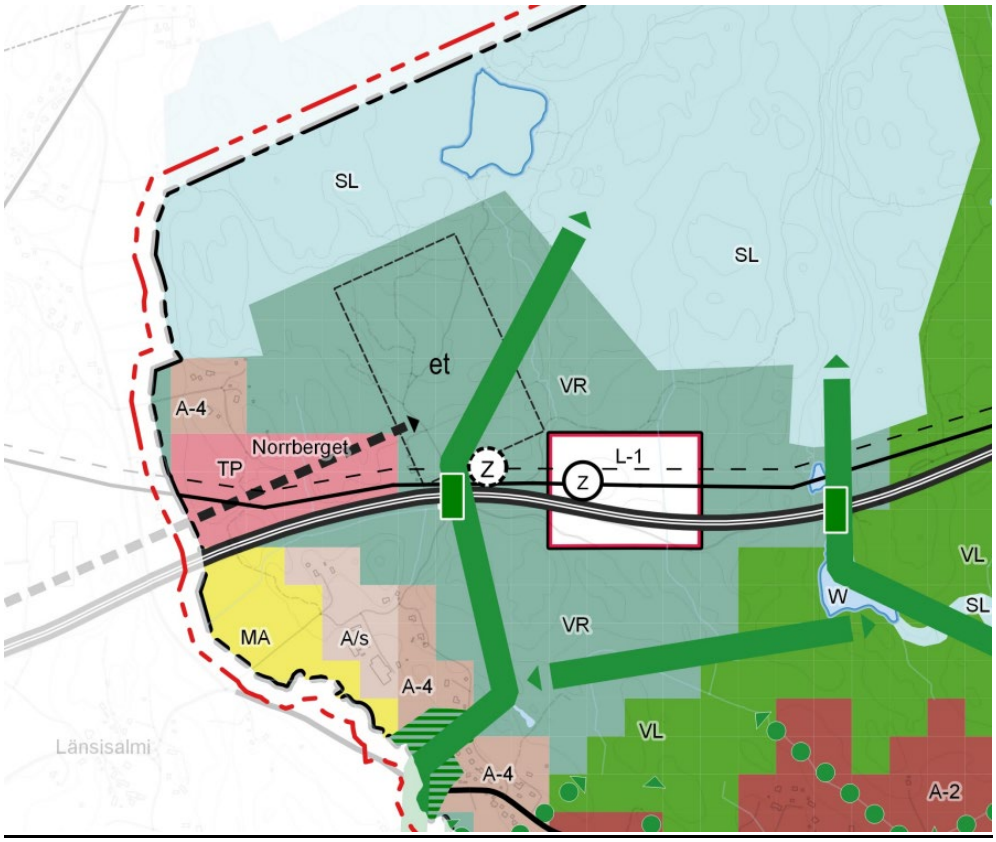


Figure 19-5. Illustration of the plan proposal for Östersundom component master plan on 2 June 2026, covering the Norrberget area. Green corridors are marked with green lines.

In addition, in options VE3a and VE3b, the planning area is located in the immediate vicinity of the green corridor linking the Natura area of Mustavuori grove and the Östersundom waterfowl habitats and the extensive forest areas on the Sipoonkorpi side (Figure 19-5). The corridor is important for the hazel grouse population. In previous land use planning projects in Östersundom and the most recent Natura assessment of the Östersundom master plan (Erävuori et al. 2024), the hazel grouse has been identified as one of the most critical species forming the grounds for the protection of the Natura area of the Mustavuori grove and the Östersundom waterfowl habitats. The land use of the planning area of the nuclear power plant is more extensive than presented in the master plan, and the road connection for the project has been marked in the area of the required green corridor critical for the hazel grouse, which crosses the motorway (Figure 19-5). As a result, significant impacts in project options VE3a and VE3b cannot be ruled out at the outset. In addition, the implementation of the project options may have significant synergies with the underground civil engineering maintenance area marked to the east of the planning area in the master plan, the ET area (in the underground plan, the sewage treatment plant reservation). In the Natura assessment of the master plan, the starting point has been that the above-ground parts primarily allow for the marking of the hiking and outdoor area (VR area), which overlaps with the ET area.

When considering the project alone or together with other land use in the area, significant adverse impacts on the movement routes of the hazel grouse cannot be ruled out.

Copyright © Helen Nuclear Ltd

For the Natura area of Mustavuori grove and Östersundom waterfowl habitats, Natura assessment must be carried out for the Vuosaari project options VE2a and VE2b and the Norrberget project options VE3a and VE3b.

19.2.2 Kallahti ridge, meadow and water areas FI0100063

The grounds for the protection of the Natura area is the Habitats Directive (SAC area), comprising six habitat types of the Habitats Directive. Of aquatic habitat types, the habitat types include sandbanks which are slightly covered by sea water and coastal lagoons. Other habitat types represent coastal and forest habitats.

In the Salmisaari project option VE1, all land use is located at a distance of more than 10 kilometres and impacts on the Natura area are ruled out.

In the Vuosaari and Norrberget project options, above-ground construction is located at a distance of about 2.5 kilometres at its closest, and the impacts of above-ground land use on the grounds for the protection of the Natura area are ruled out. For the Natura area, the only part of the project with possible impacts is the sea water cooling required by the CHP plant options VE2b and VE3b in Vuosaari and Norrberget. The EIA procedure examines the cooling water intake and discharge points for the Vuosaari and Norrberget CHP plants (VE2b, VE3b), which are located in the marine areas of Helsinki and Sipoo (Figure 19-2 and Figure 19-4). In terms of the aquatic habitat types of the Natura area, discharge waters released into the sea through discharge points have a warming impact on seawater. The thermal load of discharge waters can change the prevalence and abundance of underwater species and thus the status of the habitat types. The discharge points of the Vuosaari and Norrberget project options VE2b and VE3b are identical, and the closest ones (P3, P4) are located at a distance of 2.7–3.0 kilometres from the Natura area at their closest. Without more precise information on the thermal load and dispersion of discharge waters in the marine area, significant impacts on underwater habitats cannot be ruled out. Significant adverse impacts on the habitat types that form the grounds for the protection of the area cannot be ruled out.

A Natura assessment must be carried out for the Natura area of Kallahti ridge, meadow and water areas, covering the Vuosaari project option VE2b and the Norrberget project option VE3b.

19.2.3 Sipoonkorpi FI0100066

The grounds for the protection of the Natura area is the Habitats Directive (SAC area), covering 11 habitat types listed in the Habitats Directive, and, of the species listed in Annex II and IV of the Habitats Directive, *Herzogiella turfacea* and the scarce fritillary.

In the Salmisaari project option VE1, all land use is located at a distance of more than 10 kilometres and impacts on the grounds for the protection of the Natura area are ruled out.

The Vuosaari project option VE2a includes only the construction of the heating plant in the Vuosaari planning area without new electricity, district heating or road connections. At its closest, the Vuosaari planning area is located at a distance of 6,6 kilometres from the Natura area. The Vuosaari project option VE2b includes the construction of the CHP plant in the Vuosaari planning area and the related electricity and cooling water connections, with electricity transmission connections located at a distance of 3.6 kilometres at their closest. In both project options, impacts on the grounds for the protection of the Natura area are ruled out due to distance. Habitat types and species or habitats of species which form the grounds for the

Copyright © Helen Nuclear Ltd

protection can only be affected in the immediate vicinity of the Natura area, through the marginal effect, for example. The project option also has no hydrological connection to the Natura area (various small catchment areas).

In the Norrberget project options VE3a and VE3b, the closest structures to the Natura area are nuclear power plant areas (Figure 19-3). The shortest distance between the planning site and the Natura area is 2.6 kilometres. The impacts of the project option on the Natura area are ruled out. The planning area is located in the rocky forest area in Norrberget, whose small catchment area is bordered to the east by the Storträsk lake with its drainage ditch and nearby small swamps. Indirect water or groundwater impacts and marginal effects are ruled out due to the location of the small catchment area and the distance of the planning area. The populations of protected species in the Natura area in the Norrberget area are not affected due to the distance.

Significant cumulative impacts with other projects have not been identified due to the relatively large distance of the activities of the project options from the Natura area.

The possibility of significant adverse impacts on the grounds for the protection of the Sipoonkorpi Natura area is ruled out, and no Natura assessment is required.

19.3 Impact assessment and methodology

The EIA programme describes in tables and maps the nature conservation areas, the areas reserved for nature conservation and Natura 2000 areas located in the surroundings of the planning areas. The data is based on, for example, the map data and spatial data of the Finnish Environment Institute (Syke 2025), the City of Vantaa (2025) and the City of Helsinki (2025), as well as the data of the component master plan of the Sipoo archipelago and coastal areas (Sipoo Municipality 2014). The information is reviewed in the EIA report, and descriptions are provided for those sites affected. Initial information sources used are the decisions to establish nature conservation areas and the descriptions and biotope information sheets of Natura areas, as well as, if necessary, other existing information from the areas, such as the nature site data of cities and the species observation data of the Finnish Biodiversity Information Facility. If necessary, the assessment area is expanded to correspond to the project's impact area.

The EIA report assesses the impacts that implementing the different project options would have on nature reserves, areas reserved for conservation and Natura 2000 sites. The impact assessment is carried out in accordance with the *Ecological Surveys and Ecological Impact Assessment* (Luopas) guide (Mäkelä & Salo 2024). The assessment takes into account both direct and indirect impacts and assesses their significance. Other impact assessments and modelling carried out during the EIA reporting phase will be used in the assessment. Recommendations are made to prevent and mitigate adverse impacts.

In the EIA programme phase, the need for Natura assessment has been assessed (see chapter 19.2). For the Vuosaari project option VE2b, a Natura assessment of the impacts of the project on the Natura area of the Mustavuori grove and the Östersundom waterfowl habitat will be prepared as an appendix to the EIA report in accordance with Section 35 of the Nature Conservation Act, as its electricity transmission connection in all options is located in the Natura area. For the assessment, Natura habitat data from Metsähallitus and species observations from the Finnish Biodiversity Information Facility are requested. During 2026, the necessary nature surveys will be carried out for a Natura assessment in the part of the Natura area that is located in the planned construction area and its vicinity. The habitats under the

Copyright © Helen Nuclear Ltd

Habitats Directive, notable plant species and breeding birds in the area are mapped. Particular focus will be placed on the verification of the presence of the habitats and species forming the grounds for protection. In addition, for the Vuosaari heating plant project option VE2a, a Natura assessment will be carried out on the impacts of the project on the Natura area of the Mustavuori grove and the Östersundom waterfowl habitat, as, for example, noise impacts during construction cannot be excluded at the EIA programme phase. It is estimated that a Natura assessment is also needed for the impacts of Norrberget project options VE3a and VE3b on the Natura area of the Mustavuori grove and the Östersundom waterfowl habitats, as the planned construction partly lies within a forest area identified as a critical ecological corridor, particularly for the hazel grouse, which is one of the bird species forming the grounds for protection of the Natura site. The Natura assessment is prepared as an appendix to the EIA report.

In project options VE2b and VE3b for the CHP plants, a Natura assessment is carried out of the impacts of the project on the Natura area of Kallahti ridge, meadow and water areas and included as an appendix to the EIA report, as the impacts of the cooling water heat discharge of the CHP plant cannot be excluded at the EIA programme phase. The assessments take into account other possible projects and plans with which the project may have cumulative impacts. The impacts on the Natura site of Mustavuori grove and Östersundom waterfowl habitats have recently been assessed during the draft stage of the pending Östersundom component master plan (Erävuori et al. 2024).

The impact assessment is carried out by biologists with experience of similar impact assessments and who have previously participated in impact assessments for projects in the same area.

The table (Table 19-6) below presents the justification for targeting the environmental impact assessment by project option for protected areas (for background on targeting, see chapter 7.2.1).

Table 19-6. Justification for targeting the environmental impact assessment by project option in terms of protected areas. x = the project option for which the assessment is specifically targeted.

	Protected areas	Justification
VE1		The closest nature reserves are more than a kilometre away and the closest Natura area is about five kilometres away, and they are not affected according to preliminary assessments.
VE2a	x	The nearest nature reserves and the closest Natura area are less than a kilometre away.
VE2b	x	The planned electricity transmission connections are located in the Natura area and nature conservation areas.
VE3a	x	The planning area borders a national park.
VE3b	x	The planning area borders a national park.

Copyright © Helen Nuclear Ltd

20 CLIMATE

20.1 Current status

20.1.1 Climate

The project area is located in the southern boreal climate zone in Uusimaa. In the region, the average temperature for the year is about 4.5–6 degrees Celsius, and the warmest month is July, when the average temperature is usually 16.5–17.5 degrees Celsius. On average, there are 8 hot days on the coast and 19 hot days on the mainland in summer. Annual precipitation ranges from more than 600 mm to more than 700 mm. The rainiest month is usually August with an average rainfall of about 80 mm. (Climate guide 2022)

The length of the growing season in Uusimaa is about five to six months. First snow is generally received on the mainland in early November and a couple of weeks later on the coast. The arrival time of permanent snow cover ranges from the first half of November to mid-January. The thickness of the snow cover is between 15 and 35 centimetres in early March. Permanent snow cover lasts for about 2.5–4 months, staying the longest in the northwestern part of the region. (Climate guide 2022)

The average temperature for 1996–2025 was about 6.7 degrees Celsius at the Helsinki Kaisaniemi observation station (Finnish Meteorological Institute 2026a). The average temperatures for the comparison periods 1991–2020 and 1981–2010 were 6.5 degrees Celsius (Finnish Meteorological Institute 2026b) and 5.9 degrees Celsius (Pirinen et al. 2012). The average temperature has risen from one reference period to another by 0.6 degrees Celsius, and the period 1996–2025 was about 0.2 degrees Celsius warmer than the reference period 1991–2020. Average temperatures have risen in all months (Figure 20-1).

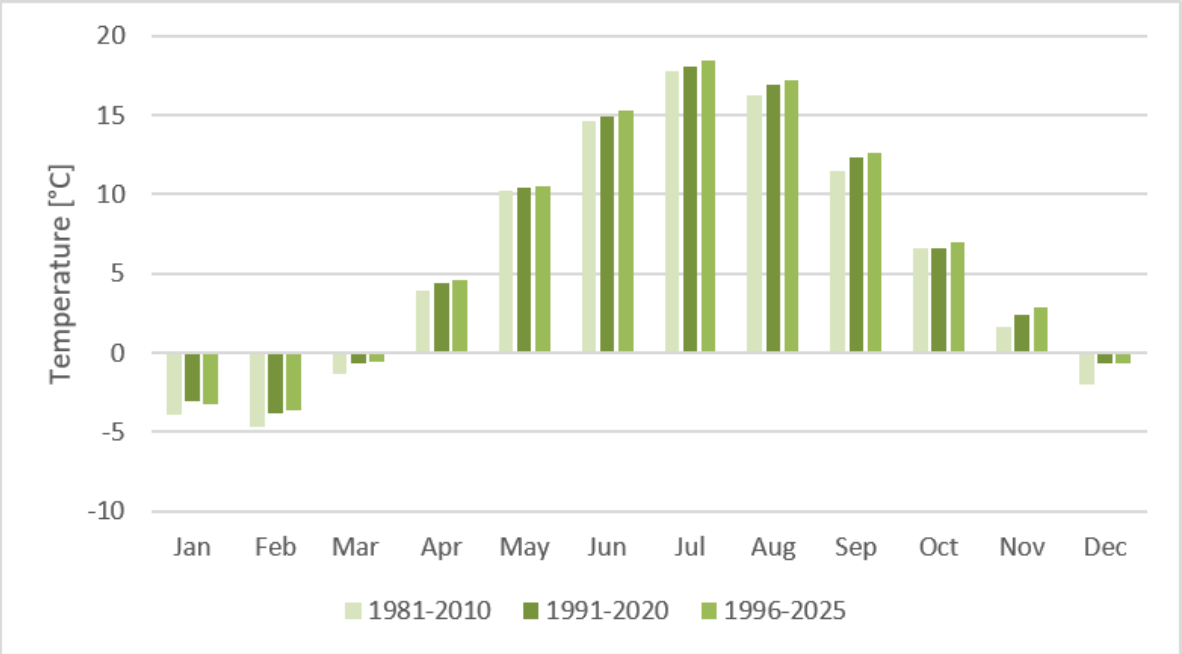


Figure 20-1. The average monthly temperature at Helsinki Kaisaniemi observation station for the reference periods 1981–2010 and 1991–2020 and for 1996–2025. (Finnish Meteorological Institute 2026a, Finnish Meteorological Institute 2026b & Pirinen et al. 2012).

At the Kaisaniemi observation station, the average annual rainfall for 1996–2025 was 665 millimetres (Finnish Meteorological Institute 2026a). The corresponding values for the reference

Copyright © Helen Nuclear Ltd

periods 1991–2020 and 1981–2010 were 653 millimetres (Finnish Meteorological Institute 2026c) and 655 millimetres (Pirinen et al. 2012). Precipitation has decreased by 0.3% from one reference period to another and increased by 1.8% from the reference period 1991–2020 to 1996–2025. The average monthly rainfall amounts have not changed significantly (Figure 20-2).

