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Biodiversity at Volvo Group Real Estate

Identification of a suitable biodiversity framework and action plan for enhanced biodiversity

Master's thesis in Industrial Ecology

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Abstract

This master's thesis was done by request of Volvo Group Real Estate (VGRE) in Gothenburg, Sweden. The aim of this master's thesis was to decide upon a framework for biodiversity assessment and to develop an action plan for biodiversity for VGRE. A literature study in which criteria was found in order to identify a suitable biodiversity assessment framework was conducted. In addition, a field study, during which an assessment of VGRE:s approach to biodiversity was made. The field study took place at the VGRE site in Tuve, Sweden.

The research questions in this master's thesis gained insight into the data needed when performing a biodiversity assessment and which framework for biodiversity assessment that is most suitable for VGRE. They also investigated what the direct drivers of biodiversity loss that VGRE:s site in Tuve contributes to, how VGRE can reduce their negative impact on biodiversity at their site in Tuve and what actions that can be put in place in order to enhance and/or restore biodiversity at the site. During the master's thesis it was found that a recurring issue for businesses and industries is that there are many variables and corresponding complications when performing biodiversity assessments. The frameworks for biodiversity assessments, developed by various organisations (both governing and independent), are more complicated than they make light of. There is a certain level of knowledge and expertise needed to implement and/or supplement the frameworks used for biodiversity assessments.

The literature and field study was iterative and the selected framework was Biodiversity Net Gain (BNG). In addition, the framework should be able to handle time and resource constraints that may appear while leaving space for the inclusion of tools for continuous reassessment and evaluation. Therefore, in addition to BNG the company will need to adhere to the Mitigation Hierarchy. It was also suggested that the company will use the State, Pressure and Result (SPR) framework to find suitable indicators to monitor their efforts in a quantifiable way. The criteria that the selected framework needed to adhere to was decided upon during both the literature study and the field study. The action plan was divided into two parts, one for areas that are to be exploited and one for areas that are already exploited. In addition, good principles, are included as guidelines for the company to follow.

Keywords: Biodiversity, Biodiversity Assessment, Ecosystem Services, Biodiversity Net Gain, Mitigation Hierarchy, Sweden, Genetic Diversity, Real Estate, Framework, Biodiversity Enhancement and Restoration.

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Julia Brunke, Gothenburg, June 2024

Acronyms

Below is the list of acronyms that have been used throughout this thesis listed in alphabetical order:

BNG	Biodiversity Net Gain
BGP	Biodiversity Gain Plan
DEFRA	Department for Environment, Food & Rural Affairs
EIA	Environmental Impact Assessment
ESs	Ecosystem Services
GBF	Global Biodiversity Framework
LPA	Local Planning Authority
NCP	Natures Contribution to People
NVI	Nature Value Inventory
OBGP	Overall Biodiversity Gain Plan
PBGP	Phase Biodiversity Gain Plan
SBTs	Science Based Targets
SPR	State, Pressure and Response (framework)
SQS	Subcommission on Quaternary Stratigraphy
SES	Socio-Ecological Systems
STES	Socio-Technical-Ecological Systems
STS	Socio-Technical Systems
UN	United Nations
VGRE	Volvo Group Real Estate

Glossary

Biodiversity	The variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems (United Nations Environment Programme, 1992).
Biodiversity Assessment	A measurement of certain specified ecosystem components. (e.g. species richness and their relative abundance) (Winter et al., 2017).
Biodiversity Gain Plan	A plan that states how the objective of a 10% increase in biodiversity will be gained through the development project. It must contain a certain amount of information on specific matters to enable the LPA to grant the plan (DLUHC, 2024).
Biodiversity Net Gain	A way of improving or creating biodiversity in an area by putting demands on development projects to have a positive impact (DLUHC, 2024)
Biotope	The spatial environment of a biotic community. An area of uniform environmental conditions providing a living place for a specific assemblage of plants and animals. Is sometimes used interchangeably with 'habitat'.
Data	Simply put, it is information that can be used to analyse something or make decisions. It can be facts or numbers.
DEFRA	Abbeviation for "The Department for Environment, Food and Rural Affairs" which is one of the ministerial departments of the Government of the United Kingdom.
Grey Literature	This is scientific information that is not formally published as articles in scholarly journals.
Habitat	The spatial environment of specific species. An area of uniform environmental conditions providing a living place for a specific assemblage of plants and animals. Is sometimes used interchangeably with 'biotope'.

Nature Value Inventory	A survey that should be performed by experts in the field of ecology, biology and ecosystems. In Sweden it should be done according to the Swedish standard ftSS 199000:2021 (formerly ftSS 199000:2013).
Terrestrial Ecoregions	Defined as areas of land that share a large majority of dynamics, species and other environmental conditions (WWF, 2012). Globally there are 867 terrestrial ecoregions which can be further grouped toghether into 14 different types of biomes (forest, grassland, taiga etc.).
The Anthropocene	A proposed geologic epoch spanning from the year 1952 and forward (Witze, 2024). It was rejected by geologists on the 6th of March 2024 but is still a valid cultural concept describing the era of accelerated human impact on our planet.
The Holocene	The current geologic epoch which started 11700 years ago and spans up until the present day (Fairbridge and Agenbroad, 2019).
Volvo Group Real Estate	A global function within the Volvo Group that focuses on property management. Group Real Estate is responsible for the entire life cycle of the facilities including related services and solutions.

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Introduction

Biodiversity is in decline, you might have noticed the lack of bugs on the car window when driving during the summer (Cardoso et al., 2020). The money saved on wiper fluid might seem like a nice counterweight to the ever-increasing price of produce. Or you might have noticed, just as Rachel Carson did in 1962, an eerie silence during a spring morning. Silence, which is usually disturbed by the sound of hungry, newly hatched baby birds. The contributing factor of the silence may differ from that of which Carson wrote about in her book Silent Spring, but the silence persists. Bird control spikes and other forms of hostile architecture does exactly what it's supposed to. It works, and the pesticide we spray also works and we are left with silence and clean windows. It truly is a dream come true, for human wellbeing. If the irony is unclear, this is not a dream come true, this is not beneficial for human wellbeing, this is cause for concern. But what is biodiversity, and why should we care if it is in decline?

The Convention on Biological Diversity (United Nations Environment Programme, 1992), article two defines biodiversity as:
"The variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems"

Biodiversity can be enhanced and reduced. When reduced it is commonly referred to as biodiversity loss and when humans are to blame it is called anthropogenic biodiversity loss. This is not to be confused with natural biodiversity loss following seasonal changes, wildfires, floods or volcanic eruptions (Rafferty, 2024). The ecosystems are continuously adapting to these changes due to ecological succession (Rafferty, 2024; Thompson, 2024). This natural biodiversity loss is temporary and is actually dependent on the original biodiversity to get through these natural shifts of habitat composition (Thompson, 2024). However, the anthropogenic biodiversity loss is severe, long lasting and often viewed as permanent (Rafferty, 2024). This issue surrounding biodiversity loss is important for businesses and industries to take into account, and they can do so through biodiversity assessments.

A recurring issue for businesses and industries is that there are many variables and corresponding complications when performing biodiversity assessments (Lee and Kim, 2021; Andréasson, 2023). The frameworks for biodiversity assessments, developed by various organisations (both governing and independent), are more

complicated than they make light of. There is a certain level of knowledge and expertise needed to implement and/or supplement the frameworks used for biodiversity assessments (Andréasson, 2023). This said knowledge and expertise can be outsourced to consulting firms which then can cause internal and external issues for the company. These issues can be one or some of the following:
(1) External: A perceived financial loss with a perceived "non-financial gain" when defending biodiversity enhancing investments to stakeholders and investors (Andréasson, 2023).
(2) Internal: The company does not have sufficient knowledge about the product requested. In those cases problems arise when the work is done and the product is gone over within the company. If there is a lack of knowledge surrounding the product or service ordered, the company can't double-check that everything has been done. Nor can one make demands on those who perform the service (Sustainability Manager, VGRE, personal communication, 2024).

In order to see the value of implementing biodiversity enhancing actions, different governing bodies can use varying policy instruments to push the sector with its businesses, industries, companies and investors in the right direction (Lee and Kim, 2021; Andréasson, 2023). Fines for destruction of ecosystems and harm to biodiversity is one way to go and subsidies for biodiversity enhancing actions is another. However, the latter is difficult to measure and monitor in a consistent way since ecological scales, more often than not, don't align with the spatial planning scales of which urban planning resides (i.e., local, regional, national and international) (Sen and Dhote, 2023). But there is a way suggested and currently used by the UK government, implementation of the Biodiversity Net Gain (BNG) framework (Baker et al., 2019; DLUHC, 2024).

The case company of this master's thesis is Volvo Group Real Estate (VGRE), a function within Volvo Group that focuses on real estate acquisition, development and maintenance. It is a global function with 300 employees in 30 nations. VGRE is currently reliant on external contractors such as architecture firms, environmental consultant agencies and consults with specific expertise when expanding or developing, already existing and/or new areas for developmental projects. In order to be able to make demands to said contractors regarding biodiversity planning, VGRE needs more knowledge to identify the most vital actions for biodiversity management. This issue mostly stems from poor structures and lack of established frameworks for the employees to follow (Sustainability Manager VGRE, personal communication, 2024). With all this in mind, it is crucial to investigate the biodiversity adaptation and mitigation requirements and initiatives currently in place at the VGRE, and eventual corresponding knowledge gaps that may exist, before conducting the study. The company also wants to be able to perform biodiversity enhancing actions in a quantifiable way (Sustainability Manager VGRE, personal communication, 2024).

1.1 Aim and Objectives

Aim
The overall aim was to develop an action plan for biodiversity management within VGRE. This was achieved by:

1. Conducting a literature study in which criteria was found in order to identify a suitable biodiversity assessment framework
2. By doing a field study during which an assessment of VGRE:s approach to biodiversity was made. The field study took place at the VGRE site in Tuve, Sweden.

General objective
Suggest a framework for assessing biodiversity for VGRE that fits the criteria decided upon in the literature study. In addition, the framework should be able to handle time and resource constraints that may appear while leaving space for the inclusion of tools for continuous reassessment and evaluation.

Specific objectives for VGRE, Tuve site
Investigate how previous and current biodiversity assessments are performed at the Tuve site in regard to how they map current ecological infrastructure (habitats, flora, fauna etc).
Investigate if the assessments cover how the current land use and land use change impact the biodiversity in the company owned land and in the adjacent environment.
Assess and evaluate the current data gathering process at the site and identify key data that is, or can be, vital for continuous long-term assessment of biodiversity.

1.2 Research Questions

1. What data is needed in order to perform a biodiversity assessment?
2. What biodiversity framework is suitable for VGRE to use when performing a biodiversity assessment and how can it be specified in order to meet the company's demand?
3. What are the most prominent direct drivers of biodiversity loss that VGRE:s site in Tuve contributes to?
   (a) How can VGRE reduce their negative impact on biodiversity at their site in Tuve and what are the actions needed to be put in place in order to enhance and/or restore biodiversity?

1.3 Delimitations

The scope of the study was delimited to VGRE:s site in Tuve, Sweden and the direct drivers of biodiversity loss that they contribute to. The time frame of this project was delimited from the time when Volvo started their exploitation in the area of the site and goes on indefinitely. During the literature study, delimitations was made regarding the criteria for the selection of framework. The field study was made at

the VGRE site in Tuve. However, the overall goal of the study was to generate a generic action-plan for VGRE to use at varying geographical sites and therefore the geographic delimitation's vary throughout.

1.4 Limitations

Field study The study was only related to the outdoors environment and documents (grey literature) relating to the the outdoors and no assessment of the indoor environment or documents relating to it was made.

Literature study The goal of the study was to find a framework for biodiversity assessment which fits a set of criteria which was also decided upon during the literature study. With that in mind other ways to go about was left out of the selection process. The study was limited by language (English and Swedish).

2
State of the Art

This chapter gives insight into the current knowledge surrounding selected topics which are deemed of interest to this master's thesis. Some parts is to be further discussed upon in **Chapter 4** "Results and Discussion" while other parts are for background purposes.

2.1 Socio-Technical-Ecological Systems

In the field of systems thinking there is a rise of using the term Socio-Technical-Ecological Systems (STES) (Ahlborg et al., 2019; Tan et al., 2020). This stems from a choice being made to take the formerly separate terms Socio-Technical Systems (STS) and Socio-Ecological Systems (SES) and viewing them as one. When the technical curriculum, the social sciences and the field of ecology is viewed as entirely separate entities it contributes to many issues within our societal system. If we look back a few years, we can lift the following quote from Andrew Revkin, written in The New York Times 1992:

"Two billion years ago, cyanobacteria oxygenated the atmosphere and powerfully disrupted life on Earth, but they didn't know it. We're the first species that's become a planet-scale influence and is aware of that reality. That's what distinguishes us."

The quote is as relevant today as it was in 1992 and we, as a species, might have to get used to being responsible for the creation of, and the living standards of "the Anthropocene". This concept is the most common suggestion to use when referring to the geological epoch in which humans have impacted and altered earth system processes (Ahlborg et al., 2019). However, in a press statement on the 6th of March 2024 the Subcommission on Quaternary Stratigraphy (SQS) voted against the concept being used. After the vote was cast and the result was revealed, two members of the SQS are trying to challenge the vote one more time. But, the decision is supposed to be viewed as "final" and put an end to the 15 year debate (Witze, 2024).

The funny thing about any decision made by a small number of persons such as a commission, is that the vote does not really matter for human culture. In this context it is impossible to erase the cultural impact that the concept of "the Anthropocene" has had on society (Witze, 2024). It has been used for numerous years and all literature mentioning it cannot be altered or redacted from history. This is the main

reason for the concept being used in this master's thesis, it may not be recognised as a geologic epoch but the overall definition still holds meaning in society.

2.2 Ecosystem Services and Nature's Contribution to People

Recently researchers have shifted the view of society from STS and SES to STES, as earlier descibed (Tan et al., 2020; Ahlborg et al., 2019). To fit the new view of society and be inclusive of the benefits humans reap from nature, other than those we can put economic value on a new trans-disciplinary tool was developed (Hill et al., 2021; Ellis et al., 2019). The concept we know as "Ecosystem Services" (ESs) is now being referred to as "Nature's Contribution to People" (NCP) in multiple more recent publications, but the concepts are not directly interchangeable (Kadykalo et al., 2019). You might wonder why, rightfully so, because both concepts ultimately work as tools when valuation of nature is on the table. Well, the names of the tools give an indication on how they differ. The ESs concept is based on an anthropocentric view where the ecosystems surrounding humans provide society with services. The reaping of benefits are one sided, favouring society. The second tool, NCP, is also one sided as in who reaps the benefits and it also favours society. However, the wording makes a difference. While skipping over the etymology of the words "services" and "contribution", the difference should still be clear. It is basically the same as "having an expectation of something being provided" versus "having something, which is deemed as vital, being given with no charge". The latter is more likely to invoke a feeling of gratefulness while the former makes for quite a spoiled and entitled outlook on life. The words used are important, the words used have value and how we use words are likely to change even more in the future, all to correct past mistakes. Even though Díaz et al. (2015), in the IPBES conceptual framework, started introducing the term NCP, the human absolute dependance on natural capital is not a revolutionary discovery (Díaz et al., 2015; Diaz et al., 2018; Hill et al., 2021; Tan et al., 2020; Jax et al., 2013). However, the "how to" regarding economic valuation of biodiversity and biodiversity management can be...

The concepts of ESs and NCP are not interchangeable in the means of that they don't refer to the exact same things (Kadykalo et al., 2019). This is vital to take into consideration when reading literature and collecting data, as it may otherwise become confusing. The NCP concept is in no need for the concept of ESs to be replaced. It rather permits that ESs can be used as a tool when there is a need for descriptions to be made regarding the human-nature interactions (Hill et al., 2021). While the ESs concept uses four groups when describing the human-nature interactions known as "provisioning, regulating, cultural and supporting" the NCP concept uses three: "material, non-material and regulating". In this paper the ESs have been fitted into NCP categories to adhere to the evolving language. This is visualised in **Figure 2.1**.

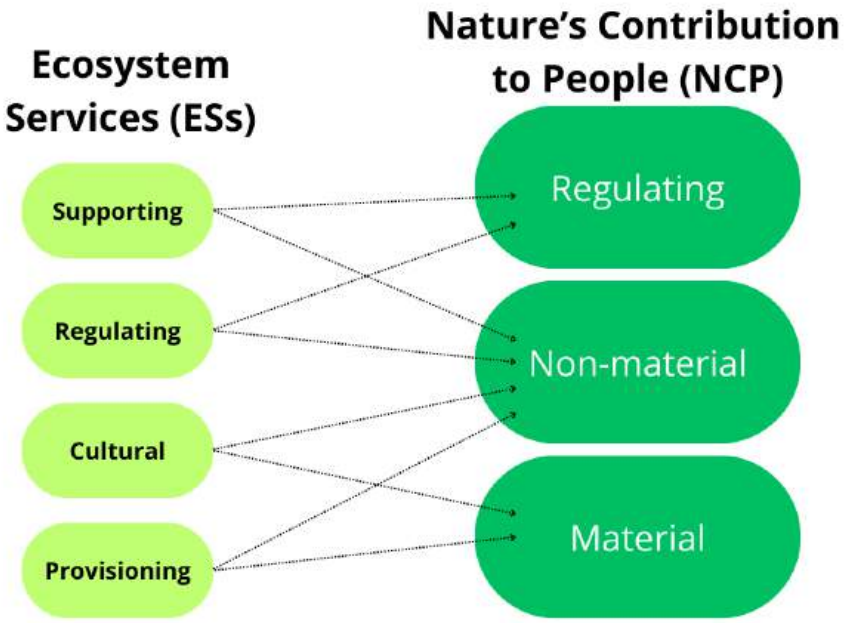


Figure 2.1: How the groups in ESs fits within the groups of NCP. Adapted image from (Diaz et al., 2018).

These two groups differs in a few ways, for instance; using the NCP groups does not confine the entities of nature which provides the contributions to the ecosystem level. The NCP approach also emphasises that human culture penetrates all interactions with nature and is therefore included in all three groups instead of having a stand-alone group as in ESs. Nevertheless, the ESs categories can in most instances fit rather well into the 18-NCP classification and reporting system (Hill et al., 2021). The 18-NCP classifications and three groups in which the human-nature interactions are described according to NCP is seen in **Figure 2.2**.

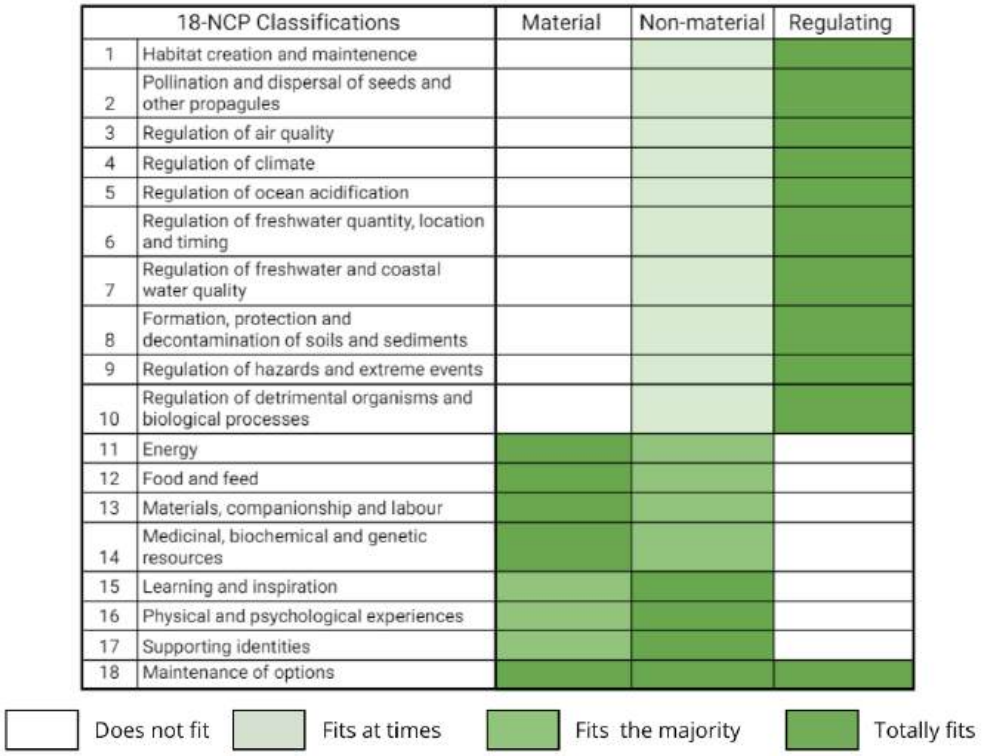


Figure 2.2: The 18-NCP classifications and how they fit into the three NCP groups. Adapted image from (Diaz et al., 2018).

2.3 Ecosystem services and ethics

It is impossible to discuss the concept of ESs without taking values and ethics into account (Jax et al., 2013). This is due to the fact that ESs refers to human needs and puts the interest of humans first and foremost.

When a human being believes that the only thing possessing intrinsic value in life is human beings that humans belief is referred to as "Anthropocentrism" (Rottman, 2014). One with this ethical view believes that all other life holds instrumental value, i.e., value because it brings benefits to the one entity with intrinsic value. The opposite of anthropocentrism is "Biocentrism" in which one believes that all life has equal moral standing and is entitled to equal moral consideration.

When delving into more ethical views one can ponder on what one consider immoral. If one has an "anthropocentric" view on life one can still believe that pollution of the environment is immoral. But not because it harms the environment per se. No, rather because it may cause harm to or negatively affect lives of people. One can also from a "biocentric" point of view argue to convince one with an "anthropocentric" viewpoint that depletion of resources is immoral because it takes away from future generations. The main takeaway is this, if you know your own moral standing and ethical view you can use it to your benefit if you try to argue your point across to someone with another (Rottman, 2014).

2.4 Genetic Diversity

When trying to maintain/reestablish the long-term health of ecosystems it is vital to look at factors besides species loss. It is known that loss of genetic diversity, mainly in combination with fast population decline, raises the probability of inbreeding (Rafferty, 2024). Genetic diversity is important because high genetic diversity makes a population more resilient to disease, makes it easier to adapt to changes in the environment, raises the success rate of reproduction, enables innovation and raises the overall ecosystem health visualised in **Figure 2.3** (University of Gothenburg, 2020; Heller and Zavaleta, 2009).

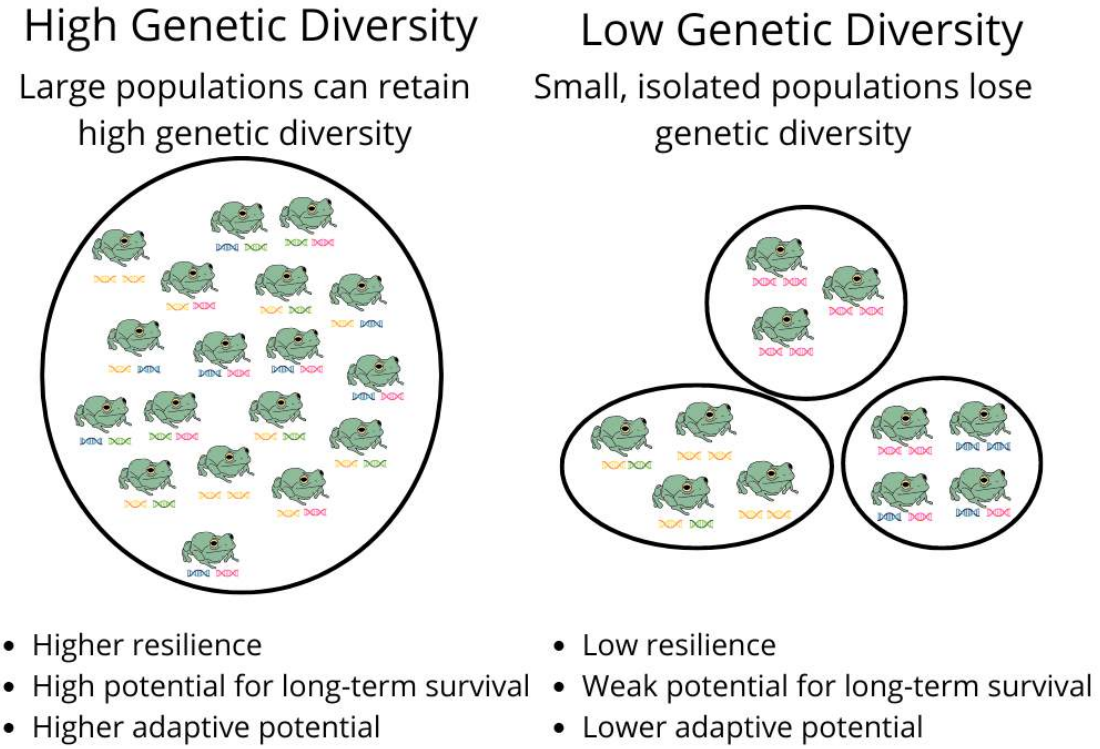


Figure 2.3: Image depicting the importance of genetic diversity by comparing a large population to smaller, isolated populations. Adapted from (University of Gothenburg, 2020).

Genetic diversity is listed as a "limitation" in a study by Sen and Dhote (2023), indicating (by definition) that the researchers could not take that into account due to external constraints (Sen and Dhote, 2023). What these external constraints are and how they can be mitigated is not mentioned. Furthermore, due to being a limitation they omitted instruments that account for genetic biodiversity in their study. They did mention that the United Nations (UN) deemed it important to take genetic diversity into account and how other researchers listed genetic diversity as one of the defining traits of urban biodiversity. The concept of urban biodiversity or

rather "the inclusion of biodiversity into urban planning" is what the authors of the 2023 study is aiming to construct a framework for (Sen and Dhote, 2023). Therefore, by omitting genetic diversity as a variable within their suggested framework their work will need further development before being suitable for use. It is however vital to note that in some cases limitations can be necessary in order increase the generalisability of studies.

