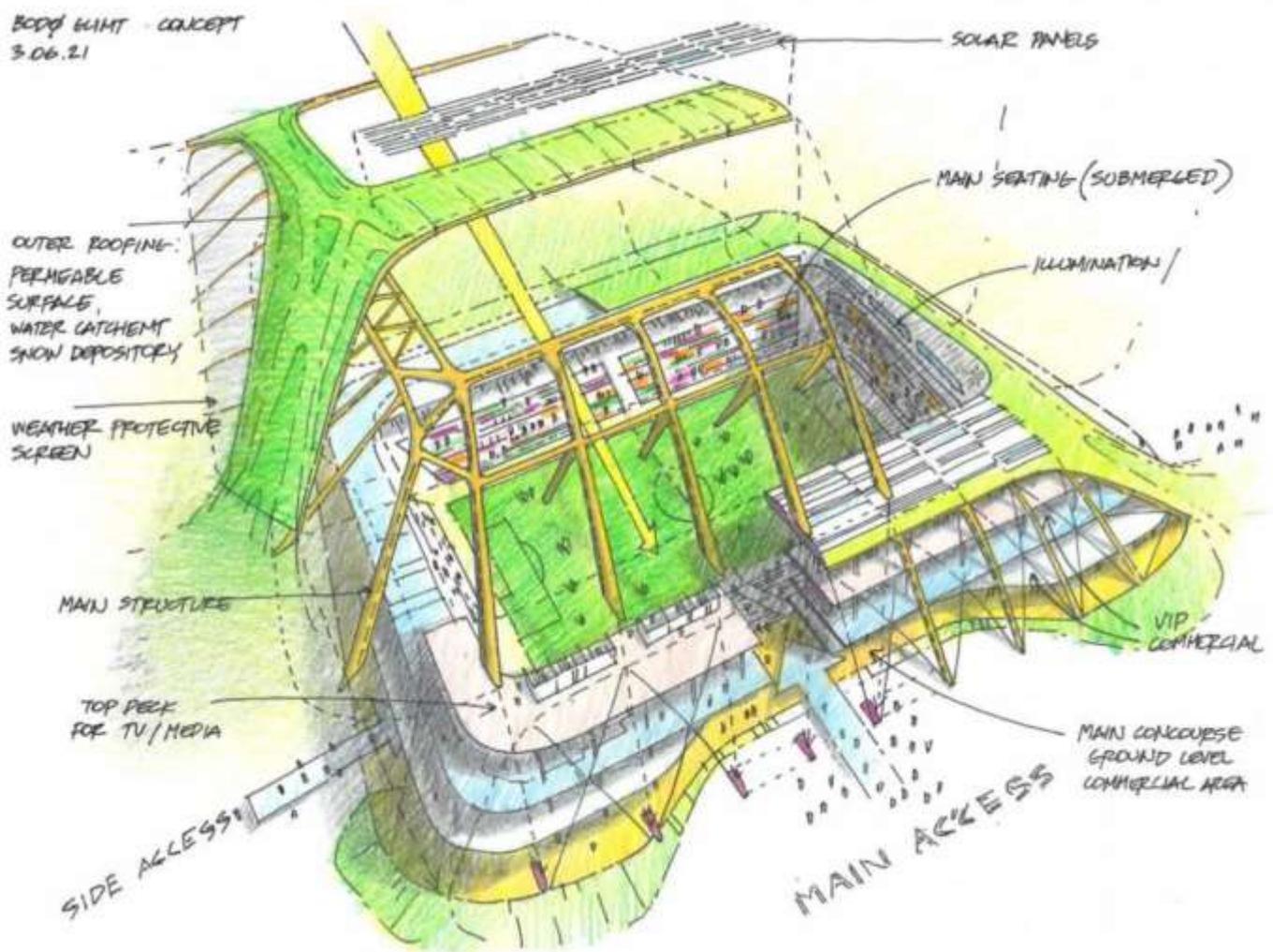


LE01 & LE04 - Ecology Strategy and enhancement of biodiversity

Fag: Økologi Dokumentnr.:LE01_01 Versjon: 01 Dato:01.05.2022



Summary

Bodø Storstue will be built in the outskirts of Bodø city and shall be certified according to the BREEAM communities manual. This document ("LE01 & LE04 - Ecology strategy and enhancement of biodiversity") covers the credit ID's LE01 and LE04, which is about the impact on, and conserving of and enhancing the biodiversity on the site.