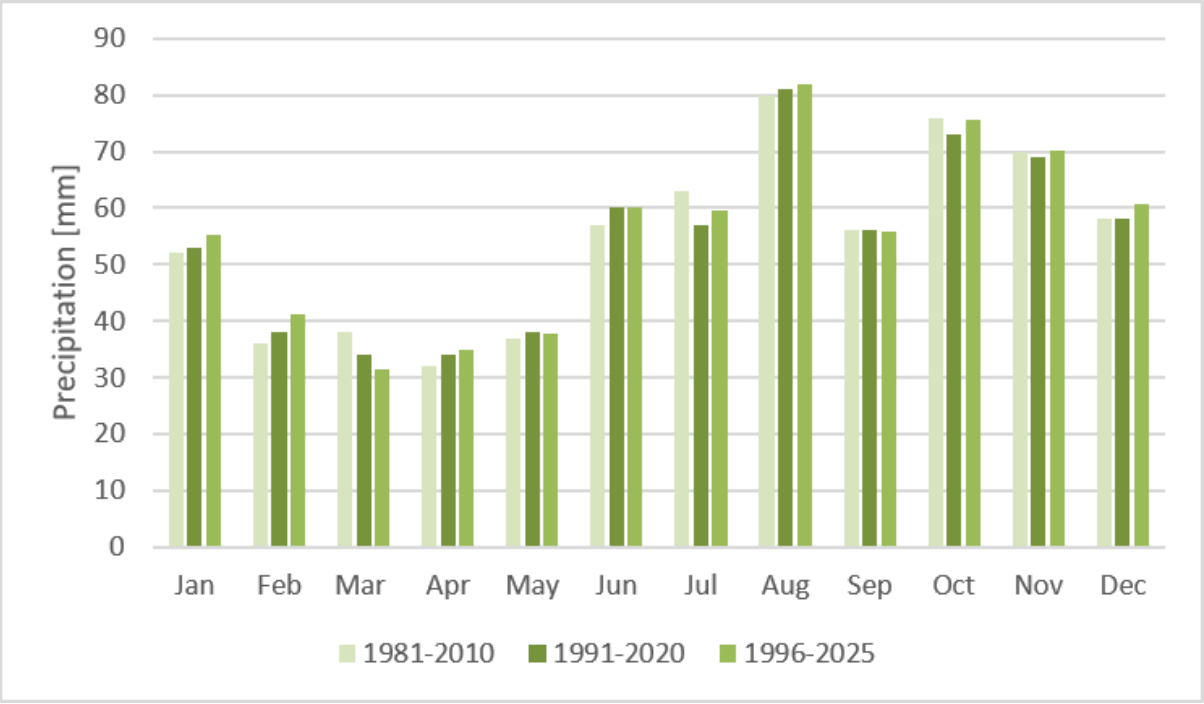


Figure 20-2. The average monthly precipitation at Helsinki Kaisaniemi observation station for the reference periods 1981–2010 and 1991–2020 and for 1996–2025. (Finnish Meteorological Institute 2026a, Finnish Meteorological Institute 2026c & Pirinen et al. 2012).

Climate in the project area is estimated to warm during the current century by approximately 1.7–5.0 degrees Celsius compared to the reference period 1991–2020 (Figure 20-3). Annual precipitation is estimated to increase by 5–13% (Figure 20-4). The changes will depend on the evolution of global greenhouse gas emissions projected under the so-called SSP scenarios. (Finnish Meteorological Institute 2023)

Copyright © Helen Nuclear Ltd

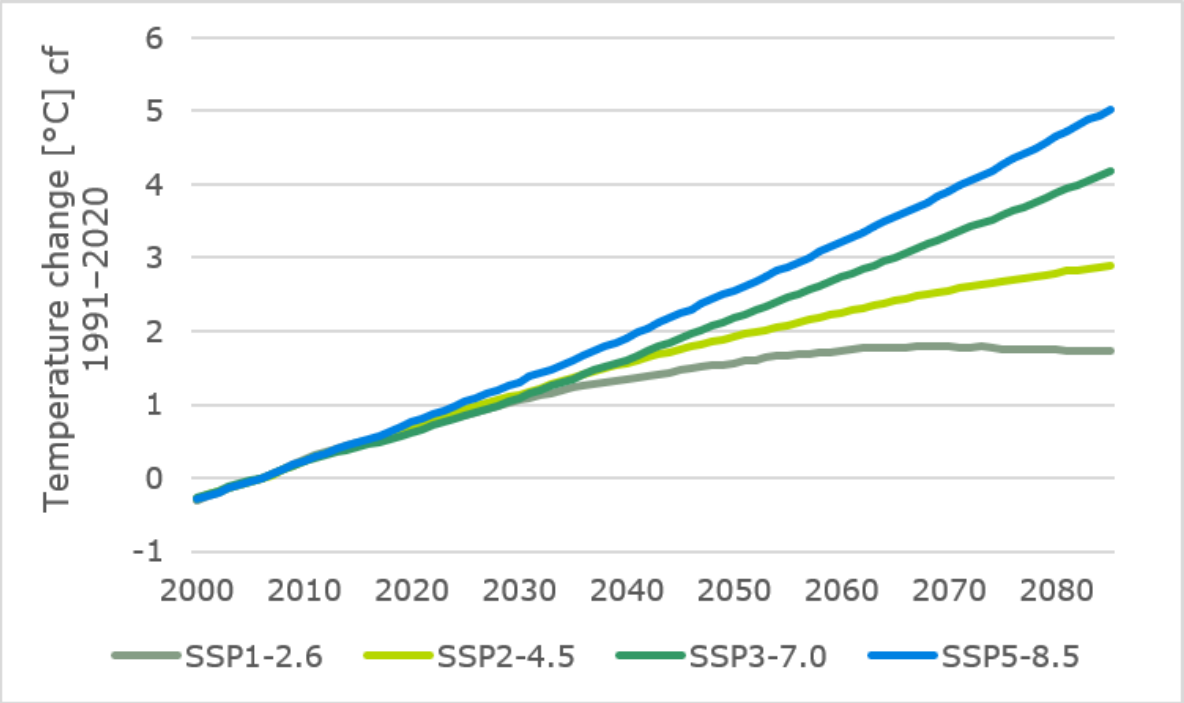


Figure 20-3. Estimated change in average annual temperature in Helsinki under different greenhouse gas emission scenarios up to 2085. The changes are compared to the period 1991–2020. (Finnish Meteorological Institute 2023)

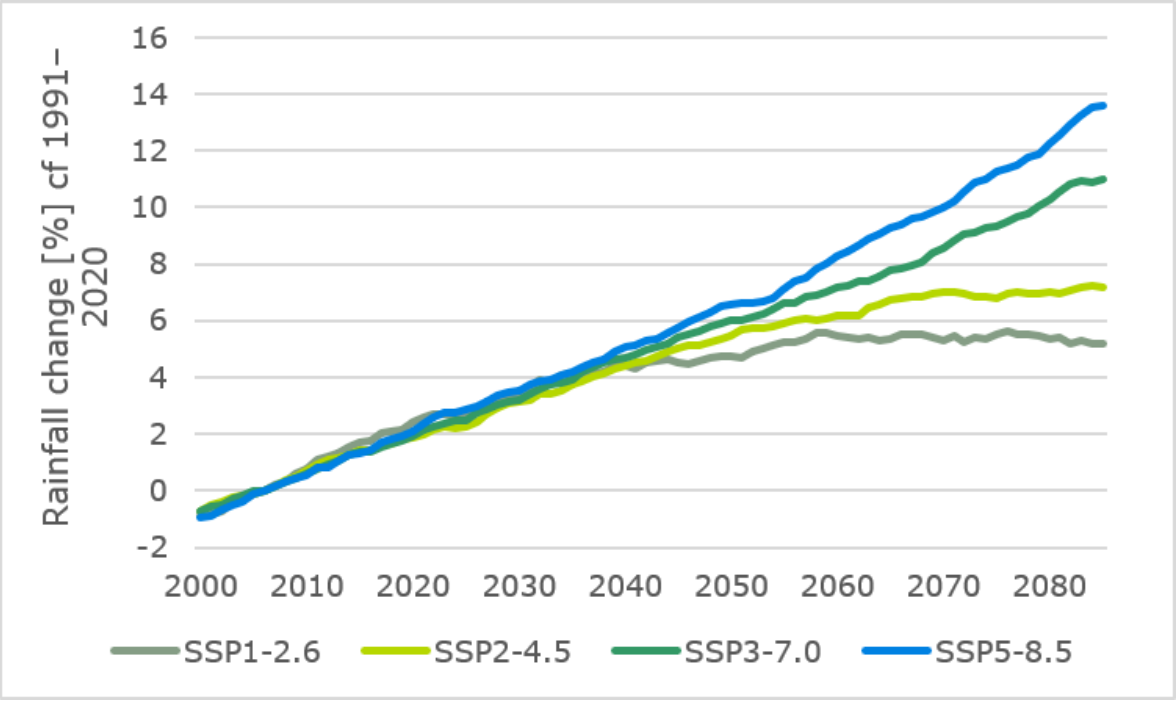


Figure 20-4. Estimated change in the average annual precipitation in Helsinki under different greenhouse gas emission scenarios up to 2085. The changes are compared to the period 1991–2020. (Finnish Meteorological Institute 2023)

20.1.2 Flood risks

In the future, climate change may increase the risk of coastal flooding in Finland due to rise in sea level and sea level fluctuation. The lowest recommended height of buildings in Helsinki is

Copyright © Helen Nuclear Ltd

292 cm (N2000 system) (Kahma et al. 2024). The project provides for a flood altitude level of 4.5 metres in the high emission scenario model (SSP5-8.5) for the nuclear power plant.

For the flood risk zones, coastal flood areas are presented below, based on the baseline scenario with a frequency of 1 in 250 years (1/250a) and a special scenario in the 22nd century, in the flood climate scenario SSP5-8.5 (high) occurring in 1/250 per year.

In its current state, the Salmisaari planning area is located in very small parts, for the area surrounding the plant's seawater channel and the entrance to the underground access tunnel, in a coastal flood risk area, based on the baseline scenario of flood risk zones (frequency 1/250a) (Figure 20-5). For the other parts, however, the ground level of the planning area is in its current state mainly above 280 cm (N2000).

In the special scenario based on the climate scenario SSP5-8.5 (high), the Salmisaari planning area is located almost entirely in a coastal flood risk area (Figure 20-6).

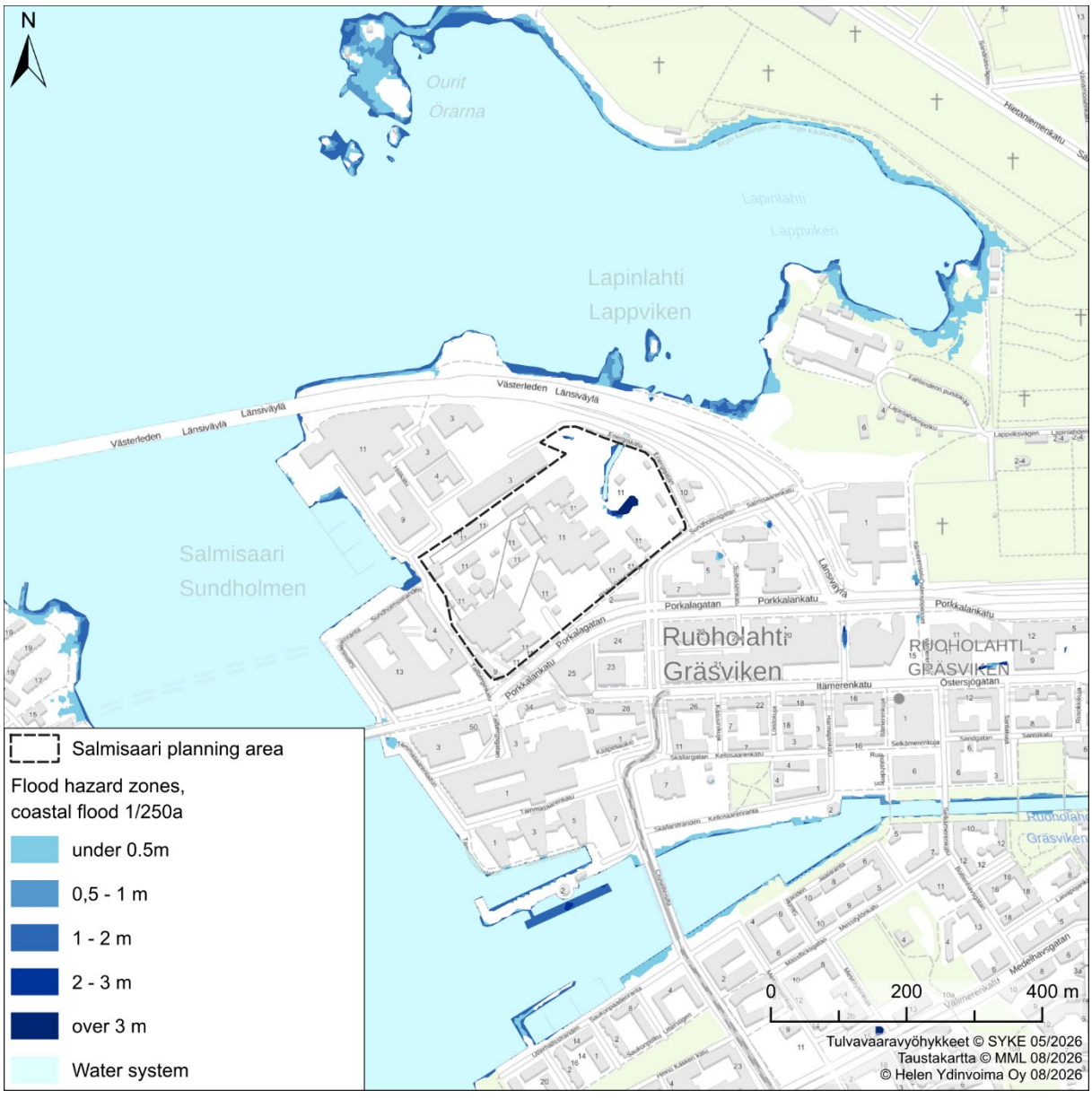


Figure 20-5. Salmisaari (VE1), flood risk zones in the baseline scenario with a frequency of 1/250a.

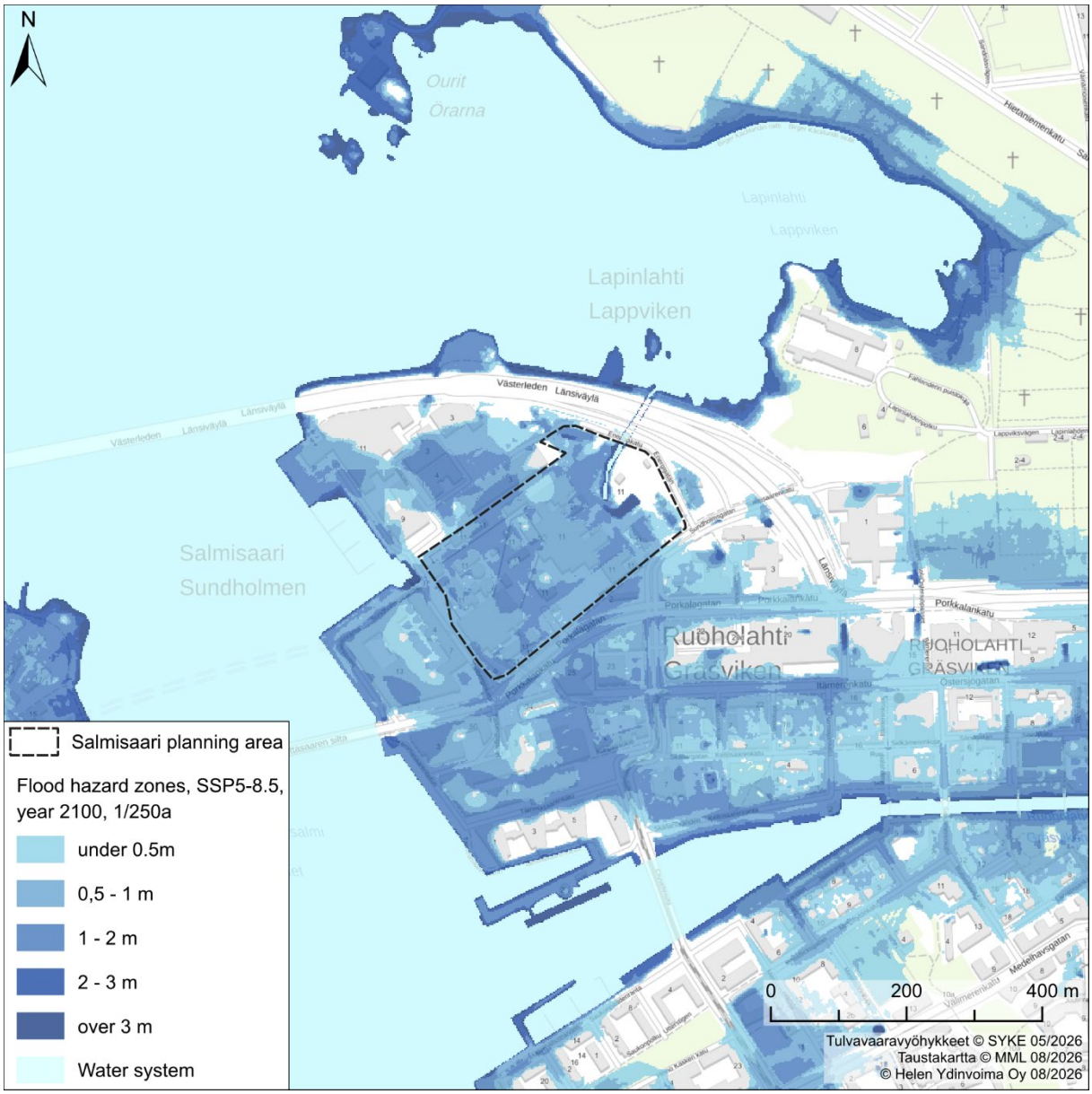


Figure 20-6. Salmisaari (VE1), flood risk zones in the special scenario SSP5-8.5, year 2100, frequency 1/250a.

