Environmental Impact Assessment

Larsboda strand



Authors: Maria Isaksson, Cecilia Lindén, Xiaomeng Ma, Viggo Norrby, Frida Orveland, Amanda Philipsson, Kristin Strandberg

Foreword

This report is the result of a project work within the course *Case studies in Environmental Impact Assessment* at Stockholm University. The course is a mandatory part of the Master programme *Environmental Management and Physical Planning* at the Department of Physical Geography. This programme is multidisciplinary with both Swedish and international students. The course comprises 15 HEC, i.e. ten weeks of study. The project part covers five weeks with the aim to give the students an opportunity to analyse the environmental impact of a planned project and to get some practice in how to make an Environmental Impact Assessment.

This time we have chosen to study the environmental impact of plans on new residential areas in the Stockholm region. The population in this region is expected to increase rapidly, according to the Regional Development Plan with more than 900 000 inhabitants to the middle of this century. Thus there is a great need for new apartments to be built. However, this could mean a negative impact for some valuable green areas around Stockholm. Many of these areas are important for biodiversity and for recreation. To analyse these conflicts and to suggest mitigation measures have been an important task for the students in this project.

The students alone are responsible for results and conclusions in this report and it cannot be regarded as the position of Stockholm University. The project supervisors have been Salim Belyazid, Bo Eknert, Peter Schlyter, Ingrid Stjernquist and Johanna Gordon, all from the Department of Physical Geography.

We want to thank all those who have been helpful in providing the students with information and materials as well as have taken time to give interviews. Without your help this project could not have been realised.

Stockholm, January 2017
Bo Eknert
Lecturer
Department of Physical Geography, Stockholm University

Authors

Project Hammarbyskogen

Amanda Salguero Engström	Bachelor in *Geography*. (Current: *Master's in Environment and Health Protection*)
Helena Berglund	Bachelor in *Biology-Earth Science*. (Current: *Masters in Geomatics with Remote Sensing and GIS*)
Jenny Schelin	Bachelor in *Biology-Earth Science*. (Current: *Master's in Environmental Management and Physical Planning*)
Malin Jigrud	Bachelor in *Biology*. (Current: *Master's in Environmental Management and Physical Planning*)
Ole van Allen	Bachelor in Earth Science (Current: *Master's in Environmental Management and Physical Planning*)
Patrick Lindén	Bachelor in *Geography*. (Current: *Master's in Environmental Science*)
Ramya Weisner	Bachelor in Earth Science (Current: *Master's in Geology Sciences*)
Sara Zentner	Bachelor in *Political Science*. (Current: *Master's in Urban and Regional Planning*)

Project Larsboda

Maria Isaksson	Bachelor in Geography. *(*Current: *Independent Master's courses)*
Cecilia Lindén	Bachelor in Biology-Earth Sciences. (Current: *Master's in Landscape ecology*)
Xiaomeng Ma	Bachelor in Ecology. (Current: *Master in Environmental Management and Physical Planning*)
Viggo Norrby	Bachelor in Geography. (Current: *Master in Environment and Health Protection*)
Frida Orveland	Bachelor in Biology-Earth Sciences. (Current: *Master's in Environmental Management and Physical Planning*)
Amanda Philipsson	Bachelor in Environmental Science. *(*Current: *Independent Master Courses)*
Kristin Strandberg	Bachelor in Urban and Regional planning. (Current: *Master in Environmental Management and Physical Planning*)

Project Magelungens Strand

Christoffer Ekström	Bachelor in Environmental Science. (Current*: Master's in Landscape ecology*)
Ihsin Cheng	Bachelor in Bioenvironmental systems engineering. (Current: *Double major in Forestry and Resources Conservation*)
Isla Hämäläinen	Bachelor of Geography. (Current: *Master's in Environmental Management and Physical Planning*)
Karin Klerby Blomqvist	Current: *Bachelor´s in Geography*
Rasmus Gustavsson	Bachelors of Criminology. (Current: *Master's in Landscape ecology*)
Tor Ekholm	Bachelor of Biology. (Current: *Master's in Environmental Management and Physical Planning*)

Project Norra Kymlinge

Anna Österman	Bachelor in Biology and Earth Science. (Current: *Independent Master courses)*
Christiane Kaiser	Bachelor in Geography. (Current: *Master's in Environmental Science)*
Jennie Jalkner	Bachelor in Molecular Biology. (Current: *Master's in Environmental Management and Physical Planning)*
Johanna Lennartson	Bachelor in Urban Planning. *(*Current: *Master's in Social science, specializing in Urban Planning)*
Mattias Jaktlund	Bachelor in Geography. (Current: *Independent Master courses)*
Saad Kadif	Bachelor of Biology and Earth Science. (Current: *Master's in Geomatics with Remote Sensing and GIS*)
Tina Koskela	Bachelor in Geography. (Current: *Master's in Environment and Health Protection*)
Sunil Chopra	Bachelor of Environmental Science. (Current: *Masters in Environmental Science)*

Project Riddersvik

Natacha Bjurberg Kessidis	Bachelor in Geography. (Current: Master's in Environmental Management and Physical Planning)
Stina Ljungberg	Bachelor in Environmental Science. (Current: Master's in Environmental Management and Physical Planning)
Mårten Oswald	Bachelor in Marine Biology
Filippa Pershagen	Bachelor in Geography (Current: Master's in Environmental Management and Physical Planning)
Lukas Scholz	Bachelor in Biosciences. (Current: *Master Programme in Ecology and Biodiversity*)
Rikard Stenberg	Bachelor in Geography (Current: Master in Environmental Management and Physical Planning)
Johanna Ström	Bachelor in Environmental Science (Current: *Master's in Environment and Health Protection*)

List of Actors

Act Relative to the Transportation of Dangerous Goods - Förordning om transport av farligt gods

Culture and Recreation Committee- Kultur- och fritidsnämnden, Sundbyberg

Culture Committee- Kulturnämnden, Stockholm Stad

County Administrative Board - Länsstyrelsen

City Planning Office - Stadsbyggnadskontoret

City Planning Committee- Stadsbyggnadsnämnden

Environmental Administration - Miljöförvaltningen

Stockholm County Council - Landstinget

City Museum of Stockholm - Stadsmuseet

Stockholm Stad, Municipality of Stockholm - Stockholms stad

City Council - Kommunfullmäktige

Municipal Executive Committee - Kommunstyrelsen

City District Administration - Stadsdelsförvaltning

Cultural Heritage Law - Kulturmiljölagen

Traffic Office - Trafikkontoret

Swedish Transport Administration - Trafikverket

Swedish Transport Agency - Transportstyrelsen

Swedish Environmental Protection Agency - Naturvårdsverket

Swedish Environmental Code - Miljöbalk

Swedish National Heritage Board - Riksantikvarieämbetet

Swedish National Land Survey - Lantmäteriet

Swedish Society for Nature Conservation Naturskyddsföreningen

Swedish Civil Contingencies Agency - Myndigheten för Samhällsskydd och Beredskap

National Board of Housing, Building and Planning - Boverket

Development Committee - Exploateringsnämnden

National Board of Health and Welfare - Socialstyrelsen

Technical committee: Tekniska nämnden

Land and Environment Court of Appeal - Mark- och miljööverdomstolen

Svea Court of Appeal - Svea hovrätt
Heritage Conservation Act - Kulturminneslagen

Development Administration - Exploateringskontoret

The Greater Stockholm Fire Brigade - Storstockholms brandförsvar

Glossary

Accessibility	Refers to both physical accessibility, such as roads and paths, but also psychological accessibility, such as feeling of privacy and barriers in the landscape
Amphibians	Ectothermic, tetrapod vertebrates of the class Amphibia. Ex: Frogs
Arboretum	A display garden with different trees, mostly for educational purposes
Biodiversity	Refers to species diversity and genetic diversity of terrestrial and aquatic organisms in an area
Biotope	Biological term for a type of environment which constitutes a habitat for a certain assemblage of species of plants and animals
Carbon dioxide sink	A natural or artificial reservoir that accumulates and stores some **carbon**-containing chemical compound for an indefinite period
Chemical status	Refers to the statues of water based on the levels of pollutants in surface water. Classification scale is good or satisfactory / not reaching good status
Comprehensive plan	Covers the entire municipality's area. It shows how the municipality would like the city and land to be and appear in the future and which areas the municipality thinks should and should not be used for building
Coniferous forest	A terrestrial biome found in temperate regions of the world with warm summers and cool winters and adequate rainfall to sustain a forest

Connectivity	In ecology, is the degree to which the landscape facilitates or interfere with the movement of species among resource patches, such as e.g. mating- or feeding grounds
Core area	In ecology an area which qualities make it particularly valuable to plants and animals
Cultural heritage	The legacy of physical artifacts and intangible attributes of a group or society that are inherited from past generations, maintained
Cultural landscape	Refers to landscapes transformed by human activity. For example, farmland, urban landscapes and industrial landscapes
dB, dB(A)	A logarithmic unit used to express the ratio of two values of a physical quantity Ex: dB(A), A-weighting, a sound level unit
Deciduous forest	Forests where a majority of the trees lose their foliage at the end of the typical growing season are called deciduous forests. These forests are found in many areas worldwide and have distinctive ecosystems, understory growth, and soil dynamics
Detailed development plan	Law-binding rules for where new buildings may be located and how they should appear
Dispersal	The movement of individuals (animals, plants, fungi, bacteria, etc.) from their birth site to their breeding site ('natal dispersal'), as well as the movement from one breeding site to another ('breeding dispersal')
Ecoduct	A bridge for increased connectivity for ground-bound animals
Ecosystem Services (ESS)	*Provisioning*, such as the production of food and water; *regulating*, such as the control of climate and disease; supporting, such as nutrient cycles and crop pollination; and cultural, such as spiritual and recreational benefits

Edge nibbling	Long term removing of small pieces of a specific area
Effect	The physical change of the environment Ex: remove some trees to make a road What the effects result in; for example less nature → less health is the actual impact
Fault scarp	A small step or offset on the ground surface where one side of a fault has moved vertically with respect to the other. It is the topographic expression of faulting attributed to the displacement of the land surface by movement along faults
Fragmentation	The emergence of discontinuities (fragmentation) in an organism's preferred environment (habitat), causing population fragmentation and ecosystem decay
F-6	A school with classes from the preparatory year up to year six
F-9	A school with classes from the preparatory year up to year nine.
Förbifart Stockholm	A bypass with the purpose to improve the accessibility for car traffic in Stockholm
Green corridor	An area of habitat, connecting populations of species, that has been separated by human activities. The exchange of individuals between populations may decrease negative effects such as inbreeding and a reduction of genetic diversity which often occur within isolated populations.
Green compensation	Compensation for lost green areas. Ex: Through management measures, restoration of damaged environments, creating new habitat or by the long-term protection of natural areas that previously lacked protection etc.
Geomorphology	Scientific study of the origin and evolution of topographic and bathymetric features created by physical, chemical or biological processes operating at or near the Earth's surface.

Habitat	Refers to the living environment where a plant or animal species live under specific conditions
Hard surface	Refers to the area that does not allow rainwater infiltrated
Hibernation	Is a state of inactivity of animals, where body temperature, heartbeat and metabolic rate drop
Impact	What the effects result in; for example less nature → less health is the actual impact. Ex: Habitat fragmentation due to removed trees
Infrastructure	Refers to physical structures and functions in society. Includes the roads, sewerage, electricity supply and waste management
Makrophyte	An aquatic plant that grows in or near water
National Interest	Areas with values regarded as important on a national level e.g. natural and cultural environments that are of importance to preserve
Natura 2000	An area or network protected by the EU to promote certain natural environments
Newly arrived	Recently immigrated persons with residence permission where the municipality is responsible for finding housing options for them.
Noise	Refers to unwanted sound in air, ground and water. Noise pollution can affect human and animal health.
Orientability	The capacity of an area to be orientated by a person with visual or cognitive deficiencies

Recreation area	Refers to an area that is attractive for various recreational activities for the public. For example, the areas suitable for walking, jogging and playing or just enjoyment of surroundings
Recreational values	Values that involve the availability for walking, playing and other leisure activities
Red listed species	Classification of threatened species measuring conservation status of individual species, developed by the IUCN.
Safety distance	Guidelines regarding the distance to residential areas from different elements, e.g. cultural objects and industrial facilities, that has been established by statutory authorities e.g. National Board of Housing, Building and Planning and The Environmental Protection Agency
Storm water	Refers to the water on surfaces that cannot be infiltrated. Origin of the water is from rain, melting and flushing water or emergent groundwater.
Socioduct	A broader bridge that is built to reduce social barriers between areas and create social connectivity
Soil condition	Soil structure, stratigraphy and quality
SS	Suspended Solid
Stockholms Green Wedges	A collection of 10 large nature areas in Stockholm county which extends from the suburbs outside Stockholm and inwards toward the city center. Providing green infrastructure close to developed areas

Usability	The degree to which an area an environment is accessible and orientable for persons with disabilities
Water condition	Refers to abiotic factors such as chemical and physical conditions, as well as the ecological status, in the aquatic environment within an area
Water recipient	The term for water bodies that receives waste products through the transportation of water
Wetland	A land area that is saturated with water, either permanently or seasonally, such that it takes on the characteristics of a distinct ecosystem
Wooded bog areas	A bog is an area of moist, soggy ground, usually with peat formed by the decay and carbonization of mosses and other vegetation in the bog

Abbreviations

Zn - Zinc

Cu - Copper

Cr - Chromium

Cd - Cadmium

Hg - Mercury

EIA - Environmental Impact Assessment

EIS - Environmental Impact Statement

EPA - Environmental and Protection Agency

ESS - Ecosystem Services

EQS - Environmental Quality Standards

EQO - (The Swedish) Environmental Quality Objectives

NO_2 - Nitrogen dioxide

N - Nitrogen

Ni - Nickel

NOx - Nitrogen Oxides

P - Phosphorus

PAHs - Polycyclic aromatic hydrocarbon

RUFS - Regional utvecklingsplan för Stockholm

PBL (The Planning and Building Act) - Plan- och bygglag

SPO (Species Protection Ordinance) - Artskyddsförordningen

1. Background and Purpose

This report consists of Environmental Impact Assessments of five areas in the Stockholm region. The areas are currently unexploited and the planning processes are all in different stages. The common denominator is that they are all are located in green areas within a region with growing population and housing shortage (Länsstyrelsen, 2016).

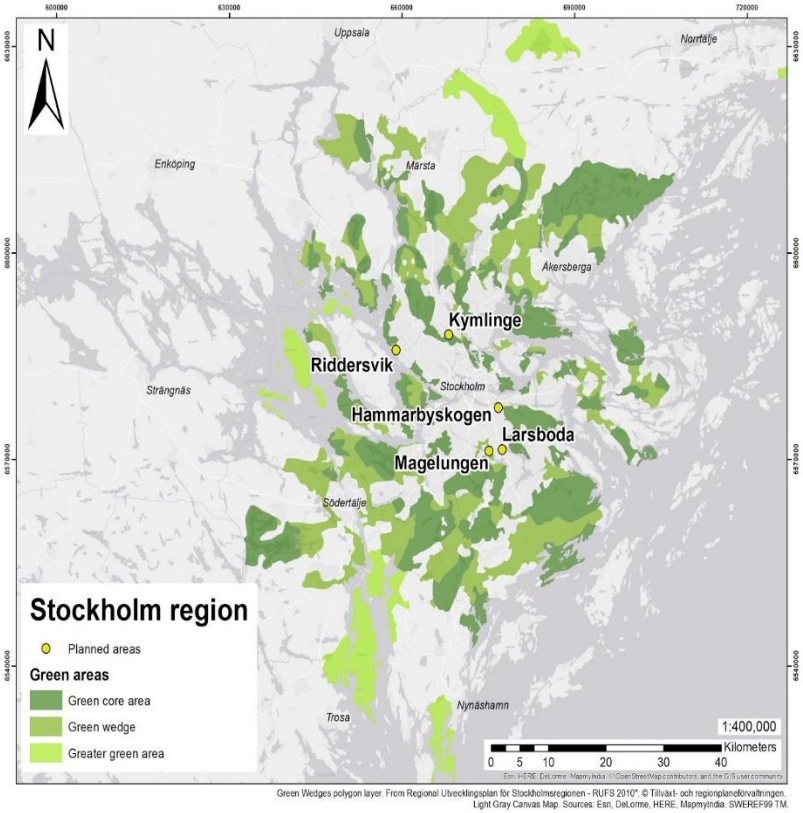


Figure 1. Map marking the project areas and important green areas as pointed out in the Regional Development Goals (RUFS, 2010:156).

To give the reader the background and to explain why we make Environmental Assessments, the following section explains the planning and legal framework and environmental objectives common to the individual assessments in this common report.

2. The Swedish Planning Process

The legal framework for the Swedish planning process is defined primarily in the Plan and Building Act (SFS, 2010:900) and in the Environmental Code (SFS, 1998:808). It is the Swedish municipalities that have a monopoly on planning in Sweden (Nyström & Tonnell, 2012). But the framework for the planning process is set by the government through the Plan and Building Act. The County Administrative Boards (*Länsstyrelserna*) monitor that the planning in the municipalities follow the national interests and goals, they also are required to act as an advisor for both the constructor and the municipality.

The municipalities can act both as an authority and a property owner (Boverket, 2016a). The municipality writes and approves the Comprehensive Plan (*översiktsplan*), Detailed Development Plans (*detaljplaner*) and Area Regulations (*områdesbestämmelser*) (Nyström & Tonell, 2012). In every municipality there is a local Building Authority (*byggnadsnämnd*) that is constituted of trustees and public servants that approves and monitor the plans from a legal point of view (Boverket, 2016a).

The developer (*byggherre*) is the person or organisation that has been commissioned to construct the project (or parts of it). They have the overall responsibility to make sure that the project fulfills current laws and that monitoring is done in a proper way (Boverket, 2016a; Byggherrarna, 2016).

The Comprehensive Plan is there to regulate the development of the municipality as a whole. It must display the intended use of water and land and the end result present the *"usage/conservation of land and water, localization and dimensions of buildings, infrastructure and service"* (Nyström, 1999:119). The Comprehensive Plan should be accepted by the City Council (kommunfullmäktige), every four years and the Council should decide whether the plan shall be extended or is in need of renewal (Boverket, 2016b). It is not legally binding, and can therefore not be appealed against. Though whenever the municipality should choose to develop areas in such a way that they do not conform to the Comprehensive Plan, they must present their reasons for doing so through a programme (Nyström & Tonell, 2012).

The Detail Development Plan is more of a small scale, detailed document that is legally binding. This process is initiated by the municipality or developer. The initial phases of planning are not regulated in law, therefore an agreement is often struck in the beginning between the involved parties to divide the costs of the planning process (Iverlund & Ultenius, 2008). At the start of the process a promemoria is written by the Town Planning Office, which describes the project. Should the Detailed Development Plan differ from the Comprehensive Plan, a programme might also be developed. Before the programme stage there will often be a pre-study of the area, with the purpose to find out whether the project should be done at all (ob. cit).

At the next stage investigations are carried out; possible impacts are examined from an economic, environmental and social perspective. The Environmental Assessment (*miljöbedömning*) also helps to inform the decision of whether an Environmental Impact Assessment (EIA) will be necessary. During the development of the Detailed Development Plans the municipality is required to consult the County Administrative Board (*Länsstyrelsen*), the Land Surveying Authorities (*Lantmäteriet*) and other municipalities that may be affected by the proposed plan (Iverlund & Ultenius, 2008). They must also arrange so the people that might get affected by the plan, as well as relevant authorities and organizations, can have their opinions stated (Nyström & Tonell, 2012).

Referral and consultation documents are then developed and the proposed plan will be tried against the Plan and Buildings Act. Once approved the proposed plan must be presented in a public space for at least 3 weeks (Nyström & Tonell, 2012). The presented plan must at least contain; a map of the plan with conditions, a description of the plan, description of implementation, an account of the consultation process, a base map, list of real estate, illustrations and if applicable the program and the EIA (Iverlund & Ultenius, 2008). During this time different stakeholders can state their issues with the plan. At the end of the time of presentation, the municipality must compile the opinions on the plan in a verdict (ob. cit.). Should the plan substantially change in light of the stakeholders' critique then the plan must be presented to the public in the same fashion once more.

Once the presentation period is over either the County Administrative Board approves the plan or, if the plan is considered to be of minor importance, they delegate the decision to the Municipal Board (*kommunstyrelsen*). The

decision is followed by a period (*besvärsskede*) lasting three weeks during which the individuals that did not have their complaints catered to during the time of presentation may appeal against the plan with the County Administrative Board as first instance, and the government as second instance (Iverlund & Ultenius, 2008). Should the plan not be appealed against or the appeal be denied, then the plan will enter into legal force at the end of the three-week period.

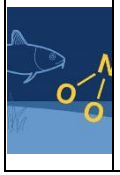
3. Environmental and Planning Objectives

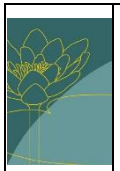
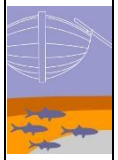
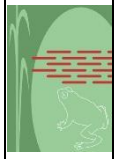
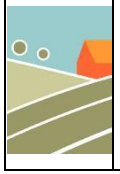
3.1. Environmental Objectives

The Swedish Environmental Objectives (EOs) are aiming to safeguard the environment. They are consisting of three parts; the Generational Goal, 16 Environmental Quality Objectives (EQOs) and 24 Milestone Targets. The Generation Goal provides guidance to solve current environmental problems within one generation. The EQOs are a set of environmental qualities that are further specified and are supposed to be reached by 2020 (Table 1). The Milestone Targets represent necessary steps towards the achievement of the Generational Goal and the EQOs (Naturvårdsverket, 2016a; 2016b).

Table 1. The Swedish Environmental Quality Objectives and their official description (Naturvårdsverket, 2016a), an assessment of the prospects of achieving them by 2020 as well as current trends in the environment (Naturvårdsverket, 2016b). The table also contains the official illustrations of the EQOs by Tobias Flygar (Miljömål.se, 2012).

	Environmental Quality Objectives	**Description**	**Will be reached by 2020?**	**Trend**
	**Reduced Climate Impact**	"In accordance with the UN Framework Convention on Climate Change, concentrations of greenhouse gases in the atmosphere must be stabilised at a level that will prevent dangerous anthropogenic interference with the climate system. This goal must be achieved in such a way and at such a pace that biological diversity is preserved, food production is assured and other goals of sustainable development are not jeopardised. Sweden, together with other countries, must assume responsibility for achieving this global objective."	No*	Negative

	**Clean Air**	"The air must be clean enough not to represent a risk to human health or to animals, plants or cultural assets."	No	Positive
	**Natural Acidification Only**	“The acidifying effects of deposition and land use must not exceed the limits that can be tolerated by soil and water. In addition, deposition of acidifying substances must not increase the rate of corrosion of technical materials located in the ground, water main systems, archaeological objects and rock carvings.”	No	Positive
	**A Non-Toxic Environment**	“The occurrence of man-made or extracted substances in the environment must not represent a threat to human health or biological diversity. Concentrations of non-naturally occurring substances will be close to zero and their impacts on human health and on ecosystems will be negligible. Concentrations of naturally occurring substances will be close to background levels.”	No	Neutral
	**A Protective Ozone Layer**	“The ozone layer must be replenished so as to provide long-term protection against harmful UV radiation.”	Yes	Positive
	**A Safe Radiation Environment**	“Human health and biological diversity must be protected against the harmful effects of radiation.”	Partly	Neutral
	**Zero Eutrophication**	“Nutrient levels in soil and water must not be such that they adversely affect human health, the conditions for biological diversity or the possibility of varied use of land and water.”	No	Neutral

	**Flourishing Lakes and Streams**	"Lakes and watercourses must be ecologically sustainable and their variety of habitats must be preserved. Natural productive capacity, biological diversity, cultural heritage assets and the ecological and water-conserving function of the landscape must be preserved, at the same time as recreational assets are safeguarded."	No	Neutral
	**Good-Quality Groundwater**	"Groundwater must provide a safe and sustainable supply of drinking water and contribute to viable habitats for flora and fauna in lakes and watercourses."	No	Neutral
	**A Balanced Marine Environment, Flourishing Coastal Areas and Archipelagos**	"The North Sea and the Baltic Sea must have a sustainable productive capacity, and biological diversity must be preserved. Coasts and archipelagos must be characterised by a high degree of biological diversity and a wealth of recreational, natural and cultural assets. Industry, recreation and other utilisation of the seas, coasts and archipelagos must be compatible with the promotion of sustainable development. Particularly valuable areas must be protected against encroachment and other disturbance."	No	Neutral
	**Thriving Wetlands**	"The ecological and the ecological and water-conserving function of wetlands in the landscape must be maintained and valuable wetlands preserved for the future."	No	Negative
	**Sustainable Forests**	"The value of forests and forest land for biological production must be protected, at the same time as biological diversity and cultural heritage and recreational assets are safeguarded."	No	Neutral
	**A Varied Agricultural Landscape**	"The value of the farmed landscape and agricultural land for biological production and food production must be protected, at the same time as biological diversity and cultural heritage assets are preserved and strengthened."	No	Negative

	**A Magnificent Mountain Landscape**	"The pristine character of the mountain environment must be largely preserved, in terms of biological diversity, recreational value, and natural and cultural assets. Activities in mountain areas must respect these values and assets, with a view to promoting sustainable development. Particularly valuable areas must be protected from encroachment and other disturbance."	No	Negative
	**A Good Built Environment**	"Cities, towns and other built-up areas must provide a good, healthy living environment and contribute to a good regional and global environment. Natural and cultural assets must be protected and developed. Buildings and amenities must be located and designed in accordance with sound environmental principles and in such a way as to promote sustainable management of land, water and other resources."	No	Positive
	**A Rich Diversity of Plant and Animal Life**	"Biological diversity must be preserved and used sustainably for the benefit of present and future generations. Species habitats and ecosystems and their functions and processes must be safeguarded. Species must be able to survive in long-term viable populations with sufficient genetic variation. Finally, people must have access to a good natural and cultural environment rich in biological diversity, as a basis for health, quality of life and well-being."	No	Negative

**the deadline for the Environmental Quality Objective of 'Reduced Climate Impact' is 2050 instead of 2020*

3.2. Regional Objectives

The Regional Development Plan (commonly known as *RUFS*) from 2010 was developed by the Regional Development Office (Tillväxt- och Regionplaneförvaltningen, Stockholms Läns Landsting) and is the strategic development plan for all 26 municipalities in Stockholm. The Office is working on the next development plan, RUFS 2050 (RUFS, 2016). However, this plan is still in its consultation phase and might change considerably before final approval. Because of this, the focus is still on the current version from 2010.

It points out a number of important development goals for the region. By using 6 strategies with subsequent planning objectives and then followed by specific goals, RUFS shows the ideal direction of development. Two of those strategies are of specific importance for

the development proposals scrutinized in this environmental impact assessment are discussed shortly below.

One of the strategies is to "*secure existing values for future needs".* It concerns for instance the natural-, cultural- and recreational environments and states that such environments should be both protected and to be further developed. Its second objective is about climate, energy and transports. This part states that the region should decrease its effect on the environment and that the transportation systems need to be efficient. The negative effects from transportation systems should be limited.

Another strategy is to "*develop a multi-centric and dense region".* The planning goal is that the city becomes *multi-centric* and has a compact city structure. Today Stockholm is a mono-centric region with a very mono-centric city center, which puts a lot of strain on our transport infrastructure. With a growing population, the demands on all kinds of traffic infrastructure will continue to increase. Instead of leading everyone into the inner city over the Central Station, the plan point towards that new housing areas should be planned close to important core access points where they could be combined with public services. Such regional cores should be further developed. This would also make transverse travelling easier (i.e. bus or tram from east to west). One of the goals is also that people should have a good access to work places, green spaces, water and technical infrastructure.

Additional points are that the density of the built environment should increase and that it becomes more varied. An attractive city environment with public spaces, parks and green environment should be built, that also create possibilities for dynamic evening economies in the city's core areas.

The same strategy also includes goals about *green wedges and beaches*. Following this the people in the region should have "*good access to nature in close proximity to residential areas*. This means that those *assets should be secured, developed and the access to the green wedges should increase".*

It becomes clear that the problem with these goals is that that they are in conflict with each other. On the one hand, existing values should be protected for future needs. On the other hand, they are to be changed/developed for the needs of a growing population. As the RUFS-goals are not legally binding, it is up to the municipalities to make their own judgments of the importance between them.

3.3.Comprehensive Plan

In the following section, the Planning Objectives from the Stockholm Comprehensive Plan are presented in more detail. This plan is relevant for four out of five projects (Hammarbyskogen, Larsboda, Magelungen and Riddersvik) but not for the Kymlinge projec. This project it is located within the municipality of Sundbyberg. However, as the project is not mentioned in their Comprehensive Plan, this plan is not presented below.

The Stockholm City Plan (Stockholms stad, 2010) is the Comprehensive Plan showing water and land use as well as development of the built environment for the near future. An updated version of the plan is now out on consultation between 2016-11-10 and 2017-01-10. Since a final version has not been agreed on politically, we have chosen to use the 2010 version.

The plan points out four strategies that will help the city grow in a more sustainable way:

"*strengthen central Stockholm, focus on strategic nodes, connect city areas* and *create a vibrant urban environment"* (Stockholms stad, 2010).

The first focuses on how with the rapid city-growth, the inner city is expanding outside the historic city borders. Growth should be focused along the outer parts of the underground lines, which provides citizens with good public transportation access and enables more people to go by bike or walk to their destinations. Some of these are well connected to the city core but not between each other and a stated goal is to improve those connections.

The document mentions some risks when densifying: air- and noise pollution, increased pressure on logistics that can cause risks and that development might destroy green areas in a time when the need for recreational green space increases.

The second strategy focus on specific core areas and mentions Kista, Vällingby, Spånga, Brommaplan, Skärholmen, Farsta, Fruängen, Älvsjö and Högdalen. Four of the five environmental impact assessment (EIA) projects produced in this document are located in close proximity to those cores. The fifth project connects with two expanding inner city areas, Hammarby Sjöstad and Gullmarsplan.

The third and fourth strategy goals of *connecting city areas* and *creating a vibrant urban environment* put more focus on the quality of city areas. Workplaces and offices should be found around the city, which could decrease the pressure on both road- and public transportation infrastructure, and citizens could walk more often or use their bicycles. Access to schools, services, parks or green spaces should be improved. Evening activities like visiting restaurants, cafes or entertainment should be found locally. Environments that are used continually throughout the day and into the evening expand the citizens' sense of security and greatly increase the attractiveness of areas.

4. Legislation

4.1. EU Directive

In order to prevent further environmental deterioration, the EU Directive 85/337/EEC was implemented in 1985. According to the Directive, an EIA is required for two classes of projects, one mandatory (Annex I) and one discretionary (Annex II):

"Projects of the classes listed in Annex I shall be made subject to an assessment... for projects listed in Annex II, the Member States shall determine through: (a) a case-by-case examination; or (b) thresholds or criteria set by the Member State whether the project shall be made subject to an assessment... When [doing so], the relevant selection criteria set out in Annex III shall be taken into account" (EU Directive 85/337/EEC, Article 4).

In other words, all projects listed in Annex I are considered as having significant effects on the environment and require an EIA. For projects listed in Annex II, the authorities are required to decide whether an EIA is needed with the "screening procedure", which determines the effects of projects on the basis of thresholds/criteria or a case-by-case examination. Moreover, the authorities should also take into account the projects listed in Annex III.

The EIA Directive of 1985 has been amended three times, in 1997, 2003 and 2009. The implementation and development of the Directive greatly influenced the EIA systems in EU Member States. The EIA is viewed as a significant technique for incorporating environmental considerations into the planning process (Glasson *et al.*, 2013).

The EIA Directive is transposed into Swedish legislation mainly by the Environmental Code (SFS, 2000:61) and the Ordinance on Environmental Impact Assessments (SFS, 1998:905). The Environmental Code contains several provisions regarding the preparation of the EIA. It also contains chapter 6, with General Regulation on Environmental Impact Statements (EIS) and Environmental Impact Assessments (EIA). Over the past decades, EIA has become an important tool in project planning in Sweden and its applications are likely to expand further (Edvardsson, 2004).

4.2.Swedish Environmental Legislation

4.2.1. Swedish Environmental Code

National interests - Riksintressen

National interests are geographical areas determined to contain unique or otherwise important values or qualities of national concern. The term national interests are used in the Swedish Environmental Code regarding two different types of areas. One type stems from chapter 4 which states that *"the government may declare an area to be of national interest"*. The other type is described in chapter 3 of the Environmental Code and "*it is the responsibility of the relevant authorities to assert claim and oversight of the areas".*

How national interests relate to other interests is supposed to be presented in the municipalities comprehensive plans in a way that clarifies how tradeoffs and judgements are to be considered (Boverket, 2016a).

Basic provisions concerning the management of land and water areas

Authorities, organizations, companies and individuals are obliged to follow the basic provisions concerning the management of land and water areas conditioned by the Swedish Environmental Code (SFS 1998:808) in chapter 3. Land and water areas shall be used for the purposes for which they are best suited in view of their situation (chapter 3 section 1) while land and water areas that are, from an ecological point of view, particularly vulnerable shall be protected against damaging measures to the extent possible (chapter 3 section 3). Protection against damaging measures, to the extent possible, shall also apply land and water areas as well for the general physical environment that are important in regards to public interest due to their natural or cultural value for outdoor recreation. The need for green spaces in and near urban areas shall be given special consideration according to chapter 3 section 6.

Protection of areas

Nature reserves

According to chapter 7 section 8 (SFS, 1988:808), decisions regarding the establishment or alteration of nature reserves must not conflict with Detailed Development Plan or Area Regulations in accordance to the Planning and Building Act (SFS, 2010:900). Minor modifications may be made if this does not conflict with the purposes of the plans or regulations.