The site is situated in a field situated in an agricultural area. The agricultural area east of Bodø city is used for foraging and breeding by red listed bird species, most importantly the northern lapwing. The site is a part of the outskirts of the cultural landscape used for foraging and breeding by the northern lapwing. The particular site is probably not the most important subarea for this species. However, any decrease of the habitat for the bird is negative.

It is possible to enhance the biodiversity on the site and establish green corridors towards surrounding areas by following the suggestions in the ecology strategy. An important measure to achieve increased biodiversity will be to plant many and varied trees, bushes and perennial plants. Also, if possible, a green roof mimicking a meadow would be beneficial for local biodiversity, as it could provide foraging and nesting sites of insects and birds.

The masterplan as given through the documents Utomhusplan (Attachement LE05_03 and Grep i utomhusplan Attachement LE05_01) conform with the ecology strategy.

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1 Introduction

Glimtech AS is going to build a new football stadium with commercial areas and areas for recreation. The project will be certified according to BREEAM Communities Technical Manual SD202 – 1.2: 2012. This document, answers the criteria of the credit-ID's LE01 Ecology Strategy and LE04 Enhancement of ecological value.

Recommendations for conserving the local biodiversity, increasing the local biodiversity and connecting the site to surrounding areas through ecological corridors do to a large degree sort under the credit-ID LE04. However, these recommendations are closely related to the existing biodiversity on the site and the impact on this, as described in LE01. Therefore, both LE01 and LE04 are included in this document.

A major part of the LE01 in BREEAM Communities is the “Ecology strategy” (LE01, criteria 3 and CN3). The ecology strategy is supposed to achieve the following:

- Protection, enhancement and creation of local ecological habitats and the processes that sustain them (including water supply and quality; nutrient cycling; shelter; ecosystem hierarchies etc.)
- Opportunities for maximising the presence of flora and fauna species on or near to the site
- Protection, enhancement and creation of wildlife democratisation routes
- Potential damage or disturbance arising from the proposed development and its ongoing use
- The optimal balance between ecological, social and economic benefits of the proposed development and predicted damage or disturbance
- Protection and enhancement of existing ecological features.

Figure 1: Goals for the ecology strategy. Screenshot from LE01, CN3 of the BREEAM communities technical manual SD202 – 1.2.2012.

The goals of the ecology strategy as described in CN3 encompasses and depend on virtually all other criteria in LE01 and LE04. Protection of local biodiversity depends on the EclA (chapter 2), where potential damage and disturbance is assessed. Based on these findings, mitigation (chapter 3) and enhancement (chapter 4 and 6) of biodiversity can be assessed. Protection of biodiversity also depend on the construction phase (chapter 5). The balance between ecological, social and economic benefits is strongly dependent on the plans in “Utomhusplan” (Attachment LE01_04) and “Grep i utomhusplan” (Attachment LE01_05). Therefore, the entire document should be considered as the ecology strategy.

2 Ecological impact assessment

This chapter meets the compliance notes from LE01: CN1, CN4

2.1 Site description

This chapter meets the criteria 1 in LE01.

The project site is planned on a field of intensively farmed farmland, which is located close to the city center of Bodø (figure 2). The site is a part of an area of farmland, which has been farmed for many years, but is gradually decreasing in size due to expansion of the city (figure 3). The site is regulated for services, commerce, and sports activities. On the edges of the site is sparse vegetation consisting mainly of nitrogen-loving plants and pioneer species. Some larger trees are growing along the northern edge of the site.