As per the paragraph above, there is a knowledge gap in the literature regarding genetic diversity. It is suggested that the biodiversity assessment frameworks lack tools that take genetic diversity into account in a meaningful and measurable way. However, global research efforts on metabarcoding to identify organisms from environmental DNA (eDNA) may very well bridge this gap in the future (Pinakhina and Chekunova, 2020). The method of taking eDNA samples to monitor/assess invasive and endangered species is already a proven method, which in more recent years (since the mid-2000s) have gained a lot of traction. The eDNA samples can be collected from ice and permafrost, lake sediments, soils, cave sediments, air and water from stagnant water bodies, rivers, brooks, and oceans.

At the site in Tuve eDNA samples are taken to decide on if certain species (amphibians) are present in the area (Hernvall et al., 2022). The findings from those samples showed that that was the case but the amount of individuals still had to be counted by hand (Hernvall et al., 2022). The government in Sweden, through the Swedish Environmental Protection Agency (SEPA), is currently funding research on eDNA to be used as a tool for biodiversity assessments (SWEDNA, 2023; Naturvårdsverket, 2019). Hopefully, this research will give future generations more resources to work with when assessing genetic diversity.

2.5 Ecological Succession

The progression of species following ecological succession can be predicted, given that there is knowledge regarding the surrounding habitats, because the chain of events are not random (Thompson, 2024). Ecological succession can be either primary or secondary. Primary succession takes place on barren lands where a previous volcanic eruption or a retreating glacier has left the soil in a state which is unfavourable for lifeforms to reside within. Secondary succession, on the other hand is basically trivial disturbances that does not leave the area void of either nutrients or life. The area left behind is not fully deserted of life and the communities that formerly inhabited the area are removed, but not in full. Nevertheless, both primary and secondary succession (i.e. ecological succession) is followed by pioneer species settling into the area (Sottosanti, 2023). After the pioneering species comes the intermediate species and it ends in a climax community (Sottosanti, 2023; Eds Encyclopaedia Britannica, 2024). Pioneering species, such as lichens, mosses, fungi and different types of microorganisms, are the initial species that will reside in the area (Sottosanti, 2023). Their growth and reproduction rate enables them to settle and thrive in the barren areas before larger species arrive. The larger species are referred to as intermediate species in **Figure 2.4** and **Figure 2.5**. In the last stage, when the area

is deemed to be stable, it is referred to as a climax community (Eds Encyclopaedia Britannica, 2024). The climax community is often viewed as "permanent" in the sense that the existing species composition successfully reproduce themselves and eventual threatening species fail to establish themselves in the area. It is vital to note that the overall time it takes for an area to go through primary succession is far, far greater than the time it takes to go through secondary succession as seen in **Figure 2.4** and **Figure 2.5**.

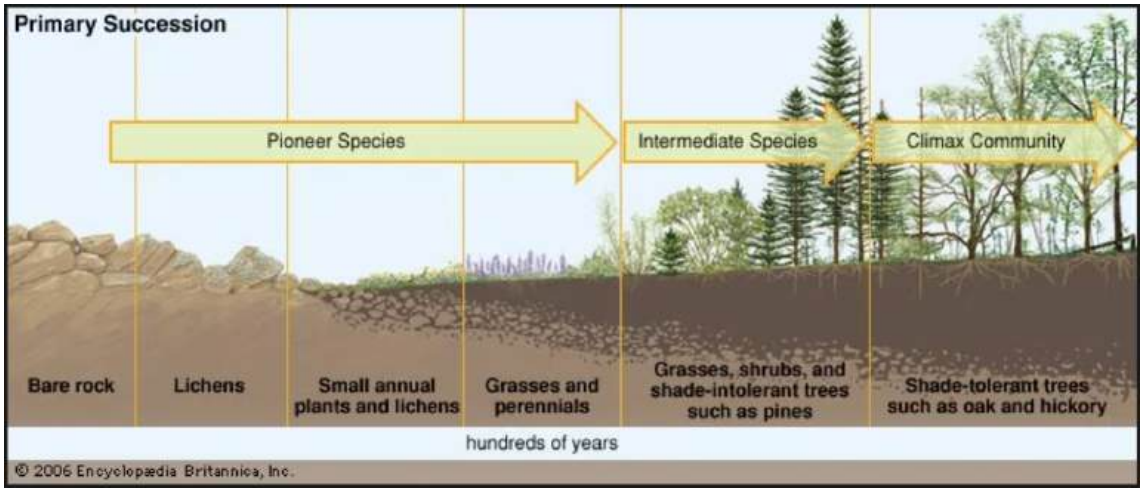


Figure 2.4: Primary succession over time on a barren land. (Image Source: Encyclopædia Britannica, Inc. (2006). *Primary Ecological Succession* [Image]. Encyclopedia Britannica. `https://www.britannica.com/science/ecological-succession/images-videos`).

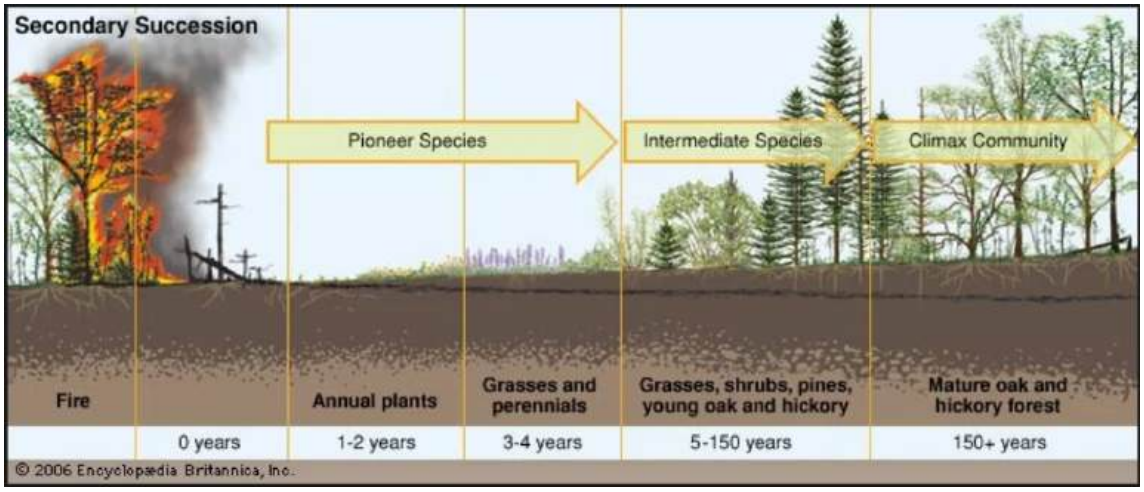


Figure 2.5: Secondary succession over time with a forest fire being the driving force behind the succession taking place. (Image Source: Encyclopædia Britannica, Inc. (2006). *Secondary Ecological Succession* [Image]. Encyclopedia Britannica. `https://www.britannica.com/science/ecological-succession/images-videos.`)

2.6 Anthropogenic biodiversity loss

Globally, the direct drivers of anthropogenic biodiversity loss is a current issue that is high on the agenda for various governing bodies (Jaureguiberry et al., 2022; European Commission, 2020a; SCBD, 2020). The five major direct drivers of anthropogenic biodiversity loss are: land/sea use change, direct exploitation of natural resources, climate change, pollution, and the spread of invasive species visualised in **Figure 2.6**. When assessing the direct drivers of anthropogenic biodiversity loss there is an overarching need to view the issue using different scopes (e.g. global, regional or national). Starting with a global scope, the major direct driver (on a terrestrial level) is land use change followed by direct exploitation as the second biggest contributor (Jaureguiberry et al., 2022).

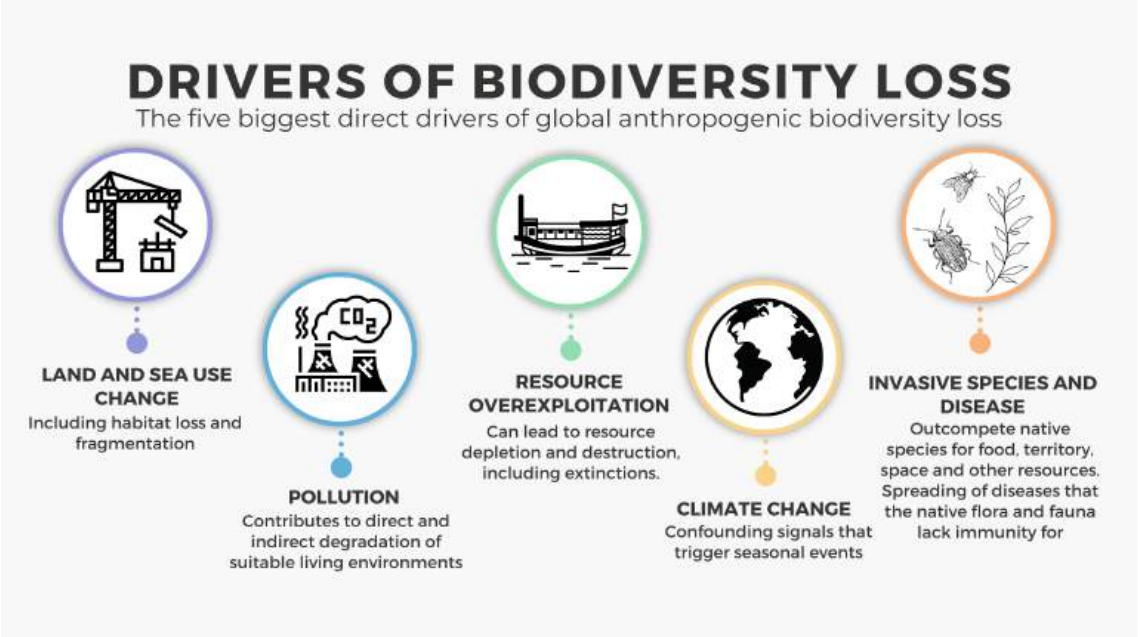


Figure 2.6: The five major direct drivers of global anthropogenic biodiversity loss. Made by the author.

During recent years developers and researchers have been trying to mitigate the current drivers and reduce anthropogenic biodiversity loss. Suggestions regarding inclusion of new design elements and promoting biodiversity enhancing building measures are made and put to the test (Grossenbraeucker, 2020; Panlasigui et al., 2021). When looking at how biodiversity can be included into urban planning there is a concept called "biophilic design" within the building and architecture sector (Panlasigui et al., 2021; Lee and Kim, 2021). This concept makes for the inclusion of elements such as environmental features into the planning stage when designing urban areas, this can result in designing urban greenspaces to support biodiversity (Panlasigui et al., 2021). However, biophilic design is viewed through an anthropocenic perspective and the main goal of its implementation is human well being and mitigation of urban environmental problems (Lee and Kim, 2021). By viewing the implementation of nature to urban areas through a myopic lens it poses a threat

towards reaching long-term ecological stability.

At VGRE, biophilic urban design elements are sometimes included in the architectural plans for expansions from architectural firms. The inclusion of beautiful, lush greenspaces in an area can benefit biodiversity but if negative aspects for biodiversity are included, such as lightfixtures aimed upwards which disturbes nightliving creatures are included just to benefit humans, it may be relevant to rethink those aspects (Naturvårdsverket, 2023b; Panlasigui et al., 2021; Lee and Kim, 2021). Therefore, a challenge the company faces is to find complementary strategies and actions to the concept in order to transform it to be truly beneficial for biodiversity, rather than omitting the concept from the internal channels of communication. This is especially true if the company wants to obtain and retain a more biocentric view and outlook.

2.7 Global Frameworks

You can realise why it is hard to regulate and monitor biodiversity on a global level. Biodiversity, simplified, is 'all the different kinds of life you'll find in one area' and therefore one can set the scope as one find suitable. However, it does not take much critical thinking skills to realise that if one wish to go in to specifics, a global scale is far too broad (Sen and Dhote, 2023; Heller and Zavaleta, 2009). The biodiversity enhancing actions that may work in 1 of the 867 terrestrial ecoregions of the world does not necessarily fit the all or even 1 of the others (WWF, 2012). Simply put, there is no 'one solution fits all' and therefore global regulations must be broad and unspecific to ensure that it does good rather than harm. And when they are broad and unspecific the regulations are open for interpretation which can result in some nations doing the bare minimum or refraining from following the regulations at all. There is also a great difference in socioeconomic status in between nations and that also affects how well the nation are able to follow the global regulations.

2.7.1 Kunming-Montreal Global Biodiversity Framework

The Global Biodiversity Framework (GBF) is the replacement to the Strategic Plan for Biodiversity and the corresponding Aichi Biodiversity Targets (Andréasson, 2023; Naturvårdsverket, 2023c). It was adopted in December 2022 at the 15th meeting of the Coference of the Parties (COP15) to the Convention on Biological Diversity (CBD). The GBF includes 4 goals and 23 target which are to be achieved by 2030. The 4 goals are: Halt loss and restore nature; Use land and seas sustainably; Share benefits and services and Mobilise necessary resources. The 23 targets can be seen in **figure 2.7**.

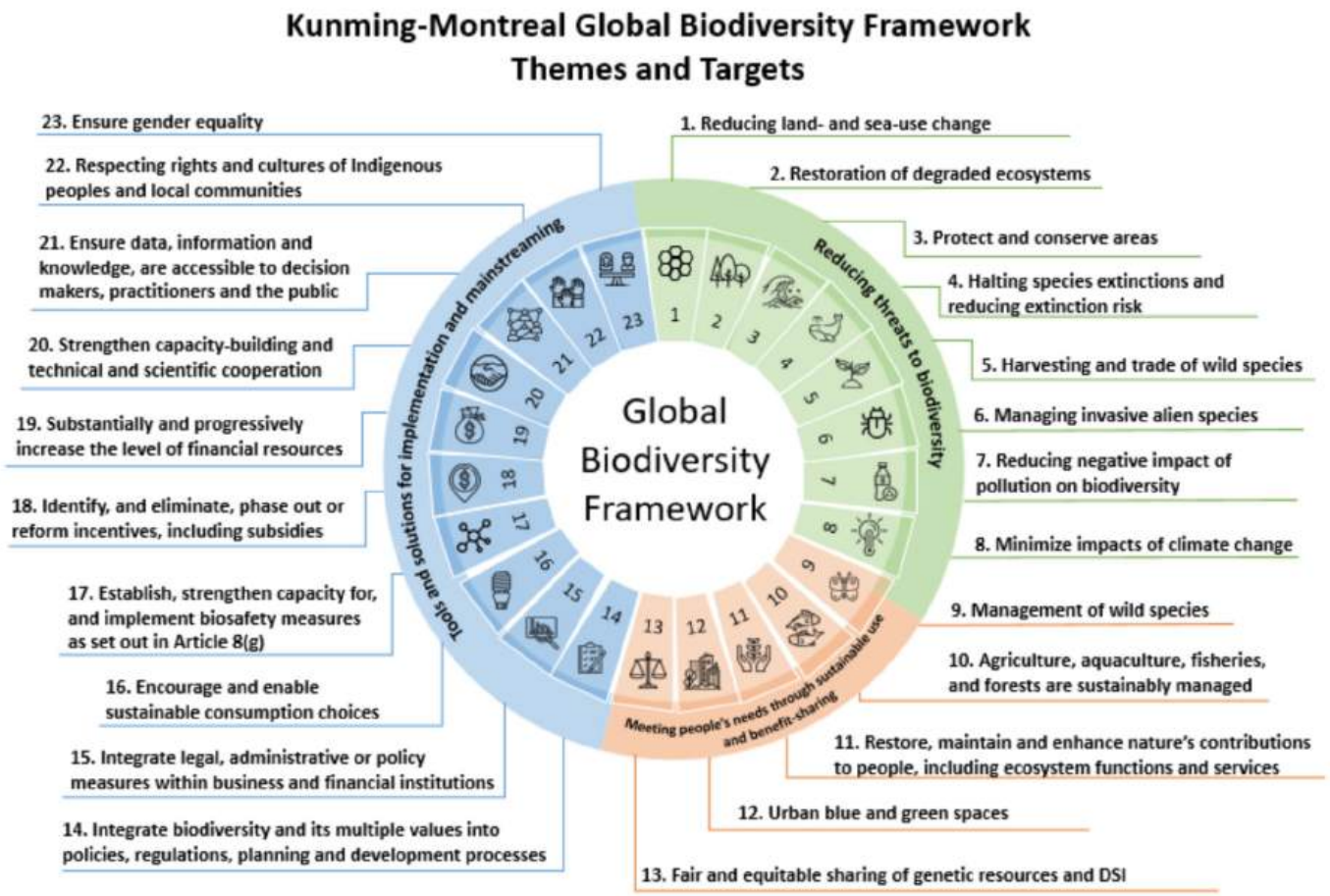


Figure 2.7: Schematic of the KMGBF goals and targets from `https://www.canada.ca/en/services/environment/wildlife-plants-species/biodiversity/2030-biodiversity-strategy-canada.html` (Environment and Climate Change Canada, May, 2023).

2.8 EU policies and regulations

The EU policies and regulations direct and indirectly affect VGRE. Due to the fact that Volvo Group is based in Sweden which is a part of Europe and also the EU, all branches needs to adhere to the European reporting standards (Sustainability Manager VGRE, personal communication, 2024).

2.8.1 Regulations

The EU Taxonomy Regulation EU 2020/852 ('the EU Taxonomy')
The EU Taxonomy is used in order to classify sustainable economic activities (European Commission, nda). This is done in relation to the six environmental objectives of the EU:

1. Climate change mitigation
2. Climate change adaptation
3. Sustainable use and protection of water and marine resources
4. Transition to a circular economy
5. Pollution prevention and control
6. Protection and restoration of biodiversity and ecosystems.

In order for an activity to be viewed as "sustainable" according to the EU Taxonomy it needs to have substantial contribution to one or more of the objectives (European Commission, nda; Andréasson, 2023). But, that is not all, it is also crucial that the activity does not cause significant harm to the other objectives which it doesn't contribute towards and also that it meets a certain defined minimum safeguard. Keep in mind that the EU taxonomy is supposed to be a reflection of current technology and policy developments and is therefore updated regularly.

The Nature Restoration Law
The law, adopted by the European Commission, entails that member nations will have to report their plans as of how they aim to restore at least 20% of land and sea by 2030 (European Commission, ndb). The final goal is to restore all areas of ecosystems in need in the EU by the year 2050.

2.8.2 Directives

The Habitat Directive
The legislation aimed at conserving biodiversity and protecting natural habitats and species within the European Union (WWF and Bain & Company, 2023; Andréasson, 2023). It establishes a network of protected areas known as Natura 2000, which includes Special Areas of Conservation (SACs) designated for habitats and species of European importance. The directive requires member states to take measures to maintain or restore habitats and species listed in its annexes to favorable conservation status, through habitat conservation and restoration, species protection, and appropriate land management practices. Member states are also required to assess the potential impacts of projects and plans on Natura 2000 sites through appropriate assessments (known as Habitats Directive Assessments) and to ensure that such

projects do not adversely affect the integrity of these sites.

The Water Framework Directive
This directive is aimed at protecting and improving the quality of surface water bodies (such as rivers, lakes, and coastal waters) and groundwater across the European Union (WWF and Bain & Company, 2023; Andréasson, 2023). It establishes a framework for integrated water management, setting objectives for achieving "good ecological status" or "good ecological potential" for all water bodies. The directive requires member states to develop and implement river basin management plans (RBMPs) that outline measures to achieve these objectives, including pollution control, habitat restoration, water flow management, and monitoring.

Corporate Sustainability Reporting Directive (CSRD)
CSRD is a EU legislation aimed at enhancing the transparency and comparability of sustainability information disclosed by companies (WWF and Bain & Company, 2023; Andréasson, 2023). It requires companies to report on a wide range of sustainability topics, including environmental, social, and governance factors. CSRD aims to standardise sustainability reporting across the EU, making it easier for investors, stakeholders, and the public to assess a company's sustainability performance.

European Sustainability Reporting Standard Environment 4
European Sustainability Reporting Standard Environment 4 (ESRS E4) is a tool that in the future can be used for assessing the potential impacts of development projects on biodiversity, ecosystems and ESs (EFRAG, 2022a; EFRAG, 2022b). It helps decision-makers identify and evaluate the ESs that may be affected by a project and assess the potential consequences of those impacts. ESRS E4 provides a structured framework for incorporating ESs considerations into strategic environmental assessments, allowing for more informed decision-making. The ESRS E4 tool is part of the full ESRS tool in which there are two cross cutting standards an ten topical standards visualised in **Figure 2.8**. As of writing there is no specification on reporting for developmental companies written.

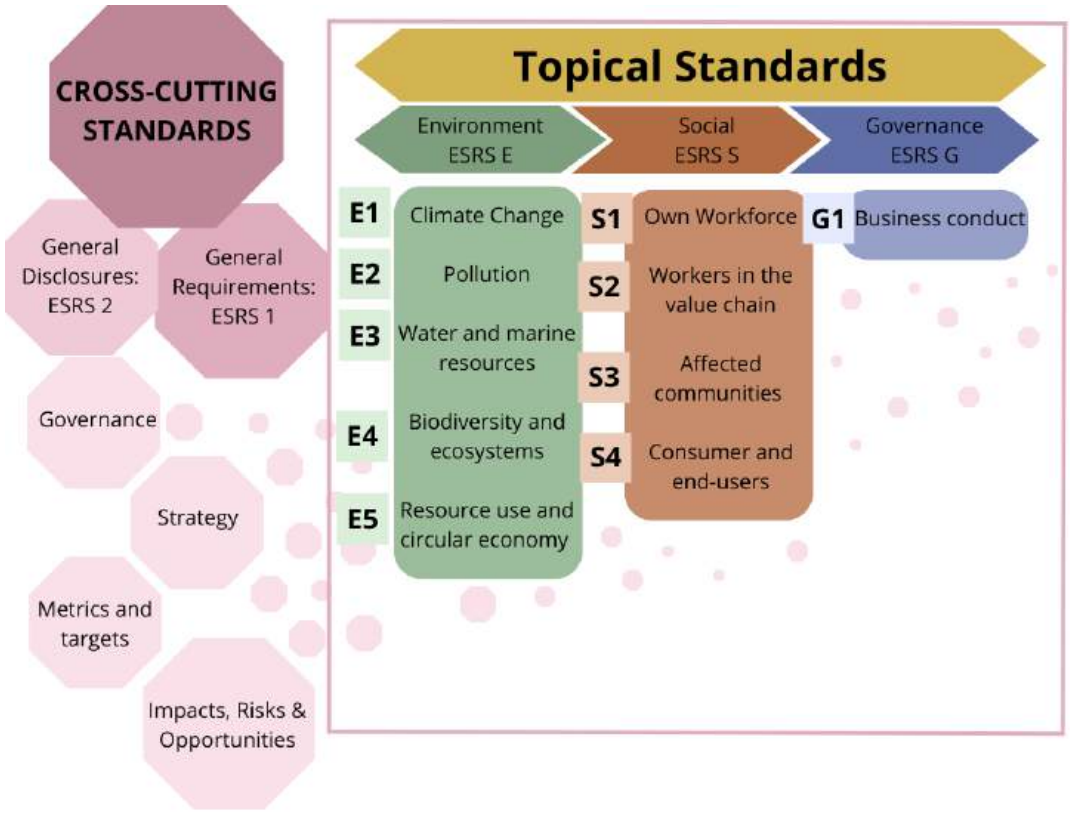


Figure 2.8: All ESRS standards and how they align with one another. Made by the author.

2.8.3 EU Green Deal

The EU Green Deal aims to transform the EU in order to strengthen the economy and being more resource-efficient (European Commission, 2020b; Andréasson, 2023). The three pillars of the EU Green Deal are:

1. no net emissions of greenhouse gases by 2050
2. economic growth decoupled from resource use
3. no person and no place left behind

The European Commission is overall striving for Europe to become the first climate neutral continent (European Commission, 2020b). It is up to the reader if you find this goal reasonable due to the fact that all nations within the continent is not member nations of the EU. Note that the EU itself is just that, a union, made up of 27 nations (European Union, 2023). The full number of nations within Europe is between 46 and 51 (Jones, 2023). The number vary depending on how they are counted and by whom they are counted (i.e., it depends on how one define Europe's borders and what one recognises to be an independent country). So by a swift calculation one can find that the member states makes up somewhere in between 53-58% of the total number of nations on the continent. It is also worth to note that the geographic size, Gross Domestic Product (GDP) and sociopolitical climate of the non-member states vary greatly.

2.8.4 Fit for 55 package

The EU Fit for 55 package is a comprehensive set of legislative proposals aimed at accelerating the European Union's efforts to combat climate change and achieve its climate targets (The European Council, nd). Introduced in July 2021, the package is part of the EU's overarching goal to reduce greenhouse gas emissions by at least 55% by 2030 compared to 1990 levels. As of now, all 27 EU Member States have accepted this deal and pledged to reduce emissions by 55% (European Commission, 2019).

2.9 Swedish policies and regulations

In Sweden the environmental demands are on national, regional and local scales.

2.9.1 The Swedish Environmental Code

The Swedish Environmental Code (Miljöbalken, SFS 1998:808) is a comprehensive legal framework that governs environmental protection and management in Sweden (Naturvårdsverket, nd). It integrates principles such as; sustainable development, precaution, and public participation to safeguard Sweden's natural resources and ecosystems.

2.9.2 A Swedish strategy for biodiversity and ecosystem services

This strategy aims to address the complex challenges facing biodiversity conservation and ecosystem management while promoting sustainable development and human well-being (Ministry of Climate and Enterprise, 2015). It provides a framework for coordinated action among government agencies, stakeholders, and the public to safeguard Sweden's rich biodiversity and ecosystem services for future generations.