Shore protection areas

Shore protection applies by the sea, lakes and watercourses with the purpose of assuring public access to outdoor recreation facilities and to maintain good living conditions for plant and animal species on land and water, according to chapter 7 section 13 (SFS 1998:808). Land and water areas shall be protected up to 100 m from the shoreline. However, the government may extend this area to not more than 300 m from the shoreline if necessary, according to chapter 7 section 14 (SFS 1998:808).

Within a shore protection area, it is, according to chapter 7 section 15 (SFS, 1988:808), prohibited to:

1. erect new buildings;
2. alter buildings in order to serve a purpose that is significantly different from previous use;
3. digging or other preparations for the purpose of construction work referred to in point 1 and 2;
4. measures which significantly affects the living conditions for animal and plant species.

According to chapter 17 section 18 (SFS, 1998:808), the County Administrative Board may grant exemptions from the shore protection in an area if it is:

1. obvious that the area lacks significance in the provision of the intended shore protection,

2. the shore protection applies to a small lake or watercourse and the areas significance for the shore protection is little, or

3. if the area, according to the Planning and Building Act (SFS, 2010:900), is part of a Detailed Development Plan and is needed for building of a defense facility, public road or rail road.

The same section also states that conditions regarding the municipality's possibility to withdraw the shore protection through provisions in a Detailed Development Plan are found in chapter 4 section 17 in the Planning and Building Act (SFS, 2010:900).

According to chapter 7 section 18 b, the municipality may allow exemption from the shore protection if there are special circumstances that motivates it. The exemption is reviewed by the County Administrative board and can be repealed if the exemption is not satisfactory as to the criteria listed in the Environmental Code.

Environmental Impact Statements

The purpose of an Environmental Impact Assessment (EIS) is to identify and describe the direct and indirect impact of a planned activity or measure on several factors, including:

"*people, animals, plants, land, water, air, the climate, the landscape and the cultural environment, on the management of land, water and the physical environment in general, and on other management of materials, raw materials and energy*", according to chapter 6 section 3 (SFS 1998:808).

Enabling the overall assessment of the impact on human health and the environment is another purpose of an environmental impact assessment.

Authorities or municipalities that establish or alters a plan or program, shall conduct an environmental assessment if the implementation is presumed to have significant impact, according to chapter 6 section 11 (SFS, 1998:808). Within the framework of an environmental assessment, the authority or municipality shall establish an environmental impact assessment to identify, describe and assess the significant impacts the plan or program is assumed to imply, according to chapter 6 section 12 (SFS, 1998:808), which further states that the environmental impact assessment shall include:

1. A summary of the content of the plan or program and main purpose
2. A description of the environmental conditions and the probable development of the environment if the plan or program is not implemented
3. A description of the environmental conditions in the areas that are likely to be affected
4. A description of present environmental problems in areas of particular importance for the environment

5. A description of how relevant environmental objectives have been considered in the plan or program
6. A description of the expected significant impact on biodiversity, population, human health, ground, water, air climate, natural resources, landscape, built-up areas, cultural heritage and the connection between these aspects
7. A description of planned measures to prevent or mitigate negative effects on the environment
8. A summarizing statement of how assessments have been made, reasons behind the chosen alternatives and problems when compiling the document
9. A description of how measures being planned for following up and monitoring of the environmental impacts
10. A non-technical summary of points 1-9.

4.2.2. Planning and Building Act

The Planning and Building Act (SFS, 2010:900) regulates provisions concerning the planning of water and land areas as well as construction. The overarching purpose is, according to chapter 1 section 1, to promote societal progress, with regard to the freedom of the individual, a clean and sustainable habitat for people in today's society and future generations. It states, in section 2, same chapter, that planning the use of land and water areas is a municipal responsibility.

The Planning and Building Act further regulates provisions on Comprehensive Plans (chapter 3), Detailed Development Plan (chapter 4-6) and Building Permits (chapter 9). According to chapter 3, every municipality must have a current Comprehensive Plan (section 1) that provides guidance for decisions on how the land and water areas are to be used and how the built environment is to be used, developed and protected (section 2). Chapter 4 section 2 regards the requirements for regulation by means of a Detailed Development Plan and includes that a municipality must examine the suitability of a land or water area for built environment and construction works for:

"*new construction works (…) if the construction works require a building permit (…) and the use of the construction works will have a significant impact on its surroundings (…)"* (SFS, 2010:900).

4.2.3. Heritage Conservation Act

The Heritage Conservation Act (SFS 2015:852) refers to the protection and preservation of cultural environments in Sweden. The act contains regulations for protection of certain cultural valuable objects and monuments. The act's main purpose is to avoid damage on the cultural environment during construction work, but also to consider objects and monuments during the planning process. The County Administrative Board has the main responsibility for the work with cultural heritage in each county, while the Swedish National Heritage Board ("Riksantikvarieämbetet") has the supervision for all of Sweden.

5. References

Laws and regulations:

EU Directive 85/337/EEC.

SFS 2015:852. *Kulturmiljölag*. Stockholm: Kulturdepartementet.

SFS 2010:900. *Plan- och Bygglag*. Stockholm: Näringsdepartementet.

SFS 1998:808. *Miljöbalk.* Stockholm: Miljö och Energidepartementet.

Other sources:

Boverket. (2016a). *Roller och ansvar*. http://www.boverket.se/sv/PBL-kunskapsbanken/detaljplan/roller-och-ansvar/ (Accessed 2016-12-15).

Boverket. (2016b). *Översiktsplanering - För en långsiktigt bra helhet.* http://www.boverket.se/sv/samhallsplanering/kommunal-planering/oversiktsplanering/ (Accessed 2016-12-14).

Boverket. (2016c). *Riksintressen*. http://www.boverket.se/sv/samhallsplanering/sa-planeras-sverige/riksintressen-ar-betydelsefulla-omraden/ (Accessed 2016-12-19).

Byggherrarna. (2016). *Vad är en byggherre?* http://www.byggherre.se/om-oss/vad-aer-en-byggherre/ (Accessed 2016-12-14).

Stockholms stad. (2010). *Promenadstaden - Översiktsplan för Stockholm*. Approved 2015.03.15 by the Municipal Council.

Edvardsson, K. (2004). Using goals in environmental management: the Swedish system of environmental objectives. *Environmental management*, *34*(2), 170-180.

Glasson, J., Therivel, R., & Chadwick, A. (2013). *Introduction to environmental impact assessment*. Routledge.

Iverlund, A., Ultenius, C. (2008). *Vem gör vad i planprocessen? Arbetsfördelning mellan kommun och byggherre.* Institutionen för Fastighetsvetenskap, KTH: Stockholm.

Miljömål.se. (2012). *Enskilda miljökvalitetsmål*. http://www.miljomal.se/sv/Publikationer-och-bilder/Logotyper-och-bilder/Enskilda-miljokvalitetsmal/ (Accessed 2016-12-12).

Naturvårdsverket. (2016a). *Sweden's Environmental Objectives - An Introduction.* Arkitektkopia AB: Bromma.

Naturvårdsverket. (2016b). *Miljömålen - Årlig Uppföljning av Sveriges Miljökvalitetsmål och Etappmål 2016.*

Nyström, J. (1999). *Planeringens grunder. En översikt*. 1st edition. Studentlitteratur: Lund.

Nyström, J., Tonell, L. (2012). *Planeringens grunder. En översikt*. 3rd edition. Studentlitteratur: Lund.

Länsstyrelsen. (2016). *Läget i länet - Bostadsmarknaden i Stockholms län 2016*. Rapport 2016:18.

RUFS - Stockholms läns landsting - Tillväxt- och regionplaneförvaltningen (2010). *Regional utvecklingsplan för Stockholmsregionen 2010 – Så blir vi Europas mest attraktiva storstadsregion.* R2010:5. Accepted by Landstingsfullmäktige in May 2010.

Stockholms läns landsting - Tillväxt- och Regionplaneförvaltningen (2016). *About RUFS.* http://www.rufs.se/in-english/ (Accessed 2016-12-13).

Table of Content

1. Icke-teknisk sammanfattning 26
2. Non-tech summary 29
3. Introduction 32
   3.1 Purpose and goal 32
   3.2 Why EIA? 32
   3.3 Boundaries 32
      3.3.1 Geographic boundary 32
      3.3.2 Time boundary 32
      3.3.3 Impact boundary 33
   3.4 Definition of environmental aspects 33
4. Methods 34
5. Project description 36
   5.1 Background 36
6. Alternatives 40
   6.1 Zero alternative 40
   6.2 Proposed plan 41
   6.3 Alternative plan 41
7. Environmental baseline, prediction of impact and consequences and mitigation 44
   7.1 Physical landscape and ground conditions 44
   7.2 Cultural landscape 47
   7.3 Noise 52
   7.4 Air quality 56
   7.5 Risk analysis of Nynäsvägen 59
   7.6 Water quality 62
   7.7 Biodiversity and connectivity 64
   7.8 Transport 67
   7.9 Recreation and outdoor activities 71
   7.10 Social analysis 79
   7.11 Predicted climate change 81
8. Summary of Environmental impact assessment 83
   8.1 Cumulative effects and CLD 83
   8.2 Impact Matrix 85
   8.3 Consequences in relation to Sweden's environmental objectives 89
   8.5 Discussion 93
   8.6 Conclusion 97
9. Final reflections 98
10. References 99

1. Icke-teknisk sammanfattning

1.1 Bakgrund

Stockholm stad befinner sig just nu i en expansiv fas och för att möta den ökande tillväxten föreslås 140 000 nya bostäder byggas innan år 2030. Den nuvarande översiktsplanen från 2010 pekar ut nio tyngdpunktsområden som föreslås utvecklas inom Stockholm stad. Ett av dem är Farsta där det planeras för 8000 nya bostäder inom programmet Tyngdpunkt Farsta (2015). Målet är att Farsta ska vändas mot sjöarna med nya bostadskvarter vid Magelungen och Drevviken utöver förtätning i Farsta centrum.

Planerna för Klockelund och Karlsvik strand togs fram för samråd inom programmet för Larsboda strand i slutet av 2009 och har sedan dess utvecklats ett antal gånger. När planerna för Tyngdpunkt Farsta startade år 2015 ökade antalet planerade bostäder kraftigt i Larsboda strand, från 440 antal bostäder till 1200.

Programmet för Larsboda strand omfattar Perstorp, Karlsvik strand och Klockelund vid Drevvikens strand samt Teliaområdet och Industriområdet på sydvästra sidan av Nynäsvägen. Den här miljökonsekvensbeskrivningen fokuserar på konsekvenserna av planerna i Karlsvik strand och Klockelund då delar av bebyggelsen planeras på befintlig naturmark och inom strandskyddat område. Sedan programmet för Larsboda strand godkändes har det tagits fram ett initierande PM för Karlsvik strand och ett förslag på detaljplan i Klockelund som för närvarande bearbetas efter avslutat samråd och planeras att få laga kraft under 2017. Miljökonsekvenserna baseras här på de senaste officiella plandokumenten och inte eventuella ändringar och bearbetningar av planerna som skett efter samrådshandlingarna och ännu inte fått något formellt beslut.

1.2 Föreslagen plan

Det totala antalet bostäder som planeras i Klockelund och Karlsvik strand är 1200 bostäder fördelat på 500 bostäder i Klockelund och 700 bostäder i Karlsvik strand. Planerna omfattar även ett antal servicebyggnader, förskolor, parker, nya vägar, parkeringsplatser och en fördelningsstation för el. Över Nynäsvägen planeras två nya övergångar för cyklister och gångtrafikanter för att binda ihop Larsboda strand med Teliaområdet och minska avståndet till tunnelbana och pendeltåg.

En stor del av bebyggelsen i Klockelund planeras på redan etablerad mark. Planförslaget förutsätter att Larsboda koloniträdgård och handelsträdgården Plantagen flyttas. En privat fastighet har köpts upp av Stockholm stad som planerar att riva fastigheten för att öppna upp marken till offentlig park. För resterande planerad bebyggelse tas ekologiskt värdefulla miljöer i anspråk samt delar av strandskyddat område. Motiveringen att bebygga mark inom strandskyddat område är bland annat att den allmänna tillgängliga ytan ska bli större jämfört med idag. Som en del i detta planeras strandområdet utvecklas till en allmän park med ett rekreativt stråk längs med Drevviken.

I den föreslagna detaljplanen för Klockelund planeras tät hög bebyggelse i 6-7 våningar längs med Perstorpsvägen för att fungera i bullerskyddande syfte. Närmare Drevviken planeras fristående stadsvillor som är 3-4 våningar med 12 lägenheter per byggnad. Placeringen av husen har tagit hänsyn till värdefulla ekar i området och andra höga naturvärden. Planen i Klockelund innebär även att tre befintliga mindre fastigheter vid Drevvikens strand kommer att byggas om till större byggnader och inrymma flera lägenheter.

I Karlsvik strand är bebyggelsen ännu ospecificerad förutom föreslagen högre höjd på de hus som har anslutning till Perstorpsvägen samt lägre bebyggelse närmare Drevviken. Förutsättningarna för att byggplanerna i Karlsvik strand ska

realiseras är att Trafikplats Larsboda byggs om och att Perstorpsvägen flyttas närmare Nynäsvägen. Nuvarande campingstugor kommer behöva nedmonteras för att ge plats för bostäder och en allmän park.

1.3 Nuläge

Området i Karlsvik strand karaktäriseras framför allt av relativt orörd lövskog medan Klockelund mestadels består av gammal jordbruksmark där det idag finns en koloniträdgårdsförening och en handelsträdgård. Strandområdet i Klockelund är klassad som särskilt värdefull kulturmiljö av Stadsmuseet. Här finns fem mindre fastigheter varav en sportstuga och ett lusthus som bedöms behöva extra bevarandestatus. Mellan koloniträdgården och handelsträdgården finns en igenvuxen visningsträdgård för olika exotiska trädarter.

I Karlsvik strand finns drygt 80 mindre campingstugor som ägs av privatpersoner på arrenderad mark av Stockholm stad. Stugorna är en kvarleva efter att staden upplät mark för arbetarklassen att tälta på under 30-talet. Successivt utvecklades tälten till permanenta stugor under 40-talet. Centralt i området finns en danspaviljong och ett antal gemensamma byggnader där Hökarängens friluftsförening anordnar aktiviteter främst under sommarhalvåret.

Öster om Karlsvik strand ligger Hökarängsbadet som är en populär tillflyktsort under sommaren. Under 2012 färdigställdes ett strandstråk i trä längs med vattnet från Hökarängsbadet fram till Klockelund. Stora rekreativa värden finns i området även om det uppfattas som delvis otillgängligt.
Grönområdet vid Larsboda strand är en viktig ekologisk spridningszon som binder samman två regionala gröna kilar, Hanvedenkilen och Tyrestakilen. Över hela Larsboda strand växer ett antal äldre stora ekar som är viktiga både ur ett lokalt- och nationellt perspektiv. Ekarna utgör en viktig livsmiljö för ett stort antal arter. Stranden och våtmarkerna är viktiga livsmiljöer för områdets groddjur. I stora delar av Klockelund finns risk för översvämning inom en 50-årsperiod då marknivån ligger nära Drevvikens normalvattenstånd, framförallt vid koloniträdgården och i närheten av vattnet.

Hela Larsboda strand är kraftigt stört av höga bullernivåer framförallt från Nynäsvägen men även till viss del från Perstorpsvägen. Den kraftiga trafiken på Nynäsvägen leder även till förorenat dagvatten och förhöjda nivåer av luftföroreningar.

1.4 Samlad bedömning

En av de mest påtagliga konsekvenserna som dessa planer medför är att de nya bostadshusen kommer vara starkt utsatta för buller från Nynäsvägen. Samtidigt kommer de nya byggnaderna medföra positiva effekter genom minskade bullernivåer i offentliga utrymmen närmare Drevviken då byggnaderna ger en bullerdämpande funktion. Att bygga tät och hög bebyggelse närmast Nynäsvägen för att skärma av buller leder samtidigt till koncentrerade luftföroreningar från Nynäsvägen och Perstorpsvägen. En annan negativ konsekvens med tät och hög bebyggelse nära Nynäsvägen är att det leder till att fler människor riskerar att bli utsatta för olyckor med farligt gods på Nynäsvägen, framför allt risk för gasexplosioner.

Planerna förväntas även medföra positiva konsekvenser för rekreativa värden, då en stor del av området omvandlas till offentlig park med förbättrad tillgänglighet längs med stranden. Tillgängligheten till och från området kommer att förbättras för gångtrafikanter och cyklister genom två planerade sociodukter över Nynäsvägen. Den förbättrade tillgängligheten till området kan dock leda till att området blir överbefolkat och därmed öka trycket på naturen och de rekreativa värdena. Befintliga verksamheter som drivs av Hökarängens friluftsförening och Larsboda Koloniträdgårdar kommer att förflyttas och försvinna

från området vilket är ytterligare en negativ konsekvens för områdets karaktär.

Landskapsbilden kommer att förändras drastiskt i området då nuvarande sparsamma enplans-bebyggelser kommer att ersättas med höghus i varierande storlek. De föreslagna planerna kommer att få stora konsekvenser på kulturlandskapet, framförallt i form av nedmontering av de små campingstugorna från 40-talet samt omlokaliseringen av Perstorpsvägen. De kulturhistoriska värdena kan stärkas genom att utforma de nya parkområdena så att de lyfter fram historisk markanvändning såsom gamla vägar och värden i vegetationen som att framhäva äldre ekar.

Eftersom en stor del av bebyggelsen planeras inom befintliga naturområden samt att Larsboda strand befinner sig i en ekologiskt känslig zon som är viktig ur ett regionalt perspektiv, kommer planförslagen troligen få betydande konsekvenser för den biologiska mångfalden. Byggskedet kommer även betyda förhöjda nivåer av buller och damm samt att grönområden runt de planerade byggnaderna kan ta skada.

1.5 Nollalternativ

Nollalternativet innebär att Larsboda strand kommer att fortsätta i samma utveckling som idag utan de föreslagna planerna att bygga bostäder i Klockelund och Karlsvik strand.

1.6 Alternativ till föreslagen plan

I ett alternativ som har utarbetats av oss för att jämföra miljökonsekvenser har bebyggelsen omlokaliserats och anpassats till strandskyddet, kuperad topografi samt bevarande av campingstugor och del av koloniområdet. Den planerade cykelvägen behålls på norra sidan av Perstorpsvägen och den historiska vägen mellan Klockelund och Karlsvik strand renoveras genom att anlägga ett rekreativt gångstråk från Perstorpsvägen till Drevviken.

1.7 Jämförelse av alternativen

En jämförelse mellan den föreslagna planen, nollalternativet och den alternativa planen visar att nollalternativet är det alternativ som kommer medföra minst negativa miljökonsekvenser även om det även där finns negativa miljökonsekvenser. Den föreslagna planen medför både negativa och positiva konsekvenser, men de negativa konsekvenserna är överlägset fler i detta alternativ. Framförallt kommer det ha störst negativ påverkan på de ekologiska värdena i Larsboda strand då livsmiljöer för groddjur försämras och flera värdefulla ekar kommer att försvinna.

Den alternativa planen medför negativa konsekvenser på kulturlandskapet, men i förhållande till den föreslagna planen så anpassas bebyggelsen till existerande topografi och campingstugor. Eftersom den alternativa planen medför att en del av koloniträdgården kan sparas finns det möjlighet att integrera odling även i det nya bostadsområdet samt stärka den biologiska mångfalden och grönstrukturen.

Då byggnaderna i den alternativa planen är placerade utanför strandskyddet hamnar de inte i de mest utsatta områdena för översvämning. Detta innebär att våtmark och dike vid stranden i Klockelund kan undvika ifyllning vilket medför att det inte blir lika stora negativa konsekvenser för groddjuren i området.

2. Non-tech summary

2.1 Background

The city of Stockholm is currently in an expanding phase and to meet the constantly increasing population growth, 140 000 new housing units are proposed to be built before 2030. The current comprehensive plan from 2010 highlights nine focus areas within the city of Stockholm for special development emphasis. One of them is the district Farsta in southern Stockholm where 8000 new housing units are proposed within the programme Tyngdpunkt Farsta (2015). The overall objective of the programme is to turn Farsta towards the lakes with new urban districts along the lakes Drevviken and Magelungen, beyond densification of Farsta Center.

The plans for Klockelund and Karlsvik strand was developed within the programme Larsboda strand late 2009 and has since developed during several occasions. When the plans for Tyngdpunkt Farsta started in 2015 the proposed number of apartments in Larsboda strand increased significantly, from 440 to 1200.

The programme for Larsboda Strand includes the areas Perstorp, Karlsvik strand and Klockelund along the Drevviken lakeside as well as the Telia area and Klockelund industrial area on the southwest side of Nynäsvägen. This environmental impact assessment focuses on the consequences from the plans in Karlsvik strand and Klockelund since parts of the developments are planned on natural landscape and within shore protected areas. Since the programme for Larsboda strand was approved, an initial PM has been developed for Karlsvik strand and a proposal for a detail plan has been made for Klockelund. The detail plan is currently being updated in regard to the appeals from consultations held in mid-2016 and is planned to be officially approved during 2017. The environmental assessment is based on the latest official planning documents and not unofficial statements after the consultation.

2.2 Proposed plan

The total number of apartments planned in the areas are 1200 units, divided on 500 in Klockelund and 700 in Karlsvik strand. The plans also include premises for services or businesses, warehouses, energy facility, preschools, parks, new roads and parking lots. Additionally, two new pedestrian/bike bridges crossing Nynäsvägen are planned that will link Larsboda strand with the Telia area and shorten the distance from the subway and commuter train.

A major part of the planned initiatives in Klockelund are located on already exploited ground. The plan proposal requires that Larsboda allotment garden and the plant shop Plantagen are relocated to make room for the new developments. A private property has been bought by Stockholm municipality who plans to demolish the villa to open up the plot to surrounding public park. Remaining planned developments are located on ecologically sensitive environments and within shore protected areas. The motivation to build within shore protected areas is amongst other to expand the public accessible areas. As a part of this the areas closest to the lake is planned to develop into a public park with a recreational passage along lake Drevviken.

In proposed detail plan for Klockelund high rise buildings of 6-7 floors are planned along Perstorpsvägen as a noise protecting measurement. Closer to lake Drevviken detached urban villas of 3-4 floors are proposed with 12 apartments per building. The placement of the villas has taken valuable oaks and other important nature values into consideration. The plan also includes reconstructing 3 existing villas along the lake into larger buildings with apartments.

The buildings of Karlsvik strand is still unspecified except higher proportions on housing next to Perstorpsvägen and lower buildings closer to lake Drevviken. Prerequisites for the developments in Karlsvik strand are reconstructing the close-by intersection Larsboda as well as relocating the road Perstorpsvägen closer to Nynäsvägen. The camping huts currently occupying Karlsvik strand need to be dismantled to make room for housings and a public park.

2.3 Present situation

Karlsvik strand is mostly characterized by relatively untouched deciduous forest while Klockelund mostly consists of old farmland, foremost occupied by an allotment garden and a plant shop. The beach area in Klockelund is classified as especially valuable cultural environment by Stockholm City Museum. Within the area there are five smaller properties, whereof a sport cabin and a gazebo are considered to need extra conservation status. Between the allotment garden and the plant shop there is an overgrown exhibition garden for several exotic tree species.

In Karlsvik strand there are over 80 smaller camping huts owned by individuals on leased land from the municipality. The camping huts are a relic from when the city allowed the working class to camp on the site during the 1930's. Successively, the camping area with tents developed into permanent camping huts during the 1940's. In the middle of the camping hut area there is a dance pavilion and a couple of common buildings where the camping hut association organizes activities during the summer.

The beach Hökarängsbadet is located to the east of Karlsvik strand and is a popular destination during the summer months. During 2012, a walk passage made of wood was finalized along the shore from Hökarängsbadet to Klockelund. The area consists of great recreational values but it is also conceived as partly inaccessible.

The green area by Larsboda strand is an important ecological dispersal zone connecting two regional wedges, Hanvedenkilen and Tyrestakilen. All across Larsboda strand a number of older oaks are growing that are important from a local and national perspective. The oaks are an important habitat for several species. The beach area and wetlands are of importance for the amphibians in the area. Large parts of Klockelund are in risk of flooding within a 50-year period since ground levels are close to lake Drevviken´s normal water levels, especially along the shoreline and by the current allotment garden.

The whole Larsboda strand area is considerably disturbed by high noise levels, especially from the highway Nynäsvägen but also partly from nearby Perstorpsvägen. The heavy traffic from Nynäsvägen also leads to contaminated storm water and increased levels of air pollution.

2.4 Overall assessment

2.4.1 Consequences of plans

The most considerable consequence of the plans is that the buildings will be substantially affected by high noise levels. At the same time, the new buildings will result in positive effects through decreased noise levels in the public spaces closer to lake Drevviken since the buildings will create a noise reducing function. Building dense, high rise buildings along Nynäsvägen to shield the noise simultaneously lead to concentrated air pollution from Nynäsvägen and Perstorpsvägen. Also, the housing along Nynäsvägen leads to more people being at risk of accidents involving transports with dangerous goods passing by on Nynäsvägen, especially the risk of gas explosions.

The plan also expects to bring positive effects to the area through enhanced recreational values when converting a big part of the area into public parks and improve the accessibility of the area.

The accessibility to and from the area will be improved for pedestrians and cyclists via socioducts crossing Nynäsvägen. The improved accessibility of the area may lead to the area becoming overpopulated and thus increase the pressure on nature and recreational values. Existing activities organized by the camping hut- and allotment garden associations will be relocated, creating additional negative consequences for the character of the area.

The landscape of Larsboda strand will change considerably since today´s sparse low-rise buildings will be replaced with several high-rise buildings of varied size. The proposed plan will have a major impact on the cultural landscape, especially in terms of the dismantling of the small camping huts from the 40's and the relocation of Perstorpsvägen. The cultural values can be enhanced by designing the new park areas so that they highlight the historical land use such as old streets and values of the vegetation for example by highlighting the old oaks of the area.

Since a large part of the developments are planned within existing green areas and since Larsboda strand is located within an ecologically sensitive zone that is important from a regional perspective, the planned proposal is likely to have a significant consequence for the biodiversity. During the plan's construction phase, there will also be increased levels of noise and dust and subsequently the green areas around the planned buildings can be damaged.

2.5 Zero alternative

The zero alternative means that Larsboda strand will continue in the same trend as today, without proposed plans in Klockelund and Karlsvik strand.

2.6 Alternative to proposed plan

In an alternative that has been developed to compare the environmental impacts with the proposed plan, the buildings have been relocated and adapted to the shoreline protection and the hilly topography as well as the preservation of camping huts and part of the allotment garden. The planned bicycle path is maintained on the north side of Perstorpsvägen and the historic route between Klockelund and Karlsvik strand is renovated by building a recreational passage from Perstorpsvägen to Drevviken.

2.7 Comparison of the alternatives

A comparison between the proposed plan, the zero alternative and the alternative plan shows that the zero option will cause the least environmental consequences. The proposed plan entails both negative and positive consequences, but the negative consequences are overall most in this alternative when comparing the alternatives. Above all, it will have the greatest negative impact on the ecological values of Larsboda strand as important habitat for amphibians' decline significantly and several important oak trees will disappear.

The alternative plan entails negative consequences for the cultural landscape of Larsboda strand but in relation to the proposed plan a bigger emphasis is put on adapting the buildings to existing topography and saving a majority of the camping huts. Since the alternative plan preserves a part of the allotment garden it is possible to integrate cultivation into the new urban area and strengthen the biodiversity and green structure of the area.

Since buildings in the alternative plan is located outside of the shore protected areas they will not be as vulnerable to flooding as in the proposed plan. Subsequently the wetland and the ditch by the shore in Klockelund can avoid filling which means that there will not be equally damaging consequences for the amphibians in the area.

3. Introduction

3.1 Purpose and goal

The main objective of this EIA is to evaluate the impacts of the proposed development projects on physical, biological, socio-economic and cultural environment in Larsboda strand, provide measures to mitigate the negative impacts and plan in such a way that a rational decision can be made about the implementation and management of the new project. The EIA aims to highlight the environmental implications of the project and also to inform the public and interested parties of the potential impacts of the project.

3.2 Why EIA?

An environmental impact assessment (EIA) should be carried out to clarify significant environmental impact of programs, plans and projects before they are adopted (Environmental code chapter 6, §3). In Larsboda strand an EIA is needed due to significant impacts on issues regarding loss of important oak habitats, high noise levels, cultural and social values as well as building within the shore protection area (Environmental code chapter 7 § 14).

3.3 Boundaries

3.3.1 Geographic boundary

This EIA is focusing on the two planned areas, Klockelund and Karlsvik strand, in Farsta, Stockholm. These two areas are part of a bigger program area called Larsboda strand (figure 1). When we in this EIA use the name Larsboda strand we only refer to the two planned areas and not the whole area that the program Larsboda strand from 2010 refers to. Other areas surrounding Klockelund and Karlsvik strand will be considered in order to see if they have significant impacts on our main focus areas. The two plans are in different stages, but since they started to be planned at the same time and are interconnected with environmental consequences this EIA focus on both of the areas.

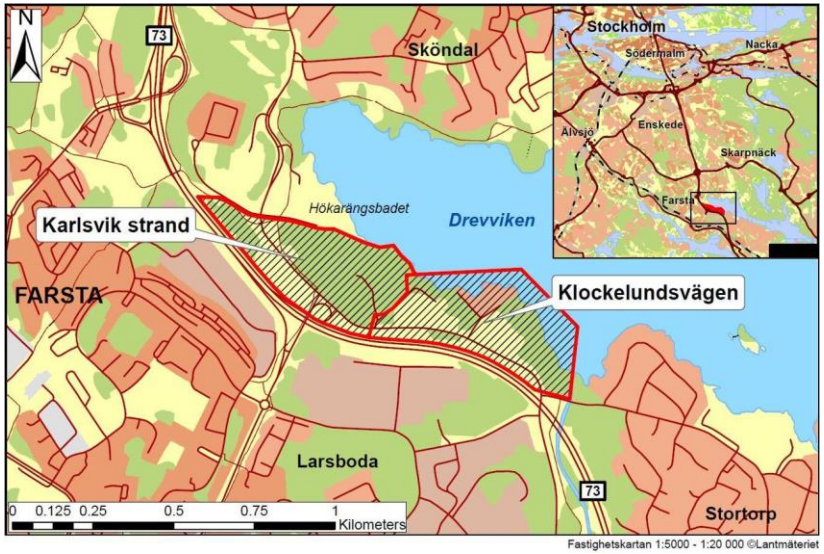


Figure 1. Overview map showing the area location of the two plans Klockelundsvägen and Karlsvik strand, which together constitutes the plan for Larsboda strand.

3.3.2 Time boundary

Our time boundary for this EIA stretches to 2030. We have chosen this time frame by estimating that both plans will be finished at this time. In the detailed development plan for Klockelundsvägen the plan is to be finished at latest in 2022. Karlsvik strand has no detailed development plan, therefore it is more difficult to estimate when the buildings will be completed. The proposal for the detailed development plan for Karlsvik strand is planned to be out on consultation at 2018, in 2030 all the buildings are expected to be finished if everything goes according to plan. For other aspects regarding environmental consequences, such as climate, the time boundary will be stretched for a longer time period depending on what impacts there will be.

3.3.3 Impact boundary

The impacts which are considered to be the most significant in this EIA for Larsboda strand are:

- Noise - Our area is highly disturbed by the heavy traffic on the highway Nynäsvägen.
- Recreation - Larsboda strand is a scenic area with a closeness to varied types of green areas. The area is used by many people around the whole of Farsta, especially during the summertime.
- Ecological connectivity and biodiversity - Along the shoreline of Drevviken the nature is sensitive with important habitats for several species. Some of the proposed buildings are planned within the shore protected area. Due to the many oaks in the area, with high values for biodiversity, Larsboda strand is an important connection between two regional green wedges, Tyrestakilen and Hanvedenkilen, which makes out an important part of ecological connectivity in Stockholm (Ekologigruppen, 2009).
- Cultural landscape - The proposed plans mean a major shift in land use with impacts on the cultural landscape. Larsboda strand has high cultural values with camping huts that contains a history of the first statutory holiday of the working class in Sweden.

Other affected areas that have minor impacts but still are assessed are: physical landscape, water condition, air quality, risks, ground condition, transport, social analysis and climate change. Environmental aspects which may be affected by the plans but not considered in this EIA is aspects regarding waste management and energy aspects. Due to uncertainties about the duration of the building phase and what type of building material that will be used these aspects are not included.

3.4 Definition of environmental aspects

Landscape: Refers to the visual aspects of landscape. Describes what the landscape contains, how it is formed and the distinct features in it.
Cultural landscape: Refers to people's present and historical use of the land. The identity of the place tied to the history of the area and to the activities going on in the area.
Ground: Refers to ground conditions in area, regarding soil type, soil thickness and pollution in ground.
Water quality: Refers to abiotic factors such as chemical and physical conditions, as well as the ecological status, in the aquatic environment within an area.
Biodiversity: Refers to specie richness of terrestrial organisms in an area and varieties within ecosystems.
Air quality: Refers to atmospheric conditions and air quality regarding concentration of pollutants that might be a threat to human health. Particles (PM10) and nitrogen dioxides (NO2) is covered for in this EIA.
Noise: Refers to unwanted sound in air, ground and water. Noise pollution can affect human and animal health, and also have negative effect on recreational values.
Risk analysis: Refers to risk for accidents which is a threat to human health and environment.
Social analysis: Refers to the social use of the area, who is there and of what purpose.
Climate effect: Refers to how changes in climate will affect Larsboda strand, in terms of flooding, precipitation and a change of temperature.
Ecological connectivity: Refers to interconnected habitats of different species where dispersal is possible to take place.
Shore protection: Refers to the law (Environmental Code chapter 7 § 13) that prohibits construction within the shoreline and assures public access to outdoor recreation and good living conditions for plants, animals and humans on land and in water.

Transport: Refers to the traffic flow and the accessibility for different means of transportation
Recreation and outdoor activities: Refers to the area that is attractive for various recreational activities for the public. For example, the areas suitable for walking, jogging and playing.