Copyright © Helen Nuclear Ltd

In its current state, the Vuosaari planning area to the east of Satamakaari is not located in a coastal flood risk area in the baseline scenario of flood risk zones, nor in the special scenario based on the climate scenario SSP5-8.5 (high) (frequencies 1/250a). In its current state, the planning area to the west of Satamakaari is located to a small extent in flood risk areas in the above-mentioned baseline scenario (Figure 20-7) and more broadly in the special scenario (Figure 20-8). Traffic connections to the area are partly located in flood risk areas from both directions. The alternative electricity transmission routes of the Vuosaari CHP plant (VE2b) are located to the east and north of Mustavuori in flood risk zones both in the baseline scenario (Figure 20-9) and more broadly in the special scenario (Figure 20-10).

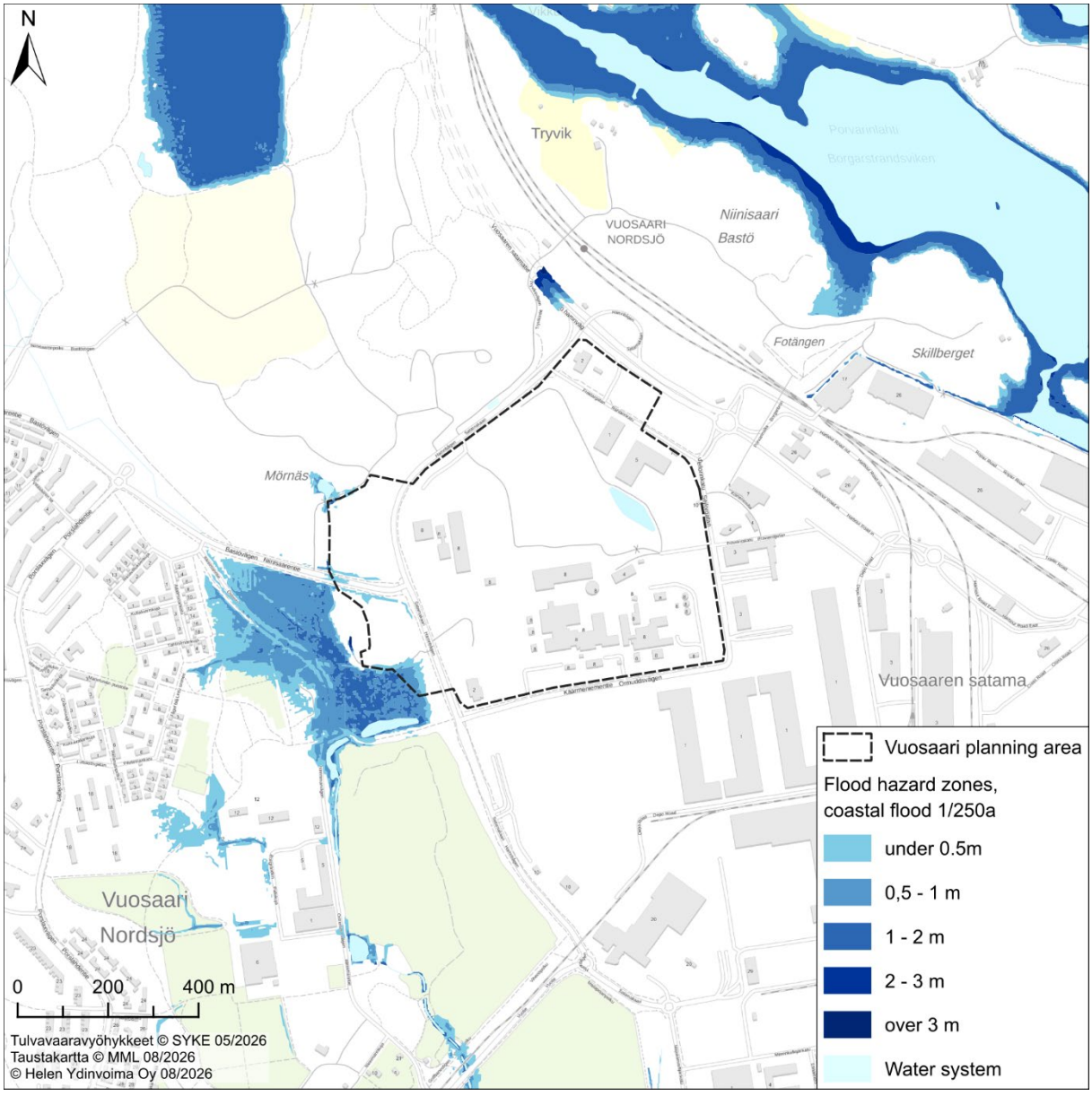


Figure 20-7. Vuosaari (VE2), flood risk zones in the baseline scenario with a frequency of 1/250a.

Copyright © Helen Nuclear Ltd

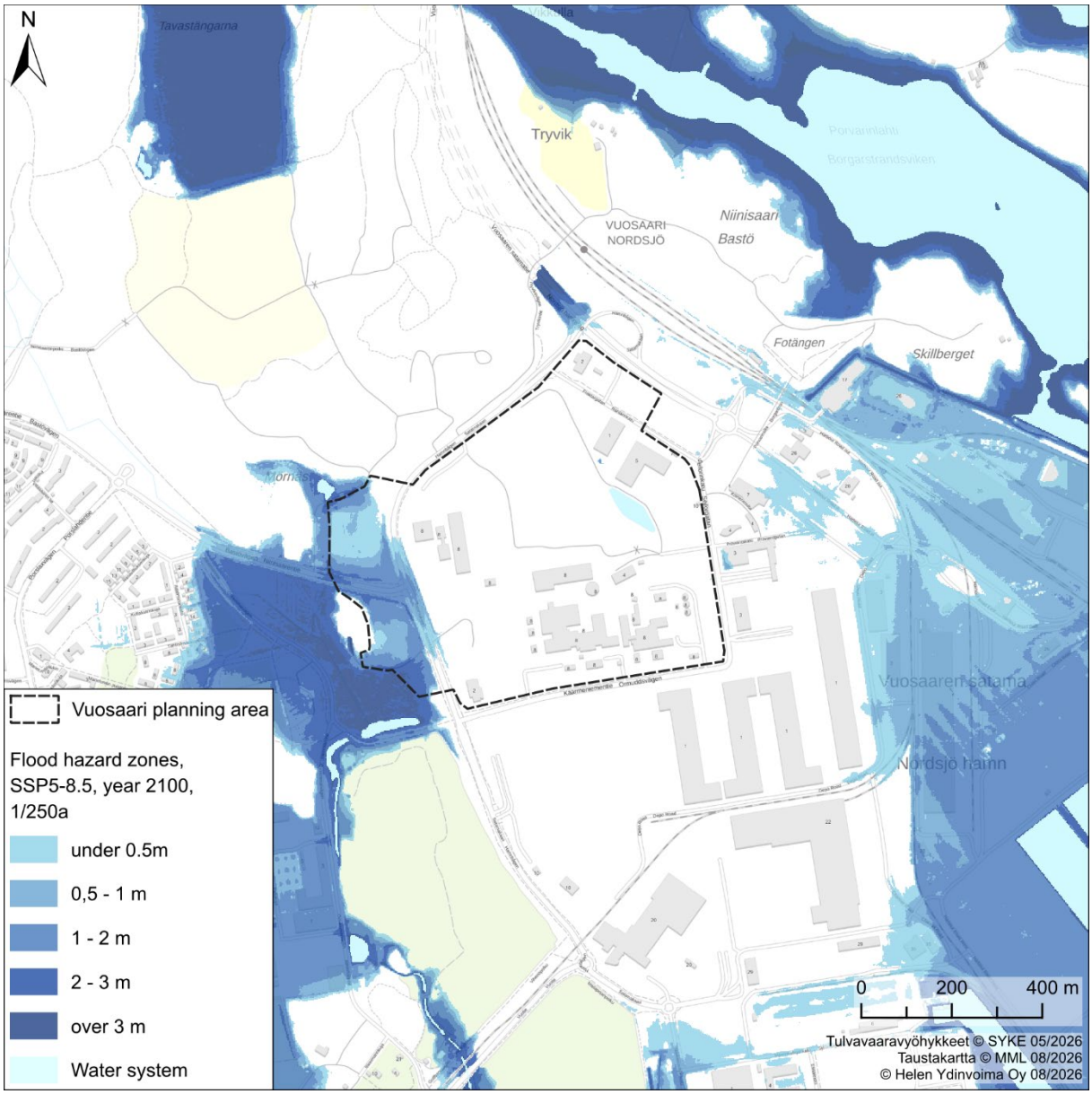


Figure 20-8. Vuosaari (VE2), flood risk zones in the special scenario SSP5-8.5, year 2100, frequency 1/250a.

Copyright © Helen Nuclear Ltd

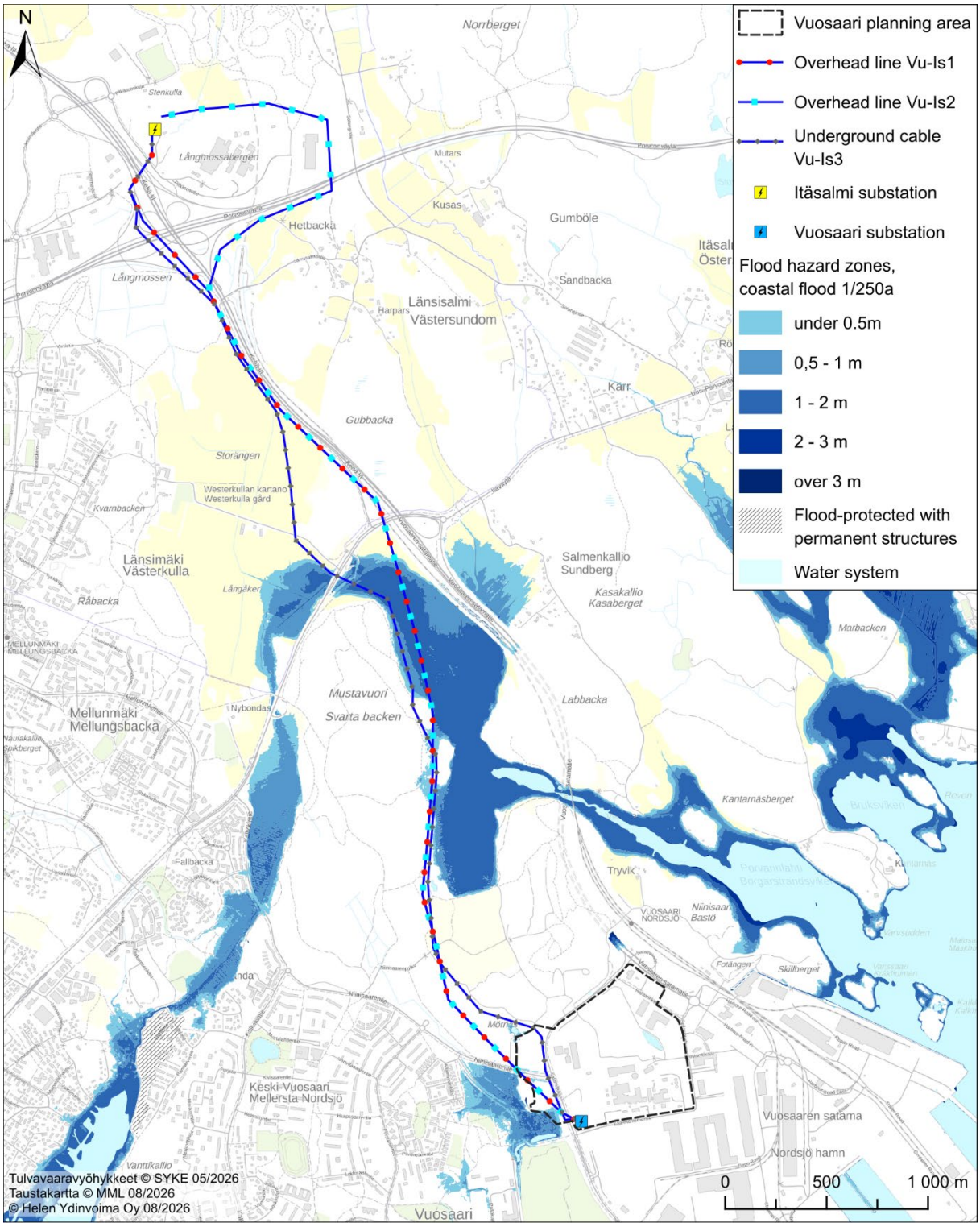


Figure 20-9. Alternative electricity transmission routes of the Vuosaari CHP plant (VE2b), flood risk zones in the baseline scenario with a frequency of 1/250a.

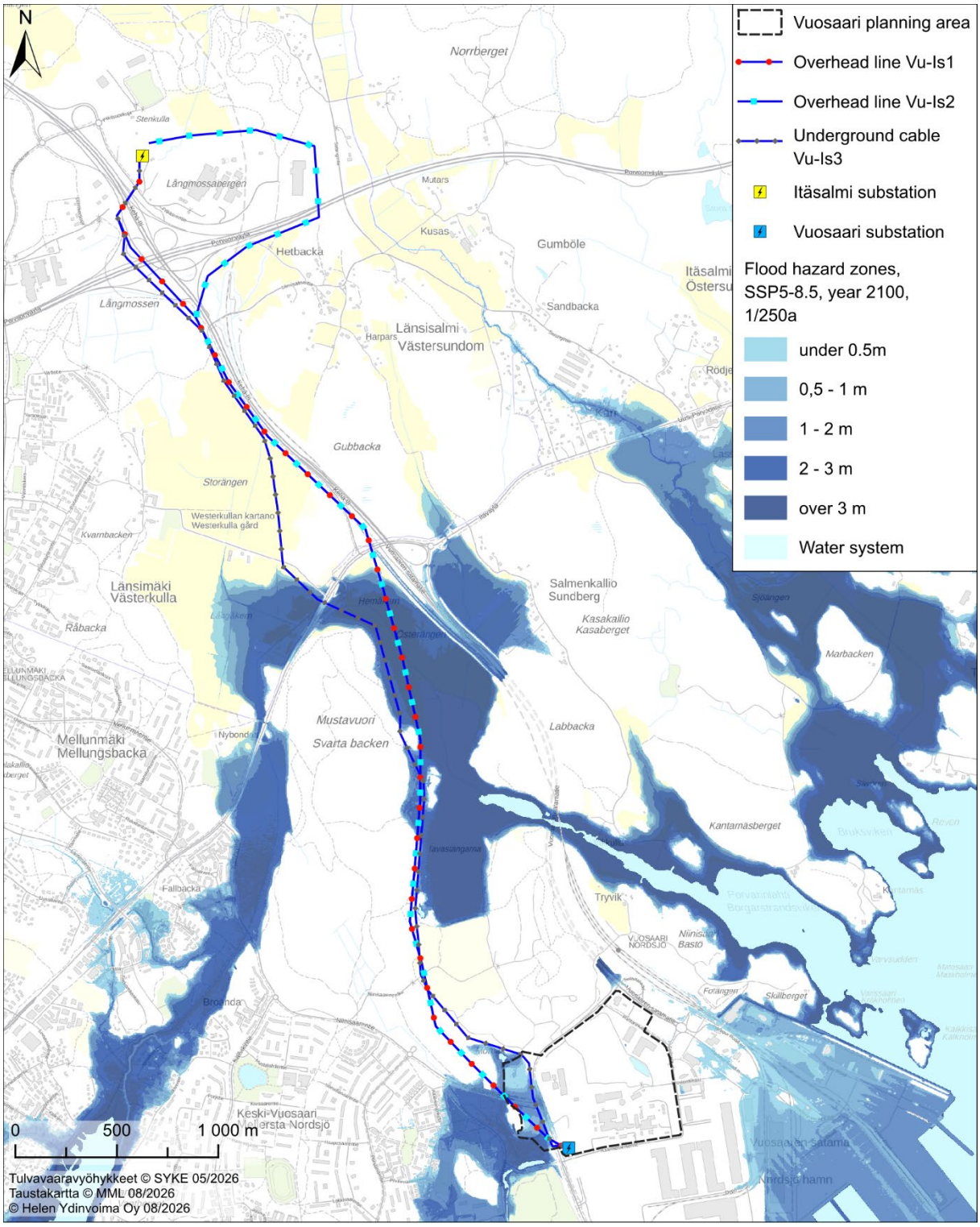


Figure 20-10. Alternative electricity transmission routes of the Vuosaari CHP plant (VE2b), flood risk zones in the special scenario SSP-5.85, year 2100, with a frequency of 1/250a.

The Norrberget planning area and the electricity transmission route options of project options VE3a and VE3b are not located in flood risk zones in the above-described baseline scenarios and special scenario (frequencies 1/250a). The nearest flood risk zones are shown in the figures below (Figure 20-11 and Figure 20-12).