2.10 Biodiversity in Gothenburg

The municipality prioritizes the preservation and enhancement of green spaces, parks, and urban forests to promote biodiversity and provide recreational opportunities for residents (The environmental administration Gothenburg, 2021). Initiatives include planting native vegetation, creating wildlife habitats, and establishing green corridors. There is no protected biotopes by the municipality other than those covered by the general biotopes protection. The biotopes covered by the general biotope protection in Sweden is (Naturvårdsverket, 2024):

- Alley
- Spring with surrounding wetland in agricultural land
- Cultivation heap in agricultural land
- Pollard willow
- Small water source and wetland in agricultural land

- Stone wall in agricultural land
- Field islet

2.11 Biodiversity at Volvo Tuve

This section gives at a quick glance an overlook of the current situation at VGRE at the site in Tuve.

2.11.1 Potential direct drivers for biodiversity loss

The main direct drivers of biodiversity loss that VGRE contrubutes towards at the Tuve site is land use change (habitat loss and fragmentation), pollution (light, soil and air) and the introduction of invasive species (WWF and Bain & Company, 2023; Thorn et al., 2021; Van den Heuvel et al., 2020). The land use change stem from the fact that developmental projects have been ongoing at the site since 1975 (Sustainability Manager VGRE, personal communication, 2024). This has led to that the former agricultural landscape, on and off, has gone through both rapid and slow changes. The pollution is being caused by the day to day operation of the factory, past pollution, expansions of the factory and the employees commuting too and from the site. A current concern that has to do with pollution is that PFAS is found at the site. This PFAS, which initially was introduced to the ground through the use of fire extinguishers containing synthetic foams rich in PFAS many years ago, is still there today. These foam extinguishers are designed for fires of flammable liquids where the PFAS act as surfactants, reducing the tension of the liquid which enables the foam to spread and suppress the fire. The introduction of invasive species is mainly caused by the introduction of mono cultures (grass lawns etc) and reducing the resilience of established ecosystems in the area by depleting them or removing them (Sustainability Manager VGRE, personal communication, 2024). Invasive species was also found on the premises during a site visit which presumably comes from an earlier project at the site when excavated masses where put in a specific area to make a small hill (Property Manager Tuve, personal communication, 2024). More on that specific matter is not further investigated in this master's thesis.

2.11.2 Incentives to work with biodiversity

The incentives to work with biodiversity at VGRE is both internal and external and is quite intertwined (Grigg et al., 2021). The main contributors to the internal incentives to work with biodiversity is a combination of: Wanting to keep old and attract new investors; Wanting to attract future employees; The internal need to attract the correct competence and; The internal standard the company want to adhere to (Sustainability Manager VGRE, personal communication, 2024). The external incentives to work with biodiversity stems from policy and regulation (Naturvårdsverket, 2024; WWF and Bain & Company, 2023; Andréasson, 2023; European Commission, ndb; European Commission, nda; Naturvårdsverket, 2023c).

2.12 Tools and frameworks

This section contains a quick summary of the Mitigation Hierarchy, the State, Pressure and Response framework and the Biodiversity Net Gain framework.

2.12.1 Mitigation Hierarchy

The Mitigation Hierarchy is a framework used to guide decision-making in environmental management and impact assessment (Bennun et al., 2015). It can be used by companies when they are developing and deciding on the implementation of strategies to minimise their impact on biodiversity and ESs. The areas most in need of mitigation measures can be identified by the use of ESRS E4. The strategies and the identified areas can then be disclosed as part of the company reporting under CSRD.

When applying the mitigation hierarchy it is vital to let each step take its time and to avoid rushing through the steps (Cares et al., 2023). The mitigation hierarchy consists of four steps: avoidance, minimisation, restoration, and offsets (Bennun et al., 2015). However, in more recent publications a fifth step, enhance, is included which refers to the implementation of measures to create new benefits in an area (Cares et al., 2023). The mitigation hierarchy prioritises actions that will avoid or minimise negative impacts on ecosystems, ESs, and biodiversity, followed by efforts to restore (or rehabilitate) affected ecosystems and, if necessary, offset any residual impacts through compensatory measures (Bennun et al., 2015; Cares et al., 2023). The overall prioritisation triangle can be seen in **Figure 2.9**.

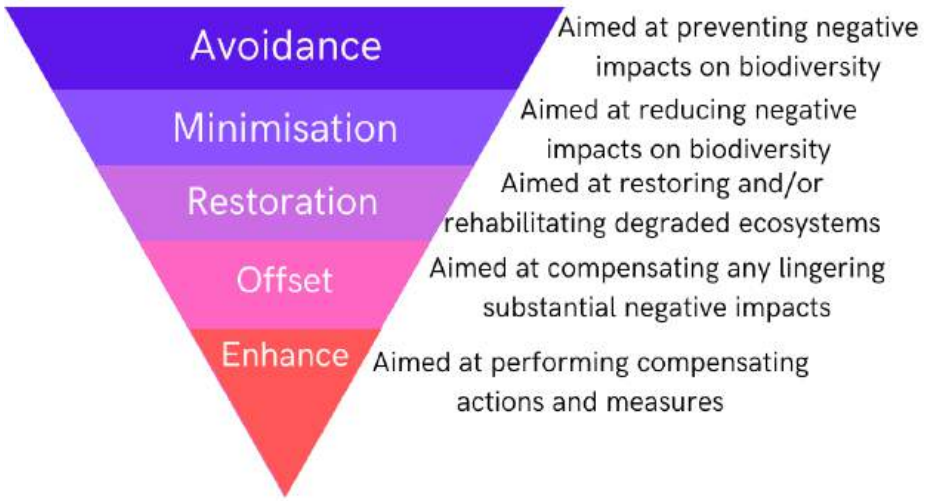


Figure 2.9: The Mitigation Hierarchy. Adapted from (Cares et al., 2023).

An overall challenge when applying the mitigation hierarchy in practice is; using it in a correct way and ensure that one is able to monitor biodiversity outcomes in a quantifiable way (Cares et al., 2023). This is can stem from the fact that projects have a tendency to skip the first steps of avoidance and minimisation and jump straight towards compensating actions. A study made by Cares et al. (2023) showed that there was a strong bias towards using compensating actions which indicates that the mitigation hierarchy is used in a poor manner. When biodiversity related indicators are not used for every step of the mitigation hierarchy there is no way to allow measurements of net gains (Cares et al., 2023). The overall success of utilising the mitigation hierarchy depend on enforcing monitoring post the decision which can certify the effect of the mitigation measures (i.e. one need to implement a monitoring program for each of the measures taken).

When applying the mitigation hierarchy in a correct way it is important to let each step take the time necessary (Cares et al., 2023). As seen in **Figure 2.9** the first step has been given the biggest slice of the triangle and therefore should be viewed as the most important step. The size of each step (or level) or the mitigation hierarchy is vital to note to get a grasp on how much time effort that should be put towards each of the steps. However, this does not mean that one can skip any of the steps when starting to work on a project (Cares et al., 2023; Bennun et al., 2015). But, when to move from one step to another is lacking guidance, just as there is no clear guidance on how to classify impacts within the mitigation hierarchy (Cares et al., 2023). This contributes to that first step of avoidance in the mitigation hierarchy is often applied in a bad way or even fully disregarded. It is important to note that the mitigation hierarchy needs to be used iterative. If one has gone through the steps of avoidance and minimisation and, when moving on to restoration and offsets, realises that it is impossible to compensate for the harm being done one must start over and at the avoidance step once more.

2.12.2 State, Pressure and Response Framework

This State, Pressure and Response (SPR) framework is used to develop indicators for site-based impacts (UNEP-WCMC, 2020). The “State” indicators should show the current condition and status of biodiversity at the site. The “Pressure” indicators should entail the main cause of biodiversity loss as well as the extent of biodiversity loss att the site. The “Response” indicators should give an overview of the actions taken to reduce the pressure on biodiversity and therefore also improve the “State” indicators.

2.12.3 Biodiversity Net Gain

Biodiversity Net Gain (BNG) is an approach designed to ensure that development projects result in a net increase in biodiversity (Baker et al., 2019; DLUHC, 2024). In essence, it means leaving the natural environment in a better state than before development took place. According to DEFRA (Department for Environment, Food & Rural Affairs), BNG involves assessing the biodiversity value of a site be-

fore development, implementing measures to avoid or minimise harm to biodiversity during development, and then delivering measurable improvements to biodiversity post-development (Baker et al., 2019). Implementing Biodiversity Net Gain (BNG) within a real estate branch of a global company involves integrating biodiversity considerations into the planning, design, and management of development projects. A starting point can be to develop a company-wide strategy to pledge to deliver BNG. It is also important to know that the mitigation hierarchy is a cornerstone when working towards achieving BNG (Baker et al., 2019). It is impossible to achieve BNG for development projects if you bypass the initial steps of avoidance and minimisation and move on directly to compensating actions. Biodiversity gains or net gains should be reached for every step of the mitigation hierarchy throughout a project.

When submitting a Biodiversity Net Plan it is demanded to include certain elements (DEFRA, 2024; DLUHC, 2024). The first thing that needs to be included is information about relevant steps either already taken or to be taken to minimise negative effects that the development will have on the biodiversity value of habitats onsite or offsite. The second and third things are the pre-development biodiversity value and the post-development biodiversity value of the onsite habitat/habitats which both are calculated by using a specific tool (further described below) (DEFRA, 2023; DEFRA, 2024). The fourth and fifth things also needs to be included, i.e., if there are any eventual off-site biodiversity gains registered as allocated to the development and if there has been any biodiversity credits purchased. However, these five things are not all that needs to be included when submitting an Overall Biodiversity Gain Plan (OBGP) or a Phase Biodiversity Gain Plan (PBGP). In these cases companies will have to look towards their Local Planning Authority (LPA) to see the specific demands put in place according to them. DEFRA currently has their additional demands for both OBGP and PBGP listed on the UK government website (DEFRA, 2024). More on specifics regarding OBGP and PBGP will not be included in this master's thesis and they are only mentioned to inform the reader about the fact that there is exceptions to the five things that are to be included when submitting a Biodiversity Net Plan to the LPA.

Calculating pre- and post- development biodiversity values
The biodiversity net gain should result in a 10% increase of biodiversity and this is calculated against the pre-development biodiversity value of the site (Baker et al., 2019). This value represents the initial value of the habitats on the site the day the planning permission is granted (Baker et al., 2019; DLUHC, 2024). The pre-biodiversity value can be calculated using an official biodiversity metric tool "the statutory biodiversity metric tool" (DEFRA, 2023). To enable easier use of the tool DEFRA has published guidance material (DEFRA, 2024). Once the pre-development biodiversity value is calculated in accordance with an approved Biodiversity Gain Plan it can't be changed for the sake of that specific planning permission. In order to do these calculations you need to be an ecologist (Baker et al., 2019; DLUHC, 2024).

3
Research methodology

The methodology used was a mixed methods research (i.e., the data is both quantitative and qualitative). The whole process was also iterative with the literature study contributing to the field study and vice versa.

3.1 State of the Art

The Introduction and the State of the Art was based on the literature study. The overall goal of the sections was to identify knowledge gaps, set a theoretical foundation, generate a problem statement, provide justification that the thesis contributes to the current knowledge and also validate the overall research approach (Paré and Kitsiou, 2017). However, with this goal in mind there is always a risk of bias when conducting a literature study (Paré and Kitsiou, 2017). This pitfall stems from the author's overall disregard to studies that don't fit the point of view the author aims to make. In these cases the author has a specific point of view in mind from the start when accumulating literature. With this approach, the final study can contain biased statements and interpretations. This is due to the subjective selection of information from the articles and that the inclusion criteria is unspecific or lacking. The author had this in mind and took precautionary actions on how to mitigate these circumstances, especially those related to confounding variables (Hassan, 2024).

3.2 Literature Study

The literature study within the report was performed as one part of the overall aim. This was: identify criteria for the selection of a biodiversity assessment framework, to select said framework and to develop an action-plan for VGRE.

Methodology
The literature search was conducted through Scopus and Google Scholar. The main search process was snowballing. Search Terms: Nature, Assessment, Framework, Biodiversity, Ecosystem, Industry, Urban, Planning, Real Estate, Mitigation & Enhancement.

Where websites or other sources of information is needed as a source the search was done through the search engine "duckduckgo" in order to limit advertisements and otherwise skewed search results. The search results was only viewed if they were

written in English or in Swedish. The selected literature had to use the proper terminology according to the field of research it claims to adhere to. The literature had to be from a trusted source and been peer-reviewed. When necessary, with inclusion of studies from additional sources: Initial screening of sources other than articles and resources from VGRE, Scopus and Google scholar (i.e. websites and books) was done by using the plugin "mybib" which gives an indication regarding how trustworthy the source is. If the literature passed the initial screening the website, sponsors of the publications and authors was checked upon to see if there was any risk of bias.

3.3 Field Study

The field study was made in order to achieve the second part of the overall aim of the project. This was: assessing VGRE:s approach to biodivesity. In accordance with the specific objectives of the project the field study analysed the frameworks currently in place at the site, defined VGRE's demands on a biodiversity assessment and the resources available to perform one. During the study the author evaluated what they are missing in accordance with the literature study. The field study was also necessary in order to answer the research questions relating to the current state of the environment. The field study was done in order to properly assess the current situation and evaluate the plans for biodiversity at the site. During the field study the following employees are paraphrased and not cited in the report due to no formal interviews taking place:

- Sustainability Manager, VGRE
- Environmental Manager, Sweden
- Environmental Manager, Tuve
- Property Manager, Tuve
- Property Project Manager, Tuve

Methodology
The field study was performed at the VGRE site in Tuve. Tuve is an industrial site with heavy traffic and major areas that are covered with asphalt. Images of areas deemed of interest to the study was included. The data and the interpretation strategy was balanced by the findings in the literature study.

The following steps were done in chronological order and were developed at the very beginning of the master's thesis. The reasoning behind each step and exact descriptions are listed after each step.

The first step of the field study was gathering data on current biodiversity assessments made at the VGRE site in Tuve. This data was in the form of discussions, documents and tours of the area. This was done first since it is important to gain an overlook of the current situation before starting an evaluation. This data can be for internal use like for example, emails, internal assessments and opinions or for external use which can be for public communication or for getting developments approved by the local planning agency (LPA) which in this case is the City of Gothenburg.

As the final report is to be published, some assessments done by consultants which are only meant for internal use (i.e., are not allowed to be used for public communication) had to be disregarded by the author. This was deemed to not affect the content or the result of the report. All data collected, in whatever form, was processed by the author either through reading, discussing or further researching depending on what was deemed appropriate.

The second step consisted of collecting data on resources VGRE currently put to use when conducting biodiversity assessments. This was done by discussing it with the Sustainability Manager for VGRE and the Environmental Manager at Tuve. The reasoning behind this step was to get a somewhat grasp on how much personnel, money and time that goes into biodiversity assessments at VGRE Tuve.

The third step was to collect and summarise the demands VGRE has on a biodiversity assessment. This was done by collecting information regarding the subject of biodiversity assessment on the internal channels and by discussing it with the personnel. This was done in order to collect all demands in one place and to have easy access to VGRE:s demands when comparing it to the expected outcome of the suggested framework.

The final step of the field study was to evaluate actions for biodiversity enhancement that was suggested by literature and also to evaluate those which are currently discussed at VGRE. The field study yielded an overview of the current situation and illuminated where improvements could be made. The selected areas eligible for improvements were then assigned corresponding mitigation measures according to the action plan. All the suggested actions will be given a time frame for implementation, monitoring and reporting in accordance with the proposed framework.

3.4 Validity of the report

The literature study is vital in order to ensure the internal and external validity of the field study and vice versa. The literature study supports the internal validity by ensuring that the data suggested for collection is meaningful and that the process is repeatable. The field study supports the internal validity of the literature study by defining demands and resources that VGRE has. The literature study supports the external validity by addressing that the field study can be generalised to fit a variety of geographic locations. The field study supports the external validity of the literature study by ensuring that the suggested method from the literature study can be tailored to specific locations without having to use external resources. To enhance the overall reliability of the field study and the literature study the decision is made to assess two different sites.

4
Results and discussion

The overall project was an iterative process where the literature study contributed to the field study and vice versa throughout the whole project. The discussion is divided into the most vital topics of the study as well as utilising headings for the different research questions. The research questions will be answered and step by step field study will be commented upon.

4.1 Literature Study

The literature study laid some of the basis for the selection of relevant criteria. The criteria for the suggested framework was also developed through discussions between the author and the supervisor from VGRE during the field study. These discussions evolved throughout the project as more information was obtained by both parties. The four guiding criteria with relevant notes are described below:

1. The framework will need to follow the mitigation hierarchy.
The overall decision to have this criteria for the suggested framework is based on wanting to facilitate the inclusion of a proactive agenda due to how the current trends in real estate and biodiversity looks like (Lee and Kim, 2021; Andréasson, 2023; Bennun et al., 2015; Cares et al., 2023). It is also included as a criteria based on the author's own ethical views, this may be controversial to be transparent about, but the overall notion that an author can remain fully unbiased is deemed to be a construct of imagination.

2. The framework will need to be able to fit into the existing day to day of VGRE.
This criteria is based on the fact that frameworks and biodiversity work is perceived as complicated for businesses (Andréasson, 2023). If the framework is overly complicated the personnel that come in contact with it poses as a threat towards the overall successful implementation of the framework. This is mainly due to the fact that personnel may want to take shortcuts or perhaps will try to work around the framework in order to avoid doing, what they view as, excess work. In this criteria, communication, education and training on the selected framework is also included because it was deemed as vital (Bennun et al., 2015). This is to minimise the feeling of aversion towards the framework and also to illuminate how the implementation can be made in an effective way for the personnel.

3. The framework will need to be adaptable depending on scope.
Working at VGRE means that you work with real estate acquisition, development and maintenance on many levels (Sustainability Manager VGRE, personal communication, 2024). It can include minor and major alterations of the landscape, as well as having both positive and negative impacts. The goal of having this criteria included is to ensure that the extent of the project doesn't impede the implementation of the framework. Depending on the scope, the indicators selected for monitoring will differ (UNEP-WCMC, 2020).

4. The framework will need to be internationally recognisable.
This is included because VGRE is a global function of Volvo Group. If the suggestion was to implement a framework specific or limited to Sweden or the EU the VGRE branch would still need to make branched outside of the EU adhere to it. Therefore, if it is recognisable it can be applied easier outside of the EU. Another option is to adapt an existing one for the global market. This would result in even more frameworks on the market or further complications of existing ones. This is already an issue and the goal of this master's thesis is not to further contribute to that issue (Andréasson, 2023).

4.1.1 Data needed for a biodiversity assessment

What data is needed in order to perform a biodiversity assessment?
This question can be heavily debated as the data itself differs depending on geographic location, time frame of the project and the scale of the project (Sen and Dhote, 2023; Winter et al., 2017; WWF, 2012; Tyler et al., 2021). The overall quality and quantity of data that can be gathered also differs depending on those variables. However, vital information needed in order to perform a biodiversity assessment according to multiple sources on large scale and small scale projects are the following:

- Species presence, both flora an fauna is important to collect data on (Tyler et al., 2021; Winter et al., 2017). This can be done by doing an NVI and meticiusly go over each area one by one over a set period of time (recommended at least 1 year due to the fact that the species present vary throughout the seasons).
- Habitats, remaining natural habitats, degrade habitats and destroyed habitats (Winter et al., 2017). When habitats are identified it can contribute to find expected species that will reside in the area or why a certain species might not be in an area (Tyler et al., 2021; Winter et al., 2017).
- Environmental, what ecosystems that are present in the area and their ecological features (Tyler et al., 2021; Winter et al., 2017).
- Chemical analyses, soil, air and water samples are important to collect (Winter et al., 2017). This will make recommendations on vegetation to use easier for a biologist. It also contributes to find expected species that will reside in the area or why a certain species might not be in an area (Tyler et al., 2021).
- Time frame, what is the expected time that the project spans for (Winter et al., 2017). This ensures that time lag due to ecosystem destruction and

recreation is considered (Tyler et al., 2021; Winter et al., 2017).
- Geographical, for this remote sensing data can be used (Winter et al., 2017). This will give an overlook of the area in question.
- Socioeconomic data, this is important to consider as, for example, how a country is run heavily impacts the overall success of a project long-term.
- Genetic Diversity, as mentioned in the **Chapter 2.4** genetic diversity is vital to maintain long-term health of ecosystems (University of Gothenburg, 2020; Winter et al., 2017). This data can hopefully be collected by the use of eDNA in the future (SWEDNA, 2023; Naturvårdsverket, 2019).
- Biological Indicators, for monitoring purposes (UNEP-WCMC, 2020; Cousins et al., 2022; Winter et al., 2017).
- Threats, to the biodiversity in the area that the project poses and other threats towards biodiversity present (Winter et al., 2017).

As previously stated all this data is sensitive to the parameters time and geographic locations (Winter et al., 2017).
The BNG framework does not explicitly state what data is needed but rather that a biodiversity assessment is a crucial first step to take when starting a new project on both an existing site or at a new development (Baker et al., 2019). Due to the complexity of data collected, the high variability of data and the high dependency on multiple factor the company is recommended to hire an in-house ecologist to ensure knowledge retention and transfer in between projects (Baker et al., 2019; DLUHC, 2024).

4.1.2 Selected framework

What biodiversity framework is suitable for VGRE to use when performing a biodiversity assessment and how can it be specified in order to meet the company's demand?
To identify a suitable framework one must initially set criteria which defines "suitable" in a specific context. The criteria developed for the framework to be used by VGRE are the following:

1. The framework will need to follow the mitigation hierarchy.
2. The framework will need to be able to fit into the existing day to day of VGRE.
3. The framework will need to be adaptable depending on scope.
4. The framework will need to be internationally recognisable.

When the master's thesis begun the first framework that came into light was BNG. The BNG framework was already found to be used by one of the architecture firms VGRE used. The Masterplan this architecture firm included the notation of the total biodiversity net gain the implementation of certain measures such as green roofs, rain gardens and meadow planting would have on an exploited site which is on route to be further developed. However, some questions regarding how the pre-development biodiversity value was calculated and what it was arose when the masterplan first arrived (Sustainability Manager VGRE, personal communication, 2024).

A current project taking place at Volvo is one that focuses on and maps the upstream and direct activities that impact biodiversity (H., Johansson, personal communication, 20-05-2024; E., Mattsson, personal communication, 20-05-2024). This is a project that look at Volvo from a global point of view. The frameworks used in this project is Science Based Targets (SBTs) for Nature and Biodiversity Risk Filter (BRF). Sadly the SBTs for Nature is unfinished as of writing this master's thesis and the BRF is incomplete in the sense that there is a lack of data needed to utilise the tools within it (Andréasson, 2023). But, it can contribute towards a general understanding on what the main driver of biodiversity loss that Volvo contribute towards. However, for small scale projects the lack of data is deemed to make it impossible to implement in a meaningful way.

With all this in mind, the selected and recommended framework for VGRE that adheres to all set criteria is BNG. It most likely exist other frameworks that also adheres to the set criterias but this was not further explored in this thesis. Note that, when implementing the BNG framework it is vital to follow the mitigation hierarchy (Baker et al., 2019). To ensure that eventual enhancing actions taking place are quantifiable and can be monitored it is recommended to follow the SPR framework to develop indicators for biodiversity (UNEP-WCMC, 2020; Scott, 2023).

4.1.3 Direct drivers of biodiversity loss at Tuve

What are the most prominent direct drivers of biodiversity loss that VGRE:s site in Tuve contributes to?
This question is answered by viewing the issue from a straight forward perspective, limiting the direct drivers to the five major ones and by viewing VGRE as a construction company (WWF and Bain & Company, 2023; Thorn et al., 2021; Van den Heuvel et al., 2020). The major direct drivers for biodiversity loss that VGRE contribute to are:

- Land use change (including habitat loss and fragmentation). This driver is included due to the fact that by being a construction company, VGRE conducts minor and major alterations to the landscape.
- Pollution (which contributes direct and indirect degradation of suitable living environments). The constructed buildings at the site is a factory with multiple departments, office buildings and parking spaces. A testing track for the trucks being built at the site is currently under construction as well which will further contribute to the pollution in the area.
- Introduction of invasive species (which out-compete the native species for food, territory, space and other resources). This issue mainly stems from back in the days as established invasive plants were found during the field study. However, it is still vital to take into consideration as VGRE expand to not choose plants that pose a risk of becoming invasive.

4.1.3.1 Reduction of negative impact on biodiversity

How can VGRE reduce their negative impact on biodiversity at their site in Tuve and what are the actions needed to be put in place in order to enhance and/or restore biodiversity?
This question can be answered by the implementation of mitigation hierarchy, SPR and BNG. It is important to note that the issue must be viewed from two scenarios for VGRE Tuve. One of which where the area is already exploited and is in need of biodiversity enhancing or mitigating actions. In the second scenario the area is to be exploited and is in need of rethinking and avoidance methods. The difference between the two scenarios are made clear in **Chapter 5** of this master's thesis and the actions that need to be put in place is also listed in said chapter. However, the common denominators for both of these scenarios is that it is vital to, collect all data needed for a biodiversity assessment, calculate the pre- and post-development biodiversity value in both instances, apply the mitigation hierarchy throughout the projects and, implement a monitoring program with indicators. There are three types of units that can be used when calculation the pre- and post-development biodiversity value (Baker et al., 2019). Those are: area habitat units, hedgerow units and watercourse units. In between these units, the biodiversity output cannot be summed, traded or converted. This is due to that you are required to deliver at least 10% biodiversity net gain for each type of unit that is applicable at the site. Simply put, if there is a loss of a certain unit it cannot be compensated for by another.

Nevertheless, one vital finding during the field study is that it is sometimes better to do something, backed by scientific research that actually brings about positive change, rather than doing nothing at all. This is mainly due to the fact that when the company expresses the willingness to contribute to enhancing biodiversity there is "Good Principles" developed for that (Ecogain, 2020). By following said principles and complementing them with facts based on the local flora and fauna VGRE in Tuve, Sweden, could start taking some action when it comes to benefiting the biodiversity in the area (Naturvårdsverket, 2023b; Naturvårdsverket, 2023a). This goes against what was found when researching the mitigation hierarchy for the State of the Art which clearly states that this way to go about (in this sense it can be considered a compensating action) is a poor application of the hierarchy (Bennun et al., 2015). However, as the company is not aiming to report on this project or report it to the LPA but rather just want to do a trial on biodiversity enhancement it was deemed better to suggest a solution than to hinder the eventual progress. The company is recommended to monitor the projects using biodiversity indicators, and to develop those further by consulting with an ecologist (UNEP-WCMC, 2020). Exactly what indicators that is to be used is not further investigated in this master's thesis.