4. Methods

In this EIA the evaluation of the proposal and consequences is based on information from documents, interviews and field inventories. Existing planning documents over the two areas have been used both as main sources for this report but also as support in the initial stage of the project.

4.1 Field inventory

Two field studies were performed during the 6th and 8th of December. During these visits an overall inventory was made, focusing on lichens, mosses, wood fungi and trees. An assessment of the forests potential biodiversity was also performed by using a nature value assessment matrix by Skogsbiologerna (Skogsbiologerna AB, 2001). According to the method, when a forest scores over 30 points it has very high nature values, when it scores 15-20 points it means high nature values and when it scores lower than 5-10 points it indicates low nature values. Also, during these two field visits, measurements of noise levels were performed at some locations within the area. The noise levels were measured using the smartphone application Buller, made by the Swedish Work Environment Authority (Arbetsmiljöverket, 2016). The noise levels were measured for 30 seconds at each location, with the phone's microphone directed at Nynäsvägen. The smartphone application then calculated a mean value of these levels. The noise levels at each location are shown in the noise level maps (figure 18 & 19).

4.2 Interviews

Due to insufficient access to public opinion concerning the use of Larsboda's recreational areas and the relocation of the allotment garden, interviews were performed with citizens in Farsta the 6th and 9th of December and with Mats Jarnhammar, urban advisor at SKL International and resident of Farsta, the 14th of December. To get a better view of how the inhabitants of Farsta value the different areas within chosen geographical scope they were asked to put markers on a map to pinpoint their least and most appreciated areas in Larsboda strand. This method was inspired by Geopanelen (DialogGuiden, 2016) and participation mapping (Chambers, 2006). Interviews was conducted with 14 people in and around Larsboda strand, and the mapping exercise was made with additional 6 persons, i.e. 20 in total. Continuous phone and mail contact with concerned stakeholders was held back and forth during the project. A complete list of contacted stakeholders is to be found in Appendix I.

4.3 GIS

All maps in this report were produced in the Geographic Information System program ArcMap 10.4 (ESRI 2015). The background maps and the aerial orthophotos were downloaded from the GET-service by SLU (The Swedish University of Agricultural Sciences). The old maps were downloaded from the internet service Historical Maps by Lantmäteriet.

4.4 Sketchup

To understand the visual look of the proposal and alternative plan the program Sketchup was used to create 3D models of the two plans (Trimble inc., 2016). For information regarding architectural facts about buildings a website calculating building heights was used called www.ctbuh.org. By creating 3D models, it is easier to understand issues regarding impact on surrounding areas, denseness of the housings as well as analyzing effects from shadows of the buildings that might affect the recreational area.

4.5 Scoping matrices

For the initial scoping process, the part in the working process where impacts to assess is identified, a checklist designed by the European Commission was used (Environmental Resources Management, 2001). The checklist used was designed as a guideline for EIA's.

4.6 Impact matrix

To get an overview of the environmental impacts from the different alternatives, an impact matrix table can be found in the end of the report (Table 3). The table consist of the three alternatives and their respective impacts on the environmental aspects covered in this EIA. The scale of impact is on a five-graded scale and reaches from Major negative impact to Major positive impact, where every step is represented by a certain color. The impact matrix is inspired by the consultant firm Ekologigruppen and modified to fit this project. The definitions of all five scales is described in figure 2.

+2	**Major positive impact**	Major positive impact on national, regional or municipal interests and objects. Alternatively, improvement of currently exceeded environmental quality standards, national guidelines or environmental thresholds.
+1	**Minor positive impact**	A positive impact that does not constitute a major positive impact.
0	**No impact**	No notable impact.
-1	**Minor negative impact**	A negative impact that does not constitute a Major negative impact.
-2	**Major negative impact**	Major negative impact on national, regional or municipal interests and objects. Alternatively, exceeding environmental quality standards, national guidelines or environmental thresholds; or clearly worsen currently exceeded environmental quality standards, national guidelines or environmental thresholds.

Figure 2. The impact scale used in chapter 8.2.

4.7 Causal Loop Diagram (CLD)

In order to get a simplified picture of the cumulative effects in Larsboda strand, a Causal Loop Diagram (CLD) was created. The CLD shows the causality and feedbacks in both the social and ecological system. The arrows explain the direction of the causality and the polarity of the arrows explain if there is a change in the same direction (+) or in the opposite direction (-).

5. Project description

5.1 Background

The two proposed initiatives in the Larsboda strand, Klockelund and Karlsvik strand, for new dwellings was approved for further development by the Urban Planning Committee of Stockholm in august 2015 when the programme for Larsboda Strand was approved. The committee suggested areas of special consideration for the forthcoming development of the two plans (Stadsbyggnadskontoret, 2015b). To meet the increased demand of housing production the Stockholm comprehensive plan (Stadsbyggnadskontoret, 2010) identified nine priority areas to support the development of a more polycentric city with dense and rich neighborhoods even in the outskirts of Stockholm. The point of departure of the plans is mainly the political pressure on enhanced housing production in Stockholm, especially considering areas in proximity of a metro station. Farsta is one of those areas of special priority which has been further developed in the programme "Tyngdpunkt Farsta" from 2015 (Tyngdpunkt Farsta, 2015). The programme proposes 8000 new housing units in Farsta until 2030, which is almost a double of today.

The initial PM for a land allocation plan of Karlsvik strand was approved 2012 for development of 40 villas. The plan was put on hold and not further developed until 2015 when the Program Tyngdpunkt Farsta (2015) was approved, with another pressure on housing developments. A new PM for a land allocation plan for Karlsvik strand was made 2015 which instead of the 40 villas suggests the building of 700 apartments in Karlsvik strand.

A detailed development plan has been developed for Klockelundsvägen which was on consultation 26 April - 7 June 2016. Comments on the proposals have since then been processed and the detailed development plan is currently being processed in consideration of received comments.

A large part of Larsboda strand is protected by the shore protection (i.e. 100 meters protected area from the shore (Environmental Code, chapter 7 §13). For general information about the shore protection see *Common intro*.

5.1.1 Klockelund

The area of development called Klockelund consists of 16 ha land situated between Perstorpsvägen and lake Drevviken (figure 3). In the detailed development plan from 2016, 500 apartments are proposed mainly on land currently occupied by the plant shop Plantagen and an allotment garden. Plantagen and the allotment garden will be relocated to make room for new developments. Besides the development of new apartments, the plan also includes two preschools, premises for services or businesses, warehouses and an energy facility. Along Perstorpsvägen a higher building height is proposed with 5-7 floors, creating an urban feel to the neighbourhood from Nynäsvägen as well as creating a noise barrier to the area facing lake Drevviken. Within the outer, higher housing development three neighbourhoods are proposed to be built, surrounded by green courtyards and an entrance square in the center. The design of the housings is suggested to be of 3-5 floors height and with a high architectural value that connects the visuality of the buildings to surrounding nature. The majority of the new housings will be on already exploited land, to preserve the surrounding nature as much as possible. Some of the proposed housings will be within the shoreline protection.

A part of the area (3.5 of the 16 hectares) is suggested to be converted into a public park to keep valuable natural assets as well as creating recreational areas for the new inhabitants and the

public (figure 4). The park is proposed to be interlinked with the green areas of Sköndal, the beach Hökarängsbadet and continue to nearby lake Magelungen by the river Forsån. The shoreline walking path is suggested to be developed for enhanced accessibility and more docks will be added to create better access to Drevviken.

To improve the accessibility of the area a bridge for pedestrians and cyclists is proposed over Nynäsvägen that will arrive to an entrance square of the new housing district.

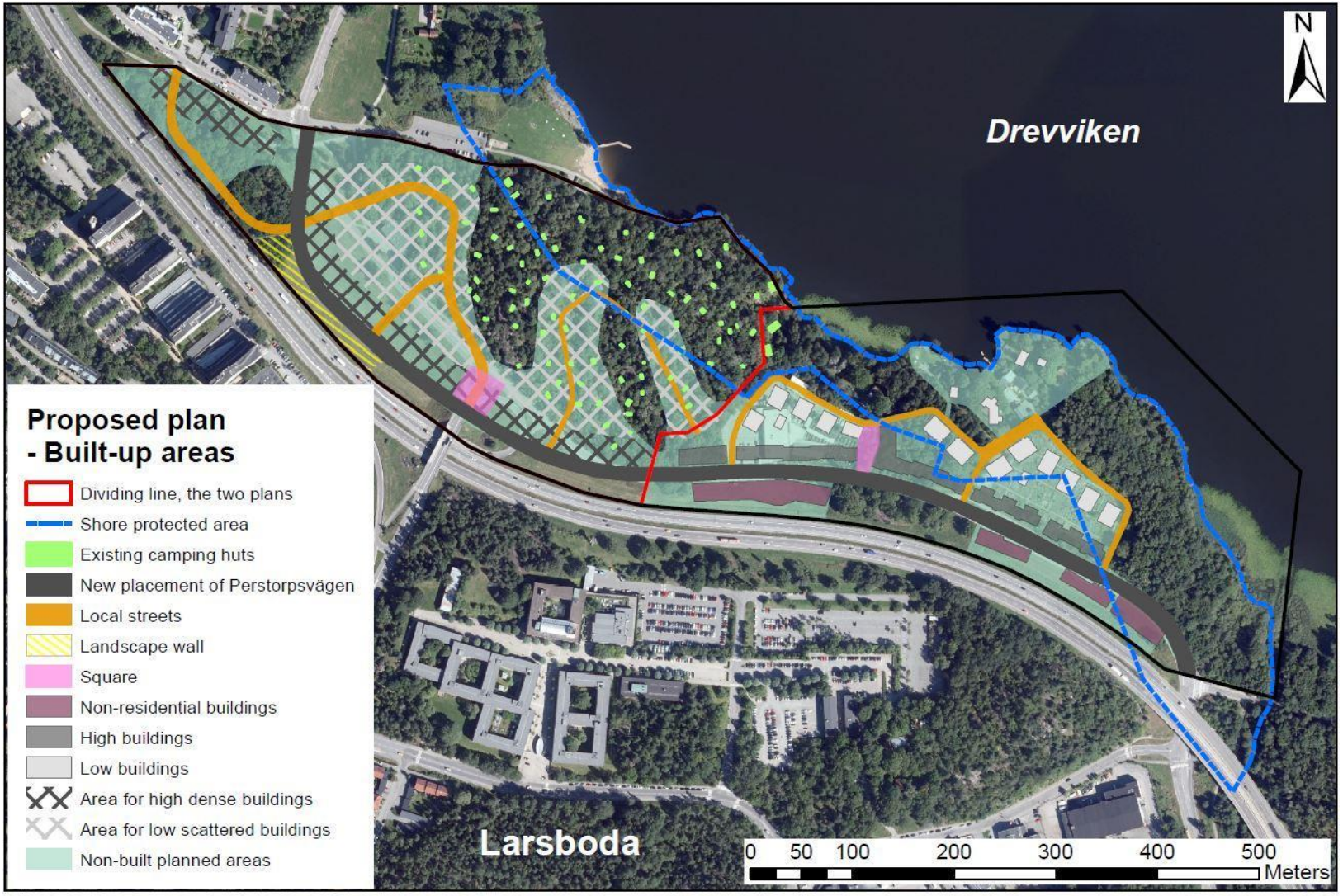
5.1.2 Karlsvik strand

The initial PM for Karlsvik strand has proposed 700 new dwellings on a 13 ha area currently hosting the camping huts (figure 3). This plan is currently undergoing changes and contains 800 dwellings in its newest form, however, since it is still unofficial we will base this EIA on the official PM from 2015.

The area facing lake Drevviken will be kept as green public space but further developed to enhance the accessibility (figure 4). To maximize the buildable area, the proposal suggests a displacement of the adjacent road Perstorpsvägen to be relocated towards south west, closer to the highway Nynäsvägen. Housing next to the relocated Perstorpsvägen is proposed to be 5-6 floors high to create a feeling of urbanity as well as to reduce noise levels. In the area with greater variety of topography a more flexible housing development of 3-5 floors is suggested, to take the varied nature landscape into consideration. Important nature values such as valuable oak trees are being considered in the location of dwellings.
The green public space along lake Drevviken will be transformed into a park, with a cohesive passage ranging from Farsta C along the whole Drevviken and further down to lake Magelungen. The camping huts are suggested to be removed and make room for proposed housing developments and public park areas. Paths are to be improved throughout the area, along the lake as well as in the forest. On the highest peak of Karlsvik strand a viewpoint is proposed to offer a great view of Drevviken.

To improve the accessibility of the area a socioduct for pedestrians and cyclists over the busy Nynäsvägen is proposed to link the central parts of Farsta to Larsboda strand.

With suggested development, some of the housings might be placed within the 100 meters of shoreline protection from the lake.



GSD-Ortofoto, 0,25 m färg. Fastighetskartan, 1:5 000 - 20 000 ©Lantmäteriet. Shore protection ©Länstyrelsen Stockholm

Figure 3. Map showing the proposed plan for Larsboda strand and the relation to the current shoreline protection and existing camping huts.

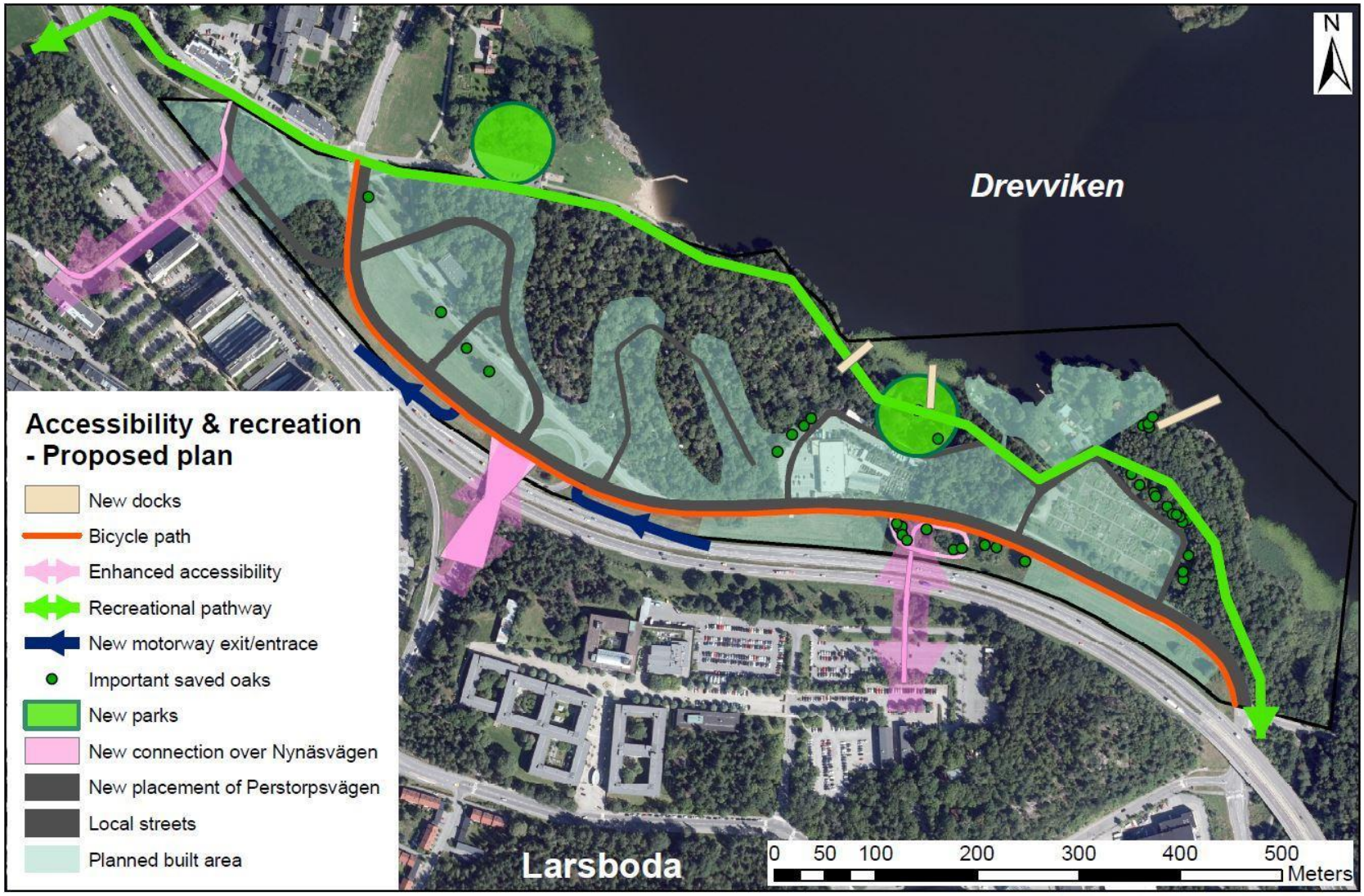
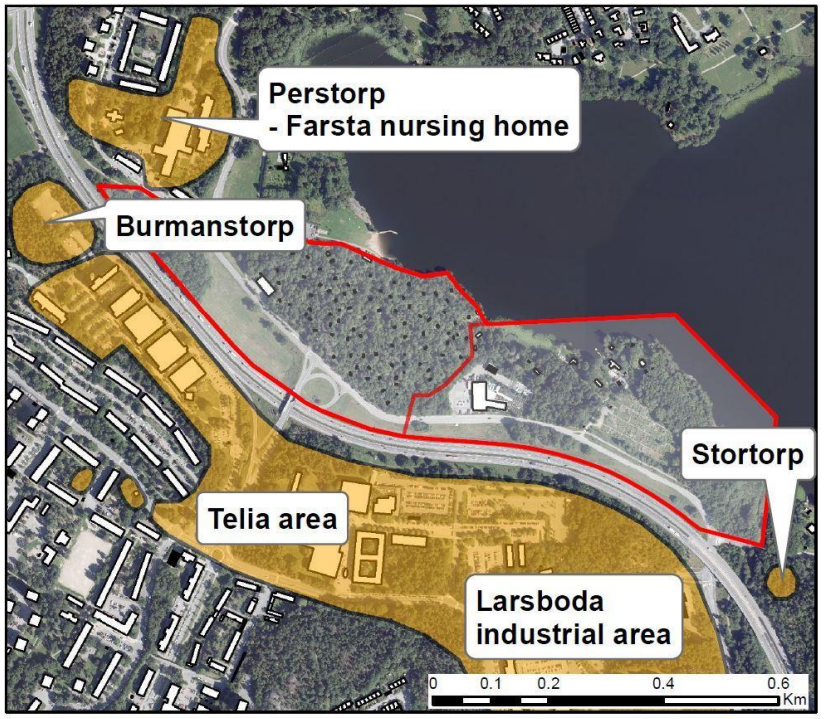


Figure 4. Map showing how the accessibility to Larsboda strand are planned in the proposed plan. The map also shows the new recreation values of the proposed plan and ecologically important oaks that are to be spared within the built area.



GSD-Ortofoto, 0.25m färg. Fastighetskartan, 1:5000 - 20 000 ©Lantmäteriet

Figure 5. Map showing the location of the neighboring planned areas (yellow) in relation to Larsboda strand (red border).

5.1.3 connection to neighbouring plans (figure 5)

Perstorp, Farsta nursing home

The proposal for Perstorp 1, next to lake Drevviken, includes 700 new dwellings whereof about 200 of them are planned to be student housing. Beside dwellings the proposal include preschools, premises for services or businesses and green areas. The neighbourhood will be characterized by a 17 floor building intended for student housing. Planned initial start is first quarter of 2017 (Stockholms stad, 2016a).

Stortorp, Larsboda

In Stortorp, 16-21 villas and terrace houses are proposed on a plot currently used as a park area. The housing is intended to follow the hilly topography. Planned initial start is third quarter of 2017 (Stockholms stad, 2016b).

Telia area and Burmanstorp

According to the development programme of Farsta "Tyngdpunkt Farsta" (2015) the area today occupied by the company Telia will be converted into a new housing area with at least 1500 new dwellings, shops, schools and preschools. A detailed development plan will soon be conducted (Tyngdpunkt Farsta, 2015).

Livsmedelscentrum, Larsboda industrial area

In the area today occupied by various industries a new food center is proposed as a reallocation measure for missing premises in the area "Slakthusområdet" that is being converted into an urban housing area. The buildings will be adjusted to food production with cooling-rooms and cargo spaces. Preliminary initial start is during 2017 (Stockholms stad, 2016c).

6. Alternatives

6.1 Zero alternative

The zero alternative refers to the alternative in which Klockelund and Karlsvik strand will have a continued development as it is today, with no implementation of the proposed plans. For this area, the biggest implications would be that there will be no new buildings, Perstorpsvägen will not be relocated, the allotment garden will remain and the camping huts will be preserved but might keep degrading. The oaks will remain, but some may suffer

from poor management, and the ecological connectivity and biodiversity will be unchanged. The noise levels in the area will remain high and the area will have the same accessibility as today. The area will by some people be perceived as dark and unsafe, according to data from interviews with local people made for this EIA (anonymous interviews on site, 6th and 9th Dec).

6.2 Proposed plan

The proposed plan alternative refers to implementation of the detailed development plan of Klockelundsvägen (Stadsbyggnadskontoret 2016) and of the proposed plan for Karlsvik strand as it is presented in the initial PM from 2015 (Stadsbyggnadskontoret, 2015c). These project plans are described in section 4.2.

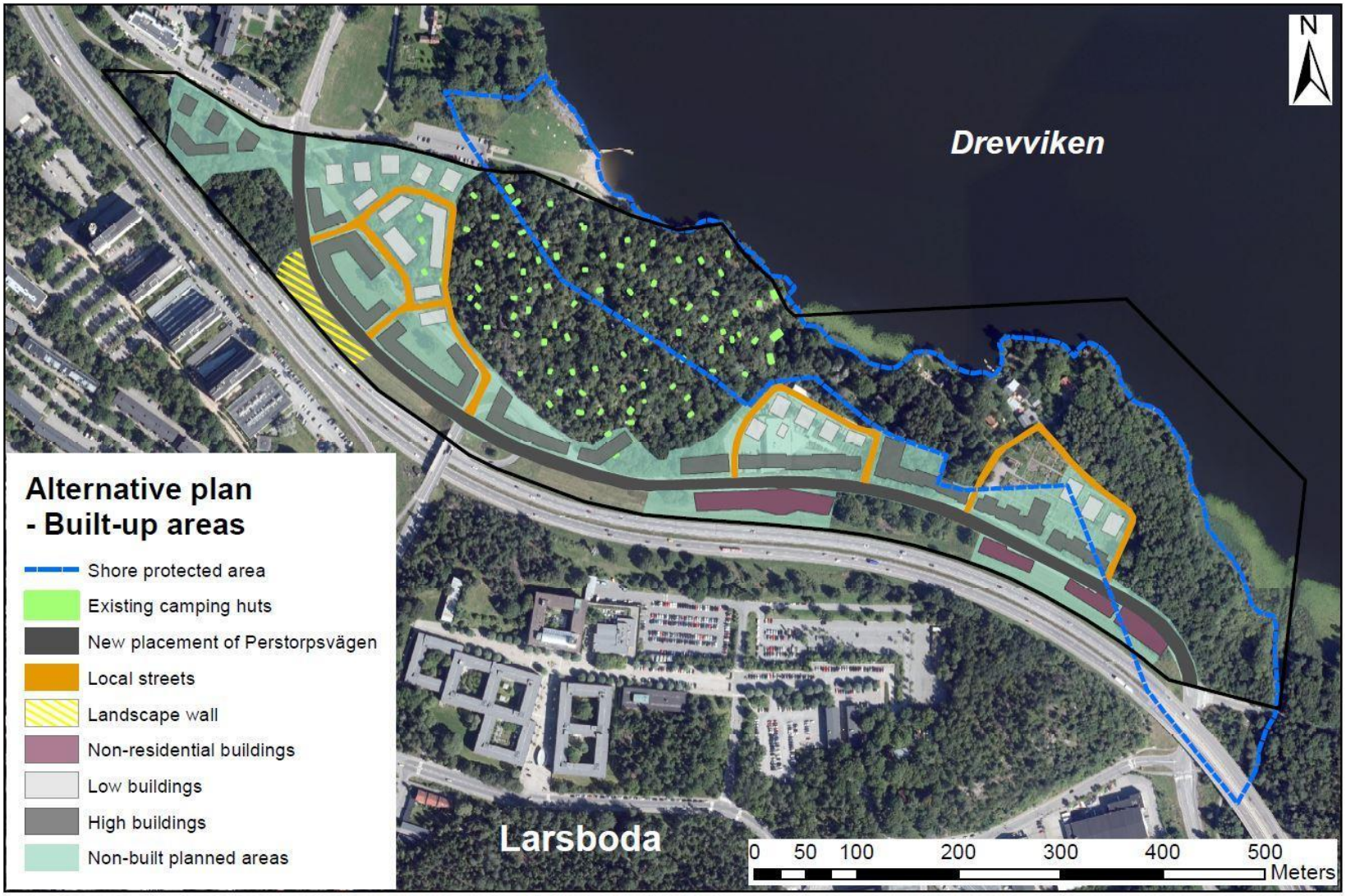
6.3 Alternative plan

The alternative plan (figure 6 and 7) is the plan which we have created as an alternative to the proposed plan. This plan is as a whole similar to the proposed plan, but with some important distinctions. To take cumulative effects into consideration the alternative plan consists of both Klockelund and Karlsvik strand. By combining the two plans, a more just environmental impact assessment can be made, since the areas are physically close and have several aspects in common.

In the alternative plan (figure 6 and 7), barely no buildings are built within the shoreline protected area, with the purpose of saving valuable nature and for saving public's access to the shore area. This implies that part of the allotment garden will be remained intact. The remnants of this area could continue to be used for gardening and for strengthening the green structure.

In this alternative, more of the area's historical and cultural values will be preserved compared to the proposed plan. Several camping huts in Karlsvik strand will be preserved, since less buildings will occupy the camping hut area. The result of this is that 8 of the camping huts must be removed, compared to removing all of them in the proposed alternative. This action in Karlsvik strand also means that more of the oaks and other trees can be spared, and also that less blasting is needed. As in the proposed plan, Perstorpsvägen is relocated to be closer to Nynäsvägen, making more space available for buildings. Buildings here will be placed with consideration to the noise and risks coming from Nynäsvägen. A bridge for bicycles and pedestrians over Nynäsvägen connecting Larsboda strand to the old Telia area and Burmanstorp will also be built same as in the proposed plan.

The alternative plan includes 33 new residential buildings: 13 three-floor, 6 four-floor, 5 six-floor and 9 seven-floor buildings. A simple calculation with apartments of 75 m2 (three-room apartments) resulted in approximately 1460 apartments in the alternative building plan. The street level of the six- and seven-floor buildings were excluded in the calculations in order to take account for the spaces between the apartments and premises for services and businesses.



GSD-Ortofoto, 0,25 m färg. Fastighetskartan, 1:5 000 - 20 000 ©Lantmäteriet. Shore protection ©Länstyrelsen Stockholm

Figure 6. Map showing the alternative plan for Larsboda strand and the relation to the current shoreline protection and existing camping huts.

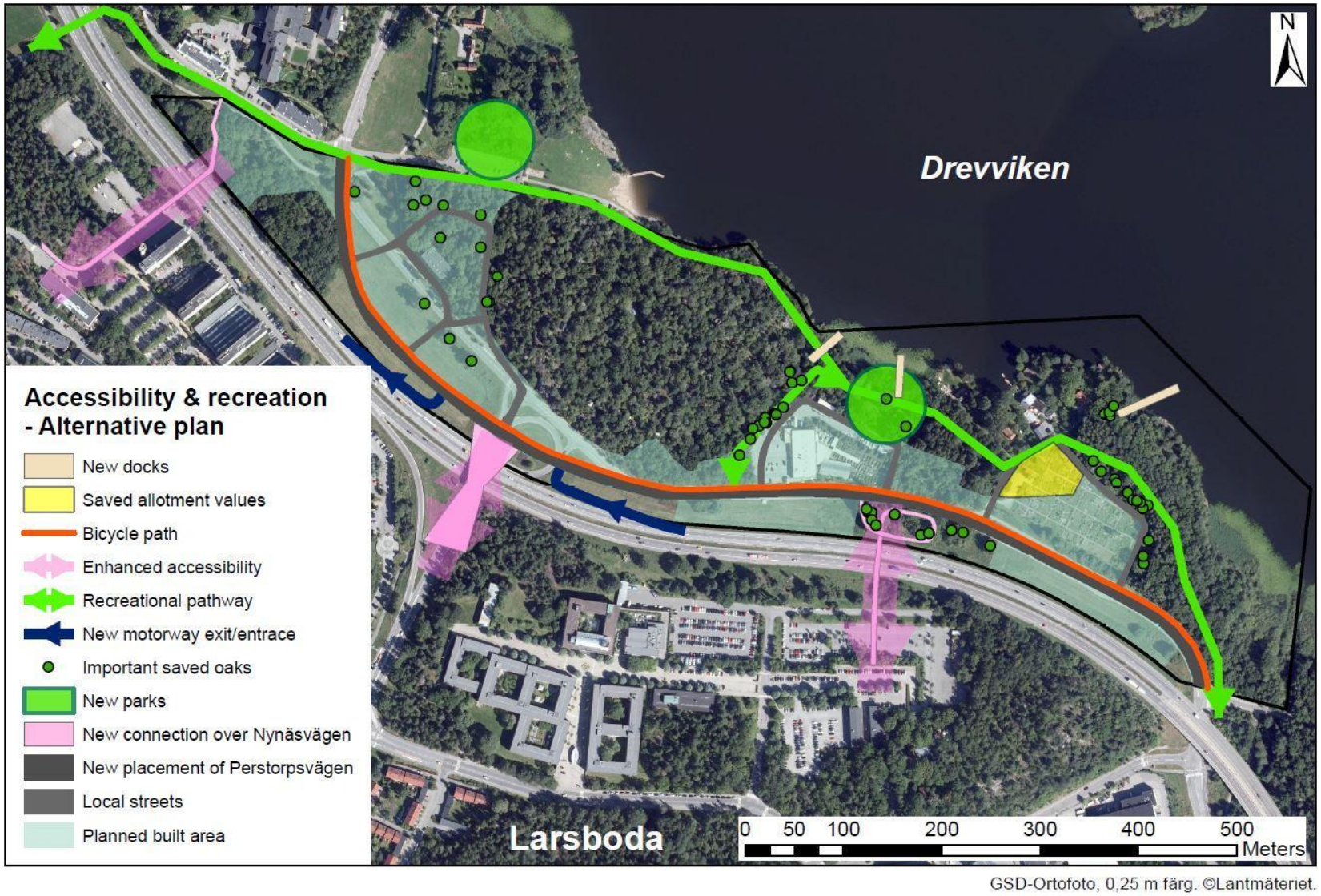


Figure 7. Map showing how the accessibility to Larsboda strand are planned in the alternative plan. The map also shows the new recreation values of the alternative plan and ecologically important oaks that are to be preserved within the built area.

7. Environmental baseline, prediction of impact and consequences and mitigation

7.1 Physical landscape and ground conditions

7.1.1 Environmental baseline

Visual landscape

The western part of Karlsvik strand is dominated by a deciduous forest mainly constituting of oaks and other leafed trees. This area is hilly with some smaller steeps facing Perstorpsvägen (figure 8). In the forest there are around 84 camping huts evenly distributed throughout the area. In the most western part of Karlsvik strand, between Perstorpsvägen and Nynäsvägen, is a smaller moraine hill with leafed trees. Northwest of Larsboda Trafikplats, between Perstorpsvägen and Nynäsvägen, is a relatively flat area mainly covered by grass where the majority of apartments in Karlsvik strand are planned to be built (figure 9).



Figure 8. Picture showing the steep topography in Karlsvik strand near the camping huts.

Klockelund is a more flat area that is dominated both by already exploited areas such as an allotment garden and a plant shop, but also by oak- and shore forests in the most southern and eastern parts. Near the shore there are also a few summer houses and all-year round villas. Every fifty years, parts of the areas closest to Drevviken is flooded (see figure 26 & 27). The south-western part of the Klockelund area constitutes of Nynäsvägen and Perstorpsvägen, with a narrow wedge of grass between the two roads. Northwest of Karlsvik strand is the beach Hökarängsbadet which is a popular place for recreation and outdoor activities. Except for the already exploited areas in Klockelund, both areas have green areas with some rural-like elements including the oak forests with small clearings, unpaved roads, an allotment garden and a pathway along the shoreline. However, the near located roads have a significant disturbing factor in terms of visual landscape and noise levels. Southeast and outside these assessed areas lies Stortorp, which is a residential area along the shores of Drevviken with villas as dominating type of housing mixed up with green structures.

Ground conditions

The hilly area in Karlsvik strand has been surged after the last ice age and therefore the ground in the higher parts is dominated by exposed bedrock (Appendix II, SGU jordartskarta, 2016). Remaining ground consists of a thinner layer of soil (0-1 meter) (Appendix II, SGU jorddjupskarta, 2016).

Klockelund area is more flat than Karlsvik strand, however, closer to the shore the ground is a bit slanting. The ground consists of mostly clay (Appendix II, SGU jordartskarta, 2016), with a thickness of about 1-5 meter (Appendix II, Sweco, 2016 & SGU jorddjupskarta, 2016). According to the Geotechnical survey by

Tyréns (2015) the slope towards Drevviken is assessed as being stable and secure in its current state.

No contaminated areas have been identified in the Larsboda area according to the County Administrative Board (Sweco, 2016).



Figure 9. Picture of a relatively flat and clayey area in Karlsvik strand between Perstorpsvägen and Nynäsvägen. In this area, most of the apartments in Karlsvik strand is planned to be built in the proposed and alternative plan.

7.1.2 Impacts for zero alternative

The visual landscape of the planned areas will look the same as today; the allotment garden does not have to be relocated, all the camping huts will remain and the forest will not be cut down.

Since a lot of the surrounding areas are planned to be built, Klockelund and Karlsvik strand will be one of few areas with no dramatic landscape changes. A possible negative consequence is how the areas will be a blocking "green barrier" between Stortorp and newly exploited areas northwest of Karlsvik strand, and therefore these areas will be that clearly connected to each other. This would be a possible positive consequence for those who want to keep the area's green elements and the "undisturbed" sort of nature.