Since the site is a intensively used farmland, the overall biodiversity on the site is considered to be low compared to natural habitats. There are some registrations of species in the Norwegian species map service (Artskart). The registrations of red listed species are sightings of birds, specifically common gull (*Larus canus* NO: fiskemåke) which is vulnerable (VU), and the near threatened (NT) common starling (*Sturnus vulgaris* NO: stær) and house sparrow (*Passer domesticus* NO: gråspurv). In the areas surrounding the site there are also sightings of other red listed bird species, but it is not probable that any of these nest within the borders of the site. Some of these species, like the critically endangered northern lapwing (*Vanellus vanellus* NO: vipe), vulnerable (*Calidris pugnax* NO: brushane) and near threatened (*Pluvialis apricaria* NO: heilo) may have used the site for foraging in some parts of the year. Also, BirdLife Bodø informs that the endangered eurasian curlew (*Numenius arquata* NO: storspove) is also frequently observed in the area during the year.

The site is probably most important for birds foraging in large, open areas, like the cultural landscape or marshlands. Of the species listed above, the northern lapwing and the Eurasian curlew are typical in this respect. In addition, the common starling often forages in fields and parks close to towns and cities and could be the bird species for which the site is most important.

Apart from the bird species, it is probably some flowering plant species in the edges of the site, at the roadsides, providing habitat and food for insects.

The invasive species persian hogweed (*Heracleum persicum* NO: tromsøpalme) is registered at several spots on and close to the site. It is assessed to the category "severe impact" (SE).

To be able to fully assess the biodiversity on the site, an on-site inspection during the growth season of the plants must be conducted.



Figure 2: The site of the new project is enclosed by roads. A line trees is situated along the northern edge of the site.

2.2 The surrounding area

This chapter meets the criteria 1 in LE01.

The site is surrounded by tarmac roads of frequent use, one of them is a highway (Riksvei 80). To the east, the site is adjacent to other fields, stretching east and northeast on what has once been wetlands. To the north, it is residential areas, where several of the plots have some tree cover. To the south and west, it is mainly commercial areas, where hard surfaces are occupying most of the area, and vegetation is scarce.

Further away from the site, there are areas with more vegetation and tree cover. The park Rensåsparken is situated about 450 meters to the northwest. This is a park a substantial tree cover but is managed as a park. Trollåsen is a larger forested hill about 400 meters to the northeast. From Trollåsen it is another 500 meters to Bodømarka surrounding Bodø city, with large areas of forests, hills, mountains, lakes and wetlands.

The forests around Bodø are mainly deciduous forests, with spruce (*Picea* and *Abies* species) planted for forestry. In the city center and around the farms, more heat-loving tree species are also planted.

The farmlands east of the site are intersected with some streams, forests and small patches of wetlands. In these areas, the bird northern lapwing is frequently observed nesting and foraging.