4.2 Field Study

The field study was conducted at the VGRE site in Tuve, Gothenburg.

4.2.1 Project planning issues

After assessing the current way to conduct day to day business at VGRE it has become evidently clear that the main threats to biodiversity enhancing actions stems from the core of the corporation structure. The very practice that ensures that the company runs smoothly (division into smaller functions, aka "groups") puts a halt to long-term thinking and cooperation within the company and between all groups. There is also a reduced willingness to pay for biodiversity enhancing activities as it may lead to greater costs in the future when the company might want to expand or build something new in an area on which they have started biodiversity enhancing measures.

There is an overarching need for someone to obtain and retain a birds eye view regarding the real estate projects at VGRE. This person needs to be able to access information about former, current and future projects in order to sync the material use and enforce biodiversity enhancing actions. The person needs to be able to access this information from other groups within the company, preferably this person should be included in projects from the very start. However, as the company is large and the person may have to much to do an action plan is a good way to cover some of the holes in the planning.

4.2.2 Step by step field study

Data on biodiversity assessments
At the site in Tuve there is an old factory for which the land was acquired in the late 70's see **Appendix B** for detail plan from 1975. Currently there is multiple ongoing developmental projects at the site see **Appendix A** for current detail plan. In the current master-plan there is suggestions for future developments. The data collected for each project vary depending on what is demanded by the municipality. The author suggests that the data collected should be that which is listed earlier in this master's thesis to ensure that it is the same for each project. The assessments made at the site are NVI and Environmental impact assessments (EIA). These have been made before the start of every project and are required in order to gain construction permits.

Mapping of resources used by VGRE when conducting a biodiversity assessment
VGRE is a small function of Volvo Group which consists of 300 people on a global level and spans 30 nations. This contributes to the fact that consultants are heavily relied upon. In addition, there is a lack of continuity as the consultancy firms used differ between projects and so does the outcome of the assessments. This can be

traced back to VGRE:s lack of proper guidelines when requesting the service (Sustainability Manager VGRE, personal communication, 2024). The result will be that they fulfill the legislation but miss the opportunity to gain higher knowledge and improve biodiversity. A clearly structured guideline regarding what to include in the request can mitigate this issue.

Summary of demands on biodiversity assessments

1. That the assessments within the biodiversity assessment (i.e., NVI and EIA) follows the frameworks and standards set out for them.
2. That the information obtained is able to be retained within the company and be allowed to be communicated to the public.
3. That the assessment highlights areas eligible for biodiversity enhancement, in such a manner that specific actions can easily be formulated. These actions should follow the principles in **Section 5.3.1**.
4. That the assessment takes habitat destruction into account and suggest eventual compensating actions that can be implemented within a set time frame.

The lack of strategies, guidelines and other tools surrounding the subject is a major issue when VGRE are to put demands on the consultants that perform assessments for them. There is a need to ensure that biodiversity assessments and NVI:s made follow the national requirements (in the case of Sweden this is ftSS 199000:2023 formerly, ftSS 199000:2013). All information should be filled in. This includes:

- Nature value classification (1-5)
- Dominating type of nature
- Existing biotopes
- If any Natura 2000 habitats are present and what they are
- A description of the area
- A list of all conservation species present
- Any earlier documentation of the area
- If any area protection is applicable at the area
- Any comments
- The total size of the area (in ha)

Identify areas to be improved, evaluate actions for biodiversity enhancement based on mitigating effect, availability and suitability

During site visits, questions arose regarding certain areas at the site in Tuve.

- Green Corridor. This was the first project that VGRE at Tuve voiced their concern for and said that they needed assistance on (Sustainability Manager VGRE, personal communication, 2024; Environmental Manager Tuve, personal communication, 2024; Environmental Manager Sweden, personal communication, 2024; Property Project Manager, personal communication, 2024).
- Lawn Makeover. This was the second project that VGRE Tuve asked for assistance on (Sustainability Manager VGRE, personal communication, 2024; Environmental Manager Tuve, personal communication, 2024).

4.3 Biodiversity enhancement projects at Tuve

Below two projects at the Tuve site is gone over, they are divided into the following 4 subheadings:

- Assignment, the project that VGRE asked for assistance on.
- Main focus, the elements that the author deemed to be of highest importance and choose to focus on.
- Main goal, the overall goal for the area in question.
- Suggestion, the suggested actions that should be taken in order to reach the main goal for the elements selected as the main focus.

In the end of this section the common theme for the projects are gone over.

4.3.1 Green Corridor

Assignment:
At the Tuve site there are questions raised regarding how to deal with excavated up masses from when a parking lot is being built. The masses are suggested to be used as a "sound barrier" against an open field and the masses are already being moved to a designated area when the inquiry for assistance is made (Visualised as area K in **Figure 4.1** and in **Figure 4.3**). This is also when Gothenburg city rejects the proposal due to the fact that the open field towards which the sound barrier is facing is 'silent' (i.e. there is plans to expand and build there in the future but right now it is just a field. Therefore, Gothenburg city view the reasoning behind the sound barrier as inadequate). Images depicting suggested developments of the area is included in the detail plan Gothenburg city has (See **Appendix A** page 11). But, the suggested masterplan the company has (**Figure 4.1**) is not included. Therefore, due to the fact that it is not an approved construction yet and not even sent in as a suggestion and has no approved building permits the argument falls short. I.e., the future eventual construction of buildings to the east cannot be used as reasoning for the implementation of a sound barrier. So, the main issue now was that the project was estimated to produce around 6000 cubic metres of soil and that the company has nowhere to put it. If the excavated masses were to be moved by truck it would take 600 trips to move it all. This is calculated based on that 1 cubic meter of the excavated masses weighs approximately 1200kg, one truck can carry around 12 tonnes. The environmental impact from the transport of this endeavour alone further motivates VGRE in Tuve to utilise the excavated masses at the site (Sustainability Manager VGRE, personal communication, 2024).

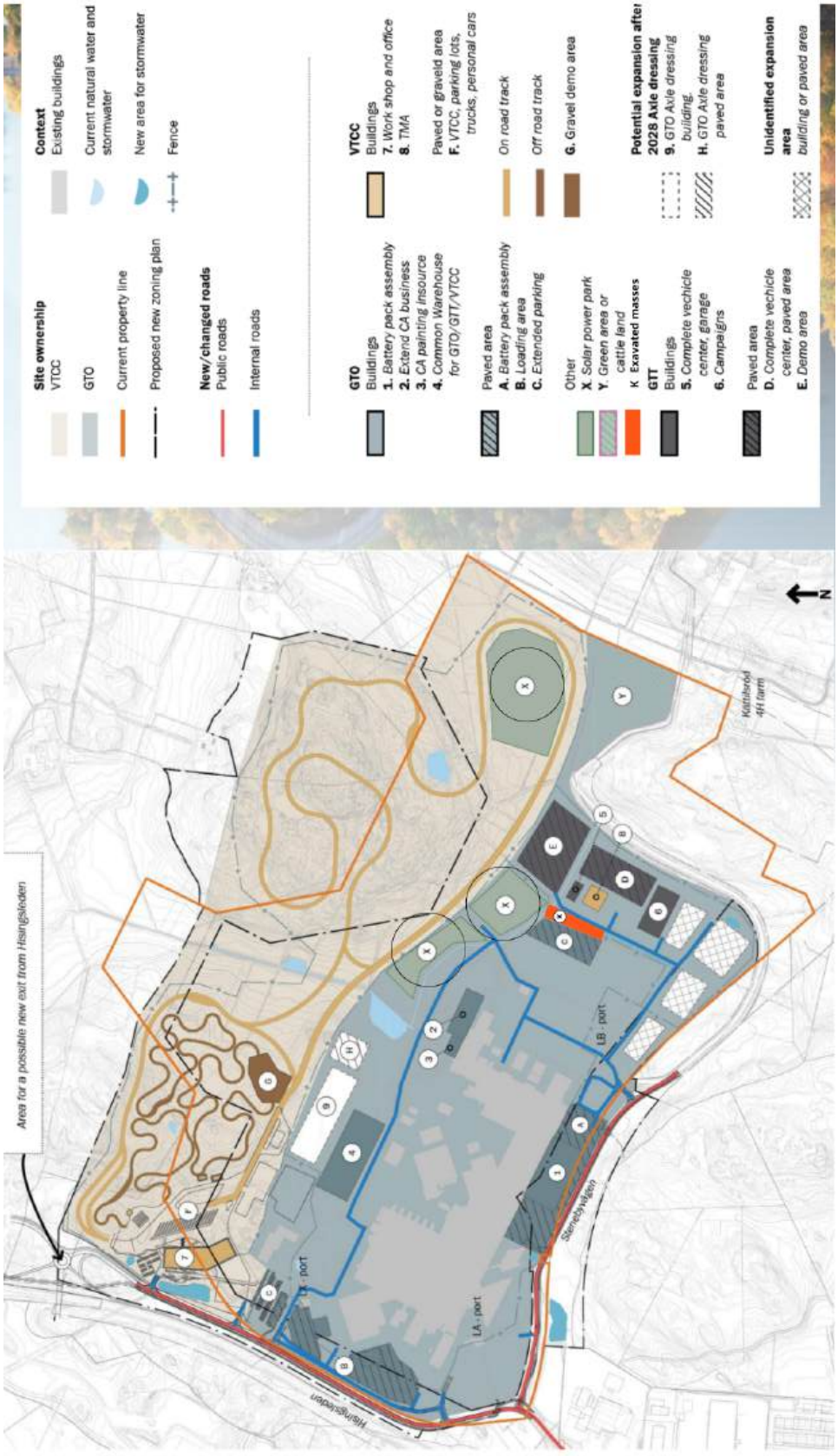


Figure 4.1: One current alternative for the suggested masterplan for the area with added area "K" for the excavated masses.

Main focus:
Gothenburg city has deemed that the stone wall and running water on either side of the affected area does not fall under general biotope protection even though the detail plan seen in **Appendix A** (page 37) clearly states so. Why that is, even though the farmland is currently (as of May 2024) utilised as a farmland, is beyond the authors comprehension. The author wants keep the main focus on the stone wall, the small ditch of running water and the forest edge in area 6a. Mainly due to the fact that the NVI that showed that amphibians, reptiles and small birds reside in area 6 and 12. And the forest edge habitats in Sweden are vital for pollinator (Naturvårdsverket, 2023b; Naturvårdsverket, 2023a). It is also not totally out of line to make assumptions regarding that wild insects and pollinators uses the stonewall for hiding and breeding. In order to mitigate the habitat fragmentation and habitat destruction and also try to ensure that the favourable living conditions for these species aren't eradicated it is important to clearly define a main focus and goal for the project. In this case the main focus was to connect two habitats which, according to the NVI, have different "nature values" with area 12 being higher than 6a & 6b. The goal was to keep important characteristics of the area while trying to enhance connecting features between the areas. By using the excavated masses as topsoil and planting trees and/or high bushes it will cause the stonewall to be covered by shadow rather than being engulfed in light (which it is now as it is enclosed between a parking lot and an open farmland).

Main goal and objectives The main goal is to facilitate habitat connection by connecting two areas currently connected by a stonewall and a small ditch.
The smaller objectives are:

- To keep the stonewall sunlit.
- To implement a management plan for the existing ditch.
- To focus on habitats for insects, amphibians and small birds currently being confirmed to reside in the area.

Suggestion:
The first suggestion during a meeting at VGRE is to use the masses as topsoil and try to establish a green corridor between area 6 and 12 in **Figure 4.2**. The suggested green corridor is illustrated in **Figure 4.3**. The excavated masses are tested through 'declaration 28' (anmälan 28) and are deemed to be of the same type and quality as the area between area 6 and 12. The suggestion of using the 6000 cubic metres of excavated masses as topsoil is deemed to be unnecessary from a ecological perspective, mainly because it is likely to cause more harm than good to the already established plants. The second suggestion is to use the masses as topsoil during the construction of one of the solar parks that are to be built in the area visualised by the circled areas labeled with "X" in **Figure 4.1**. In any case the soil is in need of being moved from Area K in **Figure 4.3**. Following the removal of the soil Area K will then be in need of restoration. This will be the case even if the masses are shipped away or used for another project.

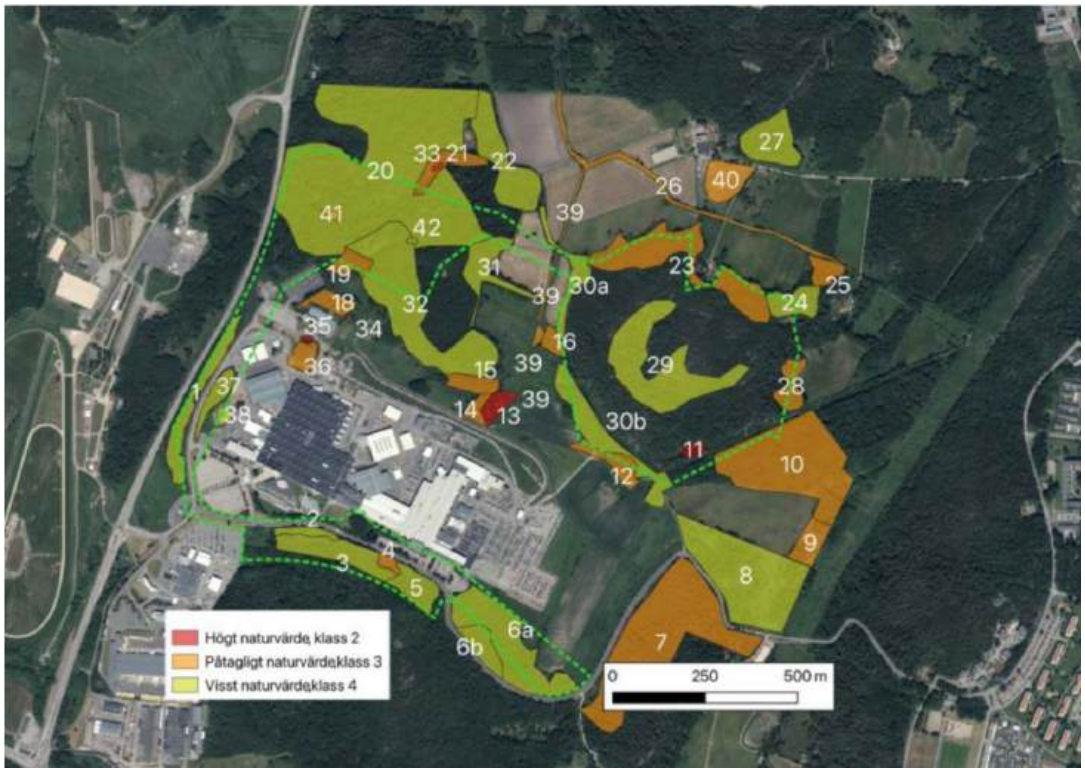


Figure 4.2: Image depicting nature values and area numbers from the NVI conducted by Naturcentrum (2023) at the Tuve site see **Appendix A**). Nature values for areas are indicated by the colour of the area with the corresponding number. Red = High nature value, class 2; Orange = Tangible nature value, class 3; Yellow = Intermediate nature value, class 4.

Figure 4.3: Image depicting the location of the excavated masses and the suggested location of the green corridor. K = Excavated masses; Green line = Green corridor.

The green corridor project is suggested to be further developed while refraining from using the excavated masses as topsoil. This is because some areas of the green corridor could introduced to meadow plants and those kinds of plants thrive in nutrient poor soil (Naturvårdsverket, 2023b). If the plan is to, in the future, build a parking lot where the farmland currently resides the stonewall is still believed to be sunlit. Therefore the suggestion is to evaluate planting low bushes and native flowers but refrain from trees to try to connect area 6 to 12 (Naturvårdsverket, 2023b). These bushes and native flowers should be planted a few metres from the stonewall in order to ensure that it remains sunlit. The selection of species to use should be made following the same principles as in the Lawn Makeover seen in the next section of this master's thesis (i.e., consult the NVI, consult relevant literature and consult an ecologist). In addition, VGRE should consult the county board for more precise information even though the stone wall doesn't fall under the Swedish general biotope protection law. This is because it will be more efficient for VGRE in the long run to ensure that what they do doesn't harm the environment and that they can start as early as possible to take the time lag of planting into account.

4.3.2 Lawn Makeover

Assignment:
At the Tuve site they want to transform an area from a green grassy lawn to a more productive area which hopefully can benefit the local flora and fauna. The company has a fence heading towards the road with some trees adjacent to it. The fence must remain somewhat clear and visible for security reasons.

Main focus:
The main focus of this area was to facilitate birds and pollinators to thrive by inclusion of flowering and fruit bearing vegetation. It was also deemed vital to take employee satisfaction into account as it will make it more likely for employees to take care of the area. This has proven to be an issue as a tour of the full site showed that even though trashcans are available the ground is quite littered at sites where benches are present. The area was somewhat covered by the NVI. During a site visit the soil was found to be quite moist.

Main goal and objectives:
The main goal is to implement structures that will transform the area from a grassy lawn to an area rich in biodiversity that will facilitate birds and pollinators.
The smaller objectives are:

- To implement a management plan for the area.
- To focus on habitats the animals currently being confirmed to reside in the area.
- To select appropriate vegetation to implement in the area.
- To identify biodiversity indicators for the company to use when evaluating and monitoring the progress of the project. For this the SPR framework was used (UNEP-WCMC, 2020).

Suggestion:
The selection of plants to implement in the area were selected based on three different fact sheets downloaded from "Naturvårdsverket" (Naturvårdsverket, 2023b). The selection of herbs was made by searching the internet for suitable non-invasive herbs and then, to find the specifics regarding under what conditions the herbs will thrive the herbs where identified in a book the author had gotten from her grandmother who has been gardening throughout her life (Seymour, 1978). The suggested structures that are to be included at the site is visualised in **Figure 4.4**. Suggested structures and the main benefactors from the different structures are visualised in **Figure 4.5** and described in **Table 4.1** (Seymour, 1978; Naturvårdsverket, 2023b; Naturvårdsverket, 2023a).
More exact descriptions of the suggested structures in the area are listed below:

- Solitary bushes: The solitary bushes are included in the plan as they, apart from making the area interesting to look at, will flower and bear berries that benefits biodiversity.
- Solitary trees: The solitary trees are implemented as they can contribute shade, flowers and fruits.
- Hedges: The hedges are to act somewhat as sound and pollution deterrent from the adjacent road. The hedge can not be closer to the fence than 2 meters as it will then be a security risk for the company (Property Manager Tuve, personal communication, 14-05-2024)
- Herb garden: The garden will divided into two parts, one which is dry and sunlit with lime rich soil and the other with damp soil, in a shaded area with a more acidic soil. The "dry" garden will also implement an open sandy area for solitary bees.
- Blanket box: A box with blankets for the personnel to use when they feel like utilising the garden area.
- Fruit bearing bushes: Bushes that gives berries more commonly used for human consumption but is just as popular among birds.
- Pond: The pond will have refrain from having steep edges as to minimise the risk of wildlife, insects etc to drown. The pond can also include a birdbath adjacent to the structure.
- Compost: A pile of sticks and leaves that are left in a sunlit area at the end of a stone wall that borders the lawn.

Figure 4.4: Suggested structures to be implemented in the area, mockup of placements.

Figure 4.5: The full area of the project with suggested structures visualised as capital letters, letter descriptions can be found in **Table 4.1**.

Table 4.1: Letter descriptions of the suggested structures with their main beneficiaries.

Lawn makeover		
Letter	Structure	Main beneficiary
A	Blanket box	Employees
B	Herb gardens	Employees, pollinators and natural enemies of insect pests
C	Hegdes	Wild insects, birds, pollinators and natural enemies of insect pests
D	Compost/Pile of sticks	Wild insects, wood fungi, mosses and lichens
E	Pond	Birds, amphibians, wetland insects, wild insects, wild flowers and field game
F	Solitary trees	Employees, Wild insects, Pollinators, soil organisms and natural enemies of insect pests
G	Solitary bushes	Employees, Wild insects, birds, pollinators and natural enemies of insect pests
H	Fruit bearing bushes	Wild insects, birds, pollinators and natural enemies of insect pests
I	Birdhouses, bat boxes, dead wood left on the ground, insect hotels and a stonewall	Wild insects, wood fungi, mosses and lichens, birds, bats, amphibians, wild flowers and reptiles
J	*not a structure, there is invasive species that needs to be taken care of in this area	The overall landscape will benefit

Trashcans are to be used, and they should look like trashcans (i.e. there should be no reason to fail to see them or mistake them for something else). The compost pile is not to be disturbed by day to day activities and should only contain sticks, grass clippings and raked leaves from the vegetation in the area. No pesticides or fertiliser are to be used. Mechanical weed removal is used throughout the area. Lawn mowing should be kept at a minimum and the clippings are to be moved to the compost pile.

Suggested plants and their correlating structures are listed in **Table 4.2** (Seymour, 1978; Naturvårdsverket, 2023b; Naturvårdsverket, 2023a).
Herb garden: The garden will divided into two parts, one which is dry and sunlit with limerich soil and the other with damp soil, in a shaded area with a more acidic soil. Suggested plants for the gardens are: Thymus vulgaris, Petroselinum crispum, Lavandula angustifolia, Salvia rosmarinus, Calluna vulgaris, Origanum vulgare, Foeniculum vulgare, Allium schoenoprasum, Rumex rugosus, Artemisia dracunculus, Salvia officinalis, Origanum majorana, Melissa officinalis, Hyssopus officinalis, Laurus nobilis, Levisticum officinale, Capparis spinosa, Allium × proliferum and Sanguisorba minor (Seymour, 1978; Naturvårdsverket, 2023b; Naturvårdsverket, 2023a).

Table 4.2: Suggested species for inclusion in structures

Latin name	**Swedish Name**	**Flowering Period**	**Height**	**Structure**
Ribes uva-crispa	Krusbär	April - May	1 m	Fruit bearing bushes
Rubus idaeus	Hallon	April - May	1-2 m	Fruit bearing bushes
Chaenomeles japonica	Rosenkvitten	May - June	1-1,5 m	Fruit bearing bushes
Ribes (different kinds)	Vinbär (röda, svarta, vita)	May - June	1-2 m	Fruit bearing bushes
Ribes alpinum	Måbär	May - June	1-2 m	Hedge
Prunus spinosa	Slån	May - June	1-3 m	Hedge
Salix caprea	Sälg	April - May	3-15 m	Hedge
Crataegus monogyna	Hagtorn	May - June	1-6 m	Hedge
Lonicera periclymenum	Inhemsk Vildkaprifol	June - August	2-10 m	Hedge
Rhamnus cathartica	Getapel	June - July	6-7 m	Hedge
Rhamnus frangula	Brakved	May - September	2–3 m	Hedge
Prunus domestica	Plommon	April - May	2-6 m	Solitary bushes and trees
Sorbus intermedia	Oxel	May - June	3-20 m	Solitary bushes and trees
Prunus padus	Hägg	May - June	3-14 m	Solitary bushes and trees
Sorbus aucuparia	Rönn	May - June	3-15 m	Solitary bushes and trees
Prunus domestica ssp. insitita	Krikon	June - July	2-5 m	Solitary bushes and trees
Malus domestica	Äpple	June - July	3-5 m	Solitary bushes and trees
Sambucus nigra	Fläder	June - July	3-5 m	Solitary bushes and trees
Populus tremula	Asp	March - April	15-30 m	Solitary bushes and trees

4.3.3 Common Theme for the projects

The main direct drivers of biodiversity loss at the VGRE site in Tuve is stated earlier in this chapter. But in accordance with those VGRE should implement these precautionary actions throughout their work:

1. minimise land use change (including habitat destruction and fragmentation)
2. avoid, or at best, minimise pollution
3. minimise the introduction of invasive species and disease

These precautions are noted in some form in each of the projects listed above.

Suggested biodiversity indicators according to SPR
These indicator species and indicators are mere suggestions but will need to be further developed in collaboration with an ecologist. In addition land-use change should be looked into as being used as an indicator.

- State: Lichen, bats and amphibians as indicator species. Canopy cover as an indicator.
- Pressure: Lichens are sensitive to air and nitrogen pollution (Scott, 2023). Bats are sensitive to light pollution (Scott, 2023). Amphibians are sensitive to changes in the water quality (Scott, 2023). Canopy cover can be used to measure human impact.
- Response: Tree and lichen growth. Species present of amphibians. Canopy cover.

Structure building descriptions:
When building (or buying) homes for insects one can go about in multiple different ways depending on the species that one wish to benefit. But one thing insect hotels has in common is that they should be placed in sunlit locations and in close proximity to flowers. If one wish to build a bumblebee house, an upside down terracotta pot placed so that the only thing above ground is the hole at the bottom will do just fine. When trying to implement structures to benefit birds and bats the most common thing to implement are boxes in trees. This is important, since old, hollow trees are rare. These boxes can and should be specified to the species present in the area and will provide them with nesting opportunities.

4.4 Sources of error

There is an underlying potential for bias when conducting a literature study. There limitation to literature in English and Swedish also resulted a inevitable gaps in the literature collected.

5

Action Plan and Good Principles

This chapter contains the action plan developed for VGRE and lists good principles to adhere to when working towards BNG. The action plan is divided into two parts. One focused on areas that are already exploited and one that is more precautionary focused on areas that are to be exploited.

5.1 Action Plan - For already exploited areas

1. Conduct a thorough biodiversity assessment to understand the current state of biodiversity in the area. Identify any remaining natural habitats, species presence, and ecological features.
2. Implement measures to mitigate existing biodiversity impacts and restore degraded habitats. This may involve habitat restoration projects, rewilding initiatives, and green infrastructure improvements to enhance biodiversity values.
3. Develop strategies to compensate for biodiversity losses that have occurred due to previous development activities. This may include funding conservation projects in nearby areas, creating new habitats, or enhancing ecosystem services.
4. Implement monitoring programs to track biodiversity outcomes over time and adjust management actions as needed. Regular monitoring helps ensure that BNG targets are being met and that biodiversity gains are sustained over the long term.