Larsboda areas ground condition will most likely maintain the same if no plan is implemented. The slope to Drevviken will potentially be a risk area for landslide in the future but for now it is estimated as being safe (Tyréns, 2015).

7.1.3 Impacts with proposed plan

With the proposed plan, there will be changes in, or elimination of, elements which have been characterizing the landscape for a longer period of time. This includes many of the camping huts, the allotment garden and part of the forest including older oaks. Blasting of mountain in Karlsvik strand and land rise in Klockelund will transform the landscape. Also, Perstorpsvägen will be relocated closer to Nynäsvägen. The few buildings today in the planned areas is in form of villas, camping huts and a plant shop. The number and size of planned houses will therefore create a big contrast from today's existing landscape.

The raise of the ground level can result in settlements in underlying clay. Therefore, it is not recommended to raise the ground. It is also not recommended to perform fillings on top of the clayey slope downwards to Drevviken (Tyréns, 2015).

The hardening of ground will also pose a big change in the physical landscape and ground condition. In the detailed development plan for Klockelundsvägen, the City Building Office state that they will try to have as much green areas around the buildings as possible (Stadsbyggnadskontoret, 2016), but the hardening of relatively large ground areas is inevitable.

As seen in the visualization of the plan in figure 10, Klockelund will transform the landscape drastically by adding higher residential buildings to an area today characterized by few and low buildings. The high-rise buildings create shadows that mostly affect the public space surrounding the new developments but also in some extent the walking path by the shoreline and existing villas and their gardens. For further information on sun conditions see appendix III.



Figure 10. 3D visualization of the proposed plan in Larsboda strand, viewed from east. Sun conditions from the 26th of June at 15.00.

7.1.4 Impacts for alternative plan

New buildings will mainly take up areas which have already been exploited in more recent time. This mean most of the camping huts can be maintained. However, the new buildings will still have a big impact at the visual landscape in planned areas. As in the proposed plan Perstorpsvägen will be relocated closer to Nynäsvägen.

The alternative plan also has drastically impact of the visual landscape in Larsboda strand, as seen in figure 11. The distinguished difference concern saving some valuable parts such as the allotment garden and most camping huts creating a milder intervention in Larsboda strand. By saving a part of the allotment garden the proposal creates a more open feel to the area with less concern of shadows by the shoreline and existing villas. For more information regarding effects of shadows see appendix III.



Figure 11. 3D visualization of alternative plan in Larsboda strand, viewed from east. Sun conditions from June 26 at 15.00.

7.1.5 Mitigation measures

In the proposed plan caution should be taken when exploiting Karlsvik strand; minimize blasting in mountain and keep more of the camping huts. The buildings should not differ too much from surrounding landscape. Implement green roofs and gardens between houses to keep a green feeling in the area and history of the allotment garden.

When constructing buildings in areas where the solid ground is below the groundwater level or where there is a thick layer of clay, it is recommended to pile down into the solid ground to keep it stable (Tyréns, 2015).

For the alternative plan, the same mitigation measures should be taken as above regarding the green structure issue. With exploitation for house building major changes in the visual landscape is as good as inevitable since so much of this landscape is dominated by the absence of residences.

7.2 Cultural landscape

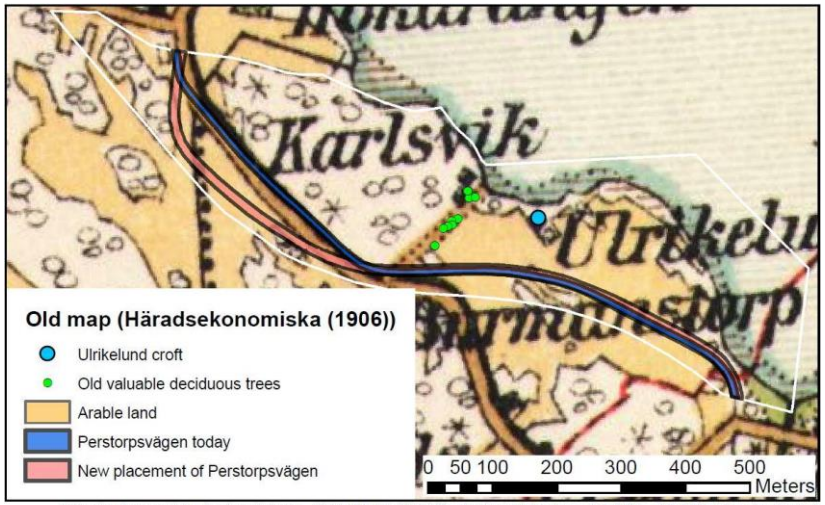
The cultural landscape reflects upon people's present and historical land use. The identity of the place is tied to the history of the area and to the current activities in the area. For the ability to read the historical landscape in the present cultural landscape, the roads, the buildings and the vegetation are of great importance (Hedlund, 2016, personal communication, 6th Dec).

The characteristics in the cultural landscape in Larsboda strand is an allotment garden, camping huts, a demonstration garden, old deciduous forest and old farming land that is overgrown today. The prediction of impacts in this section is based on a field visit, old historical maps of the area, interviews with John Hedlund and Klara Johansson at Stockholm City Museum, an inventory of the cabins (WSP, 2012), consultation response from Stockholm City Museum for the proposed detailed development plan for Klockelundsvägen (2016) and an archeological prestudy of Larsboda, Karlsvik, Klockelund (Hedlund, 2013).

7.2.1 Environmental baseline

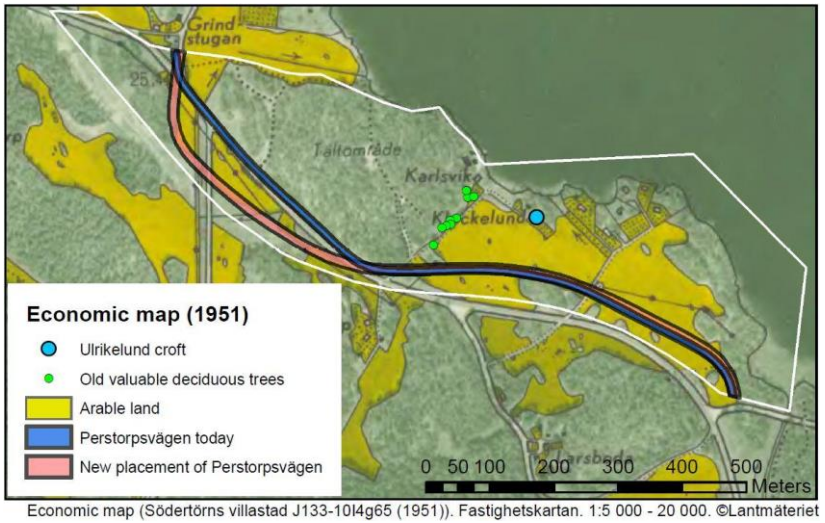
Until 1950, Larsboda was rural land with limited buildings and a hilly terrain with beautiful nature (Stadsmuseet, 2009). This is partly preserved along Drevviken, which has a beautiful natural environment with remains of old farmland and camping huts from the 1940´s (figure 14). The southwest part of Drevviken beach in Larsboda strand is pointed out to be historically valuable by the Stockholm City Museum (Stadsmuseet, 2016) because of old properties, parks and gardens by the water.

The camping huts are a very unique feature in Stockholm and have a high historical value since the city leased the land to the working class to spend their first statutory holiday in 1938. At first the land was used for temporal tents in the summer but gradually evolved to permanent camping huts (Stadsmuseet, 2016). Today there are 84 camping huts and 9 belonging buildings in the area of Karlsvik strand, owned by individuals. The historical value is not in the individual camping huts, but in the phenomenon and the function of them with a present association that organize activities for the camping hut owners that are also open to the public (Johansson, 2016, personal communication, 6th Dec).



Häradsekonomiska kartan (Länna J112-75-25 (1906)). Fastighetskartan. 1:5 000 - 20 000. ©Lantmäteriet

Figure 12. Map over Larsboda strand from 1906 visualizing the old placement of the road in relation to the current and planned placement of Perstorpsvägen. The map also shows the placement of the croft of Ulrikelund and a line of old valuable deciduous trees.



Economic map (Södertörns villastad J133-10l4g65 (1951)). Fastighetskartan. 1:5 000 - 20 000. ©Lantmäteriet

Figure 13. Map over Larsboda strand from 1951 visualizing the old placement of the road in relation to the current and planned placement of Perstorpsvägen. The map also shows the placement of the croft of Ulrikelund and a line of old valuable deciduous trees.

Old maps from 1906 (figure 12) and 1951 (figure 13) show that the present Perstorpsvägen have had the same alignment on the west side in the area of Karlsvik strand since 1906 and is a distinguished border between forest in the north and old farmland on the south side.



Figure 14. One of the 84 camping huts in Karlsvik Strand. Photo: Bo Eknert

The tree inventory made by Arbor Konsult AB (2015) shows old valuable deciduous trees in a line from Perstorpsvägen to the shoreline. In the same line as the old deciduous trees there used to be a road, shown in the maps from 1906 and 1951. Today the remaining of the road is just a small walking path, in great need of restoration (figure 15). The road was used to access a croft called Ulrikelund that appears in maps from 1874. Today there is a residential building from 1930 also called Ulrikelund at the same spot as the old croft (figure 17). The historical maps show a difference in land use from forest on the west side of the old road in Karlsvik strand and farmland on the east side in Klockelund.

The almost 1 ha allotment garden (figure 16) on the east side of the area has been an existing allotment garden since 1983 (Stockholms Fastighetskontor, 1990). The former land use is also shown to be old farmland in the old maps. The allotment garden is not mentioned to have any preservation status for their cultural heritage in the remittance response from Stockholm City Museum (Stadsmuseet, 2016) for the detailed development plan for Klockelundsvägen.



Figure 15. An old road between Klockelund and Karlsvik strand.



Figure 16. The allotment garden in Klockelund.



Figure 17. The property Ulrikelund where the old croft used to be.

East of Plantagen there is an old demonstration garden (arboretum) with exotic tree species, which has been abandoned for over ten years. The previous plant store company Hortus hired a landscape architect to design the garden. In the garden there are some exotic trees planted and also a constructed pond with some reed. Most of the trees are still growing but the garden has been very poorly maintained and some of the trees have fallen or been overgrown. Today it is far from accessible since it is mostly fenced and also lacks clear pathways inside.

7.2.2 Impacts for the zero alternative

A positive impact in the zero alternative is that a lot of the historical cultural landscape will be preserved by not moving the road Perstorpsvägen and saving the camping huts and the allotment garden. The association for the camping huts and the allotment garden have the possibilities to flourish either of their own or finding synergies together without the anxiety of relocating. There is still uncertainty for the future of the camping huts since they are privately owned with no regulation plan of how they should be maintained. Many of the camping huts are in bad condition and have been exposed to sabotages like fires (figure 18).



Figure 18. One of the camping huts in Karlsvik strand that has been exposed to sabotage.

There will probably be an overall negative impact regarding the vegetation with no new management plan for the green area. The

old farmland in Klockelund will eventually be overgrown and merge with the forest in Karlsvik strand. The prediction is that the oaks will have less sunlight with more surrounding vegetation. The demonstration garden is overgrown and will keep degrading without maintenance.

7.2.3 Impacts with proposed plan

The proposed plans mean that there will be a major shift in land use from natural forest, a shop area (Plantagen), camping huts and gardening to a public park and residential housing. This will have both positive and negative impacts on the cultural landscape, but a lot of the cultural heritage will be lost.

There are uncertainties of how big the impacts will be concerning the change in vegetation because it depends on the design of the park that is still in progress (Styring, 2016, personal communication, 6th Dec). If the park is designed to highlight the former cultural landscape, it might have a positive impact (Hedlund, 2016, personal communication, 6th Dec). On the other hand, if focus is shifted to mainly create new values in the park, it will have a negative impact regarding the cultural landscape.

There will be a negative impact on the ability to read the historical landscape from the 18:th century, if Perstorpsvägen is moved towards Nynäsvägen. The old road between Klockelund and Karlsvik strand is not taken into consideration in the plan proposal, instead there are plans of creating a new local street east of the road, which does not have the same alignment and this will have a negative impact on the cultural heritage.

Another negative impact will be that the history with the camping huts and the association connected to them will be lost (Stadsmuseet, 2016). There is a need of further investigation to assess the value of the camping huts, if it is local value or a part of Sweden's national history of the working class statutory holiday. According to the Environmental Code, chapter 7 § 9, municipalities and the County Administrative Board can make a culture reserve to keep valuable cultural landscapes. This area has been rejected as a culture reserve in 2010 by the County Administrative Board after a proposal from Hökarängens friluftsförening (Outdoor Association) (Länsstyrelsen Stockholm, 2010). The County Administrative Board assessed that the area had high historical value, but did not meet the demands of a cultural reserve (Länsstyrelsen Stockholm, 2010). Meaning that the camping huts might not have a significant regional or national value.

Other buildings that will be demolished and have a negative impact on the cultural landscape is the croft Ulrikelund, the property Larsboda 2:3 and Larsboda 2:5. Even though the croft Ulrikelund is not the original croft from the 18:th century, it still has preservation status according to Stockholm city museum (Stadsmuseet, 2016). The demolishing of property Larsboda 2:3 from 1930 and replacing it with a new house with eight apartments (figure 19) is criticized by Stockholm City Museum (Stadsmuseet, 2016) because of the historical cultural values with small summerhouses along Drevviken.



Figure 19. The new house that is proposed on the property Larsboda 2:3. Source: Stadsbyggnadskontoret, 2016.

The arboretum will be replaced with a residential building. This is not predicted to have a significant impact on the cultural landscape due to the need of restoration of the arboretum. Also, the arboretum does not strengthen the values of the surrounding broadleaved forest.

7.2.4 Impacts for alternative plan

In the alternative plan there is also a major negative impact on the cultural landscape since there will be big change in the land use as in the proposed plan. The impacts is not as significant as in the proposed plan because the alternative takes consideration of the terrain and makes it possible to let the area with the camping huts preserve as much of the character as possible. In the alternative plan there are no new buildings by the shoreline (Larsboda 2:3, 2:4, 2:5) which mean that the cultural landscape with small houses by the beach will be preserved.

7.2.5 Mitigation measures

To strengthen the cultural landscape and the identity of the place, new roads should have the same alignments as the old historic roads as much as possible. The historical difference in land use can be highlighted with a more distinct border between Klockelund and Karlsvik strand by the old road towards the shoreline from Perstorpsvägen. If the old road is also renovated to highlight the values of the old trees and make a recreational pathway that is connected to the walking path by the shoreline it can strengthen the cultural values.

Another thing is to keep a major part of the camping huts and integrate the dance pavilion and the common buildings in the public park to strengthen the cultural heritage and welcome more people to the area. To preserve the cultural heritage, the area with the camping huts should be documented before building new houses in Larsboda strand. An assessment is needed to see what kind of regulation plan that is possible for the camping huts. Experiences from similar camping hut area in Farstanäset should be taken into account for the assessment.

7.3 Noise

The data for the environmental baseline and prediction of impacts is based on a survey made by Åkerlöf Hallin Akustikkonsult AB (2016) for Klockelund, Bullerkartan by City of Stockholm (Dataportalen, 2012), the proposed detailed development plan for Klockelundsvägen (2016), the remittance for the programme, Larsboda strand (2010) and our own noise measurements in Karlsvik strand made in December 2016.

Aspects related to noise levels not taken into account: selection of building material and duration of building phase.

7.3.1 Environmental baseline

The traffic from highway Nynäsvägen, the main road in this area with the speed limit 90km/h, and Perstorpsvägen, next to Nynäsvägen with the speed limit 50km/h, is causing high noise level in the planned area. At Nynäsvägen the noise level is above

75 dBA sound equivalent, and at Perstorpsvägen the level is 65-75 dBA sound equivalent. Closer to the shores of Drevviken the noise level is lower, 55-65 dBA (Dataportalen, 2012) (figure 18). Our own measurement of noise levels in Karlsvik strand is shown in figure 18 & 19. The noise level from the roads varies in different times of the day and year, for example the noise level will be higher in rush hours and weekdays when the most trucks and other vehicles is driving by the areas. This is especially true for Nynäsvägen which is an important transport route for trucks on their way to and from Nynäshamns harbour (Rydström & Johansson, 2007).

7.3.2 Noise regulations and guidelines

Regulation (2015:216) about traffic noise around residential buildings:

Noise from traffic and railway should not exceed 55 dBA equivalent sound level at apartments facade, and at common outside areas it should not exceed 50 dBA equivalent sound level or 70 dBA maximum. If this is not possible at least half of the rooms in each apartment should have a more silent facade where 50 dBA equivalent sound level is not exceeded, and where noise level is not above 70 dBA maximum from 22.00-06.00. If 70 dBA maximum at common outside area is not possible then it should at least not be exceeded more than five times per hour and not with more than 10 dBA maximum (SFS 2015:216).

Guidelines from Boverket (2008:1):

Except from the regulations above, Boverkets (National Board of Housing, Building and Planning) guidelines in "Buller i planeringen" (Boverket, 2008) says that in certain cases it is possible to accept buildings where equivalent noise level is 60-65 dBA, but with the same condition that half of the rooms in each apartment have a more silent side where equivalent noise level is < 50 dBA. In specific cases, for example in city environment, buildings where equivalent noise level is above 65 dBA can be accepted. These buildings should be designed in a way where they as much as possible are turned in a more silent direction.

7.3.3 Impacts for zero alternative

No big changes in impacts on noise is predicted for the zero alternative. Nevertheless, plan proposals in surrounding areas might mean an increase in noise coming from increased traffic to new residential areas in Larsboda and also the planned food center might imply more traffic and noise. Predictions of increased traffic by cars and heavy vehicles on Nynäsvägen (Brandskyddslaget, 2016, Trafikverket, 2012) will to some extent increase the noise level. On the other hand, the reduced speed limit on Perstorpsvägen from 50 km/h to 40 km/h will reduce some of the noise. It is however not clear how much these factors combined will change the noise level in Larsboda strand.

Recreational values in the planned areas will be affected by noise from traffic on Nynäsvägen and Perstorpsvägen in the same amount as today. If the area is considered as a park the adequate noise level according to Naturvårdsverket's (Swedish Environmental Protection Agency) guidelines should be 45-50 dBA sound equivalent, or 10-20 dBA lower than the more noise surroundings (Naturvårdsverket, 2007).

7.3.4 Impacts with proposed plan

In the building phase, the neighbours will be strongly affected by noise from construction work and by increased local traffic from construction machinery. This will also have negative impacts on

recreational values in planned areas. In Karlsvik strand there will probably be need for blasting rock which will cause much noise and vibrations.

Noise levels at buildings facade towards Nynäsvägen will exceed the recommended 55 dBA sound equivalent (Åkerlöf Hallin Akustikkonsult AB, 2016). Detailed development plan of Klockelundsvägen has taken mitigation measures with noise reduction walls along Nynäsvägen. Also, planned garages and storage rooms along Nynäsvägen is expected to have a noise reducing effect. This mitigation together with planned formation of planned buildings the apartments will have a silent side with maximum of 55 dBA sound equivalent. Karlsvik strand will have high noise levels on facades facing Nynäsvägen and Perstorpsvägen. Noise reduction walls and landscape walls is planned to be built along Nynäsvägen in Karlsvik strand (Stadsbyggnadskontoret, 2015c), but these will probably not have any effect for apartments at higher floors. Compared to Klockelund there is no survey done for Karlsvik strand.

In the future with more people living in Klockelund, Karlsvik strand and surrounding planned areas the noise level from local traffic will increase. The reduced speed on Perstorpsvägen from 50 km/h to 40 km/h will have a reducing effect on noise (Trafikverket, 2004), but compared to the noise coming from Nynäsvägen and increased traffic on Perstorpsvägen the effect might only be minor. Increased heavy traffic on Nynäsvägen (Brandskyddslaget, 2016) will have a noise increasing effect; noise levels from heavy traffic is in average 10 dBA higher compared to passenger cars (Trafikverket, 2004).

Buildings and noise walls along Nynäsvägen will lower the noise level in areas closer to Drevviken. This will have a positive impact on recreational values and nature experience in these areas.

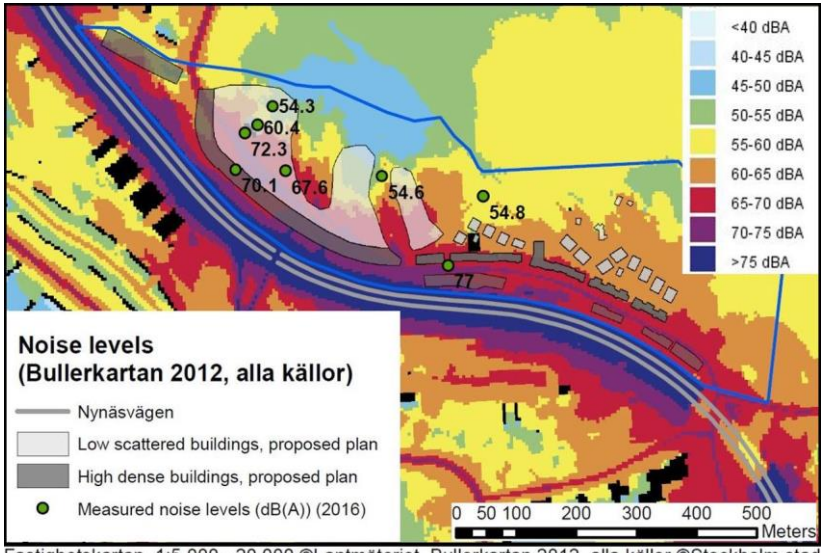


Figure 20. Map showing noise levels in planned area and placement of buildings according to the proposed plan. Note that the noise levels are measurements of today's values, and that they will be affected by the planned buildings. The green dots mark our own measurements performed in December 2016. Note that our measurements were taken around noon at weekdays and only shows the sound level at that moment.

7.3.5 Impacts for alternative plan

Impacts for the alternative plan will be mostly the same as for the planned activity (figure 20 & 21). The placing and design of buildings near Nynäsvägen in Karlsvik strand is not determined in the proposed plan, but it looks similar to the alternative plan with higher buildings near the road and lower closer to the forest.

Noise reduction walls and landscape wall along Nynäsvägen in Karlsvik strand will reduce the noise on the facades at lower heights, but not at the higher parts.

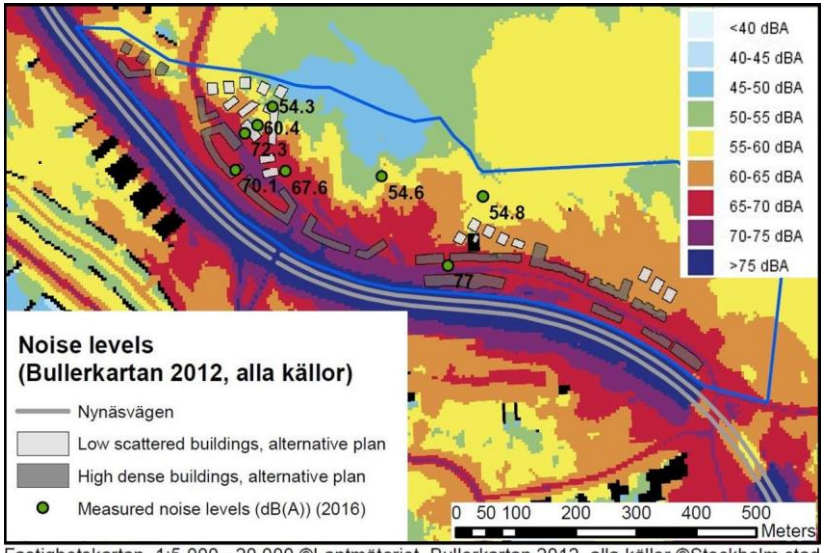


Figure 21. Map showing noise levels in planned area and the placement of the buildings according to the alternative plan. Note that the noise levels are measurements of today's values, and that they will be affected by the planned buildings. The green dots mark our own measurements performed in December 2016. Note that our measurements were taken around noon at weekdays and only shows the sound level at that moment.

7.3.6 Mitigation measures

For both action alternatives, a mitigation measure for reducing noise impact during building phase, is to schedule the most intense building phases to times of day and season, when neighbours and outdoor activity will be the least affected.

To make the noise reduction walls blend in with the rest of the landscape and strengthen the green structure in the area, it could be covered with vegetation.

Buildings in Karlsvik strand need to be formed and designed in a such a way that most of the rooms of each apartment will face a more silent side (below 55 dBA sound equivalent) and a common outside area with adequate noise levels. The buildings at higher elevations than the road will probably be impossible to cover with noise reduction walls (Trafikverket, 2004), and therefore the need for a more silent side and common outdoor courtyard is very high. Between the planned buildings and roads, leave as many trees as possible to make use of their (relatively limited) noise reduction function (Trafikverket, 2004).

The preschool at western Klockelund should be in a more silent area, behind other buildings for example. It is planned for noise reduction walls along the playground, to reach a noise level of <55 dBA. However, in the remittance consultation for the detailed development plan it is described that the kids also play outside the playground, since the playground itself is too small. In these areas the noise level is probably too high. One suggestion could be to expand the playground with more noise reduction walls. Another could be to replace one of the more silently placed apartment buildings in Klockelundsvägen with the preschool. The latter is to prefer since this preschool also suffers from the poor location near the highway with regard to risks and surroundings.

For Karlsvik strand the houses will be more exposed to noise compared to Klockelundsvägen since they will be closer to Nynäsvägen and Perstorpsvägen. Noise reduction walls might not be enough as mitigation measure. According to Trafikverket (2004) a two meter high noise reduction wall might dampen the

noise with up to 10 dBA if the ground between road and buildings is hard. For both alternatives, this area's ground is soft which will reduce the noise reduction walls efficiency with a few dBA, since the soft ground itself is dampening. Nevertheless, the noise reduction walls must be of good standards regarding height, compactness, placing and angle towards the buildings (Trafikverket, 2004). Other effective solutions are more expansive and demanding, such as speed limitation on Nynäsvägen or "silent asphalt" near Karlsvik strand. The need for a more silent facade for each apartment (< 55 dBA) will be very high, and therefore much effort should be put to include this aspect when designing the houses. Noise reducing materials in frames and windows should be chosen to create a good sound environment inside the apartments.

Finally, it is worth considering the risk of increased noise on the other side of Nynäsvägen coming from reflections of the noise wall at Larsboda strand's side of Nynäsvägen (Trafikverket, 2004). Therefore, it might be useful to plan for noise reduction walls at the other side of Nynäsvägen, especially since this area is planned for dwellings as well.

7.4 Air quality

Used indicators of air quality is concentrations of PM10 and NO2 per cubic meter air, since these are the air pollutants with concentrations closest to limit values in Sweden's Environmental Quality Standards (SLB analys, 2015). These are also the indicators used in air pollutant survey maps made by SLB analys, the responsible department of Environmental Administration in Stockholm regarding air and noise measurements.

6.4.1 Environmental baseline

The air quality, measured in particles (PM10) and nitrogen dioxides (NO2), in the planned areas meets the national environmental quality standards. Close to Nynäsvägen the air quality is more affected by pollution from the traffic than rest of the area and on the road itself there are parts of it just outside the planned areas where level of PM10 is above environmental quality standards (SLB analys, 2015) (figure 22 & 23).

7.4.2 Impacts for zero alternative

Concentrations of PM10 and NO2 in the planned area will increase due to increased traffic on nearby roads, but it will most likely remain within limits of environmental quality standards in areas close to residentials.

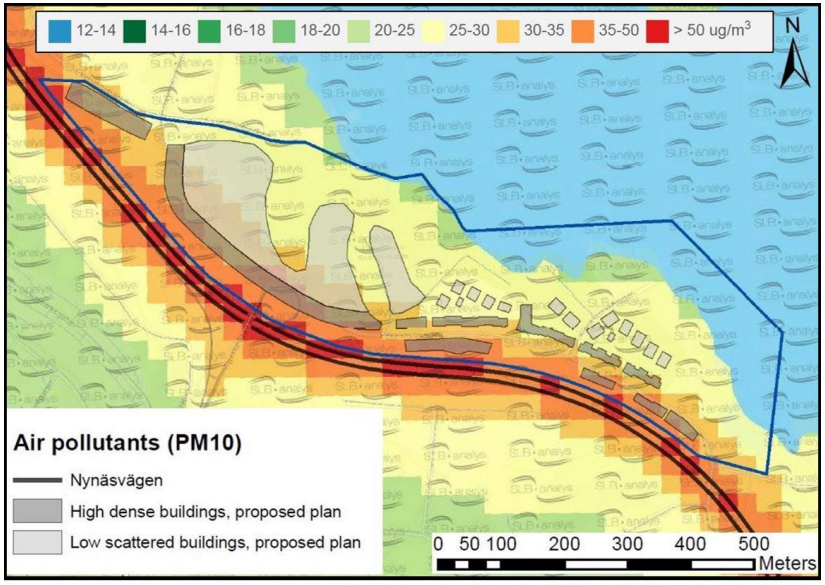
7.4.3 Impacts with proposed plan

In the building phase, the air quality will be affected negatively by increased heavy traffic in area, and also by dust coming from construction work, blasting and earthmoving.

According to an assessment that is made for the detailed development plan of Klockelundsvägen (Stadsbyggnadskontoret, 2016), air quality is within the environmental quality standards. However, it does not say if that statement is for the situation of today or for the future situation.

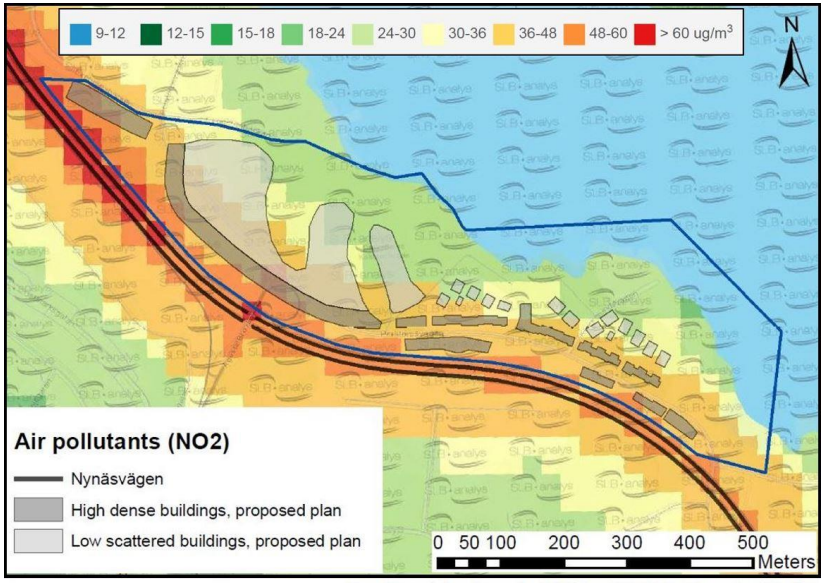
Spaces between garages and Nynäsvägen might be of locally lower air quality, since the air will not flow and be exchanged as much here (see Discussion for more on this issue). For people being in these sort of closed areas, the air quality might be an issue to analyze further.

For Karlsvik strand the situation is probably a lot like Klockelund, since it is at similar distance from Nynäsvägen and Perstorpsvägen, which are the major pollutant sources in area. Nevertheless, the formation of buildings in this area may not have as negative consequences for the air as in Klockelund. Prediction of more traffic in the future on Nynäsvägen (Trafikverket, 2012) and Perstorpsvägen will increase emissions of NO2 and PM10 from traffic.



Fastighetskartan, 1: 5 000 - 20 000. ©Lantmäteriet
Luftföroreningskarta. ©Stockholms stad (SLB)

Figure 22. Map showing concentrations of PM10 and the planned buildings in Larsboda strand according to the proposed plan. Red areas are where concentration of PM10 is above the environmental quality standards. Note that the air quality might be different when buildings have been built.

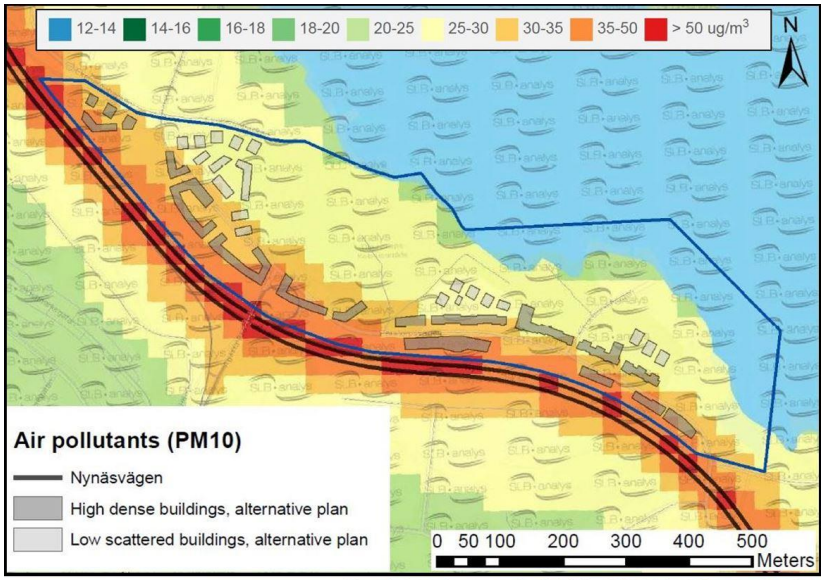


Fastighetskartan, 1: 5 000 - 20 000. ©Lantmäteriet
Luftföroreningskarta. ©Stockholms stad (SLB)

Figure 23. Map showing concentrations of NO2 and the planned buildings in Larsboda strand according to the proposed plan. Red areas are where concentrations of PM10 is above the environmental quality standards. Note that the air quality might be different when buildings have been built.

7.4.4 Impacts for alternative plan

Similar impacts as with the planned alternative is to be predicted (figure 24 & 25).