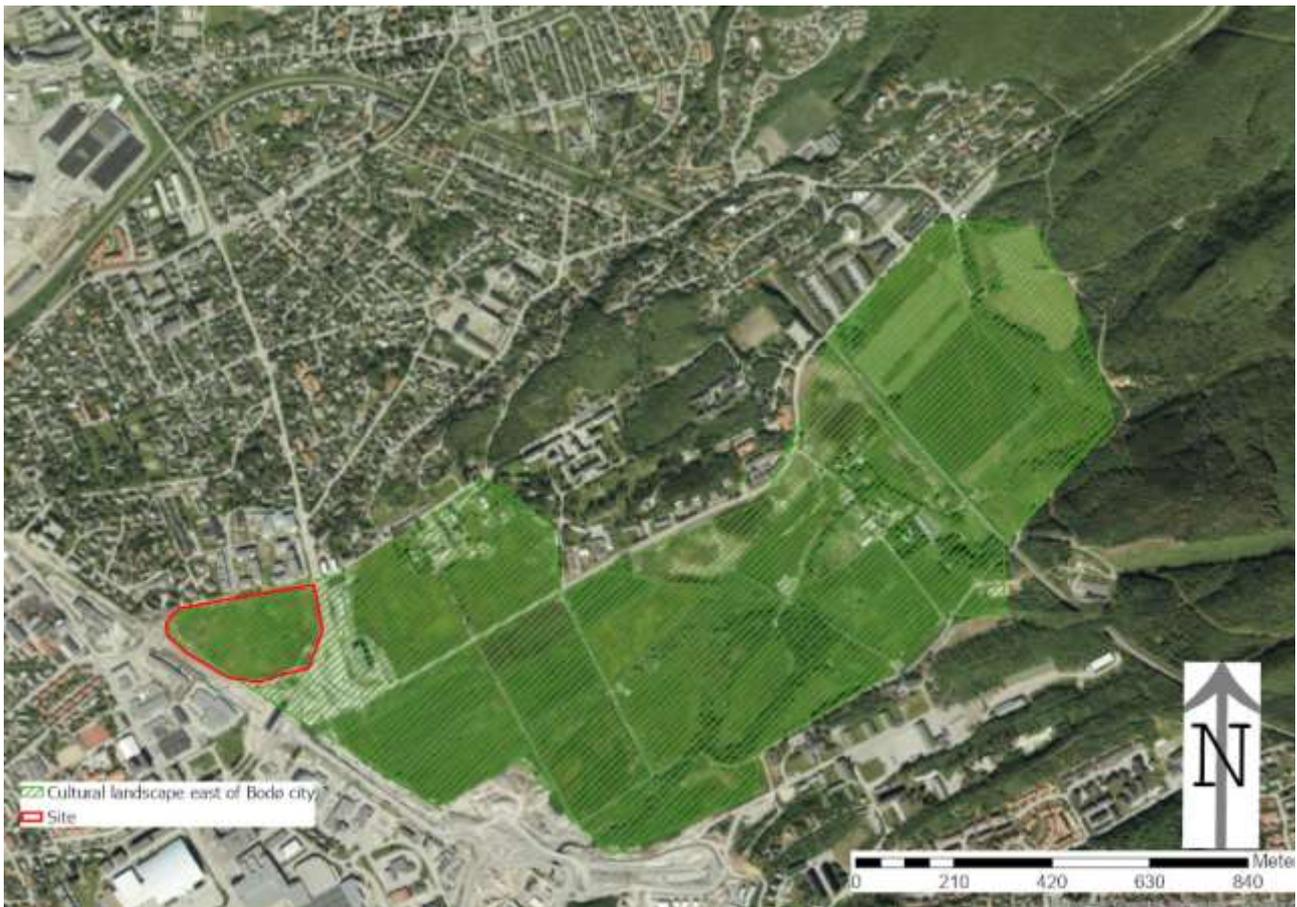


Figure 3: The site as part of the cultural landscape east of Bodø city.

2.3 Valued ecological features and ecological impact assessment

This chapter meets the criteria 1 in LE01.

The most important ecological feature of the site and the surrounding area is its value as nesting and foraging area for northern lapwing, common starling and other red listed bird species. The most important part of the farmlands regarding bird habitats, are probably the larger areas to the east, closer to the small river Bodøgårdselva. The particular site is probably of little importance for the northern lapwing, as it is to a large degree enclosed by urban structures. For the common starling, however, the area is probably frequently used for foraging, and the sites value for the common starling will decrease.

Nevertheless, any decrease in open farmland and increase in developed area with significant used by persons, will probably have a negative impact on the local bird community. This is because they get smaller areas for foraging, and because the distance between the nesting sites and people decreases.