5.2 Action Plan - For areas that are to be exploited

1. Conduct a comprehensive biodiversity assessment of the site before any development activities begin. Identify key habitats, species, and ecological functions present in the area. Determine the baseline biodiversity value of the site using recognized assessment methodologies. For Sweden this is an NVI following Swedish standard ftSS 199000:2023.
2. Design the development project to avoid or minimise impacts on biodiversity wherever possible. This may involve selecting development sites with lower ecological value, avoiding sensitive habitats, and designing infrastructure to minimise habitat fragmentation. Incorporate green infrastructure elements such as permeable surfaces, green roofs, and rain gardens to minimise habitat loss and promote biodiversity.

3. Develop a detailed BNG action plan that outlines specific measures to enhance biodiversity on-site and achieve a net gain in biodiversity. This may include habitat creation, enhancement of existing habitats, and implementation of green infrastructure features. Develop a landscape plan that prioritises native vegetation and habitat creation. Plant native trees, shrubs, and wildflowers to provide food and shelter for local wildlife. Create wildlife corridors and green spaces to connect fragmented habitats and promote species movement. Install bird and bat boxes, insect hotels, and other wildlife-friendly features throughout the development. Restore degraded habitats such as degraded woodlands, grasslands, or wetlands through active management techniques such as invasive species removal, planting, and habitat restoration. Create new habitats such as wildflower meadows, wetland ponds, and butterfly gardens to increase biodiversity value. A plan that states how the objective of a 10% increase in biodiversity will be gained through the development project. It must contain a certain amount of information on specific matters to enable the LPA to grant the plan (DLUHC, 2024).
4. Develop a long-term management plan for the conservation and enhancement of biodiversity on-site. Implement monitoring programs to track biodiversity changes throughout the development process and ensure compliance with BNG targets. Regular monitoring helps identify any negative impacts and allows for timely adjustments to mitigation measures. Engage with residents and community stakeholders to promote stewardship of natural areas and encourage participation in biodiversity monitoring and conservation activities.
Calculate the residual impacts of the development on biodiversity after avoidance, minimization, and enhancement measures have been implemented. Develop a strategy for offsetting these residual impacts through off-site biodiversity conservation or restoration projects, such as land acquisition for conservation, habitat restoration initiatives, or funding for biodiversity conservation programs in the local area. Communicate with stakeholders, including local communities, regulatory agencies, and conservation organisations, throughout the project lifecycle to ensure transparency and gather input on biodiversity enhancement efforts. Provide regular updates on the progress of BNG implementation and biodiversity outcomes through newsletters, community meetings, and project websites.

5.3 Good Principles

The principles in this section are sourced from the literature study (Ecogain, 2020; Cares et al., 2023; Bennun et al., 2015; Heller and Zavaleta, 2009).

5.3.1 For biodiversity

1. Refrain from introducing invasive species to the area and remove any that are present.
2. When planting, only use native plants that have a low risk of becoming invasive.
3. Utilise local water sources and refrain from removing existing open water.

4. Implement flowering and fruit bearing bushes and trees. Try to extend the time when flowers bloom throughput the season and day by having a great variation of plants.
5. Avoid implementing hard surfaces in areas where greenery, gravel or sand can be used.
6. When designing light fixtures and calibrating them, remember to aim them downwards to minimise the disturbance to wildlife active at night.
7. When designing new lawns or redesigning existing lawns, think about variation when it comes to maintenance. Human utilisation is not the main goal here so coexistence with insects and other wildlife should be taken into account.
8. Raise awareness of the biodiversity enhancing action that has been made, when informed, employees and other visitors to the premises may be more inclined to care for the area and educate themselves.
9. Base the suggested biodiversity enhancing measures that are to be made on the existing area and existing habitats. Identify areas in need of habitat construction and identify what type of habitats that best fit the current landscape.
10. Consider that preserving the existing biodiversity at a site is usually better than creating new. This is due to the fact that it takes years for the biodiversity to establish itself and reach a climax community.

5.3.2 For areas that are to be exploited

1. Demand an NVI that adheres to a specific standard (e.g. Swedish standard ftSS199000:2023).
2. NVI:s and EIA:s should be read and approved by a person responsible for biodiversity and sustainability at the company (preferably an ecologist) to ensure coherency in between projects.
3. Hire an ecologist to make an initial biodiversity value calculation according to BNG, this company and person should be hired with long-term thinking in mind to ensure that VGRE personell retains the knowledge.
4. Identify areas that are eligeble for “set asides” in which biodiversity enhancing actions can take place.
5. Identify areas for biodiversity enhancing measures, such as habitat restoration, creation and expansion. This can be based on the in-house ecologist recommendations. Doing this as an initial step is more beneficial than doing it as an afterthought.
6. Use native and regional plants and take the time to exterminate invasive species.

5.3.3 For already exploited areas

1. Go over existing NVI:s and assess if they are current by consulting the municipality or the county board. If they are, good. If not, order an NVI that adheres to a specific standard (e.g. Swedish standard ftSS199000:2023).

2. Identify areas that can be improved or restored at the site. This can be lawns, rooftops, woody areas, parking lots or other areas not given as examples in this master's thesis.
3. Use native plants when planting.
4. Exterminate invasive species at the site. Refrain from using pesticides and instead opt for mechanical removal of weeds and invasive plants.
5. Consult local gardeners regarding perennial plants and habitats for beneficial insects.
6. Consult ornithologists regarding local birds. Design birdhouses and space them out accordingly to the species present at the site.
7. Use information gathered from the Environmental Protection Agency of the nation, in this case it is SEPA (Naturvårdsverket).
8. Include insect hotels and bumblebee houses.
9. Include bird and bat boxes.

5.3.4 According to Mitigation Hierarchy

This section contains the summarised information regarding key principles and steps (Bennun et al., 2015; Cares et al., 2023).

Avoidance

- Always gain access to, and make use of, the most relevant data and expertise available. Demand that biodiversity assessments, NVI:s and EIA:s are up to code.
- Avoid habitat destruction and fragmentation. Account for territorial buffer-zones.
- Engage project planners and engineers with ecologists/environmental professionals from the very beginning of a project.
- Ensure that there is effective communication between the technical, social and environmental elements of the project (i.e., use STES not SES and STS).
- Make mitigation requirements explicit in contractor agreements.
- Plan and conduct appropriate stakeholder consultation, with results feeding back into planning.
- Remember that this is an iterative process. If the restoration, offsets and enhancement can't atone for damages that will be done there is a need to look back towards the avoidance and minimisation steps of the process.

Minimisation

- Minimise light, noise, chemical and other types of pollution.
- Implement resource-efficient building design and construction practices to minimise the consumption of natural resources, energy, and materials.
- Utilise materials that may be sourced from the sites before ordering the same material from another area or company to enforce circularity.
- Make use of the expertise that the relevant brought in specialists bring to the table and make predictions regarding unavoidable negative impacts. These

negative impacts should be unfeasible to avoid and minimisation measures should be developed as a response.
- Inform all professions engaged in the project in a suitable way depending on relevance to the project.
- Implement workshops in order to make for good communication and to set a common goal for the project. Include ecologists, engineers, finance managers and others. A vast mix of people makes for more perspectives to be brought to light.
- On the same note, encourage all perspectives and innovation without letting it go to far cost wise. If a measure is yet to be proven the discussion can tend to escalate. Decide upon one person to lead the discussions, this could be a consultant that is brought in for a specific project and should only be tasked with retaining an unbiased view.
- Remain realistic. The feasibility of the minimisation measure is key, if the method is unproven there is cause to be cautious. Remember that the suggested method should work, not only on paper, but in real life as well.
- Make predictions regarding the risks and remaining negative impacts that remain after the avoidance measures has been implemented. Determine the technical feasibility and make a cost benefit analysis to decrease the number of unrealistic options.
- Put all specifics into writing in order to gain approval from the LPA and to further inform the relevant stakeholders of the selected methods of minimisation.
- Never stop looking towards additional minimisation actions and opportunities during the whole lifespan of the project. New perspectives and opportunities can arise whenever so develop a system, perhaps a suggestion box, to categorise the suggestions depending on site/project/species/ecosystem etc.

Restoration
- Implement waste reduction and recycling measures to minimise the generation of construction and demolition waste.
- Make appropriate calculations regarding the pre-development biodiversity value of the area in question.
- Decide upon and define a feasible goal for the restoration project. The main goal should be clearly stated and make subsections for specific objectives that the restoration can benefit and detail why specific choices were made.
- Define the ecosystems which are in need of restoration or rehabilitation.
- Monitor and manage adaptive throughout the project.

Offsets
- Apply the mitigation hierarchy.
- Evaluate and decide upon if the project has caused damage in such a way that amends actually can be made in a meaningful way.
- Evaluate if the offset suggested indeed compensates for what will be lost during the project.
- Is the overall outcome of the offset able to be quantified in regard to what

biodiversity gains it will produce? Go over the design and implementation in detail to make a well founded decision.
- What stakeholders are currently engaged in the project and during what time frame are they expected to be involved? Evaluate if more stakeholders are needed to diversify the pool and also evaluate if one type is over represented.
- Decide if the offset is will have a positive result that would not be possible if the decision to take action was left unmade.
- Make sure that the offset made will last at least as long as the project will impact the environment. Another important factor to take into account here is that time-lag need to be accounted for.

Enhance
- Follow the good principles for biodiversity expressed in **Section 5.3.1**
- Implement habitat management plans, such as prescribed burning, invasive species control, and habitat restoration, to maintain and enhance ecosystem function.
- Implement environmental monitoring programs to track biodiversity indicators and assess the effectiveness of mitigation measures.
- Replant native tree species in deforested or degraded areas to restore forest ecosystems, increase carbon sequestration, and enhance biodiversity.
- Install green roofs, rain gardens, and permeable pavement to manage stormwater runoff, reduce urban heat island effects, and enhance habitat connectivity.

6
Conclusions

The master's thesis found that for VGRE to be able to implement a new framework there is some core changes that need to be made, but more on that in the next paragraph. The literature and field study was iterative and the selected framework was BNG. In addition, the framework should be able to handle time and resource constraints that may appear while leaving space for the inclusion of tools for continuous reassessment and evaluation. Therefore, in addition to BNG the company will need to adhere to the Mitigation Hierarchy. It was also suggested that the company will use the SPR framework to find suitable indicators to monitor their efforts in a quantifiable way. The criteria that the selected framework needed to adhere to was decided upon during both the literature study and the field study. The action plan was divided into two parts, one for areas that are to be exploited and one for areas that are already exploited. The good principles and action plan developed in this master's thesis is recommendations and are meant to be a step towards working with biodiversity in a structured way at VGRE.

To circle back to the core changes that need to be made at the company in order to implement the suggested framework, there is a need for a new way of thinking at the company. New strategies, structures and guidelines will need to be implemented to ensure that the employees can get the best possible opportunities to adhere to the framework. This new way of working will mainly affect the beginning of the project planning process as successful implementation of BNG, mitigation hierarchy and the SPR relies heavily on biodiversity being thought of at the very start of the project. There is a need for further development of the project planning process to ensure that biodiversity is clearly included. The shift towards including biodiversity in the process will take resources (such as time) and it will be relevant to oversee the competences needed to be consulted at the beginning of a project. By using the knowledge from ecologists, biologists and landscaping architects VGRE should have good opportunities to seamlessly implement biodiversity into their day to day and project planning process.

6.1 Recommendations

For Volvo Group
As this master's thesis was focused on, and limited to, VGRE and biodiversity it is recommended to look further into how the different groups within Volvo Group communicates on other types of projects and perhaps find better solutions regarding knowledge transfer and retention within the company. In addition, at VGRE, it is recommended to look further into hiring someone to further develop the specific demands on a biodiversity assessment according to BNG and according to what VGRE wants to accomplish in the future. This project is not to be rushed but is recommended be started in the year of 2024.

For Gothenburg City
The city should look into how it can use the city Master Plan as a tool in order to integrate biodiversity in the urban space (Sen and Dhote, 2023). The city have a lot of power when it comes to building permits. Therefore, to put up demands on implementation of the mitigation hierarchy on said permits is recommended to be further looked into.

6.2 Further Studies

This master's thesis does not go in to depth regarding biodiversity indicators and the "how to" when to choose and pick them based on the region or nation one currently resides in. This would be interesting to look further into as a set list for Sweden depending on latitude/longitude and project type would be useful to have.

There is a need for more data on how biodiversity enhancing and mitigating actions behaves over time (Heller and Zavaleta, 2009; Panlasigui et al., 2021). More information regarding actions that are "always good" and "always bad" (depending on geographic location and time of year) should be researched, as well as an expected time frame for implementation of these suggested "always good" actions. This suggested research should also go deeper into how biodiversity is linked to the mental and physical health of human beings (Sen and Dhote, 2023). This would further contribute to the beneficial view of STES within the field of ecology (Ahlborg et al., 2019; Tan et al., 2020).

Bibliography

Ahlborg, H., Ruiz-Mercado, I., Molander, S., and Masera, O. (2019). Bringing technology into social-ecological systems research—motivations for a socio-technical-ecological systems approach. *Sustainability*, 11:2009.

Andréasson, H. (2023). *Business & Biodiversity - How businesses understand and work with biodiversity.* Chalmers University of Technology. [Master's Thesis] https://odr.chalmers.se/server/api/core/bitstreams/31811a81-8a6a-421f-a906-a7a94326ab19/content.

Baker, J., Hoskin, R., Butterworth, T., Kate, K. t., and White, N. (2019). *Biodiversity net gain. Good practice principles for development. A practical guide.* CIEEM. https://cieem.net/wp-content/uploads/2019/02/C776a-Biodiversity-net-gain.-Good-practice-principles-for-development.-A-practical-guide-web.pdf.

Bennun, L., Ekstrom, J., and Mitchell, R. (2015). *A cross-sector guide for implementing the Mitigation Hierarchy Prepared by The Biodiversity Consultancy on behalf of IPIECA, ICMM and the Equator Principles Association: Cambridge UK.* Cross Sector Biodiversity Initiative. http://www.csbi.org.uk/wp-content/uploads/2017/10/CSBI-Mitigation-Hierarchy-Guide.pdf.

Cardoso, P., Barton, P. S., Birkhofer, K., Chichorro, F., Deacon, C., Fartmann, T., Fukushima, C. S., Gaigher, R., Habel, J. C., Hallmann, C. A., Hill, M. J., Hochkirch, A., Kwak, M. L., Mammola, S., Ari Noriega, J., Orfinger, A. B., Pedraza, F., Pryke, J. S., Roque, F. O., Settele, J., Simaika, J. P., Stork, N. E.,

Suhling, F., Vorster, C., and Samways, M. J. (2020). Scientists' warning to humanity on insect extinctions. *Biological Conservation*, 242:1–12.

Cares, R. A., Franco, A. M. A., and Bond, A. (2023). Investigating the implementation of the mitigation hierarchy approach in environmental impact assessment in relation to biodiversity impacts. *Environmental Impact Assessment Review*, 102:1–12. https://www.sciencedirect.com/science/article/pii/S0195925523001804.

Cousins, S., Lindgren, J., Plue, J., Brown, I., and Kimberley, A. (2022). *Landskapsindikatorer för biologisk mångfald*. Naturvårdsverket. https://www.naturvardsverket.se/publikationer/7000/978-91-620-7064-9/.

DEFRA (2023). *Statutory biodiversity metric tools and guides*. UK Government. https://www.gov.uk/government/publications/statutory-biodiversity-metric-tools-and-guides.

DEFRA (2024). *The Statutory Biodiversity Metric User Guide*. UK Government. https://assets.publishing.service.gov.uk/media/65c60e0514b83c000ca715f3/The_Statutory_Biodiversity_Metric_-_User_Guide_.pdf.

Diaz, S., Pascual, U., Stenseke, M., Martin-Lopez, B., Watson, R. T., Molnár, Z., Hill, R., Chan, K. M., Baste, I. A., Brauman, K. A., Polasky, S., Church, A., Lonsdale, M., Larigauderie, A., Leadley, P. W., , A., , F., Schröter, M., Lavorel, S., Aumeeruddy-Thomas, Y., Bukvareva, E., Davies, K., Demissew, S., Erpul, G., Failler, P., Guerra, C. A., Hewitt, C. L., Keune, H., Lindley, S., and Shirayama, Y. (2018). Assessing nature's contributions to people. *Science*, 359:270–272.

DLUHC (2024). *Biodiversity net gain*. UK Government. https://www.gov.uk/guidance/biodiversity-net-gain.

Díaz, S., Demissew, S., Carabias, J., Joly, C., Lonsdale, M., Ash, N., Larigauderie, A., Adhikari, J. R., Arico, S., Báldi, A., Bartuska, A., Baste, I. A., Bilgin, A., Brondizio, E., Chan, K. M., Figueroa, V. E., Duraiappah, A., Fischer, M., Hill,

R., Koetz, T., Leadley, P., Lyver, P., Mace, G. M., Martin-Lopez, B., Okumura, M., Pacheco, D., Pascual, U., Pérez, E. S., Reyers, B., Roth, E., Saito, O., Scholes, R. J., Sharma, N., Tallis, H., Thaman, R., Watson, R., Yahara, T., Hamid, Z. A., Akosim, C., Al-Hafedh, Y., Allahverdiyev, R., Amankwah, E., Asah, S. T., Asfaw, Z., Bartus, G., Brooks, L. A., Caillaux, J., Dalle, G., Darnaedi, D., Driver, A., Erpul, G., Escobar-Eyzaguirre, P., Failler, P., Fouda, A. M. M., Fu, B., Gundimeda, H., Hashimoto, S., Homer, F., Lavorel, S., Lichtenstein, G., Mala, W. A., Mandivenyi, W., Matczak, P., Mbizvo, C., Mehrdadi, M., Metzger, J. P., Mikissa, J. B., Moller, H., Mooney, H. A., Mumby, P., Nagendra, H., Nesshover, C., Oteng-Yeboah, A. A., Pataki, G., Roué, M., Rubis, J., Schultz, M., Smith, P., Sumaila, R., Takeuchi, K., Thomas, S., Verma, M., Yeo-Chang, Y., and Zlatanova, D. (2015). The ipbes conceptual framework — connecting nature and people. *Current Opinion in Environmental Sustainability*, 14:1–16.

Ecogain (2020). *Biodiversity enhancing measures on premises*. Vattenfall. `https://group.vattenfall.com/siteassets/corporate/who-we-are/sustainability/doc/environmental-brochure_biodiversity-on-premises-200525.pdf`.

Eds Encyclopaedia Britannica (2024). *Climax | Description & Ecology*. Encyclopedia Britannica. `https://www.britannica.com/science/climax-ecology`.

EFRAG (2022a). *[Draft] European Sustainability Reporting Standards - ESRS E4 Biodiversity and ecosystems*. EFRAG. `https://www.efrag.org/Assets/Download?assetUrl=%2Fsites%2Fwebpublishing%2FSiteAssets%2F11%2520Draft%2520ESRS%2520E4%2520Biodiversity%2520and%2520ecosystems%2520November%25202022.pdf`.

EFRAG (2022b). *ESRS E4 BIODIVERSITY AND ECOSYSTEMS*. EFRAG. `https://www.efrag.org/Assets/Download?assetUrl=%2Fsites%2Fwebpublishing%2FSiteAssets%2FESRS%2520E4%2520Delegated-act-2023-5303-ann`

ex-1_en.pdf.

Ellis, E. C., Pascual, U., and Mertz, O. (2019). Ecosystem services and nature's contribution to people: negotiating diverse values and trade-offs in land systems. *Current Opinion in Environmental Sustainability*, 38:86–94.

European Commission (2020a). *EU Biodiversity Strategy*. European Commission. https://biodiversity.europa.eu/countries/sweden/eu-biodiversity-strategy.

European Commission (2020b). *The European Green Deal*. European Commission. https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en.

European Commission (n.d.a). *EU Taxonomy Navigator*. European Commission. https://ec.europa.eu/sustainable-finance-taxonomy/.

European Commission (n.d.b). *Nature Restoration Law*. European Commission. https://environment.ec.europa.eu/topics/nature-and-biodiversity/nature-restoration-law_en.

European Union (2023). *The European Union*. The European Union. https://european-union.europa.eu/easy-read_en.

Fairbridge, R. W. and Agenbroad, L. D. (2019). *Holocene epoch | Causes, Effects, & Facts*. Encyclopedia Britannica. https://www.britannica.com/science/Holocene-Epoch.

Grigg, A., Burns, A., Dimitrijevic, J., Leach, K., Dunn, K., Brooks, S., and Houdet, J. (2021). *Biodiversity measures for business - Corporate biodiversity measurement, reporting and disclosure within the current and future global policy context*. UNEP-WCMC. http://dx.doi.org/10.13140/RG.2.2.27417.65121.

Grossenbraeucker, V. (2020). How "sponge cities" can mitigate the climate change risks. https://blog.dormakaba.com/how-sponge-cities-can-mitigate-the-climate-change-risks/.

Hassan, M. (2024). *Confounding Variable - Definition, Method and Examples*. Re-

search Method. `https://researchmethod.net/confounding-variable/`.

Heller, N. E. and Zavaleta, E. S. (2009). Biodiversity management in the face of climate change: A review of 22 years of recommendations. *Biological Conservation*, 142:14–32.

Hernvall, P., Hellström, M., and Birgersson, V. (2022). Groddjursinventering med eDNA i fyra dammar, Tuve, Västra Götalands Län. MIX Research SE. rapport 2022:10.

Hill, R., Dıíaz, S., Pascual, U., Stenseke, M., Molnár, Z., and Velden, J. V. (2021). Nature's contributions to people: Weaving plural perspectives. *One Earth*, 4:910–915.

Jaureguiberry, P., Titeux, N., Wiemers, M., Bowler, D. E., Coscieme, L., Golden, A. S., Guerra, C. A., Jacob, U., Takahashi, Y., Settele, J., Díaz, S., Molnár, Z., and Purvis, A. (2022). The direct drivers of recent global anthropogenic biodiversity loss. *Science Advances*, 8:1–11.

Jax, K., Barton, D. N., Chan, K. M. A., de Groot, R., Doyle, U., Eser, U., Görg, C., Gómez-Baggethun, E., Griewald, Y., Haber, W., Haines-Young, R., Heink, U., Jahn, T., Joosten, H., Kerschbaumer, L., Korn, H., Luck, G. W., Matzdorf, B., Muraca, B., Neßhöver, C., Norton, B., Ott, K., Potschin, M., Rauschmayer, F., von Haaren, C., and Wichmann, S. (2013). Ecosystem services and ethics. *Ecological Economics*, 93:260–268.

Jones, M. (2023). *How many countries are there in Europe?* Norwegian SciTech News. `https://norwegianscitechnews.com/2023/07/how-many-countries-are-there-in-europe/`.

Kadykalo, A. N., López-Rodriguez, M. D., Ainscough, J., Droste, N., Ryu, H., Ávila Flores, G., Le Clec'h, S., Muñoz, M. C., Nilsson, L., Rana, S., Sarkar, P., Sevecke, K. J., and Harmáčková, Z. V. (2019). Disentangling 'ecosystem services' and 'nature's contributions to people'. *Ecosystems and People*, 15:269–287.

Lee, S. and Kim, Y. (2021). A framework of biophilic urbanism for improving climate change adaptability in urban environments. *Urban Forestry & Urban Greening*, 61:1–10.

Ministry of Climate and Enterprise (2015). *Swedish strategy for biodiversity and ecosystem services*. Regeringen och Regeringskansliet. https://www.government.se/articles/2015/08/swedish-strategy-for-biodiversity-and-ecosystem-services/.

Naturvårdsverket (2019). *DNA methods in environmental monitoring*. Naturvårdsverket. https://www.naturvardsverket.se/en/international/research/the-environmental-research-fund/research-efforts-nature/dna-methods-in-environmental-monitoring/.

Naturvårdsverket (2023a). *Blombesökande insekter i Sverige*. naturvårdsverket. https://www.naturvardsverket.se/amnesomraden/pollinering/vilda-pollinatorer-och-pollinering/blombesokande-insekter-i-sverige/.

Naturvårdsverket (2023b). *Faktablad*. naturvårdsverket. https://www.naturvardsverket.se/amnesomraden/pollinering/faktablad/.

Naturvårdsverket (2023c). *Konventionen om biologisk mångfald (CBD)*. naturvårdsverket. https://www.naturvardsverket.se/om-miljoarbetet/internationellt-miljoarbete/internationella-miljokonventioner/konventionen-om-biologisk-mangfald-cbd/.

Naturvårdsverket (2024). *Biotopskyddsområden*. Naturvårdsverket. https://www.naturvardsverket.se/vagledning-och-stod/skyddad-natur/biotopskyddsomraden/.

Naturvårdsverket (n.d.). *Om Milöbalken*. Naturvårdsverket. https://www.naturvardsverket.se/lagar-och-regler/om-miljobalken/.

Panlasigui, S., Spotswood, E. N., Beller, E., and Grossinger, R. (2021). *Biophilia Beyond the Building: Applying the Tools of Urban Biodiversity Planning to Create Biophilic Cities*. MDPI. https://www.researchgate.net/publicati

on/349654102_Biophilia_Beyond_the_Building_Applying_the_Tools_of_Urban_Biodiversity_Planning_to_Create_Biophilic_Cities.

Paré, G. and Kitsiou, S. (2017). *Chapter 9 Methods for Literature Reviews*. University of Victoria. https://www.ncbi.nlm.nih.gov/books/NBK481583/.

Pinakhina, D. V. and Chekunova, E. M. (2020). Environmental dna: History of studies, current and prospective applications in fundamental and applied research. *Ecological Genetics*, 18:493–509.

Rafferty, J. P. (2024). *Biodiversity loss | Causes, Effects, & Facts | Britannica*. Encyclopedia Britannica. https://www.britannica.com/science/biodiversity-loss.