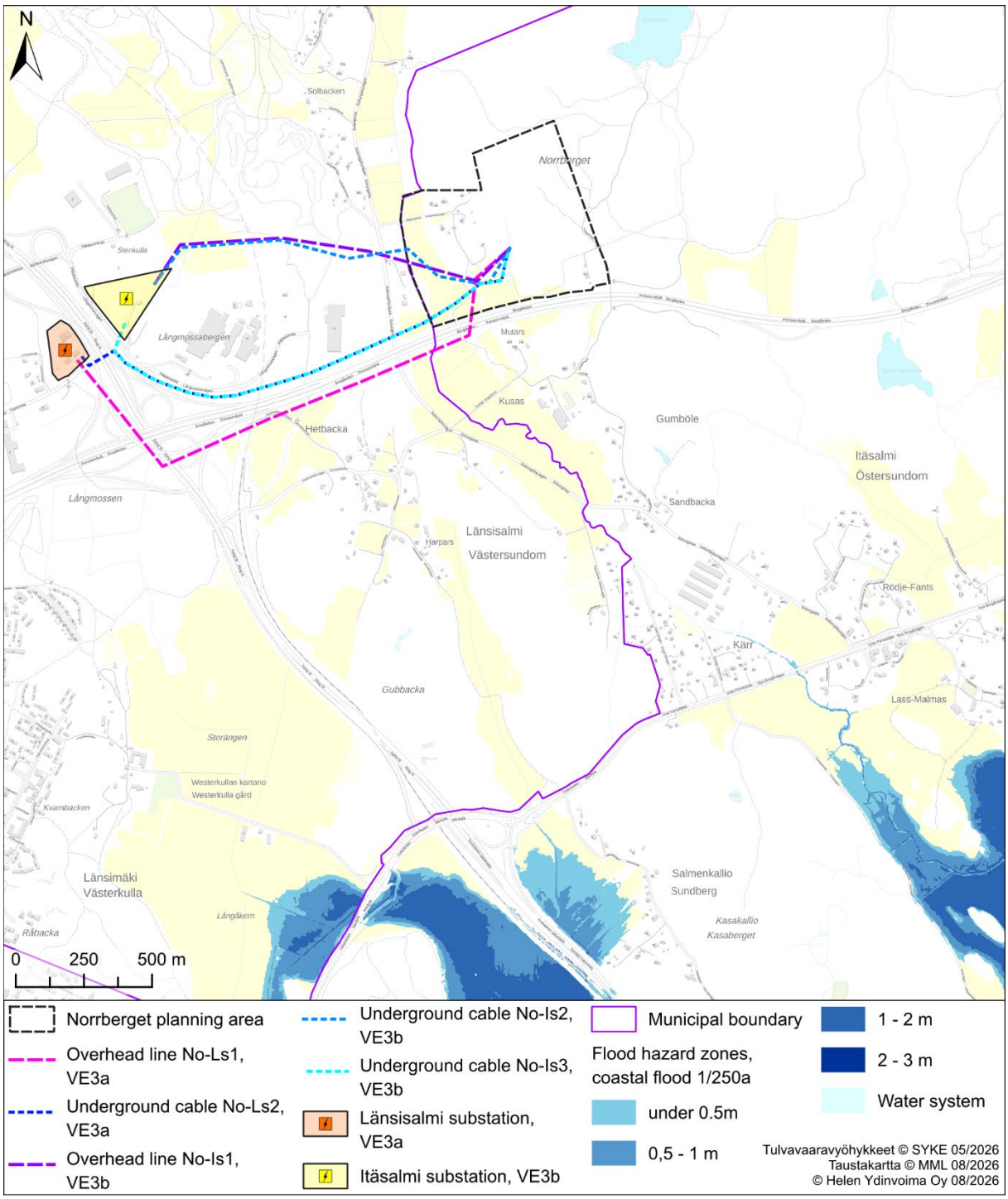


Figure 20-11. The Norrberget planning area and the electricity transmission routes of project options VE3a and VE3b, flood risk zones in the baseline scenario with a frequency of 1/250a.

Copyright © Helen Nuclear Ltd

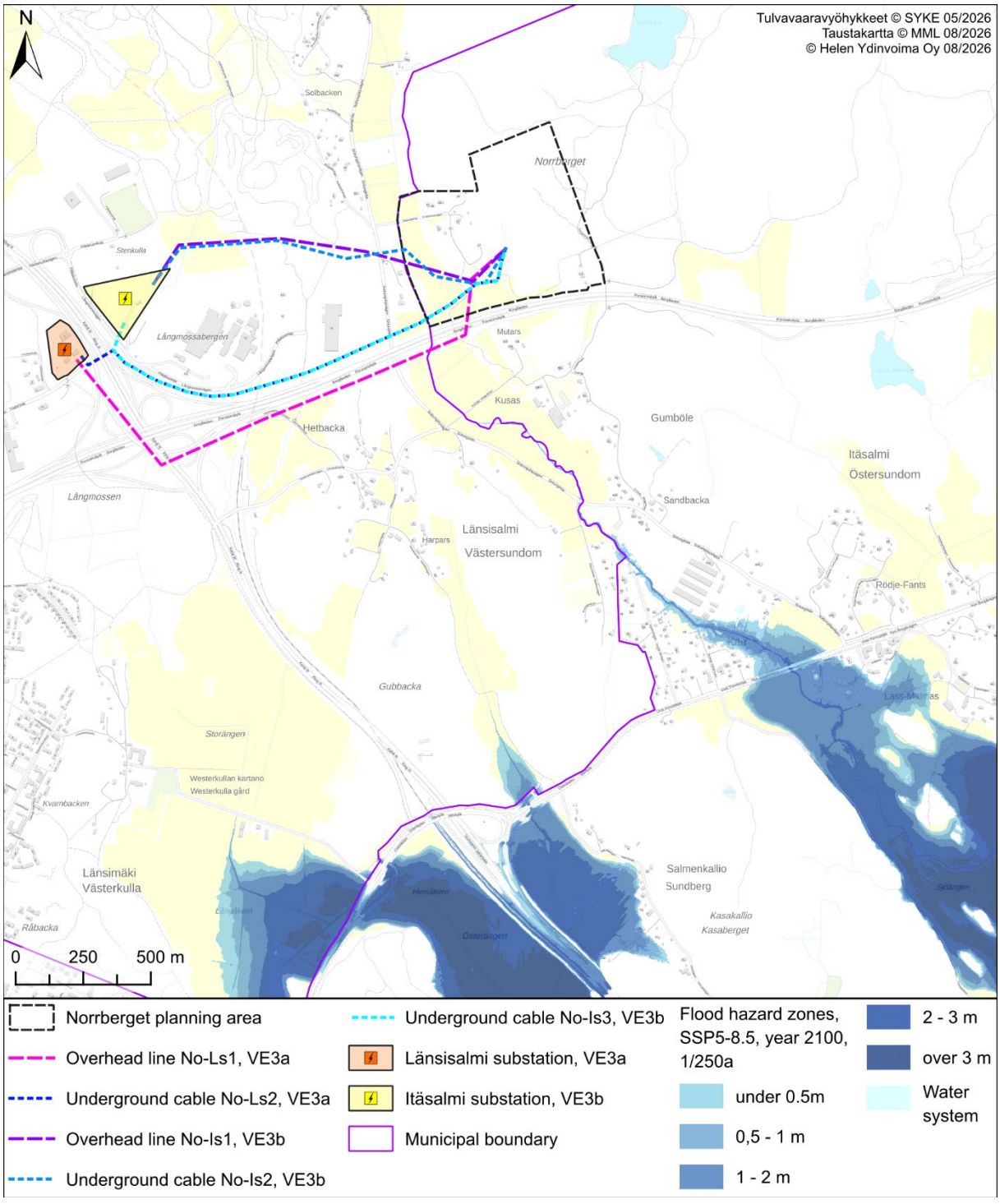


Figure 20-12. The Norrberget planning area and the electricity transmission routes of project options VE3a and VE3b, flood risk zones in the special scenario SSP-5.85, year 2100, with a frequency of 1/250a.

20.1.3 Greenhouse gas emissions

The goal of the Uusimaa region is to be carbon neutral by 2030 (Helsinki–Uusimaa Regional Council 2020). This target is achieved by reducing greenhouse gas emissions by 80% compared to 2005 levels and by capturing or compensating for the remaining emissions.

The City of Helsinki's target is to reduce emissions by 85% from 1990 levels by 2030. The target concerns direct emissions (so-called Scope 1 and 2). A net zero target has been set for

Copyright © Helen Nuclear Ltd

2040, which means that the city's emissions and sinks are in balance: greenhouse gases can only be produced to the extent that natural sinks or other removals – such as technical and biological decarbonisation solutions – can absorb. (City of Helsinki 2026d).

In accordance with the Hinku calculation rules of the Uusimaa region and the City of Helsinki, greenhouse gas emissions were 5,084.6 $ktCO_2e$ and 1,694.8 $ktCO_2e$ in 2024 (Finnish Environment Institute 2026g). Emissions have decreased in Uusimaa by about 44% from the 2005 reference level and in Helsinki by about 53% since 1990. In order to achieve the target of an 80% emission reduction, emissions should be reduced to a level of 1,821.9 $ktCO_2e$ for the region. The calculation method used in monitoring the City of Helsinki's climate goals differs from the Hinku calculation. The corresponding greenhouse gas emissions in 2024 were 1,633 $ktCO_2e$, and an 85% reduction from 1990 would mean a reduction to 527.3 $ktCO_2e$ by 2030.

District heating was Helsinki's largest source of greenhouse gas emissions in 2024, accounting for 46% (Figure 20-13). The next largest sources of emissions were road traffic and electricity consumption, accounting for 30% and 9% respectively. Total emissions from district heating amounted to 780.9 $ktCO_2e$, and they have decreased by about 51% since 1990. Most of the district heat consumed was used for heating residential buildings. In 2024, emissions from district heating in Uusimaa were 1,319.9 $ktCO_2e$, representing about 26% of the region's total emissions. (Finnish Environment Institute 2026g) Emissions from district heating in Helsinki have decreased significantly in 2025, which reduces the share of district heating in the city's total emissions and presumably makes road traffic the largest source of emissions (City of Helsinki 2026e). However, regional emissions data for 2025 are not yet available at the time of writing.

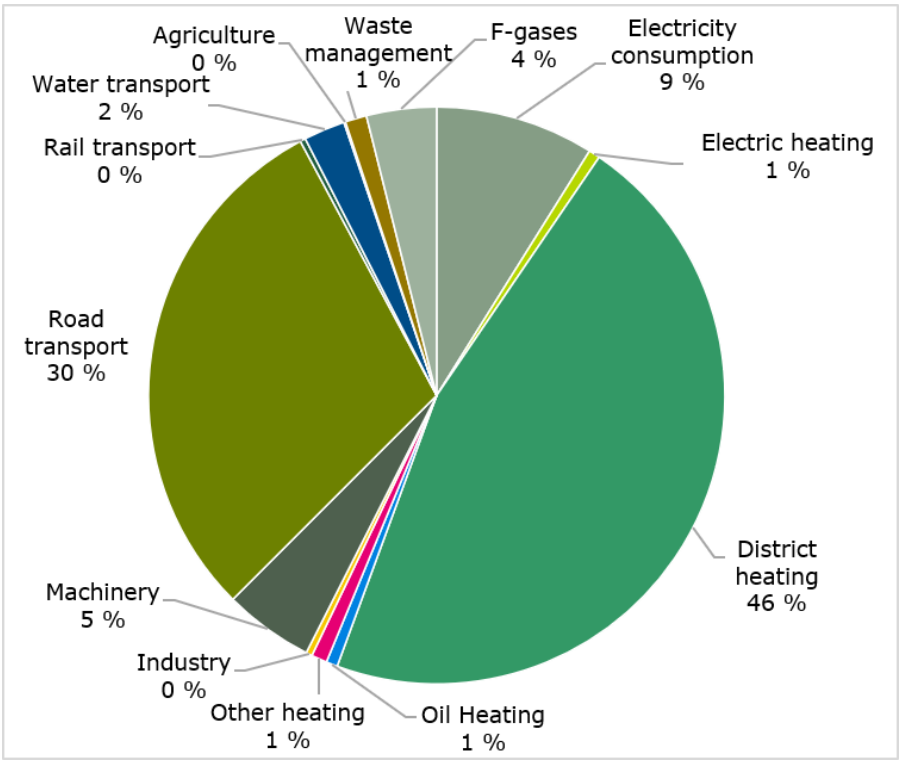


Figure 20-13. The City of Helsinki's greenhouse gas emissions in 2024 divided into categories according to the regional emissions calculation model of the Finnish Environment Institute. The calculations are based on Hinku calculations without carbon offsets. (Finnish Environment Institute 2026g)

Copyright © Helen Nuclear Ltd

Like the regional emission reduction targets, Helen has its own climate targets. The company's goal is net zero emissions and to move away from combustion-based energy production by 2040. In addition, the goal is to reduce direct climate emissions from district heating by at least 95% from the level in 1990 by the year 2030.

According to data published by the company, Helen's direct greenhouse gas emissions from its own energy production were about 1,260 $ktCO_2e$ in 2024 and 550 $ktCO_2e$ in 2025. The figures include both heat and electricity production. The reduction in emissions between 2024 and 2025 has been driven by, for example, increased use of wind power in electricity production and the cessation of coal combustion in heat production. The specific emissions of energy produced by Helen were 114 gCO_2e/kWh in 2024 and 53 gCO_2e/kWh in 2025. (Helen Ltd 2026c)

20.2 Impact assessment and methodology

The assessment report qualitatively and quantitatively examines the effects of the project on climate change and the effects of climate change on the project. In addition, the significance and impacts of the project are assessed in terms of the EU, national and regional climate objectives, as well as of those of Helen's. The assessment draws, where applicable, on the Ministry of the Environment's report Ilmastovaikutusten arviointi YVAssa ja SOVAssa (Assessment of climate impacts in EIA and SEA) (Hildén et al. 2021).

The project's negative climate impacts are assessed by calculating the carbon footprint during the project's life cycle, adapting the Finnish Transport Infrastructure Agency's low-carbon assessment method for infrastructure construction (Finnish Transport Infrastructure Agency 2023). The carbon footprint consists of material- and energy-based greenhouse gas emissions during construction and operation, and after operations have ended. During the construction phase, emissions are caused, for example, by the manufacture and transport of building materials, as well as the use of machinery, excavation and the transport of rock material. During operations, emissions are generated indirectly from the production and supply chain of nuclear fuel, as well as from the handling of conventional and hazardous waste and nuclear waste. In connection with decommissioning, they arise from the dismantling of structures and the transport and handling of dismantled materials. In addition, activities affecting trees and soil during the construction phase cause losses of carbon sinks and storage.

In terms of construction and decommissioning, greenhouse gas emissions from the manufacture and transport of main building materials, construction site operations and the processing of dismantled materials at the end of the life cycle are calculated based on the information available at the reporting phase. Emission coefficients from the national emissions database (Finnish Environment Institute 2026h) as well as the One Click LCA software can be used in the assessment. The impacts of construction on the carbon balance of soil and trees are assessed with the help of the Carbon Map tool (Carbon Map 2026) compiled by the Finnish Environment Institute, Natural Resources Institute Finland and Avoin ry. In addition, the public spatial datasets of the Finnish Environment Institute and the Natural Resources Institute Finland can be used.

The calculation of greenhouse gas emissions during operation takes into account, for example, the manufacture and transport of nuclear fuel, water and chemicals consumed in the process, as well as the plant's energy consumption and the fuel consumption of emergency diesel generators. It also includes the transport and treatment of nuclear waste and other possible waste

Copyright © Helen Nuclear Ltd

generated during operations. For example, the Ecoinvent database and the national emissions database are used as data sources for the calculation. The assessment of impacts during the operational phase is carried out on the basis of information available at the reporting phase.

The climate impacts of the project are assessed by comparing the emission intensity of the energy produced in the project with the emission intensity of the district heat and/or electrical energy produced in other ways due to the non-implementation of the project. The energy produced by nuclear power causes no direct greenhouse gas emissions during operation, apart from minor emissions from emergency backup generators, making it a better option for the climate than energy production based on combustion processes. If the project is not implemented, emissions will arise directly from the continued use of biomass and fossil fuels (VE0). The impacts of non-implementation are assessed at a general level based on public reports and data sources. The overall climate impacts of the project are also examined from the perspective of regional and national emission reduction and climate targets.

The impacts of climate change on the project are assessed by examining the risks caused by extreme weather events and the adaptation measures required by them. Risks may be caused, for example, by coastal and stormwater floods as well as rising temperatures. Due to the location of the project area, the risk of coastal floods may increase with climate change. Flood risks are covered in connection with the project's risk assessment and climate risk assessment. Increasing precipitation, on the other hand, places demands on stormwater treatment. An increase in temperature can have an impact, for example, on the sizing of cooling processes. Research publications and public spatial datasets are used as data sources for the analysis. During the project's construction, a safe building level will be adopted, where flood risks have been taken into account.

The EIA report describes in more detail the assumptions, calculation methods and parameters used in the assessment, as well as the associated uncertainties. The data obtained from the project and previous surveys are used as input data for the calculation and, if necessary, research data is used. One factor of uncertainty in the calculation is the reliability of the preestimated input data. Possible measures to mitigate adverse climate impacts are also described in connection with the assessment.

The table (Table 20-1) below presents the justification for targeting the environmental impact assessment by project option for climate impacts (for background on targeting, see chapter 7.2.1).

Copyright © Helen Nuclear Ltd

Table 20-1. Justification for targeting the environmental impact assessment by project option in terms of climate impacts. x = the project option for which the assessment is specifically targeted.

	Climate	Justification
VE1	x	Helen's goal is to move away from combustion by 2040. In district heat production, fossil fuels have been replaced, among others, by biomass. The use of nuclear power in district heat production can enable moving away from the use of fossil fuels and biomass.
VE2a	x	Helen's goal is to move away from combustion by 2040. In district heat production, fossil fuels have been replaced, among others, by biomass. The use of nuclear power in district heat production can enable moving away from the combustion of fossil fuels and biomass.
VE2b	x	Helen's goal is to move away from combustion by 2040. In district heat and electricity production, fossil fuels have been replaced, among others, by biomass. The use of nuclear power in district heat and electricity production can enable moving away from the combustion of fossil fuels and biomass.
VE3a	x	Helen's goal is to move away from combustion by 2040. In district heat production, fossil fuels have been replaced, among others, by biomass. The use of nuclear power in district heat production can enable moving away from the combustion of fossil fuels and biomass.
VE3b	x	Helen's goal is to move away from combustion by 2040. In district heat and electricity production, fossil fuels have been replaced, among others, by biomass. The use of nuclear power in district heat and electricity production can enable moving away from the combustion of fossil fuels and biomass.