The development of the site will most likely not have negative impacts on biodiversity outside the boundaries of the site. An exception from this could be reduced populations of the northern lapwing and eurasian curlew as their foraging areas decrease, and for migrating birds, as their resting areas during migration decrease.

2.3.1 Consultation with local organizations

This chapter meets the criteria 2 in LE01.

The local organization BirdLife Bodø confirms that the northern lapwing uses the cultural landscape east of Bodø city for breeding but could not determine which sub-areas that species or the eurasian curlew preferred for breeding and foraging (Attachment LE1_03).

3 Protection, mitigation and compensation

This chapter meet the compliance notes from LE01: CN3, CN5

3.1 Protection of ecological features

The red-listed bird species in the area is probably the most important ecological feature in the area. These species thrive on large and open cultural areas. As the project decreases the area of the cultural landscape, and the area in itself is important, it is almost impossible to protect this ecological feature.

Lagre trees of native species found during the on-site inspection should be protected and kept as parts of the final planting.

3.2 Mitigation and compensation

This chapter meets the criteria 4 in LE01.

It is possible to mitigate the loss of the open agricultural areas on the site by creating an artificial cultural landscape on the site. This could be done by lowering the stadium into the ground and establishing a green roof mimicking a meadow (see 4.1.1).

A possible solution to aid the local population of northern lapwing, is to re-open areas that has been extensively farmed cultural landscapes in the past but is now grown by trees. However, this is a solution requiring significant effort each year, as the grass must be cut. Also, it requires buying land or making agreements with local landowners, to get the areas needed for the compensation areas.

To be able to build the stadium, the topsoil shall be moved to another location where it can be used for agricultural means. In this process, it could be an option to clean new areas for vegetation and establish fields in those areas. If that is done in connection with Rønvikjordene, this could compensate for the lost foraging area for the northern lapwing.

Even though it is probably not possible to compensate for the lost agricultural areas as foraging habitats for the bird species, it is possible to take measures to mitigate for the local population of common starling. The common starling nests in bird boxes, and frequently use bird boxes located close to humans. A mitigation measure should therefore be to establish colonies of nesting sites for common starling (see chapter 4.1.6).

To compensate the local insect community, the food plants lost at roadsides should be replaced by planting flowering plants on the site, see chapter 4.1.4.

4 Enhancement of ecological value – net gain in biodiversity

This chapter meet the compliance notes from LE01: CN3

This chapter meet the compliance notes from LE04: CN2. Additionally it meets the criteria 1-5 in LE04.

The site used to be a part of the cultural landscape east of Bodø. In earlier days, when the cultural landscape was more extensively farmed, it was an important habitat for many species of several species groups, like birds, plants and insects. The project should aim for the outdoor areas to include elements of the cultural landscape, like meadows, flowers and tree groups.

Today, the site consists of heavily farmed farmland, with some vegetation along the edges. The site has now a low diversity in vegetation, which often leads to a low biodiversity. To increase the biodiversity on the site, the vegetation should be more diverse. The recommendations given below, if followed, will increase the biodiversity on the site.

4.1 Recommendations

4.1.1 Green roof

The football stadium could be constructed with a flat or gently sloping roof, and the entire stadium may be lowered down in the ground, so that the roof may be in contact with the ground. This could make it possible to lay a green roof. The green roof should be made to imitate a flowering meadow, as this is a habitat important for pollinating insects, and could also be a possible habitat for nesting and foraging for northern lapwing. When establishing a meadow, it is important that the soil used is suitable for this. Nutrient-rich soils with a high capacity of storing water should be avoided. Poor, dry soils is preferable.

A simple green roof with shallow soil and only *Sedum* species, is not very beneficial for the biodiversity. As the vegetation is short and the species diversity among plants low, the roof will only provide habitat for a small number of species. If a *Sedum*-covered roof is chosen, it should be made more diverse by having areas of deeper soil or planting boxes, where larger plants can grow. If it is chosen a solution with planting boxes, the plants from 4.1.4 can be used, to provide food for pollinating insects. The planting boxes or areas with deeper soil should be at least 2x2 meters, to provide spaces for ground nesting bird species to nest.