Rottman, J. (2014). *Breaking down biocentrism: two distinct forms of moral concern for nature*. Front Psychol. https://doi.org/10.3389%2Ffpsyg.2014.00905.

SCBD (2020). *Find National Targets*. CBD. https://www.cbd.int/nbsap/targets/.

Scott, E. (2023). *Indicator Species and Keystone Species Explained: Honey Bees and 18 Other Examples*. bestbees. https://bestbees.com/2023/03/28/indicator-species-keystone-species/.

Sen, J. and Dhote, M. (2023). Mainstreaming biodiversity in urban habitats for enhancing ecosystem services: A conceptual framework. *Sustainable Development Goals Series*, 13:349–368. https://doi.org/10.1007/978-3-031-44397-8_19.

Seymour, J. (1978). *The Self-sufficient Gardener*. Dorling Kindersley Ltd.

Sottosanti, K. (2023). *Pioneer species | Ecology*. Encyclopedia Britannica. https://www.britannica.com/science/pioneer-species.

SWEDNA (2023). *SWEDNA - Swedish eDNA lab | University of Gothenburg*. Gothenburg University. https://www.gu.se/en/research/swedna.

Tan, P. Y., Zhang, J., Masoudi, M., Alemu, J. B., Edwards, P. J., Grêt-Regamey, A., Richards, D. R., Saunders, J., Song, X. P., and Wong, L. W. (2020). A

conceptual framework to untangle the concept of urban ecosystem services. *Landscape and Urban Planning*, 200:1–11.

The environmental administration Gothenburg (2021). Naturen - göteborg har en hög biologisk mångfald. https://goteborg.se/wps/portal/enhetssida/miljo-och-klimat-goteborg/miljo-och-klimatprogrammet/naturen.

The European Council (n.d.). *Fit For 55*. Consilium. https://www.consilium.europa.eu/en/policies/green-deal/fit-for-55/.

Thompson, J. N. (2024). *Ecological succession | Definition & Facts | Britannica*. Encyclopedia Britannica. https://www.britannica.com/science/ecological-succession.

Thorn, J., Mangieri, C., Olago, D., Baker, J., and Buhigas, M. (2021). *Future-proofing Infrastructure to address the climate, biodiversity and pollution crises*. UN Environment Program. https://www.unep.org/resources/publication/future-proofing-infrastructure-address-climate-biodiversity-and-pollution.

Tyler, T., Herbertsson, L., Olofsson, J., and Olsson, P. A. (2021). Ecological indicator and traits values for swedish vascular plants. *Ecological Indicators*, 120:1–13.

UNEP-WCMC (2020). *Biodiversity Indicators for Site-Based Impacts*. Conservational International and Fauna & Flora International. https://resources.unep-wcmc.org/products/WCMC_RT284/access?option=9&endpoint_id=848623.

United Nations Environment Programme (1992). *Convention on biological diversity,*. UNEP. https://wedocs.unep.org/20.500.11822/8340.

University of Gothenburg (2020). *This is genetic biodiversity | University of Gothenburg*. University of Gothenburg. https://www.gu.se/en/cemeb-marine-evolutionary-biology/management-conservation/baltgene/this-is-genetic-biodiversity.

Van den Heuvel, L., Blicharska, M., Masia, S., Sušnik, J., and Teutschbein, C. (2020). Ecosystem services in the swedish water-energy-food-land-climate nexus: Anthropogenic pressures and physical interactions. *Ecosystem Services*, 44:1–13.

Winter, L., Pflugmacher, S., Berger, M., and Finkbeiner, M. (2017). Biodiversity impact assessment (bia+) - methodological framework for screening biodiversity. *Integrated Environmental Assessment and Management*, 14:282–297.

Witze, A. (2024). Geologists reject the anthropocene as earth's new epoch — after 15 years of debate. *Nature*, 627:249–250. `https://www.nature.com/articles/d41586-024-00675-8`.

WWF (2012). *Terrestrial Ecoregions of the World | Publications | WWF*. WWF. `https://www.worldwildlife.org/publications/terrestrial-ecoregions-of-the-world`.

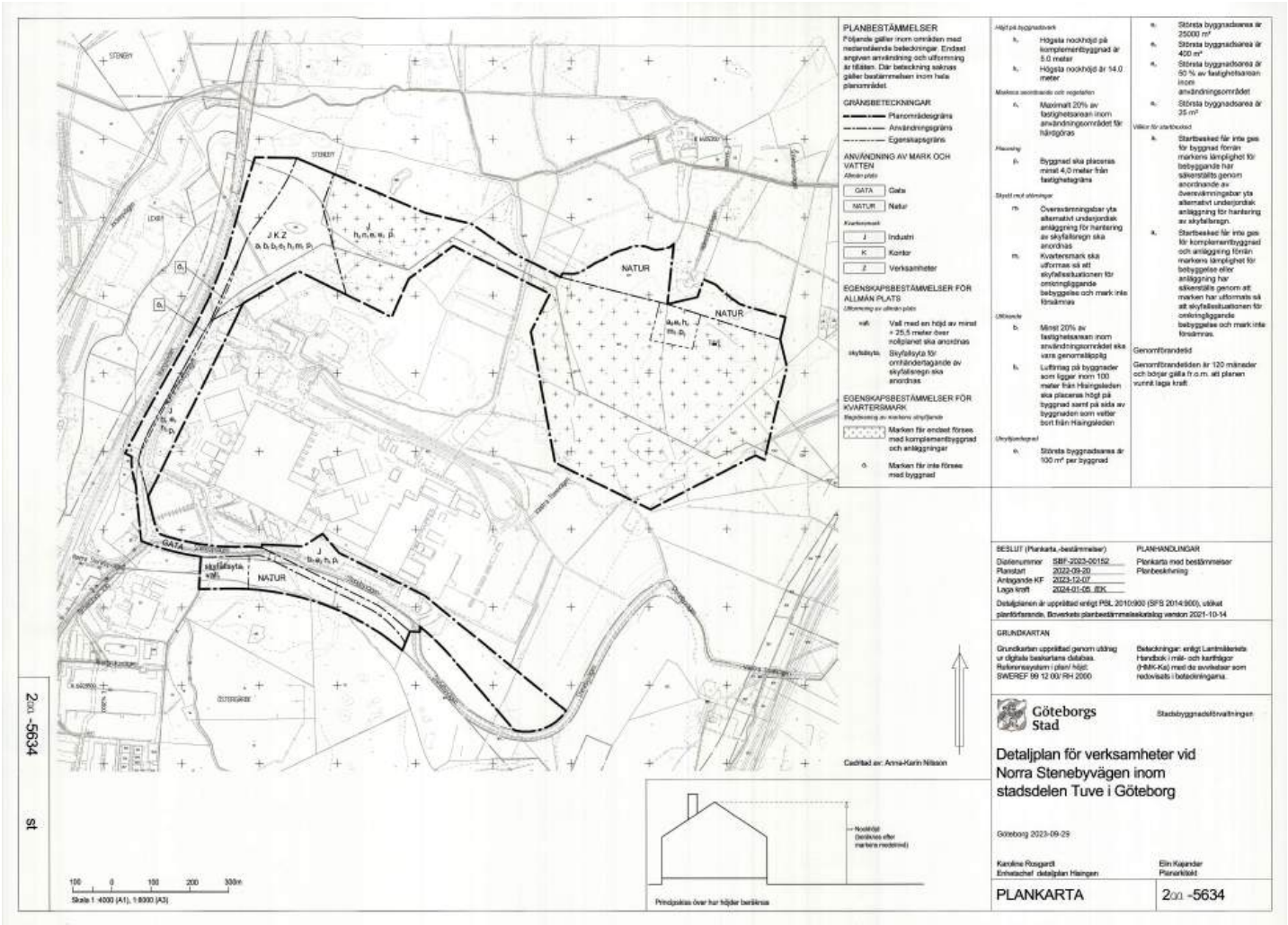
WWF and Bain & Company (2023). *Swedish businesses & the biodiversity crisis - Opportunities & risks associated with biodiversity loss*. WWF. `https://www.wwf.se/dokument/rapport-swedish-businesses-and-the-biodiversity-crisis/`.

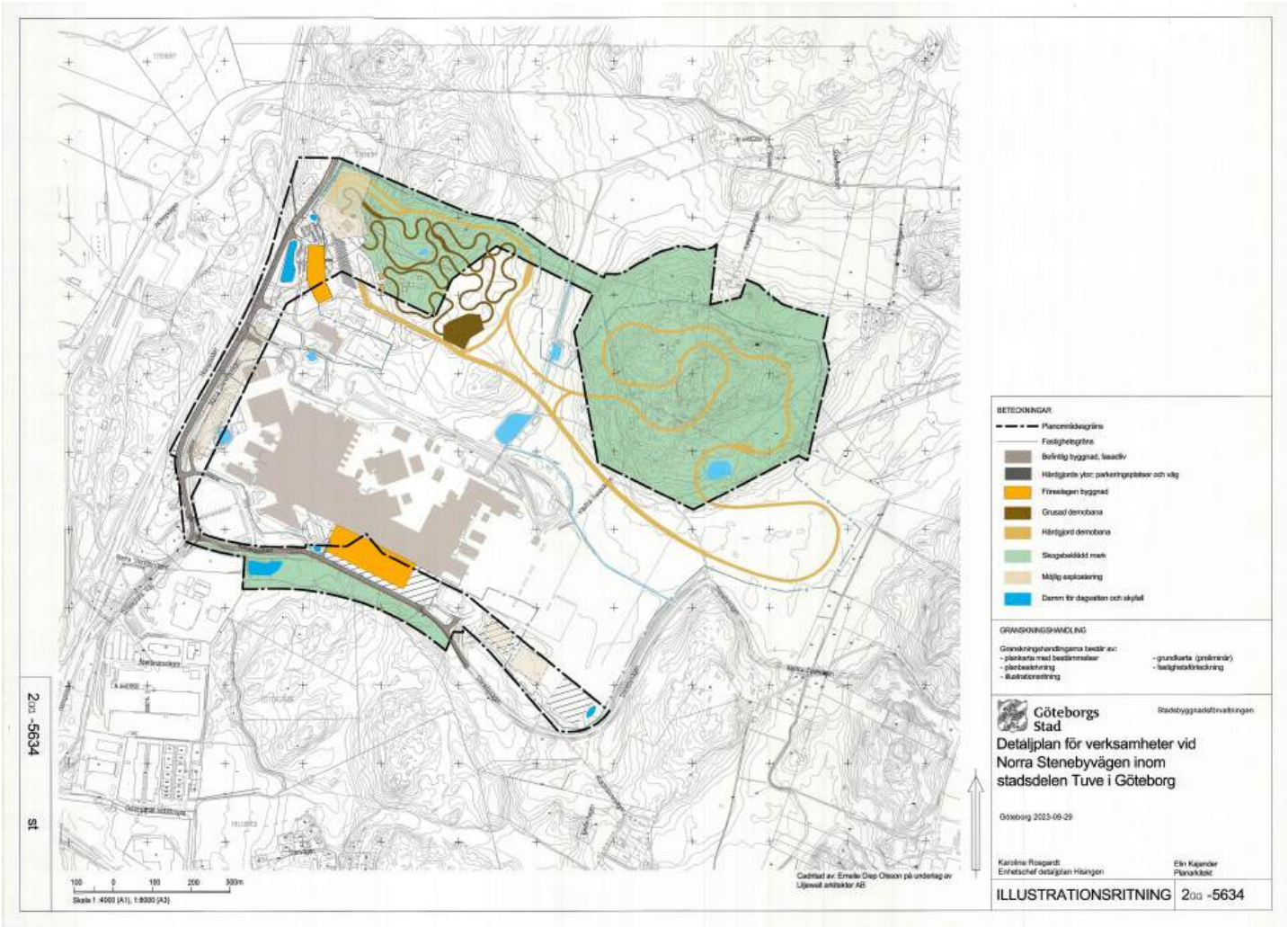
A

Appendix A

A.1 Detailplan Tuve, Gothenburg City, Selected Pages (In Swedish)

Downloaded from `https://goteborg.se/wps/portal/start/goteborg-vaxer/sa-planeras-staden/detaljplanering/hitta-gallande-detaljplaner`


PLANBESTÄMMELSER
GRÄNSBETECKNINGAR
ANVÄNDNING AV MARK OCH VATTEN
EGENSKAPSBESTÄMMELSER FÖR ALLMÄN PLATS
EGENSKAPSBESTÄMMELSER FÖR KVARTERSMARK
NATUR
GATA
Detaljplan för verksamheter vid Norra Stenebyvägen inom stadsdelen Tuve i Göteborg
PLANKARTA
2000 -5634
st


BETECKNINGAR
Planområdesgräns
Fastighetsgräns
Befintlig byggnad, teacliv
Hårdgjorda ytor: parkeringsplatser och väg
Föreslagen byggnad
Grusad dennobana
Hårdgjord dennobana
Skogsbeklädd mark
Möjlig exploatering
Damm för dagvatten och skyfall
GRANSKNINGSHANDLING
Granskningshandlingarna består av:
- plankarta med bestämmelser
- planbeskrivning
- illustrationsritning
- grundkarta (preliminär)
- fastighetsförteckning
Göteborgs Stad
Stadsbyggnadsförvaltningen
Detaljplan för verksamheter vid Norra Stenebyvägen inom stadsdelen Tuve i Göteborg
Göteborg 2023-09-29
Karolina Rosgardt
Enhetschef detaljplan Hisingen
Elin Kajander
Planarkitekt
ILLUSTRATIONSRITNING
2000 -5634
2000 -5634 st
100 0 100 200 300m
Skala 1: 4000 (A1), 1:8000 (A3)
Ritad av: Ermelie Diep Olsson på uppdrag av Uljewall arkitektur AB

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Stadsbyggnadsförvaltningen

Göteborgs Stad

Detaljplan för verksamheter vid Norra Stenebyvägen inom stadsdelen Tuve i Göteborg

PLANBESKRIVNING

Antagandehandling

Antagen av KF / ~~SBN~~ den 7 / 12 2023
§ 80 KSN
Laga kraft den 5 / 01 2024 / EK

Innehållsförteckning

ANTAGANDEHANDLING

Inledning

Figur 1: 3d-vy över möjlig utveckling av området. (Liljewall arkitekter, 2023)

Ärendeinformation

Planbeskrivning upprättad: 2023-09-29
Aktbeteckning: 2 -5634
Detaljplanens namn: Detaljplan för verksamheter vid Norra Stenebyvägen inom stadsdelen Tuve i Göteborg
Kommunens namn: Göteborgs Stad
Planstart: 2022-09-20

Detaljplanen är upprättad med utökat planförfarande enligt PBL (2010:900, SFS 2014:900).

Göteborgs Stad har genomfört en omorganisation vid årsskiftet 2022/2023. Detta ärende hade fram till 2022-12-31 diarienummer 0659/22 hos Stadsbyggnadskontoret. Sedan 2023-01-01 hanteras ärendet istället av Stadsbyggnadsförvaltningen.

Diarienummer Stadsbyggnadsförvaltningen: SBF-2023-00152
Handläggare SBF: Elin Kajander
Tel: 031-368 19 03
elin.kajander@stadsbyggnad.goteborg.se

Diarienummer Exploateringsförvaltningen: EXF-2023-00154
Handläggare EXF: Josefin Halldin
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Sammanfattning

Syfte och förutsättningar

Volvo Lastvagnar AB inkom den 11 mars 2022 med en ansökan om planbesked, ansökan kompletterades den 14 juni 2022. Ansökan avsåg en förfrågan om att, genom detaljplaneläggning, utöka befintligt industriområde vid Volvo Lastvagnar i Tuve med ytterligare exploaterbar mark för industri, verksamheter/kontor samt ge möjlighet för demonstrationsbanor. Ansökan om planbesked har behandlats och ett positivt planbesked gavs den 23 augusti 2022 av Byggnadsnämnden.

Detaljplanens syfte är att göra möjligt för nyetablering av ett kundcenter och tillhörande demobanor samt en utökning av befintlig industriverksamhet. Byggnadernas utformning ska anpassas till befintlig bebyggelse i området för att inte i för stor utsträckning påverka landskapsbilden. Syftet är även att ge möjlighet för ny kommunal gata, omdragning av befintlig kommunal gata samt att genom planläggning av områden till allmän plats för natur säkerställa natur-, kultur- och sociala värden inom dessa områden.

Planområdets läge

Planområdet ligger öster om Hisingsleden, norr om Björlandamotet och väster om Tuve samhälle (se figur 5).

Planförslagets huvuddrag

Detaljplaneförslaget ger möjlighet för utbyggnad av industri i söder och nybyggnation av industri/verksamhet/kontor i nordväst (se illustration och plankarta i figur 2 och 3). I delområde B och C (se figur 4) planläggs kvartersmark med byggrätt för komplementbyggnader och anläggningar. Inom detta område ämnar exploatören upprätta demonstrationsbanor. Detaljplanen ger möjlighet för uppförande av demobanor inom delområde B och C. Upprättande av demonstrationsbanor (motorbana) är en lovpliktig åtgärd och kräver anmälan om miljöfarlig verksamhet enligt Miljöprövningsförordningen 30 kap. 3§.

Vidare ger planförslaget möjlighet för flytt av Stenebyvägen till nytt läge söder om befintlig sträckning. Planförslaget ger också möjlighet för bebyggande av allmän plats för gata i väster, Norra Stenebyvägen. I söder och nordöst planläggs områden som allmän plats för natur, med syfte att säkerställa att dessa områden bibehålls som naturområden.

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Figur 2: Illustrationskarta som visar maximal byggrätt inom planområdet. Gula figurer; Planerad tillkommande bebyggelse, Ljusgul; Möjlig ytterligare bebyggelse. Grått; hårdgjord mark. Kurvade linjer; demobanor (bruna terräng, gula asfalterade). (Liljewall arkitekter, 2023)

Figur 3: Plankarta som visar markanvändning och egenskapsbestämmelser inom planområdet. Grå ytor; Allmän plats för gata. Gröna ytor: Allmän plats för Natur. Blå ytor: Kvartersmark för industri, kontor och verksamheter. (SBF, 2023)

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Södra delen av området omfattas av parker- natur- och rekreationsområden; Hisingsparken. Följande inriktning gäller för dessa områden:

- Stads- och stadsdelsparker.
- Parkkvaliteter och ekosystemtjänster ska utvecklas i alla parker. Genom detta kan parkerna ges förutsättningar att hysa såväl ekologiska som sociala värden och motsvara riktvärden för stadsparker och stadsdelsparker.
- Byggnad och ianspråktagande för andra ändamål är parkrelaterade ska inte tillåtas. Stora parker ska så långt som mojigt hållas fria från trafik- och industribuller och vara enkla att nå med kollektivtrafik och cykel.

Del av området omfattas av gällande plan 1480K-II-3458; Stadsplan för delar av stadsdelarna Björlanda och Tuve i Göteborg (Steneby industriområde). Detaljplanen omfattar kvartersmark för industri, trafikändamål och allmänt ändamål. Genomförandetiden har gått ut. Området omfattar också del av gällande plan 1408K-II-4444; Detaljplan för ny sträckning på Stenebyvägen v. Tuvevägen inom stadsdelen Tuve. Detaljplanen omfattar kvartersmark för industri, allmän plats för natur samt industrigata. Detaljplanen går marginellt in i det område som omfattas av industrigata. Genomförandetiden för detaljplanen har gått ut.

Området omfattas inte av strandskydd, Natura 2000 eller riksintressen. Dammar och stenmurar inom området omfattas av generellt biotopskydd.

Befintliga förhållanden

Mark, vegetation och fauna

Planområdet utgörs idag huvudsakligen av natur- och öppet landskap. Området är obebyggt och omfattas av kuperad skogsmark, en öppen dalgång, vägområden med mera. Geoteknisk utredning (COWI, 2023), Markteknisk undersökningsrapport (COWI, 2023), Bergteknisk utredning (COWI, 2023) och en Översiktlig miljöteknisk markundersökning har tagits fram och bilagts handlingarna. En sammanfattning av dessa finns under *Sammanfattning av innehåller i planeringsunderlagen*. Dessa tar upp information kopplat till mark, vegetation och fauna. En naturvärdesinventering har också tagits fram och bilagts handlingarna (Naturcentrum, 2023). Resultatet av inventeringen presenteras dels nedan dels under *Sammanfattning av innehållet i planeringsunderlagen*.

Naturvärden

En naturvärdesinventering har tagits fram och bilagts handlingarna (Naturcentrum, 2023). Inventeringsområdet för inventeringen har sträckts sig utanför planområdet. Totalt har 41 olika objekt (sammanlagt 75 hektar) med naturvärden registrerats inom inventeringsområdet. I figur 29 visas identifierade naturvärdesobjekt tillsammans med plangränsen. Utifrån aktuell plankarta innefattas helt eller delvis objekten: 1–6a och 6b, 10–12, 16, 18–21, 23, 24, 28–32, 37–39 och 41–42. Av dessa har ett objekt högt naturvärde (objekt 11). 10 har påtagligt värde (objekt 4, 10, 12, 16, 19, 21, 23, 28, 39 och 41) och resterande visst naturvärdevärde.

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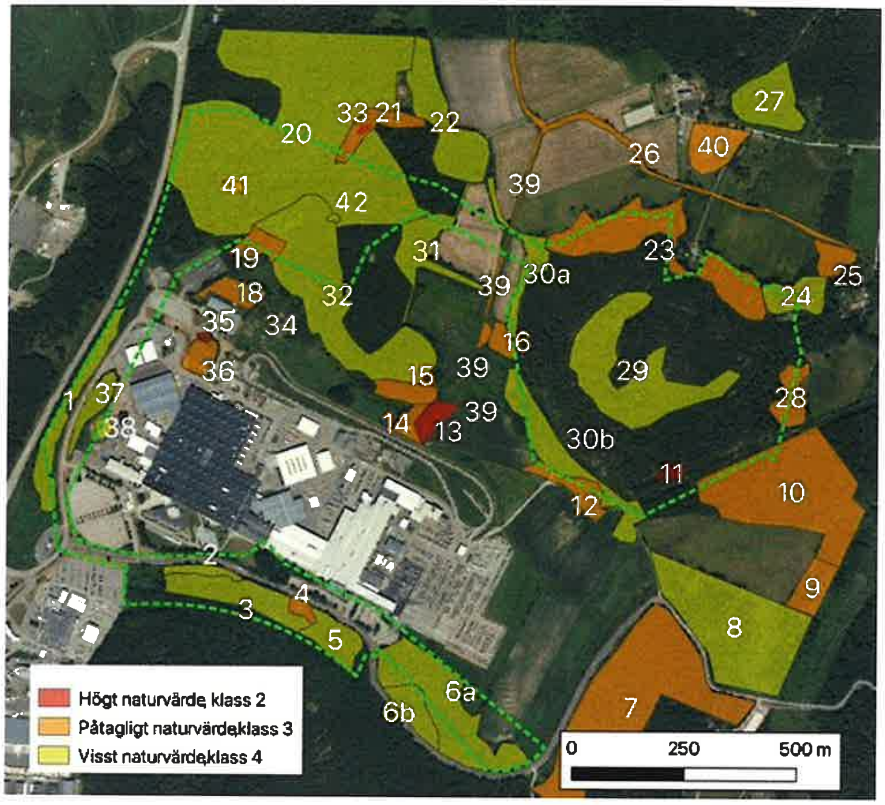

Figur 29: Kartbild som visar naturvärden och objektsnummer inom inventeringsområdet. Grön linje avser ungefärlig planområdesgräns (Naturcentrum, 2023)

Inventeringsområdet beskrivs vara av mestadels vardagskaraktär, men på sina håll finns platser med mycket död ved, åldrande träd, ett åldersmässigt varierande trädskikt och försumpade marker. På längre sikt skulle dessa kunna utvecklas till naturskogsliknande miljöer (visst naturvärde, klass IV). Objekt med påtagliga naturvärden (klass III) utgörs bland annat av mer öppna hag- och betesmarker samt trivial lövskog. Slutligen finns flera dammar och småvatten varav många med höga naturvärden (klass II) i form av en rik fauna av insekter, amfibier och fåglar.

Till Naturvärdesinventeringen hör följande bilagor:

- Redovisning av naturvärdesobjekt
- Fågelinventeringar
- Inventering av kärrtrollsländor
- Kartering av hasselsnokshabitat
- Fladdermusinventering
- Groddjursinventering
- Kompletterande groddjursinventering
- Artskyddsutredning

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Inventeringsresultat arter.

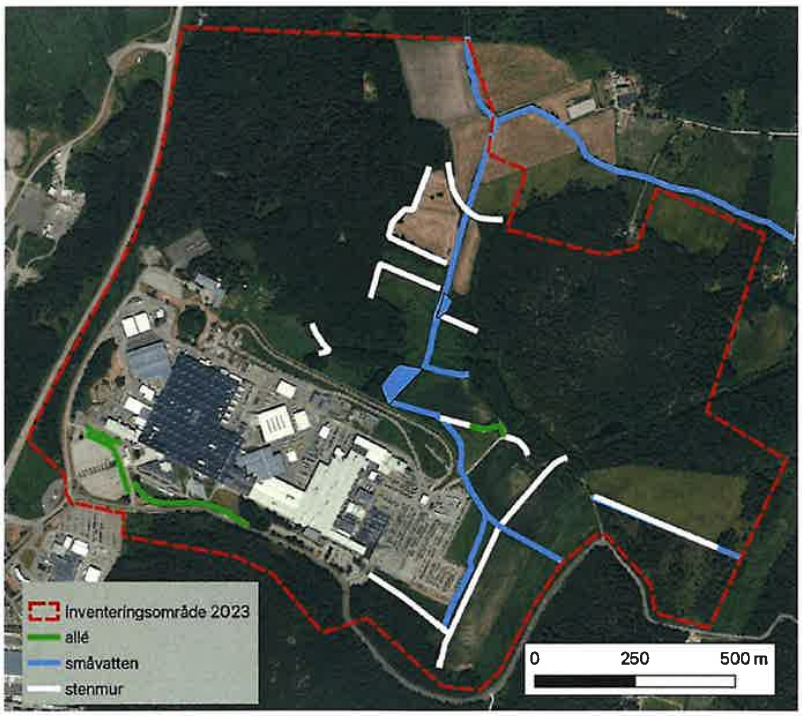
Sammanlagt har ett fyrtiotal naturvårdarter inklusive ett tjugotal särskilt skyddsvärda fåglar identifierats inom utredningsområdet. De olika utredningarna presenteras under *Sammanfattning av innehållet i planeringsunderlagen* samt ingående och med resultat i respektive bilaga till Naturvärdesinventeringen (Naturcentrum, 2023).