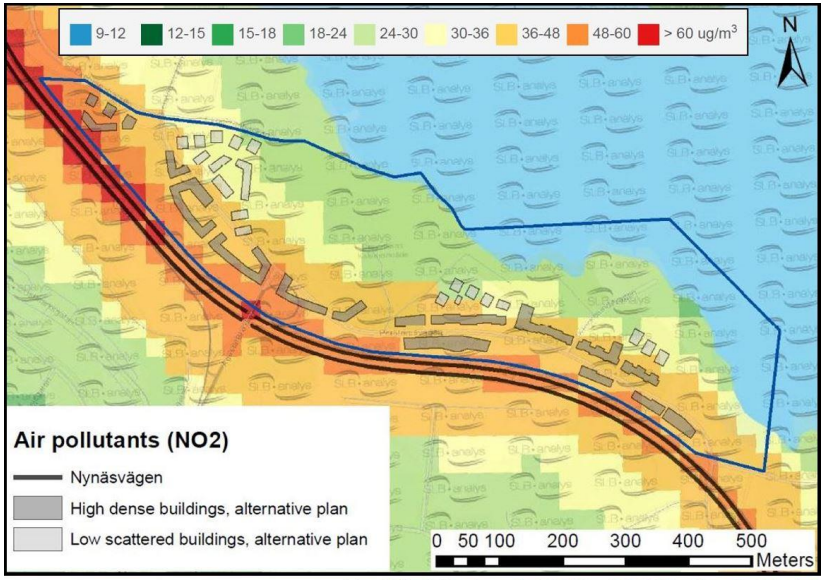
Fastighetskartan, 1: 5 000 - 20 000. ©Lantmäteriet
Luftföroreningskarta. ©Stockholms stad (SLB)

Figure 24. Map showing concentrations of PM10 and the planned buildings in Larsboda strand according to the alternative plan. Red areas are where concentrations of PM10 is above the environmental quality standards. Note that the air quality might be different when buildings have been built.

7.4.5 Mitigation measures

Prediction of more traffic in the future on Nynäsvägen and Perstorpsvägen will increase emissions of CO2, NOx and PM10 from traffic. Therefore, it is in need of predictive surveys of air quality and how it will be affected by changes in flows of traffic. Particles (PM10) and NO2 is most relevant to monitor in this area according to SLB analys (2015).

One way where a project plan of this kind can support regionally good air quality is to reduce the new residents habit of using fireplaces for wood burning.



Fastighetskartan, 1: 5 000 - 20 000. ©Lantmäteriet
Luftföroreningskarta. ©Stockholms stad (SLB)

Figure 25. Map showing concentrations of NO2 and the planned buildings in Larsboda strand according to the alternative plan. Red areas are where concentrations of PM10 is above the environmental quality standards. Note that the air quality might be different when buildings have been built.

Recent research has shown that human health is more affected by pollution coming from wood burning than that coming from traffic (SVT, 2016). Therefore, inside fireplaces could be excluded when planning the new apartments, and by that strive for a better air environment. Furthermore, buildings should have appropriate air ventilation, in case air quality will be worsened. This is most relevant for windows and ventilations in houses facing the area

between garages/storage rooms and Nynäsvägen, where air quality can be expected to be worse.

7.5 Risk analysis of Nynäsvägen

7.5.1 Environmental baseline

Nynäsvägen is classified as a primal transport route for dangerous goods (Länsstyrelsen Stockholm, 2016a). A risk analysis was made where the probability of risks for human health coming from accidents in areas close to Nynäsvägen was identified (Brandskyddslaget, 2016). These were accidents with combustible gases, and accidents with flammable liquids. For both of these, the level of risks is classified as "relatively large" (Brandskyddslaget, 2016). The risk level will be higher in the future since transport of flammable and explosive goods on Nynäsvägen will increase as Nynäshamns harbour is planned to expand (Brandskyddslaget, 2016, Rydström & Johansson, 2007).

7.5.2 Transport and dangerous goods regulations and guidelines

In guidelines from County Administrative Board of Stockholm "Riktlinjer för planläggning intill vägar och järnvägar där det transporteras farligt gods" (Guidelines for planning next to roads and railroads where dangerous goods are transported) it is normally not suitable with residential buildings within a distance of 75 meters from a transport route for dangerous goods (Länsstyrelsen Stockholm, 2016b). If residential buildings are planned 75-150 meters from this type of road, the potential risk should be considered in the planning process, but normally there is no need for making a full risk assessment. Depending on how close to the road buildings are planned, there might be a need for mitigation measures. However, no buildings should be built closer than 25 meter from the road according to The County Administration Board. The County Administrative Board recommends to have a safe distance to the road instead of building within the critical distance and taking mitigation measures.

7.5.3 Impact for zero alternative

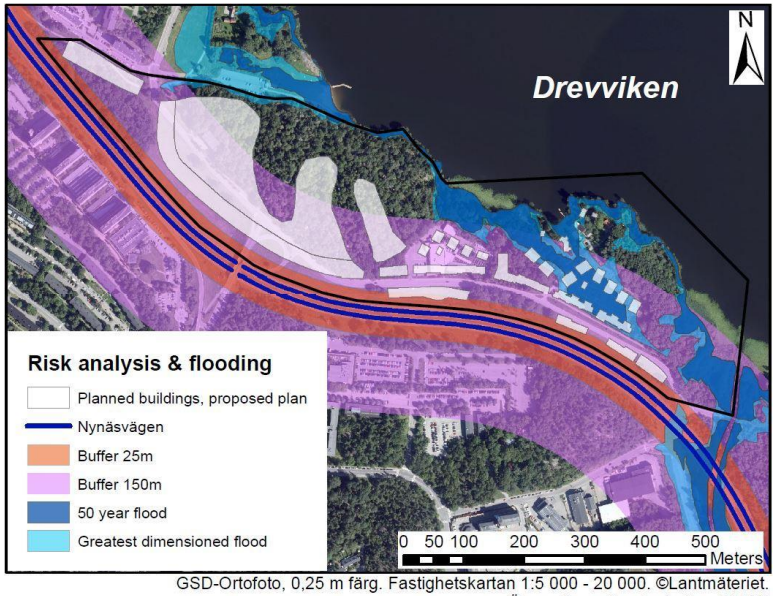
The level of risk near Nynäsvägen will increase with an increased transport of dangerous goods (Brandskyddslaget, 2016, Rydström & Johansson, 2007). With the zero alternative no buildings will be built within a critical distance from the road and therefore there will be no big impacts on risk for human health. Some of the buildings in the area today are closer than 150 meter (figure 26).

7.5.4 Impacts with proposed plan

The area between Nynäsvägen and Perstorpsvägen on the east side, where some buildings are planned in the detailed development plan for Klockelundsvägen, has been analyzed for the risk associated with transport of dangerous goods (Brandskyddslaget, 2016). Some buildings will be as close as 16 meters from the road, which is acceptable according to the detailed development plan since they are facilities where people do not stay for a longer period of time (garages and storage rooms). These buildings may also function as risk reducing barriers for the apartments that is further away from Nynäsvägen. However, protecting barriers of this sort is not planned all along Nynäsvägen in Larsboda strand and can therefore only be said to protect some, but not all, of the apartments closer to Perstorpsvägen.

On the west side in Karlsvik strand, all the apartments are planned with no garages or other “protective” buildings towards Nynäsvägen. Instead, noise reduction walls are planned to be built along Nynäsvägen. Even though it is not written in the PM from Stadsbyggnadskontoret (2015c), specific noise reduction walls might function as a protecting barrier from risks of this sort (Brandskyddslaget, 2016). Part of the distance is planned to have a landscape wall as a noise reduction barrier and the rest of the distance will have a more regular wall.

In the same PM from City Building Office (Stadsbyggnadskontoret), buildings with a distance of 75 meter to Nynäsvägen needs a risk assessment. It is not clear how many of the buildings that will be within this distance. The same document says there will be no buildings closer than 25 meters to Nynäsvägen (Stadsbyggnadskontoret, 2015c).

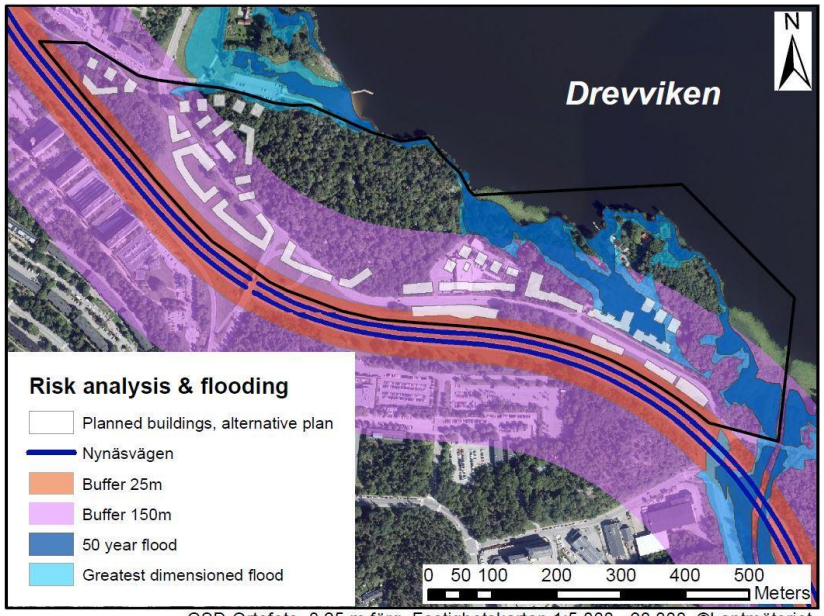


GSD-Ortofoto, 0,25 m färg. Fastighetskartan 1:5 000 - 20 000. ©Lantmäteriet. Översvämmningskartering. ©MSB

Figure 26. Map showing Nynäsvägen with two buffers (25 and 150m) to visualize the risk of accidents (made by transport of dangerous goods) in relation to the buildings in the proposed plan. The map also shows the extent of a possible flooding of Drevviken.

7.5.5 Impacts for alternative plan

The predicted impacts for the alternative plan is similar or the same as for the proposed plan (figure 27).



GSD-Ortofoto, 0,25 m färg. Fastighetskartan 1:5 000 - 20 000. ©Lantmäteriet. Översvämmningskartering. ©MSB

Figure 27. Map showing Nynäsvägen with two buffers (25 and 150m) to visualize the risk of accidents (made by transport of dangerous goods) in relation to the buildings in the alternative plan. The map also shows the extent of a possible flooding of Drevviken.

7.5.5 Mitigation measures

For Klockelund, the proposed barriers in form of garages and storage rooms along Nynäsvägen should be built since they will function as risk reducing measurements for people living in the apartments closer to Drevviken. This is also suggested for the alternative plan.

In the whole of Larsboda strand it is necessary, in regard to the distance, to build more protecting walls along Nynäsvägen. Buildings within the area of increased risk should be built with adequate material with consideration of risks in area. However, how long this distance of concern should be is not completely clear. According to the latest guidelines, it could be motivated to consider the risks if buildings are closer than 150 meters to Nynäsvägen (Länsstyrelsen, 2016b). In the PM of Karlsvik strand, 75 meters is used as a threshold for concern. A suggestion could be to make a new risk assessment for the whole Larsboda strand area, together with expertise and in consultation with the County Administrative Board before deciding suitable distances. Moreover, since the survey was made in Klockelund, a new guideline document has been released (Länsstyrelsen, 2016b).

In the proposed plan for Karlsvik strand, the buildings are not as closely built as they are in Klockelund, but instead, they will not have protecting barriers in form of garages and storage rooms. Therefore, the buildings in Karlsvik strand need a more detailed risk analyses to see if it is a suitable place to have apartments at. The planned noise barriers in Karlsvik strand must be of a kind which also function as protection barrier from risks concerning possible accidents with combustible gases and flammable liquids on Nynäsvägen. To be more protective, these walls should be higher than the proposed two meters, preferably they should have the same relative height as the buildings they are protecting (Brandskyddslaget, 2016). Noise barriers of this kind should also be used in Klockelund, where garages and storage rooms are not protecting the dwellings. Moreover, it is of relevance to investigate if the landscape wall in Karlsvik strand also has the potential to be risk reducing. If not, it should be considered to be changed into a regular wall, with risk reducing characteristics.

For our alternative the buildings in Karlsvik strand have the same problems as in the proposed plan. The same mitigation measures should be taken as in the proposed plan. Facades facing the road

should be constructed in such a way that accidents from mentioned risk can be minimized.

7.6 Water quality

The water condition mainly refers to the chemical and ecological characteristics of water in Drevviken. The physical characteristics like water temperature, conductivity etc. are not taken into consideration. The current contamination situation of stormwater in Larsboda Strand is estimated by the use of StormTac database (2016), which is a user-friendly and self-explanatory single model that includes the interactions within the whole watershed system. The model is updated continuously with new data and are in accordance with the latest scientific findings.

7.6.1 Environmental baseline

Lake Drevviken is over 5 km^2 and is thereby the largest lake in Tyresån lake system, which is the largest continuous system of lakes and rivers in the Stockholm area (Stockholms stad, 2015). The system is regulated by Miljöbarometern (The Environmental Barometer) of dams at several outlets, but Drevviken outlet is not regulated (Stockholm stad, 2015). The inflow to the lake is from Magelungen through Forsån, the outflow finally reaches Kalvfjärden in the Baltic Sea through Tyresån. Parts of the lake are also covered by the nature reserve Flaten.

Currently the ecological status of Drevviken is "unsatisfying" and does not meet the goal for chemical status of Drevviken (Miljöbarometern, 2016). Major environmental problems of Drevviken is oxygen-poor conditions, environmental toxins (tributyltin compounds), high levels of ammonia, acidification and altered habitats through physical impact. The stormwater from Larsboda strand will flow into Drevviken and cause water pollution. Table 1 shows the current contamination situation of stormwater in Larsboda strand, which is estimated with the use of The StormTac database (2016) and the standard of StormTac surface water guideline values.

Table 1. Estimated contamination situation of stormwater in Larsboda strand and the standard of StormTac surface water guideline values (StormTac database, 2016).

Concentration(ug/L)	Larsboda strand	Standard
P	100	160
N	2000	200
Pb	10	8
Cu	20	18
Zn	60	75
Cd	0.3	0.4
Cr	6	10
Ni	3	15
Hg	0.04	0.03
SS	60000	40000

From the table above, it is concluded that the major pollutants in the stormwater in Larsboda strand are nitrogen (N) and

suspended solids (SS) which may have potential to cause eutrophication and acidification in Drevviken.

7.6.2 Water regulations and guidelines

Larsboda strand is located within the surface water body Drevviken (SE656793-163709), the general guidelines concerning recommendations on water protection are under the provisions of Chapter 7. §21, §22 Environmental Code.

§21 A land or water area may be designated a water protection area by a County Administrative Board or a municipality for the purpose of protecting surface water or groundwater supplies that are, or are likely to be, used as water catchments.

§22 The municipality or the County Administrative Board shall issue rules for water protection areas imposing any restrictions on the right to dispose of property in the area that may be necessary in order to fulfil the purpose of the area. Where necessary, the municipality or the County Administrative Board may stipulate that signs or fences shall be put up and that another's land may be used for this purpose. The rules shall take effect immediately even if they are appealed against.

The County Administrative Board or the municipality may in special circumstances grant exemptions from the rules issued for a water protection area.

7.6.3 Impacts for zero alternative

There is no obvious change in water condition. However, contaminants from nearby industrial area could flow into Drevviken with stormwater and cause a direct pollution. The nitrogen dioxides in vehicle exhaust emissions from Nynäsvägen would also affect the water condition, accelerating the acidification of water area. The continued level of nutrients from residential area would promote excessive plant growth and decay, favouring simple algae, causing a severe reduction in water condition (Chislock *et al*., 2013).

7.6.4 Impacts with proposed plan

The stormwater from construction sites would contain increased suspended solids (SS) and contaminants that may cause physical, chemical and biological impacts on water condition. The debris and rubbish from construction activity also have the potential to cause water pollution and reduce the aesthetic quality of Drevviken as well. New buildings, like apartments, preschools and public parks, would undoubtedly increase the accessibility in Larsboda strand that may also affect the water condition.

The detailed development plan in Klockelundsvägen has taken mitigation measures that several ditches should be built to purify the stormwater before it flows into the Drevviken, the existing ditches should also be updated. According to the detailed plan, the concentration of pollutants would decrease if the ditch solution is implemented.

7.6.5 Impacts for alternative plan

In Klockelund, the predicted impact on water condition will be similar to the planned activity during the construction phase. The contaminants from construction sites as well as the recreational activity would have potential impacts on water condition. However, the relocation of buildings in alternative plan would have a positive impact on the water condition since no buildings

are built within the shoreline protective area, which means a reduction of human activity near the water area.

7.6.6 Mitigation measures

The following mitigation measures are considered to practically minimize and control the stormwater from construction activity and preventing further pollution in Drevviken. Nynäsvägen should be improved with well-designed drainage systems, as it was mentioned in the planned activity, before the construction is undertaken. The stormwater would be collected by the temporary drainage system with sufficient number of ditches and then discharged to the updated stormwater drainage system along the improved Nynäsvägen. Moreover, the construction activities should be carried out sequentially, phase by phase or sub-area to sub-area, rather than in parallel. With the implementation of these measures, the risk from construction stormwater can be reduced.

7.7 Biodiversity and connectivity

Oaks of different size and age is quite evenly distributed throughout the Larsboda strand area and a major part of this section will deal with the ecological importance of oaks and dispersal of oak-dependent species. Therefore, it is necessary to describe the characteristics of oaks more thoroughly. Oaks make up a special habitat for almost 1500 different species (Hultengren *et al*., 1997), particularly wood-living insects, lichens, mosses and fungi. Moreover, hollow oaks are especially important habitats for a lot of birds, bats and other mammals. Oaks offer several different habitats during their lifetime since they undergo an ever-changing process (Mörtberg, Zetterberg & Gontier, 2007). This leads to a succession of different species that inhabits the oak in specific stages of its lifetime. When the oak grows older, the specialists of the earlier type of life stage is exchanged by new species that are adapted to the oak in that particular life stage. This means that oak living species need to be able to move around between oaks in different life stages periodically (Mörtberg, Zetterberg & Gontier, 2007). However, the movement between oaks are starting to become problematic since habitats and landscapes get all more fragmented, mostly due to construction. Stockholms oak districts are unique and something that is worth to preserve (Ekologigruppen, written communication, 2016).

7.7.1 Environmental baseline

Larsboda strand is characterized by a broad-leaved deciduous forest and a presence of oak, birch, hazel, ash, maple but also pine, spruce and occasional willow trees. Approximate estimation of quantity of the different tree species is found in appendix IV. Karlsvik strand has a range of young and old trees with sun exposed clearings due to the removal of a lot of brushwood. There are especially many oaks in this area, ranging in size and age. These habitats make up a core area of oaks and is part of an important dispersal zone for oaks at a landscape level (Miljöförvaltningen, 2009). The forest area overall is a link between the green wedges Hanveden and Tyresta, a so called green connection (RUFS, 2016).

Nature values and threatened species

The nature value assessment indicates that there is a high potential for biodiversity and nature values in the area (appendix V). We found a parasitic fungus specie (*Phellinus ferreus*) (ArtDatabanken, 2016c) that grows on weaker oaks, which is a good indicator specie for forests that are worth to preserve

(Ekologigruppen, 2016, written communication). However, there were only few findings of this specie in the area. Additionally, we found occasional findings of two other parasitic fungi species (*Phellinus robustus* and *Phellinus pini*), both classed as near threatened (NT) (ArtDatabanken, 2015) (figure 28). However, the current decline of both species is assessed as being close to the limits for the classification vulnerable (VU) (ArtDatabanken, 2016b & ArtDatabanken, 2016c), which is a higher grade of threat. A complete list of species found in the area during the field study is included in appendix VI.

Indicator species often signal a long continuity and/or a long availability of a particular environment or substrate. The oak and pine fungi (*Phellinus robustus* and *Phellinus pini)* indicates that there have been old trees for a long period of time in the area. These types of areas are therefore also suitable for other red-listed and important species (Ekologigruppen, 2016, written communication). *Phellinus pini*, grows on old pines and is actually common in Stockholm because we have a lot of old trees left, but in the rest of Sweden it is all the more rare, which is why it is classed as near threatened.



Figure 28. Oak fungi (*Phellinus robustus*) and pine fungi (*Phellinus pini*).

Amphibians

The area is also of importance for amphibians, especially along the shoreline and within the shoreline area where hibernation areas as well as dispersal zones exists. Wetlands, damp habitats and broadleaf forests are also great environments for amphibians while they are active on land during summer- and wintertime. These environments are also important for dispersal. In the old arboretum, next to Plantagen, there is a pond that housed Smooth newt (*Lissotriton vulgaris*) for a couple of years in the beginning of the 21:th century (Artportalen, 2016). This indicates that the area has a good status for supporting amphibians.

Allotment garden

In Klockelund, the allotment garden attracts a lot of insects, and thereby also some birds. The insects contribute in dispersal of the plants and increase the biodiversity in the area.

7.7.2 Impacts for zero alternative

If the proposal is not implemented the area will continue to have the nature values it has today. However, some of the trees are standing too tight which makes their overall health decline and in some parts of the area the oaks are affected by young deciduous trees that grow up and into their crowns, which results in dead branches (Miljöförvaltningen, 2009).

7.7.3 Impacts with proposed plan

The oaks within the camping hut area are threatened to be removed due to new buildings and expansion of roads. This area houses one of the largest and thickest oaks in the dispersal zone (Miljöförvaltningen, 2009). The proposed construction results in destruction of a lot of oaks, both young, old and large. This will

reduce the dispersal zone and thereby the condition of the oak living species in the area and surrounding areas.

During the construction phase, it is uncertain how much space is needed, apart from the actual house area. This might have bigger effects for surrounding nature than it seems, when only taking the allotted house space into consideration.

About 6 ha of the proposed construction in Larsboda strand is within the core dispersal zone for oak. The proposed plan will affect 6,5 ha particularly vulnerable areas, such as the broadleaf environments and the shore area (Miljöförvaltningen, 2009). This will have a big impact on amphibians in the area. Not only will their habitats be diminished, which will disturb mating and hibernation, but buildings and noise reduction walls will become barriers that block dispersal as well.

There will probably be a negative impact for the amphibians when the arboretum and the pond will be replaced with residential buildings. The ditch, where a lot of amphibian activity is present (Miljöförvaltningen, 2009), is to be destroyed and filled with soil. This will cause a dramatic change for the amphibians since it is the only ditch in the nearby area.

Oak-dependent insects will be greatly negatively affected when the oaks are cut down. If several oaks within an area are cut down, leaving a void, it will lead to a loss of habitat for oak-dependent species which will cause a loss of biodiversity and functional dispersal zones (Mörtberg, Zetterberg & Gontier, 2007). Additionally, several oak living insects fly relatively low (Miljöförvaltningen, 2009), which means that when dense buildings higher than 2 meters are constructed it will affect the insects' availability for dispersal. This will weaken the dispersal zone of oak living insects because it will be more difficult to locate new fitting habitats and a biodiversity loss is a fact.

Since the proposal includes the construction of two preschools with a lack of playground area the planners state, in the Detailed development plan (Stadsbyggnadskontoret, 2016), that the nearby forest will be used as a complementary playground for the kids. The flora and fauna in the nearby forest will probably be highly affected by persistent visits. Besides this, there are construction plans for a playground next to one of the preschools, but the effects on surrounding nature is unknown today since the whereabouts of the playground is not fully decided.

If the allotment garden is removed a biodiversity loss will be a fact, with especially a loss of insects and birds.

7.7.4 Impacts with alternative plan

Since more camping huts will remain with this alternative, a lot of the forest that grows intertwined with the camping huts will also be preserved. This will mean that the loss of biodiversity and connectivity will not be as severe as in the alternative with the planned proposal. This also means that the largest oak will be safe from destruction.

In the alternative plan, more consideration is taken to maintain coherent diverse oak habitats, with a range in size and age. This will help to maintain the connectivity in the area, both for the present and for the future and it is also important for future regeneration.

The amphibian habitat will not be as disturbed or demolished as in the proposed plan since less of their habitat is fragmented by the construction. Especially the vulnerable habitat nearby Drevviken and the ditch will be unharmed. However, when creating the park and making the shoreline more accessible, the area might have a higher pressure from visitors which will affect the amphibians negatively.

The buildings in the alternative plan is not as dense as in the proposed plan, but they will still become barriers for amphibians and insects in the area. However, the effect will be milder with this alternative, at least for the amphibians. The noise reduction walls will have the same negative effect of the dispersal of both amphibians and insects.

Since a part of the allotment garden is reserved the negative effects on the biodiversity will not be as major. Some of the values of the biodiversity will remain semi-intact, such as insects and birds. The reserved allotment garden area is too small to maintain the values it has in the zero alternative.

7.7.5 Mitigation measures

To preserve the valuable oak habitats, it is important to avoid isolating the different habitats from each other, a guideline is a minimum of <200-500 meters between the dispersal zones (Miljöförvaltningen, 2009). This will be achievable if it is considered early in the planning stage so that the construction of buildings will not cause fragmentation.

Some of the trees will need to be maintained to avoid degradation. Certain trees thrive best when standing openly and light, especially oaks, and they will need clearance of surrounding trees to not degrade.

In the detailed development plan for Klockelund (Stadsbyggnadskontoret, 2016) it is stated that they will place the wood from the cut down trees in the surrounding nature. If oaks are to be cut down, it is important to stay true to this statement. It is a good mitigation measure and a good way of preserving some of the biodiversity in the area. To let the oak wood remain and decay on the ground of the area will benefit many insects that are dependent on the presence of dead wood.

If the park is kept too clean, regarding natural waste, it will be inhospitable for a lot of oak-dependent species. Therefore, branches, twigs, leaves etc. needs to lay on the ground and continue a natural decaying process to not risk losing more biodiversity in the area. If the area is perceived as untidy and rough, it might be a good idea to have a public information sign that educates the visitors of its importance for the wildlife.

If the amphibian habitats are highly affected by the construction it might be a fitting mitigation measure to build a new pond, construct a new ditch or new wetlands.

7.8 Transport

This section is about different means of transportation within and to Larsboda strand and prediction of how traffic flow will change with the proposed plans. The alternatives are based on remittance response from the Traffic office (Trafikkontoret, 2016) to the detailed development plan for Klockelund, an interview with Martin Styring at the City Building Office (2016, 6th Dec), mail conversations with Stockholm's public transport (SL) (Mikael Eriksson, 2016), guidelines from Stockholm traffic management (Stockholm Trafikförvaltning, 2015) and Stockholm municipal guidelines for roads and bikes (Stockholms stad, 2015).

Especially the plans in Karlsvik strand are very dependent on the plan of rebuilding Trafikplats Larsboda, which is outside the boundaries of what the City Building Office are authorized to do. Unfortunately, response from Trafikverket and the Exploateringskontoret (Development Administration) about updated information of the building plans at Larsboda Trafikplats is overdue. Therefore, there is a lot of uncertainties about the proposed plan and its impacts.

7.8.1 Environmental baseline

Larsboda strand is situated 12 kilometers south of central Stockholm, along Perstorpsvägen, next to Nynäsvägen. Nynäsvägen is an important road for the whole Stockholm region, since it connects Haninge, Nynäshamn and Stockholm, and is also of national interest for communication (Trafikverket, 2016). During one day, 45 000 cars pass the traffic junction south of Larsboda strand (Trafikverket, 2015).

Nynäsvägen is easily accessible by car, but the design of Trafikplats Larsboda does not make room for bus stops connected to Nynäsvägen. The closest core network for public transport is the metro station Farsta centrum and the commuter train station Farsta strand.

According to guidelines from Stockholm Traffic Administration (Stockholm Trafikförvaltning, 2015), residential areas within 900 meter to core network for public transport have good access to public transport. From Larsboda strand it is about 1,5 km to the metro station and commuter station, and two bus lines have bus stop in the area. Line 184, towards Farsta strand and line 181 towards Skarpnäck metro station. It takes about 45 minutes travelling from Larsboda strand to the city centre of Stockholm with public transport, compared to 11 minutes by car, depending on at what time of the day it is (SL Reseplanerare, 2017).

Nynäsvägen is a barrier for pedestrians and cyclists that hinder movement from Larsboda strand towards Farsta city centre. Today it is possible to cross the road at two places by bike or walking, one is southeast of the area and the other is at Trafikplats Larsboda. The latter has crossing points that are unsafe to cross (Styring, 2016, personal communication, 6th Dec).

Perstorpsvägen connects Larsboda strand with Sköndal and Tyresövägen in the west and Larsboda and Magelungsvägen at the east side. Every day there are about 5000 cars passing by Pertorpsvägen and the maximum speed is 50 km/h (Stadsbyggnadskontoret, 2015a) (figure 29).



Figure 29. Perstorpsvägen next to Plantagen in Klockelund. On the left side of Pertorpsvägen there is a three meter wide regional commuter

road for bikes and pedestrians that is in bad shape according to the Traffic Office (Trafikkontoret, 2012).

There are two big parking lots in Larsboda strand facilitating visitors that come by car, one at Hökarängsbadet and another one at Plantagen. For the camping hut owners there is a parking lot by the hill closeby the huts, and the allotment gardeners park their cars by the allotment garden.

7.8.2 Impacts for zero alternative

The traffic on Nynäsvägen is predicted to increase, both by cars (Trafikverket, 2012), and also by heavier traffic, since the harbour in the city centre of Stockholm will be shut down and Nynäshamn harbour will be extended (Brandskyddslaget, 2016).

The public transport is predicted to be of low frequency in the zero alternative, depending on other exploitation proposals in the vicinity. SL is not planning on increasing the public transport if no more residential areas are built that demand public transport (Mikael Eriksson, 2016, e-mail), which means that visitors are likely to go by car when visiting Larsboda strand. For this purpose, the parking space at Hökarängsbadet and Plantagen will be important to facilitate visitors in the area.

The bike path connected to Ågesta Broväg is planned to be rebuilt, which might improve connections over Nynäsvägen. There will be no new passages over Nynäsvägen, hence, the highway will still be a barrier of connecting the two areas on both sides of the road (figure 30).



Figure 30. Perstorpsvägen in the forefront and Nynäsvägen in the background.

7.8.3 Impacts with proposed plan

Traffic on Nynäsvägen will increase as the predictions in the zero alternative. With the proposed plans in Larsboda strand, 1200 new apartments are going to be built. The two plans are a part of a bigger program where 5000 new apartments are planned. This will lead to increased pressure of people using the roads, in which the traffic on Pertorpsvägen also will increase.

There are uncertainties of the impacts of public transport because it is dependent on the rebuilding of Trafikplats Larsboda. The City Building Office are discussing this with the Development Administration, Traffic Office and Swedish Transport Administration, but there is still no official plan for Trafikplats Larsboda (Styring, 2016, personal communication, 6th Dec). Depending on if or how Trafikplats Larsboda is rebuilt, it might be possible with bus stops connected to Nynäsvägen. SL has

currently no plan of establishing more bus lines along Nynäsvägen (Mikael Eriksson, 2016, e-mail). According to the detailed development plan for Klockelund the new exits over Nynäsvägen for pedestrians and bicyclists will reduce the distance to 800 meter to the metro and 1000 meter to the commuter trains. This means that the metro station will be within a walkable distance from the residential areas according to guidelines from Stockholm Traffic Administration (Stockholm Trafikförvaltning, 2015). Still many new residents are expected to own a car and the Traffic Office claims that the parking norm needs to be higher because of the far walking distance to the metro and commuter train (Trafikkontoret, 2016).

Within the detailed development plan for Klockelund, there are plans of rebuilding Perstorpsvägen to create space for bus stops. According to SL, there are plans to establish bus traffic on Perstorpsvägen between Trafikplats Larsboda and Stortorpsvägen. Bus line 181 also planned to have more frequent traffic when Sköndal and Farsta expands with more residential housing (Mikael Eriksson, 2016, e-mail). If public transport improves, that might also ease the pressure of parking space at Hökarängsbadet for visitors and result in a lower car dependency for new residents in Larsboda strand.

It will be difficult to build parking space within the plans for Karlsvik strand because of hilly terrain and need for blasting. Therefore, a parking that is big enough to cover the needs both for Klockelund and Karlsvik strand is planned within the detailed development plan for Klockelund (Styring, 2016, personal communication, 6th Dec). Since the plans for Karlsvik strand is in a later stage the surplus of parking space is of risk of being used by the future residents in Klockelund and raise the available parking per household.

Two new socioducts over Nynäsvägen for bicyclists and pedestrians is proposed within the detailed development plan for Klockelund and in the PM for Karlsvik strand. The new socioducts is planned to connect Larsboda strand with the newly planned housing district in the old Telia area which will have a positive impact for the accessibility for pedestrians and bicyclists over Nynäsvägen.

Sidewalks are planned to be built along both sides of Pertorpsvägen (figure 31). The bike path is planned to be moved to the north side of Pertorpsvägen. This is criticized by the Traffic Office because it worsens the ability to cross Trafikplats Larsboda (Trafikkontoret, 2016).

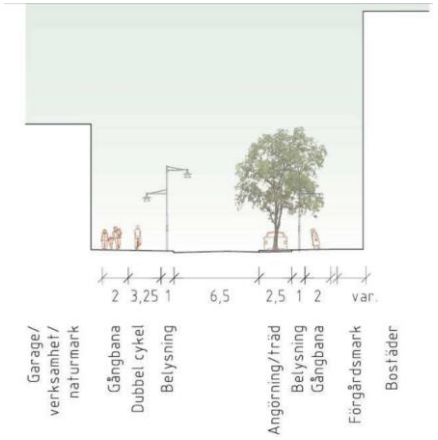


Figure 31. Suggested reconstruction of Perstorpsvägen. Source: Stadsbyggnadskontoret, 2016.

6.8.4 Impacts for alternative plan

The predicted impacts for the alternative plan is similar or the same as for the proposed plan. The accessibility to the bike path for residents in Larsboda strand will improve in our alternative when the path is kept on the north side of the road.