4.1.2 Conservation of existing trees

The biodiversity related to trees will increase as the tree grows older, as birds nest and species of insects, mosses, lichens and fungi gradually colonize the tree. To conserve the trees that already exists in an areas, an easy way to increase the local biodiversity. On the actual site, especially the trees along the northern edge of the site are large and should be conserved. It is not possible to determine the species of the trees prior to an on-site inspection, but based on accessible imagery, it seems to be mainly *Salix* and *Populus* species.

Some of these trees may be native species like *Salix caprea* while others are probably foreign *Populus* species. The native species should be prioritized for conservation, but as these *Populus* trees are large and most species does not impose a great risk for Norwegian biodiversity, they could also be conserved. The exception is *Populus balsamifera*, which is a much-used species in northern Norway, and if the trees prove to be *P. balsamifera*, they should be removed.

4.1.3 **Planting of new trees**

Trees provide habitats and food for a number of different species of birds, mammals, insects, mosses, lichens and fungi. Additionally, they can make corridors for movement of species between larger habitats. Therefore, planting of trees is an efficient way to increase the biodiversity on a site.

All trees that get planted should be native species to Norway, and preferably native to the Bodø region.

Planting of small trees should include rowan *Sorbus aucuparia*, as this species is both good for pollinating insects in spring, and also provide food for berry-eating bird species in the autumn. Other species of small trees that can be used are goat willow *Salix caprea*, bird cherry *Prunus padus* or apple species *Malus* spp.

Of larger trees, birch *Betula pubescens*, Scots pine *Pinus sylvestris*, aspen *Populus tremula* and grey alder *Alnus incana* are local species and should be used. Alternatively, other native Norwegian species that are not so common in the region could be used, likeelm *Ulmus glabra*.

To provide cover for birds and more “forest-looking” patches, trees should be planted in groups, rather than in lines.

Some of the trees that have the potential to become large trees, should be given enough space and time grow large and old. In a long-term perspective, these trees will need space for a root zone of about 80 m², which equals a root zone with a radius of ca. 5 meters. The depth of the soil should be at least 2 meters in a radius of 1 meter around the trunk, and about 0,75 meter outside the 1-meter radius. These trees should only be removed if they propose a real danger to its surroundings, and only after consideration of an arborist.

4.1.4 **Bushes and perennial plants for pollinating insects**

Flower beds should be adapted to attract pollinating insects. Flowering bushes and perennials can provide food for pollinating insects. A large number of different species should be used, to attract many species of insects and to provide nectar during a longer period of the growing season. Local species growing wild in the Bodø region is preferable, but other species could also be used, see under.

Bushes: the following species are recommended for the site: *Rubus idaeus* (NO: bringebær), *Viburnum opulus* (NO: korsved), *Ribes nigrum* (NO: solbær), *Rosa mollis* (NO: bustnype) and *Rosa majalis* (NO: kanelrose). Even though it does not provide food for insects, *Hippophaë rhamnoides* (NO: tindved) is recommended if the plants used are of Norwegian origin.

Perennial plants: the following perennial plants are recommended for the site, if suitable for the local climate: *Crocus chrysanthus*, *Narcissus pseudonarcissus*, *Primula vulgaris*, *Tulipa sylvestris*, *Geum coccineum*, *Euphorbia amygdaloides*, *Aquilegia vulgaris*, *Paeonia officinalis*, *Geranium x magnificum*, *Geranium macrorrhizum*, *Geranium pratense*, *Anchusa officinalis*, *Nepeta cataria*, *Echium vulgare*, *Salvia officinalis*, *Linum perenne*, *Althaea officinalis*, *Aster alpinus*, *Leucanthemum vulgare*, *Lavandula angustifolia*, *Verbascum nigrum*, *Thymus vulgaris*, *Helenium autumnale*, *Echinacea purpurea*.