Särskilt skyddsvärda träd.

Några få "grova träd" (75–100 cm i diameter) har registrerats, men inga "jätteträd" (> 1 meter i diameter). Ett par grova hamlade askar växer strax intill fabriksområdet (Unnered och Steneby gamla tomter) och hålaspar/boträd för hackspettar förekommer men i låg utsträckning.

Biotopskydd och andra värdefulla strukturer.

Ett tjugotal avgränsade så kallade generella biotopskydd enligt Miljöbalken 7§ 11 har registrerats inom inventeringsområdet. Dessa avser stenmurar och småvatten (öppna diken/ dammar) i odlingslandskapet samt ett antal alléer och trädrader belägna både utanför och inom fabriksområdet (se figur 30). Det finns ett stort antal stenmurar inom områdets skogar och från områden där hävden upphört. Dessa stenmurar vittnar om landskapets tidigare historia som odlings- och beteslandskap. Skyddet innebär att dispens krävs för att få utförda åtgärder som kan skada naturmiljön (7 kapitlet 11 § miljöbalken). Andra värdefulla strukturer som karterats utgörs av stenrösen. Dessa är inte skyddade av det generella biotopskyddet i miljöbalken.



Figur 30: Kartbild som visar generella bioptopskydd enligt miljöbalken inom utredningsområdet (Naturcentrum, 2023).

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Sammanfattning av innehållet i planeringsunderlagen

Miljökonsekvensbeskrivning

En miljökonsekvensbeskrivning har tagits fram och bilagt planhandlingarna (COWI, 2023). Miljökonsekvensbeskrivningen syftar till att utreda planens effekter och konsekvenser utifrån de studerade miljöaspekterna. Resultat från utredningen finns på ett flertal ställen i planbeskrivningen, bland annat under *Beskrivning av detaljplanen - Överväganden som ligger till grund för detaljplanen* samt under *Konsekvenser*.

Mark, vegetation och fauna

Sammanfattning av naturvärdesinventering

En naturvärdesinventering (NVI) har tagits fram och bilagts handlingarna (Naturcentrum, 2023). Utredningen syftar till att dokumentera biologisk mångfald i området, samt utgöra underlag för beskrivningar av ekologiska konsekvenser och åtgärder. Naturvärdesinventeringen innehåller en allmän beskrivning av området, enskilda naturvärdesobjekt, generella biotopskydd, skyddade arter samt värdefulla strukturer som till exempel gamla grova träd, med mera. Inventeringen har utförts enligt Svensk Standard (SS199000:2014) där områden med naturvärden delas in i fyra olika naturvärdesklasser.

Fältarbetena har utförts under april till september 2022 (kompletterande artinventeringar har fortsatt under 2023). Områdets olika områden och vegetationstyper har besökts och genomsökts en eller flera gånger. Totalt har cirka 35 fältbesök genomförts. Inventeringarna har riktats mot olika typer av naturmiljöer och kärlväxter, men även mot andra växt- och djurgrupper som fåglar, trollsländor, groddjur (amfibier), reptiler, fladdermöss, lavar, mossor och svampar. Särskilt fokus har varit att uppmärksamma eventuella förekomster av rödlistade, skyddade (fridlysta samt arter i art- och habitatdirektivet), sällsynta arter och signalarter tillsammans med de mindre mark- eller vattenområden som utgör livsmiljö för dessa arter.

Till Naturvärdesinventeringen hör bilagorna:

- Redovisning av naturvärdesobjekt
- Fågelinventeringar
- Inventering av kärrtrollsländor
- Kartering av hasselsnokshabitat
- Fladdermusinventering
- Groddjursinventering
- Kompletterande groddjursinventering
- Artskyddsutredning

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Nedan följer en kort beskrivning av respektive bilaga. För mer ingående beskrivning samt resultat hänvisas till aktuell bilaga.

Fågelinventering

Naturcentrum har inom ramen för detaljplanearbetet genomfört en fördjupad artinventering av häckande fåglar. Huvuddelen av fältarbetena har genomförts under 2022 med kompletteringar under 2023. Arbetena har fördelats på flera dag- och nattbesök.

Inventering av kärrtrollsländor

Naturcentrum har inom ramen för detaljplanearbetet inventerat kärrtrollsländor på västra och centrala Hisingen under juni 2022. Totalt inventerades 21 olika dammar eller vattenförekomster varav 6 inom planområdet. Varje damm besöktes vid minst ett tillfälle.

Kartering av hasselsnokshabitat

Naturcentrum har tagit fram en sammanställning av lämpliga övervintrings- och parningsmiljöer för hasselsnok i och omkring planområdet. Rapporten beskriver resultat av fältbesök, tolkning av flygbilder samt kunskap om artens habitatkrav.

Fladdermusinventering

Naturcentrum har under juli 2022 genomfört en fladdermusinventering i och omkring planområdet. Fladdermusinventeringen utfördes med automatiska inspelningsboxar (auto-boxar) men också genom manuell inventering där området genomströvades till fots med handhållen fladdermusdetektor. Totalt användes åtta autoboxar. En av dessa var en långtidsbox som var aktiv i cirka två veckor medan de övriga sju endast vara aktiva under två separata nätter. Manuell inventering genomfördes samma nätter.

Groddjursinventeringar

MIX Research Sweden AB har genomfört en groddjursinventering med eDNA i fyra dammar inom planområdet. eDNA (environmental DNA) är samlingsnamnet på de genetiska avtryck som alla levande organismer lämnar efter sig i miljön. eDNA kan utvinnas från en liten mängd vatten och med hög precision ange vilka arter som är närvarande i till exempel sjöar, vattendrag eller hav. Genomförda arbeten bestod bland annat av provtagning, bearbetning, art- och habitatanalys samt fastställande av behov av åtgärder och uppföljning. Kompletterande inventering har utförts av Naturcentrum under våren 2023, ytterligare ett antal våtmarker/småvatten har inventerats.

Artskyddsutredning

Naturcentrum har utarbetat en artskyddsutredning utifrån de fördjupade inventeringarna och karteringarna i Naturvärdesinventeringen med bilaga 1 till 7. I utredningen bedöms vilka arter som skulle kunna påverkas på ett sådant sätt att deras bevarandestatus lokalt (Hisingen/mellersta Hisingen) kan försämras och för vilka arter landskapets kontinuerliga ekologiska funktion skulle kunna försämras. Vidare föreslås skyddsåtgärder som kan sättas in för att undvika att så sker.

Sammanfattning av lokaliseringsutredning för ianspråktagande av jordbruksmark

En lokaliseringsutredning för ianspråktagande av jordbruksmark har tagits fram och bilagts handlingarna (Liljewall, 2023). Ett genomförande av detaljplanen innebär att

jordbruksmark tas i anspråk, vilket också är bakgrunden till att lokaliseringsutredning tagits fram.

Den planerade verksamheten ställer vissa grundläggande krav för sin funktion och genomförbarhet. Följande grundläggande krav/urvalskriterier har därför legat till grund för urvalet av alternativa lokaliseringar:

- Mark i anslutning till befintlig huvudanläggning i Tuve, alternativt i anslutning till större transportled som underlättar en gen kommunikation mellan anläggningarna och funktioner för besökare i centrum.
- Mark som ej redan är utpekat som verksamhetsområde eller utredningsområde för blandad stadsbebyggelse, planeringsreserv eller som av olika anledningar ska skyddas enligt kommunens översiktsplan eller mark som redan är föremål för planering genom detaljplaner eller planprogram.
- Mark på ca 80 hektar och som utgörs av både flack och kuperad terräng.

Av de alternativa lokaliseringar som identifierats har tre alternativ studerats djupare och värderats utifrån ett antal bedömningskriterier:

A – Tuve, Göteborg (huvudalternativet)

B – Öster om Kongahällavägen, Göteborg

C – Norr om Ryamotet, Härryda

Sammanfattningsvis bedöms huvudalternativet intill befintlig anläggning i Tuve som det mest lämpade alternativet. Se tabell.

Bedömningskriterier	A - Tuve (huvudalternativet)	B - Öster om Kongahällavägen, Göteborg	C - Norr om Ryamotet, Härryda
Stöd i ÖP	Delvis	Nej	Delvis
Befintlig DP	Delvis	Nej	Områdesbestämmelser
Storlek	80 hektar	80 hektar	80 hektar
Markägare	Flera (staden, Volvo)	Flera (staden, privata)	Flera (privata)
Koppling till led	Ja	Nej (4 km)	Ja (RV 40)
Gen kommunikation	Ja	Ja	Delvis (ej till fabriken)
Avstånd till fabrik	0 m	Ca 5 km	Ca 40 km
Topografi	Flackt och kuperat	Flackt och kuperat	Flackt och något kuperat
Kultur/naturvärden (ÖP)	Fornlämningar	Fornlämningar Naturvärden	Övriga lämningar Sumpskog
Jordbruksmark	Ca 70 000 kvm	Ca 120 000 kvm	0 kvm
Påverkan på närliggande bebyggelse	Nej	Delvis	Nej
Samnyttjande infrastruktur/tekniska anläggningar	Ja	Nej	Okänt

Figur 35: Tabell som visar bedömningskriterier och de respektive alternativa lokaliseringarna (Liljewall, 2023).

Sammanfattning av geoteknisk utredning och markteknisk undersökningsrapport

En geoteknisk utredning (Geoteknisk utredning, COWI, 2023) och tillhörande Markteknisk undersökningsrapport (Mur Geoteknik, COWI, 2023) har tagits fram och bilagts handlingarna. Marken inom planområdet utgörs av relativt flack lermark och höjdpartier med morän och berg i dagen. Runt det vattendrag som går igenom planområdets mellersta del utgörs marken överst av svämsediment. Fyllnadsmaterial

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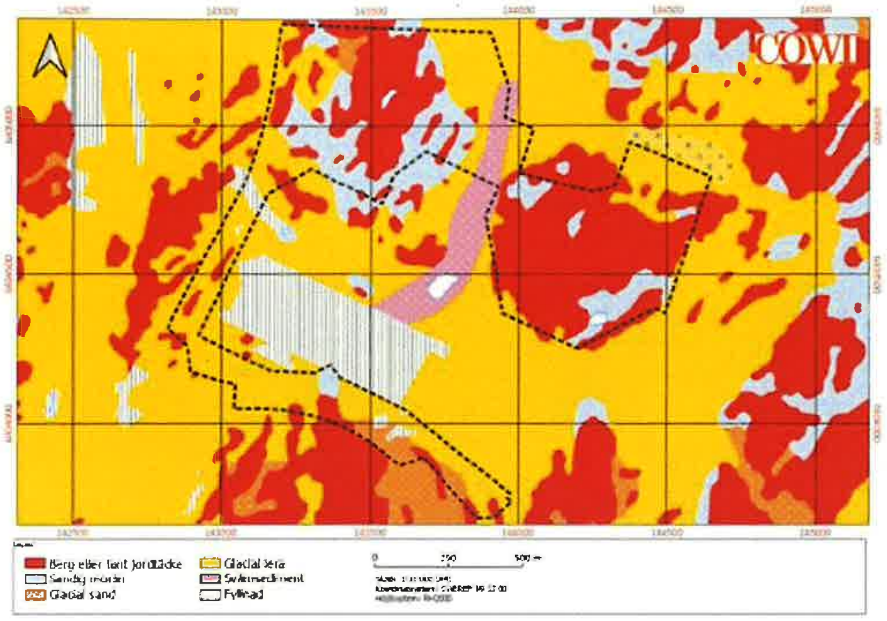
förekommer inom delar av området och längst i sydost finns postglacial finsand i anslutning till berg i dagen. Enligt SGU:s jorddjupskarta varierar jorddjupen inom spannet 0–20 meter.



Figur 36: Jordartskarta över området. Streckad linje avser ungefärlig planområdesgräns (avviker i nordväst och i sydväst). (COWI, 2023)

Sammanfattning bergteknisk utredning

En bergteknisk utredning har tagits fram och bilagts handlingarn (COWI, 2023). Berggrunden i området är övervägande obetydligt vittrad och medel- till storblockig. Lokalt förekommer trasigare partier. Stabilitetshöjande åtgärder bedöms inte vara nödvändiga under befintliga förhållanden.

Lösa block som potentiellt kan röra sig har observerats på ett par platser (nordvästra höjdens västra krön, nordöstra höjdens sydkrön), men fallhöjden skulle vara under metern vid ett eventuellt blocknedfall och block skulle fångas upp av naturmark nedanför. Således bedöms det inte föreligga någon risk för ras på befintliga naturstigar där människor rör sig. Åtgärder som föreslås på grund av detaljplanens genomförande presenteras under *Tekniska frågor – tekniska åtgärder*.

Sammanfattning översiktlig miljöteknisk markundersökning

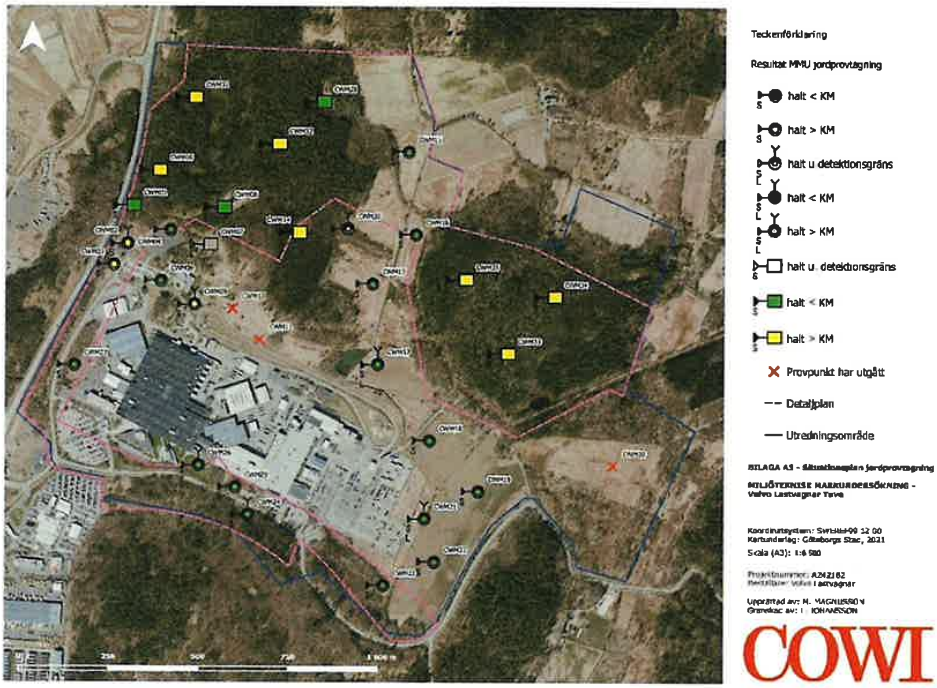
En översiktlig miljöteknisk markundersökning har tagits fram och bilagts handlingarna (Översiktlig miljöteknisk markundersökning, COWI, 2023). Undersökningsområdet avser ett större område än detaljplaneområdet. Jordprovtagning utfördes genom skruvborrning med borrbandvagn och provgropsgrävning för hand med spade, totalt 32 punkter. I samband med jordprovtagningen installerades fem stycken grundvattenrör. Se figur 37 och 38.

ANTAGANDEHANDLING

Resultaten från analyser av jordproverna uppvisade totalt sex provpunkter med halter över Naturvårdsverkets riktlinjer för känslig markanvändning (KM). Halter av bland annat Alifater >C16-C35, kobolt och PFAS har påträffats inom flera områden, varav ett har använts som förvaringsyta för diverse massor och snöplogning.

Analys av grundvattnet i två provpunkter påvisade mycket höga halter av ämnesgruppen PFAS. Halterna av PFAS översteg nivån där insats ska utföras för att vända betydande och ihållande uppåtgående trender. I två av de analyserade grundvattenproverna överskred PFAS även gränsen för miljökvalitetsnormen för grundvatten.

Åtgärder kopplat till resultatet i utredningen beskrivs under *Tekniska frågor – tekniska åtgärder*.



Figur 37: Situationsplan jordprovtagning. Blå gräns är undersökningsområdet, rosa gräns är ungefärlig planområdesgräns. (COWI, 2023)

B

Appendix B

B.1 Full Detailplan Tuve 1975, Gothenburg City (In Swedish)

Downloaded from `https://goteborg.se/wps/portal/start/goteborg-vaxer/sa-planeras-staden/detaljplanering/hitta-gallande-detaljplaner`

Förslag till
stadsplan
för delar av stadsdelarna
BJÖRLANDA och TUVE
I GÖTEBORG
(Steneby industriområde)
uppgjort på stadsbyggnadskontoret,
stadsplaneavdelningen i juli 1975

STADSPLANEKARTA

Göteborg den 1 juli 1975

Stadsplanechef — Tf chef IT-byrån / Louise Österlin

Grundkartan kompl. betr. förnminnen.

Tillhör länsstyrelsens beslut 1976-05-20
11 | 082 | 143 | 76

Fastställelsebeslutet har vunnit laga kraft enl regeringens beslut 1976-10-14

Christina Carlson
Christina Carlson

1975 -12- 18 § 41
betygar å länsstyrelsens vägnar
[illegible]

Godkänd ur sekretessynpunkt
för spridning.
Statens lantmäteriverk 1975-07-16.

Beteckningar:
Linje, betygen 3 (tre) utanför del område, som förslaget avser.
Föreslagen gräns för byggnadskvarter.
Gällande gräns för andra områden än byggnadskvarter, avsedd att bibehållas.
Gällande gräns för andra områden än byggnadskvarter, avsedd att utgå.
Föreslagen gräns för andra områden än byggnadskvarter.
Allmän plats gata.
Allmän plats park, plantering, lekplats o dyl.
+ 0.00 Föreslagen gatuhöjd.

Beteckningen, vilka hänför sig till stadsplanebestämmelserna.

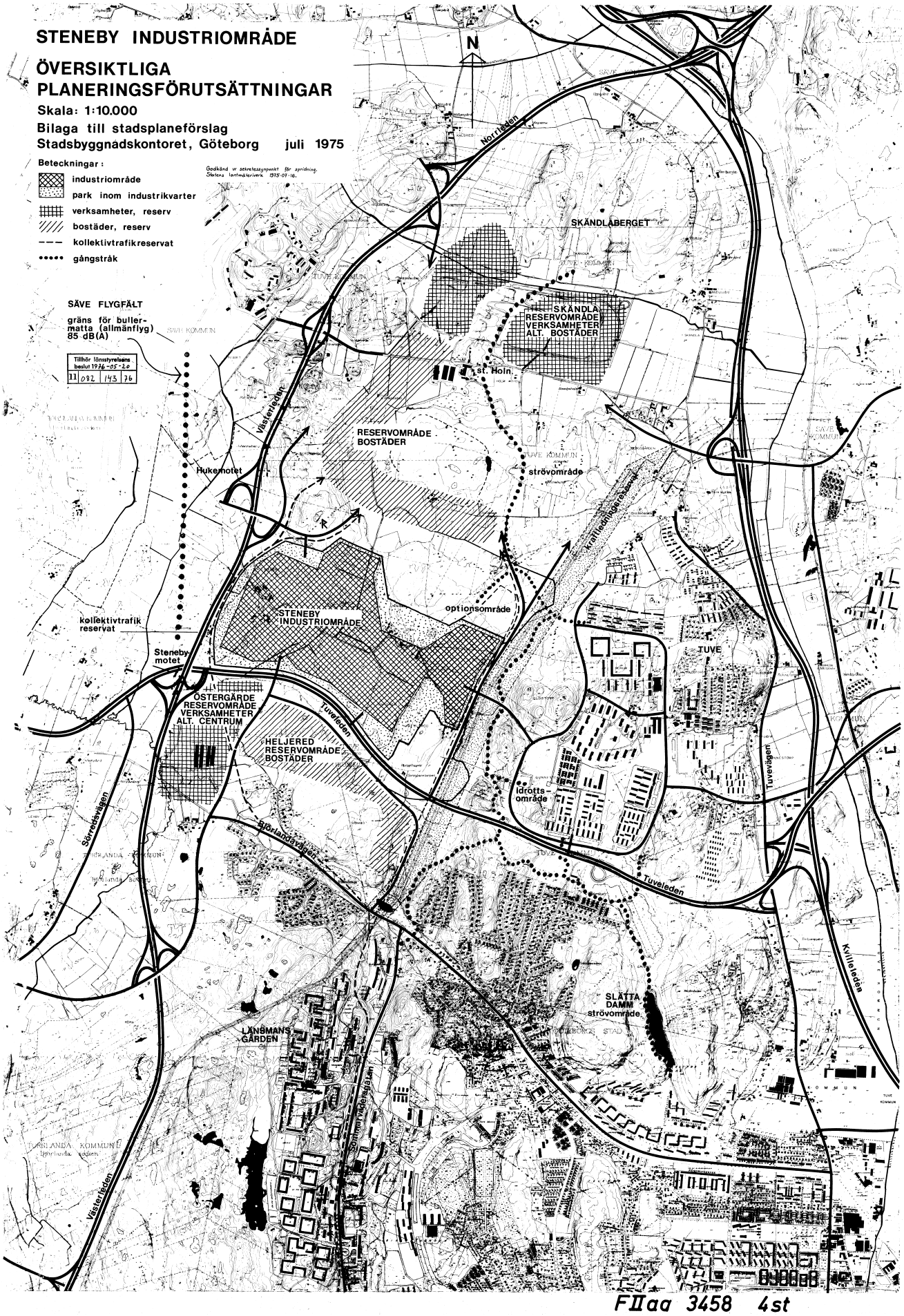
Befintlig fastighetsgräns.
Befintlig byggnad, fasadliv.
Befintlig byggnad, takkonturer.
Utfartsförbudslinje, ej avsedd att fastställas.

Skala 1:2000

Fiaa 3458
4st.


Tillhör länsstyrelsens beslut 1976-05-20
11 082 143 76
Fastställelsebeslutet har vunnit laga kraft enl regeringens beslut 1976-10-14
Christina Carlson
1975 -12- 18
betygar å tjänstens vägnar
TUVELEDEN
Fiiaa 3458
4 st.


Bil. B
3-3
Tillhör länsstyrelsens beslut 19 Fastighetsbestämmelser
Fastställelsebeslutet har vunnit laga kraft enligt regeringens beslut 1976-10-14
Christina Carlson
Förslaget ansluter i denna del till ett förslag till byggnadsplan för delar av fastigheterna Norum 1:1, Tången 1:6, 1:11, 1:8 Tuve kommun, upprättat i mars 1966
Förslaget ansluter i denna del till ett förslag till byggnadsplan för delar av fastigheterna Glastorp 1:4, 1:8 Norum 1:1 m fl:1:4 Tuve kommun, upprättad i september 1966
Tuve Centrumväg
Norumsvägen
Glastorpsvägen
Arvesgärde
VATTEN RESERVOAR
VATTENRESERVOAR
IDROTTSOMRÅDE
Tången
Fiaa 3458
4 st.


STENEBY INDUSTRIOMRÅDE
ÖVERSIKTLIGA PLANERINGSFÖRUTSÄTTNINGAR
Skala: 1:10.000
Bilaga till stadsplaneförslag
Stadsbyggnadskontoret, Göteborg juli 1975
Beteckningar:
industriområde
park inom industrikvarter
verksamheter, reserv
bostäder, reserv
kollektivtrafikreservat
gångstråk
N
Norrleden
SKÄNDLABERGET
SKÄNDLA RESERVOMRÅDE VERKSAMHETER ALT. BOSTÄDER
SÄVE FLYGFÄLT
gräns för bullermatta (allmänflyg) 85 dB(A)
Tillhör länsstyrelsens beslut 1976-05-20
11 082 143 76
Västerleden
RESERVOMRÅDE BOSTÄDER
Hukemotet
strövområde
kraftledningsreservat
kollektivtrafik reservat
STENEBY INDUSTRIOMRÅDE
optionsområde
Stenebymotet
ÖSTERGÄRDE RESERVOMRÅDE VERKSAMHETER ALT. CENTRUM
HELJERED RESERVOMRÅDE BOSTÄDER
Tuveleden
TUVE
idrotts-område
Tuvevägen
Särretorpsvägen
Björlandavägen
SLÄTTA DAMM strövområde
LÅNGMANS GÅRDEN
Kvilleleden
Västerleden
FIIaa 3458 4st

Bil. 3

STADSBYGGNADSKONTORET Göteborgs kommun

Stadsplaneavdelningen

Göteborg

15 1975-07-01

PM 1

Sida 1/8

3458

Beskrivning över förslag till stadsplan för delar av stadsdelarna Björlanda och Tuve i Göteborg (Steneby industriområde) uppgjort i juli 1975

Förslaget är avfattat på karta i tre blad (Stadsplanekarta) och i särskild handling (Stadsplanebestämmelser). Förslaget åtföljs av bilagor:

Översiktskarta visande planområdets läge (bilaga i beskrivningen)
Karta i ett blad i skala 1: 10 000 visande översiktliga planeringsförutsättningar
Promemoria angående översiktliga planeringsförutsättningar

För området gäller utomplansbestämmelser.

Förslaget omfattar en yta av ca 250 ha, varav ca 135 ha föreslås bli utnyttjade för industriändamål. Planområdet ansluter i öster till bostadsbebyggelsen i Tuve, för vilken stadsplan fastställts av länsstyrelsen den 14 oktober 1969 och den 25 maj 1970, och gränsar i nordost till två områden, för vilka förslag till byggnadsplan upprättats i september 1964 respektive mars 1965. Byggnadsplaneförslagen har emellertid ej fastställts.