Copyright © Helen Nuclear Ltd

21 USE OF NATURAL RESOURCES AND CONVENTIONAL WASTE

21.1 Current status

21.1.1 Salmisaari

In the planning area, at the pellet heating plant of the Salmisaari power plant, renewable natural resources, wood-based biomass, are used in heat production. In addition, the Salmisaari power plant area also has non-combustion based heat production (electric boilers and an air-to-water heat pump plant). In addition to the area's soil, the planning area used for industrial purposes does not accommodate recoverable natural resources or business activities that use natural resources, such as extraction of soil or rock materials, or known reserves of rock materials, extraction of peat, mining, forestry or agriculture. (Finnish Environment Institute 2026i, Finnish Environment Institute 2018, TUKES 2023)

21.1.2 Vuosaari

The Vuosaari power plants located in the planning area produce electricity and heat from natural gas, which is a non-renewable fossil resource. In addition, the bioenergy heating plant using biomass, including logging residue chips, operates as a so-called baseload plant in the area. The area also has a natural gas backup heating plant, a heat pump that uses sea water and waste heat from power plants, and a heat accumulator. In addition, there is a service station in the planning area examined in the EIA procedure, which enables the use of natural resources to be used as fuel. In addition to the above-mentioned operations, the planning area does not accommodate business activities that use natural resources or recoverable natural resources, with the exception of the area's soil.

The Itäsalmi substation is located in the Rudus rock material area, where the stone-based building materials recycling service operates. The operations are based on the use of soil and rock materials. The Vuosaari substation is an existing substation area whose recoverable natural resource is the area's soil.

The electricity transmission options, the overhead line Vu-Is1, the overhead line Vu-Is2 and the underground cable Vu-Is3, from the Vuosaari CHP plant (VE2b) to the Itäsalmi substation are largely located alongside the existing power line and road network. The routes partly pass through wooded or arable land, where timber or land used for agriculture can be used as natural resources.

In project option VE2b, cooling water intake and discharge tunnels are located in the bedrock of the Vuosaari Harbour area as excavated tunnels, continuing to the marine area off the harbour. In the marine area, the tunnel entrance is in the seabed. Recoverable natural resources are rock materials and the marine area which can be used for fishing, for example.

21.1.3 Norrberget

The planning area is partly forested, where natural resources can be used in forestry. In addition, arable land is located in the area, which can be used in agriculture. Recoverable natural resources in the area of planned road connections include trees and arable land.

The Länsisalmi substation is an existing substation area whose recoverable natural resource is the area's soil. The overhead line No-Ls1 and underground cable No-Ls2 from the

Copyright © Helen Nuclear Ltd

Norrberget heating plant (VE3a) to the Länsisalmi substation run along the road, bordering wooded and arable areas.

The Itäsalmi substation is located in the Rudus rock material area, where the stone-based building materials recycling service operates. The operations are based on the use of soil and rock materials. The overhead line No-Is1 and underground cable No-Is2 from the Norrberget CHP plant (VE3b) to the Itäsalmi substation run alongside the existing power line, and the underground cable No-Is3 runs at the side of the road. All options border wooded and arable areas.

Rock materials are the natural resources to be recovered as the KL1 district heating line is excavated in the rock. The natural resources of the KL2 district heating line, partly excavated in the rock and partly in the ground, include rock materials as well as wooded and arable land in the area of the excavated district heating line.

In project option VE3b, cooling water intake and discharge tunnels are excavated into the bedrock, continuing to the marine area off the harbour, where the tunnel's entrance rises to the seabed. Recoverable natural resources are rock materials and the marine area which can be used for fishing, for example.

21.2 Impact assessment and methodology

The EIA report describes the impacts on natural resources that may arise from enabling or restricting their use.

The assessment takes into account economic activities that use natural resources, identified on the basis of spatial data available for the project area and its surroundings. Natural resources can also be used for recreational purposes, which is discussed in chapter 13. The project is based on the exploitation of a natural resource, uranium, the need for and procurement of which are described in general terms based on the project's technical description and on information from other similar projects. Other materials required by the project and the materials released by it, such as aggregate and soil materials, and their quantities are also examined at a general level. The impact assessment focuses on whether the project promotes or prevents the sustainable use of natural resources. For the purpose of the impact assessment, a study is carried out on the utilization and temporary storage of excavated rock material, which identifies potential end use sites and available landfill areas subject to a permit (see chapter 21.2.1).

Conventional waste is considered part of the impacts on the exploitation of natural resources, since waste management plays an essential role in their sustainable use. The quality and quantity of conventional waste generated in the project, as well as further processing and compliance with the waste hierarchy are described at a general level. Waste is assessed on the basis of the information available from the project's technical design and previous similar projects. The impacts are assessed based on the properties of the waste and the treatment possibilities. It is also assessed whether sustainable waste management is feasible.

In project options VE1, VE2a, VE2b, VE3a or VE3b, no significant or scarce recoverable natural resources are located in the project area. The construction of the project requires conventional industrial project materials, which means that dismantling generates similar waste. During the operation, conventional waste as well as hazardous waste such as waste oils are generated. Approximately 100–250 tonnes of natural uranium, which is about 0.1–0.4% of the

Copyright © Helen Nuclear Ltd

world's annual natural uranium consumption, is needed annually to produce the necessary nuclear fuel, about 69,000 tonnes (World Nuclear Association 2026). However, the implementation of the project requires large-scale excavation in project options VE2b, VE3a and VE3b.

The table (Table 21-1) below presents the justification for targeting the environmental impact assessment by project option for using natural resources and conventional waste (for background on targeting, see chapter 7.2.1).

Table 21-1. Justification for targeting the environmental impact assessment by project option in terms of using natural resources and conventional waste. x = the project option for which the assessment is specifically targeted.

	Exploitation of natural resources and conventional waste	Justification
VE1		No significant or scarce recoverable natural resources are located in the project area. Conventional waste resulting from the implementation of the project is typical industrial project waste.
VE2a		No significant or scarce recoverable natural resources are located in the project area. Conventional waste resulting from the implementation of the project is typical industrial project waste.
VE2b	x	No significant or scarce recoverable natural resources are located in the project area. The implementation of the project requires extensive excavation. Conventional waste resulting from the implementation of the project is typical industrial project waste.
VE3a	x	No significant or scarce recoverable natural resources are located in the project area. The implementation of the project requires extensive excavation. Conventional waste resulting from the implementation of the project is typical industrial project waste.
VE3b	x	No significant or scarce recoverable natural resources are located in the project area. The implementation of the project requires extensive excavation. Conventional waste resulting from the implementation of the project is typical industrial project waste.

21.2.1 Study on the utilization and temporary storage of excavated rock material

The implementation of the project requires large-scale excavation especially in project options VE2b, VE3a and VE3b. The rock material generated during construction will be primarily used in other infrastructure projects in the nearby area that are ongoing at the same time. The use of rock material can promote the sustainable use of natural resources. It is also possible that temporary storage of the rock material will be necessary.

Copyright © Helen Nuclear Ltd

For the purpose of the impact assessment, a study on the utilization and temporary storage of excavated rock material is prepared. The study on the utilization and temporary storage of rock material examines the quantity, quality, reuse and potential temporary storage areas of the rock material generated in different project options. The survey examines the transport volumes of rock material and identifies transport distances and routes to potential reuse and temporary storage sites. In principle, the main roads of the survey area are used for transporting rock material. The quantities transported are measured in loose cubic metres, because the rock material excavated from the bedrock is looser and occupies more space than solid rock. The study takes into account differences in the potential for reusing rock material generated in open-pit and tunnel excavation.

The purpose is to find out the needs of temporary storage of rock material generated during excavation, potential temporary storage and possibilities to use rock material in other ongoing or planned infrastructure projects. According to a preliminary assessment, the study area is the Uusimaa region. As a rule, the rock material generated from construction is used as close as possible to the project area. The work examines existing temporary storage sites or landfill areas and their capacities. The aim is also to identify the need for possible new temporary storage or landfill areas. The survey is conducted as a desktop work. Where possible, discussions will be held with the authorities responsible for mass coordination in the survey area regarding potential reuse sites.

Copyright © Helen Nuclear Ltd

22 NUCLEAR AND RADIOACTIVE WASTE

22.1 Impact assessment and methodology

The formation, quality and quantity of nuclear waste and other radioactive waste arising during the operation of the nuclear power plant, and its treatment and storage, are described, taking into account the waste's activity levels (very low-level, low level, intermediate level and high level nuclear waste). In this case, nuclear waste management is part of the normal operation of the nuclear power plant. The impacts of the construction and operation of an underground final disposal facility (low and intermediate level waste) and a possible above-ground final disposal facility (very low-level waste) on the site will be assessed as part of this EIA procedure. The impacts of the disposal of very low, low and intermediate level waste at the plant site are assessed, taking into account alternatives to disposal, based on the requirements set for the disposal of waste in laws, decrees and regulations. The impact assessment examines, among other things, the impacts on soil and bedrock, groundwater and surface waters, also taking into account possible disturbances and exceptional situations. The construction of an underground final disposal facility requires excavation, and the assessment of the impacts during construction takes into account, among other things, the impacts on the soil, bedrock and groundwater, as well as the noise, dust and vibration impacts. Possible options for off-site final disposal of power plant waste are described, although the impact assessment is not part of this EIA procedure.

The impacts of the construction and operation of an on-site interim storage of high-level waste, i.e. spent nuclear fuel, are assessed. The impact assessment examines, among other things, the impacts on soil and bedrock, groundwater and surface waters, taking into account possible disturbances and exceptional situations. The alternatives for the final disposal of spent nuclear fuel are also described, but the assessment of the impacts of the final disposal of spent nuclear fuel is not part of this EIA procedure. Shipments of waste from the plant site to final disposal are taken into account at a general level.

The impacts of nuclear waste and other radioactive waste arising from the operation of the nuclear power plant are assessed on the basis of the properties of the waste and the treatment methods. The assessment is carried out as an expert assessment on the basis of the technical design of the project, as well as existing information about the projects and studies that have already been carried out.

The table (Table 22-1) below presents the justification for targeting the environmental impact assessment by project option for radioactive waste (for background on targeting, see chapter 7.2.1).

Copyright © Helen Nuclear Ltd

Table 22-1. Justification for targeting the environmental impact assessment by project option in terms of radioactive waste. x = the project option for which the assessment is specifically targeted.

	Radioactive waste	Justification
VE1	x	The limit on the annual dose received by an individual of the population from the normal operation of a nuclear power plant is 0.1 millisieverts (Nuclear Energy Decree 161/1988, Sections 22 b, d). This also includes the treatment and storage of radioactive waste. In EIA procedures for nuclear power plants, the impact assessment has included an examination of radioactive waste, so the matter will be examined also in this EIA procedure.
VE2a	x	
VE2b	x	
VE3a	x	
VE3b	x	

Copyright © Helen Nuclear Ltd

23 EXCEPTIONAL AND EMERGENCY SITUATIONS

23.1 Impact assessment and methodology

23.1.1 Methods used for modelling severe accidents

As part of the environmental impact assessment, a highly unlikely severe reactor accident at the nuclear power plant is modelled and the impacts of the accident are assessed. The modelling is done separately for the CHP plant and heating plant options. In the modelling, the radioactive release is scaled for the most important emission nuclides on the basis of 100 TBq cesium-137 of the Nuclear Energy Decree (161/1988 § 22 b) and 4,300 MW of the heat output of the Olkiluoto 3 nuclear power plant unit, as follows:

- CHP plant (1,400 MWth) 33 TBq cesium-137
- Heating plant (210 MWth) 5 TBq cesium-137.

The heating plant consists of several plant units. A plant unit consists of reactors located in the same building and the same pool. For the heating plant, the modelling considers the loss of one complete plant unit (4–6 reactors), not just one reactor.

The Olkiluoto 3 nuclear power plant unit has been selected as the reference plant due to its modern design and advanced safety systems, which are considered representative of the accident management capabilities of new nuclear power plants.

The severe accident release considered in the modelling includes not only caesium-137, but also other nuclides released in a severe accident. The release height has been set at 30 metres and the release duration at 12 hours. The release is modelled using a combination of the ARTM (Lagrange) and ATSTEP (Gauss) models up to a distance of 1,000 km.

In the modelling, either a representative year or meteorological data for five years are used as weather data. The 95th percentile is used for the weather data, taking into account all weather conditions.

In the short term, the model calculates the external radiation dose from the release plume and fallout, as well as the internal radiation dose from inhalation. Long-term radiation doses also take into account food routes and external exposure from environmental contamination. Recommendations and dose coefficients by the International Commission on Radiological Protection (ICRP) are used in the calculation of radiation doses.

The results of the modelling are presented as radiation doses, fallout, and possible restrictions on the use of foodstuffs, the environment and areas. The transboundary impact assessment presents country-specific maximum results for radiation doses.

The impact assessment is carried out at the EIA reporting phase for each project option. The table (Table 23-1) below presents the justification for targeting the environmental impact assessment by project option for exceptional and emergency situations (for background on targeting, see chapter 7.2.1).

Copyright © Helen Nuclear Ltd

Table 23-1. Justification for targeting the environmental impact assessment by project option in terms of exceptional and emergency situations. x = the project option for which the assessment is specifically targeted.

	Exceptional and emergency situations	Justification
VE1	x	EIA procedures for nuclear power plants must examine and model a severe reactor accident at a nuclear power plant and the dispersion of radioactive releases.
VE2a	x	
VE2b	x	
VE3a	x	
VE3b	x	

Copyright © Helen Nuclear Ltd

24 IMPACTS ON SAFETY AND ENVIRONMENTAL RISKS

The EIA procedure initially identifies the environmental risks related to the project and its various project options and assesses their potential impacts on the environment and public health. The environmental risk assessment examines the risks posed by major process disruptions, fires and chemicals, as well as those related to weather conditions and traffic. The assessment also takes into account the possible risks to the project caused by activities near the project and, correspondingly, the risks from the project to other nearby activities. The examination takes into account nearby economic activity, residential areas, recreational areas and other sensitive sites.

Conventional accidents and incidents, their impacts and likelihood, are assessed during construction and operation (for nuclear safety, exceptional and emergency situations are discussed in chapter 23). The review includes all activities of the entire project, including road traffic. Accident risks caused by extreme weather phenomena that increase with climate change are also taken into account.

The type, probability, and significance of environmental accidents and safety risks associated with the project are assessed under normal conditions and in the event of a disturbance.

Based on the results of the assessment, measures are proposed to prevent the identified accident and disruption risks and mitigate the consequences. The results of the impact assessment will be taken into account in further operational planning.

The assessment is carried out by experts familiar with accident and disruption risks in nuclear energy and industrial processes. The assessment is based on the planning information available for the project and any hazard assessments or risk analyses carried out. In the identification of accidents and disturbances and their impact assessment, the nature of the chemicals and operations, as well as the statement issued on the EIA programme, are taken into account.

The table (Table 24-1) below presents the justification for targeting the environmental impact assessment by project option for conventional accidents and disturbances (for background on targeting, see chapter 7.2.1).

Table 24-1. Justification for targeting the environmental impact assessment by project option in terms of conventional accidents and disturbances. x = the project option for which the assessment is specifically targeted.

	Conventional accidents and disturbances	Justification
VE1	x	Identifying the potential environmental impacts of accidents and disruptions both inside and outside the plant area during the EIA procedure ensures that preventive and preparatory measures are taken into account as planning progresses.
VE2a	x	
VE2b	x	
VE3a	x	
VE3b	x	

Copyright © Helen Nuclear Ltd

25 CUMULATIVE IMPACTS WITH OTHER PROJECTS

25.1 Other projects

In EIA procedures, the project's cumulative impacts are, in principle, examined only with fully permitted projects. However, other projects have also been taken into account in this chapter, as these projects are located in the vicinity of the project being examined in this EIA procedure and potential synergies may arise.

Fingrid Oyj is planning a new 400 kV power line between Anttila in Sipoo and Länsisalmi in Vantaa. An EIA procedure has been carried out for the project and a reasoned conclusion on the EIA report has been issued on 18 February 2026.

Fingrid has chosen the route of the new 400 kV power line between Anttila and Länsisalmi. In the southernmost section of the route, from Landbo to Länsisalmi, the planned power line will run alongside Fingrid's existing 400 kV power line to its north, on shared towers with Fingrid's existing 110 kV power line. The construction of the power line is scheduled for 2028–2030. (Fingrid Oyj 2026)

Vantaan Energia Oy has an ongoing carbon dioxide recovery project in which the carbon dioxide from the flue gases of the waste incinerators at the Vantaa Långmossebergen waste-to-energy plant is recovered and transmitted to Vuosaari Harbour via an underground pipeline. An EIA procedure has been carried out for the project and a reasoned conclusion on the EIA report has been issued on 11 March 2026.

The Port of Helsinki Ltd is planning the expansion of West Harbour and the construction of a harbour tunnel. The aim is to centralise passenger traffic between Tallinn and Helsinki to West Harbour. The aim is to expand the current quay structure of West Harbour and build a new harbour yard at the southern tip. The harbour tunnel is planned to be built from West Harbour to Länsiväylä. An EIA procedure has been carried out for the project and a reasoned conclusion on the EIA report has been issued on 11 March 2024. According to the current estimate, the construction of the harbour tunnel will take place between 2028 and 2032 (Port of Helsinki 2026a).