Perennial plants in wet flowerbeds: *Caltha palustris*, *Lythrum salicaria*, *Iris pseudacorus*, *Filipendula ulmaria*, *Polygonatum multiflorum*, *Comarum palustre*, *Geranium sylvaticum*, *Geum rivale*, *Trollius europaeus*, *Viburnum opulus*, *Succisa pratensis*.

4.1.5 **Removal of invasive plant species**

Invasive plant species can be a threat to local biodiversity by outcompeting and displacing the local plant species. Also, by Norwegian law you must take measures not to disperse invasive species during construction work (Naturmangfoldloven § 28). Therefore, any construction and building projects that handle soils should eradicate invasive species from the site, and make sure not to disperse these species.

After the on-site inspection, and prior to the start of the construction phase, it will be made a plan for eradicating and avoiding dispersal of invasive plant species.

Prior to the on-site inspection, persian hogweed (*Heracleum persicum*) is registered on the site. This is a species which should be prioritized for eradication. If other species of high risk are discovered during the on-site inspection, these may also be species that should be eradicated.

For the soil infested with persian hogweed, the procedure outlined in Attachment LE04_02 "Bjørnekjeksarter (*Heracleum* spp.)" must be followed.

4.1.6 Bird boxes

It is recommended to facilitate for some bird species that nest in holes, and that readily make nests in areas with significant human traffic. As hollow trees can be scarce in the modern cultural landscape, bird boxes are a good measure to facilitate for birds. On this site, both common starling and house sparrow are observed, which make them bird species to target for the bird boxes.

It is mainly the diameter of the hole in the bird box that decides which bird species that will nest in the box, in combination with the size of the box.

Starling box: Hole diameter: 50 mm. Interior bottom: 150-170 mm. Box height: 350-400 mm.

The starling thrives when in a colony of several birds, so 5 or more boxes should be hanged at each site. They could be hanged in trees, on walls or a separate stand.

House sparrow box: Hole diameter: 40 mm. Interior bottom: 100-150 mm. Box height: 250 mm.

4.1.7 Hedgehog corner

The hedgehog is a red listed species that often thrives in populated areas. The hedgehog population in Bodø is among the northernmost populations in the world, and this population does not easily connect with other populations. It is possible to create a habitat for hedgehogs using a hedgehog house and plants.

The hedgehogs prefer to make their burrows in places with bushes and tall vegetation. Therefore, the hedgehog house should be placed underneath bushes. Hedgehog houses can be bought, for instance her: <https://fuglebutikken.no/butikk/dyr-butikk/dyr/utedyr-og-fugl/pinnsvinhus-med-vindfang/>

The hedgehog corner should be placed in northern or eastern part of the site, as these areas are closest to other possible habitats, and it is in this part that roads are safest to cross.

4.1.8 Natural insect hotels

In the last years, insect hotels have been a popular addition to gardens. However, the number of species that actually use these hotels is probably low as far north as Bodø. Insect hotels is a replacement for dead vegetation, and the local insect fauna is probably more adapted local dead vegetation than insect hotels. Therefore, it is a good measure for the local insect fauna to place dead logs on the site. These dead logs should be at least 10 cm in diameter at the thinnest, and at least to meters long. They should be of deciduous trees like aspen, alder or willow. The logs could also be large trees of other species that are cut in Bodø at the same time as the construction takes place.

4.2 Wildlife corridors and green infrastructure

This chapter meet the compliance notes from LE04: CN2

The purpose of wildlife corridors is to connect larger natural areas, in order to make it possible for animals to move between these areas. For example, will many bird species hesitate to cross open areas without tree cover, but they will move in cover of the tree canopies to avoid raptors. The same will apply to insects and smaller mammals, but they could also use lower plants like bushes.

The site can be used to strengthen the connection between Rensåsen and the western vegetated areas, and Bodin Gård and Trollåsen in the east.