7.8.5 Mitigation measures

To avoid insecure crossing points at Trafikplats Larsboda, and have the bike path closer to the residential buildings, it would be preferable to have the path on the north side of Pertorpsvägen, as in the alternative plan.

In the proposed detailed development plan for Klockelund, the parking norm is 0.6 with a suggestion of increasing it so that the building companies can get reduction of parking places if they come up with mobility management solutions for other means of transportation except cars. To avoid that the whole responsibility of mobility management solutions for bikes and other alternatives for not using cars is put on the building companies more concrete plans for bike prioritization should be implemented in the detailed development plan.

7.9 Recreation and outdoor activities

Except for the material mentioned in Method, this section is also based on the program plan Tyngdpunkt Farsta (2015), a field visit to Larsboda strand, interviews conducted with citizens in Farsta the 6th and 9th of December and email contact with concerned associations in Larsboda strand.

7.9.1 Environmental baseline

Larsboda strand is partly a scenic area with high recreational values. According to the Sociotope map of Stockholm, Larsboda strand constitutes of the following values: urban farming, floral glory, green oasis, nature play, peacefulness, sport activity, views, contact with water, outdoor swimming, ice skating, outdoor gym and swimming facility (figure 32 & table 2). Important parts of Larsboda's recreational areas are beach Hökarängsbadet, an allotment garden and a camping hut area in Karlsvik strand. These areas form an essential part of Larsboda strands recreational values due to their high ecological, social and cultural values. North of Larsboda strand lies beach Hökarängsbadet, which is an important hub for recreation, sport activities and attracts lots of visitors both summer- and wintertime. In the northwestern part of Larsboda strand, the 84 camping huts are situated. Hökarängens frilufsförening is the responsible association for these huts. Along the water below the camping huts, a landscaped wooded walking path has been built to improve the accessibility along the shoreline (figure 33).

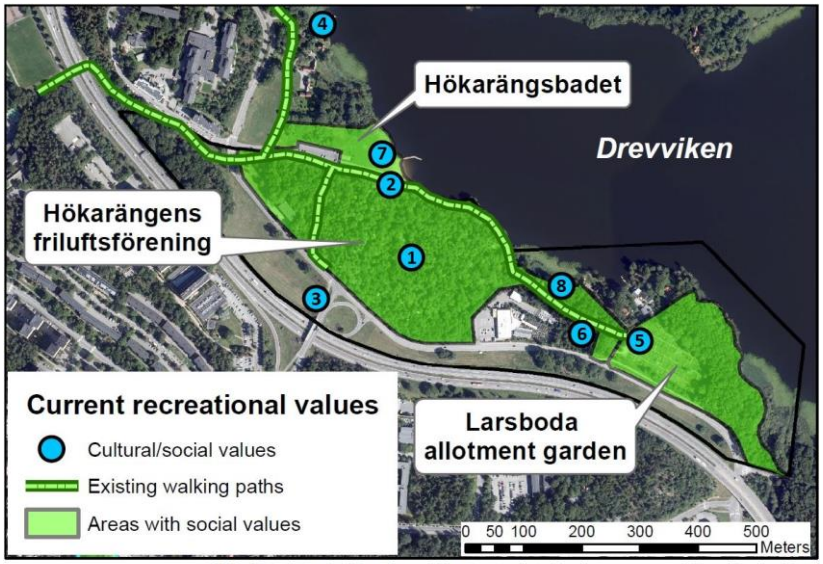


Figure 32. Map showing the baseline of the current recreational and social values. Areas and the quality values (shown in the explanation Table 2) are obtained from the Sociotope map (Stockholm stad, 2016d). 1. Cafe and dance pavilion, 2. Cafe, 3. Sledding hill, 4. Local boat club, 5. Allotment garden, 6. Arboretum, 7. Beach, 8. Croft.

Table 2. Explanation of the sociotope values of Larsboda's recreational values in figure 32.

Area	Sociotope values
Hökarängsbadet	Green area, nature play, peacefulness, ball games, view, water contact, beach, ice-skating, open-air café, outdoor gym, swimming facility
Hökarängens friluftsförening	Nature play, walking, peacefulness, view, water contact
Larsboda allotment garden	Green area, floral splendor, growing, water contact



Figure 33. A wooden walking path has been built to improve the accessibility along the shoreline in Karlsvik strand.

Accessibility and noise levels

Karlsvik strand and Klockelund has been criticized by the public for bad ability to orientate, a feeling of privatized public space surrounding the camping huts as well as overgrown nature that hinders the accessibility to these areas (figure 35). The newly constructed walking path along the shoreline has increased the accessibility to the area, but as the walking path ends, many experience the place to be dark, unsafe, littered and inhospitable (figure 34).



Figure 34. The walking path on the east side of Larsboda strand.



Figure 35. The area with the camping huts in Karlsvik strand is criticized for feeling private and not welcoming for the public.

Nynäsvägen is a big barrier that limits the availability from large parts of Farsta to access Larsboda´s recreational areas. By beach Hökarängsbadet there is a large parking lot that is full during the summer time (anonymous interviews on site, 6th and 9th Dec). The high noise levels from traffic on Nynäsvägen and Perstorpsvägen greatly affect Larsboda´s recreational values, as it affects the general experience of green areas.

Larsboda associations

The responsible association for the camping huts is Hökarängens friluftsförening which consists of the camping huts, a dance pavilion (figure 36), a sauna and a barbecue area. During the summer months “Café Ekskogen” offers a range of different activities such as exhibitions, guided tours, courses in handicrafts and live music. The area is public, but the huts are owned by individuals and the land is leased one year at a time from the municipality.



Figure 36. Common area and dance pavilion managed by Hökarängens friluftsförening.



Figure 37. Larsboda allotment garden.

Southwest of Larsboda, on Klockelundsvägen, lies an allotment garden (figure 37) 100 meters from Drevviken, which constitutes of 72 farming plots. The responsible association is Larsboda Koloniträdgårdsförening. The allotment garden is multifunctional: it performs an important element for the areas green structure, enhances biodiversity and contributes to local food security (FSSK, 2015). According to Delshammar (2011), urban farming activity can also have a positive effect on human health.

7.9.1 Impacts for zero alternative

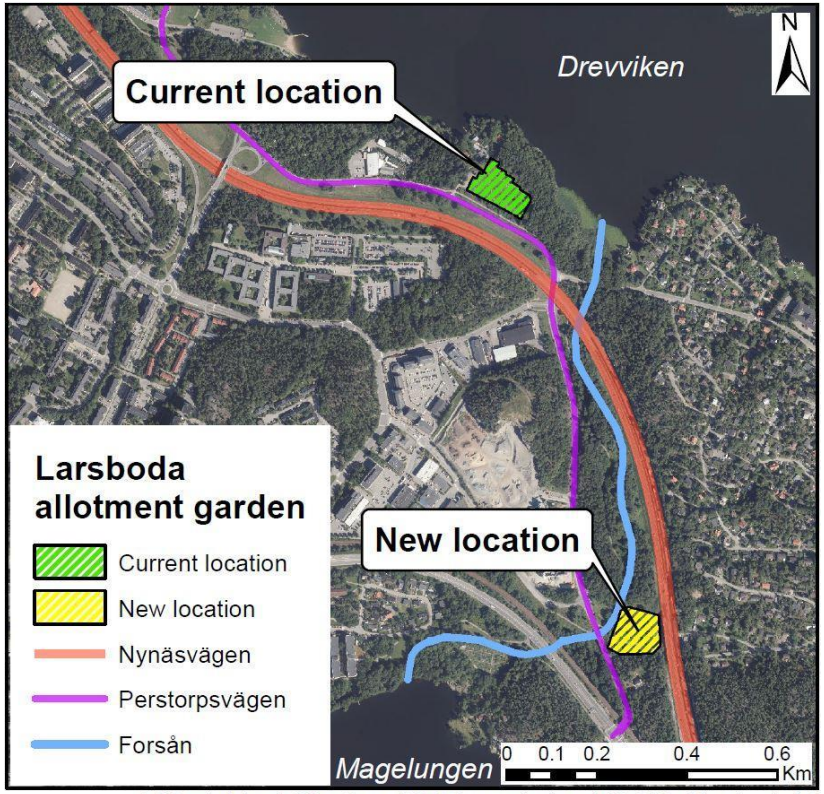
If the planned proposal is not implemented, most of the recreational values will remain the same as today. The valuable and sensitive nature in Karlsvik strand, with its related recreational values, will be preserved. Also, the allotment garden with its floral glory and urban farming activity will remain unexploited by building. Recreational values will continually be negatively affected by high noise levels from Nynäsvägen and Perstorpsvägen. The value of the camping huts will probably degrade if the huts are not renovated, which in turn will negatively affect their recreational and social values. The unsafe, dark and littered surroundings, near Plantagen in Karlsvik strand and Klockelund, will keep degrading if not taken care of and the accessibility to these areas will remain low. The sledding hill will remain in the zero alternative (figure 38).



Figure 38. The popular sledding hill by Nynäsvägen that will be removed if Trafikplats Larsboda is rebuilt according to the proposed plan.

7.9.4 Impacts with proposed plan

Due to the planned activity with new dwellings in Klockelund, the allotment garden is to be relocated to a new area along Forsån, on Forsfararvägen (figure 39). Larsboda Koloniträdgårdsförening will be compensated for the trouble of relocating, by being granted a new area to cultivate. The chairman, Leif Eriksson, has unwillingly accepted the offer after several years of struggling to stay in the current area as long as City Building Office keep their promise about compensation. Due to the uncertainties about the relocation of the allotment garden, the association has had difficulties to rent their farm plots. In a recent survey, 30 members indicated that they were interested in a farm plot after the relocation. Some members have listed themselves elsewhere and some members cannot cope with the move and will stop cultivating (Leif Eriksson, 2016, email). Interviews performed with two members of the association shows that neither of them are happy with the relocation. They think that the new area is shady and highly disturbed by noise from heavy traffic (anonymous interviews, 6th and 9th Dec).



GSD-ortofoto, 0.25 m färg. GSD-Terrängkartan 1:50 000. ©Lantmäteriet

Figure 39. Map showing the current location of Larsboda allotment garden (green area) and the planned new location (yellow area), in relation to the roads (Nynäsvägen and Perstorpsvägen) and the stream Forsån.



Figure 40. New allotment garden area besides Forsån.

The new area for the allotment garden is situated in a relatively open space, whereof only a few trees have to be cut down to make way for the allotment garden (figure 40). In the middle section of the area there is only tall grass, which probably has no greater natural values that will be affected when removed. According to the assessment that the Environmental Administration (Miljöförvaltningen, 2009) performed, the new location for the allotment garden, compared to the current location, is more shady, has a longer travelling distance for residents coming from the north of Farsta and is more exposed to noise due to heavy traffic. The new location is therefore assessed to be worse than the current location and is also linked to uncertainties which needs to be further investigated (see *Uncertainties with plan* further below).

All of the camping huts in Karlsvik strand are suggested to be removed to make room for apartments and public park areas (figure 29). This means a major loss of recreational values for the camping huts owners and to other people that enjoys the area today.

In program plan Tyngdpunkt Farsta (2015) it is proposed how Farsta can be developed into a unified, modern and walk friendly city district. The proposal is grounded in different strategies, among others ”Vänd Farsta mot vattnet” (turn Farsta towards the water) in which Drevviken and Magelungen are focus areas. A local trail to co-join these areas called “Farstastråket” is proposed, with the aim to improve the accessibility to respective beach areas. Also, a continuous walking path along the shoreline is proposed, to be able to connect Larsboda to surrounding areas. Another aim with this strategy is to develop attractive living-environments for Farsta residents, while at the same time strengthening the recreational values. By transforming routes that today constitutes a barrier between central Farsta and Drevviken, the purpose is to increase the accessibility to Drevviken’s recreational areas.

To increase public access to Larsboda’s green areas, a park is to be built in Klockelund area and a cohesive passage ranging from central Farsta to Drevviken. Also, paths to improve accessibility are to be constructed throughout Larsboda strand, along Drevviken as well as in the forests. The proposed plan is expected to improve the recreational areas by making them more attractive and accessible, which in turn would attract more people to visit Larsboda strand. The increased activity in Larsboda strand would

have both negative and positive effects. The positive effects are that it will lead to more people taking part of the scenic area with its high recreational values, which have positive effects on social activity and human health. The negative impacts on recreational values could be that the area gets overly crowded and lead to increased pressure on flora and fauna. Consequences of the increased flow of visitors are lacking in the current project plans. Other impacts concerning this issue are increased traffic, increased degradation of the ground and increased noise levels.

The proposed plan would mean that the oak trees and other valuable vegetation would be removed in Larsboda strand, which would have major impact on the recreational values as the area would lose parts of its green identity. Building within the shoreline would also risk having impacts on these ecological values.

The proposed plan in Larsboda will have some impact on the sociotope values, especially "peacefulness", "green oasis" and "floral glory" are at risk of being affected. The construction phase in Karlsvik strand and Klockelund will lead to increased noise levels throughout the area which will contribute to a disturbance of experienced outdoor recreation.

Uncertainties with proposed plan

Due to lack of information about the relocation of allotment garden, it is assessed that there are big uncertainties considering what environmental impacts this may have. The City Building Office has performed preparatory studies that indicates that the water quality in Forsån will not be affected. Several NGOs (Naturskyddsföreningen, Söderorts Naturskyddsförening and Drevviken Långsjöns fiskevårdsförening) argue that the relocation of the allotment garden could degrade the water quality in Forsån and Drevviken, partly by the move itself and partly because of claiming natural land for development (Stadsbyggnadskontoret, 2015b). Forsån is a part of EU's water directive (2000/60/EG) and should be investigated more thoroughly before relocating the allotment garden here. Also, every fifty years, parts of the areas around Drevviken are flooded, including the new proposed allotment garden area (Myndigheten för samhällsskydd och beredskap, 2016). This needs to be taken into consideration when planning the new location for the allotment garden since it could have environmental och recreational impacts. Our own biological inventory of the area shows traces of beaver in this area and along Forsån, which is something that could be negatively affected by human activity.

7.9.5 Impacts with alternative plan

In the alternative plan it is suggested that 76 of the camping huts should be remained due to their high cultural, social, and recreational values. This would mean that less apartments will be built in Larsboda strand, but it is assessed that the camping hut area has too many high values to be removed.

Another part of the alternative plan is to keep part of the allotment garden and integrate it in new development plans in Klockelund (figure 5). Integrating a part of the allotment garden plots (about the size of 2 plots) would strengthen the green structure and also offer the residents the possibility to grow flowers or food which would add recreational value. These plots are to be offered to new residents in Klockelund, as the Larsboda Koloniträdgårdsförening has been offered another location.

The major difference between the two alternatives are regarding saving a part of the allotment garden and saving more camping huts, and the main reason for these suggestions are to add value to Larsboda's existing values by improving them. Both impacts regarding improved accessibility and risk of overcrowding are equal for both alternatives, but with the alternative plan, the risk of overcrowding will be mitigated by keeping most of the camping huts, which means less apartments will be built (and therefore less crowded). To assure public access to outdoor recreation facilities along the shoreline, there should be no building within the shore protection.

7.9.6 Mitigation measures

Many of the camping huts needs to be renovated if not risking further degradation. The camping hut area is today perceived as private, inaccessible and with unsafe surroundings, which affects the use of it. To add value to the camping hut area, increased public access is suggested to be able to include more people. This could be made by adding information about their cultural value and ongoing activities. Also, extended social activity by the camping hut area is suggested.

Improve, secure and clean up the surroundings along the shoreline in Karlsvik strand. This part of Larsboda has great potential to become an even more beautiful and well used promenade for Farsta citizens.

To add value to the allotment garden, a suggestion is to cooperate with nearby schools to inform and teach pupils about the value of the area, or maybe to let them cultivate themselves. This activity could be linked to studies about sustainable development, resilience, climate change, food security and ecosystem services. Sweden is experiencing a growing interest for urban farming (Church *et al.*, 2014), which should be taken into account as it could be part of a strategy that encourages sustainable development.

In the design of the new park in Klockelund, it is important to take account of the existing biodiversity and the ecological values, to keep Farsta's green identity. When natural land is removed to build new residential areas, it is important to compensate for the losses that it entails. To mitigate the loss of green areas, one strategy could be to work with green noise protection, such as in figure 41, which would add recreational values to the area, but also compensate for the loss of plants in the allotment garden. However, it should be emphasized that this type of compensation never can replace the natural values that are removed.



Figure 41. Picture showing an example of green noise protection. Jansson & Partner, 2016.

7.10 Social analysis

7.10.1 Environmental baseline

The nature in Larsboda strand is of big social value for the inhabitants of Farsta, regardless of age and gender. The closeness to the natural areas around Drevviken and close by lake Magelungen has been identified as a main attraction of living in Farsta, which also contributes to Farsta´s green identity and recreational value. The most appreciated areas in Larsboda strand are the beach Hökarängsbadet, the walking path by the shoreline as well as the open green spaces (White arkitekter, 2015).

The green area around Drevviken is also important for the children and teenagers in Farsta. Especially the beach is of great value for recreational purposes, playing games and school activities. Other green areas in Larsboda strand is today not frequently used by the younger generation, which could be enhanced by better accessibility (Topia landskapsarkitekter, 2013).

Result from interviews and mapping

When looking at the participative map (figure 42), it is very clear that half of the planned area is most frequently used and appreciated today, i.e. along the beach and walking path by the shoreline. After the walking path the area is perceived as a private space due to fences around the privately-owned villas, the municipally owned villa Ulrikedal and the plant shop. Around the camping huts in Karlsvik strand the accessibility and feeling of private space have also been criticized which hinders the usability of the public area. The area is today mostly used for walks, bike rides, jogging, fishing, walking dogs, picnics, playing with kids and swimming.

Some of the most appreciated areas pinpointed on the map include the local boat club, favourite nature spots, sledding hill, café in the summertime, privately owned camping huts, most appreciated view spots, several favourite places for picnics and swimming spots along the shore. The least appreciated areas include problems with accessibility (both concerning difficulties with crossing Nynäsvägen and bad accessibilities for pedestrians), failed tree planting area, unpleasing ditch, unappreciated building by the beach, lack of lightning in the area and unappreciated industrial area. For further information, see appendix VII.



Figure 42. Map of Larsboda (Google Maps). Map conducted on site and on interview, 5th ,9th and 14th of December 2016. Red dots represent negative impressions and green dots represent positive impressions of the area.

7.10.2 Impacts for zero alternative

Without any intervention in the area it will continue to be a recreational hub important for the inhabitants of Farsta. The low accessibility and the feeling of privatized space will keep half of the area to be less frequently used by the public, compared to the area with the walking path and the beach. The allotment garden and camping huts will still be social meeting points of great values for those utilizing the facilities, but less for the public of Farsta. A feeling of unsafety due to lack of lighting will continue to be an issue that will limit the usage of the area to the hours of sunlight.

7.10.3 Impacts with proposed plan

A big part of the proposal highlights the importance of enhanced accessibility to the public green areas surrounding lake Drevviken. By demolishing the municipally owned croft "Ulrikelund" (placed between the current plant shop and the lake) a large green area is opened up to the public that connects the green areas of Karlsvik strand, Klockelund and then further down to Magelungen. The private feel of the green area in Klockelund is resolved by opening up areas that are fenced today which also contributes to removing today´s perceived barrier between the two areas.

Since the area already is a very popular destination for the inhabitants of Farsta, especially regarding the beach on sunny summer days, the area risks getting over crowded with the new inhabitants. Whether the planned docks along the shoreline is enough to sustain the growing population of Farsta is uncertain due to lack of information. When reading the proposal keywords, such as building condominiums with "high architectural values" in the park area, reveals what type of residents that are desirable in the neighbourhood. Also, when calculating the number of apartments, the planned activity generates 260 less units compared to the alternative plan, even though less area is occupied. Since calculations were made with 75 square meter apartments the proposed alternative must compose of very big apartments, i.e. bigger than three room apartments, and thus be planned for socio-economic stronger buyers. Rental apartments are only situated along Perstorpsvägen potentially creating a barrier between the inhabitants of the area as well as putting the socio-economic weaker population in a more sensitive and hazardous environment. Since surrounding neighbourhoods of Farsta is of a lower socio-economic position, the new developments risk creating a negative segregational effect in Farsta where the public is rather excluded than included in the public urban space. There is a risk that the area is perceived as private and not open to all citizens. Impacts of social matters are hard to predict since they are very dependent on the specific location and its social nature. However, there is a potential risk of negative effects in the neighbourhood where the green areas of Farsta is perceived to belong to the more socio-economic strong and not to all citizens.

The removal of the camping huts will have major social impacts, especially the loss of social activities hosted by Hökarängens friluftslivsförening in the camping hut area. The social activities by the camping huts are of great importance to locals and the members of the association. Thus, the area has great potential to create new social values. If development plans are implemented the areas around Larsboda strand will connect Stortorp, Perstorp and Sköndal together as residential areas. This might be a positive consequence for the social connectivity between residential areas along Drevviken and to the former Telia industrial area.

7.10.4 Impacts with alternative plan

Both impacts regarding physical accessibility and risk of overcrowding are equal for both alternatives. The major difference between the two alternatives concern keeping a part of the allotment garden and saving more camping huts. The main reasons for this is to continue fostering the location specific values that the area have today, i.e. the historical and present social and environmental values of the allotment garden and camping huts as well as building outside the shore protection. Another reason is to respect the complaints from the existing villa owners in the area that have stated a threat from the closeness of the new developments on the current allotment garden (Stadsbyggnadskontoret, 2015b). By keeping a part of the allotment garden some of the former social values of the area will be kept, and can work as a link between former and present use of the area. It will also ensure the area will to not feel privatized and only intended for the new inhabitants of the area, but rather includes the former users of the neighbourhood.

Subjects that have not been taken into account in this section but that are of crucial importance for the social analysis of the neighbourhood are the extended need for municipal services such as schools, preschools, daycares, libraries and medical centers for the new inhabitants of Farsta.

7.10.5 Mitigation measures

To ensure that the green areas keep being open to everyone, regardless of gender, age and socio-economic status, it is crucial to plan the green areas surrounding the new housing as openly and inviting as possible. By creating a shared ownership of the open spaces between the old users and the new inhabitants a more welcoming atmosphere can be ensured.

To prevent segregational effects municipal services (such as library, museum etc) open for all inhabitants of Farsta could be located in Larsboda strand to encourage a natural flow of inhabitants creating a mixed use of the neighbourhood.

It is important to listen to the inhabitants of Farsta and consider their way of using the area today, as a way of implementing equal values in the plan of the new neighbourhood. Additionally, a thorough follow up of social values after the plan has been implemented is important to understand and evaluate how the planned proposal affects issues such as social equality, well being, welcoming atmosphere and safety.

7.11 Predicted climate change

The UN's Intergovernmental Panel on Climate Change (IPCC) has concluded that global warming so far has been 0.7 degrees over the last 100 years. If the reduction target in global emissions are reached, it will be possible to control the temperature increase in the longer term, however, the continued warming is unavoidable.

7.11.1 Environmental baseline

Temperature will rise more in Sweden and Scandinavia than the global average. A large number of coupled atmosphere-ocean general circulation models (AOGCMs) shows the average temperature in Sweden would rise by 3-5 degrees by the 2080s in comparison with the period 1960-1990 (Lind & Kjellström 2008). Sea levels are expected to rise by 0.2-0.6 meters globally over the next hundred years and are expected to rise by up to 0.2 meters in seas adjoining Sweden. The precipitation patterns will also change in the future. Precipitation will increase in most of the

country during the autumn, winter and spring. In summer, the climate will be warmer and drier, particularly in southern Sweden (Andréasson *et al*., 2004).

As the Larsboda strand is located in Farsta, Stockholm, the meteorological data of Stockholm county obtained from Swedish Meteorological and Hydrological Institute (SMHI, 2016) were considered. Figure 43 shows the calculated change in annual mean temperature (°C) and annual precipitation (%) in Stockholm county during the years 1961-2100 compared with normal (mean for 1961-1990).

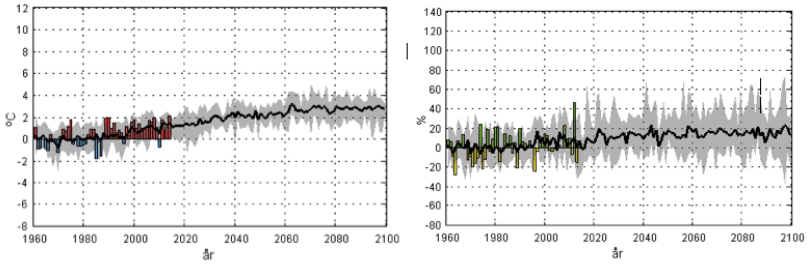


Figure 43. Calculated change in annual temperature (°C) and annual precipitation (%) in the Stockholm county for the period 1961-2100 compared with 1961-1990.

With the increasing of sea level and rainfall, the quantity of stormwater will increase in most parts of the country which will lead to high risk of flooding, landslides and erosion. The flooding map (see figure 26 & 27) show that parts of Larsboda strand today is flooded at elevated sea levels in Drevviken. The ground in Karlsvik strand is higher and the water flows downwards and accumulates in Klockelund, which means that there is a high risk of flooding in Klockelund in periods of intense precipitation.

7.11.2 Impacts for zero alternative

The effect of greenhouse gases released into the atmosphere causing global warming will probably increase the risk of flooding. The flooding might also damage the sewerage system, power transmission, roadways and other structures in Larsboda strand. In more serious cases, the lack of clean water combined with the destructed sewerage system will increase the probability of infectious disease that is harmful for human health. It also has far-reaching impact on local ecosystems due to the loss of habitats and valuable native species.

7.11.3 Impacts with proposed plan

With the planned activity, there may be an increase in the risk of flooding in Larsboda strand due to the increasing hard surface, the buildings can be vulnerable to climate change. In addition, extremes of future temperature and high precipitation can also directly or indirectly increase the probability of causing harm. Especially in the winter, since sudden heavy snows can cause more rainwater and meltwater that could destroy houses, paved areas and roads. In the detailed development plan for Klockelund, with the mitigation measures, the likelihood of the destruction of the building foundations will reduce due to the raising of the ground level. Other ground movement like landslide and erosions will also be reduced.

7.11.4 Impacts with alternative plan

The impact of predicted climate change on construction will be similar to the proposed plan. All the activity on a construction site can increase the risk of flooding, landslide and erosion in Larsboda strand that would destroy the building, roads and other infrastructures. The only difference regards the scale of risks,

where the alternative plan contains less buildings within the most crucial area of flooding, compared to the proposed alternative.

7.11.5 Mitigation measures

Climate adaptation policy

Climate adaptation measures will be required within most aspects of society, new guidelines should be introduced to protect existing and future buildings from new risks. Since the 2007 vulnerability assessment (Swedish Commission on Climate and Vulnerability, 2007), the Swedish government has implemented several concrete adaptation measures. For example, it established an adaptation coordination post at all the 21 Swedish county boards to coordinate regional adaptation, and it changed the Planning and Building Act (2010:900) to state that adaptation concerns are to be considered in municipalities' comprehensive and location-specific planning (White paper-climate change adaption in the Nordic countries, 2013).

Reducing greenhouse gas emissions

According to the Swedish Climate and Energy Policy (2009), the greenhouse gas emissions should be 40 percent less in 2020 compared to 1990, greenhouse gas emissions measured in carbon dioxide equivalents will have to decrease by about 20 million tons. In order to reach the target, several measures can be implemented. For example, using the advanced engines and vehicle technology to reduce the toxicity of exhaust leaving the engine.

Adapting buildings to climate change

In Sweden, the adaption may be with regard to limiting snow load and flooding risk in particular. The construction standard should be enhanced for the new buildings. For the already existing houses in covered area, instructions for the owners are required, and they should contain the typical weaknesses of the buildings as well as the guidance on how to remedy them. Higher foundation is another effective way to avoiding the flooding, in Larsboda detailed development plan, the building should be constructed with a minimum floor level of 1.5 meters according to County Administrative Board.

Adapting roads to climate change

New roads must be designed in accordance with predicted future climate change. For existing roads, high flooding risk from increasing precipitation should be taken into consideration. Mitigation measure like ditch solutions should be implemented to store the stormwater in order to reduce the flooding risk. In this case, Trafikverket (Swedish Transport Administration) should update the road drainage systems to adapt to the future climate, both with regard to new construction and when managing existing infrastructure.

8. Summary of Environmental impact assessment

8.1 Cumulative effects and CLD

Cumulative effect refers to the impacts that result from incremental changes caused by other past, present or reasonably foreseeable actions together with the project. The impact of the construction activity might be individually relatively minor but in combination major. The cumulative effect of this project is illustrated with a Causal Loop Diagram (CLD) shown in figure 44. The Causal Loop Diagram gives a simplified picture of the cumulative effect in Larsboda strand with the construction activity and only the most significant elements are taken into account.

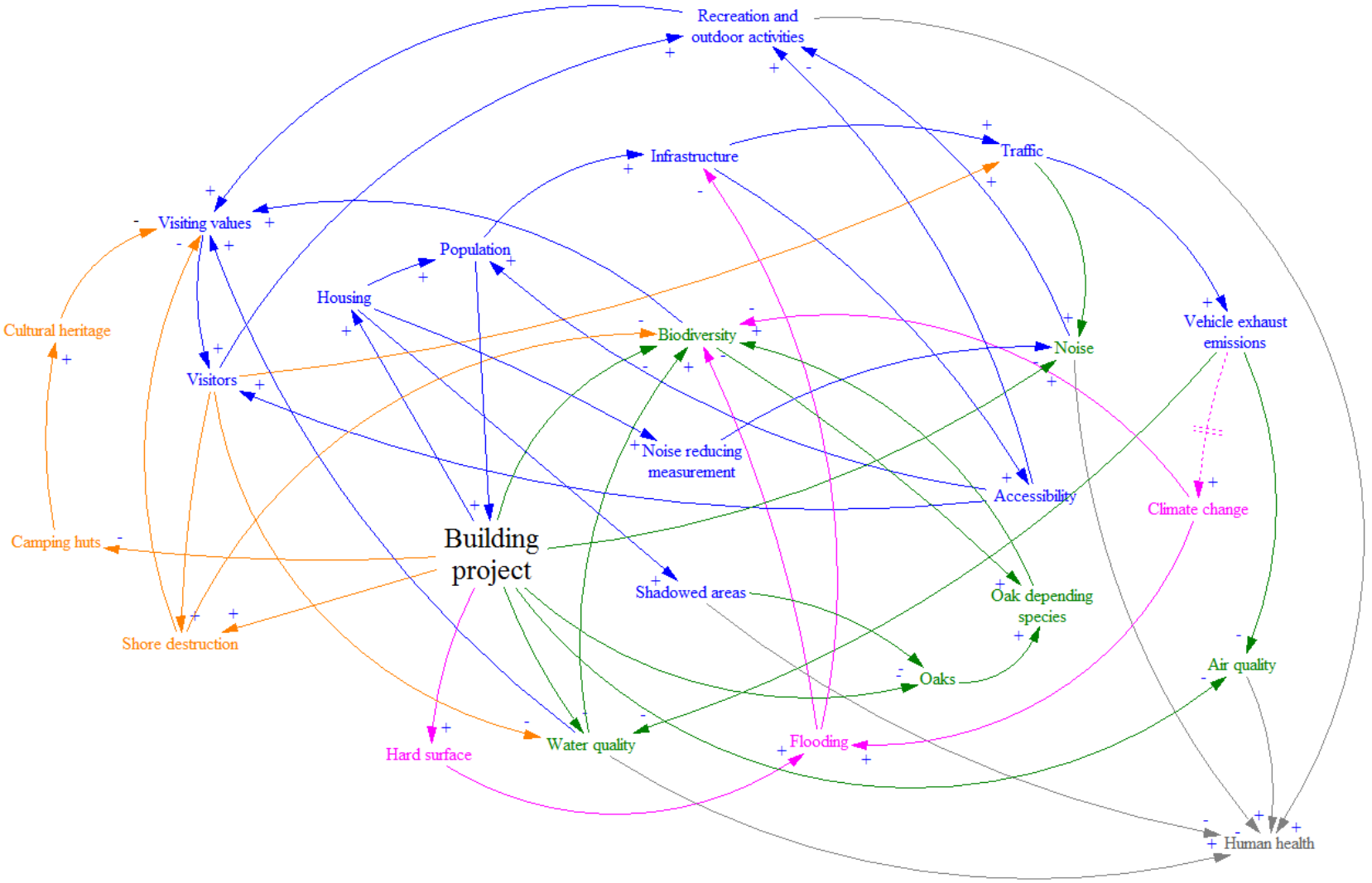


Figure 44. The Causal Loop Diagram (CLD) of the ecological and social system with the building project in Larsboda strand. The arrows explain the direction of the causality and the polarity of the arrows explain if there is a change in the same direction(+) or in the opposite direction(-).

The blue part of the CLD represents the social part in Larsboda strand. With the *Building project*, the *Housing* and *Population* in Larsboda Strand will increase as planned, which will definitely lead to new *Infrastructure* and improved *Accessibility*. As a result, the *Recreation and outdoor activities* and *Traffic* in Larsboda strand will be enhanced. Higher *Accessibility* means more *Population* and *Visitors*. The *Recreation and outdoor activities* will enhance the *visiting values* that will attract more *Visitors*. More *Housing* leads to more *Shadowed areas* and *Noise reduction measurements* referring to noise reducing walls and decreased noise levels through high buildings.

The green part of the CLD shows the ecological part in Larsboda strand. The pollutants from *Building project* have the potential to cause lower *Water quality* that may lead to lower *Biodiversity*. The *Air quality* will subsequently be affected as well. The precious *Oaks* will decrease with the *Building projec*t and decrease *Oak depending species,* this leads to worsened *Biodiversity.* Subsequently the *housing projects* will increase *shadowed areas* leading to fewer *oaks.* Besides, the *Vehicle exhaust emissions* will affect the *Water quality* and *Air quality*.