The Port of Helsinki Ltd's Vuosaari Harbour is to be developed particularly to meet the needs of freight traffic and larger container ships. The harbour yard is planned to be expanded, in addition to which land reclamations of less than 10 hectares are planned, which will create additional space for freight and car passenger traffic. The expansion of the Vuosaari Harbour area will be implemented in phases. The work will begin with the preparation of an environmental impact assessment in 2026. The expansion of the Vuosaari Harbour yard takes place towards the end of the harbour development programme, i.e. in the 2030s. (Port of Helsinki 2026c)

25.2 Cumulative impact assessment

The impact assessment examines the potential cumulative impacts of the nuclear power plant project in conjunction with other projects in the vicinity. In the assessment of cumulative impacts, consideration is given to activities planned for the area that the project may interact with and for which sufficient information is available for the assessment.

Fingrid's 400 kV and 100 kV power lines from Anttila to Länsisalmi are located in the Norrberget planning area. Fingrid's new 400 kV power line will widen the current transmission line area

Copyright © Helen Nuclear Ltd

by about 10 metres in the north direction. The power line options of the nuclear power plant project are located in the same transmission line area alongside Fingrid's new 400 kV power line. In the cumulative impact assessment, the impacts of Helen's nuclear power plant project options VE2b, VE3a and VE3b on Fingrid's new power line are assessed.

The Norrberget planning area is located approximately 500 metres east of Vantaan Energia Oy's waste-to-energy plant. To the south of the Vuosaari planning area, a carbon dioxide liquefaction plant and an interim storage are planned for the carbon dioxide recovery project. The carbon dioxide transmission pipe from the waste-to-energy plant to the liquefaction plant and interim storage in Vuosaari crosses the electricity transmission options of the Vuosaari CHP plant (VE2b) and the Norrberget project options (VE3a and VE3b) for the nuclear power plant. The EIA report assesses the cumulative impacts of Helen's nuclear power plant project and its Vuosaari project options VE2a and VE2b and Norrberget project options VE3a and VE3b with Vantaa Energy's carbon dioxide recovery project.

The Salmisaari planning area is located approximately 1.4 km from West Harbour. The planned harbour tunnel is located in the Länsiväylä area less than 100 metres from the boundary of the Salmisaari planning area. The EIA report assesses the cumulative impacts of Helen's nuclear power plant project option VE1 with the Port of Helsinki's expansion project.

The Vuosaari planning area is located in the Vuosaari Harbour area. In both the Vuosaari and Norrberget project options, the cooling water tunnel options and alternative intake and discharge points are located in the marine area off Vuosaari. The EIA report assesses the cumulative impacts of Helen's nuclear power plant project and its Vuosaari project options VE2a and VE2b and Norrberget project options VE3a and VE3b with Vuosaari Harbour's expansion project. The assessment is based on the information available on the harbour project at the EIA reporting phase.

26 ASSESSMENT OF TRANSBOUNDARY IMPACTS

Finland is a party to the Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention), which aims to promote transboundary cooperation and opportunities for public participation when a project planned in a particular country (the party of origin) is likely to have transboundary environmental impacts on the territory of another country (the affected party). Nuclear power plants are mentioned in the Espoo Convention as projects in connection with which an international consultation must be carried out as part of the EIA procedures.

Within the EIA procedure, the assessment covers both the impacts occurring within Finland and any potentially harmful transboundary impacts caused by the project. In accordance with the Espoo Convention, certain countries are notified of the project and given the opportunity to participate in the procedure. Appendix 1 to the EIA programme contains the international consultation document for the programme phase, which is submitted to these countries.

A summary of the assessment of transboundary impacts is included in the EIA report material.

Preliminary assessment indicates that the project is not likely to cause significant transboundary impacts. A severe reactor accident and the resulting radioactive release could potentially have harmful transboundary impacts. The radius of the assessment area for radioactive release dispersion modelling in the event of an accident, carried out during the EIA reporting

Copyright © Helen Nuclear Ltd

phase, is 1,000 kilometres (see chapter 23.1.1). The transboundary impact assessment presents country-specific maximum results for radiation doses.

27 IMPACTS OF DECOMMISSIONING

The planned service life of the nuclear power plant is at least 60 years. The impacts of the decommissioning of the plant are assessed at a general level in accordance with the life cycle approach required by the EIA Act. Impacts will be assessed on the basis of the available data.

A decommissioning licence in accordance with the Nuclear Energy Act will be applied for in due course and an EIA procedure will be carried out.

28 IMPACTS OF THE ZERO OPTION

As the zero option (VE0) in the EIA procedure, the option of not implementing the project is considered, that is, a situation where a nuclear power plant is not built. In this case, Helen will not move away from combustion-based energy production, but energy production in Helsinki will continue at the current production facilities. In addition, the production investments already decided at Helen will be implemented. In the zero option, the positive and negative environmental impacts of the project will not materialise.

The assessment report presents the current state of the environment in the project's impact area and its likely development in a situation where the project is not implemented. The impacts of not implementing the project are illustrated, for example, by emission calculations. The zero option differs from the project options especially in terms of the environmental impacts arising from the use of wood biomass, as the use of fossil fuels will be reduced to a rather small extent due to the investments already decided in Helen's system.

29 EXAMINING ALTERNATIVES TO NUCLEAR POWER

Helen's goal is to move away from combustion-based energy production by 2040. As an alternative to nuclear power to achieve the goal, the EIA reporting phase will examine the electrification of district heat production based mainly on the implementation of new electric boilers in Helsinki. This alternative is described at a general level, and the surveys are not extended to all types of impacts in the EIA procedure. Other non-combustion-based district heating production solutions already identified or implemented by Helen are described in chapter 2.7.

In this survey, the electricity required by electric boilers is expected to be produced at new onshore wind farms outside Helsinki. The need for electricity would be several hundred megawatts, and even now, electricity transmission connections to the Helsinki Metropolitan Area limit the increased use of electricity in Helsinki. Thus, the new electricity production capacity to be built, as well as the new electricity transmission connections, are a prerequisite for there to be enough electricity to heat Helsinki.

In the survey, it is taken into account that the energy must be sufficient to heat Helsinki even in times when there is no wind. The combination of heat storage and electric boilers can partly be used for this. The times when there is no wind can be very long in winter, and, at the same time, the need for heat is very high in cold weather. It is not possible to size heat storages so that they would be sufficient on their own in all situations without other heat production and the possibility of charging the heat storages. Thus, in addition to heat storage, the use of electric boilers is necessary in times when there is no wind. In this case, other energy production for times when there is no wind is needed as an electricity source for electric boilers. This other

Copyright © Helen Nuclear Ltd

electricity production may come from other operators' power plants outside Helsinki or Finland. In the survey, production is assumed to be gas-fired condensing power, generated using natural gas or biogas. The survey highlights possible annual emissions and their range. The range describes the difference between 100% biogas and 100% fossil gas.

Large-scale storages excavated in bedrock are assumed to be used as heat storages. In this survey, energy storage focuses on heat storage rather than electricity storage, as the objective is to meet the demand for district heat. Storing heat is cheaper than storing the same energy as electricity. The survey takes into account that separate electric boiler capacity and electricity transmission connections are required for charging the heat storages.

At times of peak demand, electric boilers in Helsinki would operate at full capacity regardless of the price of electricity. This would affect electricity demand and electricity prices across Finland.

The above-mentioned estimates are made on a general level, without taking a position on the location for this new electricity production or the routes of electricity transmission connections. The exact locations of the heat storages and electric boilers in Helsinki are not known when preparing the EIA report, so any new heat and electricity transmission connections that may be needed in the Helsinki area cannot be taken into account in this survey. In the survey, the land use of wind farm construction is taken into account on a general level, based on publicly available information. In addition, the land area required for electric boiler plants and the electricity transmission infrastructure they need are assessed. The land use of electric boiler plants is small compared to transmission connections and wind farms, but, on the other hand, it is not easy to find space for these plants in the urban structure.

The survey does not take into account the life cycle of the current or implemented electricity production. It is expected that a significant part of the currently operating wind and nuclear power plants will be at the end of their life cycle in the 2060s. It is not yet known how these would be replaced (cf. the nuclear power plant designed by Helen will be in operation for an estimated 60 years).

The survey also does not take into account the challenges to the electricity system resulting from the fact that electricity consumption is located in a different part of Finland than electricity production. The EIA report does not set out how to remedy the problem.

When considering the options, it must be taken into account that district heat production is a critical sector in terms of security of supply, and therefore its production must be sufficiently ensured and decentralised. The last few years have shown that energy availability and prices can fluctuate significantly. Therefore, district heat production should be based on several different sources and supply channels. Helen is already rapidly electrifying the procurement of district heat. If the current combustion-based production were to be replaced only by electricity-based solutions, Helsinki's district heat production would be entirely dependent on electricity transmission connections.

30 UNCERTAINTIES IN THE IMPACT ASSESSMENT

Available environmental information and impact assessment always involve assumptions and generalisations. Similarly, the project's technical details will be refined during the EIA procedure as planning progresses, when moving from the programme phase to the reporting phase, and also after the EIA procedure. The available technical information is still preliminary during

Copyright © Helen Nuclear Ltd

the pre-planning phase of the project. Lack of information can cause uncertainty and inaccuracy during the assessment work. For this reason, in accordance with the precautionary principle, impact assessments are aimed to be carried out according to the so-called worst-case scenario in terms of environmental impacts.

During the assessment work, potential uncertainties are identified as comprehensively as possible, and their significance for the reliability of impact assessments is assessed. These are described in the assessment report.

31 HARM PREVENTION, MITIGATION AND IMPACT MONITORING

One of the purposes of the environmental impact assessment procedure is to examine the possibilities of preventing and mitigating the harm caused by the project. During the assessment work, the possibilities of preventing or limiting the adverse impacts of the project on, for example, water, nature and people are investigated and presented. With regard to mitigation measures, safety standards and publications on good practices related to operations are taken into account. The results of this assessment will also have an impact on the planning of the project during the EIA procedure.

According to the Environmental Protection Act, the operator must be aware of the environmental impacts of its operations. In connection with the impact assessment, a proposal is drawn up to form the content of the project's environmental impact monitoring programme. The objective of monitoring is:

- Produce information about the impacts of the project.
- Find out which changes are a consequence of implementing the project.
- Find out how the results of the impact assessment correspond to reality.
- Find out how successful the mitigation measures have been.
- To initiate necessary actions in case unforeseen significant harm occurs.

A more detailed proposal for the environmental impact monitoring programme will be presented later in connection with the environmental permit application.

Copyright © Helen Nuclear Ltd

32 REFERENCES

The date in brackets after the online sources indicates when the source has been referenced.

AFRY Finland Oy 2023. Vuosaaren alueen yhteistarkkailu: vuosien 2019–2022 kokoomaraportti. AFRY Finland Oy, 24.5.2023

AFRY Finland Oy 2026. Bedrock- and Soil Study. 101032444-001-E001, 2.3.2026. Helen Oy.

A-Insinöörit Suunnittelu Oy 2025a. Salmisaaren rakennettavuusselvitys. 15.4.2025. Helen Oy.

A-Insinöörit Suunnittelu Oy 2025b. Vuosaaren rakennettavuusselvitys 31.3.2025. Helen Oy.

A-Insinöörit Suunnittelu Oy 2025c. Norrbergetin rakennettavuusselvitys 15.4.2025. Helen Oy.

Airaksinen, O. & Karttunen, K. 2001. Natura 2000 -luontotyyppiopas. 2. korjattu painos. https://helda.helsinki.fi/server/api/core/bitstreams/49344cb9-7333-43f0-bc0f-53db0c76ae7c/content (28.4.2026).

Aroviita, J., Mitikka, S. & Vienonen S. (toim.) 2019. Pintavesien tilan luokittelu ja arviointiperusteet vesienhoidon kolmannella kaudella. Suomen ympäristökeskuksen raportteja 37/2019. Suomen ympäristökeskus. 182 s.

Aroviita, J., Siimes, K., Martinmäki-Aulaskari, K., Turunen, J., Hoikkala, L., Attila, J., Järvenpää, L., Järvinen, M., Lehtinen, S., Mykrä, H., Nygård, H., Takolander, A., Tolonen, K., Karttunen, K., Karjalainen, S. M., Kuoppala, M., Korhonen, P., Kulo, K., Olin, M., Ruokonen, T., Sairanen, S., Aronsuu, K., Ruuskanen, A. & Mitikka, S. 2025. Pintavesien tilan luokittelu ja arviointiperusteet vesienhoidon neljännellä kaudella. Suomen ympäristökeskuksen raportteja 37/2025. https://helda.helsinki.fi/handle/10138/29865

Birdlife Suomi ry 2026a. Kansainvälisesti tärkeät lintualueet. https://www.birdlife.fi/suojelu/alueet/iba/

Birdlife Suomi ry 2026b. Suomen tärkeät lintualueet. https://www.birdlife.fi/suojelu/alueet/fi-niba/

Birdlife Suomi ry 2026c. MAALI-hankkeessa tuotetut aineistot yhdistyksittäin. https://www.birdlife.fi/suojelu/alueet/maali/yhdistysten-maali-raportit/

Elminen, T., Airo, M.-L., Niemelä, R., Pajunen, M., Vaarma, M., Wasenius, P., Wennerström, M., 2008. Fault structures in the Helsinki area, southern Finland. Tectonic Evolution of the Svecofennian Crust in Southern Finland - a Basis for Characterizing Bedrock Technical Properties/Pajunen, M. (Ed.). Geological Survey of Finland, Espoo.

Elminen, T. 2020. Pääkaupunkiseudun kallioperäkartan päivitys 2020. GTK:n työraportti 38/2020.

Erävuori, L., Kiiski, J., Salo, P. & Arola, M. 2024. Östersundomin osayleiskaavaluonnoksen Natura-arviointi. Sitowise Oy. 141 s.

Euroopan komissio 2024. Komission tiedonanto Euroopan parlamentille, neuvostolle, Euroopan talous- ja sosiaalikomitealle ja alueiden komitealle. Euroopan vuoden 2040 ilmastotavoite

Copyright © Helen Nuclear Ltd

sekä eteneminen kohti ilmastoneutraaliutta vuoteen 2050 mennessä kestävässä, oikeudenmukaisessa ja vauraassa yhteiskunnassa. 6.2.2024.

Fingrid Oyj 2026. Fingrid on valinnut reitin kantaverkon voimajohdolle Sipoon Anttilasta Vantaan Länsisalmeen. Lehdistötiedote 20.4.2026. https://www.fingrid.fi/ajankohtaista/tiedotteet/2026/fingrid-on-valinnut-reitin-kantaverkon-voimajohdolle-sipoon-anttilasta-vantaan-lansisalmeen/ (21.4.2026)

FCG Suunnittelu ja Tekniikka Oy 2016. Vuosaaren meriväylän ja Vuosaaren sataman vesiliikennealueen syventäminen. Hakemussuunnitelma vesilain mukaista lupahakemusta varten. 24.9.2015 P26085, P26115. Liikennevirasto, Helsingin Satama Oy

Geologian tutkimuskeskus 2025. (Geological Survey of Finland 2025) Uudet kiviaineksen tuotantokohteet vahvistavat Keski-Pohjanmaan kestävää rakentamista ja alueellista elinvoimaa. https://www.gtk.fi/ajankohtaista/uudet-kiviaineksen-tuotantokohteet-vahvistavat-keski-pohjanmaan-kestavaa-rakentamista-ja-alueellista-elinvoimaa/ (20.4.2026)

Geologian tutkimuskeskus 2026a. (Geological Survey of Finland 2026a) Maaperä 1:20 000-aineisto, https://hakku.gtk.fi/. 22.4.2026

Geologian tutkimuskeskus 2026b. (Geological Survey of Finland 2026b) Maankamara-karttapalvelu. [http://gtkdata.gtk.fi/maankamara]

Haikonen, A. 2008. Vaaralan jätevesipumppaamon ylivuodon jälkeinen kalastoselvitys syksyllä 2008. Kala- ja vesitutkimus Oy. Raportti.

Haikonen, A., Helminen, J. & Vatanen, S. 2013. Siian lisääntymis- ja poikasalueiden inventointi Helsingin ja Espoon merialueella. Kala- ja vesimonisteita nro 113. 16 s. + liite.

Happo, L., Hynninen, M., Haikonen, A., Kervinen, J. & Vatanen, S. 2023. Lämpöpumppuhankkeen kalasto ja kalastusselvitykset vuonna 2022. Kala- ja vesijulkaisuja nro 350. 59 s. + 3 liitettä.

Happo, L., Norontaus, M., Hynninen, M., Haro, E., Karppinen, P. & Vatanen, S. 2024. Helsingin ja Espoon edustan merialueen kalataloudellinen yhteistarkkailu vuosina 2018–2023. Kala- ja vesijulkaisuja nro 433. 106 s. + 12 liitettä.

Happo, L., Vatanen, S., Kervinen, J. & Ruuskanen, A. 2022. Vuosaaren sataman ja väylän syventämisen kalataloustarkkailu – Jälkiseuranta vuonna 2022. Luode Consulting Oy, raportti 21.10.2022. 17 s. + 4 liitettä.

Happo, L. & Janatuinen, A. 2023. Helsinki-Espoon kalatalousalueen käyttö- ja hoitosuunnitelma. Kala- ja vesijulkaisuja nro 368. 115 s. + liitteet.

Helen Oy 2024. Vuosaaren biolämpölaitos. Ympäristömeluselvitys. Akukon Oy. 26.2.2024

Helen Oy 2025. Vuosaaren A- ja B-voimalaitokset sekä lämpöpumppulaitos. Akukon Oy. 29.4.2025

Helen Oy 2026a. Salmisaaren voimalaitos. Ympäristömeluselvitys. Akukon Oy. 20.3.2026

Helen Oy 2026b. Hiilineutraalisuusohjelma. https://www.helen.fi/tietoa-meista/vastuullisuus/hiilineutraalisuusohjelma (1.4.2026).

Copyright © Helen Nuclear Ltd

Helen Oy 2026c. Tilinpäätöstiedote 2025. https://www.helen.fi/globalassets/tietoa-meist%C3%A4/raportit-ja-julkaisut/helen_tilinpaatostiedote_2025.pdf (1.4.2026).