The probably best way to strengthen the connections between surrounding areas is to plant groups of trees on the site. Preferably, the trees should be planted along the northern edge of the site, as this would be most beneficial. Also, trees should be planted in groups rather than in a line, as this provides more cover for birds.

If the recommendations in chapter 3 is followed, and the greenspace is established according to the landscape design outlined in the "Utomhusplan", the green infrastructure will be significantly improved.

5 Reducing the impact during the construction phase

This chapter meets the criteria 3 in LE01.

The construction phase will generate a considerable amount of traffic and noise on and around the site. To reduce the negative impact on migrating and breeding birds that use the flat cultural lands, as much as possible of the construction should be carried out in the period august-march.

During the construction phase, it is a high risk of dispersing invasive plant species when handling soil. If the soil in some parts of the site is labelled as infested, this soil must be handled following a plan, and not be moved to new sites. After the on-site inspection, it will be made a plan for avoiding dispersal of invasive plant species.

6 Management during the operation phase

This chapter meets the criteria 3 in LE01.

6.1 Management of trees

All trees should be allowed to grow large, old and die a natural death. Trees should only be removed if they propose a real danger for its surroundings. Before a decision of cutting a tree is taken, an arborist must be consulted, to evaluate if the tree really propose a danger.

Branches that die should be left on the trees until they fall of and should thereafter be left lying on the ground. Dead branches can be habitats for fungi and insects.

6.2 Bird boxes

It is recommended that the bird boxes are cleaned annually. This is not absolutely necessary but is recommended to ensure that birds use the bird boxes every year. If the bird boxes are not cleaned, the birds may choose not to nest in a box some years, due to high numbers of parasites.

6.3 Green roof

If it is decided that the stadium shall have green roofs resembling meadows, these will require maintenance, including yearly haying and removal of hay.

At this stage in the project, it is only an idea to have a green roof, and if it is decided to go forward with this, it will require a more elaborated plan for establishing and maintaining the meadows on the roof.

6.4 Bushes and perennial plants

Bushes and perennial plants should be replaced when they die. Mechanical removal of weeds should be applied when necessary. Planticides and pesticides should not be used, as these can harm local biodiversity.

6.5 Invasive plant species

Known localities of invasive plant species should be surveyed yearly the first five years after supposed eradication of the species. If invasive plant species appear on these sites, they should be removed according to given instructions. If invasive plant species of other species or are suspected to have appeared on other parts of the site in the operation phase, experts on the matter should be contacted to investigate the suspected localities and make a plan for eradication of the species.

7 Confirmation of masterplan

This chapter meet the criteria from LE01: 5 and 8 .

The documents functioning as the masterplan in this project are the documents "Utomhusplan " (Attachement LE01_04) and "Grep i utomhusplan" (Attachement LE01_04).

The ecologist hereby confirms that the masterplan, through the mentioned documents conform with the ecology strategy. As the masterplan suggests a varied planting of trees, bushes and perennial herbs, it will increase the biodiversity of the site, as these plants will attract an increases number of species of insects, birds and epiphytic organisms. the ecologist also confirm that the detailed landscaping and planting design and site-specific protection measures conform with the ecology strategy.

8 Confirmation of suitable qualified ecologist

This chapter meet the compliance notes from LE01: CN2, CN6.

This chapter meet the compliance notes from LE04: CN1

The ecology strategy is elaborated by Hauk Liebe. He has a B.Sc in ecology and natural resource management, and a M.Sc in natural resource management from the Norwegian University of Life Sciences in 2019. See attachment LE01_02.

The elaboration of the ecology strategy has been in cooperation with Eirik Thorsen. Thorsen has a M.Sc in natural resource management from the Norwegian University of Life Sciences, with specialization in management of fish and wildlife. He has worked with assessments on biodiversity, impact assessments and BREEAM documentation in Norconsult since 2012. See attachment LE01_02.