The orange part of the CLD shows the shore protection and cultural heritage in Larsboda strand. More *Visitors* will be attracted to Larsboda strand with the proposed plan that might lead to lower *Water quality* and more *Traffic*. What's more, there will be a high risk of *Shoreline destruction* due to the *Building project*, the increasing number of *Visitors* and the *Recreation and outdoor activities* near the shoreline. Then more *Shoreline destruction*, the more loss of *biodiversity*, the less *Visiting values*. In the *Building project*, a number of *Camping huts* with high historical value will be removed that would have a negative effect on the *Cultural heritage*.

The pink part of the CLD represents the effect that the predicted *Climate change* might have on Larsboda strand. The *Vehicle exhaust emissions* from Nynäsvägen would increase the future temperature and precipitation with a delay that have a high potential to increase the *Flooding risk* in Larsboda strand and worsen the *biodiversity* and *Infrastructure*.

The gray part of the CLD shows that increasing *Shadowed areas*, lower *Water quality* and *Air quality*, higher level of *Noise* and high *Flooding* will significantly affect *Human health* in Larsboda strand.

The cumulative effects of the project is illustrated with the CLD presented above, the social and ecological system in Larsboda strand can be affected through the combined impacts of human activities but these impacts cannot simply be added up. For instance, the biodiversity in Larsboda strand can be destructed directly by the building project, it can also be affected with the loss of precious oak species and oak depending species, the high risk of flooding due to climate change and increasing hard surface is another significant influential factor. Moreover, since these two areas, Klockelund and Karlsvik strand, are very interrelated, the interaction effect between them should also be considered over time.

8.2 Impact Matrix

The impact matrix (see Table 3) contains the three alternatives and their respective impacts on the environmental impacts presented in this EIA. The matrix has a five-graded scale and ranges from major negative impact to major positive impact. Every step is represented by the certain color.

Table 3. Impact Matrix showing the level of environmental impacts in relation to the three planning alternatives.

	Zero alternative	Proposed plan	Alternative plan
Physical landscape and ground condition	**+-0** Landscape will look mostly the same as today and ground condition will not change.	**-2** Dramatic changes when when residential buildings will replace allotment garden, oak forest and other non-exploited areas. New and relocated roads. Ground will be hardened and elevated in some areas.	**-1** Still big changes, but not as dramatic when more forest will be preserved, no buildings within shore protected area and parts of allotment garden is spared.
Cultural landscape	**+-0** No dramatic changes on the cultural landscape. There is uncertainty regarding the camping hut area with no existing regulation plan. The cultural landscape might be degraded if the oaks and old farming land in Klockelund continues to grow with more vegetation.	**-2** There will be dramatic change with a total shift in land use. A significant impact with losing the camping huts, replacing some of the small houses by the shoreline with multifamily housing and moving Perstorpsvägen closer to Nynäsvägen.	**-1** A negative impact with relocating the road, and building many residential buildings but the impact will not be as significant as in the proposed plan since many camping huts are preserved and there are no new houses by the shoreline. The old road between Klockelund and Karlsvik strand is also renovated with the new recreational walking path.
Water quality	**+-0** Continued water pollution due to the emissions from Nynäsvägen	**-1** Stormwater contains pollutants from construction sites and nutrients from allotment garden. The increased vehicle exhausts emissions from Perstoprsvägen also have the potential to cause water pollution.	**-1** Same as for the proposed plan.

Biodiversity & connectivity	**+-0** Trees stand too close and shaded which declines their general health. Some parts are overgrown. Unfragmented.	**-2** Dispersal of oaks, amphibians and insects are highly disturbed by construction of residential buildings and the protective noise measurements. The ditch is filled, meaning a loss of important amphibian habitat. Fragmentation will take place and biodiversity will be lost.	**-1** No dwellings in the shoreline protection will mean less disturbed wildlife. More oaks are preserved which will not be as negative for the dispersal of oak-dependent species as in the proposed plan. The ditch will remain. Fragmentation will still take place and biodiversity will be lost.
Air quality	**+-0** Concentrations of PM10 and NO2 will have a slight increase due to increased traffic on Nynäsvägen	**-1** Dust from construction. More people will live in areas close to Nynäsvägen where air quality is near EQS.	**-1** Same as for the proposed plan.
Noise	**-1** Noise levels are currently high in the area and will increase slightly due to increased traffic on Nynäsvägen.	**-1** Increased noise from construction and blasting. Buildings near Nynäsvägen will have high noise level surroundings. High demand on mitigation measures.	**-1** Mostly same as for the proposed plan.
Risk analysis	**+-0** Residential areas near Nynäsvägen with higher risk due to increased transportation of dangerous goods will not be built.	**-1** Residential buildings and preschools will be built near Nynäsvägen, which is associated with risks. Garage and storage will be built very close to road. High demand on mitigation measures.	**-1** Mostly same as for proposed plan.
Recreation & outdoor activity	**-1** Bad accessibility. Recreational values will remain the same, except for the camping huts that will degrade if not taken care of.	**-1** Better accessibility and public space, but will lead to increased pressure on recreational values. Loss of camping huts and allotment garden.	**+2** 76 camping huts spared, part of allotment garden being kept at today's location, no dwellings within shoreline.

Social analysis	**+-0** Continuously a popular destination for inhabitants of Farsta but with limited accessibility in parts of the public space. Preserved social values.	**-1** Risks creating a private feel to the new area and a segregational barrier that excludes the public. Risk of crowdedness. The physical accessibility is enhanced through better paths and open space.	**+-0** Ensures more green space from old social values (cottages and allotment garden) that can work as a bridge between old and new uses of the area. Risk of crowdedness.
Climate	**+-0** Continued greenhouse gas emissions from heavy traffic in Nynäsvägen as well as risk of flooding in parts of the area.	**-1** Increased greenhouse gas emissions from heavy traffic in Nynäsvägen and Perstorpsvägen due to increasing number of residents and visitors. Increased risk of flooding due to the increasing hard surface.	**-1** Mostly same as for the proposed plan
Transport	**-1** Bad accessibility for visitors without car. Minor renovation of the bicycle path at Perstorpsvägen. Lower speed at Perstorpsvägen. More cars at Nynäsvägen.	**+1** More traffic at Nynäsvägen and Perstorpsvägen. Probably better public transport with more bus lines at Perstorpsvägen and bus stop at Nynäsvägen but still faster to go by car. Better accessibility for bikes and pedestrians with socioduct over Nynäsvägen and a renovation of the bicycle path.	**+1** Mostly same as for proposed plan.

8.3 Consequences in relation to Sweden's environmental objectives

The matrix (Table 4) shows the consequences of zero alternative, proposed plan and alternative plan in relation to the Sweden's environmental objectives. Both positive and negative effects of the subjects are presented under the different options.

Table 4. Consequences in relation to environmental objectives.

Environmental objectives	Zero Alternative	Proposed Plan	Alternative Plan
Reduced climate impact	**Negative effect** Continued greenhouse gas emissions from heavy traffic on Nynäsvägen.	**Negative effect** Increased greenhouse gas emissions from heavy traffic on nearby roads when the number of residents in the area are increasing.	**Negative effect** Increased vehicle exhausts from nearby roads when the number of residents in the area are increasing.
Clean air	**Negative effect** Continued vehicle exhausts from Nynäsvägen polluting the air.	**Negative effect** Increased vehicle exhausts from nearby roads when the number of residents are increasing.	**Negative effect** Increased vehicle exhausts from nearby roads when the number of residents are increasing.
Natural acidification only	**Negative effect** Continued acidic emissions from heavy traffic on Nynäsvägen.	**Negative effect** Increased acidic emissions from heavy traffic on nearby roads when the number of residents are increasing. Increased water pollution due to the increasing number of visitors and residents.	**Positive effect** Purification of stormwater. **Negative effect** Increased water pollution due to the increasing number of visitors and residentials.
A non-toxic environment	No significant impacts.	No significant impacts.	No significant impacts.
A protective ozone layer	No significant impacts.	No significant impacts.	No significant impacts.

A safe radiation environment	No significant impacts.	No significant impacts.	No significant impacts.
Zero eutrophication	**Negative effect** Continued nitrogen dioxide emissions from heavy traffic on Nynäsvägen.	**Negative effect** Increased nitrogen dioxide emissions from heavy traffic on nearby roads when the number of residents are increasing. Increased water pollution due to the increasing number of visitors.	**Positive effect** Reduced nitrogen dioxide emissions. Purification of stormwater. **Negative effect** Increased water pollution due to the increasing number of visitors.
Flourishing lakes and streams	**Negative effec**t Pollution in lakes and streams will continued to disturb the wildlife. Continued water pollution due to the traffic emissions.	**Negative effect** Pollution in lakes and streams will continued to disturb the wildlife. Increased water pollution due to the traffic emissions and increasing number of visitors and residents.	**Positive effect** Reduced vehicle emissions. Purification of stormwater. **Negative effect** Increased water pollution due to the increasing number of visitors and residents.
Good quality groundwater	No significant impacts.	No significant impacts.	No significant impacts.
A balanced marine environment, flourishing coastal areas and archipelagos	No significant impacts.	No significant impacts.	No significant impacts.
Thriving wetlands	No significant impacts.	**Negative effect** Habitat destruction in shore areas. Reduction of the capacity to provide ecosystem services.	**Positive effect** Less loss of amphibian habitat, especially since shore protected areas will not be exploited.

Sustainable forests	**Positive effect** Preservation of precious oak species. **Negative effect** Deterioration of precious oak species due to poor management.	**Positive effect** Oaks forest might have enhanced management if area will be park. **Negative effect** Disappearance of precious oak species. Disturbance of the wildlife since some forests disappear.	**Positive effect** Preservation of more precious oak species. Less loss of amphibian habitat.
A varied agricultural landscape	**Positive effect** Preservation of allotment garden and arboretum. Preservation of camping huts. **Negative effect** Deterioration of allotment garden and arboretum due to poor management. Poor management of the camping huts.	**Negative effect** Relocation of the allotment garden. Loss of camping huts.	**Positive effect** Preservation of some part allotment garden. Preservation of most of the camping huts. **Negative effect** Most of the allotment garden and arboretum will be exploited. Some of the camping huts will be lost.
A magnificent mountain landscape	No significant impacts.	No significant impacts.	No significant impacts.
A good built environment	**Negative effect** Continued noise from heavy traffic on Nynäsvägen. Low accessibility. Continued darkness and unsafety.	**Positive effect** Increased accessibility and social connectivity. Reduced noise level if noise reduction barriers are built. **Negative effect** Noise from the construction site. Some apartments will be in areas with high noise levels. Loss of cultural heritage and values.	**Positive effect** Reduced noise level if noise reduction barriers are built. Increased accessibility and social connectivity. More of cultural landscape is preserved. Clearer connection to historical values. **Negative effect** Noise from the construction site.

			Some apartments will be in areas with high noise levels.
A rich diversity of plant and animal life	No significant impacts.	**Negative effect** Destruction of the amphibian habitats due to the new dwellings. Disappearance of valuable oaks and oak living species.	**Positive effect** Preservation of more valuable oak species. Less loss of amphibian habitat. Part of allotment preserved. **Negative effect** Plants and animals will to some extent still be negatively affected by exploitation.

8.5 Discussion

8.5.1 Joining the plans of Karlsvik strand and Klockelund together

In this EIA we propose an alternative plan where the two planned areas Klockelund and Karlsvik strand will be combined to one development plan. We find several advantages by doing this. First and foremost, this proposal is based on our own understanding of the area when visiting it for field studies. The two areas are very interrelated when it comes to physical elements of the landscape. Both of them are within the shore protected area of the northwestern part of Drevviken and they both have broad-leafed forests with notable amounts of old oaks in it. Moreover, they are to the same extent affected by noise, risks and pollutants from Nynäsvägen. To some extent they also share the cultural landscape in form of historic land use, roads and recreational usage. With these similarities in mind, the consideration of environmental aspects is easier to take into account if both areas are planned together, since one action in Klockelund most likely will affect the environment in Karlsvik strand and vice versa. Also, an action in one of the areas will probably have similar effect on surrounding landscape. This is especially true for the impacts on water quality in Drevviken and organisms who are depending on connections between oak forests.

This also leads us to the advantage that the estimation of the plans environmental impacts will be more just and closer to reality if they are estimated together. If consideration is taken to only one of the plans the environmental impacts might not be classified as significant (which also was the case in the City building office's assessment of the plans (Stadsbyggnadskontoret, 2016, Stadsbyggnadskontoret, 2015c)). If the impacts for both areas are combined, the environmental impacts might in some aspects actually be significant. This would not mean to simply add up impacts to get a more significant total impact, it would rather be to acknowledge the fact that these two areas are very connected and that they therefore should be assessed together. This sort of reasoning goes for much of the politics of planning in Sweden. By dividing bigger planned areas into smaller areas the estimation of their environmental impacts will of course be less than it would have been by a plan for a bigger area. This kind of planning, by some called the "salami effect" (Emmelin, oral, 2016), will make less of the planned areas considered to have a significant environmental impact (which in turn will make them free from the obligation to do an EIA).

The two areas Klockelund and Karlsvik strand (with 1200 new apartments in total) is a minor part of the development plans for Farsta with its 8000 new apartments until 2030 (Tyngdpunkt Farsta, 2015). Surrounding Larsboda strand there are several projects currently being finalized that is estimated to get built during 2017. To estimate the environmental impacts on a more strategic level there is a need for a strategic environmental assessment that preferable would be made together with the programme Tyngdpunkt Farsta (2015).

It is hard to predict how the cumulative effects of the plans will develop when building such major developments within a limited time span. As intended to illustrate in the Causal loop diagram (CLD) in figure 44 there are several affecting factors that together can create cumulative effects unthought of on before hand. This opts for a holistic evaluation of the developments of the whole Farsta, to avoid combined negative consequences of the plans. By joining the plans of Karlsvik strand and Klockelund together we argue that the cumulative effects might at least be easier to

identify and evaluate, compared to evaluating the two plans separately.

8.5.2 Contradicting goals

When evaluating in what ways the plans might affect the environmental aspects covered in this EIA, it is clear that different environmental goals will contradict each other if a plan is implemented. In these cases, it is important to discuss which goal that is most relevant to prioritize. One example in this EIA is the possible conflict of achieving goals concerning noise and goals concerning air quality. High dense buildings along Nynäsvägen with the purpose to reduce noise level closer to Drevviken, will at the same time leads to concentrated levels of polluted air from the traffic. In areas between garages and apartments the polluted air coming from Nynäsvägen will be more still since it is "trapped" between the buildings. If garages and storage rooms were not built as a barrier between road and apartments the air could flow more freely and increase in quality, but that would also reduce the noise dampening effect. For this area the noise might be a bigger issue since it clearly will exceed national standards. Additionally, in this case, the placement of non-residential buildings along Nynäsvägen will help reduce the risks coming from transport of dangerous goods.

Subsequently, by building noise walls and high rise buildings along Perstorpsvägen the public space closer to Drevviken can be enjoyed with less noise from the highway. The same interventions can also create barriers that excludes the public from using the public spaces and cause a privatized feeling to the neighbourhood. Since high noise levels are a big concern for the area, the noise reduction measurements are prioritized and puts extra pressure on creating an open urban atmosphere where all inhabitants feel welcome.

Another contradiction concerns the recreational use of the area as the calm and unexploited values it has today, but also lacking accessibility and lights which, if dealt with, might change the appreciated calmness and "wilderness" of the area. In this discussion, it is important to question for whom the area is planned for, is the purpose to save as many of today's values as possible or to satisfy the majority? It is hard to satisfy all but by acknowledging the different users, their needs and appreciations, it is easier to find a fitting middle way. A participatory mapping like the one made in this EIA is one way to acknowledging different users value of the area but there is need for more investigation to get a more just picture of how different users perceive the area.

Concerning the cultural heritage there are also some contradictory goals to consider regarding the accessibility. Saving the main part of the camping huts as in our alternative would reduce the negative impact on the cultural landscape. At the same time the result from our interviews with local people indicates that the camping huts make the area feel partly private and unwelcoming (anonymous interviews on site, 6th and 9th Dec, 2016).

8.5.3 Conflict between urbanization and nature conservation

Another major contradiction is between conserving nature values and meeting the goals for housing developments within Stockholm. The population of Stockholm county is constantly growing (SCB, 2016). This increase leads to a higher pressure on the residential development (Naturvårdsverket, 2015) but also an increased need for green space near urban areas (RTK, 2008). The municipalities need to develop more residential buildings to ease the residential deficiency in the county. However, the municipalities also need to compensate for the loss of green space.

This creates a conflict between nature conservation and residential development.

The green areas within the conurbation are the first to go when new residential areas are constructed, which leads to a loss of connectivity and biodiversity (RTK, 2008). To avoid fragmentation and maintaining functional ecosystems, more environmental consideration needs to be taken into account in the planning phase of exploitation (Naturvårdsverket, 2015). The Swedish Environmental Protection Agency states that only 10 % of the comprehensive plans on municipal level fully include the Environmental Quality Standards, in spite of the fact that it is a demand in chapter 5 §4 of the Planning and Building act (Naturvårdsverket, 2015). The values of nature conservation and residential development does not need to collide if environmental consideration is included in the planning phase.

8.5.4 Shore protection and the lesson from the verdict of lake Råstasjön

In the alternative plan we decided not to build within the shore protected area. Reasons for this is mostly originating from demands in the Environmental code chapter 7 § 13. But also the recent verdict from lake Råstasjön motivates an excluding of building activities within the shore protected area (Svea hovrätt, 2016). The City Building Office had in this case permit from the Land and Environment Court to build within shore protected area around lake Råstasjön. But after an appeal from local nature protection organisations and others, the Land and Environment Court of Appeal overturned this permit and decided that no buildings should be built within shore protection area. Reasons for the repeal was that the municipality's reasons in the detailed development plan to build within shore protected area was not strong enough.

The judgement from the Land and Environment Court of Appeal can be seen as precedent in other similar cases regarding residential building permits within shore protected areas, since this was one of the first cases where the shore protection regulation was tested in the highest court (Vi i Solna, 2016). There are some differences between Råstasjön and Larsboda strand shore area. For example, Råstasjön has more obvious high nature values since it is a well-known birding area and therefore has much more data confirming the high nature values. For Larsboda strand however there is high values around the oaks and along the shore for amphibians. A coming survey will be made by nature organizations will show how high these values are (Ekologigruppen, written communication, 2015).

Another difference is that Råstasjön already was well used for recreation and had high accessibility. For Larsboda strand the area's accessibility has been criticized by some, but not all (anonymous interviews on site, 6th and 9th Dec, 2016). One argument that was on the developer's side in Råstasjön was that the planned area should be within short walking distance to the planned metro station "Arenastaden", and was supposed to be an important part of a new city district. In Larsboda strand the distance to the metro and commuter train is further than one kilometer, and therefore this argument is not as strong as it was in Råstasjön. With this comparison and the final verdict of Råstasjön in mind, we consider it to be wise to not build within shore protected area. This might also enhance the chance to approve the detailed development plan without too many appeals, and by that a possibility to faster meet the high needs for more available apartments in Stockholm.

8.5.5 Plans in progress makes impacts difficult to assess

Some environmental impacts are not easy to predict since some of the information in the detailed development plan is not decided upon yet. For example, there is not much official data about the land rise in Klockelund. To predict impacts from this we would have needed data about where it will take place, with what material and how is it supposed to be done.

Moreover, Karlsvik strand and Klockelundsvägen is not at the same place in the planning process. While Klockelundsvägen has been assessed by consultants in several aspects, Karlsvik strand has not gotten that far. This is the case for example regarding noise, which we predict will mean a major negative impact for people moving to the area. As it is now, much has to be done in forthcoming planning to mitigate the noise levels, especially in Karlsvik strand.

8.5.6 Sweden's environmental objectives

Sweden has set objectives for the future state of its environment, these goals are intended to ensure that the country's major environmental problems have been solved by 2020, the future generations are promised to have clean air, healthy living environments and rich contact with nature (Naturvårdsverket, 2012). In order to achieve these goals, 16 environmental quality objectives should be taken into consideration when a certain construction activity will be implemented. In this EIA, the consequences of zero alternative, proposed plan and alternative plan in relation to Sweden's environmental objectives are shown in the Table 4.

In the zero alternative, there will be both positive and negative effects due to the continued vehicle exhausts and poor management. In the proposed plan, the negative effects greatly outweigh the positive effects in aspects of reaching the environmental goals. Most of the objectives would be negatively affected due to the increased vehicle exhausts, the disappearance of oak species, the destruction of habitats, the loss of camping huts and the relocation of allotment garden. The alternative plan, however, would reduce some of the negative impacts in the proposed plan and have a relatively positive effect on the environment. For instance, the preservation of oak species and camping huts would positively affect the objectives like *Sustainable forest*, *A varied landscape* and *A rich diversity of plant and animal life*.

Since the objectives have now served as signposts for environmental actions in Sweden, the alternative plan is more suitable in aspects of achieving the environmental objectives. Nevertheless, further monitoring and auditing is also required in order to have a complete evaluation of the plan.

8.5.7 Monitoring and evaluation

Monitoring can help to keep track of the progress of the project implementation and reveal the mistakes at early stage in order to achieve the pre-set targets and objectives. Monitoring can also help with identifying the most valuable and efficient use of resources. Since monitoring is a long-term process it is not included in this EIA but the responsible stakeholders should carry out the monitoring and evaluation of Larsboda strand project and ensure it develops smoothly as well as follow up on the development of the project in the long term.

8.6 Conclusion

Planned initiative in Larsboda strand is expected to imply significant environmental impact in regards of biodiversity loss as well as dramatic change of physical and cultural landscape. The alternative plan is in many ways similar to the proposed plan but with some important distinctions. Important green values have been taken into account such as generally building outside shore protected areas, taking more consideration of valuable oak habitats and saving a part of the socially and environmentally important allotment garden. The culturally valuable camping huts have also been taken into consideration, creating an historical bond to the new area. By building smaller apartments, i.e. three room apartments in general, the area can be used more efficiently and fit more apartments into a smaller area.

It is important to consider that Nynäsvägen is crucial for many of the environmental impacts in Larsboda strand. At the same time as the new buildings will reduce the noise level from the road, more new residents living close to the road will be exposed to high levels of noise and risk of accidents with dangerous goods on the road.

Even though Larsboda strand has a vulnerable nature with high biodiversity to preserve, it is also a very attractive area to exploit for real estate companies. New people will have access to the area in expense of relocating some of the present users of the area, such as the allotment gardeners and camping hut owners.

Even if the zero-alternative got the highest score in the impact matrix (table 3) it still needs to be assessed towards the increasing demand on housing production in the city of Stockholm. The housing situation in Stockholm is already witnessing massive shortages, and is every year getting worse due to a growing population (SCB, 2016). To work efficiently towards the goal of more apartments built in Stockholm it would be wise to not build within shore protected area, and by that enhance the possibility of starting the building process without too much appeals and long-drown juridical processes. To conclude, it is assessed to be of significant importance to enhance building production and that it should be prioritized, but with special consideration of the site's specific needs such as the important social, ecological and cultural values of Larsboda strand.

9. Final reflections

The work of writing an EIS has given rise to a number of issues regarding the work of creating an EIA for projects in the Stockholm region. These are the final reflections from all five groups that have been doing EIA:s of five different areas during this course. The areas were Hammarbyskogen, Kymlinge, Larsboda, Magelungen and Riddersvik.

- The municipalities have sometimes decided to split a larger project into several smaller ones. This can be a sign of them trying to avoid having to make an EIA.
- Most of the municipalities have estimated that an EIA is not needed for the projects. Since some of the impacts in the EIS:s in this paper have been major negative, another sign of the municipalities avoiding to make EIA:s can be said to be found. Together with the municipalities splitting projects into smaller ones, one can say that there is a tendency that the municipalities are showing an “avoidance syndrome” concerning the EIA process.
- Overall, coordination between the regional plans and the local plans is needed. The regional planning is concerning infrastructure while the municipalities themselves are to decide if and where to contribute with new housing units. This have given rise to gaps between goals when state authorities and regional plans count on the municipalities to do their part, while the municipalities have other plans. With this, the regional plan becomes subordinated the local plans, especially since the municipalities have planning monopoly in Sweden and there are no sanctions for not building more housing units or not following the regional plan. There is also a need for infrastructure planning to go well with future housing planning in order to create better conditions for the future.
- Goals to preserve natural values can sometimes stand in conflict with goals of developing infrastructure and the housing situation in Stockholm. Often, the most attractive places are also the most vulnerable.
- There could also be a better collaboration between the municipalities to create better relations and to make sure they are all contributing to reach the regional goals.
- To create better conditions for the EIA process, there should be certain standards and data for the municipalities to provide and keep track of, for example noise level maps.
- Overall, a lack of relevant information have limited the work with these EIA:s. For most of the projects described in this report, a detail development plan has not been available but only “starting PM”:s giving an overview of the planned projects. For some, the plans have even changed during the working process, which have caused problems and confusion.
- If an EIA is not carried out, major negative, or positive impacts from a project risks not being found or highlighted. With this report, some major impacts have been found that can help decision makers when developing the proposed new residential areas.

10. References

Andréasson, J., Bergström, S., Carlsson, B., Graham, L. P., & Lindström, G. (2004). Hydrological change-climate change impact simulations for Sweden. AMBIO: A Journal of the Human Environment, 33(4), 228-234.

Arbetsmiljöverket (2016). Buller (Smartphone application). Version 2.0.1. Developed by Valtech AB.

Arbor Konsult AB (2015). Trädinventering & okulär besiktning. Klockelund, Farsta. PDF-document. http://insynsbk.stockholm.se/Byggochplantjansten/Pagaende-planarbete/PagaendePlanarbete/Planarende/?JournalNumber=2011-15589&rid=108255&flg=0&subtyper=Planf%C3%B6rslag,&plantype=Planf%C3%B6rslag

ArtDatabanken (a). Artfakta Phellinus pini. http://artfakta.artdatabanken.se/taxon/5442 Retrieved 2016-12-11.

ArtDatabanken (b). Artfakta Phellinus robustus. http://artfakta.artdatabanken.se/taxon/5445 Retrieved 2016-12-11.

ArtDatabanken (c). Artfakta Phellinus ferreus. http://artfakta.artdatabanken.se/taxon/5435 Retrieved 2016-12-11.

Artdatabanken. Rödlistade arter i Sverige 2015. PDF-document. http://www.artdatabanken.se/media/2013/hela-boken.pdf 211 p.

Artportalen (2016). http://www.artportalen.se/Sighting/7293294 Retrieved 2016-12-11.

Boverket (2008) Buller i planeringen - Planera för bostäder i områden utsatta för buller från väg- och spårtrafik. Allmänna råd 2008:1. Boverket. PDF-document. http://www.boverket.se/globalassets/publikationer/dokument/2008/buller_i_planeringen_allmanna_rad_2008_1.pdf 96 p.

Brandskyddslaget (2016): PM Risk Klockelund. PDF-document. http://insynsbk.stockholm.se/templates/main/pages/xGetDocument.aspx?FileId=5664476&FileName=5664476_2_6.PDF&DataSource=2&JournalNumber=2011-15589 9 p.

Chambers, R. (2006). 'Participatory mapping and geographic information systems: Whose map? Who is empowered and who is disempowered? Who gains and who loses?' The Electronic Journal on Information Systems in Developing Countries (EJISDC), 25 (2): 1-11

Chislock, M. F., Doster, E., Zitomer, R. A., & Wilson, A. E. (2013). Eutrophication: causes, consequences, and controls in aquatic ecosystems. Nature Education Knowledge, 4(4), 10

Church, A., Mitchell, R., Ravenscroft, N. & Stapleton, L.M. (2014). 'Growing your own': A multi-level modelling approach to understanding personal food growing trends and motivations in Europe. Ecological Economics 110 (2015) 71-80.

Dataportalen (2012). Bullerkartan. Dataportalen, Stockholms stad. http://dataportalen.stockholm.se/dataportalen/ Retrieved 2016-12-21.

Delshammar, T. (2011). Urban odling i Malmö. Stad & Land, 181.

DialogGuiden. http://www.dialogguiden.se/article/show/418 Retreieved 2016-12-04.

Ekologigruppen (2009). Strandpromenad Drevviken- programillustration och analys av påverkan på rekreation- och naturvärden. http://insynsbk.stockholm.se/templates/main/pages/xGetDocument.aspx?FileId=1319896&FileName=1319896_2_1.PDF&DataSource=2&JournalNumber=2007-04025. 18 p.

Environmental Resources Management (2001). Guidance on EIA Scoping. European Commission. http://ec.europa.eu/environment/archives/eia/eia-guidelines/g-scoping-full-text.pdf. 38 p.

Föreningen Stor-Stockholms Koloniträdgårdar (FSSK) (2015). Synpunkter på förslag Program Tyngdpunkt Farsta, Dnr 2012-09102.

Föreningen Stor-Stockholms Koloniträdgårdar (FSSK). http://fssk.se Retrieved 2017-01-08.

Hedlund John (2013). Arkeologisk förstudie 2013 Larsboda Karlsvik Klockelund. Stockholm stadsmuseum. PDF- document http://insynsbk.stockholm.se/Byggochplantjansten/Pagaende-planarbete/PagaendePlanarbete/Planarende/?JournalNumber=2011-15589&rid=108255&flg=0&subtyper=Planf%C3%B6rslag,&plantype=Planf%C3%B6rslag 8 p.

Hökarängens friluftsförening. https://hokarangensff.wordpress.com Retrieved 2016-12-04.

http://digitalastadsmuseet.stockholm.se/fotoweb/Grid.fwx?archiveId=5000&search=(IPTC187%20contains(SSMB_0029494_01_)) Retrived 2016-12-23.

http://www.riksdagen.se/sv/dokument-lagar/dokument/svensk-forfattningssamling/forordning-2015216-om-trafikbuller-vid_sfs-2015-216 Retrieved 2016-12-21.

Hultengren, S., Pleijel, H., & Holmer, M. (1997). Ekjättar: historia, naturvärden och vård. Naturcentrum.

Jansson & Partner (2016). http://www.janssonpartner.se/bullerskyddstaket Retrived 2016-12-23.

Länsstyrelsen Stockholm (2016) (a): Länsstyrelsen i Stockholms läns kungörelse om sammanställning av rekommenderade vägar och lokala trafikföreskrifter för transport av farligt gods i Stockholms län. (dnr 451-41970-2014). PDF-document. http://www.lansstyrelsen.se/stockholm/SiteCollectionDocuments/Sv/nyheter/2016/01FS%202016%2010%20inkl%20bilagor.pdf 16 p.

Länsstyrelsen Stockholm (2016) (b). Riktlinjer för planläggning intill vägar och järnvägar där det transporteras farligt gods. PDF-document. http://www.lansstyrelsen.se/stockholm/SiteCollectionDocuments/Sv/publikationer/2016/fakta-2016-4.pdf 7 p.

Länsstyrelsen Stockholm, enheten för kulturmiljö (2010). Avslag av väckt fråga om byggnadsminnesförklaring samt avvisande av initiativ att bilda kulturreservat av område med campingstugor vid Larsboda, Drevviken, Farsta 2.1, Stockholms kommun. Received by mail from Klara Johansson, antikvarie, Stadsmuseet i Stockholm.

Lind, P., & Kjellström, E. (2008). Temperature and precipitation changes in Sweden: a wide range of model-based projections for the 21st century. SMHI. PDF-document. http://www.smhi.se/polopoly_fs/1.113639!/RMK_113.pdf 66 p.

Miljöbarometern (2016). Stockholms stad. http://miljobarometern.stockholm.se/vatten/sjoar/drevviken/ Retrieved 2017-01-08.

Miljöförvaltningen (2009). Larsboda strand programområde. Utredning av konsekvenser för Natur och Rekreation. http://insynsbk.stockholm.se/templates/main/pages/xGetDocument.aspx?FileId=1392847&FileName=1392847_2_1.PDF&DataSource=2&JournalNumber=2007-04025 27 p.

Mörtberg, U., Zetterberg, A., & Gontier, M. (2007). Landskapsekologisk analys i Stockholms stad: Habitatnätverk för eklevande arter och barrskogsarter. PDF-document. http://miljobarometern.stockholm.se/content/docs/tema/natur/Habitatverktyg_ek_barrskogsarter_2008.pdf 58 p.

Myndigheten för samhällsskydd och beredskap (2016). Portalen för översvämningshot. https://gisapp.msb.se/Apps/oversvamningsportal/enkel-karta.html

Naturvårdsverket (2007). God ljudmiljö… mer än bara frihet från buller. Report 5709. PDF-document. https://www.naturvardsverket.se/Documents/publikationer/620-5709-X.pdf?pid=3317 24 p.

Naturvårdsverket (2012). Sweden´s environmental objectives--an introduction, 2012. PDF-document. http://www.swedishepa.se/Documents/publikationer6400/978-91-620-8620-6.pdf?pid=6759 28 p.

Naturvårdsverket (2015) . Styr med sikte på Miljömålen – Naturvårdsverkets fördjupade utvärdering av miljömålen 2015. Rapport 6666. PDF-document. https://www.naturvardsverket.se/Documents/publikationer6400/978-91-620-6666-6.pdf?pid=16477. 140 p

Statistiska centralbyrån, (SCB), 2016. Folkmängd efter region, år 1991 – 2015. http://www.statistikdatabasen.scb.se/pxweb/sv/ssd/START__BE__BE0101__BE0101C/BefArealTathetKon/?rxid=7a1fbde9-3112-44fe-b818-85ff3a9bd79e. Retrieved 2016-12-20.

Regionplane- och trafikkontoret (RTK), 2008. Grönstruktur och landskap i regional utvecklingsplanering. Rapport 9:2008. PDF-document. http://www.rufs.se/publikationer/20082/20089-gronstruktur-och-landskap-i-regional-utvecklingsplanering/. 74 p.

RUFS. Gröna kilar. http://www.rufs.se/sakomraden/gronstruktur/grona-kilar/ Retrieved 2016-12-04.