Helsingin kaupunki 2016. (City of Helsinki 2016) Yleiskaava 2016. https://www.hel.fi/fi/kaupunkiymparisto-ja-liikenne/kaupunkisuunnittelu-ja-rakentaminen/suunnittelun-ja-rakentamisen-tavoitteet/yleiskaava (15.4.2026)

Helsingin kaupunki 2017. (City of Helsinki 2017) Helsingin uhanalaiset luontotyypit, Norrbergetin noro. https://ptp.hel.fi/ltj_documents/html/linkitetyt_ltj/Luontotyypit/lt_2017_132.pdf

Helsingin kaupunki 2020. **(City of Helsinki 2020)** Pääkaupunkiseudun merialueen tila 2018–2019. Helsingin kaupunki, Kaupunkiympäristön julkaisuja 2020:25.

Helsingin kaupunki 2022a. **(City of Helsinki 2022a)** Helsingin kaupungin kansallinen meluselvitys 2022. Melulaskennat yhteispohjoismaisella laskentamallilla. Promethor Oy.

Helsingin kaupunki 2022b. **(City of Helsinki 2022b)** Karttapalvelu. https://kartta.hel.fi/. Purojen kohdetiedot.

Helsingin kaupunki 2023a. (City of Helsinki 2023a) Osallistumis- ja arviointisuunnitelma, Länsiväylän ympäristön osayleiskaava. 18.4.2023. Helsingin kaupunki. https://www.hel.fi/static/public/hela/Kaupunkiymparistolautakunta/Suomi/Paatos/2023/Kymp_2023-05-09_Kylk_15_Pk/E99C90AC-B61F-CAAA-BF0E-87461BA00000/Liite.pdf

Helsingin kaupunki 2023b. (City of Helsinki 2023b) Pääkaupunkiseudun merialueen tila 2022 – Kasviplankton, eläinplankton ja pohjaeläimet. Helsingin kaupungin kaupunkiympäristön toimiala, Kaupunkiympäristön aineistoja 2023:10.

Helsingin kaupunki 2024b. (City of Helsinki 2024b) Pääkaupunkiseudun merialueen tila 2023 – Kasviplankton, eläinplankton ja pohjaeläimet. Kaupunkiympäristön aineistoja 2024:9

Helsingin kaupunki 2025a. (City of Helsinki 2025a) Östersundomin osayleiskaava, osayleiskaavaluonnos 28.1.2025. Helsingin kaupunki. https://ahjojulkaisu.hel.fi/87CA0471-F7D5-CFA3-A49C-9469BC100001.pdf

Helsingin kaupunki 2025b. (City of Helsinki 2025b) Pääkaupunkiseudun merialueen tila 2023**.** Veden fysikaalinen, kemiallinen ja hygieeninen laatu. Kaupunkiympäristön aineistoja 2024:21

Helsingin kaupunki 2025c. (City of Helsinki 2025c) Helsinki josta voimme olla ylpeitä. Kaupunkistrategia 2025-2029. https://www.hel.fi/static/helsinki/kaupunkistrategia/Kaupunkistrategia-2025-2029.pdf

Helsingin kaupunki 2026a. (City of Helsinki 2026a) Länsiväylän ympäristön osayleiskaava. Helsingin kaupunki. (10.4.2026) https://www.hel.fi/fi/kaupunkiymparisto-ja-liikenne/kaupunkisuunnittelu-ja-rakentaminen/hae-suunnitelmia-ja-hankkeita/lansivaylan-ympariston-oyk

Helsingin kaupunki 2026b. (City of Helsinki 2026b) Karttapalvelu – avoimet aineistot. https://kartta.hel.fi/

Helsingin kaupunki 2026c. (City of Helsinki 2026c) Luontotietojärjestelmän virkaversio (vaatii käyttäjätunnukset). https://kartta.hel.fi (29.4.2026).

Copyright © Helen Nuclear Ltd

Helsingin kaupunki 2026d. (City of Helsinki 2026d) Päästövähennystavoite. Helsingin ilmastotyö. https://ilmasto.hel.fi/hillinta/hiilineutraali-helsinki-paastovahennysohjelma/ (21.5.2026)

Helsingin kaupunki 2026e. (City of Helsinki 2026e) Ilmastonmuutoksen hillintä. https://www.hel.fi/fi/paatoksenteko-ja-hallinto/strategia-ja-talous/toimintaympariston-muutokset/ilmasto-ja-luonto/ilmastonmuutoksen-hillinta#liikenteen-paastot-nousevat-suurimmaksi-paastolahteeksi-vuonna_2025 (25.5.2026).

Helsingin kaupunki 2026f. (City of Helsinki 2026f) Avoimet paikkatiedot. Helsingin kaupunki. https://www.hel.fi/fi/paatoksenteko-ja-hallinto/tietoa-helsingista/kartat-ja-paikkatieto/paikkatiedot-tehokayttoon/avoimet-paikkatiedot (27.5.2026)

Helsingin Satama Oy 2026a. (Port of Helsinki 2026a) Satamatunneli. https://www.portofhelsinki.fi/uudistamme-satamaa/lansisataman-kehittaminen/satamatunneli/ (28.4.2026)

Helsingin Satama Oy 2026b. (Port of Helsinki 2026b) Vuosaaren satama. https://www.portofhelsinki.fi/ammattilaisille/rahti-ja-matkustajasatamat/vuosaaren-satama/ (28.4.2026)

Helsingin Satama Oy 2026c. (Port of Helsinki 2026c) Vuosaaren sataman kehittäminen. https://www.portofhelsinki.fi/uudistamme-satamaa/tulevaisuuden-satama/vuosaaren-sataman-kehittaminen/ (8.5.2026)

Hiilikartta 2026. Kaavoittajan karttatyökalu – Hiilikartta. Suomen ympäristökeskus, Luonnonvarakeskus ja Avoin ry. https://hiilikartta.avoin.org/ (1.4.2026).

Hildén M., Mela H. & Saastamoinen U. 2021. Ilmastovaikutusten arviointi YVAssa ja SOVAssa - vaikutusten tunnistaminen ja johdonmukainen käsittely. http://urn.fi/URN:ISBN:978-952-361-257-0 (1.4.2026).

Hyvärinen, E., Juslén, A., Kemppainen, E., Uddström, A. & Liukko, U.-M. (toim.) 2019. Suomen lajien uhanalaisuus – Punainen kirja 2019. Ympäristöministeriö & Suomen ympäristökeskus. Helsinki. 704 s.

Ilmasto-opas 2022. **(Climate guide 2022)** Uusimaa – merellisen ilmaston maakunta. https://www.ilmasto-opas.fi/artikkelit/uusimaa-merellisen-ilmaston-maakunta (1.4.2026).

Ilmarinen, K. & Oulasvirta, P. 2012. Silakan kutualueet ja niiden tarkkailu. Teoksessa Vatanen, S., Haikonen, A. & Piispanen, A. (toim.). 2012. Vuosaaren sataman rakentamisen aikaisen (2003–2008) vesistö- ja kalataloustarkkailun yhteenvetoraportti. Kala- ja vesimonisteita nro 57. 198 s. + 16 liitettä.

Ilmarinen, K. & Oulasvirta, P. 2011. Silakan kututarkkailu. Teoksessa Vatanen, S. & Haikonen, A. (toim.). 2011. Vuosaaren sataman ja voimalaitosten vesistö- ja kalataloustarkkailu vuonna 2010. Kala- ja vesimonisteita nro 45. 49 s. + 6 liitettä.

Ilmatieteen laitos 2023. (Finnish Meteorological Institute 2023) Kuukauden keskilämpötilan ja sademäärän muutoksen ennuste. Ilmatieteen laitoksen avoin data. https://paituli.csc.fi/download.html (1.4.2026).

Ilmatieteen laitos 2026a. (Finnish Meteorological Institute 2026a) Ilmatieteen laitoksen avoin data. Havaintojen lataus, kuukausitilastot. https://www.ilmatieteenlaitos.fi/havaintojen-lataus (31.3.2026).

Copyright © Helen Nuclear Ltd

Ilmatieteen laitos 2026b. (Finnish Meteorological Institute 2026b) Ilmatieteen laitoksen avoin data. Lämpötilatilastot. https://www.ilmatieteenlaitos.fi/1991-2020-lampotilatilastot (31.3.2026).

Ilmatieteen laitos 2026c. (Finnish Meteorological Institute 2026c) Ilmatieteen laitoksen avoin data. Sadetilastot. https://www.ilmatieteenlaitos.fi/1991-2020-sadetilastot (1.4.2026).

Jalkanen, J., Nieminen, E. & Ahola. A. 2025. Luontotyyppien ekologisen tilan arviointi ekologisessa kompensaatiossa. Versio 1.0–2025. 104 s.

Jalkanen, J., Mahlio, O., Nieminen, E., Kassi, T., Luoma, E., Huttunen, J., Tuomisaari, J., Pursiainen, A., Halme, P., Ahlgren, H., Hannula, A., Kemppainen, M. & Lähde, E. 2026. Rakennetun ympäristön luontotyypit ja niiden ekologisen tilan arviointi. Green Building Council Finland. https://figbc.fi/julkaisut/rakennetun-ymparistön-luontotyypit-ja-niiden-ekologisen-tilan-arviointi.

Janatuinen, A. 2011. Vantaan virtavesiselvitys 2010–2011. Vantaan kaupunki. 140 s. + liitteet.

Janatuinen, A. 2013. Östersundomin alueen purojen sähkökoekalastukset syksyllä 2012 ja keväällä 2013. Virtavesien hoitoyhdistys ry. Raportti. 29 s. + liitteet.

Järvi-meriwiki 2026. Sinileväarkisto. https://www.jarviwiki.fi/wiki/Sipoon_saaristo. 05/2026

Kahma, K., Björkqvist, J-V, Johansson, M. 2024. Ohje turvallisten rakentamiskorkeuksien soveltamiseksi Helsingin merenrannoilla. Helsingin kaupunki, Kaupunkiympäristön toimiala Kaupunkiympäristön aineistoja 2024:13. https://ptp.hel.fi/Documents/turvalliset_rakentamiskorkeudet/ohje_turvallisten_rakentamiskorkeuksien_soveltamiseksi_helsingin_merenrannoilla_2024-10-31.pdf ISBN 978-952-386-494-8 verkkoversio pdf, ISSN | 2489-4257 verkkojulkaisu.

Kala- ja Vesitutkimus Oy 2005. Sedimenttien haitta-ainekartoitus Helsingin vesialueella. Helsingin kaupungin ympäristökeskus.

Kalastusrajoitus.fi 2026. https://kalastusrajoitus.fi/#/kalastusrajoitus (30.4.2026)

Kangas, N. 2007. Helsingin kalaston historiaa, muutoksia ja nykypäivää. Helsingin kaupungin ympäristökeskuksen monisteita 2/2007. 34 s. + liitteet.

Karppinen, P., Olsen, S., Helminen, J., Haikonen, A., Vatanen, S., Rautanen, E. & Kervinen, J. 2016. Helsingin ja Espoon edustan merialueen kalataloudellinen yhteistarkkailu vuosina 2014 ja 2015. Kala- ja vesijulkaisuja nro 198. 63 s. + 12 liitettä.

Keskinen, H.-L., Raunio, A., Forss, S., Kartano, L., Karttunen, K., Kokko, A., Kontula, T., Koskela, K., Mäkelä, K., Pykälä, J., Ryttäri, T. & Väänänen, M. 2024. Luonnonsuojelulain luontotyyppien inventointiohje, luonnos 15.5.2024. https://www.ymparisto.fi/sites/default/files/documents/LSL_luontotyyppien_inventointiohje_luonnos20240515.pdf.

Kontula, T. & Raunio, A. (toim.). 2018. Suomen luontotyyppien uhanalaisuus. Luontotyyppien punainen kirja. Suomen ympäristökeskus ja Ympäristöministeriö. Suomen ympäristö 5/2018. Osat 1 ja 2.

Copyright © Helen Nuclear Ltd

Korja, A., Kosonen, E. (eds.) 2015. Seismotectonic Framework and Seismic Source Area Models in Fennoscandia, Northern Europe. Institute of Seismology, University of Helsinki (Raportti S-63, 268 s.).

Korpinen, S., Laamanen, M., Suomela, J., Paavilainen, P., Lahtinen, T. & Ekebom, J. (toim.) 2018. Suomen meriympäristön tila 2018. SYKEn julkaisuja 4. Suomen ympäristökeskus.

Korpinen, S., Laamanen-Nicolas, L., Piepponen, H., Bäck, M., Ekebom, J., Suomela, J., Lahtinen, T., Paavilainen, P. & Rinne, H. 2024. Suomen meriympäristön tila 2024. Suomen ympäristökeskus.

Laitala, Matti 1991. Helsingin kartta-alueen kallioperä. Summary: Pre-Ouaternary rocks of the Helsinki map-sheet area. Suomen geologinen kartta 1: 100 000. Kallioperäkarttojen selitykset, 2034 Helsinki. 47 sivua, 15 kuvaa ja 12 taulukkoa.

Lappalainen, J., Kurvinen, L. & Kuismanen, L. (toim.) 2020. Suomen ekologisesti merkittävät vedenalaiset meriluontoalueet (EMMA). Suomen ympäristökeskus. Suomen ympäristökeskuksen raportteja 8/2020.

Lehtinen M., Nurmi P. ja Rämö T. (toim.). 1998. Suomen kallioperä: 3000 vuosimiljoonaa. Helsinki, Suomen Geologinen Seura ry., 375 s.

Leppänen, J.-M., Rantajärvi, E., Bruun, J.-E. ja Salojärvi, J. 2012. Meriympäristön nykytilan arvio. Suomen merenhoitosuunnitelman valmisteluun kuuluva. 28.9.2012. Ympäristöministeriö.

Luode Consulting Oy 2021. Vuosaaren vesistötarkkailujen vuosiraportti 2020. Luode Consulting Oy

Mattila, B.-N., Vatanen, S. & Happo, L. 2023. Kalastus Vuosaaren sataman ja väylän ympäristössä vuonna 2022. Kala- ja vesijulkaisuja nro 376. 15 s. + liite.

Metsäkeskus 2026. Avoin metsätieto. Erityisen tärkeät elinympäristökuviot. https://www.metsakeskus.fi/fi/avoin-metsa-ja-luontotieto/luontotietoaineistot/erityisen-tarkeat-elinymparistot (29.4.2026).

Merenhoidon ympäristötavoitteiden tarkistaminen 2024: https://www.ymparisto.fi/sites/default/files/documents/Tausta-asiakirja%20Merenhoidon%20ymp%C3%A4rist%C3%B6tavoitteiden%20tarkistaminen%202024_0.pdf

Merialuesuunnittelu 2026. Merialuesuunnitelma 2030. Merialuesuunnittelu. (20.4.2026) https://meriskenaariot.info/merialuesuunnitelma/suunnitelma-johdanto/

Museovirasto 2020. (Finnish Heritage Agency 2020) Vedenpohjan luotaus arkeologisen inventoinnin osana. 9 s. https://museovirasto-craft-assets-production.s3.eu-north-1.amazonaws.com/Kulttuuriymparisto/Museovirasto_vedenpohjan_luotausohje_2020.pdf

Museovirasto 2026a. (Finnish Heritage Agency 2026a) Museoviraston karttapalvelu. https://kartta.museoverkko.fi/ (15.4.2026)

Museovirasto 2026b. (Finnish Heritage Agency 2026b) Kulttuuriympäristön palveluikkuna, muinaisjäännösrekisteri. https://www.kyppi.fi/palveluikkuna/mjreki/read/asp/r_default.aspx (14.4.2026).

Copyright © Helen Nuclear Ltd

Mäkelä, K. & Salo, P. 2023. Luontoselvitykset ja luontovaikutusten arviointi. Opas tekijälle, tilaajalle ja viranomaiselle. Suomen ympäristökeskuksen raportteja 43/2023. Suomen ympäristökeskus ja Ympäristöministeriö.

Mäntykoski, A., Nylander, E., Ahokas, T., Olin, S., Vähä-Vahe, A. & Närhi M.-A. 2022. Elinkeino-, liikenne- ja ympäristökeskus, Raportteja 17/2022. Kymijoen-Suomenlahden vesienhoitoalueen vesienhoitosuunnitelma vuosille 2022–2027, Osa 1., Vesienhoitoaluekohtaiset tiedot s. 170.

Nieminen, M. & Ahola, A. (toim.) 2017. Euroopan unionin luontodirektiivin liitteen IV lajien (pl. lepakot) esittelyt. Ympäristöministeriö, Suomen ympäristö 1/2017: 1–278.

Niinimäki, J., Paasivirta, L., Heitto, A., Oulasvirta, P. & Vatanen, S. 2004. Vuosaaren satamahankkeen vesistö- ja kalatalousseuranta 2003. Vuosaaren satamahankkeen julkaisuja 1/2004.

Nordbäck, N., Aaltonen, I., Elminen, T. & Karjalainen, A. 2026. Geological evaluation for potential nuclear power plant locations. GTK/624/03.02/2025, 21.1.2026, Geologian tutkimuskeskus, 59 s.

Närhi, M.-A. 2011. Vantaan Krapuojan ja Kurmuniitynojan ekologinen tila pohjaeläimistön kuvastamana. Pro gradu -tutkielma. Helsingin yliopisto. 54 s. + liitteet.

Okulus Oy 2025. Salmisaaren B-voimala, rakennushistoriaselvitys 2025. Arkkitehtitoimisto Okulus Oy. 248 s.