Planområdet omfattar industrimark för planerad utbyggnad av centrallager och lastvagnsfabrik för AB Volvo. Utbyggnaden beräknas bli påbörjad under innevarande år och den första etappen beräknas bli färdig 1977.

De översiktliga planeringsförutsättningarna som gäller för området redovisas i bilagd promemoria jämte karta i skala 1:10 000

Kommunen äger ca 60% av marken. Övrig mark är i privat ägo.

Befintliga förhållanden i juli 1975 inom planområdet framgår av kartskiss på sidan 8.

Befintlig bebyggelse utgörs huvudsakligen av jordbruksfastigheter. Byn Steneby består av tre gårdar och byn Unnered av fyra gårdar jämte ett fritidshus. I planområdets sydvästra del finns ett par gårdar samt ett mindre antal villor och fritidshus. I den sydöstra delen ligger gården Kättilsröd.

Fornlämningar från förhistoriska boplatsområden och gravfält finns huvudsakligen inom planområdets västra del. Vissa av fornlämningarna har under de senaste åren grävts ut av Göteborgs arkeologiska museum. Kompletterande undersökningar och utgrävningar pågår under sommaren 1975. Inom planområdet finns inga fornlämningar som inte kan tas bort efter vederbörlig undersökning. I nordväst - strax utanför planområdet - ligger en fornlämning (hällristning) som har särskilt stort värde. Denna får ej flyttas utan skall bevaras i ett väl tilltaget terrängavsnitt, vars karaktär och topografi inte får förändras.

1480K-II-3458

Områdets topografi kännetecknas av ett större uppodlat slättlandskap och öster om detta en smalare dalgång. Två relativt flacka höjdpartier ingår i området, ett större i norr och ett mindre i sydost, Kättilsrödsberget. I öster ingår den brantare skogklädda höjdryggen som gränsar till bebyggelsen i Tuve. I söder ingår en mindre del av höjdpartierna norr om Heljered.

Vegetation finns huvudsakligen på de högre partierna. Särskilt värdefull sådan finns utspridd på flera mindre områden, t ex utefter höjderna i söder, i sydost kring gården Kättilsröd samt i ett område omedelbart öster om höjdpartiet i norr. Vissa skogsbryn är särskilt värdefulla för landskapets karaktär, nämligen brynet kring ett skogsområde i nordväst samt brynet mot skogen i södra delen av planområdet.

Utförda grundundersökningar visar att goda grundförhållanden råder inom stora delar av planområdet. Detta gäller främst de högre belägna delarna men även delar av slätten samt dalgången i öster. Grunden utgörs här av fasta jordlager med litet djup till berg. Vissa avsnitt av planområdet, framförallt inom ett centralt på slätten beläget område, består av lerjordar med dålig bärighet. Djupet till fast botten varierar från 5 till 25 meter.

Planförslaget innebär att AB Volvos planerade utbyggnad av centrallager och lastvagnsfabrik förläggs till det föreslagna industrikvarteret, vars yta uppgår till ca 135 ha. 27 ha utgörs av grönområden, fördelade dels som naturpark på höjdpartierna i norr och sydost dels som en planteringszon utefter kvartersgränsen.

Det föreslagna kvarteret är i sin helhet avsett för industriellt ändamål. I det nordvästra partiet som - särskilt med tanke på en eventuell framtida användning av området norr om kvarteret för bostadsändamål - bedömts vara känsligt från landskapsbildssynpunkt, skall industribebyggelsen utformas med särskild hänsyn härtill.

Inom industrikvarterets sydvästra del, där uppförandet av en lagerbyggnad och kontorsbyggnad avses påbörjas under 1975, föreslås att byggnadshöjden begränsas till horisontalplanet 51 m över kommunens nollplan. Lagerbyggnadens höjd över mark blir ca 14 m, medan kontorsbyggnadens höjd blir 14-17 m. För övriga delar av det föreslagna industrikvarteret föreslås byggnadshöjderna 12 respektive 14 m, där den lägre höjden avser det parti i nordväst som bedömts vara känsligt från landskapsbildssynpunkt. Efter prövning kan byggnadsnämnden medge högre höjd än 12 m respektive 14 m om särskilda skäl finns.

Säve flygplats som är belägen väster om planområdet, är idag militär flygplats. Detta innebär för planområdet att byggnader och andra föremål inte får överstiga ett horisontalplan beläget 89,95 m över kommunens nollplan. En eventuell lokalisering av allmänflyget till Säve flygplats, varvid standardklass III eller IVj förutsatts, kräver ytterligare begränsning till 70 m över kommunens nollplan. Stadsplanebestämmelserna har utformats med hänsyn härtill. I förslaget har avsteg gjorts från denna höjdbegränsning för den befintliga reservoaren i Glöstorp. Särskilda anordningar med hänsyn till flygsäkerheten förutsätts därvid genomförda.

17

De större sammanhängande naturparkområdena i kvarterets norra och sydöstra del skall användas för de anställdas rekreation men även hållas tillgängliga för allmänheten. Mindre byggnader för fritidsverksamhet kan efter byggnadsnämndens hörande få uppföras inom dessa områden, medan särskild planutredning eller stadsplaneändring skall föregå uppförandet av större anläggningar (exempelvis simhall). Det förutsätts att allmänheten får tillträde till sådana eventuella anläggningar.

Planteringszonen som föreslås omedelbart innanför kvartersgränsen är 20 m bred och utgör ett område som skall ordnas som plantering. Där så är lämpligt kan befintliga vegetationspartier bevaras. Utefter den södra kvartersgränsen planeras en lokal körväg på kvartersmark parallellt med Tuveleden. Vägen förlägge på vissa ställen invid kvartersgränsen, varvid planteringsområden avsätts innanför vägen. Dessa föreslagna planteringsområden utgörs av befintliga värdefulla vegetationspartier med vackra bryn, bl a en björkdunge i öster och en mindre samling ekar i väster vilka växer på ett något upphöjt terrängparti. Dessa båda vegetationspartier utgör värdefulla inslag i landskapsbilden, och ingrepp i dem som förändrar deras karaktär och möjligheter att fortbestå bör därför icke göras.

En eventuell framtida expansion av industriområdet kan tillgodoses genom att kvarteret när så erfordras utvidgas i den nordöstra delen utanför planområdet. Detta parti medger en utökning av kvartersytan med ca 6 ha. Samma principer med byggnadshöjder och omgivande planteringszoner som redovisas i föreliggande planförslag bör även gälla vid eventuell planläggning av detta område. Områdets läge framgår av den bilagda kartan i skala 1:10 000 avseende "översiktliga planeringsförutsättningar".

För den individuella trafiken planeras en etappvis utbyggnad av två primärleder, Västerleden och Tuveleden, utefter kvarterets västra respektive södra gräns, samt en matargata utefter den östra gränsen. Matargatan får förbindelse med bostadsbebyggelsen i Tuve genom en gata i öst-västlig riktning som eventuellt kan reserveras enbart för busstrafik.

Tillfarter till industrikvarteret kan anordnas i nordväst vid läget för den planerade planskilda korsningen Hukemotet på Västerleden, i söder från två plankorsningar på Tuveleden och i öster från den ovan nämnda föreslagna matargatan.

Västerledens utbyggnad på sträckan Bräckemotet - Agnesbergsbron skall enligt ett av kommunfullmäktige godkänt förslag till fördelningsplan för statskommunala vägar påbörjas 1977, och leden beräknas vara utbyggd på hela sträckan i början av 1980-talet. Leden utformas i denna utbyggnadsetapp med två körfält och plankorsningar.

Tuveledens utbyggnad påbörjas tidigast 1980. Leden sträcker sig från Västerleden i väster till Tuvevägen i öster. Leden är tänkt som en fyrfältig väg men byggs ut med två körfält i en första etapp. Planskilda korsningar för GCM-trafik är tekniskt möjliga och lämpliga att utföra i flera punkter.

Den del av Tuveleden som ingår i planförslaget sträcker sig genom ett skogsparti som är värdefullt från landskapssynpunkt. Vid detaljprojektering och utbyggnad av leden bör därför speciell omsorg ägnas åt vården av skogen i dess närmaste omgivning. Möjligheterna att bevara speciellt värdefulla träd bör beaktas.

Av den bilagda kartan i skala 1:10 000 framgår att Tuveledens förlängning väster om Västerleden skulle kunna böja av mot sydväst till Björlandavägen. Därigenom skulle västerifrån kommande trafik kunna ledas via Tuveleden istället som för närvarande via Björlandavägen in mot centrala staden. En sådan trafiklösning skulle möjliggöra en eventuell avstängning av Björlandavägen för genomfartstrafik. Sörredsvägen kan därvid förlängas fram till Tuveleden. Detta innebär förenklade transportvägar mellan det planerade industriområdet och Volvo Torslandaverken.

För att förse det planerade industrikvarteret med en tillfart under dess första utbyggnadsskede färdigställs en arbetsväg från Björlandavägen fram till kvarterets sydvästra gräns redan under 1975. Arbetsvägens södra del byggs i Västerledens sträckning och dess norra del ansluter strax söder om industrikvarteret till den befintliga Stenebyvägen, vilken breddas på sin återstående del fram till kvartersgränsen.

AB Volvos ianspråktagande av Stenebyområdet innebär att den befintliga Stenebyvägen måste stängas av och att en provisorisk förbindelsegata måste byggas runt utbyggnadsområdets första etapp som ersättning för den avstängda delen av Stenebyvägen. Denna provisoriska förbindelse utgörs delvis av planerade lokalgator inom industrikvarteret. Förbindelsen avses hållas öppen till dess att Tuveleden är utbyggd.

Stadsplanekartan visar den utbyggnadsetapp av trafiklederna - illustrerad med streckade linjer - som kommer att användas under lång tid framöver. Av den bilagda kartan framgår utformningen vid fullständig utbyggnad, varvid Västerleden förutsätts vara utbyggd med planskilda korsningar. Industribebyggelsen kommer att planeras så att buller från primärlederna Västerleden och Tuveleden ej ger upphov till störningar för verksamheten inom industrikvarteret. Därvid förutsätts att de delar av verksamheten som är bullerkänsliga orienteras in mot kvarterets mitt. Den framtida planläggningen av Heljereds- och Östergärdeområdena söder om planområdet avses bli utformad så att erforderligt bullerskydd från primärlederna erhålls.

Det befintliga gång-, cykel- och mopedstråket längs Björlandavägen sammanbinds med en befintlig mindre väg i Heljered utefter kraftledningarna fram till det föreslagna industrikvarterets sydöstra hörn. I väster kan den befintliga Stenebyvägen utnyttjas för GCM-trafik. GCM-stråkens korsningar med Tuveleden utformas planskilt. Vid den framtida detaljplaneläggningen av Heljered och Östergärde kan det bli nödvändigt att göra en omarbetning av GCM-systemets utformning i dessa områden. I öster längs den föreslagna matargatan samt längs den föreslagna bussgatan finns utrymme för separata GCM-vägar. GCM-förbindelser i öst-västlig riktning förutsätts ordnade inom industriområdet, eventuellt sammankopplade med AB Volvos interna transportvägar.

Kollektivtrafikförsörjningen av industriområdet kommer i en första etapp att ske med bussar från Björlandavägen och Västerleden. Efterhand som trafiklederna byggs ut kan busstrafikeringen utökas med flera linjer. I en framtid kan busstrafiken eventuellt kompletteras eller ersättas med spårbundna kollektivtrafikmedel. För dessa finns reservat i nord-sydlig riktning såväl öster som väster om det föreslagna industriområdet. Reservaten, som till stor del ligger inom trafikledernas skyddszoner, bör båda bibehållas så länge som osäkerhet råder beträffande den framtida markanvändningen inom områdena norr och söder om planområdet.

Industriområdet kan busstrafikeras enligt två huvudprinciper. Enligt den ena av dessa principer kan en eller flera busslinjer försörja området, varvid bussarna körs på interna vägar inom kvarters-

mark, dock utanför inhägnat område. Lämpliga sträckningar för busslinjer kan vara längs de interna vägar som planeras utmed Västerleden och Tuveleden och som fortsätter utefter Kättilsrödsbergets västra och norra sida, varigenom en direkt förbindelse kan erhållas med Tuve bostadsområde. En förutsättning för linjedragning enligt denna princip är dock att s k återvändsgator undviks. Busslinjernas dragning liksom start- och målpunkter blir även beroende av utbyggnaden av angränsande områden och deras behov av busstrafikförsörjning. På grund av industrikvarterets storlek kan det med denna matningsprincip bli tämligen långa gångavstånd mellan hållplatserna och målpunkterna inne i området. Enligt den andra busstrafikeringsprincipen kan spårvägens bussar köras på huvudvägarna fram till en bussterminal förlagd vid korsningen mellan Västerleden och Tuveleden. Till denna terminal kan AB Volvo ansluta med egna matarbussar som kör på kvartersmark även innanför inhägnat område. Detta system ger större trafikeringsflexibilitet och kortare gångavstånd. Olika kombinationer av de två huvudprinciperna är också möjliga.

Under planeringsarbetets första skede diskuterades ytterligare en kollektivtrafikförsörjningsprincip, innebärande att bussar körs tvärs genom kvarteret - eventuellt delvis planskilt - för att på detta sätt ge kortare och effektivare linjedragning och kortare gångavstånd. Bussförsörjning efter en sådan princip bedöms emellertid av AB Volvo innebära alltför allvarliga störningar i produktionsprocessen inom industrikvarteret. Dessutom tillkommer bevakningsproblem.

Oberoende av vilken princip som väljs för kollektivtrafikförsörjningen reserveras en yta inom trafikområdet vid korsningen mellan Västerleden och Tuveleden för en bussterminal. En detaljerad plan över hur kollektivtrafikförsörjningen bör lösas i de olika utbyggnadsskedena bör utarbetas i samråd med AB Volvo och Göteborgs spårvägar efterhand som planerna på industriområdets utbyggnad antar en mer konkret form.

Det skogklädda höjdpartiet i planområdets östra del, vilket utgör en fortsättning norrut på strövområdena kring Slätta Damm, föreslås utlagt som allmän plats, park. Parkområdet bildar en skyddszon mellan industriområdet och bostadsbebyggelsen. Parkområdet har förutsättningar att bli attraktivt som strövområde med varierande terräng och natur, omväxlande skog och öppen mark samt fina utsiktspunkter. Vissa avsnitt av skogsmarken inom området kräver uppröjning. På stadsplanekartan finns parkvägar illustrerade. En del av dessa är befintliga. Parkområdet knyts samman med Slätta Dammområdet via planskilda förbindelser över Tuveleden. Mot norr och nordväst utanför planområdesgränsen fortsätter strövområdet upp till och förbi gården Stora Holm. Även om delar av dessa områden norr om det föreslagna industrikvarteret i framtiden kan tänkas bli bebyggda, bör betydande ytor kunna ligga kvar som naturmark. Den ungefärliga framtida utsträckningen av strövområdet framgår av den bilagda kartan.

I planförslaget ingår ytterligare ett parkområde beläget på den sydöstra delen av Kättilsrödsberget.

I planområdets östra del finns två befintliga 130 kV kraftledningar längs den västra kanten av det skogklädda höjdpartiet. Väster om

dessa ledningar reserveras utrymme för ytterligare en 130 kV ledning. Öster om ledningarna kan ett område med bredden 85 m eventuellt behöva tas i anspråk för två 400 kV kraftledningar. Kraftledningsreservatet ingår i föreslagen allmän plats, park.

Vattenförsörjning och avledande av spillvatten för industrikvarteret ordnas genom att en gemensamhetstunnel byggs från befintlig tunnel vid Toredalsgatan upp mot Kättilsrödsberget. Denna tunnel beräknas dock vara utbyggd först omkring 1980. Under tiden fram till tunnelns färdigställande sker vattenförsörjningen i en första etapp via en provisorisk ledning från Björlandavägen till kvarterets sydvästra hörn och i en andra etapp - fr o m oktober 1977 - via en ledning från kvarterets östra del till den befintliga reservoaren i Glöstorp. Glöstorpreservoaren beräknas ha tillräcklig kapacitet fram till 1980, varefter ökad volym kan erhållas antingen genom att en ny reservoar uppförs på Kättilsrödsberget eller genom att reservoaren i Glöstorp kompletteras. Stadsplaneförslaget upptar byggnadsrätt för en vattenreservoar på Kättilsrödsberget. Spillvatten avleds från området genom en spillvattenledning i gemensamhetstunneln till Ryaverket. Under det första utbyggnadsskedet, dvs fram till oktober 1977, ombesörjs omhändertagande av spillvatten av AB Volvo. Under tiden fram till gemensamhetstunnelns färdigställande pumpas spillvattnet via en tryckavloppsledning till befintligt ledningssystem i Glöstorp.

Dagvatten tas om hand i industrikvarterets norra del dit större delen av marken har avrinning. Den bäck som härifrån rinner norrut mot dammen vid Stora Holm kan dock inte utan att åtgärder vidtas ta emot den ökade vattentillströmningen. Fördröjningsmagasin måste därför anordnas inom industrikvarteret innan vattnet släpps ut i bäcken. I ett senare skede kommer en tunnel att sprängas norrut till Askesybäcken som mynnar i Nordre Älv.

Elförsörjningen planeras ske från befintlig mottagningsstation norr om bebyggelsen i Tuve. Ledningen dras i kabel, eventuellt utefter de befintliga 130 kV ledningarna fram till industrikvarterets östra gräns.

Värmeförsörjningen kan eventuellt ordnas genom energiverkens försorg. Förhandlingar pågår mellan AB Volvo och energiverken om anslutning till planerade fjärrvärmeledningar öster om kvarteret. I de första utbyggnadsstadierna kommer dock uppvärmningen att ordnas med provisoriska anläggningar. Planförslaget upptar ett reservområde för en hetvattencentral i sydvästra kanten av Kättilsrödsberget. Även om ett nytt kraftvärmeverk byggs i kommunen kan en sådan central behövas för att klara toppbelastningarna. Om förhandlingarna mellan AB Volvo och energiverken emellertid skulle resultera i att AB Volvo inte är intresserat av värmeleveranser från kommunen, bortfaller det viktigaste motivet för att lokalisera hetvattencentralen till Kättilsröd.

Teleförsörjningen sker genom att Stenebyområdet ansluts med ledningar mot öster till Glöstorp. Inom södra delen av Kättilsrödsberget finns en rikstelekabel. Läget för denna kabel, som berör kvartersmark, säkerställs genom ett reservat för underjordiska allmänna ledningar.

För industrikvarterets brandskydd redovisas tillfart i första utbyggnadsetappen dels från sydväst via arbetsvägen i Västerledens sträckning och dels från öster via Stenebyvägen med tillfart genom bostadsbebyggelsen i Tuve. Efterhand som utbyggnad av industrikvarteret och omgivande

trafikleder sker, planeras tillfarter via Västerleden i nordväst, Tuveleden i söder och en matargata i öster. Industrikvarteret avgränsas därmed på tre sidor av trafikleder.

På grund av industrikvarterets storlek och det varierande användningssättet kan brandrisker av olika slag förekomma inom området. Det förutsätts att samråd mellan AB Volvo och brandförsvaret om områdets brandskydd sker så tidigt som möjligt. Sådana samråd bör exempelvis omfatta planering av sprinkleranläggningar, erforderliga skyddsavstånd mellan olika byggnader och framkomlighet för utryckningsfordon på kvartersmark.

Den första utbyggnadsetappen (1975-1977) omfattar en lagerbyggnad, inrymmande ca 50 000 m^2, en 4-vånings kontorsbyggnad, samt byggnader för rammontering och balkhålning. Alla dessa byggnader, som sammanlagt upptar en markyta av ca 10 ha, kommer att uppföras i det föreslagna industrikvarterets sydvästra del. Antalet anställda beräknas 1977 uppgå till 600 personer.

Beträffande senare utbyggnadsetapper kan följande noteras enligt AB Volvos nuvarande bedömningar. Omkring 1980 uppförs en kontors- och administrationsbyggnad ca 300 m norr om rammonteringsbyggnaden. Under 1980-talet följer en etappvis utbyggnad av lastvagnsfabrikens monteringsenheter samt anläggningar för teknisk utveckling i kvarterets norra del och utrustning i dess nordöstra del. Omkring 1985 beräknas ca 2300 personer vara sysselsatta i området. 1990 beräknas antalet sysselsatta uppgå till ca 5 000 personer.

Stellan Haverling
Stadsplanechef

Anders Tyllström
T f chef IT-byrån

Louise Österlin
Louise Österlin

STADSBYGGNADSKONTORET
Stadsplaneavdelningen
Göteborg

1975-07-01

28

Stadsplanebestämmelser tillhörande förslag till stadsplan för delar av stadsdelarna Björlanda och Tuve (Steneby industriområde) uppgjort i juli 1975

Beteckningarna hänför sig till stadsplanekarta.

§ 1. Stadsplaneområdets användning

mom. 1 Med A betecknat område får användas endast för allmänt ändamål.

mom. 2 Med J betecknat område får användas endast för industriellt ändamål; dock får bostäder inredas i den utsträckning byggnadsnämnden prövar detta erforderligt för bevakning.

mom. 3 Med J1 betecknat område får användas endast för industriellt ändamål av sådan beskaffenhet som ej vållar olägenhet för angränsande områden med hänsyn till sundhet, brandsäkerhet och trevnad; dock får bostäder inredas i den utsträckning byggnadsnämnden prövar detta erforderligt för bevakning.

mom. 4 Med T betecknat område får användas endast för trafikändamål.

mom. 5 Inom med Zt betecknat område - begränsat av streckprickad linje - får sådana anordningar ej vidtagas som förhindrar att området under kvarter eller annat område användes för allmänna ledningar i tunnel.

mom. 6 Med kors betecknat område får bebyggas endast med ekonomibyggnader i den utsträckning byggnadsnämnden prövar detta lämpligt.

mom. 7 Med prickar och kors betecknat område får icke bebyggas; utan hinder härav får mindre byggnader för fritidsverksamhet uppföras om detta i varje särskilt fall av byggnadsnämnden prövas förenligt med ett prydligt och ändamålsenligt utnyttjande av området.

Område som även betecknats med p1 skall hållas som naturpark.

mom. 8 Med prickar betecknat område får icke bebyggas.

Område som även betecknats med p2 skall ordnas som plantering.

Inom i första stycket angivet område som även betecknats med u får icke vidtagas anordningar som hindrar framdragande eller underhåll av underjordiska allmänna ledningar.

§ 2. Bebyggelsens omfattning

Av fastighet som omfattar med J eller J1 betecknat område får högst 50% (femtio procent) av fastighetens areal bebyggas.

§ 3. Byggnads höjd och källardjup

mom. 1 Inom med rektangel betecknat område får byggnad uppföras till högst den höjd i meter som angives inom rektangeln. Ovan det plan som är beläget på den för byggnad tillåtna största höjden får lokaler ej inredas.

För särskilt fall må sådan större höjd kunna medgivas, som påvisas

vara erforderlig och som byggnadsnämnden med hänsyn till sundhet och brandsäkerhet samt i övrigt ur allmän synpunkt prövar lämplig.

mom. 2 Inom med romb betecknat område får byggnad uppföras till högst den höjd i meter över stadens nollplan som angives inom romben. Ovan det plan som är beläget på den för byggnad tillåtna största höjden får lokaler ej inredas.

mom. 3 Inom med Zt jämte halvcirkel med kors betecknat område får ingen del av byggnad läggas på lägre höjd i meter över stadens nollplan än det plan, som fixeras av de höjder, som angives inom halvcirklarna, därvid höjderna tolkas så som tillämpas beträffande gata.

§ 4. Anordningar som berör luftfarten

Inom stadsplaneområdet får byggnad, skorsten, annan byggnadsdel, flaggstång eller annat dylikt fast föremål som kan befaras hindra luftfarten icke överstiga 70,0 (sjuttio) meter över stadens nollplan.

Stellan Haverling
Stadsplanechef

Anders Tyllström
T.f. chef IT-byrån

Louise Österlin

Kopians riktighet bestyrkes:

LÄNSSTYRELSEN
Göteborgs och Bohus län
Planeringsavdelningen

11 BESLUT 1976-05-20

1(6)

11.082-143-76

Byggnadsnämnden i
Göteborgs kommun

Förslag till stadsplan för delar av stadsdelarna Björlanda och Tuve i Göteborg (Steneby industriområde)

Rubricerade stadsplaneförslag upprättades i juli 1975 av stadsplanechefen Stellan Haverling, t f chefen för IT-byrån Anders Tyllström och Louise Österlin inom stadsbyggnadskontoret.

Planförslaget består av stadsplanekarta i 3 blad med tillhörande stadsplanebestämmelser och åtföljs av beskrivning.

1975-12-18 beslutade Göteborgs kommunfullmäktige att anta förslaget samt översända det till länsstyrelsen för fastställelseprövning.

Länsstyrelsen fastställer jämlikt 26 § byggnadslagen ifrågavarande stadsplaneförslag.

Besvär över detta beslut kan anföras genom skrivelse till regeringen. Skrivelsen skall ha inkommit till bostadsdepartementet, Fack, 103 20 Stockholm, inom tre veckor från detta besluts datum. Besvär får dock anföras endast av sakägare, som i ärendet framställt yrkande, vilket helt eller delvis lämnats utan bifall. I besvärsskrivelsen skall tydligt anges vilket beslut som överklagas och vad som yrkas. Vidare bör klaganden meddela sin fullständiga adress.

Vid den slutliga handläggningen av detta ärende, i vilket länsarkitekten Frans Scherman beslutat och byrådirektören Elof Persson varit föredragande, har även förste länsassessorn Carl-Otto Lindberg, naturvårdsdirektören P-O Lindqvist och bitr överlantmätaren Bertil Lindén deltagit.

Frans Scherman

Elof Persson

8

Enligt bostadsdepartementets diarium har besvär anförts över detta beslut.
Datum 15/6-76
Registratorn/Sign.

Kopians riktighet bestyrkes:

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