Rydström A-C. & Johansson V. (2007). Miljöriskanalys av transporter av farligt gods på väg och järnväg samt i farleden utanför hamnen. Enviro planning. PDF-document. http://www.bjorko.nu/dumpning/document/Bilaga_20_Utredning_miljoriskanalys_transporter.pdf 138 p.

Skogsbiologerna AB (2001). Nature value assessment matrix, retreived from http://www.ssc-forestry.com/skogsbiologerna/ Retrieved 2016-12-05.

SL Reseplanerare (2017). http://reseplanerare.sl.se/bin/query.exe/sn Retrived 2017-01-08.

SLB analys (2015). Luftföroreningskartor. SLB analys, Stockholms stad. http://slb.nu/slbanalys/luftfororeningskartor/ Retrieved 2016-12-21.

SLB analys (2016). Beräkningar för halter av partiklar PM10 och kvävedioxid, NO2, år 2015 och 2020. SLB analys, Stockholms stad. http://slb.nu/slbanalys/ Retrieved 2016-12-17.

SMHI (2016). Klimatscenarier. http://www.smhi.se/klimat/framtidens-klimat/klimatscenarier

Stadsbyggnadskontoret (2010). PROMENADSTADEN Översiktsplan för Stockholm. Stockholms stad. PDF-document. http://vaxer.stockholm.se/globalassets/tema/oversiktsplanen/promenadstaden_oversiktsplan-for-stockholm.pdf 92 p.

Stadsbyggnadskontoret (2015) (a). Detaljplan för fastigheten Perstorp 1 m.fl. i stadsdelen Farsta. https://insynsverige.se/documentHandler.ashx?did=1827122 Retrieved 2017-01-08.

Stadsbyggnadskontoret (2015) (b). Samrådsredogörelse för Program Tyngdpunkt Farsta.

Stadsbyggnadskontoret (2015) (c). Startpromemoria för planläggning av område vid Karlsviks strand, del av fastigheten Farsta 2:1 m. fl. i stadsdelen Larsboda, Stockholms stad (ca 700 lägenheter). Tjänsteutlåtande Dnr 2012-13613. PDF-document. http://insynsbk.stockholm.se/templates/main/pages/xGetDocument.aspx?FileId=4986469&FileName=4986469_1_6.PDF&DataSource=3&JournalNumber=2012-13613&MeetingNumber=7405355 21 p.

Stadsbyggnadskontoret (2016). Detaljplan för området vid Klockelundsvägen, Larsboda 2:3 m fl. i stadsdelen Larsboda, Stockholms stad. PDF-document. http://insynsbk.stockholm.se/Byggochplantjansten/Pagaende-planarbete/PagaendePlanarbete/Planarende/?JournalNumber=2011-15589&docview=1#stage2 60 p.

Stadsmuseet (2009). Larsboda: information till dig som äger ett kulturhistoriskt värdefullt hus i ytterstaden.

Stadsmuseet, (2016). Remissvar angående förslag till detaljplanen för Larsboda 2:3 m fl, Klockelundsvägen i stadsdelen Larsboda. Sbk dnr 2011-15589. Kulturförvaltningen.

Stockholm Trafikförvaltning (2015). Riktlinjer planering av kollektivtrafiken i Stockholms län. PDF-document. http://www.sll.se/Global/Verksamhet/Kollektivtrafik/Kollektivtrafiken%20v%C3%A4xer%20med%20Stockholm/SU/Riktlinjer/Riktlinjer-planering-kollektivtrafik-stockholmsl%C3%A4n-2016.pdf 50 p.

Stockholms Fastighetskontor (1990). Områdesbeskrivningar. Egensdomsavdelningen i samverkan med FSSK. Received by mail from Lennart Pöppel, chairman of FSSK.

Stockholms stad (2015). Cykelplan. PDF-document. http://bygg.stockholm.se/PageFiles/1119571/Cykelplan_slutlig_webbversion.pdf 56 p.

Stockholms stad (2016) (a). Stockholm växer. Perstorp 1, Farsta. http://vaxer.stockholm.se/projekt/farsta-perstorp-1/ Retrieved: 2016-12-15.

Stockholms stad (2016) (b). Stockholm växer. Stortorpsvägen, Larsboda. http://vaxer.stockholm.se/projekt/farsta-stortorpsvagen/ Retrieved 2016-12-15.

Stockholms stad (2016) (c). Stockholm växer. Livsmedelscentrum. http://vaxer.stockholm.se/projekt/larsboda-larsboda-livsmedelscentrum Retrieved: 2016-12-15.

Stockholms stad (2016) (d). Sociotopkartor. http://www.stockholm.se/TrafikStadsplanering/Stadsutveckling/Sociotopkartor/ Retrieved: 2017-01-09.

StormTac corporation (2016). StormTac database. http://www.stormtac.com/index.php

Svea hovrätt (2016). Mål nr P 6876-15. Domstolshandling, Mark- och miljööverdomstolen. http://www.markochmiljooverdomstolen.se/Domstolar/markochmiljooverdomstolen/Svea%20HR%20P%206876-15%20Dom.pdf 30 p.

Svensk författningssamling (SFS): Förordning (2015:216) om trafikbuller vid bostadsbyggnader. Svensk författningssamling 2015:216.

SVT Nyheter. Ny studie: Vedrök dödar fler än bilavgaser. http://www.svt.se/nyheter/inrikes/luftfororeningar-fran-mysbrasor-skordar-liv. Retrieved 2017-01-10.

Sweco (2016). Dagvattenutredning Klockelund. PDF-document. http://insynsbk.stockholm.se/templates/main/pages/xGetDocument.aspx?FileId=5664456&FileName=5664456_2_6.PDF&DataSource=2&JournalNumber=2011-15589 19 p.

Swedish Climate and Energy Policy. An integrated climate and energy policy (2009). PDF-document. http://www.government.se/49b75f/contentassets/356adb8355814d75851d87342bdfad44/an-integrated-climate-and-energy-policy 4 p.

Swedish commission on climate and vulnerability (2007). Sweden facing climate change--threats and opportunities. PDF-document. http://www.government.se/49b75f/contentassets/5f22ceb87f0d433898c918c2260e51aa/sweden-facing-climate-change-sou-200760 261 p

The Swedish Environmental Code. ID-number: Ds 2000:61.

Topia landskapsarkitekter (2013). Barnkonsekvensbeskrivning. Stockholms stad. PDF-document. http://insynsbk.stockholm.se/Byggochplantjansten/Pagaende-planarbete/PagaendePlanarbete/Planarende/?JournalNumber=2012-09102 90 p.

Trafikkontoret (2012). Perstorpsvägen och Flatenvägen, cykelåtgärder. PDF-document. https://insynsverige.se/documentHandler.ashx?did=1716210 10 p.

Trafikkontoret (2016). Remissvar på förslag till detaljplan för område vid Klockelundsvägen, Larsboda 2.3 m. fl. Stadsdelen Larsboda. S-DP 2011-15589. Stockholm.

Trafikverket (2004). VÄG- OCH GATUUTRUSTNING 7 Bullerskydd. VV publikation 2004:80. PDF-document. http://www.trafikverket.se/TrvSeFiler/Foretag/Bygga_och_underhalla/Vag/Vagutformning/Dokument_vag_och_gatuutformning/Vagar_och_gators_utformning/Vag_och_gatuutrustning/07_bullerskydd_gatuutrustning.pdf 16 p.

Trafikverket (2012). Väg 73 Trafikplats Vega Tpl Trångsund – Tpl Handen Arbetsplan. Teknisk PM Trafik, Vägutformning och Vägteknik. PDF-document. http://www.trafikverket.se/TrvSeFiler/Fillistningar/Arbetsplan_Vega/3t140001_teknisk_pm_vag_del1.pdf 7 p.

Trafikverket (2015). Trafiken på väg 73 och Nynäsvägen. http://www.trafikverket.se/nara-dig/Stockholm/projekt-i-stockholms-lan/trafikplats-vegahanden/Omradesinformation/Trafiken-pa-vag-73-och-Nynasvagen/ Retrieved 2016-12-21.

Trafikverket, (2016). Riksintressekartan. https://riksintressenkartor.trafikverket.se/Riksintressen/ Retrieved 2016-12-21.

Tyngdpunkt Farsta (2015). Stockholms stad. PDF-document. http://bygg.stockholm.se/-/Nyheter/Farsta-Tyngdpunkt-/Tyngdpunkt-Farsta-nu-godkant-i-namnd/ 82 p.

Tyréns (2015). Geoteknisk Promemoria Klockelund. PDF-document. http://insynsbk.stockholm.se/templates/main/pages/xGetDocument.aspx?FileId=5664464&FileName=5664464_2_6.PDF&DataSource=2&JournalNumber=2011-15589 46 p.

Vi i Solna. Råstasjön kan bli prejudikat. http://www.stockholmdirekt.se/nyheter/rastasjon-kan-bli-prejudikat/dbbojg!CE43U31Cm8jSTKeRQN9bA/ Retrieved 2016-12-21.

White arkitekter (2015). Social Miljöanalys centrala Farsta. PDF-document. http://insynsbk.stockholm.se/Byggochplantjansten/Pagaende-planarbete/PagaendePlanarbete/Planarende/?JournalNumber=2012-09102 90 p.

White paper-climate change adaption in the Nordic countries (2013). https://www.sei-international.org/mediamanager/documents/Publications/Climate/N-CMAEP-2013-White-Paper-Nordic-Countries-Adaptation.pdf 40 p

WSP (2012). Inventering av campingstugeområde vid Drevviken i Farsta. Received by mail from Klara Johansson, antikvarie, Stadsmuseet i Stockholm.

Åkerlöf Hallin Akustikkonsult AB (2016). Trafikbullerutredning för detaljplan. Klockelund, Larsboda, Stockholm. PDF-document. http://insynsbk.stockholm.se/Byggochplantjansten/Pagaende-planarbete/PagaendePlanarbete/Planarende/?JournalNumber=2011-15589&rid=108255&flg=0&subtyper=Planf%C3%B6rslag,&plantype=Planf%C3%B6rslag 28 p.

Oral and written references:

Anonymous interviews, Larsboda citizens, conducted in Larsboda strand, 2016-12-06 & 2016-12-09.

Emmelin, Lars., 2016: Lecture held at Stockholm University, Stockholm, 2016-11-15.

Eriksson, Leif. Chairman, Larsboda Koloniträdgårdsförening, email and phone contact: 2016-12-09

Eriksson, Mikael, Strategic Planner busstrafik SL, email, 2016-12-08.

Hedlund John, archaeologist, Stadsmuseet Stockholm, interview, 2016-12-06

Jarnhammar, Mats, urban advisor SKL International, interview 2016-12-14

Johansson Klara, antiquarian, Stadsmuseet Stockholm, interview, 2016-12-06

Styring Martin, City planner, Stadsbyggnadskontoret, Stockholm, interview, 2016-12-06

Vicente, Raul, ecologist at Ekologigruppen, interview 2016-12-11.

GIS- and Sketchup references:

CTBUH (Council on Tall Buildings and Urban Habitat) (2016). CTBUH Tall Building Height Calculators. http://www.ctbuh.org/TallBuildings/HeightStatistics/HeightCalculator/OnLineCalculator/tabid/1068/language/en-GB/Default.aspx Retrieved 2016-12-19.

ESRI (2015). ArcMap: ArcGIS Desktop: Release 10.4. Redlands, CA, USA.

Trimble inc. (2016). SketchUp Make: Version 17.1.174.

Figures

Where reference is not mentioned in figure-texts the figures and photos are produced and owned by the authors of this report.

Appendices

Appendix I: Contact list

Appendix II: Soil class

Appendix III: Sun conditions

Appendix IV: Tree specification

Appendix V: Nature values matrix

Appendix VI: Species in Larsboda

Appendix VII: Participative map

Appendix I: Contact list

People who have been contacted and who have contributed with information to this EIA.

- Anonymous interviews with Farsta citizens
- John Hedlund, Stockholm Stadsmuseum
- Klara Johansson, Stockholm Stadsmuseum
- Leif Eriksson, Larsboda Kolonilottsförening
- Lennart Pöppel, Stor-Stockholms Koloniträdgårdsförening
- Martin Styring, Stadsbyggnadskontoret, Stockholms stad
- Mats Jarnhammar, Urban advisor at SKL International, living in Farsta
- Mikael Eriksson, *Strategisk planerare busstrafik, Storstockholms lokaltrafik*
- Mårten Pehrsson, Miljöförvaltningen, Stockholms stad
- Raul Vicente, Ecologist at Ekologigruppen
- Staff at Plantagen, Farsta

Appendix II: Soil class and soil depth

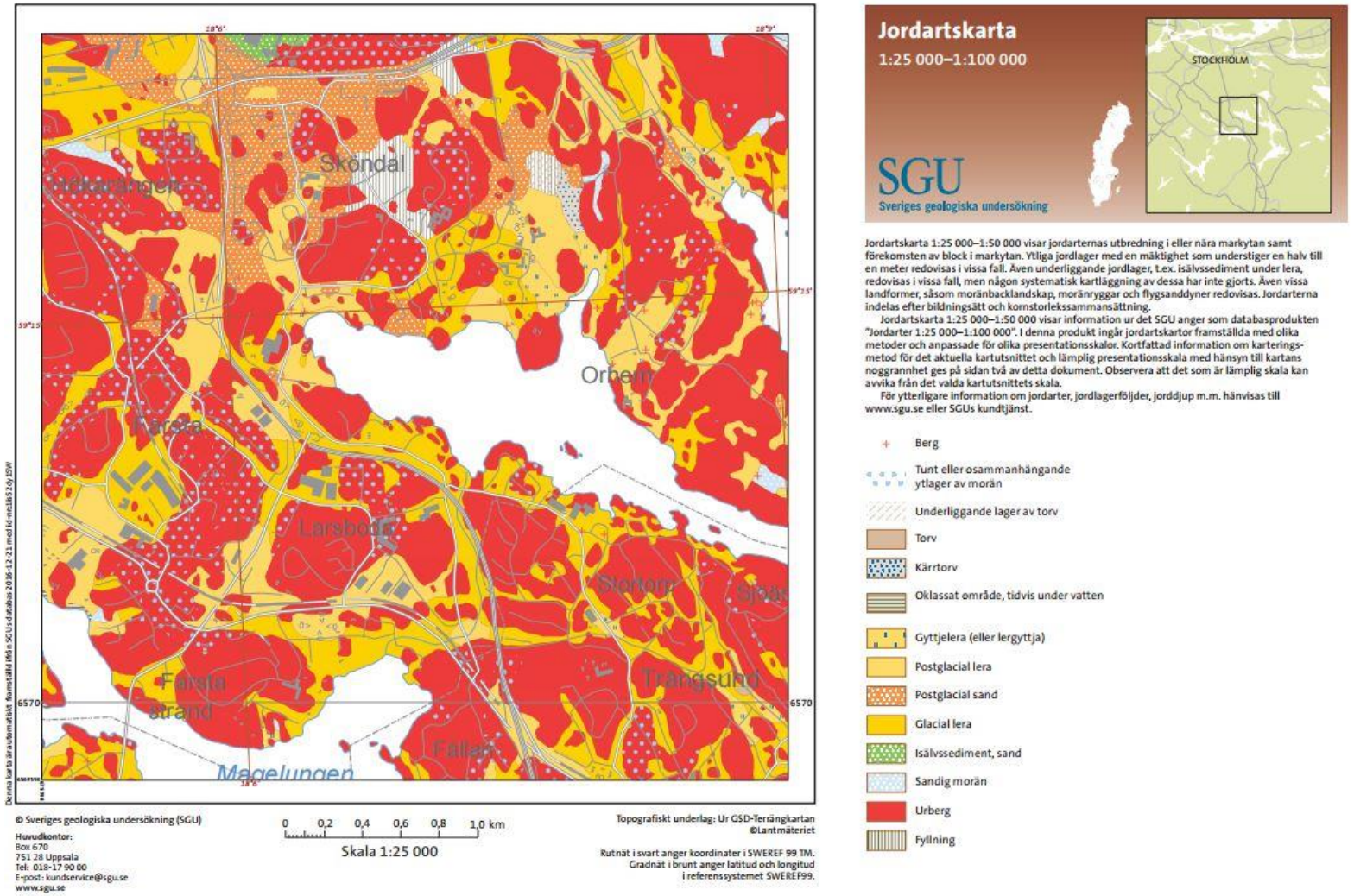


Figure 1. Map from SGU jordartskarta (2016) showing soil classes in Larsboda and surroundings. Larsboda strand (in center of the map) is dominated by glacial clay (yellow) and bedrock (red).

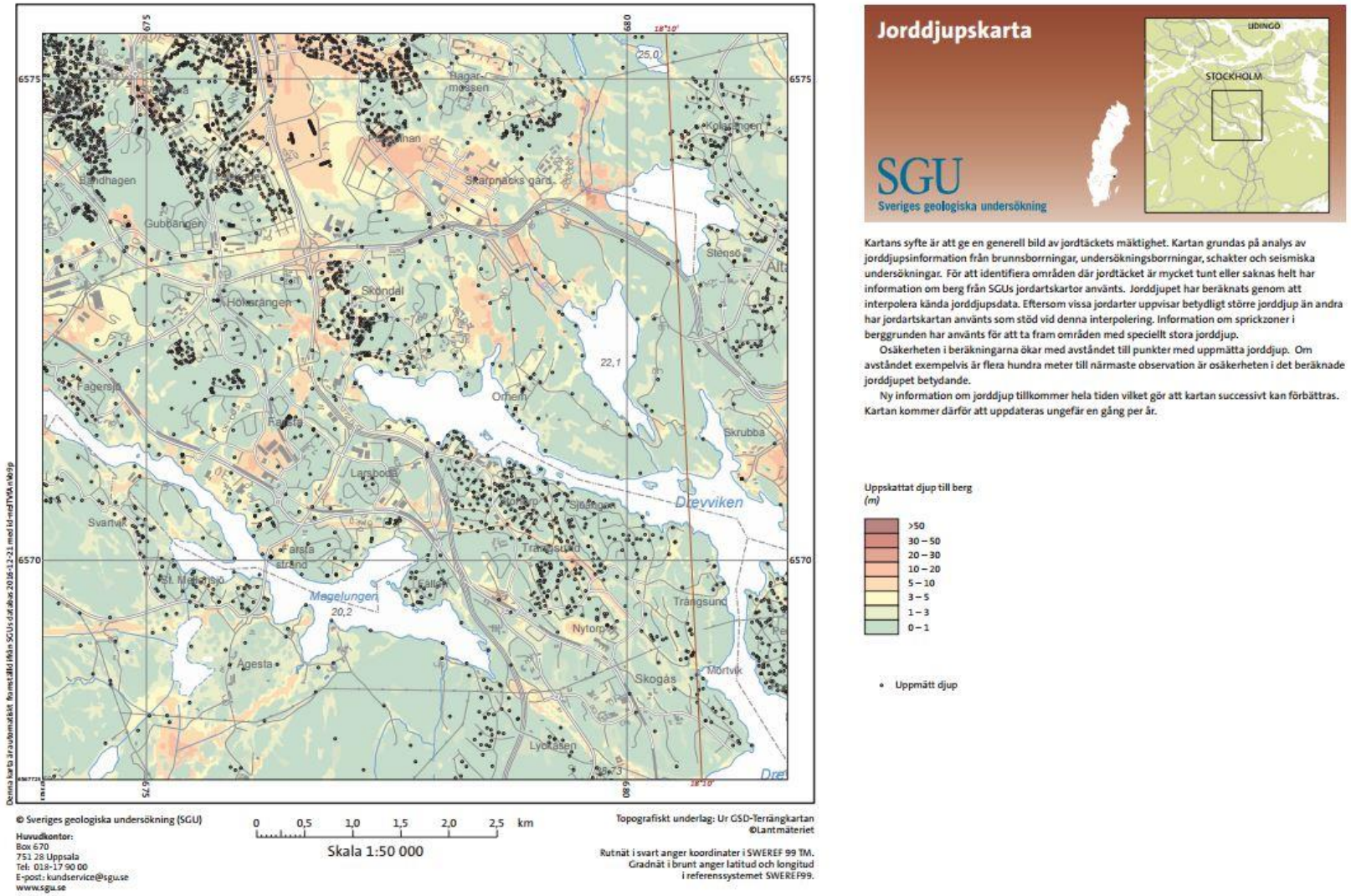


Figure 2. Map from SGU jorddjupskarta (2016) showing soil depth in Larsboda strand and surroundings. In Larsboda strand the soil depth is ranging from 0-1 (green) meters to 5-10 meters as most.

Appendix III: Sun conditions

Sun and shadow conditions with alternative plan. All pictures are 3D-models made with the program Sketchup (Trimble inc., 2016)

Note that typography is not included in the plans and might have effects on the result.



Sun condition June 26th at 15.30



Sun conditions December 26th at 12.00



Sun conditions September 26th at 14.00

Sun conditions with proposed plan

Note that typography is not included in the plans and might have effect on the result



Sun condition June 26th at 15.30



Sun condition September 26th at 14.00



Sun condition December 26th at 12.00

Appendix IV: Tree specification

Table 1. Table showing approximate number of trees found in Larsboda strand during inventory made in December 2016.

Trees	**Approximate number of tree findings** *(Occasional - Some - Many - Lots of)*
Acer platanoides - Maple (Lönn)	Many
Betula pendula - Birch (Vårtbjörk)	Some
Corylus avellana - Hazel (Hassel)	Many
Fraxinus excelsior - Ash (Ask)	Some
Picea abies - Spruce (Gran)	Occasional
Pinus sylvestris - Pine (Tall)	Occasional
Quercus robur - Oak (Ek)	Lots of
Salix sp. - Willow trees (Videsläktet)	Occasional

Appendix V: Nature values matrix

ASSESSMENT OF FOREST BIODIVERSITY POTENTIAL

SITE	B	TREES	B
1. Conspicuously broken terrain / varied topography	X	41. Several > 2 m high hazel / yew	X
2. Vertical cliff / scree-slope > 10 m high	/	42. Substantial amounts of > 2 m high junipers / shrubs	/
3. Forested gorge / ravine > 10 m deep	/	43. As above / hazel and in open, sun-exposed conditions	
4. Site characterised by S - SW facing slope steeper than 15% (3:20)	/	44. Several hawthorn / whitebeam / crab apple / gean / buckthorn > 10 cm	
5. Site characterised by N – NE facing slope steeper than 15% (3:20)		45. Substantial amounts of aspen / sallow / rowan / black alder / oak > 10 cm	
6. At least part of the site located above 450 m. altitude / prealpine		46. Substantial amounts of elm / lime / maple / ash > 10 cm	/
7. Site surrounded by forest / terrain buffering local climate		47. Substantial amounts of broadleaf trees > 20 cm	
8. Site characterised by normally wet / very wet forest		48. Several elm / lime / maple / ash > 40 cm	/
9. Area > 0,1 ha of forested rocky outcrop / ground with very shallow soils	X	49. Several broadleaf trees > 40 cm	
10. Lichens cover > 50 % of the ground		50. Several trees > 40 cm	X
11. Site characterised by a conspicuous herb component / *Ribes* / *Lonicera*	/	51. Substantial amounts of trees > 40 cm	/
12. Lime- / hyperite-rich soils / conspicuous amounts of orchids / liverworts	/	52. Several trees > 60 cm	/
DYNAMICS		**STRUCTURE**	
13. Signs of former - recent forest fire on stumps / trees		53. Trees > 10 cm characterised by a conspicuous girth / age variation	X
14. Several living trees with fire-scars		54. Several trees stand out as consp. older / larger than the stand in general	X
15. Several living trees with scars from more than one fire		55. Several trees with conspicuously thick branches and low / wide crowns	/
16. Recently burnt area > 0,1 ha with substantial amounts of living / dead trees		56. As above and in open, sun-exposed conditions	
17. Forest area > 0,1 ha unaffected by a recent radical disturbance		57. Several solitary trees > 60 cm	
18. Spruce constitutes less than 10% of the stand volume / basal area	X	58. Substantial amounts of conspicuously retarded / stunted trees > 10 cm	
19. Several canopy gaps less than 0,1 ha with natural regrowth of main species	X	59. Substantial amounts of formerly - recently snow-broken trees > 10 cm	
20. Site characterised by a thick, continous moss cover on rocks and boulders	X	60. Substantial amounts of basally multi-stemmed trees / coppice > 10 cm	
21. Conspicuous signs of woodpecker activity on living trees / dead wood	/	61. Substantial amounts of trees on buttresses	/
22. Seasonally inundated arrea >0,1 ha in forested surroundings	/	62. Several stems with conspic. occurrences of mixed mosses / lichens / *Lobaria*	X
23. Signs of beaver activity		63. Several trees with conspicuous occurrences of pendulous lichens	
24. Signs of former - present grazing / meadow mowing / pollarding / coppicing	/	64. Substantial amounts of trees with consp. occurrences of pendulous lichens	
25. Present grazing / meadow mowing / pollarding / coppicing		65. Open / semi open canopy / several conspicuous anthills	
HABITATS		**DEAD WOOD**	
26. Boulder terrain > 0,1 ha / large boulders > 2 m high	X	66. Conifers; several erect dying / dead trees / > 2 m high stumps > 20 cm	
27. A total of > 0,1 ha sandy, sun-exposed, sparsely vegetated ground		67. As above and in sun-exposed conditions	
28. Shaded > 2 m high conspicuous vertical cliff with a mixed moss cover	/	68. Broadleaves; several erect dying / dead trees / > 2 m high stumps > 20 cm	/
29. Area > 0,1 ha of normally wet / very wet forest	/	69. As above and in sun-exposed conditions	/
30. Area > 0,1 ha of wet / very wet, conspicuously sloping forest	/	70. Substantial amounts of erect dying / dead trees / > 2 m high stumps > 20 cm	/
31. Area > 0,1 ha dominated by luxuriant herbs / tufted ferns	/	71. Several windthrown trees with upturned roots	/
32. Forest in contact with open water / wetland > 0,1 ha	/	72. Several rot-broken trees	/
33. Spring / spring brook in forested surroundings	/	73. Several downlogs > 20 cm.	/
34. Non-seasonal brook / watercourse in forested surroundings	/	74. Several downlogs > 20 cm in open sun-exposed conditions	
35. As above, and meandering in sand / silt	/	75. Several downlogs > 20 cm with a mixed, partly velvety moss cover	/
36. White-water / rapids / waterfall in forested surroundings	/	76. Several downlogs > 20 cm in various stages of decay	/
37. Open / semi-open, non-cultivated grass- / herb- / heath-area > 0,1 ha		77. Substantial amounts of downlogs > 20 cm	/
38. Conspicuous, sun-exposed forest brow with herbs / shrubs	/	78. Several downlogs > 40 cm	/
39. Conspicuous hollow tree / nest of coarse twigs / several nesting holes	/	79. Several trees / stumps / logs with conspicuous occurrences of fungi	X
40. Hollow tree > 40 cm with a major cavity in the trunk	/	80. Subst. amounts of trees / stumps / logs with conspic. occurrences of fungi	/
General Swedish version SITE SCORE	8,5	Skogsbiologerna AB © 2001 Excel STAND SCORE	7

An assessment of the forests potential biodiversity was performed by using a nature value assessment matrix by Skogsbiologerna (2001). According to the method, when a forest scores over 30 points it has potential of having very high nature values, when it scores 15-20 points it means potential for high nature values and when it scores lower than 5-10 points it indicates low nature values. The score of 15.5 means the area has potentially high nature values.

8,5 + 7 = 15,5

Figure 1. Figure showing the result from our inventory of forest biodiversity potential in Larsboda strand in December 2016. Matrix is collected and modified from Skogsbiologerna AB (2001).

Appendix VI: Species in Larsboda

Table 1. Table showing species found during two field trips to Larsboda strand in december 2016. Redlisted species is marked with (NT) (near threatened).

Fungi	Lichens	Mosses	Birds
Daedalea quercina (Korkmussling)	*Evernia prunastri* (Slånlav)	*Dicranum montanum* (Stubbkvastmossa)	*Accipiter nisus* (Sparvhök)
Phellinus ferreus (Västlig rostticka)	*Hypogymnia physodes* (Blåslav)	*Dicranum scoparium* (Kvastmossa)	*Carduelis carduelis* (Steglits)
Phellinus pini (Tallticka) **(NT)**	*Melanelia fuliginosa* (Glänsande sköldlav)	*Hypnum cupressiforme* (Cypressfläta)	*Certhia familiaris* (Trädkrypare)
Phellinus punctatus (Kuddticka)	*Parmelia saxatilis* (Färglav)	*Leucodon sciuroides* (Allémossa)	*Coccothraustes Coccothraustes* (Stenknäck)
Phellinus robustus (Ekticka) **(NT)**	*Parmelia sulcata* (Skrynkellav)	*Pleurozium schreberi* (Väggmossa)	*Dendrocopos major* (Större hackspett)
Phellinus tremulae (Aspticka)	*Pertusaria albescens* (Mjölig porlav)	*Polytrichum juniperinum* (Enbjörnmossa)	
Piptoporus betulinus (Björkticka)	*Psilolechia lucida* (Citrongul skivlav)		
Stereum rugosum (Styvskinn)	*Umbilicaria sp.* (Navellavar)		
	Xanthoria parietina (Vägglav)		

Appendix VII: Participative map

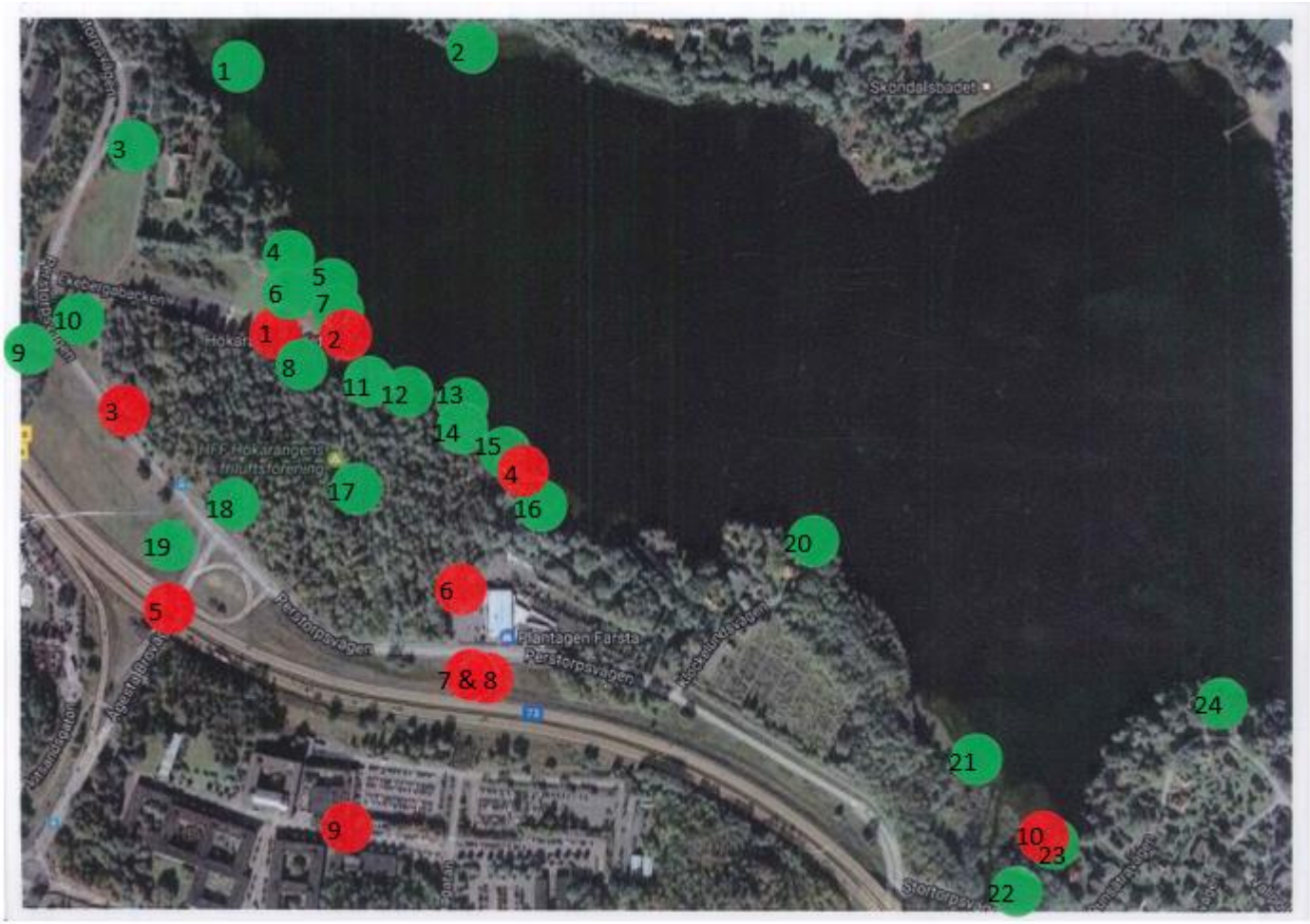


Figure 1. Participative map over Larsboda strand. Red dots are least appreciated spots, green dots are appreciated spots. Based on own interviews with visitors in area in December 2016.

 = Appreciated spots around Larsboda strand

1. Boat club
2. Appreciated view
3. Running track towards Sköndal starts
4. Picnic place on a rock
5. Swimming spot
6. Swimming spot
7. Swimming spot
8. Café in the summer time
9. Oak forest on hill
10. Appreciated trees
11. Walking path
12. Walking path
13. Walking path
14. Walking path
15. Swimming spot
16. Walking path
17. Café/dance pavilion in summer time
18. Camping hut
19. Sledding hill in winter time
20. Picnic/view spot
21. Walking path
22. Forest
23. River with unused potential
24. Picnic spot

 = Least appreciated spots around Larsboda strand

1. House in need for renovation
2. Outside barbecue where wood from camping huts is used
3. No pedestrian lane
4. Lack of lighting
5. Unpleasant bridge for pedestrians
6. Unpleasant path
7. Failed tree plantation
8. Failed tree plantation
9. Unappreciated area
10. River with unused potential