Pajunen, M., Airo, M.-L., Elminen, T., Niemelä, R., Salmelainen, J., Vaarma, M., Wasenius, P., Wennerström, M. 2002. Kallioperän rakennettavuuskartta 1:50 000. Espoo, Helsinki, Vantaa. Kallioperän geologiseen kehitykseen pohjautuva rakennettavuusluokittelu. 1 kartta. K.21.42/2002/7 http://tupa.gtk.fi/raportti/arkisto/k21_42_2002_7.pdf

Pirinen, P., Simola, H., Aalto, J., Kaukoranta, J.-P., Karlsson, P., Ruuhela, R. 2012. Tilastoja Suomen ilmastosta 1981–2010. http://hdl.handle.net/10138/35880 (26.11.2025).

Ramboll Finland Oy 2013. Vuosaaren uusi C-voimalaitosalue. Maaperän pilaantuneisuustutkimus. Tutkimusraportti. 82141074-016, 24.9.2023. Helsingin Energia

Ramboll Finland Oy 2026. Onnettomuudet kartalla. https://mobilityanalytics.ramboll.com/onn/poliisi/

Rockplan 2023. Sea Water System Project, Geological coordination model – Information description, internal document provided by Helen.

Sipoon kunta 2014. Saariston ja rannikon osayleiskaavan aineisto. https://www.sipoo.fi/kaavoitus-ja-kehittaminen/voimaan-tulleet-yleiskaavat/saariston-ja-rannikon-osayleiskaava/ (26.5.2026)

Sitowise Oy 2023. Vuosaaren kivihiilen varmuusvarasto. Kentän jatkokäytön selvitys. YKK68239, 6.10.2023. Fimpec. 12 s.

Sitowise Oy 2025. Fingrid Oyj:n Länsisalmi-Anttila 400 kilovoltin voimajohtohanke. Ympäristövaikutusten arviointiselostus 2025. Liite 5. Luontoselvitysten erillisraportti.

Suomen Lajitietokeskus 2026. Laji.fi -verkkopalvelu. https://laji.fi/ (29.4.2026).

Copyright © Helen Nuclear Ltd

Suomen ympäristökeskus 2018. **(Finnish Environment Institute 2018)** Corine maanpeite 2018. (10.4.2026)

Suomen ympäristökeskus 2023. **(Finnish Environment Institute 2023)** Turvetuotantoalueet ja niiden jälkikäyttö. (viitattu 10.4.2026)

Suomen ympäristökeskus 2026a. **(Finnish Environment Institute 2026a)** Ympäristöhallinnon avoimet ympäristötietojärjestelmät. http://www.syke.fi/avointieto. Pintavedet 3. suunnittelukausi / SYKE (4/2026)

Suomen ympäristökeskus 2026b. (Finnish Environment Institute 2026b) Ympäristöhallinnon avoimet ympäristötietojärjestelmät. http://www.syke.fi/avointieto. Pintavesien tilan tietojärjestelmä, vedenlaatu VESLA /SYKE (04/2026)

Suomen ympäristökeskus 2026c. **(Finnish Environment Institute 2026c)** Ympäristöhallinnon avoimet ympäristötietojärjestelmät. http://www.syke.fi/avointieto. Pohjaeläinrekisteri / POHJE / SYKE (4/2026)

Suomen ympäristökeskus 2026d. (Finnish Environment Institute 2026d) Ympäristöhallinnon avoimet ympäristötieto-järjestelmät. http://www.syke.fi/avointieto. Ympäristökarttapalvelu Karpalo, huhtikuu 2026

Suomen ympäristökeskus 2026e. (Finnish Environment Institute 2026e) Ympäristöhallinnon avoimet ympäristötieto-järjestelmät. http://www.syke.fi/avointieto. Ympäristötiedon hallintajärjestelmä Hertta. Pohjavedet, huhtikuu 2026

Suomen ympäristökeskus 2026f. (Finnish Environment Institute 2026f) Ladattavat paikkatietoaineistot. https://www.syke.fi/fi-FI/Avoin_tieto/Paikkatietoaineistot/Ladattavat_paikkatietoaineistot#Y (28.4.2026).

Suomen ympäristökeskus 2026g. (Finnish Environment Institute 2026g) SYKE – Kuntien ja alueiden KHK-päästöt. https://paastot.hiilineutraalisuomi.fi/ (1.4.2026).

Suomen ympäristökeskus 2026h. (Finnish Environment Institute 2026h) Kansallinen päästötietokanta. https://co2data.fi/ (1.4.2026).

Suomen ympäristökeskus 2026i. **(Finnish Environment Institute 2026i)** Maa-ainestenottoluvat ja kiviainesvarannot –karttapalvelu. (10.4.2026)

Säteilyturvakeskus 2023. (Radiation and Nuclear Safety Authority 2023) Valvonnasta vapautettujen jätteiden jätehuolto. STUK opastaa. Syyskuu 2023. ISBN 978-952-309-577-9. https://www.julkari.fi/server/api/core/bitstreams/07767cda-1f6a-4cab-bc85-7b141b411f37/content

Säteilyturvakeskus 2026a. (Radiation and Nuclear Safety Authority 2026a) Ydinlaitosten säteilyturvallisuus. https://stuk.fi/ydinlaitosten-sateilyturvallisuus (viitattu 21.4.2026)

Säteilyturvakeskus 2026b. (Radiation and Nuclear Safety Authority 2026b) Suomalaisen keskimääräinen säteilyannos. https://stuk.fi/suomalaisten-keskimaarainen-sateilyannos (viitattu 23.3.2026)

Säteilyturvakeskus 2026c. (Radiation and Nuclear Safety Authority 2026c) Luonnon taustasäteily. https://stuk.fi/luonnon-taustasateily (viitattu 23.3.2026)

Copyright © Helen Nuclear Ltd

Tarvainen, T. (toim.) 2006. Alkuaineiden taustapitoisuudet pääkaupunkiseudun kehyskuntien maaperässä. Summary: Geochemical baselines around the Helsinki metropolitan area. Geologian tutkimuskeskus, Tutkimusraportti – Geological Survey of Finland, Report of Investigation 163. 40 sivua, 18 kuvaa ja 10 taulukkoa.

Tarvainen, T., Hatakka, T., Salla, A., Jarva, J., Pitkäranta, P., Anttila, H. & Maidell-Münster, L. 2013. Pääkaupunkiseudun maaperän taustapitoisuudet. Summary: Geochemical Baselines in the Helsinki Metropolitan Area. Geologian tutkimuskeskus, Tutkimusraportti 201, 91 sivua, 28 kuvaa, 54 taulukkoa ja 4 liitettä.

Teollisuuden Voima Oyj 2025. Teollisuuden Voiman ja Rauman Biovoiman yhteistyö huoltojätteen käsittelyssä säästää sekä euroja että luontoa. 11.11.2025 https://www.tvo.fi/ajankohtaista/tiedotteetporssitiedotteet/2025/teollisuudenvoimanjaraumanbiovoimanyhteistyohuoltojatteenkasittelyssasaastaasekaeurojaettaluontoa.html

Teollisuuden Voima Oyj 2026. Teollisuuden Voima Oyj:n osavuosikatsaus 1.1.–31.3.2026. https://www.tvo.fi/material/sites/tvo/sijoittajasivut/t4rsgkjn2/Q1_2026_FIN_24042026.pdf

TUKES (Turvallisuus- ja kemikaalivirasto) 2023. Kaivos- ja mineraalirekisterin kartta-aineisto. (10.4.2026)

Työ- ja elinkeinoministeriö 2026. (Ministry of Economic Affairs and Employment 2026) Kansallinen energia- ja ilmastostrategia. Työ- ja elinkeinoministeriön julkaisuja 2026:4. 6.2.2026. https://urn.fi/URN:ISBN:978-952-327-952-0 (11.6.2026)

UNECE 2022. Carbon Neutrality in the UNECE Region: Integrated Life-cycle Assessment of Electricity Sources. United Nations Economic Commission for Europe. https://unece.org/sites/default/files/2022-04/LCA_3_FINAL%20March%202022.pdf

Unesco 1991. Fortress of Suomenlinna. https://whc.unesco.org/en/list/583/ (15.4.2026)

Uski, M., Oinonen, K., Lund, B., Soosalu, H., Ottemöller, L., Sørensen, M.B., Voss, P.H., & Korja, A. 2025. FENCAT—an update of the Fennoscandian earthquake catalogue. Geophysical Journal International, v. 242, no. 3, ggaf242, https://doi.org/10.1093/gji/ggaf242

Uudenmaan liitto 2020. (Helsinki-Uusimaa Regional Council 2020) Hiilineutraali Uusimaa 2030 -tiekartta. Painopisteet ja toimintalinjaukset. Uudenmaan liiton julkaisuja B 61 - 2020, päivitetty 12/2022. https://uudenmaanliitto.fi/wp-content/uploads/2022/12/Hiilineutraali-Uusimaa-2030-tiekartta.pdf (1.4.2026)

Uudenmaan liitto 2022. (Helsinki-Uusimaa Regional Council 2022) Missä maat on mainioimmat. Uudenmaan kulttuuriympäristöt. Uudenmaan liiton julkaisuja E 245-2022. https://uudenmaanliitto.fi/wp-content/uploads/2022/05/Missa-maat-on-mainiommat.pdf

Uudenmaan liitto 2023. (Helsinki-Uusimaa Regional Council 2023) Uusimaa-kaava 2050. https://uudenmaanliitto.fi/kaavoitus-ja-liikenne/maakuntakaavat/uusimaa-kaava-2050/

Uudenmaan liitto 2025a. (Helsinki-Uusimaa Regional Council 2025a) Voimassa olevat maakuntakaavat. Uudenmaan liitto. (30.11.2025) https://uudenmaanliitto.fi/kaavoitus-ja-liikenne/maakuntakaavat/tulkinta-voimassa-olevasta-maakuntakaavatilanteesta/

Uudenmaan liitto 2025b. (Helsinki-Uusimaa Regional Council 2025b) Osallistumis- ja arviointisuunnitelma, VISIO – Innovatiivinen vihreä siirtymä, Uudenmaan 5. vaihemaakuntakaava. Uudenmaan liitto 6/2025.

Copyright © Helen Nuclear Ltd

Uudenmaan liitto 2026a. (Helsinki-Uusimaa Regional Council 2026a) VISIO – Innovatiivinen vihreä siirtymä, Uudenmaan 5. vaihemaakuntakaava (luonnos). 12.3.2026. Uudenmaan liitto. https://uudenmaanliitto.fi/wp-content/uploads/2026/03/Kaavakartta-VISIO-kaavan-luonnos-2026-1.pdf

Uudenmaan liitto 2026b. (Helsinki-Uusimaa Regional Council 2026b) Kaavamerkinnät ja -määräykset, VISIO - Innovatiivinen vihreä siirtymä, Uudenmaan 5. vaihemaakuntakaava, Kaavaluonnos https://uudenmaanliitto.fi/wp-content/uploads/2026/03/Kaavamerkinnat-ja-maaraykset.-VISIO-kaavan-luonnos-2026.pdf

Vahtera Emil ja Lukkari Kaarina 2015. Pääkaupunkiseudun merenpohjien tila ja fosforin sisäinen kuormitus. Helsingin kaupungin ympäristökeskuksen julkaisuja 7/2015.

Vantaanjoen kalatalousalue 2022. Vantaanjoen kalatalousalueen käyttö- ja hoitosuunnitelma 2022–2031. Raportti. 91 s.

Vantaan Energia Oy 2025. Jätevoimalan hiilidioksidin talteenotto, hiilidioksidin siirtoputki sekä nesteytyslaitos ja välivarastointi. Vantaan Energia Oy. Ympäristövaikutusten arviointiselostus 20.11.2025

VnP 993/1992. Valtioneuvoston päätös melutason ohjearvoista 993/92. Ympäristöministeriö, 1992. Helsinki.

Vantaan kaupunki 2007. (City of Vantaa 2007) Kulttuurimaisemaselvitys.

Vantaan kaupunki 2023. (City of Vantaa 2023) Vantaan yleiskaava 2020 kaavakartta 11.1.2023, Arvokas kulttuuriympäristö. https://www.vantaa.fi/fi/asuminen-ja-rakentaminen/kaavoitus/yleiskaavoitus/vantaan-yleiskaava-2020

Vantaan kaupunki 2026a. (City of Vantaa 2026a) Ojangon Pitkäsuontielle hiilidioksidin talteenotto ja varastointi -hanke. Vantaan kaupunki. (10.4.2026) https://www.vantaa.fi/fi/kaavoitus/kaavat/ojangon-pitkasuontielle-hiilidioksidin-talteenotto-ja-varastointi-hanke

Vantaan kaupunki 2026b. (City of Vantaa 2026b) Vantaan karttapalvelu. https://kartta.vantaa.fi/ (29.4.2026).

Vantaan kaupunki 2026c. (City of Vantaa 2026c) Vantaan karttarajapinnat. Vantaan kaupunki. https://gis.vantaa.fi/rajapinnat/ (27.5.2026)

Vantaanjoen ja Helsingin seudun vesiensuojeluyhdistys ry 2024. Vantaanjoen yhteistarkkailu, vedenlaatu 2023. Raportti 14/2024.

Vatanen, S. & Haikonen, A. 2007. Vuosaaren satamahankkeen vesistö- ja kalatalousseuranta 2006. Vuosaaren satamahankkeen julkaisuja 1/2007.

Vatanen, S. & Haikonen, A. (toim.). 2010. Vuosaaren sataman ja voimalaitosten vesistö- ja kalataloustarkkailu vuonna 2009. Kala- ja vesimonisteita nro 28. 48 s. + 6 liitettä.

Vatanen, S. & Haikonen, A. (toim.). 2011. Vuosaaren sataman ja voimalaitosten vesistö- ja kalataloustarkkailu vuonna 2010. Kala- ja vesimonisteita nro 45. 49 s. + 6 liitettä.

Vatanen, S. & Haikonen, A. 2012. Koivusaaren osayleiskaavan vaikutus alueen pohjaeläimistöön, kaloihin ja kalastukseen. Kala- ja vesimonisteita nro 89. 25 s. + 5 liitettä.

Copyright © Helen Nuclear Ltd

Vatanen, S., Haikonen, A. & Piispanen, A. (toim.). 2012. Vuosaaren sataman rakentamisen aikaisen (2003–2008) vesistö- ja kalataloustarkkailun yhteenvetoraportti. Kala- ja vesimonisteita nro 57. 198 s. + 16 liitettä.

Vatanen, S., Happo, L., Haikonen, A., Olsen, S., Rautanen, E., Karppinen, P. & Kervinen, J. 2019. Helsingin ja Espoon edustan merialueen kalataloudellinen yhteistarkkailu vuosina 2012–2017. Kala- ja vesijulkaisuja nro 257. 102 s. + 22 liitettä.

Vatanen, S. & Niinimäki, J. 2005. Vuosaaren satamahankkeen vesistö- ja kalatalousseuranta 2004. Vuosaaren satamahankkeen julkaisuja 1/2005.

VELMU-karttapalvelu 2026 (VELMU map service 2026**)**. Vedenalaisen meriluonnon monimuotoisuuden inventointiohjelman (VELMU) karttapalvelu. https://velmu.syke.fi/ (Luvun 15 viittaukset 5.5.2026, luvun 16 viittaukset poikastuotantoalueet: siika 25.4.2026, muut lajit 30.4.2026).

Vieraslajit.fi 2026. Vieraslajiportaali. http://vieraslajit.fi/ (28.4.2028).

Väylävirasto 2023. (Finnish Transport Infrastructure Agency 2023) Infrarakentamisen vähähiilisyyden arviointimenetelmä. Väyläviraston ohjeita 43/2023. https://vayla.fi/suunnittelu-rakentaminen/hankkeiden-suunnittelu/paastolaskenta (1.4.2026).

Väylävirasto 2026. (Finnish Transport Infrastructure Agency 2026) Suomen Väylät – avoimet aineistot. https://suomenvaylat.vayla.fi/

World Nuclear Association 2026. World Nuclear Power Reactors & Uranium Requirements. https://world-nuclear.org/information-library/facts-and-figures/world-nuclear-power-reactors-and-uranium-requireme (20.4.2026)

Ympäristöhallinto 2026. (Environmental Administration 2026) Kansallismaisemat. https://www.ymparisto.fi/fi/luonto-vesistot-ja-meri/maisemat/kansallismaisemat (15.4.2026)

Ympäristöministeriö 1992. (Ministry of the Environment 1992) Maisemanhoito. Maisema-aluetyöryhmän mietintö I. Mietintö 66/1992. https://helda.helsinki.fi/items/6675faaf-c530-4bc2-8da8-b83e3668cd3c

Ympäristöministeriö 2007. (Ministry of the Environment 2007) Melutta -hankkeen loppuraportti. Ympäristöministeriön ra-portteja 20/2007. Ympäristöministeriö, Helsinki, 2007.

Ympäristöministeriö 2015. (Ministry of the Environment 2015) Sedimenttien ruoppaus- ja läjitysohje. Ympäristöhallinnon ohjeita I / 2015, Helsinki 2015.

Ympäristöministeriö 2021. (Ministry of the Environment 2021) Suomen merenhoitosuunnitelman toimenpideohjelma vuosille 2022–2027. Toim. Laamanen, M., Suomela, J., Ekebom, J., Korpinen, S., Paavilainen, P., Lahtinen, T., Nieminen, S., Hernberg, A. Ympäristöministeriön julkaisuja 2021:30, ISBN PDF 978-952-361-198-6, http://urn.fi/URN:ISBN:978-952-361-198-6

Ympäristöministeriö & Suomen ympäristökeskus 2021. (Ministry of the Environment & Finnish Environment Institute 2021) Suomen lajien alueellinen uhanalaisuusarviointi 2020. https://punainenkirja.laji.fi/regional (28.4.2026)

Copyright © Helen Nuclear Ltd